RES4Africa Foundation
Knowledge Platform

The path of RE development in Africa in the last 10 years

RES4Africa
An outlook of the continent
Africa’s population is growing at a fast pace

AFRICAN POPULATION (MLN) BY AREA (2010-2020)

- Western Africa
- Northern Africa
- Eastern Africa
- Central Africa
- Southern Africa

**2010**

- Nigeria: 16%
- Ghana: 27%
- Côte d’Ivoire: 26%
- Niger: 11%
- Rest of ECOWAS: 17%

**2020**

- Nigeria: 30%
- Ghana: 8%
- Côte d’Ivoire: 27%
- Niger: 16%
- Rest of ECOWAS: 2%

<table>
<thead>
<tr>
<th></th>
<th>2010 - 2020</th>
<th>TOT Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ (mln):</td>
<td>94 36 89 38 46</td>
<td>303</td>
</tr>
<tr>
<td>CAGR (%):</td>
<td>2.7% 2.0% 3.0% 2.4%</td>
<td>2.7%</td>
</tr>
</tbody>
</table>
People are moving to urban areas and getting connected

Urbanization in sub-Saharan Africa has been moving faster compared to other regions in the world. This trend will be more and more evident due to the population growth foreseen for the coming years.

People living in urban areas by region (% of population) – 2009-2018

<table>
<thead>
<tr>
<th>Region</th>
<th>2009</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Saharan Africa</td>
<td>5%</td>
<td>25%</td>
</tr>
<tr>
<td>MENA</td>
<td>22%</td>
<td>56%</td>
</tr>
</tbody>
</table>

Individuals using the Internet (% of population) – 2009-2017

Africa experienced a digital transformation. In 2017 the Internet was used by 25% of people in sub-Saharan countries and by 65% in the MENA region, while the World and the OECD’s average was 50% and 82% respectively.
600 million people still lack access to electricity

While India and Latam experienced a reduction in the number of people without access to electricity with a yearly rate of 19.1% and 6.5% respectively, in sub-Saharan Africa the electrification pace is not keeping up with population growth.
Firms are suffering economic losses because of lack of quality services

80% of firms in sub-Saharan Africa suffer frequent electricity disruptions. Outages vary from 15 up to more than 60 hours each month in many sub-Saharan Africa countries, compared to 27 hours experienced in India and half an hour by OECD countries.

Frequent outages lead to economic annual losses for many firms in sub-Saharan Africa, with an average of 8% of total turnover (2% of annual GDP).

Low water levels due to droughts strongly affect the number of outages of countries that depend on hydropower for much of their electricity generation.
MENA and Sub-Saharan Africa will be highly impacted by climate change effects

Low electricity share and residential sector predominance on total final energy consumption are indicative of a slow industrialization process playing a braking role in the Africa’s economic growth.

Despite North Africa and South Africa are relatively industrialized, industry and other services currently constitute less than 20% of final consumption in Sub-Saharan Africa.
MENA and Sub-Saharan Africa will be highly impacted by climate change effects

From 2010 to 2020, Africa has been the second-most climate vulnerable region of the world after South Asia and displays the lowest climate readiness. Niger and Guinea-Bissau have been the most vulnerable countries of the continent.

In the future, associated with a 2°C temperature rise, the warm spell duration is expected to increase by 56 days compared with current levels.
Because of decarbonization policies and technological innovation, MENA countries may not be able to exploit their fossil resources.

A third of global oil reserves, half of gas reserves and over 80% of current coal reserves should remain unused from 2010 to 2050 in order to meet the 2 °C target.

In this context, it is estimated that the Middle East will be able to exploit only about 60% of its oil reserves – leaving more than 260 billion barrels underground – and about 40% of its gas reserves.

Gas will nevertheless maintain its role as an important component of global decarbonization due to its key role in displacing coal from the energy mix.

Such a development would represent an unprecedented challenge for MENA oil exporters. Their entire economic and socio-political models would need to structurally change – or keep on changing - in order to adapt to the new reality.
The transition to a net-zero emissions world is going to be a metal-intensive one

The decarbonization path towards an electricity-based economy and the emissions reduction commitments made in the last years will require increasing amounts of raw materials and stress global supply chains.

African countries are home to most of these minerals. Mali and Ghana are among the biggest producers of lithium of the continent, crucial for the supply chains of RE industries in Europe and beyond.

Mozambique and South Africa hold reserves of graphite, platinum and lithium, while Zambia alone provides 10% of the global supply of copper.
The transition to a net-zero emissions world is going to be a metal-intensive one

The continent is endowed with enormous quantities of minerals, ores and metals, most of which are strategic for the global energy transition. Nevertheless, all countries in the continent are considered to be commodity dependent, with local differences in terms of merchandise.

West Africa (together with Central Africa) displays the highest dependence on commodities, with their share representing about 95% of the total merchandise exports.
Off-grid systems are relevant for rural access to electricity and have gained momentum in the last ten years.

Rural electrification rates in the area experience common disruptions of service and losses linked to the national grid at about 39%.

With the decrease of PV systems' costs and innovative financing models, the number of people with access to electricity in Sub-Saharan Africa rose consistently thanks to decentralized solutions.

In West Africa, there are 385 mini grids operating, with a power of around 30MW (95% PV). In 2019, more than 10 million people in the area had access to electricity thanks to off-grid technologies. It has to be noted that most of the mini-grids in place were funded by development programmes and cooperation agencies.
The market for start-ups operating in the solar home system and mini-grid sectors grew consistently.

As most of the times grid extension to remote areas constitute an economic and technical barrier for governments, there has been space for hybrid ventures\(^1\) to invest in mini-grids.


The Energy Sector Management Assistance Program (ESMAP) estimates that globally almost $220 billion will be needed to connect 490 million people to 210,000 mini-grids by 2030.

The biggest challenges for mini-grids development are i) access to finance, ii) unreliable regulations and iii) lack of viable business models.
Only 2% of global investments in renewable energy went to Africa between 2000 and 2020

The investments in renewable energy in Africa grew consistently between the decade 2000 – 2010 and 2010 – 2020, shifting from 4.8 Bln $ to 55 Bln $.

Investments are concentrated in a handful of countries, indeed 4 countries alone attracted 75% of all investments: South Africa, Morocco, Egypt and Kenya.
The Renewable Energy sector employs 12 million people worldwide, but less than 3% are located in Africa.

DISTRIBUTION OF RES JOBS WORLDWIDE (%), 2021

Worldwide, the RES sector employed 12.7 million people in 2021, a 64% increase compared to 7.3 million in 2012.

Of those 12.7 million people, 42.2% were located in China, 9.8% in Europe, 10% in Brazil and only 2.4% in Africa.

Despite its tremendous potential, the region of West Africa employed approximately 66,000 people, or 0.55% of the worldwide workforce.
Overview of the regulatory framework
The regulatory framework in the continent is fragmented and has large space for improvement

54 African countries submitted *Nationally Determined Contributions (NDCs)* towards the Paris Agreement. Of this, only 30 transposed the NDC into national RES targets and only 3 are on track to meet their RES target.
The regulatory framework in the continent is fragmented and has large space for improvement.

RISE scores reflect a snapshot of a country’s policies and regulations in the energy sector, organized by the three pillars of sustainable energy: energy access, energy efficiency, and renewable energy. It shows that the results achieved in Africa have been limited to a small number of countries.
In MENA Regulatory frameworks have developed over the last decade

RISE scores reflect a snapshot of a country’s policies and regulations in the energy sector, organized by the three pillars of sustainable energy: energy access, energy efficiency, and renewable energy.

Between 2010 to 2019, the MENA region’s RISE scores rose significantly, with Algeria and Egypt emerging as the countries demonstrating the most substantial improvement over the period.

**RENEWABLE ENERGY RISE SCORE BY COUNTRY IN MENA (2010 VS 2019)**

<table>
<thead>
<tr>
<th>Score 67-100</th>
<th>Score 34-66</th>
<th>Score 0-33</th>
<th>No Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2019</td>
<td></td>
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</table>
A good benchmark: Morocco has made significant progress towards meeting its ambitious RE targets

- Over the last decade, the country embarked on a liberalization process, enacting Law 13-09 on renewable energy, which allowed IPPs to sell electricity to large final customers.

- By recently amending the Law 13-09, Morocco is moving towards further opening its electricity market to IPPs by allowing them to access the medium voltage grid.

- Also, the amendment of the Self-Generation Decree, and the newly published Grid Code is improving the market transparency on grid connection procedures.

- Challenges: despite the Laws and regulations currently in place, the amendment process of the 13.09 law has been very slow, and the lack of secondary legislations still prevent the opening of the Medium Voltage Market to IPPs. Finally, the Energy Regulator ANRE, was established in 2016.
In West Africa, regulatory barriers are holding back renewables compromising the sustainable development of the region

<table>
<thead>
<tr>
<th>Slow regional integration process</th>
<th>Unclear political will to support regional integration and to strengthen WAPP authority</th>
</tr>
</thead>
</table>
| Unclear routes to market          | Feed in tariff poorly implemented  
Auction programmes not finalized  
Direct PPAs not implemented |
| Non cost-reflective tariff        | No cost reflective tariffs that would allow the system to achieve financial sustainability |
| Inefficiency of infrastructures   | Infrastructure investment gap in transmission and distribution sector and missing regulation to engage private sector investment |
Space for improvements still remains at all levels

Regulatory and Policy Risks are perceived as high by investors. Laws and regulations currently in place are rather strong, but barriers stem from their inadequate, incomplete or delayed implementation.

### Regulation
- Politics often interfere with regulatory progress
- Poor or inadequate implementation due to lack of secondary legislation
- Very slow amendment processes

### Tenders
- Lack of transparency: and standardized documentation
- Slow auction processes
- Cancellation / downsizing of capacity are common
- Local content requirements often too high

### PPAs
- Lack of bankability
- Currency convertibility issues
- Sovereign Guarantees are often a problem
- In some cases, IPPs must secure financing from a local bank, which may be reluctant to fund RES Projects.

### Business Environment
- Eye-catching unrealistic targets
- Lack of transparency on key elements, such as tariffs, that are not published by Regulator
A focus on tariffs and inefficiencies
Underpricing is the highest contributor to utilities’ inefficiencies in MENA

The most significant driver of the quasi-fiscal deficits is the underpricing of electricity, which costs on average 3.2% of GDP, and accounts for about 73% of hidden costs.

Most of MENA’s economies see end-user tariffs fall under the global average price per MWh ($13.9). Yet there is a general lack of political will to restructure tariffs and cut subsidies to improve cost-recovery.

### BREAKDOWN OF HIDDEN COSTS

- **Underpricing**: 73%
- **Collection Losses**: 14%
- **T&D losses**: 9%
- **Overstaffing**: 4%

### COMPARISON OF AVERAGE END-USER AND COST-RECOVERY TARIFFS IN THE REGION

- **Average end-user tariff**
- **Cost Recovery tariff**
- **World Average Tariff for Household Users**
- **World Average Tariff for Business Users**
West Africa electricity market is characterized by inefficiencies, with utilities struggling to implement cost-reflective tariffs.

Prices are among the most expensive in the world, averaging about $0.20/KWh and sometimes as high as $0.40/KWh. More than twice the global average. Part of this cost stems from the fact that nations in the region have so far dealt with energy problems independently, trying to match national demand with domestic generation.

Public utilities in West Africa struggle to recover the cost of producing electricity due to reliance on small-scale expensive oil-fired power generation, expensive imported fuel and rampant operational inefficiencies.
Adopt a clear regulatory framework and ensure its implementation as a starting point for positive, long-term development of RES

- **Ease FDI barriers** – where they exist – that impede foreign IPP participation.
- **Implement standard and bankable PPAs** to reduce the cost of capital and the cost of debt.
- **Organize competitive procurement schemes** to attract international companies and improve sector competitiveness.
- **Establish multiple routes-to-market** to allow IPPs to choose from a portfolio of opportunities.
- **Ensure a balance between local content rules and market competitiveness** to stimulate both international and local engagement.
- **Apply cost-reflective tariffs** to guarantee affordable energy while ensuring the sustainability of electricity production.
Regional electricity market integration
Lack of T&D lines between countries hinders access to power integration

With a total length of 89,731 km, transmission network in Africa is small if compared to the continent’s area: 3.3 meters of line per square km, about 10 times less than in India.

Transmission lines between national grids are insufficient in Sub-Saharan Africa even in power integrated region (Eastern Africa, Southern Africa and West Africa).

Poor power integration limits the access to new markets and new sources of supply, requiring the single utilities a larger investment and preventing countries for taking advantage of economies of scale.
Regional interconnections in MENA either exist or are planned, but inter-regional trade is limited

There are 3 main inter-regional connections:

- **Morocco – Tunisia – Algeria**: fully connected and synchronized with the Pan-European high-voltage transmission network
- **GCC**: Kuwait – Saudi Arabia – Bahrain – Qatar – UAE – Oman

Only 2% of the total annual generation is traded across borders for various reasons such as lack of trading rules and regulations, technical issues etc. Most are one-off, irregular trades.

In Europe about 9% of total annual generation is traded across borders.
Some countries in West Africa have to deal with an excess of (costly) unused generation capacity, while others have a deficit of production.

West African countries have experienced difficulties in planning the evolution of their energy markets, resulting in relatively low levels of regional trade: only about 8.5% of electricity production is traded on average every year in West Africa.

One of the most significant challenges in the area is to synchronize all domestic networks into a single grid (as they present technical differences), even though some countries have been successfully connected (Ivory Coast, Ghana, Burkina Faso, Togo, and Benin).

In the region, only Nigeria has been exploiting its connection with many exchanges, primarily because of the attractiveness of exports compared to domestic demand.
Promoting regional integration is essential to attract investments and support economic development and prosperity

Confirm and strengthen political will – at the national level and through regional organisations – to support decarbonised and sustainable development within a realistic roadmap.

Leverage international cooperation and attract international investments for regional and continental interconnection

Support the further development of a power trading market, with appropriate structures and rules, to accelerate regional energy integration and maximise the value of the power pools

Update energy development plans
Reinforce strategic and results-oriented partnerships with various African and International organizations
Channel investments into strategic projects in line with national and regional plans
Strengthen coordination and cooperation between national and local governments, IFIs and international cooperation agencies
Make progress in unbundling state-owned utilities
Improve knowledge sharing
Confirm the political will to strengthen power pools’ responsibilities.
Establish policies and a regulatory framework that clearly address key barriers
The role of IPPs and international tenders
IPP Investments in Africa are mainly concentrated in Morocco, Egypt and South Africa.

In West Africa, a few countries (including Senegal) succeeded to attract IPPs due to its formal regulatory framework, showing how decisive clear and sound policies could be to attract private investment in the region.

### Main Players in Africa

- **Enel**
  - Headquarters: Rome
  - Employees: 66,000
  - Installed capacity in Africa: 945 MW

- **Acwa Power**
  - Headquarters: Riyadh
  - Employees: 3,900
  - Installed capacity in Africa: 759 MW

- **Engie**
  - Headquarters: Paris
  - Employees: 171,000
  - Installed capacity in Africa: 454 MW (47 MW in Senegal)

- **EDF**
  - Headquarters: Paris
  - Employees: 163,000
  - Installed capacity in Africa: 218 MW

- **Old Mutual**
  - Headquarters: Cape Town
  - Employees: 31,000
  - Installed capacity in Africa: 580 MW

### Utilities

- **Enel**
  - Morocco: 1,159 MW
    - Acwa Power: 65 MW Solar, 61 MW Wind
    - EDF: 67 MW Wind + 266 MW Solar + 80 MW Wind
    - Engie: 151 MW Wind

- **Egypt: 612 MW**
  - EDF: 66 MW Solar + 33 MW Solar
  - Actis: 250 MW Wind
  - Engie: 105 MW Wind
  - Acwa Power 25 MW Solar + 133 MW Solar

- **Senegal: 205 MW**
  - Actis: 158 MW Solar
  - Engie: 47 MW Solar

- **Ivory Coast: 46 MW**
  - EDF: 15 MW Biomass

- **Zambia: 27 MW**
  - Enel: 27 MW Solar

- **South Africa: 2,000 MW**
  - Enel: 546 MW Wind, 302 MW Solar
  - Old Mutual: 298 MW Solar, 282 MW Wind
  - EDF: 150 MW Wind, 20 MW Solar
  - Engie: 302 MW Solar, 40 MW Wind
  - Actis: 00 MW Wind, 105 MW Solar
  - Acwa Power: 20 MW Solar

### Private Equity

- **Actis**
  - Morocco: 65 MW Solar, 61 MW Wind
  - Egypt: 612 MW
  - Senegal: 205 MW
  - Ivory Coast: 46 MW
  - South Africa: 2,000 MW

- **Old Mutual**
  - Egypt: 612 MW
  - South Africa: 2,000 MW
The time factor: process from tender to construction is often lengthy and costly

Except for South Africa, investments are often characterized by mismatches of planned and actual dates of both bidding and awarding phases, which negatively affect investors’ risk perception.
Instruments exist but with space for improvements

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Scaling Solar</th>
<th>GETFiT</th>
<th>REIPPPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensures political support</td>
<td>Fair risk allocation between public and private sector</td>
<td>First structured auction program in the continent (2011)</td>
<td></td>
</tr>
<tr>
<td>Ensures bidders’ reliability and competitiveness</td>
<td>Allocation of risks to the party which is best positioned to manage it</td>
<td>Delivered almost 4 GW in operation of wind and solar plants</td>
<td></td>
</tr>
<tr>
<td>Fully developed project agreements and credit</td>
<td>Public sector to absorb the credit risk in relation to the single offtaker of electricity (counterparty risk guarantee)</td>
<td>Bankable PPA backed by sovereign guarantee</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Weaknesses</th>
<th>Scaling Solar</th>
<th>GETFiT</th>
<th>REIPPPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited technological and geographical coverage</td>
<td>Limited to small scale projects</td>
<td>Interferences by the State-owned off-taker Eskom caused substantial delays in program implementation</td>
<td></td>
</tr>
<tr>
<td>After 5 years since the launch of the initiative, operational plants only in Zambia</td>
<td>Private sector to absorb all manageable risks, particularly technological and operational risk</td>
<td>Grid connection issues (costs higher than expected)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Challenging local content/ownership requirements due to limited local manufacturing capacity</td>
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</tbody>
</table>
To ensure an effective regulatory system to foster RE development, an **open**, **attractive** and **ready** market is needed.
Renewable energy potential is still untapped
Huge untapped resources can meet the continent’s growing demand

Africa has plentiful renewable energy resources: bioenergy, hydropower, solar and wind power account for the bulk of the resources.

This RE potential capacity could generate up to 24 000 TWh of electricity each year: this is almost 90% of the World’s electricity generation in 2018, and more than 26 times the African electricity generation.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Potential Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>11 000 GW</td>
</tr>
<tr>
<td>Hydro</td>
<td>1 750 GW</td>
</tr>
<tr>
<td>Wind</td>
<td>1 300 GW</td>
</tr>
<tr>
<td>Geo Potential</td>
<td>15 GW (East Africa)</td>
</tr>
</tbody>
</table>

Note: Africa RE installed capacity in 2018: 46 GW

Sources: IRENA, 2019 IEA, 2019
Bioenergy is still the largest source of energy in Africa

With 16% of the world’s population, Africa accounts for only 6% of the global energy demand and little more than 3% of the electricity demand.

Bioenergy is the largest source of energy in Africa today, meeting over half of the final energy consumption, but the use of charcoal for heating and cooking brings environmental (emission and uncontrolled deforestation) and healthy issues.
With just 2% of global RE capacity, Africa is lagging behind other regions of the world.

### RE Share in electricity capacity 2010 - 2020

<table>
<thead>
<tr>
<th>Region</th>
<th>RE Capacity 2010</th>
<th>RE Capacity 2020</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>28</td>
<td>53</td>
<td>+25 GW</td>
</tr>
<tr>
<td>India</td>
<td>57</td>
<td>143</td>
<td>+86 GW</td>
</tr>
<tr>
<td>Central &amp; South America</td>
<td>157</td>
<td>250</td>
<td>+93 GW</td>
</tr>
<tr>
<td>North America</td>
<td>257</td>
<td>471</td>
<td>+214 GW</td>
</tr>
<tr>
<td>Europe</td>
<td>375</td>
<td>701</td>
<td>+326 GW</td>
</tr>
<tr>
<td>China</td>
<td>252</td>
<td>933</td>
<td>+681 GW</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>220</td>
<td>338</td>
<td>+117 GW</td>
</tr>
</tbody>
</table>

### World RE capacity
- 2010: 1346 GW
- 2020: 2889 GW
In MENA, only 4% of power generation comes from renewables.
RE growth has been unbalanced and concentrated in a handful of countries – MENA focus

5 countries (Egypt, United Arab Emirates, Morocco, Jordan and Israel) accounted for more than 80% of the additional solar and wind capacity.

**RE INSTALLED CAPACITY (GW)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Egypt</th>
<th>United Arab Emirates</th>
<th>Morocco</th>
<th>Jordan</th>
<th>Israel</th>
<th>Rest of MENA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>8.6</td>
<td>3.4</td>
<td>5.9</td>
<td>1.9</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>2019</td>
<td>12.5</td>
<td>5.9</td>
<td>6.3</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

**2010-19 RE ADDITIONAL CAPACITY**

- **Solar**: +8.5 GW
- **Wind**: +14.5 GW
- **Hydro**: +2.6 GW
- **Other**: +3.4 GW

United Arab Emirates
Morocco
Egypt
Israel
Jordan
Rest of MENA

**Pie Chart**

- United Arab Emirates
- Morocco
- Egypt
- Israel
- Jordan
- Rest of MENA
- Other
The West Africa region is still highly relying on fossil fuels to satisfy its electricity demand

West Africa is the second largest energy market of the continent, with a total of 31.1 GW installed, with fossil fuels accounting for the most significant share in terms of generation.

Burkina Faso, Cabo Verde, Gambia, Guinea-Bissau, and Niger rely on oil power generation for more than 80% of their generation.
RE growth has been unbalanced and concentrated in a handful of countries – West Africa focus

ECOOWAS INSTALLED CAPACITY (GW), 2020

Hydro represents the vast majority of the 6.5 GW renewable capacity. 4 countries (Ghana, Guinea, Ivory Coast and Senegal) accounted for 80% of the additional RES capacity in the last decade.
High-risk perception is due to several factors and hampers investment appetite

Despite a growing energy demand and a huge potential in electricity production from renewable energy sources, **investments in renewables are still limited in Africa**.

This scarce investment appetite can be interpreted as a sign of **market unreadiness and high-level of perceived risk** of the business environment mainly due to the lack of:

1. **Political stability**
2. **Macroeconomic conditions**
3. **Clear and ready policy and regulatory frameworks**
4. **Institutional stability**
5. **Transparency**
High-risk perception is due to several factors and hampers investment appetite

A sovereign credit risk can be defined as a measure of 4 dimensions:

- Financial
- Economic
- Exposure to international credit agencies
- Political

Efficient and comprehensive de-risking tools are essential to minimize the overall business risk and improve the attractiveness of the continent to investors.
Only 2% of the global RES investments are directed to the African continent, that is highly relying on FDI.

FDI represents 6% of the global RE investment, in Africa this share rise to almost 50%.

Due to the pandemic, global energy investments are estimated to have dropped by 18% in 2020.
Investments in RES must increase in the next decade to reach national targets

Despite the necessary increase of investment, single national markets in Western Africa are too small to attract investment and regional synergy should improve. The expected increase in RES capacity in West Africa is +6.3 GW.
To meet the IRENA 1.5°/2°C Scenario, it is necessary to double RES investments.

An average of $16 billion per year is needed to meet the IRENA’s Transformative Energy Scenario (TES), while current expenditure is only half of that.

On the other hand, investments in non-renewables are estimated to be higher than they should be to meet the TES Scenario: $22 billion compared to a recommended no more than $14 billion a year.

In terms of installed renewables capacity, although improvements are in sight, even if present plans are fully implemented, it will not be sufficient to meet the TES goals.