
Helios Infinitas
Business Development & Consultancy
Rural electrification: The first step to a bright future
Caroline Nijland, Helios Infinitas

Helios Infinitas

1. **Track record**. Helios Infinitas has more than 27 years of experience in implementation of rural electrification projects/ energy companies in Sub-Saharan Africa, setting up and leading DESCO's, raising funds and Lobby with governments.

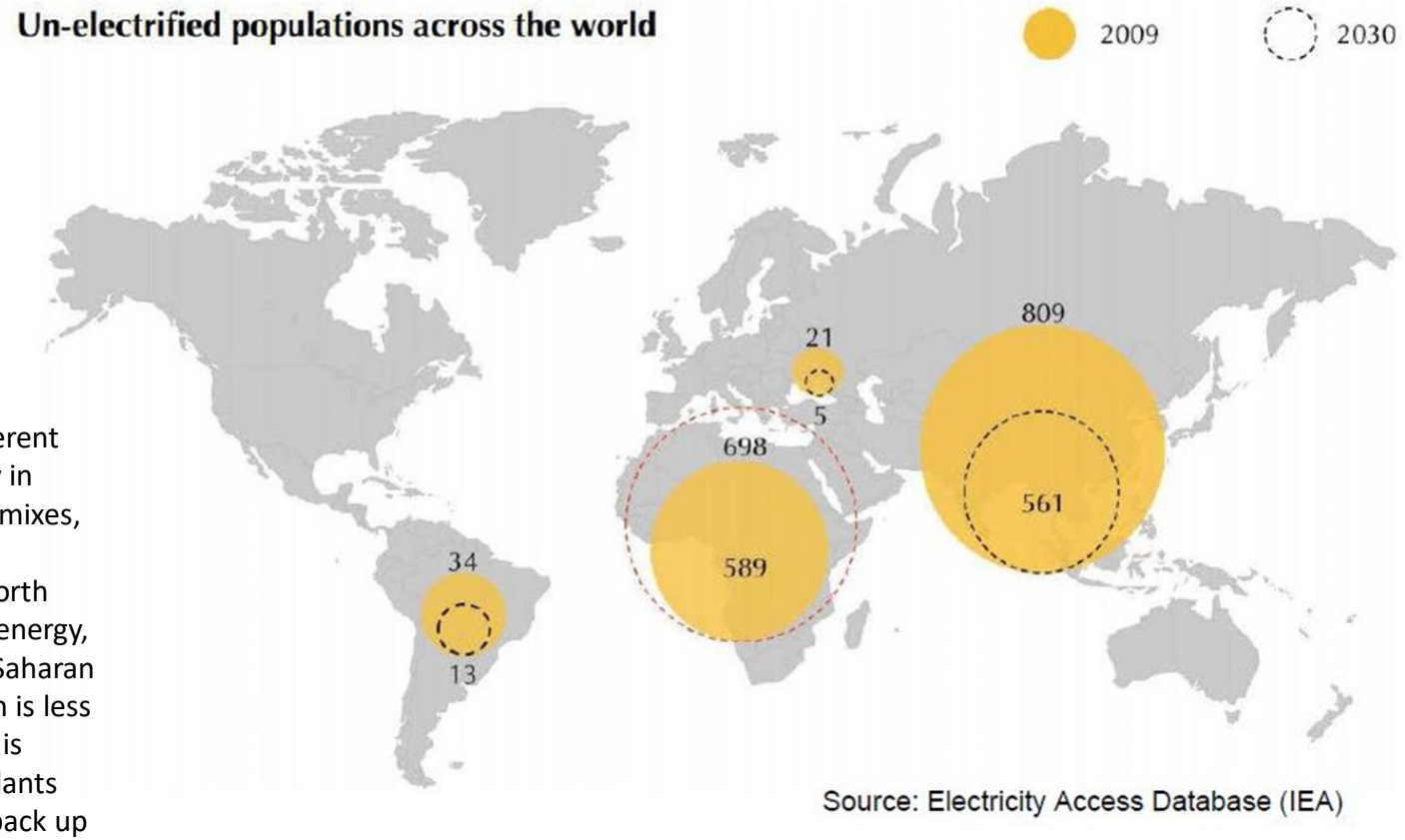
2. **Advisory services** / business development/ fundraising /project and operational management / training and lobby in the field of renewable energies and rural electrification/energy access in Africa.

3. **Ultimate goal of Helios Infinitas**: Scale-up the distribution of PULSE appliances in Sub-Saharan Africa (100.000 smallholder farmers equipped with PULSE appliances in 2030) through a standard business development concept approach.

Africa: Context energy 2009-2022 and forecast 2030

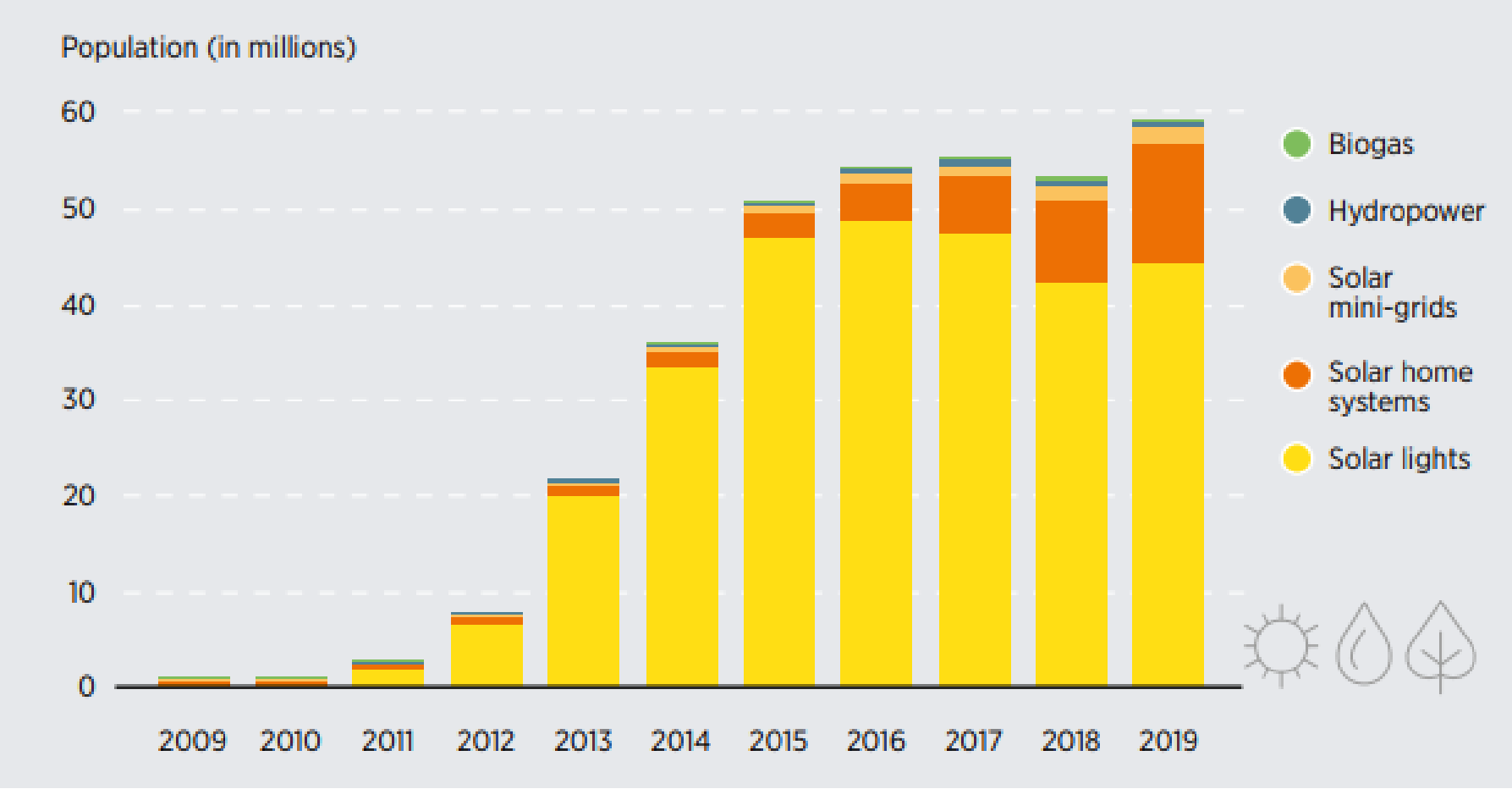
The UN Agenda has set the of goal universal access to electricity by 2030

Electrification 2009-2030



African energy plans must recognise the vastly different realities and starting points of each African country in terms of both current energy access levels, energy mixes, and current roadmap choices. The energy access challenges of Africa cannot be overstated. While North African countries have close to universal access to energy, the total power generation capacity of the 48 sub-Saharan African countries amounts to 45 GW in 2021, which is less than that of Spain. About a quarter of this capacity is currently unavailable, mainly due to aging power plants and lack of maintenance, which means expensive back up diesel generator systems make up for the shortfall. This serious case of crippling underinvestment means that around 600 million people, about 43% of all Africans, live without access to electricity.

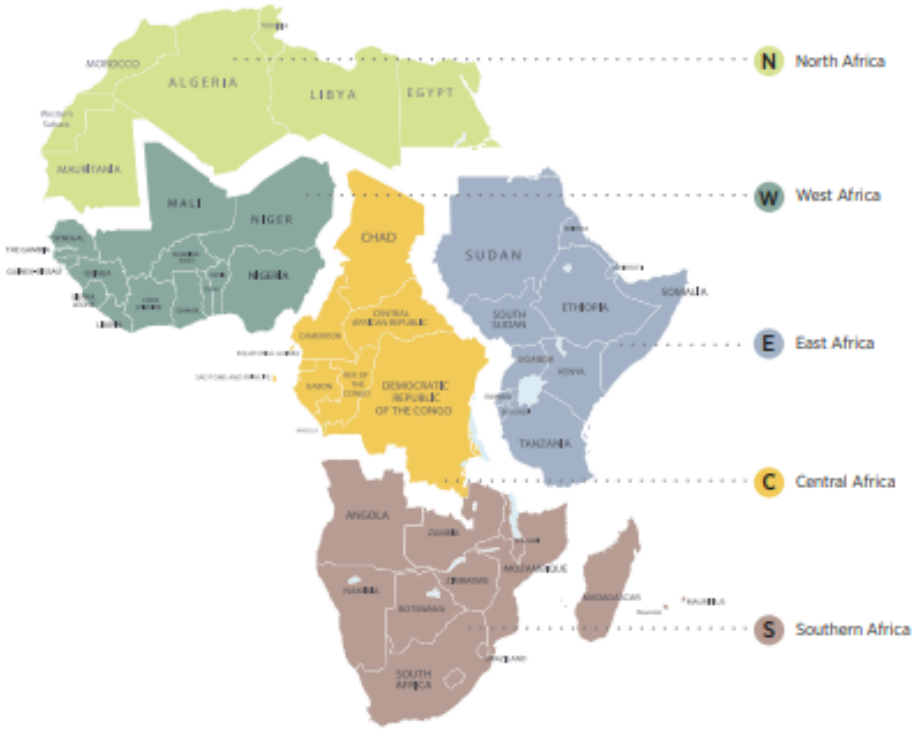
African population served by off-grid RE 2000-2019



Source: Irena (2023)

Africa’s energy landscape

Figure 1 | **Africa’s energy landscape: Present***

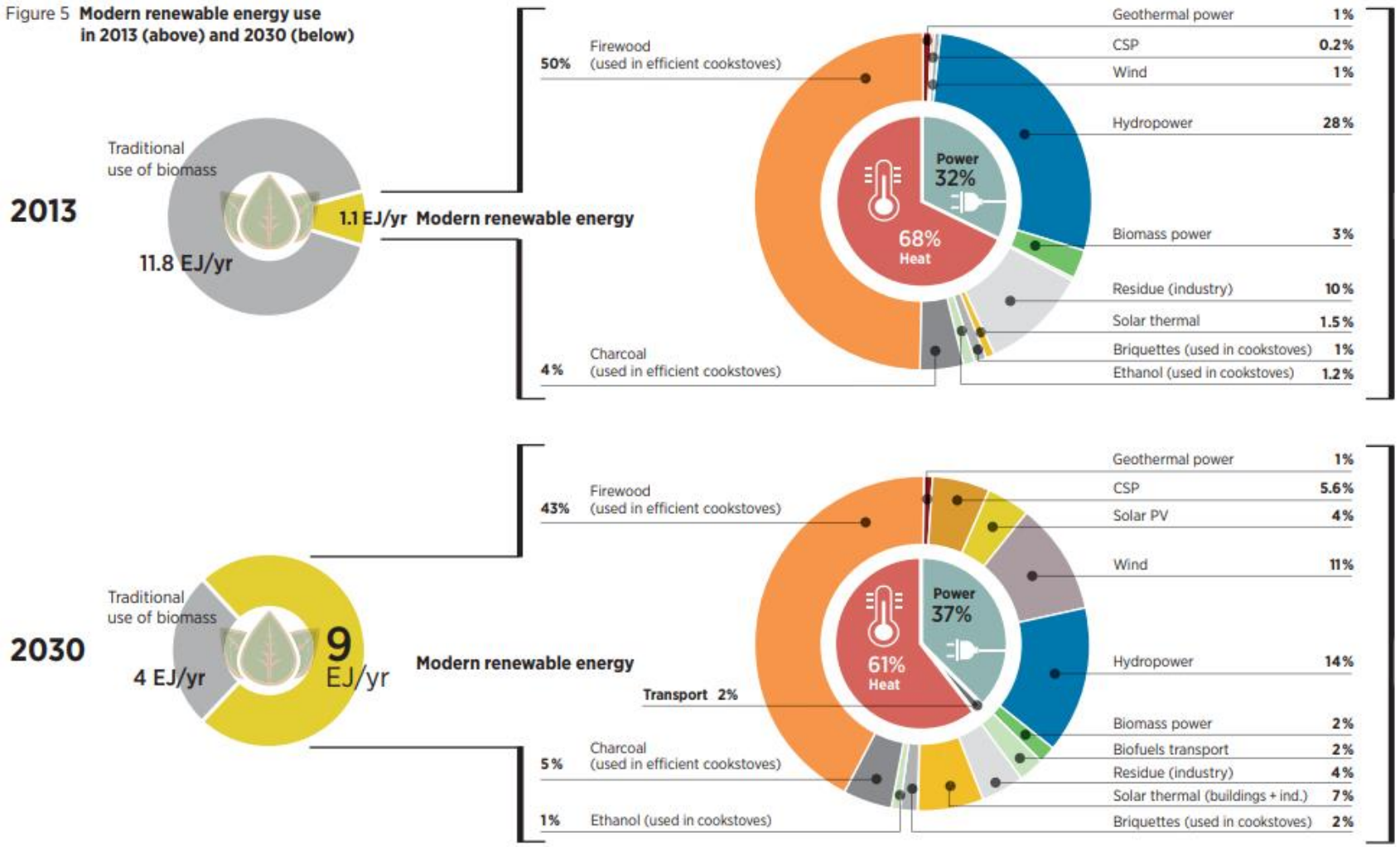


	Population (million people)	GDP billion/yr (current international $)	Access to electricity (% population)	Electricity (KWh per capita)
N North Africa	175	1936	98%	1574
W West Africa	327	1310	47%	188
E East Africa	303	646	23%	91
C Central Africa	115	227	25%	167
S Southern Africa	177	1100	43%	2061

*Note: statistics refer to 2013, except for access to electricity which refers to 2012.

Source: Africa 2030: Roadmap for a RE future, IRENA

Modern renewable energy use in 2013 and 2030

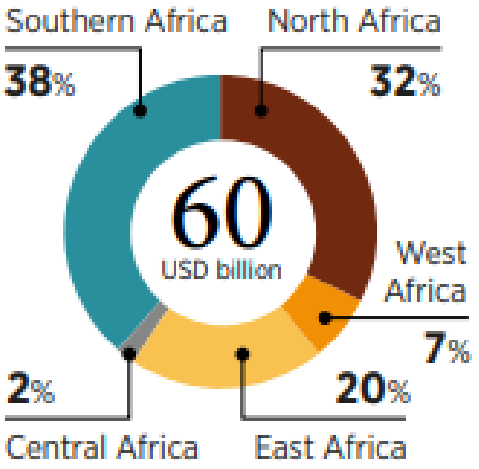


Source: Africa 2030: Roadmap for a RE future, IRENA

Summary of RE investments 2000-2009 and 2010-2020

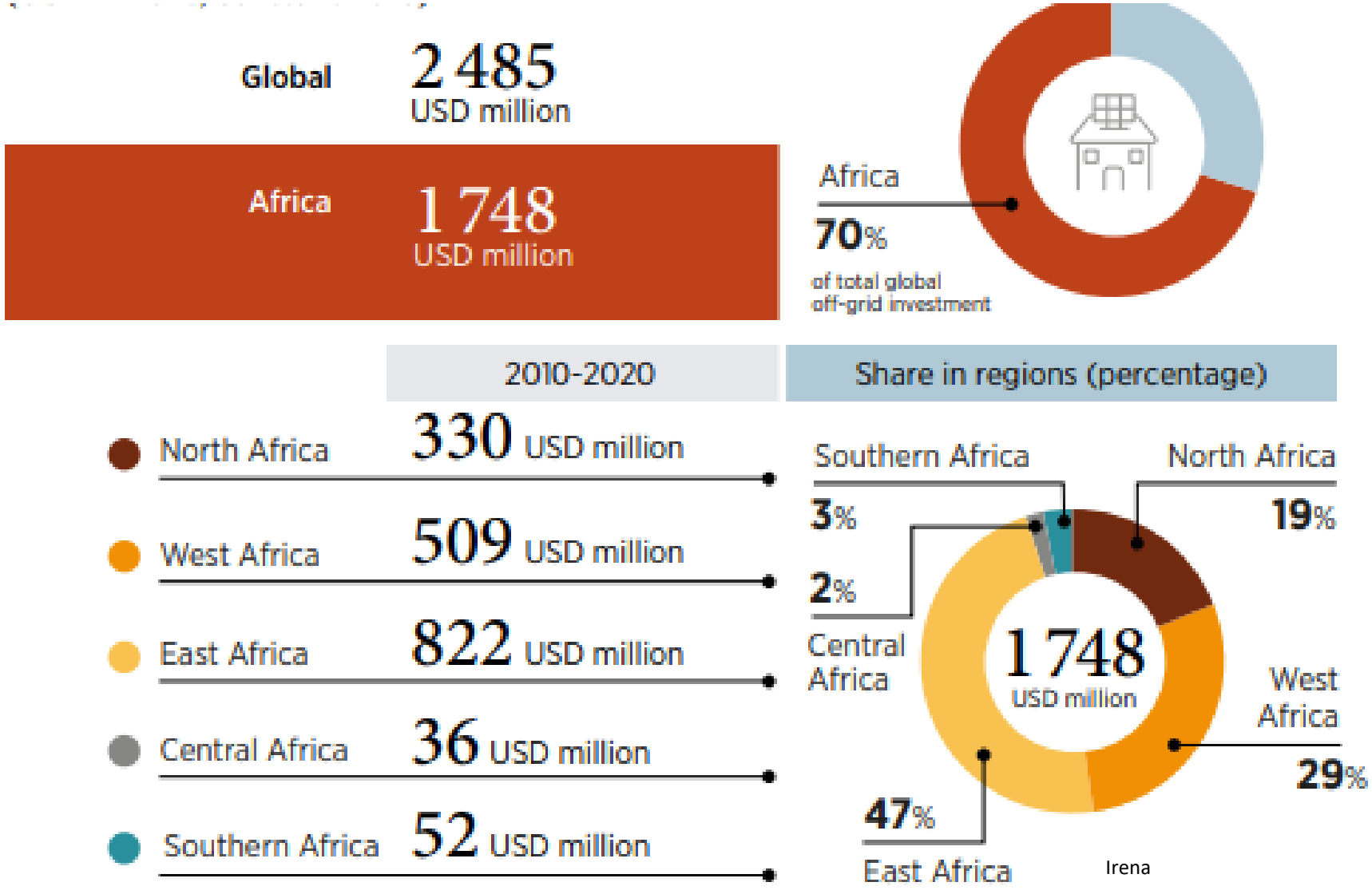
Overall renewable energy investment in Africa and globally, 2000-2020 (USD Billions, current 2020)

	2000-2009	2010-2020	Cumulative 2000-20
Global	587 USD billion	2 254 USD billion	2 841 USD billion
Africa	4.8 USD billion (0.8% of global investment)	55 USD billion (2.4% of global investment)	60 USD billion (2% of global investment)
North Africa	1.9 USD billion	17.5 USD billion	
West Africa	0.5 USD billion	3.9 USD billion	
East Africa	2.0 USD billion	9.7 USD billion	
Central Africa	0	1.3 USD billion	
Southern Africa	0.3 USD billion	22.4 USD billion	



Source: Irena (2009)

Off-grid RE investments in Africa 2000-2022

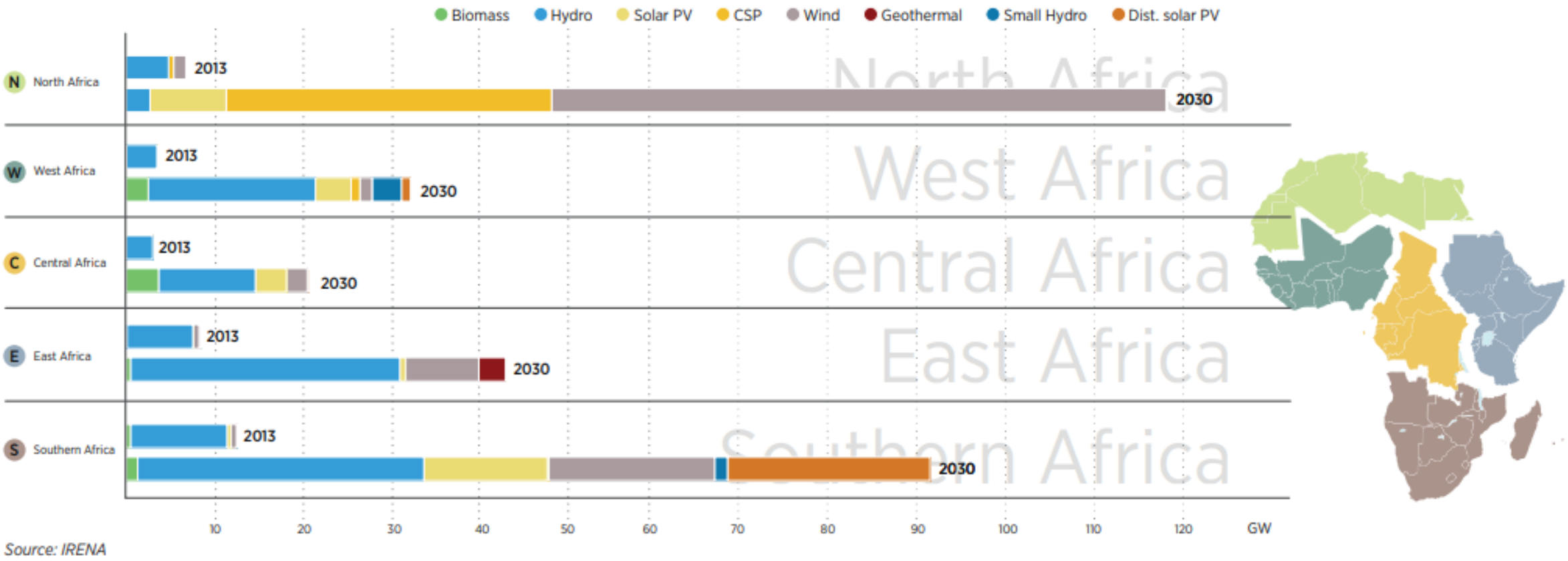


Irena

An African green deal for social and economic development

Source: Irena

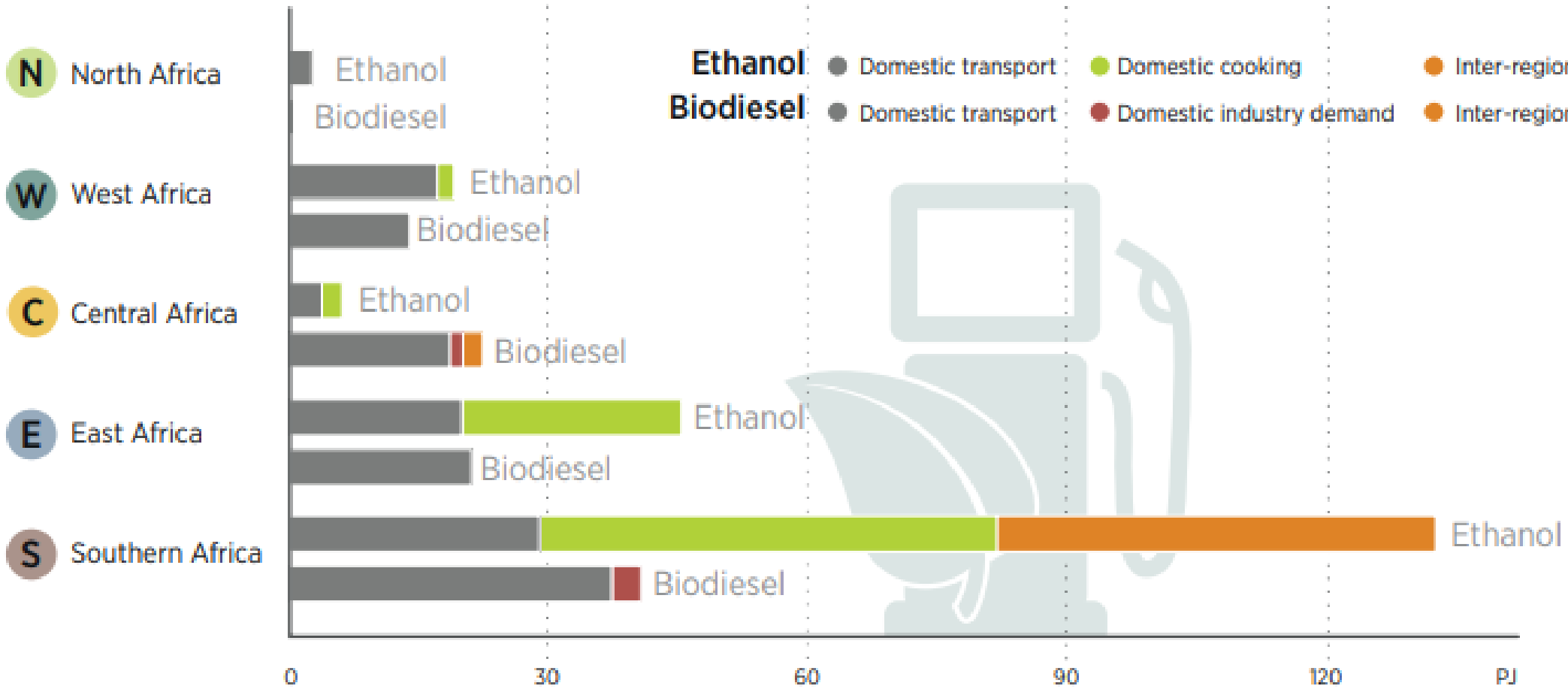
Capacity development of Remap options in 2030



Source: IRENA

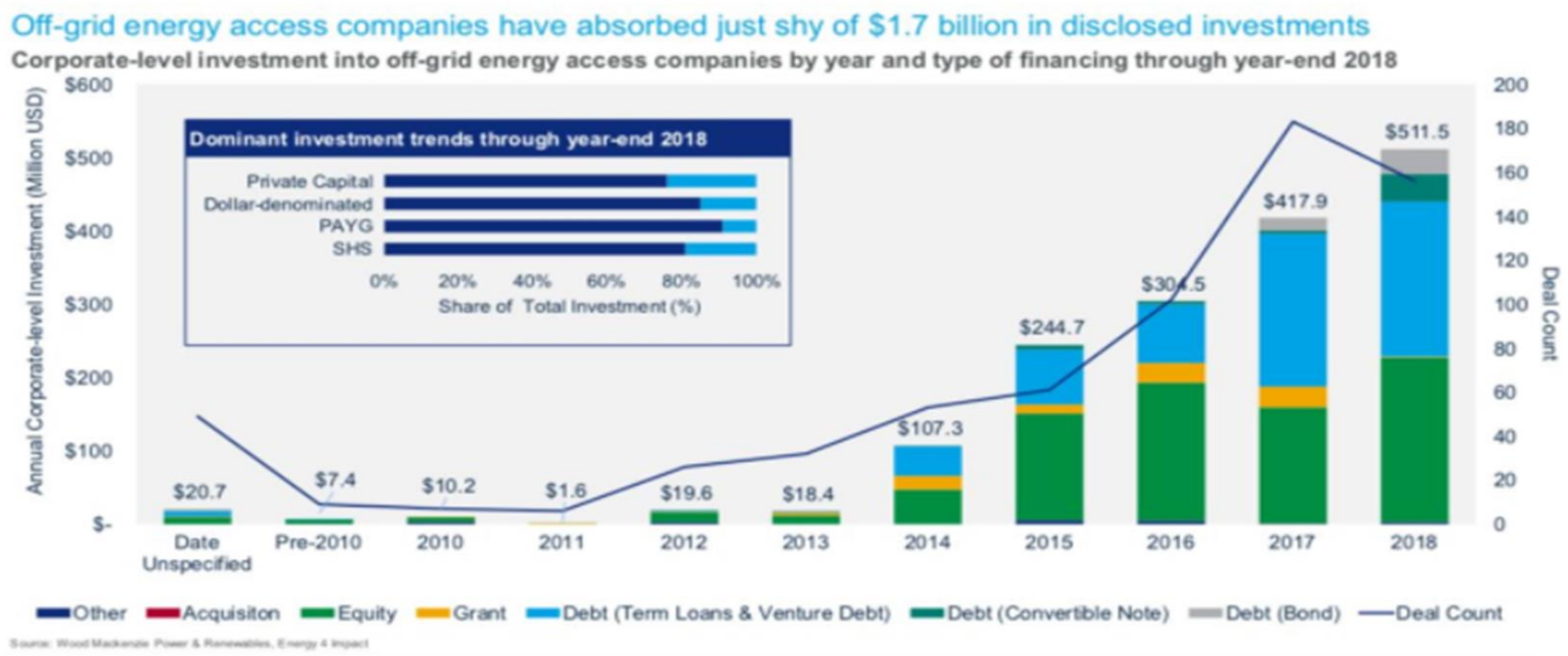
Source: Africa 2030: Roadmap for a RE future, IRENA

Ethanol and bio diesel use in 2030



Source: Africa 2030: Roadmap for a RE future, IRENA

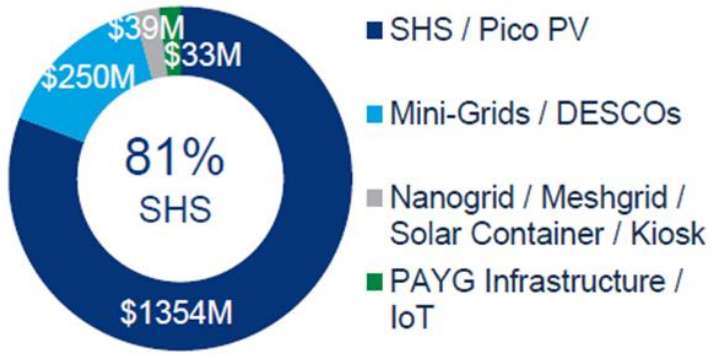
Investments in the off-grid energy access sector



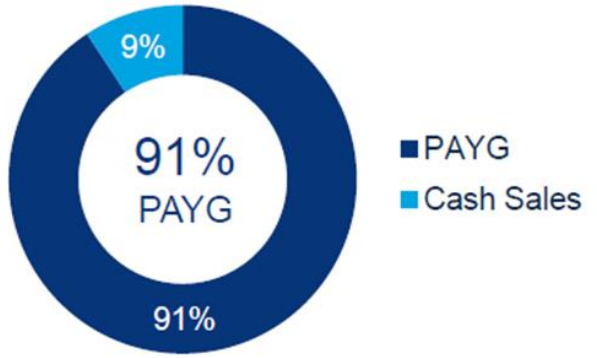
Source: Wood MacKenzie Power and renewables Global off-grid renewable investments

Dominant trends in energy access investment landscape

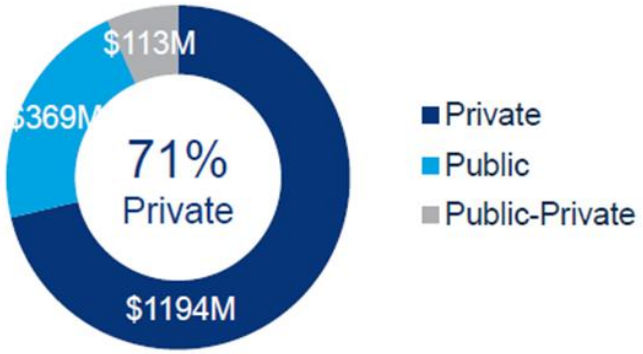
Solar Home Systems (SHS) and pico PV products dominate



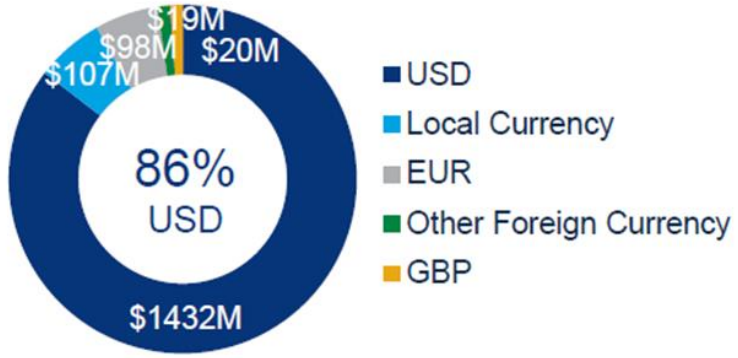
The PAYG business model is a clear winner over cash sales



Energy access finance is 71% sourced from private capital markets



86% of investments are dollar-denominated, but local currency deals are on the rise

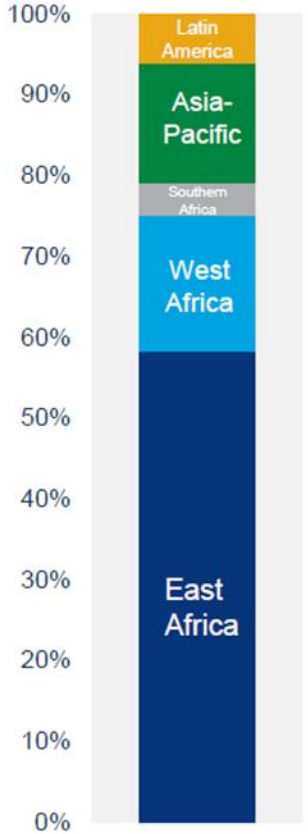


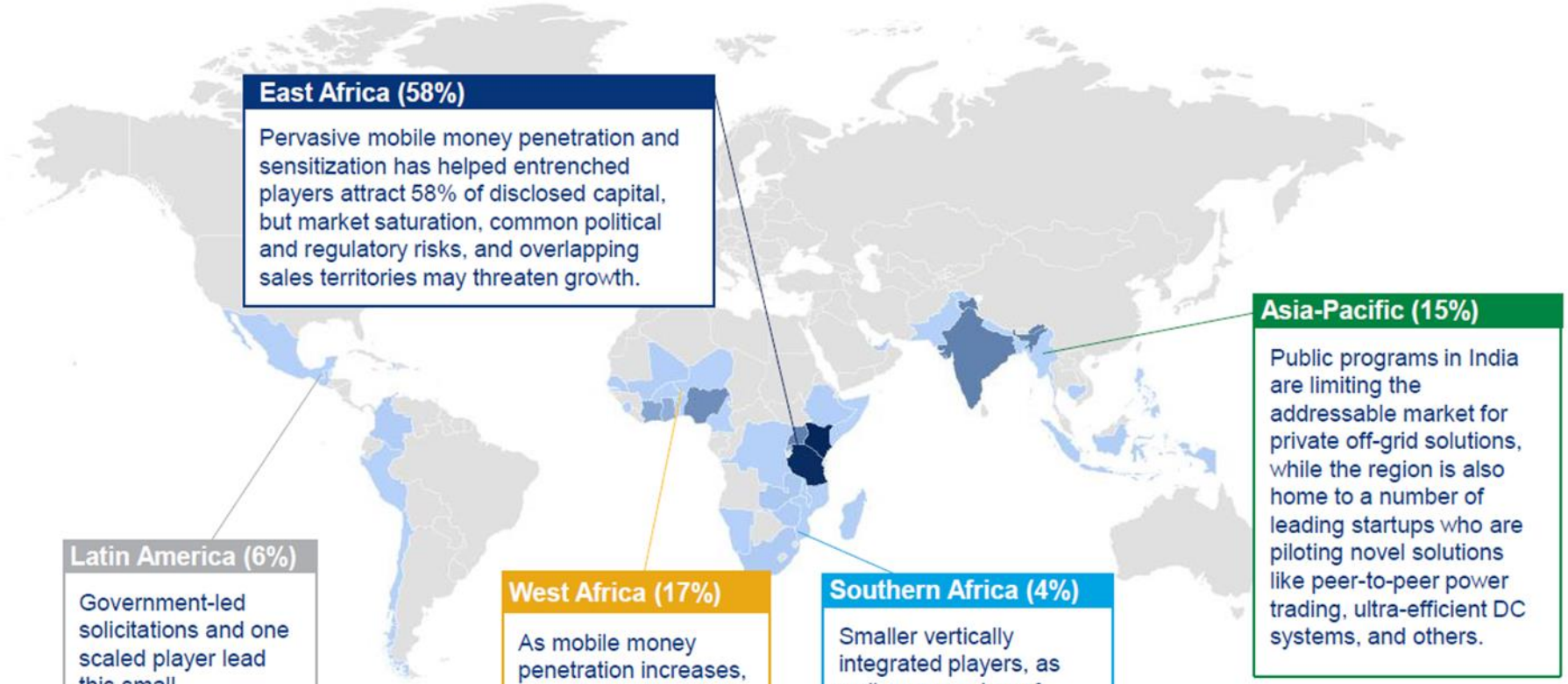
Source: Wood MacKenzie Power and renewables Global off-grid renewable investments

Geographic concentration

Mobile money penetration is a key driver of capital flows, but regional concentration may not be capital efficient

Regional shares of total disclosed investment, USD equivalent 2010-2018





East Africa (58%)

Pervasive mobile money penetration and sensitization has helped entrenched players attract 58% of disclosed capital, but market saturation, common political and regulatory risks, and overlapping sales territories may threaten growth.

Latin America (6%)

Government-led solicitations and one scaled player lead this small addressable market.

West Africa (17%)

As mobile money penetration increases, attention (and capital) have turned toward West African markets, particularly Nigeria.

Southern Africa (4%)

Smaller vertically integrated players, as well as a number of licensed distributors lead penetration into these more nascent markets.

Asia-Pacific (15%)

Public programs in India are limiting the addressable market for private off-grid solutions, while the region is also home to a number of leading startups who are piloting novel solutions like peer-to-peer power trading, ultra-efficient DC systems, and others.

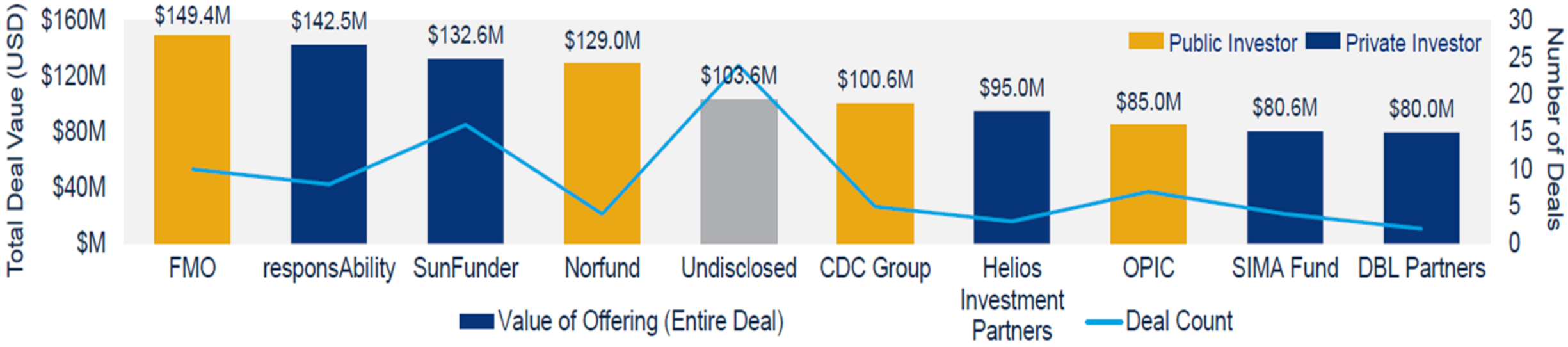
Source: Wood Mackenzie Power & Renewables Global Off-Grid Renewables Investment Datahub

Strategic investors (2010-2018)

The sector's top investors are mostly specialized public and private funds

Is public sector capital crowding in private investment–or crowding it out?

Top 10 Investors by Total Deal Value (by sum of deal totals in which the investor participated), 2010-2018

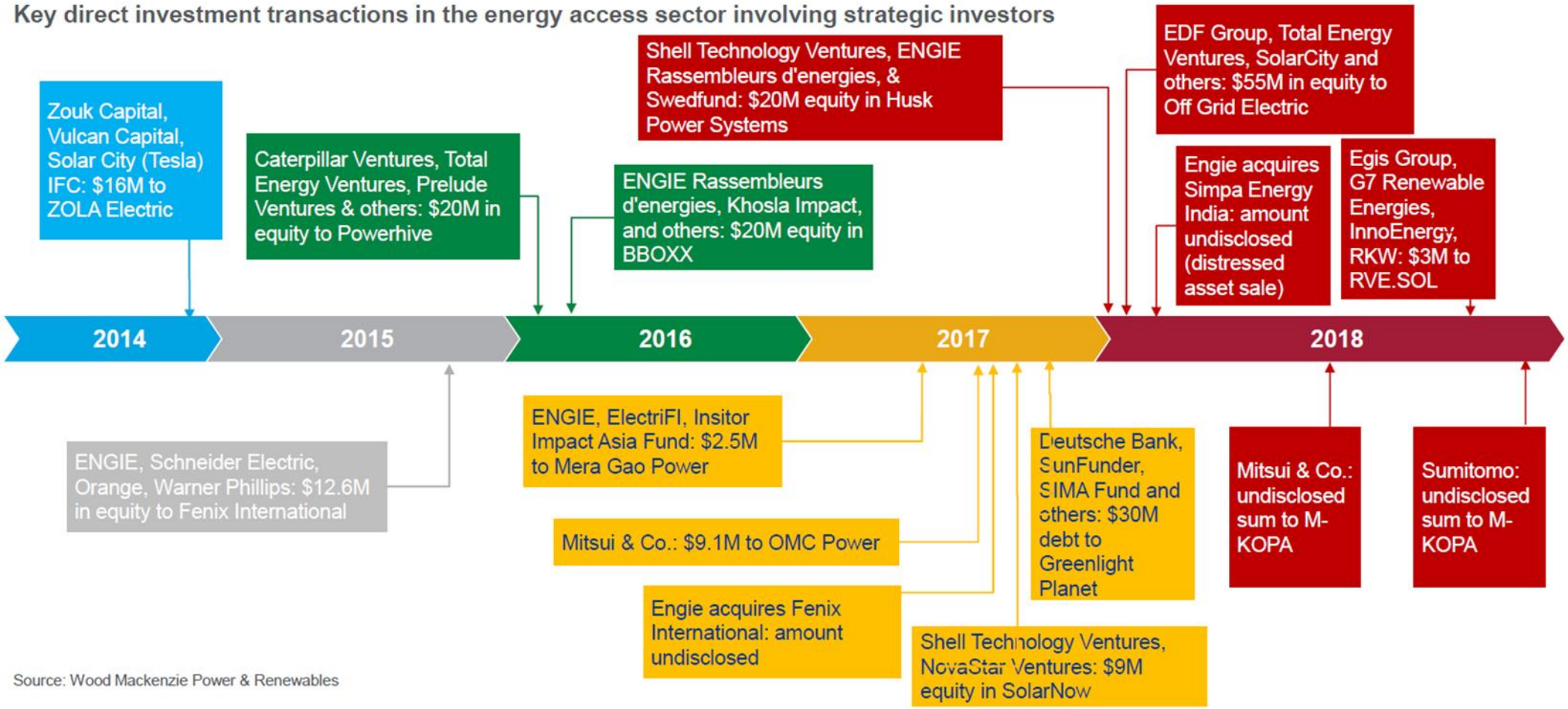


Source: Wood Mackenzie Power & Renewables Global Off-Grid Renewables Investment Datahub

Strategic investment

Direct & venture investing: Strategics are testing the waters for future M&A targets

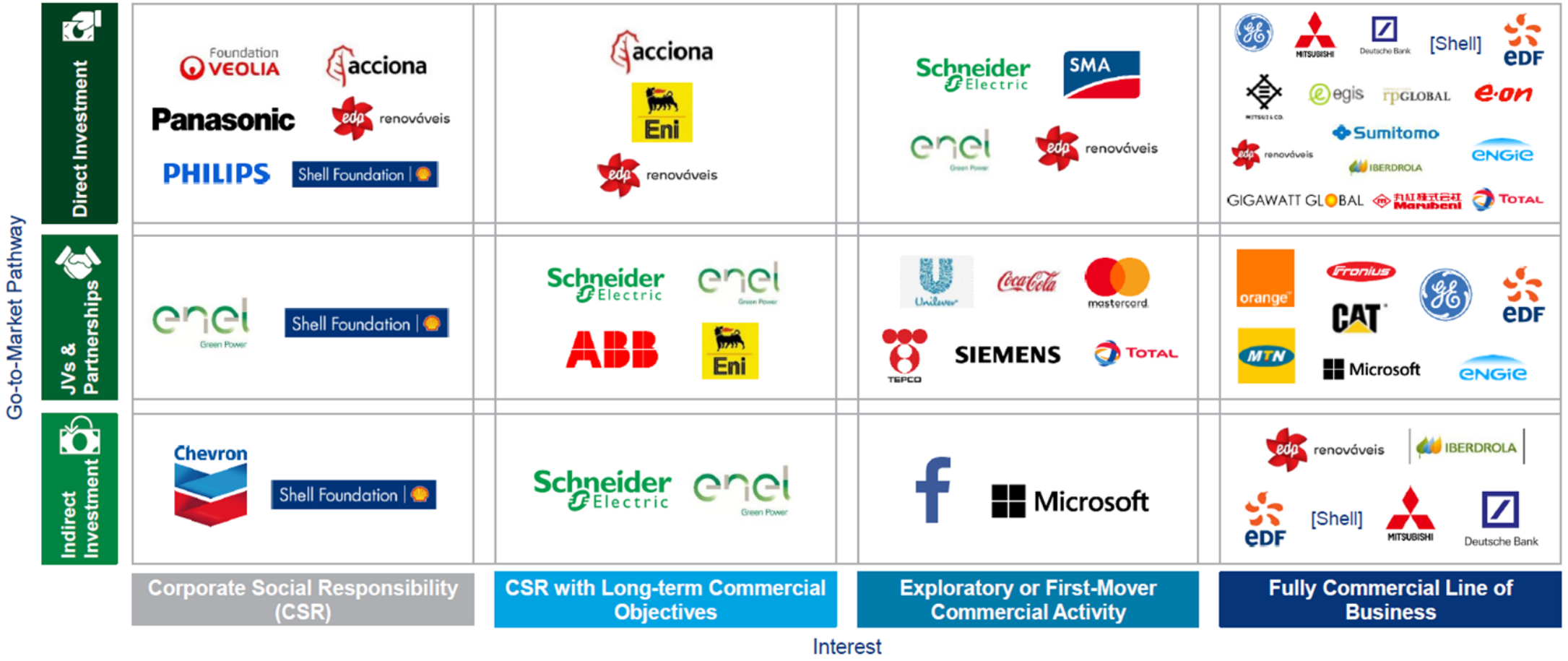
Key direct investment transactions in the energy access sector involving strategic investors



Source: Wood Mackenzie Power & Renewables

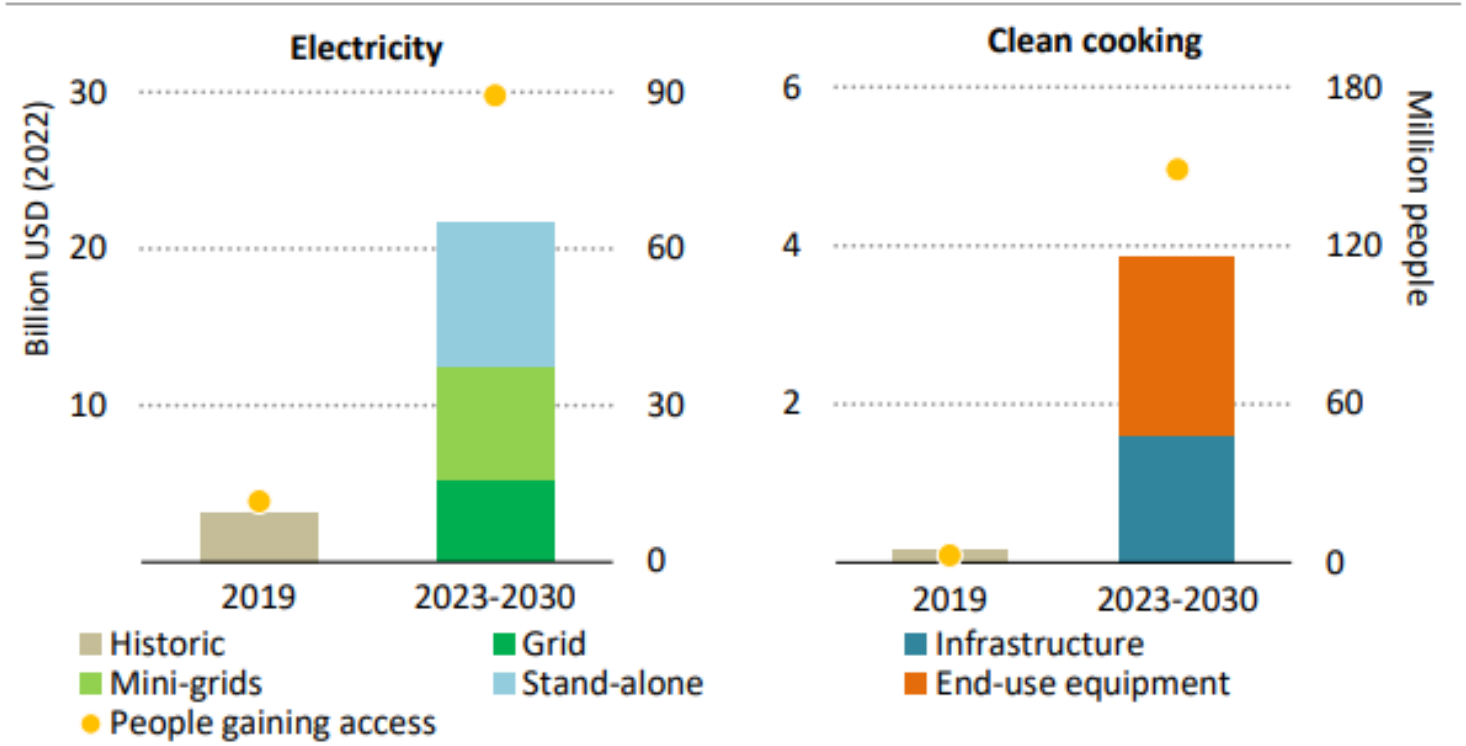
Strategic investors: customer value in the “next billion”

75 percent of strategic investments support fully commercial, exploratory, or first-mover activity



Source: Wood Mackenzie Power and Renewables

Annual investment in and people gaining access to electricity and clean cooking in the SAS



To achieve universal access goals, investment in access to electricity needs to increase sevenfold and investment in clean cooking over twenty-fold

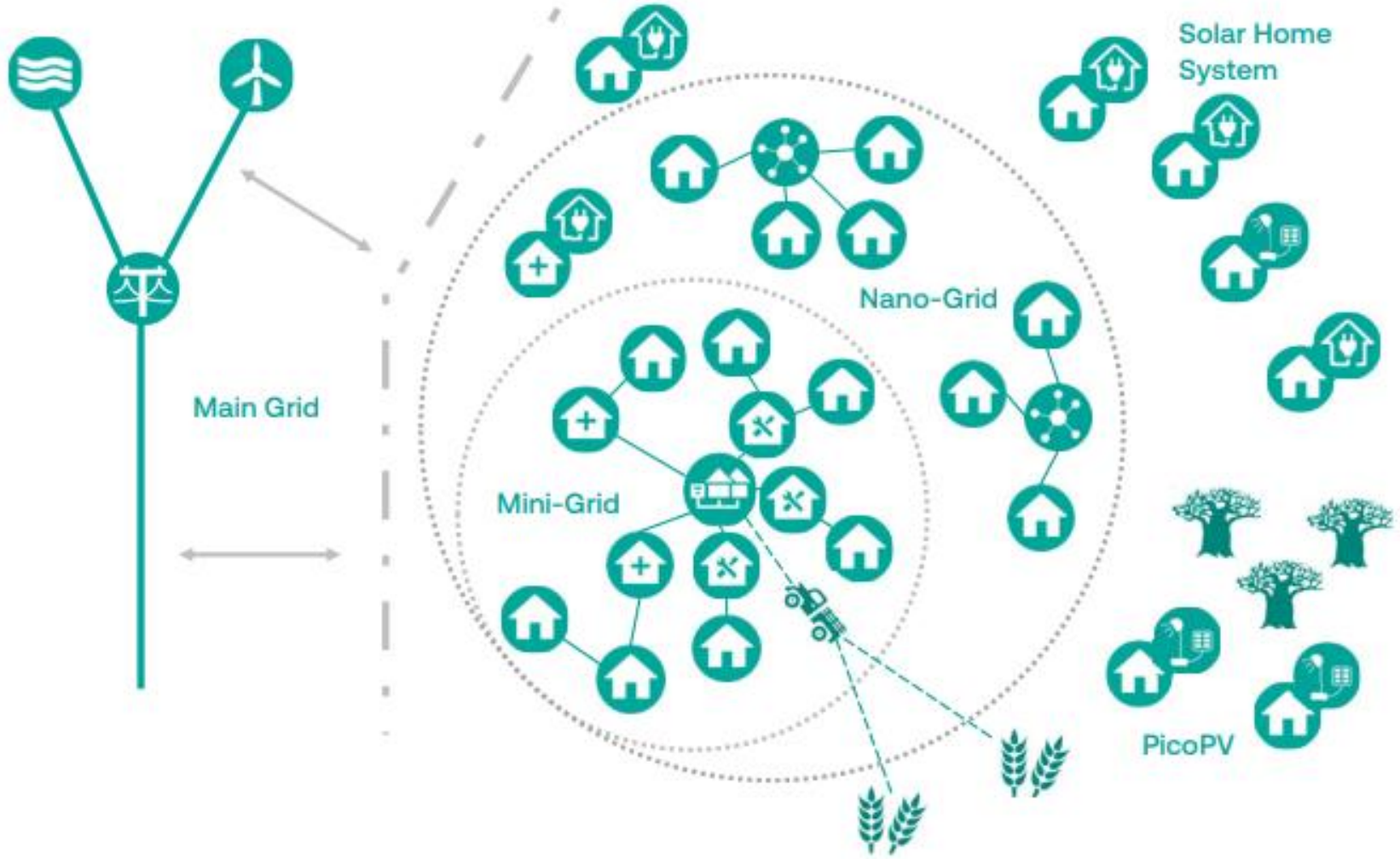
Note: Historical data for investment in access to electricity comprise not only first access projects, but also investment aimed at improving the level of access for households already with access.

Sources: IEA (2023). A Vision for Clean Cooking Access for All; SE4All and Climate Policy Initiative (2021). Energizing Finance: Understanding the Landscape.

Energy access in SSA

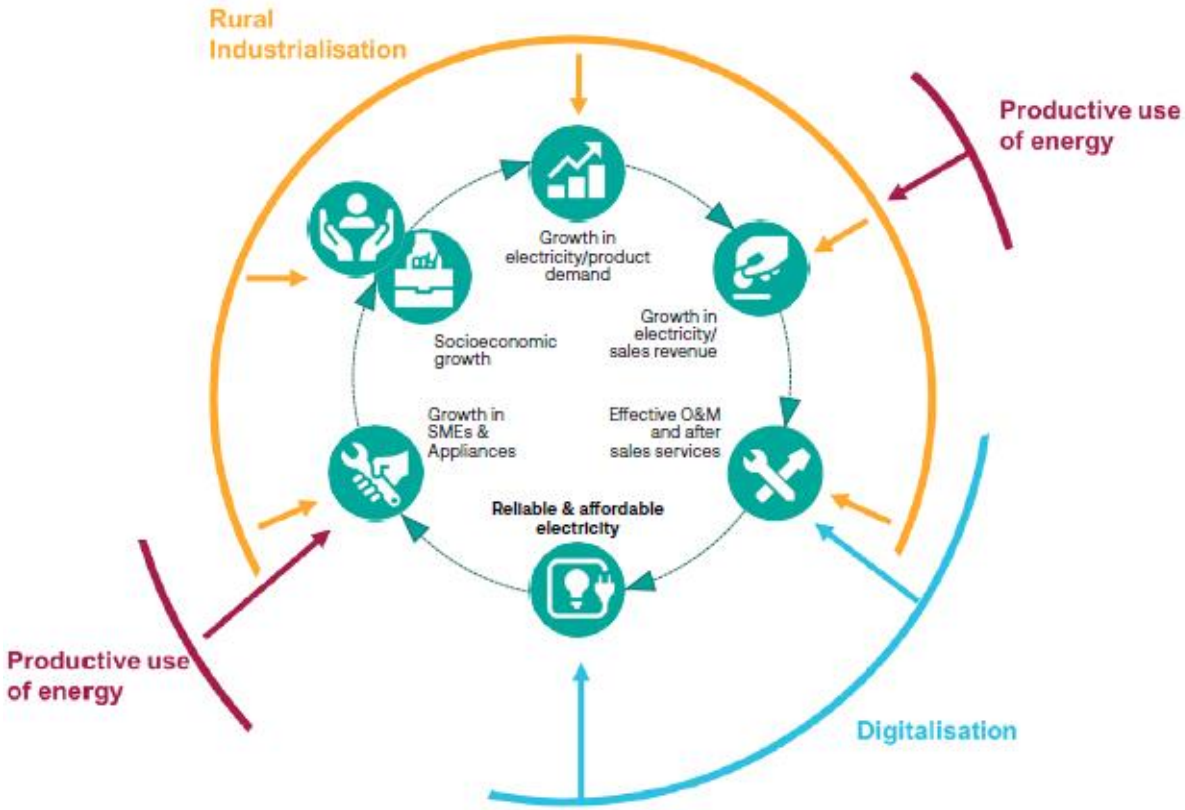
Integrated electricity supply solutions

— A range of customers in off-grid areas may be served by a single company through various technologies, or different companies in partnership.



Source: Trends in Rural Off-Grid Electrification (EnDev)

Rural electrification



Digitalisation: data aggregation and analysis, remote management and analytics, asset management and monitoring, inventory management, mobile money customer transactions, customer and contract management….for cost effective O&M costs and smooth operations

Source: Trends in Rural Off-Grid Electrification (EnDev)

Trends in the energy access sector

Current trend

Future trend

picoPV	SHS	Nano-grids	Mini-grids	Detail
				Wider inclusion of small-scale Productive Use into SHS opens competition between SHS and traditional small-scale mini-grids. Additionally mini-grids are increasingly fostering productive use.
	Productive use of energy			Completion of the digitalisation processes incl. Artificial Intelligence (AI) and blockchain features simplifying off-grid company management, making project development and operations more efficient, transparent and reducing fixed cost.
Digitalisation				Solar home system companies are bundling more and more diverse products & services on the back of technology that can enforce payments by switching off the solar system's electricity output.
	Add-on Products & Services			Technology switches from lead-acid to Lion batteries for mini-grids. Second Life batteries may come into play and open some interesting investment opportunities within the hardware supply market.
		Battery innovation		Mini-grid operators have the opportunity to actively shape rural industrialisation by processing agricultural goods in rural communities, trading these goods to national and international markets.
			Rural industrialisation	Single companies will operate mini-grids and SHS in parallel to cover complete communities through integration of mini-grid companies with SHS companies to gain efficiency and effectively address demand.
	Integrated mini-grid and SHS solutions			The reductions in CO2 realised through the provision of renewable energy will be capitalised on by project developers and retailers of solar systems, once the ecosystem has reached sufficient scale.
Carbon credits				

Source: Trends in Rural Off-Grid Electrification (EnDev)

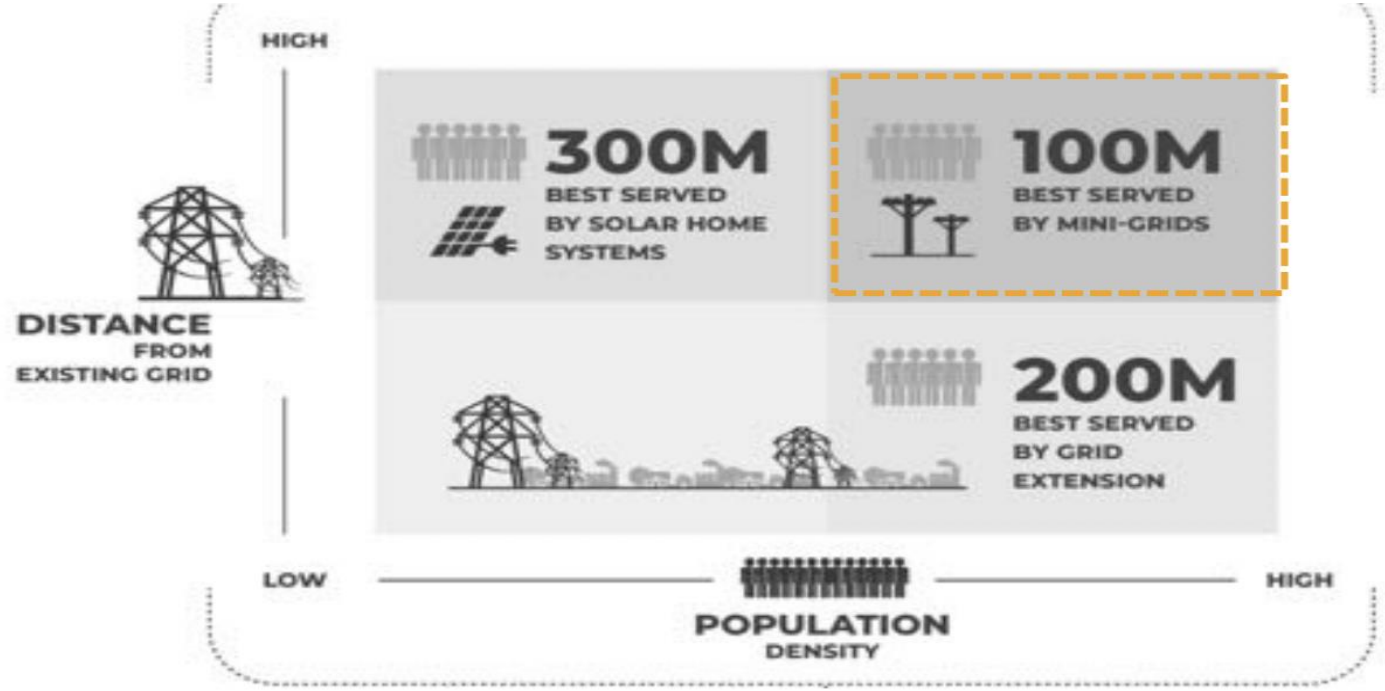
UN SE4ALL - Global Tracking Framework

Tiers based on regular use of appliances and attributes of electricity supply

Energy Access according to Global Tracking for SE4ALL	**No**	**Basic**	**Advanced**			
Attributes	Tier-0	Tier-1	Tier-2	Tier-3	Tier-4	Tier-5
Services		Task light AND phone charging	General lighting AND television AND fan	Tier-2 AND any low-power appliances	Tier-3 AND any medium power appliances	Tier-4 AND any higher power appliances
Peak Available Capacity[12] (Watts)	-	> 1 W	> 20W/50W	> 200W/500W	> 2,000W	> 2,000W
Duration (hours)	-	> 4 hrs	> 4 hrs	> 8 hrs	> 16 hrs	> 22 hrs
Evening Supply (hours)	-	> 2 hrs	> 2 hrs	> 2 hrs	> 4 hrs	> 4 hrs
Affordability	-		√	√	√	√
Formality (Legality)	-			√	√	√
Quality (Voltage)	-			√	√	√
Indicated Minimum Technology		**Nano-grids/ Micro-grids,** Pico-PV/Solar lantern	**Micro-grids/ Mini-grids,** Rechargeable batteries, Solar Home systems	**Micro-grids, Mini-grids,** Home systems	**Mini-grids** AND grid	**Mini-grids** AND grid

Source: RECP_Minigrid_Policy_Toolkit

Mini-grid



Source: CrossBoundary Energy Access

Modern Mini-Grid Investments in Africa

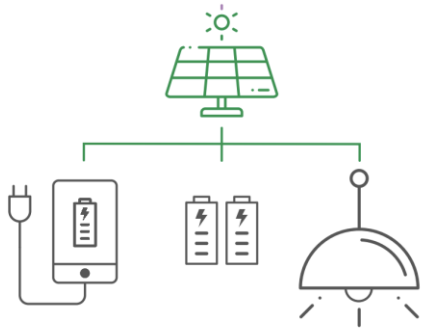
- High Average Investment Per User
- Low Average Revenue Per User
- Uncertainty in load and revenue forecasting
- Limited economic activity precludes demand growth
- OPEX floor reduces site profitability
- Uncertain interactions with utilities and national planning
- Uncertain and dynamic regulatory environments
- Dynamic subsidy and capital environments
- High WACC reflecting several sources of investment risk

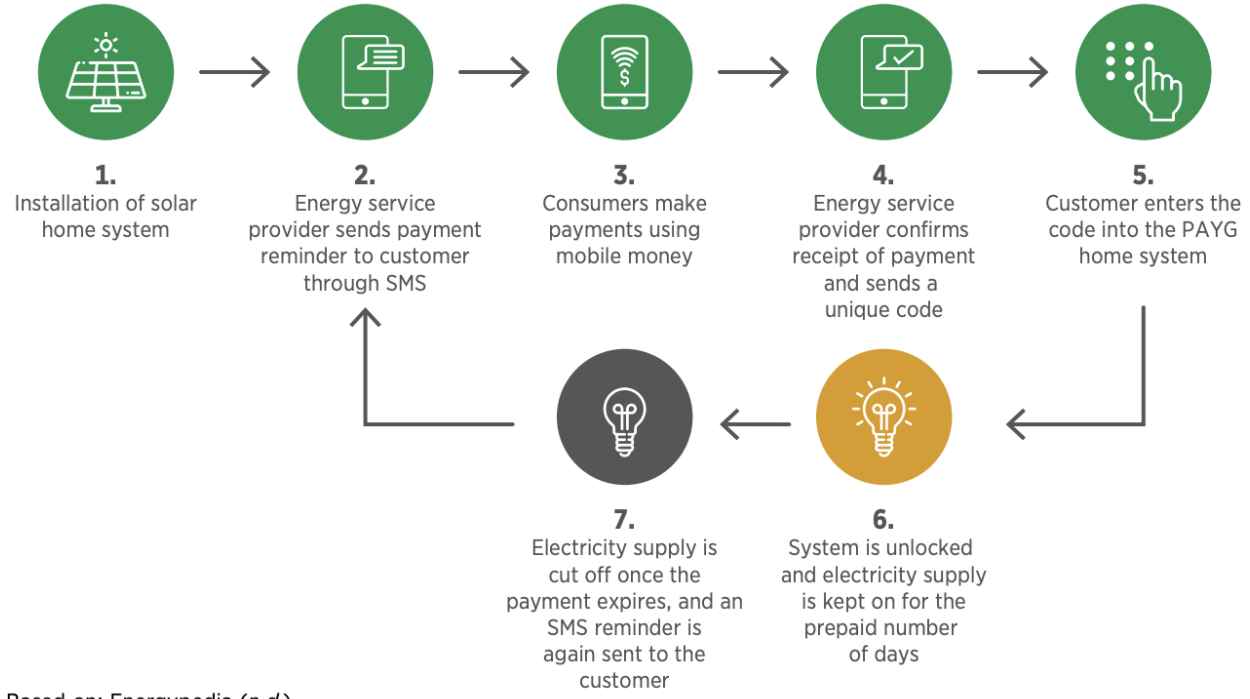
Source:Public-Private Partnership in rural electrification programs in Africa. (z.d.).

Business model Pay-as-you-go

The core components of a solar home system, based on the PAYG business model, are:

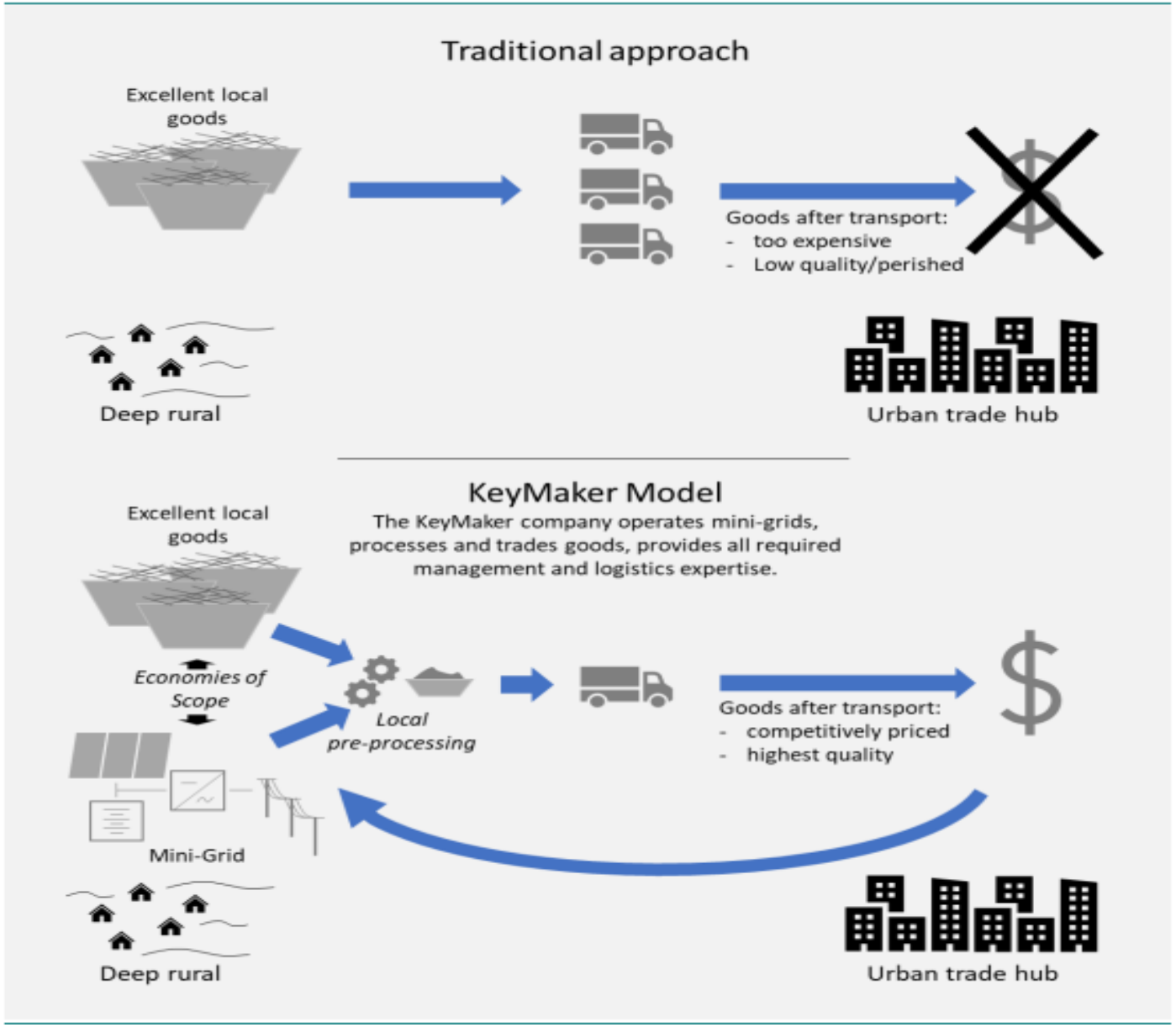
(i) Solar PV power part (modules, inverter, cables, etc.)
(ii) Battery storage system (optional)
(iii) Mobile payment system
(iv) Information and communications technology, with control units providing • information on the charge left in batteries • weather forecasts • payment reminders
(v) Power-consuming appliances, like LED bulbs or mobile phones (plus phone-charging cables)





Based on: Energypedia (*n.d.*).

Keymaker model



Source: KeyMaker Model fundamentals, 2017

Illustrative range of product specifications of typical PULSE appliances

Irrigation Pumps

Surface water pumps
- Wattage: 75w – 1.5kW
- Head: 6-75m

Submersible pumps
- Wattage: 0.45-22kW
- Head: 4-310m

Other - Livestock

Poultry incubators
- Wattage: 75w – 100W
- Capacity: 48-1000 eggs

Milk machines
- Wattage: 1,1kW
- Head: 20 cows/day

Cooling/Drying

Chilling systems
- Wattage: 40-200W
- Capacity: Up to 45l of milk/day

Refrigeration
- Wattage: 40-400W
- Capacity: 50-400l

Freezing/ice making
- Wattage: 95W
- Capacity: 1.2kg/day

Walk-in cooling units
- Wattage: 2kW+
- Capacity: 9 tonnes+

Fan cooling/drying
- Wattage: <50W
- Capacity: 25-100kg

Agro-processing

Flour Milling
- Wattage: 500-750W
- Capacity: 25 -160kg/hr

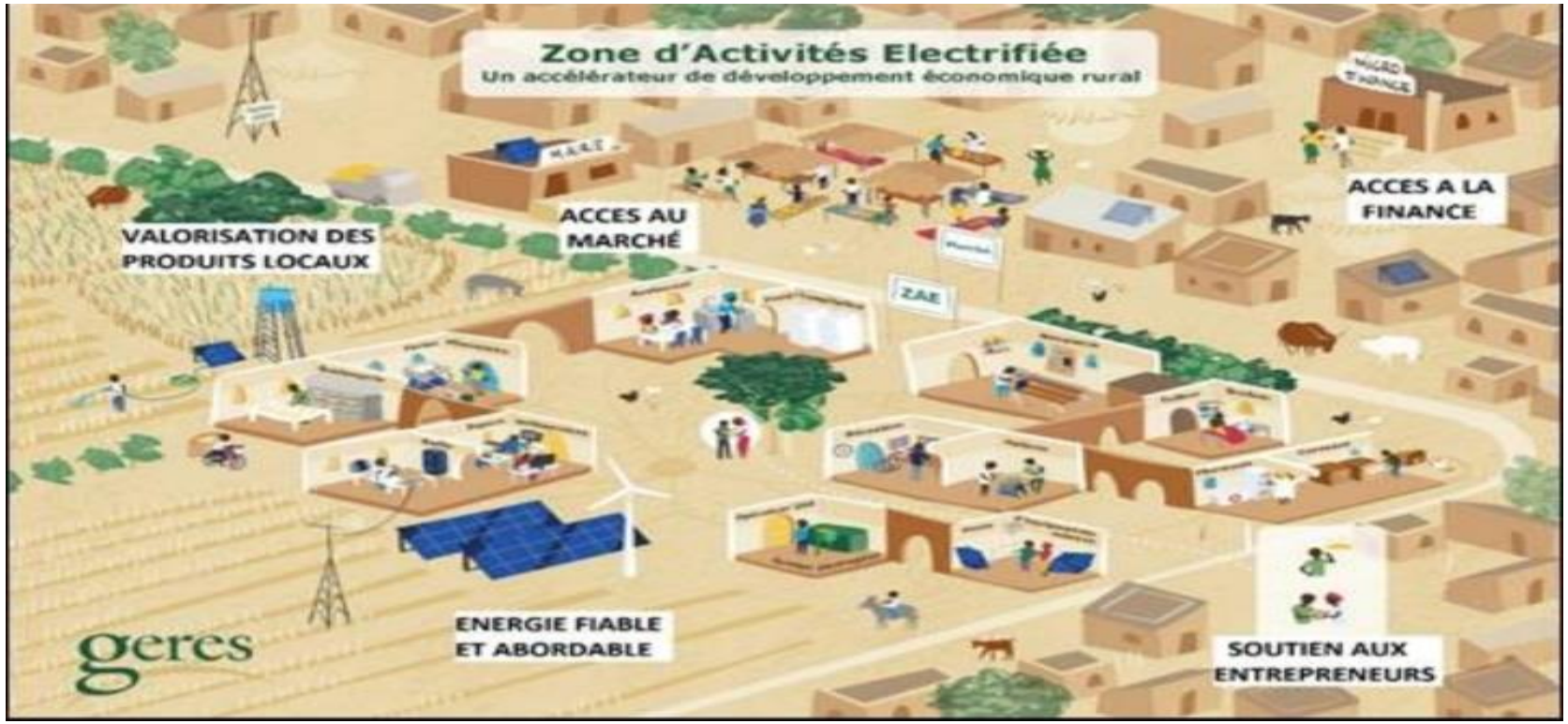
Husking/Threshing/Hulling
- Wattage: 100-375W
- Rice Capacity: 35 -70kg/hr
- Maize Capacity: 250kg/hr

Grating
- Wattage: 250W
- Capacity: 100kg/hr

Oil & nut presses
- Wattage: 1.5kW
- Capacity: 20kg/h

Source: The Market Opportunity for Productive Use Leveraging Solar Energy (PULSE) in Sub-Saharan Africa", 2019

Green Business areas: Scheme



GERES

Project : Opening of an electrified business park in Konséguéla, a rural area of Mali

https://youtu.be/afTFRXwHs2o?si=sO90cGL2OGcsznoS

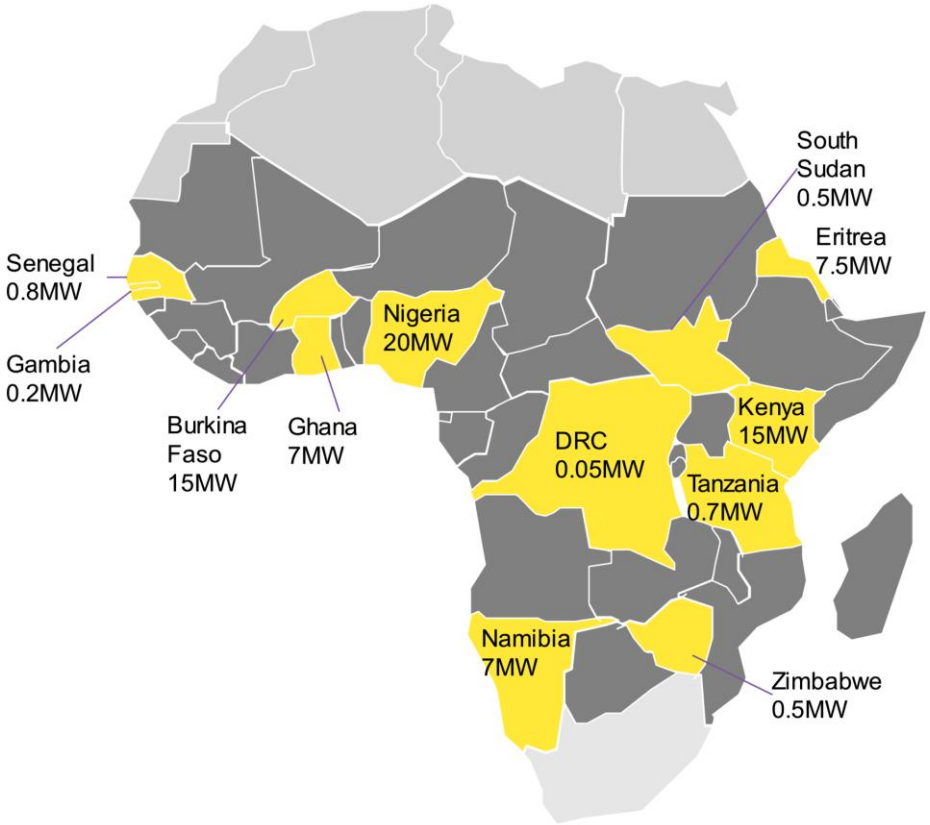
Source: Geres

E-mobility: Kampala gears up for e-mobility

https://www.youtube.com/watch?v=fSjzZ44Kmjo

Countries in Africa with C&I projects

C&I: Defined as a generation system tied to a (single) commercial or industrial end user. Renewable energy C&I systems are being employed on a profitable basis throughout Africa in industries, such as mining, concrete, tea and coffee, fruit and vegetables, meat and fish. C&I systems generally make financial sense in off-grid regions, or areas of poor grid reliability, where raw materials can be processed before transport to urban and international markets.



Source: BloombergNEF. Note: Countries colored in yellow indicate that there are known C&I solar projects plus installed capacity that developers reported to BNEF.

Countries in Africa with C&I projects

Helios Infinitas
Business Development & Consultancy

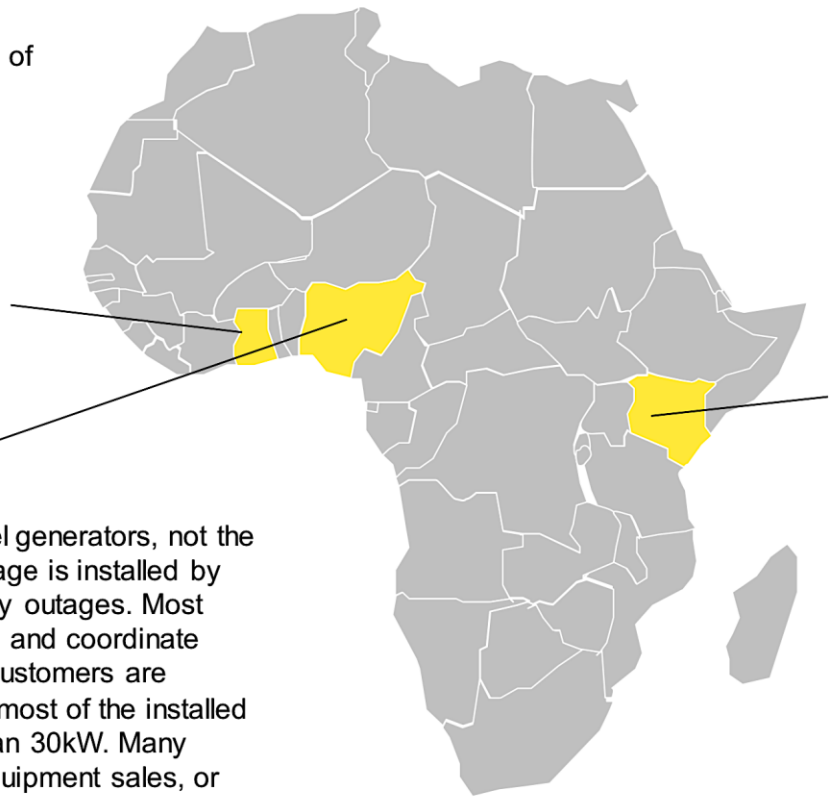
Ghana, 7MW

The market is dominated by a handful of projects in the industrial and mining sectors. Ghana has Africa's highest electricity tariffs for industry. Local banks have not been involved in C&I solar deals to date.

Strict local content rules and interest rates around 30% for Cedi loans are posing major hurdles for accelerated growth.

Nigeria, 20MW

C&I solar competes mainly with diesel generators, not the electricity grid in Nigeria. Battery storage is installed by default due to the frequent and lengthy outages. Most systems include uptime commitments and coordinate solar, diesel, batteries and the grid. Customers are relatively comfortable with solar, and most of the installed capacity is used in projects of less than 30kW. Many projects to date have been sold as equipment sales, or financed through developer equity. The Bank of Industry is offering local financing though this fund has been untapped to date.



Kenya, 15MW

Most C&I solar projects in Kenya today serve industrial sites, thanks to high electricity tariffs and a functioning tax incentive scheme. Local developers see growth opportunities in manufacturing, agricultural, and horticultural facilities. The regulatory framework for C&I solar in Kenya is relatively friendly, though proposed net metering and retail liberalization rules have been on hold. Several local banks have taken exposure to C&I solar and one of them told BNEF they consider expansion.

Source: BloombergNEF. Note: Installed capacity refers to what the developers interviewed by BloombergNEF said they had commissioned as of November 2018.

JUST TRANSITION

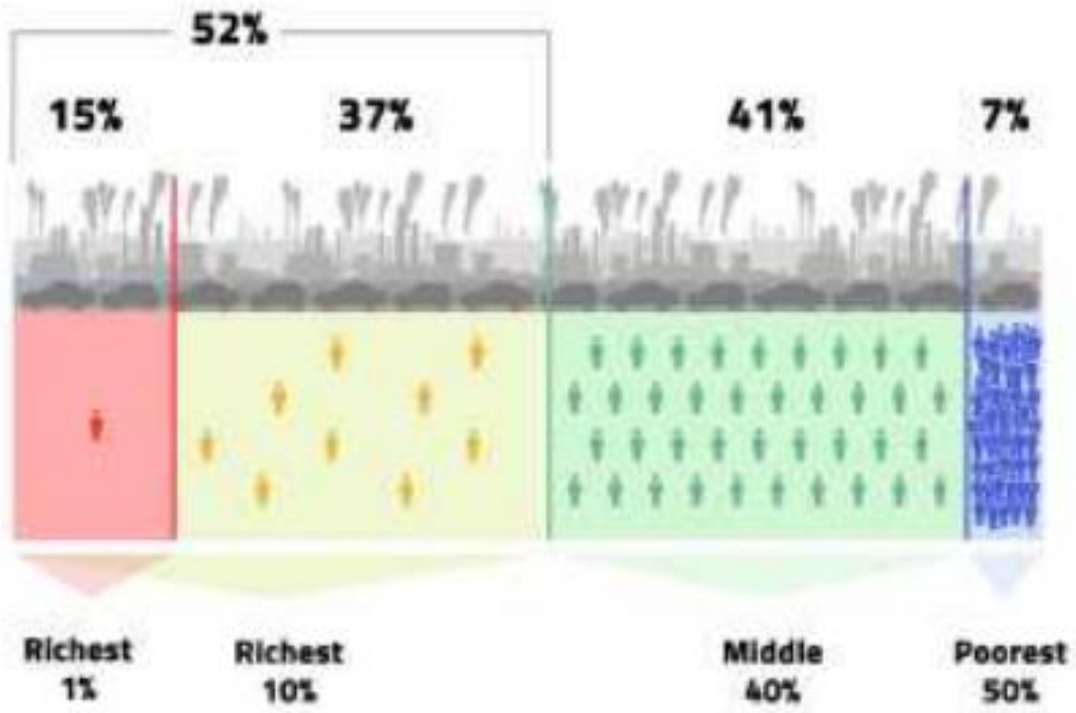
A CLIMATE, ENERGY AND DEVELOPMENT VISION FOR AFRICA

Examples of traps that African countries need to avoid include:

- **Expansion of fossil fuel extraction for export markets** and the locking in of fossil fuels in domestic energy systems, which ensure further climate impacts and risk becoming stranded assets. This includes dangers of hypothetic carbon, capture and storage (CCS) as justification for prolonged production and use of fossil fuels.
-**The promotion of 'offset markets**' where African forests and lands are supposed to remove carbon dioxide to justify further emissions mainly in wealthy countries (often driving greenwashing efforts by corporations and countries to declare themselves 'net-zero').
-**Corporate monopolisation** of farming through digitalisation, and genetic modification, in the name of climate action.
-**Large scale geoengineering schemes for carbon dioxide removals** such as Bioenergy with Carbon Capture and Storage (BECCS) that would require massive land areas and risk severe harm to human rights, ecosystems, and peoples' livelihoods.
-**Propositions for experimentation and deployment of solar geoengineering** — an inherently ungovernable, unpredictable, and likely catastrophic speculative technology.

Source: https://justtransitionafrica.org/

Ensuring energy access and efficiency



Cumulative emissions 1995-2015: Inequality in energy use also translates into inequality in emissions of greenhouse gases.[57]

In terms of energy use, the per capita electricity consumption in sub-Saharan Africa, excluding South Africa, amounts to 180 kWh per person, compared with those in rich advanced economies of 6500 kWh/person in Europe and 13,000 kWh/person in the US. Hardly anywhere are global inequalities more apparent than in terms of energy use. These gross inequalities in energy use also translate directly into corresponding injustices in relation to emissions, with the world's 10% wealthiest people responsible for more than 50% of the world's emissions, and the 50% poorest — many of them Africans — emitting less than 7%.

Source: https://justtransitionafrica.org/

A CLIMATE, ENERGY AND DEVELOPMENT VISION FOR AFRICA

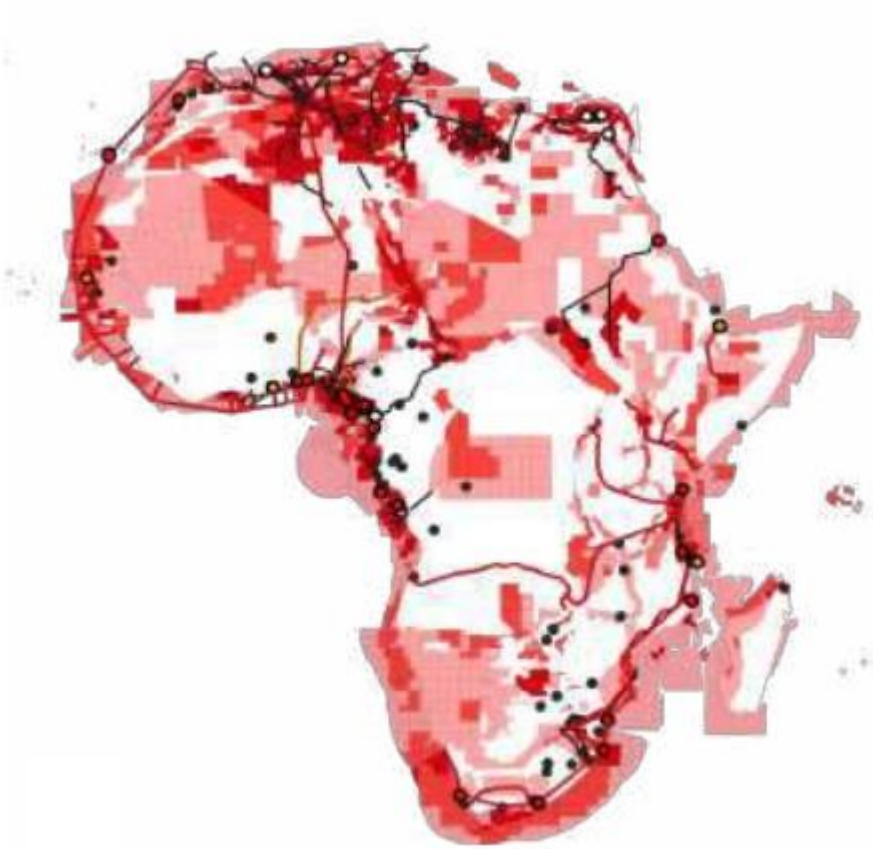
African economies suffer at least three structural deficiencies that constrain development potential:

a) a lack of food sovereignty;
b) a lack of energy sovereignty; and
c) low-value-added content of exports relative to imports.

These deficiencies in turn contribute to structural trade deficits, weakened African currencies and pressure to issue debt denominated in foreign currencies, resulting in more indebtedness. Faced with depreciating currencies and rising import prices, African governments typically resort to subsidising necessities and artificially maintaining exchange rates by accumulating more debt

Source: https://justtransitionafrica.org/

Renewables versus fossil fuels



The map shows both current and planned fossil fuel infrastructure across Africa, including oil and gas pipelines, liquefied natural gas terminals, and coal mines. It also highlights oil and gas lease blocks to show where land is available for licensing, currently licensed for ongoing exploration, and already leased for production. The map shows both the intense scale of the fossil fuel infrastructure, covering the entire continent, as well as the density of export related infrastructure, especially in North Africa, visualizing how Europe's demand for African fossil fuels has driven much of the investment.

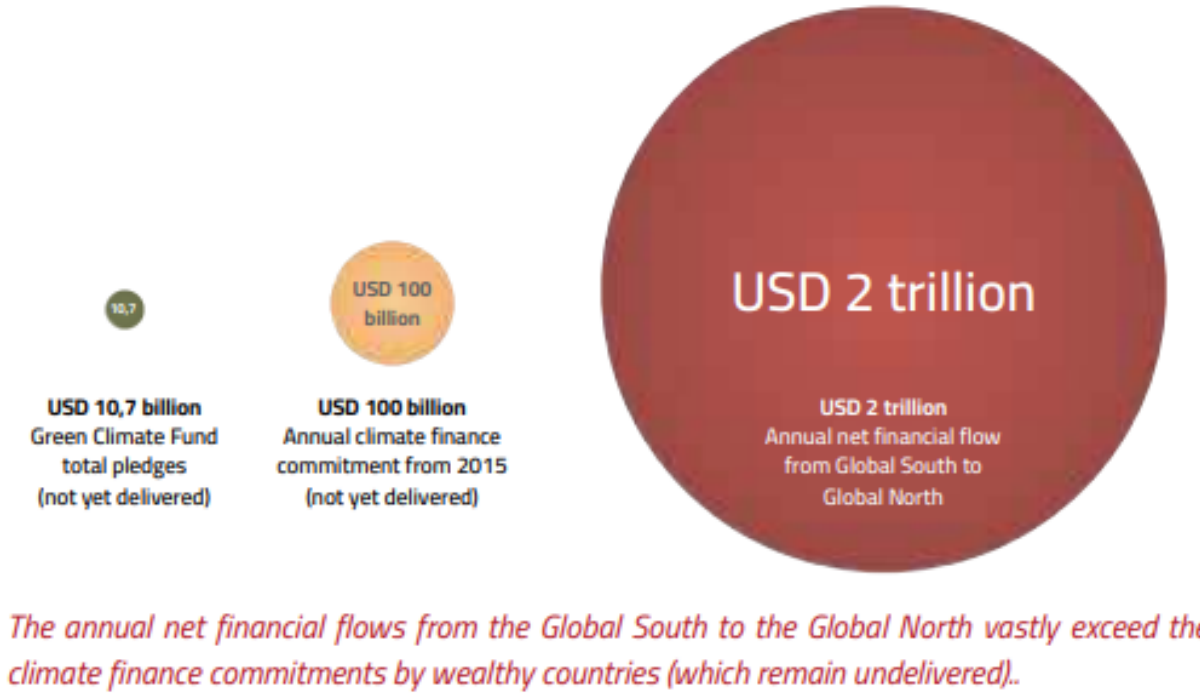
Source: https://justtransitionafrica.org/

Climate related investments

Figuur 4. Totaal bestemming van klimaatgerelateerde investeringen, 2019-2020[20] (NB: De blauwe/cursieve cijfers verwijzen naar publieke investeringen, de oranje cijfers verwijzen naar private investeringen.)

Source: https://justtransitionafrica.org/

The Green Climate Fund



The annual net financial flows from the Global South to the Global North vastly exceed the climate finance commitments by wealthy countries (which remain undelivered)..

Developing country producers with high dependency on fossil fuels for their state revenues (i.e. African producers) would secure support in gaining access to technology and finance and have more time than wealthy producers who would need to phase out earlier and at faster pace. Several African countries have also already acknowledged and begun using the '**Fair Shares' metric** for calculating the level of support through international cooperation that African countries should be entitled to.

Source: https://justtransitionafrica.org/

Energy supply

Achieving these goals through intelligent management of demand, smart grids, and interconnected small and large renewable energy generation sites that effectively power all industrial needs, including heavy industry. Such ‘virtual power plants’ that interconnect numerous smaller renewable energy generation sites can effectively provide powerful baseloads and unprecedented resilience in ways that cater to the most demanding needs.

From one-directional centralised fossil fuel-based energy systems to multi-directional, renewable energy provision at all scales. In the future, because of cost-competitiveness of distributed renewables, the system architecture can be based on interconnected and multi-directional, smart grids and island grids. Solar PV (roof and ground-mounted) will be installed literally everywhere. Wind turbines will complement where economically viable. Dispatchable generators (biogas, biomass, hydro, and battery storage) will complement the local island grid. Each island grid can in principle run on its own but higher reliability and lower costs are achieved by interconnecting over time.

Source: https://justtransitionafrica.org/

Energy vision— key principles and approaches for the energy transition

-African ownership

-Energy systems design

Mapping and long-term plans and trajectories

Envisioning people-centred energy systems.

-Energy sovereignty as a development strategy

-Policy priorities

Comprehensive, programmatic policies

Capacity mobilisation and –building

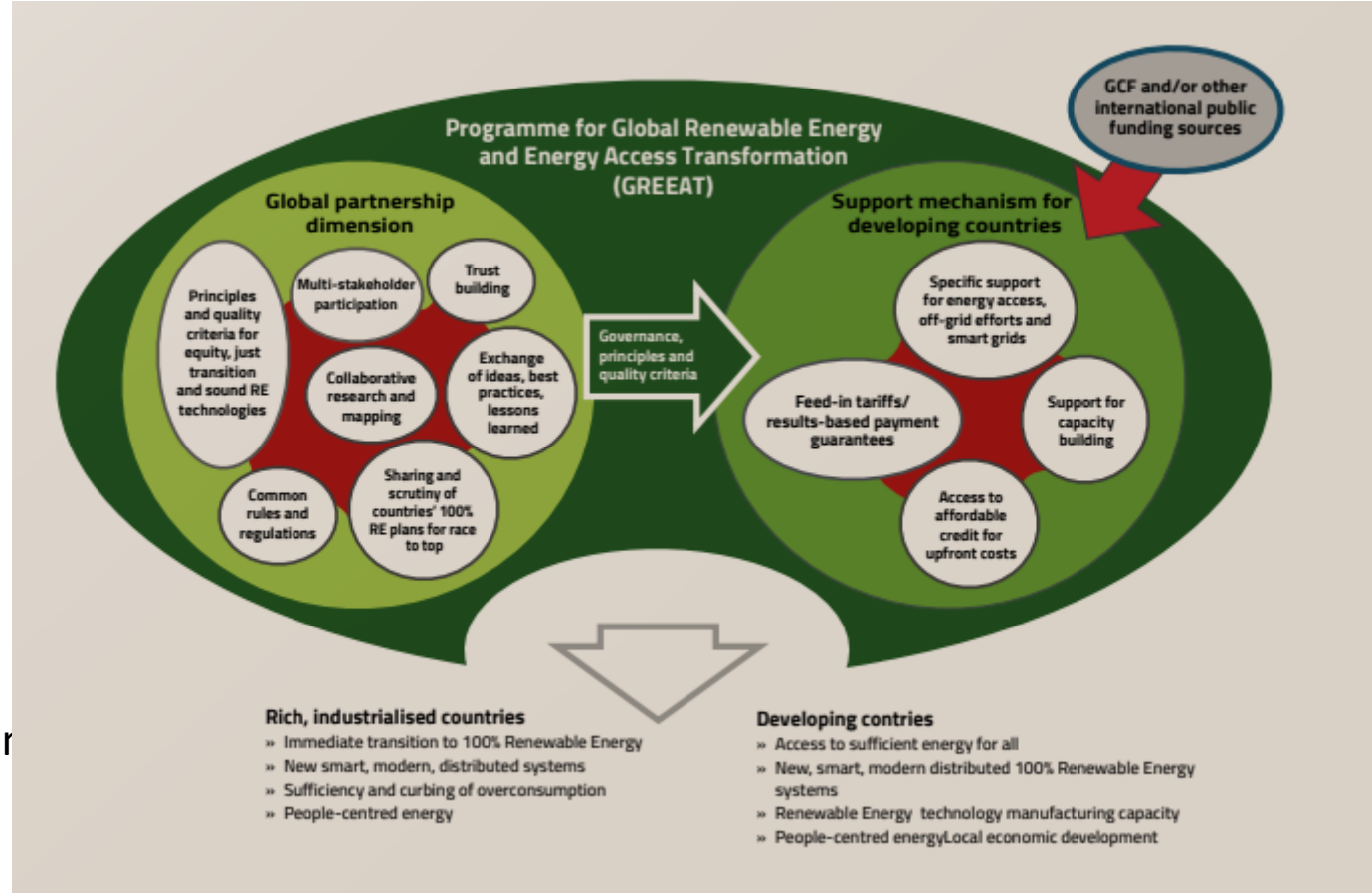
Clean and healthy cooking

Energy efficiency

Off-grid solutions

-Equity, process, and stakeholder participation

Ensure the whole value chain of energy production available, sustainable and causes no harm



The world needs a comprehensive programme to effectively drive people-centered renewable energy deployment everywhere, across every community. Countries need to cooperate, share best practice and execute robust, bold funding schemes that can enable all developing countries to rapidly move towards 100% renewable energy. A globally funded scheme for feed-in tariffs/ payment guarantees could provide an essential motor for such efforts as presented in the GREEAT framework.8

Source: https://justtransitionafrica.org/

Energy vision

"From an African perspective, the concept of 'just transition' needs to be fully unpacked to ensure it is a genuine effort to transform the global economy into a sustainable, prosperous, and equitable system, rather than a make-belief concept designed to preserve the status quo. The fact of the matter is that we can either decarbonise the Global North or develop Africa, but we cannot do both, unless the Global North gives up its obsession with economic growth and consumerism and embraces a genuine degrowth approach to its economic policies."

"Vanuit Afrikaans perspectief moet het concept van 'rechtvaardige transitie' volledig worden ontvouwd om ervoor te zorgen dat het een oprechte poging is om de wereldeconomie te transformeren in een duurzaam, welvarend en rechtvaardig systeem, in plaats van een schijnconcept dat is ontworpen om de status-quo te behouden. Het feit is dat we óf het mondiale Noorden koolstofarm kunnen maken, óf Afrika kunnen ontwikkelen, maar we kunnen niet allebei doen, tenzij het mondiale Noorden zijn obsessie met economische groei en consumentisme opgeeft en een echte degrowth-aanpak van zijn economisch beleid omarmt."

Source: https://justtransitionafrica.org/

Thank you

Helios Infinitas
Mobile: +31 655387505
Email: heliosinfinitas@gmail.com
Website: www.heliosinfinitas.com