RUBAVU: The sun shone from a cloudless sky in a quiet neighborhood of the lakeside village of Nyamyumba at the lake Kivu in Northwestern Rwanda. This landscape offers the unique water views and direct access to private beach. Beyond this tourism attraction, the region is also known for having natural swimming pools which became famous for their hot spring and a popular destination for visitors in Rwanda.

“Most of reservoirs of hot water here have been for a long time used for the main purpose of tourism,” says Jean Damascene Bikorimana, a local resident from Rubavu district, Western Rwanda.

Bikorimana is among many local residents who are earning a living by providing massage therapy for many tourists who flock to this remote rural region for relaxing purpose.

Although local administrative authorities are delighted with the direct and indirect job opportunities created for residents as a result of this tourism attraction, geothermal stakeholders consider instead to tap these clean energy resources by implementing large-scale schemes with the aim to normalise electricity supply to the national grid.

Rwanda plans to supply electricity to its entire population (52 percent through grid expansion and 48 percent through off-grid technologies) by 2024. To date, 75.3% of Rwandan households have access to electricity, according to official statistics.

Lake Kivu is one of the lakes found in the Great Rift Valley with significant geothermal energy potential offering an indigenous environmental friendly alternative to Rwanda

Home to several hot springs, major part of Western Rwanda which is positioned in the Western Albertine rift of the Great Rift Valley boast high potential as a center for geothermal power,

Geothermal energy is generated when super hot steam from the earth crust is used to rotate turbines of power generators. The steam is ejected through drilled wells sometimes up to more than three kilometres deep into the ground.

Now officials are considering to invest in geothermal because it supplies clean, renewable power around the clock while emitting little greenhouse gases.

Apart from job creation for local residents, Geothermal power, considered a stable and non-emitting power source, now occupies only a tiny share of the East African country’s energy mix.

Geothermal master plan

To date, geothermal resources in Rwanda have mainly been used for indirect uses including generation of electricity with little application in direct uses such as hot bathing for tourism purpose. Geothermal energy, which is typically heat from the earth according to experts, is cost effective, reliable, sustainable, and environmentally friendly.

Before the Government embarked on exploring the use of available geothermal sources, production of electricity in this East African country was mainly 100 % from hydro resources but since the year 2002, it changed to 40% from hydro and 60% from thermal.

Most of geothermal landscapes in Western Rwanda are promoted as important geotouristic attractions

The current geothermal master plan developed in 2015 and which focuses on capitalizing the abundant renewable source potential in the country to turn it into power is still at an early stage, according to experts.

The latest preliminary findings by the Kenya Electricity Generating Company (KenGen), which was contracted to conduct a thorough surface exploration of geothermal energy, indicated that Rwanda’s potential is estimated to be more than 700 Megawatts.

Rwanda’s unique tectonic and geological setting of the volcanoes area and other surface hydrothermal manifestations have indicated the existence of potential geothermal systems, according to the summary.

The Chief Executive Officer of the Government’s Rwanda Energy Group (REG), Ron Weiss is convinced that the initiative is a modern attempt by the country to capitalize on its abundant geothermal and turn it into power. “It has become crucial to tap into the available geothermal intensity to support the national grid,” Weiss said.

Geothermal potential areas in Rwanda (Source: Rwanda Energy Group – REG)

Currently, Rwanda wants to use its underground for electricity production, expecting it to achieve 48% offgrid and 52 on-grid connections with 512 MW installed power generation capacity from its current 216 MW by 2024. Yet geothermal power plant exists on Rwandan soil, expectations of geothermal energy still remain high in the country.

Boosting clean energy access

So far hot springs have been identified in the country near the Lake Kivu (West) and the prospective areas for geothermal energy development are the Volcanoes National Park, the Graben of Rubavu (Northwest) and Mashyuza (Southwest) and with respective surface temperature of 74 C, 69C and 54 C.

Rwanda has moved one step closer to its dream of constructing a geothermal plant

Experts estimate that the geothermal potential of the East African Rift Valley, a geothermal hot spot that spans 11 countries, at more than 15,000 megawatts, but the valley’s massive potential remains largely untapped except for budding projects underway only in Kenya and Ethiopia.

Estimates by Rwanda Energy Group show that the country still needs to mobilise at least $600 million to ensure 100 percent access to electricity for the entire country’s population by 2024.

Share of electricity production by source in the period 2010-2020, Rwanda (Source: World Bank)

Reacting to the current situation in the country, Rwanda’s Minister for infrastructure, Dr Ernest Nsabimana, observed that the private sector and financial institutions are key players in boosting clean energy access through geothermal plants.

In the meanwhile, some energy experts believe that, yet geothermal energy is considered a reliable renewable energy source, this requires a greater start-up cost. Rwanda has so far conducted wo feasibility studies that were launched in 2013

at a cost of $ 300,000 to lead to drilling of geothermal energy.

According to Uwera Rutagarama, member of the Steering Committee of the African Geothermal Development Programme (ARGeo), initial findings confirmed the presence of geothermal potential from depths of a few metres to multiple kilometres beneath the Earth's surface. "Large part in Western Rwanda is located within the rift valley, we hope this project will boost the electricity generation thanks to this geothermal power capacity," she said.

Jean Damascene Habimana, a renewable energy researcher and lecturer at Carnegie Mellon University Africa based in Kigali observed that yet geothermal energy is still under deep investigations in Rwanda, hope is permitted as the country is currently switching to renewable energy sources.

"Geothermal is very predictable and reliable source of energy in comparison to other renewable energy resources," he said.

Both Habimana and Rutagarama believe that intense work has been done to increase clean energies in the East African country's electricity generation.

Through different research studies conducted by Rwanda Energy Group-Energy Development Corporation limited (REG-EDCL) Rwanda has identified four geothermal potential prospects, Karisimbi, Rubavu, Bugarama and Kinigi. So far, only two exploration wells have been drilled in Karisimbi to 3,015 and 1,367 m depth, respectively.

Actions for emission reduction

Developing and facilitating clean energy is one important path for the country to go carbon-neutral, according to Faustin Munyazikwiye, the Deputy Director General of Rwanda Environment Management Authority (REMA).

"This one of the innovative ways of raising climate finance without relying on existing traditional ways," Munyazikwiye said.

Faustin Munyazikwiye, the Deputy Director General of REMA and UNFCCC National focal point for Rwanda

Experts gathered in November last year on the sidelines of the Global climate

summit in Sharm El Sheikh, Egypt agreed that renewables offer a way out of import dependency, allowing countries especially in Sub-Saharan Africa to diversify their economies and protect them from unpredictable fossil fuel price swings while driving inclusive economic growth, new jobs and poverty alleviation.

Renewable energy was an important talking point at COP27, as many of the greenhouse gases (GHGs) that blanket the planet and trap the sun's heat are generated through energy production – burning fossil fuels to generate electricity and heat.

Currently African countries are emphasizing to take advantage from a carbon market, with their abundant renewable resources such as geothermal sources requiring significant capital injections for effective development.

Rwanda's Minister for Environment Dr Jeanne d'Arc Mujawamariya said that despite the fact that Rwanda's contribution to global greenhouse gas emissions is relatively small, the country has pledged thanks to these initiatives to undertake national measures and actions for emission reduction especially from the energy sector. In 2020, Rwanda committed to reduce its emissions by 38% by the year 2030.

Renewable energy projects have been given the highest priority in climate financing in Rwanda (Source: Fonerwa)

With technical and financial support, Rwanda emphasizes to reduce its total emissions by 4.6 million tonnes of CO2. Measures include the deployment of various renewable energy schemes, improving energy efficiency in industrial processes, introducing vehicle emission standards, rolling out electric vehicles and promoting on-farm biogas use.

Over the next decade, according to the latest estimates by the Rwanda Green Fund, the country will require approximately $11 billion, made up of $5.7 billion for mitigation and $5.3 billion for adaptation.

According to Teddy Mugabo, the Chief Executive Officer at Rwanda Green Fund, 43 projects have been supported so far from both public and private sectors and NGOs to implement various initiatives dedicated to reducing Greenhouse gas emissions in Rwanda. "Job creation has been an effective way to improve livelihood of different people thanks to these projects," she said.

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