Green Hydrogen Economy in Southern Africa

Subjects: Others

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Green hydrogen energy is significant in decarbonizing the entire hydrogen value chain network from its generation to the end-user sectors. It can help achieve the UN Sustainable Development Goals (SDGs), especially the UNSDG 7, and regional sustainability. Further, the public sector (especially governments) are recognized to have a pivotal role in hydrogen energy deployment because it can enhance or drive the transition from a fossil fuel-based economy to a green economy, especially if the hydrogen energy ploicies are clearly articulated or translated into hydrogen energy statute in each Southern African Development Communities (SADC) country. To ensure that communities and SADC nations appreciate the hydrogen energy economy, there is need to also communicate the benefits that come with green hydrogen, alongside the global pursuit to reduce GHG emissions that cause climate change.

Keywords: policies ; green hydrogen ; Southern Africa

1. Hydrogen Energy Background

The energy sector in Southern Africa is faced with challenges and barriers to fully develop renewable energy and green hydrogen within the institutionalization, financial, and legal frameworks, which may lead to poor energy policies and renewable energy financing mechanisms that consequently lead to poor investor confidence and poor partnerships for take-off contracts and feed-in laws. Furthermore, such poor energy policies compromise the business climate for the development and competitiveness of renewable energy resources and other secondary projects such as hydrogen energy development [1].

While the renewable energy sector has also not enjoyed dedicated policies in the SADC region, the green hydrogen energy sector has enjoyed some fair share of these policies globally, especially in leading countries for green hydrogen development such as Germany, Japan, and South Korea. However, there is a need for enhanced policy support in all regions including SADC and at each stage of the three stages of green hydrogen policy support: technology readiness, market penetration, and market growth [2][3].

On a bright note, efforts have been made at a regional level to benchmark the SADC Protocol on the management of the environment to achieve sustainable development and Rio + 20 outcomes [4], the SADC region needs to develop a green economy strategy and action plan that will enhance sustainable development. This strategy aims at building a green economy that catalyzes the social, economic, and environmental challenges faced in the region to achieve resource efficiency and environmentally sustainable economies with low-carbon technology deployment, thereby creating a climate-change resilient region [5]. This can be achieved by pursuing sustainable practices during the production and distribution of goods and consumption [6]. The result of these efforts is an ecologically sustainable region that improves socio-economic development and human well-being over time while reducing environmental risks for future generations, thereby committing to the achievement of the UN sustainable development goals [7].

The establishment of a green hydrogen economy in SADC would help the region to reach sustainable development, to decarbonize the region, and reduce the effects of climate change. Furthermore, the decarbonization process would conjointly create many opportunities in the process of transitioning to a green hydrogen economy [8][3].

While this article focuses on green hydrogen, which uses electrolysis to break water into hydrogen and oxygen, the most predominant hydrogen type in Southern Africa is grey hydrogen. The grey hydrogen technologies deployed include a steam methane reforming (SMR) plant and coal gasification plant with coal and natural gas as the main feedstock. This hydrogen production method produces hydrogen and carbon dioxide (CO_2) as a by-product. Blue hydrogen and turquoise hydrogen are not popular in Southern Africa because of the cost that comes with the technologies for carbon capture and storage (CCS) and carbon capture and utilization (CCU), respectively [9]. Although the decarbonization process would conjointly create many opportunities in the process of transitioning to a green hydrogen economy, an enabling environment with clearly defined hydrogen energy policies is necessary. The enabling conditions for the development of a

green economy through carbon emission-free energy carriers such as green hydrogen require national regulations and policies that are well outlined, with all incentives and subsidies also well-articulated. Unfortunately, in Southern Africa, a general approach is adopted to the energy sector where renewable energy resources are not well emphasized, and this puts secondary energy carriers such as green hydrogen development at a disadvantage.

2. Policy Option Recommendations for Enhanced Hydrogen Energy Production

A hydrogen energy matrix for all the policies in SADC countries concerning renewable energy and green hydrogen would assist in showing the status of how investment-ready SADC concerns green hydrogen. Furthermore, it also helps to ensure the local and international investors include a financial cost component, associated with policy formulation in their project proposals.

It can be inferred that most of the green hydrogen projects implemented in Southern Africa are either privately funded or are funded by international players. The private and international community has been very instrumental in leapfrogging the sensitization of the public sector concerning hydrogen energy through projects such as the Atlas of Green Hydrogen Generation Potential (H2Atlas), which is implemented by the Southern African Science Service Center for Climate Change and Adaptive Land Management (SASSCAL) in twelve (13) SADC states [10]. An analysis of the existing hydrogen energy using a policy evaluation matrix was conducted in **Table 1**. The evaluation design matrix tool helps to plan and organize the existing policies in a table with one row for each evaluation question and columns that address evaluation design issues such as existing policies, renewable energy policies, or hydrogen energy policies, etc. Depending on what is prevailing, either a tick (√) or cross (X), was used to affirm the status in each SADC nation.

Table 1. Hydrogen energy policy evaluation matrix.

		Energy Policy	Renewable Energy Policy	Hydrogen Energy Policy	Country Hydrogen Energy Initiative	International/Private Hydrogen Energy Initiative
1.	South Africa (Lesotho)	√	√	X	√	√
2.	Namibia	√	√	X	X	√
3.	Botswana	√	√	X	X	√
4.	Zimbabwe	√	√	X	X	√
5.	Zambia	√	√	X	X	√
6.	Mozambique	√	√	X	X	√
7.	Mauritius	√	√	X	X	√
8.	Tanzania	√	√	X	X	√
9.	Malawi	√	√	X	X	√
10.	DRC	√	√	X	X	√
11.	Madagascar	√	√	X	X	√
12.	Angola	√	√	X	X	√
13.	Eswatini	√	√	X	X	√

Note: Lesotho is analyzed as part of the Republic of South Africa.

Table 1 shows that almost all countries have general energy policies and specific renewable energy or promulgated to incorporate renewable energy or other modern clean energy resources and technologies. It can also be seen that no SADC country has specific hydrogen energy policies in their energy policy framework, with only South Africa as the only country with hydrogen energy footprints and local initiatives. This shows that currently, all SADC nations do not have long-term hydrogen policies that can create sustainable markets for green hydrogen, and enhanced decarbonization of the current fossil fuel-based economies. Such policies are necessary to underpin investments by all energy suppliers, distributors, and users in the private and public sectors.

2.1. Policy Option Recommendations

Policy option recommendations on how to enhance hydrogen energy production to guide SADC countries to ramp their transition to a hydrogen energy-based economy can be made.

- **Establishing the role of hydrogen within long-term energy strategies.** There is a need to have these policies embedded in national, regional, and local governments to guide future expectations. In this way, firms would have their

long-term goals outlined. Some key industrial sectors that can be targeted include refineries, chemical, iron and steel, transport, buildings, and energy generation and energy storage.

- **Stimulate commercial demand for green hydrogen.** While green hydrogen technology is available, to date, its cost remains a challenge. This shows that there is a need for countries in the SADC region to create sustainable markets for green hydrogen, reduce carbon emissions from fossil fuel-based hydrogen, and underpin the energy investments by local, private, and public investors and all supply chain distributors and end-users. Furthermore, scaling up the supply chain network of green hydrogen could lead to increased energy production, while an emphasis on clean energy would increase the production cost of energy from fossil fuel-based electricity because of carbon capture, utilization, and storage.

- **Investment risks sharing and incentivizing.** New entrants or firms that express interest in hydrogen energy production, supply, distribution, and infrastructural development projects usually bear the highest risk at the deployment stage, especially those in the private sector. There is a need to assist the private sector with hydrogen energy mentorship, incentivize loans, provide guarantees, and tax rebates on tools, and even provide rewards.

- **Public financial institutions support for research and development (R&D)**. This approach is necessary for the hydrogen production and supply chain network because the cost of production plays a critical role in any business. R&D is a crucial strategy that can lower the production costs, improve technology performances of electrolyzers, fuel cells, and any other hydrogen-based technologies. This can also be extended to the desalination processes, especially in countries that have a seashore. SADC countries have almost 10,000 km of a seashore from Tanzania on the east coast to the DRC on the west coast of Southern Africa. Furthermore, the actions that any government takes, especially through providing financial mechanisms for the public, are significant in promoting R&D, risk management, and attracting both international investors and private investors.

- **Eliminate unnecessary regulatory barriers and harmonize standards.** In most SADC countries, hydrogen energy project developers may face licensing barriers due to unclear licensing requirements and regulations, and such inconsistencies are capable of retarding progress in the transition to hydrogen energy-based economies. This calls for several commitments in the form of a Memorandum of Understanding (MOU)/treaties, and dialogue among different stakeholders including the government, private sector, civil society, and the community at large.

- **Engage internationally and track progress**. Apart from HYSA in South Africa, since there is very little research and development currently ongoing in Southern Africa, nations are encouraged to enhance their international and bilateral cooperation with firms and companies that are global leaders in hydrogen deployment to keep up with international standards, embrace knowledge sharing, lessons learnt, and adopt best practices in the hydrogen energy industry.

- **Explore opportunities to enhance future hydrogen development progress.** By building on current policies, infrastructure, and skills, enhanced investor confidence, and lower costs, nations in Southern Africa can:

  - Transform the existing industrial seaports into hubs for lower-cost, lower-carbon hydrogen;

  - Use the existing natural gas/coal infrastructure to accommodate green hydrogen energy supplies;

  - Improve the transport freight and fleets by making road and railway corridors that are hydrogen energy ready and build infrastructure that can, in the short-term, help export green hydrogen and in the long run, cater for fuel-cell vehicles and other hydrogen energy end-line users and make the entire value chain more competitive; and

  - Establish the shipping routes to kick-start the international hydrogen trade.

Furthermore, for hydrogen to enhance green energy transitions, it should be embraced in areas where it is missing, such as in power production/generation, buildings, and the transport sector. The policy recommendations on how to enhance hydrogen energy production to guide the SADC countries to ramp their transition to a hydrogen energy-based economy are made in line with the International Energy Agency (IEA) recommendations [3].

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