INVEST IN THE ENERGY SECTOR OF KENYA
With a mix of solar, wind, hydro and geothermal energy providing for approximately 93% of the country’s energy needs, Kenya is a pioneer in renewable power on the continent. The majority of its approximately 2.7 GW installed capacity is derived from hydropower (677 MW) and geothermal energy (690 MW). By 2030, the country aims to achieve a 100% energy mix, reducing its consumption derived from geothermal (745 MW) and hydropower (740 MW). Kenya Electricity Generating Company (KenGen) – the country’s largest power producing company producing approximately 70% of electricity consumed in the country – currently carries an installed capacity of 1,631 MW and expects to produce an additional 410 MW from wind, 2,029 MW from geothermal, 90 MW from hydropower and 40 MW from solar by 2028.

**A Diversified Supply Mix**

Kenya is the largest producer of geothermal energy in Africa – with 745 MW of installed geothermal capacity - and the first African country to develop its geothermal resources. Notably, Ethiopia is the only other country to harness geothermal energy in Africa, and while it currently only produces 7.3 MW, it is estimated to be able to generate up to 10,000 MW from its 7,000Km portion of the East African Rift Valley.

According to the Geothermal Development Company and Ministry of Energy and Petroleum, Kenya also has the potential to produce 10,000 MW of geothermal-powered electricity from its portion of the Rift Valley Basin. Geothermal energy in Kenya is primarily extracted from the Olkaria resource utilizing the 75 MW Wellhead generation plants built by KenGen: Olkaria I (185 MW), Olkaria II (105 MW) and Olkaria IV (140 MW), with a third private plant Olkaria III (139 MW). Relatively clean, low-carbon and cost-efficient, geothermal projects continue to be developed by KenGen, the Geothermal Development Company and Independent Power Producers (IPPs). By 2030, the country aims to produce 5,540 MW of geothermal power, which would increase the share of geothermal power to 51% of Kenya’s electricity supply.

In July 2019, Kenya inaugurated its Lake Turkana Wind Power plant (LTWP), representing the largest wind power plant in Africa. The plant consists of 365 turbines capable of rendering 310 MW of reliable, low-cost energy to Kenya’s electrical grid. The United Nations Environment Program estimates that the East African country has the potential to produce as much as 3,000 MW of wind-powered energy. Connected to the grid in September 2019, the LTWP plant has produced over 1.2 billion kilo-
watt-hours of electricity and led to up to $77.5 million in cost savings from reduced consumption of diesel-generated thermal power. With an average of five to seven peak sunshine hours per day, Kenya boasts high insolation rates and a promising potential for solar power to diversify its power generation mix and reduce its energy costs. Developed by the Rural Electrification and Renewable Energy Corporation (formerly the Rural Electrification Authority), the 55 MW Garissa Solar Power Station serves as the first plant in Kenya to harness solar energy and was inaugurated in December 2019.

Off-Grid Renewable Solutions

In areas that bear a high cost of connection to the national grid, a number of off-grid solutions have been able to provide cheaper alternatives for connecting rural communities, such as the conversion of off-grid diesel stations into hybrid diesel-solar or diesel-wind systems. With an estimated capital cost of $1,000 per household connection, fully renewable energy mini-grids have been implemented in Kenya since 2017 and complement other rapidly scalable solutions such as solar lanterns and single-home solar systems. Off-grid renewable energy companies such as M-Kopa, Azuri and Mobisol have been developing services that target consumers in rural and urban areas that are expensive or difficult to connect to the national grid by offering pay-per-use solar power, which consumers can purchase through their mobile devices. Despite the recent proliferation of innovative renewable solutions, one of the challenges that remain in the development of Kenya’s renewables sector is the lack of coordination between public sector, on-grid planning and private sector, off-grid connections. For example, off-grid connections often overlap with the same areas in which Kenya Power has on-grid connections planned, leading to redundancies, inefficiencies and sunk costs. While the recent 2019 Energy Act sought to improve regulations pertaining to private investment in off-grid solutions, mini-grids still remain outside of the country’s current electricity policies and strategies, including the 2018 Kenya National Electrification Strategy, which focuses primarily on efforts to extend the national grid. As a result, progressive energy policies are needed, along with potential subsidies for off-grid extensions, both of which could help drive private investment from IPPs into mini-grid projects and reduce the amount of time it takes for investors to recoup their costs.

Key Areas for Renewable Investment

- **WIND**: Proven potential as high as 346 w/m² and wind speeds over 6 m/s.
- **SOLAR**: Relatively stable off-grid PV market with insolation estimated at more than 23,000 tWh/year.
- **BIOMASS**: Cogeneration using charcoal, wood-fuel and agricultural waste. Total estimated generation is 193 MW.
- **GEOTHERMAL**: Proven potential as high as 10,000 MW along key sites in the Rift Valley.
- **HYDROPOWER**: Potential of 1,000 MW from small scale hydropower plants.
- **BIOGAS**: Potential to produce over 130 MW of power.

A Decade in Renewable Capacity and Generation

![Graph showing renewable capacity and generation from 2008 to 2018](image-url)
FINANCING THE SECTOR

Kenya remains one of the few African countries that has been able to mobilize private investment into its power sector.

In the past, Kenya’s power sector utilized concessional financing from development partners and finance institutions to obtain capital for the construction of large-scale energy infrastructure, from building power plants to installing transmission lines. However, two decades ago, Kenya began to effectively mobilize private investment to meet its financing needs. In contrast to most sub-Saharan countries, in which electricity is often 100% state-owned, generated and distributed, Independent Power Producers (IPPs) make up a sizable share of Kenya’s electricity supply mix, representing approximately 30% of generation capacity and 53% of incremental generation capacity since 1990.

Entering the market through a mix of directly negotiated and competitively bid projects, IPPs began with regulated power purchase agreements to supplement power production. IPPs are considered attractive due to their tendency to exceed the technical and operational performance of their public counterparts, to reinvest in technology and innovation, to recoup the cost of investment through the retail of electricity and to reduce the burden of public sector financing.

An Innovative Model

Through its initiative known as ‘Maximizing Finance for Development,’ the World Bank spearheaded the utilization of commercial financing, in partnership with the Kenyan government, to meet energy infrastructure needs in the country. Since 1997, this approach has resulted in progressive reforms in sector policies, laws, regulation and institutions to create conditions that foster private sector investment and establish effective planning, tendering and contracting capabilities. The first phase of reform differentiated policy and regulatory functions from commercial interests, liberalized generation activities, unbundled generation from transmission and distribution activities, established the national sector regulator and introduced cost-reflective tariffs. Two major utilities in the country - Kenya Power and Kenya Electricity Generation Company - are now publicly listed companies that are able to tap into capital markets for outside investment. The second phase involved ameliorating the operational and financial performance of sector utilities, establishing a close relationship between generation and distribution utilities through dynamic power purchase agreements, and establishing new entities with directives for developing transmission, geothermal resources and rural electrification.

Roadblocks to Private Investment

Challenges remain in driving private sector participation in building generation, transmission and distribution capacity. These include a challenging financial ecosystem for commercial capital, in which commercial banks are often crowded out by multilateral banks on both loan tenure and interest rates. Processes related to project selection, negotiation of Power Purchasing Agreements, securement of land and the provision of Letters of Support by the Kenyan government remain inconsistent and difficult to navigate, leading to increased costs and time delays, especially for private off-grid developers. For the public sector, state-owned enterprises often encounter inadequate financing models, and the government continues to carry significant financial exposure when it comes to the energy sector. Once financing is secured, high infrastructure development costs are faced, and a long lead-time is required for implementation.

Loan Guarantees

Despite these obstacles, one of the ways in which Kenya has succeeded in attracting private investment is by providing a financial backstop for independent producers. In sub-Saharan Africa, governments often provide subsidies to offset the high cost of power generation. However, these subsidies make power projects less bankable, reducing returns on investment in the process. As a result, the Kenyan government has turned to alternative financing to back IPP projects. For example, the East African country received a Partial Risk Guarantee from the World Bank to backstop IPP projects, and in April 2018, received an $180 million International Development Association (IDA) Guarantee to mobilize private sector financing and strengthen the financial position of KenGen. Guarantee instruments from the IDA, the concessionary arm of the World Bank Group, promote private sector involvement in the generation sector, further enhanced by risk mitigation instruments from the Multilateral Investment Guarantee Agency and equity and debt support from the International Finance Corporation. With financial guarantees in hand and a stable, government-backed regulatory environment, Kenya has been able to draw substantial private investment into its power sector, with at least three billion dollars in private capital mobilized in the power sector between 1997 and 2018.
Kenya has cemented its reputation in the past twelve months as the continent’s leader in renewable energy.

InfraCo Africa, in partnership with Gigawatt Global, commits to developing two 20 MW solar plants in Samburu and Transmara.


The World Bank approves up to $180 million risk guarantee to Kenya Electricity Generation Company.

Rural Electrification and Renewable Energy Corporation announces 147 new solar power plants targeting high-solar localities.

Voltalia SA wins the contract to build a 55 MW solar park in Kenya for I Alten Energias Renovables.

CDC invests nearly $70 million into a solar power plant in the Malindi region.

The Ministry of Petroleum and Mining signs a Head of Terms agreement for a 60,000 - 80,000 barrels per day oil processing facility.

Kenya’s first utility-scale Independent Power Producer solar project achieves financial close.

The Lake Turkana Wind Farm, Africa’s largest wind power project, comes online.

Diageo commits $230 million to renewable energy projects across 11 of its African brewing sites, including three in Kenya.
Kenya signs a Memorandum of Understanding for the development of **Africa’s first large-scale hybrid wind, solar PV and battery storage project** with Windlab and Eurus Energy.

The European Investment Bank and Dutch development bank FMO provide financing for the construction and operation of two solar photovoltaic parks totaling 80 MW.

Aceleron and Total **Access to Energy Solutions** commits to providing off grid Kenyans with cleaner and more affordable power.

The Kenya Renewable **Energy Association** lobby for withdrawal of tax on solar energy products.

The International Renewable Energy Agency increases on-ground impact aimed at scaling up renewables in Kenya.

Kenya brings a **50 MW solar plant in Garissa online**, increasing renewable energy to more than 90 percent of current power mix.

Kenya is ranked fifth globally in an annual Bloomberg index measuring investments and opportunities in clean energy.

The U.K. pledges to invest **over $65 million into renewable energy projects in Africa**, including solar farms in Kenya.

Kenya’s first green bond is listed for trading on the Nairobi Securities Exchange.

Construction begins on the first hybrid wind, **solar PV and battery storage plant in Africa**.
Kenya’s power sector serves as a success story within sub-Saharan Africa’s energy landscape. With strong government leadership, active participation of the private sector since the entrance of Independent Power Producers (IPPs) in the early 1990s and an enabling environment for innovation in off-grid technologies, Kenya has a penchant for transforming its natural resources into clean, accessible power. Between 2013 and 2017, the East African nation nearly doubled electricity access rates from 25% to 46%, and currently boasts the highest electricity access rate in East Africa, with nearly three-quarters of the population connected to the national grid. Moreover, its rich endowment of renewable resources has resulted in the country becoming one of the lowest cost developers of geothermal power in the world, the first developer of geothermal power on the continent and a leader in the number of solar power systems installed per capita. As Kenya continues on a growth trajectory marked by rising electricity demand, investment opportunities are boosting the country’s generation, transmission and distribution capabilities.

Demand

Power demand hovered around 1,802 MW in 2018, peaked at 1,912 MW in November 2019 and has been rising at a rate of 3.6% annually. This year, it is expected to reach 2,600 – 3,600 MW, which translates to a doubling in demand since 2015. Three hundred to 800 MW is estimated to stem from large industrial projects requiring significant electricity use; 200 – 300 MW will be derived from converted latent demand through connections that have not yet been filled; and 2,100 – 2,500 MW will remain from baseline demand.

Of the 7.5 million customers of Kenya Power – Kenya’s partially state-owned company that transmits, distributes and retails electricity – five percent represent commercial customers, including businesses, factories and industry. Of the 5%, the largest 6,000 customers are responsible for 60% of domestic power consumption, averaging more than 15,000 electricity units per month. The largest consumer of electricity in the country is Kenya Pipeline Company, a state corporation responsible for transporting and storing petroleum products to consumers, followed by Bamburi Cement, an industrial company specializing in cement and concrete. Per capita consumption in domestic households...
remains low, however, with the average electricity consumption per citizen of 167 kWh per year.

**Generation**

Kenya’s current effective installed electricity capacity is approximately 2.7 GW, which relies heavily on renewables such as geothermal and hydropower. Approximately 93% of power is generated from a range of renewable sources. Geothermal sources have overtaken hydropower as Kenya’s main power source since 2015, helping to ensure energy security in periods of drought. Meanwhile, hydropower constitutes approximately a third of energy generated, while solar, wind and biomass account for remaining capacity. Kenya Electricity Generating Company (KenGen), Kenya’s largest power producing company, generates approximately 70% of installed capacity. The remaining 30% is generated by IPPs, with the following firms active in Kenya: Westomont, AEP Energy Africa (Iberafrika), OrPower4 Kenya Limited (a subsidiary of Ormat Technologies, Tsavo Power Company, Aggreko and Africa Geothermal International. IPPs operate across 15 plants, including three small-scale hydro plants, one geothermal plant, one biomass plant and 10 fuel oil plants. By the end of 2020, it is estimated that over 60% of Kenya’s power will be generated by IPPs across 52 plants.

**Transmission and Distribution**

Around three-quarters of the population are connected to the national grid, representing one of the highest connection rates in sub-Saharan Africa. Kenya Power (KP) is currently the sole distribution company in Kenya, negotiating Power Purchase Agreements with generation providers and operating the country’s national grid as well as several off-grid stations in the northern region of the country. KETRACO, Kenya’s Transmission System Operator, is currently in the process of building approximately 4,500 km of new transmission lines, along with introducing Kenya’s first high-voltage 400 kV and 500 kV DC lines and three major regional interconnectors to Ethiopia, Uganda and Tanzania. The 1,045 km Kenya-Ethiopia Electricity interconnection represents the longest transmission line in East and Central Africa, as well as Kenya’s first direct current line having 500kV high-voltage direct current. Intended to transport power to the Southern African Power Pool, the line reached its testing phase in September 2019 and is planned for completion by April 2020. The project is being undertaken by KETRACO and funded by the African Development Bank, French Development Bank, World Bank and government of Kenya at a cost of $620 million. Other developments include the construction of the 400 kV/40 km double circuit Isinya-Konza Transmission Line Project, for which China Aerospace Construction Group Corporation won a multi-million-dollar tender in November 2019. The project aims to increase the quality and quantity of the power supply in Konza Technopolis – a large technology hub planned by the government as part of its national development plan – and the surrounding areas.

**Future Outlook**

Despite the impressive growth of Kenya’s power sector in recent years, investment is needed to achieve the government’s target of universal electricity access by 2022. In 2017, approximately four million households still lacked access to electricity, 3.6 million of which were in rural areas. For Kenya, 100% access to electricity remains integral to achieving its development goals under Vision 2030 – the country’s development blueprint for becoming an industrialized, middle-income economy by 2030. In December 2018, the government launched the Kenya National Electrification Strategy, which outlines a plan for connecting the remaining households and businesses to the national grid in 14 off-grid counties. In addition to expansion of the national grid, the strategy centers on private sector involvement in developing off-grid solutions, including both mini-grids and standalone solar systems. Moreover, opportunities for investment lie in the optimization of the construction of transmission lines and the identification of new and innovative partnership models to fund the growing needs of an advanced power sector.

**WHY KENYA?**

**Renewable Resources**

Proven wind energy potential as high as 356 w/m² and speeds over 6 m/s.

6 GW of hydropower potential estimated.

**8th Largest Global Producer of Geothermal**

14 high temperature potential sites along the Rift Valley, holding more than 10,000 MW of potential energy.

**Cooperative Government**

Promotion of energy production through public-private partnerships.

**Enabling Environment for Innovation**

Active private sector participation, including renewable-focused start-ups and SMEs.

**World Bank-backed Loan Guarantees**

Partial risk guarantees backstop Independent Power Producer projects, along with risk mitigation instruments and equity and debt support.
# Renewables in the Region and Beyond

<table>
<thead>
<tr>
<th>Country</th>
<th>Installed Capacity (MW)</th>
<th>Peak Demand (MW)</th>
<th>Surplus/Deficit (MW)</th>
<th>Primary Sources of Estimated Renewable Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burundi</td>
<td>50</td>
<td>100</td>
<td>50</td>
<td>Hydropower: 1.7 GW Solar: 2,000 kWh/m²/year</td>
</tr>
<tr>
<td>DRC</td>
<td>2,677</td>
<td>4,977</td>
<td>1,300</td>
<td>Wind and Solar, 85 GW Total</td>
</tr>
<tr>
<td>Djibouti</td>
<td>126</td>
<td>206%</td>
<td>80</td>
<td>Geothermal and Solar, 300 MW Total</td>
</tr>
<tr>
<td>Egypt</td>
<td>45,192</td>
<td>30,400</td>
<td>14,792</td>
<td>Hydropower: 2,800 MW Solar: 1,970-3 200 kWh/m²/year</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>4,206</td>
<td>3,700</td>
<td>506</td>
<td>Wind: 3.6 MW</td>
</tr>
<tr>
<td>Kenya</td>
<td>2,711</td>
<td>1,640</td>
<td>1,071</td>
<td>Geothermal: 10 GW</td>
</tr>
<tr>
<td>Libya</td>
<td>10,238</td>
<td>-</td>
<td>-</td>
<td>Solar: 27,000 GW</td>
</tr>
<tr>
<td>Rwanda</td>
<td>218</td>
<td>231</td>
<td>13</td>
<td>Solar: 66.8 TWh per year</td>
</tr>
<tr>
<td>Sudan</td>
<td>3,736</td>
<td>3,000</td>
<td>736</td>
<td>Solar: 2000 kWh/m²/year Wind: 5.1-7.1 m/s</td>
</tr>
<tr>
<td>South Sudan</td>
<td>131</td>
<td>300</td>
<td>169</td>
<td>-</td>
</tr>
<tr>
<td>Tanzania</td>
<td>1,513</td>
<td>1,998</td>
<td>485</td>
<td>Solar PV: 800 MW</td>
</tr>
<tr>
<td>Uganda</td>
<td>1,177</td>
<td>670</td>
<td>507</td>
<td>Hydropower: 2,000 MW Biomass: 1,650 MW Geothermal: 450 MW</td>
</tr>
</tbody>
</table>
Established in 2005, the Eastern African Power Pool (EAPP) seeks to optimize collective energy resources, including renewables, to boost access to electricity through regional power interconnections.