



Sub-Saharan Report [Business Plus]

These reports are by Mr. Ryota Kikkawa, an expatriate employee working in Johannesburg with a view across the region.

Business Plus

With a growing population, abundant natural resources, and enormous infrastructure and industrial development potential, Africa, particularly sub-Saharan Africa, has been called the "Continent of Hope". In Marubeni's mid-term management plan, "Global Challenge 2018", sub-Saharan Africa has been cited as an important region to actively pursue opportunities to lay the groundwork for future business.

The Marubeni Research Institute has modified the "Sub-Saharan Report", which basically presented an overview of sub-Saharan countries, to focus on the latest business trends and prominent business models in the region, including Marubeni's own businesses. This revised version is called "Sub-Saharan Report [Business Plus]".

Contributing to Both an Environmentally-Friendly and Stable Power Supply - Marubeni's Olkaria Geothermal Power Plant Project in Kenya

February 8, 2019

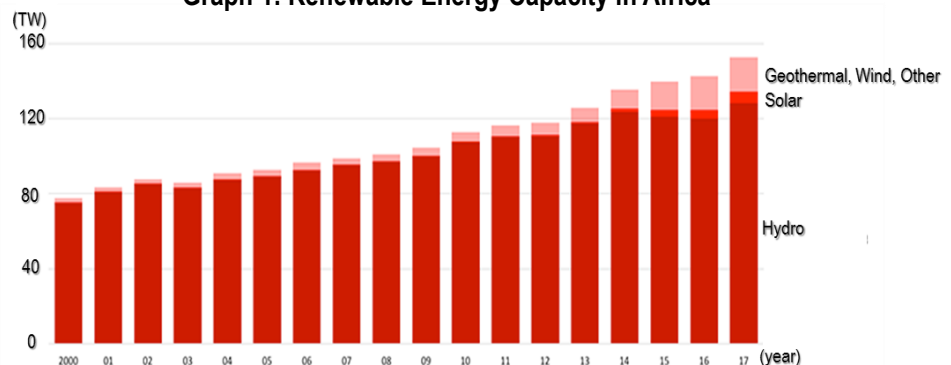
Environmental Awareness in Africa on the Rise

In recent years, environmental awareness has been increasing worldwide (note 1). When we hear the term environmental policies we tend to think that only developing countries are working on this problem. According to the Intergovernmental Panel on Climate Change, Africa, including desertification, is considered to be particularly susceptible to climate change and even though it is a developing region action toward climate change is being taken. For example, nearly all African countries have joined the Paris Agreement, the international accord on climate change, in which each country sets goals on greenhouse gas reduction while promoting industrialization. Sustainable Development Goals (SDGs) (also note 1), which we have heard a lot about recently, are regarded as very important in Africa. In order to achieve the SDGs in the 54 countries of Africa the Sustainable Development Goals Center for Africa (SDGC/A) was established. The SDGC/A is composed of the presidents of Africa's countries with the aim of achieving SDGs throughout Africa through policy proposals and innovation (note 2).

Renewable Energy Expanding

As previously mentioned, environmental awareness is rapidly increasing in Africa. On the other hand, many countries in Africa are in the process of developing, so the rapid development of industry and economic growth are essential to improving people's daily living standards. In this regard, energy is indispensable in supporting economic growth, so producing clean energy becomes important to achieving high economic growth and protecting the environment at the same time. In Africa, such internationally supported measures as the African Renewable Energy Initiative (note 3), launched at COP21

Graph 1: Renewable Energy Capacity in Africa



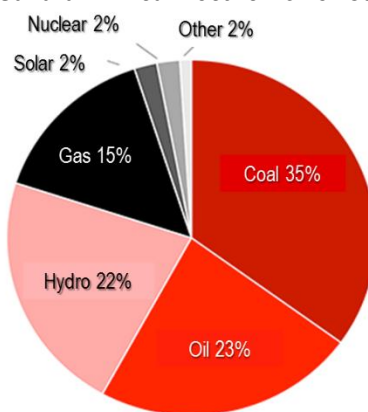
Source: International Energy Agency

(21st Conference of the Parties to the UN Framework Convention on Climate Change) and the U.S. led Power Africa Initiative (note 4) is helping to expand renewable energy fueled electric power in Africa (graph 1).

Hydro Power

Renewable energy has already reached a certain level of development through hydro power. Looking at sub-Saharan Africa's energy mix we see that hydroelectric power makes up 22% of total electric power generation following coal and oil (graph 2). It especially thrives on the rivers running through Central and Southern Africa. Large hydroelectric power generation can be found on the Zambezi River flowing through Zambia, Zimbabwe, Malawi and Mozambique, the Congo River running through the Democratic Republic of the Congo and Angola's Kwanza River among others.

Graph 2: Sub-Saharan Africa Electric Power Capacity by Fuel



Source: International Energy Agency

Solar Power

Solar power is one renewable energy that is currently being actively introduced in sub-Saharan Africa. It is said that Africa has the potential for 10 terawatts (TW) of solar powered electricity and the African Union (AU) has set a new plan to create 300 GW in solar power capacity in the region. In addition to the fact that the cost of solar power is decreasing, many countries are promoting solar power through the application of feed-in-tariffs (FIT). As a result, solar powered electricity, including a number of solar power plants in excess of 100 megawatts (MW), is rapidly progressing in sub-Saharan Africa. The electricity grid in many parts of sub-Saharan Africa is underdeveloped, so small-scale off-grid solar power generation is expanding in many places. (For details on off-grid solar power in sub-Saharan Africa please refer to our October 2018 sub-Saharan Africa report.)

Geothermal Power

For Japanese companies, renewable energy is expected to be a strong growth field for them in Africa, with geothermal powered electricity especially having bright potential. In particular, the intercontinental Great Rift Valley runs through much of Kenya and parts of Ethiopia and can provide them with a combined 12 gigawatts (GW) in geothermal resources, with Kenya's geothermal reserves said to be the 4th largest in the world (map 1, picture 1). Geothermal power has relatively little carbon dioxide, especially when compared to fossil fuel power generation, and since there are no seasonal weather and climate concerns as there are for solar and hydro power strong consideration can be given to it for use as a baseload power supply (note 5). Japan, as a volcanic rich country, has abundant geothermal resources and as a by-product Japanese companies possess world-class geothermal power generation technology. In regards to geothermal power generation

systems, Japanese companies (Toshiba, Mitsubishi Hitachi Power Systems (MHPS), Fuji Electric) command a 60% global market share and it is expected that Japanese companies will lead in the development of geothermal power projects in Africa (table 1).

Map 1: The Great Rift Valley's Location



(Map created by the writer.)

Note: The Great Rift Valley is an enormous contiguous geographic trench that runs from the Dead Sea on the Arabian Peninsula through the Red Sea and on to Ethiopia, Kenya and Tanzania. There is elevated heat creating thermal bulges in the mantle in these trenches right below the ground boundary plate exuding extremely high geothermal temperatures.



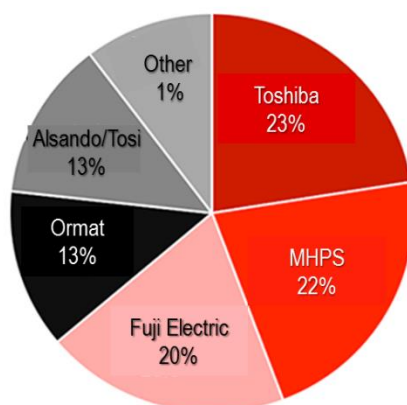
Picture 1: Steam emanating from the ground of the Great Rift Valley
(Picture taken by the writer.)

Table 1: Global Ranking of Geothermal Resources by Country

Country	Geothermal Resources (Gigawatts (GW))	Geothermal Power Capacity (kilowatt hour (kW))
U.S.	30	3,450
Indonesia	28	1,340
Japan	24	530
Kenya	7	590
Philippines	6	1,870
Mexico	6	1,020
Iceland	6	670
Ethiopia	5	10
New Zealand	4	1,010
Italy	3	920

Source: Japan Agency for Natural Resources and Energy

Graph 3: Share of Global Geothermal Power Systems by Company



Source: Bertani "Geothermal Power Generation in the World 2010-2014 Update Report" (2015)

Olkaria Geothermal Power Plant Project

The government of Kenya has set a goal to increase its geothermal fueled electric power capacity by 6.5 GW by 2030. Kenya already has about 600 MW of geothermal power in the country which makes up about 40% of the country’s total electricity output. As part of this and in order to meet Kenya’s growing yearly electric power demand, especially clean energy, Marubeni received an \$8.6 billion order from Kenya’s state-owned power company, Kenya Electricity Generating Company (KEGC), to construct a geothermal electric power plant.

The plant will be located about 120 kilometers northwest of the capital city of Nairobi in Olkaria in the Great Rift Valley, an area rich in geothermal resources. Olkaria already has geothermal power plants with the first one, a 15 MW unit which was also sub-Saharan Africa’s first geothermal power plant, starting operation in 1981. In the ensuing years other geothermal power plants were built in at the same location with the Olkaria Power Station now boasting a total of 5 units with a generating capacity of 185 MW, making it the largest geotherm power complex in sub-Saharan Africa. In addition to the Olkaria I Power Station, the Olkaria II and Olkaria III Power Stations are also operating in the same area (table 2).

Table 2: Olkaria Geothermal Power Stations’ Background

Date	Details	Accumulated Power Capacity (MW)		
		I	II	III
1981	Olkaria I Power Station Unit 1	15		
1985	Olkaria I Power Station Units 2/3	45		
2000	Olkaria III Power Station Unit 1			13
2003	Olkaria II Power Station Units 1/2		35	
	Olkaria III Power Station Unit 2			84
2010	Olkaria II Power Station Unit 3		70	
2015	Olkaria I Power Station Units 4/5	185		
2016	Rehabilitation of Olkaria I Power Station Units 1/2/3 begins through funding from JICA to KEGC (2021 completion)	190		
2018	Marubeni receives order to construct Olkaria I Power Station Unit 6 (2021 completion)	260		

Source: Various media reports

Marubeni's Prospects for Electric Power Development in Africa (Mr.Seto, GM, Marubeni Power Systems)

The demand for urban infrastructure in sub-Saharan Africa is growing due to rising domestic demand and rapid urbanization as a result of population growth. Expanding electric power demand is accompanying this and countries are laying out plans to meet this demand based on power sources that meet their own particular circumstances.

Construction of the Olkaria geothermal power plant is in line with Marubeni's own policy of expanding its involvement in renewable energy by doubling the current share of its net renewable energy power capacity to about 20% of the Marubeni Group's total energy portfolio over the next 4 to 5 years. With the Olkaria geothermal plant project as a bridgehead, we will continue to make efforts to meet sub-Saharan Africa's robust electric power demand through the export of high-quality infrastructure and contribute to the economic development of the region.

Furthermore, the electrification rate of sub-Saharan Africa is only around 35% with it being only 20% in rural areas, so more than half the population without access to electricity in the entire world lives in this region. This is one of the biggest problems inhibiting economic development and restraining economic growth in sub-Saharan Africa. In addition to the off-grid community-based power supply business with WASSHA in areas without electricity access in Tanzania, by pursuing and developing these and other types of electric power projects Marubeni can contribute to the electrification of areas with no electricity access and bring electric power to many of the 1.1 billion people currently without electricity worldwide and help develop local economies in the process.

Note 1: SDGs are sustainable development goals outlined by the UN in 2015. They entail such aims as the eradication of hunger and countering climate change, 17 goals in all to be reached by 2030.

Note 2: The SDGC/A is headquartered in Rwanda. The Board of Directors is co-chaired by President Kagame of Rwanda and Mr. Aliko Dangote, the CEO of the Dangote Group of Nigeria. The other board members consist of the presidents of Ghana, Guinea, the Ivory Coast, Chad, Benin and Mozambique, and the Deputy Secretary-General of the UN, Ms. Amina Mohammed.

Note 3: At COP21 in 2015 the G-7 countries promised to invest \$10 billion in Africa's renewable energy sector by 2020. The goal was to create 10 GW of renewable energy capacity in that time frame and a minimum of 300 GW in renewable energy fueled electric power by 2030.

Note 4: It was established by former President Obama in 2013. The aim is to create 30 GW of new electric power and 60 million new electricity connections by 2030.

Note 5: A baseload power source is a relatively low cost power source that can supply electric power stably day and night and is not affected by seasonal weather or the climate. Nuclear power, coal-power and geothermal power are the power sources mainly applicable.



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In order for the Marubeni Research Institute to acquire first hand information from the field and contribute to the company's strategy, young Marubeni staff well-versed in economic and industry analysis have been posted to the region.

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