ELECTRICITY LAWYER

SUB-SAHARAN AFRICA (SSA) HYDROGEN (GREEN HYDROGEN) TOOLKIT

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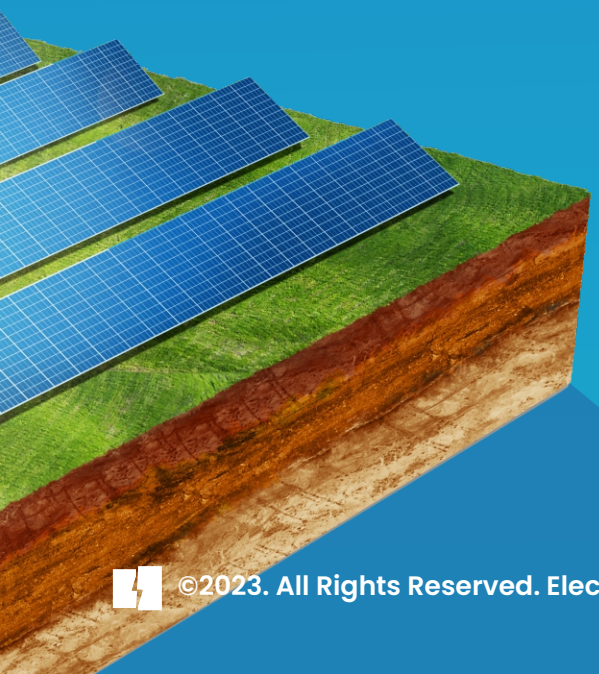

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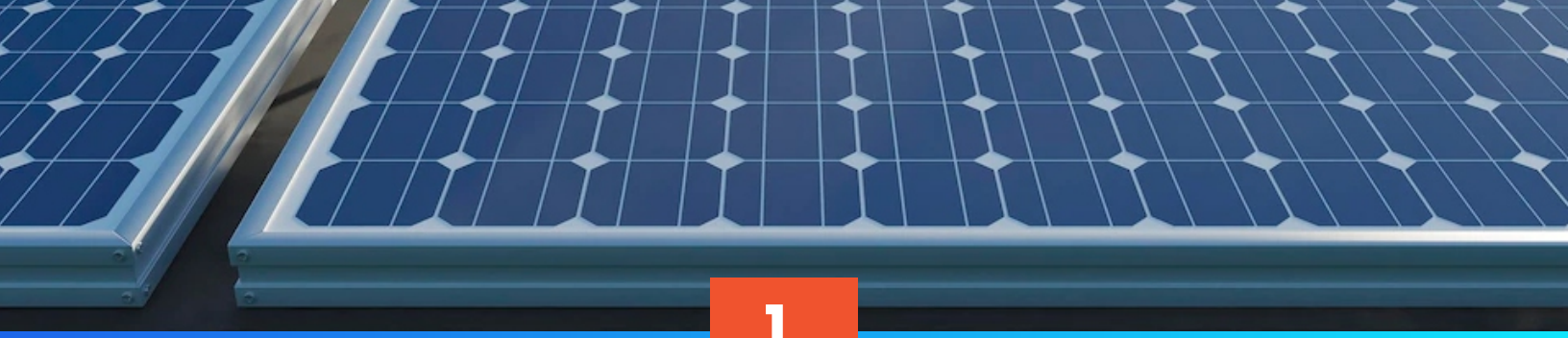


1. Introduction

DW Planet describes hydrogen as 'the magic fuel that can power our cars, trucks, trains, ships, and planes, and even steel can be produced using hydrogen'. Hydrogen (H2) is the most abundant element (gas) in the universe that can be found in almost everything. It is considered a clingy gas, as such it bounds up with other elements, most commonly with oxygen and water. To get pure hydrogen, the bonds must be split up. The simplest way to achieve this is via electrolysis. It involves introducing baking soda into water to help with conductivity; when current is passed into the solution, bubbles form along the wires which represents water splitting into hydrogen and oxygen. There should be twice as much oxygen as hydrogen released and this is because H2 is made up of two hydrogen atoms but only one oxygen atom.

Hydrogen is the universe's oldest, lightest, and most abundant element. It is an ultra-light energy driver as a gas, and the only emission released is water vapour. Hydrogen can also be utilized in fuel cells to produce electricity, by chemically reacting with oxygen without generating any pollutants or greenhouse gases. This chemical process produces only pure drinkable water as a by-product. However, the primary application of hydrogen currently is as a feedstock for manufacturing. Hydrogen gas is generally utilized as a feedstock in the (petro)chemical industry, which includes crude oil refining where it is utilised to remove impurities, in chemical production; to upgrade heavy oil fractions, and as a reducing agent in iron production.

Despite its abundance on earth, hydrogen does not exist in huge quantities in its pure form. There are no large deposits of hydrogen that can be collected from the earth. Hydrogen is almost entirely found in compounds, most notably water molecules (hydrogen and oxygen) and fossil fuels (hydrogen and carbon). These chemicals can produce hydrogen with the input of energy. There are two ways to unlock energy from the unlocked hydrogen: (1) it can be burned (2) it could be used to power a fuel cell.

When burned, it may produce heat of over 1000°C while generating no CO2. Furthermore, hydrogen can be used in fuel cells to produce energy by chemically reacting with oxygen, without generating any pollutants or greenhouse gases. Fuel cells work like a battery running on hydrogen and oxygen. They react to supply electricity that could for example power a car. The only by-product is heat and water. Hydrogen is regarded as a much-needed energy supply propellant for countries across Sub-Saharan Africa (SSA), considering that national grids in most SSA Countries cannot fully assure access to electrification in remote and rural areas, given financial and infrastructure limitations. As such, the utilisation of hydrogen could be a plausible alternative for increased electrification in the region.

1.1 Types of Hydrogen

There are different modes of extracting hydrogen from its bonded element. Scientists have associated each method with a colour. Consequently, there are seven (7) different colours of hydrogen namely grey, blue, green, black, pink, turquoise, and yellow hydrogen, each associated with its method of production. Each of these colours will be discussed briefly in this section.

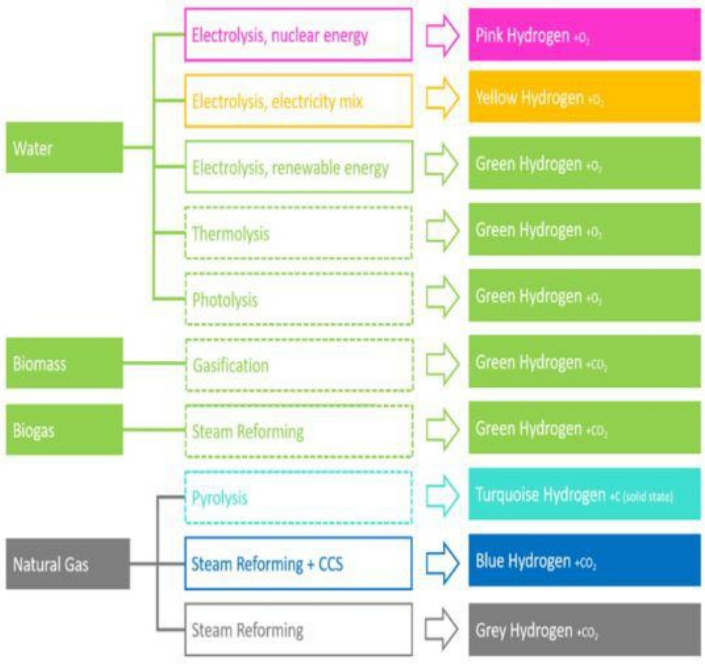


Figure 1. Overview of possible hydrogen production pathways using various technology options and electricity sources. Dashed boxes indicate technologies that are not yet available on an industrial scale.

Source: Lena Maria Rigsgwandi & Ors, Current Legislative Framework for Green Hydrogen Production by Electrolysis Plants in Germany (2022)

- **Grey Hydrogen:** Grey hydrogen is the most common form of H2 and is generated from natural gas, or methane, through a process called “steam reforming”. In comparison with other hydrogen types, except for green hydrogen, grey hydrogen process generates just a smaller number of emissions than black and brown hydrogen-making processes.
- **Black Hydrogen:** Black Hydrogen also referred to as brown hydrogen is considered the most environmentally unfriendly hydrogen type. This is because its production emits carbon dioxide and carbon monoxide which are not recaptured.
- **Blue Hydrogen:** The term blue hydrogen refers to hydrogen produced through steam reforming and the generated carbon is captured and stored underground through the utilisation of carbon capture and storage technology. Due to carbon capture, blue hydrogen is sometimes referred to as carbon neutral.
- **Pink Hydrogen:** Pink hydrogen is created through electrolysis of water, but the electrolysis process is powered by nuclear energy rather than renewables, as is the case in green hydrogen production.
- **Turquoise Hydrogen:** Turquoise hydrogen refers to a way of creating the hydrogen element through a process called 'methane pyrolysis', which generates solid carbon.
- **Yellow Hydrogen:** The term yellow hydrogen refers to hydrogen production through electrolysis of water using solar power. It is also used to refer to hydrogen that is generated through electrolysis of water using mixed sources depending on the availability of the energy source.
- **Green Hydrogen:** Green Hydrogen is produced via electrolysis, by splitting water molecules into their component parts using renewable energy. Green Hydrogen is also referred to as renewable hydrogen because the energy source supports energy supply decarbonization and can contribute to the sustainable development of the economies of SSA Countries.

For countries in SSA like Nigeria, Algeria and Angola that are fossil-fuel dependent economies and possess large natural gas reserves, blue hydrogen is often recommended as a low-carbon option for these countries, as they seek to increase

their integration of clean energy into their fuel mix. Due to its abundant solar, wind, hydro and natural gas resources, Africa can position herself as a potential location for the production and export of climate-friendly hydrogen, based either on renewable electricity (green hydrogen) or natural gas, in combination with carbon capture and storage technologies (blue hydrogen).

Considering the global sustainability agenda, the focus of this toolkit is on green hydrogen. Green hydrogen which is created using renewable energy is best suited for a fully sustainable energy transition. Water electrolysis powered by renewable electricity is the most established technology for manufacturing green hydrogen. Other renewable-based hydrogen production methods are possible, but these technologies are not yet technically mature enough for commercial production.

2.

Hydrogen in Sub-Saharan Africa: A Case Study

Hydrogen has been utilized as an energy source for several decades. The energy resource is produced by electrolysis which splits water molecules. Hydrogen is considered green when renewable energy is used for its production, thus making it a carbon-neutral gas that can be transported through pipelines and storage containers. It has been argued that green hydrogen is the only viable option to reduce greenhouse gas emissions in countries aiming to mitigate the effects of climate change. Essentially, green hydrogen offers developing countries the possibility of producing local clean fuels that can subsequently be used to decarbonize activities, thereby enhancing energy security.

Sub-Saharan Africa is rich in energy resources that can be used to produce hydrogen. Research reveals that in 2022, Africa was host to 62GW of all forms of renewable energy capacity. Countries in Sub-Saharan Africa, like Kenya, Mauritania, Namibia, and South Africa are leading other countries in the region to develop a robust green hydrogen ecosystem. For instance, South Africa has launched a Strategy, known as the Hydrogen South Africa (HySA) that addresses the production of hydrogen. However, this production is for the domestic manufacturing of hydrogen-related technologies and products.

Internationally, there is some awareness and commitment to developing a green hydrogen economy in Africa. The H2Atlas-Africa project, a collaboration between the German government and Sub-Saharan African partners, intends to generate 165,000 TWh per year in West Africa through several initiatives. Germany has also inked collaboration agreements with Namibia and the Democratic Republic of the Congo, in addition to initiatives with South Africa and Morocco.

Green hydrogen that can be produced at a cheap cost can act as a catalyst for improving energy availability and expediting the continent's transition to 100% renewable energy, considering it offers possible storage options for reducing the unpredictability of renewable energy systems. With cleaner renewable energy sources, this will offer more reliable energy supply. For instance, a solar-hydrogen mini-grid that powers 3,000 homes and businesses in Uganda has been deployed as of 2018. The development of green hydrogen may also encourage the deployment of more renewable energy systems, providing communities with more renewable energy generation capacity.

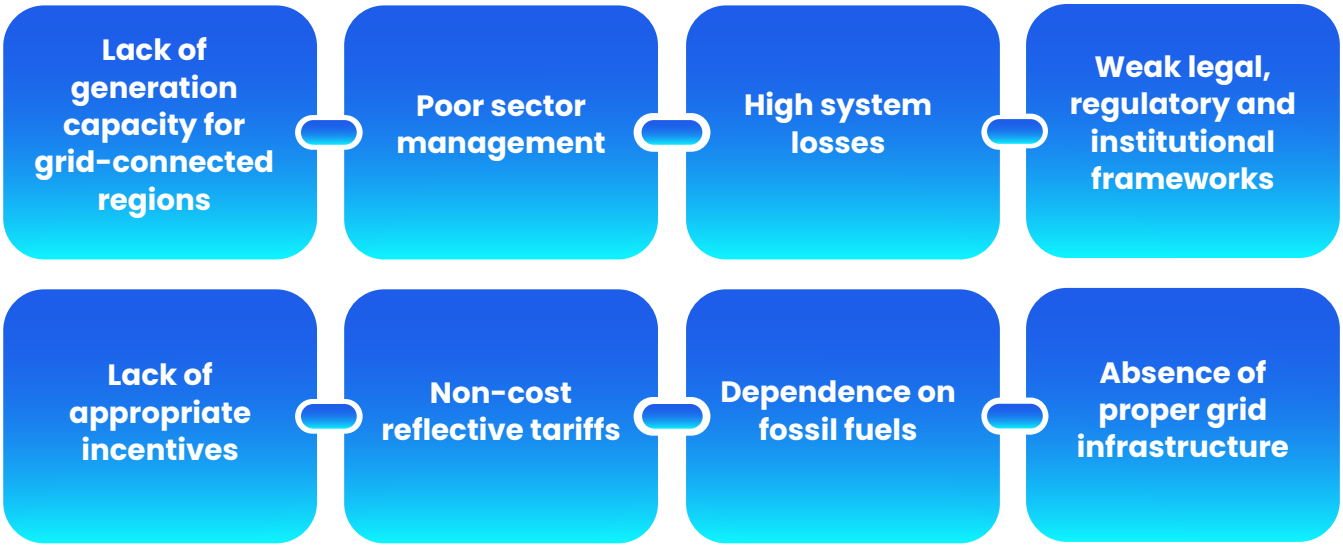
2.1 Hydrogen Potential across Sub-Saharan Africa

The presence of abundant energy resources in the Sub-Saharan African Region positions the region to stand out as a viable location to produce climate-friendly energy sources. For instance, Africa has a large untapped hydropower potential which is mainly located along the Congo and Nile Rivers. It is observed that countries like Nigeria and Angola in the Sub-Saharan Africa region have some of the largest gas reserves in the world. Hydrogen is identified as a potential alternative fuel and an energy carrier for the future power supply. It could help to make the transition away from fossil fuels and towards sustainable energy a reality in Africa.

The use of hydrogen and fuel cells is not common in Sub-Saharan African nations. Although a few applications are being implemented and developed in various nations, theoretical and numerical research has made significant progress in this field. Namibia chose Hyphen Energy as its preferred bidder in early November 2021 to build the nation's first sizable green hydrogen project close to the Tsau Khaeb National Park. The German business Emerging Energy Corporation (EEC) and the government of Niger inked a contract in February 2021 to develop the hydrogen market. The biggest large-scale (10 GW) plant to produce hydrogen can be found in Mauritania, where the Project "Nour" demonstrated in its pre-feasibility studies the production potential of green hydrogen. Senegal has not intervened in the hydrogen technology debate. Nonetheless, some researchers have attempted to create a mechanism for storing hydrogen in a compact, lightweight, and secure container with added functionality.

2.2 Energy Challenges across SSA

More than half of the African population lacks access to electricity. The per capita consumption of energy in Sub-Saharan Africa, excluding South Africa, stands at 181 kWh as of 2017, according to the African Development Bank (AfDB). It should be noted that despite the large potential and capacity of hydrogen in the region, there are still challenges encountered in expanding local access to renewable energy. These challenges include the following:



3.

Case Study of Countries from the Global North and lessons that can be gleaned from their experience(s)

Case study of two countries in the Global North: Japan who aspire to be one of the biggest consumers of hydrogen in the world and Australia who represent the supply side of green hydrogen are considered in this section.

Australia

Australia developed a National Hydrogen Strategy in November of 2019. Australia's Energy and Climate Change Ministerial Council (ECMC) in February 2023 agreed to review the 2019 strategy to ensure that it positions Australia on a path to becoming a global leader by 2030; on both an export basis and for the decarbonisation of Australian industries. This review process is currently on-going. Australia's hydrogen strategy explores Australia's clean hydrogen potential; considers future scenarios with wide ranging growth possibilities; outlines an adaptive approach that equips Australia to scale up quickly; includes showcases from each state and territory in terms of renewable energy and green hydrogen development; and details nationally coordinated actions involving governments, industry, and communities. Australia's strategy extensively spells the journey to becoming a hydrogen powerhouse. The first step in the plan is to build a large-scale clean hydrogen industry which will be achieved by creating hydrogen hubs where users of hydrogen are co-located in metropolitan, regional, and remote areas. The strategy considers the hubs to be key in developing the early stages of the hydrogen industry. It considers that the hubs will make infrastructure more economic, promote efficiencies from economies of scale, foster innovation, facilitate the sharing of expertise and services, and promote sector coupling. In the first phase (already underway as of 2021), the objectives are to: create, test, and prove Australia's clean hydrogen supply chains; encourage global markets to

emerge in line with mutual interests; and build cost-competitive production capability.

Activities in this phase include:

- **Developing supply and demand:** Pilots, trials and demonstration projects which will drive technological development, develop industry expertise, promote international collaboration, enable business model innovation, and prove hydrogen supply chains at scale. Many projects that support this are already in their early stages.
- **Responsive regulation:** Review and reform underpinning regulatory and legal frameworks, to develop consistent approaches for: – efficient supply chains and markets – a supportive investment environment – robust training requirements and safety standards.
- **International engagement:** Develop strategic and coordinated international outreach focused on key markets, to harmonise standards and encourage trade.
- **Skills and workforce:** Improve workforce skills and establish training regimes.
- **Community confidence:** Work with industry to earn the community's trust and build confidence in hydrogen.
- **Innovation and R&D:** Provide targeted support for research and development activities, with a focus on international collaboration and Australian priorities.

Furthermore, the Strategy recognises that government, community, and industry will need to work together to achieve the goal of becoming a leader in clean hydrogen by 2030. As such, the strategy includes a common vision of (1) an environment conducive to investment, through better and consistent regulation (2) helping to build relationships with future country markets and (3) supporting early-stage technology development, until the industry matures. Australia views hydrogen as more than just a climate-friendly fuel, and instead as a crucial element for protecting its national interest revolving around economics. Australia currently generates $70 billion AUD a year exporting coal and LNG to Asia. The inevitable decline of these businesses has long been a divisive political issue in Australia, with strong opposition from climate change advocates.

Thus far, Australia has several hydrogen mega-projects underway with the support of

both government and industry. In Southeast Australia, a $500 million AUD pilot project began producing hydrogen for export in 2021. Both the Australian and Japanese governments have partnered with industry to fund the project. Furthermore, there is also the Asian Renewable Energy Hub, a Hub that intends to build 15 GW of wind and solar generation this decade, making it the world's largest power producing facility behind China's Three Gorges Dam. The electricity would power electrolysers to generate large quantities of hydrogen. Much of this hydrogen would be converted to ammonia for export, while some could be used locally to decarbonize regional steel production. The project plans to begin exporting as soon as 2028, with an initial capital cost of $22 billion AUD. In the long term, plans exist to scale the facility up to 26 GW. Lastly, another project in South Australia aims to build the largest green ammonia plant in the world. Led by an Australian hydrogen company, H2U investments, the project has attracted investment from Mitsubishi Heavy Industries, and plans to commence commercial production by the end of 2022. The total cost of the project is estimated to be $240 million AUD. These significant investments from both the public and private sector reflect the commitment in Australia to the country's developing hydrogen economy.

Japan

Japan, as an island nation with minimal domestic energy capacity and largely driven by its high dependence on imports for its energy resources, commenced investment in hydrogen since at least the 1970s. In a statement by Japan's Prime Minister Yoshihide Suga in late 2020, it was declared that Japan views hydrogen, of which there is inexhaustible deposits, as a new power source. Japan's intention to create hydrogen airplanes and hydrogen cargo ships was also declared at the time. Consequently, 70 billion Yen (837 million CAD) of Japan's resources was devoted to hydrogen development in 2020, with the following set to be nearly 85 billion yen (one billion CAD).

As part of COVID-19 stimulus, Japan further announced an additional 24 billion CAD for a green technology fund, which includes additional funding for hydrogen projects. These streams of funding are focused on specific areas of hydrogen development.

Japan has and continues to invest substantial amounts in fuel cell research and commercialization, expanding hydrogen distribution networks, and subsidies for commercial fuel cell vehicles. As a result of Japan's lack of domestic energy capacity, Japan intends to be a major importer of hydrogen. As such, the first ship in the world

designed to carry hydrogen on the open ocean (the Suiso Frontier built by Japan's Kawasaki Heavy Industries) made its inaugural trip from Japan in December 2021 and arrived in Australia in January 2022. Another Japanese company, Chiyoda, launched a demonstration project shipping hydrogen from Brunei to Japan. Rather than liquefying hydrogen, Chiyoda mixes their hydrogen with toluene to create a stable substance that can be transported using existing ships. The toluene is extracted before end use. Yet another company, Toshiba, opened a new solar power farm in 2020 dedicated solely to hydrogen production. This budding hydrogen supply is used to supply a growing list of demonstration projects funded by the government, including a hydrogen-powered hotel, and a project to blend hydrogen with town gas. Japan has the largest network of hydrogen filling stations in the world, at 135. Nearly 4,000 hydrogen vehicles are currently in service; most are owned by the government, while a few are bought by wealthy, environmentally conscious enthusiasts. The government has ambitious plans to see 200,000 of these vehicles on the road by 2025. While another Japanese company, Toshiba, is also looking into demand for its fuel cells for railroads and ships, and power stations.

Takeaways from the Australian and Japanese Case Study

1. **Understanding the Country's strength:** The case of Australia and Japan illustrate the need to understand the uniqueness of each country in carving a green hydrogen pathway. Australia understands its position as a major energy exporter and the potential that the country possesses to transition into becoming a leading hydrogen exporter. As such, the country's policy and strategy are geared towards developing green hydrogen value chain activities from the generation of renewable energy infrastructure(s) to the development of hydrogen hubs/infrastructures. In this vein, Australia has also taken the approach of building relationships with other countries to facilitate international trade of its green hydrogen resources. On the other hand, Japan understands that its geographical location and capabilities limits its ability to produce green hydrogen on a large scale. As such, Japan's effort is channelled towards building a green hydrogen supply chain and technology for the transportation and utilisation of green hydrogen within its jurisdiction.

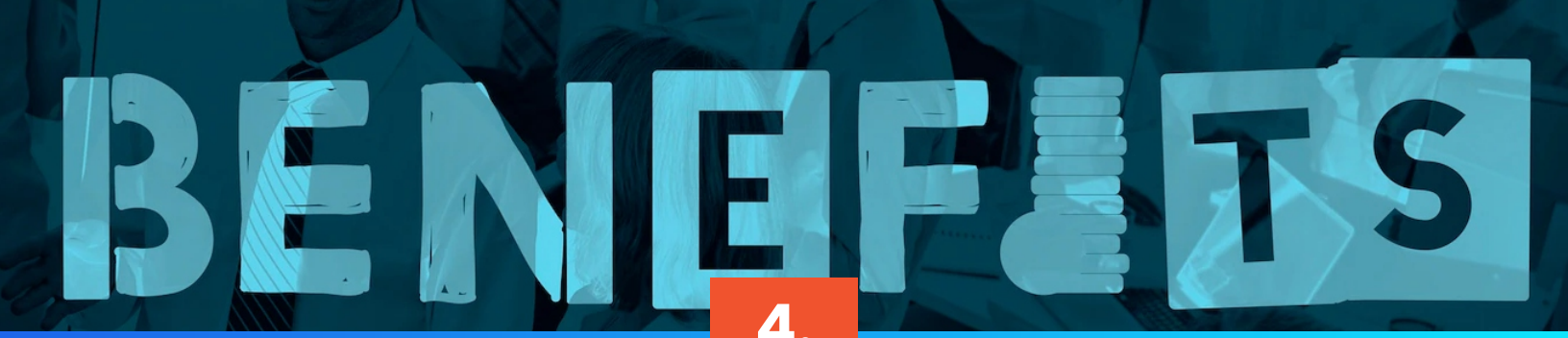
2. **Strategy/Policy Development and Understanding Policies that support Green Hydrogen:** Australia's development of a Strategy reveals the need for the government of a nation who seeks to develop its green hydrogen sector to craft an appropriate plan for the sector. Policy formulation should incorporate stages of development to ensure a progressive and holistic advancement of the sector, as can be gleaned from the experience of Australia. Following Australia's Strategy, several investments have been welcomed from international partners which are aiding the development of Australia's green hydrogen sector. As the penetration of green hydrogen technologies increases and costs come down, policies will have to evolve accordingly.

3. **Build Community Confidence:** Australia's policy recognises the need for government to work in harmony with industry and community to earn the community's trust and build confidence in hydrogen. SSA governments looking to adopt green hydrogen should entrench community confidence building through transparency measures. Not only does this increase the attractiveness of the hydrogen sector for private investments, but it could also garner community support for green hydrogen development.

4. **Innovation and Research & Development (R&D):** Considering that green hydrogen is a novel industry, SSA countries desiring to venture into green hydrogen must give due consideration for R&D and factor R&D into any action plan or strategy for the development of the sector. In the case of Australia, R&D is factored in the national hydrogen strategy, while Japan has extensively developed and continues to develop technologies to power the green hydrogen era. SSA countries must consider the need for innovation through R&D to ensure that technologies for the utilisation of the purported green hydrogen development are locally available and accessible at an affordable rate. Dependence on import where technologies are priced in foreign currency will significantly affect their affordability and steep the pace of adoption of hydrogen.

5. **Status, Drivers, and Barriers:** As submitted by the International Renewable Energy Agency (IRENA) in her Green Hydrogen Policy Guide, the first stage to designing the green hydrogen policy is to determine the status, drivers, and barriers of Green Hydrogen in the respective country. Considering that green hydrogen can be used in many different applications, hydrogen can contribute to

energy security by providing another energy carrier with different supply chains, producers, and markets; this can diversify the energy mix and improve the resilience of the system. The drivers of green hydrogen include the low variable nature of renewable energy, (VRE) electricity costs; etc. As the share of VRE rapidly increases in various markets around the world, the power system will need more flexibility. Broader use of hydrogen can provide such flexibility. As a result, interest in hydrogen is now widespread in both public and private institutions; and Government objectives for net-zero energy systems. The Barriers to Green Hydrogen development include high production costs; lack of value recognition; lack of dedicated infrastructure; energy losses; and the need to ensure sustainability.



4. Benefits of Green Hydrogen for SSA

The use of green hydrogen as an energy source in SSA, regardless of its environmental implications, presents several benefits for SSA, as highlighted below.

4.1 Improving Energy access

Hydrogen is an energy source with the fortune of not being depletable like fossil fuels or uranium resources. It can contribute to electrification in remote areas across SSA and improve overall energy access in SSA countries, and there are already various examples of how hydrogen has been exploited in SSA to promote rural electrification. For instance, in Uganda, a solar–hydrogen powered mini-grid which was initiated in 2018 has already been successfully deployed to power 3,000 households and businesses. Also, in Mali, a natural hydrogen field was discovered in the village of "Bourakebougou" in the northern part of the country in 1987. The quantity of that pure hydrogen at 98% was estimated at 28 x 106 m3H2. In 2013, Mali's first pilot plant was launched, and that natural hydrogen fuelled a power generator to electrify the village. The natural hydrogen extracted from the ground was not stored but directly used as fuel for generator. The project made Mali the first country in Sub-Saharan Africa to exploit natural hydrogen for electrification.

4.2 Carbon Neutrality

A proper exploitation of hydrogen will also contribute to SSA's carbon neutrality, in line with the expectations contained in the Paris Agreement of 2015 and the relevant Nationally Determined Contributions submitted by these countries in pursuance to the Agreement. For example, it has been determined that most power plants in SSA can benefit from integrating hydrogen into their gas turbines (as part of planned upgrades for existing power plants) as doing this will contribute to the capacities of these plants to produce electricity with lower carbon emissions.

Currently, North Africa has the greatest potential for power generation using blue hydrogen from fossils, due to its existing gas power plant infrastructure. It is also recorded that green hydrogen use could also support the path of SSA countries to net-zero emissions, notably in industry (iron and steel industry in South Africa, Morocco, or Mauritania; methanol industry in Nigeria and South Africa), and mobility (as part of a mix of technologies – fuel cells, electric vehicles, biofuels sectors; in public transports as highlighted in South Africa).

Hydrogen has been used as a fuel for decades. It is produced by using electrolysis to split water molecules. When renewable energy is used for its production, the result is green hydrogen, a carbon-neutral gas that can be transported via pipeline and storage containers to where it is required. Hence, through green hydrogen, SSA countries will be offered the possibility of producing a local clean fuel that can be used to decarbonize hard-to-abate sectors, while enhancing energy security.

4.3 International Partnerships with European Union Countries

The large resource potential of hydrogen in SSA has already spurred political engagement with several European Countries, most notably Germany. In 2022, the German government was reported to have partnered with several African countries to develop a Hydrogen Potential Atlas and has committed $45.7 million to the National Green Hydrogen Development Strategy of Namibia. In 2022, Germany and the Democratic Republic of the Congo took up discussions that could see the country relaunch the controversial Inga Dam III project. The government of Niger in February 2022 signed an agreement with German company Emerging Energy Corporation (EEC) to develop a hydrogen market in the country. Germany has also set up so-called Hydrogen Offices in Angola and Nigeria to facilitate dialogue with these fossil fuel-exporting economies.

4.4 Renewable Energy Export

The discovery of hydrogen's potential in SSA provides an opportunity for rising ambitions by SSA Countries to export large quantities of hydrogen from Africa to Europe. For instance, the government of Niger plans that the green hydrogen produced in its territory will be exported to the international market, particularly to Europe and America. Also, the European Union is reportedly working to shift to green hydrogen by 2050, with imports from Africa and other regions forming part of the equation. In March

2022, the European Union announced its commitment to 10 million tonnes of green hydrogen imports per year, as part of the 'RepowerEU' plan to move European countries away from their dependence on Russian gas supplies.

However, whether exportation will be feasible remains an open question, given the constraints around transport infrastructure, water access, in addition to crucial climate-related considerations. Moreover, any strategy to develop hydrogen exports will have to consider the industrial policy ambitions of important European countries or risk losing the goodwill of these key allies.

4.5 Curbing SSA's Economic, Environmental, and Social Challenges

Besides the issue of electrification, SSA countries have many other associated challenges that hydrogen can help remedy, to a large extent. Studies have been conducted to prove this - for instance, in Ghana, hydrogen technology development was dedicated to household cooking fuels (modified green cooking stoves) to improve women's life in their daily activities. The chosen field was guided by the fact that energy for cooking accounts for almost 95% of the household energy use in the country. Following the running of a dynamic simulation by experts to evaluate the potential of solar hydrogen to cover Ghana's cooking demand estimated at 2.5 kWh/day, results exhibited stove efficiency of 60%, corresponding to 4.2 kWh/day, which largely covers the demand.

Also, the economic challenges in SSA countries currently make alternative solutions like hydrogen-based electricity more cost-efficient. Green hydrogen can also increase SSA's renewable electricity market growth potential substantially and broaden the reach of renewable solutions in SSA countries. Hydrogen is a form of by-product from renewable energy that presents SSA countries with an additional option for energy generation, in a bid to overcome energy poverty and support development, without damaging human health or the environment.

4.6 Job Creation

The deployment of green hydrogen will also create job opportunities for many Africans in several years and decades. These potential job opportunities span across the green hydrogen value chain, including renewable electricity generation to power the electrolysers. Illustratively, renewable energy generation present job opportunities for

technicians, project developers, renewable energy equipment manufacturers, critical minerals mining for renewable energy equipment manufacturing (batteries, wind technology and solar PV), maintenance and operation of the renewable energy facility, financer providers and advisers, and supply chain, etc. The green hydrogen facility planned for the Northern Cape region of South Africa is forecasted to create 20,000 jobs by 2030.

5. Challenges to the Exploitation of Hydrogen in SSA

The present challenges to the exploitation of hydrogen in sub-Saharan Africa include the following:

5.1 Resource Curse and Resource Conflicts

The paradox of plenty, another name for the resource curse, is the inability of many resource-rich nations to completely capitalize on their abundance of natural resources and for their governments to adequately address requirements related to public welfare. Natural resource discoveries could lead to better development results, but compared to their less resource-rich neighbours, nations that are wealthy in natural resources frequently have greater rates of conflict and authoritarianism and poorer rates of economic stability and growth. Resource exploitation may have a negative impact on the environment and put further strain on already-scarce natural resources. In the case of green hydrogen development, water is considered a scarce resource as access to clean water remains a dire challenge in the Global South. Furthermore, the construction of renewable energy infrastructure for power electrolysers for green hydrogen production may result in habitat loss, wildlife extinction, and environmental deterioration. In addition to the effects of utilising water for green hydrogen production by splitting the hydrogen element in water from oxygen, renewable energy initiatives also put pressure on water supplies through the utilisation of hydropower for electricity generation.

5.2 Corruption and Lack of Transparency

Transparency is a means to greater accountability and increased level of performance. For instance, higher performance during open bidding auctions has been associated with transparency regarding mineral prospects. It has been revealed that corruption affects large-scale renewable power projects, which are set up to

exclude important stakeholders, thereby negatively impacting local communities. Corruption and lack of transparency have in time past manifested through forced resettlements of local community dwellers for the siting of projects. A typical illustration is the tussle in Kenya which led to the institution of legal action in Kenya's high court between Marsabit County residents and the government over the land on which Africa's biggest wind farm was to be initiated. The project, which the government regards as its ambition for clean and renewable energy and a symbol of its Vision 2030, was inaugurated by President Uhuru Kenyatta in July 2019. It comprises 365 wind turbine generators, each with a capacity of 850 kW. The total wind farm capacity is 310 MW. Five years before the farm's inauguration, the affected communities sued the government for irregular allocation of 150 000 acres of community land in the Sarima area of Loiyangalani District. The land was allocated to Lake Turkana Wind Power Limited for the generation of wind-powered electricity. The action is a source of threat to stability in the area.

To combat corruption, fraud, and bad governance, all of which can prohibit a country from taking advantage of the potential presented by natural resource development, transparency is a vital prerequisite.More knowledge about the operating environments in various nations and the risk associated with their investment is beneficial for those who invest in the extractive industries. Transparency benefits the Government of respective countries by increasing its reputation for investors with subsequent increase in investment, and access to credit and decreased investor risk(s).

5.3 Environmental Impacts

Production of green hydrogen necessitates a significant amount of water, land, and renewable power. One major source of environmental concern is water scarcity and depletion of water reserves. Access to water continues to be a major challenge in Africa. This has led to the United Nation's recognition of access to water as a human right. According to United Nations Children's Fund (UNICEF) about 418million people lack access to a basic level of drinking water in Africa. The use of water to generate hydrogen could significantly deplete the water reserves in Africa, which is a direct environmental impact; further worsening the issue of access to water in Africa.

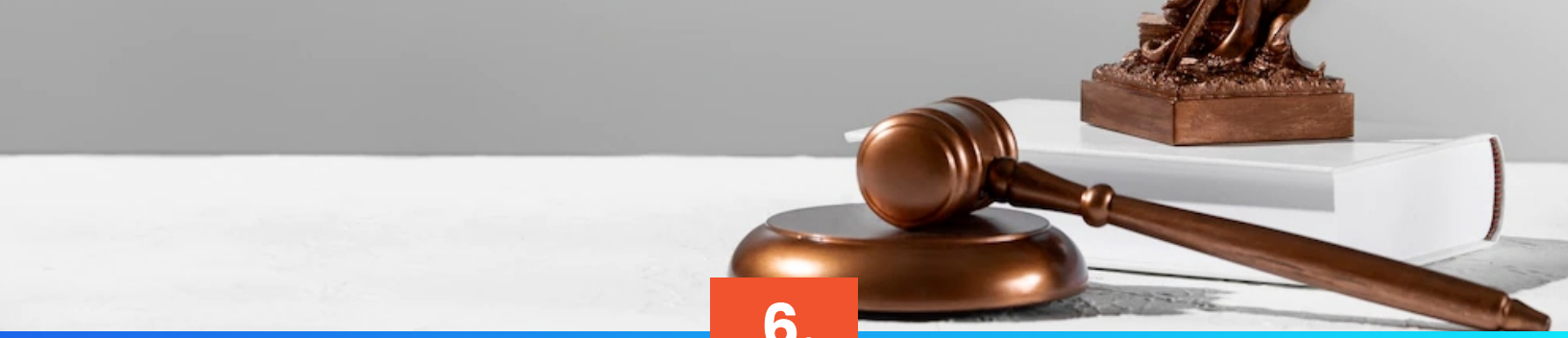
A further environmental impact of green hydrogen production is environmental pollution. The use of seawater for green hydrogen production, having deionised the

water using desalination plants have gained traction as a means of addressing the competing interest between right to water and the use of water for green hydrogen production. However, it has been noted that while the use of deionized water produced by desalination plants may reduce freshwater demand, it generates a need to discharge a stream of brine into the water sources and soils.

Finally, the production of ammonia and methanol (which are green hydrogen-based feedstocks) have been noted to generate waste and often involves the use of catalysts and other chemicals that can be toxic or harmful to the environment, potentially contaminating water sources and soils during production and transportation, if not handled properly. In case of continuous discharge or leaks into water bodies, this may represent an immediate danger to aquatic life, with subsequent impacts on the livelihood of communities depending on it.

5.4 Severe Energy Poverty throughout SSA

Significant energy poverty still persists in many African nations, particularly across Sub-Saharan Africa. If investments in decentralized renewables are delayed and newly constructed renewable capabilities are not also used for the local population's energy supply, investing in export projects to produce green hydrogen and its derivatives might potentially entrench existing energy poverty. This is because of the competing interest between the generation of electricity to advance access to electricity in SSA and the generation of electricity as a means of generating further source of energy (green hydrogen) for export. The framework(s) for the exploitation and use of natural resources in Africa have consistently shown a propensity to favour exportable economic activities against domestic activities. This is evident in the lack of available natural gas for power generation in Nigeria, whereas Nigeria is a major producer and exporter of natural gas. Similarly, there is a likelihood for countries within SSA to support increased renewable energy generation for green hydrogen generation (an exportable resource) as opposed to increased electricity generation for the purpose of powering local communities who may be unable to afford the cost reflective tariffs for such electricity.



6.

Legal and Regulatory Frameworks for Green Hydrogen Production Across SSA

A few select countries within SSA are currently developing green hydrogen facilities. These countries include Djibouti, Mauritania, Namibia, and South Africa; while other countries such as Nigeria have recognised green hydrogen as a renewable energy source within existing legal and regulatory frameworks. This section considers the legal and regulatory framework(s) for green hydrogen development across SSA countries. Considering that green hydrogen is considered a renewable energy source given that it utilises 100% or close to 100% renewable energy to power the electrolyser and the process of green hydrogen production emits only water, the framework for renewable energy generation will apply to green hydrogen development in the various countries across SSA.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
1	**ANGOLA**	• **ANGOLA STRATEGY 2025 (Ae2025):** The AE2025 serves as the power sector's long term vision outline, The Strategy serves as a guideline towards the achievement of certain goals in the power sector, including but not limited to the increased use of renewable energy in the energy mix, and the increased electricity generation capacity to over 9,000 MW by 2025. The Strategy identifies investments in the power sector as crucial to its development.
2	**BOTSWANA**	• **BIOMASS ENERGY STRATEGY 2009** The Strategy was developed under the Ministry of Minerals, Energy and Water Resources of Botswana and is supported by the German Development Corporation (GIZ). It outlines biomass energy demand, woody and nonwoody biomass supply, potential interventions, and a comprehensive strategy for the utilization of biomass energy resources.
3	**BENIN**	• **NATIONAL RENEWABLE ENERGY DEVELOPMENT POLICY (PONADER) 2020-2030** This was adopted to provide new guidelines for the implementation of actions contributing to the implementation of the vision of "renewable energy as a priority source of optimal sustainable satisfaction and national energy needs by 2030". A first for Benin to have a national policy that clearly reflects the government's vision and ambitions for renewable energy for the next ten years.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
4	**BURKINA FASO**	• **ENERGY SECTOR POLICY 2014-2025** The Energy Sector policy serves as the energy policy for the electricity sector of Burkina Faso, defining the energy targets of the energy sector in the State to be achieved by 2025. The policy aims towards the provision of sustainable access for all to energy resources, the increased use of renewable energy resources in the energy mix, and the development of technologies used in supplying energy to households in Burkina Faso. • **DECREE NO. 2019-0902 /PRES/PM/ME/MINEFID/MCIA** This decree establishes the modality of access to renewable energy by auto -producers to the electricity network and the conditions and processes to be followed by relevant stakeholders in the power sector for purchasing excess energy from such auto-producers. • **NATIONAL AGENCY FOR RENEWABLE ENERGIES AND ENERGY EFFICIENCY (ANEREE)** The ANEREE is responsible for the promotion, stimulation, coordination, and facilitation of all operations aimed at the development of renewable energies and energy efficiency.
5	**BURUNDI**	• **NATIONALLY DETERMINED CONTRIBUTIONS (UPDATED 2021)** Burundi's updated NDC includes an unconditional pledge to reduce emissions by 3.04% by 2030, or 12.61% with international support. One of Burundi's adaptation and resilience areas in the NDC is energy. One of the envisaged activities is the utilisation of renewable energy sources. The NDC includes the development of a logical framework to monitor and assess the implementation of the priority mitigation and adaptation actions. Women, youth, indigenous communities, researchers, civil society, and the private sector participated in its revision, helping ensure that the path of climate action in Burundi considers the distinct needs of communities from the ground level up.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
6	**CAPE VERDE**	• **STRATEGIC PLAN FOR SUSTAINABLE DEVELOPMENT (PEDS) 2017-2021** The PEDS provides directives towards the implementation of certain sustainable development-oriented programmes which would help provide a green and better future for all Cape Verdeans. The Plan comprises the state government taking advantage of the great potential Cape Verde has in renewable energy resources, especially in wind and solar energy, for the purpose of reducing the cost of electricity and water, achieving increased energy security and competitiveness in the power sector. • **DECREE-LAW NO. 1/2011** This law provides directives relating to the usage of renewable energy resources by independent operators and self-producers in electricity production. The law contains provisions relating to incentives, access, licensing, and renewable energy exploitation. The law also provides for the drawing up of a Strategic Sectoral Energy Plan on Renewable Energy (PESER) which upholds the increased use of renewable energy resources in energy production.
7	**CAMEROON**	• **CAMEROON VISION 2035** This policy is a strategy programme containing guidelines for the development of Cameroon and certain goals to be met by the State by 2035. The Vision 2035 strategy places energy infrastructure as a significant aspect to the growth of the State and looks to employ renewable energy resources in the increase of electricity production, revitalization of transmission and distribution facilities, and the provision of revenue for the State.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
8	**CENTRAL AFRICAN RRPUBLIC (CAR)**	• **NATIONAL ENERGY POLICY 2010** The National Energy Policy was promulgated by the Ministry of Energy to serve as a guide regarding the nation's energy supply activities. The policy focuses on the adequate provision of energy services to the populace, increased use of renewable energy in the energy sector, and proper administration of energy supply activities.
9	**CHAD**	• **ENERGY MASTER PLAN 2009** The Energy Master Plan significantly notes that Chad has a good potential for renewable energy. Particularly, there are solar resources throughout the country, good wind potential resources in the north and a good biomass potential in the southern zone. The Master Plan highlights the need for rural electrification with great utilization of renewable energy sources. Agency for Renewable Energy Development (ADER) ADER was established in 2012 and is tasked with the responsibility of mobilizing investment for renewables. It participates in the design of the national plan for the development of renewable energy and advises on measures necessary to implement the national strategy for renewable energy development.
10	**COMOROS**	• **NATIONAL ENERGY SECTOR STRATEGY, 2012** The National Energy Sector Strategy defines the energy needs of Comoros and includes within its provisions, the increase of access to public electricity service. The strategy also focuses on the increased use of renewable energy in the fuel mix, and the provision of adequate energy supply services to all within Comoros

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
11	**CONGO (BRAZZAVILLE)**	• **NATIONALLY DETERMINED CONTRIBUTION (NDC) (UPDATED 2021)** Congo's updated NDC introduced an unconditional pledge to cut greenhouse gas emissions by 17.09% relative to business-as-usual by 2025, with a reduction of 39.88% conditional on support. One of the target sectors for adaptation and resilience measures is the energy sector. Congo's NDC envisages the utilisation of renewable energy sources in Congo's energy mix.
12	**CONGO (DEMOCRATIC REPUBLIC)**	• **NATIONALLY DETERMINED CONTRIBUTIONS, 2021** The Democratic Republic of the Congo (DRC) intends to conditionally reduce its greenhouse gas (GHG) emissions by at least 21% by 2030.2 While the DRC has historically been a low emitter, the country's 2021-2023 National Sustainable Development Strategy includes plans to increase the use of renewables and improve energy access, partly through hydropower and solar electricity generation.
13	**COTE D'IVOIRE**	• **NATIONAL ENERGY ACTION PLAN RENEWABLES (PANER) 2016-2030** PANER contains basic data on the national policies for the development of renewable energies and proposes achievable objectives and targets, based on national potentials and socio-economic assessments.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
14	**DJIBOUTI**	• **DJIBOUTI VISION 2035** The Vision 2035 identifies energy access and energy security for its strong population as strategic goals and central to expanding manufacturing and industrial activities. The plan sets forth the ambitious targets of meeting 100% of the energy demand in Djibouti through renewable energy by 2020 • **NATIONAL ELECTRICITY SECTOR STRATEGY AND ACTION PLAN (2014- 2020)** This strategy focuses on the approach, responsibilities, and sources of finance for conventional and decentralised electrification and for promoting renewable energy sources. • **THE GEOTHERMAL ENERGY DEVELOPMENT OFFICE (ODDEG)** ODDEG was established in 2014 under the President's office with the aim identifying the various types of geothermal resources of the country and is vested with the responsibility of carrying out the exploration for geothermal energy resource, alongside the study of the energy resource.
15	**EQUATORIAL GUINEA**	• **NATIONALLY DETERMINED CONTRIBUTION (NDC) (UPDATED 2022)** Equatorial Guinea's NDC include adaptation and resilience action in diverse sectors including infrastructure, health, water etc. The United Nation's Development Programme (UNDP) has assisted the government of Equatorial Guinea in aligning the NDC with the Sustainable Development Goals and reviewing legal frameworks. This support also included guidance on renewable energy policies and capacity strengthening of national institutions engaged in the NDC enhancement and implementation.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
16	**ERITREA**	• **ENERGY POLICY 2009** The Energy policy gives independent power providers the option of generating power using a variety of sources including wind, solar, geothermal, or other state-of-the-art conventional energy technologies. REC is the Renewable Energy Centre of the Eritrean Ministry of Energy and Mines. The department was established in 1995, following independence from Ethiopia in 1992. REC is involved in a range of other renewable energy technologies, including solar photovoltaic systems for schools, health centres and homes, and solar water pumping.
17	**ESWATINI**	• **ENERGY MASTERPLAN 2034** This document builds on the 2003 National Energy Policy, notably to boost the production of energy from renewable sources. As stated in the document, the masterplan seeks to provide national decision makers with the quantitative basis for planning future energy sector development through identifying and addressing the country's distinct barriers in the supply of energy. It uses modelling tools to build its recommendations that include the development of renewable energy options involving the private sector; the creation of a comprehensive distributed power generation plan; and the need to develop policies and regulations to facilitate private sector engagement in rural electrification. It also sets energy efficiency goals.
18	**ETHIOPIA**	• **GEOTHERMAL RESOURCES DEVELOPMENT PROCLAMATION NO. 981/2016 (AS AMENDED BY PROCLAMATION NO. 1204/2020) (GEOTHERMAL PROCLAMATION)** This was enacted as a special legislation that regulates geothermal energy development in the country of Ethiopia. Geothermal Resource Development of Council of Ministers Regulations No. 453/2019 (Geothermal Regulation): This Regulation was enacted to foster the implementation of the Geothermal Resources Development Proclamation No. 981/2016 (as amended by Proclamation No. 1204/2020)

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
19	**GABON**	• **NATIONALLY DETERMINED CONTRIBUTION (UPDATED 2022)** Gabon's unconditional commitment it its updated NDC is to attain a carbon-neutral economy up to and beyond 2050. With international support, the country pledges to continue to act as a "net carbon sink" by maintaining its net carbon absorption of at least 100 million tCO2eq per year beyond 2050. UNDP's climate promise is helping Gabon's NDC through the establishment of adaption and resilience action in sectors including the energy sector.
20	**GAMBIA**	• **ENERGY POLICY 2005** The Energy policy of 2005 sets the objectives for the government of the energy sector and aims for the deployment of renewable energy resources in the electricity sector. It provides a roadmap for the electricity sector in the country. • **RENEWABLE ENERGY ACT 2013** The Renewable Energy Act promotes the use of renewable energy resources to achieve better electricity productivity thereby reducing the utilization of fossil fuels, greenhouse gas emissions and the demand burden on the NAWEC. The Act established the Renewable Energy Fund and provides incentives for renewable energy facilities and rules for Feed-In-Tariff.
21	**GHANA**	• **RENEWABLE ENERGY ACT, 2011** The Renewable Energy Act of 2011 was promulgated to serve as the threshold provision for the augmentation of renewable energy use in the energy mix. The Act stipulates regulations on the utilization of renewable energy resources in electricity production; and provides for a Renewable Energy Fund which would help in the promotion and execution of renewable energy development projects.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
22	**GUINEA**	• **NATIONAL ENERGY DEVELOPMENT POLICY, 2012** Guinea has in place, a National Energy Development Policy which seeks to guarantee the availability, quality, and reliability of electricity supply to contribute to the provision of social services, social transformation, and poverty reduction; and the promotion of renewable energy utilization and energy efficiency programs to reduce the dependency on fossil fuels and enable exports.
23	**GUNIEA BISSSAU**	• **NATIONAL ACTION PLAN FOR THE RENEWABLE ENERGY SECTOR (PANER) OF GUINEA-BISSAU PERIOD 2015-2030** This National Action Plan for the Renewable Energy Sector (PANER) of Guinea-Bissau for the period 2015-2030 was developed within the framework of an ECOWAS regional process. PANER includes baseline data on the current state of renewable energies, and proposes achievable targets based on the assessment of RE potential and socioeconomic conditions, including disaggregated indicators. In addition, an overview of the laws, incentives, and measures to be implemented in the country, with a view to achieving the established goals, was included. National Institute for Applied Research and Technology (INITA) The National Institute for Applied Research and Technology is placed under the supervision of the Ministry of Energy, Industry and Natural Resources and is responsible for promoting and coordinating research into technological advancement and resource development, particularly the development of renewable energy resources.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
25	**LESOTHO**	• **LESOTHO ELECTRICITY AUTHORITY ACT NO.12 OF 2002 AMENDED BY LESOTHO ELECTRICITY AUTHORITY (AMENDMENT) ACT, 2006 AND 2011** This Act established the Lesotho Electricity Authority who is responsible to, inter alia, monitor and enforce technical standards; oversee all contractual arrangement; resolve disputes; facilitate efforts to expand rural electrification and aid with analytical aspects of tariff setting and collection process for off-grid electrification. The Act also provides with respect to licensing of "regulated activities" in the electricity sector and related matters. Regulated activities in the sector are the generation, transmission, and distribution of electricity. In exercise of its duty, the Authority shall have regard to environmental standards. • **LESOTHO ELECTRICITY AUTHORITY (APPLICATION FOR LICENCES) RULES, 2012**: This Regulation relates to procedures for obtaining a licence to generate, transmit, distribute, supply, or import and export electricity from the Lesotho Electricity Authority. An application for a licence shall be accompanied by a summary providing the effect of the business on environment and human health. The Authority shall, within fourteen days of receipt of the application made pursuant to rule 3, publish a notice in respect of the application. Such notice shall contain information on likely effects of the business on the environment and human health. An environmental impact assessment licence shall be providing for an operational authorisation or permit.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
	LESOTHO	• **LESOTHO ENERGY POLICY 2015-2025** Lesotho's Energy Policy 2015-2025 was made with the vision that energy shall be universally accessible and affordable in a sustainable manner, with minimal negative impact on the environment. Policy Statement 4 indicates that the Government will improve access to renewable energy services and technologies. Policy Statement 14 provides that the Government will create an enabling environment that will attract investment and financing at all levels of the energy sector value chain. The Strategies include the creation of an enabling environment that encourages investment in the energy sector which may include facilitating the establishment of international/local and/or public/private partnership and Renewable Energy Feed-In-Tariffs (REFIT) programme; Reduced levies and taxes on imported components of renewable energy systems such as solar panels, hydro/wind turbines and solar collectors, etc. • **LESOTHO RENEWABLE ENERGY POLICY, 2013** The objectives of the Lesotho Renewable Energy Policy are to enhance the energy security of Lesotho by reducing reliance on fossil fuels and imported electricity; enhance the access to modern energy for rural and decentralised areas of Lesotho; and ensure the protection of the environment through reduction of Greenhouse Gas (GhG) emissions from the energy sector in Lesotho and prevent other related environmental damages.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
26	**LIBERIA**	• **THE NEW 2015 ELECTRICITY LAW OF LIBERIA** The purpose and scope of the 2015 Electricity Law is to establish the legal and regulatory framework for the generation, transmission, distribution, and sale of electricity within the territory of the Republic of Liberia, and the import and export of same. This law aims to facilitate the implementation of the National Energy Policy whose goals include but are not restricted to the following: • Expand on a sustainable basis the availability of electricity services with the goal of attaining universal access to electricity service. • Promote the development of renewable energy resources for electricity generation. • Encourage efficient use of electricity resources and facilitate economic development. • **RURAL AND RENEWABLE ENERGY AGENCY (RREA) ACT, 2011** Liberia established a wholly government owned autonomous Rural and Renewable Energy Agency (RREA) dedicated to the commercial development and supply of modern energy services to rural areas with an emphasis on locally available renewable resources. The objectives of the RREA as specified in the proposed Act creating it are as follows: (a) To promote improved access to modern energy services in the rural areas of Liberia. (b) To facilitate and accelerate the economic transformation of rural Liberia by promoting the development and supply of modern energy products and services to rural areas with an emphasis on locally available renewable resources. (c) To introduce and promote the enactment of regulations and policies in the exercise of the functions of the Agency. (d) To administer, secure, enforce, design, and execute policies, strategies, plans, and programs relating directly and indirectly to the functioning, growth, and development of the rural energy sector.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
	LIBERIA	The institutions in the electricity sub-sector in Liberia comprise: the Ministry of Lands, Mines and Energy (MLME), The Department of Energy (DOE), MLME; Energy Regulatory Board (ERB) and Liberia Electricity Regulatory Commission (LERC); the Liberia Electricity Corporation (LEC) and the Rural and Renewable Energy Agency (RREA) • **NATIONAL ENERGY POLICY FOR LIBERIA, 2009** Liberia has a Vision ("Liberia RISING 2030") aiming for Liberia to become a Middle-Income Country by the year 2030, this includes, and proposes the targets of 70% of Monrovia to be connected to the electricity grid and 35% of the rural areas of Liberia connected to mini-grids/isolated, stand-alone units by 2030. The Government, through the Ministry of Lands, Mines and Energy (MLME) in May 2009 adopted its energy strategy and relevant targets (access, capacity, generation, energy security) in the National Energy Policy for Liberia (NEPL), an Agenda for Action and Economic and Social Development with the technical and financial assistance from USAID. The principal objective of the National Energy Policy was to ensure universal access to modern energy services in an affordable, sustainable, and environmentally friendly manner in order to foster the economic, political, and social development of Liberia. • **NATIONAL RENEWABLE ENERGY ACTION PLANS (NREAPS), 2015-2020/2030** The objective of this policy is to increase national awareness on renewables and energy efficiency and remove barriers to investment and market development through a national policy instrument. Information and awareness raising campaigns and programmes, and planned revisions of at least once every five (5) years will be undertaken with the expectation that every community will be aware of energy management, conservation and efficiency measures and requirements in all sectors.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
27	MADAGASCAR	• **LAW NO. 2017- 020 OF 10 APRIL 2018 ON THE ELECTRICITY CODE IN MADAGASCAR** To achieve the objective of access to electricity for 70% of households by 2030, the new law puts in place tools that aim at improving governance and to reassure investors. The Act benefits small projects through a simplified regime, with a simple declaration for hydroelectric installations that produce less than 500 kW, wind farms that are less than 250 kW and solar installations that are less than 150 kW. The Law includes a certain number of incentive measures in favour of green energy. A new notion, that of the "green supplier", relates to those suppliers of electricity produced from renewable energy, and accords them a favourable tax status. • **NATIONAL ENERGY POLICY, 2016** Aims to increase the share of renewable energy in the country's energy mix to 85% by 2030, with a particular focus on wind and solar power. This ambitious target is supported by various international organizations, such as the World Bank and the African Development Bank, which have provided funding and technical assistance for renewable energy projects in Madagascar. There is no specific renewable energy policy in Madagascar. However, one of the key objectives of the Ministry of Energy is to increase the electricity access rate, and make it affordable to the population, through tapping the renewable energy potential of the country, thus offering a guarantee of sustainability. Madagascar is aiming for 85% of power generation to come from renewables by 2030, consisting of 75% hydro, 5% solar and 5% wind.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
28	**MALAWI**	• **ENERGY REGULATION ACT, 2014** **The Electricity Act regulates conditions for issuing licenses for engaging in the business of generation, transmission, wheeling, distribution, sale importation and exportation, use and safety of electricity in Malawi.** The Law empowers the Malawi Energy Regulatory Authority to issue or not issue licenses for engaging in the electricity business. According to the Act, rural electrification means grid and off grid extension of distribution lines and installation of solar photovoltaic systems, generation of electricity from mini- and micro-hydro with internal rates of return of up to 6% per annum and line capacity less than 66KV and/or generation capacity up to 5MW. The Act states that the regulatory authority shall prescribe special and less onerous licensing regulations in respect of applications for rural electrification. • **NATIONAL ENERGY POLICY, 2018** The overall goal of the Energy Policy is to provide a guiding framework for increased access to affordable, reliable, sustainable, efficient, and modern energy for all sectors and every person in the country. Policy Priority Area 1.5 focuses on Electricity from Renewable Energy (RE). The Policy recognizes that Malawi is well endowed with renewable energy resources including good sunshine throughout the year for photo-voltaic and photo-thermal applications, reasonable wind speeds for water pumping and power generation, several perennial rivers with hydro power potential, reasonably large quantities of biomass materials for electricity generation and hot springs for geothermal power generation. Thus, the Policy aims to strengthen the exploitation of renewable energy resources through the integration of inclusive renewable energy utilisation into the Integrated Resource Plan, promulgating and regularly reviewing standards for Renewable Energy Technologies (RET) products, especially Solar PV and Pico Solar Products.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
	MALAWI	The Policy also aims to promote use of renewable energy technologies and manufacture of renewable energy products such as solar panels through expediting assessment and development of renewable energy resources such as geothermal, solar, wind and biomass; Adopting a Renewable Energy (RE) strategy that promotes RE through incentives to new players; Establishing fiscal incentives for renewable energy using existing funds such as the Rural Electrification Fund; Developing a strategy for public awareness campaigns on renewable energy technologies targeted at rural, urban and peri-urban consumers and focusing on availability, benefits, and suppliers; and Promoting RET products for vulnerable and marginalized groups. etc
29	**MALI**	• **NATIONAL ENERGY POLICY (PEN), 2006** The policy's guiding principles are based on decentralization, liberalization, a programmatic and participatory approach, competitiveness, and the implementation of Public Private Partnerships (PPPs). The PEN constitutes a tool for, amongst others, ensuring a better balance between energy supply and demand with a view to improving access to electrification and reducing geographic imbalances between the grid and off-grid areas covered. • **NATIONAL STRATEGY FOR THE DEVELOPMENT OF BIO-FUEL, 2008** The National Strategy for the Development of Biofuel was adopted in June 2008. It aims, firstly, at enhancing affordable local energy production through the development of biofuels to meet the country's socio-economic needs. Secondly, it aims to reduce the country's dependency on oil imports. • **NATIONAL CLIMATE CHANGE POLICY AND A NATIONAL CLIMATE CHANGE STRATEGY, 2011** The National Climate Policy and the National Climate Change Strategy of Mali integrate Renewable Energy into their action plans.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
	MALI	• **FRAMEWORK FOR RURAL ELECTRIFICATION, 2021** This framework led to the creation of Agence Malienne pour le Développement de l'Energie Domestique et l'Electrification Rurale (AMADER, a rural electrification policy), with a mandate to promote rural energy services and household energy. The REF to promote rural energy access was set up in 2000 and has been managed by AMADER since 2005. The Government of Mali (GoM's rural energy access agenda aims to create an enabling environment to attract private energy service companies to rural energy service delivery schemes, by facilitating access to the Renewable Energy Fund (REF). The REF aims to (i) make rural electrification projects commercially viable; (ii) allow cost reflective and affordable tariffs for the country's rural population; (iii) utilize subsidies to buy down capital investment costs; and (iv) promote PPPs.
30	**MAURITANIA**	• **NATIONAL STRATEGY 2020** In 2020, Mauritania in collaboration with the European Union launched a national strategy which has been adopted by Mauritania to transform its energy sector and aims to increase the share of renewable energy in its energy mix to 60% by 2030.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
31	**MAURITIUS**	• **ELECTRICITY ACT, 2005** The Act defines generation broadly as the conversion of any form of energy into electrical energy, which includes renewable energy and provides for the issuance of licenses for the provision of electricity services. • **MAURITIUS RENEWABLE ENERGY AGENCY ACT, 2015** The Act established the Mauritius Renewable Energy Agency with the aim of (a) promoting the adoption and use of renewable energy with a view to achieving sustainable development goals; (b) advising on possible uses of liquid natural gas; (c) creating an enabling environment for the development of renewable energy; (d) increasing the share of renewable energy in the national energy mix; (e) sharing information and experience on renewable energy research and technology; and (f) fostering collaboration and networking, at regional and international levels, with institutions promoting renewable energy. • **MAURITIUS RENEWABLE ENERGY ROADMAP 2030** Renewable Energy Roadmap 2030 was launched by the Ministry of Public Utilities in 2019 to chart a way to achieve a target of 35% of renewable energy by 2025. It also includes energy scenarios to meet 40% of renewable energy by 2030. The renewable energy target in the energy mix was revised from 35 % to 60% by 2030 together with the phasing out of coal in the generation of electricity. To achieve a target of 60% by 2030, Mauritius' Central Electricity Board (CEB) has launched several RE Schemes and Request for Proposals, in line with the provision of the RE Roadmap.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
32	**MOZAMBIQUE**	• **LAW 12/2022, OF JULY 11** The law regulates the entire chain of energy generation, from production, storage, transport, distribution, commercialisation, to the consumption of energy, while also touching on import and export issues. The production, storage, transportation, distribution, sale, import and export of electricity are all regulated activities. The regulation of the sector is split between the government and an independent regulator, the Autoridade Reguladora de Energia or simply ARENE. • **INTEGRATED POWER SECTOR MASTER PLAN, 2018** The central goal of national strategies in Mozambique is to achieve countrywide energy access by 2030. The objective of the Integrated Power Sector Master Plan is to formulate a comprehensive "National power system development master plan" for 25 years including power generation, transmission, and distribution planning 2) To familiarize the formulated master plan to relevant government agencies and conduct technical transfer concerning the planning. • **MOZAMBIQUE RENEWABLE ENERGY PLAN, 2022** The Plan itemized the Centralized Options as one of the options for modern sources of power that can be used for "centralized" power production and fed into both the Mozambique and SAPP grids. All these options have a "scalability" advantage over large dams: they can be brought on in increments that match growth patterns in energy use, and without incurring huge debt over long periods. They include Biomass steam cogeneration; Pico-, Micro- and Mini-Hydro; Wind farms; Concentrating solar; and Other Potential Grid Supply Options.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
33	**NIGER**	• **NATIONALLY DETERMINED CONTRIBUTIONS, 2021** Niger's NDC introduced an unconditional pledge to cut greenhouse gas emissions in the Energy sector by 11.20% by 2025 and 10.60% by 2030 relative to business-as-usual. In addition, there is a target to of 48% and 45% emission reduction in the energy sector for the same target years (conditionally). This plan envisages the utilisation of renewable energy sources. UNDP's climate promise is currently helping Niger in this regard in sectors including the energy sector.
34	**NIGERIA**	• **ELECTRICITY ACT, 2023** The Act recognises generation of electricity from renewable sources. The Act also imposes an obligation on Nigerian Electricity Regulatory Commission (NERC) and the Independent System Operator (ISO)to promote electricity generation from renewable energy sources with the possibility of Renewable Obligations on distribution and supply licensees. The Act further incorporates the Rural Electrification Agency. • **NERC MINI GRID REGULATION, 2016** This regulation provides for the grant of permits and license rights to develop mini-grid or isolated mini-grid projects. • **NIGERIA RENEWABLE ENERGY MASTER PLAN, 2013** The Renewable Energy Master Plan (REMP) seeks to increase the supply of renewable electricity from 13% of total electricity generation in 2015 to 23% in 2025 and 36% by 2030. Renewable electricity would subsequently account for 10% of Nigeria's total energy consumption by 2025.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
35	**NAMIBIA**	• **NATIONAL RENEWABLE ENERGY POLICY, 2017** This policy seeks to provide access to modern, clean, environmentally sustainable, and affordable energy services for all Namibians. It aims to boost public and private investments in renewable energy projects, create an enabling regulatory and economic environment for the sector, promote connected and off-grid schemes, pursue climate resilience in the energy sector, and accelerate the development of energy storage facilities. The policy recommends the government to consider a subsidy framework. Solar, wind, or invader- bush based bioenergy are sources primarily favoured, considering that the hydropower sector is subjected to high climate change uncertainty.
36	**RWANDA**	• **RWANDA ENERGY POLICY, 2015** The Rwanda Energy Policy (REP, 2015) highlights measures that need to be undertaken to promote energy efficiency through a combination of approaches such as regulations, new codes and standards, introduction of economic incentives such as subsidies for installation of solar water heaters, industrial end-users undertaking energy efficiency audits, barrier removal programmes such as examining systemic disincentives or reducing split incentives for energy-efficient technologies in buildings and pursuit of bulk procurement strategies such as the importation of light-emitting diode (LED) lamps.
37	**SAO TOME AND PRINCIPE**	• **NATIONAL RENEWABLE ENERGY AND ENERGY EFFICIENCY ACTION PLANS FOR SÃO TOMÉ AND PRÍNCIPE 2021-2030/2050** The Plan recognizes that the sustainable industrial and socio-economic development of São Tomé and Príncipe (STP) is heavily dependent on reforming the energy sector and transitioning from an almost complete reliance on fossil fuels to renewable energy (RE), coupled with energy efficiency (EE). However, introducing RE and EE products and services into the market is hampered by a wide range of demand-side and supply-side barriers, which need to be addressed simultaneously. The NREAP and NEEAP propose a set of targets and measures to be implemented by 2030 and 2050.

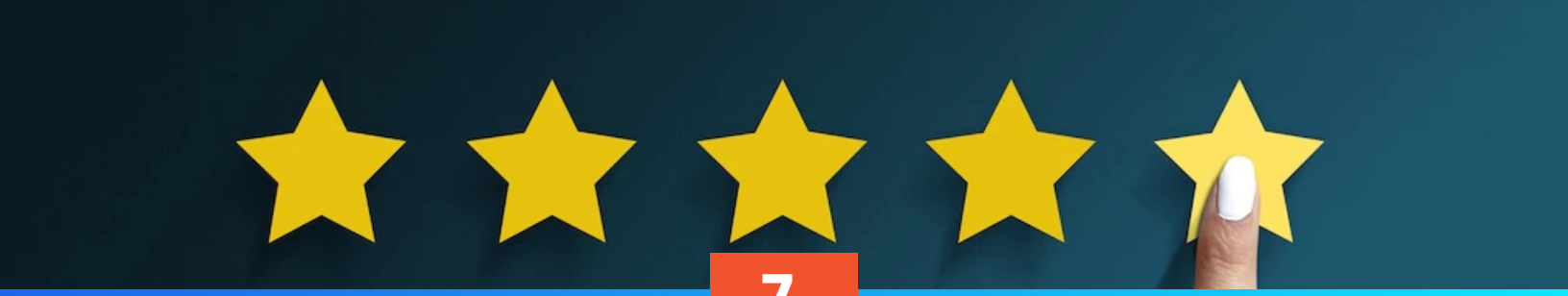
S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
38	**SENEGAL**	• **THE ENERGY POLICY OF THE REPUBLIC OF SENEGAL, 2018** The objective pursued by the Government in the electricity sub-sector is to ensure the availability of quantity and quality of electrical energy, competitive and produced from a variety of technologies including, notably, coal, gas, hydroelectricity to wind power and solar energy. The Government considers that the construction of low-cost production facilities, such as coal-fired power plant, is an essential step in achieving the short-term objectives of the PSE and the development of the country.
39	**SEYCHELLES**	• **NATIONAL CLIMATE CHANGE STRATEGY AND NATIONALLY DETERMINED CONTRIBUTION (NDC), 2021** Seychelles pledges to reduce its economy wide absolute GHG emissions by 21.4% in 2025 and 29.0% in 2030 relative to baseline emissions subject to international support (GoS, 2015). The legislated targets of renewable energy consumption are set at 5% by 2020 and 15% by 2030, as outlined in the 2010 Energy Policy (GoS, 2010). Additionally, the Seychelles Sustainable Development Strategy (SSDS) 2012-2020 incorporates national priorities for sustainable development and formulates guiding principles for the energy and transport sector (GoS, 2012).
40	**SIERRA LEONE**	• **RENEWABLE ENERGY POLICY OF SIERRA LEONE, 2016** The Government of Sierra Leone is setting as its target 4,703 Ktoe/annum (79.7%) and 8,950 Ktoe/annum (84%) of renewable energy contribution to final energy consumption by 2020 and 2030 respectively, to be produced mainly from biomass, solar, hydro and wind.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
41	**SOMALIA**	• **NATIONALLY DETERMINED CONTRIBUTION, 2021** Somalia generally lacks nationwide energy planning. Mini power grids mostly rely on diesel generators and, to operate, these generators demand diesel at their dispersed power plants. The Nationally Determined Contributions communicated by Somalia sets an ambitious emissions reduction target of 30% below business-as-usual by 2030, conditional on international public and private support. However, there are no cogent plans for the integration of renewable energy in the NDC.
42	**SOUTH SUDAN**	• **NATIONALLY DETERMINED CONTRIBUTIONS, 2021** South Sudan's NDC envisages the use of waste as a resource for energy generation.
43	**SOUTH AFRICA**	• **INTEGRATED RESOURCE PLAN (IRP), 2019** The updated IRP 2019 indicates the planned decommissioning of 11.5 gigawatts (GW) of old coal-fired power plant, and a major new-build comprising 14.6 GW of utility-scale wind, 6.0 GW of utility-scale solar photovoltaic (PV), and about 5 GW of distributed self-generation by electricity consumers, all complimented by 3 GW of gas- or diesel-fired power, and 2 GW of battery storage. In addition, IRP 2019 incorporates a "smoke and mirror" provision to appease various stakeholder groupings, such as 1.5 GW of new coal-fired power, 2 GW of hydropower imports and 1.8 GW of nuclear power.
44	**SUDAN**	• **NATIONALLY DETERMINED CONTRIBUTIONS (NDC) (UPDATED 2022)** Sudan's NDC indicates a commitment to reduce greenhouse gas emissions by 38% in the energy sector. The revised NDC also identifies agriculture as a key adaptation priority and proposes scaling-up more efficient irrigation systems powered by renewable energy. Renewable energy utilisation is a key component of this agenda.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
45	**TANZANIA**	• **NATIONAL ENERGY POLICY, 2015** Tanzania's National Energy Policy, 2015 was created to address the lingering energy challenges and achieve the desired policy objectives. The Government formulated the National Energy Policy, 2015 to further enhance provision of adequate, reliable, and affordable modern energy services to Tanzanians in a sustainable manner.
46	**TOGO**	• **NATIONALLY DETERMINED CONTRIBUTIONS (NDC) (UPDATED 2021)** Togo's NDC expanded the economy-wide emissions reduction target in the updated NDC, from 11.14% to 20.51%, relative to business-as-usual by 2030, with another 30.06% conditional on support. Togo's adaptation and development measures are key priorities under Togo's NDC, with targets including 100% rural electrification by 2030. This envisages the utilisation of clean energy solutions.
47	**UGANDA**	• **RENEWABLE ENERGY POLICY, 2007** The Government's overarching policy vision for renewable energy is to make modern renewable energy a substantial part of national energy consumption, where modern renewable energy is understood to mean renewable energy resources that are transformed into modern energy services like electricity. To achieve its goal, several supporting objectives are identified. These include: maintaining and improving the responsiveness of the legal and institutional framework to promote renewable energy investments; establishing an financing and fiscal policy framework for investments in renewable energy; increasing public awareness in renewable energy and promoting investment in this area; promoting research and development and international co-operation in renewable energy technologies (RETs); utilizing biomass energy efficiently and sustainably; and promoting the conversion of municipal and industrial waste to energy.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
48	**ZAMBIA**	• **MINI GRID REGULATION, 2018** This regulation provides for Mini-grid Licences with defined geographical areas and licence conditions based on installed capacity; conditions for application and considerations for award of licenses; provides for Willing Buyer / Willing Seller model; all Renewable Energy sources (e.g., Hydro, PV, Wind, Bio) and technical requirements depend on installed generation capacity. • **RENEWABLE ENERGY STRATEGY AND ACTION PLAN, 2022** The Action Plan itemises its vision as the scaling-up of Renewable Energy in Zambia to enhance wide access to modern energy services, improved national energy security, increased sustainable national economic productivity and socioeconomic development. This Action plan provides for Zambia's RE targets which aims to add about 2,015MW of grid-connected RE to current generation including 1,383MW of hydro, 500MW of solar, 130MW of wind and 2.2MW of geothermal power and off grid RE targets of 4,829 million Zambians to mini-grids or 19.1% of the population, with 1,851 GWh by 2030. In addition, it aims to connect 7,999million Zambians to SHS, or 31.6% of the population, with 35 GWh by 2030.

S/N	COUNTRY	RENEWABLE ENERGY LAWS, REGULATIONS, POLICIES, AND INSTITUTIONAL FRAMEWORK
49	**ZIMBABWE**	• **ENERGY REGULATORY AUTHORITY ACT (CHAPTER 13:23) (ZERA ACT), 2011** Energy Regulatory Authority Act (Chapter 13:23) (ZERA Act), which establishes the Zimbabwe Energy Regulatory Authority (ZERA), has a statutory definition of renewable energy. Renewable energy is defined in the ZERA Act as "energy generated from natural resources such as sunlight, wind, rain, water, tides, geothermal heat, plants, and biomass which are naturally replenished, and "renewable energy source" shall be construed accordingly. • **RURAL ELECTRIFICATION FUND ACT (CHAPTER 13:20), 2002** The Rural Electrification Fund (REF) was established in terms of the Rural Electrification Fund Act (Chapter 13:20). The Rural Electrification Agency (REA) was established under this Act. Among other things, REA is responsible for ensuring that rural areas, with an electricity penetration rate of *circa* 13%, have access to electricity, especially through the deployment of off-grid solar solutions. REA is also responsible for developing the grid infrastructure in rural areas to ensure that electricity reaches even the most remote parts of the country. • **NATIONAL ENERGY POLICY, 2012 (NEP)** The NEP recognised the importance of developing a comprehensive renewable energy policy to enhance the contribution of renewable energy to the overall energy supply in Zimbabwe. • **NATIONAL RENEWABLE ENERGY POLICY, 2019 (NREP)** NREP sets out in detail the ambitious targets of the government in the development of renewable energy and its contribution to the overall electricity supply in Zimbabwe. NREP defines "renewable energy" as referring to "small hydro (equal to or less than 30MW), solar, wind, geothermal, biofuels and biomass and other such clean energy sources approved by the Ministry responsible for Energy in Zimbabwe".



7. Recommendations for the development of a Green Hydrogen Economy across SSA

This toolkit has portrayed both the prospects and challenges of using hydrogen, specifically green hydrogen as an energy source in SSA countries. It is on this premise that the following recommendations are proffered:

7.1 Policy Approaches

According to International Renewable Energy Agency (IRENA), transitioning green hydrogen from a niche player to a widespread energy carrier will require an integrated policy approach to overcome initial resistance and reach a minimum threshold for market penetration. Policies play a central role in the development of any sector of the economy through the provision of improved macroeconomic conditions and free market supply-side policies including privatisation, deregulation, lower taxes, less regulation to stimulate private sector investment, etc. The development of a thriving the green hydrogen sector in SSA will largely depend on policy development. Countries can promote market forces that incentivise green hydrogen development through policies. In this light, IRENA recommends that policy approaches should have four central pillars. These four central pillars which are itemised below are of crucial importance even in the context of green hydrogen development across SSA.

7.1.1 National Hydrogen Strategy: As a starting point, it is important that each country defines its green hydrogen ambition or targets and the required level of support that it needs to achieve such target, in addition to the country's desired pathway for achieving the target. This defined hydrogen strategy for example is reflected in Australia's hydrogen policy. Australia's policy clearly defines its ambition to be the hub for hydrogen export in 2050. This target in addition to other policy measures have seen private investments in Australia's hydrogen development. Japan's Basic Hydrogen Strategy targets commercial scale green hydrogen capacity of 300,000 tons of hydrogen annually.

7.1.2 Policy Priorities: As has been noted in a plethora of research, hydrogen is considered a fuel of the future because of its ability to power processes that other renewable energy sources whose utilisation depends on the conversion of the harnessed energy to electricity may not be able power. For example, renewable energy sources such as solar and wind energy rely on the renewable energy equipment such as wind turbines and solar systems, to convert the harnessed energy from the sun and wind to electric energy, before it can be utilised; unlike hydrogen that can be used directly to fuel and power processes. Nonetheless, it has been noted that green hydrogen policies should identify and focus on applications that provide the highest value. The International Energy Agency (IEA) in its report tagged "The Future of Hydrogen" identified four value chains that offer "springboard opportunities to scale up hydrogen supply and demand". These areas can be regarded as applications that provide the highest value. They include the application of hydrogen in the transport, building and power sectors.

7.1.3 Guarantees of Origin: The recent drive for hydrogen development and utilisation is largely based on the transition to clean energy sources. As noted within this toolkit, hydrogen comprises of different colours and each colour represents the processes through which the hydrogen is produced for end-use. Although each hydrogen type is named by a colour, the physical content of all hydrogen type is the same. As such, they cannot be differentiated by the end-produce. For this reason, guarantees of origin are important to assure the purchaser of the green hydrogen produce that the hydrogen has been produced in a climate friendly manner and therefore can be classified as green or environmentally friendly. The carbon emissions assigned to hydrogen production and transportation should reflect its whole life cycle to enable effective evaluation of hydrogen production emissions, through reliable and accurate GHG accounting. Life Cycle Assessment (LCA) is a method that quantifies the effects of a certain product on the environment by evaluating all the GHG emissions arising over its entire value chain and lifetime; therefore considering the utilisation of renewable energy sources such as PV and wind in the green hydrogen production process and factoring same into assigned carbon credit(s) for green hydrogen producers.

7.1.4 Origin schemes need to include clear emission labelling for hydrogen and hydrogen products to increase consumer awareness and facilitate carbon reduction incentives.

7.1.5 Governance System: As green hydrogen becomes mainstream; policies should cover its integration into the broader energy system.

7.2 Significant Infrastructural Investment

The green hydrogen sector requires development across several value chains. Hydrogen infrastructure for producing and delivering hydrogen is primordial to reach the transition to a hydrogen economy. Infrastructure like pipelines, liquefaction plants, trucks, storage facilities, compressors, and dispensers are essential. However, economic viability can pose as a barrier. This will call for concerted efforts of both the private and public to invest in infrastructural development. Governments must enact policies and frameworks that incentivize such investments to make green hydrogen commercially viable.

7.3 Supportive Legislative Framework(s)

Many African Countries have strived to develop legal instruments regarding renewable energy but do not presently have official hydrogen policies nor byelaws in place. The legislative framework should be aligned and restructured by introducing green hydrogen production to accomplish their green economy transition for the future. Some African countries do not currently factor green hydrogen in the list of renewable energy options within the general energy mix and overall electrification planning; the non- inclusion does not display to the international community and potential investors a readiness to venture into green hydrogen development and production within jurisdictions where they have not been factored into existing policies. For SSA countries, who desire to utilise green hydrogen production as part of its energy transition or electrification strategy, it is important that the inclusion of green hydrogen as a renewable energy option in existing laws and policies is given due consideration.

7.4 Increased Access to Finance

Green hydrogen can be economically viable even though green hydrogen is more capital intensive than fossil fuels. Green Hydrogen is more capital intensive than fossil

fuels because the value chain for fossil fuel including the production and end-use technology have been established for decades. Green hydrogen on the other hand requires modern digital technology to scale up production and usage.. Hydrogen's success will largely depend on sponsor financing through equity or grant funding, but governments, developers and financiers will play an important role. Governments will need to play the role of policy formation and creative incentives that will attract investors, developers will need to invest innovatively with innovative business models such as via Joint Ventures, Partnerships, Mergers and Acquisitions, etc. For example, Japan H2 Mobility, a joint venture of more than 20 participating companies was established in 2017 to accelerate deployment of hydrogen filling stations. In addition, financiers must show willingness to finance, subject to project credibility. In the United States of America (USA), $4.5bn in loan funding can be accessed to support green hydrogen production and infrastructure, while more than $17bn has been allocated to support the manufacture of fuel cell electric passenger vehicles and components.

7.5 Energy Power Reshuffle

African countries who participate in the green hydrogen industry can benefit from the numerous gains that green hydrogen possesses, ranging from the utilisation of the resource itself and the production for exports. This should be a focus for international partners. African countries should not limit its activity in the green hydrogen space to exports alone as providers of raw materials but should invest in the development of the full value chain activity. To fully incorporate this, African countries must also build skills and capacity in the labour market of the sector to be fully integrated in the jobs created from the green hydrogen value chain.

7.6 Multi-Stakeholder Partnerships & Community Participation

Energy policies and plans are often made at the international and national levels, wherein the government, in cooperation with large companies and partners from donor countries, implement large scale Renewable Energy projects without due and extensive inclusion of local stakeholders at the community level. However, decision makers should engage communities on the front lines for renewable energy and hydrogen projects. It has been noted that although green hydrogen projects will have positive impacts on the local economies and communities, the projects may also have a negative effect on several of the communities' rights and interests, particularly where

the green hydrogen projects are competing with local communities for the same resources (e.g., water resources). Community involvement through the engagement and involvement of the community from the start of the project could help identify potential issues and address such issues before they materialize. Deliberate effort is needed to assess and remove barriers to participation and create relationships with communities, civil society, and all relevant stakeholders.

7.7 Good Governance & Transparency

The principles of good governance and openness should serve as the foundation r for the development of roadmaps for green hydrogen. Increased investments by investors can be encouraged by a display of transparency and good governance, which will in turn benefit respective countries and the governments in promoting green hydrogen. Furthermore, ensuring maximum compliance with human rights standards, anti-corruption standards, and promotion of good governance on all sides should be considered priority in developing the green hydrogen sector. This would require institutions and bodies that support relevant national and international government agencies, and appropriate transparency mechanisms such as the Extractive Industries Transparency Initiative (EITI). The EITI's developed standard which was formed in 2003, to increase transparency over payments and revenues in the extractive sector. It covers four thematic areas: anti-corruption, energy transition, gender social and environmental issues, and revenue collection. Anti-corruption considers new provisions to enhance opportunities for countries and companies to use the EITI platform to identify and address corruption risks in the natural resource sector; energy transition supports disclosures and public debates on the impacts of the energy transition, by shedding light on relevant policies, and the revenues that countries can expect to receive from their oil, gas and minerals under different market scenarios; gender social and environmental issues help to ensure that natural resources are managed in the interest of all citizens and that there are strengthened provisions on promoting greater diversity in decision-making and disclosures that consider gender, social and environmental issues; and revenue collection covers new and refined provisions requiring more comprehensive and detailed disclosures, which can help countries strengthen their tax base and raise revenues. These EITI mechanisms can be adopted in national policies or utilised as a benchmark for developing national transparency mechanisms to encourage private participation in green hydrogen production and development in countries across SSA.

Disclaimer

The devised method of data representation and the mode of populating the information in this Toolkit document is not premised on and does not in any way imply the opinion of International Organizations, Ministries, Governmental Bodies and Regulatory Entities of SSA countries, relating to the legal status of the country, the territory, boundary, or delimitation of the country's frontiers.

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