

# Policy Framework for Enhancing Energy Access and Shift Toward Renewable Energy Sources in Namibia

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**Abstract:** This policy framework is essential for enhancing energy access and shift towards renewable energy sources in Namibia, as the country faces significant challenges in achieving universal energy access and transitioning to a sustainable energy future. Although Namibia is well-positioned to harness its abundant renewable energy resources, such as solar, wind, and biomass, to transform its energy landscape, the country still depends on traditional energy, predominantly biomass, for energy among rural households, leading to environmental degradation and health risks. Also, the country remains heavily reliant on imported electricity with underdeveloped infrastructure, financial constraints, technical capacity deficiency, and poor implementation of policies and regulatory framework. These challenges hinder the country's ability to ensure energy security, regardless of the strengths and opportunities of the existing national energy policy, as weaknesses and threats of the same policy deter progress. As such, this policy framework calls for expanding renewable energy capacity, strengthening rural electrification efforts, enhancing institutional support and cross-sector collaboration, facilitating regional integration and improved energy security, and enhancing financial mechanisms for renewable adoption. These recommendations will help Namibia to reduce its dependence on imported energy and create a more resilient and inclusive energy sector. This transformation aims to contribute to socio-economic development, environmental sustainability, and improved living standards for Namibians to realise the country's alignment with global energy transition goals.

**Keywords:** Renewable energy development in Namibia, Renewable energy sources in Namibia, Energy access in Namibia, Energy security in Namibia

## 1. Introduction

Over the last decade, Namibia's population has drastically increased from 2.5 million in 2011 to 3.05 million in 2024 (Namibia Statistics Agency [NSA], 2024). As the country is divided between urbanised regions and expansive rural areas, 53.7% of the population lives in urban areas, while the rest reside in rural areas (NSA, 2024). From the economic perspective, while the country has experienced moderate economic growth over the years, reaching a GDP per capita of about USD 4 743 in 2023 (World Bank, 2024a), inequality continues to persist with a GINI coefficient of approximately 64.2 (World Economics, 2019). This income disparity and sparse population in rural regions hinders service delivery, particularly for energy, which remains critical to supporting social and economic development. These challenges drive urban migration, indicating the need for reliable energy access intensification to accelerate social welfare and prosperous industrialisation goals as stipulated in Namibia's 5<sup>th</sup> National Development Plan (National Planning Commission, 2017).

Given that background, Namibia's energy landscape has undergone significant evolution shaped by its geographical, economic, and political circumstances. From the colonial era to

post-independence aspirations, Namibia has faced energy challenges while striving for sustainable development and energy security. Historically, the country's energy sector has been suffering from the issues of infrastructure deficit and reliance on traditional biomass fuels such as wood and dung for cooking and heating (Gross and Mautz, 2022). During the colonial era, Namibia was administered by Germany and later by South Africa. Energy development during this period was primarily focused on supporting the needs of the colonial powers, with little consideration for the long-term energy requirements of the Indigenous population (Gross and Mautz, 2022). The years following the country's independence in 1990 marked a turning point in Namibia's energy trajectory, as the government began to recognise the need to modernise the energy sector to meet the growing demands of households, businesses, and industries (National Planning Commission, 2017).

In so doing, Namibia embarked on initiatives to diversify its energy mix and promote renewable energy sources, given its abundant solar and wind resources, which present opportunities for sustainable energy development (International Energy Agency [IEA], 2022). The country launched the Renewable Energy Feed-In Tariff (REFIT) program in 2010, aiming to incentivise investment in renewable energy projects, particularly solar and wind farms (Namibia Investment Promotions Director Board [NIPDB], 2023). Also, Namibia committed to renewable energy by reinforcing its participation in international agreements and initiatives promoting sustainable development and climate action. The country ratified the Paris Agreement in 2016, affirming its commitment to reducing greenhouse gas emissions and transitioning towards a low-carbon economy (United Nations Climate Change, 2016).

However, with an annual power consumption of 600 MW and a projected growth rate of 5% for annual demand (National Planning Commission, 2017), the country still relies heavily on imported energy, which accounts for approximately 61%, mainly from South Africa, while local generation accounts for a mere 39% of electricity production (Ministry of Mines and Energy, 2017a). As a monopolised energy market, NamPower serves as both the power producer and the sole purchaser. Electrification rates stand at 56.19%, with urban and rural accounting for 74.75% and 33.21%, respectively (IEA, 2022). These statistics indicate a pressing need to address the issue of energy poverty. Thus, this policy framework aims to enhance energy access across Namibia by promoting renewable energy development, improving rural electrification, and strengthening energy security through coordinated stakeholder action. In so doing, the study explores the main energy sources in Namibia, assesses the challenges to energy access and ongoing efforts, performs a SWOT analysis of the existing energy policy, and provides recommendations for enhancing energy access in Namibia.

Following this background, this policy framework comprises five sections, with the current section detailing the background. Section 2 unpacks the main sources of energy in Namibia; section 3 highlights the challenges to energy access and ongoing efforts; section 4 focuses on the SWOT analysis of the existing energy policy; and section 5 provides a conclusion and recommendations for enhancing energy access in Namibia.

## **2. Main Sources of Energy in Namibia**

Namibia's energy portfolio is characterised by a wide range of sources, including both conventional and renewables. Extensive renewable resources include solar, wind, biomass, and hydroelectric capacity, with its finite domestic fossil fuel reserves.

### **2.1. Hydropower**

Hydropower holds significant potential as an energy source in Namibia, although it is relatively underdeveloped compared to other renewable energy options. The country's rivers, including the Kunene and Orange, offer opportunities for hydroelectric generation (NIPDB, 2023). However, challenges like water scarcity and the high capital costs of infrastructure development hinder the widespread adoption of hydropower.

## **2.2. Solar, Wind, Geothermal, Biofuels, and Waste**

Namibia has diverse renewable energy potentials, with solar, wind, geothermal, biofuels, and waste as promising sources (Ministry of Mines and Energy, 2022). The country's abundant sunlight makes solar power a particularly attractive option, with vast desert expanses offering ideal solar energy generation conditions. Wind resources are also abundant, especially along the coastal regions, presenting opportunities for wind farm development. While geothermal energy remains largely untapped, the potential exists in certain regions, offering a reliable and sustainable energy source. Biofuels from agricultural residues and waste biomass carry the potential for decentralised energy production to support rural communities while reducing reliance on fossil fuels. Additionally, waste-to-energy technologies provide a sustainable solution for managing municipal and industrial waste by turning it into electricity or heat. Thus, embracing these renewable energy sources is necessary to enhance energy security and mitigate environmental impacts for sustainable development and economic welfare.

## **2.3. Firewood**

In Namibia, where energy resources are scarce, firewood remains a vital source of energy for many households, predominantly in rural areas (Gross and Mautz, 2022). With limited access to electricity and modern fuels, communities gather and burn firewood for cooking, heating, and other domestic needs. However, this dependence comes with environmental degradation and health issues. Thus, there is a need to promote sustainable forestry practices and alternative clean energy sources.

## **2.4. Charcoal**

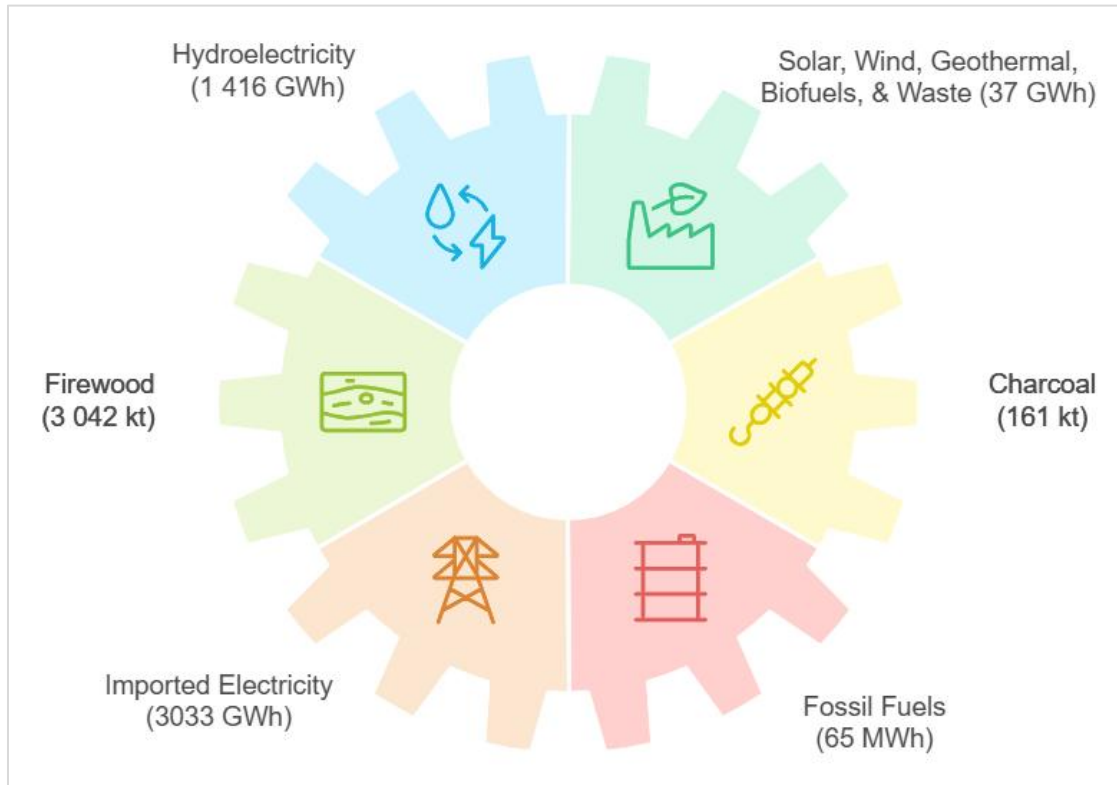
Charcoal serves as a prevalent energy source in Namibia due to its affordability and accessibility (Gross and Mautz, 2022). Many households rely on charcoal for cooking and heating, especially in rural areas with limited access to electricity or gas. Nevertheless, the production of charcoal often involves unsustainable practices like deforestation and contributes to air pollution. Hence, promoting sustainable modern biomass sources and efficient kiln technologies is essential to mitigate environmental degradation while ensuring continued access to affordable energy.

## **2.5. Fossil Fuels**

Fossil fuels, predominantly diesel and imported coal play a significant role in Namibia's energy landscape by powering industries, transportation, and electricity generation (Namcor, 2023). While these resources provide reliable energy, they pose environmental challenges, including greenhouse gas emissions and air pollution. Due to fluctuating global prices, Namibia's heavy reliance on imported fuels also exposes it to economic vulnerabilities. To address these issues, exploring renewable energy alternatives and diversifying the energy mix is vital for promoting sustainable practices towards more resilient and environmentally friendly energy.

## **2.6. Imported Electricity**

Namibia imports significant electricity from neighbouring countries, primarily South Africa (Ministry of Industrialisation and Trade, 2020). Power purchase agreements and regional transmission networks facilitate the importation of electricity to meet domestic demand, particularly in urban centres and industrial hubs. Nonetheless, the reliance on imported electricity exposes Namibia to supply disruptions and price volatility, highlighting the importance of enhancing domestic energy production capacity (Gross and Mautz, 2022). Figure 1 illustrates Namibia's main energy sources and their production capacity.



**Figure 1:** Namibia's energy sources

Source: Authors' compilation using AFREC (2019) data

### **3. Challenges to Energy Access and Ongoing Efforts**

Although Namibia has gained from diversifying its energy mix, the country is still faced with various challenges which impede its ability to attain energy efficiency. These challenges include but are not limited to inadequate infrastructure, financial constraints, limited technical capacity, poor implementation of policy regulatory framework, and dependence on imported energy.

#### **3.1. Inadequate Infrastructure**

Limited infrastructure presents a significant challenge to Namibia's energy sector development. Remote rural areas often lack access to electricity grids, hindering efforts to electrify these regions, while inadequate transportation networks impede the distribution of energy resources, such as fuel and equipment, to various parts of the country (Gross and Mautz, 2022). Insufficient infrastructure also hampers the implementation of renewable energy projects, as connecting remote renewable energy sources to the national grid requires huge funds for transmission infrastructure.

#### **3.2. Financial Constraints**

Scanty financial resources and investment barriers hinder Namibia's scale-up of renewable energy projects. Inadequate access to capital impedes investment in critical infrastructure upgrades and the adoption of renewable energy technologies, while high upfront costs associated with modernising existing energy systems and expanding access to electricity in rural areas strain government budgets (Ministry of Mines and Energy, 2017b).

### **3.3. Limited Technical Capacity**

Namibia's technical expertise in renewable energy deployment and management is still developing. A shortage of skilled professionals, particularly in the fields of engineering, project management, and policy development, continues to hinder the implementation of renewable energy projects and the effective operation of energy infrastructure (Ministry of Mines and Energy, 2017b). This highlights the need for more technical experts in the country.

### **3.4. Poor Implementation of Policy and Regulatory Framework**

While Namibia has made strides in developing policies and regulations to support renewable energy deployment, there remain inconsistencies, gaps, and delays in implementation (Gross and Mautz, 2022). This hinders the creation of an enabling environment for energy development.

### **3.5. Dependence on Imported Energy**

Namibia's reliance on external suppliers for electricity (primarily from South Africa) and liquid fuels exposes it to price volatility and supply chain risks. Global oil price fluctuations and exchange rate variability drive up domestic energy costs, which make it harder to maintain affordable energy prices (Gross and Mautz, 2022).

Overall, these challenges hinder the country's ability to improve energy access. Therefore, the country has been determined to address these challenges by implementing several policies and programs. For instance, Namibia established the National Energy Policy to ensure energy security (Ministry of Mines and Energy, 2017a), as well as the Interim Renewable Energy Feed-in Tariff (REFIT) program, which incentivises Independent Power Producers (IPPs) to develop solar and wind projects (Ministry of Mines and Energy, 2017b). These projects' 70 MW capacity addition reflects early successes but signals a need for scaled-up efforts. The country also developed the Rural Electricity Distribution Master Plan (Ministry of Mines and Energy, 2000) and the Off-Grid Energisation Master Plan, which provides a structured approach to extending access to energy in rural areas (Ministry of Mines and Energy, 2007). However, implementation has been slow.

## **4. SWOT Analysis of Namibia's Existing National Energy Policy**

Namibia has an existing national energy policy that was established in 2017 (Ministry of Mines and Energy, 2017a). This section performs the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis to identify areas for improvement.

### **4.1. Strengths**

The policy aligns with Namibia's Vision 2030 and the United Nations Sustainable Development Goal 7 (SDG 7), emphasising affordable, secure, and sustainable energy access by promoting domestic renewable resources like solar and wind to reduce import dependency. It establishes a robust regulatory framework managed by the Electricity Control Board (ECB) to encourage private sector investment through support for Independent Power Producers (IPPs) and prioritising rural electrification through the Rural Electricity Distribution Master Plan and Off-Grid Energisation Master Plan.

### **4.2. Weaknesses**

The policy highlights Namibia's reliance on imported energy but lacks specific short-term actions to reduce this dependency, such as diversification efforts or emergency energy security measures. Additionally, the policy falls short in financial strategies, as it does not clearly define mechanisms like subsidies or tax incentives to attract investment in renewable

energy, especially for rural electrification. The absence of statistical targets and timelines limits effective progress tracking and accountability, while an underdeveloped monitoring and evaluation framework hinders the assessment of policy impact. Furthermore, although the policy prioritises renewables, it does not address the technical challenges of integrating intermittent sources into the grid, risking stability, and limiting their role in enhancing energy security.

#### 4.3. Opportunities

The policy underscores Namibia's abundant solar and wind resources, presenting opportunities to expand renewable energy generation. This aligns well with global shifts toward renewables and attracting potential international investment and technical assistance. The policy also emphasises regional cooperation through platforms like the Southern African Power Pool (SAPP) that can enhance energy security and reduce costs and access to global green funds and climate financing (Gu et al., 2023), bolstering clean energy projects and climate resilience efforts.

#### 4.4. Threats

The policy is silent on four main potential threats. First is the reliance on imported electricity and fuel, which makes it vulnerable to global market fluctuations, exchange rate volatility, and price increases. This has the potential to worsen both affordability and energy security. Second is climate-related risks, such as droughts that affect hydropower and extreme weather events that damage infrastructure, potentially hindering energy supply. Third is integrating renewable sources like solar and wind into the grid, which is complex and requires advanced technology and investment that strains existing resources (Obrenovic and Jalilov, 2014; Asa et al., 2022; Yu et al., 2023). Last is bureaucratic delays and limited financial resources, which could hinder the implementation of policy goals, especially for renewable energy expansion and rural electrification efforts. Figure 2 depicts the SWOT analysis of Namibia's existing energy policy.

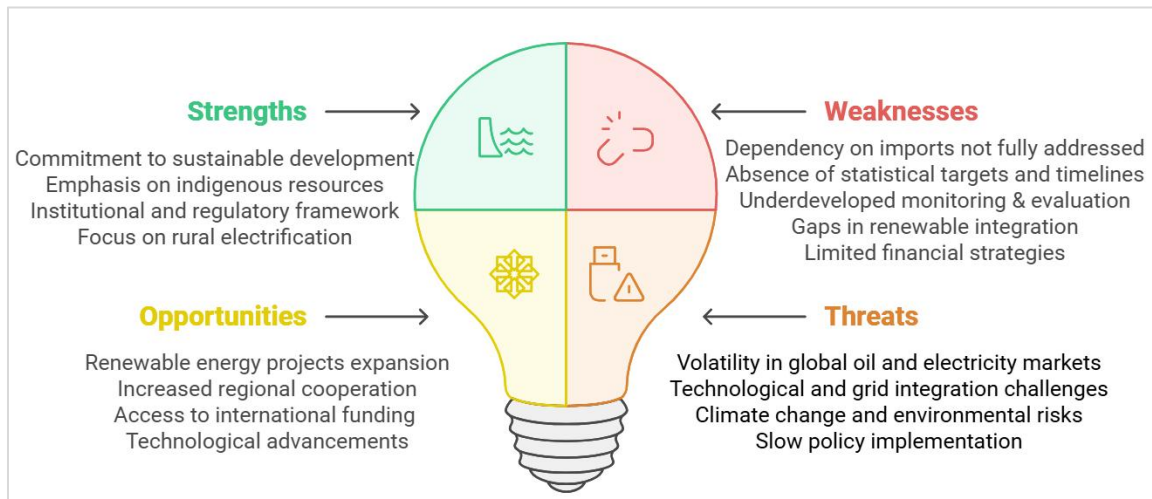


Figure 2: SWOT analysis of Namibia's energy policy

Source: Authors' development (2024)

## 5. Conclusion and Recommendations

In conclusion, Namibia's pursuit of sustainable and accessible energy is guided by national policy. However, the policy has room for improvement, giving rise to developing this framework that highlights collaborative stakeholder efforts and a strong commitment to advancing renewable energy. Expanding renewable capacity, prioritising rural electrification,

and fostering regional cooperation open pathways for Namibia to reduce its dependence on energy imports and strengthen energy security. This approach supports fair and equitable energy access for communities across both urban and rural areas.

Namibia's 2017 National Energy Policy provides a solid foundation for supporting energy security and economic growth. However, the following recommendations outline practical strategies to improve energy access and shift toward renewable energy sources to achieve universal energy access and reduce reliance on imports. Each recommendation is aligned with the key roles of specific stakeholders to ensure efficient implementation, as displayed in Figure 3.

**a) Expand renewable energy capacity**

Encourage investment in solar, wind, and biomass projects by providing tax incentives, subsidies, and a streamlined approval process for IPPs and developing energy storage solutions and grid management tools to stabilise renewable energy integration. This requires key stakeholders, including:

- The Ministry of Mines and Energy (MME) to reform the existing energy policy by adding target statistics and timeframe, as well as to formulate policy incentives, facilitate tax relief for renewable energy projects, and coordinate with the Ministry of Finance to structure subsidies.
- NamPower manages grid expansion and storage integration for renewable energy sources and procures energy from Independent Power Producers (IPPs) to stabilise supply.
- The Electricity Control Board (ECB) to regulate and license IPPs to ensure a transparent and efficient approval process and set standards for renewable energy sources.
- Namibia Energy Institute (NEI) to conduct further research on the technical aspects of renewable integration and advise on best practices for energy storage.

**b) Strengthen rural electrification efforts**

Allocate additional funding to the Rural Electricity Distribution Master Plan with a high priority on high-impact areas. Also, promote using mini-grids and off-grid solar systems for isolated communities, using public-private partnerships to reduce costs and improve sustainability. The key stakeholders include:

- MME to administer the rural electrification master plan, allocates government funding, and facilitates public-private partnerships.
- NamPower and Regional Electricity Distributors (REDs) to implement grid extension projects and manage distribution networks in rural areas, focusing on underserved regions.
- Ministry of Finance (MoF) to provide tax breaks and subsidies for companies and households adopting off-grid renewable energy systems.
- NEI to develop community training and awareness programs to educate rural populations on adopting and maintaining off-grid solutions.

**c) Increase institutional support and cross-sector collaboration**

Enhance coordination between the MME, ECB, NamPower, and local governments to streamline renewable project approvals, align renewable development goals, and clarify licensing processes. Additionally, strengthen cross-sector collaboration to mobilise resources and technical expertise efficiently. Relevant stakeholders encompass:

- MME to lead coordination efforts, establish timelines for project approvals, and align sector goals with other national policies.
- ECB to standardise the licensing process and facilitate regulatory compliance for new renewable energy projects.
- NamPower collaborates with REDs to address infrastructure requirements and co-manages renewable energy integration.

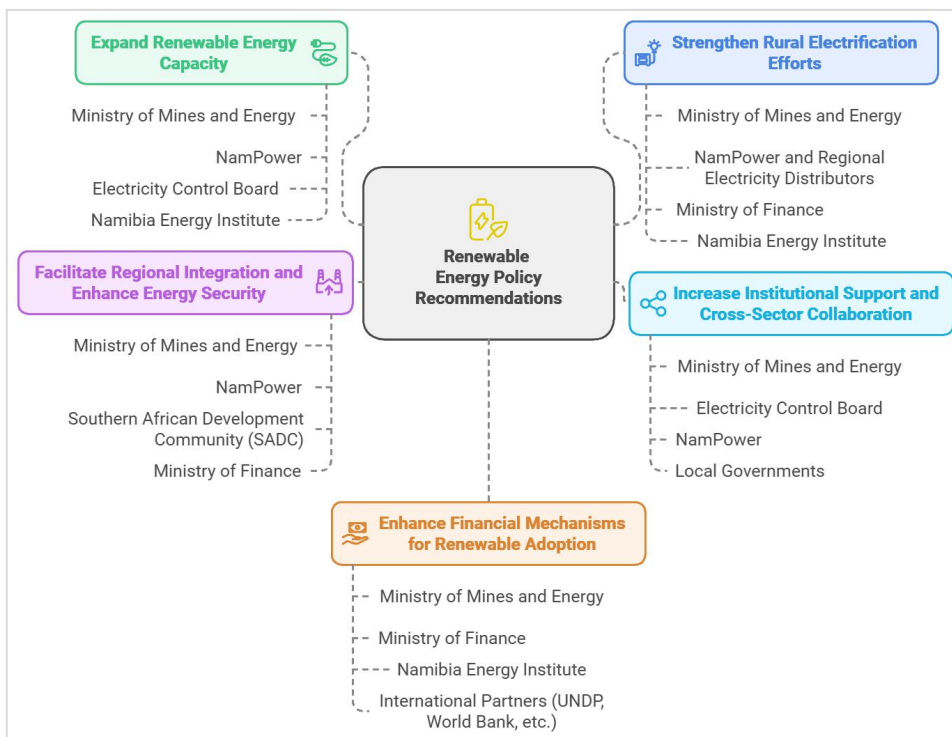
- Local governments to ensure local planning and support community engagement for energy project adoption.

**d) Facilitate regional integration and enhance energy security**

Strengthen Namibia’s participation in the Southern African Power Pool (SAPP) by pursuing bilateral agreements and joint renewable projects with neighbouring countries to improve energy security and manage import dependency. The key stakeholders comprise:

- MME to lead bilateral negotiations and develops energy trade policies in line with SAPP guidelines, ensuring mutual benefits and energy security.
- NamPower to represent Namibia in SAPP, manage cross-border transmission infrastructure, and coordinate electricity import/export agreements.
- Southern African Development Community (SADC) to facilitates regional energy cooperation by aligning regulatory frameworks and promoting cross-border renewable energy projects.

MoF to mobilise financial resources for infrastructure development in cross-border energy initiatives and oversee investment in joint projects.



**Figure 3:** Renewable energy recommendation and key stakeholders

Source: Authors’ development (2024)

**e) Enhance financial mechanisms for renewable adoption**

Expand funding mechanisms like the Solar Revolving Fund to support renewable energy installations for households and SMEs. Introduce specialised biomass and wind energy funds and seek international financial and technical assistance to bridge funding gaps for large-scale infrastructure projects. Also, invest revenue from fossil fuels in developing renewable energy projects. Relevant stakeholders include:

- MME to manage the Solar Revolving Fund, introduce targeted renewable funds for other energy sources, and seek international partnerships for renewable funding.
- MoF to allocate budgetary support and provide financial guarantees for renewable energy investments and to work with international donors and financial institutions to



secure funding. The MoF should also enforce policies for using revenues from fossil fuels on renewable energy projects.

- NEI to provide technical assistance and consult on funding feasibility for renewable projects, aligning with international standards to attract global financing.
- International partners like the UNDP, World Bank, AfDB, etc., to provide funding, technical guidance, and capacity-building support for Namibia's renewable energy expansion.

## References

- AFREC. (2023). *Key Africa Energy Statistics*. Retrieved December 31, 2024, from
- Asa, A. R., Campbell, H., and Nautwima, J. P. (2022). A critical review of organizing knowledge management for innovation. *International Journal of Management Science and Business Administration*, 8(2), 7-15. Gu, X., Firdousi, S. F., Obrenovic, B., Afzal, A., Amir, B., and Wu, T. (2023). The influence of green finance availability to retailers on purchase intention: A consumer perspective with the moderating role of consciousness. *Environmental Science and Pollution Research*, 30(27), 71209–71225. [CrossRef](#)
- Gross, M., and Mautz, R. (2022). Sector brief Namibia: Renewable energies. In *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)*. [CrossRef](#)
- International Energy Agency. (2022). *Tracking SDG 7. Namibia*. Energy Sector Management Assistance Program (ESMAP). Retrieved December 31, 2024, from [CrossRef](#)
- International Renewable Energy Agency. (2020). *Namibia Energy Profile*. Masdar City: IRENA International
- Ministry of Industrialisation and Trade. (2020). Energy Sector. Retrieved December 31, 2024, from [CrossRef](#)
- Ministry of Mines and Energy Namibia. (2022). Green Hydrogen and Derivatives Strategy. In *Harwambee Prosperity Plan 2021-2025, II*, 1–48. Retrieved December 31, 2024, from [CrossRef](#)
- Ministry of Mines and Energy. (2000). *Namibia Rural Electricity Distribution Master Plan*. Government of the Republic of Namibia.
- Ministry of Mines and Energy. (2007). *Off-Grid Energisation Master Plan for Namibia*. Government of the Republic of Namibia.
- Ministry of Mines and Energy. (2017a). *National energy policy* [CrossRef](#)
- Ministry of Mines and Energy. (2017b). *National renewable energy policy* (Issue January).
- Namibia Investment Promotions and Development Board. (2023). *Namibia Energy Sector Overview*. Retrieved December 31, 2024, from Namibia Investment Promotions Director Board. (2023). *Green Hydrogen Namibia2*. Retrieved December 31, 2024, from
- National Planning Commission. (2017). *Namibia's 5th National Development plan (NDP5)*, 5.
- Obrenovic, B., and Jalilov, S. (2014). Building a better national innovation system through effective knowledge sharing: A case of Croatia. *International Journal of Management Science and Business Administration*, 1(1), 41–51.
- United Nations Climate Change. (2016, October 10). Paris Agreement: Status of Ratification. Retrieved December 31, 2024, from World Bank. (2023). *GDP per capita (current US\$) - Namibia*. Retrieved December 31, 2024, from [CrossRef](#)
- World Economics. (2019). *Gini year: Namibia*. Retrieved December 31, 2024, from [CrossRef](#)
- Yu, Y., Hu, W., Dong, C., Gu, X., and Obrenovic, B. (2023). E-commerce development and green technology innovation: Impact mechanism and the spatial spillover effect. *Sustainability*, 15(17), 12988. [CrossRef](#)