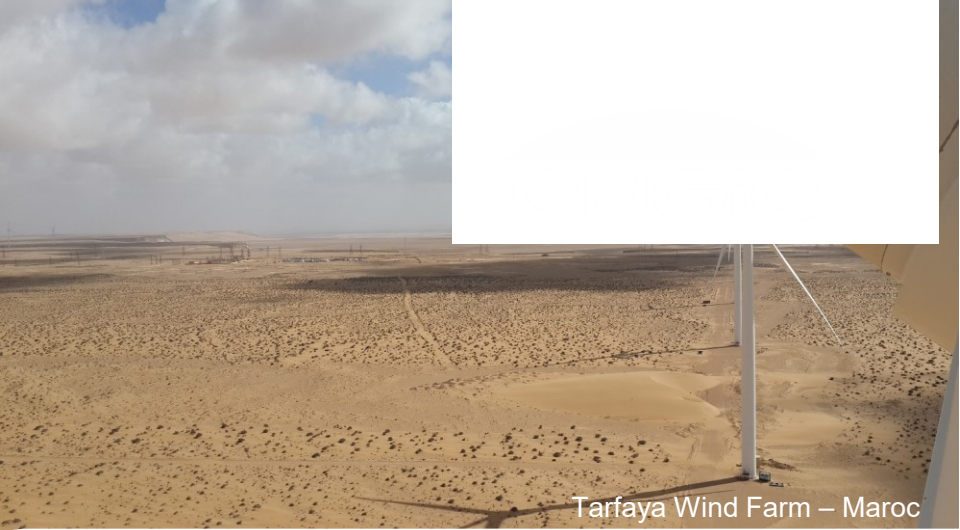




Solar Home System – Uganda



Tarfaya Wind Farm – Maroc



**Centralized and decentralized energy solutions for Africa:
cutting edge technologies supported by and co-developed
with the African actors**

Bruno BENSASSON, ENGIE, CEO BU Africa
Sustainable Energy for Africa, Brussels, October 23-25th, 2017



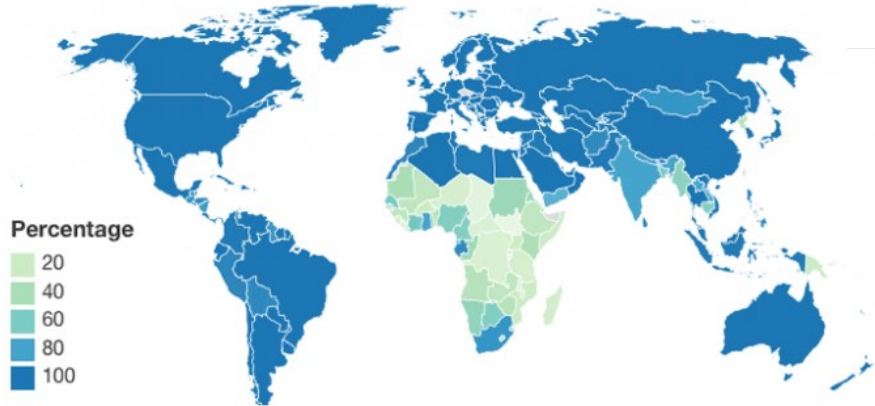
Power Corner Mini-Grid- Tanzania

Energy Services, Renault – Morocco

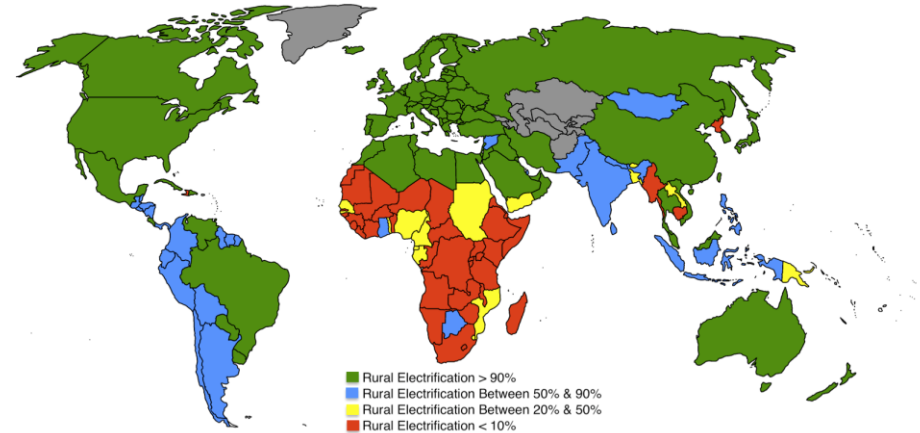
www.engie-africa.com/fr

Africa needs electricity ...

World Map of Electrification rate

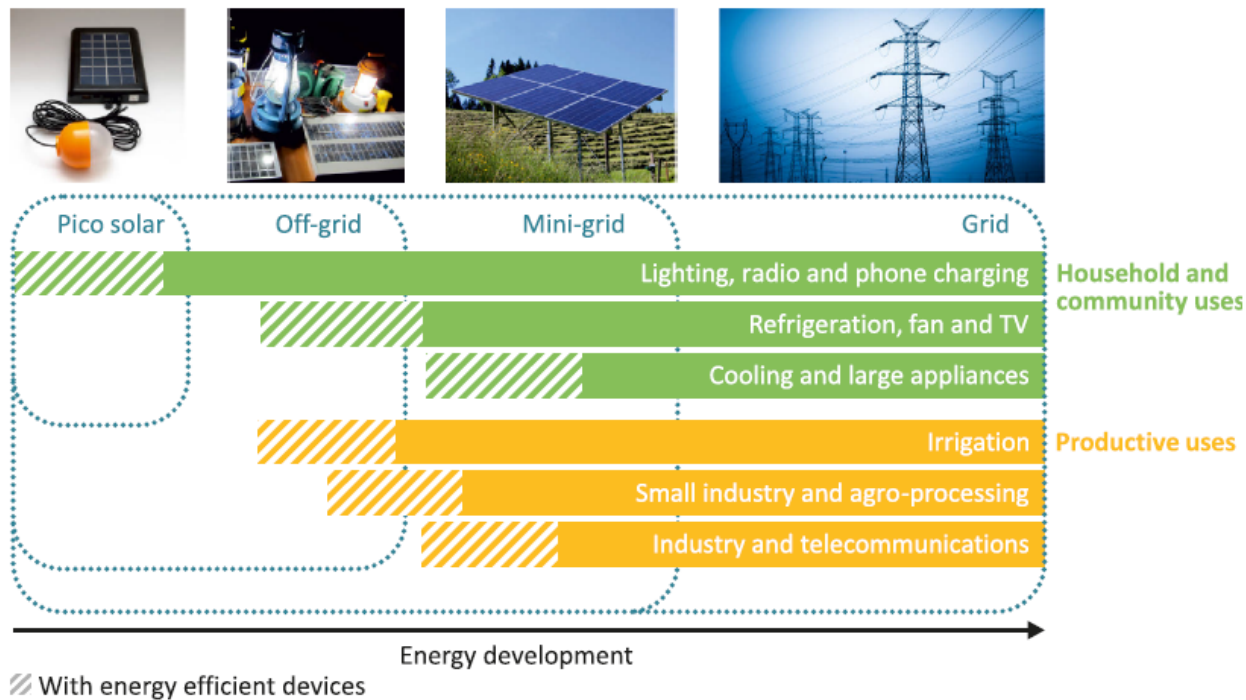


World Map of Rural Electrification rate



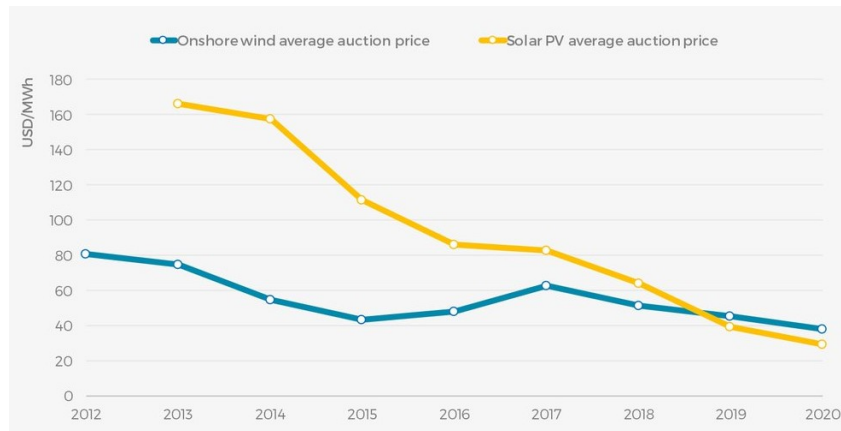
Electrification of Sub-Saharan Africa, **access to safe and reliable energy**, is an issue for **urban, peri-urban and rural populations**

... and adequate Energy Solutions are available: diversity of technologies, different scales for different uses, corresponding to different business models

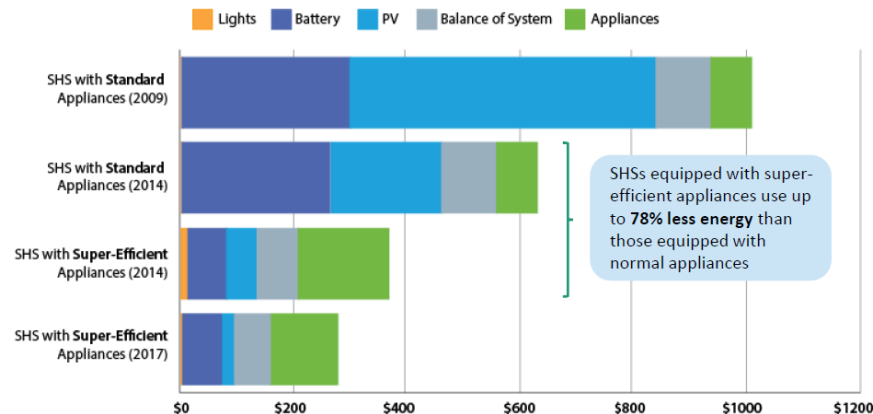


Affordable & Clean Energy for a connected Africa ... yes, today it is possible

Announced wind & solar PV average auction prices by commissioning date (2017)



Solar home System purchase price per type of appliance

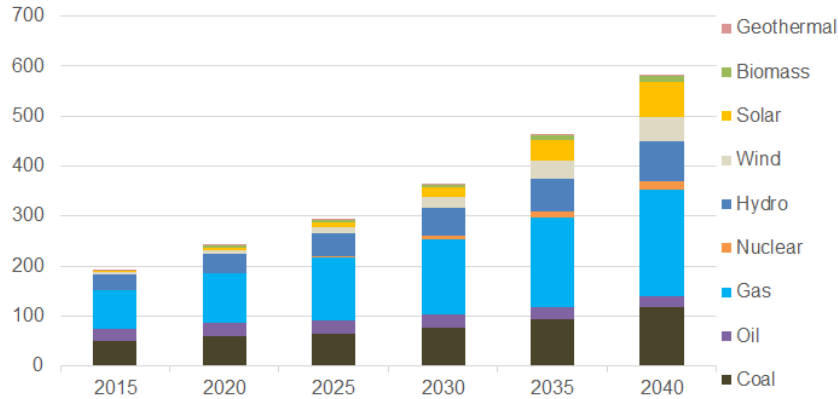


*Systems provide energy for 4 lights, a 19" color TV, a radio, and mobile phone charging
* Appliance use assumption: lights = 4hrs/day, TV = 3hrs/day, radio = 6hrs/day, mobile phone = 1 charge per day

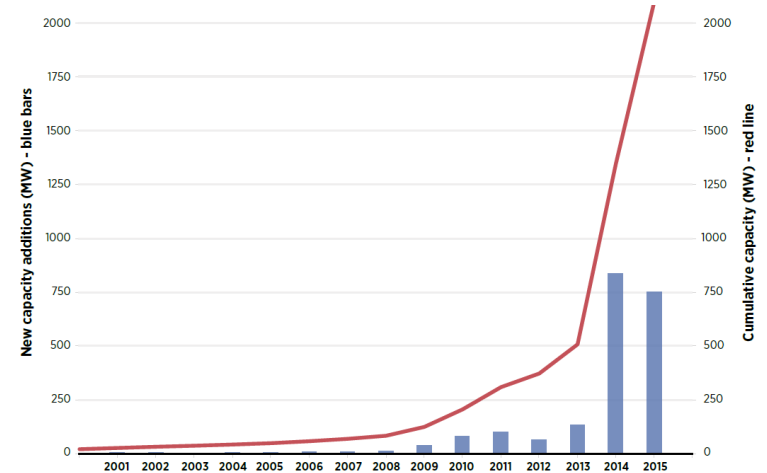
Beyond the **drop in costs of clean technologies**, international institutions have taken the measure of the **urgency of electrifying Africa**, setting up **development and financing programs** and African governments have become aware of the **impact of climate change**,

Centralized Energy in Africa: an evolution that reflects availability and cost of the resources, as well as geo-politic challenges

Africa Installed Capacity Forecast by fuel

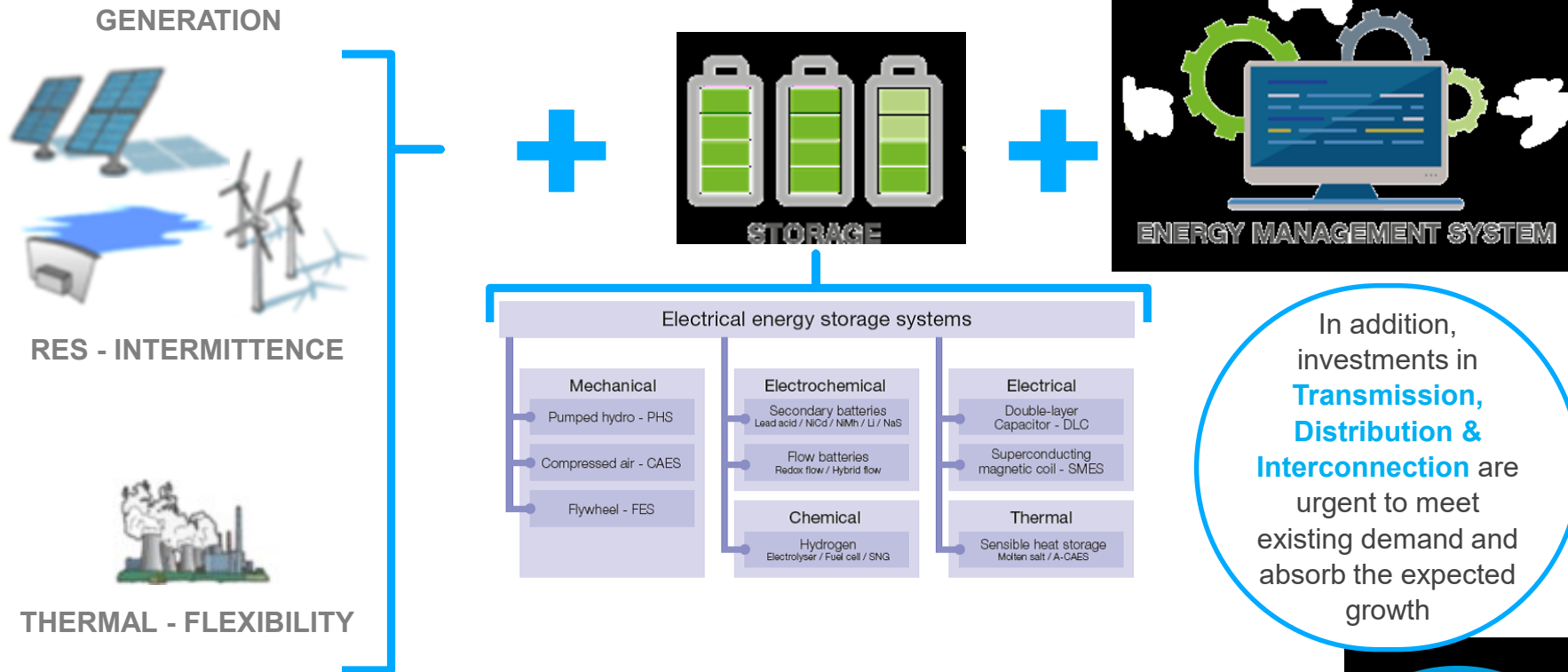


Africa's total cumulative installed capacity of solar PV, 2000-2015



Beyond the diversity of energy sources in the 54 African countries, a common trend shows more and more penetration of **renewable energy and natural gas**

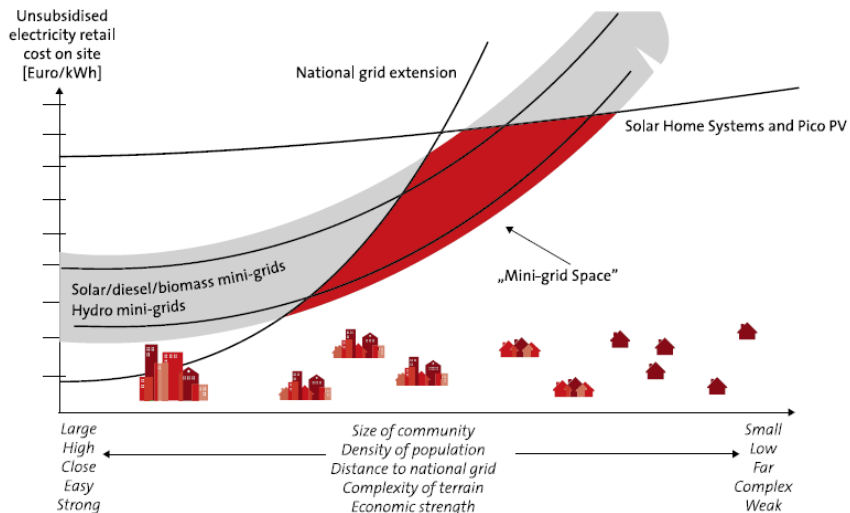
The development of Centralized Renewable Energy requires new (and affordable?) solutions to address intermittence



In addition, investments in **Transmission, Distribution & Interconnection** are urgent to meet existing demand and absorb the expected growth

Mini-Grid solutions are competitive with grid extension depending on density of power consumption and its distance to grid.

Illustrative the mini-grid Space



Mini-grid solutions allow electrification of entire communities with a single project and provide **flexibility** to **scale up or connect** with the grid at a later stage

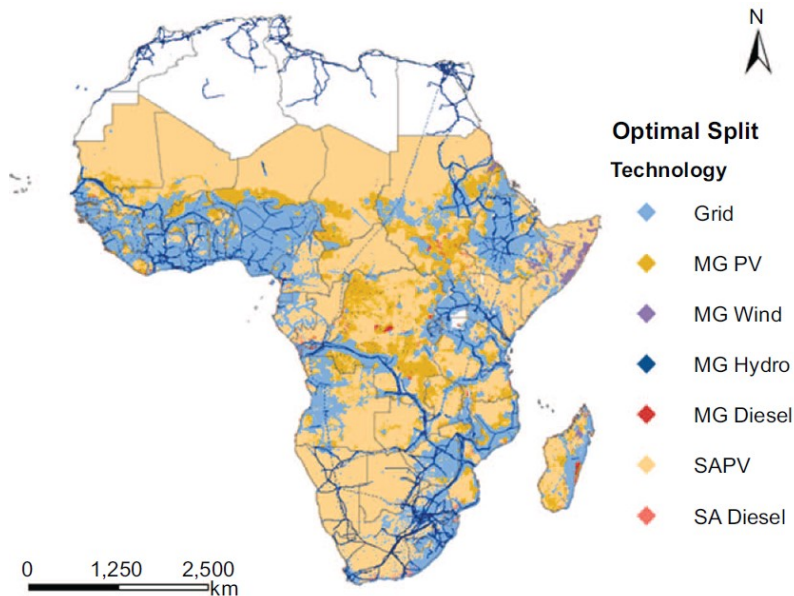
Global Cost of electricity generated by mini-grid systems (2015)



The **drop in solar PV and battery costs**, and of other mini-grids solutions will offer more important economic opportunities in the coming years

Different technologies of Mini-Grids, and a big potential for Solar PV in Africa

Estimation of spatial electrification optimization in Sub-Saharan Africa

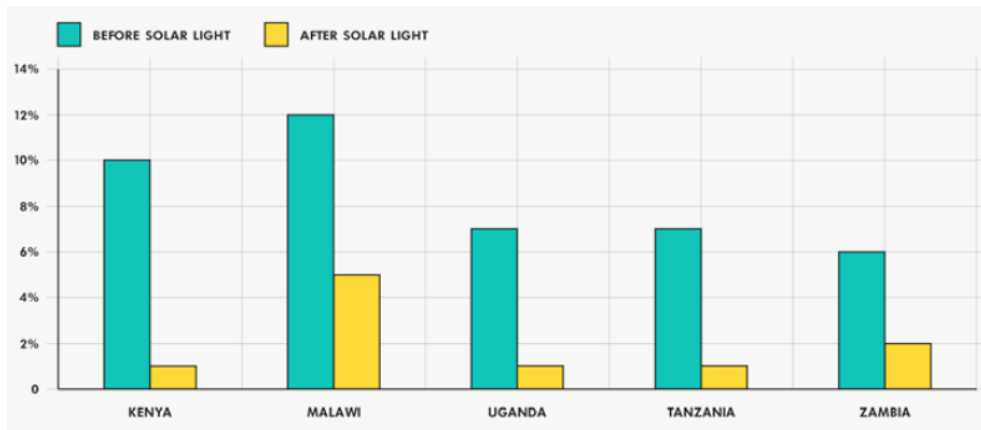


Advantages and Limitations of different technical solutions

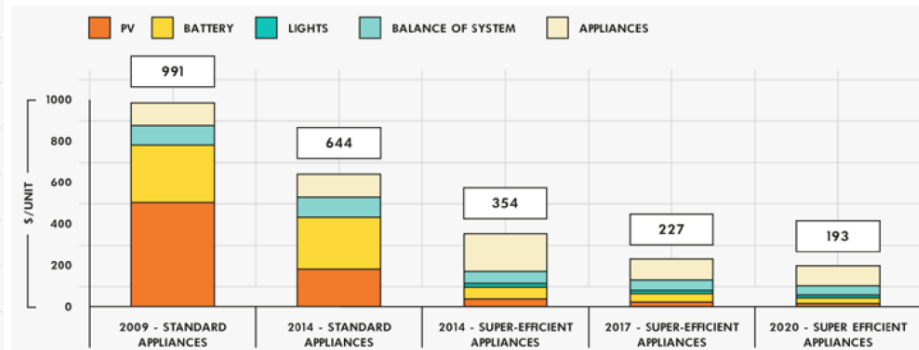
Micro/mini hydro	Solar-battery	Solar-battery + diesel	(solid) Biomass gasifier	Wind-battery	Diesel
GENERAL ADVANTAGE					
Low cost per kW and per kWh	Abundant resource in Africa	Flexibility through diesel back-up	Easy storage (biomass, gas can be stored,	complementary source to solar PV or diesel	Independence of availability of RE resources
GENERAL LIMITATIONS					
Lack or seasonality of flow*	access to funds for high initial Investment	Access for diesel Supply	technology less mature than others	Spatial & temporal variability of the resource	Fuel Cost CO ₂ & environmental impact

Solar Home System is the fastest & cheapest solution to meet the basic electricity needs in isolated areas

Portion of average household spending devoted to lighting



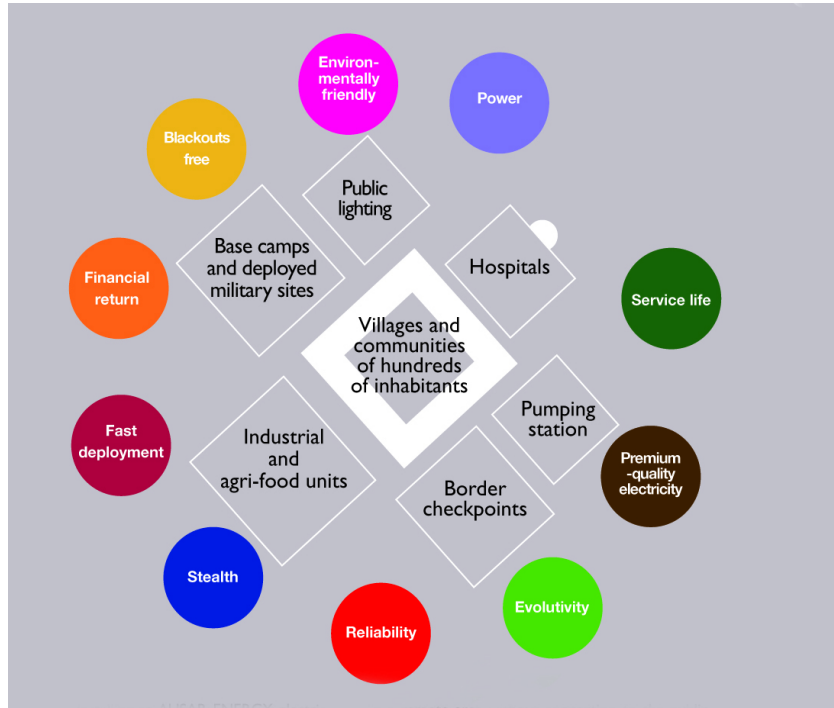
Cost trends of solar home systems with 19" TV, radio and two lights (US\$/unit)



Beyond the drop in costs, the emergence of **pay-as-you-go models** transforms the market. They enable customers to pay the upfront costs of a solar home system in **affordable instalments** over time and **increases consumer confidence** by shifting the risk of faulty technology to the supplier. It allows households to start climbing the **SOLAR ENERGY LADDER** (as their income rises, families and small businesses can afford larger systems)

Energy services, with adapted energy solutions, in B2B markets will contribute strongly to meeting Africa's growing energy needs

Micro Grids solutions for large electrification



Between grid and mini-grid, large micro grid, LED public Lighting, District Cooling, telecom tower solarisation are some solutions to **provide electricity for industries and public sector.**

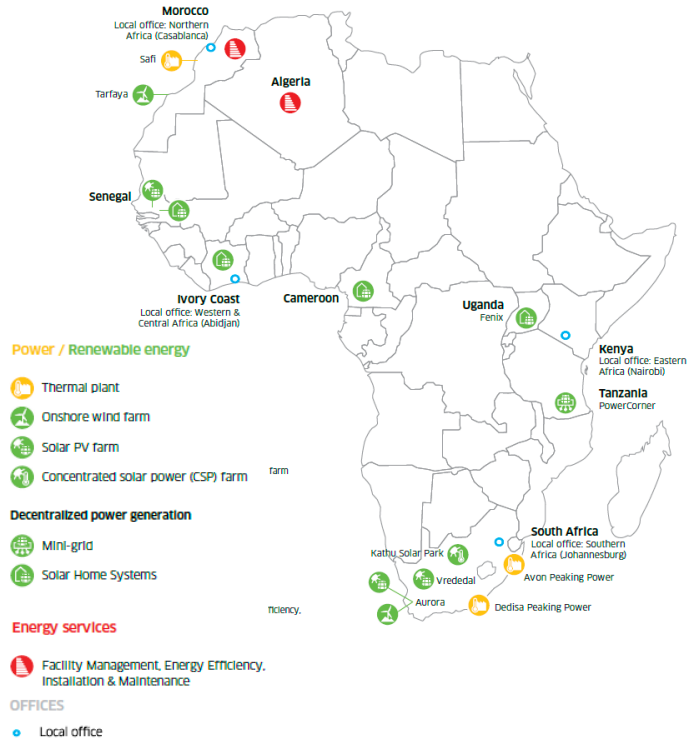
The development of Energy Solutions in Africa can only result from the collaboration between all the relevant actors.

- **Centralized** : Governments, Utilities, Transmission & Distribution companies, IFC, banks, ...
- **Decentralized** : Governments, Utilities, Telecom operators, local authorities, final clients, lenders, ...
- **B2B Services** : Government, Utilities, International & National Industries, Local competences, Universities & Training institutions

In addition the implementation of **favorable governance** is necessary to stimulate and protect public and private investments



ENGIE's presence in Africa



Do you have
QUESTIONS