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POWER SECTOR IN AFRICA: PROSPECT AND POTENTIAL

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Executive Summary

Africa's growth of 3.6 per cent in 2015 was mainly driven by the strong agricultural output in select countries, which overweigh the slowdown in resource rich countries due to the fall in commodity prices during the year. In 2016, the continent's growth is estimated to be marginally higher at 3.7 per cent. Though Africa's growth was resilient amid a weak global economy and lower commodity prices, its economic outlook is vulnerable to commodity price shocks and global economic performance. Further, economies in Africa are at different levels of development.

In order to have a sustainable growth, the need of the hour for Africa today is to address its huge infrastructure deficit that crippled the continent. Ironically, for a continent which has a potential to dominate in energy supply globally, power remains the largest infrastructure bottleneck faced by the continent. The study delves into the existing situation of the power sector in Africa, the challenges to its development and the strategies for enhancing power supply in the continent. It also highlights avenues for enhancing India's power sector engagements in the region.

Power Sector in Africa: Current Scenario

Sub-Saharan Africa has the lowest access to electricity ratio (as per cent of population) in the world at 37.5 per cent in 2014. This value is singnificantly lower than the global average. For Africa as a whole, per capita electricity consumption is one-fifth the global average, and there are wide variations both within and between countries.

In some countries, most of the generated electricity is either directly produced or flows directly to business operations, bypassing a significant part of the population, thus reducing the access to electricity. This may possibly explain why, relatively large economies that have relatively high power generation compared to its peers, have low access to electricity. In some countries, on the other hand, enterprises chose to share or have their own power generators. According to World Bank Enterprise Survey, 50.9 per cent of the firms in Sub-Saharan Africa either own or share a generator.

The transmission and distribution networks in the region also lack efficiency, resulting in significant electric power distribution losses and reducing the supply (access) for the end-use sectors. In 2014, the distribution losses in Africa stood at an average of 21.1 per cent of the output. This ratio of distribution losses to its total generation for Africa has deteriorated, worsening from 11.9 per cent in 2005 to 21.1 per cent in 2014. Distribution losses as a percentage of total output is nearly 50 per cent in some countries (more than 100 per cent losses in the case of Benin, implying the loss of imported electricity).

A comparison between generation and distribution losses in actual terms highlights that higher the generation, higher are the distribution losses. This also asserts that increase in generation infrastructure in Africa, has not been accompanied by an equivalent increase in distribution infrastructure.

This inadequate power transmission and distribution capacity, further adds to the cost of getting electricity. Across Sub-Saharan Africa in 2012, the average cost of generating electricity was around US$ 115 per megawatt-hour (Mwh). At an estimated

[1]World Bank, "Growing Africa:Unlocking the Potential of Agribusiness", 2013.

18 per cent loss rate, this translates (for generation costs alone) into around US$ 140 per MWh consumed, still without provision for the other substantial costs related to power supply. Further, these additional costs, including the transmission and distribution infrastructure and retail costs, can add US$ 50 - US$ 80 per Mwh to the average cost to consumers. The high cost of electricity generation may also be one of the reasons for Sub-Saharan Africa to have the lowest access to electricity rates, compared to other regions in the world. Industrial activities are also compromised because of these high prices. In the formal sector, 5.2 per cent of the annual sales of firms are lost due to electrical outages in Sub-Saharan Africa. This situation is much worse in the informal sector, with power outages causing upto 16 per cent loss of sales revenues.

Since African countries are rich in resources, lack of power does not completely restrain growth. This kind of growth, however, comes at a significant cost. In the commercial, industrial, and residential sectors, many individuals and businesses own their own generators to make up for the lack of access to and supply of energy. Investment in generators, are an equally costly affair, costing nearly three times the price of purchasing electricity from the public grid. Even if subsidies are considered, it would still be more expensive. This additional cost may be a tradeoff for ensuring continuous electricity. Grid power in Africa is intermittently or entirely unavailable for many firms affecting businesses. Due to this, some businesses make adjustments in the form of choice of business, choice of location, output reduction, factor substitution and self-generation. In larger firms, the additional price for generator power is a necessary and acceptable cost of doing business.

Further, the cost of power generation technology generally represents only part of the total cost of providing electricity. If a centralized grid is used, transmission and distribution can add significantly to the total supply costs. Centralized grids require substantial investments in high voltage transmission lines, transformers, as well as medium- and low-voltage distribution networks. The cost per unit of energy delivered depends heavily on the length of the system and the demand density. While a centralized grid may be the cheapest solution for a large city, an off-grid or mini-grid system will usually be more economical for a remote dwelling or community. According to an IRENA Report, the grid cost will on average be of the same order of magnitude as the level of investment required for the power supply units, effectively doubling the investment needs. It is also pertinent to note that, though the unit cost of fossil-fuel based generating plant is low, it is offset by the grid costs, potentially making off-grid solutions with renewables the most economic approach today.

Case for Switching to Renewable Sources

Africa's power sector is highly dependent on coal, oil and gas, accounting for nearly 80 per cent of Africa's total power generation. Excessive dependence on these fossil fuel powered plants creates a problem of supply and price variability, apart from having its environmental implications. Further, large transmission and distribution losses have resulted in low access to electricity and thus a greater dependence on generators, which equally add to costs. While Africa contributes the least to greenhouse gas (GHG) emissions, it is most vulnerable to climate change impacts such as droughts and reduced agricultural yields. Thus, there is an increasing need for Sub-Saharan countries to design low-fuel, low-carbon power systems for electricity generation. Renewable energy can alleviate the problem of access to energy, especially in remote locations of Africa where the cost for transporting electricity from large-scale power plants is significantly high.

Renewable power accounts for 19 per cent of Africa's total power generated in 2014. Hydroelectricity dominates Africa's renewable power segment, other non-hydroelectric renewables include electricity through solar, wind, tide and wave. However, hydroelectricity generation in Africa is only 5 per cent to 10 per cent of its total technical potential. The remaining hydropower technical potential, which is between 100 GW to 150 GW, would require significant investments in transmission lines to connect projects to demand centres. Further, climate change is projected to also have a significant impact on hydropower generation, particularly due to the projected erratic rainfalls in the coming years. There is an increasing need towards shifting to alternative sources of energy, particularly solar, wind, tide, wave and biomass. Africa's varied climatic zones provide sufficient resources in the form of sunlight, wind, waves, and biomass, among others.

Africa's wind potential with a capacity factor of above 30 per cent exceeds 300 GW, most of which is still untapped. However, the end-use of Africa's wind potential will require significant investments in transmission systems to connect these resources to their demand centres, raising the supply costs by 0.05 US$/Kwh to 0.20 US$/Kwh. The recent investment costs for projects in Kenya, Morocco and South Africa ranged between 1,600 US$/Kwh and 3,000 US$/Kwh, which is much higher than installed costs in other developing countries such as India and China.

Bioenergy as a source of electricity is yet to be explored to its fullest potential in Africa. The primary challenge of biomass electricity is the cost involved in collecting and transporting residues. Further, issues like waste management and climate change make it less attractive.

In order to reduce transportation costs, mini and off-grid sources of electricity, especially from sources like solar, offers increasing potential to electrify homes in many rural areas of Sub-Saharan Africa.

Africa's Solar Power Potential

Majority of the African continent lies between the Tropic of Cancer and the Tropic of Capricorn; and the equator passes through Gabon, Republic of Congo (Congo), the Democratic Republic of the Congo (DR Congo), Uganda, Kenya and Somalia. Africa has a huge resource of high quality solar power, particularly North Africa and some parts of Southern and East Africa.

Though there is large technical potential for concentrating solar power (CSP) and photovoltaics (PV) in Africa, the key factor holding back the development of solar power in Africa being its price and variability. Technological developments, however, have resulted in rapid cost reductions for solar PV, which declined by 75 per cent from 2009 to 2015. As a result, the levelised costs of electricity (LCOE) for African utility-scale solar projects has also declined rapidly, ranging between US$ 0.13 and US$ 0.26 /Kwh during 2013 and 2014. The lowest cost in Africa for utility-scale PV solar project is less than US$ 0.075 /Kwh in South Africa, which is among the most competitive PV projects worldwide. This cost gap signifies the immense potential of cost reduction for other African countries. For Africa, there is a need for an increasing co-existence of both, CSP and PV solar systems.

Power Trade in Africa

All five power pools in Southern Africa Power Pool (SAPP), Western Africa Power Pool (WAPP), Eastern Africa Power Pool (EAPP), Central Africa Power Pool (CAPP) and Comité Maghrébin de l'Electricité (COMELEC) (for North Africa) are recognized specialized institutions in their respective Regional Economic Communities (RECs). Although all power pools are working towards promoting energy trade,

the level of energy traded in 2009 ranges only between 0.2 per cent (in CAPP) and 7.5 per cent (in SAPP).

Pooling energy resources through regional power grid promises to reduce power costs. If pursued to their full economic potential, regional grid could reduce the annual costs of power system operation and development by US$ 2 billion per year – about 5 per cent of total power system costs. The cost of power trade between regions in Africa also depends on the intra-regional transmission connectivity. On an average, 7 per cent of the generated power is lost during intra-regional power trade in Sub-Saharan Africa. The situation is even worse for North Africa, with a distribution loss of 20 per cent in intra-regional trade, mainly due to the large distances and climate impact.

Potential and Prospects for Development of Power Sector in Africa

Electrification is strongly correlated with the GDP size of an economy. According to a McKinsey Report, inadequate electric supply along with high costs, would slow down GDP growth by 1-3 percentage points. Lack of timely and quality access to electricity, reduces revenues of businesses making it uncompetitive, slowing job growth, and affecting GDP per capita and thus growth.

The study therefore establishes a relationship between electrification rates and GDP per capita. Countries with electrification rates of less than 80 per cent of the population generally have comparatively low GDP per capita. The only countries that are exception to these are those with significantly endowed natural resources, such as Equatorial Guinea, Angola, Botswana and Namibia.

There exists immense potential for the power sector development in Africa. The study establishes that if Africa's GDP grows at an annual average rate of 4.6 per cent, the annual electricity demand is expected to increase by 7.6 per cent. In order to tap this potential, an enabling environment needs to be created through a stable policy and investment environment and appropriate developmental policies along the power value chain.

Power policies in African economies have generally focused on generation to address low access situation. The traditional approach leads to developmental plans falling down at other steps in the value chain and slow power sector development. However, in order to sustainably develop the power sector in Africa there is an increasing need to first breakdown the power value chain, analyze its individual components, and accordingly design power policies incorporating the shortfalls in each of them.

In Africa, most governments need to streamline sectoral **governance** and **promote efficiencies** through, inter alia, better maintenance of existing infrastructure, institutional reform of utilities and service providers, administrative and regulatory reforms, and improved subsidy policies and practices. Addressing these could save nearly 20 per cent (US$ 17 billion/year) of the US$ 93 billion required annually to fill the infrastructure gap in Africa. Reverse-bid auctions and tendering mechanisms have ensured full government control over technology choice and project size, apart from having electricity generation at competitive prices. Additionally, price-revealing function of auctions may result in notably lower prices. To further make the most of reverse-bid auctions and tendering mechanisms other criteria on environmental impact, increase in local manufacturing content may also be imposed.

Investing in **off-grid renewable energy** is an attractive option, where most of the population either has no access to grids (mainly due to distance frontier) or finds it unaffordable to connect to the grid. Off-grid solar energy, in particular, can enable users to access

lighting and in some cases afford mini renewable-based electricity generators. Further, according to the World Bank's Enterprise Surveys, 39.3 per cent of the firms surveyed identify electricity as a major constrain to doing business. Tackling the energy challenge, especially in urban areas, can improve the performance of African firms as well as attract greater investments.

While off-grid power generation systems are the best possible option for the power problem in Africa, off-grid systems based on solar or wind require electricity storage to make them truly useful. The present electricity storage systems that either exist or are under development in Africa, are expensive and tend to be best suited to large-scale applications. Nevertheless, with improved technologies and rapidly falling prices for solar generation, there have been developments in electricity storage facilities thus providing the potential for small-scale, off-grid power networks.

Further, African countries can also enter in the production chain of manufacturing materials and components required for power generation plants and distribution lines to encourage local sourcing. African companies could also enter the construction, operation and maintenance stream for power projects. Local sourcing may thus reduce costs. Such participation may be particularly high in case of renewable energy technology; nevertheless, these opportunities differ by the type of renewable electricity. For hydropower projects, civil works that can be carried out with local resources can represent up to 65 per cent of the value chain. For geothermal projects, more than half of the investment costs can be sourced locally. Different technologies offer different short-term opportunities for Concentrating Solar Power (CSP) projects. The vacuum tubes and parabolic mirrors required in parabolic trough plants are produced in a few dedicated facilities in Europe and the US, and would require massive scale-up before considering local manufacturing. For solar towers, the other main CSP technology, the flat mirrors, mirror support structures, heliostats and the tower itself, can be produced locally in many countries. This enables up to 60 per cent of the capital expenses for CSP solar towers to be sourced locally.

- ***Role of Private Sector***

The international private sector is set to play a crucial role in addressing the African continent's energy deficit. Presently, African countries including Côte d'Ivoire, Nigeria and Senegal have preferred to promote public-private partnerships (PPP) to address the power deficit situations in their respective countries. On the other hand, Ethiopia and Tanzania's power sector development has mainly been restricted to their respective governments. Countries like South Africa and Kenya have chosen the hybrid routes through IPPs.

Globally, private investment in infrastructure has been a successful model. In the coming years, with the increasing demand and the lack of resources, especially financial resources, of some African nations, PPP structures would serve useful. The 250 MW Bujagali Hydroelectric Power Plant in Uganda is the largest private sector investment in the region, with an investment of US$ 900 million. The Project is a public-private partnership owned by Sithe Global of the USA, Industrial Promotion Services of Kenya (which is owned by the Aga Khan Fund for Economic Development), and the Government of Uganda.

Given the vast prospects of the power sector in Africa, other foreign governments, including the US, the UK and Norway, are also collaborating with the international private sector for electricity generation, transmission and distribution in the continent.

- ***Finance for Power Projects***

According to the PIDA, Africa's energy demand is expected to increase to 3,100 terawatt-hour by 2040. Against this demand, installed capacity is

expected to increase by only 700 GW. Further, it is also estimated that Sub-Saharan Africa will need a capital investment of nearly US$ 835 billion by 2040 to be able to supply this growing electricity demand. This includes US$ 490 billion for generation capacity and an additional US$ 345 billion for transmission and distribution networks. On the other hand, the current annual power sector investment in Africa is less than US$ 5 billion. Putting this into perspective, the estimated investment requirement to cater to the growing electricity demand in Sub-Saharan Africa for the power sector alone accounts for one-fifth its projected GDP size in 2040.

So far, private sector investments have mainly been in areas such as mobile telephones, thermal power plants, and container terminals because it is easier to estimate the risks and net cash flows associated with such assets. In other areas, such as power, water, and railways, the private sector has preferred the use of concessions and other types of contracts. Financing infrastructure projects has traditionally been challenging, simply because of the nature of investment, which are large in size and having a long maturity period. Establishing infrastructure as an asset class could target dedicated investors such as impact investors or crossover investors such as sovereign wealth funds. Investments in project specific bonds, such as green bonds, have been relatively easier to market and distribute to institutional investors.

In order to achieve this level of investment, there is a need to steadily improve the investment conditions for electricity access-related projects. There is an increasing need for clarity in the investment framework, market transparency and consultation over the pace of grid extension in Africa. This would allow the stakeholders to make informed decisions. Directing the finances to more efficient energy solutions would build credibility to the investments in Africa, apart from creating new business opportunities and improving energy security.

- ***Developing Linkages with Investment Promotion Agencies***

Many countries in the Africa have set up specialized investment promotion agencies/ Chambers of Commerce to promote and facilitate inflow of foreign investment into these countries, while also serving as one-stop-shop for investment related activities. In light of the key role of these institutions, building closer cooperation and linkages between these investment promotion agencies in Africa would serve to enhance access to information about investment opportunities in the region.

Such relationship would serve to enhance knowledge about potential areas for investment, particularly in the power sector, upcoming projects, prospective investment partners, as also procedures, rules and regulations required for venturing into specific sectors in these countries and incentives offered to investors. Further, investment promotional events with select investment promotion agencies would foster increased interaction between potential investors and concerned agencies in potential sectors in target countries in the region.

- ***Making electricity more Affordable***

Electricity connection charges can be made affordable in two ways. The first way is to reduce the electricity tariffs, by adopting less expensive technical specifications. This would mean the cost of obtaining electricity, in the form of cost to internal wiring incurred by new consumers, needs to also go down. Methods of charging these could also be revised, connection fees may be charged across a period rather than having an upfront cost. This would increase the coverage of access to electricity, by allowing households with lower income to also obtain electricity, rather than incurring the same amount of expenditure from the substitution of electricity for kerosene and batteries.

According to the world Bank, making electricity connection and consumption more affordable while minimizing utilities' financial losses is a priority in Sub-Saharan Africa. Select ways of making power affordable include:

- **Improving operational efficiency:** Reduction in combined transmission, distribution, and bill collection losses to 10 per cent of transmitted electricity, would reduce deficits in one-third of Sub-Saharan Africa.
- **Increasing tariffs in most cases:** Funding gap cannot be bridged solely by eliminating operational inefficiencies, there is a need for tariff increase as well tariff increases are likely needed. Small and frequent tariff increases may find wider acceptance, as long as electricity access is reliable.
- I**nstalling individual metering:** Balking at the high, upfront cost of connection, poor households tend to share one electricity meter. That often makes them ineligible for subsidized rates. Individual meters in poor households can help utilities target subsidies better.
- **Installing prepaid meters that would benefit both utilities and customers:** For low-income households, the ability to pay in small increments helps align electricity payments with income flows, while utilities are guaranteed payments upfront.
- **Sharing connection costs:** The first priority in increasing access to electricity is to make the initial connection affordable to the poor. One option is to share the costs across all electricity users, including large- and medium-size firms.

Way Forward: Role of India

Investment in clean energy and power generation from renewable sources have been on a rise in India, largely at the back of energy security concerns, government support, initiatives taken on account of climate change, increasing cost competitiveness of renewable energy technology, distributed electricity demand, favorable foreign investment policy, and vast untapped potential.

As a result, India's renewable energy installed capacity has grown at a stupendous pace from 3.9 GW in 2002-03 to about 35.8 GW in March 2015. Programmes such as Grid Connected Rooftop and Small Solar Power Plants Programme have significantly helped in meeting the energy demands by encouraging installation of rooftop solar photovoltaic power generation plant for self-consumption as well as supply/sale of electricity to the grid. Similar programmes, if successfully implemented in African countries, can help bridge the power deficit in these countries and reduce the impact due to power outrages arising from conventional sources of energy.

India's commitment to reduce its carbon emissions per unit of GDP growth by 33 to 35 per cent by 2030 from the 2005 levels is further expected to increase the focus on renewable energy sector, and improve the prowess of the companies engaged in the renewable energy sector of India. India's experience in the renewable energy sector can be of immense benefit to the African countries in their efforts towards sustainable development. Already, there are several instances of Indian companies engaging in development of renewable energy sources in the African continent for the mutual benefit of both parties.

Biomass gasification has been successfully applied in India and rice-husk gasification is a widely deployed technology. To produce electricity, piles of rice husk are fed into small biomass gasifiers, and the gas produced is used to fuel internal combustion engines. The operation's by-product is rice-husk ash, which can be sold for use in concrete. Several equipment suppliers are active and one, Husk Power Systems (HPS), has installed 60 mini power plants that

power around 25,000 households in more than 250 communities. These systems have low investment costs (US$ 1,000 to US$ 1,500/ kW) and have overall efficiencies of 7 per cent to 14 per cent, but are labour-intensive in maintenance and operation. India may share its expertise in Biomass gasification with Africa.

Important public infrastructure and power projects in Africa funded totally or in part by India's lines of credit (LOCs) have also made it possible for state-owned companies to extend their footprint in African economies.

With the many African countries being part of over 120 prospective members for International Solar Alliance (ISA), there exist scope for further alliance between India and the region on solar energy. This is especially so, given the strong focus of the governments in the region on rural electrification and the inadequate grid connectivity which renders cooperation on specialized solar power an attractive proposition.

Investing in Power Systems in Africa are emerging as important markets for Indian companies. With around 600 million people without electricity in the continent, there is an urgent need to bridge the gap by adding capacity in Africa.

In the power sector, the first large turnkey project export by an Indian company was done by Bharat Heavy Electricals Limited (BHEL) in Libya in 1977, and since the past few decades, several Indian companies have been expanding their operations in the field of exports. Power systems in Africa are emerging as important markets for Indian companies. With around 600 million people without electricity in the continent, there is an urgent need to bridge the gap by adding capacity in Africa. Indian Project exporter may leverage this rising gap.

In the generation segment, a majority of Indian boiler-turbine-generator (BTG) manufacturers have forayed into the engineering procurement construction (EPC) segment as a forward integration of their capabilities. Most Indian balance of plant (BoP) players have evolved from general civil contractors, leveraging their competence in civil works. In the T&D segment, transmission tower EPC players offer a range of integrated services including designing, manufacturing, erection, testing and commissioning of transmission line towers. They have significant overseas presence as well, especially in South American, African and Middle-Eastern markets.

Indian companies are also increasingly bidding for projects funded by Multilateral Development Banks (MDBs). In fact, of the contracts secured by India in projects funded by African Development Bank, Asian Development Bank, and World Bank, power sector accounts for the largest share in value terms. Due to their technical expertise and relevant experience in such sectors, Indian companies are often well placed to secure contracts in projects funded by MDBs.

Export-Import Bank of India: Financing Power Sector in Africa

Export-Import Bank of India (Exim India) commenced operations in 1982. The Bank was set up under an Act of Parliament (Export-Import Bank of India Act 1981), for providing financial assistance to exporters and importers, and for functioning as the principal financial institution for promoting the country's international trade. In its endeavour to promote India's international trade, Exim India's vision has evolved from financing, facilitating and promoting trade and investment, to a conscious and systematic effort at creating export capabilities. Exim India today seeks to develop commercially viable business relationships with externally oriented companies.

Africa has always been a focus region for Exim India, and thus a critical component of its strategy to promote and support two-way trade and investment. As a partner institution to promote economic development in Africa, the commitment towards building relationships with the African Region is

reflected in the various activities and programmes, which Exim India has set in place.

Exim India has representative offices in three countries in Africa viz., Abidjan in Côte d'Ivoire, Addis Ababa in Ethiopia and Johannesburg in South Africa. These three offices play key roles in facilitating economic cooperation with the African Region, and are closely associated with several of the Bank's initiatives. The representative offices interface with several multilateral institutions, as well as Indian missions in the region with the aim of increasing bilateral commercial engagements between the two regions.

Exim India's exposure in the power sector to the African region include financing at various stages of new power generation, transmission and distribution projects, as well as improvement in quality of existing power supply. Projects financed by Exim India have positively impacted the access to reliable electricity in several countries in Africa.

- ***Lines of Credit***

To enhance bilateral trade and investment relations, Exim India has in place several lines of credit (LOCs), which are extended to a number of institutions/ agencies in Africa. These LOCs supplement the 'Focus Africa' programme of the Government of India (GOI) and are extended especially to priority sectors, identified by GOI for mutual cooperation and benefit. These LOCs enable buyers in the overseas country to finance developmental projects equipment and other goods and services on deferred payment terms. Besides these operating LOC extended at the behest of GOI, Exim India extends its own commercial LOCs to various financial institutions and other entities in Africa, such as, PTA Bank (covering 17 countries in the eastern and southern African region), BOAD (covering 8 countries in the West African region), Indo-Zambia Bank, Nigerian Exim Bank and Afreximbank. Most of these LOCs have facilitated in strengthening the infrastructure sector of Africa either directly or indirectly. As on April 30, 2017, the total number of operative LOCs to Africa stood at 153 extended to 44 countries and amounting to US$ 7.6 billion. Of these, 148 LOCs aggregating to US$ 7.5 billion, to 41 countries are guaranteed by GOI. Of the 86 power projects valued at US$ 2.05 billion executed / or being executed under LOCs, 55 projects of value US$ 1.54 billion are in Africa (nearly 75 per cent of the total power projects).

- ***Project Exports***

Exim India has been providing a steady stream of support to project activities in engineering, procurement, and construction (civil, mechanical, electrical or instrumental). This includes the provision of specific equipment related to supplies, construction and building materials, consultancy, technical know-how, technology transfer, design, and engineering (basic or detailed). Exim India also supports existing or new projects, plants or processes that require additional assistance in processes such as international competitive bidding, including multilaterally funded projects in India. During 2016-17, 11 power projects amounting to US$ 271 mn covering 7 countries in Africa were being executed by Indian exporters with the support of Exim India.

- ***Buyer's Credit under National Export Insurance Account (NEIA)***

In order to provide further impetus to project exports from India on medium- or long-term basis, especially in the infrastructure sector, in April 2011, a product called Buyer's Credit under National Export Insurance Account (BC-NEIA) was introduced. Under this programme, Exim India facilitates project exports from India by way of extending credit facility to overseas sovereign governments and government owned entities for import of goods and services from India on deferred credit terms. Indian exporters can obtain payment of eligible value from Exim India, without recourse to them, against negotiation of shipping documents. NEIA is a Trust, set up by

Ministry of Commerce and administered by ECGC. As on March 31, 2017, Exim India sanctioned an aggregate amount of US$ 1.86 billion under BC-NEIA for 15 projects in Africa valued US$ 1.87 billion. Of these, the Bank has sanctioned US$ 512.1 million under BC-NEIA for four power projects, including transmission and distribution network in Zambia, Cameroon, Senegal and Ethiopia

- ***Finance for Joint Ventures Overseas***

Further, Exim India supports Indian companies in their endeavour to globalise their operations, through overseas joint ventures (JVs) and wholly owned subsidiaries (WOS). Such support includes loans and guarantees, equity finance and in select cases direct participation in equity along with Indian promoters to set up such ventures overseas. In the African Region, Exim India has supported several such ventures in countries such as South Africa, Kenya, Mauritius, Ghana, Nigeria, Sudan, Egypt, Zambia, Morocco, Uganda and Tanzania, across a range of sectors like agriculture and food processing, agro-based products, auto and auto components, chemicals, construction, electronics, engineering goods, EPC services, mining and minerals, plastics and rubber products, packaging, pharmaceuticals, software and IT enabled services, and textiles. These ventures serve to promote value addition, as also contribute to capacity building and capacity creation in host countries. As on March 31, 2017, Exim India through its overseas investment finance programme has supported 43 such ventures, set up by Indian companies in 15 countries in Africa with an aggregate sanction amount of ₹ 4.9 billion.

- ***Association with African Development Bank (AfDB)***

India is a member of the African Development Bank (AfDB) Group. Many Indian companies participate in projects funded by the AfDB Group. Exim India works very closely with AfDB and has an active programme which offers a range of information, advisory and support services to Indian companies to enable more effective participation in projects funded by multilateral funding agencies, including AfDB. Exim India assists Indian companies in projects supported by AfDB by not only fund and non-fund based assistance, but also by providing advance alerts on upcoming opportunities. With support from Exim India, Indian project exporters have secured a number of overseas contracts in Africa in sectors such as power, telecommunications, transport, water supply and sanitation. Exim India and AfDB have also signed an agreement for co-financing projects in Africa. The agreement envisages joint financing of projects (priority being given to support projects of small and medium enterprises) in regional member countries of AfDB. Exim India also organizes Business Opportunities seminars in Projects funded by AfDB across various centres in India.

Africa – India Partnership Day

Exim India together with FICCI (Federation of Indian Chambers of Commerce and Industry) organizes the Africa – India Partnership Day, on the sidelines of AfDB's Annual Meeting, with an objective of sharing India's developmental experiences with Africa, particularly in Public-Private Partnership model of financing infrastructure development. Exim India, along with FICCI, has so far hosted three such events; first being on May 30, 2013 in Morocco; followed by Rwanda on May 22, 2014; Côte d'Ivoire on May 27, 2015; and Zambia on May 24, 2016. The Africa-India Partnership Day has become a regular feature of the AfDB Annual Meeting, and showcases the immense scope for expanding the mutually enriching partnership between Africa-India.

- ***Kukuza Project Development Company (KPDC) in Africa***

Africa is a region of opportunities, as the continent is receiving plenty of investments in the infrastructure space. The PPP structure is slowly getting popularised by the national governments, increasing the interest

of the private sector in infrastructure development. However, institutional capacity in several African nations is in a nascent stage.

Addressing the limited institutional capacity in Africa on conceptualisation, management, execution and imparting project development initiatives, Exim India, along with IL&FS and State Bank of India, joined hands with the AfDB, and promoted a Project Development Company for infrastructure development in Africa.

The Company, named Kukuza Project Development Company (KPDC), has been incorporated in Mauritius in July 2015. 'Kukuza' in Swahili means 'a cause to growth'. Reflecting the name, the KPDC is expected to provide specialist project development expertise to take the infrastructure project from concept to commissioning in the African Continent. The KPDC will provide the entire gamut of project development expertise to various infrastructure projects, including as project identification, pre-feasibility/ feasibility studies, preparation of detailed project reports, environmental and social impact assessment.

On the sidelines of the India-Africa Forum Summit (IAFS), which was held during October 26-29, 2015, in New Delhi, Exim India held the inaugural meeting of KPDC.

The KPDC shall utilise the domain expertise of each partner during the project development process to establish a bankable and sustainable implementation format based on an in-depth understanding of the concerns of all the stake holders - public authority, users community, developers/ investors and lenders.

In a Nutshell

In sum, Exim India, with its comprehensive range of financing, advisory and support services, seeks to create an enabling environment for enhancing two-way flow of trade, investment and technology between India and the African Region. While promoting infrastructure development and facilitating private sector development in host countries, the various efforts of Exim India, ensconced in its range of activities, also contribute towards institutional building in the African Region.

1. Background

According to the African Economic Outlook 2016, real GDP of Africa is expected to grow at 3.7 per cent in 2016[1], as compared to 3.6 per cent in 2015, reflecting the gradual improvement in international and domestic conditions. In 2015, Africa's growth was manly driven by the strong agricultural output in select countries which overweigh the slowdown in resource rich countries due to the fall in commodity prices during the year. Other factors which also determined growth during the year were strong private consumption and investment in the construction sector. Though in 2015 Africa's growth, as a whole, was resilient amid a weak global economy and lower commodity prices, its economic outlook is vulnerable to commodity price shocks and global economic performance. Further, economies in Africa are at different levels of development.

On the hindsight, most countries in Africa are mineral resource-rich, whose potential are largely untapped. Africa also has the advantage of a young and growing population and is projected to have the fastest urbanization rate in the world[2]. The continent also has a huge potential to develop a strong manufacturing sector, which could play a significant role in economic development of the continent, which include creating employment opportunities, catering to domestic demand, and generating exports surplus, among others.

However, the need of the hour for Africa today is to address huge infrastructure deficit that crippled the continent, which include road and rail connectivity, access to power, healthcare and telecom, among others, and to create enabling environment for growth and development. Ironically, for a continent that has a potential to dominate in energy supply globally, power remain the largest infrastructure challenge faced by the continent.

The study delves into the existing situation of the power sector in Africa, the challenges to its development and the strategies for enhancing power supply in the continent. It also highlights avenues for enhancing India's power sector engagements in the region.

[1]African Economic Outlook 2016, African Development Bank (AfDB), Organisation for Economic Co-operation and Development (OECD), United Nations Development Programme (UNDP)
[2]Lions on the Move II: Realizing the Potential of Africa's Economies, McKinsey Global Institute (MGI), September 2016.

2. Power Sector in Africa: Current Scenario

An irony to the power situation is that Africa, particularly Sub-Saharan Africa, is rich in energy resources, but is very poor in energy supply. An overview of the current scenario in the power sector of Africa is broadly based on select parameters namely, access to electricity; consumption, generation and distribution losses; and cost of power.

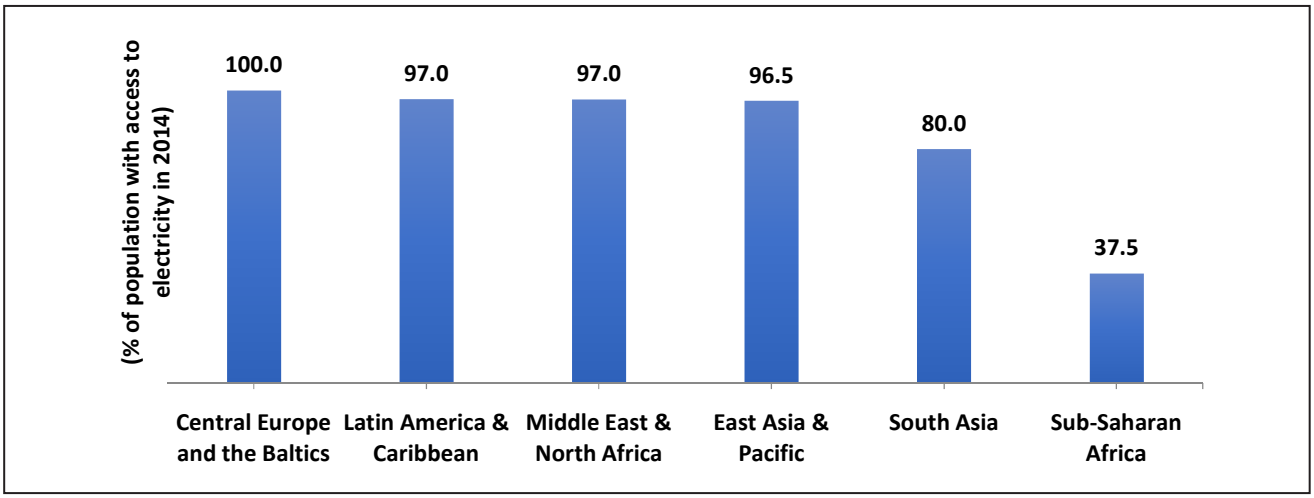
2.1. Access to Electricity

Access to energy is essential for poverty reduction and economic growth. Energy has been a crucial input for the production of nearly all goods and services. Further, sustainable growth, through industrialization, increase in agricultural productivity, education, communication and healthcare, also depend significantly on reliable availability of electricity.

Countries in Sub-Saharan Africa have varying levels of electrification, which is measured by the percentage of the population having access to electricity. On an average, Sub-Saharan African countries have an electrification level of nearly 37.5 per cent . Access to electricity in Sub-Saharan Africa is the lowest in the world, as compared to 97 per cent of Latin America and the Caribbean (LAC) in 2014, Middle East and North Africa (MENA) (97 per cent), and South Asia (80 per cent) **(Chart 2.1)**. Globally, 85.3 per cent of the world population has access to electricity.

Globally, Sub-Saharan Africa countries are generally among lowest ranks in terms of access to electricity. Select countries among these (that rank the lowest in terms of access to electricity in Africa) include South Sudan (4.5 per cent of population with access to electricity in 2014), Burundi (7 per cent),

Chart 2.1: Region-wise Access to Electricity



Note: Data pertains to 2014
Source: World Bank database; and Exim Bank Analysis

[3]For the purpose of this study, energy implies electricity/power.
[4]Measured in terms of 'access to electricity (% of population)'; data is sourced from World Bank Statistics and pertains to 2012 (latest available)

Chad (8 per cent), Liberia (9.1 per cent), and Malawi (11.9 per cent). Among the larger economies[5], countries with low access to electricity include DR Congo (13.5 per cent), Tanzania (15 per cent), Ethiopia (27.2 per cent), Angola (32 per cent), Kenya (36 per cent) and Nigeria (57 per cent), and among others **(Annexure I)**.

On the other hand, few African countries have also shown significant improvements in access to electricity. Swaziland, which had 36.5 per cent of its population with access to electricity in 2005, improved to 65 per cent of its population having access to electricity in 2014. Similarly, Ghana improved from 54.9 per cent in 2005 to 78.3 per cent in 2014, Cabo Verde from 67 per cent in 2005 to 90.2 per cent in 2014 and Comoros from 51.6 per cent in 2005 to 73.8 per cent in 2014.

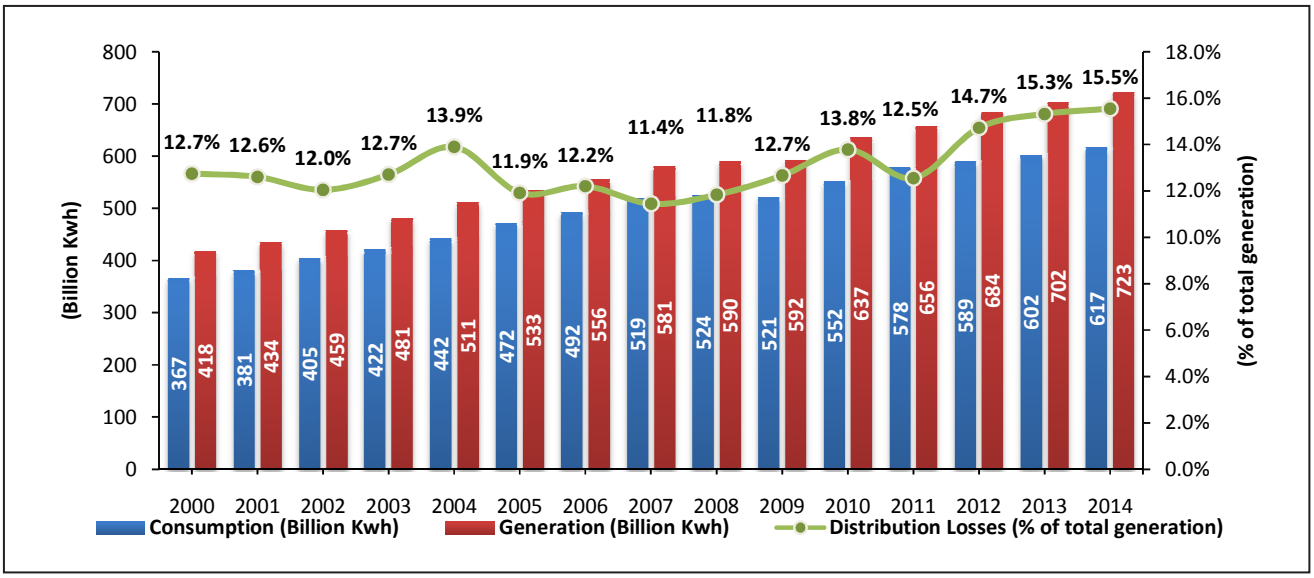
2.2. Consumption, Generation and Distribution Losses

Africa's electricity generation increased to 723 billion kilowatt hours (Kwh) in 2014 from 418 billion Kwh in 2000 **(Chart 2.2)**. Major producers of electricity in the region are South Africa (32.7 per cent of Africa's total power generated in 2014), Egypt (22.5 per cent), Algeria (8.4 per cent), Libya (4.9 per cent), Nigeria (4 per cent), Morocco (3.8 per cent), and Tunisia (2.5 per cent). South Africa has traditionally dominated Africa's power generation **(Annexure II)**.

Similarly, electricity consumption has also increased to 617 billion Kwh in 2014 from 367 billion Kwh. Major consumers of electricity in Africa include South Africa (34.5 per cent of Africa's total consumption in 2014), Egypt (23.3 per cent), Algeria (8 per cent), Morocco (4.7 per cent), Nigeria (3.9 per cent), and Tunisia (2.4 per cent).

Per capita electricity consumption in Africa is one-fifth the global average, and there are wide variations both within and between countries[6]. In some countries, most of the generated electricity is either directly produced or flows directly to these operations, bypassing a significant part of the population, thus reducing the access to electricity[7]. This may explain why large economies that have relatively high

Chart 2.2: Power Consumption/ Generation/ Distribution Losses in Africa



Source: U.S. Energy Information Administration; and Exim Bank Analysis

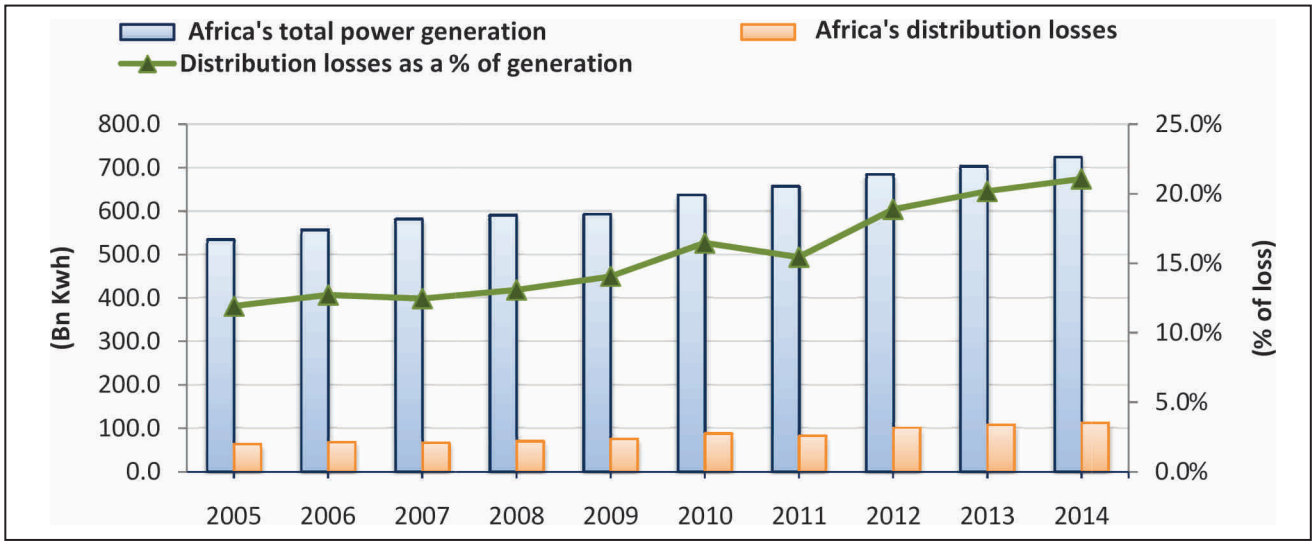
[5]Source: U.S. Energy Information Administration; and Exim Bank Analysis
[6]International Energy Agency, World Energy Outlook 2016.
[7]KPMG Sector Report, Power in Africa, 2015.

power generation compared to its peers, have low percentage in access to electricity. In some countries, on the other hand, enterprises chose to share or have their own power generators. According to World Bank Enterprise Survey[8], 50.9 per cent of the firms in Sub-Saharan Africa either own or share a generator. As in the case of South Africa, which is the largest producer and consumer of electricity in Africa, still has a relatively lower access to electricity rate (86 per cent), compared to countries in the region such as Algeria, Tunisia, Egypt, Seychelles, Mauritius, and Libya, which have nearly 100 per cent electricity access rates. Further, the share of firms that own or share a generator in South Africa is also low at 18.4 per cent. Thus, implying the possibilities of firms having access to electricity directly from the grids. As in the case of Nigeria, which is the largest economy in Africa, has one of the lowest rates of net electricity generation per capita in the world[9]; with the rate of firms owning or sharing a generator as high as 70.7 per cent. Nevertheless, purchase of generators is an equally costly affair, further adding to the cost of doing business.

Furthermore, the quality of electricity for those with access is also questionable. In Africa, most people with access to electricity suffer from load shedding and blackouts. According to the World Bank, an average Sub-Sahara African firm faces power outages 5.4 hours 8.3 times in a typical month. This case is much worse in select Sub-Saharan economies, Nigeria experienced an outage of 11.6 hours 32.8 times in a typical month in 2014. This effectively leads to loss of economic activities for 380 hours, averaging to nearly 16 days of a month[10].

The transmission and distribution networks in the region also lack efficiency, resulting in significant electric power distribution losses and reducing the supply ultimately available to end-use sectors. In 2014, the distribution losses in Africa stood at 21.1 per cent of the output **(Chart 2.3)**. Since 2005,

Chart 2.3: Distribution Loss as per cent of Total Generation in Africa



Note: Distribution losses and power generation represented on the primary axis; distribution losses as a % of generation represented on secondary axis
Source: U.S. Energy Information Administration; and Exim Bank Analysis

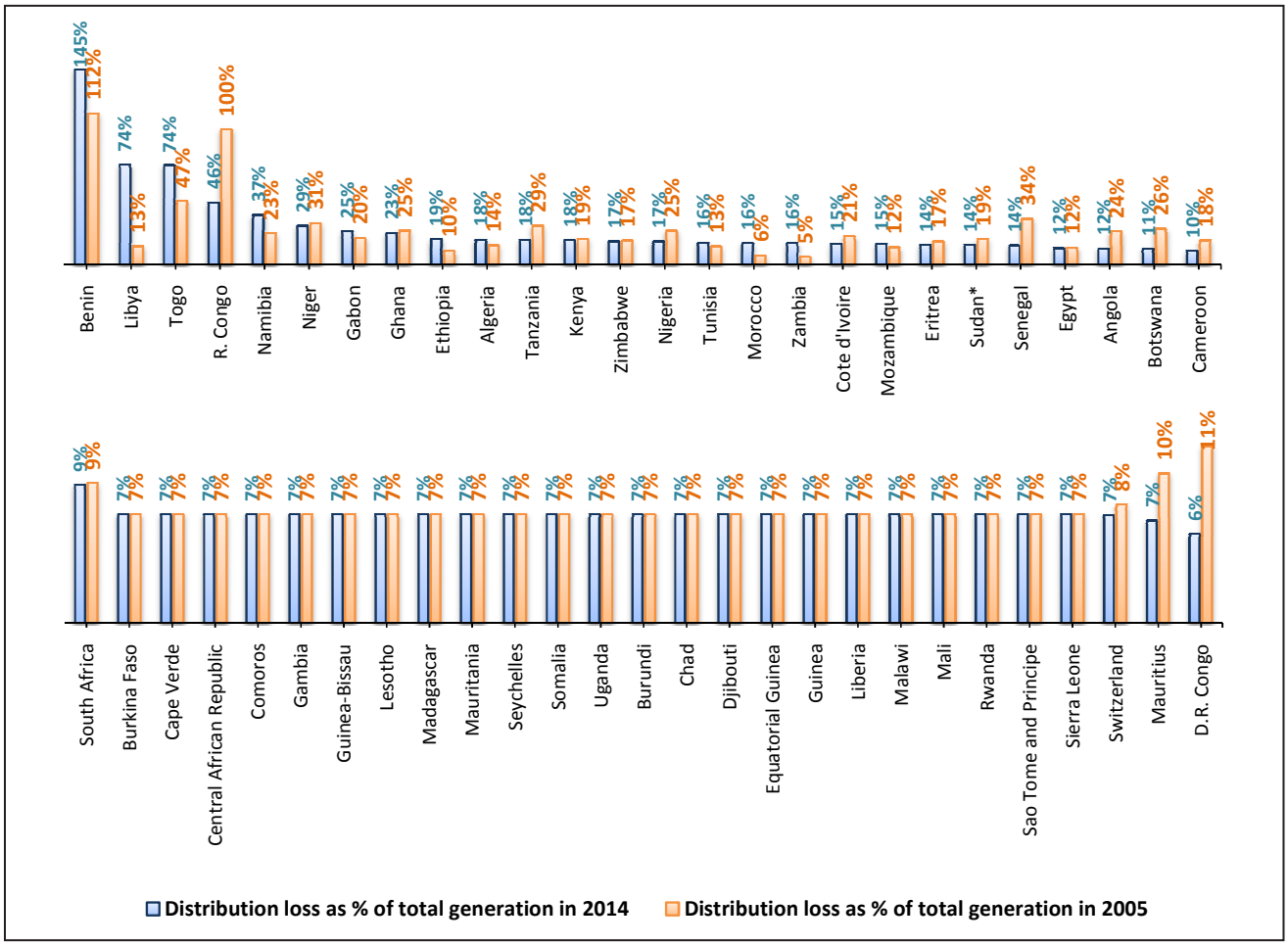
[8]World Bank Enterprise Survey online database (accessed on May 1, 2017) (http://www.enterprisesurveys.org/data/exploretopics/infrastructure#all-countries--1)
[9]Country Analysis Brief: Nigeria, U.S. Energy Information Administration, May 6, 2016
[10]Having an optimistic estimate that the electricity outage may be at any hour of the day, not necessarily during the working hours of a firm.

the ratio of distribution losses to its total generation has deteriorated, worsening from 11.9 per cent in 2005 to 21.1 per cent in 2014. Distribution losses as a percentage of total output is nearly 50 per cent in some countries (more than 100 per cent losses in the case of Benin, implying the loss of imported electricity) **(Chart 2.4)**. On the other hand, select countries that have shown an improvement (reduction) in distribution losses between 2005 and 2015 include Republic of Congo, with an improvement from 100 per cent distribution loss of output in 2005 to 46.1 per cent, Senegal (from 33.7 per cent loss to 13.8 per cent), Botswana (from 26.3 per cent loss to 11.5 per cent), Angola (from 24.2 per cent loss to 11.7 per cent), and Tanzania (from 28.6 per cent loss to 18.1 per cent).

Africa's distribution losses, in absolute terms, stood at 112.4 billion Kwh in 2014; and major countries that have high transmission and distribution losses include Libya (26.3 billion Kwh), South Africa (20.9 billion Kwh), Egypt (19.1 billion Kwh), Algeria (11 billion Kwh), and Nigeria (4.9 billion Kwh). A comparison between generation and distribution losses in actual terms highlights that higher the generation, higher are the distribution losses. This also asserts that increase in generation infrastructure has not been accompanied by an equivalent increase in distribution infrastructure.

Transmission and distribution losses are of two types, technical losses and non-technical losses. Technical losses reflect broken or poorly maintained power

Chart 2.4: Distribution Loss as per cent of Total Generation in African Countries



*Sudan including South Sudan
Source: U.S. Energy Information Administration; and Exim Bank Analysis

lines and transformers; and non-technical losses at the distribution level include commercial losses (where end users are not being billed for power) and collection losses (where end users are billed but revenue is not collected due to non-payment). Technical losses in generation reflect low levels of plant utilization, which can range from 10 – 30 per cent across Sub-Saharan Africa[11]. Further, lack of proper maintenance of power plants along with inefficient system design and operation also affect its full capacity utilization.

Further, within Africa, distribution losses in Sub-Saharan African countries are higher than North African countries, in similar lines with access to electricity. Thus, signifying the importance of distribution infrastructure for a country.

According to the African Economic Outlook 2016, there is a need for better management systems and policies for maintaining key infrastructure, power being one of them. Further, major power projects suffer losses on their lines by nearly 50 per cent, due poor infrastructure (including maintenance, and distribution and transmission). In Sub-Saharan Africa, this irregular electricity production has affected economic activities in Ghana, Nigeria, Senegal and South Africa, among others.

2.3. Cost of Power

The inadequate power transmission and distribution capacity adds to the cost of getting electricity. Across Sub-Saharan Africa in 2012, the average cost of generating electricity was around US$ 115 per megawatt-hour (Mwh). At an estimated 18 per cent loss rate, this translates (for generation costs alone) into around US$ 140 per MWh consumed, still without provision for the other substantial costs related to power supply. These additional costs, including the transmission and distribution infrastructure and retail costs, can add US$ 50 - US$ 80 per Mwh to the average cost to consumers[12].

The cost of electricity generation is significantly higher in many African countries than in other regions of the world. This may also be one of the reasons for Sub-Saharan Africa to have the lowest access to electricity rates, compared to other regions in the world. Industrial activities are also compromised as a result of these high prices. According to World Bank's Enterprise Survey, 5.2 per cent of the annual sales of firms in the formal sector are lost due to electrical outages. The situation is much worse in the informal sector, with power outages causing upto 16 per cent loss of sales revenues[13].

African countries are rich in resources, so although the lack of power inhibits growth, it does not completely restrain it. This growth, however, comes at a significant cost. In the commercial, industrial, and residential sectors, many individuals and businesses own their own generators to make up for the lack of access to and supply of energy. Investment in generators are an equally costly affair, costing three times the price of purchasing electricity from the public grid[14]. It would still be more expensive if the grid power reflected actual costs, which is without subsidies. This additional cost may be a tradeoff for ensuring continuous electricity. Grid power, however, is intermittently or entirely unavailable for many firms affecting businesses. Due to this, some businesses make adjustments in the form of choice of business, choice of location, output reduction, factor substitution and self-generation. In larger firms, the additional price for generator power is a necessary and acceptable cost of doing business.

[11]The Roadmap, Power Africa, USAID, May 2016
[12]International Energy Agency's (IEA) Africa Energy Outlook – A Special Report in the 2014 World Energy Outlook series
[13]African Economic Outlook 2016
[14]Ibid.

Nonetheless, the widespread use of generators in Sub-Saharan Africa distorts the cost of doing business and thus investments. For heavy industries such as smelters, energy costs are a significant proportion of a company's cost base. Apart from heavy industries, use of generators also affects other sectors that act as catalysts to the industrialization of Africa. In Nigeria, for example, diesel fuel is also a major expense for banks to ensure that their branches have electricity. Similarly, diesel fuel is often a major expense for the leading African mobile-phone companies, representing upto 60 per cent of operators' network costs[15]. As a result, businesses that do operate in Sub-Saharan Africa have a much higher relative energy expenses than their counterparts in other countries, thus making the industries uncompetitive.

The power situation of households in Africa is broadly of two types - one is that there is no access to electricity from the grid in the local area, and the other is electricity is available, but at high prices, which makes it unaffordable to households. According to a World Bank study[16], as regards urban electricity access, 93 per cent of Sub-Saharan Africa's urban population are physically at closer proximity to a grid, however, 75 per cent of these have access to electricity connection.

Further, a World Bank study[17] reports that most households that have electricity supply use it primarily for lighting and communications (including radio and television). While those without electricity supply depend on alternative sources such as kerosene lamps, candles, and battery enable torches, among others. The most common source for lighting used by more than two-third of households in Sub-Saharan Africa is kerosene. The cost of purchasing and running these different lighting devices, as well as the quality of light provided differ across households and countries.

Apart from electricity tariffs, there are additional costs that are incurred on obtaining the electricity connection. According to World Bank study[18] the high up-front charges, including utility charges and the cost of wiring, to be borne by a consumer for getting electricity through the grid connection are the major obstacles to making electricity accessible and affordable. Connection charges for a small residential consumer varies considerably from US$ 10 to around US$ 200 in African countries. In some cases, the cost of obtaining electricity includes the administrative costs, while in some it includes the full cost of extending the grid to that particular house.

In addition, the cost of power generation technology generally represents only part of the total cost of providing electricity. If a centralized grid is used, transmission and distribution can add significantly to the total supply costs. Centralized grids require substantial investments in high voltage transmission lines, transformers, as well as medium- and low-voltage distribution systems. The cost per unit of energy delivered depends heavily on the length of the system and the demand density. While a centralized grid may be the cheapest solution for a large city, an off-grid or mini-grid system will usually be more economical for a remote dwelling or community. For instance, according to an IRENA Report, as a rule of thumb, the grid cost will on average be of the same order of magnitude as the level of investment required for the power supply units, effectively doubling the investment needs. It is also pertinent to note that, though the unit cost of fossil-fuel based generating plant is low, it is offset by the grid costs, potentially making off-grid solutions with renewables the most economic approach today[19].

[15]Sourced from Emmanuel Okwuke, "Nigerian telcos spend N10b yearly on diesel to power base stations – Airtel boss," February 2014, dailyindependentnig.com; and published in Brighter Africa, McKinsey & Company, February 2015.
[16]Africa's Power Infrastructure - Investment, Integration, Efficiency, The World Bank Group, 2011
[17]Connection Charges and Electricity Access in Sub-Saharan Africa, World Bank Policy Research Paper 6511, June 2013
[18]Ibid.
[19]Prospects for the African Power Sector, International Renewable Energy Agency (IRENA), 2012.

2.4. Renewable energy

Africa's power sector is highly dependent on coal, oil and gas, accounting for nearly 80 per cent of Africa's total power generation[20]. Excessive dependence on these fossil fuel powered plants creates a problem of supply and price variability, apart from having its environmental implications. Fuel producers artificially hoard electricity supply during times of low prices, and in times of high prices consumers suffer an economic loss[21]. Further, as highlighted in the earlier sections, large transmission and distribution losses have resulted in greater dependence on generators, which equally add to costs. While Africa contributes the least to greenhouse gas (GHG) emissions, it is most vulnerable to climate change impacts such as droughts and reduced agricultural yields. Thus, there is an increasing need for Sub-Saharan countries to design low-fuel, low-carbon power systems for electricity generation. Renewable energy can alleviate the problem of access to energy, especially in remote locations of Africa where the cost for transporting electricity from large-scale power plants is significantly high.

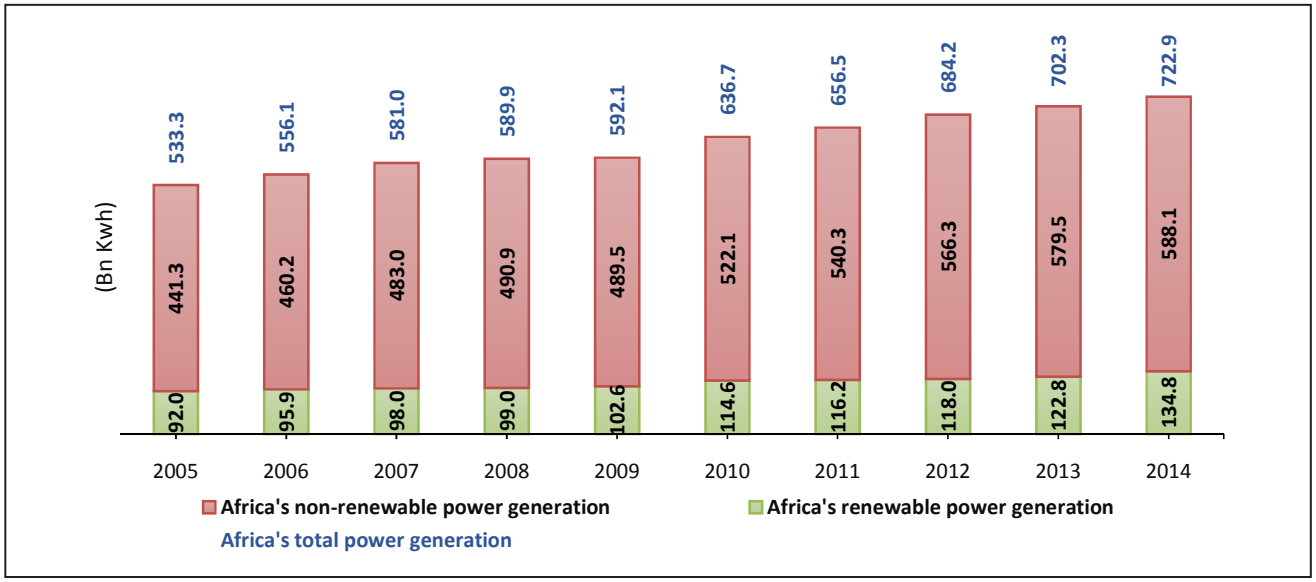
While Africa's renewable power, including hydroelectricity, accounts for 19 per cent of its total power generated in 2014, the renewable power generation has not witnessed significant growth over the past 10 years **(Chart 2.5)**.

- ***Hydroelectricity***

Africa has abundant hydropower resources, mainly dominated by resources from the Congo river, the Zambezi, the Niger river and the Nile. The Central African region has around 40 per cent of Africa's hydro resources, followed by East (28 per cent) and Southern Africa (23 per cent)[22]. The Grand Inga Hydro Power Plant on the Congo River, when fully developed, will have a power generation capacity exceeding 44,000 MW, which is half of Africa's current installed electricity capacity[23].

Hydroelectricity dominates Africa's renewable power segment **(Chart 2.6)**, other non-hydroelectric

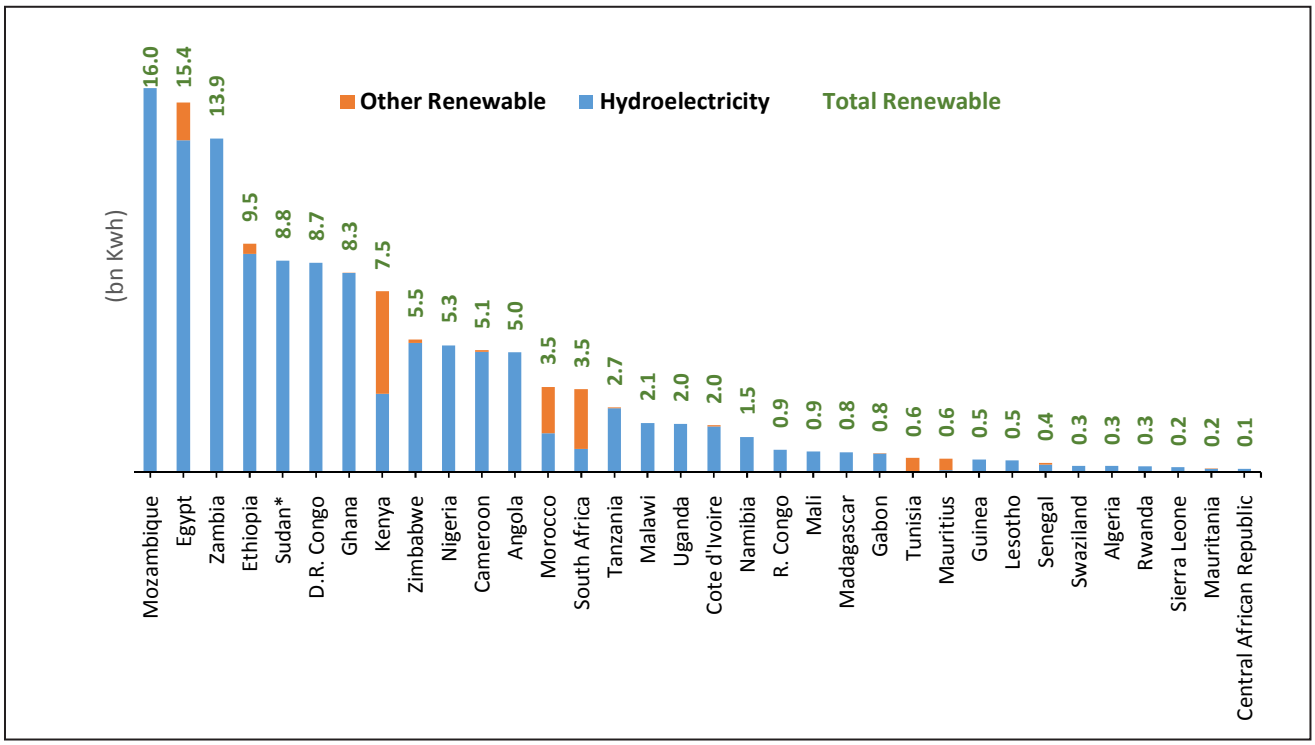
Chart 2.5: Renewable Power Generation in Africa



Source: U.S. Energy Information Administration; and Exim Bank Analysis

[20]IRENA
[21]The energy challenge in Sub-Saharan Africa: A guide for advocates and policy makers, Part 1: Generating energy for sustainable and equitable development, Oxfam Research Backgrounder, 2017
[22]Africa 2030: Roadmap for a Renewable Energy Future, IRENA, 2015
[23]African Economic Outlook 2016

Chart 2.6: Sources of Renewable Power Generation in Africa



Note: data pertains to 2014; *Data for Sudan includes South Sudan
Source: U.S. Energy Information Administration; and Exim Bank Analysis

renewables include electricity through solar, wind, tide and wave. However, hydroelectricity generation in Africa is only 5 per cent to 10 per cent of its total technical potential, equivalent to 10 per cent to 20 per cent of the total economically feasible potential[24]. The remaining hydropower technical potential, which is between 100 GW to 150 GW, would require significant investments in transmission lines to connect projects to demand centres. Further, climate change is projected to also have a significant impact on hydropower generation, particularly due to the projected erratic rainfalls in the coming years. There is an increasing need towards shifting to alternative sources of energy, particularly solar, wind, tide, wave and biomass. Africa's varied climatic zones provide sufficient resources in the form of sunlight, wind, waves, and biomass, among others.

Very few African countries have a significant exposure to the alternate forms of renewable energy (excluding hydroelectricity). These include Kenya, South Africa, Morocco, Egypt, Mauritius and Tunisia.

- ***Solar Energy***

Majority of the African continent lies between the Tropic of Cancer and the Tropic of Capricorn; and the equator passes through Gabon, Republic of Congo, the Democratic Republic of the Congo (DR Congo), Uganda, Kenya and Somalia. Africa has a huge resource of high quality solar power, particularly North Africa and some parts of Southern and East Africa, which have long sunny days.

There are two types of technologies through which solar power is produced, concentrating solar power

[24]Prospects for the African Power Sector, International Renewable Energy Agency (IRENA), 2012

(CSP)[25] and photovoltaics (PV)[26]. According to IRENA[27], Africa's solar power generation potential far exceeds its expected future demand. As at 2015, there were more than 14 GW of solar PV and 6 GW of CSP in Africa, either announced or in the pipeline.

Africa's cumulative solar PV installed capacity has increased substantially in the recent years. Since 2009, solar PV installed capacity increased more than ten-fold from 127 megawatt (MW) to 1,334 MW as at the end of 2014. This growth was mainly driven by the recent capacity additions in South Africa.

Though there is large technical potential for CSP and solar PV in Africa, the key factor holding back the development of solar power in Africa is its price and variability. Technological developments have resulted in rapid cost reductions for solar PV, which fell by 75 per cent from 2009 to 2015. As a result, the levelised costs of electricity (LCOE)[28] for African utility-scale[29] solar projects has also declined rapidly, ranging between US$ 0.13 and US$ 0.26 /Kwh during 2013 and 2014. The lowest cost in Africa for utility-scale PV solar project is less than US$ 0.075 /Kwh in South Africa, which is among the most competitive PV projects worldwide. This cost gap signifies the immense potential of cost reduction for other African countries. At the same time, PV solutions for rural areas can play a vital role in enhancing off-grid energy access.

The CSP market is small compared to the PV market. As of March 2015, Algeria, Egypt, Morocco and South Africa are front-runners in the continent commissioning six CSP projects with an installed capacity of just over 180 MW. However, CSP projects in Africa are catching up. Botswana, Namibia, Sudan, Tunisia have projects with total installed capacity of 6.4 GW underway.

Theoretically, while CSP requires land area with high direct solar irradiances, typically deserts, PV can be universally used in applications ranging from household systems to utility-scale. However, given the geographic positioning of Africa, CSP is equally attractive because its efficiency increases with irradiation level, which is not the case for solar PV where efficiency declines with rising collector temperatures. Further, CSP also allows to store solar energy as heat, which can be used to generate electricity when there is low or no sunshine. CSP systems are capital intensive, with investments ranging between 5,800 US$/KW (for those with no storage) and 10,150 US$/KW (with 7 hours of storage) for the six projects in Africa. This is far higher than 1,820 US$/KW to 4,880 US$/KW for PV systems. With new technology, this cost has been declining and is expected to fall further in the coming years. For Africa, there is a need for an increasing co-existence of both, CSP and PV solar systems.

Africa's market for basic solar-powered lights, basic charging systems and appliances and small home solar systems has been increasing in the recent years. This has also gradually seen the rise of off-grid solutions through pay-as-you-go (PAYG) solar companies. Select PAYG companies in Africa include M-Kopa, Off-Grid Electric, d.Light, Bboxx, Nova Lumos and Mobisol. These companies sell solar power products ranging from basic solar-powered lights to small home solar systems against a small upfront payment and regular 'top-ups', usually sent via mobile money services. These companies are primarily in East and West Africa. In East Africa, Bboxx sells about 200 small-scale systems per day, which has a 50W roof mounted solar panel and a lead-acid battery, it also sells phone chargers and LED lights[30].

[25]CSP plants use mirrors to concentrate sunlight onto a receiver, which collects and transfers the solar energy to a heat transfer fluid that can be used to supply heat for end-use applications or to generate electricity through conventional steam turbines (Source: IRENA).
[26]PV, also called solar cells, are electronic devices that convert sunlight directly into electricity (Source: IRENA).
[27]Africa 2030: Roadmap for a Renewable Energy Future, IRENA, 2015
[28]The LCOE of a given technology is the ratio of lifetime costs to lifetime electricity generation, both of which are discounted back to a common year using a discount rate that reflects the average cost of capital (Source: IRENA)
[29]A solar facility with a threshold size of 10 MW
[30]Global Trends in Renewable Energy Investment 2017, UN Environment's Economy Division in cooperation with Frankfurt School, UNEP Collaborating Centre for Climate & Sustainable Energy Finance and produced in collaboration with Bloomberg New Energy Finance.

- ***Wind Energy***

Africa's wind energy potential far exceeds its demand. Nevertheless, Africa's wind quality varies across the region. East, North and Southern Africa have particularly excellent wind resources. Mainly the north-west Atlantic coast, the Red Sea coasts, the Horn of Africa, South Africa and Namibia all have high-quality wind resources. Africa's wind potential with a capacity factor of above 30 per cent exceeds 300 GW, most of which is still untapped[31].

In 2014, the total installed wind capacity in Africa was 2,462 MW, with Morocco having the highest installed capacity. Typically most African wind power projects are small, with an installed capacity of less than 150 MW.

Globally, on-shore wind is now one of the lowest-cost sources of electricity available. In Africa, the LCOE range for wind power is between 0.046 US$/kWh to 0.145 US$/kWh for projects installed in 2013 and 2014. However, the end-use of Africa's wind potential will require significant investments in transmission systems to connect these resources to their demand centres, raising the supply costs by 0.05 US$/kWh to 0.20 US$/kWh. The recent investment costs for projects in Kenya, Morocco and South Africa ranged between 1,600 US$/Kwh and 3,000 US$/Kwh, which is much higher than installed costs in other developing countries such as India and China at 1,300 US$/Kwh. Nevertheless, these costs are expected to decline with the prospective shift to procuring locally manufactured components for wind energy[32].

- ***Energy from Biomass Residues***

In the recent years, bioenergy has come to be a significant source of renewable power globally. Biomass residue, from which bioenergy is sourced, is generated at various stages of agricultural and forestry production. Bioenergy as a source of electricity is yet to be explored to its fullest potential in Africa. Currently, it is mainly used for cooking and industrial use. Bagasse is the most important form of biomass for Africa's bioenergy. In 2011, bagasse accounted for 94 per cent of the total installed bioenergy power generation capacity (860 MW)[33]. Most of Africa's biomass electricity potential lies in Central Africa, accounting for nearly 60 per cent of Africa's estimated biomass electricity of 2,631 terawatt hour (Twh). An alternative is co-firing of biomass in coal-fired power plants. However, issues like waste management and climate change make it less attractive. The primary challenge of biomass electricity is the cost involved in collecting and transporting residues. Conversion of feedstocks into fuels or final energy closest to its point of consumption is thus most effective. In cases where the wastes may have negative environmental impacts, there exist cost-effective solutions for their treatment in addition to energy production.

- ***Geothermal Energy***

The availability of high-quality geothermal resources in Africa is limited compared to its wind and solar potential. Africa's estimated geothermal potential is around 15 GW, mainly concentrated in the Rift Valley, particularly Kenya and Ethiopia[34]. As of 2014, the installed capacity of geothermal energy in Africa stood at 606 MW, 95 per cent of which was in Kenya. The overall scope for geothermal plants in Africa is limited because they are highly capital intensive with large upfront costs. They also require a well connected transmission line network.

Renewable energy can play a significant role in Africa's power sector development by increasing the access to electricity across the continent. The right

[31]Prospects for the African Power Sector, IRENA, 2012
[32]Africa 2030: Roadmap for a Renewable Energy Future, IRENA, 2015
[33]Prospects for the African Power Sector, IRENA, 2012
[34]Africa 2030: Roadmap for a Renewable Energy Future, IRENA, 2015

mix of both fossil fuels and renewables is crucial to Africa's transformation.

2.5. Power Trade

Power trading in Africa started in the 1950s through bilateral agreements, first of which was between DR Congo and Zambia. These bilateral arrangements graduated to becoming regional power pools. The first power pool was the Southern Africa Power Pool (SAPP), created in 1995. Currently, there exist five major power pools in Africa.

Southern Africa Power Pool (SAPP): It is a cooperation of the national electricity companies in Southern Africa under the auspices of the Southern African Development Community (SADC), created in 1995. The members of SAPP include all the 15 SADC members namely, Angola, Botswana, DR Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. The members have created a common power grid between their countries and a common market for electricity in the SADC, with South Africa, Zambia and Mozambique being the largest energy producers in the pool. It is now the most advanced power pool on the continent. SAPP introduced the Short-Term-Energy Markets (STEM) in April 2001, which run on daily and hourly contracts. This led to the development of a competitive energy market in the form of a Day-Ahead Market (DAM) in 2003 (with short-term contracts made anonymously through the power pool and where guarantees are required)[35]. South Africa and some North African countries record the largest electricity surpluses on the continent. However, South Africa's electricity surplus relative to its consumption is not very significant, and the country needs to maintain a surplus in order not to overload the grid when demand fluctuates (i.e. between winter and summer)[36]. In addition, SAPP requires South Africa to export surplus electricity to its neighbouring countries. Among SAPP nations, South Africa exports power mainly to Zimbabwe. Mozambique, which had been a net electricity importer, became a net exporter in 1998 with the increase in generation capacity by installing new hydropower projects. In 2014, net exports of South Africa were at 2.7 Twh, and net exports of Mozambique were at 2.5 Twh[37].

Western Africa Power Pool (WAPP): It is a specialized institution of ECOWAS. It was established in 2001 to promote energy trade between member countries. It covers 14 of the 15 countries of the regional economic community (Benin, Côte d'Ivoire, Burkina Faso, Ghana, Gambia, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo). WAPP is made up of public and private generation, transmission and distribution companies involved in electricity operations in West Africa. It has to date, 27 member companies. The WAPP 2011 Master Plan foresees a number of projects that will help achieve the adequate energy trade (which includes a renewable energy proportion of per cent) by 2020. Currently the power trade in WAPP is still under bilateral or multilateral agreements, trade through WAPP is yet to begin[38].

Eastern Africa Power Pool (EAPP): It was established in 2005 with the signing of an Inter-Governmental Memorandum of Understanding (IGMOU) by seven Eastern Africa countries, namely Burundi, DR Congo, Egypt, Ethiopia, Kenya, Rwanda and Sudan. In further development, EAPP was adopted as a specialized institution to foster power system interconnectivity by the heads of states of the Common Market for Eastern and Southern Africa (COMESA) region.

[35]Sourced from SAPP official website (http://www.sapp.co.zw/) and AfDB
[36]KPMG Sector Report, Power in Africa, 2015.
[37]African Economic Outlook 2016
[38]Sourced from WAPP official website (http://www.ecowapp.org/) and AfDB

Tanzania, Libya and Uganda have joined EAPP in March 2010, February 2011 and December 2012, respectively. The EAPP System Master Plan (2011) and the study on the Regional Market Operation Center (RMOC) have projected that the DAM will be fully operational by 2017[39].

The Union of Power Utilities in Africa (UPDEA) assisted Central Africa region in establishing Central Africa Power Pool (CAPP) in 2003. It is still in still in the developmental stage. The North African countries have an Association of Power Utilities, the "Comité Maghrébin de l'Electricité (COMELEC)" established in 1989.

All five power pools in South, West, Central and East Africa and COMELEC are recognized specialized institutions in their respective Regional Economic Communities (RECs). Although all power pools are working towards promoting energy trade, the level of energy traded in 2009 ranges only between 0.2 per cent (in CAPP) and 7.5 per cent (in SAPP)[40].

Pooling energy resources through regional power grid promises to reduce power costs. If pursued to their full economic potential, regional grid could reduce the annual costs of power system operation and development by US$ 2 billion per year – about 5 per cent of total power system costs[41].

Further, at the cross-regional level, select African countries have made significant progress. The Ethiopia-Kenya Power Interconnector and the Zambia-Tanzania-Kenya Power Interconnector will link the SAPP and the EAPP, to create a large regional electricity market[42].

The cost of power trade between regions in Africa, also depends on the intra-regional transmission connectivity. On an average, 7 per cent of the generated power is lost during intra-regional power trade in Sub-Saharan Africa. The situation is even worse for North Africa, with a distribution loss of 20 per cent in intra-regional trade, mainly due to the large distances and climate impact[43].

In the case of renewable power, power trade would require the installation of new high-voltage, direct current (HVDC) electric power transmission systems. This may result in an additional installed cost of nearly 100 US$/KW.

The DESERTEC consortium[44], which proposes to export electricity to Europe, is likely to further develop the renewable energy situation in North Africa, with significant reductions in costs. The DESERTEC initiative proposes to have a capacity installation of 100 GW of renewable capacity producing 400 Twh of electricity for export to Europe by 2050.

[39]Sourced from EAPP official website (http://eappool.org/) and AfDB
[40]Power Trade in Africa and the Role of Power Pools, July 10, 2013, AfDB
[41]Brighter Africa, McKinsey & Company, February 2015
[41]Brighter Africa, McKinsey & Company, February 2015
[42]African Economic Outlook 2016
[43]Prospects for the African Power Sector, IRENA, 2012
[44]DESERTEC is a large scale project aimed at creating a global renewable energy plan based on the concept of harnessing sustainable power from sites where renewable sources of energy are more abundant and transferring it through HVDC transmission systems to consumption centers.

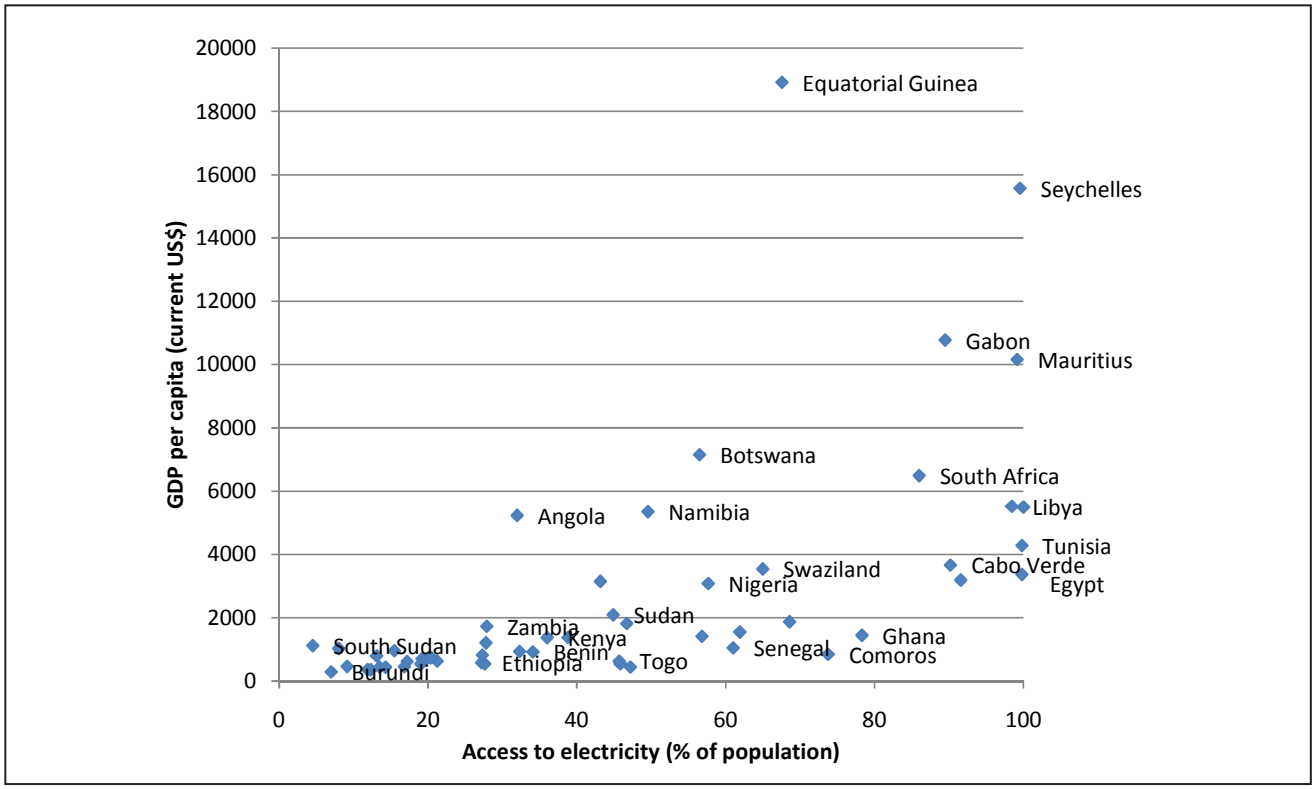
3. Potential for Development of Power Sector in Africa

Africa's power sector has a vast potential for development, particularly in terms of enhancing access to electricity, increasing installed capacity and overall consumption. Bridging the energy gaps is also essential for enhancing Africa's competitiveness and thus economic development. Currently, nearly 70 per cent of Africa's total population lacks access to electricity through the main grid, with over a third of its urban population lacking access to electricity. This is far lower than the power situation in developing Asia or Latin America, where less than 5 per cent of the urban population lack access to electricity.

3.1 Impact of Electrification on GDP

Electrification is strongly correlated with the GDP size of an economy. According to a McKinsey Report[45], inadequate electric supply along with high costs, would slow down GDP growth by 1-3 percentage points. Lack of timely and quality access to electricity, reduces revenues of businesses making it uncompetitive, slowing job growth, and affecting GDP per capita and thus growth. The report concludes that countries with electrification rates of less than 80 per cent of the population

Chart 3.1: Relationship between Electrification and GDP Per Capita – Select African Economies



Data pertains to 2014 and represents data for 54 African economies, however only select countries have been labeled.
Source: U.S. Energy Information Administration; World Bank Database (accessed on May 01, 2017) and Exim Bank Analysis

[45]Brighter Africa, McKinsey & Company, February 2015.

have comparatively low GDP per capita (less than US$ 3500). The only countries that have electrification rates of less than 80 per cent with GDP per capita greater than US$ 3,500 are those with significant wealth in natural resources, such as Equatorial Guinea, Angola, Botswana and Namibia **(Chart 3.1) (Annexure III)**. However, even these countries fall short of economic prosperity. Further, not only does the access to electricity impact GDP per capita, but also the quality of electricity. Thus emphasizing the need for reliable and quality access to electricity is essential in fueling economic growth.

3.2 Power Value Chain

Power policies in African economies have generally focused on generation to address low access situation. The traditional approach leads to developmental plans falling down at other steps in the value chain and slow power sector development. However, in order to sustainably develop the power sector in Africa, there is an increasing need to first breakdown the power value chain, and analyze its individual components, and accordingly design power policies incorporating the shortfalls in each of them **(Exhibit 3.1)**.

The power value chain provides a disaggregated view of the power sector. By planning along the value chain, countries can realize efficiencies and better meet their overall power development objectives.

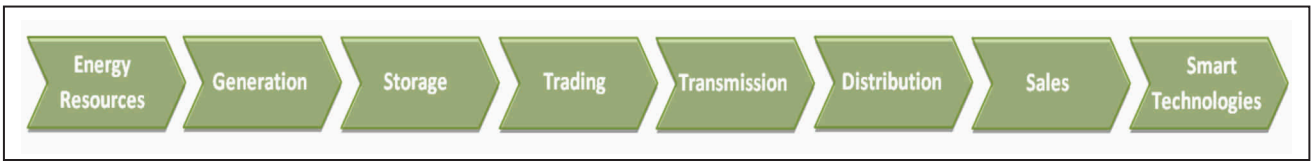
A regional breakup of the power value chains in the Sub-Saharan Region reveals that the power sector in Central Africa[46] experiences pervasive energy challenges. Central Africa's policy approach requires addressing issues in the entire value chain. For East Africa[47], considering its high dependence on hydropower, there is a need to focus on diversifying the energy mix in the region. In West Africa[48], transmission and distribution poses a major problem in the power value chain. Though the Southern African region[49], mainly due to South Africa, has emerged to have the most developed power sector in the whole of Sub-Saharan Africa, there is a need for development in the power value chain on a regional basis, mainly with regards to its interconnectivity[50].

3.3 Power Sector in Africa: Projected Growth in Demand

According to McKinsey[51], industrial and residential power demand is projected to increase to 1,600 Twh by 2040. If Sub-Saharan Africa achieves these demand levels, it would represent a four-fold increase in power consumption compared the present levels, with an annual growth of about 4.5 per cent.

If Sub-Saharan Africa's power consumption reaches these estimated levels in 2040, it would be nearly

Exhibit 3.1: Power Value Chain



Source: Sub-Saharan Africa Power Outlook 2016, KPMG Africa Infrastructure

[46]Central Africa region comprises eight countries namely Cameroon, Central African Republic, Chad, Congo, Democratic Republic of Congo, Equatorial Guinea, Gabon and Sao Tome and Principe.
[47]The East African region comprises 13 countries, namely Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Seychelles, Somalia, South Sudan, Sudan, Tanzania and Uganda.
[48]West African region includes Benin, Burkina Faso, Cabo Verde, Cote d'Ivorie, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo.
[49]Southern Africa includes Angola, Botswana, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe.
[50]Sub-Saharan Africa Power Outlook 2016, KPMG Africa Infrastructure
[51]Brighter Africa, McKinsey & Company, February 2015

half of the European Union's consumption in 2010, or the equivalent of Latin America and India combined in 2010. Implying that Sub-Saharan Africa's per capita consumption would still be significantly lower than any other region.

Commercial and industrial demand is projected to grow over three-fold from about 330 Twh in 2010 to about 1,100 Twh by 2040. This represents annual average growth of 4.1 per cent over the 30-year period. South Africa and Nigeria are expected to remain the largest commercial and industrial consumers of electricity, with both countries together accounting for more than 50 per cent of Africa's 2040 demand. As an analogy, it may be implied that the Sub-Saharan region's commercial and industrial energy demand (1,107 Twh) by 2040 will also be half of what the European Union consumed in 2010 (2,275 Twh).

The study projects GDP growth of about 4.6 per cent a year across Sub-Saharan Africa, rising from US$ 1.3 trillion in 2010 to about US$ 4.7 trillion in 2040, at 2005 constant prices.

According to the study, in developing and emerging markets, the annual electricity demand (excluding residential demand) growth is generally higher than GDP growth, with ratios typically between 1.2:1 and 2.3:1, averaging to 1.66 per cent. Therefore, if Africa's GDP is estimated to grow at an annual average rate of 4.6 per cent, according to this methodology, the annual electricity demand is expected to increase by 7.6 per cent.

A study by the United Nations University[52] highlights that economic development policies implemented by national and regional governments and/or international bodies will have a significant impact on energy demand and greenhouse gas (GHG) emissions. This will increase the pressure on local and regional energy supplies as well as on carbon mitigation systems, accentuating the need for energy conservation and GHG emissions reduction actions. Hence, the best way to reduce GHG emissions is to modify the existing oil and coal plants to natural gas-run plants and the promotion of local renewable energy sources.

3.4 Access to Electricity: Scope for Renewable Power Generation

According to IRENA[53], one-fourth of the existing (54 GW) generation capacity of Africa is expected to retire by 2030. Considering the projected increase in demand there would be an urgent need to develop additional sources of power, along with the necessary transmission and distribution systems. Presently, over 600 million people in Sub-Saharan Africa do not have access to electricity from the central grid systems and around US$ 11 billion is spent annually on kerosene, batteries and candles for providing light[54]. Distribution systems also play an important role for providing access to electricity as well as adding to costs of obtaining electricity. However, the cost of per unit generated completely depends on the demand density and the length of the distribution system. Essentially, larger the power generation unit, larger is the grid requirement to distribute power. According to IRENA, investment requirements for distribution networks are on average similar to those required for the power supply units, effectively doubling the investment needs. Generator powered by hydrocarbons provide electricity in areas with no power, but are an expensive option, both to acquire as well as to operate, apart from its maintenance cost. The use of decentralized power systems, mainly

[52]Energy futures modelling for African countries, United Nations University World Institute for Development Economics Research, Working Paper 2017/56
[53]Africa Power Sector: Planning and Prospects for Renewable Energy, IRENA, 2015
[54]Power Sector in Africa, Sector Report, KPMG, 2015

renewable, may possibly reduce the power problems in Africa. Though there have been several arguments for and against decentralized power systems, it may be concluded that a centralized grid may be the cheapest solution for large cities. However, for remote dwellings or communities an off-grid or mini-grid system is a more economical option. The growing infrastructure needs, along with the large geography of Africa, gives rise to increased attractiveness of developing off-grid or isolated mini-grid systems to reach and supply remote villages and rural areas.

Globally, investments in renewable energy (excluding large hydro projects[55]) has more-than doubled from US$ 159 billion in 2007 to US$ 242 billion in 2016. According to IRENA[56], there would be similar shifts in the power generation in Africa, particularly Sub-Saharan Africa. In Sub-Saharan Africa, renewable energy sources are estimated to provide 46 per cent of total electricity by 2030, a rise from its current 19 per cent average, while the rest would mainly be coal fueled power generation. By 2030, renewable energy in Sub-Saharan Africa would largely be dominated by hydroelectricity, accounting for 22 per cent of total electricity generation in the region. Share of solar power generation is forecast to increase to 13 per cent from solar PV (mainly off-grid), 8 per cent from wind and 2 per cent from biomass. Further, approximately 17 per cent of the generated electricity would be traded within the region in 2030.

Investing in off-grid renewable energy is an attractive option, where most of the population either has no access to grids (mainly due to distance frontier) or finds it unaffordable to connect to the grid. Off-grid solar energy, in particular, can enable users to access lighting and in some cases afford mini renewable-based electricity generators. Further, according to the World Bank's Enterprise Surveys, 39.3 per cent of the firms surveyed identify electricity as a major constrain to doing business. Tackling the energy challenge, especially in urban areas, can improve the performance of African firms as well as attract greater investments.

According to an analysis by the ReCalc programme of World Wildlife Fund for Nature (WWF)[57] on a sample of 24 African cities, re-allocating fossil-fuel subsidies to investments in renewable energy options, would result in an additional investment of US$ 16 billion in renewable energy during 2017 and 2025. These, in turn, would increase the installed capacities in these 24 cities by 6,600 MW and generate 16 million Mwh annually. This switch to renewable energy sources could reduce lifetime greenhouse gas emissions by 590 million tonnes of carbon dioxide and directly save 20 million litres of water.

While off-grid power generation systems are the best possible option for the power problem in Africa, they come along with some challenges, which need to be addressed as well. Especially the off-grid systems based on solar or wind require electricity storage to make them truly useful. The present electricity storage systems that either exist or are under development in Africa, are expensive and tend to be best suited to large-scale applications. Nevertheless, with improved technologies and rapidly falling prices for solar generation, there have been developments in electricity storage facilities thus providing the potential for small-scale, off-grid power networks. Technological developments in solar power are mainly focused towards rapid cost reductions and capacity additions, particularly for solar PV, which are the best suited alternatives to rural areas. Wind power generation, on a smaller scale, is also

[55]Of more than 50MW; Sourced from Global Trends in Renewable Energy Investment 2017, UN Environment's Economy Division in cooperation with Frankfurt School, UNEP Collaborating Centre for Climate & Sustainable Energy Finance and produced in collaboration with Bloomberg New Energy Finance.
[56]Africa Power Sector: Planning and Prospects for Renewable Energy, IRENA, 2015
[57]Sourced from the African Economic Outlook 2016

emerging as an off-grid solution, with the scale of a wind turbine typically suitable for a set of households or for a small village.

The case for off-grid power solutions is observed in Tanzania, at Tabora, Dodoma and Katavi regions. More than 840 households and small factories have been connected to solar grid systems. Solar panel feed batteries in large numbers are housed in shipping containers, with the power then carried to the community through distribution lines identical to those used by Tanesco, a state-run power utility. There are around 14 solar containers or "solar generators", each with the capacity to supply electricity to 60 households or businesses, in the installed region. The total cost for the installation, including maintenance and repairs for five years, for these 14 solar generators was around US$ 6 million. The cost per household through this arrangement approximated to US$ 7,000 per household, relatively low compared to the investments required for generating and distributing power to these households and business through the central grid. This model is also being replicated in Senegal, Mali, Cameroon and Gambia[58].

In addition, Kenya plans to launch a solar power project in 2017 worth US$ 150 million to increase the access to electricity to schools, poor households, off-grid areas without power access. In more isolated areas, this project plans to equip households with home solar systems. This power would also be used to pump water to supply homes and fields. The plan also provides for technical assistance and training to help make the scheme more sustainable.

According to a study conducted by McKinsey[59], Sub-Saharan Africa has rich primary-energy resources, with sufficient coal, gas, geothermal, hydro, solar, and wind resources to deliver more than 12 TW of capacity. Majority of it is through solar energy, which can deliver about 10 TW. Of which, only a small fraction of the power generation potential has been developed.

Of the remaining 2 TW, there is potential for:

- About 400 GW of gas-generated power, with Mozambique, Nigeria, and Tanzania alone representing 60 per cent of the total capacity;
- About 350 GW of hydro, with the DR Congo accounting for 50 per cent;
- About 300 GW of coal capacity, with Botswana, Mozambique and South Africa representing 95 per cent of this;
- Nearly 109 GW of wind capacity, although it is relatively expensive compared with other sources;
- The proven geothermal resource potential is only 15 GW, but this is an important technology for Ethiopia and Kenya, which hold 80 per cent of it.

Of the 48 Sub-Saharan countries, 21 have a generation capacity of less than 200 MW, well below the minimum efficiency scale. As a result, they pay a heavy penalty of US$ 0.25 /KW, twice the level in the region's larger power systems.

In conclusion, energy efficiency is also a crucial component affecting commercial and industrial demand. While there is a significant improvement opportunity available, there is limited policy focus on the issue in most African countries.

3.5 Stable Policy Environment

In any economy lacking adequate infrastructure, the role of government is very crucial at all levels, from local to national. In the case of Africa, which is lacking core infrastructure for facilitating businesses and investments, particularly power, necessary infrastructure and electrification programmes can help connect regions and localities of high demand

[58]Power Sector in Africa, Sector Report, KPMG, 2015
[59]Brighter Africa, McKinsey & Company, February 2015

to the main grid to increase the access to electricity. Apart from this, the government through its policy options can also play a significant role in the appropriate pricing of power.

In Africa, most governments need to deal with sectoral governance issues and overcoming inefficiencies through, inter alia, better maintenance of existing infrastructure, institutional reform of utilities and service providers, administrative and regulatory reform, and improved subsidy policies and practices. Addressing these could save nearly 20 per cent (US$ 17 billion/year) of the US$ 93 billion required annually to fill the infrastructure gap in Africa[60].

As established in the earlier section, switching to alternate options particularly off-grid renewable solutions could improve the power situation in Africa. There is an increasing need for African governments to increase and support the use of renewable technologies through necessary and relevant policy actions.

Efficient power trade is also an alternative solution to improving the access to electricity across regions in Africa. IRENA estimates that Africa's power trade at full potential can save an annual cost of an estimated US$ 2 billion every year[61].

A stable policy environment, may also be created by streamlining and standardizing policies and procedures ranging from having a fresh investment in the power sector to obtaining an electricity connection.

Feed-in tariffs (FIT) and feed-in premiums (FIP) could also be used by the government for regulating energy costs. Both are standard long-term power purchase agreement policy mechanisms, where the developer has a price guarantee (through a set price or premium) for a fixed period of time, generally ranging from 10-25 years. Both focus on supporting the development of new renewable energy projects by offering long-term purchase agreements for the sale of renewable electricity. FIT and FIP are typically popular in Europe. Select African countries like South Africa, Kenya and Uganda, have also introduced its renewable energy FIT. However, these countries are shifting away from the traditional FIT mechanisms to a more market-friendly renewable support system.

South Africa shifted to renewable energy auctions in August 2011 to replace its FIT programme that was adopted in 2009. The shift was mainly due to the potential challenges to grid stability caused by fluctuating energy production from large number of wind power plants; fears of growing expenses on the treasury due to the renewable FIT's guarantee to buy all renewable electricity; and possible administrative delays caused by an overwhelming number of applications to understaffed authorities[62]. Renewable energy auction, called the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in South Africa, was considered to be a better scheme for securing competition and lowering prices.

Such reverse-bid auctions and tendering mechanisms have ensured full government control over technology choice and project size, apart from having electricity generation at competitive prices. Additionally, price-revealing function of auctions may result in notably lower prices. To further make the most of reverse-bid auctions and tendering mechanisms other criteria on environmental impact, increase in local manufacturing content may also be imposed.

[60]Financing African Infrastructure: Can the World Deliver?, Global Economy and Development program, Brookings Institution, March 2015
[61]Africa's Renewable Future: The Path to Sustainable Growth, IRENA, 2013
[62]Renewable Energy Auctions in Developing Countries, IRENA, 2013

Further, apart from providing energy at competitive prices, promoting renewable energy through auctions to Independent Power Producers (IPPs) eases the fiscal burden, particularly of the public African power utilities. Most public electricity utilities suffer major losses by under charging power (especially through subsidies), poor revenue collection, high maintenance costs and high transmission and distribution losses. Thus blocking the much needed capital for other infrastructure investments.

A World Bank study[63] has analyzed the case for IPPs in five countries namely, Kenya, Nigeria, South Africa, Tanzania and Uganda. The study concluded that in order to encourage the private sector participation in IPPs, the government must provide an enabling and sound investment climate. Currently, there are 126 IPPs with an installed capacity of 11 GW with investments worth US$ 25.6 billion in 18 of the 48 Sub-Saharan countries. The study recommends that there is a need for larger IIP spread across the region, in order to optimize the benefits.

According to the study, factors that would create an attractive investment climate for IPPs include:

- More competitive procurement efforts from countries in Sub-Saharan Africa, which include encouraging long-term contracts through a competitive bidding process, this can help secure reduced prices and help avert other issues, such as the possibility of a problematic contract.
- Clear and conducive energy sector policies, structures and regulatory environment.
- Systematic and dynamic power sector planning, including the ability to accurately project future electricity demand, determine best supply or demand management options and anticipate how long it will take to procure, finance, and build the required electricity generation capacity.
- Financial viability of the public utility is crucial. Given issues such as high losses, poor billing and collections, it will be important to mitigate risk through measures that include providing financial guarantees and security measures to assure new investors.

According to the IMF[64], energy subsidies absorb a large amount of public resources. In spite of this, Africa, particularly Sub-Saharan Africa, has the lowest access to electricity rate across the world. Further, there are two main problems created by energy subsidies, one being these subsidies are poorly targeted providing benefits to all users and hence not really effective, other being that they are a disincentive to regular maintenance and future investments, as they burden the balance sheets of these public utilities. According to the study, there is an increasing need for subsidy reforms to make better use of the budgetary resources, increase electricity output as well as investments and thus increasing the access to electricity.

Further, African countries can also enter in the production chain of manufacturing materials and components required for power generation plants and distribution lines to encourage local sourcing. African companies, could also enter the construction, operation and maintenance stream for power projects. Local sourcing may thus reduce costs. Such participation may be particularly high in case of renewable energy technology; nevertheless, these opportunities differ by the type of renewable electricity. For hydropower projects, civil works that can be carried out with local resources can represent up to 65 per cent of the value chain. For geothermal projects, more than half of the investment costs can be sourced locally. Different technologies offer

[63]Independent Power Projects in Sub-Saharan Africa—Lessons from Five Key Countries, World Bank, 2016
[64]Energy Subsidy Reform in Sub-Saharan Africa, Experiences and Lessons, IMF, 2013

different short-term opportunities for concentrating solar power (CSP) projects. For example, the vacuum tubes and parabolic mirrors required in parabolic trough plants are produced in a few dedicated facilities in Europe and the US, and would require massive scale-up before considering local manufacturing. For solar towers, the other main CSP technology, the flat mirrors, mirror support structures, heliostats and the tower itself, can be produced locally in many countries. This enables up to 60 per cent of the capital expenses for CSP solar towers to be sourced locally[65].

3.6 Power Trade

Cross border transmission projects and power pooling at a regional level, if functioning optimally, can offer economies of scale to small countries with limited access, thus benefiting larger areas of Africa. This in turn, could have a desirable impact on the economy of that region. Countries would be able to diversify their resources to other critical areas of development, insulate themselves from electricity and its price fluctuations, attract greater investments in sectors such as manufacturing and other infrastructure, among others. Further, if regional power plants focus on renewable sources of power generation, it can reduce dependence on fossil fuel imports. For example, Kenya may share its energy from geothermal with South Africa, which is currently powered by coal, while Central Africa can share its hydropower generated electricity with Senegal, which is currently powered by diesel[65]. The East and Southern Africa Clean Energy Corridor is one such initiative in this regard. It was adopted in January 2014 and aims at having cross-border trade in renewable power through a continuous network from Egypt to South Africa. Such regional cooperation will also be crucial in closing the existing power gap in the continent.

3.7 Select Programmes for Energy Sector Development[67]

While the Sub-Saharan African power sector faces many challenges, there has been some significant improvement with the announcements of new initiatives for the renewable power sector development.

- Africa Renewable Energy Initiative (AREI) is an initiative led by African Union's commission, the New Partnership for Africa's Development (NEPAD)'s Agency, the African Group of Negotiators, the African Development Bank, the UN Environment Program (UNEP), and the International Renewable Energy Agency (IRENA). This programme aims at reducing greenhouse gases with the installation of large-scale renewable energy capacity in Africa by 2020.

- Further, Nigeria envisaged to have 10 per cent of its energy consumption met by renewable sources by 2025; Kenya is planning to generate 19,200 MW of clean energy by 2030, and Morocco is planning to increase the share of renewables to half its energy mix by 2030. South Africa's Renewable Energy Independent Power Producer Procurement Program (REIPPPP) is making a significant impact in Africa, following its launch in 2011.

- Tanzania adopted a new Electricity Act in 2008, standardizing Power Purchase Agreements to boost small-scale renewable power.

[65]Africa's Renewable Future: The Path to Sustainable Growth, IRENA, 2013
[66]Brighter Africa: The growth potential of the Sub-Saharan electricity sector, McKinsey, 2015
[67]ibid

- Morocco launched a new national framework for the deployment of renewable energy in 2010. Under this framework, a governing agency, the Moroccan Solar Energy Agency (MASEN), was established to manage the tendering process to achieve the solar energy target of 2,000 MW.
- African Heads of State supported the Programme for Infrastructure Development for Africa (PIDA) in 2012. PIDA's pipeline projects, which are to be implemented between 2012 and 2020, included fifteen energy projects, amounting to nearly US$ 40 billion. PIDA gives preference to cross-border energy projects.
- Mozambique's Fundo Nacional de Energia (FUNAE), a public fund established in 1997 to promote sustainable rural electrification and rural access to modern energy services. FUNAE has implemented numerous successful solar, wind and hydropower projects, which have increased electricity access of several villages, schools and clinics.
- In Mauritius, the government plays an instrumental role in promoting bagasse energy generation. The legislations in the Sugar Sector Package Deal Act, 1985 and the Sugar Industry Efficiency Act, 1988, improved the business environment for the sugar industry, by providing incentives for generating electricity. In 1991, the government and the sugar industry created the Bagasse Energy Development Programme to optimise the use of by-products of sugar production.

Box 3.1: South Africa's Renewable Energy Independent Power Producer Procurement Program (REIPPPP)

South Africa launched the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) in 2011, with an aim to reduce the country's dependence on coal as a source of energy. The programme aims at developing the renewable energy sector in South Africa by encouraging private sector investments. The REIPPPP is designed to contribute to meeting South Africa's renewable energy target, while encouraging foreign investment. During 2011-2015, the REIPPPP helped generate 5,243 MW through 79 projects, which amounted to 28 per cent of South Africa's national renewable energy target of 18,800 MW to be supplied by renewable energy by 2030. Pricing has a 70 per cent weightage in the bid selection process, the remaining 30 per cent weightage is for other factors such as job creation, local content and black economic empowerment, among others.

The South African experience suggests several key lessons for successful renewable energy programs in other emerging markets. The success of the REIPPPP makes evident the interest of global investors in renewable energy projects if the procurement framework is clear and well designed. REIPPPP's rolling series of bidding with substantial capacity allocations also helped build confidence among investors. Incentives in the form of certain exemptions from some of the national public-private partnership (PPP) regulations, and the provisions of the Preferential Procurement Policy Framework Act also assisted in fast-tracking the program, without negatively impacting transparency or quality. Further, the requirement that bids should be fully underwritten with debt as well as equity, discouraged competitive bidders from under-bidding the contracts. Further, the REIPPPP in turn also benefitted South Africa's capital market, which offered long-term project finance.

Source: Energy Intelligence, South Africa (http://www.energyintelligence.co.za); Independent Power Projects in Sub-Saharan Africa—Lessons from Five Key Countries, World Bank, 2016; and South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons, World Bank Group, 2014.

3.8 Role of Private Sector

The international private sector is set to play a crucial role in addressing Africa's energy deficit. Presently, African countries including Côte d'Ivoire, Nigeria and Senegal have preferred to promote public-private partnerships (PPP) to address the power deficit situations in their respective countries. On the other hand, Ethiopia and Tanzania's power sector development has mainly been restricted to their respective governments. Countries like South Africa and Kenya have chosen the hybrid routes through IPPs.

Globally, private investment in infrastructure has been a successful model. In the coming years, with the increasing demand and the lack of resources, especially financial resources, of some African nations, PPP structures would serve useful. The 250 MW Bujagali Hydroelectric Power Plant in Uganda is the largest private sector investment in the region, with an investment of US$ 900 million. The Project is a public-private partnership owned by Sithe Global of the USA, Industrial Promotion Services of Kenya (which is owned by the Aga Khan Fund for Economic Development), and the Government of Uganda.

Additionally, growth in the mining sector of the continent is also expected to increase the demand for energy. According to a World Bank report, the mining sector's demand for power in Sub-Saharan Africa is likely to triple between 2000 and 2020, reaching over 23,000 MW. Consequently, mining demand could overtake non-mining demand for power in some countries. To date, most mining companies had their own generation sets, which adds extensively to their operating costs, nearly 30 per cent of a company's costs. According to the World Bank, there is a need for power-mining integration, which would result in substantial cost savings to mines, electrification to communities, and investment opportunities to the private sector[68].

Given the vast prospects of the power sector in Africa, other foreign governments, including the US, the UK and Norway, are also collaborating with the international private sector for providing electricity to Africa. Norway's state-owned development fund, Norfund, has partnered with Britain's development fund, CDC Group, in an attempt to provide an additional 5,000 MW of new capacity in Africa. The US backed 'Power Africa' initiative, launched in 2013, is a multi-stakeholder partnership programme between the governments of the US, Tanzania, Kenya, Ethiopia, Ghana, Nigeria and Liberia. This multi-government initiative partners with the private sector to increase the number of people with access to power in Africa.

3.9 Finance for Power Projects

According to PIDA, Africa's energy demand is expected to increase to 3,100 Twh by 2040. Against this demand, installed capacity is expected to increase by only 700 GW. Further, it is also estimated that Sub-Saharan Africa will need a capital investment of nearly US$ 835 billion by 2040 to be able to supply this growing electricity demand. This includes US$ 490 billion for generation capacity and an additional capacity US$ 345 billion for transmission and distribution networks. On the other hand, the current annual power sector investment in Africa is less than US$ 5 billion. Putting this to perspective, the AfDB projects a nominal GDP of US$ 4.3 trillion for Sub-Saharan Africa in 2040[69], a three-fold increase from US$ 1.4 trillion in 2015. Therefore, estimated investment requirement to cater to the growing electricity demand in Sub-Saharan Africa for the power sector alone accounts for one-fifth its projected GDP size.

[68]Power of the Mine: A Transformative Opportunity for Sub-Saharan Africa, World Bank, 2015

[69]Africa in 50 Years' Time: The Road Towards Inclusive Growth, African Development Bank, 2011; GDP at current prices is calculated with the summation of Nominal GDP for Central Africa, East Africa, Southern Africa, and West Africa and is an average of the projections for a high case scenario and a low case scenario.

According to International Energy Agency (IEA) estimates, increasing the electrification rate in Sub-Saharan Africa from the existing 30 per cent to 70 per cent in 2040 would require a capital investment of US$ 205 billion.

The thinking about appropriate innovative financing solutions is also evolving. So far, private sector investments have mainly been in areas such as mobile telephones, thermal power plants, and container terminals because it is easier to estimate the risks and net cash flows associated with such assets[70]. In other areas, such as power, water, and railways, the private sector has preferred the use of concessions and other types of contracts. Financing infrastructure projects has traditionally been challenging, simply because of the nature of investment, which are large in size and having a long maturity period. Establishing infrastructure as an asset class could target dedicated investors such as impact investors or crossover investors such as sovereign wealth funds. Investments in project specific bonds, such as green bonds, have been relatively easier to market and distribute to institutional investors.

In order to achieve this level of investment, there is a need to steadily improve the investment conditions for electricity access-related projects. There is an increasing need for clarity in the investment framework, market transparency and consultation over the pace of grid extension in Africa. This would allow the stakeholders to make informed decisions. Directing the finances to more efficient energy solutions would build credibility to the investments in Africa, apart from creating new business opportunities and improving energy security.

- ***AfDB's Role in Power Sector***

In the last 40 years, the AfDB has invested US$ 13 billion on increasing power generation capacity and distribution networks across Africa, together with the institutions required to manage them. As a long term strategy, the Bank emphasizes on promoting growth that is inclusive and increasingly green in nature, with special focus on rural and semi-urban electrification; installing off-grid, decentralised electrification using renewable energy options to spread livelihood opportunities to remote areas; and helping to develop Africa's vast clean energy potential

At another level, the Bank is fostering the development of regional power pools, helping link the power grids of neighbouring countries into single networks that work to provide more reliable electricity supplies. The Bank's approvals to the energy sector in 2015 stood at UA 871.6 million[71] (13.8 per cent of the total approvals and 28.3 per cent of total infrastructure approvals in 2015), of which UA 841 billion was in loans and grants.

In 2015, there were a number of new initiatives in line with the AfDB strategy, some of which include the New Deal on Energy for Africa, the Transformative Partnership on Energy for Africa, and the Africa Renewable Energy Initiative. All of these initiatives will be critical for achieving the ambitious target of providing universal access to energy by 2025.

3.10 Developing Linkages with Investment Promotion Agencies

Many countries in the Africa have set up specialized investment promotion agencies/ Chambers of Commerce to promote and facilitate inflow of foreign investment into these countries, while also serving as one-stop-shop for investment related activities. In light of the key role of these institutions, building closer cooperation and linkages between these investment promotion agencies in Africa would serve to enhance access to information about investment opportunities in the region.

[70]Financing African Infrastructure: Can the World Deliver?, Global Economy and Development program, Brookings Institution, March 2015

[71]The Bank uses a unit of account (the "Unit of Account" or "UA") equivalent to the IMF's Special Drawing Right (SDR) as its reporting currency.

Such relationship would also serve to enhance knowledge about potential areas for investment, particularly in the power sector, upcoming projects, prospective investment partners, as also procedures, rules and regulations required for venturing into specific sectors in these countries and incentives offered to investors. Further, investment promotional events with select investment promotion agencies would foster increased interaction between potential investors and concerned agencies in potential sectors in target countries in the region.

3.11 Way Forward to Increase Access to Electricity

Electricity connection charges can be made affordable in two ways. The first way is to reduce the electricity tariffs, by adopting less expensive technical specifications. This would also mean the cost of obtaining electricity, in the form of internal wiring incurred by new consumers, needs to go down. Methods of charging these could also be revised, connection fees may be charged across a period rather than having an upfront cost. This would increase the coverage of access to electricity, by allowing households with lower income to also obtain electricity, rather than incurring the same amount of expenditure from the substitution of electricity for kerosene and batteries. For example, in Senegal, monthly bills include a charge that allows their up-front connection and wiring costs to be repaid over time. A number of credit schemes have been introduced, such as in Côte d'Ivoire, Kenya and Botswana, to enable payment of connection charges to be spread out over time. These credit schemes have been linked to the electricity provider or government, rather than provided by commercial financial institutions[72].

According to World Bank[73], making electricity connection and consumption more affordable while minimizing utilities' financial losses is a priority in Sub-Saharan Africa. Select ways of making power affordable would include:

- **Improving operational efficiency:** If utilities could reduce combined transmission, distribution, and bill collection losses to 10 per cent of transmitted electricity, deficits could disappear in one-third of the countries.
- **Increasing tariffs in most cases:** Funding gap cannot be bridged solely by eliminating operational inefficiencies. There is a need for tariff increase as well. Small and frequent tariff increases may find wider acceptance, as long as electricity access is reliable.
- **Installing individual metering:** Balking the high upfront cost of connection, poor households tend to share one electricity meter. That often makes them ineligible for subsidized rates. Individual meters in poor households can help utilities target subsidies better.
- **Installing prepaid meters that would benefit both utilities and customers:** For low-income households, the ability to pay in small increments helps align electricity payments with income flows, while utilities are guaranteed payments upfront.
- **Sharing connection costs:** The first priority in increasing access to electricity is to make the initial connection affordable to the poor. One option is to share the costs across all electricity users, including large- and medium-size firms.

While connecting to the grid is a solution for all urban Africans and many rural ones, the study also acknowledges that rural electrification is essential. Mini and off-grid electricity, especially from sources like solar, offers increasing potential to electrify homes in many rural areas of Sub-Saharan Africa.

[72]Building Electricity Supplies in Africa for Growth and Universal Access, The New Climate Economy, 2015.
[73]Making Power Affordable for Africa and Viable for Its Utilities, World Bank, 2016

3.12 Way Forward: Role of India

Investment in clean energy and power generation from renewable sources have been on a rise in India, largely at the back of energy security concerns, government support, initiatives taken on account of climate change, increasing cost competitiveness of renewable energy technology, distributed electricity demand, favorable foreign investment policy, and vast untapped potential.

As a result, India's renewable energy installed capacity has grown at a stupendous pace from 3.9 GW in 2002-03 to about 35.8 GW in March 2015. Programmes such as Grid Connected Rooftop and Small Solar Power Plants Programme have significantly helped in meeting the energy demands by encouraging installation of rooftop solar photovoltaic power generation plant for self-consumption as well as supply/sale of electricity to the grid. Such programmes, if successfully implemented in African countries, can help bridge the power deficit in these countries and reduce the impact due to power outrages arising from conventional sources of energy.

Sharing experience in the renewable energy sector: India's commitment to reduce its carbon emissions per unit of GDP growth by 33 - 35 per cent by 2030 from the 2005 levels is further expected to increase the focus on renewable energy sector, and improve the prowess of the companies engaged in the renewable energy sector of India. India's experience in the renewable energy sector can be of immense benefit to the African countries in their efforts towards sustainable development. Already, there are several instances of Indian companies engaging in development of renewable energy sources in the African continent for the mutual benefit of both parties.

Electrification through Biomass has been successfully applied in India and rice-husk gasification is a widely deployed technology. To produce electricity, piles of rice husk are fed into small biomass gasifiers, and the gas produced is used to fuel internal combustion engines. The operation's by-product is rice-husk ash, which can be sold for use in concrete. Several equipment suppliers are active and one, Husk Power Systems (HPS), has installed 60 mini power plants that power around 25,000 households in more than 250 communities. These systems have low investment costs (US$ 1,000 to US$ 1,500/ kW) and have overall efficiencies of 7 per cent to 14 per cent, but are labour-intensive in maintenance and operation[74]. India may share its expertise in biomass gasification with Africa.

Important public infrastructure and power projects in Africa funded totally or in part by India's lines of credit (LOCs) have also made it possible for state-owned companies to extend their footprint in African economies.

With the many African countries being part of over 120 prospective members for **International Solar Alliance (ISA)**, there exist scope for further alliance between India and the region on solar energy. This is especially so, given the strong focus of the governments in the region on rural electrification and the inadequate grid connectivity which renders cooperation on specialized solar power an attractive proposition.

Investing in Power Systems: Power systems in Africa are emerging as important markets for Indian companies. With around 600 million people without electricity in the continent, there is an urgent need to bridge the gap by adding such capacity in Africa.

[74]Prospects for the African Power Sector, 2012

In the power sector, the first large turnkey project export by an Indian company was that of Bharat Heavy Electricals Limited (BHEL) in Libya in 1977, and since the past few decades, several Indian companies have been expanding their operations in the field of project exports.

Power sector in Africa has emerged as an important markets for Indian companies. In the generation segment, a majority of Indian boiler-turbine-generator (BTG) manufacturers have forayed into the engineering procurement construction (EPC) segment as a forward integration of their capabilities. Most Indian balance of plant (BoP) players have evolved from general civil contractors, leveraging their competence in civil works. In the transmission and distribution(T&D) segment, EPC players offer a range of integrated services including designing, manufacturing, erection, testing and commissioning of transmission line towers. They have significant overseas presence as well, especially in South American, African and Middle-Eastern markets.

Indian companies are also increasingly bidding for projects funded by Multilateral Development Banks (MDBs). In fact, of the contracts secured by India in projects funded by African Development Bank, Asian Development Bank, and World Bank, power sector accounts for the largest share in value terms. Due to their technical expertise and relevant experience in such sectors, Indian companies are often well placed to secure contracts in projects funded by MDBs.

4. Export-Import Bank of India: Financing Power Sector in Africa

Export-Import Bank of India (Exim India) commenced operations in 1982. The Bank was set up under an Act of Parliament (Export-Import Bank of India Act 1981), for providing financial assistance to exporters and importers, and for functioning as the principal financial institution for coordinating the working of institutions engaged in financing export and import of goods and services with a view to promoting the country's international trade. In its endeavour to promote India's international trade, Exim India's vision has evolved from financing, facilitating and promoting trade and investment, to a conscious and systematic effort at creating export capabilities. Exim India today seeks to develop commercially viable business relationships with externally oriented companies.

Africa has always been a focus region for Exim India, and thus a critical component of its strategy to promote and support two-way trade and investment. As a partner institution to promote economic development in Africa, the commitment towards building relationships with the African Region is reflected in the various activities and programmes, which Exim India has set in place.

Exim India has representative offices in three countries in Africa viz., Abidjan in Côte d'Ivoire, Addis Ababa in Ethiopia, and Johannesburg in South Africa. These three offices play key roles in facilitating economic cooperation with the African Region, and are closely associated with several of Exim India's initiatives. The representative offices interface with multilateral institutions such as African Development Bank (AfDB), Afreximbank, regional financial institutions such as Eastern and Southern African Trade and Development Bank (PTA Bank), and West African Development Bank (BOAD), and developmental financial institutions such as Industrial Development Corporation of South Africa Ltd. (IDC), as well as Indian missions in the region with the aim of increasing bilateral commercial engagements between the two regions.

Exim India's exposure in the power sector to the African region include financing at various stages of new power generation, transmission and distribution projects, as well as improvement in quality of existing power supply. Projects financed by Exim India have helped in improving access to reliable electricity in several countries in Africa.

Lines of Credit

To enhance bilateral trade and investment relations, Exim India has in place several lines of credit (LOCs), which are extended to a number of institutions/ agencies in Africa. These LOCs supplement the 'Focus Africa' programme of the Government of India (GOI) and are extended especially to priority sectors, identified by GOI for mutual cooperation and benefit. These LOCs enable buyers in the overseas country to finance developmental projects equipment and other goods and services on deferred payment terms. Besides these operating LOC extended at the behest of GOI, Exim India extends its own commercial LOCs to various financial institutions and other entities in Africa, such as, PTA Bank (covering 17 countries in the eastern and southern African region), BOAD (covering 8 countries in the West African region), Indo-Zambia Bank, Nigerian Exim Bank and Afreximbank. Most of these LOCs have facilitated in strengthening the

infrastructure sector of Africa either directly or indirectly. As on April 30, 2017, the total number of operative LOCs to Africa stood at 153 extended to 44 countries and amounting to US$ 7.6 billion. Of these, 148 LOCs aggregating to US$ 7.5 billion, to 41 countries are guaranteed by the GOI. A list of LOCs extended to African countries in the power sector is given at **Annexure 3**.

Of the 86 power projects valued at US$ 2.05 billion executed / or being executed under LOCs, 55 projects of value US$ 1.54 billion are in Africa (nearly 75 per cent of the total power projects).

- **Um Dabakir Power Station (Kosti) in Sudan,** is a 4x125 MW combined cycle power plant set up under an LOC extended by the Exim India at the behest of the GOI. It is the largest thermal power plant commissioned in Sudan. The power plant will supply one-sixth of the total power demand of Sudan. The electricity generated from the plant is also supplied to sugar and cement factories.

- T**he Nyaborongo Hydropower Project in Rwanda** was supported under Exim India's GOI supported LOC extended to the Government of Rwanda. This is slated to be Rwanda's biggest hydroelectric power plant. The plant caters to 25 per cent of total electricity demand of Rwanda.

- **Itezhi Tezhi Hydro Power Project in Zambia,** is a 120 MW power project developed by Itezhi Tezhi Power Corporation (ITPC) was a first-of-a-kind public private partnership (PPP) in the power sector in Zambia. It is currently owned by Tata Power Company, India and ZESCO, a Zambian power utility, on a 50:50 basis, funded jointly by AfDB and Exim India along with other lenders. The critical equipment for the project viz. Turbines, Generators, Main Inlet Valves, Speed Governors and Excitation System have been supplied by Alstom India Limited under the Exim India's GOI supported LOC. This is the first PPP hydro power project in Africa, generating power at its full capacity.

- **Electricity Transmission and Distribution Project covering Côte d'Ivoire and Mali:** Exim India has extended three LOCs to the Government of Mali for financing the electricity transmission and distribution project from Côte d'Ivoire to Mali. A 225 KV transmission line has been constructed from Ferkesseédougou in Côte d'Ivoire to Sikasso in Mali. Substations have been constructed at Ferkessedougou, Sikasso, Koutiala and Ségou. The transmission lines project has been successfully completed in 2012. The interconnection transmission line covers a distance of 524 kms from border town of Ferkesseédougou in Côte d'Ivoire to Ségou in Mali. The transmission line has helped Government of Mali to import power from Côte d'Ivoire at a much lower cost. The project has also contributed in development of small local industries such as welding and lathe industries, thus, providing employment and incomes to many. Increased and stable power supply has benefited the industrial regions such as Sikasso and attracted more industries to it. It has helped in the growth of mining industry, especially of gold and phosphates. The entire project has greatly contributed towards social and economic development of Mali. It has resulted in many positive externalities such as creation of economic and industrial activities, employment, poverty reduction, better health facilities, increased production, etc.

Project Exports

Exim India has been providing a steady stream of support to project activities in engineering, procurement, and construction (civil, mechanical,

electrical or instrumental). This includes the provision of specific equipment related to supplies, construction and building materials, consultancy, technical know-how, technology transfer, design, and engineering (basic or detailed). Exim India also supports existing or new projects, plants or processes that require additional assistance in processes such as international competitive bidding, including multilaterally funded projects in India. During 2016-17, 11 power projects amounting to US$ 271 million covering 17 countries in Africa were being executed by Indian exporters with the support of Exim India.

Buyer's Credit under National Export Insurance Account (NEIA)

In order to provide further impetus to project exports from India on medium- or long-term basis, especially in the infrastructure sector, in April 2011, a product called Buyer's Credit under National Export Insurance Account (BC-NEIA) was introduced. Under this programme, Exim India facilitates project exports from India by way of extending credit facility to overseas sovereign governments and government owned entities for import of goods and services from India on deferred credit terms. Indian exporters can obtain payment of eligible value from Exim India, without recourse to them, against negotiation of shipping documents. NEIA is a Trust, set up by Ministry of Commerce and administered by ECGC. As on March 31, 2017, Exim India sanctioned an aggregate amount of US$ 1.86 billion under BC-NEIA for 15 projects in Africa valued US$ 1.87 billion. Of these, Exim India has sanctioned US$ 512.1 million under BC-NEIA for four power projects, including transmission and distribution network in Zambia, Cameroon, Senegal and Ethiopia

Finance for Joint Ventures Overseas

Further, Exim India supports Indian companies in their endeavour to globalise their operations, through overseas joint ventures (JVs) and wholly owned subsidiaries (WOS). Such support includes loans and guarantees, equity finance and in select cases direct participation in equity along with Indian promoters to set up such ventures overseas. In the African Region, Exim India has supported several such ventures in countries such as South Africa, Kenya, Mauritius, Ghana, Nigeria, Sudan, Egypt, Zambia, Morocco, Uganda and Tanzania, across a range of sectors like agriculture and food processing, agro-based products, auto and auto components, chemicals, construction, electronics, engineering goods, EPC services, mining and minerals, plastics and rubber products, packaging, pharmaceuticals, software and IT enabled services, and textiles. These ventures serve to promote value addition, as also contribute to capacity building and capacity creation in host countries. As on March 31, 2017, Exim India through its overseas investment finance programme has supported 43 such ventures, set up by Indian companies in 15 countries in Africa with an aggregate sanction amount of ₹ 4.9 billion.

- Exim India has extended financial support under its Overseas Investment Finance programme for installing wind turbines in South Africa. Cookhouse Wind Farm is the largest wind farm in South Africa constructed by an Indian company. The project provided local employment to nearby community during its construction and also engaged the local community by way of direct equity participation in the project.

Association with African Development Bank (AfDB)

India is a member of the African Development Bank (AfDB) Group. Many Indian companies participate in projects funded by the AfDB Group. Exim India works very closely with AfDB and has an active programme which offers a range of information, advisory and support services to Indian companies to enable more effective participation in projects funded by multilateral funding agencies, including AfDB. Exim

India also assists Indian companies by providing advance alerts on upcoming project opportunities. With support from Exim India, Indian project exporters have secured a number of overseas contracts in Africa in sectors such as power, telecommunications, transport, water supply and sanitation. Exim India and AfDB have also signed an agreement for co-financing projects in Africa. The agreement envisages joint financing of projects (priority being given to support projects of small and medium enterprises) in regional member countries of AfDB. Exim India also organizes Business Opportunities seminars in Projects funded by AfDB across various centres in India.

Africa – India Partnership Day

Exim India, together with FICCI (Federation of Indian Chambers of Commerce and Industry), organizes the Africa – India Partnership Day, on the sidelines of AfDB's Annual Meeting, with an objective of sharing India's developmental experiences with Africa, particularly in Public-Private Partnership model of financing infrastructure development. Exim India, along with FICCI, has so far hosted three such events; first being on May 30, 2013 in Morocco; followed by Rwanda on May 22, 2014; Côte d'Ivoire on May 27, 2015; and Zambia on May 24, 2016. The Africa-India Partnership Day has become a regular feature of the AfDB Annual Meeting, and showcases the immense scope for expanding the mutually enriching partnership between Africa-India.

Kukuza Project Development Company (KPDC) in Africa

Addressing the limited institutional capacity in Africa on conceptualisation, management, execution and imparting project development initiatives, Exim India, in partnership with IL&FS and State Bank of India, joined hands with the AfDB, and promoted a Project Development Company for infrastructure development in Africa.

The Company, named Kukuza Project Development Company (KPDC), has been incorporated in Mauritius in July 2015. 'Kukuza' in Swahili means 'a cause to growth'. Reflecting the name, the KPDC is expected to provide specialist project development expertise to take the infrastructure project from concept to commissioning in the African Continent. The KPDC will provide the entire gamut of project development expertise to various infrastructure projects, such as project identification, pre-feasibility/ feasibility studies, preparation of detailed project reports, environmental and social impact assessment, etc.

On the sidelines of the India-Africa Forum Summit (IAFS), which was held during October 26-29, 2015, in New Delhi, Exim India held the inaugural meeting of KPDC.

The KPDC shall utilise the domain expertise of each partner during the project development process to establish a bankable and sustainable implementation format based on an in-depth understanding of the concerns of all the stake holders - public authority, users community, developers/ investors and lenders.

Institutional Linkages

Exim India has been consciously forging a network of alliances and institutional linkages to help further economic co-operation with the African Region. Towards this end, Exim India has taken up equity in Afreximbank, West African Development Bank (BOAD), and Development Bank of Zambia. These endeavours are supplemented by the various Memoranda of Cooperation (MOCs) / Memoranda of Understanding (MOUs), the Bank has in place, with key institutions in the African Region including: AfDB; Eastern and Southern African Trade and Development Bank (PTA Bank); Afreximbank; Banque de Financement des Petites et Moyennes Entreprises (BFPME), Tunisia; Banque Internationale Arabe de Tunisie, Tunisia; Board of Investment, Mauritius;

ECO Bank (Pan African Bank); Foreign Investment Promotion Agency, Tunisia; Industrial Development Bank of Sudan; Industrial Development Corporation of South Africa Limited (IDC); Nigerian Export-Import Bank (NEXIM); National Bank of Egypt; and Societe Tunisienne de Banque, Tunisia.

In sum, Exim India, with its comprehensive range of financing, advisory and support services, seeks to create an enabling environment for enhancing two-way flow of trade, investment and technology between India and the African Region. While promoting infrastructure development and facilitating private sector development in host countries, the various efforts of Exim India, ensconced in its range of activities, also contribute towards institutional building in the African Region.

Annexure I

Access to Electricity in Africa

Country	1990	2000	2010	2014
Algeria	94.0	98.0	99.3	100.0
Angola	28.2	31.1	34.6	32.0
Benin	22.0	25.4	27.9	34.1
Botswana	36.7	39.6	43.1	56.5
Burkina Faso	6.1	6.9	13.1	19.2
Burundi	0.1	3.9	5.3	7.0
Cabo Verde	58.2	58.6	67.0	90.2
Cameroon	29.0	46.2	49.0	56.8
Central African Republic	3.0	6.0	9.5	12.3
Chad	0.1	2.3	3.5	8.0
Comoros	42.0	44.8	51.5	73.8
Côte d'Ivoire	36.5	51.4	58.9	13.5
Dem. Rep. of Congo	6.3	6.7	15.2	43.2
Djibouti	43.3	46.2	49.7	61.9
Egypt	95.5	97.7	99.6	46.7
Equatorial Guinea	56.9	61.0	65.2	99.8
Eritrea	22.9	32.2	32.5	67.6
Ethiopia	10.0	12.7	23.0	45.8
Gabon	73.0	73.6	81.6	27.2
Ghana	30.6	45.0	60.5	89.5
Guinea	13.7	16.4	20.2	47.2
Guinea-Bissau	50.7	53.5	57.0	78.3
Kenya	10.9	14.5	23.0	27.6
Lesotho	6.4	5.0	17.0	17.2
Liberia	0.1	0.6	4.1	36.0
Libya	97.0	99.8	100.0	27.8
Madagascar	9.2	11.4	14.3	9.1
Malawi	3.2	4.8	8.7	98.4
Mali	12.0	16.7	16.6	16.8
Mauritania	11.8	14.7	18.2	11.9
Mauritius	96.6	99.4	100.0	27.3
Morocco	49.2	71.1	98.9	38.8
Mozambique	6.4	7.1	15.0	99.2
Namibia	26.4	36.5	43.7	91.6
Niger	6.2	6.7	9.3	21.2
Nigeria	41.8	44.9	48.0	49.6
Rep. of Congo	24.4	20.9	37.1	14.3
Rwanda	2.3	6.2	10.8	57.7
Sao Tome and Principe	50.3	52.9	56.9	19.8
Senegal	26.0	36.8	56.5	68.6
Seychelles	96.6	99.4	100.0	61.0
Sierra Leone	5.7	8.6	12.1	99.5
Somalia	22.2	25.9	29.1	13.1
South Africa	65.0	66.1	82.7	19.1
South Sudan	0.0	0.0	1.5	86.0
Sudan	22.6	25.5	29.0	4.5
Swaziland	28.8	31.7	35.2	44.9
Tanzania	6.8	8.8	14.8	65.0
The Gambia	17.7	34.3	31.0	15.5
Togo	10.0	17.0	27.9	45.7
Tunisia	92.6	95.0	99.5	99.8
Uganda	6.8	8.6	14.6	20.4
Zambia	13.3	17.4	18.5	27.9
Zimbabwe	28.1	34.2	36.9	32.3

Source: World Bank (accessed on May 1, 2017)

Annexure II

Country-wise Power Consumption / Generation and Distribution Losses

Country	Consumption (Bn Kwh)			Distribution Losses (Bn Kwh)			Generation (Bn Kwh)		
	2005	2010	2014	2005	2010	2014	2005	2010	2014
Algeria	27.52	33.84	49.21	4.48	9.09	11.00	31.91	43.00	60.40
Angola	2.07	4.68	8.10	0.66	0.63	1.07	2.73	5.31	9.16
Benin	0.58	0.87	1.02	0.11	0.21	0.25	0.10	0.14	0.18
Botswana	2.58	3.08	3.65	0.21	0.33	0.26	0.81	0.43	2.22
Burkina Faso	0.58	0.88	1.19	0.03	0.04	0.05	0.49	0.54	0.69
Burundi	0.16	0.23	0.38	0.01	0.01	0.02	0.10	0.14	0.30
Cameroon	3.25	5.18	6.08	0.70	0.58	0.68	3.95	5.76	6.76
Cabo Verde	0.21	0.30	0.33	0.02	0.02	0.02	0.22	0.32	0.35
Central African Republic	0.15	0.15	0.16	0.01	0.01	0.01	0.16	0.16	0.17
Chad	0.11	0.17	0.19	0.01	0.01	0.01	0.12	0.19	0.20
Comoros	0.04	0.04	0.04	-	-	-	0.05	0.04	0.04
R Congo	0.42	0.58	0.90	0.43	0.47	0.78	0.42	0.76	1.68
DR Congo	4.83	6.67	9.31	0.83	0.39	0.50	7.33	7.82	8.74
Cote d'Ivoire	2.88	4.14	5.82	1.13	1.20	1.19	5.41	5.69	7.89
Djibouti	0.22	0.33	0.37	0.02	0.02	0.03	0.24	0.36	0.40
Egypt	89.50	122.38	142.70	12.60	14.92	19.15	102.88	138.75	162.24
Equatorial Guinea	0.08	0.09	0.09	0.01	0.01	0.01	0.09	0.09	0.10
Eritrea	0.22	0.25	0.30	0.05	0.04	0.05	0.27	0.29	0.35
Ethiopia	2.53	4.18	6.69	0.29	0.75	1.78	2.82	4.93	9.52
Gabon	1.22	1.49	2.10	0.30	0.38	0.56	1.51	1.86	2.26
Gambia	0.18	0.21	0.28	0.01	0.02	0.02	0.19	0.23	0.30
Ghana	5.17	6.62	9.21	1.67	2.36	2.93	6.66	9.91	12.60
Guinea	0.82	0.85	0.91	0.06	0.06	0.07	0.88	0.92	0.98
Guinea-Bissau	0.03	0.03	0.03	-	-	-	0.03	0.03	0.03
Kenya	4.73	6.10	7.57	1.10	1.18	1.63	5.84	7.28	9.15
Lesotho	0.44	0.85	0.77	0.03	0.05	0.04	0.46	0.69	0.50
Liberia	0.19	0.23	0.30	0.01	0.02	0.02	0.20	0.25	0.32
Libya	18.52	18.88	9.26	2.84	11.64	26.30	21.31	30.61	35.47
Madagascar	1.03	1.10	1.34	0.08	0.08	0.10	1.11	1.18	1.44
Malawi	1.28	1.63	1.93	0.10	0.12	0.15	1.38	1.75	2.07
Mali	0.73	1.08	1.42	0.05	0.08	0.11	0.78	1.17	1.52
Mauritania	0.46	0.59	0.79	0.03	0.04	0.06	0.50	0.63	0.85
Mauritius	1.91	2.37	2.59	0.20	0.19	0.18	2.12	2.57	2.77
Morocco	18.31	23.67	28.87	1.22	2.68	4.23	18.72	22.41	27.09
Mozambique	9.11	10.50	12.33	1.63	2.46	2.61	13.15	16.50	17.49
Namibia	2.96	3.22	3.74	0.38	0.33	0.54	1.67	1.29	1.48
Niger	0.49	0.90	1.19	0.07	0.11	0.19	0.22	0.46	0.65

Country	Consumption (Bn Kwh)			Distribution Losses (Bn Kwh)			Generation (Bn Kwh)		
	2005	2010	2014	2005	2010	2014	2005	2010	2014
Nigeria	16.94	20.38	23.94	5.58	4.50	4.90	22.52	24.87	28.83
Rwanda	0.19	0.33	0.52	0.01	0.02	0.03	0.11	0.27	0.46
Sao Tome and Principe	0.04	0.05	0.07	-	-	-	0.04	0.05	0.07
Senegal	1.51	2.32	2.98	0.77	0.50	0.48	2.28	2.83	3.46
Seychelles	0.20	0.26	0.33	0.02	0.02	0.02	0.22	0.28	0.35
Sierra Leone	0.07	0.15	0.25	0.01	0.01	0.02	0.08	0.16	0.27
Somalia	0.25	0.29	0.32	0.02	0.02	0.02	0.27	0.31	0.34
South Africa	205.08	214.97	211.84	20.56	24.47	20.94	227.98	241.91	235.44
Sudan and South Sudan	3.38	5.91	9.94	0.78	1.45	1.65	4.16	7.36	11.60
Switzerland	57.52	60.03	57.72	4.23	4.38	4.70	55.40	63.89	67.91
Tanzania	2.52	4.10	5.03	0.98	1.05	1.10	3.43	5.09	6.07
Togo	0.61	0.74	1.10	0.09	0.09	0.10	0.18	0.13	0.14
Tunisia	11.27	13.10	14.81	1.71	1.87	2.85	12.98	14.95	17.75
Uganda	1.73	2.21	2.74	0.13	0.17	0.21	1.90	2.43	3.01
Zambia	8.59	7.93	10.52	0.48	1.85	2.16	8.85	10.34	13.93
Zimbabwe	10.43	7.48	7.96	1.58	1.69	1.65	9.04	8.44	9.70

- Indicates nil or negligible.

Source: U.S. Energy Information Administration; and Exim Bank Analysis

Annexure III

Relationship between Electrification and GDP Per Capita in Africa

Country	Access to electricity (% of population) in 2014	GDP per capita (current US$) in 2014
Algeria	100	5496
Angola	32	5233
Benin	34	916
Botswana	56	7153
Burkina Faso	19	697
Burundi	7	286
Cabo Verde	90	3661
Cameroon	57	1407
Central African Republic	12	354
Chad	8	1025
Comoros	74	841
Congo, Dem. Rep.	14	438
Congo, Rep.	43	3147
Cote d'Ivoire	62	1544
Djibouti	47	1812
Egypt	100	3366
Equatorial Guinea	68	18918
Eritrea	46	545
Ethiopia	27	574
Gabon	89	10772
Gambia	47	440
Ghana	78	1442
Guinea	28	540
Guinea-Bissau	17	616
Kenya	36	1368
Lesotho	28	1204
Liberia	9	458
Libya	98	5518
Madagascar	17	453
Malawi	12	363
Mali	27	820
Mauritania	39	1371
Mauritius	99	10154
Morocco	92	3187
Mozambique	21	623
Namibia	50	5349
Niger	14	431
Nigeria	58	3080
Rwanda	20	698
Sao Tome and Principe	69	1870
Senegal	61	1042
Seychelles	100	15571
Sierra Leone	13	794
Somalia	19	537
South Africa	86	6488
South Sudan	5	1115
Sudan	45	2088
Swaziland	65	3540
Tanzania	16	958
Togo	46	630
Tunisia	100	4277
Uganda	20	735
Zambia	28	1727
Zimbabwe	32	931

Source: World Bank (as accessed on May 1, 2017)

Annexure IV

Exim India's LOCs in the Power Sector in Africa

Sr. No.	Country	Borrower	Goods to be covered	Project value (US$ mn)
1	Sudan	Govt. of Sudan	Electricity equipment	25.25
2	Cote d'Ivoire	Govt. of Cote d'Ivoire	Supply and erection of 225 kv line between Laboa abd Boundiali alongwith extension substation at Laboa	10.80
3	Cote d'Ivoire	Govt. of Cote d'Ivoire	Supply and erection of 225 kv line between Boundiali and Ferkessedougou alongwith extension substation at Ferkessedougou and creation of new substation at Boundiali	19.20
4	Ethiopia	Govt. of Ethiopia	Electrical Equipments , Power Transmission& Distribution	65.00
5	Mali	Govt. of Mali	Electricity transmission project from cote d'Ivoire to mali	30.00
6	Sudan	Govt. of Sudan	220 Kv Gedaref-Galabat Transmission Project	24.88
7	Mali	Govt. of Mali	Construction of High Voltage Transmission Line between Ferkessedougou (RCI) and Sikasso and setting up substation at Ferkessedougou, Sikasso, Koutiala and Segou	20.00
8	Mali	Govt. of Mali	Construction of High Voltage Transmission Line between Sikasso to Koutiala	15.00
9	Mali	Govt. of Mali	Construction of High Voltage Transmission Line between Koutiala to Segou	10.00
10	Rwanda	Govt. of Rwanda	Power Project	20.00
11	Sudan	Govt. of Sudan	Project for setting up 4 x 125 MW Kosti Combined Cycle Power Plant in Sudan to be executed by Bharat Heavy Electricals Ltd. (BHEL)	350.00
12	Sudan	Govt. of Sudan	SINGA-GEDARIF transmission and Sub-Station Project	41.87
13	Niger	Govt. of Niger	Rehabilitation and Reinforcement of power stations and Rehabilitation as well as erection of power-lines between various places in Niger (supply of 28 power generators, 18 power transformers, 6 shunt compensation Systems, power cables and other electrical equipments to Niger)	20.00
14	Mozambique	Govt. of Mozambique	Consultancy services for design for Project Improving the Quality of Power Supply – Lot 1 [Distribution]	2.40
15	Mali	Govt. of Mali	225kv Transmission Line Interconnection and Equipment for Substation between Mali and Cote d'Ivoire	26.01
16	Mali	Govt. of Mali	Supply of materials and construction of 225kv Transmission Line Interconnection between Mali and Cote d'Ivoire (Section Sikasso to Koutiala)	9.99
17	Mali	ECOWAS Bank for Investment and Development	Supply of Transmission Line Single Circuit 225 KV Interconnection and completion of Substation (Koutiala-Segou) - Mali- Cote d'ivoire	10.80
18	Mali	ECOWAS Bank for Investment and Development	Supply of Transmission Line Single Circuit 225 KV Interconnection and completion of Substation (Koutiala-Segou) - Mali- Cote d'ivoire	18.93
19	D R Congo	Govt. of D R Congo	Execution of Kakabola Hydroelectric Power Project	41.69
20	Rwanda	Govt. of Rwanda	Power Project	60.00
21	D R Congo	Govt. of D R Congo	Engineering, procurement and construction (EPC) contract for 64 MW Katende Hydroelectric Project	68.71

Sr. No.	Country	Borrower	Goods to be covered	Project value (US$ mn)
22	D R Congo	Govt. of D R Congo	Engineering, procurement and construction (EPC) contract for 64 MW Katende Hydroelectric Project	99.24
23	Ghana	ECOWAS Bank for Investment and Development	Supply of Self-Help electrification project	18.76
24	Burundi	Govt. of Burundi	For financing the Kabu Hydro Electric Project in Burundi	76.88
25	Kenya	Govt. of Kenya	Consulting services for Engineering and Project Management Services for Transmission Infrastructure in Kenya	2.37
26	Burundi	Govt. of Burundi	Project Management Consultancy (PMC) for the Development of the Kabu 16 Hydro Electric Project in the province of Cibitoke and Construction of the Posts and Electric Transmission Lines	2.86
27	Zambia	Govt. of Zambia	Supply of Turbines, Generators, Main Inlet Valves, Speed Governors and Excitation System plus Supervision of Erection and Commissioning, for the Itezhi – Tezhi Hydro Power Project in Zambia	29.03
28	Togo	Govt. of Togo	supply and installation of electrical material and equipment for electrification of 39 localities	14.71
29	Kenya	Govt. of Kenya	Design, procurement, supply, erection, installation, testing and commissioning of Turkwel, Ortum and Kitale Substations [220 KV] in Kenya - Lot 1A	19.07
30	Kenya	Govt. of Kenya	Design, procurement, supply, erection and construction of Turkwel, Ortum and Kitale Transmission line [220 KV] in Kenya - Lot 1B	11.60
31	Kenya	Govt. of Kenya	Design, procurement, supply, erection and construction of Machakos Konza Kajiado Namanga Transmission line [132 KV] in Kenya - Lot 2A	11.60
32	Kenya	Govt. of Kenya	Design, procurement, supply, erection, installation, testing and commissioning of Machakos Konza Kajiado Namanga Substations [132 KV] in Kenya - Lot 2B	16.96
33	Togo	Govt. of Togo	Project Management Consultancy services	0.25
34	Senegal	Govt. of Senegal	Supply, transportation and installaiton of equipment for electrical network in different regions of Senegal	27.50
35	Mozambique	Govt. of Mozambique	Electricity equipment	9.95
36	Mozambique	Govt. of Mozambique	Consultancy services for design for Project Improving the Quality of Power Supply – Lot 2 [Transmission]	4.19
37	Mozambique	Govt. of Mozambique	supply and construction of services for improving the quality of power supply in Maputo and Matola cities in Mozambique	106.96
38	Liberia	Govt. of Liberia	Preparation of a Detailed Project Report (DPR) for Power Transmission and Distribution Project in Liberia	1.35
39	Niger	Govt. of NIger	Project Management Consultancy for Construction of Solar Thermal Plant of 5 MW in Malabaza and Electrification of 30 villages through Solar System in Niger	1.90
40	D R Congo	Govt. of D R Congo	Engineering, procurement and construction (EPC) contract for 64 MW Katende Hydroelectric Project	32.20
41	D R Congo	Govt. of D R Congo	Engineering, procurement and construction (EPC) contract for 64 MW Katende Hydroelectric Project	49.77

Sr. No.	Country	Borrower	Goods to be covered	Project value (US$ mn)
42	Comoros	Govt. of Comoros	EPC/ Turnkey 18 MW Heavy Fuel Oil Load Grid connected engine based power generation project with associated tank farm & electrical evacuation system	32.99
43	Cote d'Ivoire	ECOWAS Bank for Investment and Development	Study, supply, service and works of installation of 225 KV line Boundiali-Ferkessedougou with creation of substation at Boundiali and extension of 225 KV substation at Ferkessedougou	23.74
44	Cote d'Ivoire	ECOWAS Bank for Investment and Development	Study, supply, service and works of installation and commission of the equipment for electronic transmission value	2.13
45	Mali	Govt. of Mali	Project Management Consultancy for power transmission project connecting Bamako and Sikasso via Bougouni in Mali	1.28
46	Cote d'Ivoire	ECOWAS Bank for Investment and Development	Study, supply, service and works of installation of 225 KV line Laboa-Boundiali and extension of 225 KV substation at Laboa	14.13
47	D R Congo	Govt. of D R Congo	Consultancy contract for preparation of Detailed Project Report for development of Power Distribution Project in Bandundu Province of the Democratic Republic of Congo	0.40
48	D R Congo	Govt. of D R Congo	Consultancy contract for preparation of Detailed Project Report for transmission and distribution project in Kasai province for evacuation of electricity from Katende Hydroelectricity Power Project	1.00
49	Gambia	Govt. of Gambia	Consultancy services for design, tendering and supervision of the Electrification Expansion Project for Greater Banjul Area in Gambia	0.57
50	Togo	Govt. of Togo	Consultancy Services for the Detailed Project Update, Project Allotment and Tender Documents [phase 1] and the support to Communaute Electrique du Benin [CEB] for procurement of the 161 kV power transmission line [phase 2]	0.45
51	Gambia	ECOWAS Bank for Investment and Development	Rural electrification extension project in Gambia [Phase-II]	0.52
52	Gambia	ECOWAS Bank for Investment and Development	Rural electrification extension project in Gambia [Phase-II]	9.48
53	Côte d'Ivoire	Govt. of Côte d'Ivoire	Study, Supply, Service and works of installation of the 225 KV Laboa-Boundiali Line and extension of sub-station at Laboa (Lot No. 1.2), Electricity Network Interconnection project between Côte d'Ivoire and Mali	8.64
54	Côte d'Ivoire	Govt. of Côte d'Ivoire	Study, Supply, Service and works of installation of the 225 KV Boundiali- Ferkessedougou Line with creation of sub-station at Boundiali and extension of 225 KV sub-station at Ferkessedougou (Lot No. 2.2), Electricity Network Interconnection project between Côte d'Ivoire and Mali	15.06
55	Côte d'Ivoire	Govt. of Côte d'Ivoire	Study, Supply, Service and works of installation and commissioning of the equipment for electronic transmission (Lot No. 3.1), Electricity Network Interconnection project between Côte d'Ivoire and Mali	0.30

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