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ESTABLISHMENT OF AN INDEPENDENT SYSTEM OPERATOR FOR ENHANCED COMPETITION: ZAMBIA'S CASE

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ABSTRACT

Zambia's Electricity Industry has installed capacity of about 2,830 Megawatts (MW). The industry is dominated by ZESCO Limited which is a vertically integrated parastatal utility company with installed generation capacity of 2,300MW. The industry has four Independent Power Producers (IPPs) with a combined installed capacity of 460MW. The liberalization of the industry by the Electricity Act and the growing demand for electricity has fueled the growth of IPPs.

All existing IPPs sell their energy to ZESCO through a long term Power Purchase Agreement thereby propagating a default single-buyer model. ZESCO has been issued with an interim systems operator's licence because the utility owns the control system and the transmission infrastructure. To attract more investment and foster competition; the establishment of the open access regime and a transmission tariff has been proposed.

Stakeholders have argued that ZESCO cannot operate fairly as a system operator because the utility owns power generation stations thereby creating a conflict of interest on its part. Further, the growth of IPPs and sector in general is hampered by the dominance of ZESCO which controls access to its transmission infrastructure by third parties. Stakeholders have since called for establishment of an independent systems operator that can operate efficiently and fairly.

The paper examines open access regime and explores ways in which the establishment of an independent systems operator can be attained to attract investment and foster competition amid the challenges of the existing long-term firm contracts between ZESCO and IPPs; exacerbated by the vertically integrated structure of ZESCO.

1. OVERVIEW OF ELECTRICITY INDUSTRY IN ZAMBIA

Zambia's electricity sector has been experiencing the challenge of increasing demand for electricity arising from various demographic and economic factors. The power sector in Zambia is dominated by ZESCO Limited (ZESCO) which is a vertically integrated state utility accounting for over 70% of Zambia's generation capacity. The utility generates, transmits and distributes electricity throughout the country. Zambia's installed power generation capacity stands at 2,830 MW. The national electricity access rate is estimated at 22% and only about 5% in rural areas[1]. The power sector for a long time has not attracted investments due to a variety of reasons among them the dominance of ZESCO leading to stakeholders calling for reforms in the sector.

Zambia's power sector is predominantly hydro based, accounting for about 85% of the country's entire electricity generation. Consequently, Zambia's power sector has been very vulnerable to climate change where for instance in the 2014-15 rain season a drought was experienced that led to the decline of about 50% of the country's entire hydro electricity generation.

The other players are Copperbelt Energy Corporation (CEC) which purchases bulk power from ZESCO and supplies to the mining companies on the Copperbelt based on the long term Bulk Supply Agreement (BSA) as well the North Western Energy Corporation (NWEC) which is a private distribution company that buys power from ZESCO and supplies to the residential customers of mining townships in the North-Western Province of Zambia. Zambia has Independent Power Producers (IPPs) generating power from hydro, thermal and Heavy Fuel Oil (HFO). Table 1 shows Zambia's IPPs.

Table 1: IPPs in Zambia

	Name of IPP	Installed Generation Capacity (MW)	Technology
1	Kariba North Bank Extension	360	Hydro
2	Itezhi Tezhi Power Company	120	Hydro
3	Lunsemfwa Hydro Power Company	52	Hydro
4	Ndola Energy Corporation	105	HFO
5	Maamba Collieries Limited	300	Thermal (Coal)

Source: ERB

Kariba North Bank Extension is a Special Purpose Vehicle (SPV) that was created for the purpose of developing the power project. The SPV is entirely owned and operated by ZESCO. Itezhi Tezhi Power Company is jointly owned by ZESCO and TATA Africa which is a subsidiary of TATA from India. The rest of the companies are privately owned companies with a combined generation capacity of about 460MW.

Another player in the industry is Zengamina Power Company which operates an off-grid small hydro power station with installed capacity of 0.75 MW. With regard to rural electrification, the Government of the Republic of Zambia has set up the Rural Electrification Authority (REA) which has been tasked with the mandate of electrifying the rural areas. On the policy front, the

[1] Central Statistics Office of Zambia

Ministry of Energy provides policy direction while the Energy Regulation Board (ERB) regulates the sector.

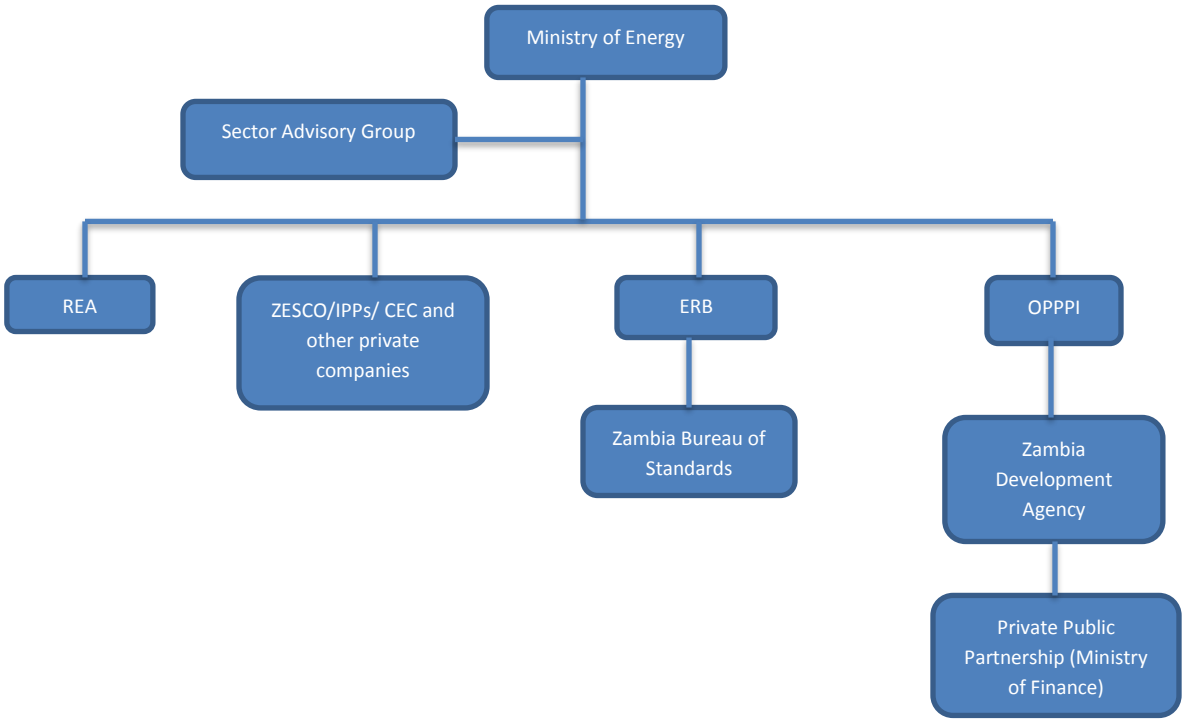
2. EVOLUTION OF THE ELECTRICITY INDUSTRY IN ZAMBIA

Zambia's economic reforms of the 1990's did not spare the electricity sector. Before the reforms which brought about economic liberalization, the energy sector was predominantly a monopoly market which was operated by then Zambia Electricity Supply Corporation (ZESCO) Limited which was formed by the Zambia Electricity Supply Act of 1969. The Act gave market dominance to ZESCO as the sole generator and supplier of electricity in Zambia.

In 1994, the Zambian Government developed the National Energy Policy (NEP). The core objective of the NEP was to develop the countries unexploited hydro potential for power generation to meet the electricity needs of the growing demand domestically and in the regional market. To achieve this objective, the government devised a strategy to end ZESCO's monopoly by opening up the industry to private sector investment.

In 1995, the Zambia Electricity Supply Act of 1969 was repealed and was replaced with the Electricity Act of 1995. The new Act liberalized the electricity sector and ended ZESCO's monopoly. Further in the same year, Parliament enacted the Energy Regulation Act that gave birth to the ERB and also introduced the Rural Electrification Levy which is 3% of the electricity bill. Further, in 2003, the Government through Parliament enacted the Rural Electrification Act which led to the establishment of REA. The Ministry of Energy also created the Office for Promoting Private Power Investments (OPPPI) as a unit dedicated to the promotion of private investment. The institutions discussed here regulate operations, pricing and promote the entry of private investors in the sector. In 1997, the Power Division of the mining conglomerate, Zambia Consolidated Copper Mine (ZCCM) was privatised to establish CEC as the first privately owned utility in the liberalised electricity market. Over the years, private investment has sprung up though very little leaving plenty of room for more private investment as the sector still remains dominated by ZESCO. Figure 1 depicts the existing institutional framework of the electricity sector in Zambia.

Figure 1: Organizational institutional framework of the electricity sector



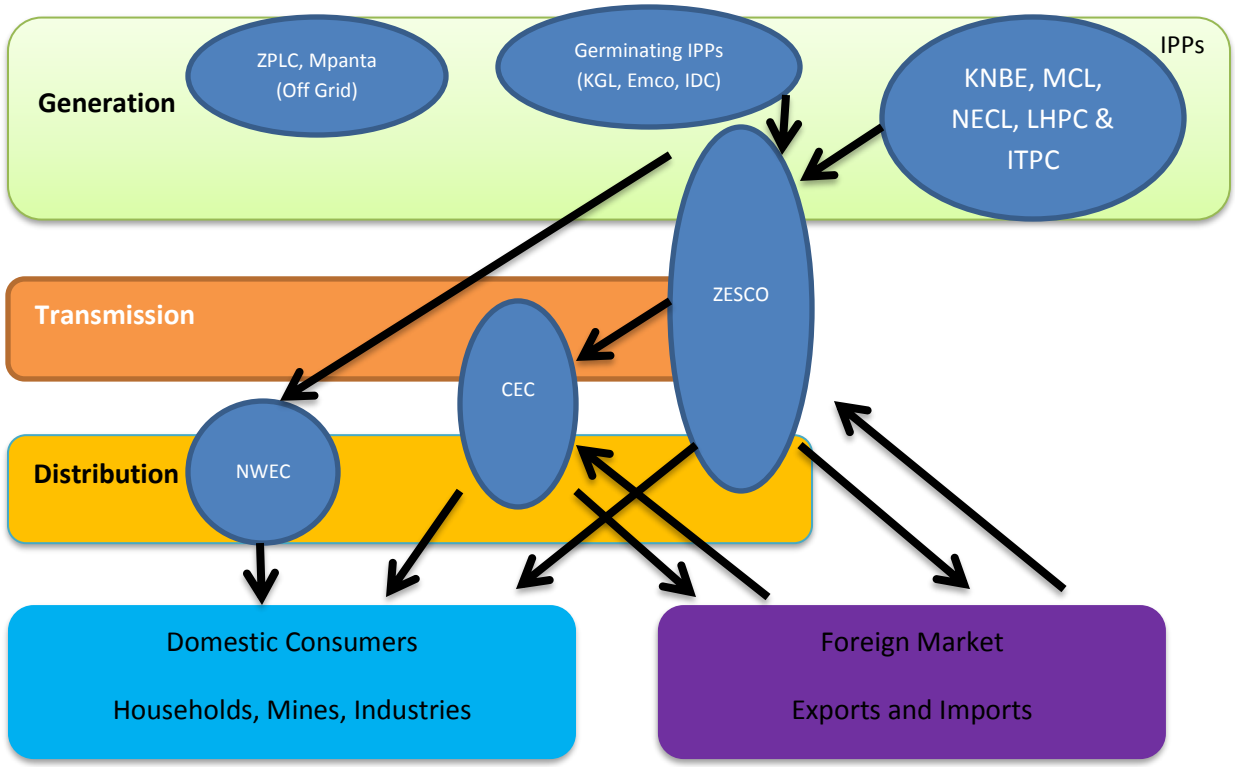
Source: Ministry of Energy-Zambia

3. ELECTRICITY MARKET STRUCTURE IN ZAMBIA

ZESCO is responsible for over 70% power generation. Out of the total power generated in the country, over 50% is sold to CEC through a Bulk Supply Agreement (BSA). CEC supplies the power purchased from ZESCO to its mining customers in the Copperbelt Province. CEC holds exclusive rights as the sole supplier of power to the mines on the Copperbelt.

All the existing IPPs sale their power to ZESCO through long term PPAs. This has created a single buyer model by default. However, the industry still remains liberalized. The market structure is as depicted in figure 2.

Figure 2: Market Structure in Zambia



The new implementation agreements between the government and private power project developers continue to perpetuate the single buyer model. The Government through ZESCO has partnered with Sinohydro of China to develop 750MW Kafue Gorge Lower. All the power generated will be sold to ZESCO. The Industrial Development Corporation (IDC) has also embarked on a programme to develop about 600MW of solar power generation plants. The first round of the programme has been executed and two projects with combined generation capacity of 100MW have been procured and all the power generated will be sold to ZESCO. Another generation project in the offing is EMCO which will develop 300MW coal thermal power generation plant which will sale the power to ZESCO. The Government has also developed the Renewable Feed-In Tariff (REFIT) Programme with ZESCO as the off-taker. With these developments, the single buyer model is envisaged to stay in the short to medium term.

4. SYSTEM OPERATOR IN ZAMBIA

The Zambian main Transmission System is owned by ZESCO as part of the vertically integrated system used in the generation, transmission and distribution of power. The other part of the transmission network is owned by the CEC which is a private company that operates 66kV and 220kV lines that traverse the Central and Copperbelt Provinces of Zambia. Additionally, Lunsemfwa Hydro Power Company which is an IPP also owns a 66kV line that its uses to evacuate the power generated from its generation stations to feed into the ZESCO transmission network.

The Zambian Transmission System is interconnected to Tanzania and Botswana on 66kV, Namibia on 220kV, Congo DR on 220kV and Zimbabwe on 330kV. The Transmission System operating voltages are 66kV, 88kV, 132kV, 220kV and 330kV.

Up until 2016, the ERB granted Transmission Licenses to companies to operate their own systems. There was no National System Operator. The transmission grid was operated and monitored by the control centres of the various owners of the systems. Each of the companies has its own operator. The ZESCO grid is operated by its own National Control Centre and the CEC grid is also operated by its own Control Centre.

Since these control centres were and are still owned by the various companies, the degree of independence has been compromised as they had to serve their grids. The control centres are answerable to their companies. There is no supervisory body but they operate according to the Electricity Act regulations, Grid Code and also being members of the Southern African Power Pool (SAPP) operate within the SAPP operating guidelines.

In 2016, ZESCO applied to the ERB for a licence to operate the national transmission grid. This is owing to the fact that the utility owns over 70% of the national electricity grid. The ERB granted the system operator licence to ZESCO for a period of five (5) years. It is argued that the granting of the system operator licence to ZESCO will negatively affect the functioning of the liberalized electricity market because ZESCO is also responsible for over 70% of power generated in Zambia therefore the utility cannot function properly as a system operator as fair competition cannot be guaranteed under the existing scenario. This is because ZESCO is also a power generator thereby creating a conflict of interest. This will compromise economic dispatch which is required to enhanced competition and achieve efficiency among power generators. The awarding of system operator's licence to ZESCO also strengthens ZESCO's market dominance and fortifies the barrier to entry into the industry. To this regard stakeholders have called for an establishment of an Independent System Operator (ISO). This has been echoed by Bushnell (1999) who has observed that;

"historically, the primary barrier to greater competition in the electricity industry has been the vertical integration of most firms. Control of the transmission grid can advantage some competitors at the expense of others. In electricity markets around the world, policymakers have attempted to solve this problem through the creation of independent 'gridcos'[2] or 'system operators' that operate their network in a non-discriminatory Manner To date, most of the concern about market power has therefore focused on the horizontal market power of large generation companies. However, the introduction of transmission rights into this process adds a new set of market power concerns. To the extent that transmission rights provide their owners with an added level of influence or control over transmission markets, some of the original concerns over 'vertical' market power must again be considered".

[2] Grid companies

An ISO can be described as the 'soul of the grid' as according to O'Donnell (2003). It has also been described as the 'air traffic controller'[3]. System operators ideally undertake control of the operations of the electricity system they preside over. They also manage the energy market especially where a competitive scheme exists. The minimum characteristics and functions of the ISO among many as summarized by Politt (2011) are hereby discussed.

The minimum key characteristics include but not limited to the following:

I. **Independence:** which implies the isolation of control from market participants to level the playing field for fair competition;
II. **Scope and spatial configuration**: the area covered by the ISO must be of good size that should be able to generate trade benefits;
III. **Operational Authority:** the ISO usually have authority over physical dispatch of power generation plants and loads. The ISO has authority over system control; and
IV. **Reliability:** the ISO takes over responsibility in ensuring short-term system stability and efficient balancing of supply and demand

Some of the minimum functions are as follows:

I. **Tariff Design and Management:** The ISO is required to design an efficient transmission tariff. The ISO is also responsible for designing the tariff. In regulated markets, ISOs work closely with the regulators in the design and administration of transmission tariffs.
II. **Congestion Management:** The ISO is responsible for managing congestion in the transmission network. This is done through pricing congestion and minimization of the costs as well as guarding against abuse by powerful generators.
III. **Parallel Path Flow:** In a transmission system, electricity reaches a single node on the network from different routes. ISOs are responsible for managing the parallel path flows to ensure that there is no interruption to supply to any node in the network.
IV. **Ancillary Services:** The ISO coordinates the ancillary services offered by the market participants.
V. **Total Transmission Capability (TTC) and Available Transmission Capability (ATC):** ISOs are responsible for the operation of the computer software used by all generators to access the transmission network. They are responsible for determining the amount of transmission existing (TTC) and the available capability (ATC) and are responsible for maintaining the system reliability.
VI. **Market Monitoring:** The ISO monitors the market to ensure that there is no abuse of the network by the market participants.
VII. **Planning and System Expansion:** The ISO is also responsible for planning of the system expansion because they are exposed to so much information required for planning purposes. ISOs play a role in coordinating and in the assessment of future investments in the transmission system.

[3] http://www.spp.org/section.asp?pageID=1

VIII. Interconnection Coordination: ISOs are usually interconnected to one another at the boundaries of their control. Therefore there is need for collaboration among interconnected networks.

5. INTRODUCTION OF THE OPEN ACCESS REGIME

Section 4 (four) of the Electricity Act Cap 433 of the Laws of Zambia gives power to the Minister of Energy to declare transmission line as a common carrier. Subsection 2 states as follows:

"(2) The Minister may, by statutory instrument, declare any transmission line to be a common carrier for the purposes of this Act.
(3) A transmission line that is declared, under subsection (2), to be a common carrier may, subject to any regulations made under this Act and any requirements made by the Minister or the Board under subsection (1), be used for the purposes of an undertaking on such terms and conditions as may be agreed between the operator of the undertaking and the owner or person in control of the line concerned or, in default of such agreement, as may be determined by the Board with the consent of the Minister."

Taking advantage of this provision in the law, the ERB has made a proposal to the Minister of Energy to declare the existing transmission network as a common carrier to allow for third party access in order to foster trade and encourage investment in the sector especially in generation. This call has been backed by various stakeholders in the energy industry. A draft Statutory Instrument has been developed. Open access regime is therefore expected to be a reality in the near future especially with the political-will shown towards reforming the electricity sector. The eminent implementation of the open access regime strengthens the case for the establishment of an ISO.

6. INDEPENDENT SYSTEM OPERATOR WITH CURRENT MARKET STRUCTURE

The Zambian electricity industry remains dominated by ZESCO through its vertically integrated structure. Many commentators have rightly observed that the awarding of the system operators licence to ZESCO augments its market dominance. This stifles competition and acts as a barrier to entry by other potential investors into the market. Stakeholders have since called for unbundling of ZESCO and establishment of the Transmission Company that should also undertake system control. Many believe that it is untenable to establish an ISO while maintaining the vertically integrated structure of ZESCO. This paper argues that an ISO can be established even with the current vertically integrated structure of ZESCO. This can be done through separation of control of the system from the ownership of the transmission infrastructure.

As earlier stated, the Electricity Act gives power to the Minister of Energy to declare a transmission line as a common carrier. If the Minister invoked his powers accordingly, it strengthens the case for separation of the national control centre from ZESCO to create an ISO. A stand-alone entity can be established to manage the control centre and execute economic dispatch as an ISO. The ISO would perform all the functions discussed in the preceding section.

The transmission owner, in this case ZESCO, will have no power over granting of third part access. The responsibility is vested with the ISO. The ISO is responsible for implementing the non-discriminatory access to the transmission network. This is expected to foster trade and will attract new players which will enhance competition. Competition brings efficiency. Consumers can benefit through improved quality of service and in the long-run may benefit from lower tariffs arising from shared distribution of efficiency gains between utilities and customers. Additional investment will also guarantee security of supply and contribute to national development. This will help in resolving the challenge of ever growing demand for electricity propelled by economic and demographic factors.

ZESCO has signed long term PPAs with the current IPPs in Zambia. All the IPPs have firm contracts hence economic dispatch is unattainable under the existing IPPs. This s a valid argument as ending the current contractual terms so that the IPPs begin to compete among themselves will be a bleach of contract which has serious cost implications on ZESCO and the Zambian Government. The Government has guaranteed the development of most of the independent power generation projects because most projects have been developed with ZESCO committing as an off-taker. The Existing PPA can be left untampered with but where possible they can be renegotiated. When these PPAs expire, they should not be extended in their current form. They will have to be subjected to the terms of the open access regime. However, for the new power generation projects, ZESCO should not be allowed to enter into long term firm contracts. All new project developers will have to abide by the dictates of the market rules to be stipulated under the open access regime.

To operationalize the open access regime and establish the ISO, it is imperative that the regulator (ERB) develops a transmission tariff and designs how the revenues are shared between the owners of the transmission infrastructure (ZESCO) and the ISO. The ERB has been proactive on this matter and has ensured that the transmission tariff methodology is one of the key outcome of the electricity cost of service study consultancy. Additionally, the ERB should also develop the guidelines for generation tariffs. The regulator will not however determine the tariff level as that will be at variance with the doctrines of competition. The generation companies should compete on price for economic dispatch to be operationalised.

The BSA involving ZESCO, CEC and the Copper mining companies on the Copperbelt poses a challenge to the operationalization of the open access regime. The BSA has no cost-pass-through clauses. The cost of electricity from generators should be past-through to all end-users which should include the mines. The Government has an opportunity to resolve this matter because the BSA will soon expire and it cannot be extended in its current form. It will be injudicious and injurious to the electricity industry, economy as a whole and to the people of Zambia if the BSA was to be extended in its current form which allows the mines to pay uneconomic electricity tariffs and yet they consume over 50% of the power generated in Zambia. The BSA should serve a lesson to developing countries that they must be meticulous and always be futuristic whenever entering into development agreements with foreign investors. Sustainable development is one that does not compromise the future generations' ability to

meet its own needs. The BSA has created problems for the contemporary generation and Government and is therefore at variance with the principles of sustainable development.

7. CONCLUSION

As the Government of the republic of Zambia contemplates on the reforms in the electricity industry, the declaration of a common carrier and establishment of the ISO through separation of the control of the system from the ownership of the transmission infrastructure is a quick win for the Government of the Republic of Zambia. This is not far-fetched because some of the necessary conditions are already in place. The Grid Code has been established through SI number 79 of 2013. Currently, the ERB is developing the Distribution Code and by the end of 2017 the transmission methodology would have been developed when the cost of service study is concluded. The establishment of the ISO is therefore the closest reachable bait for attracting investment and enhancing competition. The establishment of the open access regime and ISO is attainable even amid the vertically integrated structure of ZESCO through separation of ownership and control of the transmission infrastructure. It will set the stage for possible radical reforms that may involve full vertical and horizontal unbundling. The open access regime and creation of ISO will accelerate the growth of the electricity market in Zambia.

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