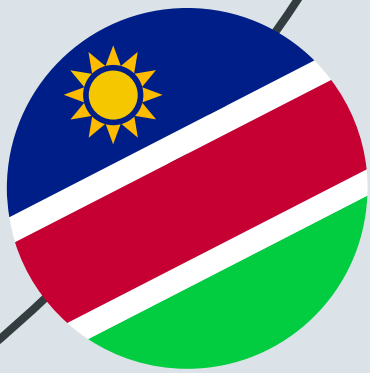
NEW CLIMATE INSTITUTE

Case study

THE LANDSCAPE OF GREEN HYDROGEN IN NAMIBIA

According to cost-projections, Namibia can theoretically produce some of most cost competitive green hydrogen globally. While the country is endowed with significant solar and wind resources, it is today highly dependent on energy imports and drought-vulnerable hydropower. It has high wealth inequality, and many people lack energy access, particularly in rural areas. Green hydrogen production, which utilises renewable energy sources, presents an opportunity to enhance domestic energy security and build domestic industry. Surplus production could be exported, thereby decreasing import dependence, and improving its trade balance. Enhanced solar and wind capacity could also increase domestic electricity generation, helping the country meet its decarbonisation and energy access targets. But Namibia lacks important regulations to align green hydrogen production with its development and decarbonisation priorities. There are no regulations on the additionality of renewables for hydrogen production which are crucial to ensure production does not compete with domestic decarbonisation or energy access. It also lacks clear mandates for local content in supply chains and incentives to promote domestic demand, potentially missing an opportunity to capture benefits locally and nurture domestic value-added industries.



This case on green hydrogen in Namibia is part of NewClimate's broader work on the role of green hydrogen in a just, Paris-compatible transition. As part of our work, we also developed cases on India and Colombia and a background report which delves into the sustainable development and climate considerations of green hydrogen production in developing and emerging economies. A third output will be published in 2024 focused on analysing the role of multilateral development banks in supporting green hydrogen initiatives.

KEY DEVELOPMENT INDICATORS

Namibia is an upper middle-income country of 2.6 million people. It has low economic complexity with the majority of its GDP driven by services, industry (i.e., mining[1]), and agriculture [2]–[4]. Despite its income classification, Namibia ranks one of the most unequal countries in the world [5] with 19% of its population living below the global poverty line [6]. In 2018, the overall unemployment rate stood at 33% and at a staggering 46% for youth [7]. Only 55% of the population have access to electricity [8], a figure that drops to 33% in rural areas [9].

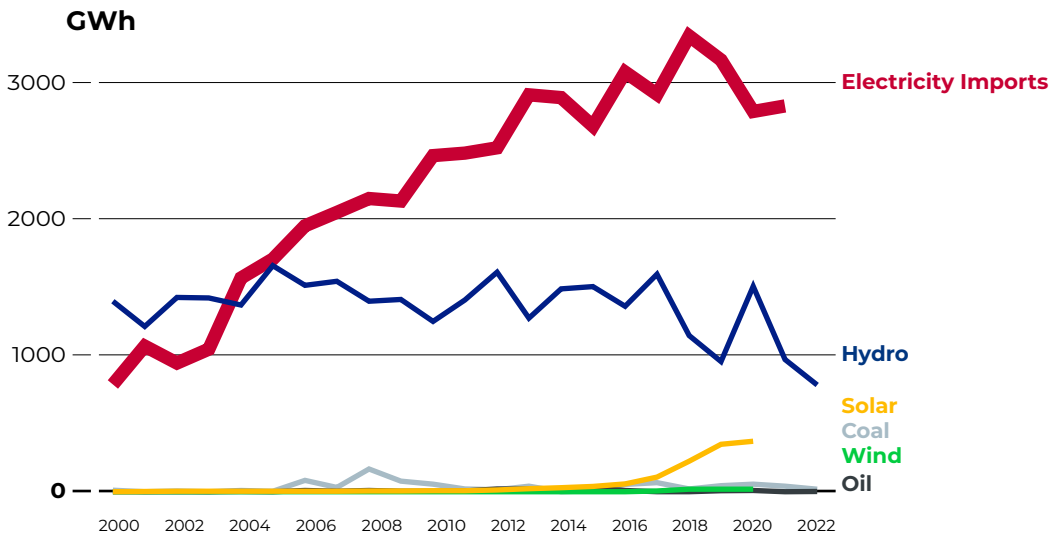
Namibia is a geographically large country with 1,500 km of coastline on the South Atlantic. But, because of its location between two deserts, the Kalahari Desert to the east and the Namib Desert to the west, it is one of the driest countries in Sub-Saharan Africa. It has low population density, with the majority of its population living in rural areas [10] and reliant on rainfed subsistence farming which is threatened by changing rainfall patterns.

Namibia's Vision 2030 sets out a framework for social and economic development with the objective to transform the country into a developed economy by 2030 [11]. Central to this Vision is the prioritisation of energy and water security, economic transformation through value-added industrialisation, and strengthened export capacity and regional integration [12], [13].

ENERGY SECTOR OVERVIEW

Namibia has some of the world's highest potential for solar and wind generation [14], [15], but currently imports over 60% of its energy from neighbours [16] which exposes it to market volatility and, in the case of imports from South Africa, load-shedding [17]. Import dependence results in reliance on regional coal-based power generation. Fossil fuel consumption is not accounted for in emissions data and therefore not reflected in Namibia's emission reporting. Hydropower makes up the majority of domestic electricity generation with wind and solar contributing a small share **(see Figure 1)**.

1 Namibia exports diamonds, uranium, copper, and gold. It also has significant reserves of cobalt and lithium, critical raw materials for renewables [1].



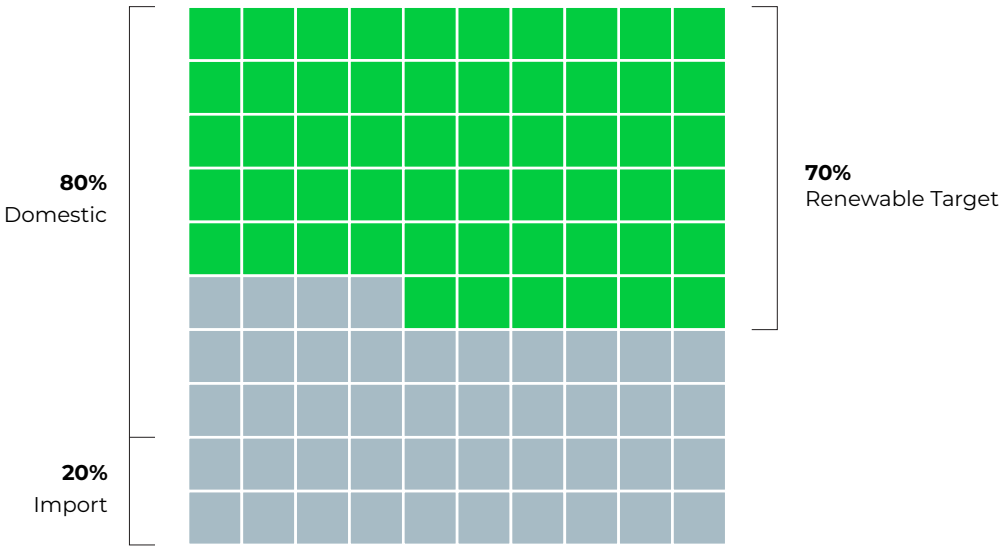
Source: Authors based on IEA data.

Figure 1:

Sources of Namibia's electricity generation

Note: Authors based on IEA data [18]. Due to data availability, data for solar and wind end in 2020. Data for energy imports also ends in 2021.

Industrialisation and the expansion of universal access to electricity are projected to double Namibia's peak electricity demand from 673 MW in 2020 to 1,348 MW in 2030 [12]. However, climate change threatens Namibia's energy security. In 2019, prolonged drought dropped hydropower electricity generation to below 40% of its capacity [19]. To address energy security concerns and reduce energy sector emissions, Namibia plans to replace imported fossil fuel energy with a diverse renewable mix which utilises its wind and solar resources. Its 2022 National Integrated Resource Plan outlines a roadmap to meet 80% of electricity requirements locally by 2028 [20] – by 2030, it plans to generate 70% of its electricity from renewable energy [21]. If Namibia meets its targets, 56% of its energy demand would be meet with renewables by 2030, leaving 24% of domestic generation from non-renewables and 20% imported from predominately coal-dependent neighbours **(see → Figure 2)**.



Source: Authors based on IEA data.

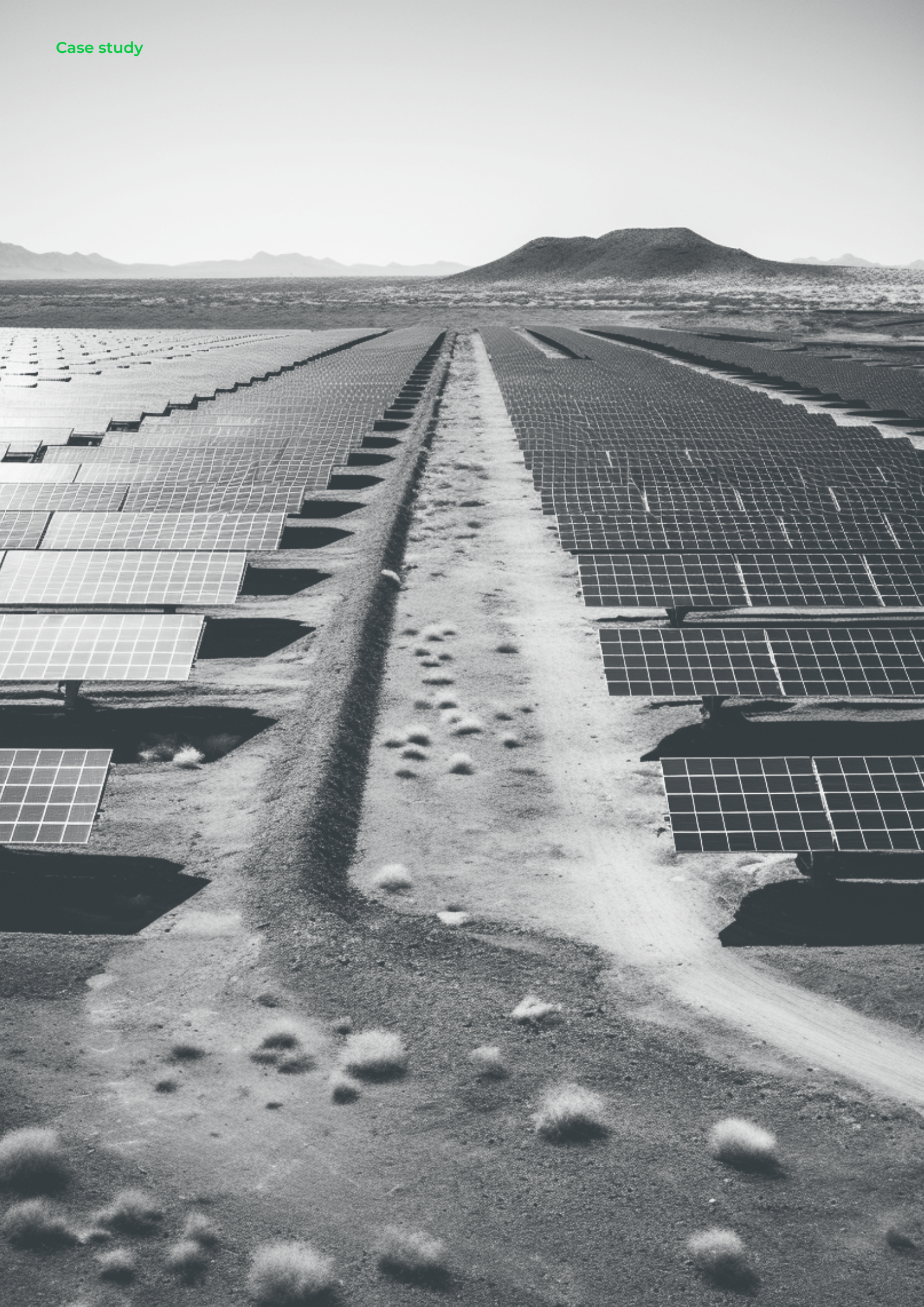
Figure 2:
Namibia's 2030 energy targets

CURRENT STATUS OF HYDROGEN AND DERIVATIVES

Domestic use of hydrogen and derivates in Namibia today is limited. The country has modest industrial capacity, does not refine oil domestically, and imports the majority of its fertiliser demand. While there is limited domestic demand, Namibia's hydrogen strategy notes green hydrogen could play a role in decarbonising the mining sector, for example through green hydrogen fuelled heavy-duty mining trucks [22]. It also notes pilot opportunities to use green hydrogen for low-emission transport solutions like tugboats and regional trains, and green ammonia for fertiliser production. Domestic demand for hydrogen could increase in the future as Namibia industrialises and increases its domestic capacity to embody hydrogen into green products (e.g., fertiliser or steel). While industrial processes and product use (IPPU) sector emissions contribute only 2% to Namibia's cumulative emissions today [23], green hydrogen, alongside direct electrification, will be important to mitigate emissions in a growing sector and ensure exports remain competitive under carbon pricing schemes. Namibia's hydrogen strategy plans to export hydrogen to Europe, China, Japan, and South Korea in the form of ammonia, green hydrogen-based hot briquetted iron, methanol, and e-kerosene [22], but the country needs to develop more complex technical and industrial capacity to produce these derivatives [24].

The production of green hydrogen in Namibia could also be important for decarbonisation, energy security, and

Case study



industrial development in the Southern African Development Community (SADC). Namibia's hydrogen strategy sets out its ambition to catalyse regional green hydrogen value chains and cooperation through green transport corridors and shared infrastructure (ports and cross-boarder pipelines and transmission networks) [22]. In the future, Namibia could export excess renewable energy generation to the Southern African Power Pool (SAPP) or export green hydrogen to more industrialised fossil-fuel-dependent neighbours. It could also support manufacturing collaborations and partnerships with neighbours to produce various supply chain components. Through the African Green Hydrogen Alliance, Namibia seeks to intensify collaboration and generate partnerships [25]. While collaboration with neighbouring countries presents opportunities, Namibia must contend with regional competitors like South Africa who have similar renewable resource potential and existing experience with hydrogen and ammonia production.

Being a net exporter of energy and hydrogen derivates could lead to an influx of foreign capital and positively influence Namibia's balance of trade. However, with limited domestic and regional demand for green hydrogen today, Namibia risks being a price taker who is dependent on international markets to offtake its supply [26]. Export of hydrogen to demand centres abroad would be in competition with domestic energy access and regional use and could potentially delay Namibia's domestic decarbonisation pathway.

POLICY FRAMEWORK

Namibia's hydrogen strategy sets a production target of 10-15 million tonnes (Mt) hydrogen equivalent per year by 2050 which equates to 5-8% of the expected international trade volume [22]. Producing 15 Mt of green hydrogen would require 750 TWh/year in renewable energy generation and, if generated exclusively from solar power would require over 250 gigawatts (GW) of solar capacity[2] (not including energy needed for desalination or to convert green hydrogen to ammonia) [22]. Namibia's domestic renewable energy generation was 1.33 TWh in 2020 – solar and wind accounted for only 0.45 TWh [27]. To meet its green hydrogen target, Namibia must massively accelerate renewable installations capacity in the coming decades.

Significant energy demand from hydrogen production could strain Namibia's supply of renewable energy and compete with and delay its efforts to reduce dependence on fossil fuel intensive imports and scale the renewable share in its energy mix. Namibia's green hydrogen strategy highlights that oversizing renewable power installations[3] can free up additional capacities for domestic use, facilitate affordable electricity access, and attract new energy-intensive industries [22]. This requires capacity to be integrated or fed into the grid. Green hydrogen installations under construction in Namibia plan to utilise captive or off grid renewable energy – meaning they do not

2 Assuming a solar capacity factor of 30% and that 44.4kWh of electricity is needed to get hydrogen out with an energy value of 33.3kWh (75% electrolyser efficiency).

3 Oversizing power installations is when more capacity is added then is required.

produce hydrogen with energy from the grid. Namibia is evaluating the potential to integrate captive installations into the grid.

While Namibia outlines its vision for green hydrogen contributing to a decarbonised grid and increased energy access, it has yet to provide regulation or detailed guidance on oversizing renewable power installations and grid integration which are needed to ensure installations contribute to development objectives outlined in its 2030 Vision and Prosperity Plan [10], [12]. Clear guidance is also needed on how electrolysers producing green hydrogen would be prioritised verses other demand sources when supply is limited (e.g., residential, or local industrial use) to ensure hydrogen production does not complete with energy access.

Capturing value locally

Scaling value-added industrialisation is one of Namibia's key development priorities. Its hydrogen strategy promotes green industrialisation through a plan to localise the upstream and downstream green hydrogen supply chain [22]. Research finds potential for Namibia to localise components of the upstream and downstream value chain, including renewable components (e.g., wind foundations and blades and copper cables); assembly of wind, solar, hydrogen and transportation infrastructure; and production of Power-to-X products (e.g., fertilisers and green steel) [28]. The country estimates that local tower and blade manufacturing and solar cell and module manufacturing could generate USD 7 billion and USD 4 billion respectively between 2035-2040 [22]. Namibia has established a green hydrogen research institute to analyse localising the value chain and support capacity building and innovation between industry, government, and academia.

To support a localised green hydrogen economy, Namibia created the Southern Corridor Development Initiative[4] (SCDI) a 26,000 km² area that will cluster supply chain components and infrastructure (e.g., renewables, electrolysers, desalination plants, storage, and transportation infrastructure) with industrial hubs [12]. The government also plans to facilitate the development of transportation and community infrastructure around production hubs (e.g., terminals, pipelines, ports, housing, healthcare, and schools). The country estimates it will need USD190 billion in investment to 2040, including USD 90 billion for upstream production and infrastructure (e.g., renewables, electrolysers, storage, and pipelines) and USD 30 billion for midstream infrastructure (i.e., ports, trucks, derivative plants) [22].

While Namibia's National Development Plan outlines its priority to "achieve industrial development through local procurement" [11], the hydrogen strategy does not outline standardised local content requirements, domestic sectoral demand-side requirements, or domestic workforce thresholds. The strategy also fails to outline sustainable standards for production and address local access to desalination installations. Namibia's National Renewable Energy Strategy notes the need to utilise its significant renewable resource

4
The SCDI has an estimated hydrogen production potential of up to 3 million tonnes per annum.

potential to ensure job creation and investment opportunities but does not provide comprehensive guidance [21]. Its National Feed-in Tariff regulation introduces specific local content requirements for some renewable instalments – up to 30% ownership for Namibians in the form of ownership, sub-contracting, or employment [29] – but it is unclear if such requirements apply to industrial scale projects. While Namibia currently lacks regulation on important aspects of renewable energy and hydrogen production, it is early days. The government plans to develop a legislative framework for synthetic fuels to support an enabling environment and guide environmental and safety standards [22]. It is crucial that the forthcoming guidelines prioritise Namibia's decarbonisation and development goals.

Namibia highlights its commitment to environmental safeguards and community-responsible development in its hydrogen strategy. It notes that it will apply its Community-Based Natural Resource Management Programme (CBNRM) to anticipate and address environmental concerns regarding green hydrogen and take a multi-stakeholder approach [22]. Specific guidelines on sustainable hydrogen development, targeted at project developers and investors, should complement CBNRM.

RECENT ENGAGEMENT WITH MULTILATERAL DEVELOPMENT BANKS

Namibia has received public and private investment to develop green hydrogen production. The European Investment Bank (EIB) and Namibia signed a Joint Declaration to unlock up to EUR 500 million in concessional finance to support the construction of key infrastructure needed for renewable generation and green hydrogen production [30]. Namibia has also signed several Memorandums of Understanding (MoUs) on green hydrogen cooperation with industrialised economies including the European Commission, Germany, Belgium, and Japan [31]–[34]. Its state-run port authority entered into partnership with the Port of Rotterdam to build infrastructure for hydrogen transportation [35]. Private investors have also jointly invested in the Hyphen energy project – the largest green hydrogen project in Sub-Saharan Africa **(see → Box 1)**.

Namibia's faces high costs of capital which limit its ability to raise funds for the complementary infrastructure needed to support a green hydrogen economy (e.g., solar and wind instalments, and transmission and transportation infrastructure) [36]. Public investment in ancillary infrastructure is needed to de-risk private sector investment in green energy and hydrogen production. However, undertaking significant debt to fund green hydrogen development could lead to unsustainable sovereign debt burden if hydrogen demand does not materialise, or production is not cost-competitive.

Box 1

Namibia's Hyphen Hydrogen Energy

Capex: $10 billion project

Location: Tsau/Khaeb National Park, part of SCDI

Full production: 350,000MT/year of green H_2 from 7GW of RE and 3GW electrolyser capacity

Lease: 40-year operation lease

Annual rental fee in operating phase: ~$27.7 million (increasing 2% each year)

Royalties: equivalent to 5% gross revenues plus Namibian taxes

Workforce: 90% Namibian employees (15,000 during construction and 3,000 after)

The Namibian government announced it would exercise its 24% equity stake in the private sector project. There are no requirements for additional local equity shareholder participation. The government's envisioned investment of $2.4 billion will be managed by the blended finance fund SDG Namibia One, which will aim to mobilise a competitive cost of capital for the green hydrogen-related infrastructure investments from private and public investors (e.g., philanthropic, development, and private). The EIB's €500 million loan is envisioned to be channelled through the facility [37]–[40].

REFERENCES

1

U.S. International Trade Administration, "Namibia - Country Commercial Guide," 2022. [Online]. Available: https://www.trade.gov/country-commercial-guides/namibia-mining-and-minerals (accessed Aug. 18, 2023).

2

Growth Lab, "Country & Product Complexity Rankings," 2021. [Online]. Available: https://atlas.cid.harvard.edu/rankings (accessed Aug. 18, 2023).

3

CIA, "The World Factbook: Namibia," 2023. [Online]. Available: https://www.cia.gov/the-world-factbook/countries/namibia/#economy (accessed Aug. 18, 2023).

4

The World Bank, "The World Bank in Namibia," 2023. [Online]. Available: https://www.worldbank.org/en/country/namibia/overview (accessed Aug. 18, 2023).

5

The World Bank, "Namibia selected indicators." World Bank Group, Washington D.C, 2023. [Online]. Available: https://documents1.worldbank.org/curated/en/099246304122337194/pdf/IDU0767095ec0e1ba042a00953a0452c2f980e9f.pdf

6

Republic of Namibia, "The Root Causes of Unemployment and Possible Policy Interventions.," Windhoek, 2020. [Online]. Available: https://www.npc.gov.na/wp-content/uploads/2023/06/The-Root-Causes-of-Unemployment-and-Posssible-Policy-Interventions-2020.pdf

7

The World Bank, "Access to electricity (% of population) - Namibia." World Bank Data, Washington D.C, 2023. [Online]. Available: https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=NA

8

The World Bank, "Access to electricity, rural (% of population) - Namibia." World Bank Data, Washington D.C, 2023. [Online]. Available: https://data.worldbank.org/indicator/EG.ELC.ACCS.RU.ZS?locations=NA

9

B. S. Mapani, R. N. Shikangalah, and A. L. Mwetulundila, "A review on water security and management under climate change conditions, Windhoek, Namibia," J. African Earth Sci., vol. 197, p. 104749, Jan. 2023, doi: 10.1016/j.jafrearsci.2022.104749.

10

Republic of Namibia, "Namibia Vision 2030: Policy Framework for Long-Term National Development," Windhoek, 2004. [Online]. Available: https://www.npc.gov.na/wp-content/uploads/2021/11/Vision_2030_Summary.pdf

11

Republic of Namibia, "Namibia's 5th National Development Plan (NPD5)," Windhoek, 2017. [Online]. Available: https://www.npc.gov.na/wp-content/uploads/2021/11/NDP5.pdf

12

Republic of Namibia, "Harambee Prosperity Plan II," Windhoek, 2021. [Online]. Available: http://hppii.gov.na/storage/2021/03/HPP2.pdf

13

IEA, "Global Hydrogen Review 2022," International Energy Agency, Paris, France, 2022. Accessed: Oct. 19, 2022. [Online]. Available: https://www.iea.org/reports/global-hydrogen-review-2022

14

ESMAP, "Global Photovoltaic Power Potential by Country," no. June. 2020. doi: 10.1596/34102.

15

The World Bank, "Offshore Wind Technical Potential in Namibia." The World Bank, Washington D.C, 2020. [Online]. Available: https://documents1.worldbank.org/curated/en/421011586852305172/pdf/Technical-Potential-for-Offshore-Wind-in-Namibia-Map.pdf

16

Business Scouts for Development, “Sector Brief Namibia: Renewable Energies,” Eschborn, 2020. [Online]. Available: https://www.giz.de/en/downloads/giz2022-en-sector-brief-namibia-renewable-energy.pdf

17

S. Petersen and E. Mbathera, “Eskom has already been load-shedding Namibia – NamPower,” The Namibian, Windhoek, May 17, 2023. [Online]. Available: https://namibian.com.na/eskom-has-already-been-load-shedding-namibia-nampower/

18

IEA, “World Energy Balances.” 2023.

19

Reuters Staff, “Namibia’s power supply squeezed as drought hits hydropower plant,” Reuters, Dec. 18, 2019. [Online]. Available: https://www.reuters.com/article/ozatp-uk-namibia-power-idAFKBN1YM18J-OZATP

20

Minister of Mines and Energy, “The 2023/2024 Budget Statement.” Government of the Republic of Namibia, Windhoek, 2023. [Online]. Available: https://www.parliament.na/wp-content/uploads/2023/03/Vote-15-Mines-and-Energy.pdf

21

Ministry of Mines and Energy, “National Renewable Energy Policy.” Government of the Republic of Namibia, Windhoek, 2017. [Online]. Available: https://www.mme.gov.na/files/publications/03f_National Renewable Energy Policy - July 2017.pdf

22

Republic of Namibia, “Namibia. Green Hydrogen and Derivatives Strategy,” Windhoek, 2022. [Online]. Available: https://gh2namibia.com/gh2_file_uploads/2022/11/Namibia-GH2-Strategy-Rev2.pdf

23

Climate Analytics, “What is Namibia's pathway to limit global warming to 1.5°C?,” 2022. [Online]. Available: https://1p5ndc-pathways.climateanalytics.org/countries/namibia/ambition-gap/

24

R. Sherbourne, “(Almost) everything you wanted to know about green hydrogen and Namibia (but were afraid to ask),” 2022. [Online]. Available: https://ippr.org.na/wp-content/uploads/2022/03/Green-hydrogen-special-briefing-Feb-2022-web.pdf

25

Climate Champions, “African Green Hydrogen Alliance launches with eyes on becoming a clean energy leader,” 2022. [Online]. Available: https://climatechampions.unfccc.int/african-green-hydrogen-alliance-launches-with-eyes-on-becoming-a-clean-energy-leader/

26

D. von Oertzen, “Issues, Challenges and Opportunities to Develop Green Hydrogen in Namibia,” 2021. Available: https: ://www.kas.de/documents/279052/279101/Issues%2C+Challenges+and+Oppurtunities+to+Develop +Green+Hydrogen+in+Namibia.pdf/a4729b11-5f95-11fc-3203-737fad34543a?version=1.0&t=1638951171809

27

IRENA, “Energy Profile Namibia,” Abu Dhabi, 2023. [Online]. Available: https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Africa/Namibia_Africa_RE_SP.pdf

28

Systemiq, “Key Questions + Initial Answers,” 2022. [Online]. Available: https://gh2namibia.com/gh2_file_uploads/2022/09/Namibias-Green-Hydrogen-Opportunity-key-questions-initial-answers-Jan-2022-_-SYSTEMIQ.pdf

29

P. I. Shilamba, “Update on the Current Power Supply Situation and Progress Made on NamPower Projects and Initiatives to Ensure Security of Supply in Namibia.” NamPower, Windhoek, 2015. [Online]. Available: https://www.nampower.com.na/public/docs/communications/Media Release/Media Briefing 13 April 2015.pdf

30

EIB, "EIB to support green energy in Namibia." European Investment Bank, 2022. [Online]. Available: https://www.eib.org/en/press/speeches/cop27-namibia-mou-hoyer

31

T. Van der Straeten, "België sluit op COP26 overeenkomst met Namibië voor import groene waterstof," 2021. [Online]. Available: https://www.tinnevanderstraeten.be/mou_belgie_namibie

32

BMBF, "JOINT COMMUNIQUÉ OF INTENT," 2021. [Online]. Available: https://www.bmbf.de/SharedDocs/Downloads/en/JOINT-COMMUNIQUE-OF-INTENT.pdf?__blob=publicationFile&v=3

33

European Commission and the Republic of Namibia, "MEMORANDUM OF UNDERSTANDING ON A PARTNERSHIP ON SUSTAINABLE RAW MATERIALS VALUE CHAINS AND RENEWABLE HYDROGEN BETWEEN THE EUROPEAN UNION REPRESENTED BY THE EUROPEAN COMMISSION AND THE REPUBLIC OF NAMIBIA." 2022. [Online]. Available: https://single-market-economy.ec.europa.eu/system/files/2022-11/MoU-Namibia-batteries-hydrogen.pdf

34

A. Dokso, "Namibia and Japan Forge Green Pathway in Hydrogen and Minerals," 2023. [Online]. Available: https://energynews.biz/namibia-and-japan-forge-green-pathway-in-hydrogen-and-minerals/

35

Kingdom of the Netherlands and Republic of Nami, "Joint Statement MOU the governments of Netherlands and Namibia." Windhoek, 2023. [Online]. Available: https://www.portofrotterdam.com/sites/default/files/2023-06/joint-statement-mou-the-governments-of-namibia-and-the-netherlands.pdf

36

H. Clynch, "Green hydrogen at heart of Namibia's Vision 2030," African Business, Jul. 10, 2023. [Online]. Available: https://african.business/2023/07/energy-resources/green-hydrogen-at-heart-of-namibias-vision-2030

37

Hyphen, "Southern Corridor Development Initiative (SCDI) Namibian Green Hydrogen Project." [Online]. Available: https://hyphenafrica.com/projects/

38

Republic of Namibia and Hyphen, "Feasibility and Implementation Agreement." 2023. [Online]. Available: https://hyphenafrica.com/wp-content/uploads/2023/06/Hyphen-Hydrogen-Energy-FIA-Infographic-04.pdf

39

Hyphen, "Hyphen Hydrogen Energy announces MoU with key partners as the Government of the Republic of Namibia confirms equity stake in US$10 billion Green Hydrogen Project," 2023. [Online]. Available: https://hyphenafrica.com/news/hyphen-hydrogen-energy-announces-mou-with-key-partners-as-the-government-of-the-republic-of-namibia-confirms-equity-stake-in-us10-billion-green-hydrogen-project/

40

Government of Namibia, "Traction: Namibia's Green Hydrogen Overview," Windhoek, 2022. [Online]. Available: https://gh2namibia.com/wp-content/uploads/2022/09/Traction-Namibias-Green-Hydrogen-Overview.pdf

Authors

Imogen Outlaw	NewClimate Institute
Hanna Fekete	NewClimate Institute
Chetna Hareesh Kumar	NewClimate Institute

Design

Yogee Chandrasekaran	NewClimate Institute
Polina Korneeva	NewClimate Institute

Editing

Aman Gill-Lang	NewClimate Institute

Disclaimer

This report is part of a joint research project by NewClimate Institute, Germanwatch, E3G and WRI funded by the German Federal Ministry of Economic Cooperation and Development. The views and assumptions expressed in this report represent the views of the authors and not necessarily those of the funder or project partners.

NewClimate – Institute for Climate Policy and Global Sustainability gGmbH

Cologne Office
Waidmarkt 11a
50676 Cologne, Germany

Berlin Office
Schönhauser Allee 10-11
10119 Berlin, Germany

Phone: +49 221 999 83 300
Email: info@newclimate.org
Website: www.newclimate.org

NEW CLIMATE INSTITUTE