

Forum: Special Conference for Climate Change

Issue: The question of promoting renewable energies in rural Africa and South America

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Introduction

For both environmental reasons and the fact that current resources are finite, renewable energy is said to be the future of the energy supply for future generations. This is especially relevant in the case of areas in Africa as well as South American countries. When looking at rural African villages, it is known that energy access has been a big issue for people residing there. Taking West Africa as a specific example, only 42% of the total population is getting regular access to energy. Only 8% of rural residents get energy regularly, with countries like Ethiopia and the Democratic Republic of Congo having approximately 130 million people combined without access to energy.

South America, on the other hand, is a large producer of oil and gas globally, with enough for it to sustain itself and export to the rest of the world. Many of these countries also have a lot of their produced oil in reserves, such as Venezuela, with 80 billion barrels in reserves, and Ecuador, with roughly 4.5 billion in oil reserves. Some of the bigger South American countries also produce gas, which is more focused on domestic demand and access. Countries like Brazil, which has 11.8 billion in reserves, have the power to become one of the biggest energy producers in the coming decade. However, experts believe that these resources won't last long because the political climates in the South American countries with the largest reserves currently discourage private investment needed to fully exploit those resources. Without investment, the countries will not be capable to develop these technologies in order to promote more storage

facility, and longevity. All three countries—Venezuela, Bolivia and Ecuador rolled back 1990s reforms and increased government involvement in their oil and gas industries.

Definitions of Key Terms

Renewable Energy

Renewable energy is energy that is gathered from resources that are regenerated naturally throughout time and are infinite. Sources such as the sun, wind, and water are used to generate electricity. For example, solar panels are used to harvest light from the sun, which is then converted into electricity to be either stored or distributed.

Africa has enormous wind, solar, hydro, and geothermal energy resource potential, and declining costs are bringing renewable sources of energy closer to the average consumer. In addition, mineral resources are rich in Central and Southern Africa and are necessary for the manufacture of electric batteries, wind turbines, and other low-carbon technology.

Latin America currently produces 25% of its energy from renewable sources, in large part due to the region's extensive use of hydropower. In reality, hydropower accounts for 80% of the region's use of renewable energy.

Energy Reserves

Energy reserves are electrical supplies that are now not in use but may be swiftly made available in the event of an unforeseen loss of generation. They are put in place by many countries to be able to provide for their population in case of emergencies.

South American countries such as Venezuela, Ecuador, and Brazil alone have approximately 96 billion in oil reserves, which are used in the event of hurricanes and other natural disasters that could result in energy shortages for a large portion of the population.

Hydroelectricity

Hydroelectricity, often known as hydroelectric power, is electricity produced by water power. In 2020, hydropower supplied one-sixth of the world's electricity, almost 4500 TWh (terawatt hours), more than all other renewable sources combined and more than nuclear power.

Africa has one of the world's largest untapped hydropower development potentials. New projects are constantly boosting hydropower production, and it represents the region's primary renewable resource.

Hydropower is the primary form of electricity production in South America, responsible for 45% of the region's total electrical supply.

Solar Energy

Solar energy is a renewable, limitless, and cost-effective source of energy. It can cook meals, heat water, and produce energy. Solar energy can also be used to generate electricity, which can be stored in solar cells.

The long-term realistic yield of a utility-size solar energy plant in Africa is 4.51 kWh on average. Africa's undeveloped solar energy potential represents an opportunity to supply its people with inexpensive, reliable, and sustainable energy.

In May 2013, Peru began working on renewable energy projects. Peru is currently implementing 49 renewable energy projects totalling 1,080 MW across the country, with seven solar farms totalling 280 MW planned. In 2018, the country's total solar energy capacity was an amazing 345 MW, surpassing Argentina and Uruguay. Argentina's solar sector is predicted to expand during the next ten years.

Wind Energy

Wind energy is a renewable and environmentally friendly source. It generates power without using any fuel or affecting the environment. Wind energy remains the most important source of renewable energy in the United States, helping to reduce the dependency on fossil fuels.

According to; *Wind Energy: Joining Forces for an African Lift-Off*, an Africa-EU Energy Partnership Policy Brief investigates the main action areas that could unlock Africa's huge wind energy potential. It claims that by collaborating, Africa and Europe can harness their existing collaboration and secure the wind sector's contribution to both Agenda 2063 and Agenda 2030.

Latin America has done well in terms of growth but is now experiencing a slowdown. Political hurdles have arisen in several economies, causing growth patterns to be unequal across the continent, particularly in high-potential areas such as Argentina. In 2018, the region had 3.7GW of onshore wind installed, with Brazil accounting for 51% and Argentina accounting for 13%. In all, Latin America has over 26GW of onshore wind built, with Brazil accounting for 57%.

Geothermal Energy

Geothermal energy is heat derived from the earth's subsurface. The geothermal energy is carried to the planet's surface via water and/or vapour. Depending on its properties, geothermal energy can be used for heating and cooling or to generate clean electricity.

East African economies produce approximately 630 MW (megawatts) of power per year from accessible geothermal resources. Kenya is the African leader in active geothermal power plants, accounting for more than 40% of the country's total energy generation.

Argentina, Bolivia, Chile, Colombia, Ecuador, and Peru all have geothermal resources. Chile has utility-scale geothermal power facilities, while Colombia has just established a small unit for self-use geothermal electricity.

Shale

Shale is a fine-grained sedimentary rock formed by the compression of silt and clay. It is made up of many thin layers that easily separate into thin pieces where the layers meet.

Key Issues

Inadequate energy infrastructure in Africa:

The problem of energy access in Sub-Saharan Africa, where large parts of the population lack a reliable supply of electricity and affordable modern cooking fuels, has various causes, including insufficient energy generation capacity, difficulties in managing energy infrastructure and attracting investments in the sector, and challenges in serving low-income users. Population growth, urbanisation, and economic development goals will all need an increase in energy use.

Over 640 million Africans lack access to energy, resulting in Africa's power availability rate of just over 40%, the lowest in the world. Sub-Saharan Africa (excluding South Africa) has a per capita energy consumption of 180 kWh, compared to 13,000 kWh in the United States and 6,500 kWh in Europe.

Access to energy is critical not only for achieving health and education results, but also for lowering business costs, unlocking economic potential, and creating employment. Inadequate energy availability causes hundreds of thousands of fatalities each year owing to the use of wood-burning stoves for cooking; hinders hospital and emergency service operations; jeopardizes educational achievement; and raises the cost of living

Implementing energy storage

Traditional fossil-fuel plants run at a reduced level, producing a regular and predictable supply of power. Renewables, on the other hand, are a far less dependable supply. Energy output from a solar farm, for example, might decline unexpectedly owing to clouds obstructing sunlight from the panels. Wind speeds, too, are difficult to predict. To prepare for this volatility, research and investment in energy storage devices is increasing.

Wind power ramp occurrences, for example, provide a significant difficulty. As a result, establishing energy storage techniques is critical. The system may not always be able to absorb surplus wind power caused by a sudden increase in windspeed. Ramp control applications enable the turbine to store this additional power in the battery rather than the generator.

Combining distributed systems

Many renewable energy producing facilities, such as solar PV and wind farms, are geographically dispersed and hence more difficult to operate without sophisticated software.

Take, for example, offshore wind farms. The world's largest offshore wind farm is now being built 74.5 miles off the coast of Yorkshire. To correctly operate these massive power plants, the data from each asset must be merged into a single entity. This program could be able to incorporate multiple pieces of distributed equipment, whether it's a full wind farm or a variety of renewable energy sources, into a single system to give a complete grid visualisation.

The complexity of this process is discouraging to governments because of how prone to error it can be. The loss of any data from a component of the plant can affect the

overall data being collected. This can cause detrimental mistakes in maintenance, check ups, etc.

Major parties involved and their views

Argentina

Argentina has held many auctions for wind, solar, small hydro, biogas, and biomass projects since 2016, in order to meet its target of boosting renewable energy output to 20% of total demand by 2025. Through phases 1, 1.5, 2, and 3 of RenovAr, the government's renewable energy programme and the Renewable Energy Futures Market, the government approved 244 projects, adding more than 6,300 MW of installed renewable energy capacity (MaTER). European and Chinese businesses dominate the sector, aided by export credit agency funding. Large American corporations, including the Advance Encryption Standard (AES) and General Electric (GE), are also involved.

Argentina's overall primary energy mix is led by natural gas (55%), oil (33%), and bioenergy (5%), with hydropower and nuclear each providing 3%. Argentina has the world's second largest shale gas resource and the fourth largest shale oil reserve. In 2019, the country produced 500,000 barrels per day of oil, of which 89,000 barrels per day were exported, although it remained a net importer of oil products.

Brazil

Brazil is one of the world's greatest energy producers, and the Western Hemisphere's third largest producer. Brazil's energy policies have been extremely effective in tackling the world's most pressing energy concerns, according to the UN's 7th Sustainable Development Goal (Ensure access to cheap, dependable, sustainable, and modern energy for all).

First, power is practically universally available across the country. Brazil has the largest electrical industry in South America. Brazil, along with Chile, has the highest rate of power availability in Latin America. Brazil's power industry serves over 50 million users, providing stable energy to 97% of the country's households.

Renewables account for about 45% of Brazil's main energy consumption, making its energy sector one of the least carbon-intensive in the world. Brazil's national grid is over 80% renewable. Looking at Brazil's energy profile over the previous few decades, it is obvious that biofuels and hydropower account for a large portion of its renewable resources.

Uruguay

Uruguay substantially changed its energy matrix from petroleum-based electricity production to renewable energy sources beginning in 2005. The country presently generates over 98% of all energy from renewable sources, notably wind and hydropower. Uruguay has 99.9% of its residences connected to the electric grid, making it one of the most electrified countries in the hemisphere.

In terms of renewable energy generation, Uruguay is one of the world's leaders. Uruguay's energy grid, which encompasses energy from both fossil and renewable sources, was 4,928 MW in 2021, according to statistics from the Ministry of Industry and Energy (National Balance Report). The energy matrix is composed of 31% hydro, 31% wind, 24% fossil, 9% biomass, and 5% solar.

The year 2021 was an exception owing to a severe drought that affected the region and necessitated the use of fossil fuel-based energy generation to meet neighbouring nation demand. In 2021, hydropower generation accounted for 37% of total energy generation, followed by 35% wind, 18% fossil, 7% biomass, and 3% solar.

Morocco

Morocco's current goal is to increase renewables' share of total electricity capacity to 52% by 2030, 70% by 2040, and 80% by 2050. According to GlobalData, Morocco's new ambitions come against the backdrop of success made in the growth of both wind and solar energy during the initial phase of energy transformation.

Egypt

Egypt is working to increase the supply of renewable electricity to 20% by 2022 and 42% by 2035, with wind accounting for 14%, hydropower accounting for 1.98%, photovoltaic (PV) 21.3%, wind accounting for 14%, concentrating solar power (CSP) accounting for 5.52%, and conventional energy sources accounting for 57.33%. This plan is now being amended and awaits approval from the Supreme Council for Energy to represent 33% of energy generated from renewable sources by 2025, 48% by 2030, 55% by 2035, and 61% by 2040. This is seen to be a highly hopeful strategy. The majority of this capacity is projected to be provided by the private sector.

Kenya

Kenya's total installed capacity of major hydropower is 826.23 MW, whereas the potential for small hydropower is projected to be 3,000MW, of which less than 30MW has been harnessed and only 15MW has been delivered to the grid. Hydropower is utilised to create electricity in certain areas of Kenya, especially along the country's five major rivers, which are Lake Victoria, the Tana River, the Great Rift Valley, the Sabaki River, and the Ewaso North River. However, fluctuating rainfall patterns and droughts reduce system output and dependability on a regular basis, necessitating the inclusion of backup oil-fired power plants into larger hydro networks

In Kenya, several energy-related start-ups have formed, including

M-KOPA, which promises to provide low-income individuals with access to energy solutions that they can actually afford by giving clients immediate access to the product while progressively growing their ownership over time via a series of flexible

micropayments. Once a customer has paid off their product's payments, they may utilise this asset, as well as their credit history with M-KOPA, to acquire access to further products and services that will allow them to progress in their life more swiftly.

Strauss Electricity, a company that provides "pay as you go" alternatives to clients who are currently off the energy grid, feels that developing and implementing Building Integrated Photovoltaics (BIPV) systems is the best solution to Kenya's energy crisis.

PowerGen Renewable Energy is an off-grid power system installer. Among other things, the firm accomplished the construction of dozens of solar and small-scale wind projects in Kenya and surrounding countries within its first year of operation. The company's major mission is to make clean, renewable energy available to an expanding number of Africans.

Vuma Biofuels is an organization that aims to turn agricultural waste into renewable energy. The company's major objective is to eradicate the usage of firewood as a fuel source in Kenya's industrial sector. Furthermore, the firm produces an environmentally beneficial clean biomass energy product manufactured from discarded sugar cane husks. Their VumaBriqa, on the other hand, are a great source of fuel for industrial boilers. They believe that the time has come for a more effective alternative to wood burning.

Development of Issue/Timeline

Date	Event	Outcome
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1860	The world's first solar energy system	Augustin Mouchot, a French investor, created the world's first solar energy system in 1860. Mochet tested his sun metre after predicting that our coal supply would run out one day.
1979	The first Brazillian ethanol powered electric car	Resulting in the drop in carbon emissions.
2008	The Renewable Energy act is passed	Provided the legal and administrative framework required for policy coordination on the development of renewable energy technologies worldwide
2009	Fuel efficiency standards are set by the department of transportation for 2020	This set the curve for the development and research into the application of renewable energies into daily practices such as transportation. This was mainly implemented in east african countries such as Sudan, Ethiopia, Kenya etc.
2013	Electric cars introduced to South Africa	The introduction of electric cars allowed for the carbon emissions to drop slightly however due to the small time in which they were introduced, it was not very heavily applied by the public.

2018	The Department for Business, Energy and Industrial Strategy (BEIS) is formed.	A department responsible for overseeing the electricity sector, including relations to renewable energy More focus on the energy sector, allowing for increased involvement in the publication of different renewable resources to cities and rural areas.
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Previous attempts to solve this issue

Hydropower in South America

Hydropower is the primary source of power generation in South America, accounting for around 65% of total electricity generated. At the end of 2010, South America's installed hydroelectric capacity totaled 153 GW.

No other region in the globe generates as much electricity from hydro, with a global average of around 16%. While hydropower is essential in several Latin American countries, potential growth differs per country. Rising energy rates and private sector engagement in hydro initiatives make hydropower an appealing alternative for meeting rising demand, according to John Targett, vice president and Latin America executive projects director for MWH Global.

Solar power in Africa

Solar power has the potential to cut emissions and increase access to energy in Africa, but the continent is still in the early phases of developing its solar resources. According to Statista, Africa generates 9% of its energy from renewable resources, while solar capacity in Africa increased by 13% between 2019 and 2020. PwC claims that Africa has "significant solar power potential." Although fossil fuels continue to dominate

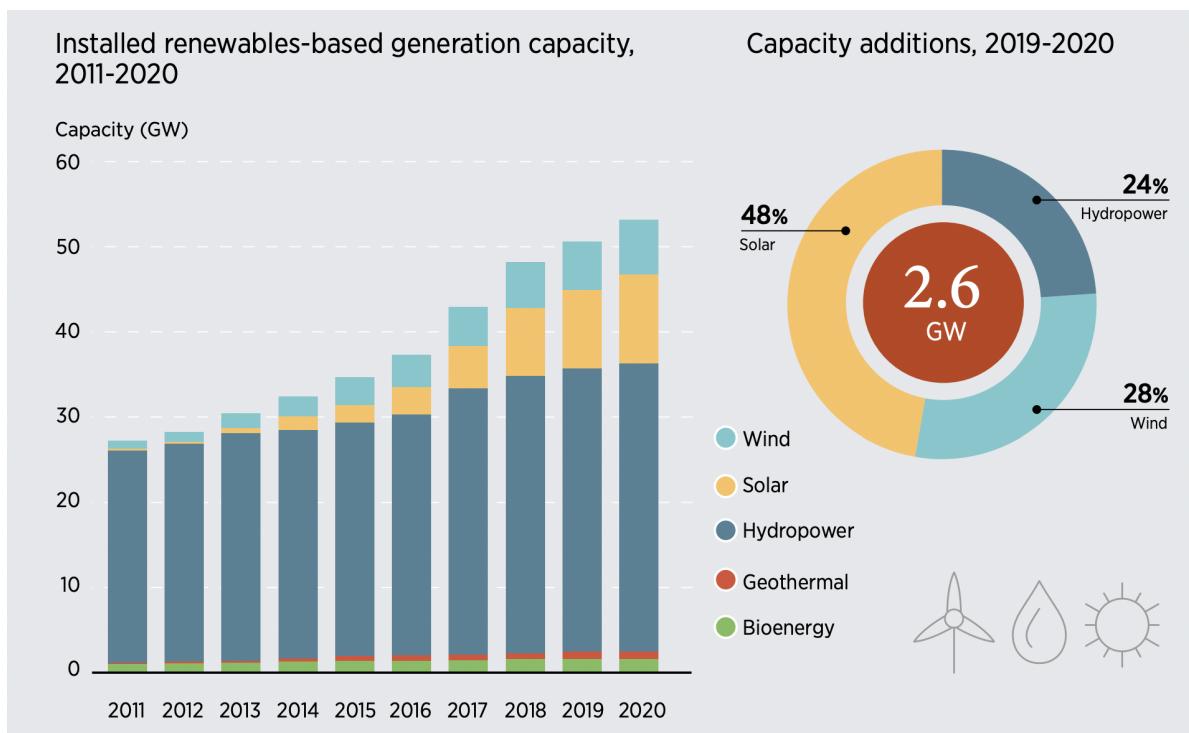
Africa's energy mix, initiatives are ongoing to advance solar and wind power technologies, according to the report.

According to PwC, solar energy provides power to rural communities without the need for costly grid connections. At \$995 per kilowatt, solar panel technology is also the most affordable of all renewable technologies. According to the survey, South Africa and Egypt have the most solar capacity, followed by Algeria. According to BP (British Petroleum), solar power will account for around 30% of Africa's energy output by 2050.

Possible Solutions

Development of hydropower in Africa

Africa has one of the world's greatest untapped hydropower development potentials. Hydropower capacity is continually expanding as a result of new developments. The graph below shows the percentage of hydropower generated from 2011 to 2020. According to the graph, it is evident that hydropower has been the most consistently produced and widely produced form of renewable energy produced in the last 9 years. This is really beneficial because it will be easier to develop and expand the technology in ways such as bringing it into homes, by scaling down the technology.



Incentives to switch to renewable alternatives

For citizens of countries to switch to renewable sources, they should be provided with some incentive that will encourage them to do so. This can include a reduced percentage of taxes, benefits pertaining to commercial experiences, premium passes etc.

Reporting on renewables

The first step toward better grid management is to control and monitor renewable energy. What energy companies do with the data collected by this equipment, though, is what will actually bring value. This is where reporting is required.

Renewable energy software should be able to visualise data in an understandable manner so that operators can see the types of data that are truly important to them. Wind farm owners, for example, are typically investors, so profit generation is an important consideration. In this case, the report should compare a turbine's output and related profit to better educate the operator about its financial success.

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