

How Green Energy and New Technologies Will Impact Kenya's Power Sector

“The waste of scarce resources in Africa’s energy systems remains stark and disturbing. Current highly centralized energy systems often benefit the rich and bypass the poor and are underpowered, inefficient and unequal. Energy-sector bottlenecks and power shortages cost the region 2-4 per cent of GDP annually, undermining sustainable economic growth, jobs and investment. They also reinforce poverty, especially for women and people in rural areas. It is indefensible that Africa’s poorest people are paying among the world’s highest prices for energy.” ~ Excerpt from the Foreword by Kofi Annan in the AFRICA PROGRESS REPORT 2015

“... and all consumers know, when the producers name the tune, the consumer has to dance.” ~ Gil Scot Heron, B-Movie

The Kenya power sector is many things to many people. For some, it is a shining African example of a [successful power sector](#) while for others, it is a scandal-ridden [den of thieves](#). For some, it is one of the world’s leaders in [green energy](#) and for others it is an unapologetic [advocate of coal power](#). As with many countries, amidst the conflicting politically-driven narratives, it is often hard to separate truth from opinion. Tabled plans serve complicated and disguised agendas of both local and international interests.

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Despite the bad press, there is much in Kenya’s power sector to be upbeat about. Compared to others in the region, the sector has performed well. Kenya Power has a reputation as a credit-worthy off-taker. The sector is, to a large degree, privately owned, funded and operated. It is “open for business” and, eventually, it gets projects done. Much of the time (but not all) companies in Kenya’s power

sector are profitable. By fortuitous accident of location and resource availability (geothermal, wind and hydro), the sector is mostly green. The sector has been able to innovate, complete projects and grow power generation with steady increases in supply and demand over 20 years. With donor support for the [Last Mile Programme](#), it has managed a massive expansion, doubling its customer base in 10 years. Kenya Power, KenGen, the Energy Regulatory Commission (ERC), parastatal agencies and independent power producers (IPPs) have talented staff who enjoy competitive salaries and benefits.

Currently, Kenya has an installed capacity of about 2600 MW. (Ministry of Energy online [statistics](#) do not include recent solar, wind and geothermal projects.) This is about one twentieth the size of South Africa’s grid and more than twice that of Uganda’s. Recent additions of wind (300 MW from Turkana) and solar (50 MW from Garissa) have ratcheted down fossil fuel-fired thermal generation and greatly increased capacity to meet peak demand, as shown in Table 1.

Source	Capacity MW	Capacity %
Hydro	705	26.6%
Fossil fuel (thermal)	306	11.5%
Geothermal	1,105	41.7%
Bagasse	42	1.6%
Wind	310	11.7%
Solar and others	183.0	6.9%
Total	2,651	100.00%

Table 1: Kenyan Electricity Global legal insights: [Kenya Energy Situation](#)

Whether the reputation is deserved or not, Kenya’s electricity sector is much-liked by African energy investors. With over 1100MW of power-producing wells, Kenya is in the global top ten of geothermal electricity producers. Turkana Wind is the single largest sub-Saharan wind power project on the continent. At 50MW, Garissa solar is the largest solar project in the East Africa region. Today, tabled investments in geothermal, wind and solar are under way that will double Kenya’s power output in 10 years and most of these are environmentally-friendly (the proposed Lamu coal plant notwithstanding). With 60 per cent of the population connected to the grid, Kenya has the highest electricity access in the region and a higher per capita electricity consumption than Nigeria.

Exceptionally expensive electricity

So, from the above, everything would seem to be satisfactory with the Kenya power sector. But not all is well. In a 2015 assessment, [Power Africa](#) lists major “bottlenecks”: inadequate early stage capital for project financing, land/right-of-way risks (i.e. for transmission projects) and IPP “procedural” and process issues. In addition, it points out that the inadequate transmission and distribution infrastructure prevents optimal deployment of the available power resource.

Kenyan industrialists put it more bluntly. For them, exceptionally expensive electricity is among the main causes of manufacturer and investor [migration](#) to neighbouring countries. Given the comparatively low-cost hydro and geothermal power in the system, they have long *expected* reduced power costs. And this is a something the government has long promised but been unable to deliver.

Although murky [deals](#) have much to do with the problem, two factors drive continued high consumer power prices. First, we can thank the unbundled power sector. In 1996, at the behest of the international community, Kenya [unbundled](#) its power sector. According to a logic pushed by the World Bank, separate companies would independently manage costs, raise finance and increase competition. They would build management efficiency and help to overcome corruption and debt accumulation. Separated entities would enable Kenya Power to place the burden of electricity costs firmly on the shoulders of consumers as there is no subsidy in the payment formulas used to calculate consumer bills.

The unbundling of the power sector and the incorporation of IPPs had a number of positive outcomes. But they did not put to rest the central problems facing the Kenya power sector, nor did they reduce energy costs.

Second, for high power prices, we can thank diesel-fueled thermal power generators. These generators, which are necessary to meet peak loads and supply power when drought reduces hydropower output, add [disproportionate](#) long-term costs to power supply. Though they usually supply less than 15 per cent of the overall supply capacity, their costs to consumers (via [fuel cost charges](#)) make up an outsized part of the monthly consumer bill.

Kenya Power: An ignoble history

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At independence, East Africa Power Company Limited (EAPCL), a Nairobi Securities Exchange-listed company, included generation systems in Nairobi, Mombasa and the Tanganyika Electricity Supply Company (that became Tanesco). In 1954, the Kenya Power Company had built transmission lines to connect Kenya to Uganda's Owen Falls Dam. In 1964, EAPCL sold its stake in Tanesco and it was much later renamed Kenya Power and Lighting Company (KPLC). Initially, most of its power generation was from the Tana River Development Company and hydropower accounted for 72 per cent of the country's electricity.

The development of Kenya's vast geothermal potential began in 1981 when the European Investment Bank kick-started the drilling of the Olkaria wells. After the first successful geothermal projects, many other financiers followed.

During the Daniel arap Moi era, high-level [cartels](#) used the energy sector investments to build political power and business empires and to fund political campaigns. Between 1983 and 1992, the power sector was plagued by scandals that had repercussions on the rest of the economy and which affected relationships with donor partners and investors. Multiple [shady deals](#) from the period, such as the Turkwell Gorge and the Ewaso Ngiro dam feasibility (it was never built), are still debated. Whatever the reality of these still-disputed deals, an outcome of the mismanagement was the withdrawal of donor support for the power sector. Following the Turkwell Gorge saga, a consultative donors' group meeting (which included the World Bank and the International Monetary Fund) imposed an embargo on Kenya's energy sector, which stalled international power project investments for almost a decade.

The World Bank and the donor community re-engaged with Kenya in 1996 with a plan to restructure the energy sector. The programme, which was part of global World Bank liberalisation initiatives, would pressure state-owned electricity companies to "unbundle" production, distribution, transmission and regulation.

This resulted in the privatisation of power production to KenGen and independent power producers. KPLC was responsible for distribution and transmission and for creating an Energy Regulatory Commission to oversee the sector. The international community anticipated that unbundling would improve the overall management of the sector, increase transparency, expand opportunities for international investment in power projects, and lower prices.

Unlike other regional power sectors (e.g. South Africa, Tanzania, and Ethiopia), Kenya eagerly went along with unbundling, perhaps because it saw business prospects in this restructuring. However, under the new rules, the same cartels responsible for tarnished projects in the previous decade contrived new opportunities for themselves. Focusing on thermal power, insiders profited hugely from the entrance of new IPPs into the unbundled sector.

Contracts for thermal generation companies are attractive; it is almost impossible for IPP players to lose money. First, simply for being there, IPPs receive a “capacity charge”, paid according to the size of the generator. Whether or not they are deployed, contracts stipulate that the IPP is paid for being on standby and ready to supply power. Secondly, all thermal IPPs are paid per kilowatt-hours supplied at a fixed rate that is well above that paid for hydro or geothermal power providers. Thirdly, IPPs receive a “fuel pass-through payment” to cover the costs of fuel purchased. (Unsurprisingly, most thermal IPP companies come from the same business ecosystems as petroleum companies.)

From the very start, the processes of awarding thermal IPP contracts were contentious. There were conflicts of interest in ownership, unusual tendering procedures and allegations of insider trading. During poor rainfall periods in 1999 and 2000, diesel plants made money and consumers suffered. In 2000, while KPLC and KenGen flirted with insolvency, the government had to take an emergency \$72 million loan to pay for fuel for generator IPPs. A 2003 parliamentary investigation committee blamed KPLC for mismanaging water from dams and creating artificial power shortages to boost thermal power generator sales.

Starting in 2008, and with the support of donor partners, the government introduced standard feed-in tariffs for wind, solar, geothermal, biomass and biogas, which would attract renewable IPPs. However, the feed-in tariffs did not fast track wind or solar. Instead, between 2008 and 2016, petroleum-fueled IPP

and KenGen generation rose from 22 per cent to 35 per cent of the [overall generation](#) capacity, while by 2016 wind (from Ngong) amounted to less than 1 per cent of the installed capacity.

If the objectives of unbundling of the sector was to open up opportunities, in the 15 years that followed, it was *mainly* IPP thermal generation players that benefited from these opportunities. As noted earlier, geothermal power sources also increased significantly during this period, but consumers mostly were impacted by the costs of the long-term agreements signed with thermal IPPs that continue to haunt the sector until today.

Under pressure from the private sector to reduce prices and improve sector performance, the Jubilee administration has made some progress. Several new geothermal plants have been added, Turkana wind and Garissa solar are in place, and there is a considerable pipeline of projects on the way. But the litany of power sector maladministration continues. Sector agencies have been accused of procurement abuses on goods that range from poles to transformers, prepaid meters and drilling rigs. Employees set up “tenderpreneur” companies to do inside deals. On what seems like a daily basis, journalists report on the corruption and leakages in the sector.

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So, even though power purchase agreements are being signed, capacity is being added and poles are being strung, the sector’s leaders have not brought down prices. Kenya’s power is still three times as expensive as power in Ethiopia and sector governance remains opaque and inefficient. Consumers are being [warned](#) by the regulator that prices are likely to rise.

Centralised or decentralised power: That is the question

The Kenyan government’s plan to address expensive power is to *increase supply* and to [renegotiate](#) unwieldy Power purchase agreements (PPA). However, in response to high prices and continued supply problems, and, in a trend that may foreshadow the future, local industry is exploring alternatives that allow them to control their own power supplies.

If the grid doubles in size in five years, Kenya Power will have to buy this power and sell it to consumers. With recent solar, wind and geothermal additions, and with another 400 MW from Ethiopia, the Kenya grid will have a growing oversupply of power.

Jubilee's Big 4 industrial agenda requires low-cost electricity for urbanisation, population growth and economic development. Its political platform promised major power supply additions from the start, and its Least Cost Power Development [Plan](#) calls for 3000 MW additions that will *double* the current grid size by 2024. This includes scores of planned KenGen and IPP projects in wind (Kipeto, Ngong Phase III, Chania, Prunus, Meru), solar (Kopere, Alten Malindi, Quaint, Gitaru and others), geothermal (over 1000MW) and coal (Lamu). But even if all of the above power projects can be completed more cost-effectively and with less political influence than in the past, it is not clear that increased supply will reduce power costs. In 2019, current peak demand is just above [1800MW](#), compared to a healthy production capacity of about 2500MW.

If the grid doubles in size in five years, Kenya Power will have to buy this power and sell it to consumers. With recent solar, wind and geothermal additions, and with another [400 MW from Ethiopia](#), the Kenya grid will have a growing oversupply of power. Globally, few economies anywhere have expanded fast enough to double power demand in less than a decade and Kenya's economy today is not poised for double-digit growth. An oversupply of power will create more, not less, problems for Kenya Power and its consumers. This comes at a time when Uganda and Ethiopia also have [oversupplies](#) and are looking to sell their surplus power. Common sense says that if the economy took 60 years to grow demand for a 2600MW grid, it will not be able to absorb an additional 3000MW in less than a decade.

Meanwhile, unhappy with expensive and often unreliable power, big customers have begun to produce power on site for their own needs at financed prices that are more attractive than Kenya Power rates. On the order of 25MW of embedded power has been installed in Kenya in the past five years, mostly in the form of solar PV but also from biogas and geothermal sources. In 2019, an additional 20 MW is likely to be added. [Malls](#), [flower farms](#), [factories](#), [tea estates](#) and [universities](#) are [taking up](#) embedded solar systems because they are reliable, they help control costs, they meet growing consumer demand for green power and they increase

productivity. As shown in Table 2, companies are finding that they can [manage their energy costs](#) in ways that support their bottom line – at prices that are lower than Kenya Power rates.

Embedded Solar Power Project	Installer	Year	Capacity MW
Doormans Coffee, Tatu City	Equator Energy	2019	1.0
Gallaria Mall	Solar Century	2019	0.56
Bidco Thika	Astonfield	2017	1.2
Swissport JKIA	SPS	2017	0.1
Waridi Flowers	Astonfield	2017 (?)	0.22
Penta Flowers	Ariya Leasing	2017	0.25
Kiliguni Serena	SPS	2017	0.3
London Distillers	Solar Century	2017	0.92
International School of Kenya	Astonfield	2016 (?)	0.15
Two Rivers Mall	Astonfield	2016	1.3
ICIPE Solar	Solar Century	2016	1.2
Garden City Mall	Solar Century	2015	0.86
Williamson Tea	Solar Century	2014	1.0
Strathmore University	QuestWorks	2014	0.6
			9.66MW

Table 2: Selected Embedded Solar PV Projects in Kenya

Although thus far the tally of embedded solar power projects is relatively small, the trend should be of concern to power sector leaders. This is because the top 6,000 power consumers (i.e. those consuming 15,000 kWh/mo) account for about 60 per cent of Kenya Power revenues. These players are watching the early adopters and meeting with the financiers and installers of embedded power systems. Trends for self-production of power will not go away.

With the rapidly decreasing costs of solar, wind, biogas and energy storage technologies, producing one's own power is increasingly viable. Globally, scores of companies are developing technologies and raising finance that can make consumers energy independent and enable them to sell excess power to the grid. Indeed, embedded solar and biogas and, increasingly, battery storage, are being actively promoted for industries, commercial establishments and households in developed countries. National power production profile curves in California, Germany and [Australia](#) now show impressive inputs from wind and solar power. A large portion of these are from household and commercial systems. As batteries get cheaper, more customers will opt to manage their own energy supply. As technology improves and costs go down, decisions will increasingly be driven by

company (and household) bottom lines.

A Green New Deal for Kenya?

Although Kenya's [new Energy Act](#) allows for net metering and distributed generation (i.e. self- production of power and sales of excess to the grid), the government and Kenya Power have been less enthusiastic about promoting embedded power. As elaborated above, the government's focus is on centralised generation projects. This is unfortunate because it is clear that, globally, a tipping point is near. Lower-cost renewables and storage are changing things quickly, enabling large companies and developments to fully manage their own power production and, moreover, to remove part of the financing burden from the state and IPPs.

The biggest question facing the power sector is this: How will it lower costs, compete and improve overall performance for a population promised 100 per cent electricity access in a global business environment where customers can increasingly generate their own power more efficiently than the power company? To survive, the power sector must anticipate changing technologies and business models or it is likely to suffer some of the same consequences that land line telephones did when they were overwhelmed by cellular technology.

Globally, whether East Africa likes it or not, the world is entering the sunset stages of the fossil fuel age and power sector business environments are unfolding very differently than they were just a few years ago. They are moving toward distributed power technologies that can improve grid stability, create jobs and add economic value. In order to fight climate change and clean up the environment, international leaders are looking to green technologies, electric cars and renewably-powered smart and decentralised grids. The good news is that this is no longer science fiction - it is reality.

Rather than fight the inevitable, Kenya - which already has a reputation for having a "green power sector" - should become a regional leader for decentralised clean energy and plan for it. Just as was done with cellular phone networks, power sector planners should rethink their strategies so as to embrace the new realities.

First, power sector planners should move away from IPP-driven exclusively large-scale project approaches that are top-down, opaque and, increasingly outdated.

Though economies of scale and stable power requirements demand that there will always be large-scale power suppliers, there is also a need to recognise the developing niches for smaller decentralised power providers and the ways in which they can help improve the overall grid.

Second, planners should give consumers a larger stake in the sector and encourage them to finance and produce their own energy. Large consumers using decentralised solar, geothermal and storage should be incentivised to supply their own power and to sell their excess power to the grid. Since such large consumers make up the bulk of Kenya Power's demand, their decisions will increasingly affect the prices and power generation choices of millions of smaller commercial and household consumers.

Thirdly, by opening up the sector, and setting targets for smaller-scale decentralised and embedded solar, wind, biogas, geothermal and storage, planners will create jobs for the financiers, developers, manufacturers and installers of these technologies. In developed economies, decentralised solar players create far more jobs than large-scale power projects, jobs that are high quality and available for local small and medium enterprise players. Given the right policy environment, the Kenyan private sector is well-equipped to move into this space and to develop new efficient business models.

Fourth, the power sector should focus on its core business: efficiently distributing and transmitting power. Many [recognise](#) that unless considerable improvements are made in the country's distribution and transmission infrastructure, generation capacity will be added in vain. Kenya Power - and the central investments in its infrastructure - need to be targeted at poorly performing parts of the distribution and transmission system. By allowing decentralised producers to add needed capacity, the power sector can simultaneously refocus its investments on Transmission and distribution improvements and reduce the need for expensive upgrades to sites where energy is self-produced.

Finally, Kenya should seek to be the hub for international electrification connections between Ethiopia, Uganda, Tanzania and SADC markets. By building up the transmission connections between these countries, it will increase local electricity supplies, lower prices and increase income opportunities from the wheeling of electricity between countries. Lower priced electricity, especially from Ethiopia, will force down prices and enable local industry, and eventually

stimulate the inevitable transition to electric [transport](#).