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Opportunities of the Energy Transitions in Africa

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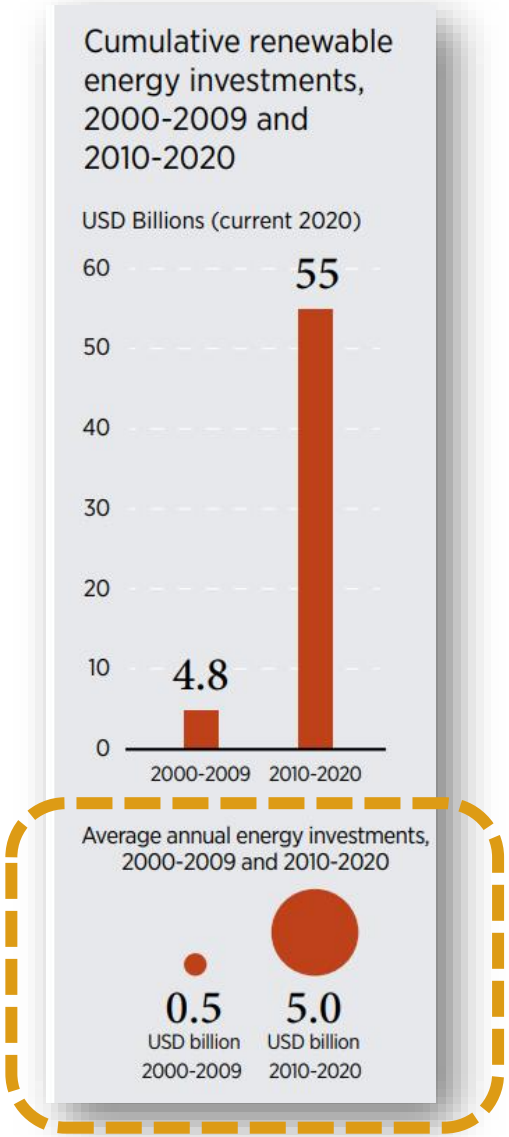
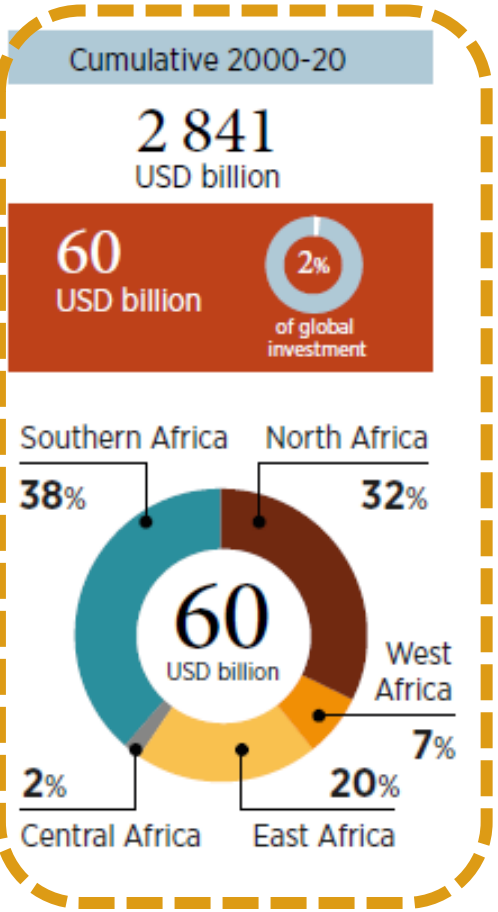
UNCTAD Technological opportunities for a low-carbon world - Perspectives from Africa
24 May 2023

Renewable electricity investment in whole Africa, 2000 – 2020



Overall renewable energy investment in Africa and globally, 2000–2020

	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	

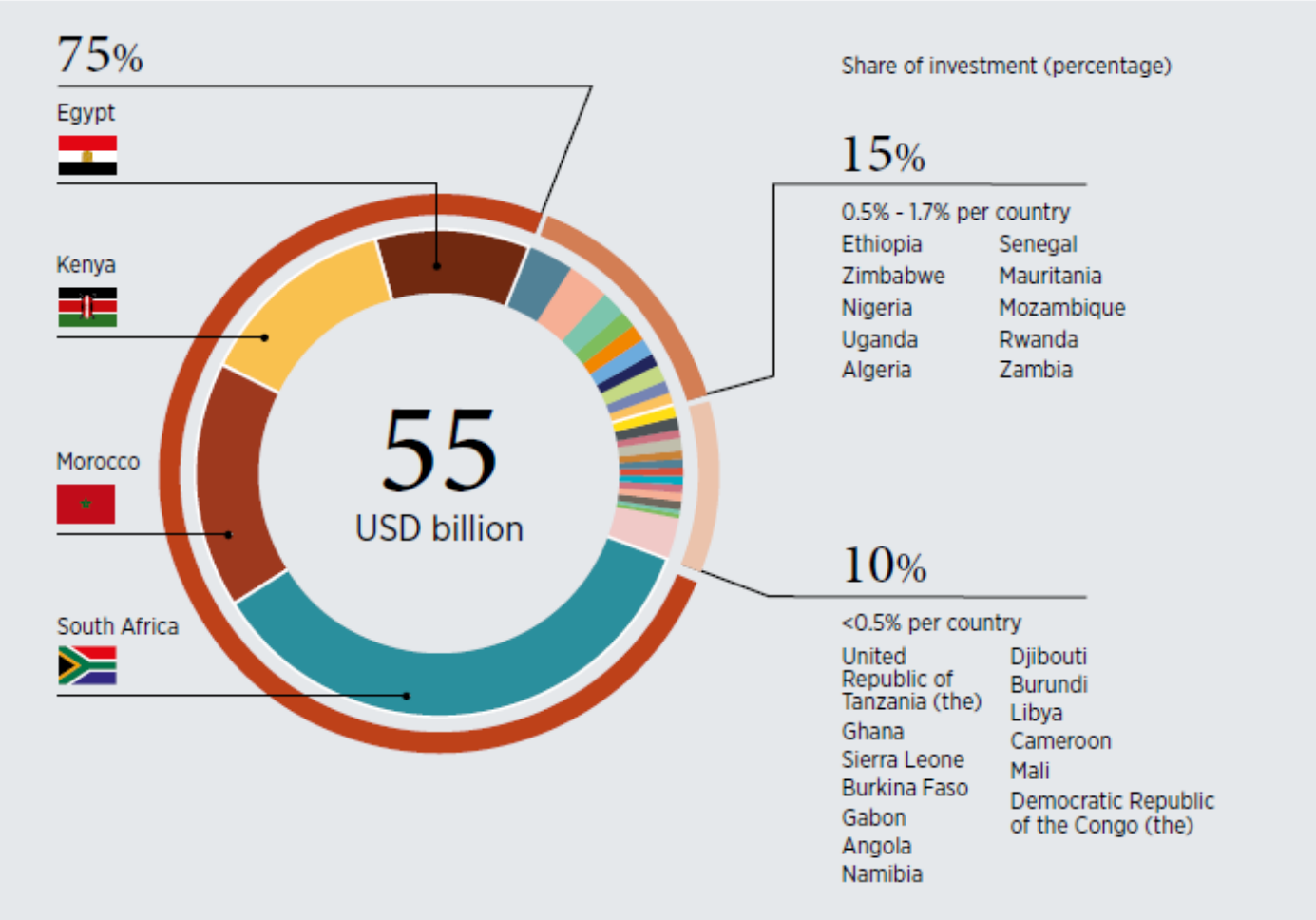


Source: BNEF (2021c).
Note: BNEF data exclude investments in large hydropower (i.e. greater than 50 megawatts).

Source: https://www.irena.org/publications/2022/Jan/Renewable-Energy-Market-Analysis-Africa

Renewable electricity investment in Africa by recipient, 2010-2020

Top recipient countries of renewable energy investment, 2010-2020

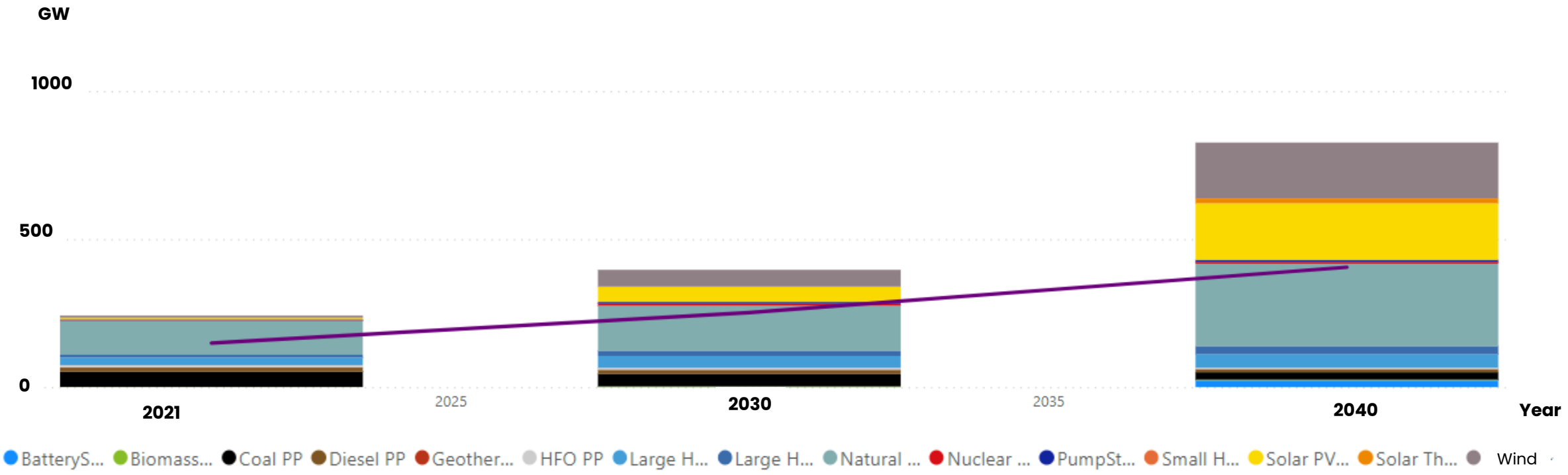


Source: Based on BNEF (2021c).
Note: BNEF data exclude investments in large hydropower (i.e. greater than 50 MW).

- Over 90% of that was committed between 2010 and 2020 was concentrated in 14 countries
- About 75% of the investments went to only 4 countries: South Africa, Morocco, Egypt and Kenya.
- Structured procurement mechanisms (FiTs, auctions) have been instrumental in driving investments e.g. South Africa's REI4P, and Scaling Solar

Source: https://www.irena.org/publications/2022/Jan/Renewable-Energy-Market-Analysis-Africa

Africa's Renewables Pathway
Capacity Expansion Power Sector



- Total cumulative investments 2021 – 2040: ~ **850 USD billion / ~ 45 USD billion per year**
- RE generation: ~ **60% - 75%** of the investments

Policies driving the deployment of renewable energy

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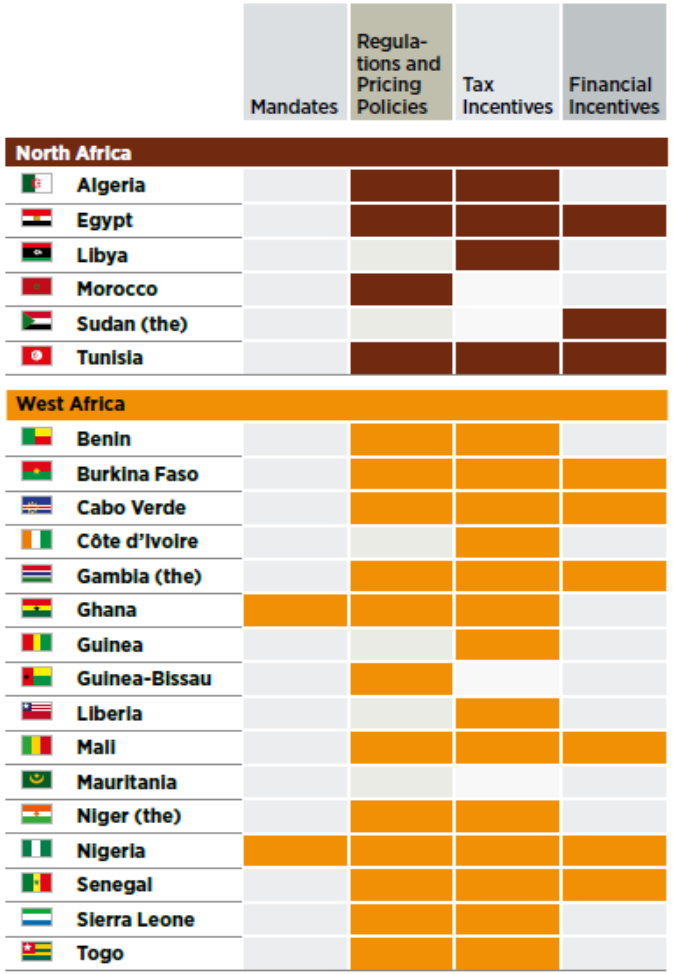
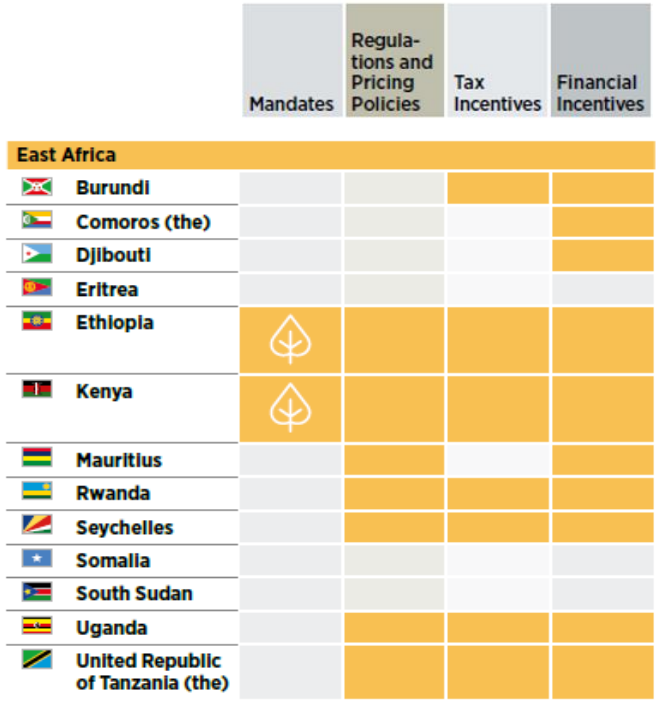
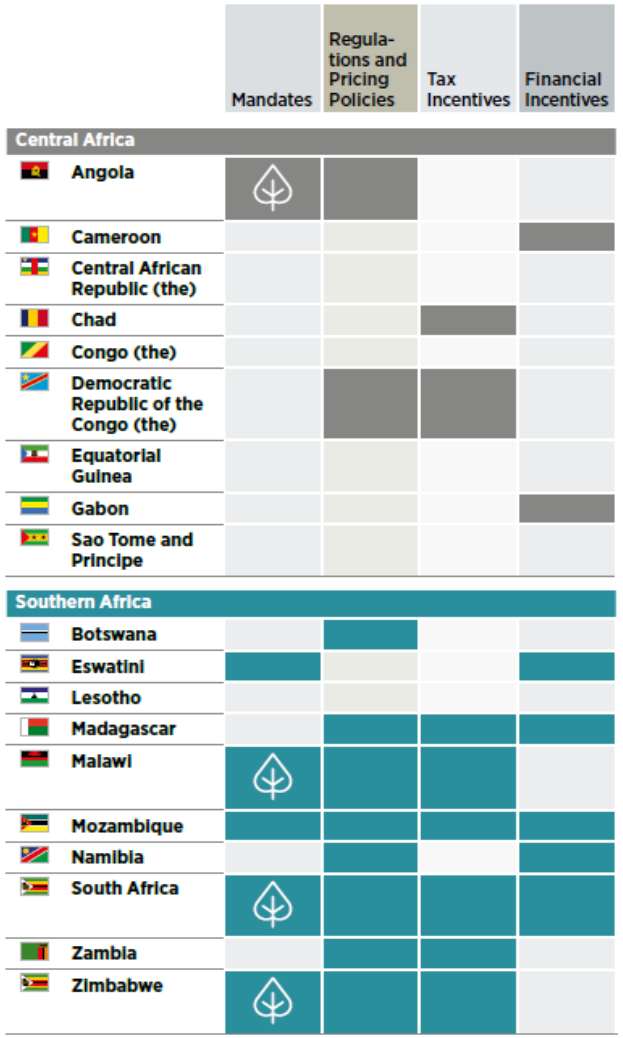
A growing number of instruments are used in support of deploying renewable energy in Africa including mandates, regulations and pricing policies, tax incentives and financial incentives.



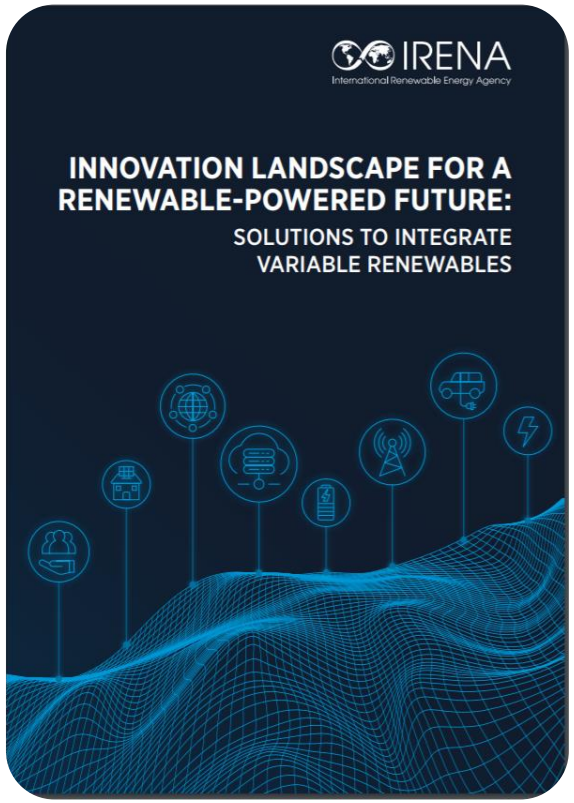


Biofuel blending mandate

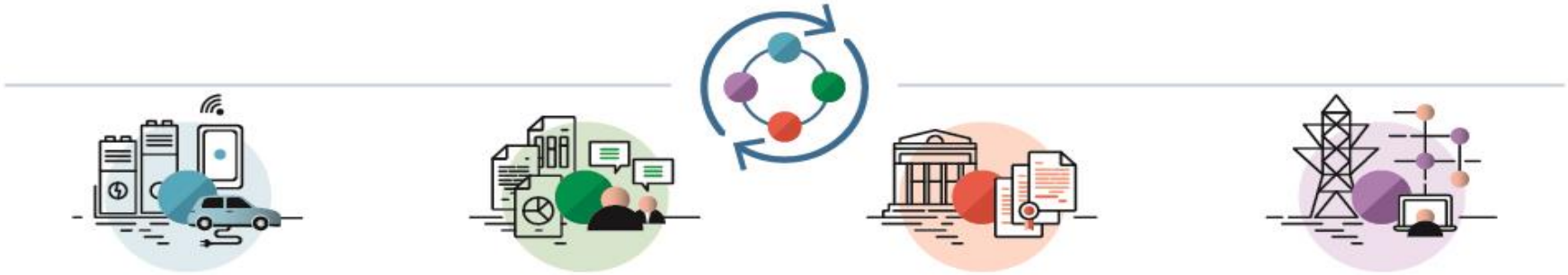


Source: https://www.irena.org/publications/2022/Jan/Renewable-Energy-Market-Analysis-Africa

Innovation for renewables-based power
The four dimensions



Innovation Landscape Report



ENABLING TECHNOLOGIES

1	Utility-scale batteries
2	Behind-the-meter batteries
3	Electric-vehicle smart charging
4	Renewable power-to-heat
5	Renewable power-to-hydrogen
6	Internet of things
7	Artificial intelligence and big data
8	Blockchain
9	Renewable mini-grids
10	Supergrids
11	Flexibility in conventional power plants

BUSINESS MODELS

12	Aggregators
13	Peer-to-peer electricity trading
14	Energy-as-a-service
15	Community-ownership models
16	Pay-as-you-go models

MARKET DESIGN

17	Increasing time granularity in electricity markets
18	Increasing space granularity in electricity markets
19	Innovative ancillary services
20	Re-designing capacity markets
21	Regional markets
22	Time-of-use tariffs
23	Market integration of distributed energy resources
24	Net billing schemes

SYSTEM OPERATION

25	Future role of distribution system operators
26	Co-operation between transmission and distribution system operators
27	Advanced forecasting of variable renewable power generation
28	Innovative operation of pumped hydropower storage
29	Virtual power lines
30	Dynamic line rating

Source: IRENA (2019), Innovation landscape for a renewable-powered future: Solutions to integrate variable renewables

Potential socio-economic benefits of renewable hydrogen production in Africa

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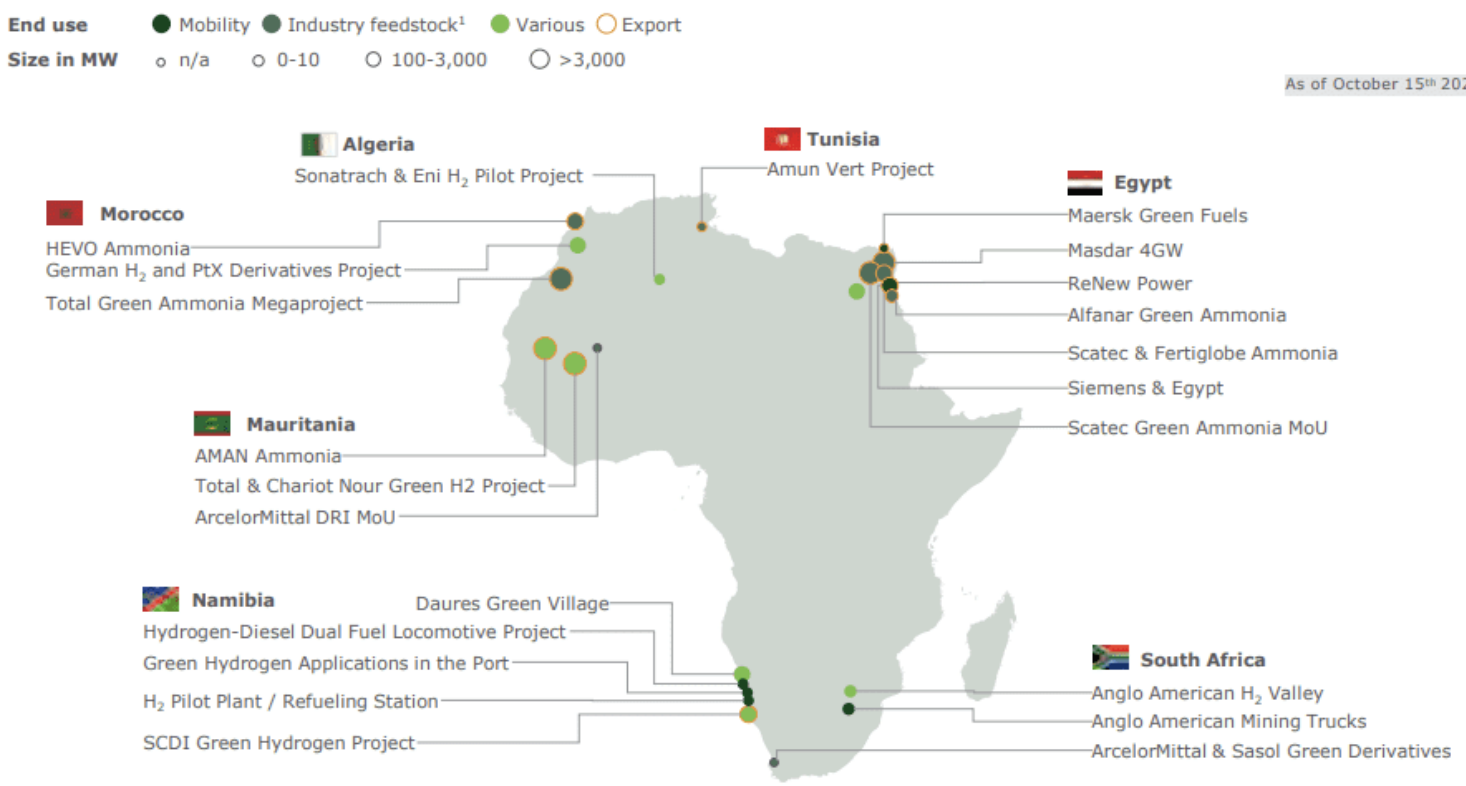
Green hydrogen project announcements in Africa



23 green hydrogen projects

3% of globally announced projects

48 GW electrolysis capacity

USD 30 bn announced investment in hydrogen value chain

WATER SECURITY

- Water stressed regions with coast access could use desalination.

ENERGY ACCESS

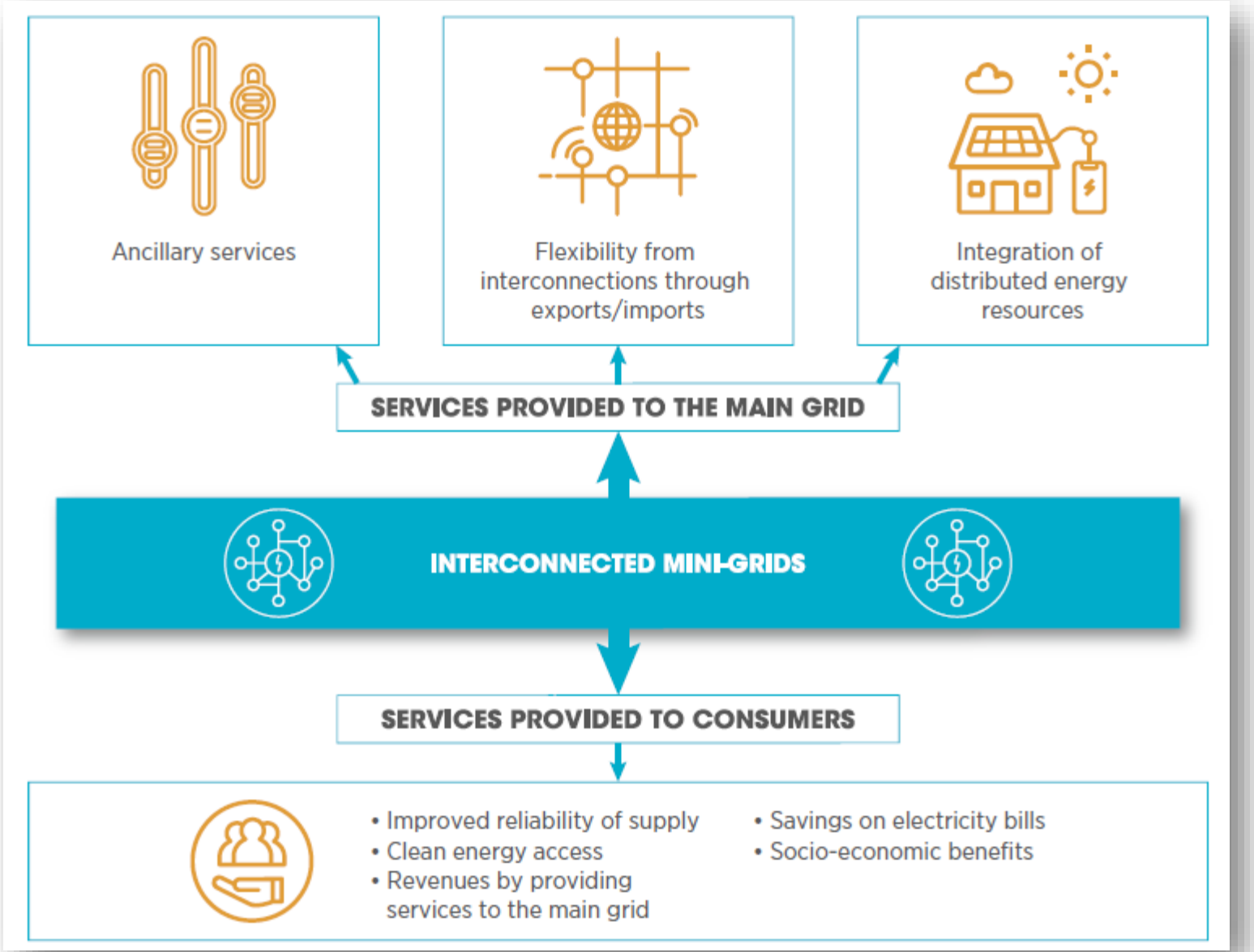
- Projects could include provisions for a minimum share of energy for local users or by larger economies of scale, lower financing costs and supply chain development

INDUSTRY

- Renewable hydrogen can offer new industrial opportunities for the production and use of commodities, such as green steel and chemicals.

Source:https://www.howwemadeitinafrica.com/africa-could-capture-10-of-global-green-hydrogen-market/148795/

Digitalisation in 'smart mini-grids' in Africa



- In the Netherlands, pilot projects with renewable mini-grids provide balancing service to the main grid
- In Tanzania, mini-grids achieve 98% reliability, compared with 47% for the national grid
- Global installed capacity for off-grid renewable mini-grids is about 4.2 GW, with high potential for grid connection

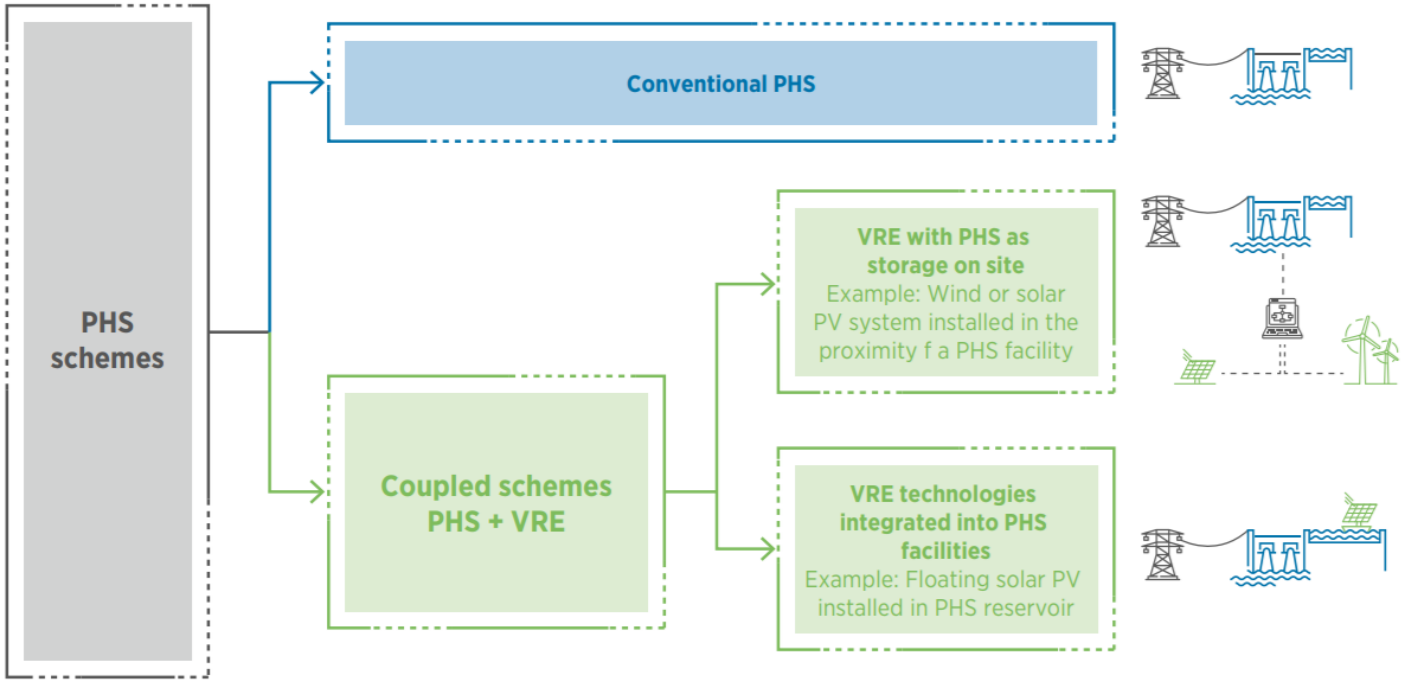
Source: IRENA (2019), Innovation landscape brief: Renewable mini-grids

Innovative operation of pump hydro storage in Africa

Table 1 Current status and examples of leading PHS initiatives

Indicator	Key facts
Geographies where the innovation is deployed	Argentina, Australia, Austria, Belgium, Bosnia and Herzegovina, Brazil, Bulgaria, China, Croatia, Czech Republic, France, Germany, India, Iran, Ireland, Italy, Japan, Lithuania, Morocco, Norway, Philippines, Poland, Portugal, Republic of Korea, Romania, Russian Federation, Serbia, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Ukraine, United Kingdom, United States of America[a]
Installed PHS capacity (GW)	161 in 2018[b]
Forecasted installed capacity	By 2030: 300 GW[c] By 2050: 325 GW[c]
Levelised cost of pumped storage (USD/MWh)	15-year lifetime: 150–200[d] 40-year lifetime: 186 (compared to 285 USD/MWh for Li-ion battery facility)[e] 100-year lifetime: 58[e]
Capital expenditure for PHS construction[f] (USD/kW)	Low end: 617 Medium end: 1 412 High end: 2 465

Figure 2 Configuration schemes for pumped hydropower storage and renewables



Note: PHS = pumped hydropower storage; VRE = variable renewable energy.

Source: IRENA (2020), Innovation landscape brief: Innovative operation of pumped hydropower storage

Policies for decentralised renewables for energy access in Africa

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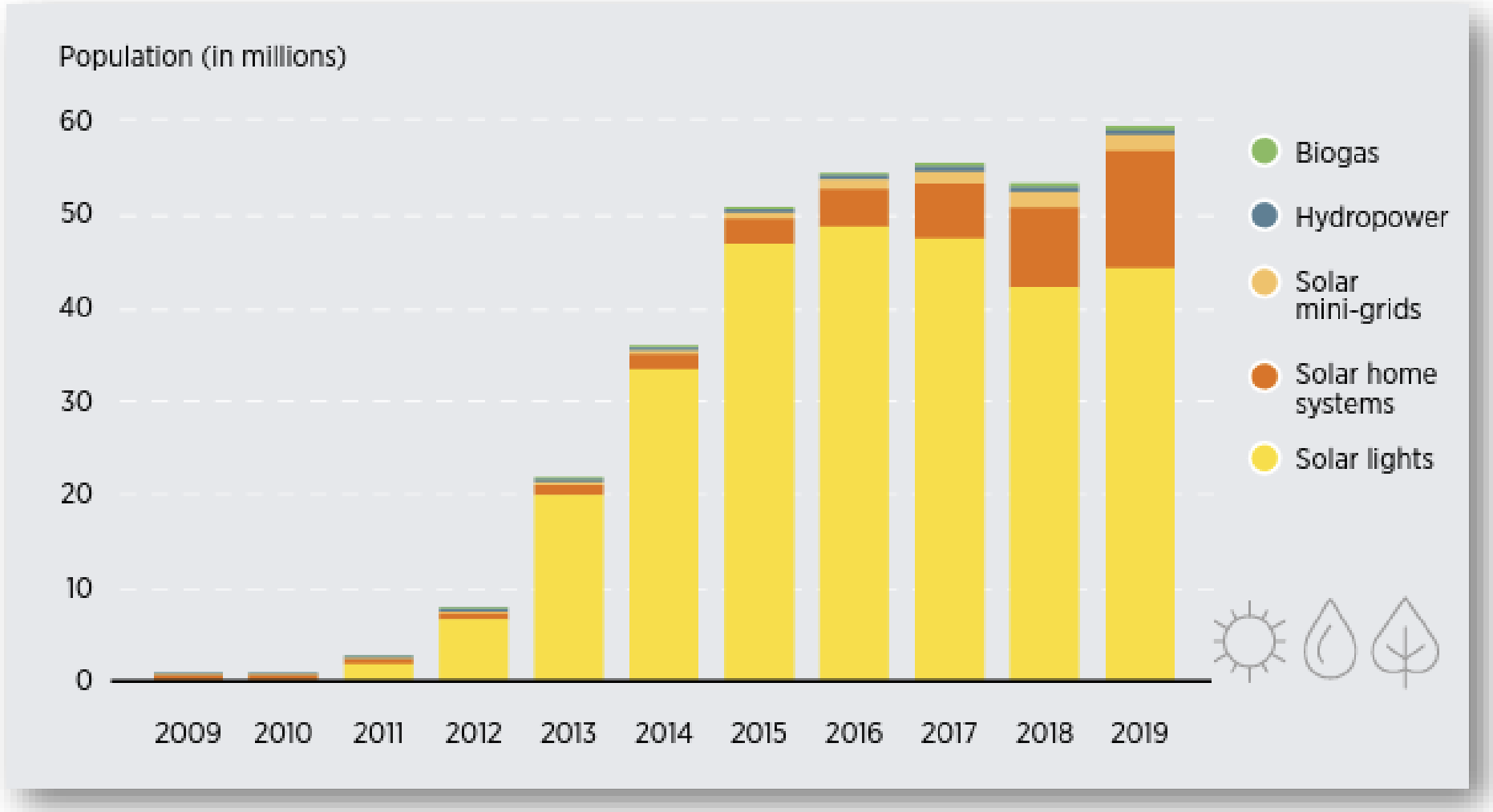
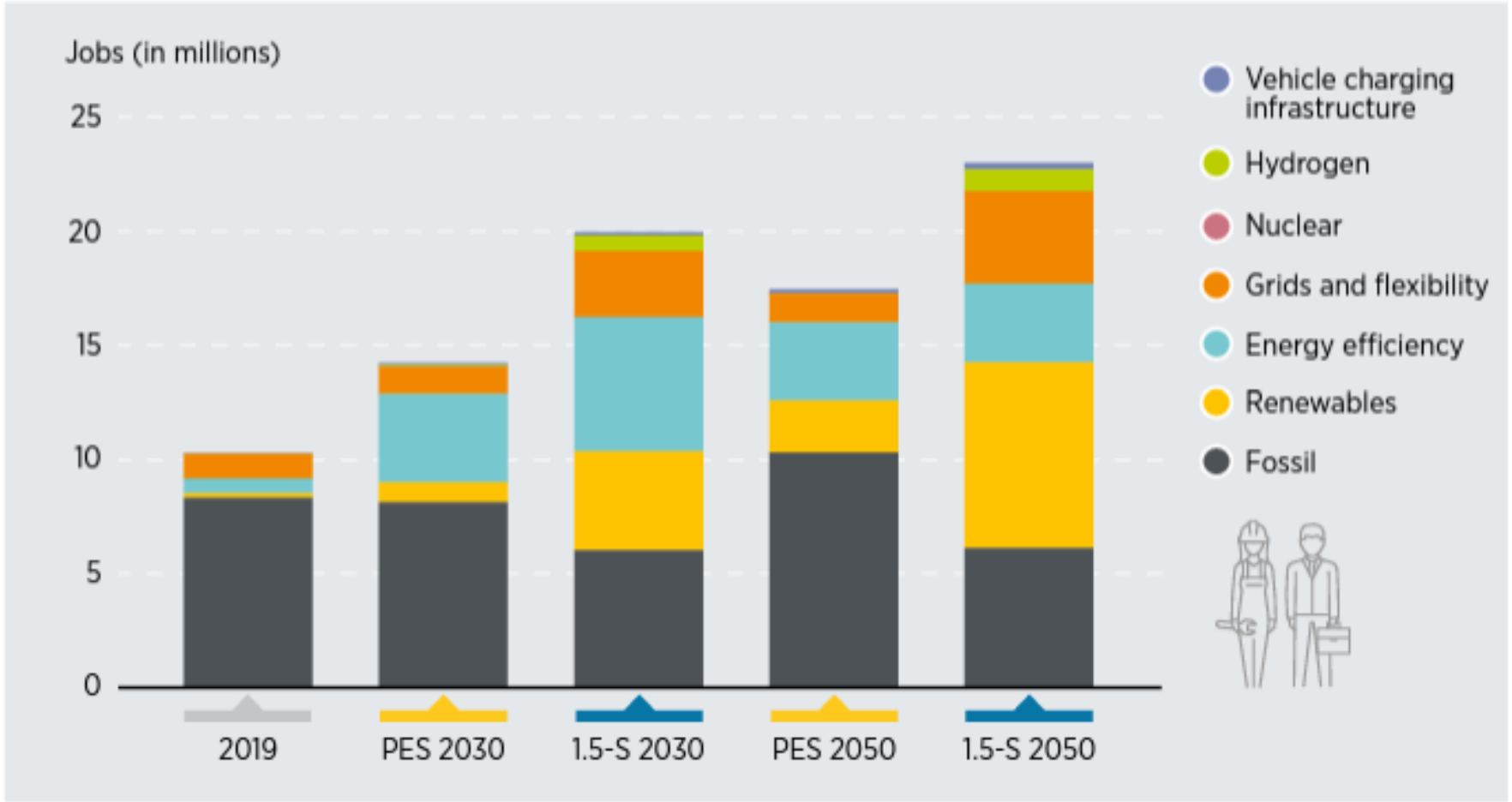
Population using off-grid electricity solutions and biogas for cooking



Source: https://www.irena.org/publications/2022/Jan/Renewable-Energy-Market-Analysis-Africa

Job creation in renewable Energy sector in Africa

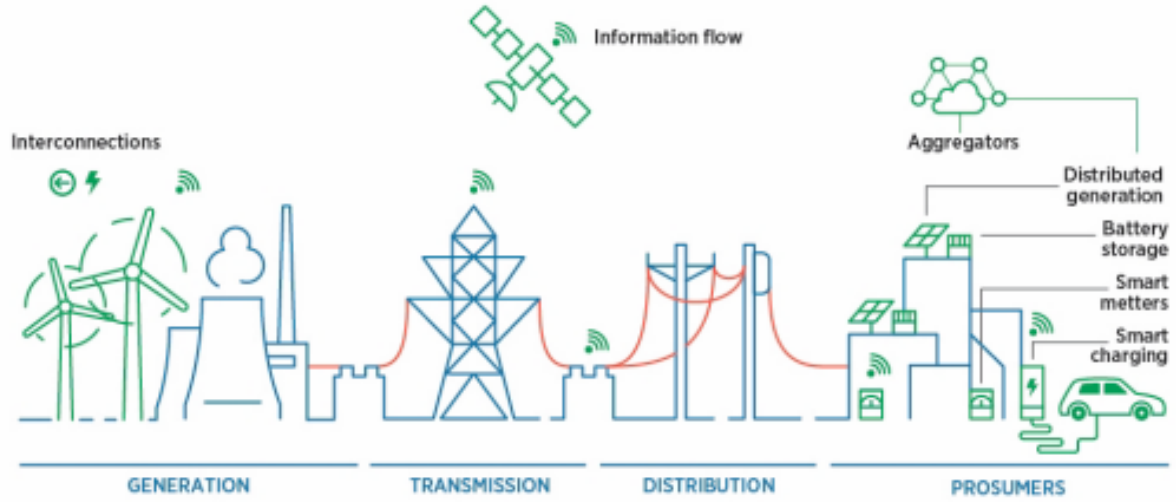
Figure 5.10 Overview of energy sector jobs in Africa under 1.5-S and PES, by sector, 2019-2050



Source: IRENA.

Source: https://www.irena.org/publications/2022/Jan/Renewable-Energy-Market-Analysis-Africa

Example of applying innovation toolbox: Ghana



- Deployment of wind and solar power plants
- Flexible operation of hydropower plants
- Installation of floating solar PV panels
- Biomass

- Regional markets

- Local flexibility markets
- Net billing schemes
- Behind-the-meter batteries
- Cooperation between TSO and DSOs, new role for DSOs
- Market integration of distributed energy resources
- Smart grids (via digital technologies)

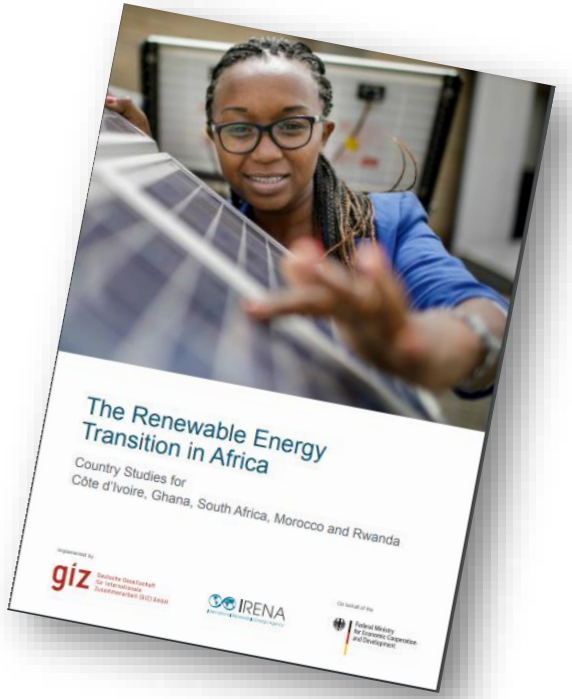
Innovations for access to electricity

- Solar photovoltaic mini-grids
- Solar home systems
- Pay-as-you-go models
- Community-ownership models

Innovations for end-use sectors

- Electrification of buildings
- EV smart charging
- Biodiesels and bioethanol for tractors
- Green hydrogen for long-haul buses and trains
- Direct electrification with renewables in industry
- Flexible demand from aluminium industry

Figure 15 – Innovations to be considered for a future renewable power sector in Ghana



Source: https://www.irena.org/publications/2021/March/The-Renewable-Energy-Transition-in-Africa

Thank you

contact us at: innovation@irena.org

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Data and Tools

Statistics

Resource Assessment

Global Atlas FOR RENEWABLE ENERGY

SOLARCITY SIMULATOR

Renewable Readiness Assessment

Analysis

Technology, Innovation and Policy

Outlook/Socio-Economics

RE-Development Nexus

Capacity Building/TA

NDC Support

CLIMATE PROMISE
A SAFE AND SUSTAINABLE FUTURE THROUGH BOLD CLIMATE ACTION
UNDP

Long-Term Energy Planning

LTES
LONG-TERM ENERGY SCENARIOS

Auctions and Policy Support

Energy for Healthcare – Country Assessments in Sub-Saharan Africa

Project Facilitation

Climate Investment Platform

CLIMATE INVESTMENT PLATFORM

GREEN CLIMATE FUND
IRENA International Renewable Energy Agency
SUSTAINABLE ENERGY FOR ALL
UNDP

ETAF

ETAF
Energy Transition Accelerator Financing Platform

IRENA International Renewable Energy Agency
صندوق أبوظبي للتنمية
ABU DHABI FUND FOR DEVELOPMENT