University of Stuttgart
IER Institute of Energy Economics
and Rational Energy Use

Fact sheet – IER project Hy4Daures Namibia

4.1 NAMIBIA'S ENERGY PROFILE

OVERVIEW

This factsheet covers Namibia's energy profile, where supply and demand sectors, renewable energy and green hydrogen potentials, energy and environmental targets are discussed. Table 1, below gives the status quo of energy, social and climate indicators relating to United Nation (UN) Sustainable Development Goals (SDGs), in particular goal no. *7 Access to clean and affordability energy*, therefore, relevant to the project. These indicators give a quick impression about Namibia's energy profile. The social indicators are discussed in details in *Factsheet 3.1 Social Evaluation*.

Table 1. Energy, social and climate indicators to be used for the evaluation of impacts of Daures GV Project

Indicator	Namibia	Assumptions	Sources
Access to electricity	56% (2024)	Population with access to electricity	WHO; IEA
Renewable energy share in: Final energy consumption Total primary energy supply Local electricity generation	 38.2% (2021) 48.7% (2021) 38.5% (2021)	Total hydro, wind, solar, geothermal, tide, biofuels, biogases, incl. traditional biomass	AFREC; IEA;
Affordability of electricity	2.1% (2024)	Avg. monthly income spent on electricity, cons. per capita	Own calculations based on: EIA; MERA; World Salaries; World Bank data
Share of informal settlement	41% (2024)	Urban population	World Bank
CO_2 per Capita	1.4 t (2024)	CO_{2eq} emissions from energy generation per capita	DOI:10.1109/REPE48501.2019.9025134
Final energy consumption per capita	10.4 MWh (2021)	Total final energy consumption per capita	Own calculations based on AFREC data
Final energy con-sumption per GDP	2.78 GWh/000'000'USD (2021)	Total final energy consumption per GDP	Own calculations based on AFREC data

Namibia's electrification rate stands at 56%, while population living in informal settlement in urban areas in Namibia is 41%. In Namibia 38.5% of locally generated electricity is owed to renewable sources, while in the total primary energy supply a share of 48.7%, and 38.2% in final energy consumption. On average a Namibian spends 2.1% of income on electricity monthly, relatively higher than SADC's (1.3%) average. Namibia has an energy related emission per capita of 1.4 t annually, final annual energy consumption per capita of 10.4 MWh and final energy consumption per GDP of 2.78 GWh/000'000'USD.

PRIMARY ENERGY SUPPLY

Namibia imports about 70% (2022) of its electricity from Zambia, South Africa and Zimbabwe through the Southern Africa Power pool (SAPP) [1]. Namibia also imports oil products and other fossil fuels including coal used in power generation, refer to figure 2.

In collaboration with

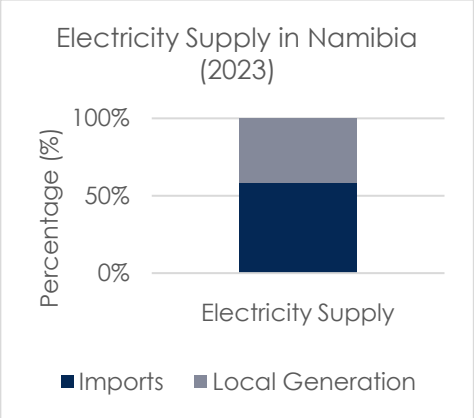

Figure 1. Electricity Supply in Namibia [1]

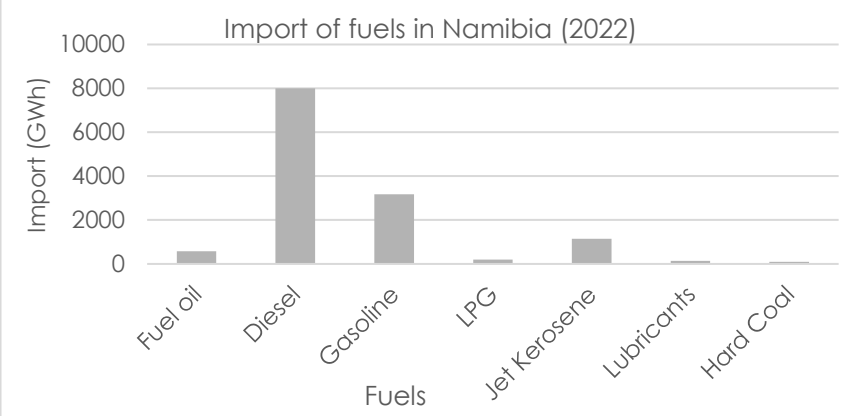

Figure 2. Imports of coal and oil products in Namibia, Source: AFREC

LOCAL ELECTRICITY GENERATION CAPACITY

Most of locally generated electricity comes from Ruacana Hydro Power Plant (347 MW), other plants include Van Eck Power Station (120 MW: coal fired plant), Anixas (22.5 MW: heavy fuel/diesel power plant), Omburu PV Power Station (20 MW). Paratus Power Station (24 MW: LFO/HFO) is a standby plant for the coastal area. There are about 21 REFITs (Renewable Energy Feed in Tariffs) plants with a total capacity of 223.8 MW [2], mostly solar and wind, that generated about 8.5% in 2023 [3].

In order to ramp up the local generation, Namibia has planned the construction of various power plants between 2024 and 2030. This includes the Otjikoto Biomass (40 MW); Baynes Hydro (300 MW); Anixas II (50 MW); Omburu BESS (20 MW); Luderitz Wind (40 MW); Kavango and Orange Hydro power plant (100 MW), and other candidate plants [2]. Namibia's local electricity generation capacity is schedulded to reach 3'116 MW by 2040, in order to reduce reliance on imports and achieve energy security.

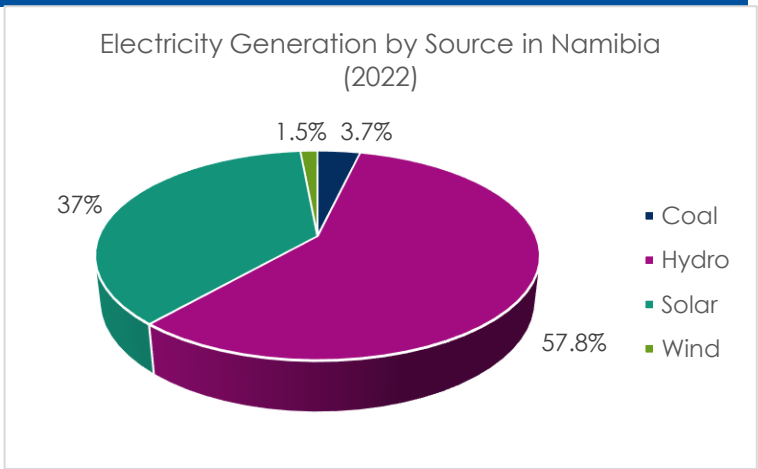

Figure 3. Electricity generation by source (2022) in Namibia (source: Ember Electricity Data Explorer, ember-climate.org)

DEMAND SECTOR

Namibia's electricity demand is about 4'000 GWh annually. Other than electricity, predominant energy carriers includes oil products (consumption mainly by the transport sector) and solid bio fuels (mainly by the residential and commercial sectors). Namibia has a final energy consumption per capita of 10.4 MWh, while final energy consumption per GDP is 2.78 GWh/000'000' USD.

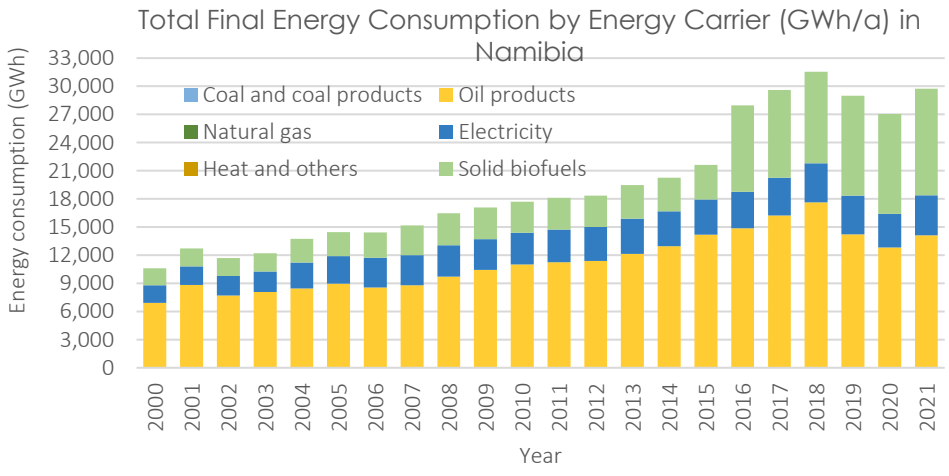

Figure 4. Namibia's final energy consumption by energy carrier (Source: AFREC)

In collaboration with

GREENHOUSE GAS EMISSIONS

Namibia's CO_2 emissions per capita is 1.4 t. Most of the emissions come from the transport sector (see figure 5). Namibia has a goal to reduce the CO_2 emissions with 91% by 2030 [3], while increasing the renewable energy share in total energy consumption to 70% [5]. This can be achieved through the construction of renewable energy-based power plants discussed under *Local Electricity Generation Capacity,* among others measures.

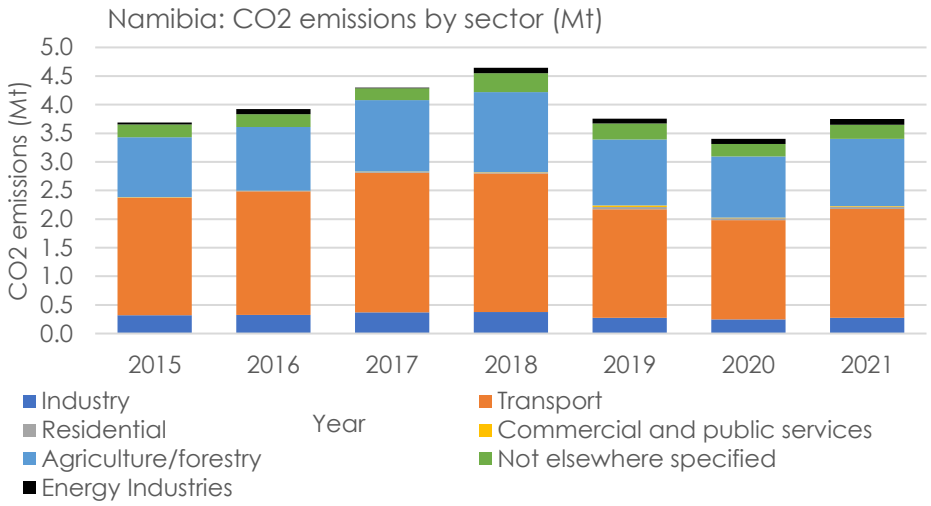

Figure 5. Namibia's Energy related CO_2 emissions by Sector (Source: AFREC)

ENERGY AND ENVIRONMENT TARGETS

Namibia has a long term goal of reaching net zero emissions by 2050 [4]. Prior, Namibia had inaugurated the Vision 2030 in 2004, whose objectives includes achievement of universal energy access and a substantial increment of renewable energy share (70%) in final energy consumption [5]. Namibia in its Nationally Determined Contribution (NDC) demonstrates its commitment to reduce the CO_2 emissions with 91% by the year 2030 and keep the rise in the global average temperature below 2°C as per the Paris Agreement and the Intergovernmental Panel on Climate Change (IPCC) [1]. With various confirmed green hydrogen pilot projects, the scope of planned hydrogen production has the potential to decarbonize Namibia's energy sector, eliminate its reliance on imported electricity and position the country as a net-exporter of clean renewable energy.

RENEWABLE ENERGY POTENTIAL

Apart from Namibia's geography and climate, large open spaces of uninhabited land makes it uniquely positioned to be one of the largest and lowest cost green hydrogen producers, Namibia has plenty of renewable energy potential. Onshore wind capacity factor of up to 58%, along the coastline, while solar of up to 35% mostly in the central parts [6]. These resources can supply low cost power to the green hydrogen projects and consequently a generation of low levelized cost of green Hydrogen. Wind power density and solar potentials for Namibia are shown in figure 6 and 7 below.

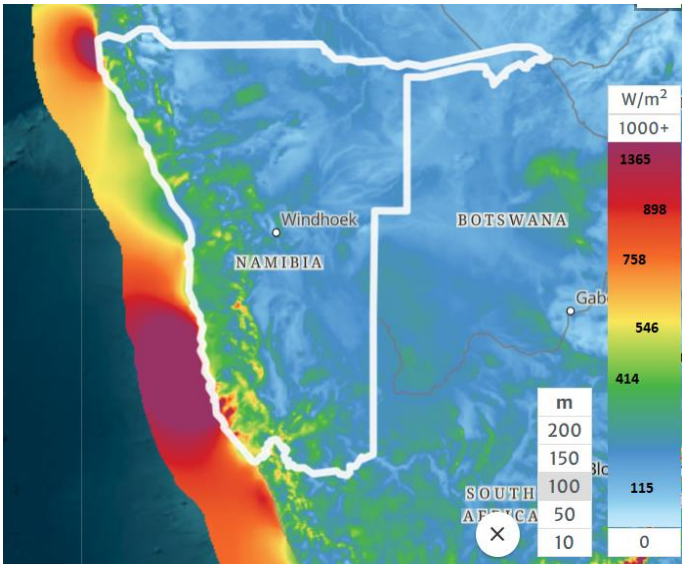

Figure 6. Namibia's wind power density
Source: https://globalwindatlas.info/en/area/Namibia

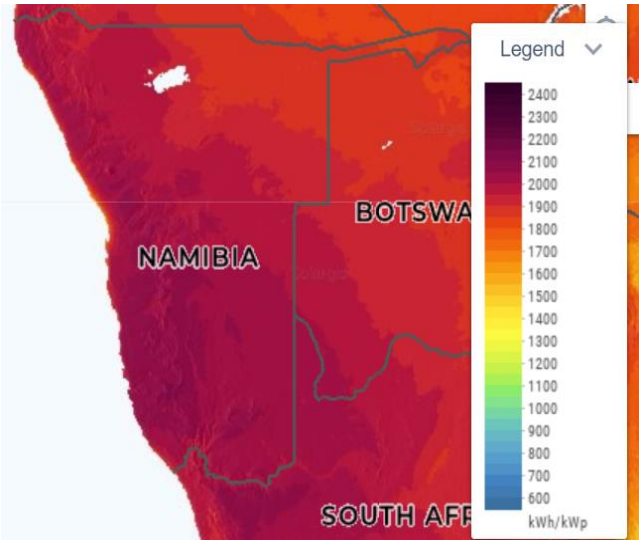

Figure 7. Namibia solar potential
Source: https://globalsolaratlas.info/map?c=-23.04618,15.322267,5

In collaboration with

GREEN HYDROGEN POTENTIAL

Green hydrogen has potential to contribute immensely to achievement of energy transition, decarbonization of the global economy, and improvement of energy access in Namibia. There are various confirmed green hydrogen pilot projects in Namibia including **Daures Green Village Project** whose Phase 4 capacity (solar of 400 MW, Wind 600 MW) could generate about 3'002 GWh electricity annually, which is about 75% of total annual electricity consumption of Namibia.

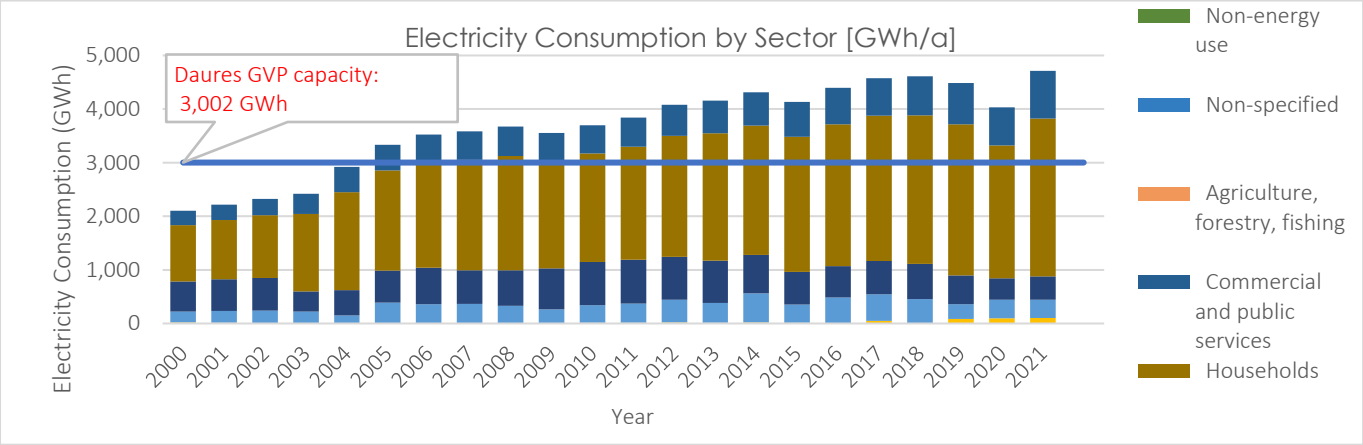

Figure 8. Potential of Daures Green Village phase 4, against the current electricity consumption by sector in Namibia

Daures Green Village project is sponsored by the Republic of Namibia, Namibia Green Hydrogen Program, German Federal Ministry of Education and Research (BMBF) and Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL). Other confirmed green hydrogen projects in Namibia includes ***Hyphen Hydrogen*** with 7 GW renewable energy generation capacity, first production expected in 2026; ***HyIron Oshivela Project*** with potential of 20 MW, planned to commence late 2024. ***Renewstable Swakopmund*** with 36 MW PV, 235 MW combined battery storage and fuel cell to provide baseload power supply, to be commissioned by last quarter of 2024. ***Hyrail Dual Fuel Locomotive*** to convert 50 locomotives into dual fuel mode, to be completed by December 2023 according to its development timeline; ***Walvis Bay Port Infrastructure*** with 5 MW electrolyzer and H2 mobile refueler, to convert port infrastructure to operate on hydrogen. the project has a 2 years' timeline. ***Cleanergy Refueling Station*** 5 MW PV pilot plant was completed end of 2023 and commercial plant planned to be completed by 2026/7 [7].

The Namibia Green hydrogen and Derivatives Strategy envisions to divide Namibia into three (3) green valleys namely, Northern, Southern and Central as seen in the map below. Valleys are crucial points for development and positioning of green hydrogen projects, ensuring evenly distribution of the projects in Namibia. The Strategy envisions to establish an integrated, thriving green ecosystem across Southern Africa by creating synergies in infrastructure (e.g., shared ports, pipelines and transmission networks); production of Ammonia, Methanol, e-kerosene, Hot Briquetted Iron (HBI) for export. The green fuels industry targets a production of up to 10-12 Mt annually green hydrogen equivalent by 2050 [6].

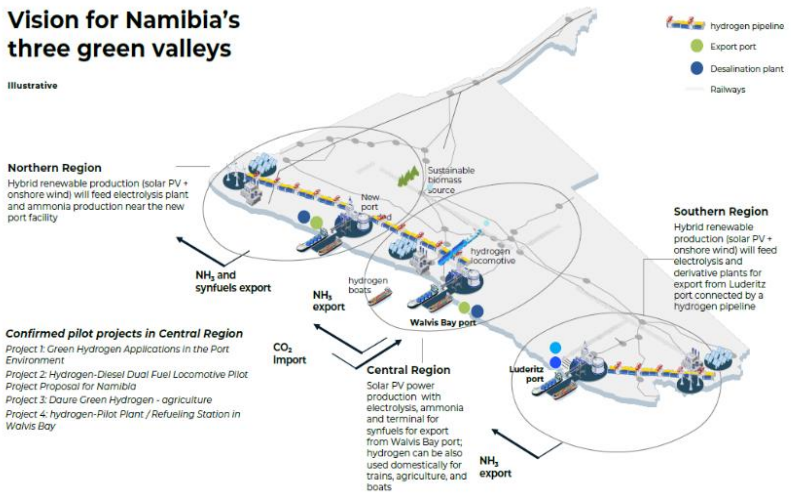

Figure 9. Green hydrogen valleys envisioned for Namibia

CONCLUSIONS & SUMMARY

- Primary energy supply and final consumption in Namibia includes oil, solid biofuels and electricity;
- Energy related CO_2 emissions emanates from the transport, buildings, agriculture, electricity generation and industry sectors;
- Electricity provision, mostly from imports, hydro and solar;
- Electricity consumption by sector: mainly households, commercial and public services, industry sectors, while oil: transport, agriculture, industry, commercial and public services sectors;
- Namibia is committed to reduce the CO_2 emissions by 91% by 2030 and keep the rise in the global average temperature below 2°C; increasing renewable energy (70%) share while achieving universal energy access;
- Renewable Energy potentials, onshore wind capacity factor of up to 58%, along the coastline, while solar of up to 35% mostly in the central parts;
- There are about seven (7) confirmed green hydrogen pilot projects in Namibia, including Daures Green village project.

FOR FURTHER INFORMATION AND FEEDBACK

Further Fact Sheets covering topics from Project Descriptions, Use Cases, Techno-Economic analysis, Social Indicators, Energy System Analysis, Macro-Economic modelling, and more are available:

https://github.com/IER-Hy4Daures/Fact-Sheets

Contact:

Laina Shipingana, M. Sc.

Institute of Energy Economics and Rational Energy Use, University of Stuttgart

laina.shipingana@ier.uni-stuttgart.de

REFERENCES

[1] "NamPower Integrated Annual Report,"2023
[2] "Ministry of Mines and Energy National Integrated Resource Plan (NIRP) Review and Update," 2022
[3] "NamPower Integrated Annual Report,"2022
[4] "Namibia's Nationally Determined Contribution Update," 2021
[5] "Namibia Vision 2030,"2004
[6] M. Rigava "Namibia Green Hydrogen and Derivatives Strategy," Windhoek: 2022
[7] Cassidy, C., Quitzow, R., "Green Hydrogen Development in South Africa and Namibia: Opportunities and Challenges for International Cooperation"

In collaboration with