

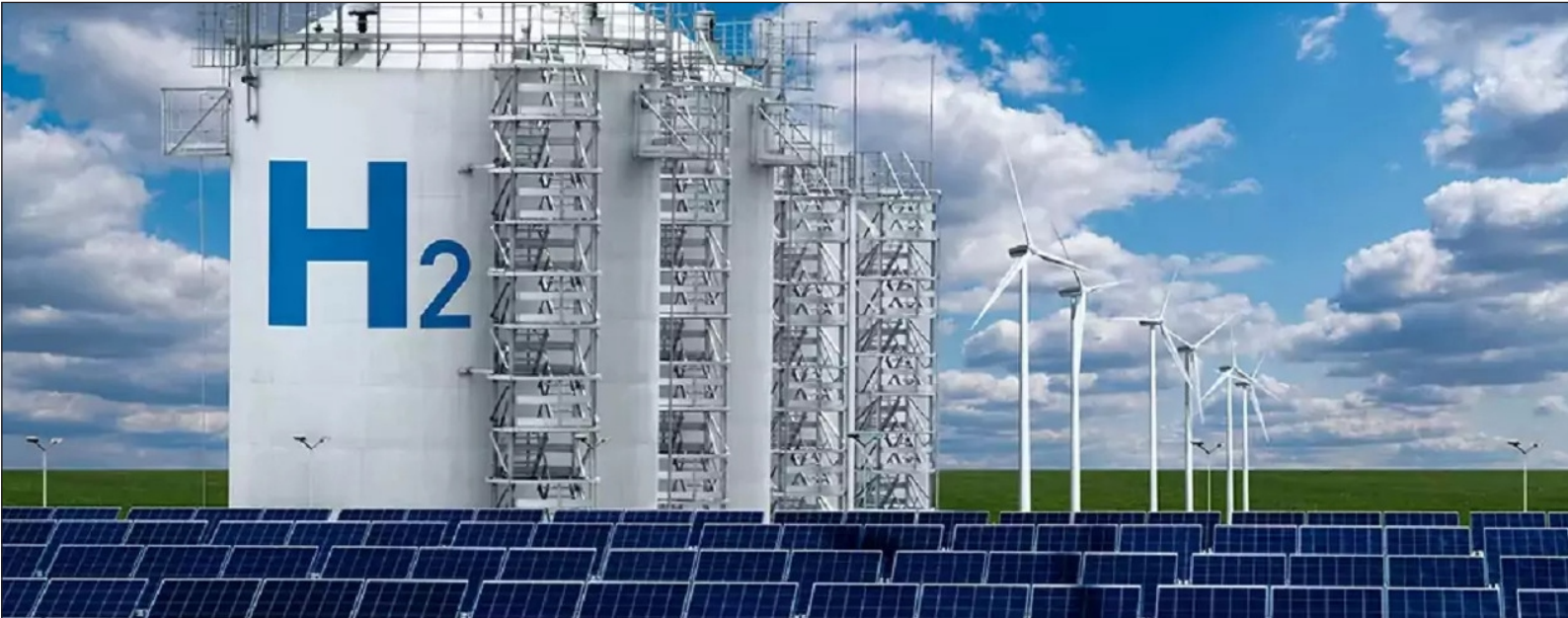


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# Nigeria's Role in Enhancing Hydrogen Production in Africa: Overcoming Challenges and Seizing Opportunities

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## Introduction

Africa, with its vast land area of approximately 30.37 million square kilometers, shares similarities with Latin America in its potential to become a production powerhouse for both green hydrogen and low-carbon hydrogen. The continent's abundant renewable energy resources, low population density, and availability of non-arable land for large-scale deployment of renewable energy positions it to uniquely play a significant role in global green hydrogen production.

Africa possesses a potential of 1000 GW from solar, 110 GW from wind, 350 GW from hydropower, and 15 GW from geothermal sources<sup>1</sup>. These resources will enable the continent to generate more energy than it would require by 2040 based on potential. Furthermore, Africa is home to about one-third of the world's major international water basins, which cover an area larger than 100,000 km<sup>2</sup>.

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<sup>1</sup>DLA Piper Africa (November 2019). The rise of alternative energy in Africa: Geothermal power generation. *Africa Connected*, 3. <https://www.dlapiperafrica.com/en/africa-wide/insights/africa-connected/issue-03/the-rise-of-alternative-energy-sources-in-africa.html>

To date, many African countries have relied primarily on hydroelectric power, with coal and natural gas being used mainly in a few countries in North and South Africa. For instance, Kenya boasts an impressive 93% renewable energy generation, with geothermal power accounting for more than 45% of total power consumption<sup>2</sup>. This resulted in a low grid emission ratio of 0.04 tnCO<sub>2</sub>/MWh in 2020. Similarly, Namibia, with a 91% renewable energy generation mix (comprising hydropower, solar, and wind), had a low emission factor of 0.058 tnCO<sub>2</sub>/MWh in 2019.

In contrast, countries like Morocco and South Africa exhibit higher emission factors (0.75 tnCO<sub>2</sub>/MWh in 2019 and 0.94 tnCO<sub>2</sub>/MWh in 2020, respectively) due to their substantial reliance on traditional electricity generation sources<sup>3</sup>. In 2019, non-renewable sources, such as coal, natural gas, and oil, fulfilled more than 80% of Morocco's electricity needs.

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<sup>2</sup>Global Energy Markets Consultants (November 2021). Challenges and opportunities to produce Green Hydrogen in Africa. <https://www.gme-global.com/uploads/archivos/2021126-045139.pdf>

<sup>3</sup>[https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical\\_Profiles/Africa/Morocco\\_Africa\\_RE\\_SP.pdf](https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Africa/Morocco_Africa_RE_SP.pdf)



Similarly, in 2020, coal-fired power stations accounted for 90% of South Africa's power demand.<sup>4</sup>

### **Opportunities for Producing Hydrogen in Africa**

Hydrogen has enormous potential to assist Africa in becoming a global leader in the future clean energy trade sector. This benefit arises from its energy storage capability, energy security, and dependability; energy system reorganization via mini-grid installation and offering strategic collaborations for the continent's economic development.

If properly utilized, the continent's resources have the potential to become a springboard for economic development and strategic trade with European and Asian countries. This has the potential to change the dynamics of the global energy landscape, with immediate consequences for African commerce and industry. The following opportunities exist for hydrogen production in Africa:

- **Positioning Africa as a Global Clean Energy Leader:** Hydrogen has the potential to propel Africa to the forefront of the global clean energy trade sector. Its benefits include energy storage capabilities, enhanced energy security, and

reliability. Additionally, it can contribute to the restructuring of energy systems through the implementation of mini-grids and foster strategic partnerships for the continent's economic growth.

- **Leveraging Resources for Economic Growth and Trade:** Africa's abundant resources can serve as a catalyst for economic development and establish strategic trade relationships with European and Asian countries. By capitalizing on these resources, Africa can significantly impact the global energy landscape and create new opportunities for its commerce and industry sectors.
- **Electrification and Economic Development:** Green hydrogen production can contribute to electrification efforts, leading to rapid economic growth by accelerating advancements in various sectors of the economy. However, to maximize these benefits, Africa must act swiftly to leverage the evolving global market, capitalizing on its expertise, partnerships, credibility, and position as an energy supplier.
- **Long-term Potential in Diverse Sectors:** Beyond existing industrial applications, hydrogen holds long-term promise in sectors like transportation, buildings, and power. Industries that are challenging to decarbonize due to

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<sup>4</sup> <https://www.eskom.co.za/wp-content/uploads/2021/08/2021IntegratedReport.pdf>



their scale and machinery size can benefit from hydrogen adoption. The competitiveness of hydrogen Fuel Cell Electric Vehicles (FCEVs) in the transportation sector will depend on factors such as fuel cell costs and the development of refueling infrastructure.

- **Facilitating Transitions for Oil and Gas Producers:** For countries like Nigeria, Angola, and Algeria, blue hydrogen (produced from natural gas with carbon capture and storage technology) offers a pathway to transition away from crude oil exports and dependence on natural gas. By improving the demand for natural gas, blue hydrogen can support the economies of these nations during the transition.
- **Stimulating Investment in Renewable Energy Projects:** Hydrogen can act as a catalyst for attracting investment in large-scale renewable energy projects, serving as an off-taker of the generated energy. In countries like Nigeria, where there have been challenges in securing investments for utility-scale renewable energy projects, hydrogen can play a crucial role in addressing these issues and fostering clean energy development.

### Challenges for Producing Hydrogen in Africa

In developing countries like Nigeria, where the deployment of large-scale solar, wind, and hydro power proves challenging, green hydrogen emerges as a viable alternative, utilizing renewable energy as its primary energy source. Producing hydrogen from low-carbon energy sources remains expensive and uncompetitive when compared to hydrogen produced from fossil fuels. To compete with gray hydrogen and fossil fuels, green hydrogen requires an abundance of incentives and purposeful government initiatives<sup>5</sup>.

According to the International Energy Agency, the cost of generating hydrogen from renewable energy resources could decline by 30% by 2030<sup>6</sup>. Such savings could be realized if international efforts to scale up the resources required for green hydrogen production are concentrated. Given market inertia, future advancements require tangible incentives, as well as additional decreases in renewable electricity costs, cost reductions for electrolyzers, and inventive

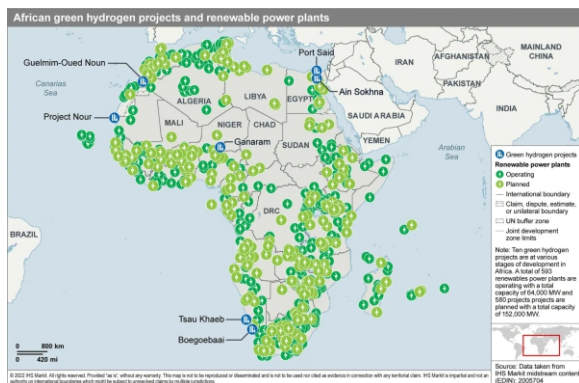
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<sup>5</sup> RECHARGE (October 2021). The Planet's Pathways.

<https://www.rechargenews.com/energy-transition/there-is-no-commercial-case-for-green-hydrogen-unless-government-incentives-or-quotas-are-put-in-place-say-ceos/2-1-1086100>

<sup>6</sup> International Energy Agency (IEA) (2019). The Future of Hydrogen, Seizing Today's Opportunities. <https://www.iea.org/reports/the-future-of-hydrogen>

means to transport huge volumes of hydrogen efficiently.



Source:

<https://www.spglobal.com/commodityinsights/en/ci/research-analysis/africa-green-hydrogen.html>

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Morocco in particular has the basis for strong industrial demand for green hydrogen. Other countries, including Egypt, South Africa and Kenya, have or are developing hydrogen strategies, yet current demand from African industries is limited. The production of green hydrogen requires a sufficient supply of renewable energy. This is currently not the case in Africa, given the relatively low deployment levels. Only about 9% of the overall energy generated in Africa comes from renewable sources. Africa is well positioned, which shows that industrial demand is limited and highly concentrated.

Production of green hydrogen requires sufficient supply of renewable energy. This is currently not the case in Africa given the relatively low deployment levels. African countries have the theoretical potential to be highly competitive in both direct electrified industries and hydrogen consumption. North Africa and the Middle East, for example, have a significant theoretical potential for green steel production using hydrogen-based Direct Reduced Iron (DRI), yet North Africa today only houses a fraction of global production, while investment in steel decarbonisation tends to focus on existing production centres in Asia, Europe and the US.

## Conclusion

Africa's green hydrogen offers an opportunity for African economies, but it will also entail significant risks, especially for those countries that are primarily focusing on the future export market for hydrogen and derived commodities, including ammonia. In the absence of stable export demand, established trade flows and hydrogen infrastructure, African economies may need to readjust their expectations and focus on attracting and developing African low-carbon industries.

## Recommendations

Addressing the challenges of deploying green hydrogen in developing countries like Nigeria requires a combination of strategic investments, policy support, and international cooperation. Some recommendations to overcome these challenges are highlighted below.

- 1. Development of a national hydrogen strategy:** There is a need for the Nigerian government to create a comprehensive national hydrogen strategy that outlines clear targets, priorities, and policy measures to support the development of green hydrogen. This strategy should be aligned with the country's broader energy and climate goals.
- 2. Investment in renewable energy capacity:** Expanding the renewable energy sector is crucial for producing cost-competitive green hydrogen. The government at all levels should prioritize investments in solar, wind, and hydropower, while also encouraging private sector participation through incentives and partnerships.
- 3. Development of hydrogen infrastructure:** Building a robust infrastructure for hydrogen production, storage, and transportation is essential for a viable green hydrogen economy. This includes investing in pipelines, refueling stations, and ports for hydrogen transport.
- 4. Create a supportive regulatory framework:** Establishing clear regulations and standards for hydrogen production, transport, and use can help create a stable market environment and attract investments. This includes developing safety protocols and permitting processes for hydrogen projects.
- 5. Foster international cooperation:** Collaborating with other countries, international organizations, and development banks can help share knowledge, technology, and financial resources. This cooperation can also lead to the establishment of international standards and certification schemes for green hydrogen.
- 6. Promote public-private partnerships:** Governments should engage with private sector stakeholders to support green

hydrogen projects and attract investments. This includes creating incentives, such as tax credits and subsidies, for companies investing in green hydrogen technologies.

- 7. Development of local industries and skills:** Building local industries and a skilled workforce for hydrogen production, distribution, and end-use applications can help create jobs and boost economic growth. This includes investing in education and training programs to develop the necessary skills for a green hydrogen economy.