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Africa's Energy Transition

Africa's growing population means there will be a corresponding growth in energy demand and renewable energy can play a key role in meeting this demand.

February, 2022

Source: 1952 Africa

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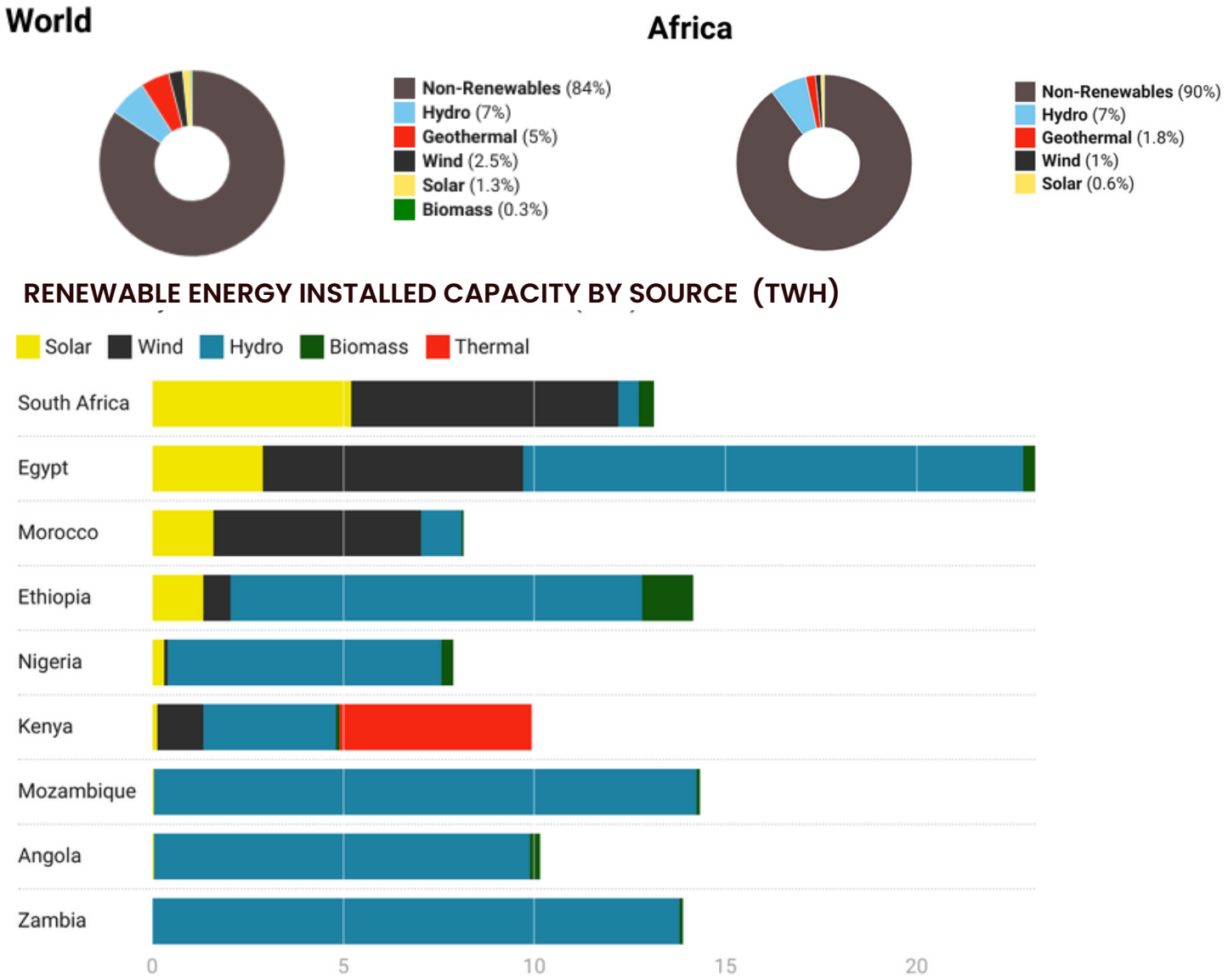
BREAKING DOWN THE ENERGY MIX



Africa's energy mix shows its slow start to the transition into renewable energy, although not as slow as we would think.

Non-renewables contribute 90% to Africa's energy mix, higher than the global average of 84%. Perhaps a better measure of the transition pace would be in comparison with a decade earlier in which case a slightly different picture is painted. The contribution of non-renewables in Africa has dropped by 1.6% - the same as the rest of the world. This shows a normal transition pace but even amongst the renewables in Africa, a transition is ongoing.

Africa's energy generation currently sits at 1.79 Exajoule (EJ), with renewable energy contributing 0.16 EJ. The most developed source of renewable energy is hydropower which is exactly at the global average of 7%. It is, however, unlikely that it will continue this dominance in the next decade as the focus is shifting away from dams - 75% of all dams used for hydropower in the continent are inactive. As the attention shifts from dams, it is going elsewhere - the sun and the wind. BP predicts that 30% of Africa's energy will be generated from solar by 2050. Countries like South Africa and Egypt have well-developed solar and wind i

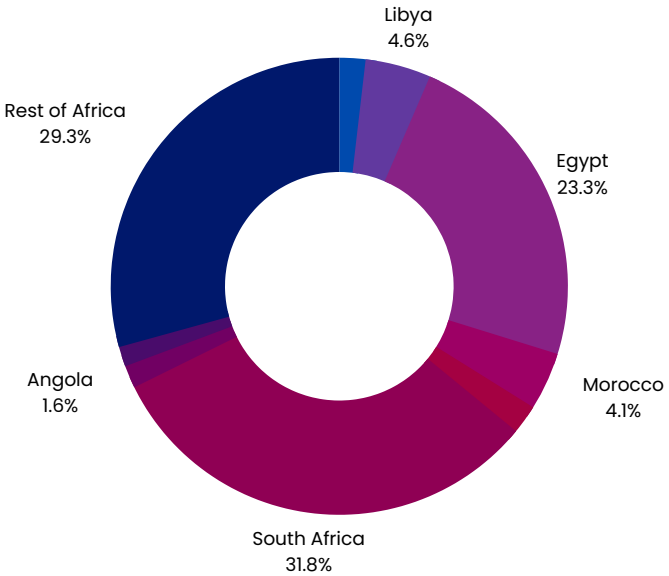
ndustries. In South Africa, wind is the primary source of renewable energy as it generates 55.6% of the country's renewable energy mix. The biggest solar and wind power plants are Noor Ouarzazate solar complex in Morocco with 580MW capacity, and Lake Turkana wind farm in Kenya with 310MW capacity both of which started operations in 2018 and 2019 respectively. Egypt also had a major boost as the Ras Ghareb wind farm started operation in 2020.

A plausible explanation for this shift is perhaps as a result of the ease in which both energy sources can function in a decentralized system, particularly solar energy. Of the total capacity of 9064 MW solar power on the continent, at least 1,500 mini-grids have been installed which can deliver power to areas a centralized system may find difficult. It is, for this reason, Nigeria's Rural Electrification Agency which secured a $350 million financing commitment from the World Bank focuses largely on mini-grids. With other strong initiatives like "solar power naija" and All On's sustainable energy for all, solar power is poised to rece-ive significant investments in the coming years, closely accompanied by wind but at the detriment of hydropower.

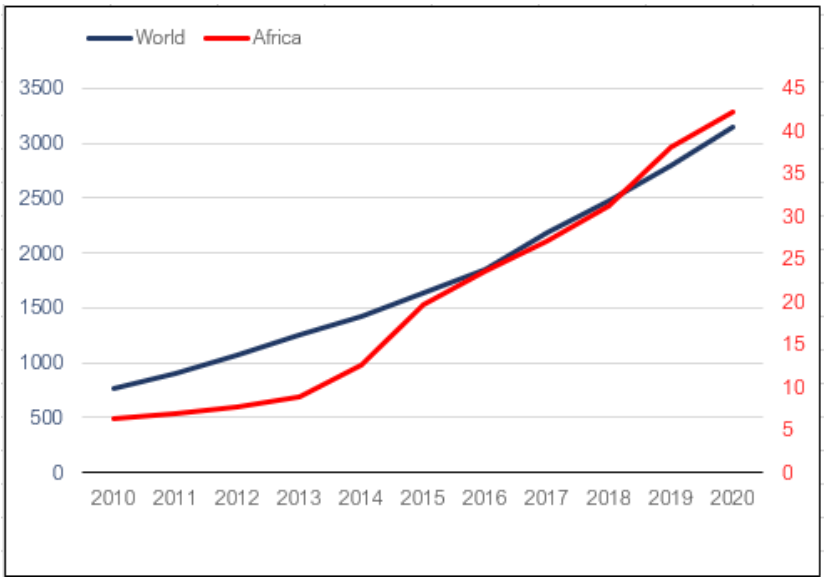
A surprise appearance in the energy mix is Kenya's geothermal energy despite its expensive and risky nature. 95% of geothermal power being generated in Africa is generated in Kenya and the country is now ranked 7th in the world. Olkaria and Eburru projects contribute to the geothermal generation of power in Kenya, the earliest of which began operation in 1981.

Biomass is still largely undeveloped in the continent and currently contributes 0.005%. This is not peculiar to Africa alone, the global average for biomass is 0.3%. This low level of development of biomass energy may be as a result of its perceived health and environmental consequence due to the emission of CO2 during the decomposition of organic waste. As a result of this, much of the focus on biomass in the next few years in Africa and the world will be academic.

Power Generation By Country



Africa's Power Generation From Renewables (TWh) In The Last Decade

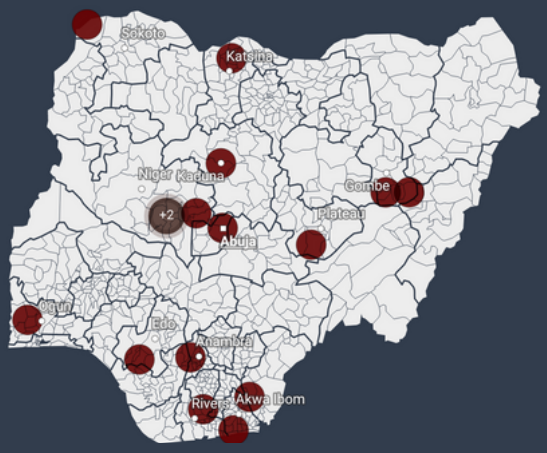


NIGERIA AS A CASE STUDY

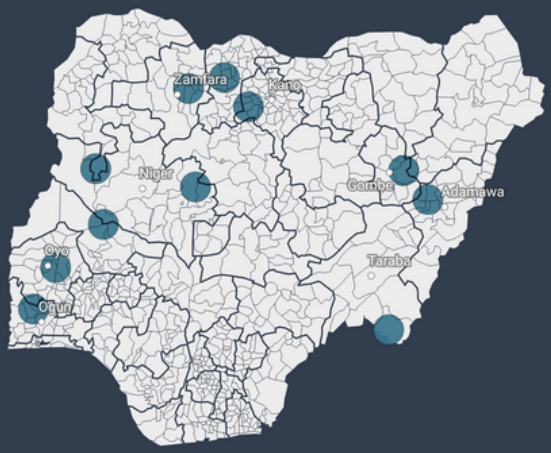
	Hydro	Gas	Wind	Solar
Total installed capacity (MW)	2,062	11,972	10	7
Available capacity (MW)	1,060	7,074	0	7
Electricity generated (MW)	415	3,320	0	4

DEVELOPER	CAPACITY	LOCATION	RESOURCE
GVE	100kW	Akpabom, Akwa-Ibom	Solar
	24kW	Onono-Anam, Anambra	Solar
	10kW	Egbeke, Rivers	Solar
	40kW	Bisanti, Niger	Solar
	24kW	Kperegi, Niger	Solar
	50kW	Angwan-Rina & Demshin, Plateau	Solar
	46kW	Kolaku, Gombe	Solar
	32kW	Ayaba, Gombe	Solar
	1MW	Wuse Market, Abuja	Solar
CREDC	50kW	Umon Island, Cross River	Solar
Nayo Tropical	100kW	Tungan Jika, Niger	Hybrid
Rubitec	85kW	Gbamu Gbamu, Ogun	Solar
GoSolar	80kW	Kurdula, Sokoto	Solar
Arnergy	40kW	Obayantor, Edo	Solar
ACOB Lighting	16kW	Dokan Karji, Kaduna	Hybrid
VERGNET	10MW	Lambar Rimi, Katsina	Wind

MINI-GRIDS DEPLOYED IN NIGERIA



DAMS IN NIGERIA (HYDRO-ELECTRIC)



	DAM	STATE	ACTIVITY STATUS	CAPACITY (MW)	TURBINES
1	Kainji	Niger	Active	760	8
2	Jebba	Niger	Active	578.4	6
3	Shiroro	Niger	Active	600	4
4	Dadin Kowa	Gombe	Dormant	40	N/A
5	Ikere	Oyo	Dormant	37.55	N/A
6	Kiri	Adamawa	Dormant	35	N/A
7	Mambilla	Taraba	Undergoing development	3,050	12
8	Oyan River	Ogun	Dormant	9	3
9	Zungeru	Niger	Undergoing development	700	4

AFRICA HAS HUGE POTENTIAL

1,449,742 TWH/YR
Solar Power

978,066 TWH/YR
Wind Power

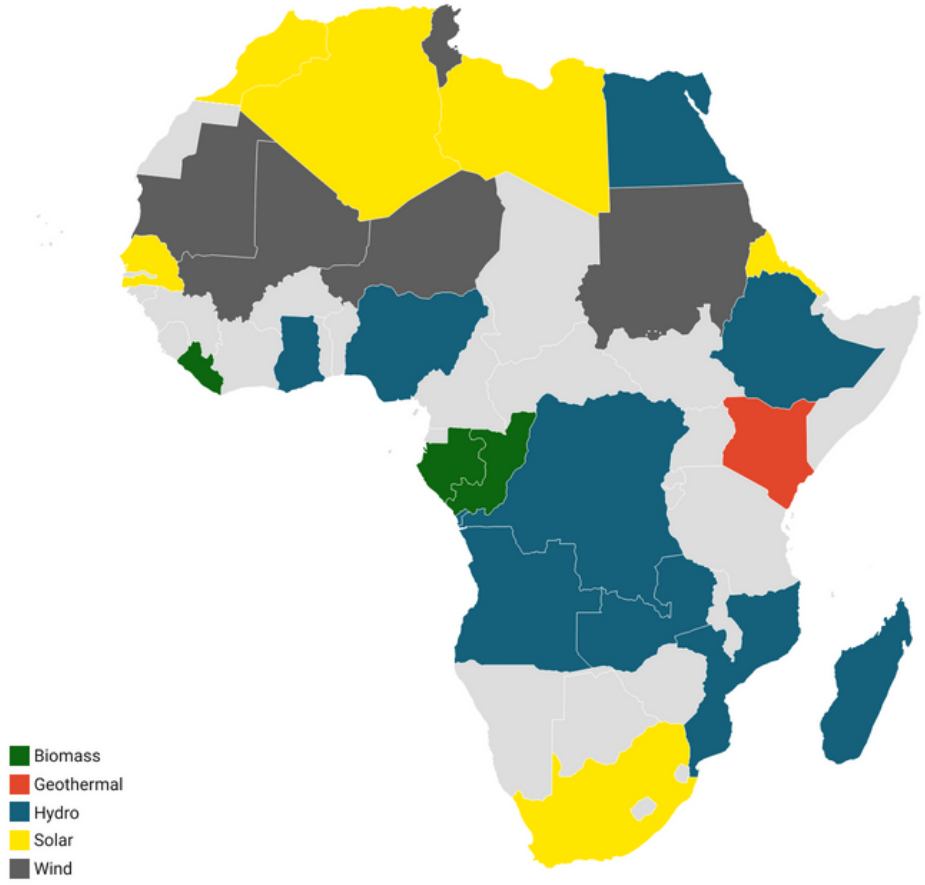
1,748 TWH/YR
Hydropower

2,374 TWH/YR
Biomass

The potential for solar power in Africa is massive due to its geographical position and, consequently, the high amount of irradiance it receives from the sun. Africa is known to be the continent with the most solar irradiance and it is no surprise that the theoretical potential for its solar power generation is estimated at 1.45 million TWh/yr, 0.75 million TW higher than the rest of the world (0.7 million TWh/yr) put together.

Wind energy is often categorized as a form of solar energy since air in motion is a direct consequence of the heat from the sun. As a result, the continent has significant potential for wind energy estimated at 978,066 TWh/yr and powerful enough to satisfy the entire continent's demand 250 times over. Biomass is third in line with 2,374 TWh/yr, closely followed by hydropower at 1,748 TWh/yr.

Renewable Energy with the highest potential in African countries



A GAP BEGGING TO BE FILLED

Much is said about the energy transition - moving from non-renewables to renewables, and there is pressure on Africa to pick up the pace. With the enormous potential of the continent in this space, it is more of a question of 'why not?' rather than 'why?'. There is also pressure on operators of non-renewables, particularly fossil fuels, to lead the investments into renewables. A lot of the international oil companies (IOCs) are bowing to such pressures but not much of it has happened in Africa. Just a few renewable energy projects (7) operating in Africa are run by an IOC, this is small when compared to over 50 projects operated by Big Oil in the rest of the world and more are in the pipeline with Shell, BP, and TotalEnergies winning bids in Scotland's offshore wind. Judging by the estimated theoretical potential of Africa's renewable energy, the level of investment so far has barely scratched the surface. To understand how far behind the continent is in terms of investments in renewables, a look at the gaps is imperative. Only 844TWh is being generated which is just enough to meet 15% of the energy demand. To put this in context, assuming renewables alone were to fill this gap, an annual investment of $70 billion would be needed (with the assumption that each contributes equal proportion of the required power). The installed solar power capacity in Africa is about 10GW but it is almost nothing In comparison with the rest of the world, barely reaching 1% of the global installed solar capacity of 720GW. Wind and hydropower are not doing any better at 0.9% and 2.8% respectively. There is so much gap to fill that the continent cannot rely on IOCs to rein in the investments needed to fill them.

ACTIVE IOC PROJECTS IN AFRICA

	IOC	Country	Name	Energy Source	Capacity	Operation Start Date
1	Total	South Africa	Prieska photovoltaic power plant	Solar	75MW	2016
2	Eni	Algeria	Bir Rebaa North photovoltaic plant	Solar	10MW	2018
3	Total	Uganda	Soroti plant	Solar	10MW	2019
4	Total	Burkina Faso	Essakane photovoltaic plant	Hybrid - solar/thermal	15MW	2018
5	Total	Egypt	Benban Solar park	Solar	126MW	2019
6	Eni	Tunisia	The Adam & Tataouine photovoltaic plant	Solar	10MW	2019
7	Eni	Angola	Caraculo photovoltaic plant	Solar	50MW	FID

In Nigeria, mini-grids have been used as a medium to hasten the pace at which the energy demand is met. Grants from the World Bank and African Development Bank (AfDB) have contributed towards the development of 15 mini-grids in the country over the last 10 years. The question of efficiency is raised since the average mini-grid can be rated at 1MW, hence, to completely close the gap, 8,000 mini-grids will be required. At the current pace, it will take at least 50 years to fully actualize this. This scenario just shows that bigger projects in renewables are needed and that would mean larger volumes of investment.

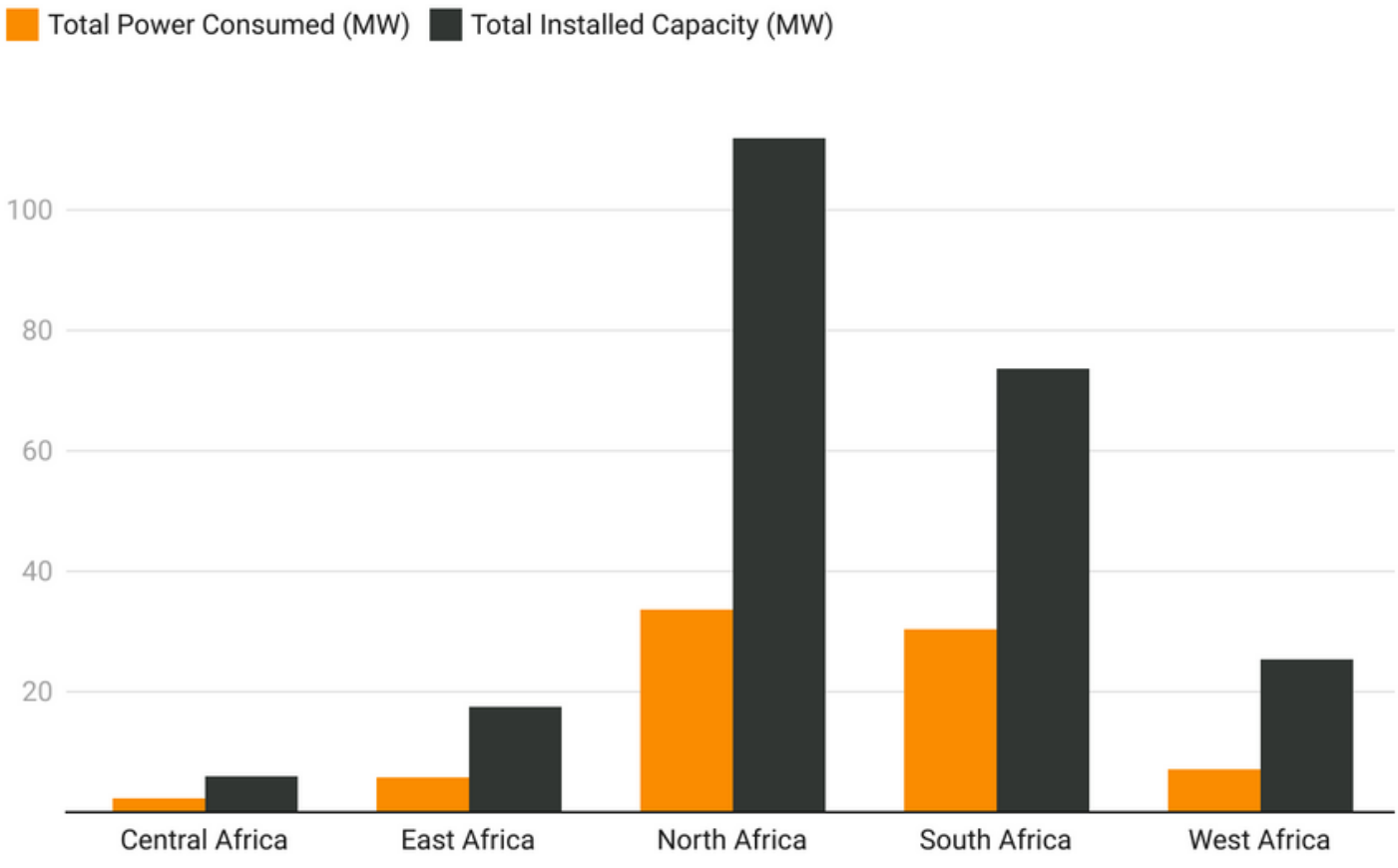
Investments are of little importance if they are not strategic.

The need for investment in renewable energy

generation has been stressed enough, even in this report. What has been rarely spoken about is what happens after. Of the total installed capacity (235GW) in the continent, only about 100GW is available. As a matter of fact, although collectively, the continent is unable to meet demand, countries like Ethiopia, Kenya, Tanzania, Uganda, and Rwanda have built up energy generation to overcapacity. Kenya's energy demand is at 2,036MW, 90% of which could be met by its current renewable energy generation capacity of 1,818MW. This has stalled the development of new projects in the country because there seemingly is no need for them. On the other hand, Kenya experiences about 16-20% loss of generated power due to aged transmission and distribution networks. This is very likely one of the issues encumbering the investment in renewable energy in the continent. Countries like Ghana and Libya have a huge gap between the installed capacity to generate power and total available power for consumption (at 53% and 59%). Legislation could play a significant role in solving this problem. In Nigeria, power generation and distribution are privatized but power transmission is not. This has significantly hampered the inflow of private investments in the transmission of power and as a result significantly less power gets to the consumers than what can be generated.

A lot of the investment needed in Africa would need to address the transmission and distribution of power in addition to power generation so as to create an enabling system for the increment of renewable energy generation.

African Regions: Total Installed Capacity vs Power Consumed (2019 Data)



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