

Towards Africa's Decarbonization: Harnessing the Green Hydrogen Potential

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Towards Africa's Decarbonization: Harnessing the Green Hydrogen Potential

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Abstract

Renewable sources of energy including wind, solar, hydropower, geothermal and tidal energy are vital in energy transition. They offer numerous economic, societal and environmental benefits. These sources of energy can accelerate progress towards Sustainable Development Goal 7 under the United Nation's 2030 Agenda for Sustainable Development which seeks to ensure access to affordable, reliable, sustainable and modern energy for all. Green hydrogen production is emerging as a key technology in the renewable energy sector. There is huge interest in the development of green hydrogen projects in Africa, building on the continent's vast potential for renewable energy. As the world continues along the path to energy transition, there is an opportunity for Africa, with its rich and largely untapped renewable energy potential, to become a key player in the growing field of green hydrogen. Green hydrogen is therefore a viable option for transforming Africa's energy sector and accelerating energy transition in the continent. This paper critically explores the role of green hydrogen in energy transition in Africa. It argues that the continent has enormous potential for green hydrogen as a clean, modern and sustainable source of energy. The paper examines the progress made towards adopting green hydrogen in Africa. It also discusses some of the challenges hindering the progress towards adopting green hydrogen in Africa. The paper further offers recommendations towards effectively harnessing the potential of green hydrogen in Africa for Sustainable Development.

1.0 Introduction

The energy sector has been identified as the cause of the global threat of climate change and accounts for approximately 73 percent greenhouse gas emissions¹. For many decades, fossil fuels such as coal, oil and gas have been major sources of global energy supply but burning these fuels produces large amounts of greenhouse gases which cause climate change and have harmful impacts on people's well-being and the environment².

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¹ United Nations., 'Affordable and Clean Energy' Available at <https://www.un.org/sustainabledevelopment/energy/> (Accessed on 11/04/2024)

² Ibid

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The United Nations notes that energy is at the heart of the climate challenge and key to confronting this challenge³. It further points out that to avoid the worst impacts of climate change, greenhouse gas emissions need to be reduced by almost half by 2030 and reach net-zero by 2050. In order to achieve this goal, it is necessary to end global reliance on fossil fuels and invest in alternative sources of energy that are clean, accessible, affordable, sustainable, and reliable⁴. As a result, energy transition has become an urgent global concern⁵.

Energy transition has also been described as the global energy sector's shift from fossil-based systems of energy production and consumption including oil, natural gas and coal to renewable energy sources like wind, solar, hydropower, geothermal and tidal energy⁶. It entails shifting from fossil fuels to renewable energy sources in an effort to reduce greenhouse gas emissions towards confronting climate change⁷. Facing global climate change and increasing scarcity and expense of petroleum, the world community is compelled to transition to sustainable energy systems as well as to better manage energy demand and supply⁸. Energy transition is a continuing process requiring long-term energy strategies and planning, with a country-tailored focus on applying appropriated energy technologies to reach net-zero emissions⁹.

³ United Nations., 'Renewable Energy - Powering a Safer Future' Available at <https://www.un.org/en/climatechange/raising-ambition/renewable-energy> (Accessed on 11/04/2024)

⁴ Ibid

⁵ Ibid

⁶ S & P Global., 'What is Energy Transition?' Available at <https://www.spglobal.com/en/researchinsights/articles/what-is-energy-transition> (Accessed on 11/04/2024)

⁷ Deloitte., 'The Energy Transition Explained.' Available at <https://www2.deloitte.com/nl/nl/pages/energy-resources-industrials/articles/future-of-energyfaq.html> (Accessed on 11/04/2024)

⁸ Solomon. B., & Krishna. K., 'The Coming Sustainable Energy Transition: History, Strategies, and Outlook.' *Energy Policy* 39 (2011) 7422-7431

⁹ United Nations Development Programme., 'Energy Transition.' Available at <https://www.undp.org/energy/our-work-areas/energy-transition> (Accessed on 11/04/2024)

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The United Nations 2030 agenda for Sustainable Development sets out the need for global energy transition¹⁰. Sustainable Development Goal (SDG) 7 under the Agenda seeks to ensure access to affordable, reliable, sustainable and modern energy for all¹¹. Among the targets under SDG 7 include ensuring universal access to affordable, reliable and modern energy services¹²; substantially increasing the share of renewable energy in the global energy mix¹³; doubling the global rate of improvement in energy efficiency¹⁴; and enhancing international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology¹⁵. Achieving the targets under SDG 7 means investing in clean energy sources such as solar, wind, hydropower and thermal energy¹⁶. It also calls for expanding infrastructure and upgrading technology to provide clean energy in all developing countries which is a crucial goal that can both encourage economic development and environmental sustainability¹⁷.

Renewable sources of energy offer numerous economic, societal and environmental benefits¹⁸. These sources of energy are available in abundance, cheaper and are a healthier option for people and the planet¹⁹. In addition, generating renewable energy creates far

¹⁰ United Nations General Assembly., 'Transforming Our World: the 2030 Agenda for Sustainable Development.' 21 October 2015, A/RES/70/1., Available at <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf> (Accessed on 11/04/2024)

¹¹ Ibid

¹² Ibid

¹³ Ibid

¹⁴ Ibid

¹⁵ Ibid

¹⁶ United Nations., 'Affordable and Clean Energy' Op Cit

¹⁷ Ibid

¹⁸ Muigua. K., 'Accelerating Energy Transition in Kenya' Available at <https://kmco.co.ke/wp-content/uploads/2023/09/Accelerating-Energy-Transition-in-Kenya.pdf> (Accessed on 11/04/2024)

¹⁹ United Nations., 'Climate Action.' Available at <https://www.un.org/en/climatechange/howcommunities-are-embracing-renewable-energy> (Accessed on 11/04/2024)

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lower greenhouse gas emissions than burning fossil fuels²⁰. Therefore, transitioning from fossil fuels, which currently account for the lion's share of global greenhouse gas emissions, to renewable energy is key to addressing the climate crisis²¹.

Green hydrogen production is emerging as a key technology in the renewable energy sector²². It has been observed that there is huge interest in the development of green hydrogen projects in Africa, building on the continent's vast potential for renewable energy²³. As the world continues along the path to energy transition, there is an opportunity for Africa, with its rich and largely untapped renewable energy potential, to become a key player in the growing field of green hydrogen²⁴. Green hydrogen is therefore a viable option for transforming Africa's energy sector and accelerating energy transition in the continent²⁵.

This paper critically explores the role of green hydrogen in energy transition in Africa. It argues that the continent has enormous potential for green hydrogen as a clean, modern and sustainable source of energy. The paper examines the progress made towards adopting green hydrogen in Africa. It also discusses some of the challenges hindering the progress towards adopting green hydrogen in Africa. The paper further offers recommendations towards effectively harnessing the potential of green hydrogen in Africa for Sustainable Development.

²⁰ United Nations., 'What is Renewable Energy?.' Available at <https://www.un.org/en/climatechange/what-is-renewable-energy> (Accessed on 11/04/2024)

²¹ Ibid

²² Radford. C., & Field. A., 'Green Hydrogen in Africa: A Continent of Possibilities?' Available at <https://www.whitecase.com/insight-our-thinking/africa-focus-winter-2023-green-hydrogen> (Accessed on 11/04/2024)

²³ Ibid

²⁴ Ibid

²⁵ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Available at <https://www.un.org/africarenewal/magazine/july-2022/green-hydrogen-viable-option-transforming-africas-energy-sector> (Accessed on 11/04/2024)

2.0 Green Hydrogen and Decarbonization

There is a consensus on the potential of green hydrogen in fostering decarbonization and addressing the adverse impacts of climate change²⁶. Green hydrogen is generated from renewable energy and water²⁷. Green hydrogen has been defined as hydrogen produced by splitting water into hydrogen and oxygen using renewable energy²⁸. Green hydrogen is obtained through a process of electrolysis powered by renewable energies such as wind and solar²⁹. The process of electrolysis involves using an electrical current to break down water molecules into oxygen and hydrogen by electrodes³⁰. The only by-product of the process of obtaining green hydrogen is water therefore resulting in a clean, sustainable system in which zero carbon dioxide emissions are emitted in energy production³¹. It has been noted that green hydrogen, being an energy carrier, would act like a battery that allows the storage of excess energy created by renewables such as solar and wind during their peak cycles³². Green hydrogen therefore reduces the intermittency of renewables that cannot generate power at all hours of the day, ensuring a sufficient and continuous supply of energy³³. This is therefore makes green hydrogen attractive on the frontiers of decarbonization an idea that envisages energy production and usage without contributing to climate change³⁴.

Green hydrogen can therefore be a critical enabler of the global transition to sustainable energy and net zero emissions economies³⁵. According to the United Nations

²⁶ United Nations Environment Programme., 'Green Hydrogen Financing' Available at <https://www.unepfi.org/training/training/green-hydrogen-financing/> (Accessed on 12/04/2024)

²⁷ Ibid

²⁸ World Economic Forum., 'What is Green Hydrogen and Why Do We Need It? An Expert Explains' Available at <https://www.weforum.org/agenda/2021/12/what-is-green-hydrogen-expert-explains-benefits/> (Accessed on 12/04/2024)

²⁹ Acciona., 'Green Hydrogen: The Energy of the Future Essential for Decarbonization' Available at https://www.acciona.com/green-hydrogen/?_adin=02021864894 (Accessed on 12/04/2024)

³⁰ Ibid

³¹ Ibid

³² Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

³³ Ibid

³⁴ Ibid

³⁵ World Economic Forum., 'What is Green Hydrogen and Why Do We Need It? An Expert Explains' Op Cit

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Environment Programme (UNEP), in order to achieve targets of net zero emissions, increasing the uptake of green hydrogen is vital³⁶. UNEP further notes that green hydrogen which is produced with renewable energy can play a key role in energy transition, as a sustainable, carbon neutral fuel³⁷. In addition, it has been noted that green hydrogen can become a key tool to replace fossil fuels in those sectors that are more difficult to decarbonize therefore contributing to climate action³⁸. It has also been asserted that green hydrogen (hydrogen produced using renewable energy) is expected to play a vital role in the global push to reach net zero, particularly in decarbonizing hard-to-abate sectors³⁹. It is a clean energy carrier that can be used in sectors where reducing carbon emissions is particularly challenging, such as heavy industry and transport⁴⁰. It is estimated that green hydrogen could account for up to 12 per cent of global energy use by 2050, contributing significantly to global decarbonization goals⁴¹. It is therefore necessary to tap into green hydrogen's potential in order to tackle critical energy and environmental challenges⁴².

3.0 Harnessing the Green Hydrogen Potential in Africa: Promises and Pitfalls

Africa has enormous potential for green hydrogen⁴³. This source of energy can be an especially viable proposition for many African countries due to the continent's vast renewable energy potential⁴⁴. The continent is endowed with renewable sources of

³⁶ United Nations Environment Programme., 'Ministers, Mayors, CEOs Announce Huge Push on Clean and Efficient Energy' Available at <https://www.unep.org/news-and-stories/press-release/ministers-mayors-ceos-announce-huge-push-clean-and-efficient-energy> (Accessed on 12/04/2024)

³⁷ Ibid

³⁸ Acciona., 'Green Hydrogen: The Energy of the Future Essential for Decarbonization'

³⁹ Climate Champions., 'Africa's Green Hydrogen Potential' Available at https://climatechampions.unfccc.int/wp-content/uploads/2022/11/AGHA-Green-Hydrogen-Potential-v2_Final.pdf (Accessed on 12/04/2024)

⁴⁰ Benkhalfa. S-E., 'Africa on Track to Leap into Global Green Hydrogen Landscape' Available at <https://www.business-sweden.com/insights/articles/africa-on-track-to-leap-into-global-green-hydrogen-landscape/> (Accessed on 12/04/2024)

⁴¹ Ibid

⁴² World Economic Forum., 'What is Green Hydrogen and Why Do We Need It? An Expert Explains' Op Cit

⁴³ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

⁴⁴ Climate Champions., 'Africa's Green Hydrogen Potential' Op Cit

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energy including wind, solar, hydro, bioenergy, ocean and tidal waves, and geothermal among other renewables⁴⁵. The abundance of renewable sources of energy in Africa particularly wind and solar means that the continent could be highly competitive in the production and supply of green hydrogen⁴⁶. It has been noted that many African countries, especially those in the north and south of the continent, are well suited to tap into the green hydrogen potential, as they have complementary load profiles for wind and solar⁴⁷.

Africa is therefore uniquely positioned to become a major producer of green hydrogen⁴⁸. The continent is blessed with some of the world's greatest solar and wind potential, much of which is currently undeveloped⁴⁹. Developing these sources of energy can be vital in harnessing the green hydrogen potential in Africa⁵⁰. It is estimated that Africa could have a green hydrogen production capacity exceeding 50 million tonnes per annum by 2035⁵¹. According to the International Energy Agency, Africa has huge potential to produce green hydrogen using its rich renewable resources⁵².

Green hydrogen is key in addressing Africa's energy challenges⁵³. It has been asserted that approximately 600 million Africans currently lack access to electricity⁵⁴. By adopting green hydrogen, Africa can enhance access to electricity and fuel its rapid population and economic growth sustainably, leveraging its vast natural resources and critical minerals

⁴⁵ Africa Union., 'Agenda 2063: The Africa we Want.' Available at https://au.int/sites/default/files/documents/33126-doc-framework_document_book.pdf (Accessed on 12/04/2024)

⁴⁶ Climate Champions., 'Africa's Green Hydrogen Potential' Op Cit

⁴⁷ Ibid

⁴⁸ Radford. C., & Field. A., 'Green Hydrogen in Africa: A Continent of Possibilities?' Op Cit

⁴⁹ Ibid

⁵⁰ Ibid

⁵¹ Ibid

⁵² International Energy Agency., 'Africa Energy Outlook 2022' Available at <https://www.iea.org/reports/africa-energy-outlook-2022/key-findings> (Accessed on 12/04/2024)

⁵³ Ibid

⁵⁴ Ibid

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essential for green hydrogen production, such as platinum⁵⁵. It has been correctly pointed out that for many African countries, the question is not how to reduce their carbon footprint since the continent's overall contribution to global greenhouse gas emissions is already low at less than 4 per cent⁵⁶. Instead, Africa's priority is how to sustainably harness its existing resources to meet the growing demand for energy needed for economic development and to lift citizens out of poverty, while following a sustainable path to a net-zero future⁵⁷. Green hydrogen therefore offers an opportunity for African countries to reduce their reliance on fossil fuels, accelerate access to electricity for millions of citizens and meet their global climate commitments⁵⁸.

There has been progress towards harnessing green hydrogen in Africa. For example, it has been noted that Morocco is advancing its position in the green hydrogen market⁵⁹. Morocco is among the countries recognised for having significant potential to become exporters of green hydrogen, with the ability to supply up to four per cent of the global demand⁶⁰. The country is attracting investors in this field and is home to ambitious projects aimed at making the country a green hydrogen powerhouse⁶¹. It has been observed that Morocco's strategic location in the north of the Continent and commitment to renewable energy, with ambitions to increase the share of total installed capacity to more than 52 per cent by 2030 further bolsters its potential as a major green hydrogen producer and exporter⁶². Namibia is also harnessing its green hydrogen potential⁶³. The country is implementing an estimated 9.4 billion US Dollars green hydrogen project,

⁵⁵ Ibid

⁵⁶ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

⁵⁷ Ibid

⁵⁸ Ibid

⁵⁹ Benkhlaifa. S-E., 'Africa on Track to Leap into Global Green Hydrogen Landscape' Op Cit

⁶⁰ Ibid

⁶¹ Ibid

⁶² Ibid

⁶³ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

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scheduled to enter production in 2026⁶⁴. The project is expected to generate 2 gigawatts of renewable electricity for regional and global markets⁶⁵. South Africa is also adopting green hydrogen. The governments of South Africa, France, Germany, the United Kingdom and the United States of America, along with the European Union have adopted a long-term Just Energy Transition Partnership to support South Africa's decarbonization efforts⁶⁶. The Partnership aims to accelerate the decarbonisation of South Africa's economy, with a focus on the electricity system, to help it achieve the ambitious goals set out in its updated Nationally Determined Contribution emissions goals⁶⁷. It aims to mobilise an initial commitment of 8.5 billion US Dollars for the first phase of financing, through various mechanisms including grants, concessional loans and investments and risk sharing instruments⁶⁸. South Africa's Just Energy Transition Partnership aims to accelerate the country's transition from fossil fuels to a low emission, climate resilient economy by developing new economic opportunities such as green hydrogen⁶⁹.

Kenya is also strengthening its position in the green hydrogen mix⁷⁰. It has been noted that the energy sector plays a crucial role in facilitating the achievement of both domestic objectives outlined in Kenya Vision 2030 and global commitments, such as the United Nation's 2030 Agenda for Sustainable Development and its SDGs, climate accords like the Paris Agreement, and the broader Africa Union's Agenda 2063⁷¹. The development of green hydrogen in Kenya is in line with national objectives, representing innovation

⁶⁴ Ibid

⁶⁵ Ibid

⁶⁶ European Commission., 'France, Germany, UK, US and EU Launch Ground-Breaking International Just Energy Transition Partnership with South Africa' Available at https://ec.europa.eu/commission/presscorner/detail/en/IP_21_5768 (Accessed on 12/04/2024)

⁶⁷ Ibid

⁶⁸ Ibid

⁶⁹ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

⁷⁰ GH2 Country Portal-Kenya., 'Green Hydrogen Vision' Available at <https://gh2.org/countries/kenya> (Accessed on 12/04/2024)

⁷¹ Ibid

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and commitment to a greener future amid the changing landscape of sustainable energy solutions⁷². Kenya possesses ample renewable energy resources to support large-scale green hydrogen production without negatively impacting access and supply of electricity to its citizens⁷³. The country produces more than 90% of its electricity from hydropower, geothermal energy, solar and wind energy as well as biomass⁷⁴. Therefore as a leading African country in renewable energy with an abundance of the elements required to develop green hydrogen, Kenya is well positioned to harness the immense opportunities presented by green hydrogen⁷⁵. The *Green Hydrogen Strategy and Roadmap for Kenya*⁷⁶ aims to harness the transformative potential of green hydrogen in Kenya as a cross-cutting enabler for the country's development agenda and as a catalyst for sustainable socio-economic development⁷⁷. The Green Hydrogen Strategy and Roadmap for Kenya notes that green hydrogen has potential applications across several important sectors in Kenya, including industry, transport, agriculture, and energy⁷⁸. It further points out that Kenya stands to gain substantial benefits from the successful establishment of a green hydrogen industry including improved balance of payments, food security and resilience, green industrialization and decarbonization, and investment in the country⁷⁹. It is therefore necessary to actualize the Green Hydrogen Strategy and Roadmap for Kenya in order to establish a robust and efficient green hydrogen industry in Kenya.

Africa therefore has huge potential for green hydrogen. Several African countries including Kenya, Morocco, South Africa, Namibia, Egypt and Nigeria are at various

⁷² Ibid

⁷³ Ibid

⁷⁴ Ibid

⁷⁵ Ibid

⁷⁶ Green Hydrogen Strategy and Roadmap for Kenya., Available at https://www.eeas.europa.eu/sites/default/files/documents/2023/GREEN%20HYDROGEN%20EXEC_0209_0.pdf (Accessed on 12/04/2024)

⁷⁷ Ibid

⁷⁸ Ibid

⁷⁹ Ibid

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stages of integrating green hydrogen into their energy mixes⁸⁰. In addition, the Africa Green Hydrogen Alliance was established in 2022 comprising of Egypt, Kenya, Mauritania, Morocco, Namibia and South Africa which are among key countries leading green hydrogen efforts on the continent⁸¹. The Alliance focuses on public and regulatory policy, capacity building, financing and certification needs to mobilise green hydrogen production for domestic use and export⁸². It has been pointed out that the Alliance will generate new industry awareness, opportunities and action and bring African governments together to mobilise a unified African voice in global climate and energy dialogues⁸³. In addition, it provides a platform for collaboration with the private sector, development finance institutions and civil society towards harnessing the green energy potential in Africa⁸⁴. It is therefore necessary for African countries to continue fostering collaboration in order to unlock the potential of green hydrogen in the continent.

Green hydrogen holds immense promise for Africa. It can enable the continent meet the growing demand for energy needed for economic development and to lift citizens out of poverty, while following a sustainable path to a net-zero future⁸⁵. Green hydrogen is necessary for Africa's decarbonization⁸⁶. Despite its importance, several challenges are likely to hinder the development of green hydrogen in Africa. Among these challenges is the volume of infrastructure development required to support green hydrogen production and export at scale⁸⁷. It has been noted that many parts of Africa that would be ideal for renewable energy generation remain underdeveloped⁸⁸. Substantial

⁸⁰ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

⁸¹ Africa Green Hydrogen Alliance., Available at <https://climatechampions.unfccc.int/africa-green-hydrogen-alliance/> (Accessed on 12/04/2024)

⁸² Ibid

⁸³ Ibid

⁸⁴ Ibid

⁸⁵ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

⁸⁶ Ibid

⁸⁷ Radford. C., & Field. A., 'Green Hydrogen in Africa: A Continent of Possibilities?' Op Cit

⁸⁸ Ibid

investments are therefore needed in transmission infrastructure to connect renewable energy sources to production facilities and export hubs⁸⁹. In addition, it has been observed that African governments will also need to balance their own broader energy strategy against heavy growth of non-dispatchable renewables, which could strain underdeveloped national transmission grids⁹⁰. Governments therefore have to consider whether to dedicate part of Africa's limited resources to developing green hydrogen as a viable solution for Africa's energy deficit⁹¹. The requirement for clean water for hydrogen production also creates additional challenges especially in regions where water resources are already scarce⁹². Despite these concerns, the potential of green hydrogen in Africa to contribute significantly to the global energy supply and create a more sustainable future is undeniable⁹³. Green hydrogen offers a pathway to decarbonize Africa and accelerate the achievement of SDG 7⁹⁴. It is therefore necessary to effectively harness the green hydrogen potential for Africa's decarbonization.

4.0 Way Forward

There is need to effectively harness green hydrogen in Africa. This source of energy can play a crucial role in decarbonizing Africa⁹⁵. The continent is a suitable place for the production of green hydrogen since it is rich with abundant renewable energy sources such as wind and solar energy⁹⁶. Green hydrogen can help African countries in achieving their national energy and decarbonization goals⁹⁷. It can enable African countries to meet the growing demand for energy needed for economic development and to lift citizens out

⁸⁹ Ibid

⁹⁰ Ibid

⁹¹ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

⁹² Radford. C., & Field. A., 'Green Hydrogen in Africa: A Continent of Possibilities?' Op Cit

⁹³ Green Hydrogen., Available at <https://centurionlg.com/2024/01/08/unleashing-africas-green-hydrogen-potential-for-a-sustainable-future/> (Accessed on 12/04/2024)

⁹⁴ Ibid

⁹⁵ AbouSeada. N., & Hatem. T., 'Climate Action: Prospects of Green Hydrogen in Africa' *Energy Reports.*, Volume 8, 2022., pp 3873-3890

⁹⁶ Ibid

⁹⁷ Ibid

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of poverty, while following a sustainable path to a net-zero future⁹⁸. It is therefore necessary to harness green hydrogen towards Africa's decarbonization and Sustainable Development.

In order to effectively harness green hydrogen, there is need to enhance investments in this crucial technology⁹⁹. Green hydrogen has been identified as a capital intensive industry that requires significant financial investments¹⁰⁰. Green hydrogen financing is therefore key in unlocking the potential of this technology in Africa¹⁰¹. It is therefore necessary to increase government investments in the green hydrogen industry in Africa¹⁰². Public-private partnerships are also key in bringing on board the private sector including financial institutions in the green energy transition¹⁰³. Developed countries also have a role to play in supporting the adoption of green hydrogen in Africa through climate finance in accordance with global climate commitments¹⁰⁴. South Africa's Just Energy Transition Partnership is a major steps towards this goal¹⁰⁵. There is need to embrace such initiatives in order to unlock climate finance in Africa which is vital in harnessing green hydrogen in addition to other climate change mitigation and adaptation strategies¹⁰⁶. Green hydrogen financing is necessary in building the necessary infrastructure to support the production of green hydrogen and efficient storage, transport and refueling facilities¹⁰⁷. It is therefore necessary to unlock green hydrogen financing and investments in order to effectively harness this technology in Africa.

⁹⁸ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

⁹⁹ Ibid

¹⁰⁰ Ibid

¹⁰¹ United Nations Environment Programme., 'Green Hydrogen Financing' Op Cit

¹⁰² Ibid

¹⁰³ Ibid

¹⁰⁴ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

¹⁰⁵ European Commission., 'France, Germany, UK, US and EU Launch Ground-Breaking International Just Energy Transition Partnership with South Africa' Op Cit

¹⁰⁶ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

¹⁰⁷ Ibid

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In addition, there is need to establish or improve the legal and policy frameworks for green hydrogen in order support the whole value chain of this vital industry¹⁰⁸. It has been noted that the regulatory landscape required for green hydrogen development is complex since it is an emerging industry, and the multi-faceted development required to support projects in Africa will inevitably touch on a range of other sectors (including power generation and transmission, water, industrial processes, transportation and export) with their own regulatory requirements and practices¹⁰⁹. It is therefore necessary for African countries to have in place efficient legal and policy frameworks in order to address the complex and cross-sectoral challenges that may arise in the development of green hydrogen industries¹¹⁰. It has been noted that by creating efficient legal and policy frameworks on green hydrogen that help mitigate risk and enable investment, it is possible for Africa to realize the economic, social, and environmental benefits of green hydrogen while accelerating the energy transition¹¹¹. African countries should thus ensure that they have in place effective and efficient legal and policy frameworks to support the development of green hydrogen.

It is also imperative for African countries to enhance research and development in the green hydrogen industry¹¹². It has been correctly noted that for Africa to effectively harness the green hydrogen potential, governments, academic institutions, and industry players need to prioritize research and development efforts focused on hydrogen production, storage, and utilization¹¹³. This includes exploring innovative technologies,

¹⁰⁸ Ibid

¹⁰⁹ Radford. C., & Field. A., 'Green Hydrogen in Africa: A Continent of Possibilities?' Op Cit

¹¹⁰ Ibid

¹¹¹ Hydrogen Council., 'The Africa Hydrogen Opportunity for a Just Transition' Available at <https://hydrogencouncil.com/en/the-africa-hydrogen-opportunity-for-a-just-transition/> (Accessed on 12/04/2024)

¹¹² Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

¹¹³ Ashurst., 'Exploring the Opportunity for Green Hydrogen Production in Africa' Available at <https://www.lexology.com/library/detail.aspx?g=a0379c68-21bd-460f-9f1c-917d2458a1e2> (Accessed on 12/04/2024)

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improving efficiency, and addressing specific regional challenges in green hydrogen development¹¹⁴. Encouraging collaboration between academia, industry, and research institutions can accelerate advancements in green hydrogen development in Africa and drive cost reductions¹¹⁵. Embracing such collaborative innovation platforms can strengthen research and the development of sustainable green hydrogen technologies that can be easily be used and maintained in Africa to continuously improve the competitiveness of the sector¹¹⁶. Research and development is therefore a vital tool in harnessing the green hydrogen potential in Africa.

Finally, regional integration and bilateral and multilateral relations are of utmost importance in harnessing the green hydrogen potential in Africa¹¹⁷. It has been noted that leading countries in the green hydrogen sector are leveraging bilateral and multilateral relationships to establish hydrogen partnerships to integrate value chains that can help signal their credibility as a supplier to the market¹¹⁸. Bilateral hydrogen partnership agreements are key in promoting access to markets, technologies, and finance necessary for the growth of this industry¹¹⁹. It is therefore necessary for African countries to strengthen regional integration in the energy sector and embrace bilateral and multilateral energy relations in order to harness the green hydrogen potential in the continent. The Africa Green Hydrogen Alliance comprising of Egypt, Kenya, Mauritania, Morocco, Namibia and South Africa is a good example that can enable African countries to leverage on regional integration and bilateral and multilateral relationships to develop their green hydrogen sectors¹²⁰. There is need for other Africa countries to follow this example in order to harness their green hydrogen potential.

¹¹⁴ Ibid

¹¹⁵ Ibid

¹¹⁶ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

¹¹⁷ Climate Champions., 'Africa's Green Hydrogen Potential' Op Cit

¹¹⁸ Ibid

¹¹⁹ Ibid

¹²⁰ Africa Green Hydrogen Alliance., Op Cit

The foregoing approaches are vital in harnessing the green hydrogen potential towards Africa's decarbonization.

5.0 Conclusion

Green hydrogen has a key role to play in fostering decarbonization and addressing the adverse impacts of climate change¹²¹. Green hydrogen has been identified as a critical enabler of the global transition to sustainable energy and net zero emissions economies¹²². Africa has enormous potential for green hydrogen¹²³. The abundance of renewable sources of energy in Africa particularly wind and solar means that the continent could be highly competitive in the production and supply of green hydrogen¹²⁴. Green hydrogen therefore offers an opportunity for African countries to reduce their reliance on fossil fuels, accelerate access to electricity for millions of citizens and meet their global climate commitments¹²⁵. There has been progress towards adopting green hydrogen in Africa with several African countries including Kenya, Morocco, South Africa, Namibia, Egypt and Nigeria integrating green hydrogen into their energy mixes¹²⁶. However, it has been noted that the capital intensive nature of green hydrogen development is a key hindrance in its adoption¹²⁷. There is need for creative solutions in order to harness the green hydrogen potential in Africa. This can be achieved through unlocking green hydrogen financing¹²⁸; establishing and improving the legal and policy frameworks for green hydrogen development¹²⁹; enhancing research and development

¹²¹ United Nations Environment Programme., 'Green Hydrogen Financing' Op Cit

¹²² World Economic Forum., 'What is Green Hydrogen and Why Do We Need It? An Expert Explains' Op Cit

¹²³ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

¹²⁴ Climate Champions., 'Africa's Green Hydrogen Potential' Op Cit

¹²⁵ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

¹²⁶ Ibid

¹²⁷ Radford. C., & Field. A., 'Green Hydrogen in Africa: A Continent of Possibilities?' Op Cit

¹²⁸ United Nations Environment Programme., 'Green Hydrogen Financing' Op Cit

¹²⁹ Yohannes. B., & Diedou. A., 'Green hydrogen: A Viable Option for Transforming Africa's Energy Sector' Op Cit

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in the green hydrogen industry¹³⁰; and strengthening regional integration and bilateral and multilateral relations in green hydrogen development¹³¹. It is necessary for all African countries to engage in harnessing the green hydrogen potential towards Africa's decarbonization and development.

¹³⁰ Ibid

¹³¹ Climate Champions., 'Africa's Green Hydrogen Potential' Op Cit

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