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CONNECTING THE DOTS

A Retrospective on Southern Africa's Energy Transition: Renewables, Resources, and Responsibility

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The views expressed are solely those of the authors.
This publication was launched during a RES4Africa Webinar held on the 30th of January 2025 and is available for download on: www.res4africa.org/library.
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The study was developed in collaboration with Enel Green Power

Introduction

RES4Africa Foundation, in collaboration with Enel Green Power, presents an in-depth analysis of the renewable energy sector's evolution in Southern Africa over the past decade. The report examines the challenges that have hindered its growth and outlines the necessary steps to attract investment and accelerate the deployment of renewable energy solutions in the region.

This analysis considers Southern Africa’s unique characteristics, taking into account its socio-economic landscape, strengths, and vulnerabilities, which vary across the region's countries. Despite these differences, the report relies on empirical data to highlight the requirements for universal access to affordable, reliable, and sustainable energy.

Southern Africa boasts the most advanced power pool on the continent, yet it remains the least funded in terms of off-grid investments. Although the region has significant potential for sustainable development—particularly with hydropower as the leading source of generation—coal still dominates the energy mix. While demographics and socio-economic conditions differ across the region, the foundations for regional integration are in place. Therefore, there is a need to bridge the existing gaps and connect the dots.

Preface

Southern Africa is a diverse region that encompasses a wide spectrum of political and economic landscapes, from thriving economies to fragile political contexts, and from resource-rich areas to those highly vulnerable to climate change.

In the last decade the quality of governance indicators of the region has declined especially in the areas of government effectiveness and political stability. Furthermore, 2024 has been a critical year, as six countries (Botswana, Mauritius, Mozambique, Namibia, South Africa, and Zimbabwe) have faced presidential or parliamentary elections. Public perception of governments' ability to address corruption is also deteriorating; concerns in Southern Africa have grown at twice the rate of those in other regions across the continent.

The energy sector in Southern Africa remains largely dependent on coal, the region’s dominant source of primary energy. However, renewable energy capacity, primarily driven by hydropower, has yet to fully tap into its potential. Southern Africa also boasts some of the highest solar photovoltaic capacity factors in Angola and Namibia, with South Africa showing strong potential for wind energy. The bulk of exploitable renewable energy sites are concentrated in South Africa, due to its more advanced grid infrastructure.

Climate change is expected to have significant consequences for Southern Africa. In the past decade, climate-related disasters have affected more than 45 million people across the region, underscoring the humanitarian crisis and the pressing need for adaptive strategies.

Preface

To fully unleash the region's potential and meet Southern Africa's climate ambitions while leveraging global commitments to increase climate investments, several actions must be prioritized: (i) unlock strategic partnerships between the private and public sectors to foster renewable energy development at scale, (ii) implement multiple actions on the regulatory and market frameworks to improve national and regional policies, (iii) seize the opportunity of the lack of a widespread fossil fuel infrastructure to transition directly to a renewable energy-based economy, (iv) strengthen regional governance and policy harmonization to advance regional integration and unlock its full potential.

The 2024 publication aims to highlight the opportunities for renewable energy growth and regional integration in Southern Africa, promoting socio-economic benefits for the evolving energy sector. It serves as a key platform for sharing insights, inspiring further research, and raising awareness about the region's vast untapped potential.

Though the path ahead is challenging, action must be taken without hesitation.

Salvatore Bernabei
President at RES4Africa Foundation
CEO of Enel Green Power

Abbreviations and acronyms

AfCFTA: African Continental Free Trade Area
AfSEM: African Single Electricity Market
AU: African Union
BESS: Battery Energy Storage System
Bn: Billions
BNEF: Bloomberg New Energy Finance
BPC: Botswana Power Corporation
CAGR: Compound Annual Growth Rate
CAP-CPS: Common African Position on Climate, Peace, and Security
CEC: Copperbelt Energy Corporation
COMESA: Common Market for Eastern and Southern Africa
CSIR: Council for Scientific and Industrial Research
DAM: Day-Ahead Market
DMRE: Department of Mineral Resources and Energy
EDM: Electricidade de Moçambique
EEC: Eswatini Electricity Company
ESCOM: Electricity Supply Corporation (Malawi)
FLNG: Floating Liquified Natural Gas
FPM-M: Forward Physical Market – Monthly
FPM-W: Forward Physical Market – Weekly
FY: Financial Year
GDP: Gross Domestic Product
GW: Gigawatt
GWh: Gigawatt hour
HCB: Hidroeléctrica de Cahora Bassa
ICED: International Centre for Evaluation and Development
IDM: Intra-Day Market
IEA: International Energy Agency
ILO: International Labour Organisation
IMF: International Monetary Fund
IPP: Independent Power Producer
IRENA: International Renewable Energy Agency
IRP: Integrated Resource Plan
LEC: Lesotho Electricity Company
LHPC: Lunsemfwa Hydro Power Company Limited
LNG: Liquified Natural Gas
LPG: Liquified Petroleum Gas
Mln: Million
MOTRACO: Mozambique Transmission Company
MPI: Multidimensional Poverty Index
MS: Member States
MW: Mega Watt
NamPower: Namibia Power Corporation
NAP: National Action Plan
NDCs: Nationally Determined Contributions
ND-GAIN: Notre Dame Global Adaptation Index
OECD: Organisation for Economic Co-operation and Development
PCIREP: Post Cyclone Idai and Kenneth Emergency Recovery and Resilience Programme
PD: Peak Demand
PV: Photovoltaic
QLFS: Quarterly Labour Force Survey
REIPPPP: Renewable Energy IPP Procurement Programme
RES: Renewable Energy Sources
RNT: Rede Nacional de Transporte de Eletricidade
SADC: Southern African Development Community
SAPP: Southern African Power Pool
SDG: Sustainable Development Goals
SNEL: Société Nationale d'Électricité
SSA: Sub-Saharan Africa
TANESCO: Tanzania Electric Supply Company
TWh: Terawatt hour
T/A: Tons per annum
UNCTAD: United Nations Conference on Trade and Development
UNDP: United Nations Development Programme
UNECA: United Nations Economic Commission for Africa
UNESCO: United Nations Educational, Scientific and Cultural Organization
USD: United States Dollars
WFP: World Food Programme
ZESA: Zimbabwe Electricity Supply Authority
ZESCO: Zambia Electricity Supply Corporation

Geographic scope of work

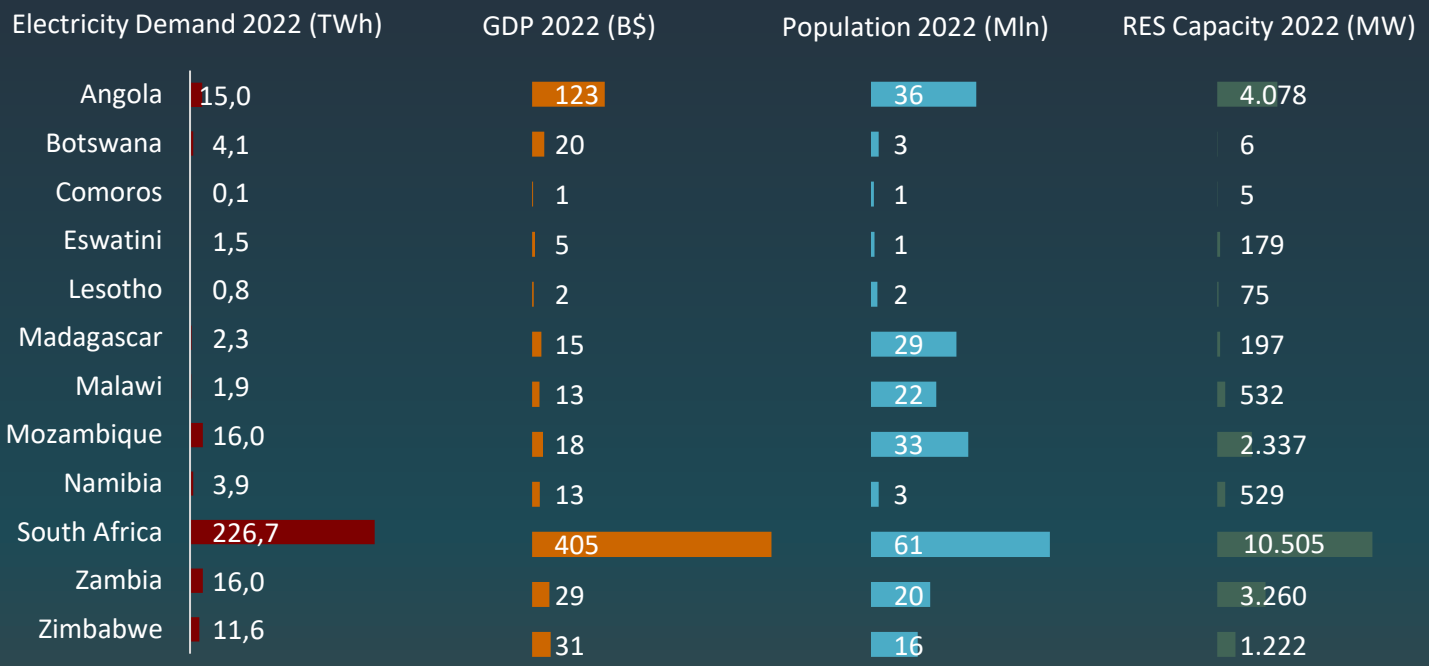
This year's publication analyzes the following countries: Angola, Botswana, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Sao Tomé & Principe, South Africa, Zambia, and Zimbabwe, as per the definition Southern Africa classification of the African Development Bank.

Occasionally across the publication data might slightly vary from this original scope, since other institutions include or exclude certain countries from the original list. Among these alternative groupings of countries, we can mention the following:

The Southern African Development Community (SADC) Secretariat is the body that facilitates the implementation of SADC programs and activities to meet its objectives and overall goal of poverty eradication and regional integration. It includes 16 Member States: Angola, Botswana, Comoros, Democratic Republic of Congo, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, United Republic of Tanzania, Zambia and Zimbabwe.

The SAPP has twelve member countries represented by their respective electric power utilities organized through SADC. Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mozambique, Namibia, South Africa, Eswatini, Tanzania, Zambia, and Zimbabwe

Southern Africa in numbers



Total 12 Southern Africa's countries	300 TWh	676 B$	226 Mln	22926 MW
Share of the World	**1,1%**	**0,7%**	**2,9%**	**0,7%**

Southern Africa is home of almost 3% of the world's population, but accounts for only just over 1% of global power demand
More than 75% of the region's total electricity demand comes from South Africa, which also represent 60% of the GDP of the region
The region is home of only 0,7% of the total RES installed capacity.

Source: Enerdata, IMF, 2022

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Chapter 1
What happened in the last 10 years

- Southern Africa's socioeconomic outlook facesa number of challenges
- Climate change poses a serious threat to the livelihood of millions
- RES share has doubled but remains only one-third of the coal-dominated electricity mix
- Off-grid solutions could support access to electricity but are not fully exploited

Chapter 2
What limited the RE growth

- A conducive investment climate is still lacking
- The benefits of regional integration are yet to be fully reaped
- The global transition era brings opportunities and challenges for the region
- Insufficient and uneven financing has limited adaptation and mitigation activities

Chapter 3
The time to act is now

- Unlock strategic partnerships between the private and public sectors to foster renewable energy development at scale
- Implement multiple actions on the regulatory and market frameworks to improve national and regional policies
- Seize the opportunity of the lack of a widespread fossil fuel infrastructure to transition directly to a renewable energy-based economy
- Strengthen regional governance and policy harmonization to advance regional integration and unlock its full potential

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1. What happened in the last 10 years

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Southern Africa's socioeconomic outlook faces a number of challenges

1. What happened in the last 10 years

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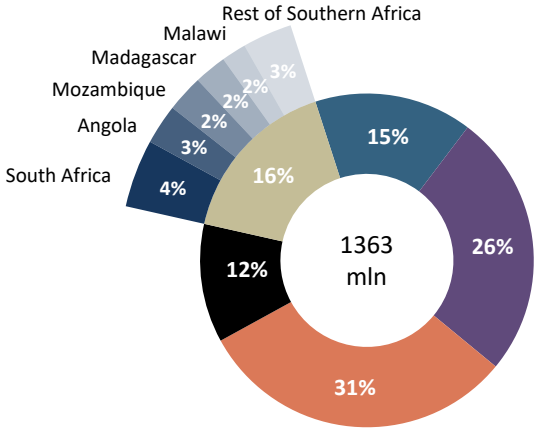
Southern Africa represents almost a quarter of continental GDP but only 16% of total population

The average economic performance of the region over the last decade hides the vast differences across countries. South Africa and Angola, the predominant economies, have witnessed negative growth, but other countries are compensating the trend with strong economic growth.

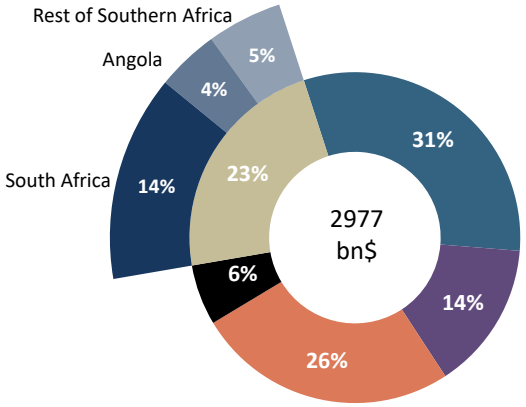
2022
AFRICAN POPULATION (MLN) BY AREA



EVOLUTION 2012-2022

						TOT Africa
Δ (mln):	100	35	78	40	48	302
CAGR (%)	2,7	1,9	2,6	3,0	2,5	2,5

2023
AFRICAN GDP (BN$) BY AREA



	GDP CAGR 2012-2022 (%)	
South Africa	-0,7%	▼
Angola	-0,4%	▼
Zimbabwe	6,2%	▲
Malawi	4,0%	▲
Botswana	3,9%	▲
Madagascar	2,8%	▲
Rest of Southern Africa	0,7%	▲

EVOLUTION 2012-2022

						TOT Africa
Δ (bn$):	120	157	176	40	0,5	491
CAGR (%)	1,7	1,9	5,4	2,6	0,0	1,8

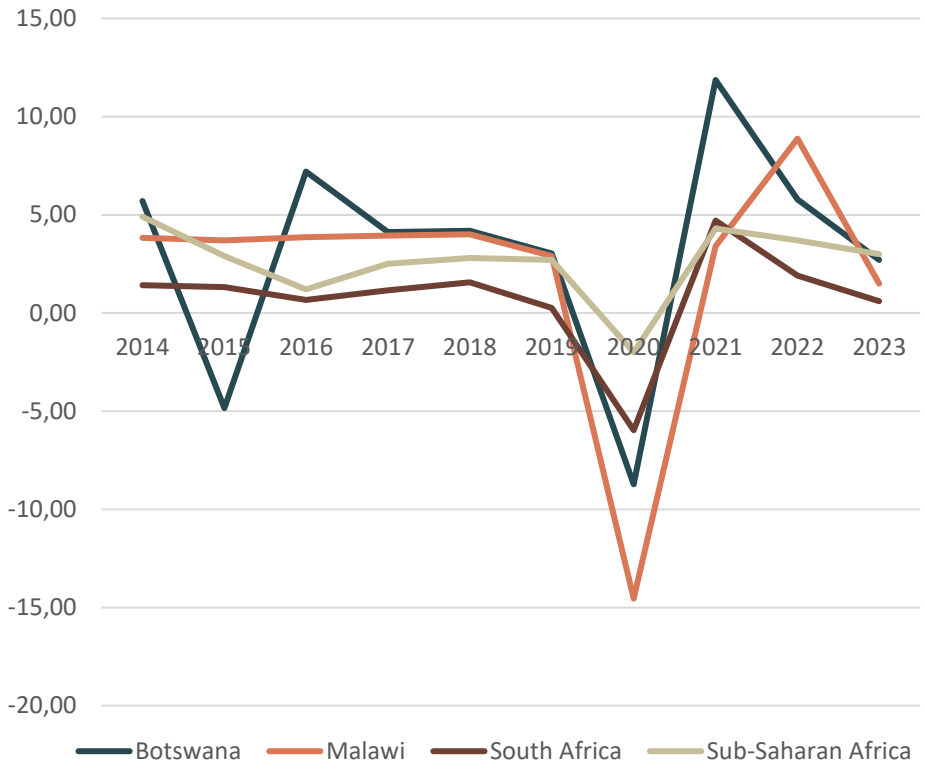
- Western Africa
- Northern Africa
- Eastern Africa
- Central Africa
- Southern Africa

Source: IMF, World Economic Outlook, 2024

SOUTHERN AFRICA'S SOCIOECONOMIC OUTLOOK FACES A NUMBER OF CHALLENGES

Last decade’s GDP growth in the region was significantly lower than the African average, with the exception of a few sectors

GDP GROWTH IN SELECTED SOUTHERN AFRICAN COUNTRIES (%), 2013-2023



In 2022, the GDP growth in the Southern Africa region barely reached 2.7%, lower than both the global average of 3.4% and Africa's average of 3.8%. This can be largely attributed to various challenges experienced in South Africa, including civil unrest and natural hazards. Adverse weather conditions also hampered growth in Zimbabwe, Zambia, Malawi, Madagascar, and São Tomé and Príncipe.

Despite these challenges, the diamond industry experienced positive performance, with sanctions against Russia benefiting exporters from countries like Namibia and Botswana, leading to increased prices and market share. Moreover, the relaxation of global travel restrictions imposed during the pandemic contributed to a resurgence in tourism in 2022. This fueled growth in economies heavily reliant on the tourism sector, such as Botswana, Mauritius, and São Tomé and Príncipe.

Source: World Bank, 2023; African Development Bank, Southern Africa Economic Outlook 2023

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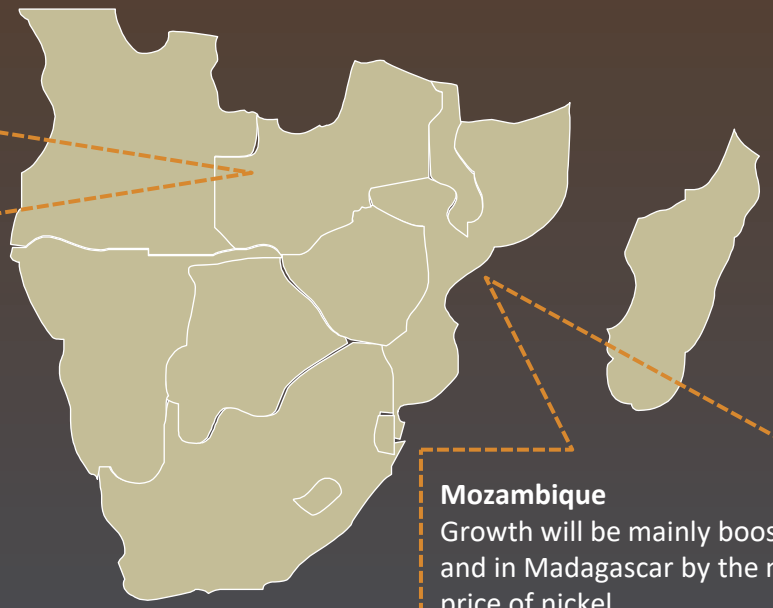
Projected growth varies across Southern African countries

The estimated projected growth for the region is low, mainly because of the low performance of South Africa, which accounts for 60% of Southern Africa's output. Top performers in 2024 were projected to be Mozambique (5%), Madagascar (4.5%), Mauritius (4.9%), Eswatini (4.9%), Zambia (4.7%) and Botswana (4.15%)



Zambia
An improved macroeconomic environment coupled with strengthened mining policy and improved electricity supply will be the primary drivers of real GDP growth.

Mauritius
The rebound of tourism activities has sustained growth in 2023 but will progressively decelerate to its long-term trend over the medium run.

Mozambique
Growth will be mainly boosted by increased demands for liquified gas, and in Madagascar by the mining sector's recovery buoyed by higher price of nickel.

Source: African Development Bank, Africa's Macroeconomic Performance and Outlook – Southern Africa, 2024

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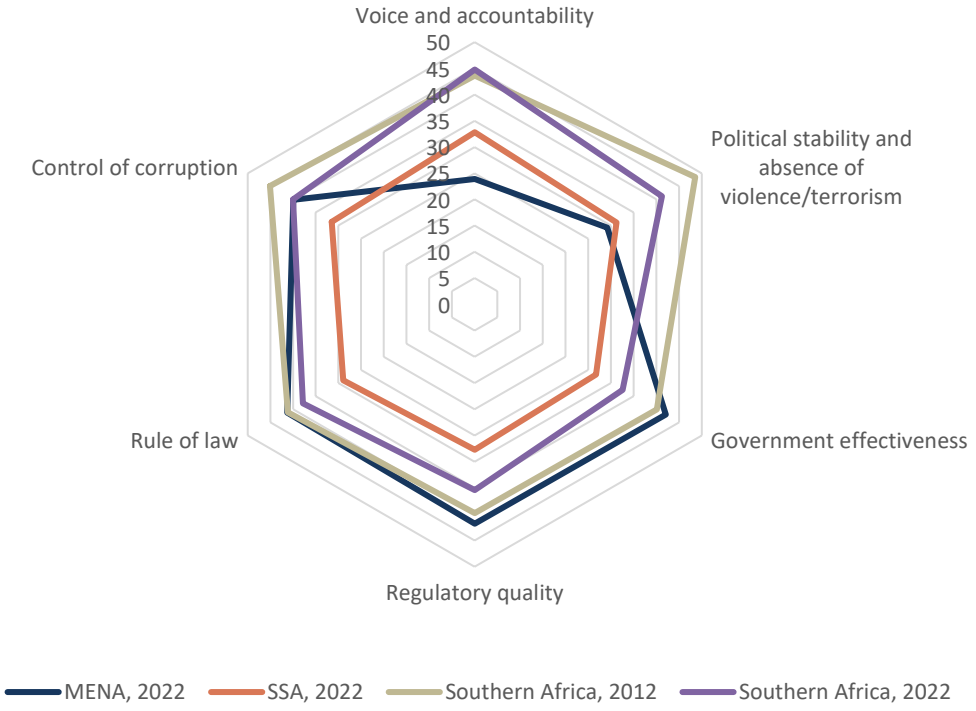
Southern Africa has seen almost all its governance indicators worsen in the last decade

QUALITY OF GOVERNANCE INDICATORS, 2012-2022



In the last decade the change in quality of governance across the continent has seen 35 countries improving while the remaining 19 witnessed a deterioration in one or more indicators. There has been very little improvement (+1.1 from 48.9) at continental level, but huge disparities exist.

People's perception of governments' ability to face corruption at continental level show that concerns have grown at twice the rate in Southern Africa compared to other regions.

Two indicators in particular saw declines; the government effectiveness and the political stability indicators, which were influenced by contested elections and political unrest. Additionally, public perception of security and safety declined significantly over the period.

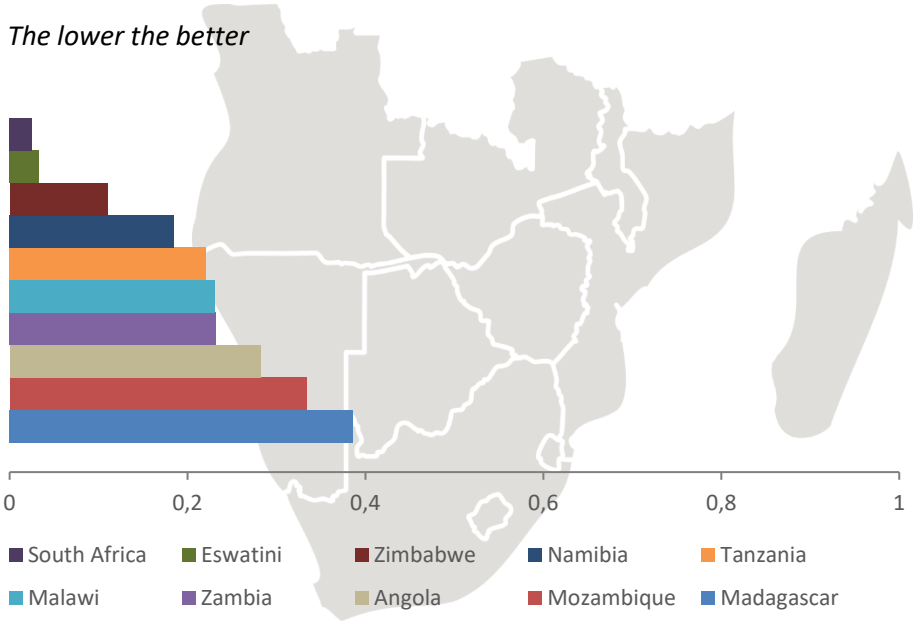
Source: The World Bank, Worldwide Governance Indicators, 2012, 2022; Mo Ibrahim Foundation, Ibrahim Index of African Governance, 2021; Statista, Human development index score of Africa by country, 2021

SOUTHERN AFRICA'S SOCIOECONOMIC OUTLOOK FACES A NUMBER OF CHALLENGES

High poverty and inequality rates remain endemic across the region, together with high youth unemployment rates

MULTIDIMENSIONAL POVERTY INDEX (MPI)

The lower the better



The Global Multidimensional Poverty Index (MPI) index is based on the following indicators: Health, Education, Standard of living

Southern Africa is one of the most unequal regions globally in income and wealth distribution. While South Africa has lower poverty rates than its neighbors, they remain high compared to countries with similar GDP per capita worldwide.

In the last decade, in each country of the region more than 50% of the total national income was concentrated in the top 10% of the population, highlighting widespread inequality.

Moreover, unemployment among the youth has remained high in most of the region's economies. The situation is particularly problematic in major economies such as South Africa (ca. 50%), Mozambique (ca. 40%) and Botswana (ca. 43%), while it has slightly improved in Angola and Zambia.

Source: The World Bank, ILO Data; Department of Statistics of South Africa, Quarterly Labour Force Survey (QLFS) Q4:2023; OECD, Africa's Development Dynamics 2023: Investing in Sustainable Development, 2023; world inequality database, 2024; UNDP (United Nations Development Programme). 2024. 2024 Global Multidimensional Poverty Index (MPI): Poverty amid conflict. New York; UNECA, Report on the Status of Poverty and Inequality in Southern Africa, 2023

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Climate change poses a serious threat to the livelihood of millions

1. What happened in the last 10 years

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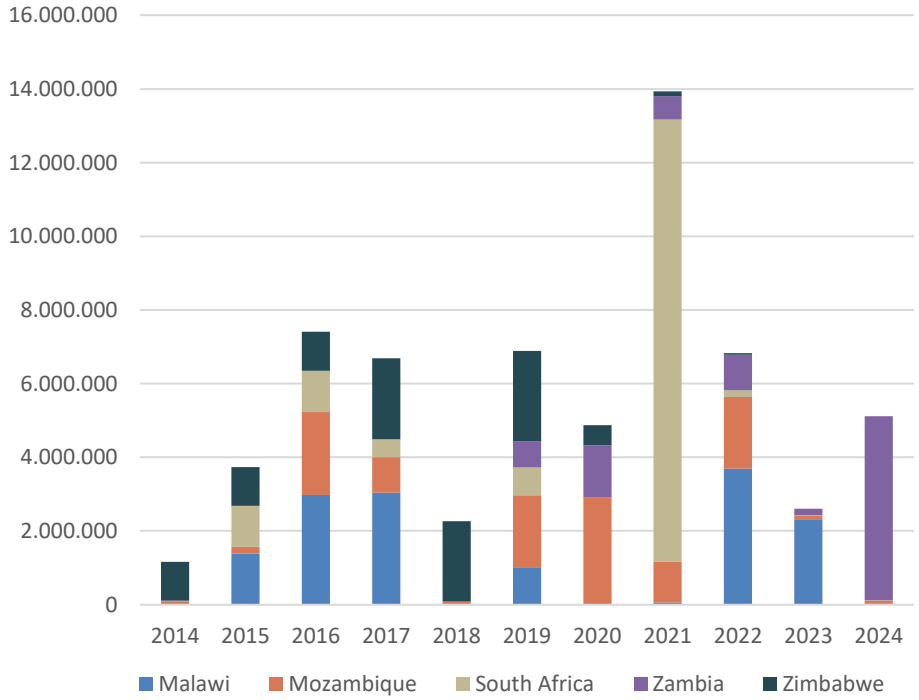
CLIMATE CHANGE POSES A SERIOUS THREAT TO THE LIVELIHOOD OF MILLIONS

Climate change impacts on Southern Africa are increasing in both intensity and frequency

TOTAL NUMBER OF PEOPLE AFFECTED BY DISASTERS



Disasters include all geophysical, meteorological and climate events including earthquakes, volcanic activity, landslides, drought, wildfires, storms, and flooding. The total number of people affected is the sum of injured, requiring assistance and homeless.

Climate change poses a significant threat in Southern Africa, impacting availability, access, utilization, and stability of key resources. Altered weather patterns and increased temperatures have resulted in erratic rainfall, affecting crop production and exacerbating vulnerabilities. The region's low adaptive capacity contributes to increased risks and impacts of natural hazards.

For instance, in Zimbabwe's semi-arid regions, smallholder farmers struggle to adapt to unpredictable rains, leading to crop failures and food insecurity. The impacts are also notable in the Okavango Delta in Botswana, a UNESCO World Heritage Site, which faces increased water stress due to changing rainfall patterns, affecting its unique ecosystem and biodiversity.

Lastly, urban areas are increasingly vulnerable to water shortages caused by prolonged droughts and groundwater overuse.

Source: WFP, CLIMATE CHANGE IN SOUTHERN AFRICA, 2021; World Meteorological Organization, State of the Climate in Africa, 2022 ; Our World in Data, 2024

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CLIMATE CHANGE POSES A SERIOUS THREAT TO THE LIVELIHOOD OF MILLIONS

Climate-related disasters have affected over 45 million people in Southern Africa in the past decade

PREVALENCE OF SEVERE FOOD INSECURITY (% TOTAL POPULATION)

	2018	2019	2020	2021
South Africa	48,30%	49,50%	51,00%	52,20%
Lesotho	40,70%	40,50%	40,40%	39,60%
Namibia	31,30%	32,10%	32,60%	33,00%
Botswana	27,00%	29,00%	30,90%	32,80%
Mauritius	26,20%	28,20%	32,60%	32,10%
Mozambique	24,00%	26,90%	30,40%	31,20%
Zambia	34,20%	32,10%	31,30%	28,60%
Angola	23,10%	23,70%	25,40%	26,70%
Malawi	6,80%	8,30%	9,10%	10,50%
Zimbabwe	6,90%	7,50%	8,00%	9,00%
Madagascar	9,50%	9,90%	10,30%	12,20%

Cyclones like Idai and Kenneth have caused devastating humanitarian and economic impacts, displacing millions and leaving widespread destruction within just six weeks. Cyclone Idai, the deadliest ever recorded in Southern Africa, destroyed critical infrastructure such as roads and bridges, severely limiting access to essential services and humanitarian aid in Madagascar. Cyclone Kenneth, on the other hand, was the most powerful tropical cyclone ever recorded in Mozambique.

Meanwhile, droughts have pushed millions to the brink of survival, intensifying food insecurity and malnutrition. In Malawi, prolonged droughts have led to extensive crop failures, forcing families to depend on food aid and humanitarian assistance to endure the crisis.

In Zimbabwe and Zambia, consecutive droughts have reduced hydropower output, leading to rolling blackouts that disrupt industries and daily life.

Sources: African Development Bank, Multinational - Programme post cyclone Idai and Kenneth emergency recovery and resilience programme for Mozambique, Malawi and Zimbabwe – (PCIREP) - Appraisal report, 2019; Stockholm International Peace Research Institute, Climate-related security risks in the SADC region, 2022; Our World in Data, 2024

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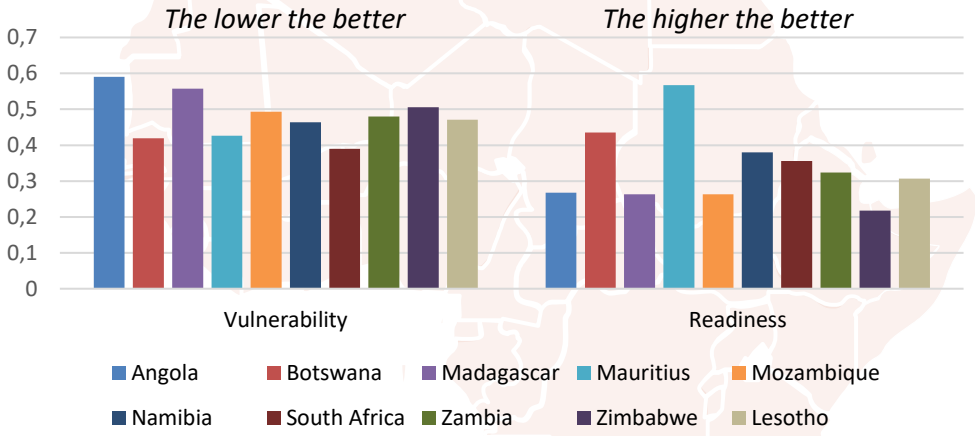
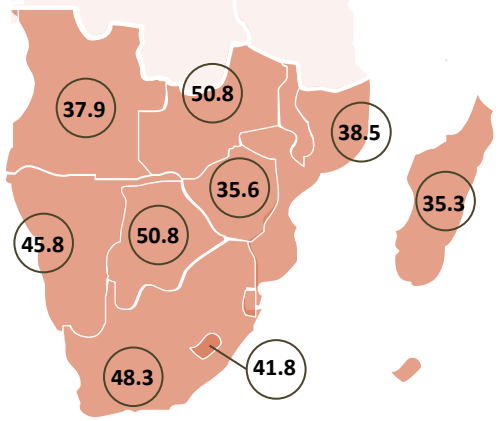
CLIMATE CHANGE POSES A SERIOUS THREAT TO THE LIVELIHOOD OF MILLIONS

Southern African countries' vulnerability reflects the region's lack of adaptation measures

VULNERABILITY AND READINESS INDICES FOR SELECTED COUNTRIES





The ND-GAIN Country Index compares each country's vulnerability and readiness indices giving an overall score between 0 and 100, with the latter representing the most positive outcome.

Limited financing, weak institutions, and competing priorities hinder climate readiness in the region. While organizations like the AU, SADC, and COMESA recognize climate threats, most national policies, such as National Adaptation Plans, fail to address their impact on social cohesion, leaving communities exposed to tensions.

The AU's development of a Common African Position on Climate, Peace, and Security and the recent SADC Summit stress the importance of proactive and context-specific climate strategies to mitigate these risks.

Zambia's Green Growth Strategy, launched in 2024, provides a promising model by integrating peacebuilding into climate action and recognizing the potential risks of ignoring local drivers of tension. Mozambique is incorporating conflict-sensitive climate policies in its coastal protection plans. Lastly, South Africa is developing climate resilience hubs in urban centers to support vulnerable communities affected by climate change.

Source: WFP, Climate change in southern Africa, 2021; University of Notre Dame, Notre Dame Global Adaptation Initiative, 2024; ACCORD. (2024). The impacts of climate change on social cohesion and stability in Southern Africa

Notes: Vulnerability measures a country's exposure, sensitivity and ability to adapt to the negative impact of climate change – food, water, health, ecosystem service, human habitat and infrastructure. Readiness measures a country's ability to leverage investments and convert them to adaptation action – economic, governance and social readiness. The ND Gain Country Index summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience.

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1. What happened in the last 10 years

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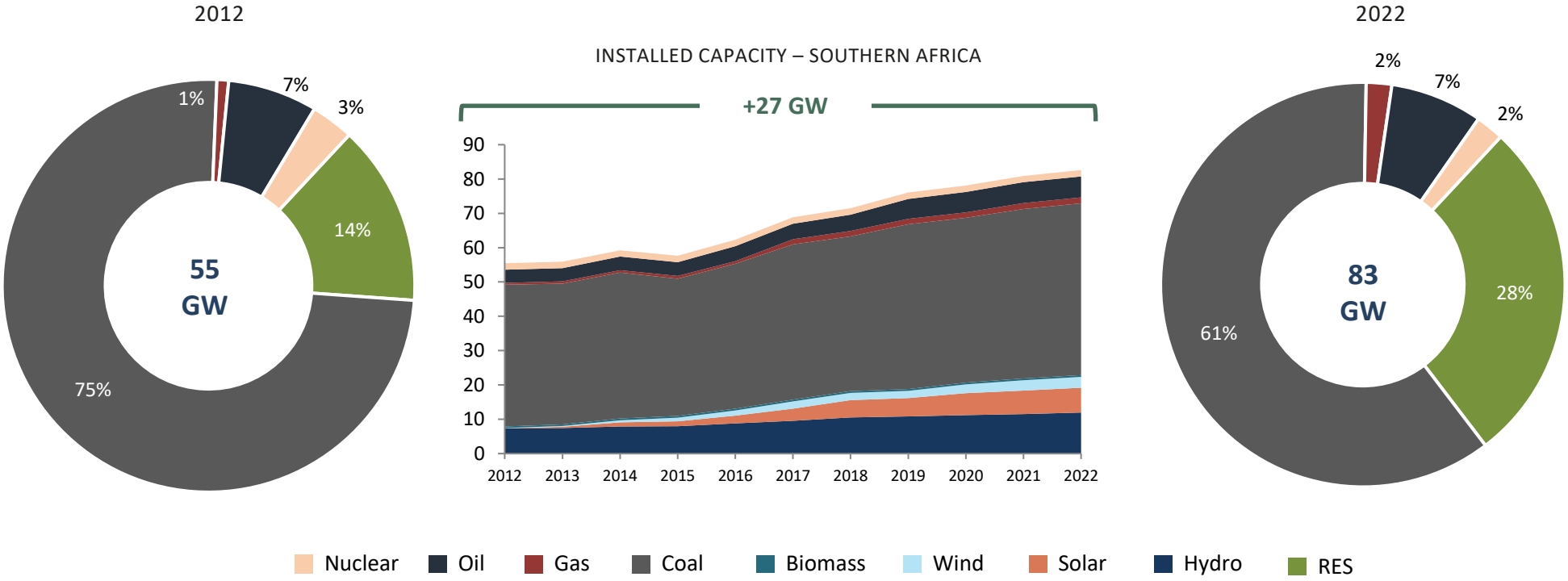
RES SHARE HAS DOUBLED BUT REMAINS ONLY ONE-THIRD OF THE COAL-DOMINATED ELECTRICITY MIX

The region, mainly driven by South African coal, accounts for 34% of continental installed capacity

Between 2012 and 2022, Southern Africa added 27 GW of new capacity, with RES accounts for 28% of total capacity in Southern Africa in 2022, with hydro highly driven by Zambia, Mozambique and Angola, while wind and solar are almost solely present in South Africa.



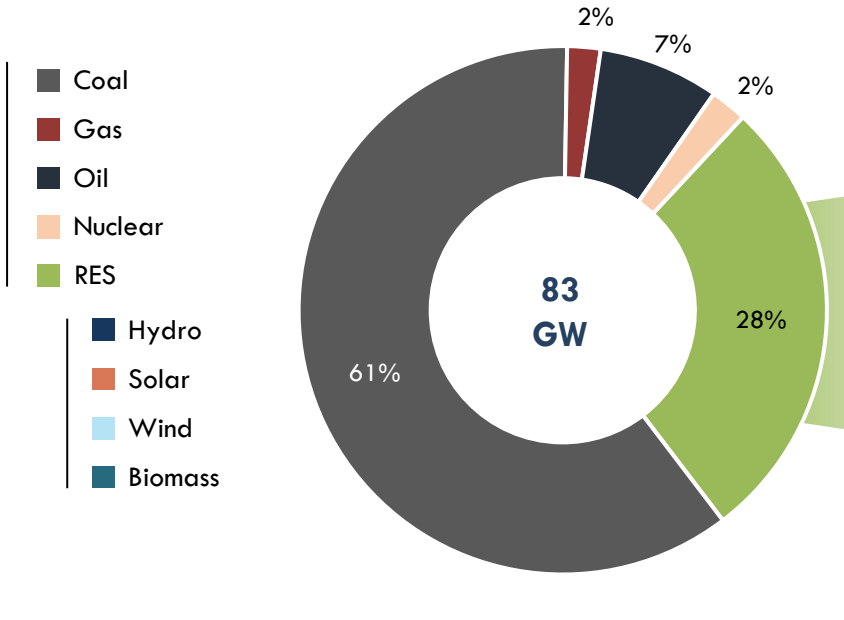
Source: Enerdata, 2024; Department of Mineral Resources and Energy of South Africa, Integrated Resource Plan 2023, 2024
Notes: Hydro (no pump) included in RES. 3) In 2023, Eskom approved construction of the first 342 MW of the 1 GW solar plant (by Soventix). Anglo American has signed an MoU with EDF to develop 3-5 GW of solar and wind plants. The first 3 solar and wind projects will add 520 MW (Northern & Eastern Cape provinces).

RES SHARE HAS DOUBLED BUT REMAINS ONLY ONE-THIRD OF THE COAL-DOMINATED ELECTRICITY MIX

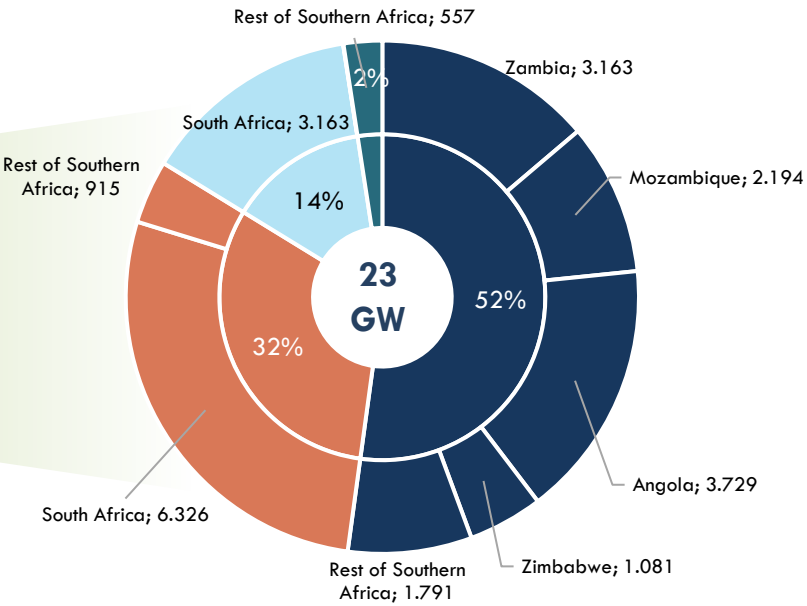
Hydro is the dominant renewable source in the region, with Angola leading in installed capacity

Despite its significant coal generation fleet, South Africa is leading the way to RES with 6.4 GW of solar under development3 and 0.7 GW under construction, and 3.5 GW of wind under development and 1.5 GW under construction. The estimated trend for 2023 and 2024 sees a decline in coal generation.

INSTALLED CAPACITY – SOUTHERN AFRICA, 2022



RES CAPACITY DISTRIBUTION BY COUNTRY, 2022 (MW)



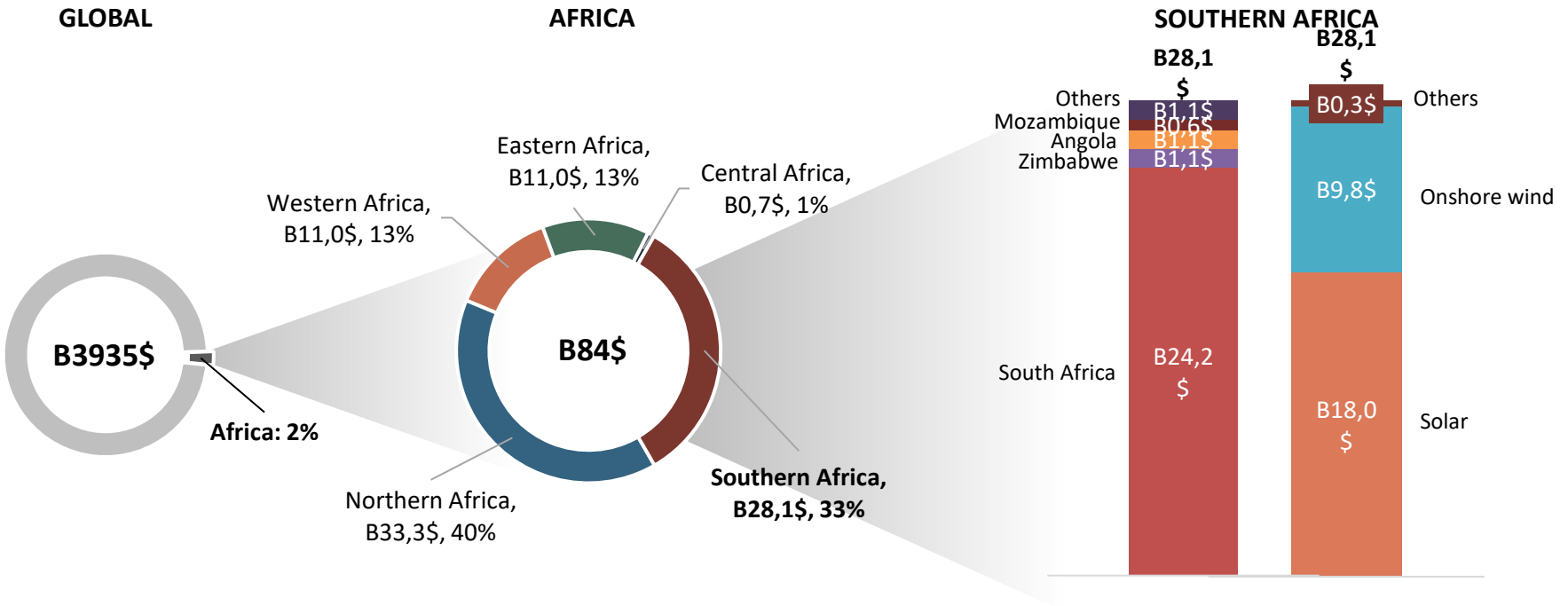
Source: Enerdata, 2024

Notes: Hydro (no pump) included in RES | Auctions 2 auctions took place in 2023 in SAF (REIPPP round 6 for PV and onsh ore wind) allocating 1 GW of PV (and no wind), i.e. 38% of target capacity, with a 30 $ / MWh average price and a much higher capacity bidded by players (9,6 GW wind & solar) while in Zambia awarded 2,5 GW solar in 2022-23 (Zesco tender)

Investments are heavily skewed towards South Africa and solar technologies

South Africa accounted alone for 86% (USD 24,2 billion) of investment in the region during 2014-2023. Zimbabwe, Angola and Mozambique together account for 10% of the investments. Solar was the most attractive technology, with two-thirds of the investments, followed by wind onshore.

RENEWABLE ENERGY (EXCL. LARGE HYDRO) INVESTMENTS 2014-2023 (B$)



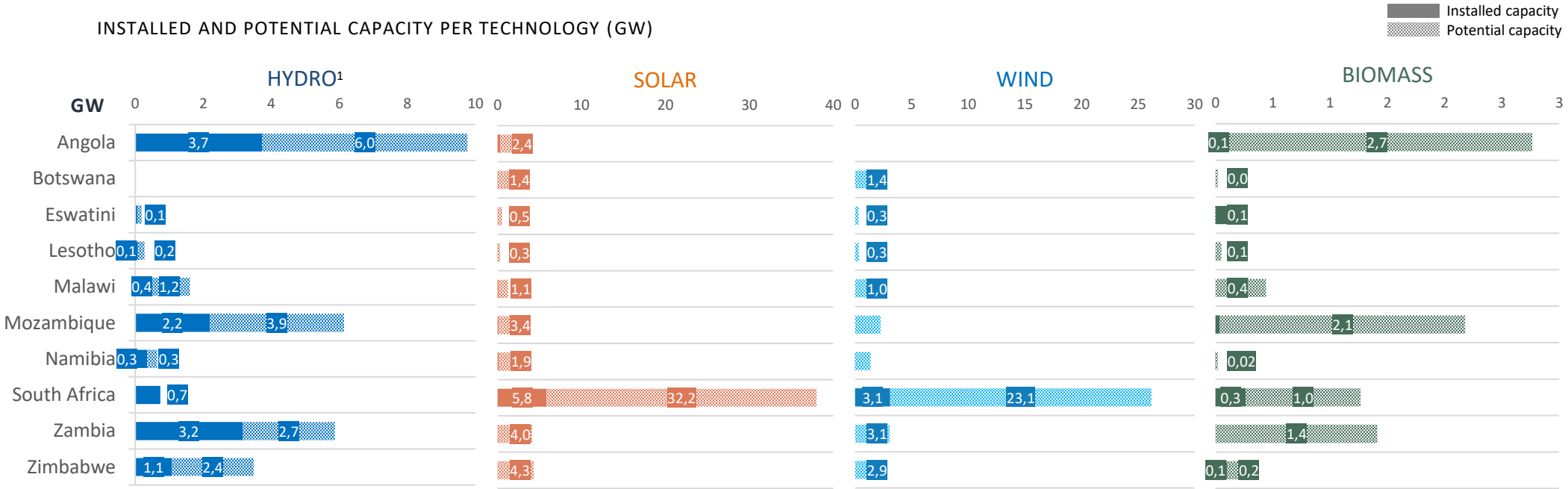
Source: BNEF (2024)
Note: Data exclude investments in Large Hydro (>50MW) and include energy storage

RES SHARE HAS DOUBLED BUT REMAINS ONLY ONE-THIRD OF THE COAL-DOMINATED ELECTRICITY MIX

The region has huge potential for solar PV, wind and hydropower generation

Southern Africa is home to some of the highest capacity factor zones for solar PV in Angola and Namibia and a good capacity factor for wind in South Africa.

INSTALLED AND POTENTIAL CAPACITY PER TECHNOLOGY (GW)



	HYDRO¹	SOLAR	WIND	BIOMASS
Potential:	**144 TWh**	**126 TWh**	**85 TWh**	**39 TWh**
Current:	(59 TWh)	(7 TWh)	(10 TWh)	(0,5 TWh)

Source: Installed capacity: Enerdata 2023; Potential capacity: IRENA - Planning and prospects for renewable power: Eastern and Southern Africa (2021),
Notes: 1Hydro includes small and large hydro. No information available for not mentioned countries.
EOH: Hydro = 5000hr, Biomass = 4500hr from internal analysis, Solar and Wind calculated from Capacity Factors found in IRENA - Planning and prospects for renewable power: Eastern and Southern Africa (2021)

CONNECTING THE DOTS

Off-grid solutions could support access to electricity but are not fully exploited

1. What happened in the last 10 years

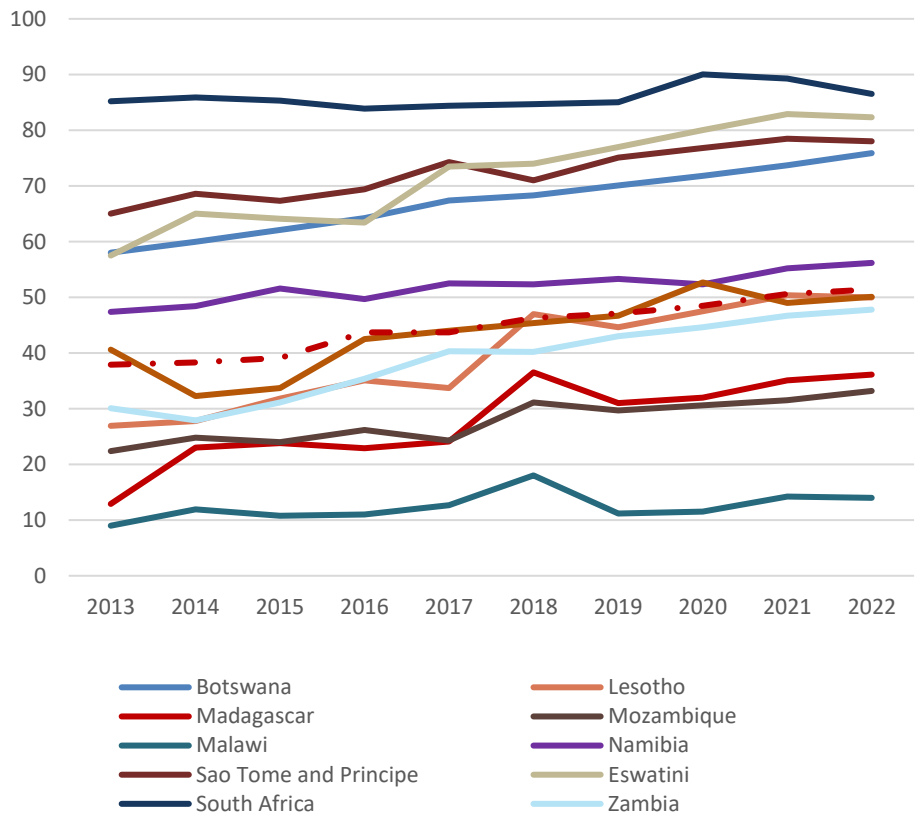
RES AFRICA FOUNDATION

CONNECTING THE DOTS

OFF-GRID SOLUTIONS COULD SUPPORT ACCESS TO ELECTRICITY BUT ARE NOT FULLY EXPLOITED

Access to electricity in the region greatly varies among its countries

ACCESS TO ELECTRICITY (% OF TOTAL POPULATION)



Overall, the regional rate of access to electricity has improved in the last decade, although the increase is mainly due to enhanced access at urban level. Some countries have achieved impressive results: Botswana's share of the population with access to electricity has grown from 58% in 2013 to 76% in 2022, and Lesotho has almost doubled the rate from 27% to 50%.

Although not common in the region, three countries (Lesotho, Eswatini and Sao Tomé and Principe) have provided respectively +23%, +30% and +24% of their rural populations with access to electricity.

As of 2022, only 4 countries in the region (South Africa, Eswatini, Botswana and Namibia) are above the sub-Saharan average (51,4%) when it comes to total (rural + urban) access to electricity.

Source: World Bank, 2024

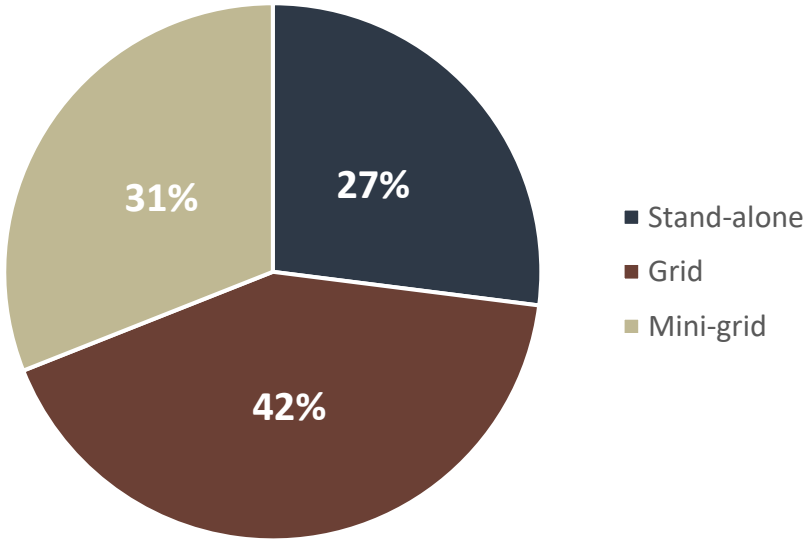
RES4AFRICA FOUNDATION

CONNECTING THE DOTS

OFF-GRID SOLUTIONS COULD SUPPORT ACCESS TO ELECTRICITY BUT ARE NOT FULLY EXPLOITED

Off-grid solutions are set to become pivotal to achieve global electrification goals

SHARE OF PEOPLE GAINING ACCESS TO ELECTRICITY BY TECHNOLOGY IN AFRICA IN THE SUSTAINABLE AFRICA SCENARIO, 2022-2030



For the first time in two decades, in 2022 the world saw a reversed trend in access to energy, moving further away from the target of SDG7. It is estimated that if this path will not change, 660 million people worldwide will still lack access to energy by 2030.

Some 5 million people in Southern Africa used decentralized systems at the end of 2019, most of them in Zambia, Malawi and Madagascar. More and more governments are including off-grid solar in their electrification plans and investments worldwide are steadily increasing.

As an example, the ASCENT Program is a multi-phase programmatic approach that aims at providing access to electricity to 100 million individuals in 20 countries across Eastern and Southern Africa until 2030. The program will be kickstarted in Rwanda, Sao Tome and Principe, Somalia and Tanzania.

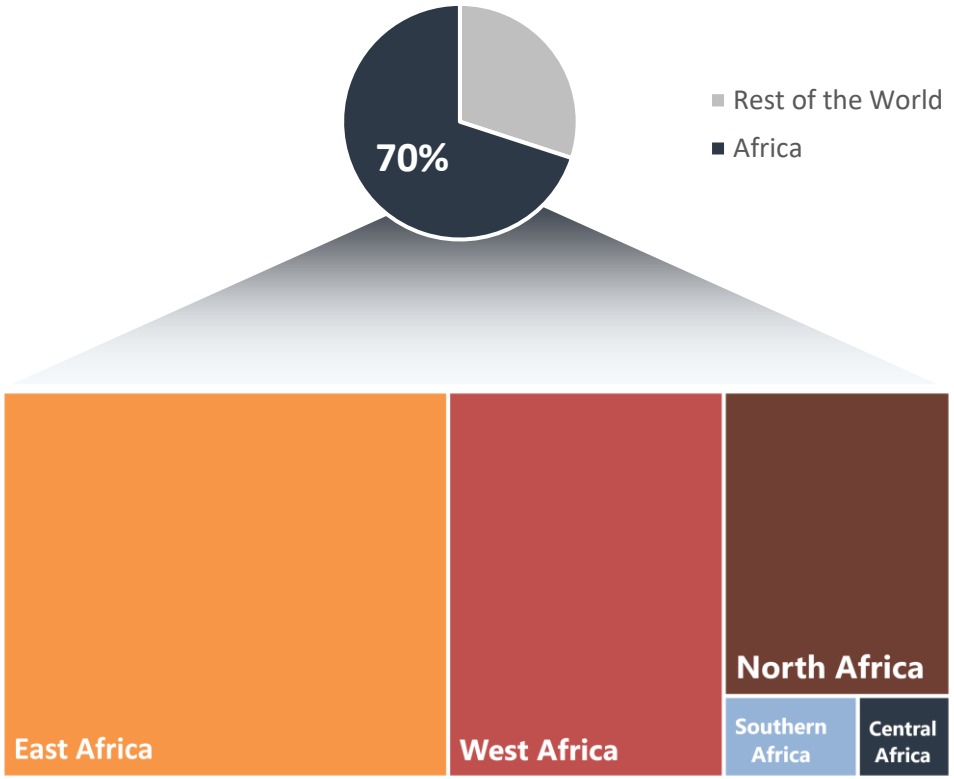
Source: IRENA, Africa and its regions, 2021; World Bank, 100 Million People in Eastern and Southern Africa Poised to Receive Access to Sustainable and Clean Energy by 2030, 2023; GOGLA, Off-Grid Solar Market Trends, 2024; IEA, Africa Energy Outlook, 2022

RES 4 AFRICA FOUNDATION

OFF-GRID SOLUTIONS COULD SUPPORT ACCESS TO ELECTRICITY BUT ARE NOT FULLY EXPLOITED

Southern Africa receives a trivial share of off-grid investment

INVESTMENTS IN THE OFF-GRID SECTOR FROM 2010 TO 2020 (MLN $)



In 2010-20, Southern Africa attracted only 3% (USD 52 million) of total investment in off-grid renewables in Africa. Mozambique and Zambia received 65% of all commitments to the region.

It is essential to establish which areas are more suitable for the deployment of Solar Home Systems, by taking into account affordability, distance to national grids, electrification rates, presence of mobile networks, population density, income level etc. This data would allow companies operating in the field to identify possible routes to market and tailor market expansion strategies.

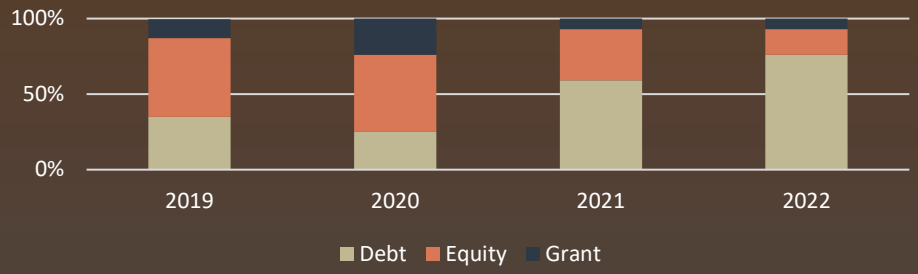
As an example, the outcome of Power Africa's efforts through various off-grid support initiatives helped 940.000 businesses and homes gain access to electricity in Malawi, Mozambique and Zambia alone.

Source: IRENA, Africa and its regions, 2022;

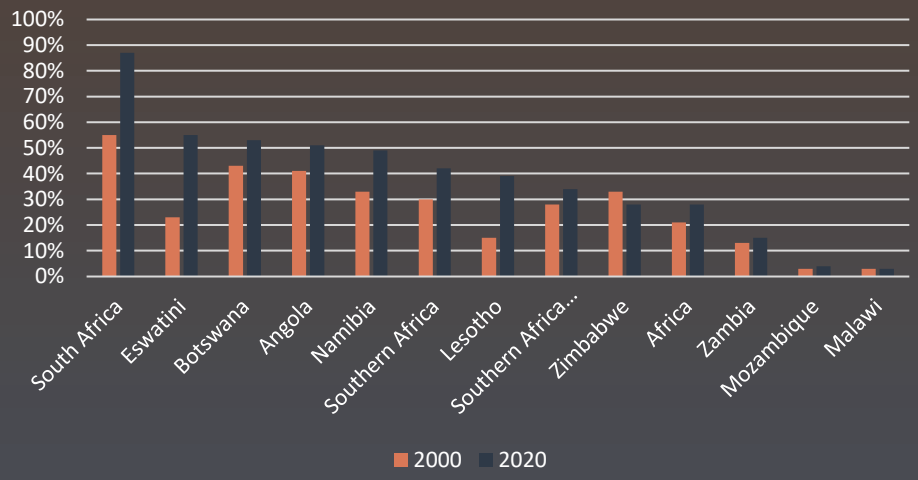
FOCUS ON

Clean cooking solutions are spreading across the region and saw a growing private sector interest in the last decades

FINANCING RAISED BY CLEAN COOKING COMPANIES (% OF TOTAL CAPITAL SHARE), 2023



SHARE OF POPULATION WITH ACCESS TO CLEAN COOKING (%), 2010-2020), 2023



Source: IEA, Water Energy Outlook, 2024

It is estimated that 4 Billion USD per year will be needed to achieve universal access to clean cooking solutions in Sub-Saharan Africa. Interestingly, private sector has been able to attract more and more capital in the last years in the form of debt (the largest part), equity and a small percentage of grants, mainly thanks to innovative financing models. Nevertheless, the public institutions retain a leading role in the sector.

Only 7 countries in Africa have explicitly mentioned e-cooking targets in their NDCs, and none of them are in Southern Africa. Other forms of clean cooking are more widely adopted, with another 31 countries mentioning them in their NDCs, including solutions such as improved cookstoves (South Africa, Eswatini, Lesotho, Malawi), replacement of fuel with LPG (Lesotho, Mozambique) and local sustainable charcoal production.

Typically, the penetration of e-cooking or other clean cooking technologies is associated with high percentages of electricity access at country level.

CONNECTING THE DOTS

2. What limited the RE growth

RES AFRICA FOUNDATION

CONNECTING THE DOTS

A conducive investment climate is still lacking

2. What limited the RE growth

RES AFRICA FOUNDATION

A CONDUCIVE INVESTMENT CLIMATE IS STILL LACKING

Most of the countries in the region have put in place targets for renewables, but few of them are on track to reach them

	RES TARGET (CAPACITY)	ACTUAL INSTALLED (2023)
ANGOLA	7.5% by 2025 (excl. large hydro)	4.5% (excl. hydro)
MADAGASCAR	80% by 2030 (generation)	41%
MOZAMBIQUE	100 MW of new wind cap.	None
SOUTH AFRICA	41% by 2030 (incl. hydro)	37%
ZAMBIA	10% by 2026 (excl. large hydro)	6% (excl. hydro)

Some pioneering countries have put in place mechanisms to support the development of renewable energy, such as feed-in tariffs and competitive tenders (Namibia, South Africa, Zambia).

Many projects are planned but are not signed off or reach financial closure due to a number of regulatory and contractual hurdles. Recently, geopolitical conflicts have led to rising component costs, making projects suddenly economically unviable. However, most often delays from securing land rights, permits or grid connection make projects unfeasible.

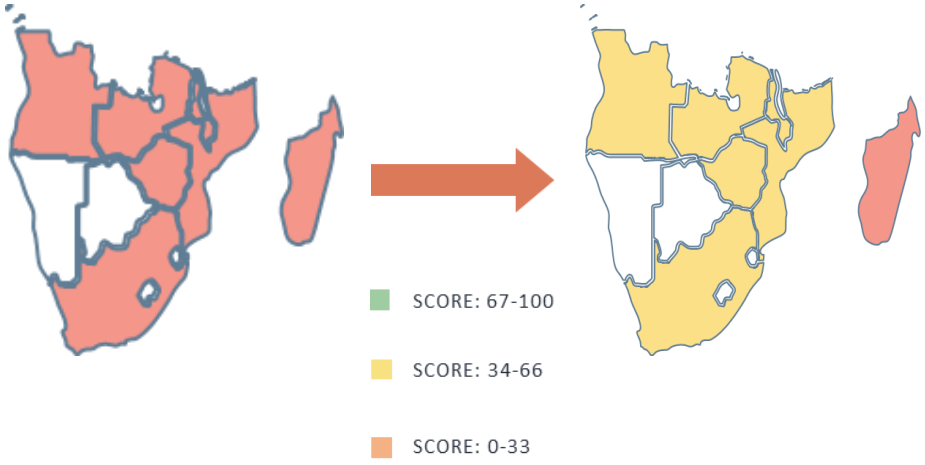
In many cases, even when funding and technical capacity are available, these administrative hurdles slow progress, preventing renewable energy from being deployed at the scale and speed needed to meet growing energy demands and climate goals.

Source: BNEF, National Plans and Strategies

A CONDUCIVE INVESTMENT CLIMATE IS STILL LACKING

The region has seen an overall development in its regulatory frameworks for RES, but room for improvement remains

RISE SCORE BY COUNTRY IN SOUTHERN AFRICA 2013 – 2023 (OVERALL SCORE)



RISE reflects a snapshot of a country's regulations in the energy sector, according to the 4 pillars of sustainable energy: Energy Access, Energy Efficiency, and Renewable Energy, and Clean Cooking.

Between 2013 and 2023, Southern African countries have made notable progress in improving their regulatory frameworks for sustainable energy. Most nations in the region have reached an intermediate level of regulatory advancement, creating a more structured and supportive environment for renewable energy development.

Countries such as South Africa, Namibia, Botswana, Zambia, and Mozambique have taken significant steps to enhance sustainability and facilitate regional energy trade. These improvements include refining policies, streamlining approval processes, and fostering cross-border electricity exchanges.

These efforts have boosted renewable energy markets and attracted foreign direct investment (FDI) in solar, wind, and hydropower projects, positioning these nations as leaders in Southern Africa's energy transition.

Source: RISE – ESMAP, 2013 - 2023

A CONDUCIVE INVESTMENT CLIMATE IS STILL LACKING

Domestic and external risks hamper the region's ability to attract investments

MAJOR BARRIERS PERCEIVED BY THE PRIVATE SECTOR AND MAJOR INDUSTRIAL PLAYERS IN SA

Slow paced and inadequately implemented reforms

Monopsonist behaviour by utilities, high off-taker risk and other vested interests

A deteriorating or **opaque sovereign credit profile**

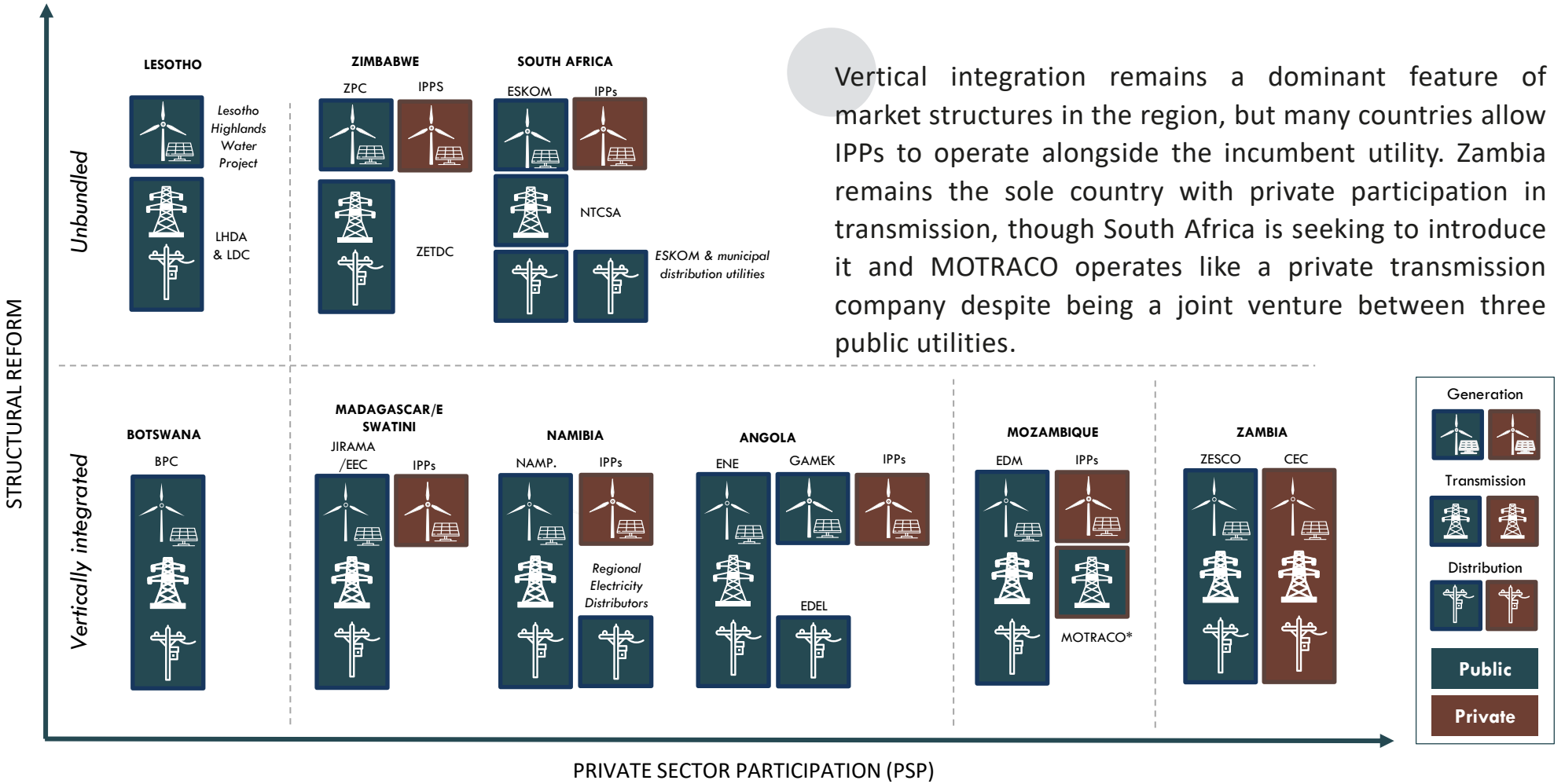
Lack of bankable projects

Challenges persist, such as South Africa's energy policy uncertainty and Zambia's regulatory delays, which hinder private sector involvement and slow the shift to renewables. In Zimbabwe and Namibia, the dominance of state-owned utilities creates issues like delayed payments to independent producers, limiting competition and progress.

In contrast, nations like Lesotho, Malawi, Eswatini, Zimbabwe, and Angola face significant barriers to expanding energy access. Many continue to rely on coal, biomass, and other traditional energy sources due to infrastructure gaps and limited institutional capacity. These dependencies hinder renewable energy development and deter private investment. Broader challenges, including aging infrastructure, power outages, and economic vulnerabilities, further exacerbate these issues.

Source: African Development Bank, Southern Africa Economic Outlook, 2023

Market structures are also heterogenous and often limit private participation



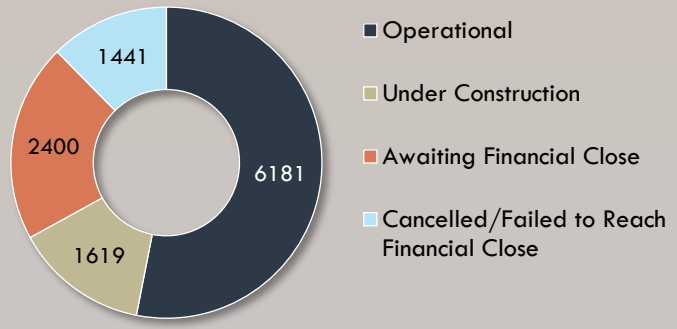
Vertical integration remains a dominant feature of market structures in the region, but many countries allow IPPs to operate alongside the incumbent utility. Zambia remains the sole country with private participation in transmission, though South Africa is seeking to introduce it and MOTRACO operates like a private transmission company despite being a joint venture between three public utilities.

Notes: MOTRACO is a joint venture between 3 state-owned utilities: Eskom (South Africa), EEC (Eswatini) and EDM (Mozambique)

FOCUS ON

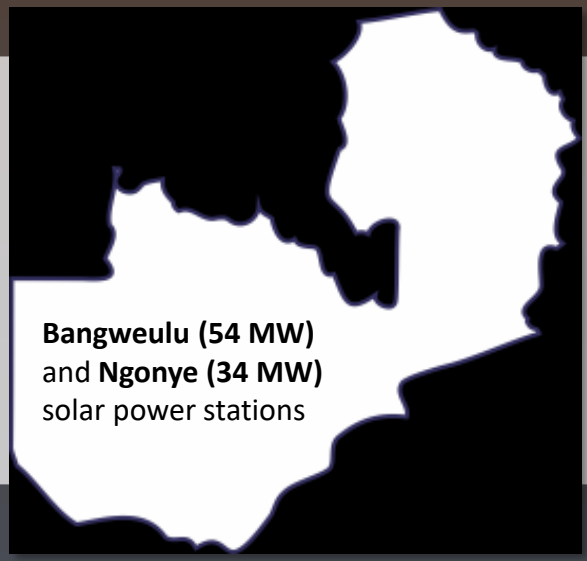
South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

CAPACITY PROCURED BY STATUS (MW)
(as of December 2024)



South Africa was the main recipient of renewable energy investment in the region, largely thanks to its competitive procurement program, the REIPPPP, launched in 2012. As of December 2024, 7 bid windows have been awarded for a total procured capacity of ~11600 MW. Under a dedicated programme, South Africa also procured 975 MW of BESS by the end of 2024 with an additional 616 MW expected to be procured in 2025.

The World Bank Group's Scaling Solar program assisted Zambia in establishing public-private partnerships for renewable energy. In 2015, Zambia's inaugural competitive auction for up to 100 MW of solar power attracted 48 developers. Two projects were selected for a total capacity of 88 MW, achieving a record low of approximately 6 US cents per kilowatt-hour. By early 2019, both projects were operational. Although a second bidding round for 500 MW was scheduled for 2017, the auction was postponed due to financial issues at ZESCO, the national utility.



Source: DMRE, Independent Power Producers Procurement Programme (IPPPP) as at 30 June 2024, 2025; IRENA, Renewable Energy Market Analysis: Africa and its Regions, 2022
Note: REIPPPP = Renewable Energy Independent Power Producer Procurement Programme

CONNECTING THE DOTS

The benefits of regional integration are yet to be fully reaped

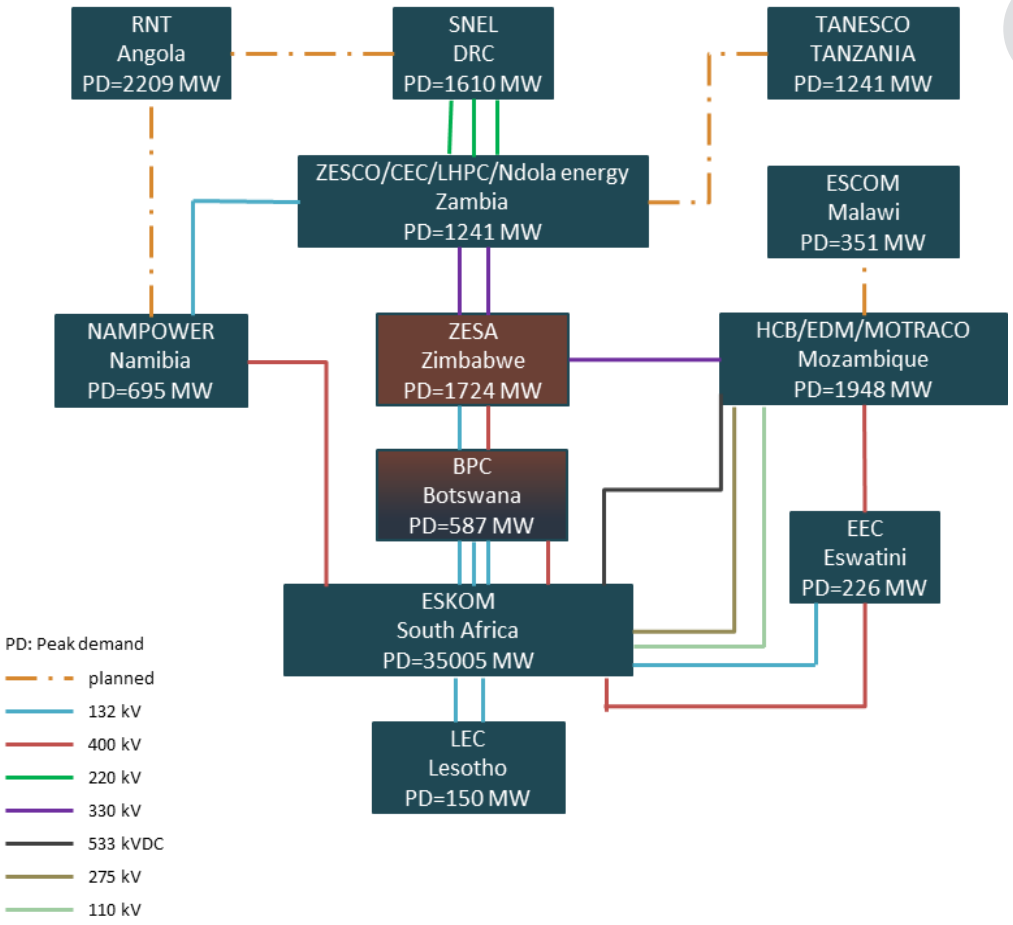
2. What limited the RE growth

RES AFRICA FOUNDATION

CONNECTING THE DOTS

THE BENEFITS OF REGIONAL INTEGRATION ARE YET TO BE FULLY REAPED

Southern Africa is home to the most developed power pool in Africa



Regional electricity system integration enhances energy security by allowing countries to share resources and balance supply and demand more effectively. It reduces costs through economies of scale and increased competition, leading to more affordable electricity prices for consumers, and support the integration of renewable energy sources.

Founded in 1995 by 12 of the 15 SADC member countries, SAPP hosts the continent's only active electricity market platform, having launched Short-Term Energy Market trading in 2001.

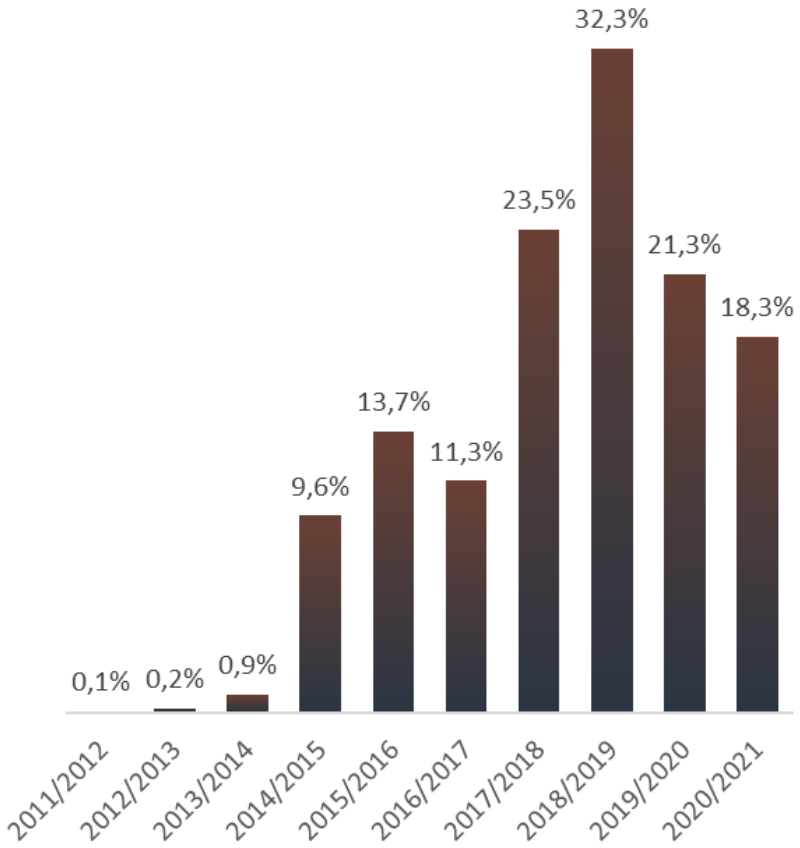
As of 2024, the SAPP market has four trading portfolios, namely Forward Physical Market – Monthly (FPM-M), Forward Physical Market – Weekly (FPM-W), Day-Ahead Market (DAM) and Intra-Day Market (IDM).

Source: ICED, Opportunities to Support and Increase Regional Power Trading in Southern Africa, 2019; SAPP, Annual Report 2021

RES AFRICA FOUNDATION

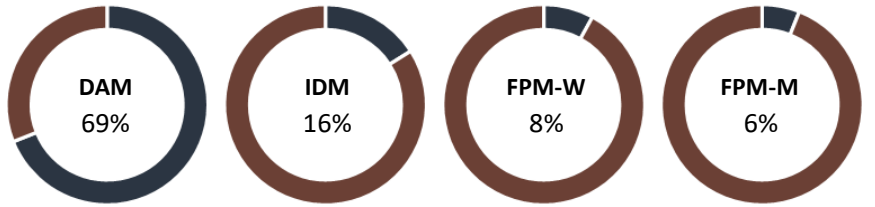
Competitive trading has been gaining ground in the SAPP

SHARE OF ELECTRICITY TRADED ON THE COMPETITIVE MARKET



The majority of trades in the SAPP are through bilateral contracts between member utilities, but since the introduction of the first Day-Ahead Market in 2009, the competitive markets have been gaining share. Most of the electricity traded competitively in the region is traded on the DAM, with the remaining one-third of trades split between the Intra-Day and Forward Physical Markets, established in 2013 and 2016, respectively.

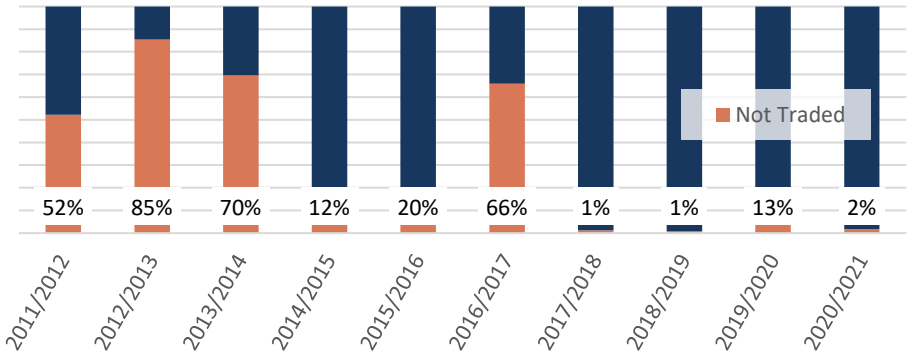
TOTAL TRADED VOLUMES AS OF 31ST OF MARCH 2021:
1.498,55 GWH



Source: ICED, Opportunities to Support and Increase Regional Power Trading in Southern Africa, 2019; SAPP, Annual Report 2021
Note: DAM = Day-Ahead Market, IDM = Intr—Day Market, FPM-W = Forward Physical Market – Weekly, FPM-M = Forward Physical Market – Monthly

Challenges remain for the full realization of regional integration benefits

ELECTRICTY MATCHED BUT NOT TRADED DUE TO TRANSMISSION CONSTRAINTS (SHARE OF TOTAL MATCHED %)



PRIORITIZATION IN ALLOCATING TRANSMISSION CAPACITY IN SAPP

Ranking	Contract type
1	Emergency energy support
2	Firm bilateral contracts as nominated day-ahead
3	FPM-Monthly and FPM-Weekly
4	Day-ahead market
5	Non-firm bilateral contracts
6	Intra-day market
7	Pay-back of 'inadvertent' energy (essentially imbalance)

Notwithstanding the benefits of regional integration, electricity trade across the region has grown slowly, and only accounts for ~3% of electricity supply.

The single most important constraint on power trading in the SAPP is the physical transmission infrastructure. Angola, Tanzania, and Malawi are still not connected to the SAPP grid. Additionally, existing lines often have little availability for market trades because of the prioritization of bilateral trades between member states, resulting in a significant share of matched trades failing to be implemented.

Additional constraints to the further development of SAPP include but are not limited to concerns around the creditworthiness of many national utilities, the need for new commercial models to unlock investment in transmission projects, and the lack of liberalization in some of the national electricity markets.

Source: ICED, Opportunities to Support and Increase Regional Power Trading in Southern Africa, 2019; SAPP, Annual Report 2021; Africa GreenCo, 2017

CONNECTING THE DOTS

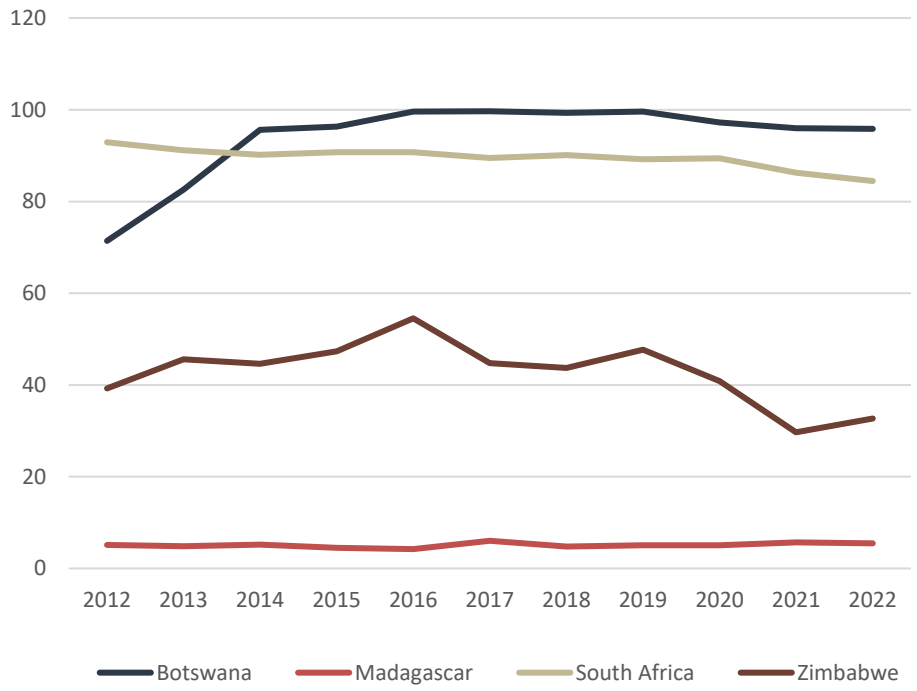
The global transition era brings opportunities and challenges for the region

2. What limited the RE growth

RES AFRICA FOUNDATION

Coal and fossil fuels remain dominant energy sources in many Southern African countries, although RES deployment is progressing

ELECTRICITY GENERATION – COAL (% SHARE OF TOTAL GENERATION)



Starting from a high base of coal, natural gas and hydropower, Southern Africa is increasingly transitioning towards variable renewable energy sources. Botswana, with over 3,200 hours of sunshine annually, is ideal for large-scale solar energy projects. Namibia aims for 1,000 MW of solar capacity by 2030, and Mozambique aims to harness its coastal wind resources.

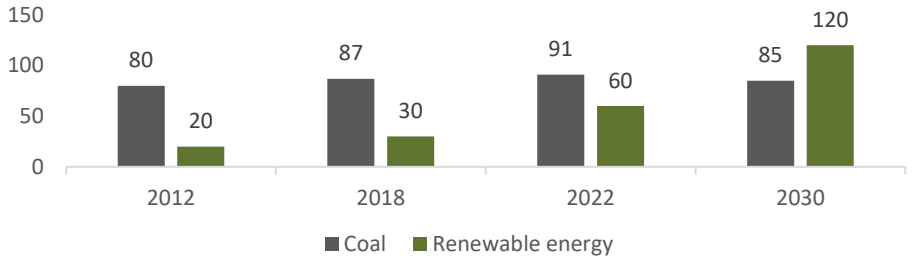
At the same time, Mozambique's natural gas sector is advancing with the Coral Sul floating LNG project, Mozambique's first operating LNG project and the second-largest FLNG vessel in the world, achieving over 3.4 million tons of LNG production annually.

This highlights the region's ongoing trade-off between expanding variable renewable energy and continuing reliance on coal and natural gas. While renewable energy is gaining momentum, fossil fuels remain a key economic driver, particularly for energy security, export revenues, and industrial applications.

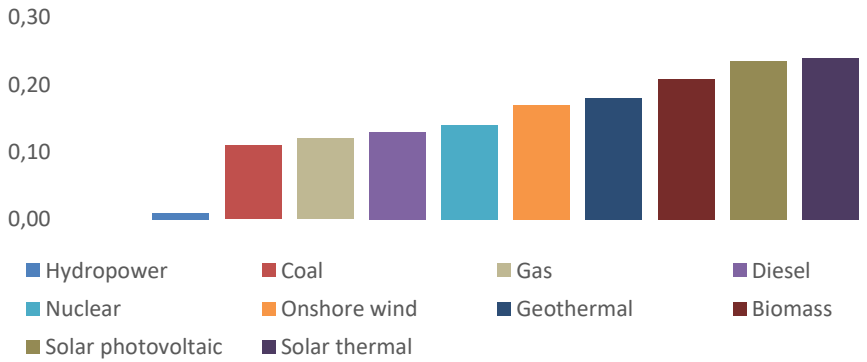
Source: Ember Electricity Data Explorer, ember-energy.org; Further Africa, Top 5 upcoming solar PV projects in Africa, 2022; ENI, Coral South, the gas field off the coast of Mozambique, 2022
Note: FLNG = Floating Liquefied Natural Gas

The energy transition is poised to significantly shift the workforce from the coal sector to renewable energies

EMPLOYMENT IN COAL AND RENEWABLE ENERGY SECTORS IN SOUTH AFRICA (THOUSANDS)



OPERATION AND MAINTENANCE JOBS CREATED BY ENERGY SOURCES IN SOUTH AFRICA (JOBS/GWH)



The transition may exacerbate socio-economic inequalities, particularly for communities reliant on coal mining. For instance, the early shutdown of the coal-fired Komati Power Station in South Africa has impacted hundreds of workers. As countries across the region move towards renewable energy, reskilling initiatives are crucial to mitigate unemployment and equip workers with the skills needed for emerging sectors.

Zambia plans to train 10,000 youths in solar technologies by 2025, while Angola's large-scale solar and wind projects are expected to create around 20,000 new jobs by 2030. Similarly, Botswana's solar initiatives are projected to generate approximately 5,000 job opportunities over the next decade.

Beyond direct employment, the renewable energy transition is driving growth in supporting industries such as manufacturing, installation, and maintenance of solar panels, wind turbines, and battery storage systems.

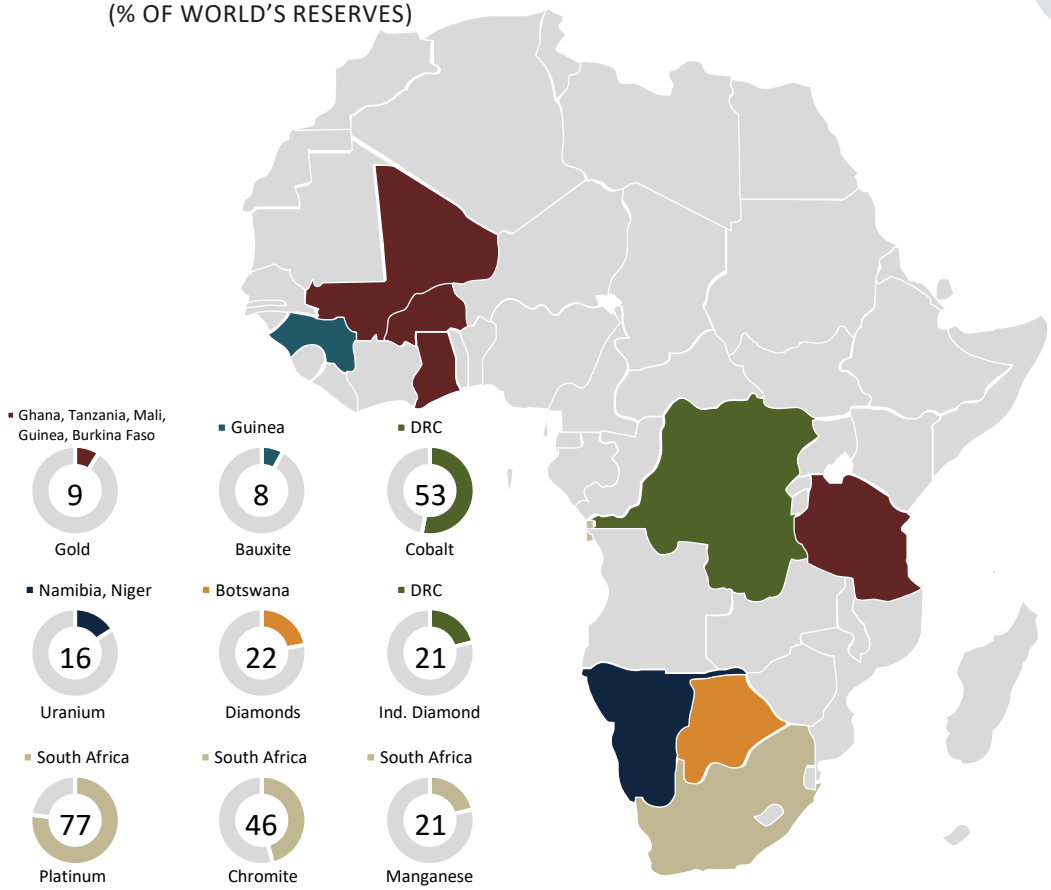
Source: Columbia | SIPA, Center on Global Energy Policy, Critical Minerals to the Rescue? Zambia and Zimbabwe Implement Divergent Policies Amid Climate Upheaval, 2023; Statista, Africa: renewable energy employment by region, 2024

CONNECTING THE DOTS

THE GLOBAL TRANSITION ERA BRINGS OPPORTUNITIES AND CHALLENGES FOR THE REGION

Critical minerals play a pivotal role in the development of RE technologies, and represent an opportunity if responsibly managed

MAPPING AFRICA'S MINERAL WEALTH: SELECTED COUNTRIES
(% OF WORLD'S RESERVES)



South Africa is a global leader in platinum and palladium production, critical for catalytic converters and hydrogen fuel cells. Zimbabwe possesses significant reserves of lithium and platinum, essential for batteries used in electric vehicles and energy storage systems. Zambia and Madagascar are major producers of copper, cobalt, and nickel, crucial for electrical wiring, magnets, and battery electrodes.

These minerals not only support the growth of renewable energy industries but also present economic opportunities for mining and processing sectors across the region. However, sustainable mining practices and resource management are essential to minimizing environmental impacts and ensuring long-term resource availability.

Balancing economic growth with environmental responsibility remains a key challenge, necessitating policies that promote sustainability in mining operations.

Source: Columbia | SIPA, Center on Global Energy Policy, Critical Minerals to the Rescue? Zambia and Zimbabwe Implement Divergent Policies Amid Climate Upheaval, 2023; WhiteCase, Southern Africa's PGMs are on the rise, 2021; IMF, Digging for Opportunity: Harnessing Sub-Saharan Africa's Wealth in Critical Minerals, 2024; Africa progress Panel, 2023

RES AFRICA FOUNDATION

CONNECTING THE DOTS

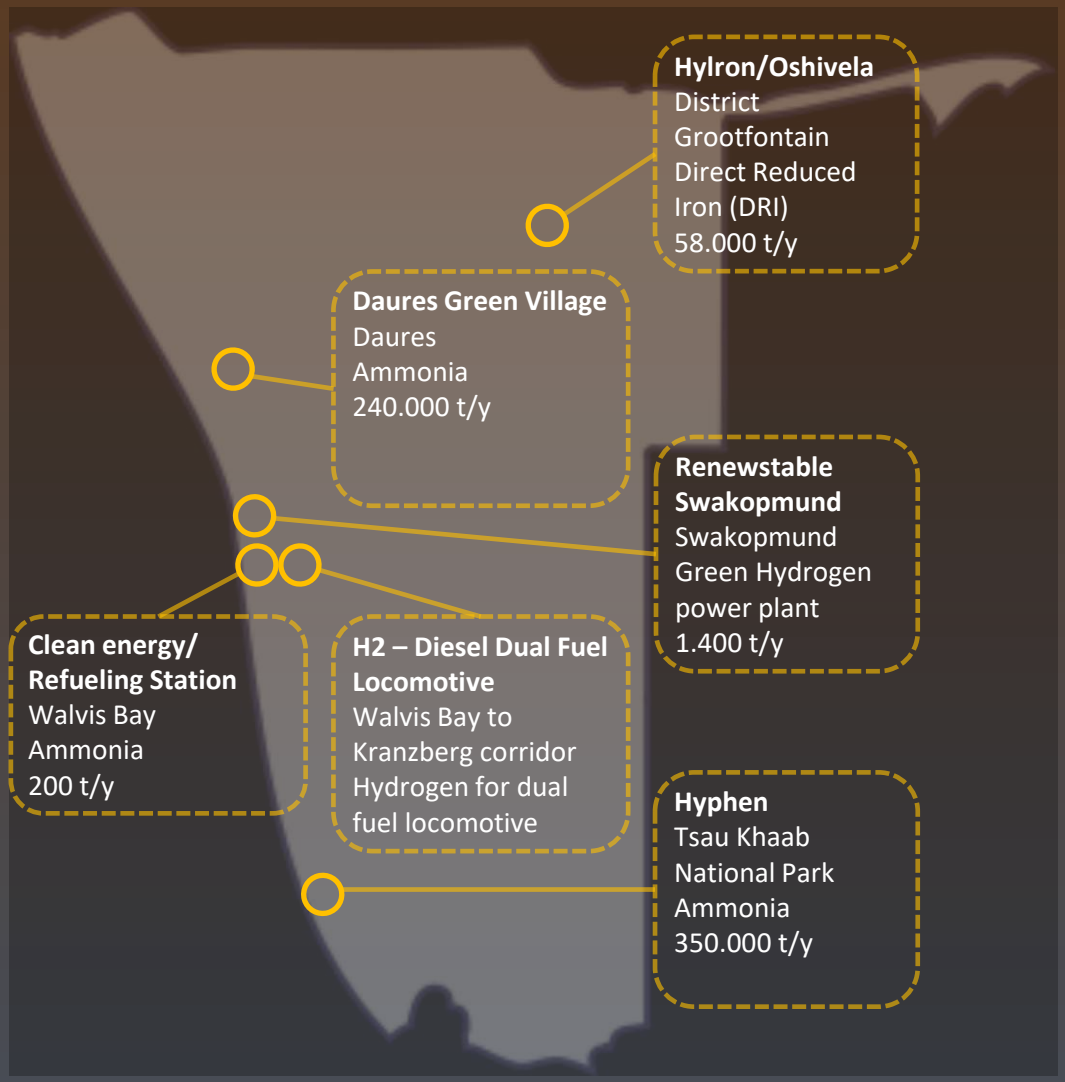
FOCUS ON

Namibian Green Hydrogen Project

Namibia is emerging as a leader in green hydrogen production, driven by its abundant solar and wind resources. The Namibian Green Hydrogen project, one of the largest in Africa, aims to develop a capacity of 5 GW, highlighting a significant opportunity for the country and the wider Southern African region to capitalize on renewable energy technologies.

However, despite its high potential, Namibia faces several challenges that could increase the cost of green hydrogen production. These include high transport costs, a lack of industrialization, and an emerging green hydrogen industry operating in a greenfield environment marked by a shortage of skilled workers and insufficient industrial and basic infrastructure.

Early pilot projects are already encountering these issues and will need to demonstrate effective solutions.



Source: Namibia Green Hydrogen Programme, 2024

RES AFRICA FOUNDATION

CONNECTING THE DOTS

Insufficient and uneven financing has limited adaptation and mitigation activities

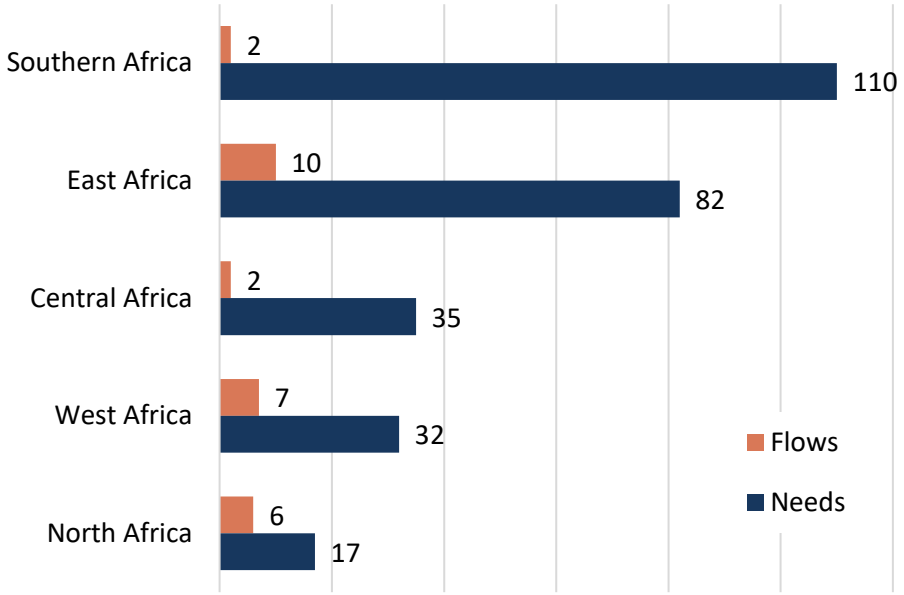
2. What limited the RE growth

RES AFRICA FOUNDATION

INSUFFICIENT AND UNEVEN FINANCING HAS LIMITED ADAPTATION AND MITIGATION ACTIVITIES

Southern Africa has the greatest climate action finance gap on the continent

CLIMATE FINANCE FLOWS AND NEEDS IN AFRICA (USD BILLION, ANNUAL AVERAGE)



With an estimated USD 1 trillion for the period 2020-2030, Southern Africa reports the greatest regional climate finance needs, representing roughly 37% of the continental total.

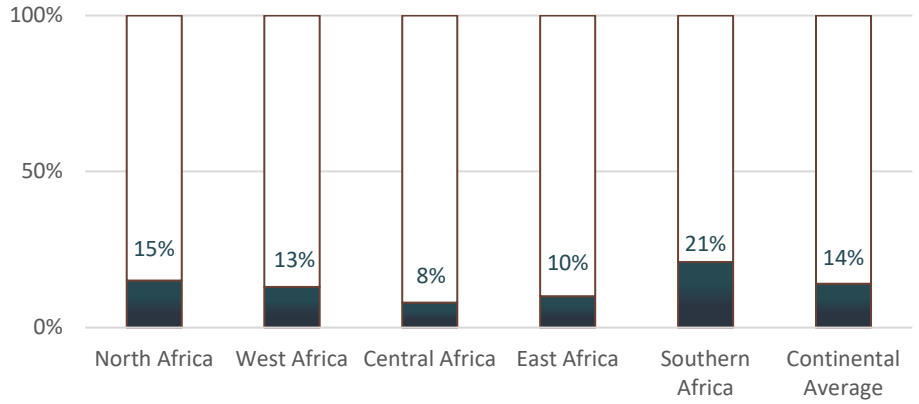
These needs are unevenly split between climate action activities. Concordantly with its status as one of the regions most exposed to the adverse impacts of climate change, adaptation takes the lion's share of support required (70%), followed by mitigation (21%), loss and damage (7.7%) and other needs.

Average annual investments pale in comparison with estimated needs, leaving behind a 93% gap. Financial flows are split unevenly between countries, with South Africa alone receiving 28% of regional financing, followed by Mozambique with 18%.

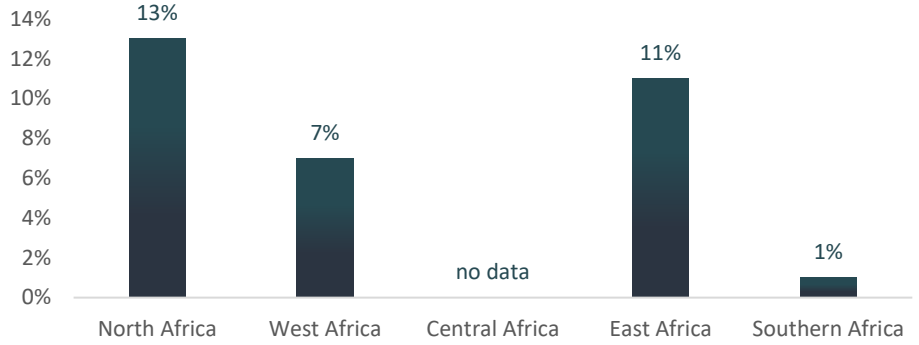
Source: African Development Bank, Southern Africa Economic Outlook 2023

Public investments in climate action are limited and additional private finance is needed to fill the gap

SHARE OF CLIMATE FINANCE COMING FROM PRIVATE SOURCE



SHARE OF NATIONAL PUBLIC BUDGET DEDICATED TO CLIMATE ACTION



Of the existing climate finance flowing into Southern Africa, 21% came from private sources – significantly higher than the continental average of 14%. However, public resources for climate action are scarce, as Southern Africa intends to dedicate only 1% of national public budgets to this end, a fraction of what its African counterparts plan to invest.

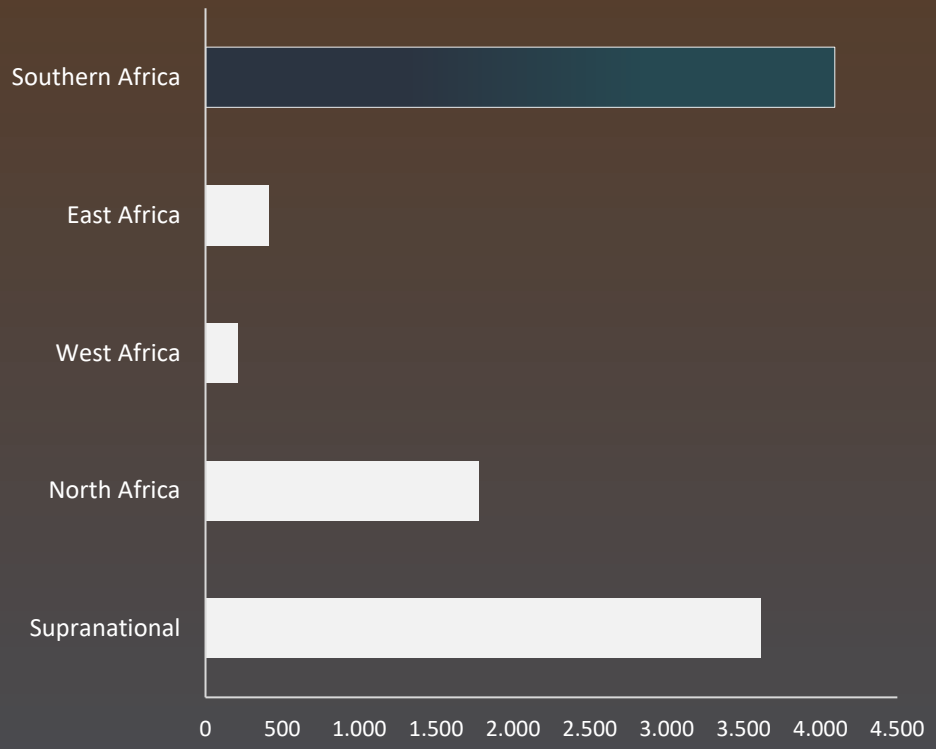
In spite of the overwhelming need for adaptation, current financial flows are mostly concentrated in mitigation. Investors tend to favor mitigation projects offering more predictable revenue streams to the less bankable adaptation projects. Indeed, in Southern Africa, renewable energy and energy efficiency projects accounted for nearly half of all climate action investments.

Source: African Development Bank, Southern Africa Economic Outlook 2023

FOCUS ON

A number of innovative financial instruments are available in Southern Africa to mobilize private sector finance

GREEN BONDS ISSUED IN AFRICA BY REGION (USD MILLION, AS AT END 2022)



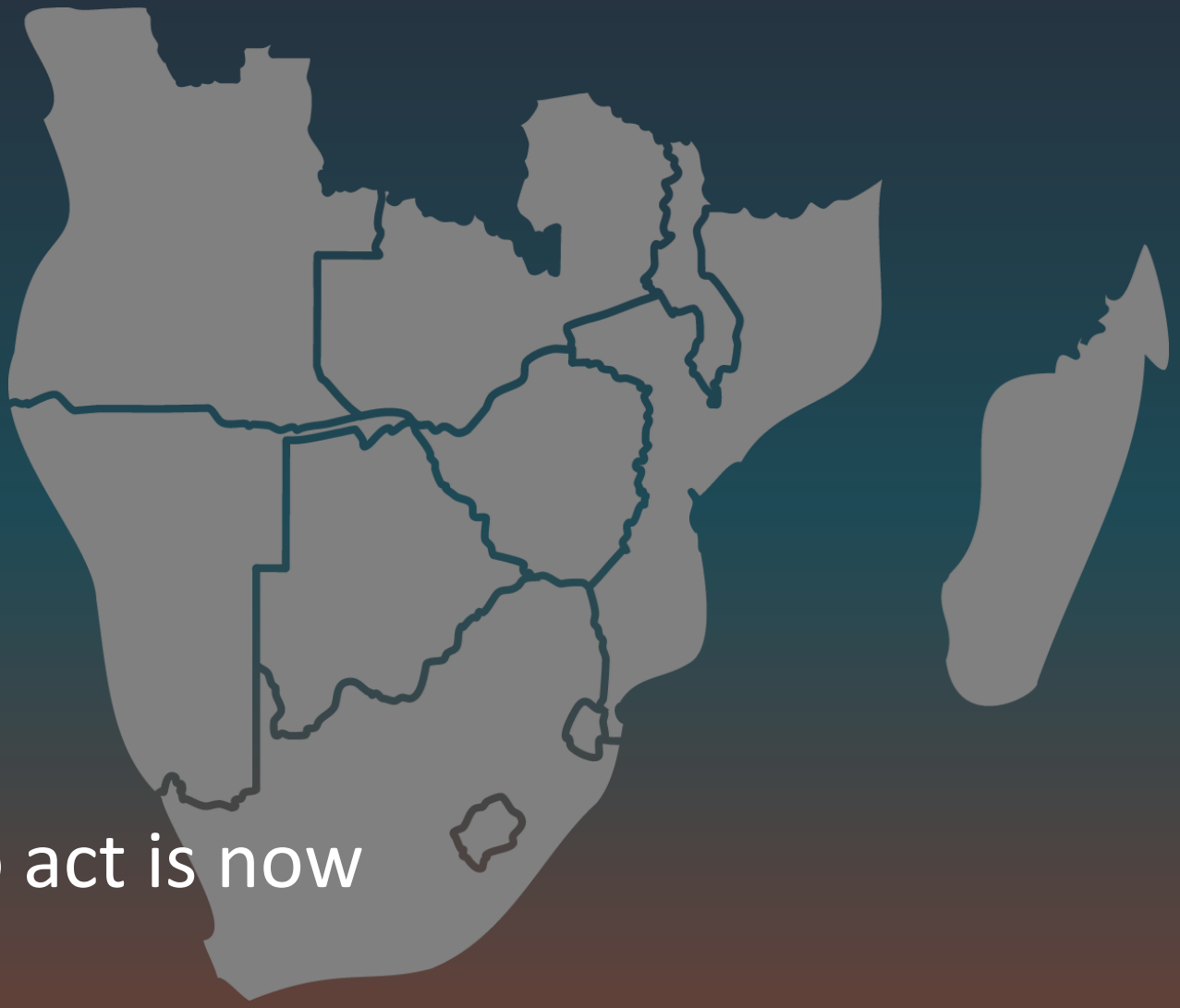
Green/climate bonds are a promising financial instrument for the region, and there is considerable investor interest in them. South Africa is the leader in their issuance, accounting for over 66% of green bonds in Africa, followed by Mauritius, Zambia and Namibia. Nedbank was the first African institution to issue a green bond in 2012 and was soon followed by other institutions and governments on the continent. Mauritius, Zambia and Namibia have also issued such bonds, with the majority of proceeds dedicated to the energy sector.

Carbon finance, which allows operators to monetize avoided carbon emissions, is also an attractive instrument for Southern Africa. Strict monitoring and reports, good governance, and accountability are key for the use of carbon finance.

Additional private finance could be channeled towards climate action in Southern Africa through the use of de-risking and credit enhancement mechanisms successfully implemented in other regions.

Source: African Development Bank, East Africa Economic Outlook 2023, Climate Bonds Initiative, Interactive Data Platform as of end 2022, retreived 03.05.2024.
Note: South Africa accounted for 3191 USD Mln as end of 2022, Mauritius for 697 USD Mln, Zambia for 200 USD Mln and Namibia 5 USD Mln.

CONNECTING THE DOTS



3. The time to act is now

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CONNECTING THE DOTS

THE TIME TO ACT IS NOW

Unlock strategic partnerships between the private and public sectors to foster renewable energy development at scale

Improving efficiency of public utilities to encourage private investors and overcome political, legal and economic risks inherently connected to public investments through state-owned enterprises that play a larger role in African investment environment compared to the world's average

Stimulate the development of Public Private Partnerships to mobilize resources which are beyond the governments' capacity. PPPs cofinance could unlock access to private sector skills and technology for governments, while better allocating risks between public and private entities

Scale up investments in off-grid solutions to foster small-scale entrepreneurship opportunities and reduce the rural-urban divide in access to electricity. This could also bring to the adoption of greener solutions for cooking and improved health conditions

Public funds could be more effectively allocated to speed up clean energy development in Southern Africa. Over the past decade, non-renewable energy has received more public funding than renewable energy, even as investments in solar energy production have increased

Development finance institutions can play a pivotal role in de-risking renewable energy investments, through different instruments such as guarantees, co-financing etc.

THE TIME TO ACT IS NOW

Implement multiple actions on the regulatory and market frameworks to improve national and regional policies

Open up the transmission segment to private sector participation. On this regard the national treasury of South Africa announced the launch of an independent power transmission pilot project.

Achieve cost-reflective tariffs: that will contribute to increased system efficiency and support accurate investment decisions and fairer consumer choices on the use of electricity

Adopt clear rules on commercial options for mini-grid operators and asset owners in case of main grid arrival. Regulations are designed to simplify the licensing process and provide a clear framework for mini-grid operators

Increase local ownership of energy projects, by enabling policies that are necessary to allow the involvement of citizens in the design, planning, implementation and management of energy projects

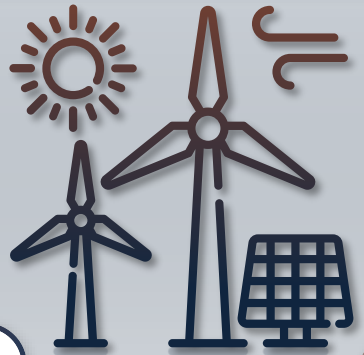
Simplify procedures for accessing authorizations and speed up the licensing process, such as the removal of the generation licensing cap in South Africa

THE TIME TO ACT IS NOW

Seize the opportunity of the lack of a widespread fossil fuel infrastructure to transition directly to a renewable energy-based economy

Fossil fuel producers in Southern Africa will have to adapt to a reduced global demand as the transition to greener technologies advances, with an impact on exports and therefore, on jobs

Give major focus to productive use of energy in the agriculture sector, given the relevance of the sector on GDP and livelihood



It is important for Southern Africa to develop industrial policies, to build skills, to create local value, and ensure local manufacturing of renewable energy equipment

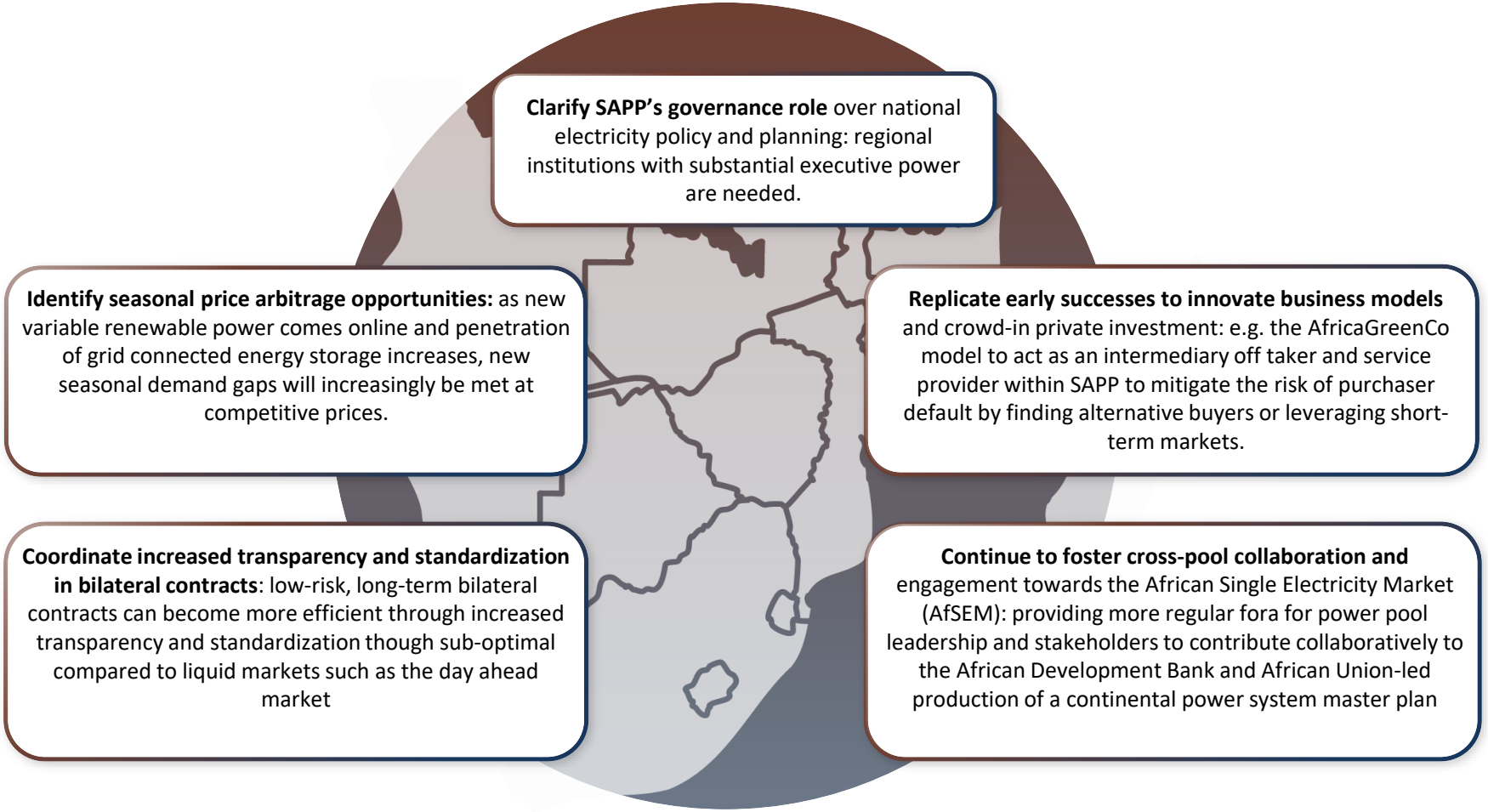
Mobilize private and public resources to phase out from fossil fuels energy systems, while ensuring that measures are in place to make renewable energy affordable for people

Develop local capacity for commodity processing and manufacturing to withstand the socio-economic vulnerability deriving from volatile commodity prices and dependence on such materials

CONNECTING THE DOTS

THE TIME TO ACT IS NOW

Strengthen regional governance and policy harmonization to advance regional integration and unlock its full potential



Clarify SAPP's governance role over national electricity policy and planning: regional institutions with substantial executive power are needed.

Identify seasonal price arbitrage opportunities: as new variable renewable power comes online and penetration of grid connected energy storage increases, new seasonal demand gaps will increasingly be met at competitive prices.

Replicate early successes to innovate business models and crowd-in private investment: e.g. the AfricaGreenCo model to act as an intermediary off taker and service provider within SAPP to mitigate the risk of purchaser default by finding alternative buyers or leveraging short-term markets.

Coordinate increased transparency and standardization in bilateral contracts: low-risk, long-term bilateral contracts can become more efficient through increased transparency and standardization though sub-optimal compared to liquid markets such as the day ahead market

Continue to foster cross-pool collaboration and engagement towards the African Single Electricity Market (AfSEM): providing more regular fora for power pool leadership and stakeholders to contribute collaboratively to the African Development Bank and African Union-led production of a continental power system master plan

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Looking back at the past
to face the present and plan
for a sustainable and prosperous
energy future for all

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