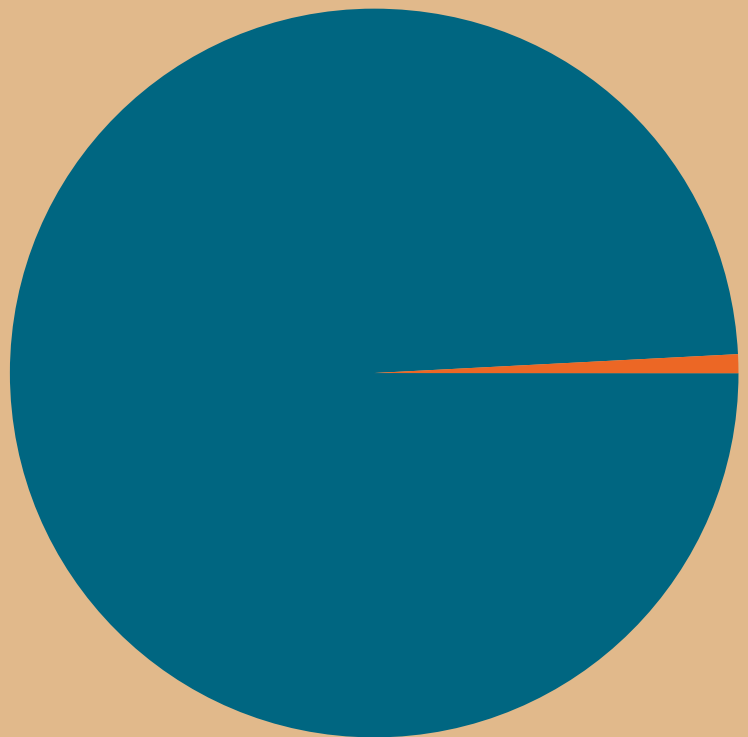




AFRICA'S ENERGY FUTURE IS RENEWABLE

Its sustainable economic development depends on it.

**THIS WAY
IS NOT
THE WAY**



 **RE investments
in Africa**

 **RE investments
in the world**

**WE NEED
A BOLD
COMMITMENT
TO DELIVER
SDG 7 IN AFRICA
BY 2030**

ABOUT THE RES4AFRICA FLAGSHIP PUBLICATION

Directed by RES4Africa Foundation's mission to "create enabling environments for scaling up renewable energy investments in Africa", the foundation's annual publication is an institutional tool to support dialogue and raise awareness on accelerating Africa's clean energy development. RES4Africa conducts continuous strategic intelligence to understand and act on the critical issues related to scaling up renewable energy investments in Africa.

As a key outcome of its strategic intelligence, the annual flagship publication seeks to:

- Shed light on a specific issue, thereby helping to raise awareness on a theme of convergence between the international development community, countries, and renewable energy business leaders;
- Provide high-level insight into the topic for decision-makers who are looking to follow RES4Africa Foundation's call for action on the way forward; and

- Contribute to the rapidly evolving international renewable energy scene, thereby helping to accelerate progress towards achieving universal energy access in Africa by 2030, in line with the United Nations' Sustainable Development Goals (SDGs) and the African Union Agenda 2063.

In light of global developments, RES4Africa's sixth flagship report aims to understand the rapidly changing global energy transition landscape, take stock of current challenges and opportunities for Africa's future energy pathways, and reaffirm RES4Africa's positioning on the role that renewable energy power technologies can play to support Africa's sustainable economic development.

The analysis' key messages inform the strategic positioning and work programs of RES4Africa, including its institutional relations with bilateral and multilateral partners.

The report draws upon existing RES4Africa's analysis, insights from members and partners, and African energy leaders – including RES4Africa's Executive Committee, the International Advisory Board, and the Youth Task Force. The publication was developed in collaboration with Enel Foundation, RES4Africa's longstanding knowledge partner, and was released during a dedicated event on June 15, 2023 in Rome, Italy, in cooperation with the United Nations Development Program (UNDP) Rome Center for Climate Action and Energy Transition.



Foreword

Salvatore Bernabei, President, RES4Africa

Roberto Vigotti, Secretary General, RES4Africa

Africa's Clean Energy Transformation – Renewables at the heart of Africa's future energy pathways

The global energy sector is in the midst of a transformation. Spurred on by a year of crisis and change – from the Covid-19 aftermath, the Russian invasion of Ukraine, and soaring prices, to the impacts of climate change – the global energy transition is now well underway, with ever-increasing clean energy investment and momentum for net-zero targets by mid-century. Energy security and sustainability nowadays go hand in hand and are top of the agenda for many governments worldwide. Africa is no

exception, with the continent facing rapidly growing energy demand, critical energy access gaps, and an imperative for development. Africa's imperative to accelerate its socio-economic development in a resilient and sustainable way could immensely benefit from accelerating clean energy deployment, as was stated at the COP27 in Sharm el-Sheikh. Failing to do so poses major threats to the continent already suffering the most from the impacts of climate change.

Yet, while global renewable energy investments reached record-high levels, renewables are still critically underfunded in Africa, signaling urgent work ahead. Despite global renewable energy investment reaching record-high levels of USD 434 billion in 2021, only 0.6% of that investment went to Africa – an 11-year low. This indicates that, despite strong investor appetite in the global clean energy transition, financing and investment don't end up yet where it is needed most. The continent had already attracted only 2% of global renewable energy investments in the past



two decades. Renewable energy investment must flow where it is most needed and where natural resources, such as wind and sun, are plentiful. Investment barriers need to be addressed, and clean energy financing has to scale up in Africa, or the continent will lose an immense opportunity to leapfrog 20th-century infrastructure toward reaching sustainable economic growth and development as per the UN Agenda 2030 and Agenda 2063 goals in the coming decades.

As energy decisions have become urgent, remaking the case for sustainable energy development in Africa is crucial. Today's energy policy, technology, and infrastructure decisions will determine the blueprint for Africa's future energy systems for the coming decades. Current macroeconomic conditions and geopolitical change mustn't distract from making Africa's power systems future-proof, inclusive, sustainable, and equitable. Although each country defines its journey and there is no single path solution for succeeding in the sustainable energy transformation of Africa's 54 countries, renewable energy technologies can unleash multiple opportunities to achieve

Africa's twin goals of sustainable access to energy and green industrialization. In the run-up to COP28 by the end of this year, it is more important than ever to make the business case for sustainable energy development in Africa and set the record straight on renewables to inform energy decisions.

Renewable energy is reaching new competitiveness levels, even in today's context of energy crisis. Power generation costs from renewable energy sources have already dropped for well over a decade. This trend now continues. Indeed, last year building new wind and solar generation became, on average, cheaper than building new fossil fuel power plants. Today, wind and solar PV LCOEs in Africa are below natural gas and compete with coal. Renewables are now the most cost-effective option for expanding installed capacity or replacing old assets worldwide, including in Africa. Beyond cost benefits, renewables also enhance energy security because of several factors, including their non-reliance on volatile fuels. Renewables are modular, adaptable, and very rapid to deploy, and can address access to energy

in remote areas. Renewable energy is also climate-resilient and catalyzes socio-economic development. Being flexible to adapt to the rapidly changing needs of the African continent is essential to ensure a just energy transition, and renewables are a vital ally.

Renewables hold new promise for Africa's green industrialization and supply chain development. A new industrial transformation is in the making, led by major policy developments across the world that push for clean energy technology investment and development. Industrial plans increasingly focus on development of clean energy technology supply chains and manufacturing, but also technologies, including green hydrogen, storage, e-mobility, digitalization of transmission and distribution grids, and industrial processes for improved use of critical minerals. Geopolitical realignment of energy supply and demand also complements the ongoing energy transition – particularly between Europe and Africa. The continent is well-positioned to capture the benefits of clean energy technology improvements. It should not miss the opportunity to benefit from the enormous advantages that can be unleashed from clean energy, power markets, grid & transmission infrastructure, and green hydrogen.

Large-scale deployment of renewables in Africa hinges on parallel investments both in transmission and distribution grids and storage infrastructure. Electricity grids are the backbone of electricity systems and the necessary carriers for increasing renewable electricity. In recent years, transmission and distribution infrastructure has received much less attention than generation capacity. Yet both are necessary to achieve SDG 7 and green industrialization in Africa. In the absence of grid development, future gains in renewable generation may be undermined by a grid network unable to cope with increasingly complex electricity flows. In many African nations, more investment in grid extension, interconnection, and digitalization is needed to enable access to electricity. Grid reinforcements are also essential for improving the quality of service provided to those connected to the grid. Storage has an increasingly important and complementary role across the entire value chain and enables access to energy at various scales. Grid management in light of increasing variable renewable electricity can be facilitated by battery energy storage systems.

Expectations for renewables in Africa are enormous, and we must ensure they become a reality. Many energy scenarios coincide that renewables are expected to lead

capacity additions in Africa's power sector by the decade's end, with solar PV estimated to outcompete other sources of power continent-wide by 2030. The International Energy Agency's most ambitious scenarios expect solar and wind energy to increase eight-fold in Africa by 2030. And IRENA's 1.5 °C scenario estimates that the share of renewable energy will reach up to 90% of power generation in 2050. As Africa's primary energy demand is set to rise by over 30% by 2030, renewable energy is expected to match over 80% of that rise. We must make these expectations a reality by overcoming investment barriers and create the future through collaboration, dialogue, and trust.

More than ever, energy pathways need to be shaped together. The private and public sectors need to work together to scale up renewable energy projects in Africa and achieve transformational change. With high expectations and evident benefits, we need to develop bold and coordinated action to ensure that investment levels reach new highs and turn expectations into a reality. In 2023, we expect the public sector to make new tools for de-risking private investment available, enabling a potential acceleration in the rollout of renewable energy projects in Africa. There is a need for a strong coalition of actors to foster trust and build public-private partnerships to bridge these investment gaps. We need

to see innovative public-private partnership collaboration to scale up investment in the continent's electrification to ensure we win the 21st-century energy transition with future-proof infrastructure.

The future is already here, and the time to act is now. This is why RES4Africa envisions renewables at the heart of Africa's energy future. The foundation acknowledges the complexity of Africa's energy transition debate and advocates with facts on the multiple benefits renewables can provide for countries to reach Africa's development goals, provided that the power infrastructure is enhanced in parallel and that flexible technologies and market instruments are adopted. We must embrace the opportunities renewable energy presents precisely because sustainable development is the bottom line. The foundation supports the creation of an enabling environment for clean energy investments in Africa and will continue to push this commitment forward. Working with members and partners, the foundation wants to be a key actor in making renewables the heart of Africa's energy. Together, we can make Africa's future energy and electricity systems future-proof, inclusive, sustainable, and equitable.

AFRICA'S ENERGY FUTURE IS RENEWABLE

Flagship Publication 2023

A global energy overview

The energy world is in the midst of a transformation following last year's unprecedented global energy crisis. Marked by a combination of factors, including the Covid-19 aftermath, the Russian invasion of Ukraine, soaring prices and the increasing impacts of climate change, 2022 was a year of change for the energy sector and the global economy. Most countries suffered severe economic repercussions and engaged in a fundamental rethinking of their energy strategies. Energy security and affordability became a priority for policymakers, industries, and households, in addition to sustainability. The coming together of these economic and geopolitical drivers with climate uncertainty highlights the clear need for an accelerated energy transition if the world is to effectively combat the adverse impacts of increasing impacts of climate change.

2022 saw a record high USD 1.1 trillion global investment in low-carbon energy technologies.

2022 saw a record high 6% increase in renewable energy capacity globally.

Despite energy security fears, the global clean energy transition is irrevocably in motion. The global events of 2022 have encouraged countries to set clean energy transition and industrial strategies and use renewable energy as an economic enabler. Over 140 countries are now committed to achieving net-zero emissions by mid-century. Several drivers, including the war in Ukraine, government policies, and technology developments, have helped to turbocharge the global clean energy transition, as is evident in the emergence of energy transition policy packages in, e.g., the USA and the European Union (EU), and elsewhere. Soaring investment in clean energy technology and ever-improving technology efficiencies reveal a shift towards a new global energy economy. In 2021, global investment in low-carbon energy technologies reached a record high of USD 1.1 trillion, with investment in renewable energy, energy storage, electrified transport, electrified heat, and hydrogen all reaching record levels. In 2021, investment in low-carbon energy technologies equaled investment in fossil fuel projects for the first time. And renewable energy capacity additions worldwide also reached a new high, increasing by 6% to nearly 295 GW globally. This shift occurred despite growing economic and geopolitical uncertainty, ongoing supply chain issues, tightening macroeconomic conditions, construction delays, and high commodity prices caused by the crises.

The costs of renewable energy technologies have been impacted in recent years, yet data suggest this is stabilizing. With the tightening of macroeconomic conditions throughout 2022, rising interest rates, inflation, and supply bottlenecks, some costs have increased for renewable energy projects. Raw material price increases started to affect the overall investment costs for new utility-scale PV and onshore wind plants, which are expected to be 15-25% higher than in 2020. Yet despite these increases, recent data suggest that at the end of 2022 the pace of cost increases seen earlier in the year started to stabilize. Expectations are that cost-competitiveness will continue to improve, especially as natural gas and coal prices continue to increase. Renewable energy is the most cost-effective power generation option in most cases, thanks to ongoing innovation and development in manufacturing. Solar PV is now the most affordable source of new electricity globally, including in Africa. And the number of renewable energy jobs will continue to increase as the global transition to net-zero economies will require further progress across the entire supply chain of clean energy technology.

Implications for Africa

Africa was severely impacted by last year's crises. The combination of the Covid-19 pandemic, Russia's invasion of Ukraine, and the impacts of climate change have unfortunately reversed much of the recent progress made towards SDG 7 goals and the 2030 Agenda in Africa. It has also led to the continent's first economic recession in 25 years, with rising debt and poverty levels, especially among the poorest. Africa's economies remain vulnerable to these events. The current crises have had a negative impact on Africa's energy systems, leading to rising energy security concerns and influencing critical energy infrastructure decisions. Energy poverty is on the rise again due to lower household incomes and logistical and financial hurdles related to the disruption of supply chains. Government incentives and the role of public utilities in alleviating the effects of the crisis have been uneven. In the meantime, Africa is increasingly facing the impacts of climate change despite having historically contributed the least to climate change. Making energy decisions that can help reverse these negative trends is crucial.

Africa faces key energy challenges to overcome in the coming decades. Access to affordable, reliable, and sustainable energy is a major challenge in Africa. The pandemic slowed the rate of new grid and off-grid connections, particularly for stand-alone off-grid systems. Population growth in Africa continues to outpace new access to electricity, with an estimated 560 million Africans still without access to electricity – 4% above pre-pandemic levels. To achieve universal access to energy by 2030, Africa's energy demand and supply landscape needs to evolve dramatically, with renewables expected to meet more than 80% of the increase in power generation by 2030. Access to electricity needs to be 3 times faster in Africa's cities and 4 times faster in remote areas to reach SDG 7. In addition to grid-based energy access extension, more than half of the new connections are to be reached via renewable, decentralized applications such as stand-alone solutions and mini-grids. Africa's expected significant economic growth in the coming

Africa experienced the first economic recession in 25 years as consequence of the polycrisis of 2019-2022.

Access to electricity needs to be 3 times faster in Africa's cities and 4 times faster in remote areas to reach SDG 7 goals by 2030.

Only 0.6% or USD 2.6 billion of global renewable energy investment went to Africa in 2021 – an 11-year low.

Africa would need only 8% of the annual USD 3-4 trillion investment per year until 2030 to reach net-zero goals by 2050, despite representing 17% of the world population.

Africa's clean energy transition needs to make sense for Africa's energy realities and sustainable development aspirations.

years, with GDP projected to reach USD 10 trillion by 2030 and USD 29 trillion by 2050, means that its rapidly expanding urban population and its industrialization needs will drive the continent's power demand.

Yet only 0.6% of the total global renewable energy investment in 2021 went to Africa – an 11-year low. While 2022 was a record-high for new renewable energy generation capacity globally, 2021 represented an 11-year low for establishing new generation capacity in Africa, with only USD 2.6 billion, or 0.6% of the total global USD 434 billion renewable energy investment going to Africa. This is a continuation from the past two decades, where only 2% of the total USD 2.8 trillion of global renewable energy investment went to Africa, with strong regional disparities. This reveals a major discrepancy between global and African investment levels in renewables and indicates urgent work ahead. Investment in clean energy in Africa remains concentrated in a few key markets, and the African clean energy investment landscape has not benefited significantly from any post-pandemic rebound. This signals an urgent need to act on the barriers hindering investment, private sector participation, and stepping up the needed infrastructure. To put this into perspective, the global energy transition requires USD 3-4 trillion investment per year until 2030 to reach net-zero goals by 2050, yet Africa would only need 8% of that worldwide investment, despite representing 17% of the world population.

Investment needs to be ramped up rapidly as there are big expectations for renewables and electrification in Africa. Renewable energy is the most cost-efficient technology in Africa, and solar and wind are expected to increase eight-fold to reach 27% of power generation by 2030. Electricity use is also expected to increase across all end-use sectors, driven mainly by households who will have increasingly obtained access to electricity. Proven renewable energy technologies with ongoing reductions in costs will have a crucial role to play in achieving universal access to energy for all Africans by 2030, supported by the emergence of new technologies such as green hydrogen. The decisions and actions taken in the next decade will determine whether Africa's future energy and electricity systems are future-proof, inclusive, sustainable, and equitable. Governments, development partners, and the private sector have an opportunity to work together to ensure a clean energy transformation is set in motion and enable it to be a catalyst for the expected economic growth and the improvement of livelihoods across the continent.

Urgent answers are needed to what Africa's future clean energy transition should look like in a way that makes sense for Africa's energy realities and aspirations. These will shape the strategic and infrastructure decisions being made, with consequences for the speed and scale of the sustainable and economic development ambitions and outcomes. At global scale, it is evident that, for most countries, the energy transition discourse is focused on energy security and decarbonization. From an African perspective, the focus and aspirations spotlight instead the need for continued development and enabling energy access. This combination of decarbonization and accelerating development agendas is also strong, given Africa's minor historical contribution to climate change. While alignment exists on the need for sustainable development, views differ on the continent's future energy mix. The call for a just and equitable energy transition narrative is also shaped by the reality of Africa's various energy profiles, including nascent and existing oil

and gas producer economies, the ongoing geopolitical realignment on energy, and energy security concerns. Current geopolitical developments are revealing a more fragmented world and new debates on the role of energy sovereignty, and market opportunities are impacting bilateral and multilateral engagement based on trust. The pathway to COP28 end of 2023 will require enormous trust-building efforts between African countries and industrialized economies to ensure a structured dialogue and foster alignment between leaders on defining and achieving global and Africa's energy transition goals.

Making the business case for renewables

Against a backdrop of uncertainty and need for urgent decision-making, it is crucial to make the business case for renewables. The attributes and benefits of renewable energy are well-known, still stand, and can make much sense for Africa. Time and time again, renewable energy technologies have been proven to be rapidly deployable, cost-efficient, have vast geographical potential, are climate-resilient, secure, and have multiple co-benefits that keep increasing – even in the context of global energy crises. Although there is no single path or silver bullet solution for succeeding in the sustainable transformation of Africa's 54 countries, and each country defines its journey, renewable energy technologies propose plentiful opportunities to support reaching Africa's twin goals of sustainable access to energy and industrialization, as per the UN Agenda 2030 and Agenda 2063 goals. By putting renewable energy at the heart of energy security, affordability, and sustainability plans, Africa has tremendous potential for sustainable development – more than ever before.

Renewable energy is reaching new competitiveness levels, even in today's context of energy crisis. It is now more cost-efficient to build new wind and solar than new fossil fuel power plants. Renewables are the least-cost option for expanding installed capacity or replacing old assets, and in some countries it is even more cost-effective to build new renewable energy capacity than continue to operate existing fossil fuel assets. Solar PV – already the cheapest power source in many parts of Africa – is expected to outcompete other sources of power continent-wide by 2030. Power generation costs from renewable energy sources have been decreasing for more than a decade, but last year, for the first time, solar PV, onshore and offshore wind became more competitive than natural gas globally and compete directly with coal. The global weighted average Levelized Cost of Electricity (LCOE) of new onshore wind projects added in 2021 fell by 15% year-on-year, while that of new utility-scale solar PV projects fell by 13% year-on-year, and offshore wind declined by 13%.

In a world where security has taken center stage, renewable energy is also effective for energy security in the long term. That makes renewable energy crucial in strengthening resilience in Africa against environmental risks, improving energy security, and fostering economic independence. Unlike conventional

Renewable energy is now the least-cost option for expanding or replacing old power generation assets in most of the world.

energy sources such as oil, gas, and coal, which can be found in a handful of African countries, renewable energy resources in Africa are abundant continent-wide. They can reduce the risks of exposure to supply disruption and price fluctuations. With the world's highest solar, hydro, wind, and geothermal energy potential, the continent is well-endowed to achieve energy security and, in doing so, Africa has the potential to become a renewable energy powerhouse.

Another benefit of renewables for Africa is the speed and ease with which they can be deployed and expanded. These technologies offer timely and easy deployment and expansion, outpacing the long lead times often associated with new fossil fuel-based power generation technologies. Being flexible to adapt to the rapidly changing needs of the African continent is essential to ensure a just energy transition. Renewable energy power plants can be connected to the power grid within two years, while smaller, stand-alone renewable energy applications have exceptionally short lead times. The latter is important for Africa, where these decentralized and modular solutions are ideal for quickly increasing urgent energy access needs in rural and peri-urban areas. They can also adapt to changing circumstances and growing needs, supporting industrialization and an ever-growing and urbanizing population.

Renewable energy infrastructure can offer resilience in the face of climate change impacts, to which Africa is among the most vulnerable regions in the world. Renewable energy infrastructure not only provides a way to achieve net-zero emissions and energy security more quickly, but it can also help to increase the energy system's resilience in the face of increasing extreme weather events. Unlike more conventional centralized grid systems, renewable energy systems can be scaled to suit the needs of specific communities, providing a more reliable and resilient energy supply. It also supports integration with other sectors, such as agriculture and water management, increasing efficiency and resilience and creating opportunities for greater agricultural activity and productivity at lower costs. Besides improving resource security, increased access to clean energy can also reduce the negative health impact associated with traditional energy consumption while benefiting communities.

The opportunities ahead

For Africa, renewable energy can unleash widespread opportunities for growth. Investing in renewable energy can greatly benefit sustainable socio-economic development by catalyzing economic growth, supporting the growth of urbanizing economies, creating jobs for youth, and improving livelihoods. Such investments have been shown to have an important multiplier effect on GDP growth, with every USD 1 invested in clean energy technologies resulting in an additional USD 0.93 of GDP growth. Clean energy projects can also help to develop greater social justice, gender, youth, and community empowerment by involving local stakeholders, reducing adverse health impacts, and expanding healthcare to remote areas. And, importantly, the renewable energy sector has the potential to create vast employment opportunities across the value chain, providing a promising prospect for Africa's future generations, expected to grow from 300,000 jobs today to up to 8 million jobs by 2050.

Investments in grid and storage infrastructure are a prerequisite to the large-scale deployment of renewables in Africa. The current state of power infrastructure in Africa represents an enormous untapped potential. The traditional centralized energy grid model found in most African countries, relying on large power stations and transmission lines, has struggled to keep up with the growing demand for electricity due to aging infrastructure and losses, leading to frequent blackouts and brownouts. Over 110 million Africans live right under the grid, without access to electricity. Power grid unreliability and losses hold back growth, costing countries up to 2% of their annual GDP and causing an indirect impact on productivity and competitiveness. Energy infrastructure has been plagued with underinvestment for years, with transmission and distribution networks attracting only 0.5% of Africa's energy investment in the past decade. Utilities have represented a roadblock to the cleaning up of the grid while also holding enormous potential to support Africa's clean energy transition. Improvements to power infrastructure, including transmission, distribution, and storage, will be essential to allow access to affordable, reliable, sustainable, and modern energy for all, as specified in SDG 7. Renewable energy development requires parallel investments in grid infrastructure and storage technology. Private sector business models and regional energy integration through the development of different regional power pools hold enormous promise for a sustainable future. By working together and engaging in power trade, neighboring governments can create and offer dependable electricity access to the region.

Replacing off-grid fossil-fuel-based solutions currently used by renewable energy for productive uses is critical. Frequent electrical outages in Africa result in around 8% of annual sales losses, and diesel generators are commonly used as backup systems. Over 75% of firms in sub-Saharan Africa experience electrical outages on average 8 times per month for more than 5 hours. Decentralized renewable energy systems can adequately power small businesses, schools, and health centers, etc., create economic opportunities and improve the quality of life in rural areas while reducing dangerous pollution. Commercial and industrial customers are turning to off-grid renewable energy systems as a potential power

Making the case for renewable energy needs to be factual: cost-competitiveness, energy security, modularity and rapid deployability, climate resiliency, as well as all the co-benefits attached, have been demonstrated over the past years.

Transmission and distribution have attracted only 0.5% of Africa's energy investment in the past 10 years, compared to 99.5% being directed to power generation.

Over 75% of firms experience regular power outages in sub-Saharan Africa.

Clean energy technology manufacturing, critical minerals, and green hydrogen represent a major opportunity for Africa to spur domestic development and industrialization.

Africa has the potential to produce green hydrogen at the cost of EUR 2/kg or less by 2030.

source reducing energy costs and dependence on aging grid infrastructure. Wind and hydropower are also being explored as potential sources of electricity for farms and rural communities. The agricultural sector, representing 60% of all jobs in sub-Saharan Africa, can benefit from renewable energy solutions such as solar-powered irrigation systems and biogas generators. Developing appropriate off-grid and decentralized solutions can improve the water-energy-food nexus and ensure food security.

Renewable energy also holds great promise for Africa's industrial development, including in clean energy technology, manufacturing and supply chains. Africa's industrial development is a key focus of the 2063 Agenda and could bring about transformation if supported by large-scale productive investment. Renewable electricity can catalyze the sustainable development of Africa's industries and supply chains, as it can help to power industrial transformation, electrify agriculture, and reduce diesel generator use. Accelerating renewable deployment in the power sector can speed up deployment in heating, cooling, transport, and industry. While it may not be the answer for all industrial sub-sector energy needs, especially for hard-to-abate sectors, renewable energy technologies are increasingly developing applications. The introduction and sustainable use of, for example, green hydrogen could sustainably industrialize Africa's carbon-intensive sectors. In addition, the critical mineral sectors represent a significant opportunity for Africa to further expand in local transformation and grow a supply chain for domestic consumption and export. By adopting sustainable mining practices and ensuring that the mining industry is socially responsible, Africa can ensure that its natural resources are utilized in a way that benefits both the environment and the local communities. Internationally, Africa has an opportunity to establish itself as a key player in the global clean energy market by investing in developing a sustainable supply chain for critical minerals and developing manufacturing and supply capacity of low-carbon energy technologies to other countries.

Momentum and expectations for Africa's green hydrogen potential is growing. Several projects have either been launched or are in the pipeline for these countries, with many targeting European markets. According to the IEA's Sustainable Africa Scenario, the continent could produce up to 5 Mt of hydrogen by 2030 and 20 Mt by 2050, with 80% from low-carbon technologies, at a cost of EUR 2/kg or less. Supported by the right planning and levels of investment, it could create a significant number of jobs and support continued economic growth. With energy costs making up to 60% of hydrogen production costs, the abundance of renewable energy resources in Africa represents a strong comparative advantage for the production of green hydrogen for both domestic and international use. The future of green hydrogen in Africa is promising as long as it complements renewable energy investment for domestic electricity production and makes sense for African countries. Careful long-term, holistic planning and overcoming considerable financial barriers is needed to then attract the needed global investment.

What is needed

It is crucial to address the barriers and identify the African continent's need for deploying renewable energy. While acknowledging Africa's current complex energy realities, increasing renewable electrification levels can be at the heart of countries' energy access, industrialization, and development objectives. Raising awareness about renewable energy technologies' realities and benefits remains critical to enable countries to achieve a sustainable transition at scale. It is important that the current macroeconomic and security climate does not overshadow the existing market and technology realities that renewables have brought forward in recent years. Ensuring information is relevant and proximate, particularly when there is a broad, compelling, and detailed body of international evidence, is more important than ever. This is especially important as governments across the continent face key, substantial, and in many cases no-regret decisions on their future energy systems, within a context of increasing global complexity and uncertainty. As each country defines its energy journey, infrastructure decisions must be informed with the best and most current knowledge so that the full benefits that renewable energy brings can be achieved. There is great value in ensuring that this decision-making process is as well-informed and supported as possible, with accurate, timely, consistent information and recommendations.

Enhancing policy and regulatory frameworks is necessary to grow investment to the needed levels. There are a number of essential steps to address these challenges, which will require political will, policy and regulation changes, and collaboration. It is possible to create an enabling environment for renewable energy investment in Africa supported by appropriate policies and regulations based on lessons learned across a variety of countries, technologies and case studies. If there is a willingness by all parties to invest the time and effort, with the provision of the appropriate supporting information, the development and implementation of conducive policies and regulations that are crucial for ensuring market openness, attractiveness, and readiness can be completed.

Accelerating and improving renewables-related infrastructure is critical. Countries need to ensure that there is a broader ecosystem of supporting infrastructure in place. Generation is only one part of the story, as there is "no transition without transmission". Many African countries have outdated and poorly maintained power grids and lack the necessary investment to upgrade and expand. Private sector expertise can deliver new generation capacity, enable power transmission and distribution infrastructure, and expand access to electricity in peri-urban and rural areas. Significant investments are needed in a range of necessary infrastructure to support renewable energy generation, such as transmission lines and storage facilities, and developing innovative solutions around utility-scale storage, green hydrogen, and integration of renewable energy.

Breaking the 0.6% renewable energy investment ceiling in Africa is an imperative. Yet work remains to be completed in several enabling areas to improve access to and scale up renewable energy investments by de-risking project opportunities in Africa. Due to specific finance, country, policy, and other

Raising awareness, enhanced policy frameworks, improved investment climate, strong capacity support and parallel investment in energy infrastructure are needed.

Breaking the 0.6% investment ceiling in Africa is a necessity.

risk factors, access to finance remains challenging for most African countries, and the cost of capital can be up to 7 times more expensive than in the US or Europe in some cases. Africa requires an unprecedented scaling up of renewable energy investments to come close to achieving any of its sustainable development goals, and access to finance is a primary challenge. Sufficient capital pools with private sector appetite to invest in African markets exist, and with renewable energy power generation becoming the least-cost source of power generation, it should become possible to scale up levels of renewable energy investments so that the continent can achieve its sustainable development goals. Innovative de-risking measures, public-private partnerships, international collaboration, and other measures will be needed to create a more conducive investment climate for renewable energy projects.

To make renewable energy growth a reality, Africa's future energy leaders need to emerge and be supported. Vocational and institutional training will help create the continent's jobs of tomorrow. Designing, developing, and operating renewable energy projects requires local skilled and educated workers, which in turn requires investment in the appropriate training programs. Capacity building must also attract funding across the ecosystem to equip workers and professionals with the necessary knowledge and skills to create and lead the renewable energy industry.

RES4Africa Foundation is committed to act on the above challenges by raising awareness, leading public-private dialogue, providing detailed and focused analysis, and leading capacity building and supporting initiatives. Since its inception in 2012, RES4Africa's action areas have been developed with a needs-based approach that responds to key local needs. The foundation pursues its mission to create a favorable environment for renewable energy investments in three geographic focus regions (the Mediterranean, sub-Saharan Africa, and South Africa) through strategic and regional work programs that target the abovementioned challenges. Its operational model will continue to:

- Advocate for the opportunities and benefits of renewable energy as the backbone of a prosperous Africa;
- Analyze solutions to expand energy access and mobilize renewable energy investments;
- Train professionals, institutions, and youth to deliver Africa's clean energy transition;
- Support the adoption of sustainable solutions to respond to Africa's electricity needs.

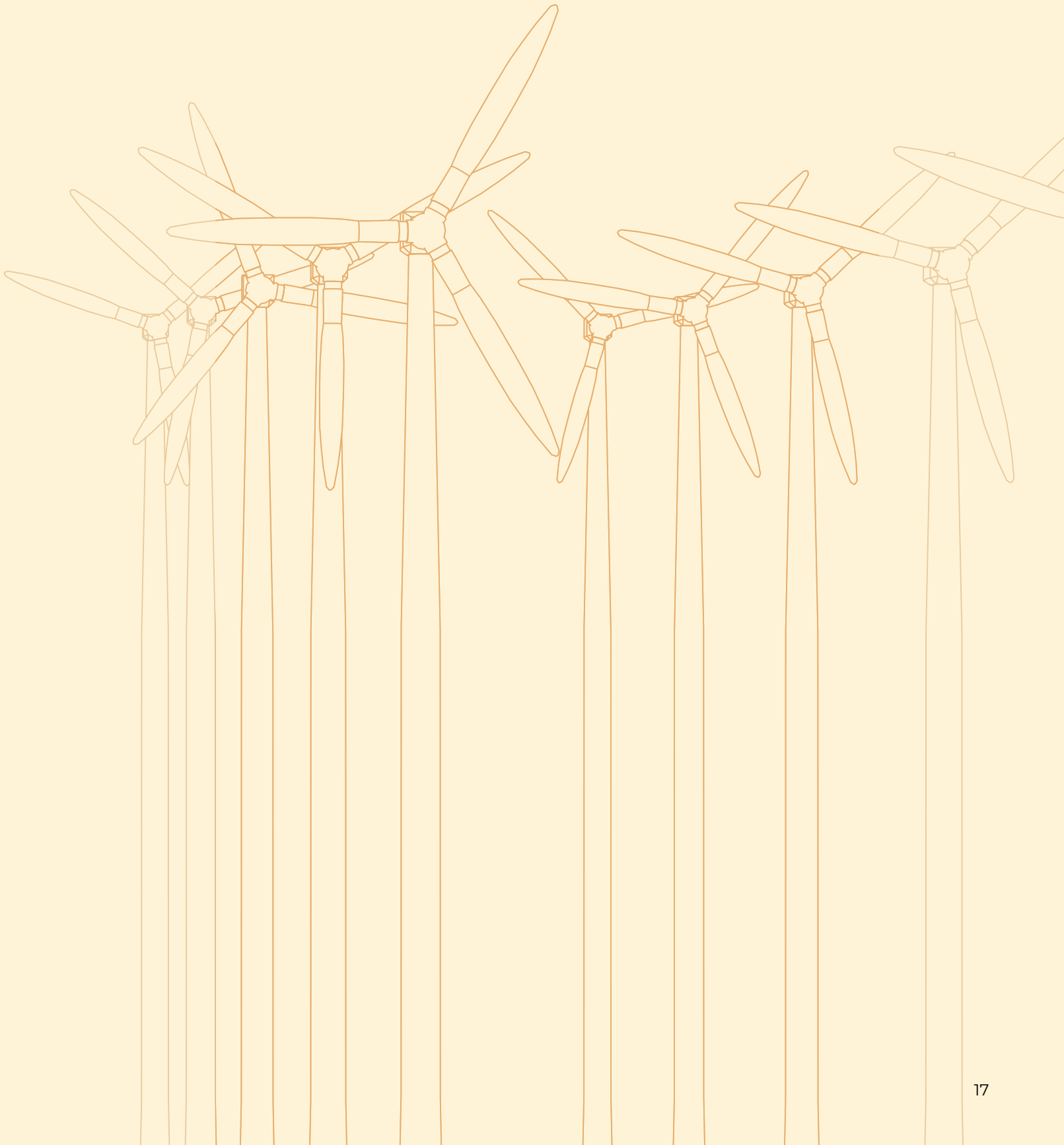


TABLE OF CONTENTS

ABOUT THE RES4AFRICA FLAGSHIP PUBLICATION	2
FOREWORD	4
EXECUTIVE SUMMARY	8
TABLE OF CONTENTS	18
TABLE OF FIGURES	20
TABLE OF BOXES	21
ABBREVIATIONS	22
CHAPTER 1: The global energy transition and Africa's just energy development pathways	24
1. Understanding the context – the past year in review	26
1.1. Backdrop: evolving economic, security, and climate challenges continue to impact societies	26
1.2. Examining the growing momentum toward a global clean energy transition	29
2. Understanding Africa's energy future	36
2.1. The impact of the global crises on African economies	36
2.2. The impact of the global crises on Africa's energy systems	39
2.3. The opportunity for change and growth in Africa	40
2.4. Successfully tackling Africa's energy challenges by fostering opportunities	42
3. Narrative evolutions on Africa's just energy transition	46
3.1. Africa's sustainable and economic development imperative	46
3.2. Pragmatism and sustainability: the energy mix debate	47
3.3. Trust and cooperation in times of geopolitical realignment and energy security	49
3.4. Climate impact and solidarity	50
3.5. A possible way forward: Africa has the power – let's use it	54
RES4AFRICA EXECUTIVE COMMITTEE MEMBERS VIEWS	56
CHAPTER 2: Making the business case for renewables and sustainable development in Africa	58
1. Making the business case for renewable energy	60
1.1. Counting the cost: renewable and conventional energy comparisons	60

1.2. Renewable energy strengthens energy security	65
1.3. Speed to market and adaptability of renewable energy technologies	69
1.4. Supporting climate resilience and sustainability	70
2. The case for renewable energy technologies to deliver Africa's just energy transition	76
2.1. The opportunity for socio-economic prosperity	76
2.2. The opportunity for industrial & supply chain development	79
2.3. The opportunity for energy access, diversity, and utility-scale generation	81
2.4. The opportunity for infrastructure transformation through transmission, distribution, and storage	85
2.5. The opportunity to expand off-grid and decentralized power	91
2.6. The opportunity for green hydrogen in Africa	93
RES4AFRICA YOUTH TASK FORCE STATEMENT	96
CHAPTER 3: The way forward: enabling Africa's sustainable energy future	98
1. What is needed to scale up renewable energy in Africa?	100
1.1. Raising awareness	100
1.2. Policy, regulatory and institutional frameworks	103
1.3. Investment climate and de-risking	106
1.4. Local capacity and industry	110
1.5. Power sector infrastructure	112
2. RES4Africa's action areas and regional programs contributing to Africa's sustainable energy future	115
2.1. RES4Africa's five action areas	116
2.2. RES4Africa's cross-sectoral programs	120
2.3. RES4Africa's three regional programs	126
2.4. Partnerships for action	136
RES4AFRICA INTERNATIONAL ADVISORY BOARD STATEMENT	138
BIBLIOGRAPHY	140
ACKNOWLEDGMENTS	152

TABLE OF FIGURES

Figure 1 - A global and unprecedented energy crisis with strong economic repercussions

Figure 2 - Global investment in low-carbon energy transition and in renewable energy in 2021

Figure 3 - Macroeconomic indicators for Africa 2010-2022

Figure 4 - SDG 7 Tracker for sub-Saharan Africa

Figure 5 - CO₂ emissions (metric tons per capita) 1990-2019, Africa

Figure 6 - Renewable energy cost-competitiveness amidst rising costs

Figure 7 - Levelized Cost of Electricity in sub-Saharan Africa, in H1 2022

Figure 8 - Weighted average cost of capital in 2022

Figure 9 - Renewables are today the most cost-competitive power technology and the momentum is only increasing

Figure 10 - Power generation by fuels in Africa's energy systems

Figure 11 - Impact of the grid unreliability on the African manufacturing sector

Figure 12 - Energy investment gap in Africa

TABLE OF BOXES

Box 1 - Clean energy and industrial policies worldwide

Box 2 - Africa, Energy & Climate - COP27 outcomes and towards COP28

Box 3 - Energy security (Kenya)

Box 4 - How green hydrogen can support energy security and other applications in Africa

Box 5 - Adaptability and deployability (Rwanda and Senegal)

Box 6 - Is a disorderly transition to net-zero inevitable?

Box 7 - Climate resilience (Mozambique)

Box 8 - Africa's future: youth and renewable energy

Box 9 - Latest technological trends - Storage

Box 10 - The potential of BESS to mitigate South Africa's current energy crisis

Box 11 - Latest technological trends - Digital innovations in the transmission and distribution infrastructure

Box 12 - Latest technological trends - Recycling of solar panels, batteries and solar lamps

Box 13 - Morocco's green hydrogen potential

Box 14 - RES4Africa Foundation's focus on strategic raising awareness

ABBREVIATIONS

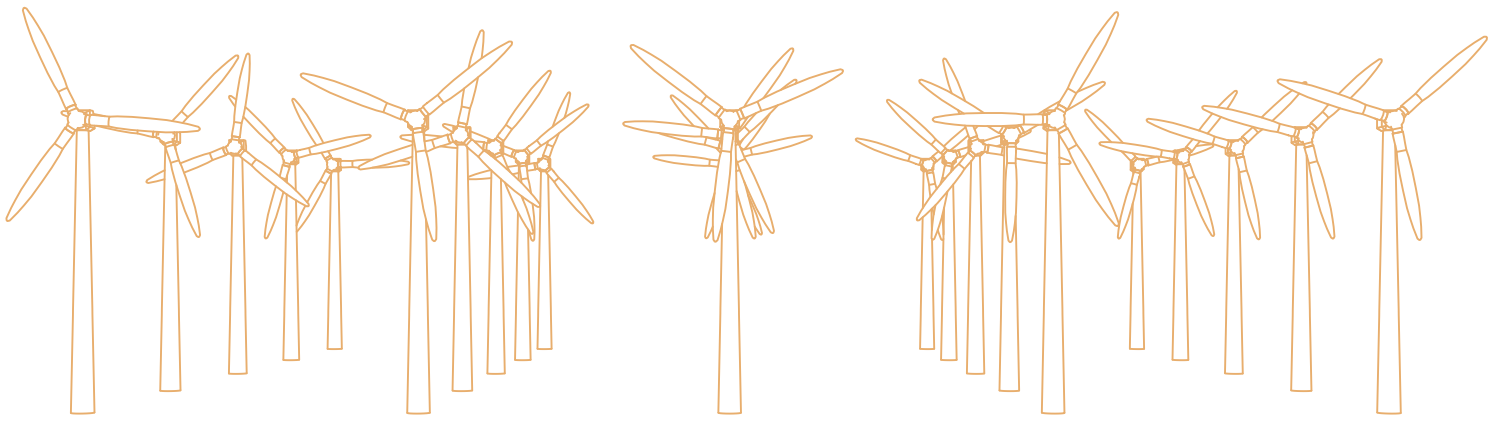
AfDB	African Bank for Development
AfSEM	African Single Electricity Market
ATC	Advanced Training Course
AU	Africa Union
BESS	Battery Energy Storage Systems
BMZ	German Federal Ministry for Economic Cooperation and Development
BNEF	Bloomberg New Energy Finance
CAPEX	Capital Expenditures
CEO	Chief Executive Officer
CMP	Continental Power System Masterplan
COP	Conference of the Parties
CSIR	Council for Scientific and Industrial Research of South Africa
CSP	Concentrated Solar Power
DFI	Development Finance Institution
DSO	Distribution System Operator
EC	European Commission
EFSD+	European Fund for Sustainable Development Plus
EIB	European Investment Bank
ESG	Environmental, Social and Governance
EU	European Union
EUR	Euros
EV	Electric Vehicle
FAO	Food and Agriculture Organization
FSTF	Financial Support Task Force
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GIS	Geographic Information System
GIZ	German Development Agency
GW	Gigawatt
HDI	Human Development Index
HLPPD	High-Level Public-Private Dialogue
IEA	International Energy Agency
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IFI	International Finance Institution
IMF	International Monetary Fund
IPCC	International Panel on Climate Change
IPP	Independent Power Producer
IRA	Inflation Reduction Act
IRENA	International Renewable Energy Agency
IRESN	Institut de Recherche en Energie Solaire et Energie Nouvelles

IRP	Integrated Resource Plan of South Africa
JETP	Just Energy Transition Partnerships
KPLC	Kenya Power and Lighting Company
kWh	Kilowatt-hour
LCOE	Levelized Cost of Electricity
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
m²	Square meter
MENA	Middle East and North Africa
MGA	Micro-Grid Academy
MoU	Memorandum of Understanding.
MW	Megawatt
NDC	Nationally Determined Contributions
ONEE	National Office of Electricity and Drinking Water of Morocco
OPEX	Operating Expenditures
PPA	Power Purchase Agreement
PV	Photovoltaics
RE	Renewable Energy
REE	Rare Earth Elements
REIPPPP	Renewable Energy Independent Power Producers Procurement Program
RISE	Renewable Infrastructure and Sustainable Energy Partnership Africa-EU
ROAR	Regulatory Openness, Attractiveness and Readiness
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SAS	Sustainable Africa Scenario
SDG	Sustainable Development Goals
TVET	Technical and Vocational Education and Training
TWh	Terawatt hour
UN	United Nations
UNDP	United Nations Development Program
UNECA	United Nations Economic Commission for Africa
UNFCCC	United Nations Framework Convention on Climate Change
USA	United States of America
USD	United States Dollar
VRE	Variable Renewable Energy Sources
WEF	World Economic Forum

CHAPTER 1
THE GLOBAL ENERGY TRANSITION AND AFRICA'S
JUST ENERGY DEVELOPMENT PATHWAYS







1. Understanding the context – the past year in review

2022 has been a year of profound change. The world was marked by intense and severe economic, energy, and climate crises whose effects are still unfolding across countries and regions. The net result has been to put human development and prosperity on hold at best and in reverse at worst in many parts of the world. It has also raised questions on trajectories ahead in the sustainability, decarbonization, and net-zero agendas, where short-term reactions to day-to-day challenges have become a more urgent preoccupation for individuals, companies, and governments. To understand how this might unfold further and what it means for Africa's just energy development, this section begins examining the global energy, economic, and climate landscape as it stands today and then reviews its impacts on Africa's socio-economic and energy realities.

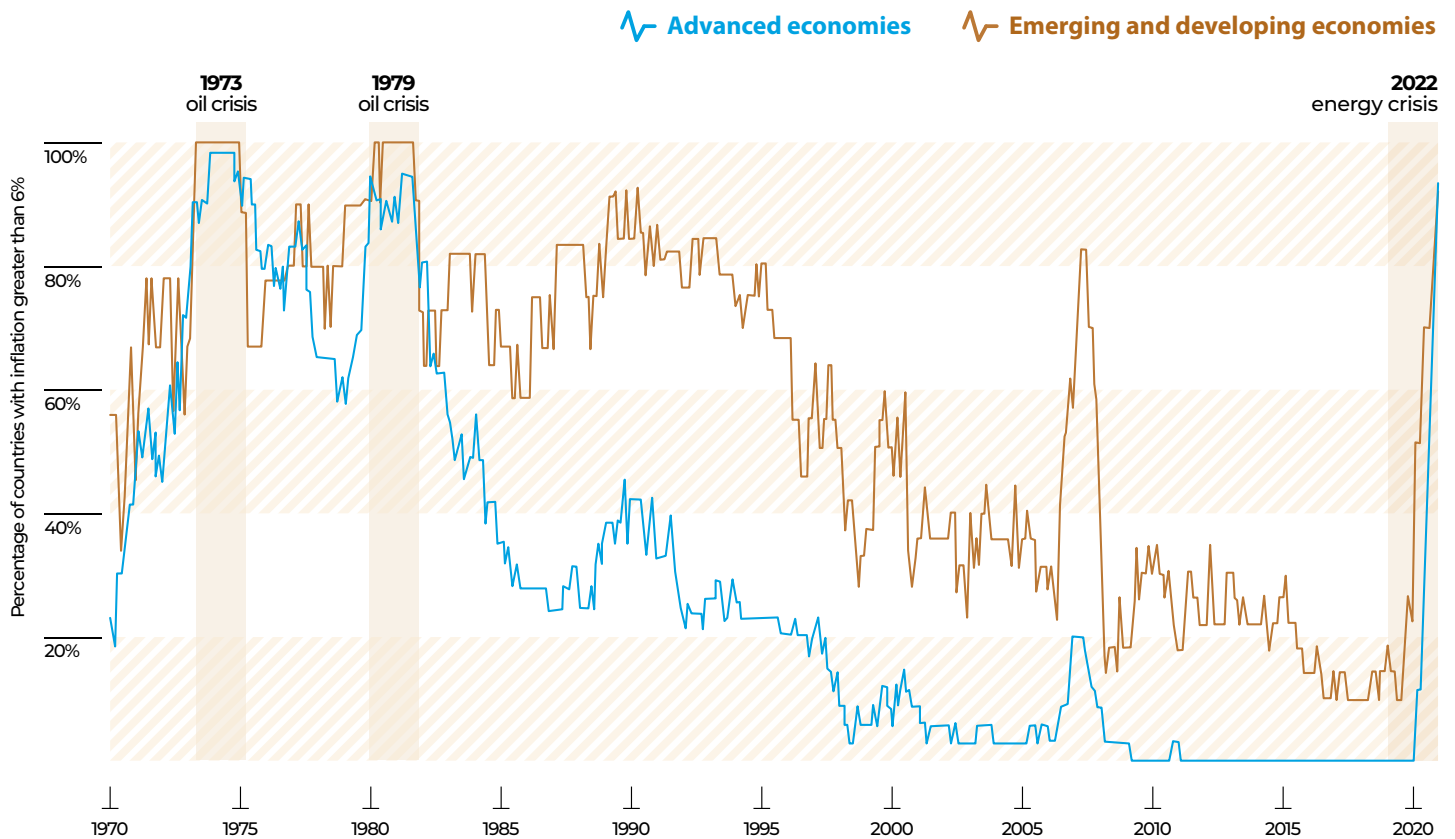
1.1. Backdrop: evolving economic, security, and climate challenges continue to impact societies

From pandemics and war to a cost-of-living crisis, the events of 2022 were an earthquake for the world at large. Spurred on by a year of crises, the world was tipped into a global and unprecedented energy crisis with substantial economic repercussions and marked by uncertainty. From the Covid-19 aftermath to the Russian invasion of Ukraine and collective knock-on effects, a historically challenging year for the energy sector and the global economy ensued, fostering a fundamental rethinking of individual country energy strategies.

Fig.1

A global and unprecedented energy crisis with strong economic repercussions

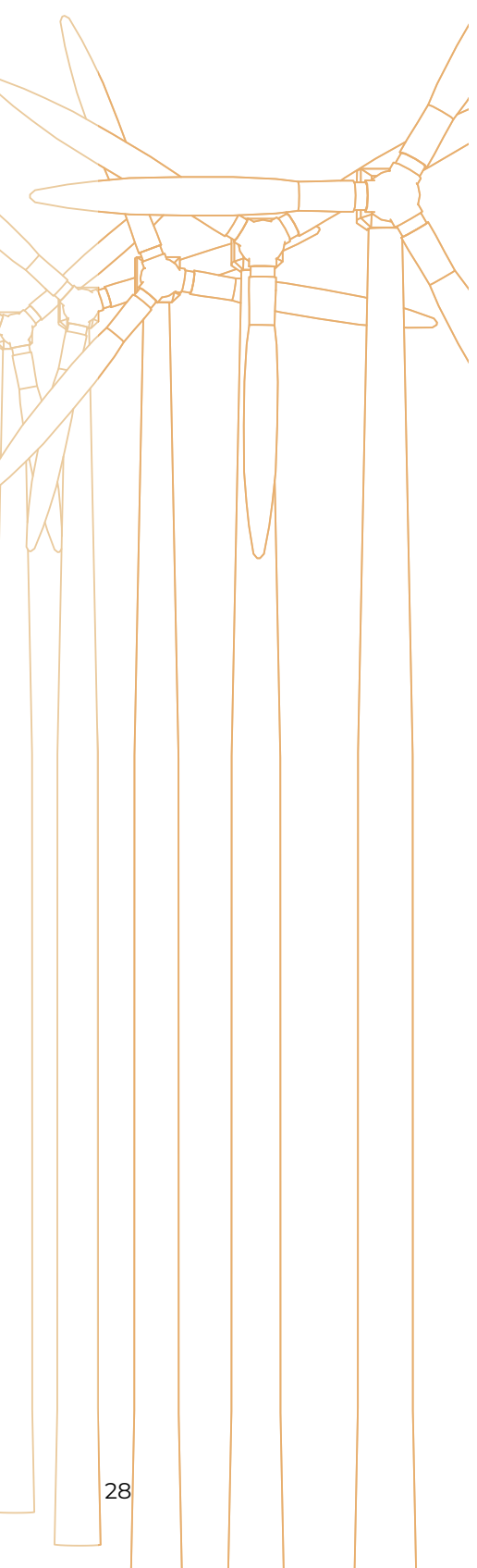
The world is witnessing an unprecedented global energy crisis particularly affecting emerging and developing economies.



IEA, 2022k

This uncertainty was already in the making during the Covid-19 pandemic. A disrupted and exceptionally energy-intensive recovery from the pandemic saw a rebound in global energy demand, causing major supply-demand challenges and inflationary pressure on energy and other commodity prices in what would become a severe cost of living in countries around the world. An unequal post-pandemic economic recovery ensued, with global economic output only recovering in most advanced economies to pre-pandemic levels. Amid the prevalence of Covid-19 variants, healthcare spending needed to protect citizens and address ever-larger waiting lists and backlogs. Societies were suddenly reminded of their energy reliance amid a most energy-intensive recovery. As the world economy returned online and oil, gas, and coal use increased, global energy-related CO₂ emissions rose by 6% in 2021, a historic high following a steep drop in 2020 during the pandemic (IEA, 2022c).

The year 2022 has been defined by slow global post-pandemic recovery, Russia's invasion of Ukraine, a cost-of-living crisis, and evermore climate urgency.



Russia's invasion of Ukraine in early 2022 sent shockwaves through the global economy and energy system. The invasion – first and foremost a human tragedy – tipped the world into a worldwide energy crisis. Immediate price shocks to the energy system caused geopolitical realignment of energy supplies due to sanctions imposed on Russia – until then, the world's largest hydrocarbon exporter. Natural gas prices increased seven-fold in global markets and ten-fold in Europe (IMF, 2022b), ushering in a worldwide cost-of-living crisis that impacted households and businesses across countries. Rising inflation and ongoing interest rate hikes left little room for economic maneuver in countries already hard hit by the pandemic and in debt distress. Taken together, the crises caused a fundamental rethinking of countries' energy strategies and ushered in a new era of complexity amid tightening macroeconomic conditions, affecting all countries and the vulnerable. This has led to new and the reemergence of old geopolitical tensions with consequences for governments, businesses and citizens at large.

Energy security and affordability have taken center stage as a priority for policymakers, industries, and households alike. Due to an overreliance on Russia for gas supplies, Europe has been at the center of this crisis, but its crippling effects have also been impacted more widely. Countries have been driving a reassessment by governments of who their allies are, not only in terms of energy security but also in terms of economic soundness and trade partners and policy (Denning, 2022). Pressures on energy markets were, of course, present before, but throughout 2022 these were exacerbated when coupled with the end of macroeconomic certainties of the last decades. Alongside the increases in energy prices, interest rates, and the cost of capital, a strong dollar and crippling inflation rates have seen the end of an era of low-interest rates and helped to create conditions for a deep economic crisis in many parts of the world.

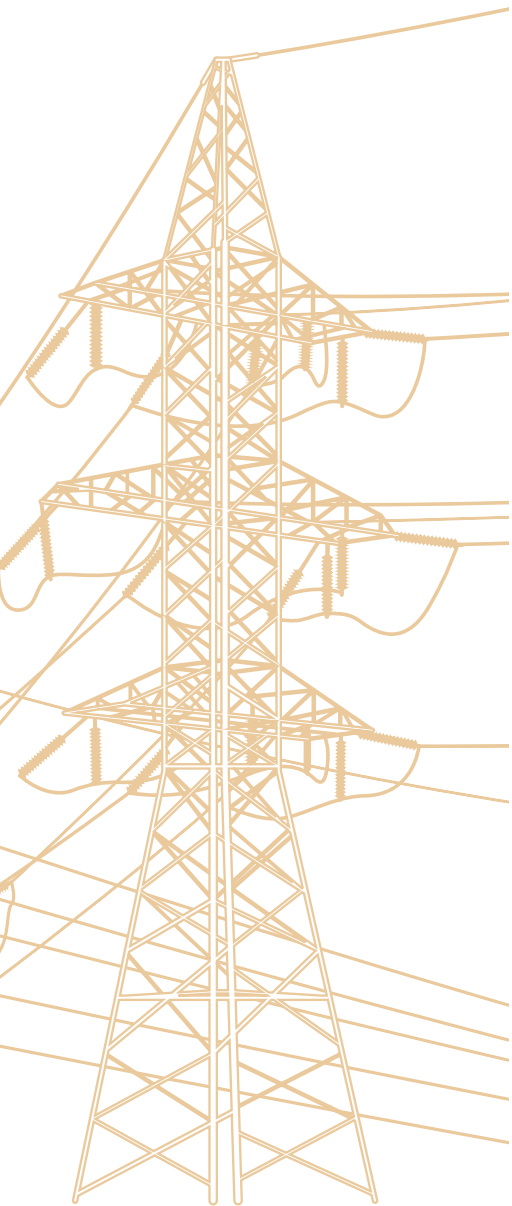
Meanwhile, the adverse impacts of climate change continue to grow. 2021 already saw a record increase in greenhouse gas emissions (IEA, 2021b) and significant extreme weather events worldwide. 2022 has been worse. It has seen some of the most extreme weather events in history, striking many more countries on a much more regular basis, with ever more significant impacts on populations and economies. The International Panel on Climate Change (IPCC) most recent sixth working group report foretells more of the same. Heat waves in Europe, hurricanes in the United States of America (USA), and floods in Africa and Southeast Asia are more likely to happen and become more extreme. While global business leaders have identified natural disasters and extreme weather events as being in the top 10 perceived risks for the medium- and long-term in a recently published World Economic Forum Global Risks Report 2023 (See Box 6 – Is a disorderly transition to net-zero inevitable?), action on this agenda continues to remain less of a priority and patchy across many countries (WEF, 2023). Leaders remain focused on other, more immediate, local concerns despite climate change being humanity's defining challenge. The conjunction of climate, economic and geopolitical uncertainty presents a clear need for an accelerated energy transition towards cleaner and secure energy sources.

In many ways, 2022 broke with the past and represented a new context and mood for the energy industry. The world has collectively plunged back into an

energy security mindset. As a result of the forces outlined above, the global energy narrative now sees a tension between short-term and long-term investment decisions, climate and security, old and new policy approaches, and competition and cooperation among countries. Increasing energy demand, high prices, supply-demand shocks, and immediate concerns over energy security and affordability have spotlighted the global oil and gas supply, the emergence of nascent producers, and a growing focus on green hydrogen (See Chapter 1 - 3. Narrative evolutions on Africa's just energy transition). This renewed focus on energy security has highlighted oil and gas, affordable, secure, and reliable energy mixes, and the role of coal, oil, and gas therein. A short-term result in Europe was that it saw a return to short-term investments in coal while pivoting to Liquefied Natural Gas (LNG) from the USA. The crisis also highlighted the importance of critical minerals and how these need to be geographically dispersed and diversified. This landscape was made more unclear by confusion in the market about sustainability and Environmental, Social and Governance (ESG) activities, whether it works and can be trusted, and short-term conjunctural decreases in the price of fossil fuels, all of which have led to doubts about the attractiveness of the economic case for renewables temporarily. This has raised questions on whether the crises would halt or accelerate the global clean energy transition progress.

1.2. Examining the growing momentum toward a global clean energy transition

Despite energy security fears, the world continues to set a course toward decarbonization. Coming out of the pandemic, 2021 saw an unprecedented number of pledges and net-zero targets in government and corporate commitments to decarbonization. To date, over 140 countries – accounting for 91% of greenhouse gases (GHG) emissions, including 12 African countries – have committed to achieving net-zero emissions by mid-century (IMF, 2022a). This course taken by countries is first and foremost informed by an increasing understanding that there is an urgent need for action on climate change. This has been starkly illustrated by the 2022 IPCC reports in line with the Paris Agreement goals and the fallout from the global energy crisis and the Covid-19 pandemic. And, with energy accounting for more than two-thirds of global GHG emissions (IEA, 2021c), the pathway to net-zero passes through decarbonizing the global energy system – a movement that now appears to be irrevocably in motion. There is also an understanding that achieving a net-zero carbon energy system is possible, cheaper, and more profitable than with alternatives (Oxford, 2022), with encouraging developments in other areas, such as ever-more ambitious energy transition plans being developed by governments, record-high investment in clean energy technology projects, the emergence of industrial policy packages, and ever-improving technology efficiencies.



Led by policy action and targets, a new global energy economy is emerging.

The energy crisis, policy action, and continuing cost reductions drive the faster deployment of clean energy technologies. Not only did global investment in low-carbon energy transition reach USD 1.1 trillion in 2022 – a new record and massive acceleration from 2021 – but, for the first time, global energy transition investment matched fossil fuel investment – despite a year of rising energy prices – from the cost of living to interest rates and technology materials. New renewable energy capacity addition is expected to reach new records by 2025 supported by significant long-term policy programs aiming to shape the energy transition through an industrial transformation in clean energy technology, manufacturing, and supply chains. Solar and wind energy are becoming more cost-competitive with fossil fuels, and utility-scale battery storage is becoming more affordable, viable, and trusted. These technologies are becoming increasingly accessible to developing countries. Energy scenarios now speak of accelerated clean energy technology development, an upcoming peak in oil and gas demand, and expect a redrawing of geopolitical maps based on renewable energy resources.

The global events of 2022 have encouraged countries to devise clean energy transition and industrial strategies to reach their net-zero targets and use accelerating renewable energy growth as an economic enabler.

In doing so, there is an opportunity for countries to participate and gain dividends from the new industrial age in the clean energy transition (IEA, 2023a). Governments understand that adopting energy efficiency measures and renewable energy sources can help them address energy security and dampen the local impact of global energy market uncertainties on their economies and citizens. The consequence of all of this is an unprecedented and accelerating race to develop clean energy projects worldwide. Recent reports from the International Energy Agency (IEA) show that clean energy technologies are currently being deployed at record levels across global industrial sectors and technology supply chains, from mining to mineral processing to material production and manufacturing operations (IEA, 2023a). With these supporting policies and programs in place, there is the opportunity for initially ambitious national climate pledges and targets to become more realistic and economically viable.

Several drivers, including the war, policies, and technology, have helped turbocharge the global clean energy transition.

What is encouraging is that, in many parts of the world, the reaction to increasing economic and geopolitical uncertainty is resulting in an accelerating effect, reinforcing the desire of governments to broaden and accelerate their clean energy transition. This is evident in the emergence of new energy transition policy packages in the USA, the European Union (EU), China, and Japan (See Box 1 – Clean energy and industrial policies worldwide). In Europe, the Russian invasion of Ukraine has played a catalytic role in accelerating the adoption of renewable energy and energy efficiency measures. Recent numbers show that important energy demand savings were achieved since the invasion, and policies were fast-tracked in remarkable ways (BNEF, 2023b). In the wake of Russia's invasion, the EU's gas demand from Russia is set to plunge from 40% to 10%; solar and wind additions increased by 41%; heat pump and electric vehicles (EV) sales went up by 40% and 15%, respectively; and Europe's CO₂ emissions contracted by 2.5% (IEA, 2023c).

Box 1 – Clean energy and industrial policies worldwide

By the close of 2022, the USA, China, India, Europe, and other countries had all launched major long-term clean energy and industrial policy to bolster their economies after the effects of the pandemic and the war in Ukraine (IEA, 2023a; IEA, 2022j). Following the start of the Ukraine crisis, the European Union (EU) issued REpowerEU, a plan to ensure the EU's energy security by providing technical assistance, capacity building, and financing for renewable energy projects in EU countries, building on the EU Green Deal and existing targets (European Commission, 2022). The USA introduced the Inflation Reduction Act (IRA) in August 2022 as a federal law allocating USD 391 billion for clean energy investments through financial incentives, tax credits, loan guarantees, and grants (The White House, 2023). One significant benefit of this law is that credits are set to run for ten years, giving the private sector the confidence to plan and invest at scale (Barbanell, 2022). In response to mixed signals on the US' IRA plans, the EU presented its own Green Deal Industrial Plan, putting Europe's net-zero industry in the forefront (European Commission, 2023). Earlier, China published its fourteenth five-year plan for renewable energy, which outlines the country's roadmap for renewable energy from 2021 to 2025. It aims to have renewable energy representing one-third of electricity consumption by 2025 (S&P Global, 2023). The Japanese government updated its renewable energy targets through its sixth Strategic Energy Plan, aiming for 36-38% of the country's energy mix to be generated from renewable sources by 2030. This target significantly increased from its previous goal of 22-24% (Investor Infrastructure, 2022). These policy developments helped to encourage other economies to follow suit and change expectations for industrial development in the world, and in Africa.

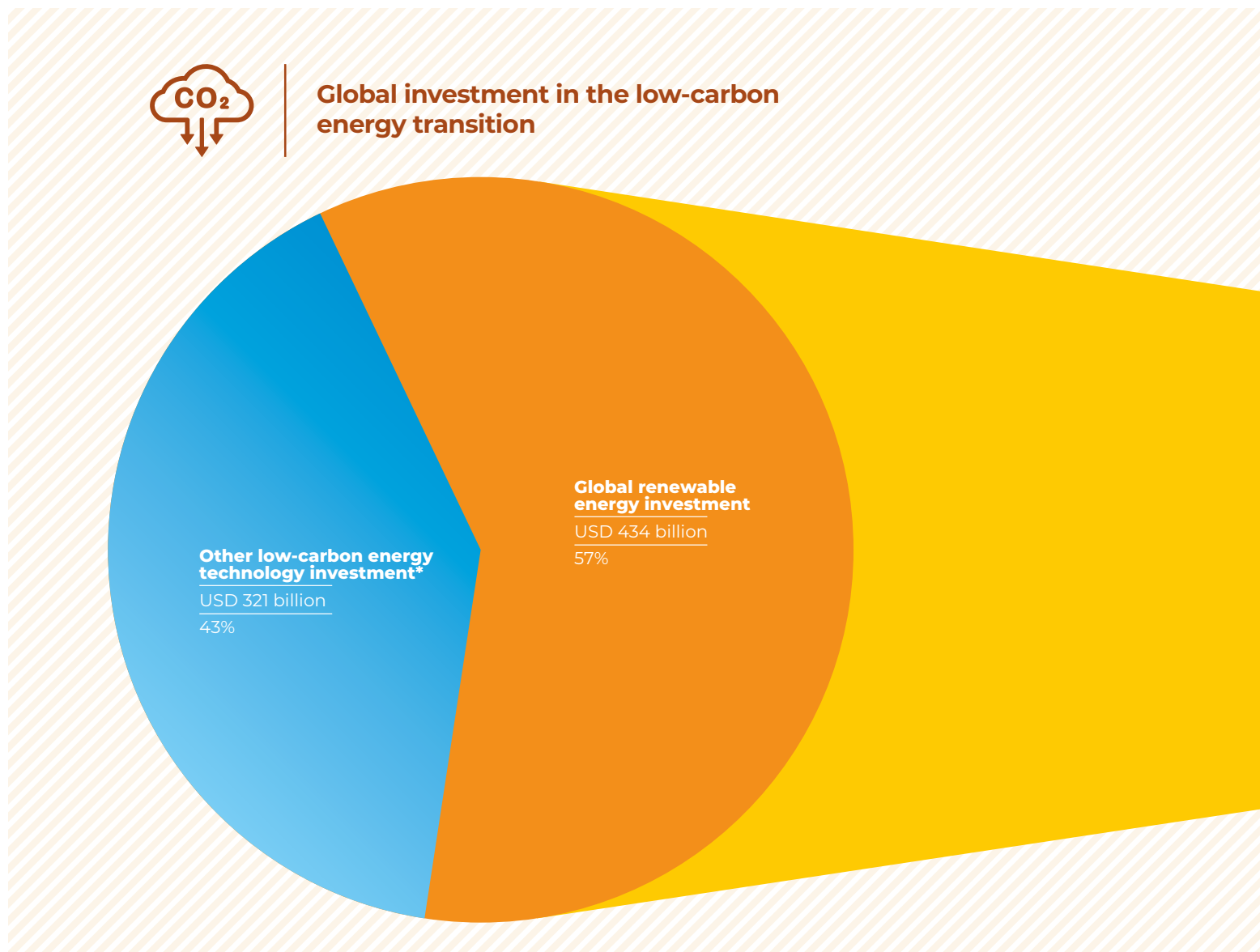
Last year the world saw low-carbon energy technology investment reach USD 1.1 trillion – a record high (BNEF, 2022f). This achievement represents another record with investment in low-carbon technologies equaling investment in fossil fuel projects for the first time (BNEF, 2022e). The investment was widely spread – including all clean energy sectors and technologies globally, with renewable energy, energy storage, electrified transport, electrified heat, and hydrogen, reaching record levels of investment (BNEF, 2022e). Total investment in renewable energy technologies reached USD 495 billion in 2022, a 17% increase from the previous year. Electric mobility reached USD 466 billion in 2022, representing a 54% increase in levels of investment compared to 2021 (BNEF, 2022e). Hydrogen received USD 1.1 billion in 2022 globally, representing only 0.1% of the total despite strong interest, but it is the fastest growing sector, with investment currently tripling year-on-year (BNEF, 2022e). In particular, 2021 saw new records for renewable energy capacity additions worldwide. The record-high levels of investment in 2021 enabled a significant amount of new global renewable energy capacity additions – an increase of 6% to nearly 295 Gigawatt (GW) globally in 2021 (IEA, 2022e). Despite ongoing supply chain issues, construction delays, and high commodity prices caused by the pandemic, the industry found ways to deliver this growth.

Yet unfortunately, only 0.6% of the total renewable energy investment in 2021 went to Africa – an 11-year low. Of the USD 434 billion invested worldwide in renewable energy technologies in 2021, while nearly half of this global investment went to China, only USD 2.6 billion or 0.6% of the total renewable energy investment went to Africa, hitting its lowest level since 2011 (BNEF, 2022g). This means that, while there is no shortage of investor appetite for clean energy projects, it often does not end up where it is needed most. Despite this year-on-year growth globally

Fig.2

Global investment in low-carbon energy transition and in renewable energy in 2021

In 2021 renewable energy investment in Africa hits an 11-year low with only 0.6% of total global renewable energy investment going to the continent.



*Low-carbon energy transition technologies include renewable energy, energy storage, electrified transport, electrified heat, carbon capture and storage (CCS), hydrogen and sustainable materials and nuclear.

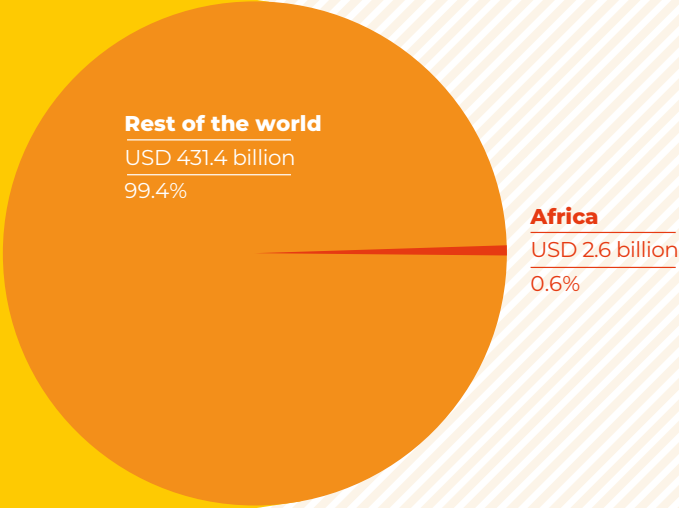
in clean energy investment, very little ends up in Africa (See Chapter 1 - 2.2. The impact of the global crises on Africa's energy systems). As mentioned in earlier reports, this remains a grave concern, and it is crucial to mobilize more financing for clean energy investments in emerging and developing economies.

The costs of renewable energy technologies have been impacted in recent years. After several years of falling costs, some have begun to increase again. In 2021 the impact of raw material price increases was not entirely passed through to final equipment prices (IRENA, 2022f), but this changed in 2022. Recent studies have shown that raw material costs for renewable energy technologies have risen (IEA, 2022e) and have, in some areas, seen significant price hikes. Photovoltaic (PV)-grade polysilicon experienced a more than fourfold increase in one year, while steel, copper, and aluminum saw increases of 50%, 70%, and 100%, respectively. Freight costs have also risen dramatically, almost five times more than at the beginning of 2021 (IEA,

For the first time ever in 2022, investment in low-carbon energy technologies reached parity with investments deployed for fossil fuel supply.



Global investment in renewable energy



- Other low-carbon energy investment
- Global renewable energy investment
- Renewable energy investment in Africa

RES4Africa 2023 compiled from various sources (BNEF, 2022a; BNEF, 2022b)

2022e). The outcome is that the overall investment costs for, e.g., a new utility-scale PV and onshore wind plants are expected to be 15-25% higher compared to 2020 (IEA, 2022e). The cost of constructing new onshore wind facilities has also increased by around 7% annually, while the cost of fixed-axis solar has risen by 14% (BNEF, 2022d). The surging freight costs significantly contribute to the price increase for onshore wind. For solar PV, the price increase is more evenly divided among freight, polysilicon, and metals (IEA, 2022e). Other areas, such as storage and electric vehicles, have also been impacted, with lithium-ion battery costs increasing on average by 7% from 2021 to 2022 due to higher commodity and components costs, and EV's price parity with gasoline and diesel cars is now expected only to be reached by 2026 (BNEF, 2022b).

Investment in clean energy supply chains hit a record high, reaching USD 78.7 billion in 2022, of which more than half was dedicated to developing manufacturing facilities for batteries and storage components.

Despite increasing renewable energy technology costs, renewables remain the most competitive option for electricity in most contexts. While these cost increases are concerning, ongoing research and development and advancements in innovation and manufacturing are expected to overcome cost increases in the medium to long term. The gains achieved to date mean that renewable energy technologies continue to represent the most competitive option for electricity in most contexts. Solar PV, in particular, is becoming the lowest-cost option for new electricity generation in most of the world, especially in Africa (IEA, 2022f). With the right business case and support, clean energy investments remain an attractive economic, social, and environmental option to countries, companies, and private capital as a form of power generation, end-use strategy, and a means to achieve a clean energy system. Growing and developing economies – where the need for infrastructure and climate vulnerability is the highest – can and should take advantage of the wide-ranging benefits that these clean energy technologies can bring (See Chapter 2: Making the business case for renewables and sustainable development in Africa). With this backdrop, transitioning to clean energy rapidly can be more cost-effective than a slow or non-existent transition (Oxford, 2022).

The increasing demand for renewable energy technologies is simultaneously helping to drive the global energy system into a new industrial age of clean energy technology manufacturing. Markets are being shaped as countries increasingly introduce industrial policies to benefit from this new clean energy age and encourage the development of supporting industrial supply chains (See Box 1 – Clean energy and industrial policies worldwide). Investment in clean energy supply chains hit a record high, reaching USD 78.7 billion in 2022, of which more than half was dedicated to developing manufacturing facilities for batteries and storage components (BNEF, 2022e). China again accounted for the overwhelming majority of this investment in new supply chain capacity, attracting 91% of 2022 clean energy manufacturing investment (BNEF, 2022e). Not surprisingly, renewable energy jobs are also booming. In 2022, renewable energy jobs hit 12.7 million globally, of which 700,000 new jobs were created between 2021 and 2022 amid the Covid-19 pandemic and the Russia-Ukraine conflict (IRENA, 2022e). As before, these remain unevenly distributed – in 2021, only 307,000 of these jobs were in Africa, and 235,000 were in sub-Saharan Africa (IRENA, 2022e).

Critical material supply pressures may challenge these levels of renewable energy growth in the coming years. There are signs of strong geographic concentration and ownership of the critical minerals, which are essential to the global energy transition. The

new energy security paradigm has not helped improve this. Driven by growing demand, trade has been increasing, which support the development of storage systems and mobility. Australia, Canada, Russia, and China are the major producers, with the latter being the largest producer of rare earth elements (REEs). However, African countries also have a role to play here with abundant mineral resources, including several critical minerals. 23 of the 54 African countries actively export critical minerals (IEA, 2022g) (See Chapter 1 - 2.3. The opportunity for change and growth in Africa). The growing importance of these minerals, and their geographic distribution, is already having significant implications for how the geopolitics of energy (especially renewable energy) continue to evolve as they have become a critical part of the global discourse on the clean energy transition. Demand for these minerals will increase exponentially as the world pursues its net-zero trajectories. In response, strategic collaboration initiatives, such as the Critical Minerals Act by the EU, have been established to ensure secure and sustainable supply chains (Reuters, 2023). These initiatives aim to reduce reliance on imports from countries with geopolitical instability or uncertain trading relationships while promoting responsible mining practices that minimize environmental impact. The success of these initiatives will be crucial for achieving a sustainable and secure transition to clean energy and will impact relations among countries going forward.

Momentum on renewable energy needs to move faster to reduce emissions. As the most recent IPCC report shows, the opportunity to limit global warming to 1.5 °C is closing quickly. Attention and action need to be more widespread, as the momentum toward renewables, albeit growing and encouraging, will on its own not correspond to a significant enough decrease in global emissions (McKinsey, 2022b). The policies that are currently in place need to be more ambitious to limit global warming to under 2 °C and will most certainly not allow us to remain below the 1.5 °C target. Recent IPCC estimates show that current policies will result in a median global warming of 2.4-3.5 °C by 2100 and currently put our ability to limit global warming to 1.5 °C beyond reach (McKinsey, 2022b). A recent IRENA report shows that the energy transition is off-track and current pledges fall short of reaching the 1.5 °C pathways (IRENA, 2023). Other IEA clean energy progress tracking reports have assessed that only electric vehicles and lighting are advancing fast enough to reach 2050 targets (IEA, 2022h). This highlights the need for even more ambitious and far-reaching policies to be implemented to meet the urgent challenge of climate change. Beyond the policy arena, far-reaching and material progress on clean energy technology, manufacturing capacity, and critical minerals is still needed.

Transitioning to net-zero economies will require an immediate and sharp decline in fossil-fuel consumption. The peak in oil and gas demand and use is expected in the next few years, no matter what, with global demand for oil expected to peak soon in all cases, even in conservative scenarios. The peak might happen as soon as 2027, with global gas demand peaking by 2040 (McKinsey, 2022c) (Bullard, 2022) (IEA, 2022j). These peaks could even arrive sooner should sustainable energy scenarios come to pass: 2024 for global oil demand and 2030 for global gas demand (McKinsey, 2022c) (Bullard, 2022) (IEA, 2022j). Unfortunately, the growth in renewable energy in the last decade has also been accompanied by an expansion in the use of fossil fuels to meet the growing energy demand. New International Energy Agency (IEA) data show that a contributing factor to this was that the global energy crisis pushed fossil fuel consumption subsidies to an all-time high in 2022 (IEA, 2023d).

Multiple energy scenarios point to both oil and gas demand peaking in the coming years, as soon as 2024 for oil, and 2027 for natural gas.

2. Understanding Africa's energy future

2.1. The impact of the global crises on African economies

It is well known that the Covid-19 pandemic and the war in Ukraine have sent shockwaves worldwide, significantly impacting the most vulnerable nations.

Africa has also been directly and severely affected, one outcome being that much of the progress achieved in recent years toward SDG 7 and the 2030 Agenda in Africa has been stalled and partially reversed (AEF, 2023). The continent's economies remain very vulnerable to external events, particularly those that affect energy, food supplies, and security or exacerbate other existing economic strains (IEA, 2022a). Many countries are now experiencing their first economic recession in 25 years, with tourism-based and oil and gas-producing countries being hit the hardest. The continent's gross domestic product (GDP) contracted 2.3% in 2020. Although it bounced back in 2021 with Gross Domestic Product (GDP) growth of 4.7%, the International Monetary Fund (IMF) predicts a slowing down of the economy in the short term, with GDP growth estimates for 2022 of 3.6% and GDP per capita not returning to its pre-crisis level until 2024 (IMF, 2022d). Recently, growth expectations for sub-Saharan Africa were decreased from 3.9% to 3.6% for 2023 (IMF, 2023).

This situation is worsened by the high level of public debt of African economies, devaluation of local currencies, and much higher borrowing costs.

These developments have contributed to rising levels of debt distress across Africa, creating a situation where many countries now only have limited room for economic maneuver. The region has seen amplified public debt, weaker growth, and high inflation, which in turn is eroding standards of living (IMF, 2023). An increasing number are currently at risk of default. In sub-Saharan Africa, debt as a percentage of GDP rose from around 30% in 2014 to over 57% in 2020, the highest level in almost two decades. In North Africa, debt rose by 12 percentage points over the same period to reach 88% of GDP (IEA, 2022a). These high debt levels in part impact curtailed access to finance and capital markets, with investors hesitant to invest, partly because of global developments and partly due to these higher perceived and actual regional risks. This will, in turn, keep the cost of capital higher. In many African countries, economy-wide capital costs are now up to seven times higher than in Europe or North America (IEA, 2022a). Not surprisingly, governments struggle to secure adequate funding for essential services like healthcare and education. With diminished financial resources, the ability of African nations to respond effectively to potential future crises will also be hampered (IEA, 2022a).

Poverty levels in Africa are rising, with high food and energy prices hitting the most vulnerable the hardest.

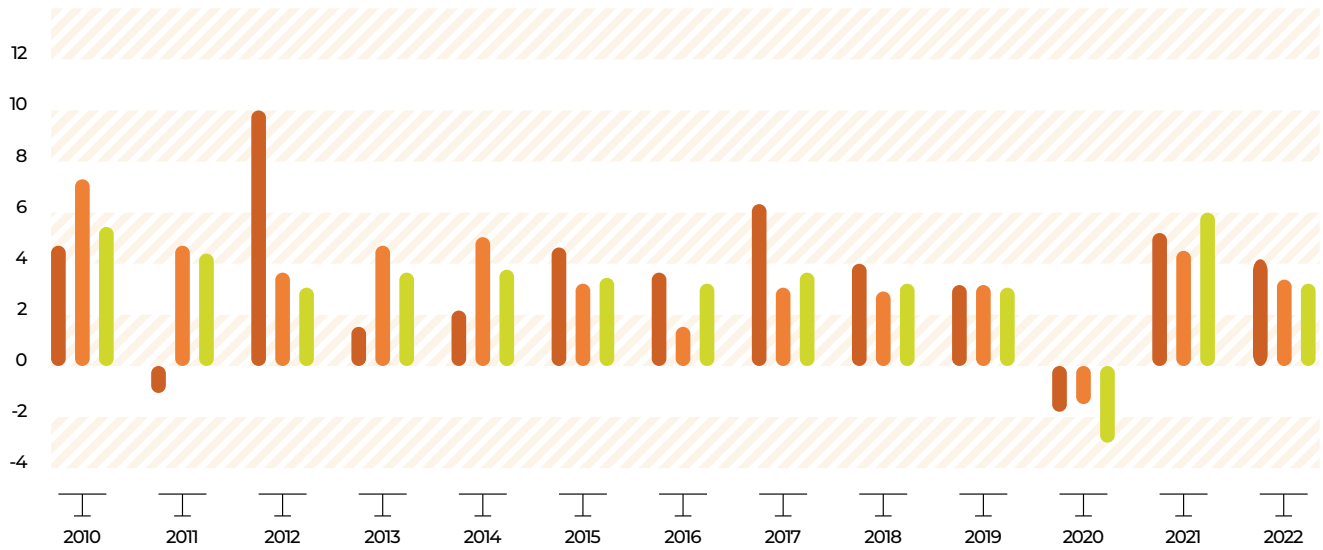
The constraints on investment have, similar to other countries, also fed through into impacts on the economy and, in particular, the ability of businesses to invest and generate employment opportunities. Studies have identified that poverty and inequality are at a record high in many African countries. The African Bank for Development (AfDB) has estimated that an additional 30 million Africans have been pushed back into poverty and that 22 million jobs have been lost, a trend expected to continue in the coming years

Fig.3

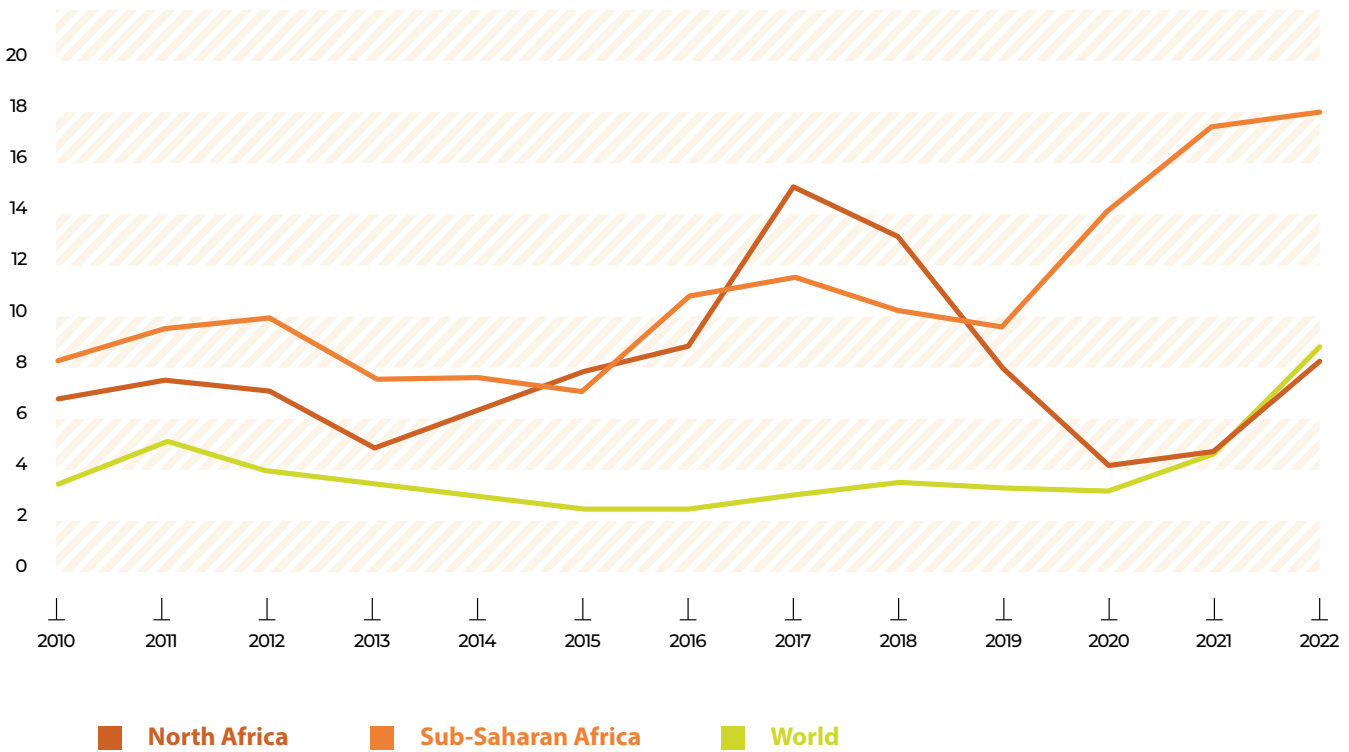
Macroeconomic indicators for Africa 2010-2022

Sub-Saharan Africa has been hit the hardest by the 2019-2022 crisis and takes longer to recover.

Annual real GDP percent change (%)

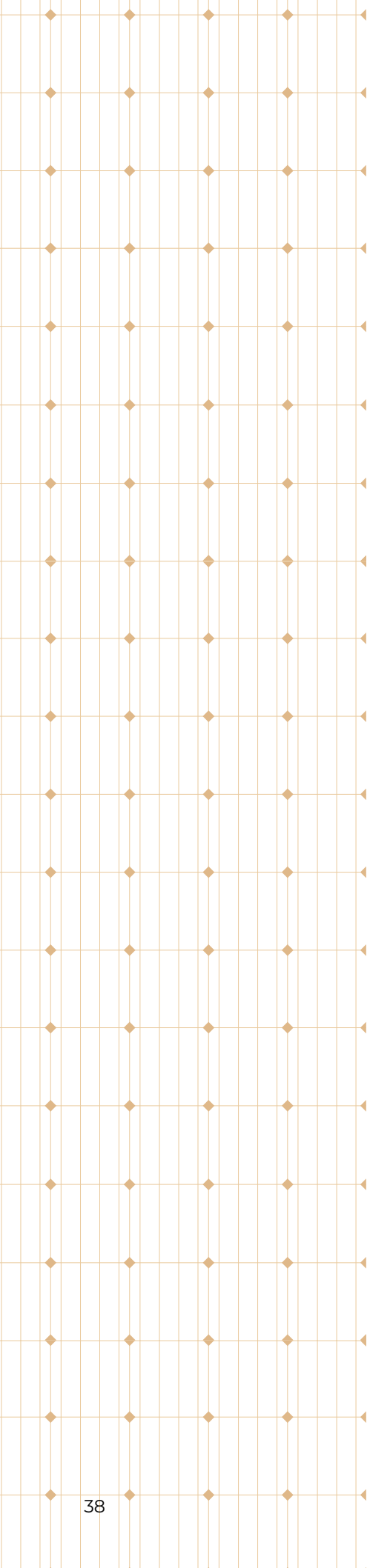


Annual inflation percent change, average consumer price (%)



■ North Africa ■ Sub-Saharan Africa ■ World

RES4Africa 2023 compiled from IMF, 2022



(AfDB, 2022b). As is often the case, the poorest people have been hit the hardest, as food and energy purchases can make up to 40% of household expenditures in sub-Saharan Africa, and household costs have been on the rise as prices have increased by 24% (IEA, 2022a). By mid-2022, around 346 million people in Africa were short of food to some degree, the most impacted being the young, women, and those living in remote areas (IEA, 2022a).

A final global crisis that has not spared Africa is climate change, with the last few years seeing a continent-wide increase in extreme weather events. What remains unjust is that African countries continue to be among the most vulnerable and affected by climate change despite contributing the least to it. Africa has been responsible for less than 3% of the total energy-related emissions globally since 1890 (IEA, 2022a). At a local level, the direct consequences of these extreme weather events might range from rising levels of climate-induced migration within and out of the continent, greater levels of regional instability and conflict, increased food insecurity and wealth inequality, regression of women and youth empowerment, and the loss of significant biodiversity and ecosystems (IEA, 2022a). The ability to mitigate and adapt to the impacts of climate change is essential to ensure that the continent can reduce its current losses of between 5% and 15% of gross domestic product to climate change, depending on the region (AfDB, 2022a).

Alongside the local impacts of global developments, the development imperative remains central. Against this backdrop, African governments aim to aim to overcome domestic challenges and achieve development imperatives. The energy demand of a rapidly growing, young, and urbanizing population, coupled with GDP growth, are putting pressure on Africa's economy and infrastructure and creating an opportunity to explore sustainable solutions for energy production. There are also imperatives and expectations for them to eradicate poverty, improve health and livelihoods, and create jobs while seeking to industrialize and diversify economies, all amid challenging macroeconomic conditions. This will require massive investment in the coming decades in infrastructure, telecoms, transport, energy, digitalization, and agriculture but also in healthcare systems, education, institutions, gender equality, and providing solutions to other challenges such as high vulnerability and exposure to the impacts of climate change.

2.2. The impact of the global crises on Africa's energy systems

The ongoing global crisis has also significantly impacted Africa's energy systems, leading to rising energy security concerns and impacting critical energy infrastructure decisions. The surge in commodity prices has had a strong negative impact on countries that import energy. In contrast, energy-producer countries have witnessed only a weak rebound in energy production and continue to face barriers to ramping up production and increasing supplies to international markets (IEA, 2022a). Energy security in Africa is also closely linked to providing energy for the 30 million refugees and displaced African victims of conflict, violence, and climate change (UNHCR, 2022).

As a result, the continent has experienced a significant setback in energy access during Covid-19. Population growth in Africa continues to outpace new access to electricity, and the pandemic has further slowed the rate of new grid and off-grid connections. Installing new stand-alone off-grid systems has been particularly affected, as most new connections have been grid connections. Sales of stand-alone solar home systems, including photovoltaic panels and batteries with a capacity of at least 20 watts, fell by about 20% in sub-Saharan Africa between 2019 and 2021 (GOGLA, 2021). The decrease can be attributed to two main reasons: lower household incomes and logistical and financial hurdles related to the disruption of supply chains. As for on-grid electricity, since 2018, the pace at which new electricity-generating projects have been added to Africa's grids has decreased. From 2011 to 2018, the annual average growth in installed capacity was 6.6%, but over the 2019-2021 period this growth rate dropped to only 3.8% (BNEF, 2022g).

Energy poverty is, therefore, on the rise again, reversing the positive trends of the past years. Rising living and energy costs weigh on the most vulnerable households and businesses. Recent estimates indicate that the number of individuals lacking access to energy in sub-Saharan Africa increased by 4% in 2021 compared to 2019, undoing the progress made over the preceding five years (IEA, 2022a). As of the start of 2022, the 10 million Africans who recently gained access to essential electricity services could no longer maintain this access due to decreased household incomes (IEA, 2022a). The Covid-19 pandemic has also led to an increase in Africans without access to clean cooking fuels and technologies. In 2022, 5 million people could not continue to pay for modern cooking fuels like Liquefied Petroleum Gas (LPG), resulting in 970 million people, or approximately 75% of the population, not having access to clean cooking facilities in 2021 (IEA, 2022a). Meanwhile, over 560 million Africans are still without access to electricity across sub-Saharan Africa (IEA, 2022i).

The number of individuals lacking access to electricity in sub-Saharan Africa increased by 4% in 2021 compared to 2019 – a reversal of progress made in over a decade.

The energy investment landscape in Africa witnessed a slowdown in energy infrastructure development as investment priorities changed and the focus shifted toward crisis response. Driven by the cost of capital increases, investment priorities have changed. Investment in clean energy in Africa is currently highly concentrated in a few key markets, with South Africa, Egypt, Morocco, and Kenya attracting approximately three-quarters of all investment in renewable energy assets since 2010, totaling USD 46 billion, with the remaining countries combined only securing USD 16 billion in investment over the same time frame (BNEF, 2022g). The African clean energy investment landscape also seems not to have benefited significantly from any post-pandemic rebound (BNEF, 2022c).

Investment in clean energy in Africa is currently concentrated in a few key markets, including South Africa, Egypt, Morocco and Kenya.

For the end user, government incentives and the role of public utilities in alleviating the effects of the crisis have been very heterogeneous. Efforts by most governments to reduce energy costs for households have primarily been limited to grid customers via public utilities. Despite retail price controls, energy prices have risen, causing financial struggles for utilities and governments. This has heightened the risk of blackouts and energy rationing. However, some African countries have made provisions to extend energy affordability initiatives to off-grid customers. Nigeria's Economic Sustainability Plan 2020 included a USD 620 million allocation for solar home installations for 5 million households. Conversely, Rwanda provided USD 30 million in subsidies to electrify remote areas with solar power systems in 2020 (IEA, 2022a). Making energy decisions that can reverse these negative trends is crucial.

2.3. The opportunity for change and growth in Africa

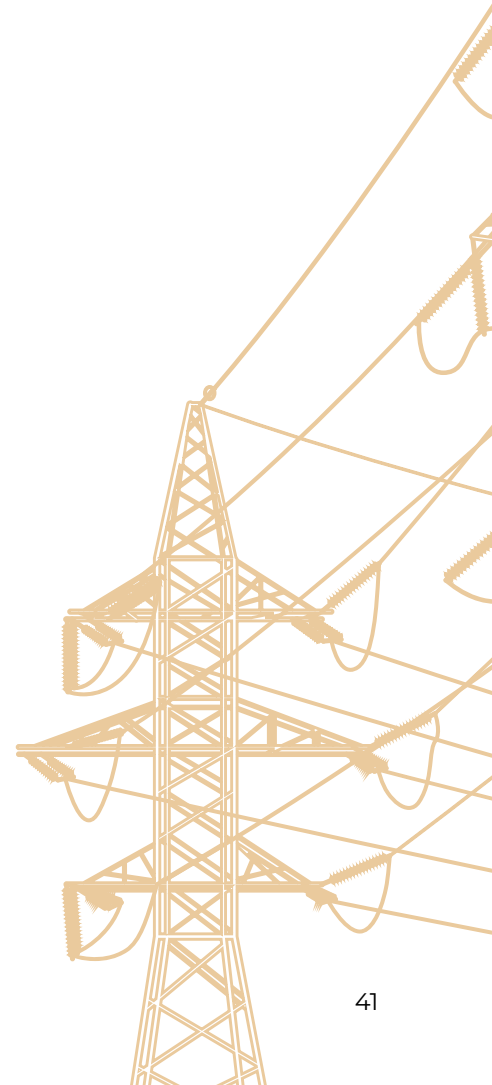
Africa is set to grow, and energy decisions in the next decade are critical for long-term sustainable development. Despite facing significant headwinds due to global socio-economic shocks, all the continent's five regions remain resilient with a steady outlook for the medium term, according to the AfDB (AfDB, 2022b). It has been known for a while that Africa is expected to become an economic powerhouse by mid-century, with GDP projected to reach USD 10 trillion by 2030, a 50% increase on 2020 levels (IEA, 2022a), and most likely reaching USD 29 trillion by 2050 (Signé, 2019). The GDP per capita is also expected to increase by 170%, from USD 2,400 (2015) in 2019 to USD 6,500 (2015) in 2050 (IRENA, 2020), and Africa is set to outperform the rest of the world in economic growth over the next two years, with real gross domestic product (GDP) averaging around 4% in 2023 and 2024 (AfDB, 2023). This growth is supported by several factors, including a rapidly expanding population, urbanization, and increasing global demand for natural resources. However, it has also been clear for many years that, for Africa to truly realize and sustain its potential, the continent's countries must prioritize development goals that enable prosperity, economic growth, and improved livelihoods.

With many African countries still developing their full energy systems, there is the opportunity to build sustainable, modern energy systems from the ground up that make full use of technological progress and learning from other parts of the world. This momentum has substantial implications for Africa's energy future. It holds new promise for the continent's economic growth and industrial and supply chain development, and can contribute to reaching Africa's twin objectives of sustainable access to energy and sustainable industrialization. A new industrial transformation based on renewables enables the development of entirely new industrial plans and supply chains, including related technologies such as green hydrogen, storage, grids & transmission, digitalization, etc., that are also possible in Africa (See Chapter 2 - 2.2. The opportunity for industrial & supply chain development).

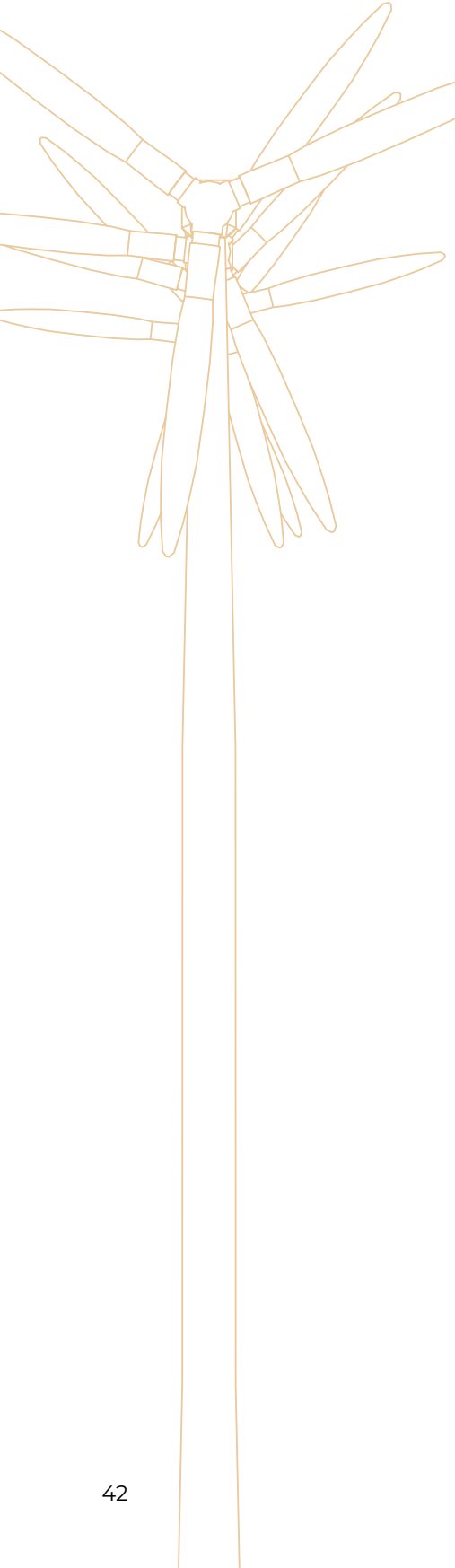
Sustainable energy can create a substantial positive socio-economic impact, including much-needed jobs. Cities will continue attracting more people as urbanization continues, but they must also provide better opportunities for jobs and income. The clean energy transition can create employment opportunities by creating new jobs across the supply chain. In Africa, there are expected to be 28 million jobs in the energy sector by 2050, with renewable energy jobs increasing from more than 0.3 million today to 8 million by 2050 (IRENA, RES4Africa & UNECA, 2022). This will contribute to a reduction in unemployment, an increase in economic activity, and help to elevate the standards of living for a significant portion of the population. As a direct consequence, the growth of a middle class with increased purchasing power and access to modern energy services for all individuals in Africa is expected to happen (IEA, 2022a). With this can then come improvements in the quality of life, increased educational and economic opportunities, and greater development of small- and medium-sized enterprises.

The decisions and actions taken in the next decade will decide whether Africa's future energy and electricity systems are future-proof and whether the energy transition is inclusive, sustainable, and equitable. Governments, development partners, local community partners, and the private sector have an opportunity to work together to learn from previous lessons, ensure that the clean energy transition in Africa is done correctly, and enable it to be a catalyst for the expected economic growth and improved livelihoods across the continent.

Africa is expected to have 28 million energy jobs by 2050, including 8 million in renewable energy, up from just over 0.3 million today.



2.4. Successfully tackling Africa's energy challenges by fostering opportunities

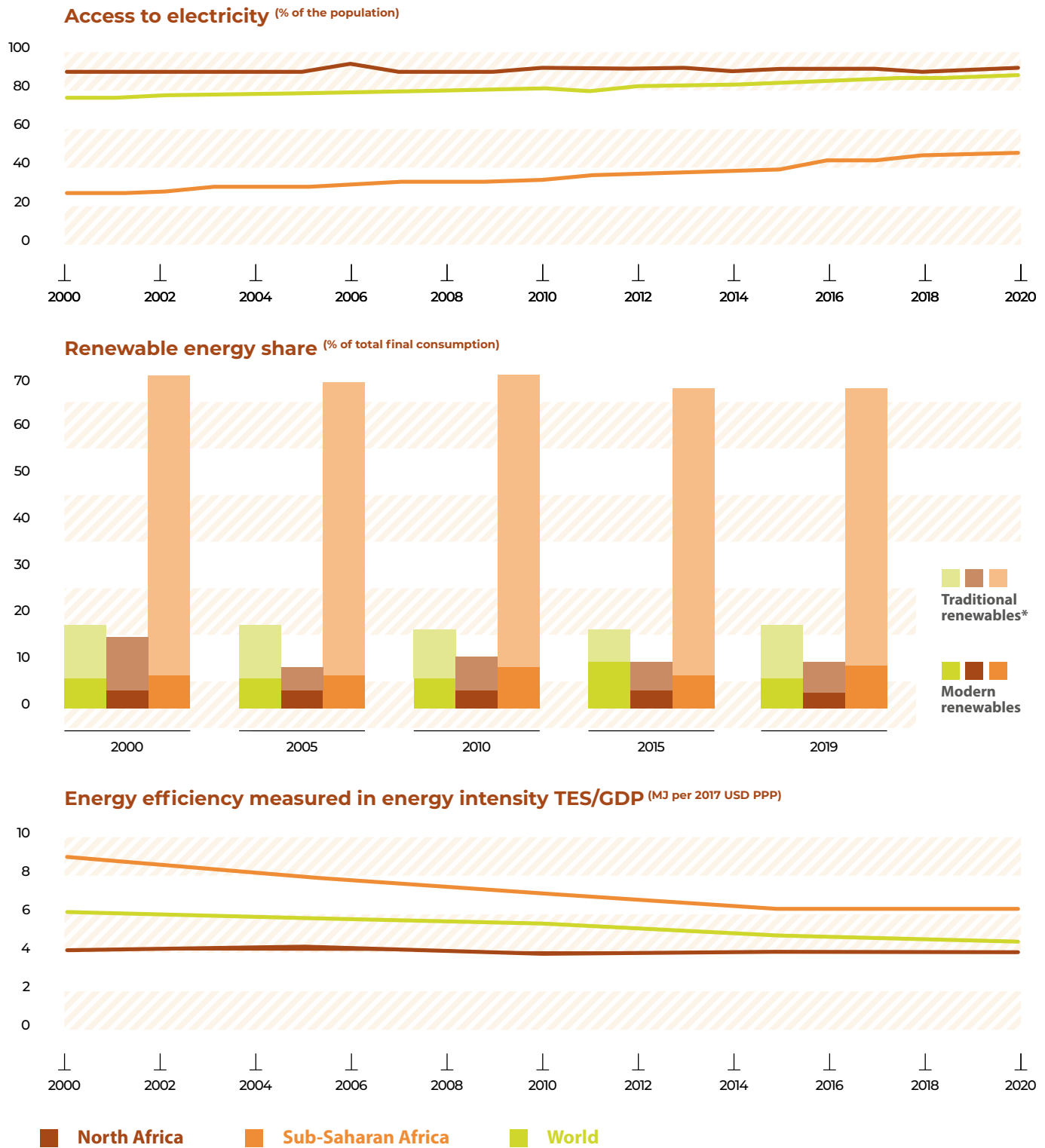


An immediate requirement is that energy needs to become universal, affordable, reliable and sustainable. Africa is home to 18% of the world's population, yet accounts for less than 6% of global energy use (IEA, 2022a) – with South Africa and North-African countries reflecting three-quarters of the continent's energy consumption (IEA, 2022a). Power shortages cost the continent about 2% to 4% of GDP per year, and electricity prices are, on average, twice as high as in other parts of the world (IEA, 2022a). That needs to change. Africa's energy infrastructure and the supply-demand gap will hold back growth unless this is met with a vast increase in affordable, reliable, and sustainable electricity supply and related generation & network infrastructure. Industries, cities, entrepreneurs, and livelihoods will all require more energy to deliver that growth, ideally with much of this coming from more affordable, reliable, and sustainable sources of electricity and related infrastructure.

Africa's most pressing energy challenge remains the hundreds of millions of Africans still lacking access to energy. As Africa's economies expand and incomes rise, energy demand is expected to increase by 60% by 2040 (IEA, 2019). Baseline scenarios estimate that current government policies will fall significantly short of meeting international objectives. Without further interventions, more than 560 million Africans and approximately one billion individuals will still lack access to electricity and clean cooking by 2030, respectively (IEA, 2022a). Sub-Saharan Africa is the only region in the world where this number continues to rise and where the cost of electricity services remains one of the highest in the world (World Bank, 2019). While success stories exist, such as in Ghana, Kenya, and Rwanda, which are on track for full access by 2030, more than half of people without access to electricity come from Nigeria, Democratic Republic of the Congo, Ethiopia, Tanzania, and Uganda (IEA, 2019). As stated in major development agendas (African Union's Agenda 2063, United Nations - UN Global Agenda 2030, and Sustainable Development Goals - SDG 7) and national development plans, Africa's future energy pathways need to prioritize ending energy poverty as it is one of the most significant obstacles to socio-economic development. To achieve universal access, the access rate needs to be three times faster than pre-pandemic levels in urban areas and four times faster in rural areas (IEA, 2022a). However, access is granted primarily through stand-alone solar home systems and mini-grids in rural areas. These technologies allow for relatively quick access and would represent around 60% of new connections by 2030 (IEA, 2022a). Proven renewable energy technologies at centralized and decentralized scales, therefore, have a crucial role to play in achieving universal access to energy for all Africans by 2030.

Fig.4 SDG 7 Tracker for sub-Saharan Africa

Enormous efforts are still needed for sub-Saharan Africa to achieve SDG 7.



RES4Africa 2023 compiled from various sources (Worldbank, 2022; IEA, 2022)

*As defined by the IEA, modern renewables include all uses of renewable energy with the exception of traditional use of solid biomass. Traditional renewables refer to the use of solid biomass with basic technologies, such as a three-stone fire or basic improved cookstoves, often with no or poorly operating chimneys.

To achieve universal access to energy by 2030, Africa's energy demand and supply landscape needs to evolve dramatically. The IEA's projection for Africa's primary energy demand shows this rising by over 30% by 2030, with renewables expected to meet more than 75% of this increase, effectively becoming the leading fuel category by 2030 (IEA, 2022a). While modern renewables grow fastest everywhere, regional disparities will continue to exist: oil and gas are expected to remain a principal source in North Africa, coal still leads in South Africa, and renewables are set to become the dominant fuel category in sub-Saharan Africa. Modern fuels are expected to dominate the final energy consumption in Africa by 2030. The total final consumption of modern fuels is expected to rise by an average of 5% per year between 2020 and 2030, a significant increase from the 2% growth seen in the previous decade (IEA, 2022a). Electricity use is also expected to rise across all end-use sectors, increasing 75% by 2030 (IEA, 2022a). Households will have driven over 50% of this growth due to universal access to electricity by 2030 (IEA, 2022a). The share of electricity in final energy consumption is expected to reach 48% by 2050 (IRENA, 2020). As a result, per capita electricity consumption jumps by 40%, which would still represent only 25% of the levels seen in other developing countries (IEA, 2022a).

Renewable energy can be the technology of choice to provide electricity access and needs to represent the majority of new capacity additions in Africa's power sector by 2030. The IEA's Sustainable Africa Scenario estimates that solar and wind combined are expected to increase eight-fold to reach 27% of power generation by 2030 (IEA, 2022a). The share of hydropower more than doubles, reaching almost 50% of the electricity mix by 2030 (IEA, 2022a). With renewable energy continuing to be the most cost-efficient technology in Africa by 2030, with declining costs in the long term and the global momentum favorable to the uptake of renewable energy, renewable energy investments are expected to grow. Other clean fuel technologies are expected to take an increasingly important role. Low-carbon hydrogen and hydrogen-based fuels are expected to displace fossil fuel use and play the role of an energy carrier in the continent's clean energy transition.

Electricity use in Africa is also expected to rise across all end-use sectors, increasing 75% by 2030.

Solar PV capacity needs to increase significantly to allow Africa to reach its clean energy goals by 2030. It is estimated that the continent will require an additional 125 GW to come online, representing a 20% increase from 2020 levels and accounting for 40% of the total new installed capacity between 2020 and 2030 (IEA, 2022a). There are, however, significant disparities between regions. In North Africa, where energy access levels are high, the share of wind and solar PV in power generation would need to increase by three percentage points, from 1% to 4%, causing the share of oil and gas in the primary energy supply to drop from 91% to 85% by 2030 (IEA, 2022a).

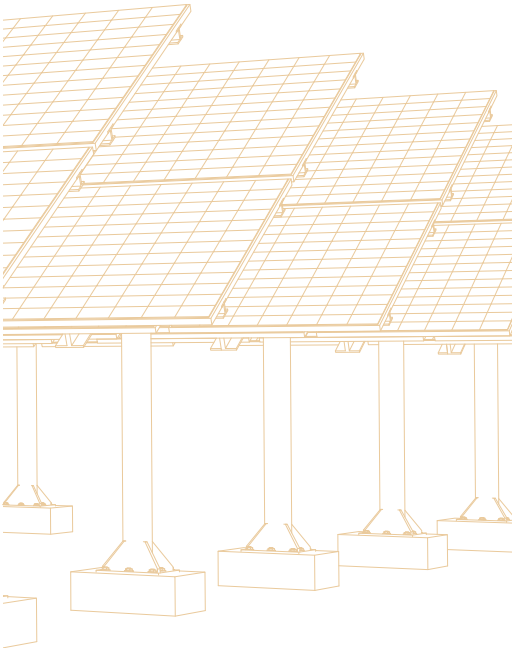
This projected increase in renewable energy is enabled by expected continued reductions in the cost of renewable energy technologies. After the recent rise in technology prices, the Levelized Costs of Electricity are projected to continue decreasing, especially for solar PV. In contrast, the cost of fossil-fuel-based power plants is projected to increase substantially (See Chapter 2 - 1.1. Counting the cost: renewable and conventional energy comparisons). These price reductions would be aided by yearly world renewable energy additions reaching 520 GW of wind and

solar by 2030, a three-fold increase from the 2016-2021 trends of 180 GW per year (McKinsey, 2022b).

Achieving a sustainable future for Africa will substantially affect the conventional energy sector. Africa holds 13% of the world’s gas reserves (Reuters, 2022), and there have been increasing expectations that the continent might begin replacing part of Russia’s gas for European countries. As energy transitions bring down hydrocarbon demand in line with global net-zero, there will be increased pressure on economic models relying on hydrocarbon revenue. It will also raise more questions about the finance available for conventional energy investments, especially where there is an increased risk of these assets becoming stranded. Near-term market opportunities should not distract from declining future oil and gas export revenues. Moreover, while these sectors have traditionally mainly been used for export revenue, the focus now must shift to meeting domestic energy demands with domestic resources. It will be vital to ensure a just energy transition approach to these future shifts.

Bringing Africa’s sustainable future to fruition is thus a formidable task. All African nations can demonstrate their unwavering commitment to sustainability by setting bold goals and implementing policies that establish a solid foundation for a thriving energy economy. Meanwhile, the international community has a critical role in supporting these national discussions and catalyzing a substantial increase in clean energy investment in Africa. This can only be achieved through a strong and concerted effort to meet and surpass current commitments for providing climate finance to developing economies. Together, these efforts would still lead to an approximately 1.7 °C increase by 2100. Energy is the golden thread for development and plays a pivotal role in catalyzing economic development, creating jobs for youth, supporting health, and improving livelihoods. This means engaging and building the necessary support across the various stakeholder groups.

Scenarios project that solar and wind combined are expected to increase eight-fold to reach 27% of power generation by 2030 to reach Sustainable Development Goals.



3. Narrative evolutions on Africa's just energy transition

Central to these global economic and technological developments is the question of what Africa's future clean energy transition should look like. What does the global energy transition mean for African countries, and how can it be driven in a way that makes sense for Africa's energy realities and aspirations? Given the multiple realities of African countries, various perspectives are inevitable. Narrative evolutions are essential to grasp because they inform and shape strategic and infrastructure decisions across countries and continents. A few key considerations are shaping this debate.

3.1. Africa's sustainable and economic development imperative

African energy and climate leaders are questioning what the global energy transition and net-zero trajectory goals mean for their countries. While the global energy transition discourse is now focused on energy security and decarbonization, Africa's continental aspirations lie in development, as enshrined at the African Union (AU) level, and the energy access and industrial needs of Africa to reach its Agenda 2063 and SDG 7. A recurring argument is that "net-zero" should not be considered a one-size-fits-all approach. After all, not all countries start their energy transition from the same place. Instead, talks on Africa's energy future should reflect the differing challenges, needs, and opportunities faced across the continent and its 54 countries. It follows that each country defines its clean energy transition path based on the country's ambitions and objectives. This debate revolves around the need to decarbonize versus accelerate development in countries with a minor historical role in creating climate change. Rooted in previous UN Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP) discussions under the theme "common but differentiated responsibilities", these ongoing debates have now become exacerbated by a broader context and crisis of energy security, climate impact, industrial policy debates, and an ongoing geopolitical realignment of resources in an increasingly multipolar world.

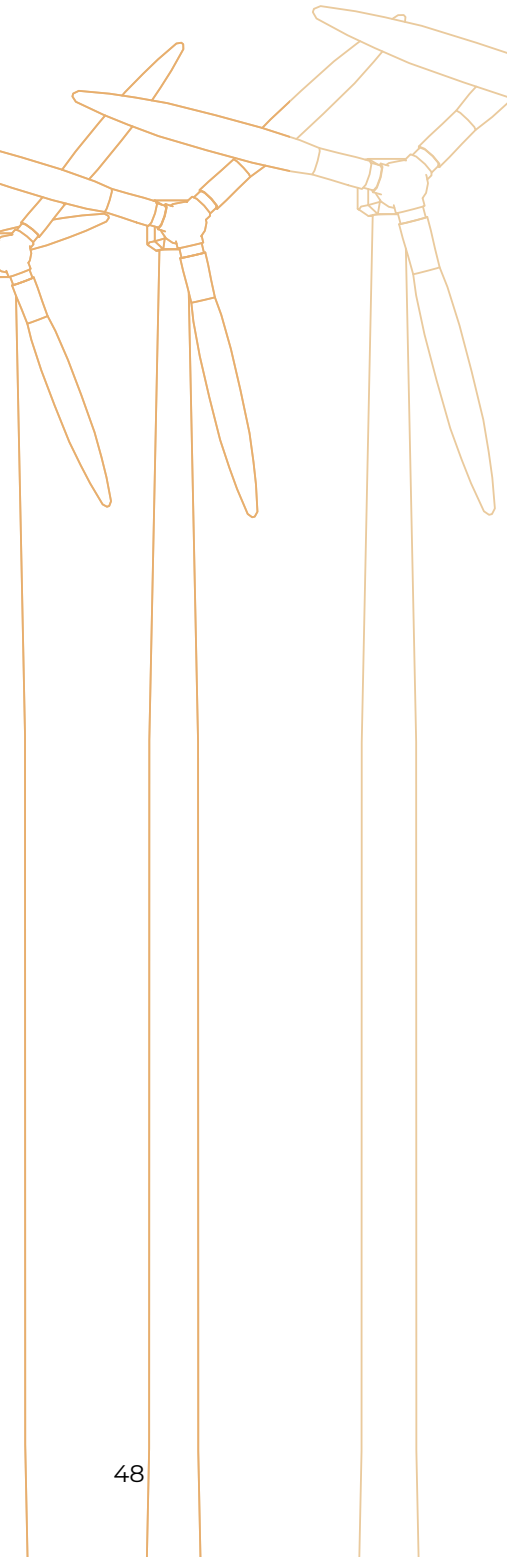
For Africa, which has a historically negligible role in causing the climate challenge, the priority is development. History has shown that energy is the golden thread for development, and that all economies require energy systems to foster economic growth, achieve development, and improve livelihoods. Therefore, Africa needs to ensure that it develops and grows sustainably, building on energy systems that accommodate Africa's rapidly growing and urbanizing economies. In that light, African countries stress their need and right for individual development and free use of their energy resources. This call for sovereignty and the concerted view was seen at COP27 in Sharm el-Sheikh – considered an African COP – and on the road towards COP28, where several African leaders stressed their need and were suitable for an energy transition "on their terms".

3.2. Pragmatism and sustainability: the energy mix debate

While there is little doubt about the imperative for Africa's sustainable development, views may differ on what energy mix should power that development. The need to build energy systems that accommodate Africa's rapidly growing and urbanizing economies raises questions about the energy mix. On the one hand, what can be inferred from the renewable energy targets and Nationally Determined Contributions (NDC) that are being published by countries in Africa is that there is a growing recognition of the potential of renewable energy, its ability to provide clean electricity, and how the continent could use its vast and untapped resource endowments for economic transformation, job creation, and poverty eradication. African countries have made political commitments to address CO₂ emissions in the energy sector, as activities in African NDCs predominantly focus on energy as a main priority, with more than 80% of countries indicating plans to implement energy efficiency measures and 94% renewable energy measures (ETTG, 2021).

On the other hand, some countries have called for an honest discussion about the continent's future energy mix proposing an open stance towards transition fuels. In particular, natural gas and green hydrogen are spotlighted in discussions on Africa's clean energy transition – especially since the start of the Russia-Ukraine conflict. The rebound of energy demand and immediate concerns over energy security, affordability, and reliability throughout 2022 have involved the oil and gas sector. Given the global economy's carbon-intensity and hard-to-abate sectors, where more sustainable energy alternatives are needed, and the growing clean energy momentum, the oil and gas sector increasingly takes part in climate discussions. The stronger-than-usual oil and gas presence at COP27 in Egypt evidenced this. In the run-up to COP27 in November 2022, African countries also sought to define a common energy narrative. This could be seen in the Kigali Communiqué (May 2022) and the African Union Commission's (AUC) African Common Position (June 2022) on a just and inclusive energy transition that maintains the continent's reliance on conventional energy to “continue to deploy all forms of its abundant energy resources including renewable and non-renewable energy to address energy demand” (African Union, 2022). There have been mixed reactions to this positioning from climate and energy voices alike – including from the renewables sector, which indicate it is based on outdated renewable energy conceptions (See Chapter 2: Making the business case for renewables and sustainable development in Africa).

Questions are asked on how African countries should balance energy transition and development imperatives, encapsulated by the concept of “a just and equitable energy transition”. This debate reflects that the continent is home to energy importers, hydrocarbon producers, as well as exporters of energy and mineral resources. Given Africa's various energy realities, countries have different views



on composing the energy mix and navigating the shift away from hydrocarbons toward cleaner energy sources. Calls for a just energy transition in Africa maintain that the balance between clean energy transition and development imperatives has to be tackled carefully so that neither fossil-fuel rich nor fragile economies are left behind. Nascent energy producers, such as Senegal, Ivory Coast, Ghana, Mozambique, Mauritania, and others, claim their right to exploit newly discovered resources for their economic development, emboldened by market signals such as unprecedented gas price surges in 2022 and new market opportunities to export to Europe. Several African countries have recently announced lithium and graphite discoveries as well. Countries will have different needs and interests around their energy transitions and expectations around the ongoing extraction and export of oil, gas, and coal reserves, as well as those of critical minerals. Current energy prices will also influence the competitiveness of some technologies to achieve universal access, notably the use of diesel generators for electricity and LPG for clean cooking.

2023 is also seeing new debates on the role of energy sovereignty and market opportunities, accelerated by the security crisis in Europe. Nascent African producer economies are claiming a prerogative to develop their resources, including for new markets. In that light, African energy leaders are asking for consistency from partner countries and international donors on limiting development financing for natural gas energy infrastructure (Shell, 2023). This has given the fossil fuel industry an impetus to become more organized on its narrative to push for a larger role in the energy mix, even where this often does not result in the most cost-effective solutions. These decisions are still primarily driven by the misplaced notion that fossil fuels have greater reliability and stability and thus are better able to provide energy security, particularly in contrast to Variable Renewable Energy sources (VRE). African leaders are weighing up integrating national renewable energy systems within a broader regional power pool against focusing on their own energy resources, including available fossil fuel assets, to address urgent energy needs and achieve their transition plans.

3.3. Trust and cooperation in times of geopolitical realignment and energy security

Energy mix debates are complemented by significant narrative shifts at a geopolitical level. The narrative of defining a just and equitable energy transition has become more complex because of Russia's invasion of Ukraine and Europe's pivot toward new energy sources. Given the fragmentation of globalization and the multipolarity of today's world, industrialized countries are competing for strategic autonomy. For example, in Europe-Africa relations, Europe's rush to find new energy sources in Africa, characterized by a somewhat uncoordinated bilateral conventional energy diplomacy, opens ways for the replacement of Russian gas with African sources, thus shifting the nature of the EU's engagement with the African continent, and leading to renewed investment in oil and gas – a very different signal than a few years ago. African energy stakeholders face the challenge of being told not to develop their conventional energy resources for local use. At the same time, EU countries have arrived in the past year to secure their energy resources in the name of energy security, making trust and solidarity issues challenging to navigate. This short-term review of oil and gas is sending signals to African countries – producers and consumers alike – that Europe and its nations have changed positions on gas as a transition fuel and other energy infrastructure decisions and informed the developments mentioned above. Moreover, there's an ongoing “disenchantment” around the EU's course of action towards African countries, with the number of initiatives that have been announced but scarcely implemented and regularly replaced by new announcements and repackaging of resources – marking a lack of coherent strategy (AEF, 2022).

In a world increasingly oscillating between geopolitical cooperation and competition, the result is that trust has suffered a setback. There is an urgent need to address the gap between commitments made by governments at summits, ministerial meetings, and climate conferences and evidence of their delivery. This will require enormous trust-building efforts between African countries and industrialized economies to ensure a structured dialogue between leaders on achieving global and Africa's energy transition goals. To fix these trust issues, new models of energy cooperation need to be characterized by enhanced mutual comprehension, international collaboration, and trust-building. More platforms for structured technical and high-level dialogue on Africa's just and equitable energy transition should be established. International forums and platforms should be used to gather different multi-stakeholder levels and understand each other's priorities, ensuring countries and actors that intervene at country/regional levels act in a coordinated manner, understand the purpose of various initiatives, and focus on delivering the UN 2030 Agenda and the Africa 2063 Agenda (AEF, 2023). 2023 will be a pivotal year for recalibrating partnerships at cross-continental and international levels.

African energy and climate leaders are questioning what the global energy transition and net-zero goals mean for their countries.

3.4. Climate impact and solidarity

The African continent accounts for less than 3% of global energy-related CO₂ emissions to date, and has the lowest emissions per capita of any region.

Africa has historically contributed the least to climate change and is expected to face some of the most substantial impacts. African countries contributed less than 3% to global GHG emissions, yet are some of the most exposed countries to the devastating effects of climate change, with important socio-economic repercussions (WMO, 2022). The ability of African countries to deliver climate mitigation and adaptation initiatives will be heavily reliant on sufficient financing being available. Meanwhile, climate and clean energy financing need to catch up. For example, there has been a disappointment in the EU's decision to allocate fewer funds to the energy transition than expected, with only EUR 2.4 billion of the EUR 150 billion meant for sub-Saharan Africa and EUR 1 billion for North Africa by 2024 in the EU's Global Gateway directed to energy (AEF, 2022) (African Union, 2023). According to an Africa-EU Energy Partnership (AEEP) report, if the current trend in the growth of EU investment continues, the funding necessary to achieve SDG 7 will be met in 2034 rather than 2030 (African Union, 2023). Developed economies had the pledge to commit USD 100 billion per year, a commitment dating back to 2009, for climate change for Africa, but it has since not been put into action (The Guardian, 2022). The loss and damage fund creation during COP27 pushed toward this idea, and this initiative is still under implementation. The next steps on the fund will be vital towards COP28.

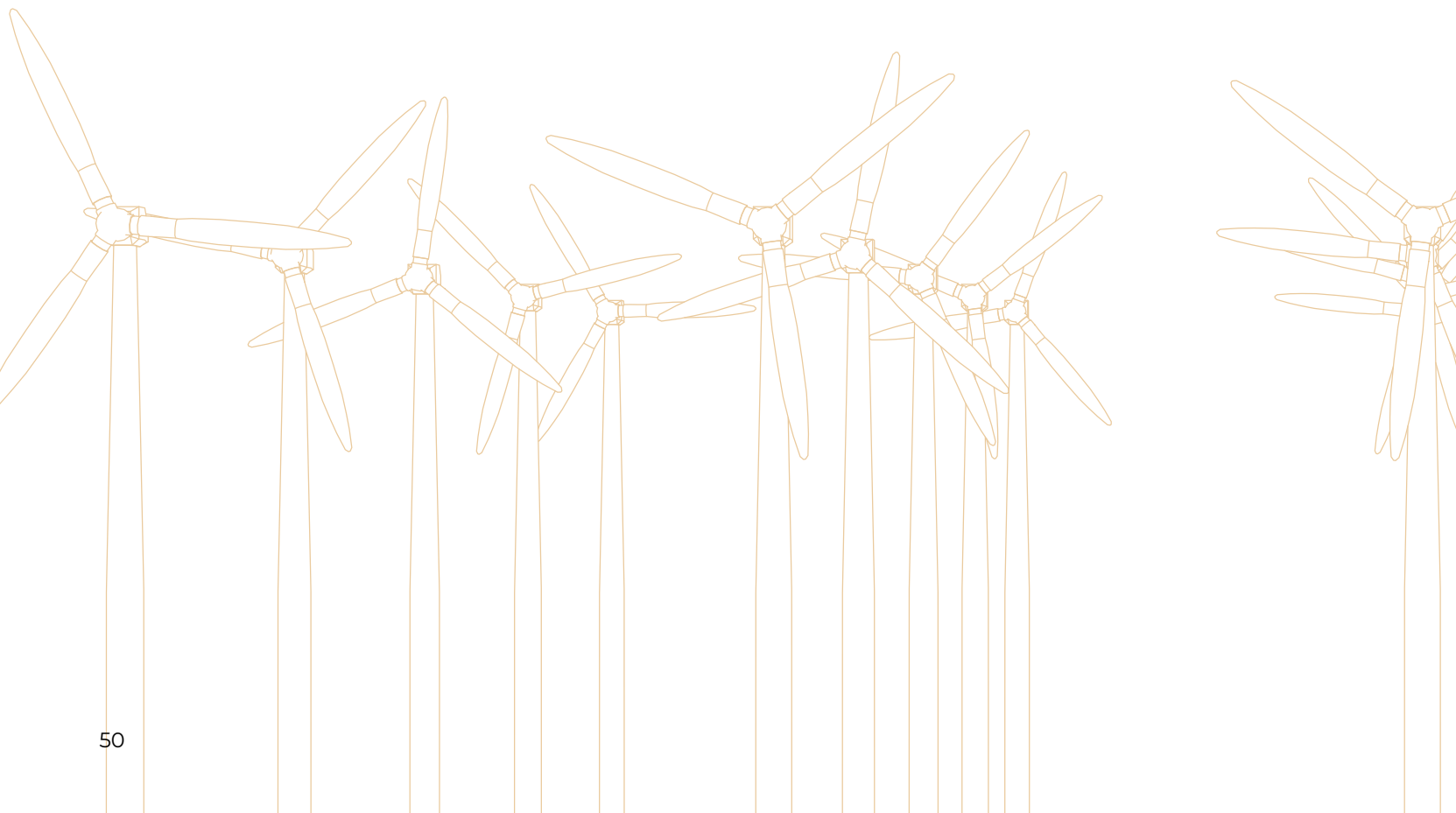
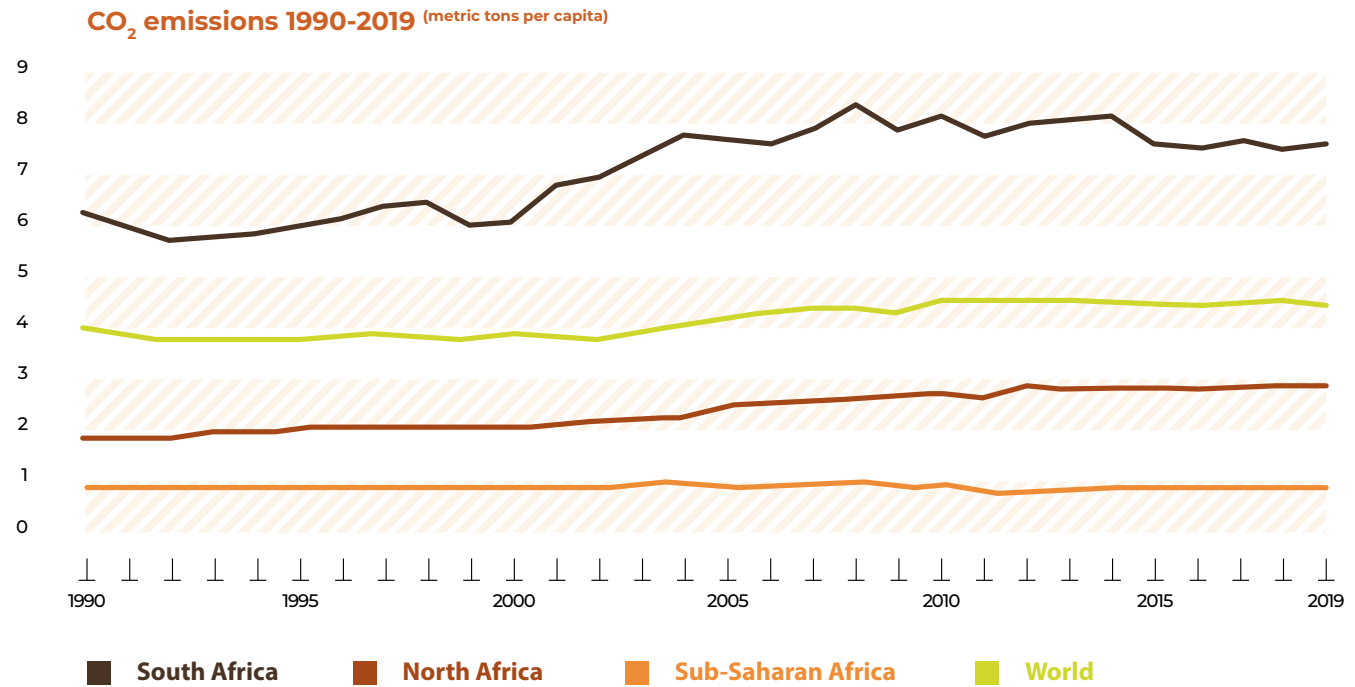


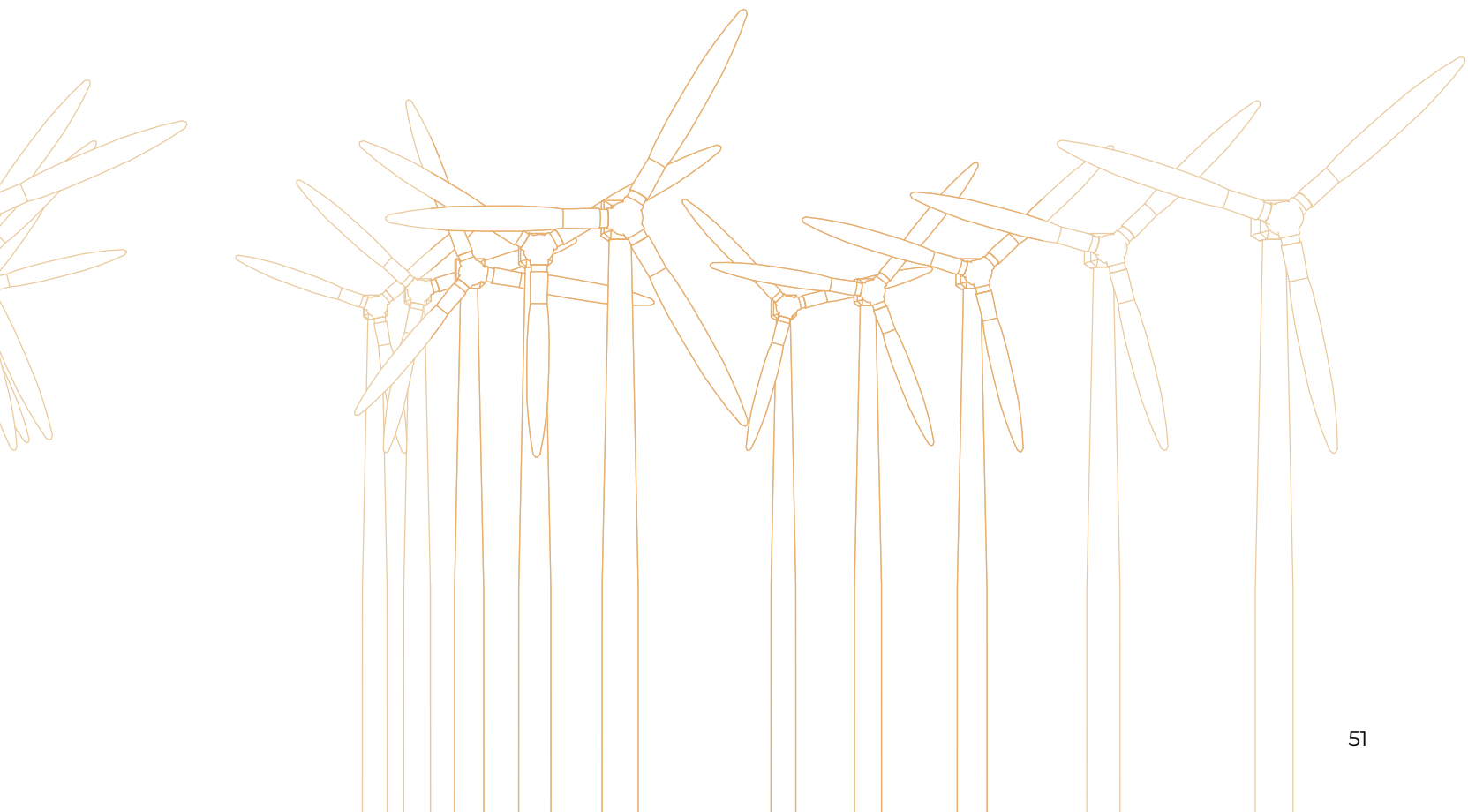
Fig.5

CO₂ emissions (metric tons per capita) 1990-2019, Africa

Africa's contribution to climate change is minimal, but its effects will affect the continent greatly. South Africa is an exception.



RES4Africa 2023 compiled from World Bank, 2022



Box 2 – Africa, Energy & Climate - COP27 outcomes and towards COP28

For the past three decades, the world has gathered annually at the United Nations Climate Change Conference to define a global response to the threat of climate change. At these COP summits – short for Conference of the Parties – countries aim to find an international consensus on key issues to deliver on the Paris Agreement target by setting climate change mitigation and adaptation goals for the world. Besides being a space for science-informed negotiations between governments, COP meetings have evolved into an inclusive marketplace where state and non-state actors collaborate for ideas, partnerships, and pledges. Coming out of the pandemic, 2021 saw an unprecedented number of pledges and net-zero targets in government and corporate commitments to decarbonization.

Last year's COP27 meeting, held in Egypt and seen as an African COP, was considered an opportunity to influence commitments and initiatives for Africa specifically. While it gathered concerted action and positioning from African countries, outcomes were mixed. Significant progress was made in pursuing global cooperation through the historic establishment of a Loss and Damage Fund for particularly climate-vulnerable countries. At the same time, a range of regional deals and initiatives were announced, such as the expansion of the Just Energy Transition Pathway (JETP) from South Africa to Vietnam and Indonesia. COP27 also acknowledged the need to reform multilateral and bilateral development lenders and align their spending with climate action. Several initial agreements for green hydrogen and renewable energy projects were signed at Sharm el-Sheikh. Yet despite holding on to the Glasgow Pact line on 1.5 °C warming, progress on emissions mitigation remained largely elusive, with no new developments on mitigation targets and no real language on fossil fuel phase-out. Negotiation on the outstanding USD 100 billion climate financing for climate-vulnerable countries also continued. After COP27, it became less apparent whether the Paris Agreement targets would ever be met (McKinsey, 2022b), reflecting a shift in the narrative to “keeping the 1.5 °C target alive” and “every degree matters”.

The countdown has now started toward COP28, hosted by the United Arab Emirates, amid expectations that a similar risk for reduced ambition on mitigation and adaptation goals could prevail. COP28 will mark the world's first global stock take, a comprehensive assessment of progress against the Paris Agreement targets since 2015. Eight months before the COP meeting, preliminary reports show that the energy transition is off-track to meet the Paris Agreement goals (IRENA, 2023c), calling for a “fundamental course correction with bold and transformative measures”. To do so, emissions must reduce by 43% in the next seven years to keep the 1.5 °C target alive. Meanwhile, the global population is expected to grow to 8.5 billion in those same seven years. “Meeting the scale of the world's fast-growing energy needs while dramatically reducing emissions is one of the most complex challenges humanity has ever faced. Nothing short of transformational progress will do across mitigation, adaptation, climate finance, loss, and damage” (IEA, 2023b).

To rebuild momentum, COP28 will focus on achieving low-carbon growth much faster than previously envisaged and reaching an energy tipping point (BBC, 2023). Beyond raising ambitions on mitigation and adaptation targets, COP28 is expected to prioritize implementing commitments. Much focus will go to recent legislation announced across Europe, the USA, and others to leverage investment flows to real projects. Expectations point towards the enhanced focus on emissions reduction, leaving the door open to fossil fuels. Expected to be a meeting point between the Global North and the Global South, it remains a place where African countries can underline the sustainable development imperative and how to create solutions to link development-orientated pathways as a foundation for low-carbon trajectory. It will be a meeting point on implementation across mitigation, adaptation, loss and damage, and climate finance goals as the primary focus.

A successful COP28 outcome is vital for all countries because the Paris Agreement target of limiting global warming to 1.5 °C is at risk, with significant consequences for all if left behind. The scale of the world's energy and climate challenges calls for sustainable and transformative action that is carried out fairly for developing economies – including Africa.

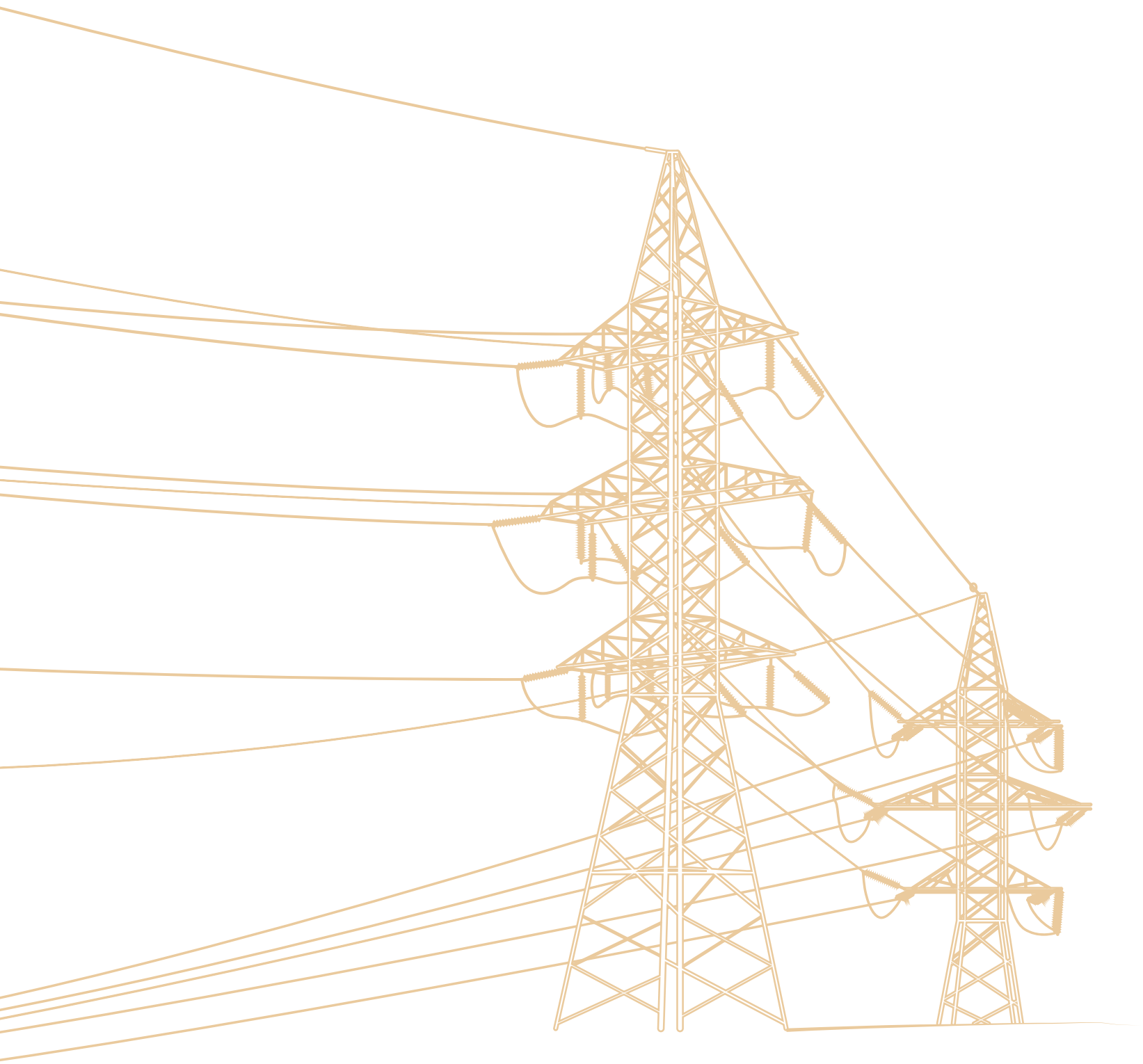
3.5. A possible way forward: Africa has the power – let's use it

The need for Africa's just and inclusive energy transition toward sustainable development emerges from the convergence of these challenges. African leaders can use the global energy transition momentum to define their transition pathways to support and enable the continent's industrialization and sustainable development.

Key attributes of this approach will encompass the recognition that:

- Africa's immediate need is not to decarbonize but rather to develop sustainably. Decisions on Africa's energy future will benefit from a balanced and long-term approach, informed by local and regional realities;
- Critical considerations of affordability, security, resilience, and resources will shape each country's defined transition, as will the country's current energy, its access to favorable natural resources, and its disposable financial resource to leverage capital and support the energy transition;
- The energy transition can and should be understood not as a burden but as an opportunity to achieve development objectives. Energy transitions that are based on sustainable energy and electrification can improve livelihoods, reduce emissions, increase GDP, create jobs, improve welfare, and create new industries that support the energy transition in and outside of Africa (IRENA, 2022a);
- African countries can prioritize their development imperative and link growth-oriented pathways as a foundation for clean energy;
- With the right policies and support, Africa has the biggest potential for clean energy and green transformation growth opportunity, especially given the local abundance of renewable energy and critical mineral resources (UN, 2022);
- The energy transition could bring about an industrial revolution if supported by large-scale productive investment and broader socio-economic development.

Given the scale of the development ambition and the long-term vision as crystallized in SDG 7 and Agenda 2063, African countries need a varied energy portfolio composed of multiple technologies across transport, industry, heating, cooling, and power, based on needs and technologies of the future. African countries remain well positioned to capture the range of benefits that could result from appropriate applications of technologies and use this to attract increasing flows of private sector investment. If it is possible to find and apply suitable development models that meet inclusivity and development aspirations while also avoiding carbon-intensive choices that other economies have pursued in the past, then the falling costs of critical clean energy transition technologies offer an incredible opportunity to follow a low-emissions pathway for growth and prosperity. Governments should seek to implement opportunities in renewable energy deployment to bypass outdated technologies to make faster progress toward a low-carbon development pathway. However, if this is not taken, it will become a significant global fault line in efforts to deliver the hoped-for economic development and SDG goal outcomes and address impending climate change challenges (IEA, 2021).



RES4Africa Executive Committee members views

Given the context, what strategic priorities do you see for making progress on Africa's clean energy development?

"Our view is encapsulated by three words: Renewables-Affordable-Financeable. Renewable – energy is abundant, its Levelized Cost of Electricity (LCOE) is falling, and batteries address intermittency. Affordable – post-Covid, many governments' anemic finances make renewable energy tariff affordability an issue that needs addressing, probably at a European level and by institutions such as the IMF. Financeable – private sector funding of African energy was only ~6% of total funding in 2020. To increase this, designed-for-purpose guarantees need to be provided by Multilaterals and Development Finance Institutions (DFI) to the private sector so that they can boost funding for African renewable energy and help reduce the funding gap relative to the capacity required."

Intesa Sanpaolo

"Renewables are an outstanding opportunity for Africa to abandon polluting and expensive fossil fuels. They will support Africa to create a local industry contributing to growth and

wealth. However, an appropriate framework must be in place. Namely, two conditions must be met: legal certainty and a clear regulatory framework with rapid permitting rules; and appropriate routes to market, which means creating mechanisms at a national level to ensure that the energy produced will be sold." – **EDP Renewables**

"Last year, the world of energy changed. We saw sky-high gas, fuel, and oil prices, reminding us of the importance of energy autonomy. In addition to that, the effects of global warming became even more real, from deadly floods in Nigeria to devastating droughts in Somalia. With this panorama, what would be a good energy strategy for Africa's energy mix? Renewable energy is necessary because it provides steady prices, increases the country's energy autonomy, and fights climate change. The next step is for Africa to solve key bottlenecks by preparing its electrical network to absorb more renewable energy."

Siemens Gamesa

"We in Schneider Electric work closely with our customers, partners, and stakeholders in Africa on energy-related solutions and programs that revolve around technology adoption and digital transformation to enhance energy access. Energy access drives socio-economic development and higher living standards in Africa and elsewhere. However, almost 800 million people worldwide don't have access to electricity, and 2 billion people are without access to reliable and safe electricity. This is why action is needed for a grand coalition of energy leaders, governments, industry, and investment community in Africa to make the economic recovery as sustainable and resilient as possible as countries across the globe now face economic inflation, and some still face the challenge of building back better in the aftermath of Covid-19." – **Schneider Electric**

“Africa is a fast-growing continent and a potential future benchmark of how the world should be shaped. Energy is a crucial driver of development for Africa’s population. The availability of energy across territories and the cost of obtaining it are highly dependent on a strategic vision of the available sources, the creation of a friendly regulatory platform, and an expectation of stability as a pre-condition for public-private joint investments. RES4Africa is committed to connecting people who may help inside and outside Africa to achieve these critical goals.” – **PwC**

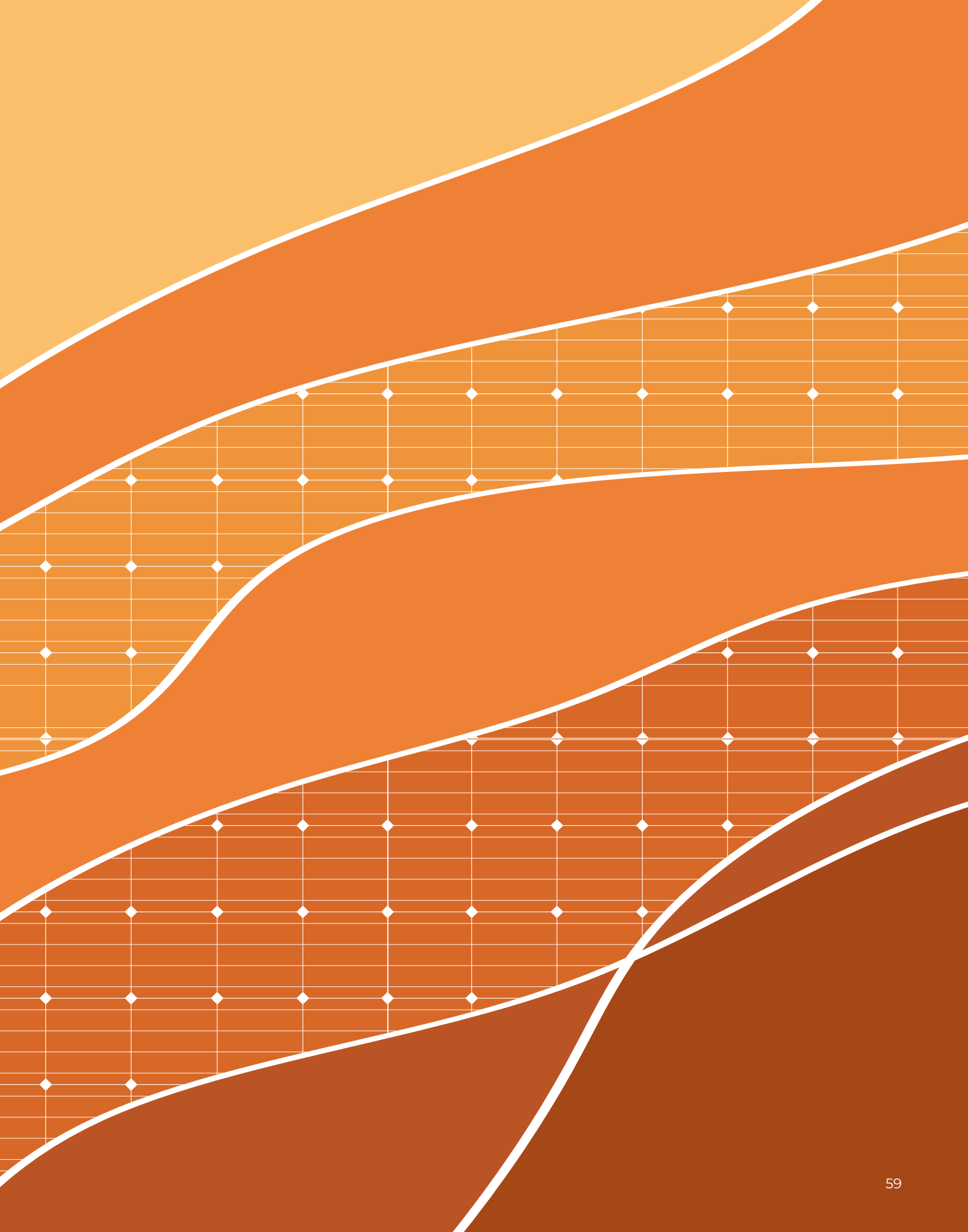
“The evolution of the energy sector over the last few years has demonstrated a considerable need for each country’s energy resilience. Interconnection across countries will be vital in sharing energy across boundaries and fostering energy interdependence. Traditional and renewable power plants and establishing a backbone network are essential for growth and prosperity. In conjunction with this, coupling Battery Energy Storage Systems (BESS) with renewable energy plants has proven to be a robust solution to reduce supply and demand mismatch. It is now a standard design for renewable energy. Moreover, Africa can be a significant player in the hydrogen and LNG export markets, creating a market with Europe seeking new solutions based on more diversified import agreements. Africa is now positioned to play a major part in the global energy sector.” – **RINA**

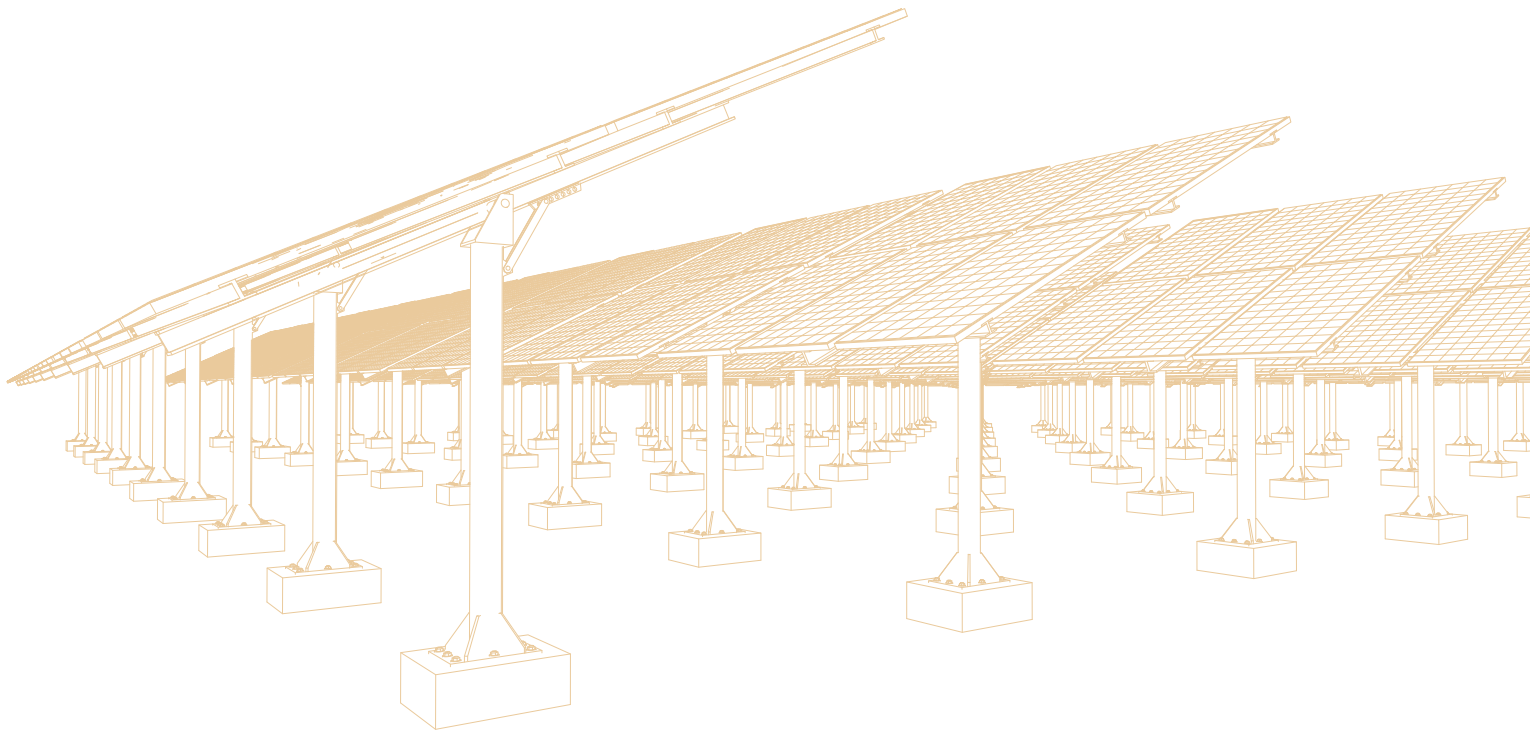
“RES4Africa was able to gain over the last 10+ years a leading position both in Europe and Africa when it comes to promoting dialogue between renewable energy public and private sector actors. It proved very effective in taking concrete actions to promote top-notch capacity-building programs specifically designed for African stakeholders. CESI is a very proud founding member of RES4Africa and is committed to actively supporting with great passion this initiative also in the near future.” – **CESI**

“We can clearly see that Africa, with its increasing energy demand and wealth of resources, will play an important role in the energy transition. When we evaluate different countries, we see different scenarios; for example, in Mozambique, where the majority of households do not yet reach energy access and each year approximately 350,000 people are newly electrified; in South Africa, load-shedding is the major issue due to supply shortage; Morocco is preparing to become a hub for energy and green hydrogen; last but not least there is a common problem on the continent: access to finance. As a result, there is no single solution. We must create custom-made solutions for each country using our know-how and expertise for Africa’s continuous and sustainable growth.” – **Prysmian**

“The drastic changes that we have witnessed across the energy sector in the past years have shown the importance of securing reliable and affordable energy, decreasing dependence on external resources and reducing exposure to market volatility. Renewable energy is a perfect ally to achieve this, with the double effect of reducing the cost for electricity and fighting climate change. African countries are uniquely positioned to pursue renewables-led energy transformation thanks to their enormous solar and wind potential, well spread across the continent. Moreover, renewable energy holds great promise also for Africa’s green industrialization. Supply chain development and local transformation can be significant drivers for countries to capture benefits from industrial development. Expectations for renewables in Africa are enormous, and we must ensure they become a reality.” – **Enel Green Power**

CHAPTER 2
MAKING THE BUSINESS CASE FOR RENEWABLES
AND SUSTAINABLE DEVELOPMENT IN AFRICA





1. Making the business case for renewable energy

Renewables are at the heart of energy security, affordability, and sustainability with enormous potential for Africa's sustainable development – more than ever before. The benefits had already been well-established: renewable energy technologies have been proven to be rapidly and easily deployable, cost-efficient, have vast geographical and application potential, are climate resilient, are secure, and have multiple socio-economic co-benefits. But do these benefits still hold in the context of changing geopolitics, energy prices, and reliability and transition pathways? While still unfolding, new data indicate that these benefits are only becoming stronger.

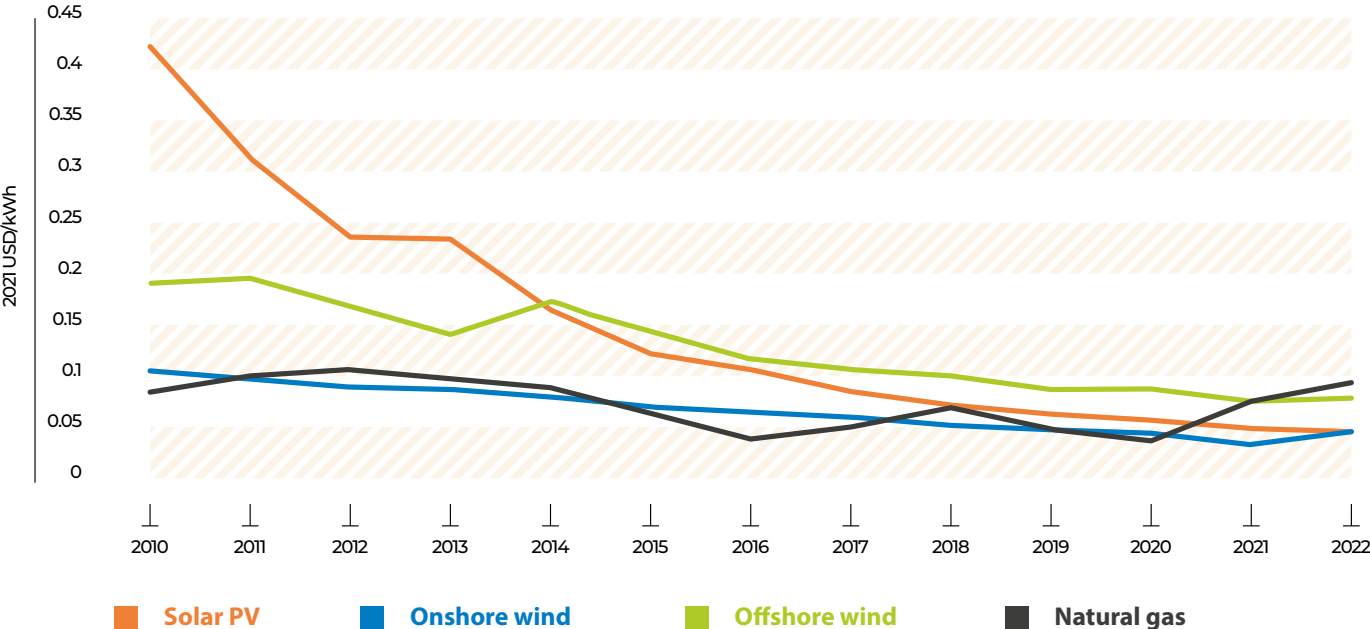
1.1. Counting the cost: renewable and conventional energy comparisons

Cost efficiency is a critical factor in energy infrastructure decisions. Many reports indicate that renewable energy costs – even in the current context – are continuing to go down. The last few years have seen tremendous progress in efficiency, scale, and economics. Data from a recent report from the International Renewable Energy Agency (IRENA) has identified that the global weighted average cost of newly commissioned solar PV, onshore, and offshore wind power projects have all continued to fall despite rising materials and equipment costs (IRENA, 2022d). Much of this is being achieved through advancements in technology, economies of scale, and more robust supply chains.

New data support that renewables are the cheapest form of installed electricity capacity around the world and virtually everywhere in Africa. This has contributed to a situation where, for projects in markets representing 96% of global electricity generation, it is now cheaper to build new wind and solar than new fossil fuel power plants. This also means renewable energy is the least-cost option for expanding installed capacity or replacing old assets (BNEF, 2022b). In some countries (representing 60% of global electricity generation), they are even cheaper to build than to continue operating existing fossil fuel assets (BNEF, 2022b). These developments have also allowed almost two-thirds of the 163 GW of newly installed renewable power in 2021 to have lower costs than the world's cheapest coal-fired option in the G20 (IRENA, 2022g). Solar PV – already the cheapest source of power in many parts of Africa – is expected to outcompete sources continent-wide by 2030 (IEA, 2022a). With the recent tightening of macroeconomic conditions and increasing interest rates, inflation and supply bottlenecks, some costs have increased for renewable energy projects (See Chapter 1 - 1.2. Examining the growing momentum toward a global clean energy transition), but expectations are that their competitiveness will continue to improve especially as natural gas and coal prices increase even more sharply (IEA, 2022e).

Fig.6
Renewable energy cost-competitiveness amidst rising costs

In 2022, solar PV, onshore and offshore wind are more competitive than natural gas globally for the first time ever.



RES4Africa 2023 compiled from various sources (IRENA, 2022; BNEF, 2022; BNEF, 2022a)

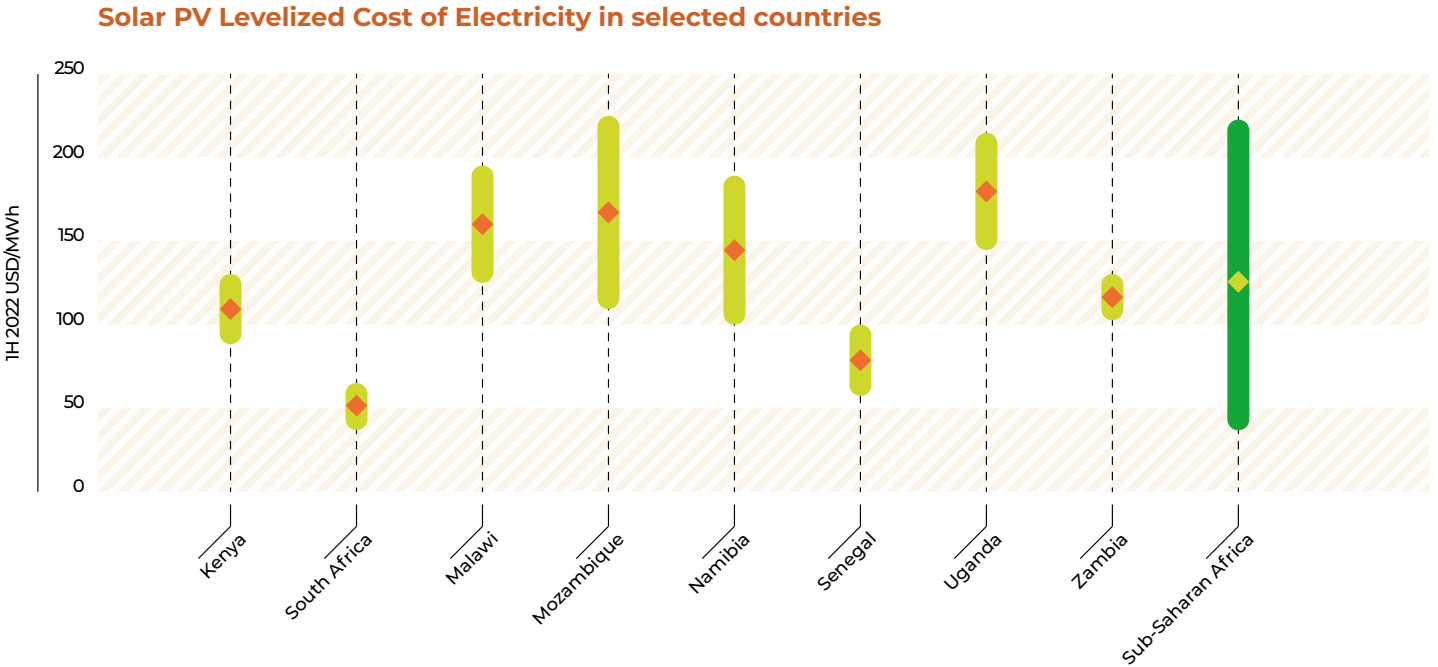
In the last decade, the global weighted average LCOE of newly commissioned utility-scale solar PV projects declined by 88%, onshore wind fell by 68%, CSP by 68%, and offshore wind by 60%.

Clean energy technology costs have fallen significantly in recent years, and are likely to continue falling, indicating the potential ahead of a fast transition to clean energy. During 2021, the global weighted average Levelized Cost of Electricity (LCOE) of new onshore wind projects added fell by 15%, year-on-year, to USD 0.033/kWh, while that of new utility-scale solar PV projects fell by 13%, year-on-year, to USD 0.048/kWh and that of offshore wind declined 13% to USD 0.075/kWh. This is not a one-off. Power generation costs from renewable energy sources have been on a decreasing trend for more than a decade. From 2010 to 2021, the industry has seen unprecedented improvements in the cost-competitiveness of RE technologies. The global weighted average LCOE of newly commissioned utility-scale solar PV projects declined by 88%, while that of onshore wind fell by 68%, CSP by 68%, and offshore wind by 60%.

Meanwhile material costs have started to impact renewable energy prices. The year 2022 saw a temporary increase in renewable energy costs from 2021, with onshore wind costs jumping by 39% to reach USD 0.046/kWh, back to 2020 levels (BNEF, 2022d). Offshore wind has increased by 1.4% to get USD 0.076/kWh and only solar PV has seen a decrease of 6.25% to reach USD 0.045/kWh. Yet this cost rise can be seen across the energy sector. In comparison, natural gas prices increased by 24% to reach USD 0.093/kWh in the same period, effectively overtaking all renewables technologies' costs for the first time (BNEF, 2022d). But the good news is that the year 2022 alone shows that the trend is slowing. New data for 2022 suggests renewable energy costs have been decreasing between January and December 2022, including a 1.7% decrease for solar PV, a 10.2% decrease in offshore wind, and a 6.3% decrease for onshore wind (BNEF, 2022a).

Fig.7
Levelized Cost of Electricity in sub-Saharan Africa, in H1 2022

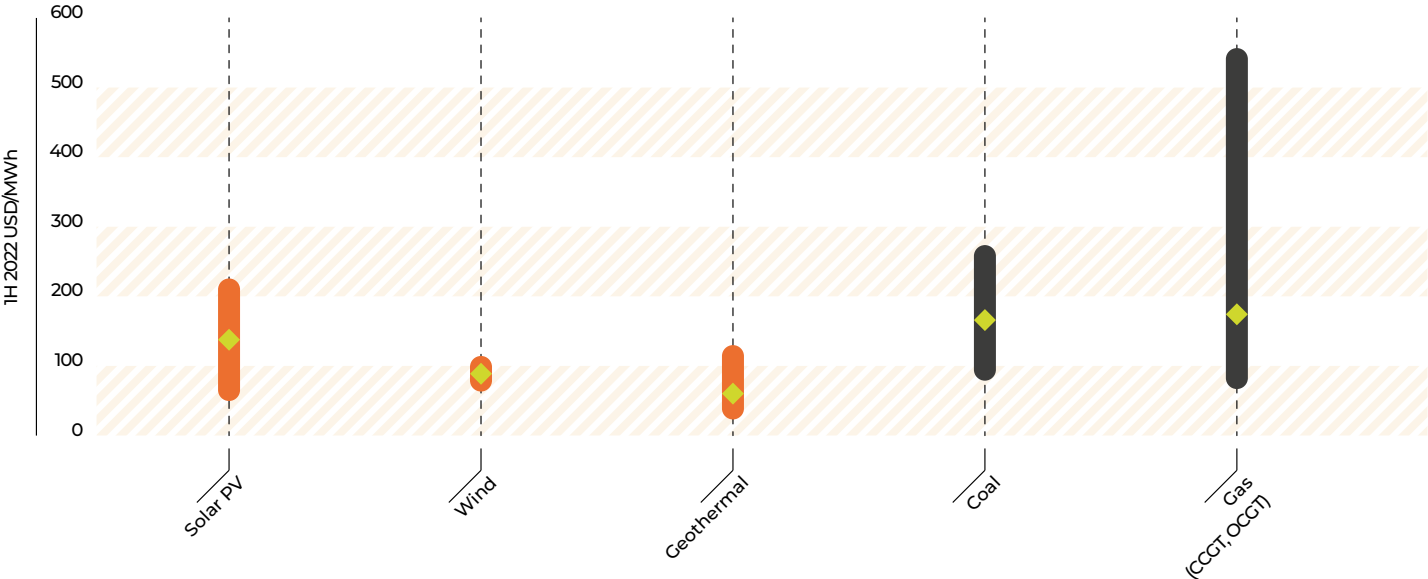
The cost of electricity in 2022 from new renewable energy assets is competitive with coal and gas alternatives in sub-Saharan Africa, with solar PV LCOEs varying greatly amongst countries.



The trend of decreasing costs for renewable energy-based power is set to continue, and storage is to follow. The addition of new renewable energy capacity globally throughout 2022 and 2023 is also expected to significantly impact electricity generation costs for the next years. Projections indicate that this expansion could reduce costs by no less than USD 55 billion in 2022 (IRENA, 2022f). This trend across the leading renewable energy technologies is expected to continue thanks to technology advancements in energy yields (McKinsey, 2022b). The cost of storage still needs to follow this trend. Energy storage system costs continue to surpass USD 300/kWh for a 4-hour system in 2022, a year that saw an increase in energy storage costs for the first time in years (BNEF, 2023c). Capital Expenditures (CAPEX) prices of storage technologies are set to resume their decrease in 2024 after 2021-2023 price increases. Promising technologies for battery components, duration, and sustainability are on a similar learning curve trajectory worldwide (BNEF, 2023c). Electrification is set to continue in areas such as clean electric cooking, electric transport and cooling, agriculture and productive uses, and storage.

Increasing renewable energy cost-efficiency contrasted with conventional power plant technologies in 2022. Compared to renewable energy price realities, conventional power plants' CAPEX prices remain stable or are increasing (McKinsey, 2022b). In contrast, Operating Expenditures (OPEX) prices have increased strongly for natural gas and remain unpredictable due to continued price volatility seen across the globe today. The prices of fossil fuels and electricity have experienced a much more rapid escalation since the final quarter of 2021 (IRENA, 2022h). Power prices soared to unprecedented levels globally, particularly in regions where natural

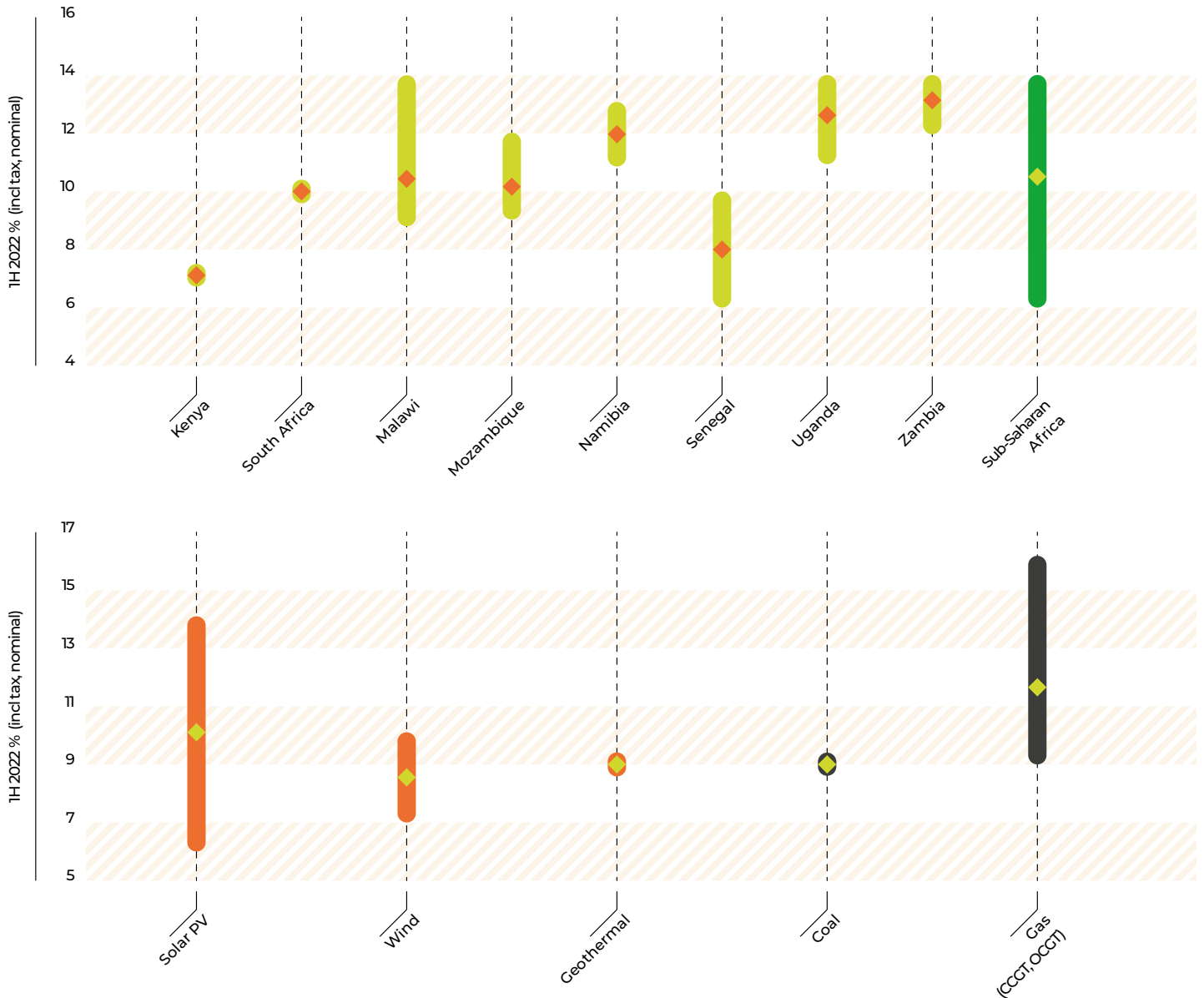
Levelized Cost of Electricity for selected technologies in sub-Saharan Africa



RES4Africa 2023 compiled from BNEF, 2022

Fig.8 Weighted average cost of capital in 2022

While the cost of capital for renewable energy is still high in sub-Saharan Africa, it was below the cost of gas and competed with coal in 2022.



RES4Africa 2023 compiled from BNEF, 2022

gas serves as the marginal technology determining the final hourly or daily price in wholesale electricity markets. This trend is especially pronounced in countries within the European Union, where between 2021 and 2022 wholesale power prices have surged more than six-fold on average in comparison to mean values observed between 2016 and 2020 (IRENA, 2022h). Consequently, natural gas has emerged as the most expensive source of bulk power generation on average, with its global LCOE exceeding that of solar and onshore wind by more than double (BNEF,

2022b). Not surprisingly, the marginal generating cost of fossil fuels remains four to six times higher than new solar and wind capacity in Europe (IRENA, 2022f).

Historical and emerging data continue to support the premise that renewable energy is today the most competitive option for power generation. This will continue to be so in the short and long term. Renewable energy project LCOEs will continue to decline, especially for solar PV and onshore wind, making it increasingly affordable to generate power using these renewable sources. Solar LCOE is expected to range from USD 0.018/kWh to USD 0.049/kWh by 2030 (IEA, 2022a), with solar power by 2030 expected to be cheaper than gas. The most competitive weighted average LCOEs below USD 0.050/kWh were seen in Egypt in 2021 (IRENA, 2022f). In contrast, the cost of constructing and operating gas and coal-fired power plants is expected to rise substantially, especially as a result of the implementation of heavier carbon tax policies, which are being adopted by many countries to mitigate the effects of climate change (IEA, 2022a). Over time, the higher costs associated with these traditional power sources can make them less and less economically attractive than proven renewable energy alternatives.

1.2. Renewable energy strengthens energy security

From energy importers to exporters, Africa is composed of different energy profiles. Despite conventional energy plants representing the predominant source of generation, oil, gas, and coal reserves can only be found in a handful of African countries. Many of those have developed extensive energy-producer economies around those resources. Yet most African economies remain highly dependent on energy imports – a situation expected to continue despite recent discoveries and a new surge in oil and gas exploration. History has shown that continued energy dependency on hydrocarbons can represent ongoing risks to the security of supply. In light of last year’s crises where energy security has taken center stage, it is important to analyze energy diversification and transition trends from a security perspective and note implications for Africa’s energy variety.

Diversifying the energy mix and transitioning to renewable energy sources protects from environmental risk, improves energy security, and fosters economic diversification. Renewable energy is effective for energy security in the long term because resources are local and indigenous. Unlike fossil fuels that are typically found in only a handful of countries, renewable energy sources in Africa are abundant, widely distributed, and can be harnessed locally, reducing the risks associated with supply disruptions and price fluctuations. With some of the highest potential in solar, hydro, wind, and geothermal capacities around the world, the continent is well endowed to achieve energy security. On average, Africa is exposed to 2,119 kilowatt-hours per square meter (kWh/m²) of solar irradiation annually (IRENA, 2022c). Wind energy is also abundant, particularly in coastal areas and high-altitude regions. Hydropower is already a significant energy source in Africa, particularly in Ethiopia, Uganda, and Zambia. Many countries have untapped hydroelectric potential, with large rivers and

Diversifying the energy mix and transitioning to renewable energy sources protects from environmental risk, improves energy security, and fosters economic independence.

waterfalls that could be used to generate electricity and micro-hydro potential along smaller water streams. Geothermal energy is also abundant in some parts of Africa, particularly in East Africa's Great Rift Valley. Countries such as Kenya and Ethiopia have already developed geothermal energy projects and are leading the way in this area (See Box 3 – Energy security (Kenya)). Technology dependence on fossil fuels perpetuates unsustainable practices and undermines efforts to mitigate climate change. In contrast, renewables reduce dependence on volatile fossil fuels, free up import resources, and set economies on a path to long-term secure and sustainable development. By promoting the development of renewable energy technologies, countries can reduce their dependence on finite and increasingly expensive fossil fuel resources and strengthen resilience and energy security in the long term. It is important that these developments are developed in accord to a just energy transition approach.

Africa has the resources to become a renewable powerhouse. The solar capacity potential is estimated at 10 TW, hydro energy at about 350 GW, wind at 110 GW, and geothermal resources at 15 GW. It has the potential to generate up to 24,000 TWh of electricity each year – 90% of the world's electricity production in 2018 – and 26 times that currently generated by the continent (AfDB, 2018). These amounts of resources have the potential to provide sustainable and affordable energy to the hundreds of millions of Africans lacking modern energy access today. In addition, using indigenous well-distributed renewable sources can reduce fossil fuel imports and costs for importer countries, thereby improving energy security.

Critical minerals are a new focus for the global energy transition. The global demand for critical minerals is increasing rapidly due to the growing demand for clean energy technologies. Many of these minerals are in short supply and prevalent in a few countries, which can create vulnerabilities in the global supply chain. Central and southern parts of Africa have abundant mineral resources essential to the production of electric batteries, wind turbines, and other low-carbon technologies. These critical minerals – including for example lithium, cobalt, platinum, and rare earth elements – are becoming increasingly important to address the growing demand for batteries, solar panels, wind turbines, etc. worldwide. The availability of critical minerals in Africa presents an opportunity to enhance global energy security while promoting economic growth and development in the region. A responsible and sustainable approach to the extraction and production of these minerals in Africa can benefit both the local communities and the global energy transition in Africa. Many barriers are still to be overcome before these become fully accessible, including weak governance and ESG concerns. But the potential for local transformation, sustainable and responsible extraction and production of these minerals in Africa could significantly enhance the continent's energy security by localizing the supply chain and reducing the risks associated with dependence on a few dominant producers. This in turn could help to boost economic growth, create jobs, and support the wider transition to a low-carbon economy in the long term.

Box 3 – Energy security (Kenya)

Renewable energy represents over 80% of Kenya's electricity mix today, including geothermal, hydro, wind and solar power. Geothermal energy is particularly abundant, representing more than half of the electricity produced. Kenya has exploited 950 MW of geothermal energy, and installed capacity could be increased eight-fold (IMF, 2022c). Kenya has also invested in large-scale wind development. The Lake Turkana Wind Power project, Africa's largest wind farm to date, has an installed capacity of 310 MW (Lake Turkana Wind Power, 2022). Solar home systems for off-grid connections are also widespread, with over 70% of the population having access to modern energy services (IRENA, 2021a). Kenya today represents the second most dynamic market for off-grid solar in the world after India, with 30,000 photovoltaic modules sold each year (Rapid Transition, 2022). This outcome is possible following years of favorable enabling policies and structural changes in the country's energy system. Kenya relies largely on domestic and affordable renewable energy sources, which benefits the country in terms of energy security.

Kenya is widely regarded as a leader in renewable energy development in Africa. The country has set a target of achieving 100% renewable energy by 2030 and is making significant progress towards reaching it. This ambitious goal is outlined in the country's National Energy Policy, launched in 2019. To achieve this target, Kenya has implemented several policy measures, including revising its feed-in tariff, establishing net metering, tax incentives, and other financial support mechanisms (Rödl & Partner, 2019). The Kenyan Government White Paper, launched in 2022, outlined critical steps for diversifying its electricity mix and improving access to electricity and service quality, among others. The paper laid out four outcomes: establishing energy as a transformational good, making Kenya a global leader in decarbonized economic growth, achieving 100 GW installed capacity by 2040 through renewables, and establishing Kenya as an investment destination for industries seeking to decarbonize. Kenya is also actively exploring the potential of green hydrogen as a key element of its strategy to achieve 100% renewable energy by 2030. Germany and the European Bank for Investment (EIB) have announced commitments to support Kenya on this (BMZ, 2022). The private sector is increasingly involved in this exploration, as Kenya signed a deal with an Australian energy company to produce green ammonia (FDI, 2022).

Box 4 – How green hydrogen can support energy security and other applications in Africa

As the energy transition is underway, much attention has gone to the potential for green in Africa. Energy security has taken center stage within governments' concerns. But energy security needs to go hand in hand with climate security, as any attempts to establish a reliable supply of energy should not sacrifice climate change gains. Green hydrogen, produced from renewable energy sources, is increasingly proposed as a solution to the possible intermittency of some sources, and aging African grids. It could also represent a solution for hard-to-abate industries that are otherwise difficult or impossible to decarbonize via electrification. Green hydrogen production could contribute to price stability for consumers and to energy security at the national level, as well as to Africa's industrialization goals (See Chapter 2 - 2.6. The opportunity for green hydrogen in Africa).

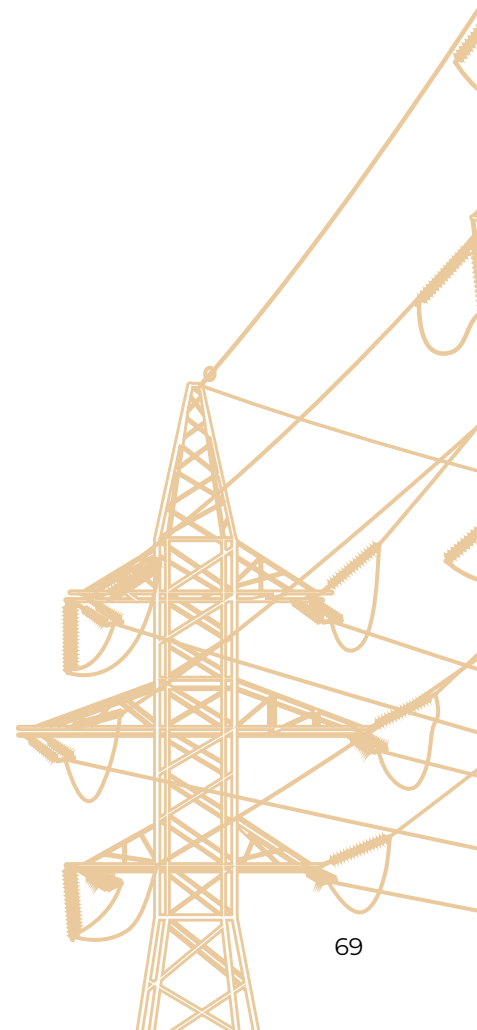
Discussions at COP27 in Egypt in November 2022 highlighted the strong potential for Africa to become a major player in the green hydrogen industry. Africa already has existing green hydrogen projects that alone could supply 10% of the world's green hydrogen market (EUI, 2022). During the COP27 conference, various project deals were discussed, including for Egypt, Mauritania, Morocco, Kenya, Namibia, and South Africa among others. Currently, there are at least 24 green hydrogen projects in Africa that are either in the planning stages or underway, representing 3% of all globally announced projects. The announced investment in Africa's hydrogen value chain is expected to exceed USD 30 billion. This demonstrates the significant potential for Africa to play a major role in the transition to green energy, which can bring about significant economic and environmental benefits for the continent (EUI, 2022). The IEA estimates that Africa has the potential to produce 5,000 megatons of green hydrogen annually, at a low cost below USD 2/kg (IEA, 2022a). Namibia, for example, is planning to export 3 million tons per year of green hydrogen to Europe, in partnership with the government of Germany (Elston, 2022). The cost of Namibian green hydrogen is expected to be around EUR 1.5-2.00/kg, one of the cheapest worldwide. This would ensure energy security both for the producing country and for Europe, which has already positioned itself as the primary market for this resource. It will be crucial to address moving forward on the necessary infrastructure in a way that makes sense for African countries to accompany and deliver on the continent's green hydrogen ambitions.

1.3. Speed to market and adaptability of renewable energy technologies

Another benefit of renewables is the speed and ease with which they can be deployed and expanded. Most new fossil fuel-based power generation technologies can take 5 to 10 years (IEA, 2018) from commission to operation, with some like nuclear and large hydro infrastructures often taking longer. By comparison, renewable energy technologies are much faster to deploy for additional energy capacity, outpacing new coal, nuclear, and gas plants. In contrast, renewable energy power plants can often be connected to the power grid within a 2-year timeframe and this makes delivering on energy planning with renewables more achievable in the short term. Furthermore, the lead times for smaller, stand-alone renewable energy applications are exceptionally short. This is particularly significant for African countries, where decentralized renewable energy solutions offer the best way to quickly increase rural energy access. As such, renewable energy is proving to be a key driver in the continent's efforts to expand its energy capacity and bring electricity to remote communities.

The adjustable and scalable nature of renewable energy matters. With their modular and resilient nature, renewable energy projects can be deployed in decentralized and modular forms, making them ideal for enhancing energy access in Africa's rural and peri-urban areas. Renewables' distributed nature enables proximity to consumption points, improving resilience and energy independence by reducing reliance on expensive and price-volatile fuel. Renewable technologies can also be configured to fit changing circumstances and growing needs, making them an easy, flexible and often more efficient option able to adapt to and follow the requirements of an ever-growing and urbanizing population.

Being flexible to adapt to the rapidly changing needs of the African continent is essential to ensure a just energy transition. With their short time-to-market and modularity, renewable energy technologies represent an immense opportunity to adapt to the ever-growing population, urbanization, and growing industrialization of the continent. Few other technologies can provide such a rapid and flexible solution to adapt to growing, seasonal energy needs, especially with the effects of climate change growingly affecting the regions differently. The growth potential for renewables in Africa is significant, and renewables' modular and decentralized nature makes these technologies an efficient fit to tackle Africa's energy access challenge. Currently, Africa accounts for less than 3% of the world's installed renewables-based electricity generation capacity, offering a big opportunity for growth in the sector. Rapid deployability, modularity and secure potential are just a few of the advantages of renewable energy sources that make them an attractive option for Africa's energy future.



Box 5 – Adaptability and deployability (Rwanda and Senegal)

Rwanda

In 2015, Rwanda completed the development of a solar PV plant in less than a year – from contract signing to operations – which became known as Africa’s fastest solar power project (The Guardian, 2015). The 8.5 MW power plant is designed to provide electricity to more than 15,000 homes and has created 350 local jobs. This short completion time was possible due to the nature of solar energy technologies today that require little infrastructure to be mounted or connected through the grid. What also helped was a favorable business environment allowing the project to be fast-tracked. Today it is featured as a benchmark project for the continent on rapid deployment.

Senegal

Senegal has made remarkable strides in the development of renewable energy over the last decade, driven by private investment and the fast and modular nature of renewable energy. With a goal of achieving full electricity access by 2025 and a 23% share of renewable energy sources in its electricity mix by 2030, Senegal plans to invest in solar and wind power, as well as hydropower projects (Ministry of Energy, 2015). The country has seen a significant increase in its renewable energy installed capacity, which rose from 12 MW in 2009 to 230 MW in 2019, with the majority of projects being procured in 2013 (RES4Africa & PwC, 2021a). Notably, Senegal has completed several solar projects, including Senergy (30 MW), Ten Merina (30 MW), and Malicounda (22 MW) between 2016 and 2017, and inaugurated West Africa’s first large-scale wind farm in 2020. With the right enabling environment, the time-to-market of renewable energy technologies can be significantly shorter. To attract further investments, Senegal modified its tax code in 2020 to exempt VAT on 22 different equipment used to produce energy from renewable sources, reducing costs by 18% (Ministry of Finance, 2021). The country also plans the liberalization of the energy sector and the restructuring of the state utility Senelec to raise efficiency in the energy sector (Energy Capital Power, 2021).

1.4. Supporting climate resilience and sustainability

Africa is among the most vulnerable regions on the planet to the impacts of climate change. Renewable energy infrastructure can offer governments and local communities’ resilience in the face of climate change, by providing them with the ability to meet their net-zero commitments and achieve energy security more rapidly. Unlike centralized grid systems, renewable energy systems can be scaled to suit the needs of specific communities, providing a more reliable and resilient energy supply. Off-grid solutions tailored to restricted geographic zones make it easier to build

climate-appropriate energy systems, ensuring that energy access remains resilient in the face of extreme weather events. In contrast, it is estimated that one out of five of Africa's LNG facilities is at risk of coastal flooding due to rising sea levels (IEA, 2022a).

Box 6 – Is a disorderly transition to net-zero inevitable?

More and more experts are sounding the alarm over the speed and impact of the most significant risks facing the world in the coming years. Africa is no exception. The 2023 WEF Global Risks Report identifies the most pressing global risks over the next one, two, and ten years worldwide. The most significant long-term threat facing humanity remains the failure to address the climate crisis, which is set to cause mass migrations, food, and water insecurity, and the erosion of social cohesion. The top-rated risks for 2023 are closely interconnected with most top risks in ten years: climate mitigation, adaptation, extreme weather, and biodiversity – in multiple complex and overlapping ways, and the report highlights that it is urgent for leaders to act on climate change now.

Top 10 Risks

“Please estimate the likely impact (severity) of the following risks over a 2-year and 10-year period”

2 Years		10 Years	
1	Cost of living	1	Failure to mitigate climate change
2	Natural disasters and extreme weather events	2	Failure of climate change adaption
3	Geoeconomic confrontations	3	Natural disasters and extreme weather events
4	Failure to mitigate climate change	4	Biodiversity loss and ecosystem collapse
5	Erosion of social cohesion and societal polarization	5	Large-scale involuntary migration
6	Large-scale environmental damage incidents	6	Natural resource crises
7	Failure of climate change adaption	7	Erosion of social cohesion and societal polarization
8	Widespread cybercrime and cyber insecurity	8	Widespread cybercrime and cyber insecurity
9	Natural resource crises	9	Geoeconomic confrontations
10	Large-scale involuntary migration	10	Large-scale environmental damage incidents

Risk categories

- Economic
- Environmental
- Geopolitical
- Societal
- Technological

Source: World Economic Forum, Global Risks Perception Survey 2022-2023

Climate change impacts top all risks in the long-term. The report findings suggest that renewable energy has a pivotal role to play in supporting and reducing the volatility of the transition in all regions, especially in emerging and developing economies including in Africa, as well as enabling humanity to achieve its climate goals. To scale up the rollout of renewable technology will require a focus on tackling non-economic barriers like permitting and fast-tracking approvals, as well as addressing the high cost of capital in emerging and developing markets. Governments must introduce ambitious, transparent and consistent climate policies to allow businesses and investors to plan for future changes. Clear incentives to invest in net-zero technologies and to shift consumer behaviors towards carbon-neutral products and services need to be introduced. They must also work with carbon-intensive sectors to introduce clear incentives to invest in net-zero technologies. New opportunities will be created, with up to 42 million people employed in renewable energy by 2050 compared to 11 million in 2018 (WEF, 2023). Governments must therefore focus on re-skilling and upskilling workers to take advantage of these opportunities.

But the biggest risk of all is inaction. The global economy could lose up to 18% of GDP if no mitigating actions are taken to combat climate change (WEF, 2023). The world is entering a new kind of industrial revolution, and it is imperative that leaders adapt and transform their businesses to be in line with a net-zero future – or at least avoid being adversely impacted by it. Investing massively in renewable energy is one solution to turn around this short-time polycrisis into opportunities that can then support and help to accelerate longer term reforms.

Deploying the use of integrated renewable energy applications will be key.

Renewable energy enables the integration of energy systems with other sectors, such as agriculture and water management, improving overall efficiency and resilience. By applying a water-energy-food nexus approach to energy solutions, there is an opportunity for greater agricultural activity and productivity at lower costs and an opportunity for increased food and water security. For example, electrical processing equipment can increase small farmers' agricultural yields by 30%, while renewable energy-powered irrigation techniques can prevent excessive water usage and scarcity (IRENA, 2021c). Solar-powered water pumps can provide clean and reliable water sources for irrigation, reducing dependence on rainwater and making agriculture more resilient to drought. For example, smallholder farmers benefitting from the "Knowing Water Better" project of the Food and Agriculture Organization (FAO) in Rwanda have adopted solar irrigation pumps from a neighboring dam that had, as a direct result, to improve their yields by about a third higher, and, most importantly, for the first time, to be able to grow crops in the dry season (IRENA, 2021c).

Access to clean energy will also reduce the negative impact on health associated with traditional energy consumption. This leads to fewer premature deaths from household air pollution, better healthcare services, increased accessibility of medical equipment, proper storage for drugs and vaccines, and expansion of healthcare to rural and remote areas. The modular, decentralized, and distributed nature of renewable energy technologies allow African countries to reduce their dependence on energy sources that are vulnerable to the impacts of climate change and build a more resilient energy system and society that is better equipped to meet the challenges of the future.

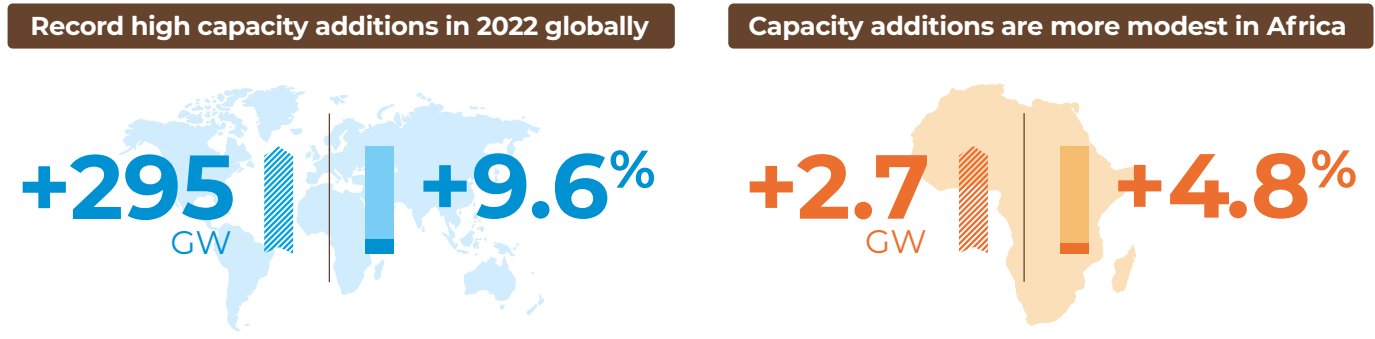
Box 7 – Climate resilience (Mozambique)

The increasing frequency and intensity of natural disasters worldwide have highlighted the importance of renewable energy as a critical component of climate resilience. Mozambique, a country heavily impacted by climate change, provides an example of the importance of renewables for climate resilience. In 2019, Mozambique was hit by two devastating cyclones, Idai and Kenneth, which together caused widespread damage to infrastructure and communities. It resulted in the destruction and damage of two 90 MW power plants, 1,345 km of transmission lines, 10,216 km of distribution lines, and 4,000 transformers (Pereira, 2019).

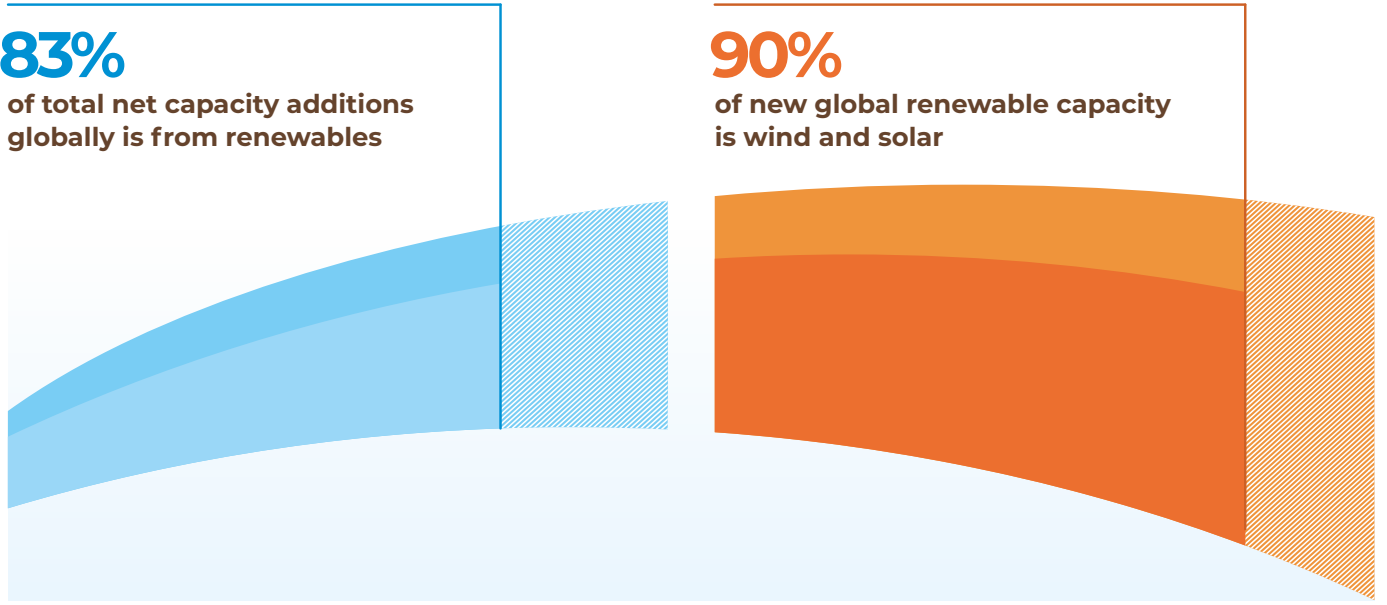
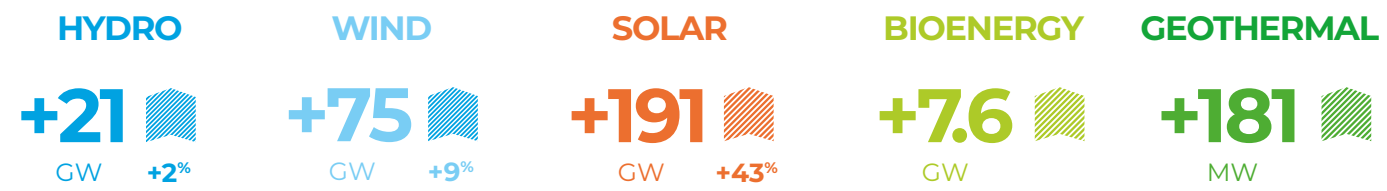
Off-grid solar solutions, such as mini-grids, proved to be critical in providing electricity to affected communities in the aftermath of the storms. These decentralized energy technologies allowed aid organizations to provide essential services such as lighting, water pumping, and medical equipment to those in need. Additionally, renewable energy-powered communication technologies provided a crucial means of communication between aid organizations and affected communities. The use of renewable energy in disaster preparedness and response efforts has therefore emerged as a key strategy in promoting sustainable development and reducing the vulnerability of climate refugees in the face of climate change.

The recommendation in the aftermath of the Idai cyclones included the uptake of alternative decentralized power systems to supply energy for critical components of the infrastructure, including telecoms, water and sanitation and health centers. In light of the growing threats of climate change, investment in renewable energy is increasingly critical to ensure that communities are equipped to withstand and recover from the effects of natural disasters.

Fig.9
Renewables are today the most cost-competitive power technology and the momentum is only increasing



Renewable energy additions (global)



Renewable power



frees economies from relying on oil and gas imports and from volatile prices

(energy security)



enables rapid electrification and access to energy, even in the most remote areas

(rapid deployability)



represents the most cost-effective option for new power generation assets in most of the world

(cost efficiency)



is made of climate proof and future proof technologies

(climate resiliency)



catalyzes socio-economic growth, enables community development, creates jobs, and fosters youth and female empowerment

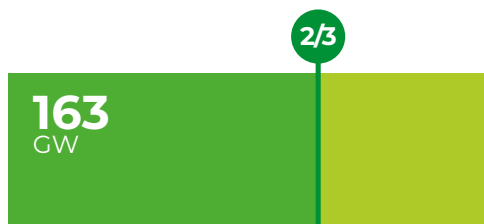
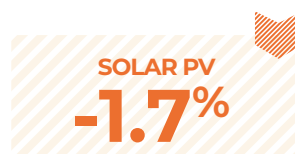
(development co-benefits)

Renewable energy cost-competitiveness

The years 2021-2022 witnessed strong energy cost fluctuation carried over from supply chain disruptions, soaring prices and economic crisis

OVERALL

Cost of electricity
(Jan-Dec 2022, globally)



Almost two-thirds or 163 GW of newly installed renewable power in 2021 had lower costs than the world's cheapest coal-fired option

New wind and solar projects are cheaper to build than new fossil fuel power plants in markets representing

96%

of global electricity generation, making it the least cost option for expanding installed capacity or replacing old assets



For the first time, in 2022 LCOE for renewable energy fell below natural gas and competes with coal

RES4Africa 2023 compiled from various sources (IRENA, 2023; BNEF, 2023)

2. The case for renewable energy technologies to deliver Africa's just energy transition

There is little doubt about the beneficial role that renewable energy can play in supporting a just and sustainable future for Africa. Renewable energy-based electricity can serve as a central strategy for African countries to achieve access to energy goals, navigate an economic course out of the energy crisis, and enable sustainable development. This is an opportunity for African states to leapfrog the rest of the world in renewable energy generation capacity and create sustainable energy systems that will support growth in the coming decades.

What is encouraging is that renewable energy is already proving to be a game-changer for African countries. With many countries having defined enabling plans and policies and with institutional frameworks and favorable fiscal incentives in place, the continent is making the right moves to ensure that renewable energy technologies are in place to deliver more sustainable development. The remainder of this section now considers several opportunity areas that should be encouraged to support the impact and effectiveness of this transition.

2.1. The opportunity for socio-economic prosperity

Energy continues to play a pivotal role in catalyzing economic growth, creating jobs for youth, supporting health, and improving livelihoods. Scaling up investment in and the rollout of renewable energy capacity would tremendously benefit Africa's sustainable socio-economic development. It would also support building energy systems across Africa that accommodate the resource needs of the continent's rapidly growing and urbanizing economies and meet energy mix and development goals. Investments in clean energy technologies have been shown to have a strong multiplier effect on GDP growth, with every USD 1 invested in clean energy technologies resulting in an additional USD 0.93 of GDP growth (SE4ALL, 2020). International experience has also demonstrated that investing in renewable energy projects can deliver economic growth and jobs, and deliver socio-economic impact.

Clean energy investments and activities can create Africa's jobs of the future. Low-carbon development strategies based on the expansion of renewable energies and energy efficiency measures have a stronger job creation impact than investments in the fossil fuel industry. While investments of USD 10 million in renewable technologies and energy efficiency are estimated to create 75 and 77 new jobs, respectively, the same investment in fossil fuels creates only 27 new jobs (McKinsey, 2020a). According to IRENA's 1.5 °C Scenario, the energy transition in Africa has the potential to generate as many as 8 million employment opportunities by 2050, which is a significant increase from the current number of over 300,000 jobs (IRENA, 2022e). With local projects increasingly including local content requirements in contractual documentation, the result is the development of healthy local markets for various renewable energy jobs. One example in Kenya, the Lake Turkana Wind Power Project, created between 1,800 to 1,900 jobs during the construction and 320 to 350 during operations, and included a local content

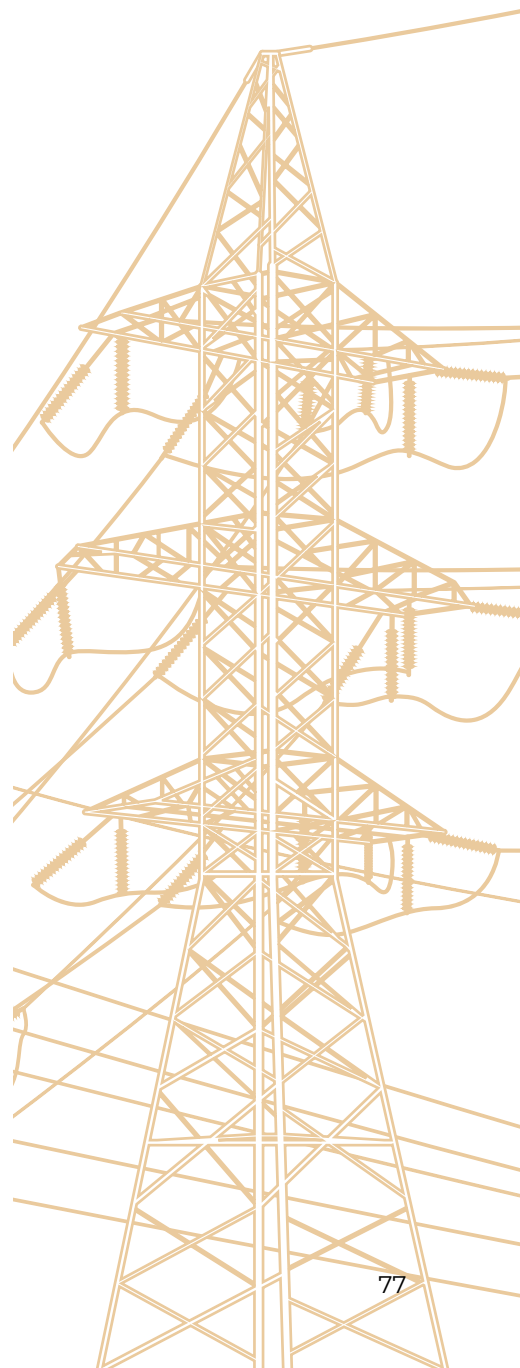
requirement that 70% of the jobs needed to be targeted for Kenyans (Vestas, 2018). The project has also created indirect jobs and is supporting local economic development.

Clean energy projects also directly develop greater social justice, gender, and community empowerment. By the very nature of the project, they involve local stakeholders for long-term socio-economic engagement. Improving access to energy enables gender empowerment by relieving time and effort spent on traditional domestic energy collection, primarily for women and girls. This liberates time to spend on household, education, or business practices instead. Such projects also promote social justice and create greater equity for local communities. Access to clean energy can reduce the negative impact on health associated with traditional energy consumption, thereby reducing the number of premature deaths from household air pollution, enabling better healthcare services, increasing the accessibility of medical equipment, providing proper storage for drugs and vaccines, and helping in expanding healthcare to rural and remote areas.

As the global energy transition generates significant demand for resources and jobs, the renewable energy sector has the potential to create vast employment opportunities across various stages of the value chain, providing a promising prospect for Africa's future generations. In Mali, for instance, the FAO has enabled more than 1,350 rural women to benefit from solar-powered irrigation infrastructure for their vegetable gardens (FAO, 2022). In Nigeria, the Solar Minigrid for Rural Electrification, and the Energizing Economies projects, both led by the Rural Electrification Agency, aimed at expanding solar energy access in schools, clinics, and markets is enabling a better learning environment, improved healthcare services, and increasing economic opportunities (REA, 2022). The project also includes training for young people to promote entrepreneurship and create jobs. In sub-Saharan Africa, achieving universal energy access is estimated to create an additional 4 million energy-related jobs by 2030 (IEA, 2022a).

Finally, renewable energy development can benefit Africa's young generations.

Young Africans represent over 70% of the continent's population and have the potential to be the protagonists of its journey to deliver a sustainable tomorrow. Increasing effort is going into empowered young energy leaders to take charge. For instance, the Youth Energy Innovators program, launched by the African Development Bank in 2020, supports young entrepreneurs with financing and capacity building. The program has already helped several youth-led renewable energy projects, such as a solar-powered poultry business in Rwanda and a waste-to-energy project in Ghana. Such initiatives are promoting sustainable development and inspiring a new generation of renewable energy leaders in Africa. RES4Africa Foundation supports young energy leaders through vocational capacity building in renewable energy and its youth advocacy program (See Chapter 3 - 2.2.7. RES4Africa Youth Program), including an annual Young Talent of the Year award (See Box 8 – Africa's future: youth and renewable energy). Looking ahead, it remains vital that all efforts to develop renewable energy look to unlock the potential of Africa's resources, talent, and communities wherever possible. Only in this way can the transition be fast, just, and impactful.



Box 8 – Africa’s future: youth and renewable energy

Africa’s young generations will be vital in delivering Africa’s clean energy transition. Young Africans represent over 70% of the continent’s population and have the potential to be the protagonists of its journey to deliver a sustainable tomorrow. Equipped with knowledge, vision and an inclination to innovation and technology means to deliver on ambitions, young people should be thoroughly involved in energy decision-making processes. As the RES4Africa Youth Task Force laid out, a vision exists for the future (See RES4Africa Youth Task Force statement). RES4Africa supports these young leaders in their energy endeavors, as they seek to launch their businesses, create their paths and improve livelihoods and their communities. These young leaders have participated in RES4Africa’s training programs, are recipients of the Young Leader Awards, and have been sensitized to what energy can do for them and their communities. Examples range wide:

- **Mohamed Alhaj** is an engineer from Khartoum, Sudan, who started “Clean Energy 4 Africa”, a knowledge & advocacy platform focusing on youth empowerment in the clean energy sphere, which is Sudan-focused and Africa-wide intended. Mohamed has renewable energy advocacy at heart and pursues this also in his capacity as chairman of the RES4Africa Youth Task Force, working closely with the foundation to grow its Youth Program. Recently, he founded a second company, Terra Energy, a Rwanda-based consulting firm with a mission to accelerate Africa’s sustainable energy transition through market research, business development, and training.
- **Martin Masiya** from Malawi started a solar-home system company during the Covid-19 pandemic in his rural community to provide affordable solar lighting for households. Three years on, 350 families and more than 2,000 people have been benefited so far, thanks to flexible payment schemes. Recipient of a top 100-youth led project advancing sustainable development worldwide, Martin is taking his company forward to create more local jobs in his community.
- **Chiemela Anosike** is an engineer focused on tackling bottom-of-pyramid energy needs in her home country, Nigeria. She started Solaris Green Tech Hub, a start-up that designs, manufactures, and provides solar booths that serve as power stations for peri-urban and rural communities without access to Nigeria’s power grid. Having witnessed inequality and energy poverty in Nigeria, she sought to provide solutions for the energy poor, especially for women. Chiemela added an awareness raising component to the start-up to overcome renewable energy and climate change myths in local Nigerian communities. Her start-up brought her to win the RES4Africa Young Talent of the Year Award at COP27 last November in Egypt.

- **Tracy Kimathi** from Kenya attended RES4Africa's vocational training in Kenya and became inspired to launch Baridi, an innovative start-up that provides solar-powered cold rooms for livestock farmers in Kenya's rural areas. Since 2021, Baridi provides solar PV electrification services and enables solar-powered cold rooms in urban meat markets. It includes a 5 kWp stand-alone PV system providing energy to 20 ft cold rooms, relying on a pay-as-you store scheme. For a small fee, butchers and meat traders can now access a solar powered cold storage unit and stock their produce, thereby reducing food losses, increasing business lifespan and profits, and presenting a useful application of the water-energy-food nexus. Tracy aims to grow to 70 cold rooms and lease to own units across East Africa and Southern Africa by 2030.
- **Norah Magero** won the first edition of the RES4Africa Young Talent of the Year Award in 2020 with Koyo, an affordable 50-litre solar-powered fridge and freezer. Based on this first successful application, she co-founded her company, Drop Access, a women-led and youth-led NGO in Kenya dedicated to the provision of sustainable energy access to rural and off-grid communities through clean and climate-smart technologies. Three years on, Norah is pursuing her mission to drive the continent's vast untapped resources for renewables, so rural communities can gain from the benefits of productive uses of energy.

2.2. The opportunity for industrial & supply chain development

Industrial development is a central goal in Africa's 2063 Agenda. Africa has vast ambitions for its industrial sector, which in 2021 represented almost 30% of sub-Saharan Africa's GDP and 13% of CO₂ emissions (World Bank, 2022e). By 2030, a nearly 40% rise in energy demand is expected for industry, freight, and agriculture (IEA, 2022a). This increase will be driven by higher production rates of essential items such as fertilizers, steel, and cement, as well as the manufacturing of appliances, vehicles, and clean energy technologies. This growth in domestic production will help to reduce Africa's current burden of imports, which currently make up more than 20% of its GDP (IEA, 2022a). However, this development must be accompanied by an industrial energy transition.

Renewable energy holds great promise for Africa's industrial and supply chain development and could bring about an industrial shift if supported by large-scale productive investment and broader socio-economic development. Governments recognize the imperative of enabling economic and industrial

One critical aspect of meeting the twin goals of sustainable access to energy and sustainable industrialization is through the potential for electrification of the industrial sector.

growth in a manner that is sustainable for the future. Renewable energy can power applications for industrial transformation, such as producing fertilizers, steel, and cement, as well as manufacturing appliances, vehicles, and clean energy technologies. Renewable energy can also enable the electrification of irrigation pumps in agriculture, reducing diesel generator use, and extending cold chains, boosting agricultural productivity. The industrial sector in Africa is set to flourish through the electrification of its processes. One critical aspect of meeting the twin goals of sustainable access to energy and sustainable industrialization is through the constant effort for electrification of the industrial sector where possible. Accelerating renewable deployment in the power sector can speed up deployment in heating, cooling, transport, and industry. While it may not be the answer for all the industrial sub-sector energy needs, especially for those hard-to-abate and carbon-intensive industries, renewable technologies are increasingly playing a role where possible. For example, green hydrogen holds strong potential for Africa's sustainable industrialization (See Chapter 2 - 2.6. The opportunity for green hydrogen in Africa). Green hydrogen could sustainably industrialize Africa's hard-to-abate sectors and boost GDP by 6 to 12% in six key countries – Egypt, Kenya, Mauritania, Morocco, Namibia, and South Africa (AGHA & McKinsey, 2022). A green hydrogen economy can create commercial opportunities, jobs, top export markets, and investment needs, enabling Africa to become a significant player in the global hydrogen market.

Africa's mineral resources have the potential to serve as a significant source of revenue, jobs, and markets for the continent, should they be managed sustainably and with the best interest of African citizens at heart.

The minerals sector represents a large opportunity for Africa to develop a blooming supply chain for both domestic consumption and export. Demand for critical minerals necessary for the global energy transition technologies will soar in the coming years. A significant proportion of the world's reserves of cobalt, manganese, and platinum – minerals that are crucial for battery and hydrogen technologies – are located in Africa, with more than 40% of the global total. While South Africa, the Democratic Republic of the Congo, and Mozambique are the primary producers, other countries could possess untapped deposits (IEA, 2022a). These minerals are essential for the production of low-carbon technologies, such as electric vehicle batteries, wind turbines, solar panels, and others. The increasing demand for these minerals presents an opportunity for Africa to boost its clean energy transition in the industrial sector. By investing in developing a robust and sustainable supply chain for critical minerals, Africa can reinforce itself as a key player in the global clean energy market. It is crucial to manage these resources prudently and, above all, in the best interests of African citizens. By adopting sustainable mining practices and ensuring that the mining industry is socially responsible, Africa can ensure that its natural resources are utilized in a way that benefits both the environment and the local communities. Africa's mineral resources have the potential to serve as a significant source of revenue, jobs, and markets for the continent. By 2030, Africa's earnings from critical mineral production could double, but greater investment in mineral exploration and production is necessary while prioritizing environmental and social considerations surrounding mining operations (IEA, 2022a).

More broadly, the potential to develop clean energy technologies value chains across the continent also exists. This presents an opportunity for Africa to become a manufacturer and supplier of low-carbon energy technologies and ensure the

continent does not remain a consumer of imported goods and services, produced in other parts of the world as long. In turn, this has enormous job creation potential across different steps of the renewable energy value chain. It is important that efforts are made to establish local supply chains. Developing local energy industries can lead to decreased imports, job creation, and the growth of local capital. The advantages that renewables provide leave no doubt that renewable electricity has a critical role in guiding Africa's journey toward achieving sustainable access to energy and industrialization.

2.3. The opportunity for energy access, diversity, and utility-scale generation

Renewable energy is a straightforward choice for African governments to achieve their energy access goals. Proven renewable energy technologies at centralized and decentralized scale can deliver universal access to energy and electrify urban, peri-urban, and remote areas. According to IEA's Sustainable Africa Scenario (SAS), access to affordable electricity by 2030 requires advancing connections to 90 million people per year, or triple the rate of recent years (IEA, 2022a). Extending national grids is the least costly pathway for 45% of those gaining access by 2030 (IEA, 2022a). While in rural areas, where 80% of the electricity-deprived live, mini-grids and stand-alone systems (mostly solar-based) are already the most viable solutions (IEA, 2022a). These technologies can be deployed at various scales, be rolled out all around, create demand, develop community empowerment, and provide energy resilience by bypassing commodities with volatile prices and availability. IEA analysis estimates the cost of reaching universal access to modern energy for all Africans by 2030 at USD 25 billion per year – around 1% of global energy investment today – similar to the cost of building one large LNG terminal (IEA, 2022a).

Renewable energy can also diversify the continent's energy mix. Africa's power landscape is currently characterized by a heavy reliance on fossil fuels, particularly coal and oil, major contributors to air pollution and greenhouse gas emissions. With the continent's population projected to reach 1.7 billion by 2030, the demand for energy is set to increase rapidly, and a shift towards cleaner and more sustainable sources of energy is essential (IEA, 2022a). Renewable energy power coming to price parity with fossil fuel globally (See Chapter 1 - 1.2 Examining the growing momentum toward a global clean energy transition) makes renewable energy an ideal choice to limit Africa's carbon footprint and address climate change concerns, reduce its dependence on imported fossil fuels and price volatility, and improving energy security. Cleaning Africa's electricity grid is a formidable task. Still, renewable energy offers a competitive choice to clean Africa's energy mix and power sector, and meet expected energy demand growth (See Chapter 2 - 2.3. The opportunity for energy access, diversity, and utility-scale generation).

Extending national grids is the least costly pathway for almost 45% of those gaining access by 2030.

Electricity and electrification will serve as a catalyst for Africa's new energy systems.

The power sector hence plays a critical role in enabling this transformation, and utility-scale renewable energy power plants are a major part of the solution. According to the IEA's Sustainable Africa Scenario, renewables could account for over 80% of new power generation by 2030, provided also that no new coal-fired power plants will be built in the foreseeable future (IEA, 2022a). Africa's power sector has strong differences across countries. Some countries, such as Kenya, Ethiopia, Uganda, Zambia, and Namibia rely heavily on renewable energy for electricity generation. Others, such as oil-producing countries, have their power system run heavily on fossil fuel. North Africa, despite many efforts made, is primarily dependent on fossil fuels for electricity generation. For the sustainable transformation of Africa's energy systems to produce the maximum socio-economic benefits, the expansion of electricity infrastructure must be aligned with socio-economic development agendas. With the region's renewable energy potential, it is possible to position renewable energy from centralized and decentralized infrastructure as a central source of electricity in Africa to power electrification and industrialization. This unparalleled opportunity can potentially lead to Africa generating up to 90% of the world's 2018 energy production and over 26 times that currently generated (RES4Africa, 2021c).

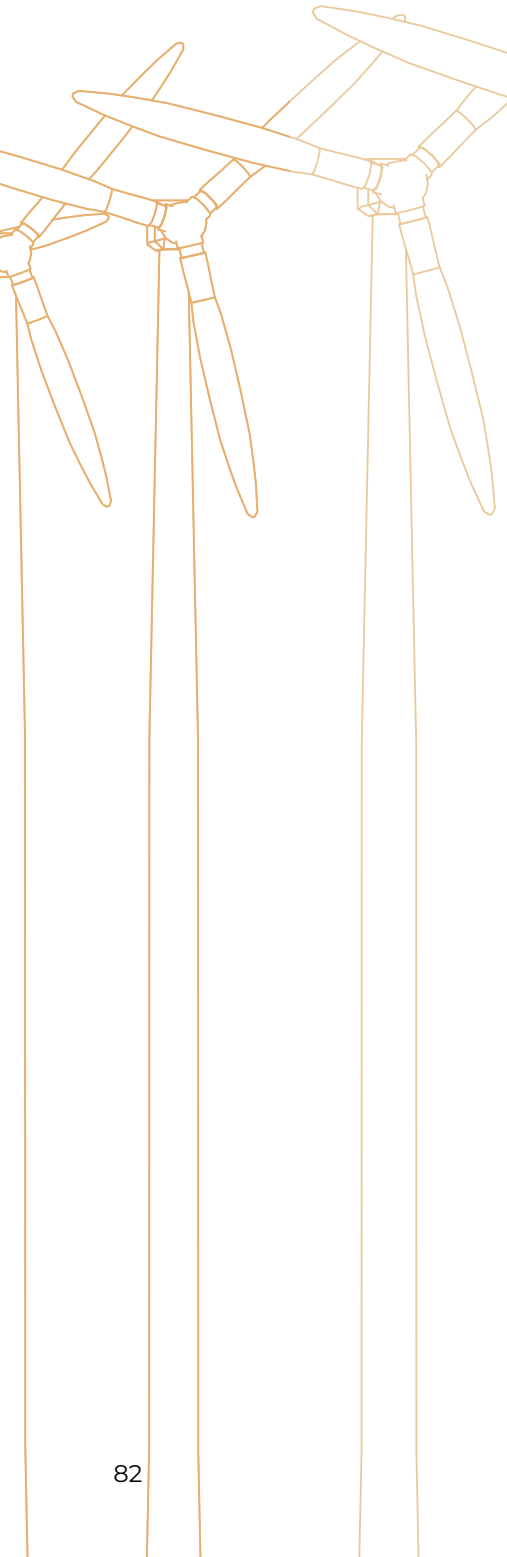
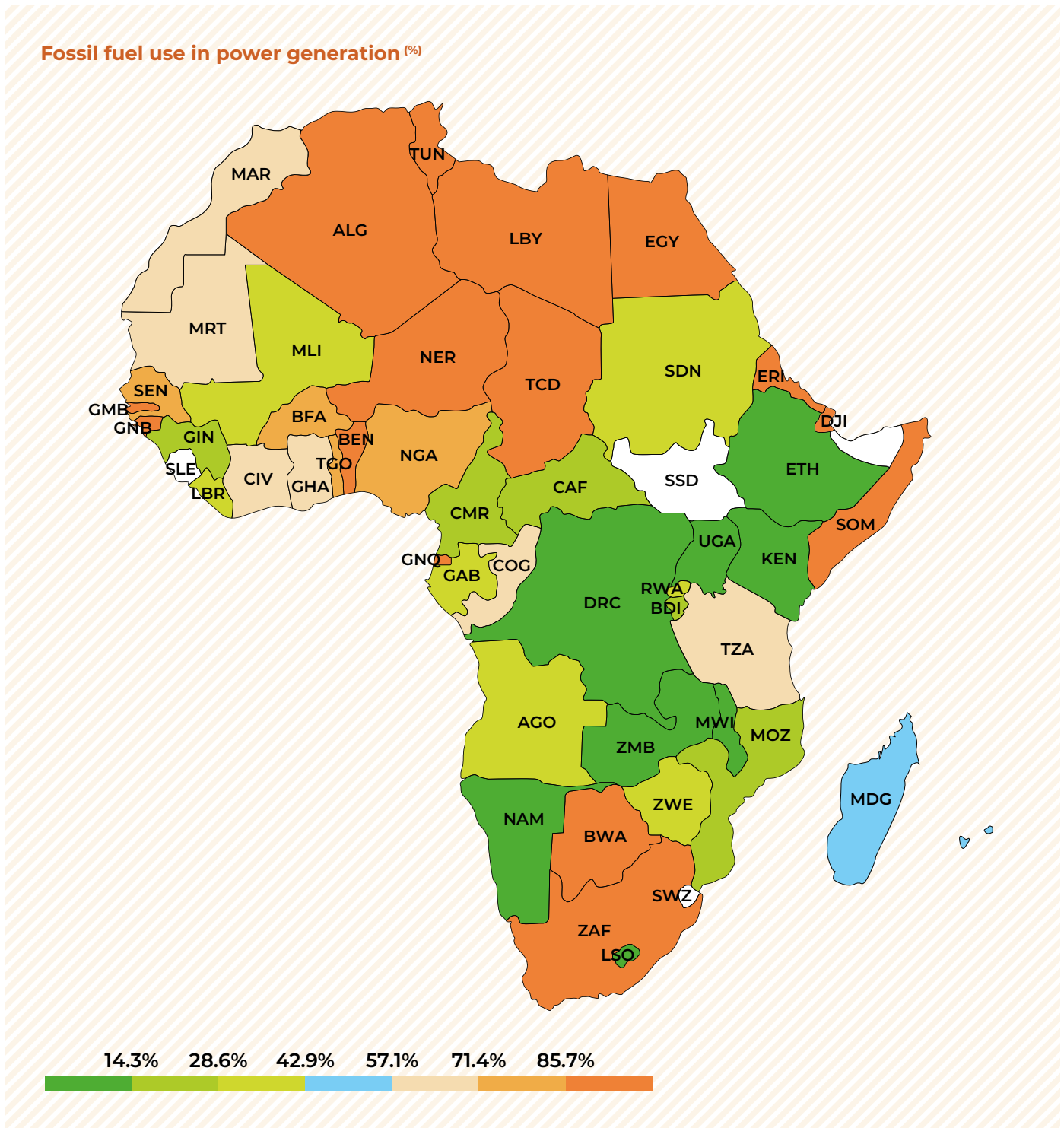
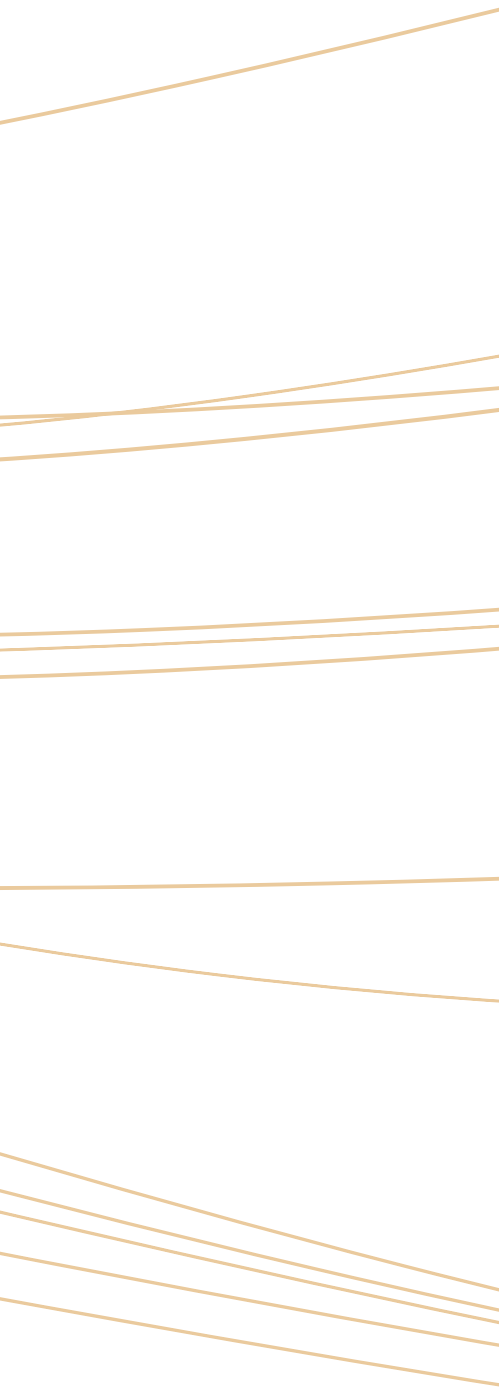


Fig.10

Power generation by fuels in Africa's energy systems

Some African countries run on clean power, while others rely on fossil fuels.





Turning to renewable energy would help utilities to address their current challenges. Utilities often represent the main problem for cleaning the grid, while holding the enormous potential to foster Africa's clean energy transition. In most countries in Africa, they are financially strained, underperforming, and inheriting years of mismanagement and corruption. The direct result is costly power generation from aging and increasingly inefficient power plants. One of the main reasons for struggling utilities is that they rely heavily on subsidies, the overwhelming majority being fossil fuel subsidies to be passed on to the customer, effectively lowering competitiveness and motivation to keep an efficient power system in place (McKinsey, 2022b). Redirecting fossil fuel subsidies to renewable energy and making them conditional to improvement would greatly benefit utilities and national power systems (McKinsey, 2022b). Kenya and Ghana, for example, have turned to renewable energy for electricity generation and are both currently in a situation of electricity surplus. In order to avoid wasting this surplus, utilities need to address their grid infrastructure challenges through necessary investments, public-private collaboration, and the necessary grid network studies (See Chapter 2 - 2.4. The opportunity for infrastructure transformation through transmission, distribution, and storage).

Regional energy integration through the different regional power pools holds enormous promise for a sustainable future. However, progress with this needs to improve. By working together and engaging in trade, neighboring governments have the opportunity to create dependable and reasonably priced electricity access to the region. This can be achieved by taking advantage of economies of scale, securing financing for infrastructure, and collaborating to share resources and achieve synergies. The integration of power is a solution to energy poverty and guaranteeing energy security to nations within the region. It can help to lower operating costs, increase the resilience of the sector and reduce unmet demand (IEA, 2022b). Through regional power trade, there can also be positive environmental effects due to increased renewable energy production, decreased fossil-fuel-based generation, and lower greenhouse gas emissions. A lot more efforts need to go into regional integration.

What is also clear is that there is a need for more involvement by the private sector in the power sector. The African power market is still primarily dominated by vertically integrated utilities, resulting in limited competition and private sector involvement. Liberalization and market competition can aid in integrating private entities into the electricity sector, while unbundling one or more utility segments can lead to improved economic and operational stability.

2.4. The opportunity for infrastructure transformation through transmission, distribution, and storage

The role of grids and power infrastructure, specifically transmission, distribution, and storage, in the energy transition cannot be overemphasized.

SDG 7 specifies access to affordable, reliable, sustainable, and modern energy for all. Electricity grids are the backbone to delivering SDG 7 as enablers of access and carriers of electricity. Transmission and distribution infrastructure have received little attention compared to generation capacity. The traditional centralized energy grid, which relies on large power stations and transmission lines, has struggled to keep up with the growing demand for electricity in many parts of the continent. This is particularly worrying as the electricity needs of the vast majority of the continent's population will be served by national grids in the long term. Aged grid infrastructure and transmission and distribution losses have also caused frequent blackouts and brownouts, posing a challenge to achieving energy security.

The current state of power infrastructure in Africa represents an enormous untapped potential.

The traditional centralized energy grid, which relies on large power stations and transmission lines, has struggled to keep up with the growing demand for electricity in many parts of the continent. Aging grid infrastructure and transmission and distribution losses are major challenges, leading to frequent blackouts and brownouts. Notwithstanding considerable variation between countries, average losses across the continent amounted to 15% against a global average of 8% (IEA, 2022a). 25% of survey respondents with a grid connection reported that the connection works only half the time or less (Afrobarometer, 2022).

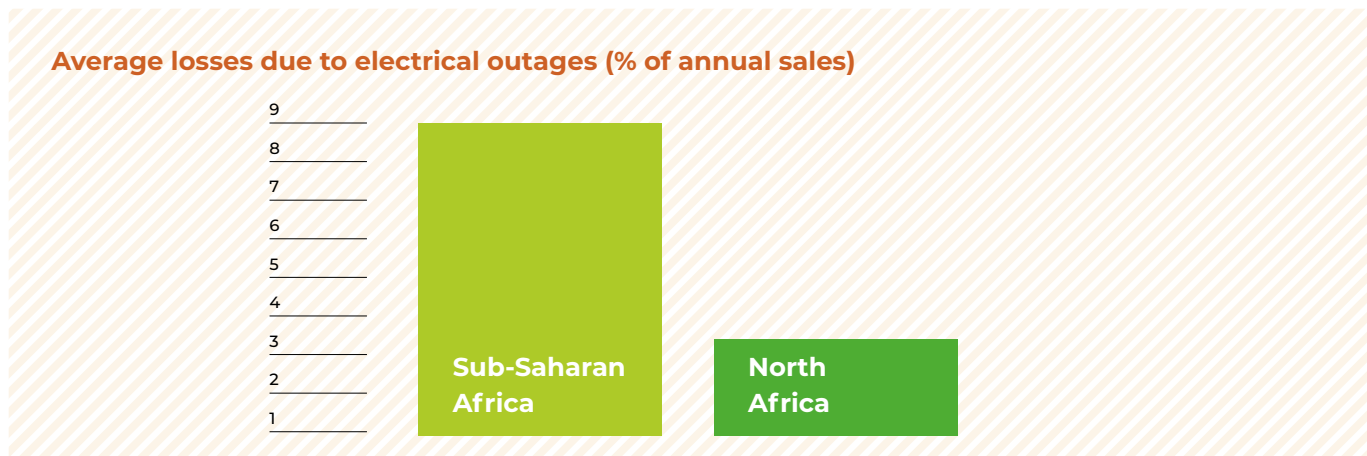
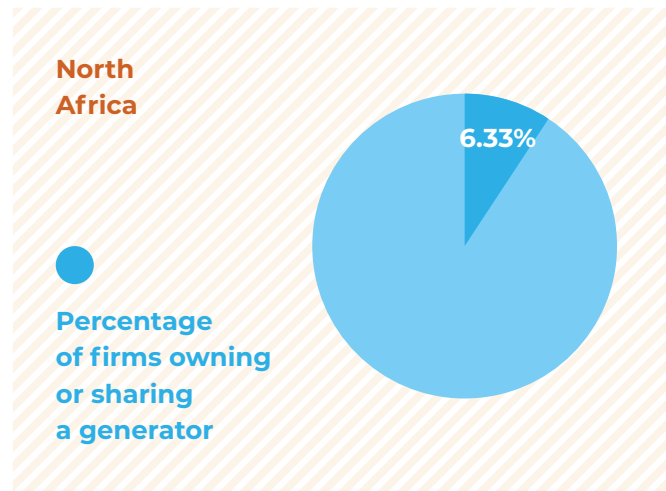
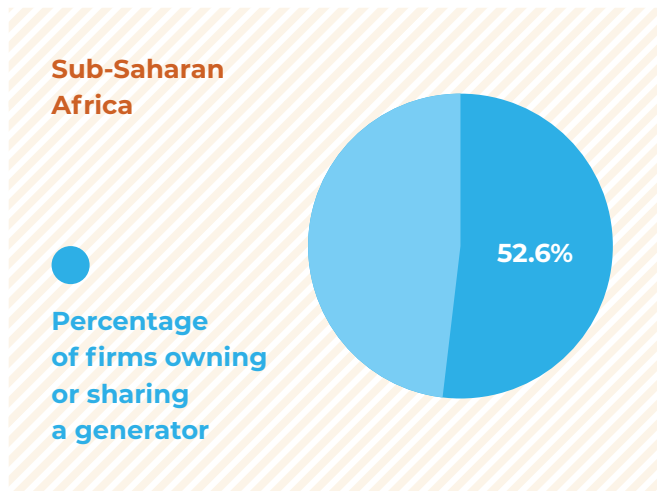
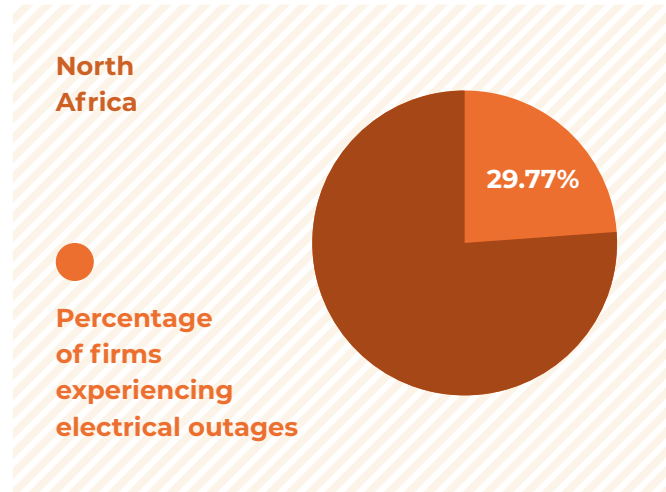
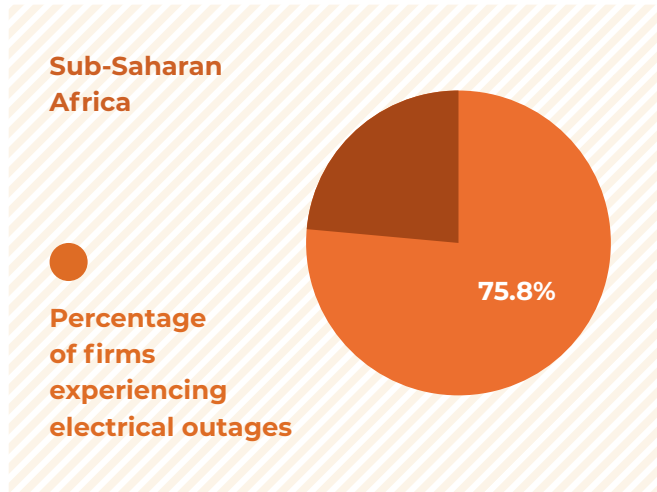
Power grid unreliability and losses hold back growth.

Business owners frequently cite electricity as a major constraint, and it is estimated that outages can cost countries up to 2% of their annual GDP (IEA, 2019). In South Africa alone, power cuts in 2023 were associated with a cost of approximately ZAR 899 million per day or USD 49 million, with stage 7 in load-shedding now reached (Bloomberg, 2023). Unreliable infrastructure also has indirect impacts on productivity: a 1% increase in electricity outages would account for a loss in firms' total factor productivity of 3.5%, on average (Mensah, 2018), employment, competitiveness, and other indicators (Rentschler & all, 2019). High losses represent substantial costs for utilities, and signify that countries only get to use a smaller proportion of the total electricity generated; therefore, in order to increase the amount of electricity available for use (to meet growing demand), generation must increase proportionally more. The length of power outages can range from a brief interruption of under an hour to more extended periods lasting over a day. In certain nations, these outages have resulted in losses of up to 25% of potential yearly revenue for companies and up to 2% of annual GDP (IEA, 2019).

Fig.11

Impact of the grid unreliability on the African manufacturing sector

The unreliability of the grid has a strong impact on commercial and industrial users, who, in turn, need to buy a backup power system, most of the time a diesel generator.



Energy infrastructure has been plagued with underinvestment for years. In the past decade, only 0.5% of Africa's energy investment went to transmission and distribution networks, the remaining 99.5% being directed to power generation (Tobin & Sparkman, 2022). The lack of sufficient investment in the energy sector continues to maintain existing issues, such as utilities facing low revenues and struggling to recover costs, while the cost of setting up new energy generation assets remains high. In addition, the already high and increasing interest rates in some African nations like Ghana, where the benchmark bank interest rate stands at 17%, further exacerbates the situation by increasing the risk premium for potential new investors in energy infrastructure (Tobin & Sparkman, 2022). This is a main reason for the private sector's under-involvement in infrastructure, as only 10% of the energy infrastructure funding in the past ten years was provided by the private sector (Bel, 2022).

The development of renewable energy on a large scale will require a parallel investment in transmission and distribution infrastructure. Large-scale deployment of renewables hinges on parallel investments in grid infrastructure, as a grid network unable to cope with increasingly complex electricity flows may undermine future gains in renewable generation. Grid reinforcements are essential for reducing technical losses and improving the quality of service provided to those connected to the grid. Regulatory reforms, particularly cost-of-service electricity pricing reforms, are needed. The IEA estimates that annual investment in the electricity grid needs to more than triple between 2026 and 2030 to reach USD 40 billion per year on average, with distribution networks accounting for close to 70% of the total (IEA, 2022a).

Storage technology also plays a crucial role across the entire value chain. Battery Energy Storage Systems (BESS) can play a role in managing electricity grids at all levels. For instance, when coupled with generation, or at substation and transformer levels, and behind-the-meter as well, grid integration and dispatching in the light of increasing variable renewable electricity is facilitated by battery energy storage systems. Such systems increase capacity, ancillary services, black start services, and others. Furthermore, the rare minerals required for such systems make many African countries strong candidates for manufacturing in the medium term (See Box 10 – The potential of BESS to mitigate South Africa's current energy crisis).

In the past decade, only 0.5% of energy investment in Africa went to transmission and distribution networks, compared to 99.5% directed to power generation.

Only 10% of energy infrastructure funding was provided by the private sector in the past 10 years.

Box 9 – Latest technological trends - Storage

As Africa increasingly looks to swap fossil fuel power for emissions-free electrification, battery energy storage technologies are becoming a vital storage tool to facilitate the energy transition. In tandem with this drive is an increasing requirement for battery energy storage devices capable of creating long-term reliability and efficiency. BESS can store excess electricity generated by wind and solar farms during periods of low demand and then release that energy back into the grid during periods of high demand. At the substation and transformer levels, BESS can help smooth out voltage and frequency fluctuations caused by variable renewable energy sources. Finally, behind-the-meter BESS can store excess energy generated by rooftop solar panels, allowing homeowners to use that energy later when the sun is not shining.

Battery storage is a rapidly evolving technology changing how energy is used and stored. The technologies have seen fast decreasing costs for the past decades, but 2022 is witnessing a price increase of 7% for lithium-ion battery packs to USD 151 per kWh (BNEF, 2023c). Although still in their early stages, sodium-ion batteries are starting to be developed on a larger scale. These batteries could potentially address the challenges faced by the battery market, including reducing costs, and become an alternative to lithium-ion batteries as early as 2026 (BNEF, 2023c). Despite rising prices in 2022, the market size for energy storage systems has doubled (BNEF, 2023c). There is a growing demand for larger and more powerful batteries that can store more energy for longer periods. This has been driven by the increasing popularity of electric vehicles and the need for reliable and efficient energy storage from renewable sources. Solid-state batteries are progressing and have promising outlooks in increasing cell-level energy density to 500 watt-hours per kilogram and decreasing battery prices in the latter half of this decade. Some prominent battery manufacturers have outlined their plans to introduce solid-state batteries into the market in the following 10 years (BNEF, 2023c). Africa is particularly well endowed when it comes to rare minerals necessary for BESS systems and can position itself as a major sustainable supplier, as long as ESG concerns are addressed and a strong supply chain established.

RES4Africa members such as Enel Green Power, Schneider Electric, and Nidec work on storage systems of all sizes to utility-scale BESS, which could represent a massive opportunity for Africa.

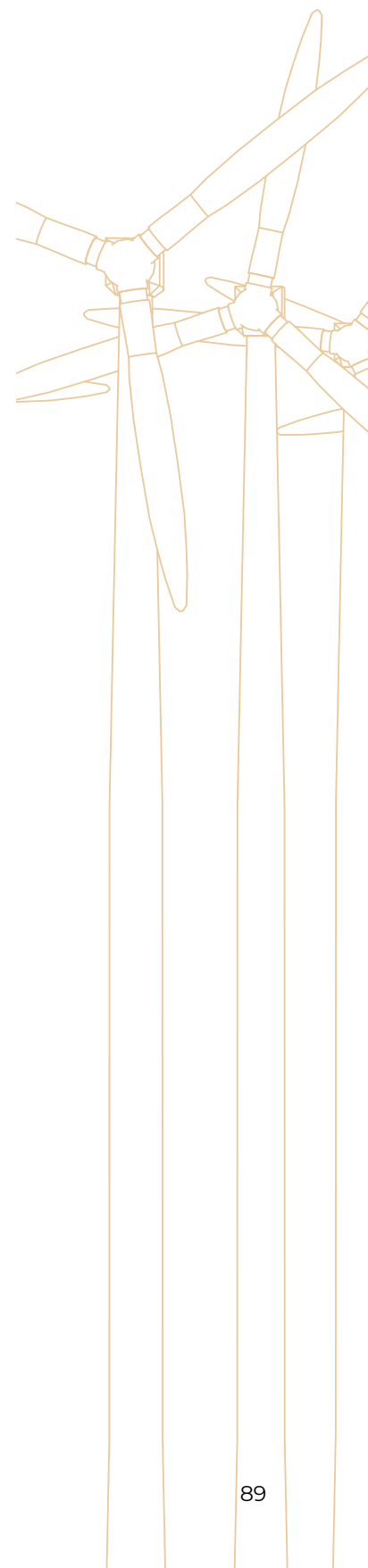
Box 10 – The potential of BESS to mitigate South Africa’s current energy crisis

In February 2023, South African President Cyril Ramaphosa declared a state of disaster due to the country’s severe electricity crisis, marked by widespread power cuts called load-shedding. To address the crisis faced by the country’s national utility Eskom, and achieve long-term energy security, the government plans to fundamentally transform the electricity sector through private investment. This renewed political will has given impetus to efforts to tackle the load-shedding crisis sustainably, with a strong emphasis on adopting renewable energy and storage. According to the Integrated Resource Plan (IRP), South Africa plans to add 6,000 MW of solar PV and 14,400 MW of wind power capacity, with an additional 2,088 MW for storage.

As part of this effort, one of Eskom’s priority initiatives involves partnering with players in battery storage technology to improve dispatchability of variable energy from renewable energy plants, add much-needed capacity to the grid, and provide alternative solutions for grid support. The distributed Battery Energy Storage Systems (BESS) project aims to develop a 360 MW storage system at various Eskom distribution sites in several provinces. As a result, Eskom has announced the construction of its first BESS project. The Elandskop BESS project, which is part of phase one of a 343 MW/1,440 MWh BESS procurement concluded by Eskom in August, will total 8 MW of power and 32 MWh of energy storage capacity. Its main role will be to boost the network during peak hours to relieve stress on the grid. The projects, which will be completed by June 2023 and December 2024 in phases one and two, respectively, will add large-scale battery storage systems to the South African grid (Murray, 2022).

Further underlining the country’s ambition to introduce BESS in South Africa, the first tender under the Renewable Energy Independent Power Producers Procurement Program (REIPPPP) exclusively for batteries was launched this year. Bids for five substations all in the Northern Cape – an area with little to no available grid capacity – will have to be made by early July 2023 for a total of 513 MW/2,052 MWh (Eskom, 2023).

RES4Africa’s study “Regulatory Assessment of Battery Energy Storage Systems in South Africa” identified the urgent need to introduce BESS into the electricity system of South Africa (RES4Africa, 2022). The report assessed a number of global benchmarks with mature storage sectors to identify key gaps in South Africa’s electricity regulation, which is not fully equipped for the introduction for storage. The study found the following key recommendations for the sustainable development of BESS.



Market design: The ideal market design for South Africa would be a hybrid model, whereby energy from BESS is sold in both a regulated market, as well as a wholesale market. Such a multi-market model would increase competitiveness to stimulate market growth whilst still supporting the financial sustainability of existing utilities.

BESS use case: Given South Africa's electricity crisis, BESS applications based on energy are shifting, especially from peak solar during the day to match morning and evening peak demand. A peak shaving capacity provision is among the most immediate and feasible options for South Africa.

Procurement mechanism: A case built upon an energy-shifting model, will require a technology-neutral auction model based on a time block system. In such a system, BESS generators will be able to participate in auctions based on the demand forecasts for each time block.

Investment: The remuneration structure for BESS generators should be outlined in regulations and reflect the ability of the technology to provide electricity to the grid at short notice during peak demand periods. Additional investment incentives should be provided in the form of tax incentives as set out in section 12 of the Income Tax Act.

What is encouraging is that countries are testing out innovative business models to encourage private-sector participation. For example, Kenya signed the first public-private partnership for grid transmission in Africa in 2022, paving the way for further investment in this area (PV Magasine, 2022). Private sector involvement can also bring much-needed expertise and innovation to infrastructure development. The latest technological trends, such as innovations in digital devices for transmission and distribution infrastructure and the latest developments in storage technology, have significant potential to enable renewable energy uptake. Private companies are often at the forefront of these innovations, driving progress and lowering costs.

Whilst the developments above hold great promise, the electrification of the continent needs to be carried out within the context of long-term transition plans. The ability to continue delivering an efficient and reliable electricity distribution service must continue as household, industry and transport consumption increases and electricity flows become more complex. This is crucial not only in rural areas far from existing grid infrastructure but also in urban and peri-urban areas under the grid. Surveys have shown that there are over 110 million Africans who live right under a grid but lack access to power primarily due to the prohibitively high connection costs (Attia, 2017). In the absence of grid development, future gains in renewable energy generation may be undermined by a grid network unable to cope with increasingly complex electricity flows. However, only a third of African nations have transparent grid extension plans in force (BNEF, 2022g).

Box 11 – Latest technological trends - Digital innovations in the transmission and distribution infrastructure

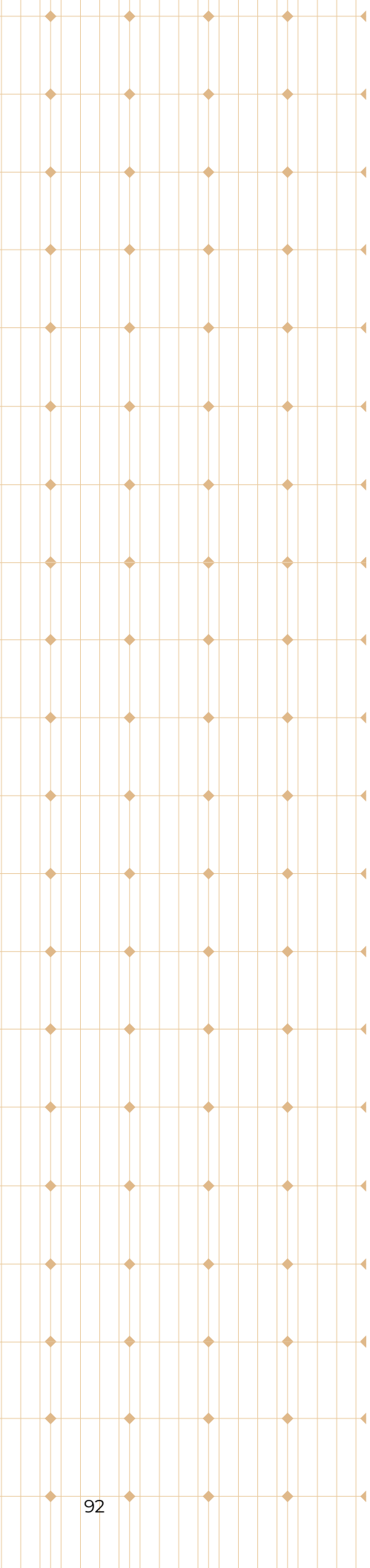
In recent years, there have been significant advancements in the transmission and distribution infrastructure, particularly in the area of digital solutions and devices. These innovations are aimed at improving the efficiency and reliability of power delivery while reducing costs and environmental impact. For Africa, where access to reliable and affordable electricity remains a significant challenge, these technological trends have the potential to transform the energy sector and accelerate economic growth. Smart grid technologies, the integration of energy and storage systems can help overcome the challenges of intermittent power supply and improve the reliability of electricity access through digital devices such as sensors, meters, and communication systems are increasingly being deployed in transmission and distribution infrastructure. These devices provide real-time data on energy consumption and grid performance, enabling utilities to quickly identify and address faults. The use of digital devices in Africa can help improve grid reliability, reduce energy losses, improve the efficiency of fault response teams, and enable more accurate billing and payment systems.

In this area, one of RES4Africa's members Gridspertise spearheads digital solutions for the transmission and distribution infrastructure and is currently exploring South Africa and Morocco to set up activities. The company focuses on helping Distribution System Operators (DSOs) in delivering sustainable and reliable smart grids globally. It will leverage Enel's existing expertise in testing, assessing, and scaling up the best technologies to operate smart grids worldwide. Gridspertise will provide access to innovative, circular-by-design, and robust solutions that have been field-tested at large scale to meet the digitalization needs of DSOs across the entire value chain. The company's portfolio of products and services will be structured around three main domains of DSOs' digitalization needs, namely, Metering and Grid Edge digitalization, Network infrastructure digitalization, and Field Operations digitalization (Enel, 2021).

2.5. The opportunity to expand off-grid and decentralized power

Low access to grid-based energy has driven businesses and agriculture to increasingly rely on decentralized fossil fuel-based solutions over the past decades, both in remote and urban areas and even in industrial zones. Over 75% of firms in sub-Saharan Africa are experiencing electrical outages, happening on average 8 times per month for more than 5 hours. This represents 8% of annual sales losses due to electrical outages (World Bank, 2022d). However, the overwhelming

Over 75% of firms in sub-Saharan Africa are experiencing electrical outages, happening on average 8 times per month for more than 5 hours.



majority of backup systems are fuel based, such as diesel generators, and are used to back up the grid or mitigate its fluctuations. Over half of Africa's firms report owning a diesel generator (World Bank, 2022d). This in turns increases their energy cost, hence reducing their profit margins. This is despite the fact that current decentralized renewable energy systems can adequately power small businesses, schools, and health centers, and have other productive uses, thereby creating economic opportunities and improving the quality of life for people in rural areas. Off-grid and decentralized applications of renewable energy have the ability to transform the energy landscape in Africa, not only improving the quality of life but also creating economic opportunities and reducing the carbon footprint of the continent.

Many commercial and industrial customers are now turning to off-grid energy systems to compensate for the unreliability of the grid. Clean off-grid solutions are considered not only as their backup source of electricity but also as their main source of power, effectively reducing their energy cost and their dependence on aging grid infrastructure and malfunctioning utilities. Innovative business models, such as lease-to-own offers, have gained attention. There is an increasing number of solar companies dedicated to commercial and industrial customers, and the market is growing. Public initiatives are also coming online, such as Nigeria's Energizing Economies Initiatives, which has powered more than 12,000 shops in the past 5 years, with a target of powering 80,000 shops in the coming years, in a pipeline of over 80 market clusters all over the country (REA, 2022). In Morocco, Safran Nacelles, an aeronautic company, has commissioned its own solar PV plant powering more than 20% of its energy needs (Le Desk, 2022).

Wind and hydropower are also being explored as potential sources of electricity for farms and rural communities. These renewable energy solutions not only offer environmental benefits but can also improve the economic livelihoods of farmers and rural communities by providing reliable and affordable energy access for productive uses. The agricultural sector represents 60% of all jobs in sub-Saharan Africa (ILO, 2020), one-fifth of the GDP (IEA, 2022a), and most of the agricultural sector is made of smallholder farmers on 1 to 3 acres of land. Yet renewable energy in agriculture can be used as a way to improve efficiency, reduce costs, and increase sustainability. Solar-powered irrigation systems are becoming more common, providing farmers with a reliable source of water without the need for fossil fuels or grid electricity. Biogas generators are also used to convert animal waste into energy for cooking and lighting. In Kenya, geothermal energy is being used to heat flower farms (GDC, 2014). Developing appropriate off-grid and decentralized solutions also enables wider improvements to the water-energy-food nexus e.g., for cold storage and food processing. It allows cold chains to be extended, enabling agricultural products to reach urban markets. To fully harness the potential of the agricultural sector, it is critical to link rural communities and off-grid energy sources to enhanced agricultural productivity and ensure food security. There are still significant challenges to overcome, such as lack of financing and technical expertise, but the potential benefits make it an area worth investing in.

Box 12 – Latest technological trends - Recycling of solar panels, batteries and solar lamps

End-of-life management of renewable energy products presents a significant challenge and opportunity for Africa. It's estimated that by 2050 78 million metric tons of solar panel waste could accumulate worldwide, which could be worth as much as USD 15 billion if recovered (IRENA, 2016). Recycling practices and policies need to be put in place now to prevent a future solid waste crisis, especially in Africa where there's growing momentum for off-grid systems and solar PV.

The challenge facing the industry in the coming years will be to meet the growing demand for renewable energy while also managing the waste and environmental impact of these products. As of today, this market is still nascent and will require a lot of innovation, from new technologies for dismantling and reusing the various components of solar panels, turbine blades, and lithium-ion batteries, to creating innovative products that simplify and make recycling safer at the products' end-of-life stages. This represents a significant opportunity for Africa to develop its e-cycling industry and create new jobs and economic growth.

RES4Africa members such as RINA Consulting and Enel Green Power are actively working on this.

2.6. The opportunity for green hydrogen in Africa

The potential for green hydrogen is attracting a lot of attention in Africa.

Today, most of the hydrogen produced and used at an industrial scale comes from gas, and even coal in South Africa's case (IEA, 2022a). In IEA's Sustainable Africa Scenario, hydrogen production in Africa is expected to reach 5 Mt by 2030, and 20 Mt by 2050, of which 80% comes from low-carbon technologies, with the right policy support and timely investment put in place (IEA, 2022a). In comparison, hydrogen demand is expected to reach 180 Mt worldwide by 2030 (IEA, 2022d). A growing interest in the production of hydrogen from renewable energy sources holds immense potential both for domestic economic growth and in terms of geopolitical positioning for Africa with its abundant and dispersed renewable energy resources.

The development of a strong green hydrogen market could enable Africa to become a global green hydrogen powerhouse.

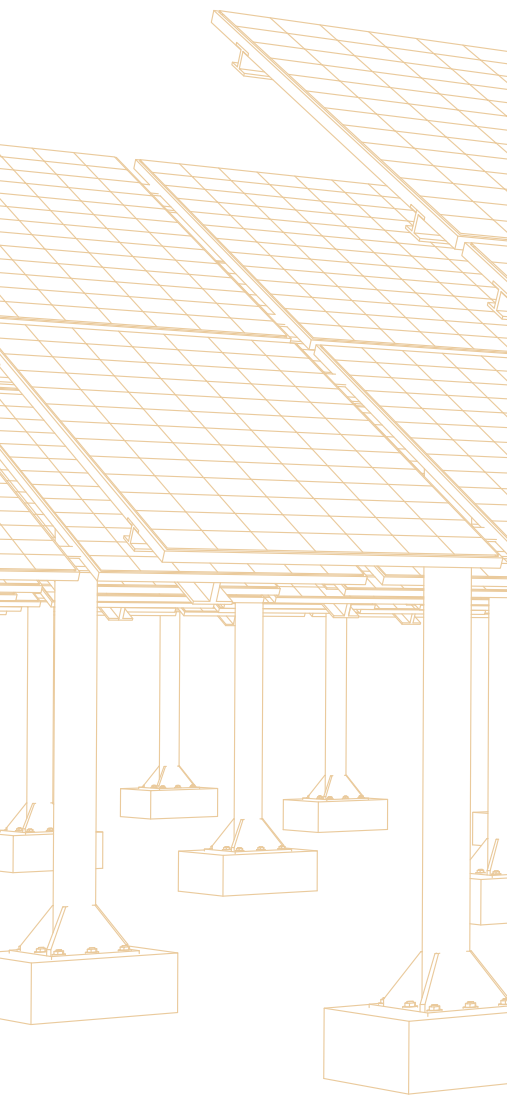
Supported by the right comprehensive plan and levels of investment, this would create significant numbers of jobs and support continued economic growth. With energy costs making up more than 60% of hydrogen production costs, the abundance of

Hydrogen demand is expected to reach 180 Mt worldwide by 2030.

Africa has the potential in terms of resources to produce 5,000 Mt of green hydrogen a year by 2035, with a cost of EUR 2/kg or less, making it economically viable.

renewable energy resources in Africa represents a strong comparative advantage for the production of green hydrogen (AGHA & McKinsey, 2022) for both domestic and international use. It is estimated that Africa has the potential in terms of resources to produce 5,000 Mt of green hydrogen a year by 2035, with a cost of EUR 2/kg or less, making it economically viable (EIB, 2022). By investing EUR 1 trillion into green hydrogen, Africa can deliver the equivalent of more than one-third of its current energy consumption (EIB, 2022). With the European Union, Japan and South Korea positioning themselves as priority export markets, since they have existing infrastructure and strong energy needs, the future of African green hydrogen is promising, as long as it complements renewable energy investment for domestic electricity consumption. This in turn could represent a GDP increase for producing countries of 12% by 2050 (AGHA & McKinsey, 2022).

Not surprisingly, momentum for an African role in this is already building and gaining traction. Several projects have either been launched or are in the pipeline for these countries, with many targeting European markets. The African Green Hydrogen Alliance was launched in 2022, with Kenya, South Africa, Namibia, Egypt, Morocco and Mauritania committing to low-carbon hydrogen production. Several initial agreements for green hydrogen projects in Africa were signed at COP27 in Sharm el-Sheikh. Hydrogen production for domestic demand, and especially hard-to-abate industrial sectors, is also picking up. South Africa is currently testing hydrogen production for mining trucks, Morocco is building a plant for renewable-based ammonia for its fertilizer industry (IEA, 2022a). However, large projects are faced with equally large financial barriers due to the substantial upfront capital investment needed, often the size of the country's economy itself. This is the case for the Hyphen Hydrogen Energy project in Namibia, a country whose GDP is around USD 11 billion, while the project is estimated to cost over USD 9 billion (IEA, 2022a). These projects, essential for Africa's energy transition and geopolitical positioning, need to be structured in the right way to enable them to then attract the levels of global investment and financial support needed.

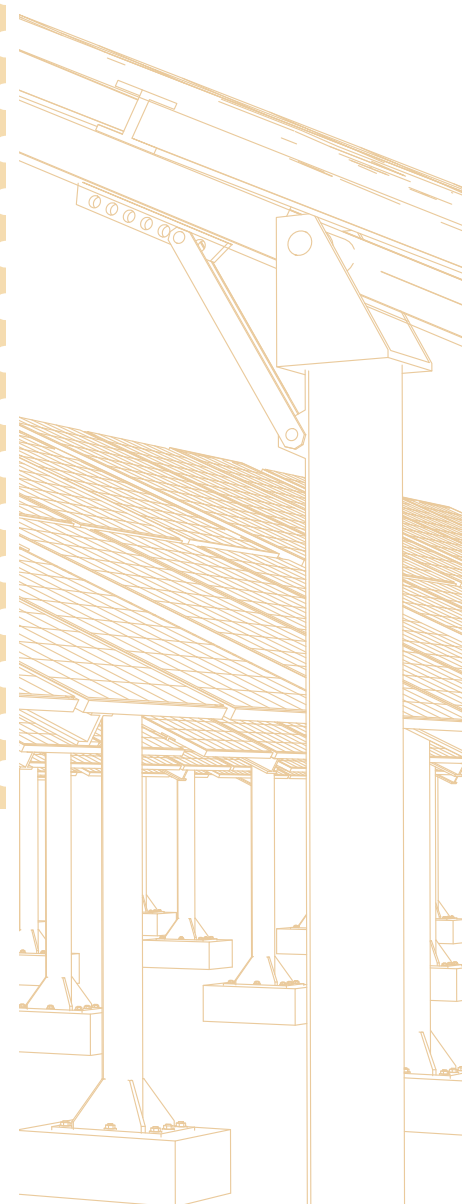


Box 13 – Morocco’s green hydrogen potential

Morocco has been exploring the potential for green hydrogen production. In 2021, the country released its Green Hydrogen Roadmap (MEM, 2021) which sets the aim to produce green hydrogen at a low cost to meet domestic energy demands and potentially support energy security in Europe. According to IRENA, Morocco is well-positioned to achieve these objectives, as it is projected to have the third lowest green hydrogen production cost by 2050, with a range of approximately USD 0.7/kgH₂ to USD 1.4/kgH₂. This puts Morocco ahead of established players in the global energy sector, including Australia, Mexico, India, and the United States, ranking only behind China and Chile. IRENA’s predictions are supported by Morocco’s plans to increase its installed renewable energy capacity in the energy mix and secure water supply for drinking and electrolysis through seawater desalination plants.

In a bid to improve access to affordable and clean energy, Morocco has co-launched the African Green Hydrogen Alliance in collaboration with Mauritania, Egypt, Kenya, Namibia, and South Africa. The primary objective of the alliance is to encourage cooperation and mutual support among its founding members to advance the development of green hydrogen in their respective countries. To achieve this, the alliance aims to promote regulatory and policy reforms, build local capacities, and attract investments in green hydrogen production to meet domestic energy demands (UNFCCC, 2022).

Morocco’s IRESEN, the national research institute on solar and new energy technologies, has installed its first micro-pilot green hydrogen production system, consisting of a 20 kW electrolyzer and PV solar panels. The pilot project aims to produce carbon-free hydrogen for green ammonia, green methanol, and green fuels while also providing training opportunities for students, researchers, engineers, technicians, and managers from various institutions (Souad, 2022).



RES4Africa Youth Task Force statement

RES4Africa Youth Task Force:

- Akil Callender, Youth Specialist, SEforALL
- Ashlin Naidoo, APO Energy, and Climate Change, City of Cape Town Municipality
- Diana Bulf, E&C Continuous Improvement & Performance Monitoring, Technical Solidarity
- Elly Kevin Oriko, Founder & CEO, Raynow Energy
- Esther Githinji, Advocate of the High Court of Kenya, Clean Energy 4 Africa
- Etumuka Mamize, Team Lead Capacity Building, SDG 7 Youth Constituency
- Jenny Daniela Salazar Zapata, Officer, Rete Giovani
- Luciana Miu, Governing Board - Advocacy and Public Relations, Energy Policy Group, European Energy Youth Network
- Maame Boateng, Partnerships Manager, Africa-Europe Foundation
- Martin Masiya, Founder & CEO, Solllys Energy Ltd
- Mohamed Alhaj, Founder & CEO, Terra Energy
- Norah Magero, Founder & CEO, Drop Access
- Oluwadabira Abiola-Awe, Ventures & Capital Campaign Associate, Student Energy
- Rebecca Bisangwa, Associate Professional Renewable Grid Integration, IRENA

We, the RES4Africa Youth Task Force, believe that young Africans must play a central role in the delivery of the continent's sustainable development, in the fight against climate change and to reach SDG 7 by 2030. Young Africans under 30 represent over 70% of the continent's population and will be the protagonists in the journey to deliver a sustainable energy future for the continent. Empowered with vision, knowledge and key capabilities, Africa's youth will play a vital role in leading Africa's clean energy transformation. This is why it is essential that young people are adequately equipped, supported and meaningfully involved in the decision-making process to take the just energy transition forward.

To enable young people to take a leading role in delivering Africa's clean energy transition, we advocate for three key action areas.

1. Go all in on capacity building:

- The clean energy transition will require a workforce with a mix of technical, regulatory, financial, economic and social skills to deliver the Africa we want. This will be crucial to meet the decarbonization goals set for the UN Agenda 2030 and Agenda 2063.
- Training and knowledge-sharing are the most cost-effective ways to ensure that youth are well-equipped to lead the clean energy transition in Africa in the years ahead. There is a need to educate youth to lead the sustainable energy transition with tailored programs, business and soft skills and providing guidance and mentoring to take their innovations to the next level.
- All stakeholders can play a relevant role in this. Local universities and higher education systems should define a focus on skills development to meet the requirements of the clean energy transition. The private sector should cooperate

with educational institutions to adapt education to the real needs of the market. Companies can help drive this shift in the education system, in cooperation with educational institutions, to help young people build a solid skills base and prepare them for the jobs and endeavors of tomorrow. It is imperative that we prioritize strong partnerships with vocational training institutes. By offering comprehensive training programs, local communities can be empowered with the essential skills required for the installation, manufacturing and maintenance of renewable energy systems.

2. Create an environment for youth-enabled innovation:

- Youth are at the core of Africa's socio-economic development. The RES4Africa Youth Task Force believes that African youth should be supported by scaling up the collaboration with the renewable energy industry to finance innovation.
- Specialized financial, business and technical support to youth-led businesses and innovations can foster the development of young leaders who will positively impact their communities, which are most negatively affected by energy poverty and climate change.
- Private sector investment in Africa's clean energy transition should include a focus on youth development initiatives as an essential aspect of local content requirements. This approach will ensure that young people are provided with ample opportunities to actively contribute to and benefit from the growth of the renewable energy sector in their communities.
- Collaboration between the private sector and government is essential to facilitate the creation

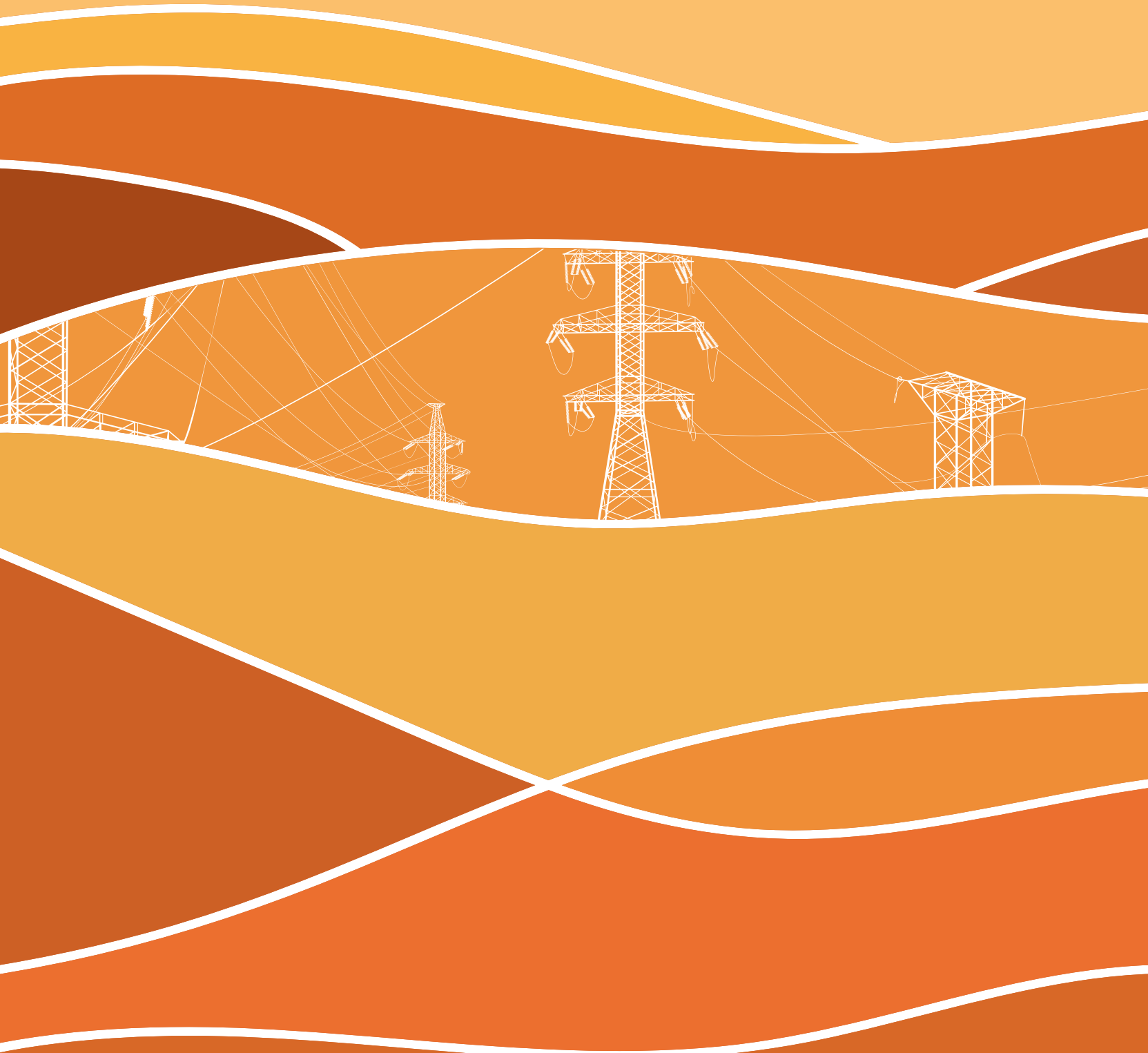
of policies and regulatory frameworks, and advancement of best practices that promote youth-focused innovation and entrepreneurship in the renewable energy sector.

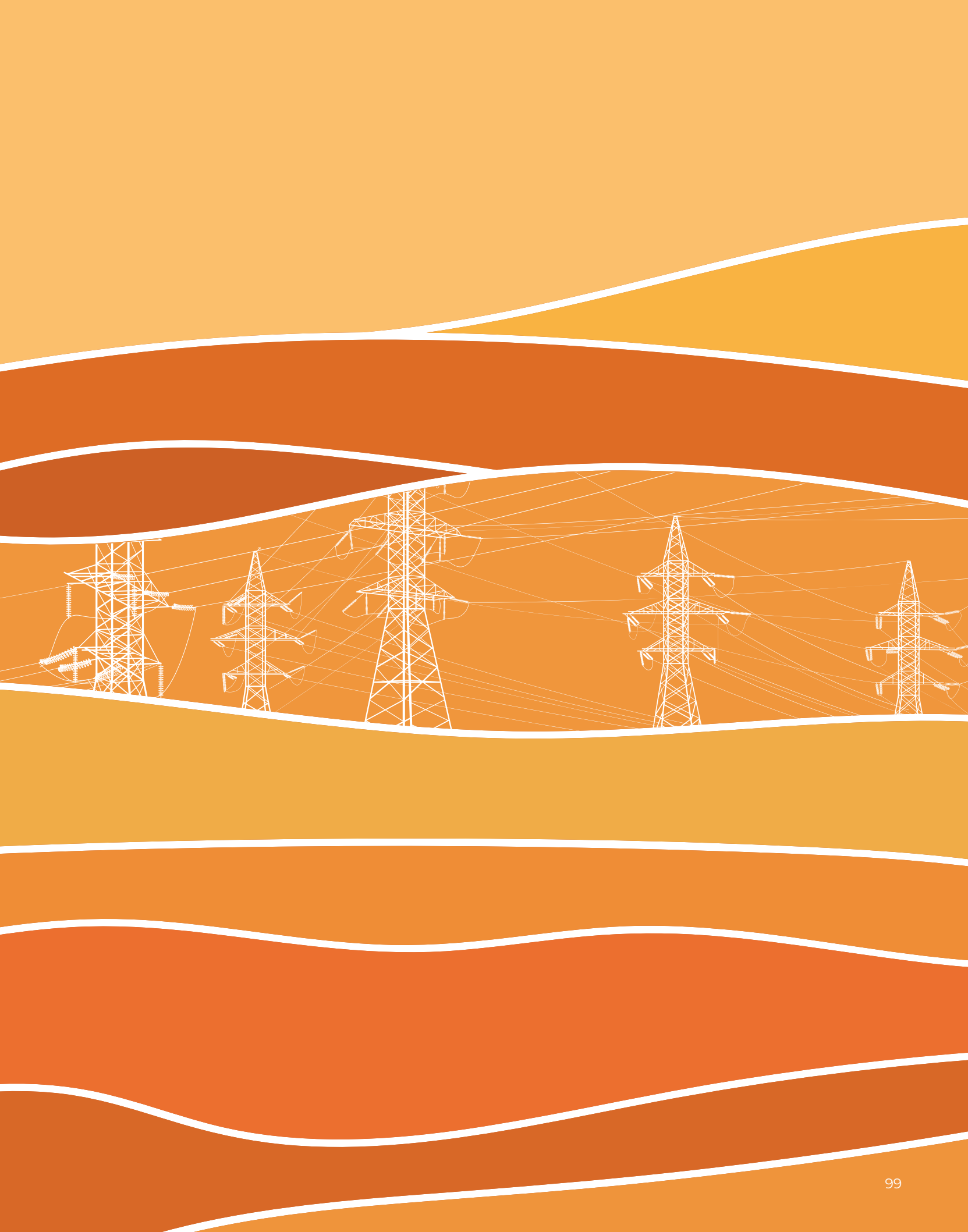
- Financial institutions play a significant role in promoting innovative finance by providing customized financial products and services that can assist young entrepreneurs to scale their renewable energy businesses. Local innovation hubs can serve to foster home-grown solutions and explore means to replicate solutions.

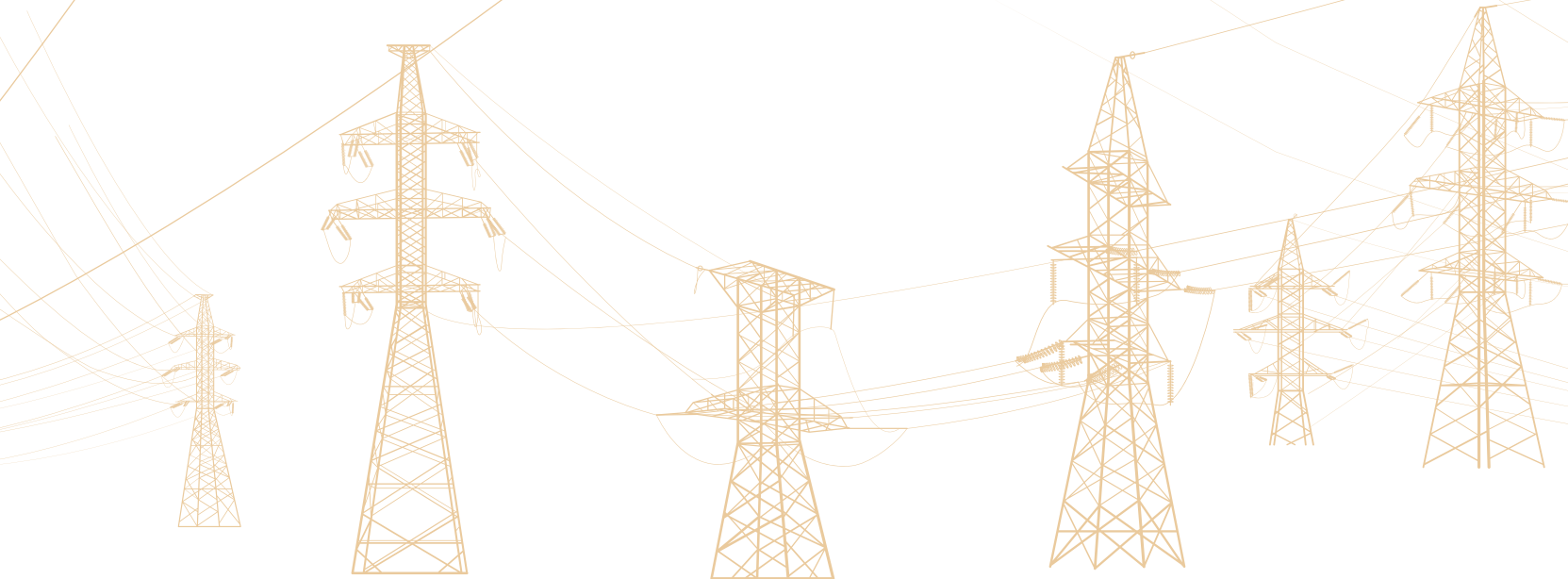
3. Meaningfully engage and involve youth:

- Africa's young generations will be the most impacted in the future by energy and climate decisions taken today. Yet young people are often sparsely involved in consultations and decision-making, which leads to an underrepresentation of their views in key policy decisions.
- The RES4Africa Youth Task Force calls for increasing the meaningful engagement of young people in policy dialogues and aims to provide an inclusive platform for youth to express their views about the delivering renewables in an impactful, sustainable and equitable way.
- The engagement of youth must be meaningful and lead to concrete action. Youth engagement must be self-organized, well-resourced and accountable, and engagement with industry and government must be direct and followed by real developments. On the road to COP28, where the voice of young Africans will resonate as strongly as ever, we wish to underline once more that there is no need to reinvent the wheel, the tools are all there. Let's use them.

CHAPTER 3
THE WAY FORWARD: ENABLING AFRICA'S
SUSTAINABLE ENERGY FUTURE







1. What is needed to scale up renewable energy in Africa?

African countries are well positioned to capture the benefits of renewable energy technologies and, in doing so, can also attract additional flows of private sector investment. Much of the knowledge and tools needed for this exist and can be reused. However, work remains in several enabling areas to bring the investment well beyond the levels seen today. These are addressed in more detail in this chapter. Public-private partnerships have decisive roles to play in all these areas, and it is essential to note that this will vary by country, as each has its unique set of circumstances and challenges. What works well in one country may not necessarily work in another due to differences in culture, politics, economy, and geography. Ignoring these specificities could lead to ineffective or harmful policies that fail to address the root causes of issues in a particular country. With the support of RES4Africa, and thanks to its in-country knowledge, there is an opportunity to ensure that Africa's sustainable energy pathways are informed by global experience, are locally appropriate, and are successfully implemented to reach Africa's sustainable development targets.

1.1. Raising awareness

1.1.1. Addressing misconceptions about renewable energy technologies

Raising awareness about renewable energy technologies' realities and benefits remains crucial in Africa to reach scale. Despite many years of profile-raising activities and a favorable international track record that has helped make renewables a relevant economic case for future energy system planning, many

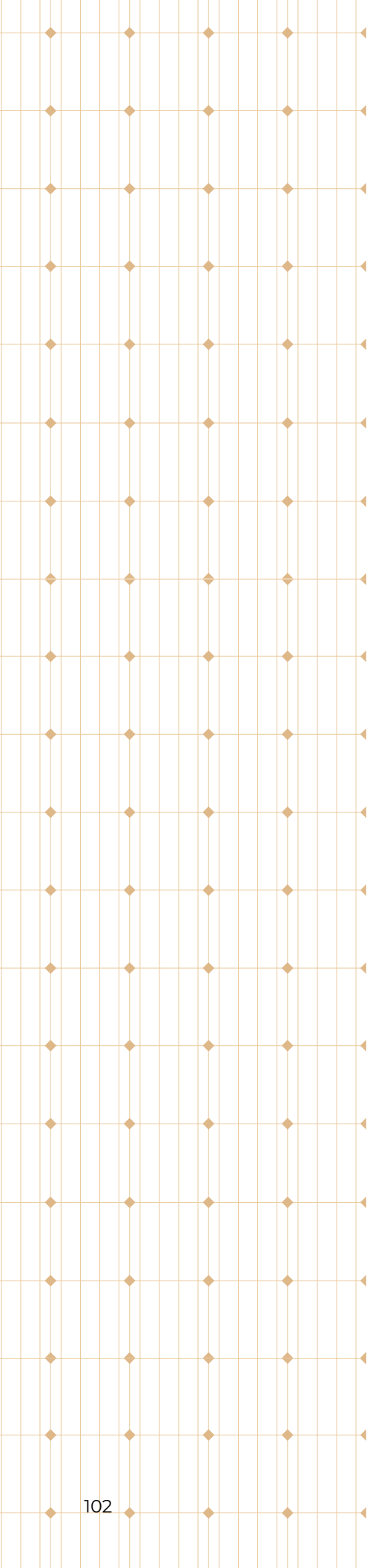
fundamental misconceptions exist about what they can and cannot do. Often based on outdated information, renewables are still burdened with the perception of past limitations. Renewable energy is still often perceived as an expensive and unreliable power alternative to conventional energy sources in Africa, unreliable for integration to the grid due to variability and intermittency, takes too long to build, lacks energy security qualities, and development benefits would be better achieved through a combination of fossil fuel development models.

Much has changed about the business case of renewable energy in Africa, but this is not well known. The renewable energy sector has evolved and changed significantly over the past decade, with accelerated deployment of better-performing and more cost-efficient technologies. Recent years have revealed lessons learned and best practices across emerging and developing economies regarding policies and markets. Technological efficiencies have improved. And a rapidly changing energy sector spurred by a need for urgent climate action is turbocharging the energy transition in countries around the world. In a rapidly changing global context, setting the record straight on different technologies' actual costs, performance, and reliability profiles remains necessary (See Chapter 2 - 1. Making the business case for renewable energy).

As each country defines its energy journey, energy infrastructure decisions should be informed with the most current knowledge. This is especially important given the longevity of energy infrastructure projects and their importance to a country's economy and society. With a complex energy legacy, efforts to develop new solutions lead to diverse debates about the possible energy pathways ahead, and incumbents are fighting hard to remain relevant. Changing the *status quo* can be an intricate matter as conventional energy sources may often be deeply entrenched in local economies. As each country decides its future energy pathway, this decision-making process must be informed and supported by accurate, timely, consistent information and recommendations, especially those around overcoming challenges preventing private sector involvement. Promoting a fact-based and balanced approach can help better inform energy infrastructure decisions and provide the right signals to private sector actors, investors, and markets to help infrastructure materialize (See Chapter 1 - 3. Narrative evolutions on Africa's just energy transition).

1.1.2. Shaping the narrative and increasing the role of the private sector

The widespread adoption of renewable energy technologies could bring about significant changes that can help overcome Africa's energy challenges. Ensuring that the realities of renewable energy inform energy discussions and knowledge exchanges is essential for all stakeholders involved. Policymakers must be informed and updated about renewable energy's economic, social, and



environmental benefits and its role in helping achieve its development goals. South-South exchanges can be most beneficial to build on progress and success stories made in recent years. It will also require educating local investors about the potential returns on investment in renewable energy projects and how these projects can contribute to broader sustainable development. That will then help remove the barriers to more significant private-sector investment. This knowledge exchange can take place regularly through a variety of inter-sectoral platforms, which can assist with the convening of relevant actors across a variety of territories and economic development plans.

Informed decision-making at the government and industry levels should be complemented by raising awareness in local communities about renewable energy. To successfully transition to renewable energy, informed decision-making is necessary at the government and industry levels and raising awareness in local communities. This involves engaging communities in developing and deploying renewable energy projects and providing the necessary information about the different types of renewable energy technologies, how they function, and their potential benefits compared to existing alternatives. Additionally, an open discussion between public and private sector actors can provide accurate and up-to-date information on renewable energy technologies, their potential benefits, and case studies of successful projects. A more inclusive and informed dialogue involving greater parts of communities can foster joint ownership and better longer-term decisions supported by local communities. Citizens' demand for increased transparency and accountability from their leaders, which requires them to be informed, is also necessary for the quickest transition that balances emissions reductions with energy security and affordability.

Raising awareness should also focus on gender and youth inclusion. As agents for change in their communities, youth and women can lead the way forward in delivering a just energy transformation in Africa. Women often face disproportionate challenges when accessing energy, including exposure to health, security, and livelihood hazards. Yet they are also essential to change actors in their communities and should be equipped with the knowledge and tools to foster clean energy pathways. Africa's young generations today are tomorrow's energy leaders. Involving and encouraging youth to participate in renewable energy initiatives can foster innovation and creativity, support the development of new businesses and advocacy platforms, and inspire them to become the decision-makers who will take Africa's sustainable development forward. Direct consultation and involvement of women and young generations as previously under-represented demographics is an effective way to address energy poverty, reduce gender inequalities, and create new inclusive opportunities for employment and entrepreneurship, thus improving economic development in communities that need it the most.

1.2. Policy, regulatory and institutional frameworks

1.2.1. Addressing legacy regulatory challenges and policy issues that hinder the transformation

Investors still perceive significant policy and regulatory barriers as a deterrent to entering the African electricity markets. Despite numerous African countries placing energy at the forefront of their national development agendas, many institutional, regulatory, and financial challenges continue to severely limit the support for and uptake of domestic renewable energy options. International investors and developers look for renewable energy project opportunities in markets that include effective, coherent and stable renewable energy policies and strategies (IRENA, 2022c). Suppose this is accompanied by inadequate regulatory frameworks, e.g., frameworks for setting tariffs and feed-in tariffs, access to the grid, and ensuring quality control of renewable energy equipment. In that case, attracting consistent investment and ensuring that any developed renewable energy projects meet appropriate standards becomes challenging.

Africa's power sector faces several issues regarding policies and regulations. One of the primary challenges is the presence of vertically integrated power utilities, which limit competition and private sector involvement in the power market (IRENA, 2022c). In such a system, a single utility, often owned by the state, is responsible for generating, transmitting, and distributing electricity. In some cases, state ownership means that the government controls power tariffs and subsidies, making it difficult for private sector investors to compete on price or be profitable. There is often also a lack of transparency in state-owned utilities, which can make it challenging for private sector investors to assess the risks and rewards of investing in the sector (IRENA, 2022c). Existing power market structures have resulted in poor power trading integration across the continent. Despite an intention to establish regional power pools across the continent, more integration needs to be achieved to enable more players to enter the market and unlock market opportunity.

The necessary steps to address these challenges will require political will and partnerships. Earlier chapters have explored how governments currently have many competing priorities that they are tasked to deliver on. With limited resources to support this delivery, the focus is often on areas perceived as having a higher priority than renewable energy. The outcome is often dispersed political will and a lack of policy coherence regarding coverage and duration for most areas. In

Policy transformation is crucial to make the power market structure attractive to investors.

the case of energy, this combination results in limited uptake of renewable energy opportunities in Africa (IRENA, 2022c). The opportunity remains to successfully address these challenges through a more coordinated effort from governments, private sector actors, and international development partners by making renewable energy a priority and setting this high on the agenda. Through the involvement of all parties and applying the appropriate knowledge and experience, the opportunity exists to tackle the challenges outlined above successfully.

Examples exist to support this proposition. Numerous African countries have made substantial changes in their policy and regulatory framework. Flagship programs such as the African Single Electricity Market (AfSEM) and the Continental Power System Masterplan (CMP) are avenues for Africa-Europe energy collaboration currently being pushed forward to improve Africa's power sector. This has provided insights and valuable lessons that can be adopted as best practices. Although there is no universal solution that can address the diverse range of challenges African countries confront, it is well known that establishing favorable policies and regulations is essential in helping to ensure market openness, attractiveness, and readiness for renewable energy opportunities. This reflects that policy and regulatory clarity makes the difference.

1.2.2. Removing barriers and implementing better policy and regulatory frameworks will encourage investment

Policies and regulations are key ingredients to creating an enabling environment for renewable energy investment in Africa. Establishing consistent national roadmaps, targets, and plans gives a clear direction to where the country is headed in the long term and sends a strong message to the private sector and investors. These roadmaps should be developed and implemented through broad stakeholder consultation and should include achievable targets and implementation possibilities through policy and regulation by providing a stable investment environment for companies. For instance, Morocco has set an ambitious target of achieving 52% of its energy mix from renewable sources by 2030. The North-African country has developed a long-term national energy strategy that outlines the policies and regulations needed to achieve this target. This strategy includes the development of renewable energy zones and establishing a renewable energy fund to support investment in projects. Implementing policies such as feed-in tariffs, net metering, and tax incentives can also achieve greater attractivity for private sector companies. For example, in South Africa, in 2011, the government introduced a renewable energy independent power producer procurement program (REIPPPP) that provides long-term power purchase agreements (PPAs) to renewable energy companies, providing a stable investment environment for the sector. These policies should, however, not be

at the expense of vulnerable communities. Promoting energy affordability and creating fair opportunities for communities at risk or affected by the transition to renewable energy sources remains crucial. Regions heavily reliant on fossil fuels must create an adequate policy framework to accelerate economic diversification. Workers in at-risk industries, such as mining, will require safety nets to ensure their livelihoods are not disrupted (McKinsey, 2022b).

Policymakers can design power market structures that encourage and attract private sector investment. These should promote competition, enable an efficient electricity market design, and integrate power trading across borders. Delivering in these areas can be pivotal in Africa's clean energy transformation, especially if accompanied by regional harmonization of rules and regulations. An efficient electricity market design is also essential to overcome endemic barriers that have slowed private sector participation in Africa's electricity markets. The private sector can help by sharing experiences and information about difficulties that it has faced locally and elsewhere. Adopting public-private partnership structures and other ways of structuring the involvement of the private sector can also help ensure that governments are more successful in designing and implementing their proposed enabling renewable energy policies and regulations (McKinsey, 2022b). Examples include streamlining the permitting and licensing process, reducing red tape, and simplifying regulatory and planning procedures. Outcomes could include a greater pool of engaged and committed private sector companies tendering for project development opportunities, leading to a more reliable and competitive electricity supply, promoting sustainable energy development, and lowering electricity costs for consumers and businesses. The active engagement of the private sector in achieving the above outcomes is essential.

Accessing land for renewable energy projects is often a significant barrier to entry and requires multi-level intervention. Governments can promote policies around alternative uses of lands such as wastelands or agrivoltaics land (which can be used for agriculture and solar-PV energy generation), thereby helping expand the area suitable for the installation of renewables (McKinsey, 2022b). Early and sustained engagement by project developers with local communities, including discussions on how the outcome would benefit them, could also enable faster completion of the development work. Innovative solutions like floating solar photovoltaics can also help overcome land constraints and expand the installation of renewable energy projects (McKinsey, 2022b).

Fossil fuel subsidies in Africa continue to hinder the uptake of renewable energy investment by distorting the market. Oil and gas companies are vested in ensuring that the *status quo* continues. Governments can rebalance or prioritize and increase the resources directed toward renewable energy. Indirect subsidies on the cost of fuel supply for public utilities create an artificial comparative advantage for fossil fuel generation units. Interestingly, the most privileged social classes in African countries, who own cars, benefit the most from such subsidies. Redirecting subsidies to lower final electricity tariffs for the least advantaged could help drive electricity uptake in Africa and spur growth in the renewable energy sector. By prioritizing and increasing the resources directed toward renewable energy, governments can take significant strides toward achieving a more sustainable energy system that benefits both the economy, society and the environment.

Addressing perceived and real risks to investment is critical to attract increasing renewable energy infrastructure financing in Africa.

1.3. Investment climate and de-risking

1.3.1. Finding ways to grow Africa's renewable energy investment beyond the current 0.6%

Total energy investments in Africa must increase to USD 190 billion annually between 2026 and 2030 to enable Africa to reach its sustainable development goals.

Investment in African renewable energy projects remains critically low. Plans to provide energy access and deliver on existing energy capacity challenges will require sizeable upfront capital flows to a region where financing is not readily flowing. As discussed earlier in the report, investment flows are nowhere near where they should be to make progress on SDG 7 by 2030 and Agenda 2063. In 2021, only 0.6% of new global renewable energy investment flowed to Africa (BNEF, 2022g). In the past two decades, only 2% of global new renewable energy generation additions have occurred in Africa, and in only a handful of countries (IRENA, 2022c). In 2020, solar PV installations in Africa counted 10.4 GW, less than the solar PV installations in the Netherlands (IRENA, 2021b; IRENA, 2022c).

Investing in African countries can still be perceived as high-risk. Despite sufficient capital pools with private sector appetite to invest in Africa's renewable energy markets, and even though renewable energy power generation has become the least-cost source of power generation, capital deployment for infrastructure still needs to be improved in African countries. This is partly due to continent and country-level risk factors and the up-front capital-intensive nature of renewable energy projects compared with other energy infrastructure projects (IEA, 2019). Various perceived political, regulatory, and financial risks associated with the continent and individual countries are commonly identified as key barriers to investment in renewable energy in Africa. What also contributes to the reluctance of investors are financially challenged utilities, a limited pipeline of bankable renewable energy projects and capital costs that can be up to 7 times higher in Africa than in the US or Europe (IEA, 2021a). Other factors that make it difficult for investors to plan and execute their investments include currency volatility and exchange rate risk, regulatory framework uncertainty, the longer-term stability of government policy, corruption, red tape inefficiencies, and the lack of transparency and ease of doing business.

Africa requires an unprecedented scaling up of renewable energy investments to come close to achieving its sustainable development goals, and access to finance is a primary challenge. Africa needs approximately USD 280 billion to meet its NDCs, when current investment levels in climate finance in Africa account for only USD 29.5 billion (McKinsey, 2022b). Meanwhile, reaching the goal of universal access to modern energy by 2030 alone calls for an investment of USD 25 billion per year (IEA, 2022a). This equates to approximately 1% of total global

energy investment today and is similar to the cost of building one LNG terminal (IEA, 2022a). In the power sector, the average annual investment needs to increase to approximately USD 80 billion per year between 2021-2030, compared to the average of USD 30 billion invested yearly over the past ten years (IEA, 2022a). Total energy investments in Africa must increase to USD 190 billion annually between 2026 and 2030 to enable Africa to reach its sustainable development goals (IEA, 2022a).

To reach sustainable development goals, delivering renewable energy solutions worldwide requires investing USD 3 to 4 trillion annually until 2030 (IEA, 2022j).

Africa would only need 8% of that worldwide investment to reach all of its SDG 7 targets, despite representing 17% of the global population (World Bank, 2022c). To help create the momentum needed for renewable energy projects requires the development of the necessary innovative financing mechanisms, concerted and coordinated action by the right stakeholders and partnerships, and bankable projects. Removing or reducing these risks can be an immediate solution to overcoming this barrier and enabling more significant finance flows. This is where development finance can come in.

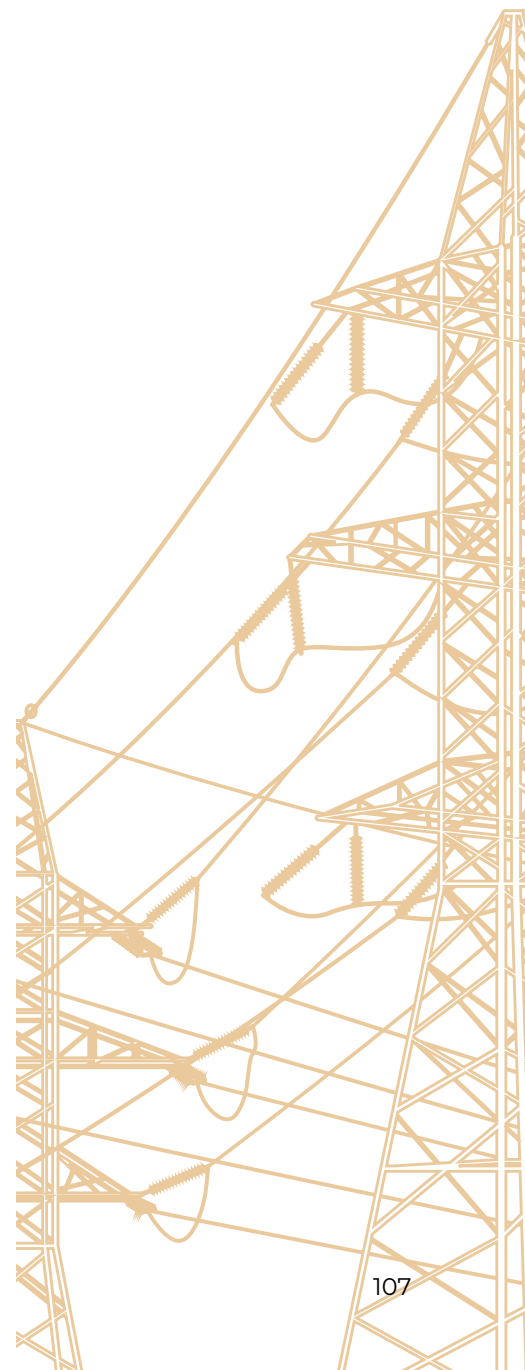
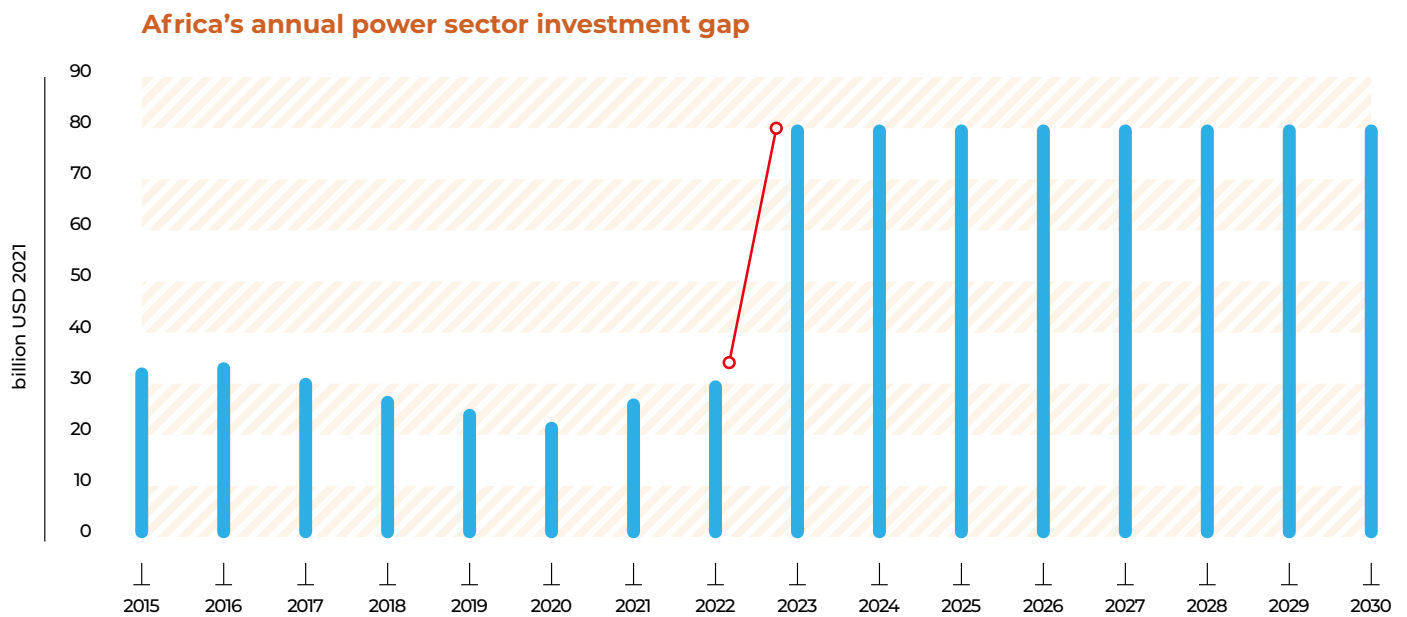
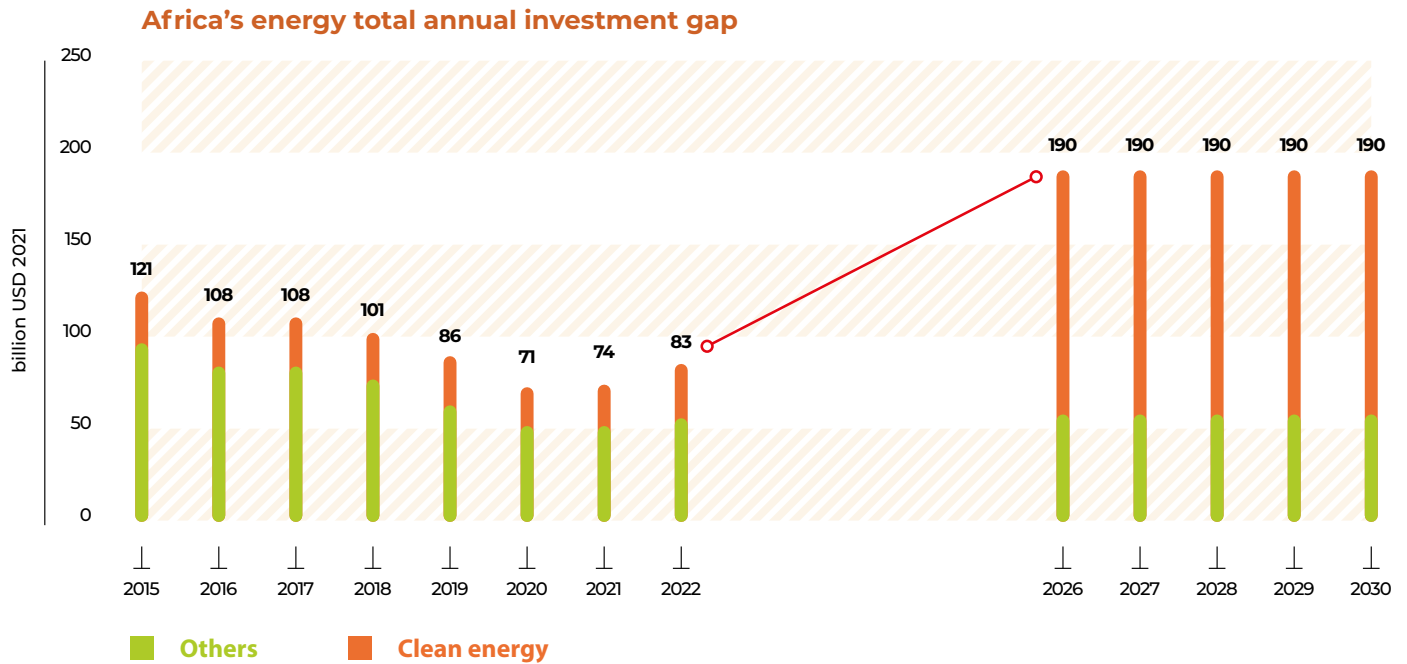


Fig.12

Energy investment gap in Africa

To achieve SDG 7 goals, total energy investment in Africa needs to reach USD 190 billion per year between 2026 and 2030, with 70% dedicated to clean energy. Investment in the power sector needs to almost triple annually by 2030.



RES4Africa 2023 compiled from various sources (IEA, 2022; IEA, 2022a)

1.3.2. De-risking the renewable energy sector to unlock investment

Bringing renewable energy investments to scale in Africa requires further de-risking of the renewable energy sector. This can be done through specific mechanisms, including de-risking instruments, policy and regulatory reforms, and targeted interventions to strengthen financial markets and institutions (Ngaryo, 2023). They will also need to be accompanied by efforts that address high-risk perceptions relating to political and economic factors, often ill-adapted regulatory systems, and persistent transmission and distribution deficiencies (IRENA, 2022c). Encouraging investments in renewables can be done through stable and attractive remuneration frameworks, market designs, and offtake structures. Additionally, establishing and scaling capacity markets can incentivize flexibility and attract investment in storage solutions like batteries and hydrogen (McKinsey, 2022b).

The first step is to create a more conducive investment climate in Africa. By having the public and private sectors working together, the needs and concerns of both parties can be addressed. This can be followed by developing more bespoke guarantees and insurance products. These instruments could then protect investors against project failures or default risks, such as political or regulatory risks, currency risks, or payment risks. For example, guarantees could cover payment obligations, provide currency hedging facilities, or offer political risk insurance that covers the risk of expropriation, war, or civil unrest. The private sector can also bring to bear its experience of financial de-risking in other parts of the world using innovative financing structures such as securitization, blended finance, or public-private partnerships. These structures can help reduce risks by diversifying funding sources, sharing risks and returns among stakeholders, and leveraging public and private sector resources. For instance, securitization can pool future renewable energy assets and issue bonds backed by the cash flows from these assets. Blended finance can combine public and private sector financing to reduce the capital costs for renewable energy projects (IRENA, 2022c).

Addressing the investment challenge in Africa will also require global cooperation and concerted actions. Governments need to take the first step to mitigate investment risks but often do not have the balance sheet strength that allows them to do so. This is where multilateral development finance institutions can have a substantial impact closely linked to their mandate (McKinsey, 2022b). There is a unique role and opportunity space for international organizations and development actors that can use development financing tools to help bridge perceived and actual risks for investors. While they already are amongst the most prominent providers of de-risking instruments in Africa (IRENA, 2022c), development finance institutions (DFIs) can also take on a more significant role in de-risking the renewable energy investment sector in Africa by providing support to project developers, establishing innovative financial instruments, mitigating investment risks, and mobilizing private sector financing. For example, designed-for-purpose guarantees could be provided

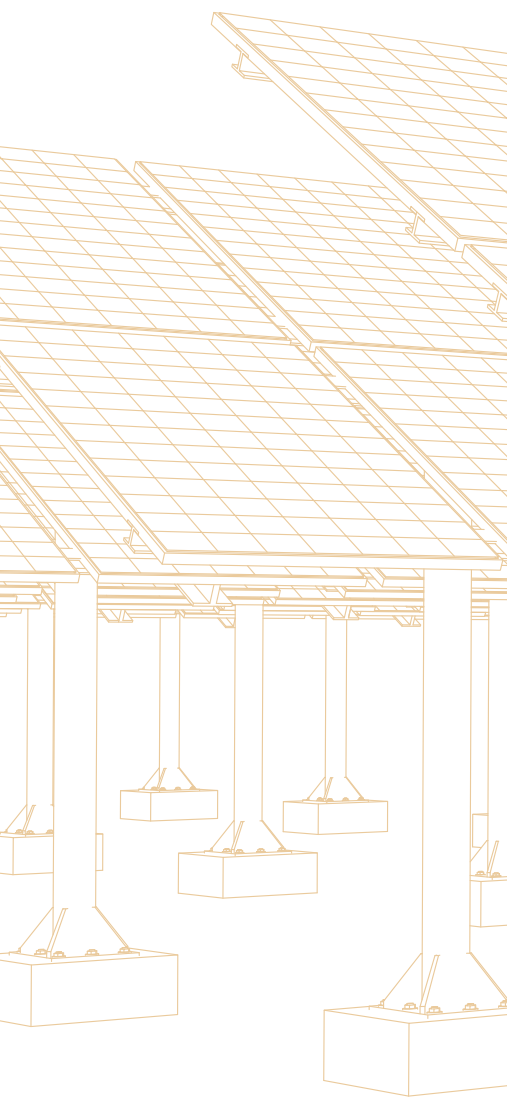
by multilateral and DFI's to the private sector to boost investment. By reducing or transferring risks associated with these investments, DFIs can help build confidence among investors and create a more stable and sustainable financing ecosystem for renewable energy projects. Private sector developers should be upfront with their concerns and needs and also propose ways in which they might be able to address some of these by themselves. And finally, philanthropic organizations can also play a significant role in catalyzing and complementing further financing in specific countries and project areas.

1.4. Local capacity and industry

1.4.1. Developing renewable energy know-how and skillsets across Africa's renewable energy sector

Designing, developing, and operating renewable energy projects requires local skilled capacity, which in turn require investment in appropriate training programs. Currently, the continent has a limited number of trained energy professionals in this field, and many universities and training institutions do not yet provide renewable energy sectoral courses. While some skills may be transferrable from other industries, renewable energy jobs also require specialized knowledge, skills, and experience in designing, installing, operating, and maintaining renewable energy systems. The current need to sometimes import this knowledge and expertise from overseas comes at a high cost. It increases the price of local renewable energy projects. More importantly, it represents a missed opportunity for local communities by needing to import knowledge and know-how instead of developing local capacity and enhancing job creation. In addition, it impedes sectoral growth with limited coordination and collaboration among stakeholders in Africa's renewable energy industry.

Globally, the renewable energy sector has already proven its strong potential for creating new jobs and transforming and absorbing existing energy jobs that may be transitioned from legacy areas. In 2021, renewable energy employment worldwide accounted for 12 million jobs, 324,000 or around 2%, in Africa (IRENA, 2022e). Africa's clean energy transformation is expected to create 8 million jobs (IRENA, 2022e). This requires preparation for all the professional skills needed to deliver and multiply these jobs. Failure to develop local capacity to meet the demand for skilled workers in the clean energy sector would result in countries not fully realizing the potential benefits of this transformation and economic sector growth. It would also limit the development of local talent and the ability to develop and maintain sustainable energy systems independently.

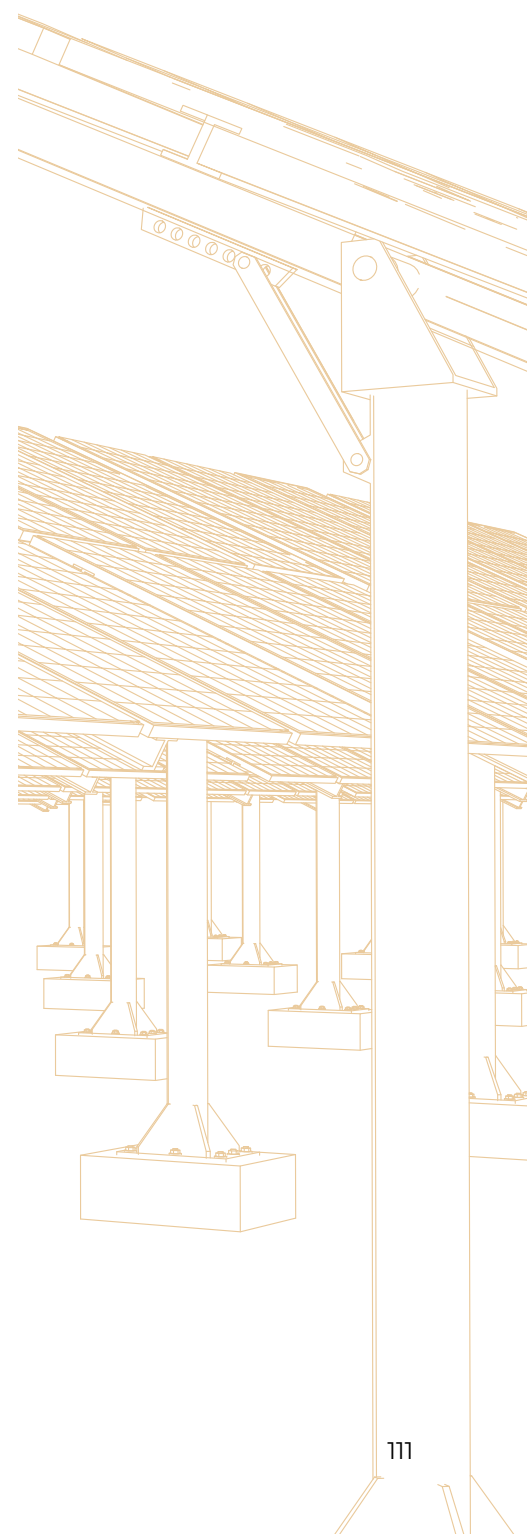


1.4.2. Building strong capacity to ensure a lasting clean energy transition

Training skilled clean energy professionals create an enormous opportunity for sectoral growth. Africa's growing, urbanizing, and increasingly young population will need jobs. Africa's nascent but growing renewable energy industry can play a huge role in creating these job opportunities. Specific attention to gender and youth inclusion in training can help to ensure that these jobs are distributed more equitably across different demographic groups and act as a strategic investment in the future of the continent's energy sector and broader economic development goals. Renewable energy is also well positioned to uplift an entire industry, as electrification can help stimulate growth across small- and medium-sized enterprises. As Africa's demand for renewable energy grows, the continent's renewable energy industry can significantly generate job opportunities, particularly for the younger generations, by absorbing existing energy jobs that may transition from legacy areas, and by developing new clean energy jobs based on related skills (IRENA, 2022e).

Providing skilled workers and supporting training programs requires resources, time, and a multi-faceted and holistic approach. There needs to be a significant and upfront investment in appropriate education and training programs, improved coordination and collaboration among the entire ecosystem of renewable energy industry stakeholders, and care and attention will need to go toward developing further specialized programs that are tailored to the industry's continuously evolving needs, based on the specifics of each country plans and targets. Many skilled workers, professionals, and entrepreneurs are needed to deliver Africa's clean energy future. To achieve these in the near future, it is imperative to build from the bottom-up by investing in coordinated polyvalent and holistic training now, building on experience from other countries further ahead on their journey. This requires cooperation between governments, educational institutions, and the private sector, greater development of comprehensive training programs, and encouragement to transfer knowledge and skills across different countries and regions.

Capacity building must focus on allowing workers and professionals to develop the knowledge and skills necessary for the renewable energy industry. This includes training tailored to institutional representatives, civil servants, middle- and top-level managers at utilities, government, and other energy-sector-related entities, who may benefit from raising awareness regarding a developed renewable energy industry and the regulatory, policy, institutional, and institutional and legislative structure that comes with it. Reaching this target group with bespoke and in-depth insights is essential in enabling a more comprehensive transformation and strengthening a country's energy institutions. The private sector, which will employ Africa's future professionals, has extensive experience training and developing people to acquire new skills. However, the focus of this development, the course



content, the qualifications, and ongoing training need to be designed and developed in coordination with other industry stakeholders for systemic change. Alongside this, there will also be a need to create other supportive institutions and the education and awareness of customers, which the private sector can inform.

Engaging with energy industry workers could quickly boost local renewable energy workforces. There is an opportunity to increase the local pool of skilled workers and institutions that could support the uptake of renewable energy projects in different African countries by engaging with existing energy sector workers and professionals. These already have many of the skills and experience needed. By developing tailored training programs for institutional representatives, civil servants, and middle- and top-level managers at utilities, government, and other energy-sector-related entities, the essential corporate, technical and business experience can be accessed. With an increased awareness of the potential and needs of a renewable energy industry, they can also provide helpful, practical input into the design of the accompanying regulatory and legislative structures. Providing this target group with customized and in-depth insights would be a cost-effective and quick way of supporting the first steps toward developing a more robust renewable energy industry (McKinsey, 2022b).

Preparing and solidifying the energy ecosystem to reach the twin goals of energy transformation and sustainable industrialization requires strong capacity and knowledge exchange at the continental scale.

Building capacity is also about getting the entire ecosystem ready. A critical aspect of developing local renewable energy industries is ensuring that public and private institutions are equipped to support these initiatives. The success of any renewable energy project depends on multiple factors and actors, many of which involve the larger ecosystem in which the project is situated. This includes institutions, commercial banks, various industries, and customers, but also government agencies responsible for energy policy and regulation and financial institutions that can provide funding and investment support for renewable energy projects. Renewable energy projects may need strong institutional support to gain traction and become financially sustainable. Commercial banks also play a critical role in developing local industries for renewable energy. They can provide access to capital for renewable energy projects and help structure financial instruments such as green bonds, which can be used to fund renewable energy projects. However, commercial banks may not have experience or expertise in financing renewable energy projects in many parts of Africa. They may benefit from training and be incentivized to participate in these projects.

1.5. Power sector infrastructure

1.5.1. Aging grids and a lack of infrastructure are slowing down progress in Africa

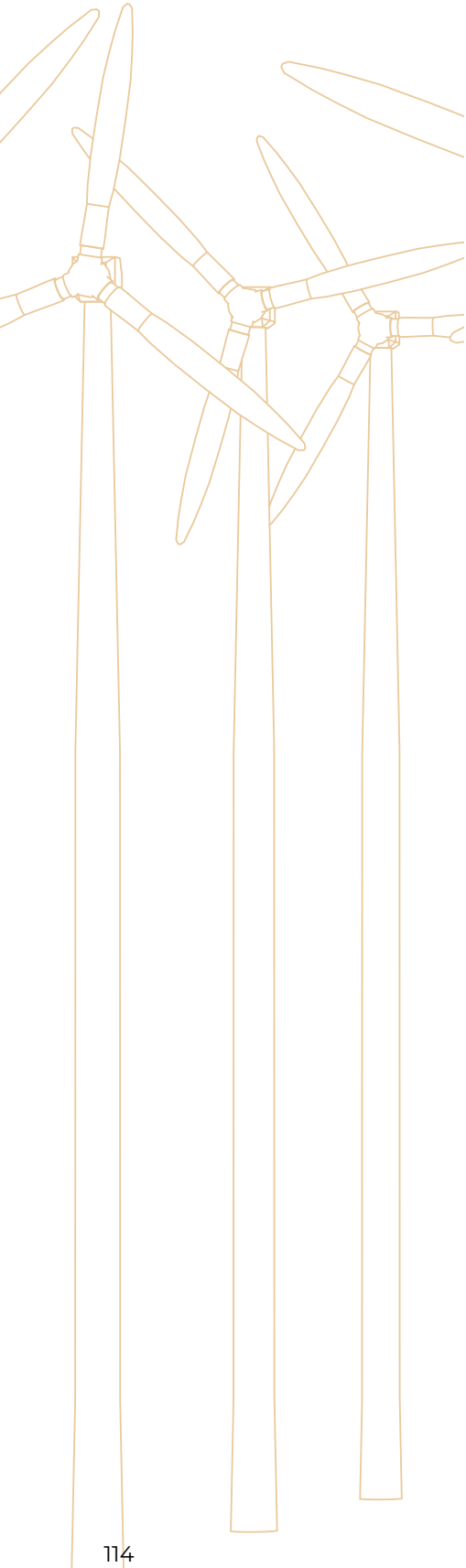
The scaling up of renewable energy infrastructure can only happen in a broader ecosystem of supporting infrastructure. Renewable energy projects rely on

accompanying technologies, and systems that are instrumental for the effective rollout of sustainable electricity. Generation capacity must be accompanied by a supporting transmission and distribution infrastructure. One cannot function without the other. Without an efficient, reliable, and far-reaching grid network, efforts to increase electricity access and develop renewables become redundant. Investment in generation capacity should also be complemented by the necessary investment in transmission and distribution. Renewable energy growth depends on the equal and parallel development of all three parts of the electricity value chain. Without adequate planning and investment in grid infrastructure, countries risk limiting the potential of renewable energy and failing to achieve their clean energy targets.

Generation is only one part of the story, as there is “no transition without transmission”. Earlier chapters have highlighted how the power sector infrastructure in Africa faces significant challenges, which hinder the development and access to reliable and sustainable energy sources. Insufficient installed capacity struggles to meet the growing demand across the continent and much of the generation capacity still includes highly polluting assets, dominated mainly by fossil fuels, which are non-renewable and environmentally harmful, and suffer from supply chain disruptions, such as fuel shortages, due to political and economic instability in the region. As countries shift towards renewable energy, they face grid capacity constraints and network planning issues that can hinder the sector’s growth. One of the biggest challenges is overgeneration, where the grid cannot take on any more power, leading to the blocking of new renewable projects. South Africa, for instance, is grappling with a severe grid capacity issue, with its aging infrastructure struggling to keep up with the demands of an evolving energy landscape. The lack of grid development plans and the unsuitability of current grids to manage the complexity and variability of renewables is exacerbating the problem. Roadmaps for renewable energy transition often focus on the deployment of renewable generation but do not account for the necessary grid infrastructure development needed to support the integration of these technologies.

Many African countries have outdated and poorly maintained power grids and lack the necessary investment to upgrade and expand. Inadequate and aging power transmission and distribution infrastructure often results in high transmission losses and frequent blackouts. Indeed, the majority of those countries which regularly report SAIDI (System Average Interruption Duration Index) and SAIFI (System Average Interruption Frequency Index) figures are well above the global median, with blackouts, brownouts, and load-shedding commonplace across the majority of the continent. Additionally, the power sector in Africa is highly centralized, which means that the power generated is mainly consumed in urban areas, leaving rural areas with limited access to electricity. Grids are primarily state-owned, with very low involvement of the private sector, and suffer from the financial constraint and inefficiencies of state utilities that cannot invest in and maintain the electricity infrastructure. Blackouts are becoming more frequent in many countries, slowing the continent’s industrialization and day-to-day business. Companies need to rely properly on national infrastructure for basic energy supplies. These power outages create annual business losses and have driven the companies to invest more substantially in backup power generation systems, usually fossil-fuel based, to provide them with a reliable yet unsustainable and costly alternative.

1.5.2. The potential for enabling and supporting power infrastructure



Private sector expertise can deliver new generation capacity, enable power transmission and distribution infrastructure, and expand access to electricity in peri-urban and rural areas.

Having fully functioning power sector infrastructure in Africa will require significant investment in new generation capacity, power transmission and distribution infrastructure, and expanding access to electricity in remote and peri-urban areas. The private sector has a role to play. A combination of appropriate government policies and incentives to encourage private sector investment and international cooperation and support to finance, implement and operate large-scale infrastructure projects. In the short term, energy providers, including utilities, transmission, and distribution companies, should prioritize clean energy transformation as part of their strategies. The transition to renewable energy sources requires a balanced approach, including accelerated decommissioning of inefficient and highly polluting fossil fuel generation assets. This includes formulating a plan to manage the risk of stranded assets associated with carbon-intensive assets while maintaining energy security and minimizing risk by securing the supply chain for raw materials, labor, and components, with a just energy transition focus. Conventional assets such as gas plants or pipelines might still be essential to ensure an adequate supply. Still, they will need to be adjusted to reflect decreasing utilization or repurposed to use a cleaner fuel mix, such as hydrogen (McKinsey, 2022b).

Modernizing and repurposing legacy infrastructure and creating new assets to accelerate the integration of renewables and cleantech into the energy system is crucial (McKinsey, 2022b).

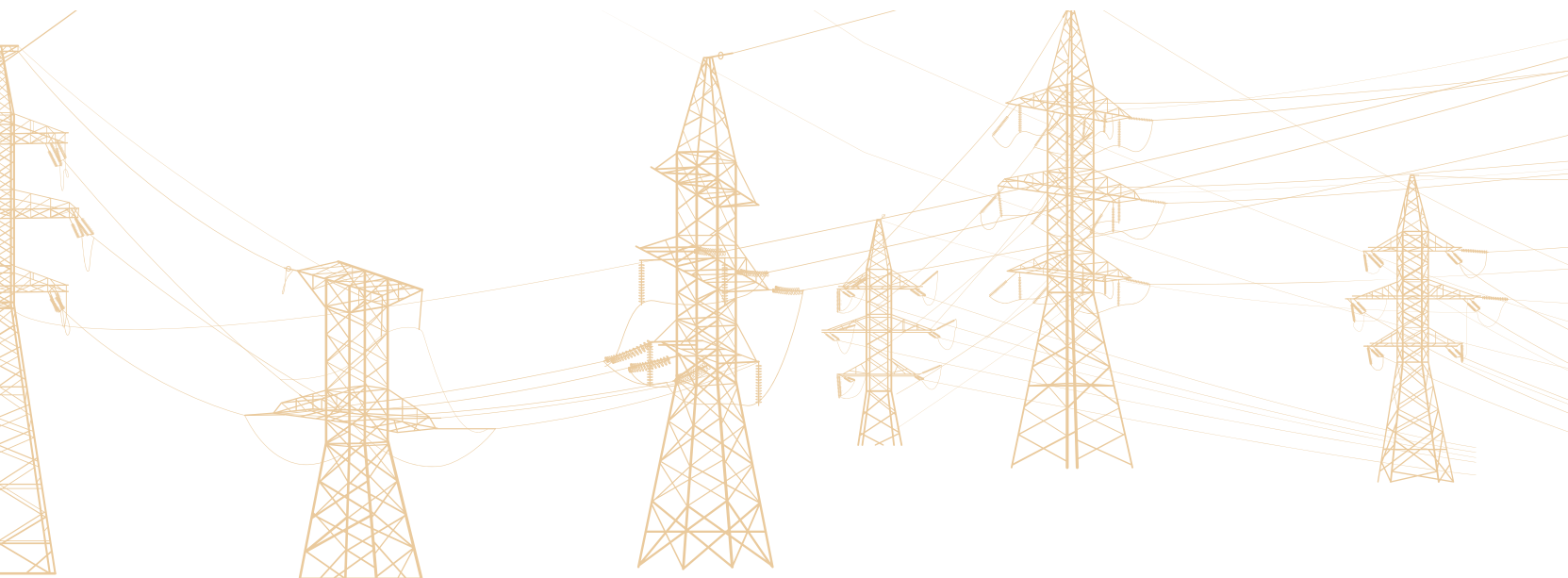
This includes investing in developing and modernizing the power grid, connecting areas with high potential for renewable generation to demand centers, and developing new flexibility solutions. Solutions can range from digital solutions for grid management and operation and demand-side management products to developing battery energy storage systems (BESS) and investments in infrastructure development such as cables (See Box 9 – Latest technological trends - Storage). Regulatory frameworks are equally important, with rampant changes needed in market grid codes and market structure to facilitate the deployment of battery energy storage systems and demand-response mechanisms and to increase the collaboration of the private sector. It will also be essential to prioritize innovation in business models and technologies and develop clean technologies' manufacturing capacity (McKinsey, 2022b).

2. RES4Africa's action areas and regional programs contributing to Africa's sustainable energy future

RES4Africa Foundation's initiatives aim to meet the above challenges by raising awareness and leading public-private dialogue, by providing detailed and focused analysis, and by pursuing capacity building and supporting initiatives. Since 2012, RES4Africa Foundation has worked to help create favorable conditions for scaling up renewable energy technology investments in Africa. It has done this through an operational model where it commits to:

- Advocate the opportunities and benefits of renewable energy as the backbone of a prosperous Africa;
- Analyze solutions to expand energy access and mobilize renewable energy investments;
- Train professionals, institutions, and youth to deliver Africa's clean energy transition;
- Support the adoption of sustainable solutions to respond to Africa's electricity needs.

RES4Africa aims to pursue its mission by addressing these challenges in three geographic focus regions (the Mediterranean, sub-Saharan Africa, and South Africa) through strategic and regional work programs. RES4Africa's action areas and work program activities have been developed with a needs-based approach that responds to the primary national and local needs highlighted earlier and in the previous detailed reports. Through these initiatives, RES4Africa aims to fulfill its mission of creating enabling environments for renewable energy investments in Africa by adding value to the area it is most suited: advocacy, analysis, capacity building, and private sector mobilization.



2.1. RES4Africa's five action areas

2.1.1. Raising awareness

RES4Africa has made awareness-raising a key focus since 2012 through its high-level advocacy work. The foundation's goal is to promote the realities and benefits of renewables and offer recommendations on accelerating renewable energy investment in African countries across the continent. In doing so, RES4Africa can help ensure that decision-making processes are informed, transparent, and inclusive, which can lead to scaling up renewable energy infrastructure decisions in Africa. This is built on a complex, multifaceted environment involving many stakeholders and a continuously evolving energy sector, requiring a structured and adaptive approach to new challenges.

For years RES4Africa has engaged in close bilateral dialogue with local energy stakeholders to understand country priorities and support informed decision-making where it can add value. The foundation regularly convenes key actors in focus countries as a platform for public-private dialogue. It facilitates discussions on Africa's energy development, showcasing international experience and lessons learned to inform local decision-making. This is done through key programs, including the sub-Saharan Africa and Mediterranean programs, Business-to-Government dialogue, and strategic intelligence analysis and communication activities (See Box 14 – RES4Africa Foundation's focus on strategic raising awareness).

Box 14 – RES4Africa Foundation's focus on strategic raising awareness

Cross-regional focus: RES4Med Program, Sub-Saharan Africa Program, and South Africa Program

Bilateral & multilateral engagement: RES4Africa has sought to develop and nurture direct ties with bilateral actors in focus countries, including most relevant energy actors (e.g., governments, policymakers, the private sector, development and finance actors, civil society, and others) but also with its multilateral partners such as international organizations, technical cooperation platforms, International Finance Institutions (IFI), DFIs, academia and others. Bilateral relations provide added value in continuous market understanding, access to local networks, and impactful delivery of activities. Multilateral engagement with regional, Pan-African, and international organizations connects the foundation with the global renewable energy community and ensures the alignment of objectives.

Business-to-Government dialogue: thanks to its unique partner and member network, RES4Africa engages in high-level Business-to-Government conversations to bring recommendations to focus countries' key energy decision-makers and actors such as energy ministers, financing institutions, energy companies, agencies, and public & private sector leaders. Through these dialogues, RES4Africa promotes public-private partnerships, advocates for policies favorable to renewable energy investments, addresses regulatory barriers, and helps create a stable and predictable investment climate.

Key Figures (2017-2022)



79

Events

organized and delivered by the foundation



60

Participations

in external events as a speaker



26

Business-to-Government

events



16

Countries

covered by the events

Strategic intelligence: RES4Africa is committed to promoting renewable energy in Africa and spreading awareness about its benefits. The foundation leads continuous strategic intelligence gathering efforts on energy trends to inform its work programs, support bilateral and multilateral dialogue, and raise awareness on central themes for Africa's renewable market development. Outcomes include a series of publications covering a range of renewable energy-related topics, such as policy and regulatory frameworks, financing mechanisms, technological innovations, and case studies on Africa.

Strategic communications: through strategic communication the foundation intends to inform stakeholders about its work, highlight the role and expertise of its network, and share content and country success stories. To achieve these goals, RES4Africa uses traditional and innovative online and offline communication tools, including digital communication, newsletters, online community platforms, *ad hoc* campaigns, interviews, thematic videos, podcasts, tailored communication materials, and a knowledge platform. These tools allow RES4Africa to communicate its messages to various audiences worldwide and position itself as a credible voice on renewable energy in Africa.

2.1.2. Policy and regulatory frameworks

RES4Africa's approach is to provide tailored recommendations for a conducive private-sector investment environment for renewable energy in African focus countries. Since its inception, RES4Africa has provided ongoing and updated comprehensive analysis of countries' electricity sectors and proposed country-specific recommendations based on international best practices. As a knowledge and analytical partner, the foundation also looks to develop innovative analytical frameworks that help to understand the ability of African countries to enable private-led investments in generation, transmission, distribution, and off-grid systems. Cross-regional programs such as **"The Missing Link"** and **"Grids4Africa"** focus on providing this tailor-made analysis to countries (See Chapter 3 - 2.2. RES4Africa's cross-sectoral programs). Moreover, RES4Africa offers on-demand technical assistance and knowledge sharing relevant to a country's energy transition pathway.

2.1.3. Investment climate and de-risking

RES4Africa is a prominent advocate for de-risking renewable energy investments in Africa. It represents the voices of 30+ industry actors who are either already investing in or seeking to invest in Africa's renewable energy future. The foundation acts as a private sector sounding board to provide recommendations on how it might be possible to mitigate both real and perceived risks that currently deter more significant capital investment. In doing so, it can support and help drive ongoing progress on de-risking investments into Africa and contribute to the search for solutions to bridge the investment gap.

As part of its advocacy efforts, RES4Africa seeks to dialogue with international development actors and push to create a comprehensive European de-risking program – as manifested in the renewAfrica initiative – supporting renewable energy investments in Africa (See Chapter 3 - 2.2. RES4Africa's cross-sectoral programs). As a member network, RES4Africa shares its accumulated knowledge and expertise of the private sector's needs to meet the requirements of debt and equity investors and is effectively marketed. Furthermore, the organization plays a crucial role in convening discussions with international investors to enhance their understanding and willingness to consider increasing their investment in Africa's renewable energy sector.

2.1.4. Local capacity and industry

Training and capacity building is a fundamental value proposition of RES4Africa's work. Since starting in 2012, the foundation has maintained that developing the necessary skills and knowledge is critical to drive and support Africa's ongoing transition towards greater use of renewable energy. As a result, the foundation offers a range of comprehensive training programs – within the RES4Africa Academy (See Chapter 3 - 2.2. RES4Africa's cross-sectoral programs) – to develop a new generation of energy leaders and equip energy professionals of all levels with the necessary skills and knowledge for future renewable energy job opportunities in Africa. One program – the Executive School – looks to provide targeted and country-specific training sessions to institutional policymakers and industry leaders to increase awareness about renewable energy. In its attempt to support job creation and youth employment, RES4Africa offers training courses to various professionals in the energy sector, including technicians, entrepreneurs, financiers, and policymakers. And finally, it also co-designs vocational capacity-building programs to equip individuals with working and entrepreneurial skills to deploy decentralized renewable energy solutions and off-grid systems, always together with local partners. With a proven six-year track record, RES4Africa has developed a diversified range of executive and vocational training programs that built a network and that have been demonstrated to enhance the skills required for Africa's energy sector. As such, between 2017 and 2022, almost 3,000 participants took part in RES4Africa's training and capacity-building initiatives.

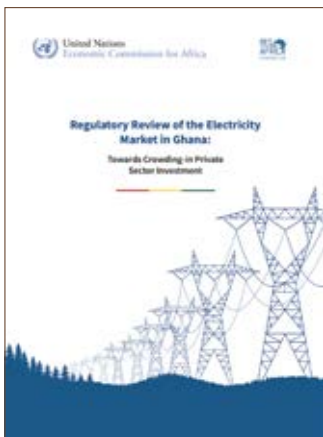
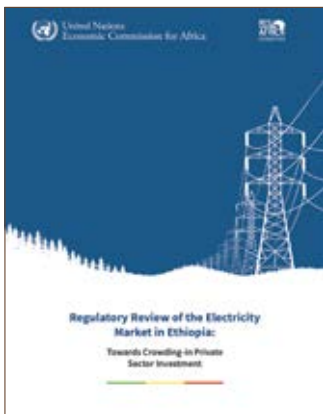
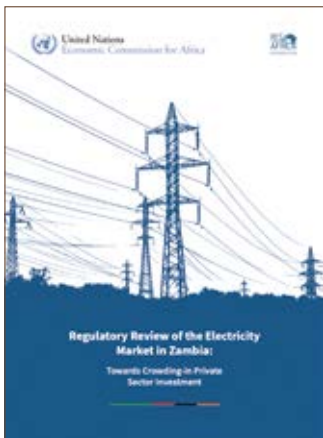
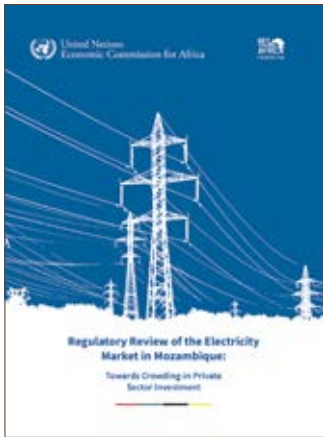
RES4Africa value proposition includes all five action areas: raising awareness, enabling policy and regulatory frameworks, improving the investment climate, the capacity building offered and the power sector infrastructure.

2.1.5. Power sector infrastructure

Scaling up RE generation projects in Africa goes hand in hand with raising investment in the transmission and distribution segments. That is why RES4Africa has initiated advocacy, analytical, and training work on this area through its "Grids4Africa" program (See Chapter 3 - 2.2. RES4Africa's cross-sectoral programs). The foundation focuses on ensuring a continuous public-private dialogue in countries on all accompanying aspects of the power sector, such as generation capacity across centralized and decentralized applications, and the necessary grid infrastructure and networks. This dialogue is critical to ensure that all stakeholders are aligned and working towards a common goal of promoting renewable energy and providing electricity access through improving the quality of service and grid infrastructure and boosting private investments and public-private partnerships.

2.2. RES4Africa’s cross-sectoral programs

2.2.1. The “Regulatory Review of the Electricity Market in Africa: Towards Crowding-in Private Sector Investment”



Policy and regulatory reforms are a central pillar of RES4Africa’s work. The “Regulatory Review of the Electricity Market in Africa program” – also known as the “Missing Link” program – is a multi-year program implemented by RES4Africa Foundation in partnership with the United Nations Economic Commission for Africa (UNECA) that supports Africa’s electricity sector development. Launched in 2019, the program takes an in-depth look at the electricity sector of 16 African countries¹ to identify gaps and provide policy and regulatory recommendations in support of Africa’s electricity infrastructure reform. The aim is to help Africa’s electricity sector crowd in private sector participation by improving the policy and regulatory environment of the power sector.

The program’s methodology clusters electricity sector-related policies, legislation, and regulatory texts under three characteristics: openness, attractiveness, and readiness. The program focuses on sharing experiences on reforms that have worked, enhancing national capacity, and building continental consensus on policies and regulatory measures. Overall, the program aims to strengthen the national capacity to conceive, adopt and implement regulatory reforms, and build continental consensus on policies and regulatory measures to enhance electricity market openness, attractiveness, and readiness. Through this collaboration, UNECA and RES4Africa aim to support Africa’s electricity sector reform agenda in order to attract private investment at scale in African electricity markets and infrastructure, including generation, transmission, distribution, and decentralized applications.

Key outcomes have included 16 individual country reports, the development of a regulatory assessment tool (the ROAR software – “Regulatory Openness, Attractiveness and Readiness”), and country engagement, such as country meetings, workshops, and regional events. The program was launched during a High-Level Public-Private Dialogue (HLPPD) event in March 2023 at the UNECA headquarters, which gathered over 200 participants (CEOs, ministers, policymakers, etc.) from 15+ African countries. The Pan-African-focused event acknowledged the importance of public-private coordination for scaling up infrastructure investments

¹ Countries include Angola, Cameroon, Democratic Republic of the Congo, Egypt, Ethiopia, Ghana, Ivory Coast, Kenya, Mauritania, Morocco, Mozambique, Rwanda, Senegal, Seychelles, South Africa, Uganda, and Zambia.

and endorsement of the reports and the ROAR approach as a valuable tool for policy and regulatory reform planning. A technical training with 25 participants took place back-to-back with the HLPPD to present key recommendations and introduce the ROAR software.

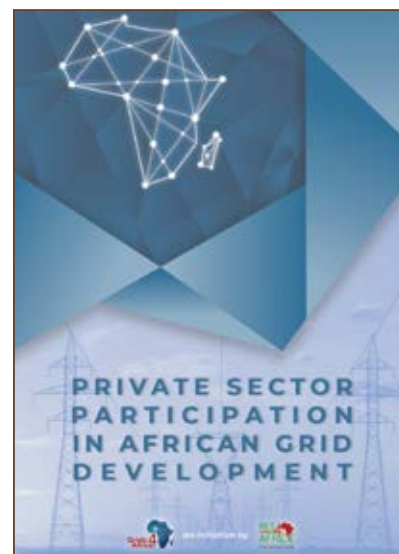
2.2.2. Grids4Africa

The foundation sought to bring greater attention to the role of grids, transmission, and distribution infrastructure as enablers of the energy transition and electricity access efforts in Africa and globally. The Grids4Africa program was initiated to achieve this goal, designed to extend, reinforce, and modernize electricity grids across the continent. Drawing on the collective electricity network expertise of RES4Africa's members, the program includes comprehensive country-focus studies, informative reports, high-level events, and bespoke capacity-building initiatives.

By way of example, Grids4Africa held two in-person country-focus events in Kenya and South Africa in 2022. Both events involved discussions on private involvement in the national grid, grid regulation, distribution grid management, and the adoption of battery energy storage systems, among others, with critical stakeholders such as the Ministries of Energy, Electricity Regulators, the Kenyan Utility (Kenya Power and Lighting Corporation), and the South African State Utility (Eskom). A closed-door roundtable during the South Africa Conference resulted in a training program proposal that focuses on using Geographic Information System (GIS) and grid management models to integrate renewable energy into the electricity system. The integration of renewables into the grid is a central topic for governments, and following numerous requests, Grids4Africa created a dedicated training program called the **Grids & Storage Labs**. The labs are *ad hoc* short courses tailored to the needs of specific African countries or entities. So far, two Grids & Storage Labs have been held in Morocco and South Africa; a third will occur in Kenya in 2022.

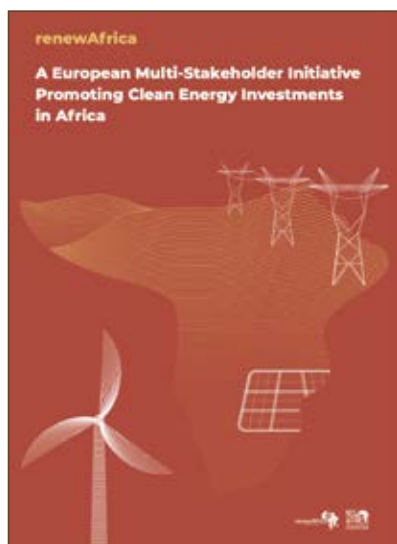
Convening discussions with all relevant institutional partners is a key focus as well. In 2022, Grids4Africa launched the **Development Partners Forum**, which gathers critical African and international actors on financing power infrastructure in Africa. In 2023, Grids4Africa plans to release a joint paper with the International Finance Corporation (IFC) and other development finance institutions on the funding of grid infrastructure in Africa, a topic covered in a closed-door online forum to discuss private-public partnerships in transmission infrastructure openly.

Grids4Africa has three studies in the pipeline for this year, which will focus on low-cost digital solutions for managing distribution grids in Africa, a report on the impact of urbanization on the grid, and a study on the definition of transmission and distribution tariffs in Morocco.



2.2.3. RenewAfrica

Driven by the need to scale up renewable energy investment in Africa, RES4Africa has gathered a coalition of leading European companies in the “renewAfrica” initiative to advocate for Africa’s comprehensive renewable energy de-risking program. Launched in 2019 with the backing of 27 companies, the initiative advocates for the creation of an EU-led program supporting renewable energy investments in Africa that could deliver comprehensive end-to-end support along the entire project lifecycle for all renewable energy technologies, infrastructure, and grids in all African countries, prioritizing utility-scale projects. The purpose of renewAfrica is to provide feedback to EU institutions from the European private sector and African stakeholder perspective on what is needed to scale up renewable energy investments across the continent. The program applies a holistic approach with three focus areas: financial support, country outreach and capacity building, and expert analytical findings to advise the EU institutions in creating the future program:



- **Financial Support:** the renewAfrica’s Financial Support Task Force (FSTF) elaborated a proposal based on in-depth research and analysis on the financial component of the program that renewAfrica advocates for. In doing so, renewAfrica functions as a sounding board to enable the mobilization of private capital for utility-scale renewable projects in Africa. Many of the FSTF Summary Memo recommendations were incorporated into a structured proposal called “Renewable Infrastructure & Sustainable Energy Partnership Africa-EU” (RISE) presented to the EU Commission in 2022 to be funded through the European Fund for Sustainable Development Plus (EFSD+), which is the investment framework for the EU external action 2021-2027. Approval of structure and technical assistance commitments proposed by RISE is currently pending.
- **Country outreach and capacity building:** in 2021 the initiative focused on initiating dialogue and building relations with a wide variety of African energy stakeholders in 10 African focus countries. Countries include Algeria, Angola, Botswana, Ethiopia, Ghana, Ivory Coast, Kenya, Mozambique, Senegal, and Tanzania. The purpose of the outreach and partnership building with African stakeholders is to gather local insights on how to tailor support services to country-specific contexts and to promote the long-term commitment of all public and private sector stakeholders to unlocking Africa’s renewable energy potential. New country engagement is taking place with Ghana and Ivory Coast in 2023, and engagement initiated in 2022 continues with stakeholders from Senegal, Kenya, Mozambique, and Ghana in the **RES4Africa Labs**.
- **Awareness raising and EU advocacy:** the renewAfrica initiative has received support from various EU institutions, including European Commission (EC) Executive Vice President Frans Timmermans, and the European Investment Bank (EIB). The European Union’s “Team Europe” approach to support African countries’ recovery from the pandemic recognized renewAfrica as instrumental in this initiative. RenewAfrica produced a policy memo in December 2022 to assess

the current evolution of the European Union-African Union relations and evaluate the evolution of the EC's position towards financing and developing renewable energy in Africa. RES4Africa has also applied to join the Global Gateway Business Advisory Group in Brussels and ensure the role of the private sector sounding board on renewable energy investment in Africa.

2.2.4. RES4Africa Academy

The RES4Africa Academy gathers all training and capacity-building initiatives that aim to promote renewables in Africa within a dynamic and inclusive learning environment. The Academy offers training programs at all levels of expertise, promoting youth and women empowerment and participation. In particular, the training initiatives are clustered into three categories:

1. The recurrent **RES4Africa Flagship Trainings** include both the Executive School and the Technical and Vocational School:
 - **Executive School:** the RES4Africa Foundation's flagship capacity-building program (previously known as the Advanced Training Course or ATC) is designed explicitly for high-level professionals, managers, and institutional profiles working in the renewable energy sector in Africa. The annual two-week in-person workshop attracts over 50 African executives in Milan, Italy, co-led with Bocconi University and MIP-Politecnico di Milano. Participants gain insights into the technical, economic, financial, and policy aspects of sustainable energy, with a particular emphasis on Africa's requirements.
 - The **Technical and Vocational School**, previously known as the Micro-Grid Academy (MGA), was established in Nairobi, Kenya, in 2018. The school's primary goal is to develop a skilled and aware workforce in Africa, specifically in East Africa, to implement decentralized renewable energy solutions (e.g., micro- and mini-grids). By doing so, the school aims to improve access to energy in urban, peri-urban, and rural communities while promoting youth empowerment through local enterprise strengthening and job creation.
2. The **Training Labs** are tailored training courses developed on the needs of RES4Africa focus countries and partners. Among courses that stand out is the **Re-skilling Lab** (see Chapter 3 – 2.3.3. South Africa Program) targeted to South Africa, which aims to support the transition from coal to renewable energy power technologies by providing renewable energy and entrepreneurship training, and the **Grids & Storage Labs**, targeted to various countries, which provides training on technical, economic, and policy aspects of variable renewable energy grid integration.
3. The **RES4Africa Knowledge Platform** aims to provide a public platform of technical training content, in line with the foundation's core principle of open knowledge sharing. Seven thematic areas that cover various stages of the

renewable energy value chain have been identified, and relevant training topics for each area have been developed by RES4Africa members. The learning modules developed for the platform are both available online and form the basis for the 2023 webinar program called “**RES4Africa Labs**”. The Labs will adopt a holistic approach that integrates the regulatory, financial, and infrastructural aspects related to the implementation of renewable energy projects in Africa. Additionally, the webinars will focus on emerging challenges and opportunities such as access to energy and the use of green hydrogen.

2.2.5. Energy Access & Water-Energy-Food Nexus

As argued, achieving universal access to energy in Africa will also rely on decentralized solutions. That is why RES4Africa works on innovative solutions for infrastructure and business models in the decentralized energy access space. This focus applies the bottom-of-pyramid and last-mile user aspects of the renewable energy transition and the broader socio-economic and development factors that come with renewables. That is the focus of RES4Africa’s “**Access to Energy**” activities, which explore innovative business models to deploy renewable-energy-based productive energy uses. To support their uptake, RES4Africa also analyzes, tests, and proposes innovative business models that can ensure access to energy for all, applying integrated **water-energy-food nexus** approaches. In that light, RES4Africa develops analyses that explore market-driven research on innovative business models. These new business models (e.g., aggregator business models) will allow the current development path to move away from a project-by-project approach towards a programmatic approach for renewable energy development and planning. The foundation applies the Energy Access and Water-Energy-Food Nexus activities (See Chapter 3 - 2.2. RES4Africa’s cross-sectoral programs) for both the Sub-Saharan Africa Program and Med Program.

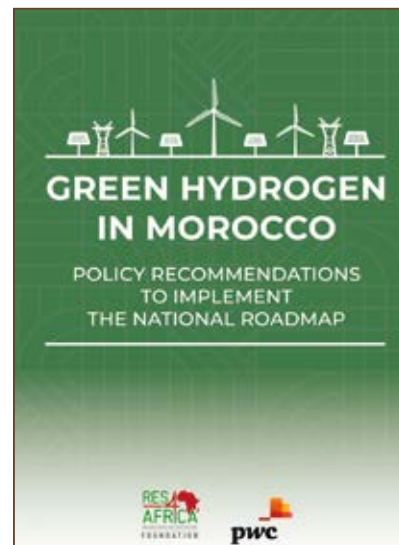


2.2.6. Green Hydrogen

RES4Africa has incorporated a working focus on green hydrogen in Africa, given growing attention. In doing so the foundation intends to create a sustainable enabling environment to support green hydrogen development. The aim is to integrate green hydrogen strategies as part of a comprehensive and holistic energy transition pathway, promote the creation of a green hydrogen ecosystem and accompany new infrastructure with additional competitive renewable energy and logistical value chains; foster knowledge, technical and human capacities; enable multi-stakeholder win-win partnerships and domestic hubs to anchor projects, and minimize environmental and safety impacts through a risk management approach.

The main activities of the Green Hydrogen Task Force:

- **Strengthening collaboration:** in 2022, RES4Africa launched a task force to lead the foundation's work on green hydrogen. The working group consists of experts from RES4Africa's membership network and its purpose is to respond to the necessity of fostering knowledge and technical and human capacity while stimulating the creation of multi-stakeholder partnerships. In 2023, the working group will enter its active working phase.
- **Advocacy:** RES4Africa's program RES4Med, in collaboration with PriceWaterhouseCooper (PwC) and ESCP Business School, published the study "Green Hydrogen in Morocco. Policy recommendations to implement the National Roadmap". It aims to shed light on the current situation and future perspectives of green hydrogen in Morocco, assessing strengths, challenges, and possible solutions to creating a dedicated regulatory and market framework. In the Ecomondo and Key Energy Forum in March 2023, RES4Africa moderated the panel "Renewable Energy and Green Hydrogen" to bring recommendations to the attention of an international energy audience.
- **Capacity Building:** Green Hydrogen is part of the curriculum of RES4Africa Executive School. Green Hydrogen's challenges and opportunities for Africa have been presented in several lectures and courses organized by partner institutions, both for European and African students and professionals (such as at the Executive Master in Global Public Diplomacy and Sustainable Development at LUISS). Meanwhile, RES4Africa Online Lab #5 in May 2023 is dedicated to Green Hydrogen potential in Africa, to put the main attention on green hydrogen into context.



2.2.7. RES4Africa Youth Program

Africa's youth will catalyze the continent's socio-economic development and shape Africa's just energy transformation. RES4Africa strives to empower them in their leadership endeavors by educating, supporting, and engaging with young leaders and their renewable energy initiatives through its Youth Empowerment Program. The program offers young leaders from across Africa an opportunity for direct dialogue among peers and conversation with private and public sector actors on what it takes for African countries' renewable energy transformation. A few key activities stand out that aims to give young leaders a platform to excel:

- **Youth Task Force:** the RES4Africa Youth Task Force gathers an extended network of youth organizations and leaders to advocate and implement activities in their respective countries and regions. By acting as an incubator, the Task Force brings different youth networks together to identify critical issues and propose solutions to the foundation on how youth perceives challenges and can contribute to overcoming them. The program's activities occur through thematic working groups focusing on capacity building, gender inclusion, innovation and finance, and the water-energy-food nexus. The work also includes short webinars

delivered by the Youth Task Force members, participation in global initiatives like the Youth Energy Transition Commission and Youth4Climate, and engagement with prospective youth organizations, ensuring visibility, exposure, and a platform to showcase leaders and their solutions.



- **Young Talent of the Year:** RES4Africa also seeks to give visibility and fosters empowerment of young leaders' initiatives through a yearly Young Talent of the Year award. The annual award initiative celebrates energy leaders with innovative ideas and supports their work with an award, technical assistance, and financial contribution. The 2022 award ceremony, held at COP27 in Sharm el-Sheikh, gave visibility to shortlisted awardees at the UN climate conference, supported by partners EIB and Enel Green Power (See Box 8 – Africa's future: youth and renewable energy).
- **Youth Start-up Initiative:** RES4Africa aims to identify and empower innovative business ideas and support them in becoming future energy entrepreneurs and leaders by developing and scaling up their viable and sustainable businesses. The initiative will work as a pre-accelerator and accelerator program, providing technical support, mentorship and coaching, and links to job and investment markets to support youth, start-ups, and innovators in the renewable energy sector. RES4Africa is working with its members and partners to launch this initiative in 2023 (See Chapter 3 - 2.3.2. Sub-Saharan Africa Program).

2.3. RES4Africa's three regional programs

2.3.1. RES4Med Program

The foundation pursues activities in specific parts of Africa, notably the Mediterranean, sub-Saharan Africa and South Africa. The RES4Med program focuses on North Africa in particular. In the last decade, countries in North Africa have faced several transformations and challenges shaping the region's future. Home to a population of 200 million, which grew by 20% in the last decade and is forecast to stabilize in the following years, the region has witnessed increasing urbanization (World Bank, 2021b). From an economic point of view, GDP growth in the region has slowed down from 2000-2009 (RES4Africa, 2021b). However, after the significant shock in 2020 caused by the Covid-19 pandemic and concomitant oil and gas price increase, North Africa's actual gross domestic product recovered strongly, resulting in increased energy consumption (AfDB, 2022c; BP, 2022). Although they share some commonalities, North African countries have been on diverging growth paths, resulting in faster growth in oil and gas exporters. Oil importers have faced growing challenges, especially in the face of the international energy crisis, with a rise in inflationary pressures due to commodity prices (World Bank, 2023).

2022 saw Egypt as the host of COP27 held in Sharm el-Sheikh. The conference brought renewed focus on accelerating the global energy transition, finding solutions to reduce global emissions, and advancing climate adaptation (See Box 2 – Africa, Energy & Climate - COP27 outcomes and towards COP28). The energy transition in Africa has been at the heart of discussions as it remains the most vulnerable continent to climate change, despite its negligible historic contribution to GHG emissions. In North Africa, the impact of climate change has been felt tangibly in the last decades. The region is facing temperatures rising at a rate 20% faster than the global average, causing severe heat waves, shortage of water, loss of biodiversity, and posing a risk to food production and the livelihood of millions (RES4Africa, 2021b). This has prompted North African countries to grow their commitment to global climate action and ambitious renewable energy strategies and targets (RES4Africa, 2021b). Renewable energy deployment has also been conceived to decrease their energy dependency and tap into their abundant solar and wind endowments for sustainable growth. Morocco, Egypt, Tunisia, and Algeria – RES4Africa’s focus countries – intend to reach an installed renewable energy capacity share of 52% (by 2030), 42% (by 2035), 30% (by 2030), and 27% (by 2030) respectively (IRENA, 2023a).

Despite these ambitious goals, the climate urgency, and the enormous potential of the region, North Africa has installed to date only 0.3% of the additional capacity of renewable energy installed worldwide in the last decade (IRENA, 2023b). While the region accounts for 3% of the global population, it received 0.6% of total renewable energy investment in the previous two decades (IRENA, 2022c). These figures reveal several challenges that must be overcome, such as incomplete regulatory frameworks, lengthy access procedures to support policies, and high investment perception risk. In addition, the power sector still faces a wide range of challenges as more grid investment is needed and intra-regional electricity trade remains limited. In the region, investments in power transmission fell by 20% between 2019 and 2020 due to the knock-on effects of the pandemic (IRENA, 2023a). North African countries would therefore have to dedicate essential resources in the following years to ensure that sufficient grid capacity is available to support their ambitious expansion plans, including innovative grid systems, as in the case of Morocco and Tunisia.

The RES4Med Program is a strategic initiative serving as a leading platform for public-private dialogue to promote renewable energy. It prioritizes activities in focus countries including Morocco, Algeria, Tunisia, and Egypt. Its primary objective is to encourage the adoption of renewable energy as a cost-effective, sustainable, and reliable energy strategy to meet the growing energy demand in the region. RES4Med plays a critical role in engaging with local stakeholders from the private and public sectors to promote renewable energy discourse and investment at the national level. The program supports private-public dialogue, shares evidence-based reports on policy and regulatory recommendations, shapes solutions based on lessons learned, and provides tailored training programs. It has also fostered market-driven strategic analysis, building on RES4Africa members’ and stakeholders’ experience. With over 20 local strategic partners, RES4Med engages with private and public stakeholders to advance knowledge and promote dialogue on renewable energy.



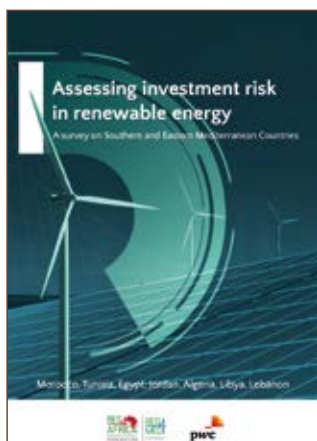
The RES4Med Program pursues the following activities that are cross-sectoral:

High-level public-private policy dialogue and raising awareness

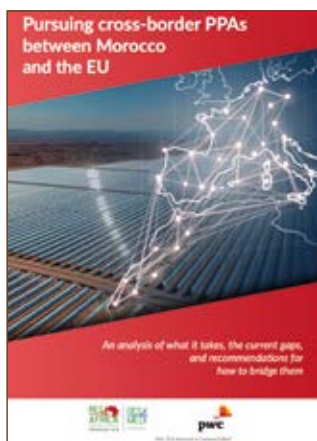
RES4Med encourages public-private dialogue through its **RES4Med days** in North Africa and hosts side events in leading European conferences, such as “Key Energy in Italy”. On these occasions, by bringing together representatives from government, industry, academia, and civil society, the foundation aims to create a space for mutual understanding and promote policies designed to activate private investment and innovation in renewable energy.

Studies and analysis

RES4Med produces evidence-based reports on policy and regulatory aspects, turning the insights into actionable recommendations for policymakers. Along with other studies, in 2022, several policy briefs have been published as a part of the “Better Policies to Accelerate the Clean Energy Transition”, focusing on net-metering, grid codes, and corporate PPAs in North Africa, as well as a report on sustainability and energy transition in Africa and developing countries. Looking at the region’s future, water scarcity and energy independency are fundamental issues to tackle, making the water-energy-food nexus an increasingly important lens for North African countries to design more integrated water, energy, and food policies. Innovative solutions and technologies such as seawater desalination, agrivoltaics, and green hydrogen will only grow in importance, and their potential needs to be used. RES4Med has developed a report on seawater desalination coupled with renewable energy in Morocco, a report on the upscaling of agrivoltaics in the Mediterranean, and an analysis on green hydrogen in Morocco, as well as a commentary on unlocking battery energy storage potential in Tunisia.

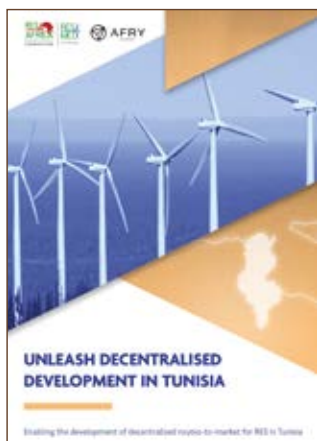


Cross-program activities on publications have included work on North Africa as well. The Missing Link program published two country reports (Morocco and Egypt) on the electricity market regulatory review (See Chapter 3 - 2.2.1. The “Regulatory Review of the Electricity Market in Africa: Towards Crowding-in Private Sector Investment”). As for 2023, the Grids4Africa program has also been active on North Africa with several ongoing activities (See Chapter 3 - 2.2.2. Grids4Africa). Grids4Africa is developing three studies under the program’s guidance, including an analysis of Morocco’s electricity interconnections, reviewing tariff methodologies, and surveying the future of energy sector regulation.



Capacity building and tailored training programs

Besides the policy and regulatory improvements, the energy transition in North Africa will require a new set of technical, economic, and regulatory core competencies. Building on its track record and the needs of North African partners, the foundation is designing new training activities dedicated to relevant topics, as well as high-level capacity-building initiatives, including “Powering the Energy Transition in North Africa” training in Caserta, Italy, in June 2023, in collaboration with the Italian Ministry of Foreign Affairs and other international stakeholders.



In collaboration with the renewAfrica program (See Chapter 3 - 2.2.3. RenewAfrica), in February 2023, RES4Med organized a training on de-risking investment in renewable energy in Egypt, which gathered 53 participants including middle- and high-level managers from the most important energy stakeholders in the country for a 2-day training in Cairo on best practices in project finance and overcoming risks and barriers related to renewable energy financing. Additionally, in February 2023, with the support of the Grids4Africa program, a training program called “Grids & Storage Lab in Morocco” was held in collaboration with the National Office of Electricity and Drinking Water (ONEE) (See Chapter 3 - 2.2.2. Grids4Africa). This training was held in Casablanca in French, and gathered 35 ONEE participants on the impact of VRE on electric power systems, grid flexibility, and how to integrate high percentages of renewable energy into the grid through grid upgrades and the use of storage. As a result, subsequent trainings are being planned in the region.

2.3.2. Sub-Saharan Africa Program

Sub-Saharan Africa is another RES4Africa focus region with its own program. Sub-Saharan Africa is a diverse and vibrant region that encompasses 48 countries, spanning from the southern tip of Africa to the Sahel region in the north. The region is home to over 1 billion people, comprising numerous ethnic groups and languages (World Bank, 2022c). The region’s natural resources include vast mineral deposits, fertile land, and abundant water resources, contributing to its economic growth. However, the region faces significant challenges, including poverty, inequality, conflict, and environmental degradation. As argued, the pandemic has led to a global economic slowdown, which has affected the region’s economies, particularly in terms of reduced trade and investment flows (IMF, 2022d). The pandemic has also disrupted global supply chains, affecting commodity prices and export revenues, critical income sources for many countries. The Ukraine-Russia conflict has further exacerbated these challenges, leading to a surge in global energy prices, significantly impacting energy-importing countries in sub-Saharan Africa.

Sub-Saharan Africa has long struggled with access to reliable and affordable energy. Today, over 560 million people in the region lack access to electricity, over half of the population (IRENA, 2022c). However, there is a growing recognition of the potential of renewable energy in the region, given its abundant natural resources and the increasing demand for energy to support its growing population and economy. This growth, combined with population expansion, is expected to drive a significant increase in energy demand. Fortunately, the region has enormous potential for renewable energy, including solar, wind, hydropower, and geothermal. For instance, the IEA estimates that sub-Saharan Africa could generate over 10,000 TWh of solar energy per year, more than ten times the region’s current electricity consumption (IEA, 2022a).

Despite the potential, sub-Saharan Africa's installed capacity for renewable energy remains low, with most countries heavily reliant on fossil fuels. The region has only 59 GW of renewable energy installed to date (IRENA, 2023b). However, there is growing interest from investors, policymakers, and communities in renewable energy, driven by the need to increase access to electricity, reduce carbon emissions, and enhance energy security. With the right policies and finance mobilization, the region could realize its potential for renewable energy, contributing to sustainable development and improving the lives of millions of people.

RES4Africa's Sub-Saharan Africa Program supports the just energy transformation of sub-Saharan Africa's countries through the foundation's key action areas. The initiative has been in place since 2016, when the foundation expanded its focus to the whole continent. The program prioritizes critical countries such as Ghana, Ivory Coast, Kenya, Mozambique, Senegal and Zambia. RES4Africa engages with stakeholders in these countries through events, webinars, workshops, other capacity-building activities, and meetings to collaborate with local entities and key decision-makers. Additionally, the program undertakes research and produces reports to support the renewable energy transition in the region, covering critical country-specific and regional issues. With these efforts, RES4Africa aims to promote sustainable and inclusive development across sub-Saharan Africa.

The Sub-Saharan Africa Program pursues the following activities that are cross-sectoral:

High-level public-private policy dialogue and raising awareness

Conferences and events: the Sub-Saharan Africa Program holds high-level policy dialogue and events to showcase specific elements of importance in focus countries. A recent example includes captive power and country outreach: together with the Grids4Africa program (See Chapter 3 - 2.2.2. Grids4Africa), the sub-Saharan Africa program organized an event in March 2023 focused on grid implications and grid regulation, as well as aggregators and case studies from South Africa on a developed captive market and key regulatory steps needed to evolve to that. RES4Africa's involvement brought more significant focus on the implications on the grid. The event gathered 100 participants and was followed by bilateral meetings with key energy stakeholders in Kenya, such as the Ministry of Energy, Kenya Power and Lighting Company (KPLC), IFC, and United Bank, to define future collaboration opportunities. As argued, accelerating renewable energy investment in the region is more than ever crucial. Through the renewAfrica initiative (See Chapter 3 - 2.2.3. RenewAfrica), RES4Africa implements advocacy and outreach activities in sub-Saharan African countries to stimulate the EU to create and adopt a single and shared EU-led de-risking program to build a pipeline of bankable renewable energy projects across Africa in support of Africa's clean energy development. Through events and stakeholder engagement activities, RES4Africa involves different sub-Saharan Africa countries such as Senegal, Mozambique, Ivory Coast, and Ghana.

Connecting the dots

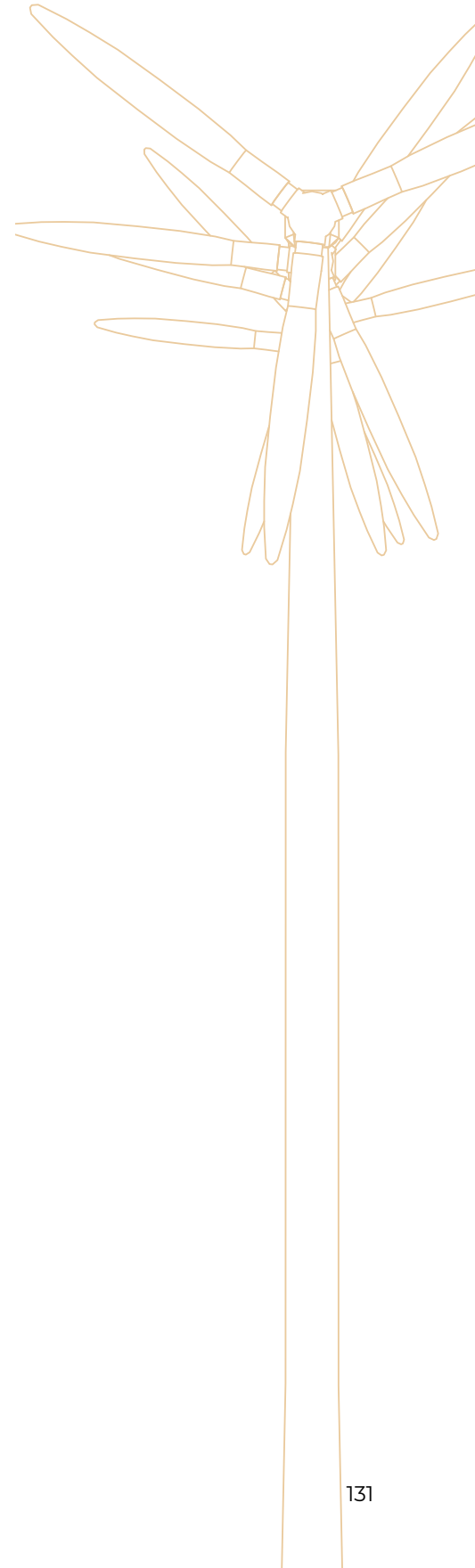
"Connecting the dots" is a series of studies that aim to shed light on Africa's energy landscape, which has the highest renewable potential in the world. Each study focuses on a region in Africa and delves into the energy developments of the past ten years, highlighting successes, challenges, and best practices in renewable energy trajectories. Previous editions focused on the African continent, the MENA region, and West Africa. A new study on East Africa is under preparation for 2023. Highlighted through a communication campaign and webinars, it seeks to create a platform for open dialogue and explore innovative ideas to help Africa sustainably achieve its energy targets. By taking a retrospective approach, the series provides a comprehensive understanding of the energy sector's evolution and the opportunities and challenges that lie ahead. The publication has gained traction as a valuable resource for policymakers, investors, and energy stakeholders, providing insights into Africa's unique energy landscape. As the energy landscape evolves, the "Connecting the dots" series will remain critical for driving conversations and shaping policies to accelerate Africa's transition to clean energy.

Energy Access and Water-Energy-Food Nexus focus

RES4Africa has been continuously working to bridge Africa's energy access gap. Recognizing the need for sustainable and integrated approaches to address the region's energy challenges, the foundation applies a water-energy-food nexus approach in its energy access work (See Chapter 3 - 2.2.5. Energy Access & Water-Energy-Food Nexus). This approach recognizes the interconnectedness between water, energy, and food systems and leverages the productive use of energy to make projects more useful and relevant for the region's context. Since 2019, RES4Africa has been using this approach to tackle the issue of rural electrification through field projects and studies in collaboration with international agencies. The foundation's partnerships with international agencies in its field projects and studies underscore the importance of collaboration in achieving ambitious goals toward sustainable energy access in Africa. For instance, RES4Africa collaborates with the German Development Agency (GIZ) on the "**Nexus Regional Dialogue Program**", which is co-funded by the EU and German Federal Ministry for Economic Cooperation and Development (BMZ) and aims to mainstream water-energy-food nexus approaches in the Middle East, North Africa Region, and Niger Basin. RES4Africa will organize local events in those regions, and a final program delivery event to showcase recommendations. In another example, the International Fund for Agricultural Development (IFAD) and the Ethiopian Ministry of Agriculture collaborate with RES4Africa on the **Participatory Small-scale Irrigation Development Program Phase II** to develop 150 small-scale irrigation projects in rural Ethiopia. By adopting the water-energy-food nexus approach, RES4Africa recognizes the critical role of energy in sustainable development and how its interconnections with water and food systems can lead to more integrated and sustainable solutions.

Capacity building

RES4Africa has long understood the importance and urgency of promoting the development of a skilled renewable energy capacity. In partnership with the AVSI



Foundation, St. Kizito Vocational Training Institute, and Strathmore University, and with the support of Enel Foundation, RES4Africa is implementing a Technical and Vocation Training Program (formerly the Micro-Grid Academy – MGA) based in Nairobi. The program intends to fill the educational gap in renewable energy and environmental, economic, and social sustainability. Through theoretical lessons, group exercises, and practical experiences at solar plants, more than 1,600 students from 40 African countries have been trained since 2018, the majority of whom declared that they had found a job or decided to start their entrepreneurial initiative thanks to the skills acquired during the training courses. This program is one component of the RES4Africa Academy (See Chapter 3 - 2.2.4. RES4Africa Academy), which offers several learning and sharing opportunities to decision-makers, managers, professionals, and entrepreneurs of African countries.



Sub-Saharan Africa's limited and aging power infrastructure poses significant challenges in incorporating increasing amounts of intermittent generation and the growing need for flexibility. Private participation must increase significantly to contribute to the significant investments necessary to address the next decade's challenges. The program includes studies and reports, events, and custom capacity-building initiatives. The sub-Saharan Africa program also incorporates elements from the Grids4Africa program on training (See Chapter 3 - 2.2.2. Grids4Africa). The program also created a dedicated training program called the Grid Development Lab and a report on economical digital solutions to help manage African distribution grids. Potential Grid & Storage development lab opportunities are under discussion with Kenya's utility KPLC and other entities.

Youth Start-up Initiative

The "Youth Start-up Initiative" is a pre-acceleration and acceleration program focused on renewable energy. This initiative, linked to the Youth Program (See Box 8 – Africa's future: youth and renewable energy), is expected to launch in 2023; it will provide African start-ups with the necessary resources, mentorship, coaching, and access to investment and markets to overcome critical challenges and support youth in becoming future entrepreneurs and leaders by developing and scaling up their businesses.

2.3.3. South Africa Program

A third programmatic focus is on South Africa. The country has a well-developed electricity network and one of sub-Saharan Africa's highest electricity access rates. Electricity generation in South Africa predominantly relies on coal (IEA, 2020). Still, efforts are ongoing to diversify the energy mix, as the coal-fired fleet is aging, and new projects will only partially compensate for the decline of the existing fleet. The government focuses on diversifying the power mix by introducing natural gas and renewables. Despite this, South Africa has seen a decrease in the past decade towards a severe electricity crisis, going from being a regional leader and exporter of electricity to planned blackouts, called load-shedding, for multiple hours daily. 2023 is on course

to be the worst year of load-shedding to date, with an average of 4 hours a day in the first quarter, massively affecting the country's industry and economic growth. The total generation capacity installed in 2022 was 54 GW (to cover a peak load demand of around 35 GW), of which 13.7% was composed of renewables including hydro (7.3% excluding hydro), 4.6% from nuclear, 1.6% from diesel, and 80.1% by coal (CSIR, 2022). As the second largest economy in Africa and the largest electricity market on the continent, South Africa's dependence on coal makes it one of the most carbon-intensive economies worldwide and the only G20 country with a rising power carbon intensity. To contrast this trend, the government undertook a series of decarbonization initiatives, reducing coal dependence on electricity generation and progressively decommissioning coal-fired power plants. Indeed, the National Development Plan 2030 envisages a decommissioning of 35 GW (out of 42 GW currently operating) of coal-fired power capacity and supplies at least 20 GW of the additional 29 GW of electricity needed by 2031 from renewables and natural gas (South African Government, 2012).

Such targets fall within the country's energy transition framework, which aims to steer the country toward renewables. However, coal has dominated South Africa's energy mix for many years as well as its economy and development, and a transition away from this implicitly results in several socio-economic challenges. Hundreds of thousands of livelihoods depend on the coal economy, and many are worried about being left behind in the transition. For this reason, South Africa has adopted a "Just Energy Transition" strategy that benefits all. Renewables are the answer to this. The energy transition in South Africa is not only a question of combating climate change. The country's coal fleets are aging and increasingly inefficient and expensive to run – reflected in the continuously rising electricity tariffs. Rebuilding and upgrading existing coal plants is highly capital-intensive and does not make economic sense, given the success of the REIPPPP and the decrease in the cost of solar and wind, which this has brought about. The government has recognized this and is making significant strides to introduce as many renewables as possible.

According to the Integrated Resource Plan (IRP) 2010-2030 (2019 edition), 6,000 MW of new solar PV capacity and 14,400 MW of new wind power capacity will be commissioned by 2030 (South African Government, 2019). Such variable renewable generation needs to be integrated into the power system, implementing adequate actions to ensure the system's security and reliability. Integrating renewable energy into the grid has been a significant challenge as the current grid cannot accommodate new generations at the needed pace. The factors for this are varied. In part, legacy coal dependence has led to an uneven grid development whereby areas around the load centers in the northeast of the country have been prioritized over grid developments in the rest of the country. Now, with the majority of solar and wind potential being located in the southwest, grid and procurement planning has reached a fork in the road; new generation projects could be located closer to the existing grid with more available capacity in the northeast but with lesser capacity factor, or in the southwest of the country where there are more excellent resources but with more significant investments in grid development.

South Africa, therefore, finds itself at a crucial point in its sustainable development. A costly energy crisis threatens a recession, and efforts to combat

it through renewables are being hampered by a grid that needs significant growth. Despite this, the country has enormous potential, reflected by continued interest in investment from private players, development partners, and foreign governments. The REIPPPP bid windows continue to be competitive, and last year the European Union, the United Kingdom, and the United States pledged USD 8.5 billion to support the transition away from coal, also known as the Just Energy Transition Partnerships (JETP) (EU Commission, 2021). This is due to continuous changes to the electricity regulation to support the growth of the commercial and industrial sectors, to unbundle Eskom to increase efficiency, ease its financial burdens, and create a more competitive market in the country. With such potential, South Africa can emerge from the crisis and become a regional leader through renewables, creating a local renewable workforce and manufacturing sector, creating jobs, and moving closer towards the just energy transition. RES4Africa has been active in South Africa, working on these issues since 2019, with a permanent presence there.

The South Africa Program pursues the following activities that are cross-sectoral:

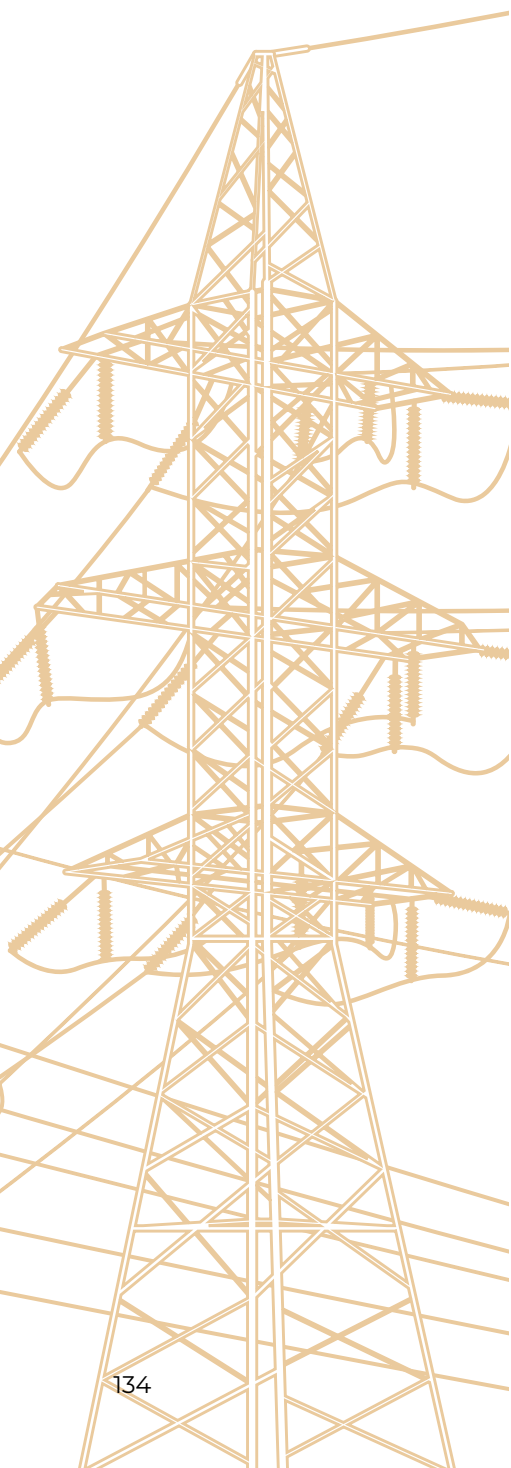
High-level public-private policy dialogue and raising awareness

Conferences and events are vital to the foundation's work in South Africa. This allows collaboration to grow between people and directly engages stakeholders to help guide work. To date, RES4Africa has held six events and conferences in South Africa, both in-person and online, on various topics, from decarbonization roadmaps to energy security, each time involving key South African entities, RES4Africa members, and international institutions. Partnerships, for this reason, are crucial to keep up to date and be directly involved with well over 24 local partners. 2 South African entities are RES4African members (Council for Scientific and Industrial Research - CSIR, and Nedbank - CIB). At the same time, MoUs exist with several partners.

AM-Powering Connexions is a series of recurring morning meetings which provide a platform for open and frank discussions on current issues in the South African electricity sector. Sessions comprise 2-3 experts briefly discussing the issue at hand, followed by an open forum and Q&A between South African stakeholders of all levels. With over 11 sessions organized, attracting average numbers of 75-80 per session, the program has close to 700 subscribers. A brief summary accompanies each session, dives deeper into critical points, and suggests further readings. The brief is sent out to all subscribers. With its flexible format, AM-Powering Connexions always covers the hot topics of the moment and has allowed for more urgent discussions, and therefore piqued the interest of many; this has meant that we have had speakers from a leading industry association, local actor, and other relevant national and international actors.

Studies and analysis

Studies & Reports: RES4Africa's studies and reports on South Africa have closely mirrored essential milestones in the country. To date, six studies have been



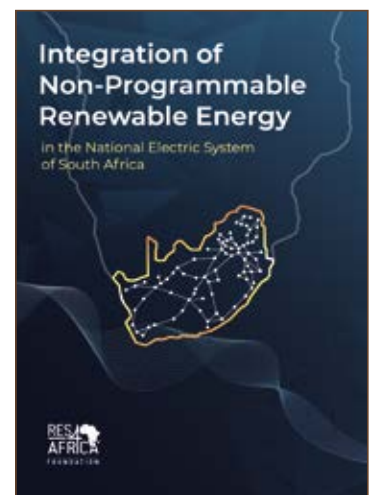
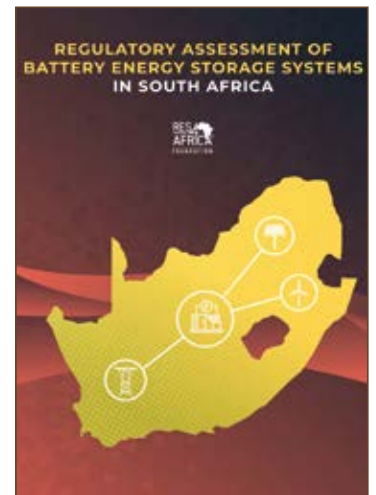
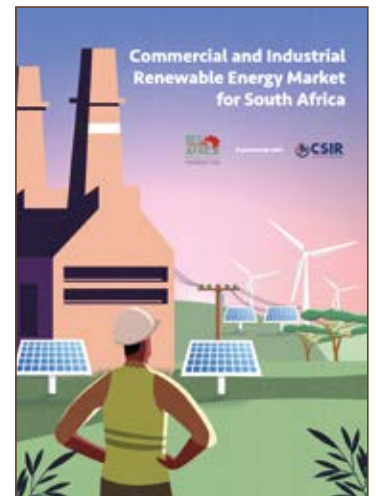
published exclusively on South Africa, reflecting the country's importance to the foundation, ranging from decarbonization to battery energy storage systems and grid integration of renewable energy in the national electric system of South Africa. Three more studies are planned for the year to continue previous studies. RES4Africa works closely with local stakeholders to identify the most critical topics to cover in the studies. Studies and reports provide greater information on critical issues, drawing from international experiences and using expertise to provide recommendations for decision-makers as South Africa undergoes its energy transition.

Capacity building

RE-Skilling Lab: with Eskom's ambitious coal plant decommissioning plan underway, RES4Africa strives to support South Africa's efforts to implement a just energy transition, which addresses the needs of workers and communities in former coal regions. To this end, the foundation established the RE-Skilling Lab in partnership with various local and international stakeholders. The initiative builds on earlier work with the CSIR on developing a re-skilling framework for the just energy transition. It aims to design an actionable re-skilling program in Mpumalanga focusing on introducing renewable-energy-related skills programs in the core offerings of Technical and Vocational Education and Training (TVET) colleges. Relying on a participatory working group approach with leading renewable energy sector players, a proposal was developed for an initial pilot training implemented through Nkangala TVET College (near Komati power station – the first to be shut down), which launched early in 2023.

- The project's first phase, the "training of trainers", is focused on training ten lecturers from the five campuses of the TVET to deliver various renewable energy courses.
- The second phase is a formally accredited renewable-energy skills program offered to learners enrolled in the college. The course includes practical lessons in a designated lab with equipment provided through RES4Africa, which mirrors real-life conditions.
- Crucial to the success of the RE-Skilling Lab is the employability of learners who have completed their training. For this reason, the RE-Skilling Lab is working closely with the local renewable energy industry to identify ideal skill sets and collaborate on student work experience opportunities. Furthermore, entrepreneurial training focused on rooftop PV panel installation and maintenance for a future distributed generation scenario.
- RES4Africa is creating a steering committee of local and international entities to help guide the RE-Skilling Lab as it expands in the following years and to ensure its continuity hand in hand with South African entities.

Power infrastructure in South Africa: the Grids4Africa program is making strides in promoting the development of sustainable energy infrastructure in South Africa through training, research, and collaborative efforts with local organizations (See Chapter 3 - 2.2.2. Grids4Africa). Under the South Africa Program and in collaboration with Grids4Africa, two workshops have been held with Eskom to present the integration of non-programmable study results. Eskom's strategic grid planning and grid planning departments are the primary recipients of the



workshops, also attended by the Independent Power Producer (IPP) office and the Energy Council of South Africa. One closed-door meeting was held between RES4Africa's grid-oriented members and Eskom to present grid solutions.

2.4. Partnerships for action

Making meaningful progress on Africa's sustainable energy pathway by 2030 cannot be done alone. Addressing the challenges and current limitations that hold back the broader adoption of renewable energy solutions in Africa requires a coordinated long-term effort from all actors. Only by creating a wealth of knowledge and experience to bear in discussions with local stakeholders, can change arise and progress be made. Partnerships are therefore not only key to the successful development of RES4Africa's activities as set out above, but they also are key to creating an ecosystem and developing synergetic areas of action that can then lead to the achievement of the hoped-for outcomes.

It takes an ecosystem of actors to move forward on Africa's clean energy pathway. Coordinated stakeholder engagement will be key to enable progress. From governments to local implementation partners, bilateral and multilateral financial and development institutions, international expert organizations, research and innovation organizations, development institutions, and investors: all have a critical role to play in creating an enabling environment, designing and delivering adequate solutions, and attracting the required amounts of finance and investment for renewable energy uptake in Africa to move forward at scale. Governments are vital in setting ambitious renewable energy targets, developing supportive and long-term signals, policies and regulations, and investing in the necessary infrastructure to support renewable energy deployment. Community actors can provide valuable insights into the local context and help to build support for renewable energy projects among local communities. Local implementation partners can help to bridge the gap between policy and practice by providing technical expertise and on-the-ground support to implement renewable energy projects. Bilateral and multilateral financial and development institutions can provide crucial financing and technical assistance, and can help de-risk investments in renewable energy projects, making them more attractive to private sector investors. International expert organizations and research and innovation organizations can provide technical expertise and knowledge-sharing opportunities to support the development of innovative renewable energy solutions.

These collaborations are possible because they are based on a few main common starting points. There is a common agreement that Africa's renewable energy transformation is vital for the continent and the world, that this transition should be just, inclusive and equitable, and that this implies continuous and ongoing dialogue between partners from within Africa (local, national, regional and continental level), the international community and all multi-stakeholder actors that are associated with this transition. There is also common agreement

that the scaling up of renewable energy projects can only happen if the private sector steps up and plays a key role, and that renewable electrification is a go-to pathway to reach multiple development goals, of which the most important is universal access to energy.

The private sector can play a catalytic role in delivering the renewable energy agenda in Africa. Private sector investment is needed to unlock the potential of renewable energy in Africa. There are significant opportunities for private sector actors to take proactive steps to help overcome barriers and work with governments to create an enabling environment for renewable energy investment in Africa. Examples are numerous. By partnering with local implementation partners, private sector actors can access specialized technical expertise, pool resources to finance renewable energy projects and work together to advocate for supportive policies and regulations. Collaboration with local partners enables private sector actors to build trust, gain local knowledge, and develop innovative solutions that meet the specific needs of African communities and businesses. The private sector can drive the transition to a low-carbon future by bringing innovative renewable energy solutions to the market and investing in renewable energy projects. By advocating for policies incentivizing renewable energy investment and providing training and technical assistance, the private sector can help build a sustainable renewable energy industry in Africa, benefiting local communities and businesses while attracting more private sector investment. Private sector actors play a critical role in driving the transition to a low-carbon energy future in Africa through innovative solutions, partnerships, advocacy, and building local capacity.

Removing the barriers to renewable energy uptake in Africa is possible and will deliver tremendous rewards. Each actor in this ecosystem outlined above is critical in creating an enabling environment for renewable energy uptake. They can identify the most effective solutions for promoting renewable energy investment and regional uptake by working together. They can also pool resources, expertise, and knowledge to drive innovation and build local capacity. This collaborative approach can help create a more predictable and stable regulatory environment for renewable energy investment in Africa, which can attract more private sector investment. Ultimately, by working together, actors in the ecosystem can help drive the transition to and deliver the benefits of a low-carbon energy future in Africa.

RES4Africa International Advisory Board statement

We, the International Advisory Board of RES4Africa Foundation, recognize the urgency and complexity of the global energy transition, and the local benefits that the transition could deliver to help mitigate the impacts of climate change and an ever-challenging global geopolitical context. With the world simultaneously facing several long-lasting crises, including the ongoing Covid-19 pandemic, global security issues, and the challenges of inflation and unpredictable energy prices, there is an urgent need to ensure that we are doing everything we can to speed up the transition toward a more sustainable future.

We renew our firm view that Africa can benefit from the global trend toward clean energy. To achieve this, we highlight the importance of renewable energy sources as a central solution alongside energy efficiency to overcome Africa's energy challenges: eradicate energy poverty, foster access to reliable, affordable, and clean energy, and pave the way for sustainable and climate resilient development. We reiterate the need to build a credible transformation pathway to ensure that no one and no place is left behind, and everyone can prosper. We stand behind ensuring that a compelling case for renewable energy is made in a world where energy security remains an urgent priority and renewable energy is expected to be the least cost option throughout Africa by 2030. We recognize that the shift towards renewable energy sources presents a complex challenge and that a comprehensive approach is needed to overcome barriers such as lack of financing, insufficient infrastructure, and widespread misconceptions.

We acknowledge the need to rapidly increase investment going into renewable energy sources in Africa and urge governments and private sector entities to prioritize, wherever and whenever possible the development of renewable energy infrastructure, including solar, wind, hydro,

bioenergy and geothermal power plants, as well as electricity transmission, distribution and storage infrastructure, and explore the potential for green hydrogen production facilities for hard-to-abate sectors. We emphasize the need to build climate-resilient energy systems, from generation to transmission and distribution to storage. This requires the mobilization of public and private financing, as well as the establishment of supportive policy frameworks and regulations.

We recognize the need for continued technology innovation and research and development to accelerate the more comprehensive application and deployment of renewable energy sources. We encourage governments and private sector entities to collaborate to promote innovation, share best practices and knowledge, and invest in renewable energy technologies.

We recognize the vital role that renewable energy can play in delivering the United Nations Sustainable Development Goals (SDGs) by 2030. We know that renewable energy can contribute to economic growth and job creation, and we call on governments to create enabling environments that promote the development of renewable energy industries, support small- and medium-sized enterprises, and prioritize the training, education and development of today's and tomorrow's energy leaders in Africa, particularly the continent's youth.

We wholeheartedly recognize and embrace Africa's need for a just and equitable sustainable energy shift. Much greater use of renewable energy can help to deliver a sustainable future for Africa, increased levels of electrification and power a strong industrialization on the continent.

We urge governments, businesses, financial institutions, civil society organizations, and

individuals to work together in the coming months as part of the road to COP28 to pave the way for a sustainable future for Africa. We, the RES4Africa International Advisory Board, support RES4Africa in our capacity as advisory board members and recognize the unique role the foundation can play in supporting governments in the transition.

We call on all stakeholders to join forces with us, take individual and collective action, and promote using renewable energy sources as a critical component of a sustainable future.

RES4Africa International Advisory Board:

- Ahmed Baroudi, SIE
- Akil Callender, SEforALL
- Esther Wanza, Youth Representative
- Guido Agostinelli, IFC
- Ignacio Pérez-Arriaga, African School of Regulation
- Laura Cozzi, IEA
- Maria Shaw-Barragan, EIB
- Rabiah Ferroukhi, IRENA
- Robert Lisinge, UNECA

BIBLIOGRAPHY

AEF. (2022). *Strategy Group Meeting on Energy*. Retrieved from Africa-Europe Forum.

AEF. (2023). *AEF Strategy Group Meeting on Sustainable Energy -April 2023*. Retrieved from Africa Europe Forum.

AfDB. (2018). *Why Africa is the next renewable energy powerhouse*. Retrieved from African Development Bank: <https://www.afdb.org/en/news-and-events/why-africa-is-the-next-renewables-powerhouse-18822>

AfDB. (2022a). *Africa loses up to 15% of its GDP per capita annually because of climate change*. Retrieved from Press Release: <https://www.afdb.org/en/news-and-events/press-releases/africa-loses-15-its-gdp-capita-annually-because-climate-change-african-development-bank-acting-chief-economist-kevin-urama-54660#:~:text=Africa%20has%20been%20losing%20from,and%20Vice%20President%20Ke>

AfDB. (2022b). *African Economic Outlook 2022*. Retrieved from African Development Bank Group: <https://www.afdb.org/en/documents/african-economic-outlook-2022>

AfDB. (2022c). *North Africa Economic Outlook 2022*. Retrieved from African Development Bank: <https://www.afdb.org/en/documents/north-africa-economic-outlook-2022>

AfDB. (2023). *Africa's economic growth to outpace global forecast in 2023-2024 – African Development Bank biannual report*. Retrieved from African Development Bank: <https://www.afdb.org/en/news-and-events/press-releases/africas-economic-growth-outpace-global-forecast-2023-2024-african-development-bank-biannual-report-58293>

African Union. (2022). *Africa Speaks with Unified Voice as AU Executive Council Adopts African Common Position on Energy Access and Just Energy Transition*. Retrieved from African Union: <https://au.int/en/pressreleases/20220722/africa-speaks-unified-voice-au-executive-council-adopts-african-common>

African Union. (2023). *SDG7 in Africa Achievable by 2034 – Upgrade of Transmission and Distribution Infrastructure Requires Urgent Attention*. Retrieved from <https://africa-eu-energy-partnership.org/report-sdg7-in-africa-achievable-by-2034-upgrade-of-transmission-and-distribution-infrastructure-requires-urgent-attention/>

Afrobarometer. (2022). *Still lacking reliable electricity from the grid, many Africans turn to other sources*. Retrieved from https://www.afrobarometer.org/wp-content/uploads/2022/04/ad514-pap10-still_lacking_reliable_electricity_from_the_grid-many_africans_turn_to_alternative_sources-afrobarometer-10april22.pdf

AGHA & McKinsey. (2022). *Africa's Green Hydrogen Potential*. Retrieved from Africa Green Hydrogen Alliance: https://climatechampions.unfccc.int/wp-content/uploads/2022/11/AGHA-Green-Hydrogen-Potential-v2_Final.pdf

Attia, B. (2017). *Living Under the Grid: 110 Million of Africa's Unconnected Customers Represent a Massive Opportunity*. Retrieved from <https://www.greentechmedia.com/articles/read/living-under-the-grid-110-million-of-africas-unconnected-customers-represent-a-massive-opportunity#:~:text=Research%20Spotlight-,Living%20Under%20the%20Grid%3A%20110%20Million%20of%20Africa's%20Unconnected%20Customers,access%20sits%2>

Barbanell, M. (2022). *A brief Summary of the Climate and Energy Provisions of the Inflation Reduction Act of 2022*. (The World Resources Institute) Retrieved from <https://www.wri.org/update/brief-summary-climate-and-energy-provisions-inflation-reduction-act-2022>

BBC. (2023). *The clean energy milestone the world is set to pass in 2023*. Retrieved from <https://www.bbc.com/future/article/20230414-climate-change-why-2023-is-a-clean-energy-milestone>

Bel, E. (2022). *Growing green: Catalyzing climate finance in African markets*. Retrieved from Atlantic Council: <https://www.atlanticcouncil.org/in-depth-research-reports/report/growing-green-catalyzing-climate-finance-in-african-markets/>

Bloomberg. (2023). *South Africa's Eskom Deepens Power Cuts to Unprecedented Level*. Retrieved from <https://www.bloomberg.com/news/articles/2023-02-22/south-africa-quietly-deepens-power-cuts-to-unprecedented-level#xj4y7vzkg>

BMZ. (2022). *Germany is supporting Kenya on its path to 100 per cent renewables-based energy generation*. Retrieved from Federal Ministry of Economic Cooperation and Development: <https://www.bmz.de/en/news/press-releases/germany-supporting-kenya-on-path-to-100-percent-renewables-135400>

BNEF. (2022a). *2H 2022 Levelized Cost of Electricity Update*. Retrieved from <https://about.bnef.com/blog/2h-2022-levelized-cost-of-electricity-update/#:~:text=At%20%2493%2FMWh%20globally%2C%20our,20%25%2C%20compared%20to%201H>

BNEF. (2022b). *A Year of breakthroughs and setbacks for the race to net zero in five charts*. Retrieved from Bloomberg New Energy Finance: <https://about.bnef.com/blog/a-year-of-breakthroughs-and-setbacks-for-the-race-to-net-zero-in-five-charts/>

BNEF. (2022c). *Africa Clean Energy Investment Sees No Post-Pandemic Rebound*. Retrieved from Bloomberg New Energy Finance: <https://about.bnef.com/blog/africa-clean-energy-investment-sees-no-post-pandemic-rebound/>

BNEF. (2022d). *Cost of New Renewables Temporarily Rises as Inflation Starts to Bite.* Retrieved from <https://about.bnef.com/blog/cost-of-new-renewables-temporarily-rises-as-inflation-starts-to-bite/>

BNEF. (2022e). *Energy Transition Investment Trends.* Retrieved from Bloomberg New Energy Finance: <https://about.bnef.com/energy-transition-investment/>

BNEF. (2022f). *Global low carbon energy technology investment surges past 1 trillion for the first time.* Retrieved from Bloomberg New Energy Finance: <https://about.bnef.com/blog/global-low-carbon-energy-technology-investment-surges-past-1-trillion-for-the-first-time/>

BNEF. (2022g). *Scaling-up Renewable Energy in Africa - A NetZero Pathfinder Report.* Retrieved from Bloomberg New Energy Finance: https://assets.bbhub.io/professional/sites/24/BNEF-Scaling-Up-Renewable-Energy-in-Africa-A-NetZero-Pathfinders-report_FINAL.pdf

BNEF. (2023a). *Energy Transition in 2023: Into a New Era.* Retrieved from <https://about.bnef.com/blog/energy-transition-in-2023-into-a-new-era/>

BNEF. (2023b). *How Europe Ditched Russian Fossil Fuels.* Retrieved from Podcast Zero Episode 28: <https://www.bloomberg.com/news/articles/2023-02-23/transcript-zero-episode-28-how-europe-ditched-russian-gas#xj4y7vzkg>

BNEF. (2023c). *Top 10 Energy Storage Trends in 2023.* Retrieved from <https://about.bnef.com/blog/top-10-energy-storage-trends-in-2023/#:~:text=Energy%20storage%20system%20costs%20stay,2023%20before%20dropping%20in%202024>

BP. (2022). *Statistical Review of World Energy 2022.* Retrieved from <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2022-full-report.pdf>

Bullard, N. (2022). *Even Conservative Estimates See Fossil Fuel Use Peaking Soon.* Retrieved from Bloomberg: <https://www.bloomberg.com/news/articles/2022-11-03/even-conservative-estimates-see-fossil-fuel-use-peaking-soon>

CSIR. (2022). *Statistics of utility-scale power generation in South Africa.* Retrieved from <https://www.csir.co.za/sites/default/files/Documents/Statistics%20of%20power%20in%20SA%202022-CSIR-%5BFINAL%5D.pdf>

Denning, L. (2022). *Climate Fight Arises as Geopolitical Power Play.* Retrieved from Bloomberg: https://www.bloomberg.com/opinion/articles/2022-12-28/climate-fight-arises-as-a-geopolitical-power-play?utm_medium=email&utm_source=newsletter&utm_term=221228&utm_campaign=sharetheview#xj4y7vzkg

EIB. (2022). *Africa's Extraordinary Green Hydrogen Potential.* Retrieved from <https://www.eib.org/attachments/press/africa-green-hydrogen-flyer.pdf>

Elston, L. (2022). *Namibia stakes its future on the green hydrogen market.* Retrieved from <https://www.energymonitor.ai/tech/hydrogen/namibia-stakes-its-future-on-the-green-hydrogen-market/>

Enel. (2021). *Enel unveils Gridspertise, the company dedicated to the digital transformation of power grids.* Retrieved from <https://www.enel.com/media/explore/search-press-releases/press/2021/09/enel-unveils-gridspertise-the-company-dedicated-to-the-digital-transformation-of-power-grids->

Energy Capital Power. (2021). *Senelec - Renforcer l'efficacité et la fiabilité du réseau électrique du Sénégal.* Retrieved from <https://energycapitalpower.com/senelec-renforcer-lefficacite-et-la-fiabilite-du-reseau-electrique-du-senegal/>

Eskom. (2023). *Eskom's Grid Capacity Connection Assessment 2023.* Retrieved from <https://www.eskom.co.za/eskom-divisions/tx/gcca/>

ETTG. (2021). *Green Transitions in Africa–Europe relations: What role for the European Green Deal?* Retrieved from European Think Thank Group: <https://ettg.eu/wp-content/uploads/2021/04/ETTG-paper-22Green-Transitions-in-Africa-Europe-relations22-pdf.pdf>

EU Commission. (2021). *France, Germany, UK, US and EU launch ground-breaking International Just Energy Transition Partnership with South Africa.* Retrieved from https://ec.europa.eu/commission/presscorner/detail/it/ip_21_5768

EUI. (2022). *Has COP27 accelerated the development of Green Hydrogen in Africa?* Retrieved from Florence School of Regulation: <https://fsr.eui.eu/has-cop27-accelerated-the-development-of-green-hydrogen-in-africa/>

European Commission. (2021). *Carbon Border Adjustment Mechanism.* Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_3661

European Commission. (2022). *REPowerEU: Affordable, Secure and Sustainable Energy for Europe.* Retrieved from https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en

European Commission. (2023). *The Green Deal Industrial Plan: Putting Europe's net-zero industry in the lead.* Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/ip_23_510

FAO. (2022). *Energie solaire et développement agricole en Afrique de l'Ouest: la FAO partage ses résultats.* Retrieved from Food and Agriculture Organization: <https://www.fao.org/africa/news/detail-news/fr/c/1628341/>

FDI. (2022). *Kenya's FFI green hydrogen deal: 'Other countries will follow suit'.* Retrieved from <https://www.fdiintelligence.com/content/interview/kenyas-ffi-green-hydrogen-deal-other-countries-will-follow-suit-81645>

GDC. (2014). *Geothermal Energy utilization at Oserian Flower Farm - Naivasha.* Retrieved from Geothermal Development Company: <https://orkustofnun.is/gogn/unu-gtp-sc/UNU-GTP-SC-18-24.pdf>

GOGLA. (2021). *Global Off-Grid Solar Market Report, Semi-Annual Sales and Impact Data.* Retrieved from https://www.gogla.org/sites/default/files/resource_docs/gogla_sales-and-impact-reporth2-2021_def2.pdf

- Holtz, L., & Heitzig, C. (2021).** *Africa's spatial distribution of road infrastructure.* Retrieved from Brookings: <https://www.brookings.edu/blog/africa-in-focus/2021/03/17/figures-of-the-week-africas-spatial-distribution-of-road-infrastructure/>
- ICA. (2022).** *Water Infrastructure in Africa.* Retrieved from Infrastructure Consortium of Africa: <https://www.icafrica.org/en/topics-programmes/water/>
- IEA. (2018).** *Average Power Generation Construction Time.* Retrieved from <https://www.iea.org/data-and-statistics/charts/average-power-generation-construction-time-capacity-weighted-2010-2018>
- IEA. (2019).** *Africa Energy Outlook 2019.* Retrieved from <https://www.iea.org/reports/africa-energy-outlook-2019>
- IEA. (2020).** *South Africa Profile.* Retrieved from <https://www.iea.org/countries/south-africa>
- IEA. (2021a).** *Financing Clean Energy Transitions in Emerging and Developing Economies.* Retrieved from <https://www.iea.org/reports/financing-clean-energy-transitions-in-emerging-and-developing-economies>
- IEA. (2021b).** *Global Energy Review: CO₂ Emissions in 2021.* Retrieved from <https://iea.blob.core.windows.net/assets/c3086240-732b-4f6a-89d7-db01be018f5e/GlobalEnergyReviewCO2Emissionsin2021.pdf>
- IEA. (2021c).** *Greenhouse Gas Emissions from Energy Data Explorer.* Retrieved from <https://www.iea.org/data-and-statistics/data-tools/greenhouse-gas-emissions-from-energy-data-explorer>
- IEA. (2022a).** *Africa Energy Outlook 2022.* Retrieved from <https://iea.blob.core.windows.net/assets/6fa5a6c0-ca73-4a7f-a243-fb5e83ecfb94/AfricaEnergyOutlook2022.pdf>
- IEA. (2022b).** *Clean Energy Transition in the Greater Horn of Africa.* Retrieved from <https://www.iea.org/reports/clean-energy-transitions-in-the-greater-horn-of-africa>
- IEA. (2022c).** *Global CO₂ emissions rebounded to their highest level in history in 2021.* Retrieved from <https://www.iea.org/news/global-co2-emissions-rebounded-to-their-highest-level-in-history-in-2021>
- IEA. (2022d).** *Hydrogen.* Retrieved from <https://www.iea.org/reports/hydrogen>
- IEA. (2022e).** *Renewable Energy Market Update - May 2022.* Retrieved from <https://www.iea.org/reports/renewable-energy-market-update-may-2022>
- IEA. (2022f).** *Solar PV tracking report.* Retrieved from <https://www.iea.org/reports/solar-pv>
- IEA. (2022g).** *The Role of Critical Minerals in Clean Energy Transitions.* Retrieved from World Energy Outlook Special Report: <https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf>
- IEA. (2022h).** *Tracking Clean Energy Progress.* Retrieved from <https://www.iea.org/news/the-clean-energy-economy-is-gaining-ground-but-greater-efforts-are-needed-now-to-get-on-track-for-net-zero-by-2050>

IEA. (2022i). *Tracking SDG7: The Energy Progress Report*. Retrieved from <https://www.iea.org/reports/tracking-sdg7-the-energy-progress-report-2022>

IEA. (2022j). *World Energy Outlook 2022*. Retrieved from <https://iea.blob.core.windows.net/assets/830fe099-5530-48f2-a7c1-11f35d510983/WorldEnergyOutlook2022.pdf>

IEA. (2022k). *World Energy Outlook 2022 Launch Presentation*. Retrieved from <https://www.iea.org/reports/world-energy-outlook-2022>

IEA. (2023a). *Energy Technology Perspective 2023*. Retrieved from <https://www.iea.org/reports/energy-technology-perspectives-2023>

IEA. (2023b). *IEA hosts COP28 President-Designate Sultan Al-Jaber for roundtable discussion with over 50 countries on the road to COP28*. Retrieved from <https://www.iea.org/news/iea-hosts-cop28-president-designate-sultan-al-jaber-for-roundtable-discussion-with-over-50-countries-on-the-road-to-cop28>

IEA. (2023c). *Russia's War on Ukraine - One year on*. Retrieved from <https://www.iea.org/topics/russias-war-on-ukraine>

IEA. (2023d). *The global energy crisis pushed fossil fuel consumption subsidies to an all-time high in 2022*. Retrieved from <https://www.iea.org/commentaries/the-global-energy-crisis-pushed-fossil-fuel-consumption-subsidies-to-an-all-time-high-in-2022>

ILO. (2020). *Report on employment in Africa (Re-Africa)*. Retrieved from International Labour Organization: https://www.ilo.org/wcmsp5/groups/public/---africa/---ro-abidjan/documents/publication/wcms_753300.pdf

IMF. (2022a). *Getting Back on Track to Net Zero: Three Critical Priorities for COP27*. Retrieved from International Monetary Fund: https://www.imf.org/en/Blogs/Articles/2022/11/04/getting-back-on-track-to-net-zero-three-critical-priorities-for-cop27?utm_medium=email&utm_source=govdelivery

IMF. (2022b). *How Europe Can Protect the Poor from Surging Energy Prices*. Retrieved from <https://www.imf.org/en/Blogs/Articles/2022/08/03/how-europe-can-protect-the-poor-from-surging-energy-prices>

IMF. (2022c). *Kenya Taps the Earth's Heat*. Retrieved from <https://www.imf.org/en/Publications/fandd/issues/2022/12/country-case-kenya-taps-the-earth-heat>

IMF. (2022d). *Regional Economic Outlook - Sub-Saharan Africa*. Retrieved from <https://www.imf.org/en/Publications/REO/SSA/Issues/2022/10/14/regional-economic-outlook-for-sub-saharan-africa-october-2022>

IMF. (2023). *Regional Economic Outlook - Sub-Saharan Africa*. Retrieved from <https://www.imf.org/en/Publications/REO/SSA/Issues/2023/04/14/regional-economic-outlook-for-sub-saharan-africa-april-2023>

Investor Infrastructure. (2022). *Policy push boost Japan's renewables sector*. Retrieved from <https://www.infrastructureinvestor.com/policy-push-boosts-japans-renewables-sector/#:~:text=Japan's%20government%20has%20also%20recently,target%20of%2022%2D24%20percent>

IPCC. (2021). *Regional Fact Sheet: Africa*. Retrieved from Sixth Assessment Report: https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Africa.pdf

IRENA, RES4Africa & UNECA. (2022). *Towards a Prosperous and Sustainable Africa*. Retrieved from <https://www.irena.org/Publications/2022/Feb/Towards-a-prosperous-and-sustainable-Africa>

IRENA. (2016). *End-of-life Management Solar Photovoltaic Panels*. Retrieved from https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2016/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf?rev=49a75178e38c46288a18753346fb0b09

IRENA. (2020). *Global Renewables Outlook: Energy Transformation 2050 - Sub Saharan Africa Factsheet*. Retrieved from https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Apr/IRENA_GRO_R10_Sub-Saharan_Africa.pdf?la=en&hash=DB067EF85E0FDB6B8762833E77CC80F3975E46DC

IRENA. (2021a). *Kenya Energy Profile*. Retrieved from https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Africa/Kenya_Africa_RE_SP.pdf

IRENA. (2021b). *Renewable Capacity Statistics 2021*. Retrieved from <https://www.irena.org/publications/2021/March/Renewable-Capacity-Statistics-2021>

IRENA. (2021c). *Renewable Energy for Agri-Food Systems*. Retrieved from https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Nov/IRENA_FAO_Renewables_Agrifood_2021.pdf?rev=531d47024c114696832884e5bf2a3b9d

IRENA. (2022a). *Could the Energy Transition Benefit Africa's Economies?* Retrieved from Rabia Ferroukhi, Mijam Reiner, Laura El-Katiri: <https://www.irena.org/News/expertinsights/2022/Nov/Could-the-Energy-Transition-Benefit-Africas-Economies>

IRENA. (2022b). *Global Hydrogen Trade to meet the 1.5°C Climate Goals*. Retrieved from https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2022/Jul/IRENA_Global_hydrogen_trade_part_1_2022_.pdf

IRENA. (2022c). *Renewable Energy Market Analysis: Africa and its Regions*. Retrieved from <https://www.irena.org/publications/2022/Jan/Renewable-Energy-Market-Analysis-Africa>

IRENA. (2022d). *Renewable Energy Power Generation Costs 2021*. Retrieved from <https://www.irena.org/publications/2022/Jul/Renewable-Power-Generation-Costs-in-2021>

IRENA. (2022e). *Renewable Energy and Jobs - Annual Review 2022*. Retrieved from <https://www.irena.org/publications/2022/Sep/Renewable-Energy-and-Jobs-Annual-Review-2022>

IRENA. (2022f). *Renewable Power Generation Costs in 2021*. Retrieved from <https://www.irena.org/publications/2022/Jul/Renewable-Power-Generation-Costs-in-2021#:~:text=The%20global%20weighted%20average%20levelised,%25%20to%20USD%200.075%2FkWh.>

IRENA. (2022g). *Renewable Power Remains Cost-Competitive amid Fossil Fuel Crisis*. Retrieved from <https://www.irena.org/news/pressreleases/2022/Jul/Renewable-Power-Remains-Cost-Competitive-amid-Fossil-Fuel-Crisis>

IRENA. (2022h). *World Energy Transitions Outlook 2022*. Retrieved from <https://www.irena.org/Digital-Report/World-Energy-Transitions-Outlook-2022>

IRENA. (2023a). *Planning and Prospects for renewable power: North Africa*. Retrieved from <https://www.irena.org/Publications/2023/Jan/Planning-and-prospects-for-renewable-power-North-Africa>

IRENA. (2023b). *Renewable Capacity Statistics 2023*. Retrieved from RES4Africa elaboration based on IRENA 2023: <https://www.irena.org/Publications/2023/Mar/Renewable-capacity-statistics-2023>

IRENA. (2023c). *World Energy Transitions Outlook*. Retrieved from <https://www.irena.org/Publications/2023/Mar/World-Energy-Transitions-Outlook-2023>

ITA. (2022). *Kenya Country Commercial Guide*. Retrieved from US International Trade Administration: <https://www.trade.gov/country-commercial-guides/kenya-energy-electrical-power-systems#:~:text=Current%20Energy%20Mix%3A%20Kenya's%20energy,thermal%2C%20biomass%2C%20and%20imports>

Lake Turkana Wind Power. (2022). *Project Overview - The Lake Turkana Wind Power (LTWP) Project*. Retrieved from <https://ltwp.co.ke/overview/>

Le Desk. (2022). *Safran Nacelles Morocco inaugure sa centrale photovoltaïque à Nouaceur*. Retrieved from Le Desk: <https://ledesk.ma/2022/12/09/safran-nacelles-morocco-inaugure-sa-centrale-photovoltaique-a-nouaceur/>

McKinsey. (2020a). *How a post-pandemic stimulus can both create jobs and help the climate*. Retrieved from <https://www.mckinsey.com/~media/McKinsey/Business%20Functions/Sustainability/Our%20Insights/How%20a%20post-pandemic%20stimulus%20can%20both%20create%20jobs%20and%20help%20the%20climate/How-a-post-pandemic-stimulus-can-both-create-jobs-and-help-the-climat>

McKinsey. (2020b). *Solving Africa's Infrastructure Paradox*. Retrieved from <https://www.mckinsey.com/~media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our%20Insights/Solving%20Africas%20infrastructure%20paradox/Solving-Africas-infrastructure-paradox.pdf>

McKinsey. (2022a). *Global Energy Perspective 2022*. Retrieved from <https://www.mckinsey.com/~media/McKinsey/Industries/Oil%20and%20Gas/Our%20Insights/Global%20Energy%20Perspective%202022/Global-Energy-Perspective-2022-Executive-Summary.pdf>

McKinsey. (2022b). *The energy transition: A region-by-region agenda for near-term action*. Retrieved from <https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-energy-transition-a-region-by-region-agenda-for-near-term-action?stcr=E3B06DFD9AAF43B2A4B28BCA1A2F7C6B&cid=other-eml-alt-mip-mck&hlkid=d087b9b3e494496086d32d4366df4ad2&hct>

McKinsey. (2022c). *The future of Africa oil and gas: Positioning for the energy transition.* Retrieved from <https://www.mckinsey.com/industries/oil-and-gas/our-insights/the-future-of-african-oil-and-gas-positioning-for-the-energy-transition>

McKinsey. (2022d). *The net-zero transition: What it would cost, what it could bring.* Retrieved from <https://www.mckinsey.com/capabilities/sustainability/our-insights/the-net-zero-transition-what-it-would-cost-what-it-could-bring>

MEM. (2021). *Feuille de route - Hydrogène vert.* Retrieved from Ministère de l'Énergie du Maroc: https://www.mem.gov.ma/Lists/Lst_rapports/Attachments/36/Feuille%20de%20route%20de%20hydrog%C3%A8ne%20vert.pdf

Mensah, J.T. (2018). *Jobs! Electricity Shortage and Unemployment in Africa.* Retrieved from World Bank Group - Policy Research Working Paper: <https://openknowledge.worldbank.org/bitstream/handle/10986/29717/WPS8415.pdf?sequence=5>

Ministry of Energy. (2015). *Plan d'Action National des Énergies Renouvelables.* Retrieved from https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country_PANER/Senegal_Plan_d_Actions_National_des_Energies_Renouvelables_.pdf

Ministry of Finance. (2021). *Interministerial decree n ° 010 158.* Retrieved from <https://www.climate-laws.org/geographies/senegal/policies/interministerial-decree-n-010-158>

Murray, C. (2022). *South Africa's Eskom starts building first battery storage system.* Retrieved from Energy Storage News: <https://www.energy-storage.news/south-africas-eskom-starts-building-first-battery-storage-system/>

Ngaryo, S.D. (2023). *Energy For Growth Hub.* Retrieved from <https://www.energyforgrowth.org/memo/how-to-de-risk-clean-energy-projects-and-cultivate-the-project-pipeline-in-sub-saharan-africa/>

Oxford. (2022). *Decarbonising the energy system by 2050 could save trillions - Oxford study.* Retrieved from <https://www.ox.ac.uk/news/2022-09-14-decarbonising-energy-system-2050-could-save-trillions-oxford-study>

Pereira, F. (2019). *Mozambique Cyclone Idai - Post Disaster Need Assessment.* Retrieved from The Cabinet for the Reconstruction of Post-Cyclone IDAI: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_704473.pdf

PV Magazine. (2022). *PowerGrid to develop Africa's first 'PPP mode' transmission project in Kenya.* Retrieved from <https://www.pv-magazine-india.com/2022/01/13/powergrid-to-develop-africas-first-ppp-mode-transmission-project-in-kenya/>

Rapid Transition. (2022). *Doing development differently: How Kenya is rapidly emerging as Africa's renewable energy superpower.* Retrieved from <https://www.rapidtransition.org/stories/doing-development-differently-how-kenya-is-rapidly-emerging-as-africas-renewable-energy-superpower/#:~:text=In%202021%2C%2081%25%20of%20Kenya's,which%20Kenya%20has%20in%20abundance>

REA. (2022). *Energizing Economies Initiative*. Retrieved from Rural Electrification Agency: <https://eei.rea.gov.ng/about-eei/> Rentschler & al. (2019). *Underutilized Potential - The Business Costs of Unreliable Infrastructure in Developing Countries*. Retrieved from World Bank Group - Policy Research Working Paper: <https://documents1.worldbank.org/curated/en/336371560797230631/pdf/Underutilized-Potential-The-Business-Costs-of-Unreliable-Infrastructure-in-Developing-Countries.pdf>

RES4Africa & PwC. (2021a). *Investor's Survey on Sub-Saharan Africa*. Retrieved from https://static1.squarespace.com/static/609a53264723031eccc12e99/t/6180ffb91e351d4c7fcdd981/1635844031170/Investor+survey+on+Sub+Saharan+Africa_RES4Africa+PwC+%281%29.pdf

RES4Africa. (2021b). *Connecting the Dots - MENA Edition*. Retrieved from <https://shorturl.at/uxBOR>

RES4Africa. (2021c). *Sustainable Electricity for a Prosperous Africa*. Retrieved from https://static1.squarespace.com/static/609a53264723031eccc12e99/t/628dfffbe8f3fc623f8de572/1653473316846/RES4Africa+5th+Flagship+Publication+2022+-+Sustainable+electricity+for+a+Prosperous+Africa_double+paged.pdf

RES4Africa. (2022). *Regulatory Assessment of Battery Energy Storage System in South Africa*. Retrieved from <https://static1.squarespace.com/static/609a53264723031eccc12e99/t/636e5649c3bc2e03d9ce3217/16681754370FINAL+Regulatory+assessment+of+Battery+Energy+Storage+Systems+in+South+Africa.pdf>

Reuters. (2022). *Africa must use its gas reserves to drive the economy, industry officials say*. Retrieved from <https://www.reuters.com/business/energy/africa-must-use-its-gas-reserves-drive-economy-industry-officials-say-2022-11-01/>

Reuters. (2023). *EU to set up central buying agency for critical minerals-draft law*. Retrieved from <https://www.reuters.com/world/europe/eu-set-up-central-buying-agency-critical-minerals-draft-law-2023-03-07/#:~:text=The%20Critical%20Raw%20Materials%20Act,greenhouse%20gas%20emissions%20by%202050>.

Rödl & Partner. (2019). *Highlights of Kenya's Energy Act 2019*. Retrieved from <https://www.roedl.com/insights/renewable-energy/2019-05/highlights-of-kenyas-energy-act-2019>

S&P Global. (2023). *China to maintain renewables growth pace in 2023 despite uncertainty*. Retrieved from <https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/energy-transition/020123-china-to-maintain-renewables-growth-pace-in-2023-despite-uncertainty>

SE4ALL. (2020). *The Recover Better with Sustainable Energy Guide for African Countries*. Retrieved from <https://www.seforall.org/system/files/2020-08/RB-Africa-SEforALL.pdf>

Shell. (2023). *The Energy Podcast*. Retrieved from Season 4, 1.5 C: <https://www.shell.com/inside-energy/the-energy-podcast.html>

Signé, L. (2019). *The high growth promise of an integrated Africa*. Retrieved from Brookings: <https://www.brookings.edu/opinions/the-high-growth-promise-of-an-integrated-africa/>

- Souad, A. (2022).** *Morocco Establishes Its First Green Hydrogen Production System.* Retrieved from <https://www.moroccoworldnews.com/2022/09/351348/morocco-establishes-its-first-green-hydrogen-production-system>
- South African Government. (2012).** *National Development Plan 2030.* Retrieved from <https://www.gov.za/issues/national-development-plan-2030>
- South African Government. (2019).** *Integrated Resource Plan 2019.* Retrieved from <https://www.energy.gov.za/irp/2019/IRP-2019.pdf>
- The Guardian. (2015).** *How Africa's fastest solar power project is lighting up Rwanda.* Retrieved from <https://www.theguardian.com/environment/2015/nov/23/how-africas-fastest-solar-power-project-is-lighting-up-rwanda>
- The Guardian. (2022).** *African countries urge rich nations to honour \$100bn climate finance pledge.* Retrieved from <https://www.theguardian.com/global-development/2022/oct/06/african-countries-urge-rich-nations-to-honour-100bn-climate-finance-pledge-cop27>
- The White House. (2023, January).** *Inflation Reduction Act Guidebook.* Retrieved from <https://www.whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf>
- Tobin, W. & Sparkman, M. (2022).** *To meet energy security and climate goals, Africa needs investment in infrastructure.* Retrieved from Atlantic Council: <https://www.atlanticcouncil.org/blogs/energysource/to-meet-energy-security-and-climate-goals-africa-needs-investment-in-infrastructure/>
- UN. (2022).** *A Just and Equitable Energy Transition in Africa for a Green Recovery, Inclusion, Climate Action, and the Attainment of the SDGs and Agenda 2063.* Retrieved from High-Level Political Forum 2022: <https://hlpf.un.org/2022/programme/a-just-and-equitable-energy-transition-in-africa-for-a-green-recovery-inclusion>
- UNFCCC. (2022).** *Africa Green Hydrogen Alliance.* Retrieved from Climate Champions: <https://climatechampions.unfccc.int/africa-green-hydrogen-alliance/>
- UNHCR. (2022).** *Africa Focus.* Retrieved from <https://www.unhcr.org/africa.html>
- Vestas. (2018).** *Socio-economic study of key impacts from Lake Turkana Wind Power (LTWP).* Retrieved from [https://www.vestas.com/content/dam/vestas-com/global/en/sustainability/corporate-integrity/csr/documents/Socio-economic-study-of-key-impacts-from-Lake-Turkana-Wind-Power-\(LTWP\).pdf](https://www.vestas.com/content/dam/vestas-com/global/en/sustainability/corporate-integrity/csr/documents/Socio-economic-study-of-key-impacts-from-Lake-Turkana-Wind-Power-(LTWP).pdf)
- Voyager. (2022).** *Letters - A Blueprint for Opportunity.* Retrieved from <https://www.voyagervc.com/news-and-letters/faster-every-day>
- WEF. (2023).** *Global Risks Report 2023.* Retrieved from World Economic Forum: <https://www.weforum.org/reports/global-risks-report-2023/>
- WMO. (2022).** *State of Climate in Africa highlights water stress and hazards.* Retrieved from World Meteorological Organization: <https://public.wmo.int/en/media/press-release/state-of-climate-africa-highlights-water-stress-and-hazards#:~:text=It%20shows%20how%20extreme%20weather,suffers%20disproportionately%20from%20the%20results>

World Bank. (2019). *Electricity Access in Sub-Saharan Africa : Uptake, Reliability, and Complementary Factors for Economic Impact*. Retrieved from <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/837061552325989473/electricity-access-in-sub-saharan-africa-uptake-reliability-and-complementary-factors-for-economic-impact>

World Bank. (2021a). *World Bank Open Data Base*. Retrieved from <https://data.worldbank.org/>

World Bank. (2021b). *World Development Indicators*. Retrieved from <https://data.worldbank.org/indicator/SP.POP.GROW?locations=MA-DZ-TN-EG-LY>

World Bank. (2022a). *Access to Electricity (% population)*. Retrieved from World Bank Database: <https://data.worldbank.org/country/kenya>

World Bank. (2022b). *Poverty and Inequality Platform*. Retrieved from <https://data.worldbank.org/indicator/SI.DST.10TH.10>

World Bank. (2022c). *The World Bank Data Base*. Retrieved from <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=1W-ZG>

World Bank. (2022d). *The World Bank Enterprise Surveys*. Retrieved from <https://www.enterprisesurveys.org/en/data/exploretopics/infrastructure>

World Bank. (2022e). *World Bank Open Data Base*. Retrieved from <https://data.worldbank.org/>

World Bank. (2023). *Altered destinies: The Long-Term Effects Of Rising Prices and Food Insecurity in the Middle East and North Africa*. Retrieved from <https://openknowledge.worldbank.org/entities/publication/bb648ce6-7265-4290-8ffc-52292de35065>

World Inequality Lab. (2022). *World Inequality Report 2022*. Retrieved from <https://wir2022.wid.world/>

Acknowledgments

Production: RES4Africa Foundation Secretariat in Rome, Italy

Project management team: Roberto Vigotti, Ana Rovzar, Assia Bellaroto – RES4Africa Foundation Secretariat

Authoring team: Ana Rovzar, Hind Couzin, Gus Schellekens

Contributors: Lorenzo Vilona, Marianna Petrosillo, Iarina Ciceu, Andrea Renzulli, Cristiana Lisi, Luca Traini, Daniele Guzzo, Paolo Cutrone, Camellia Mahjoubi, Fabrizio Bonemazzi, Ivana Senka, Carlo Cecchetti, Iryna Donchenko, Maria Caterina Mattiolo, Stefano Giacci, Adriana Maldonado

Design & Layout: Centrale Comunicazione, Rome, Italy

Creative Director: Vittorio Picello

Client Director: Gaia Graziosi

Chief Art Director: Tiziana Padelli

Layout Producer: Maria Femina

Infographics Design: Alessandro Archibugi

ISBN CODE: 9791281013018

Special thanks go to Enel Foundation, RES4Africa's longstanding knowledge partner. Thanks also go to the Executive Committee, the RES4Africa International Advisory Board, and the RES4Africa Youth Task Force.

Executive Committee Members' views (by alphabetical order): Amel Chadli (Schneider Electric), Bali Kochar (Intesa Sanpaolo), Fabrizio Acerbis (PwC), Gianluca Marini (CESI), Guido Guida (Terna), Ilhan Ozturk (Prysmian), Marcel Cabral (Siemens Gamesa), Rafael Solis (EDPR), Raimondo De Laurentiis (RINA), Salvatore Bernabei (Enel Green Power)

RES4Africa International Advisory Board members (by alphabetical order):

- Ahmed Baroudi, Director General, SIE
- Akil Callender, Youth Representative, SEforALL
- Esther Wanza, Youth Representative and Co-Founder, Raynow Energy
- Guido Agostinelli, Senior Industry Specialist, IFC
- Ignacio Pérez-Arriaga, Professor & Director of Energy Training, African School of Regulation
- Laura Cozzi, Chief Energy Modeller, International Energy Agency (IEA)
- Maria Shaw-Barragan, Director of Lending in Africa, Caribbean, Pacific, Asia, and Latin America, European Investment Bank (EIB)
- Rabia Ferroukhi, Director Knowledge, Policy and Finance Center, International Renewable Energy Agency (IRENA)
- Robert Lisinge, Chief of Section PSDFD – Energy Infrastructure & Services, United Nations Economic Commission for Africa (UNECA)

Youth Task Force members (by alphabetical order):

- Akil Callender, Youth Specialist, SEforALL
- Ashlin Naidoo, APO Energy, and Climate Change, City of Cape Town Municipality
- Diana Bulf, E&C Continuous Improvement & Performance Monitoring, Technical Solidarity
- Elly Kevin Oriko, Founder & CEO, Raynow Energy
- Esther Githinji, Advocate of the High Court of Kenya, Clean Energy 4 Africa
- Etumuka Mamize, Team Lead Capacity Building, SDG 7 Youth Constituency
- Jenny Daniela Salazar Zapata, Officer, Rete Giovani
- Luciana Miu, Governing Board - Advocacy and Public Relations, Energy Policy Group, European Energy Youth Network
- Maame Boateng, Partnerships Manager, Africa-Europe Foundation
- Martin Masiya, Founder & CEO, Sollys Energy Ltd
- Mohamed Alhaj, Founder & CEO, Terra Energy
- Norah Magero, Founder & CEO, Drop Access
- Oluwadabira Abiola-Awe, Ventures & Capital Campaign Associate, Student Energy
- Rebecca Bisangwa, Associate Professional Renewable Grid Integration, IRENA

Disclaimer: This report reflects the views of the RES4Africa Secretariat but does not necessarily reflect the views of the individual RES4Africa members or any particular funder, supporter, or collaborator.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

This publication was publicly launched on June 15, 2023 during a launch event in Rome, Italy. The publication is available for download on www.res4africa.org/library

For further information: info@res4africa.org

© June 2023, RES4Africa Foundation

Contact:

Via Ticino, 14
00198 Rome, Italy
T +39 06 8552236
www.res4africa.org



