

## 르완다 전력 시장 및 전력화 현황 분석

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### Status of Electricity Market and Electrification in Rwanda

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**Abstract** - The demand of electricity in Rwanda is growing rapidly since Rwanda is developing country. They consider the availability of an efficient and reliable electricity supply that plays a significant role in social and economic growth. Sustainable electricity technology requires a better exploitation of domestic energy resources, efficient use of energy, rationalizing energy pricing and subsidies and capacity building. In this paper, we introduce the current state of electricity market and electrification in Rwanda.

Keywords: Rwanda electricity market, Restructuring

#### 1. Introduction

An electricity market is an arrangement to transfer electric energy from producers to consumers. The vital commodity, which has a significant impact on the structure of an electricity market is the electric energy. For the transmission of electric energy to be possible a power system infrastructure is required [1]. Researches have been carried out to study about the electricity trading in a competitive market.

##### 1.1 Rwanda Electricity Network

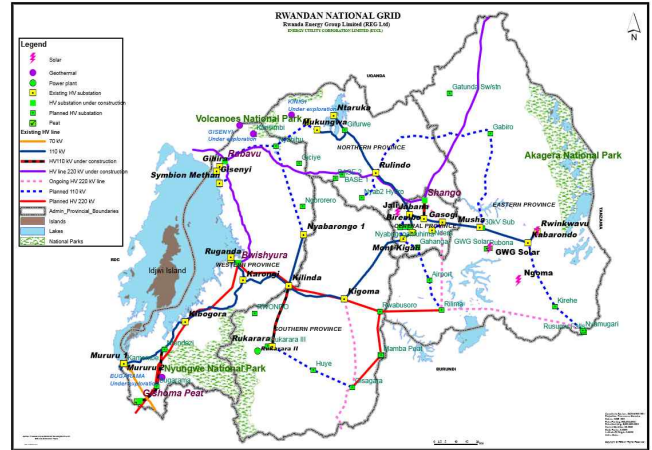
Rwanda power system consists of generation, transmission and distribution to consumers. The energy generation in Rwanda is currently dominated by Renewable energy resources [2]. The total installed electricity generation capacity has risen from about 100MW in 2012 to 216.01MW in 2018, with 52% generated from Renewable energy resources. According to [3], Up to now, Rwanda have one large nationwide interconnected transmission network. This comprises of 744,7km of high voltage (HV) transmission lines.

Rwanda's transmission network voltages are 110kV, and 220kV. The 70kV lines that existed till 2013, are being upgraded to 110kV to improve network reliability and power supply stability amidst the country's changing power demand profile [4].

##### 1.2 Restructuring

Restructuring of the power industry aims at abolishing the monopoly in the generation and trading sectors, thereby, introducing competition at various levels wherever it is possible [5]. Generating companies may enter into contracts to supply the generated power to the power distributors or bulk consumers or sell the power in a pool in which the power brokers and customers also participate.

In Rwanda, a number of government agencies play important roles in various aspects of the energy sector. However, the



<Figure 1> Rwanda National Grid Map.

ministry of infrastructure has the primary responsibility for setting the overall policy and Strategy [6].

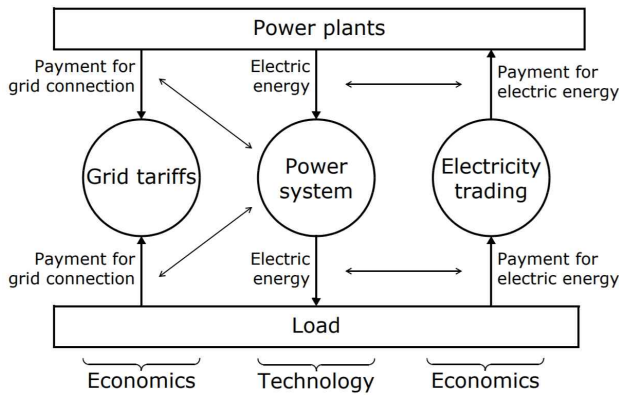
The government of Rwanda has designed a cautiously staged progression towards full restructuring of its electricity sector. In the past few years, a law was enacted to unbundle the national monopoly as a result, the Rwanda Energy Group Limited (REG Limited) and its two subsidiaries; the Energy Utility Corporation Limited (EUCL) and the Energy Development Corporation Limited (EDCL) entrusted with energy development and utility service delivery in the country [6]. Furthermore, the independent power producers (IPPs) are encouraged to participate in the generation sector. Fig. 1 describe the Rwandan National grid.

REG Limited was incorporated to expand, maintain and operate the energy infrastructure in the Country. The company is engaged in electricity generation, bulk transmission and distribution. It participate in the execution of power purchase/power sales agreements with IPPS and other regional utilities for import and export among others [3]. Power purchase agreements and electricity tariffs are approved by Rwanda Utility Regulatory Authority (RURA).

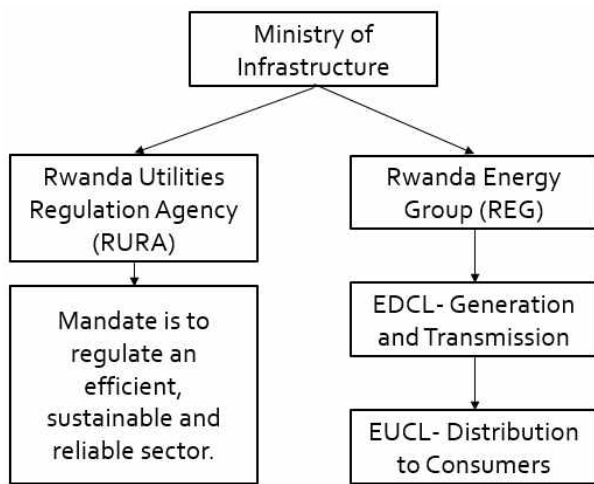
#### 2. Rwanda Electrical Market

An overview of an electricity market can be summarized as illustrated in Fig. 2. Producers owns and operate the power plants in the electric market while consumers receive the electric energy transferred through the grid.

The current electricity market in Rwanda is in the first stage of restructuring which is taking a step-by-step approach with each step involving substantial analytical and



<Figure 2> Overview of an electricity market.



<Figure 3> Energy Sector in Rwanda

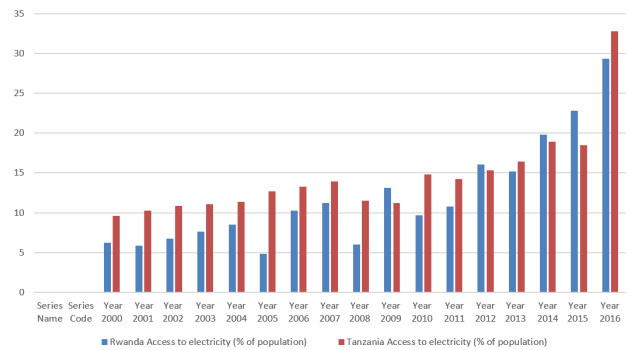
preparation work. In this stage, one transmission/distribution company (REG Limited) and many IPPs exists in the market. In this market the Rwanda Utility Regulatory Authority as an independent market operator, determines the Price. Rwanda electricity market structure is illustrated in Fig. 3.

### 2.1 Electricity trading

The electricity trading aims to ensure that the producers are paid for the energy they have generated and the consumers pays for the energy they have consumed. In Rwanda, the electric trading is organized in such a way that REG Limited combines the roles of producer, retailer, grid owner and system operator therefore managing all the steps of power delivery. Consumers have only one option to buy from REG Limited or use off-grid systems.

### 2.2 Electrification in Rwanda and Tanzania

The access to electricity in Rwanda have increased remarkably due to the Rwandan programs to increase electricity generation based on Renewable resources. However, East african countries such as Tanzania have much access than Rwanda. The world Bank data shows that only around 30% of the population in Rwanda are connected to the national grid and 11% access electricity through off-grid systems, while 32% of Tanzania population are connected to the grid. Futhermore, our countries have to learn from developed countries such as South Korea where 100% of population have access to electricity. The access to electricity



<Figure 4> Electrification status in Rwanda and Tanzania (unit of y-axis: %)

in Rwanda and Tanzania according to the World Bank data from year 2000 to 2016 are presented in Fig. 4.

### 3. Conclusion

Rwanda with its abundant renewable resources of energy has undertaken actions for the development of energy sector by promoting Renewable energy generation. Independent power producers are being encouraged to invest in the Methane gas projects, Hydropower and Solar Projects. Rwanda has also attracted private investment in improving the distribution system, the opportunity lie in Smart grids, smart meters and off-grid solutions. Exploitation of these source of electricity can shape the Rwandan electricity market to an improved level as the demand for energy grows in the country.

#### 감사의 글

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