green hydrogen MONITOR

Reviewing Namibia's green hydrogen developments

IPPR

Issue 1 June 2024

TABLE OF CONTENTS

green hydrogen MONITOR

Editorial Board
Graham Hopwood
Frederico Links

Editorial Coordinator:
Frederico Links

Design & Layout
Eagle Designs

Contributors
Roman Grynberg
Corrina van Wyk
Suzie Shefeni
Namibian Chamber of Environment (NCE)
Cover image generated with AI

Published and Distributed by:
Institute for Public Policy Research (IPPR)
House of Democracy
70-72 Frans Indongo Street
PO Box 6566 Windhoek
Namibia
www.ippr.org.na

Funded by:
Hanns Seidel Foundation
70-72 Frans Indongo Street
PO Box 90912
Windhoek
Republic of Namibia
Phone: +264 61 23 73 734
Fax: +264 61 23 21 42
e-mail: office@hsf.org.na
web: https://namibia.hss.de

Hanns Seidel Foundation

Correspondence can be sent to:
info@ippr.org.na

Foreword

Namibia's role in the global shift towards sustainable energy is centered on its ambitious green hydrogen projects. Green hydrogen, produced using renewable energy sources such as wind and solar power, offers a zero-emission alternative to traditional fossil fuels. Namibia's unique geographical and climatic conditions provide an ideal setting to produce green hydrogen, potentially making Namibia a global leader in this ground-breaking industry.

Recognising the potential of green hydrogen, the Namibian government has embarked on ambitious plans to develop this sector. The Harambee Prosperity Plan II, launched in 2021, outlined the country's vision for green hydrogen as a key driver of economic growth and sustainability. Namibia aims to leverage its renewable energy resources for the export of green hydrogen to international markets where there is a growing demand for clean energy solutions to meet climate change targets.

Despite its potential, the green hydrogen sector in Namibia faces a number of challenges. Securing necessary funding and producing hydrogen at a globally competitive price remain significant hurdles. Additionally, the evolving technology requires ongoing research and development. Namibia also needs to establish a policy and legal framework that supports the industry while ensuring environmental protection and social inclusivity.

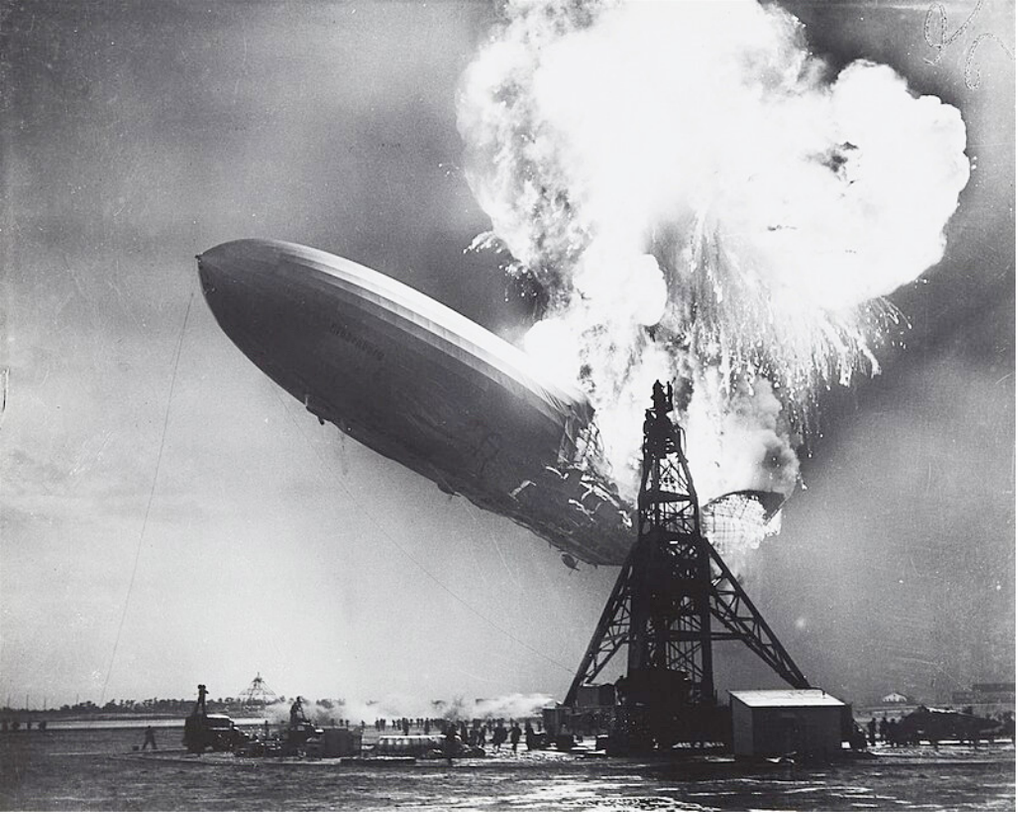
In response to these challenges, the IPPR is launching the Green Hydrogen Monitor, a publication dedicated to reviewing developments in Namibia's green hydrogen field. This is the first of two editions planned for 2024, made possible by the financial support of the Hanns Seidel Foundation (HSF). We are deeply grateful to HSF for their support.

It is important to note that the views expressed in this publication are those of the IPPR and the individual authors, not necessarily those of the HSF.

In a rapidly evolving landscape, the Green Hydrogen Monitor aims to provide updates and insights on green hydrogen-related developments in Namibia. This includes reviews of financing options, governance issues, environmental impacts, feasibility concerns, economic questions, and the changing international context.

Welcome to the inaugural edition of the Green Hydrogen Monitor!

Graham Hopwood
Executive Director
Institute for Public Policy Research (IPPR)



The Hindenburg disaster happened in June 1937 when the hydrogen-filled airship caught fire in New Jersey, USA, and 63 people died in the blaze.

Green hydrogen – Namibia's saviour or a latter-day Hindenburg?

There are numerous risks associated with the Hyphen project as with any new mega-project in a nascent industry.

• ROMAN GRYNBERG

Since the recent commitments in 2021 to decarbonize the EU economy by 2050, hydrogen has become the preferred alternative fuel source of the EU as well as other developed countries such as the USA and Japan.

Green hydrogen produced from renewable sources i.e. solar and wind power currently costs US$5-6 per kg or up to five times the market price of gas-powered 'grey' or 'black' hydrogen. There are several commercial reasons why at such prices green hydrogen is even being considered.

The first and probably the most important is the existence of what are called border adjustment measures or taxes in the EU and other jurisdictions on carbon-intensive products e.g. steel, cars, etc. that do not use green production methods. The second is that hydrogen is usable in large vehicles such as lorries, ships and possibly large aeroplanes which are less likely to be driven by direct electric engines given the state of the current technology. The third reason is that there will be a premium paid for green energy sources and state subsidies are being provided by developed countries to reach the target of decarbonization of the global economy by 2050. The fourth reason is political, many of the governments in the EU are in political partnership with Green Parties or are trying to demonstrate their green credentials.

Namibia with its abundance of sunshine and wind has now entered the push to produce and export green hydrogen. There are currently nine projects which are either in progress or under active study. The most important project by far is the Hyphen Hydrogen Energy project which will be based at Lüderitz, along Namibia's south coast. Lüderitz, according to Hyphen, is one of the three best locations in the world for generating wind and solar power.

In April this year five engineers from Oxford University, in the UK published a peer reviewed paper which modelled a green hydrogen project based on a facility at various locations in Namibia. The lowest cost location for such a project was Lüderitz with its combination of high winds from the south Atlantic and many days of sunshine needed to generate solar energy. It was estimated by the Oxford University team that the cost of ammonia, a product derived from hydrogen production, is currently Euro 5.4/kg (N$ 107/kg).

In Namibia it is only at Lüderitz where onshore wind power, currently estimated to be amongst the cheapest sources of electrical power in the world, is abundantly available which makes such a price possible. Further up the coast towards Walvis Bay where winds are neither as strong nor as consistent there is a need for a higher percentage of more expensive solar energy generation to supplement any wind turbine. Electricity generated from onshore wind is generally much cheaper than solar power, though the price of solar has been falling dramatically over the last three decades.

>

The Hyphen project is expected to be up and running by 2026/27. The expected 2030 price of green hydrogen that was estimated in the recent 2023 Nampower / Rotterdam Port joint pre-feasibility study is around Euro 3.25 (N$65). However, this is a pre-feasibility study and so the estimates are made with a margin of error of ± 50% . Thus, the price estimates in the Nampower study may well be close to the estimates of the engineers from Oxford University. However, Namibian officials have preferred to believe the McKinsey estimates of US$1/kg (N$ 19/kg) in 2030 or the International Energy Agency (IEA) estimated price of US$2.5/kg in 2030.

When asked about whether Hyphen would be competitive at these prices, the response of the Hyphen CEO, Marco Raffinetti, was very confident about the commercial viability of the Lüderitz project.

"We believe Hyphen will be one of only 10 GW scale projects globally in production by 2030. For a time it will be a seller's market, and therefore regardless of Hyphen's LCOH (levelized cost of Hydrogen), we are confident that the market price would be substantially higher and therefore the project will be viable," Raffinetti said.

The price of green hydrogen is highly subsidized in the USA, the EU and Japan. The EU, in order to facilitate decarbonization and transformation of their economies away from dependence on fossil fuels, in particular from Russia, has publicly supported the development of green hydrogen and the project in Namibia. Thus a price of Euro 5 (N$100) is entirely plausible when the price of grey hydrogen, i.e. generated from fossil fuels, is as low as US$ 1/kg ($N19). However, it has been suggested by the consulting firm McKinsey and the International Renewable Energy Agency (IRENA) that the price of green hydrogen is expected to continue to fall to these levels by 2030 because of two principal factors – the decreasing cost of solar and wind generated electricity. Second, the cost of desalination of seawater, which is necessary before the generation of hydrogen from pure water, has also been decreasing over time and is expected to continue to do so in future.

The Hyphen project, according to the Nampower / Rotterdam Port pre-feasibility study, which is public, is currently estimated to cost Euro 11 billion, which is approximately the same as Namibia's current GDP. Green hydrogen is, as so many commentators observe, "not for the faint hearted". It is currently a marginal industry which is nowhere near as profitable as oil or gas, for example.

Economic and commercial risks

There are numerous risks associated with the Hyphen project as with any new mega-project in a nascent industry.

The government has taken a 24% stake in the project and the initial risk leading up to full feasibility study has been covered by grants from the Dutch, German and other governments. The Nampower / Port of Rotterdam pre-feasibility study, which was published late last year, suggests that there are two very serious risks associated with the project.

The first is economic. According to the Nampower study, the government is expected to provide an unknown level of loan guarantees for the project. This, of course, will depend on the production by Hyphen of a bankable feasibility study, but should there be no other joint venturers and the government proves to be the final guarantor, it will be very difficult for any banking consortium to fund a project equivalent to the nation's GDP. The only way in which the government could obtain such large loans from the international money market is by leveraging its future oil revenues, as Mozambique has done in the fisheries sector. Indeed, there have been indications from government sources that this is precisely how the government intends to fund the loan guarantees needed for the development of green hydrogen projects.

This in turn raises the question of whether the government has chosen an appropriate development partner for such a large, new and risky venture. Hyphen is a joint venture between the South African subsidiary of the German transnational firm Enertrag (49%), which is a relatively large but new renewable energy producer, and Nicholas Holdings (51%), which is a completely unknown entity in this field. Even the German parent company, Enertrag, with its 800 employees and total sales of N$5 billion is not of sufficient enough girth to fund the N$200 billion Hyphen project. Nor are the two firms large enough to attract bank loans sufficient to undertake such a project. Hyphen has not hidden the fact that it is looking for a strategic partner.

Recently, it was reported that Nicholas Holdings was trying to sell an unspecified stake in Hyphen to one of the oil and gas majors for N$3 billion. The outcome of the negotiations is unknown. Assuming these reports to be correct, it is a development that is to be applauded. For the Lüderitz project to reach fruition it will require a far more substantial strategic partner or for the current owners to sell the firm in its entirety to a major energy firm. If this proposed divestment by Hyphen's owners is a positive development, then one needs to ask why the government of Namibia chose these tenderers in the first place rather than much larger firms like Sasol and Fortescue.

The Nampower study also identifies important commercial as well economic risks emanating from the Hyphen project. It states that the most significant is the risk of not being able to make a business case and procure enough off-take agreements from buyers in Europe and Asia. No bank or group of banks will fund such a large project without legal proof that there are buyers for the final product at a known price. That will mean that Hyphen and the government will have to provide evidence of legal memoranda for the purchase of the ammonia/hydrogen produced at Lüderitz. Given that hydrogen is a commodity, the main factors will be the price of the product and whether it can be sold in markets like Rotterdam. If the price is uncompetitive then the project will simply fail. Fortunately, Namibia can get out of its 24% stake in the project once the studies are completed and if it is found to be sub-economic.

Political risks of hydrogen

However, there are also very substantial political risks involved in the commencement of such a new industry. The first is that the green hydrogen industry, which has caused so many sub-Saharan African countries to study the matter (but only 6 have started to implement), is dependent entirely upon subsidies from the developed countries which claim that they are committed to decarbonization and fighting climate change. However, the possible

>

re-election of Donald Trump as US president, who has said publicly that he believes climate change is a hoax, could bring the international community's commitment to decarbonization by 2050 to an end. Trump took the USA out of the Paris Accords in June 2017 when he first became president. Moreover, he would almost certainly cancel the Biden administration's Inflation Reduction Act, which at present provides US industry with a subsidy of US$3/kg for green hydrogen for 10 years, up to a maximum of US$100 billion.

The EU has also implemented carbon border tax measures (CBTM), which will be of global significance as they will impose border taxes on commodities coming from countries exporting carbon-intensive products to the EU. Thus, anyone seeking to export to the EU will have to conform to EU carbon standards or pay a border tax. This will apply to various commodities which initially include cement, iron and steel, aluminium, fertilisers, electricity and hydrogen. It will, in effect, mean that producers wishing to trade with the EU will have to conform to given standards or impose national carbon tax measures which can be deducted from the CBTM liability. The political risk is the willingness of EU states to continue to bear what will certainly be the cost of decarbonization when new and more apparently immediate needs arise. The political shift to the far right in the EU elections may well signal a decline in support for measures to combat global warming.

Technical risks

The first and most significant technical risk is whether what is called 'white' or geological hydrogen will prove to be commercially extractable and of sufficient importance to undermine the cost efficiency of manufactured hydrogen, irrespective of whether it is black, brown, grey, blue or green. White hydrogen has been found in numerous locations including Mali, Australia, Brazil, France, and the USA. In Mali it is estimated that there is somewhere between 46 and 250 million tonnes of natural hydrogen or several years of global supply at current demand. While the Malian deposit has not been commercialized, it is producing electricity for the local village, Bourakébougou.

The Australian company Gold Hydrogen has found hydrogen in South Australia and has an estimated volume of 1.3 million tonnes. It is widely expected that a global 'gold rush' will now begin for white hydrogen which may well undercut green hydrogen. Australian firms are expecting to sell white hydrogen for US$1/kg which would undermine the position of green hydrogen producers. The US Geological Survey, in a recent study, announced that there is an estimated five trillion tonnes of hydrogen in the earth and while only a small proportion will be commercially viable, it is estimated to be enough to last for hundreds of years.

The second technical issue is more specific to the Hyphen project. Hyphen proposes to develop a facility with a 10 GW electrolyser capacity by 2030, which would need to be a modularized system of 40 or more electrolysers. This is what Hyphen has proposed in order to give it the economies of scale to dramatically lower the cost of production of green hydrogen. The problem is that the world's largest electrolyser has just recently been commissioned in Xinjiang, China, by Sinopec at 260 MW, roughly one 40th the size of the expected Lüderitz facility. There have been some serious performance issues noted with Chinese electrolysers, with the Sinopec electrolysers operating at less than a third of their installed capacity. It is expected that the Chinese manufacturers of electrolysers will be able to seriously undercut European and US manufacturers and dominate the global market as they have with solar panels. It would require the use of one quarter of China's expected electolyser production capacity of 40 GW by 2030 to achieve Hyphen's expected level of production.

The third technical risk with green hydrogen is not just capacity issues, but whether, in fact, hydrogen is being overly hyped as the silver bullet for global warming. It is entirely plausible that other technologies will prove to be far more cost efficient in terms of providing the energy that society requires for environmental sustainability. The energy efficiency of producing hydrogen is often much lower than using electricity directly to drive a motor and betting on one new technology while the world is still looking at the options for addressing decarbonisation is particularly risky. It should be recalled that the EU made the decision to implement green hydrogen decarbonization two or three years ago. White hydrogen was, at the time of the EU's decision, barely recognised as a potential low-cost substitute. White hydrogen may well prove to be a major disruptor of the EU and US march to relatively high-cost green hydrogen

Conclusion

One hopes that Namibia's gamble with green hydrogen will pay off and that this envisioned revolution in sustainable energy occurs. In this case, Namibia and the green hydrogen industry will prosper as the late President Hage Geingob had envisioned. However, this is a risky business and where there is no risk there is no profit. Hence one must weigh the considerable risks involved in an entirely new industry which rests on state intervention.

In 1925, the US Congress banned the export of helium over which it had a monopoly at the time. The ban extended to Nazi Germany and so the Nazi state decided to use hydrogen for its airships, the Zeppelins, which crisscrossed Europe and the Atlantic transporting wealthy travellers. One Zeppelin, the Hindenburg, blew up in New Jersey after a flight from Berlin, with the loss of 63 lives in June 1937. The pictures of the explosion have gone down in history and since then hydrogen, which is a highly inflammable substance, has had an extremely bad reputation. Now due to global warming it has made a comeback, but the lesson of the Hindenburg disaster is that one should not experiment with new minerals based on government interventions as this can have disastrous unintended consequences. The green hydrogen revolution is largely a product of EU intervention and subsidies. However, the EU and Namibia may well have chosen the wrong colour.

The future energy source may well be hydrogen, but Namibia may have been pushed into green hydrogen when the future may be much lower cost white or geological hydrogen. If so, the EU and by extension Namibia's proposed investments in green hydrogen may prove to be the economic equivalent of the Hindenburg disaster.■

**Roman Grynberg is an economist, economic policy analyst and author*

Photo: NCE

Tsau //Khaeb National Park

When green hydrogen turns red

The proposed hydrogen development in the Tsau //Khaeb National Park (TKNP) poses a severe threat to one of only a few global biodiversity hotspots in an arid area, and one of the largest near-pristine wildernesses on earth.

This article is an excerpt from a report titled **'When Green Hydrogen Turns Red'**, that was released by the Namibian Chamber of Environment (NCE) in May 2024.

The world currently faces twin environmental crises: climate change and biodiversity loss. The Namibian Chamber of Environment (NCE) hereby joins the International Union for Conservation of Nature (IUCN) in standing against any plan to mitigate climate change that comes at an unacceptable cost to biodiversity. Any hydrogen produced in the TKNP is correctly labelled as red hydrogen, since its production is likely to increase the threats to many species of plants and animals on the IUCN Red List and other endemic and lesser-known species that have yet to be evaluated.

Namibia's energy and sustainable development needs can be met using a strategic approach that considers the full societal and ecological costs and benefits of each form of energy production. These options must be carefully studied and compared to ensure that Namibia develops a truly sustainable energy sector that minimises costs to its biodiversity and maximises benefits for its people.

Threat to Tsau //Khaeb National Park

The German Development Bank (KfW) has invested €4 million in the TKNP infrastructure, including housing, vehicles and other necessary equipment, as part of the NamParks IV programme valued at €14.5 million. Part of this funding was used to develop the TKNP management plan6 and associated tourism development plans.

According to Lydia von Krosigk, Senior project manager for KfW, "The purpose [of NamParks] was two fold, to support conservation and to develop attractive National Parks which would then attract tourists and tourism would create the need for hotels, for lodges, for supplies, and so create employment and bring economic development. National Parks are the hubs for conservation, they are the safe havens, or special protection zones where the animals can breed."

>

Photo: NCE

If the proposed hydrogen development project goes ahead, this investment would have been wasted, as the park's biodiversity will be severely impacted and its tourism potential greatly diminished.
The German government is a key supporter of the hydrogen project and will be the main buyer for the hydrogen, ammonia and other products of this development project. It is therefore actively undercutting its own previous investment in the conservation and tourism development of TKNP.
Projects run through KfW, GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) and other German institutions conduct thorough, lengthy due diligence procedures prior to funding approval and implementation. No such due diligence was undertaken prior to the German government entering into a partnership with the Namibian government8 to publicly support hydrogen development plans in the TKNP. This indecent haste is reflected in the lack of proper planning, strategic assessment, or thought given to environmental impacts and the lack of consideration for alternative hydrogen production options that would optimise socio-economic opportunities and development for Namibia.
The park zonation outlined in the management plan has been largely ignored in the allocation of concession areas for hydrogen development. Hyphen's plans currently aim to avoid the areas of highest biodiversity importance for development (Special Value zones), but even areas with lower ranking in TKNP far surpass the diversity of plants and animals and level of endemism that characterise most protected areas in the EU. Areas zoned as Minimal Disturbance in the park management plan, where no new roads should be built and the only compatible land use is guided tourism, are earmarked for extensive wind turbine development and associated infrastructure in Hyphen's plans.
One of the main purposes of Minimal Disturbance zones is to connect areas of high biodiversity value and provide a buffer around these areas. Each wind turbine will require an access road for maintenance purposes, while the construction phase will cause extensive environmental damage besides the final disturbance footprint.
By ignoring the Minimal Disturbance zones, the Special Value (high biodiversity) zones will become islands in a sea of development (Figure 2) that will be increasingly vulnerable to poaching (especially for succulents and reptiles) and edge effects due to habitat fragmentation. Wildlife migration corridors, bird flyways, and pollination and seed dispersal processes are particularly threatened by linear infrastructure such as pipelines, roads and powerlines that will crisscross the project area.
Restoring disturbed areas in an arid environment is only possible for a few habitat types, requires substantial investment and takes several decades to reach acceptable states of restoration. Consequently, even if the project developers follow stringent, expensive restoration procedures, much of the damage done will be irreversible.

Risks to sustainable development

The future commercial success of hydrogen production in Namibia relies on a number of assumptions:
First, it assumes that the hydrogen produced in Namibia can be legitimately labelled as 'green'. While it will be produced using renewable energy, it will have a severe impact on biodiversity, with irreversible consequences for many endemic and threatened species in TKNP. Since pushing species towards extinction is known as driving them 'into the red', this project is in reality producing 'red hydrogen'. It is unlikely that the global market that is interested in tackling environmental issues such as climate change will have an appetite for 'red hydrogen', which exacerbates the global biodiversity crisis.
The second assumption is that the German market will continue to have an appetite for expensive hydrogen to address its energy shortfalls in future.
The current energy crisis in Germany is related to its refusal to use relatively clean nuclear energy, replacing it with natural gas from Russia.

>

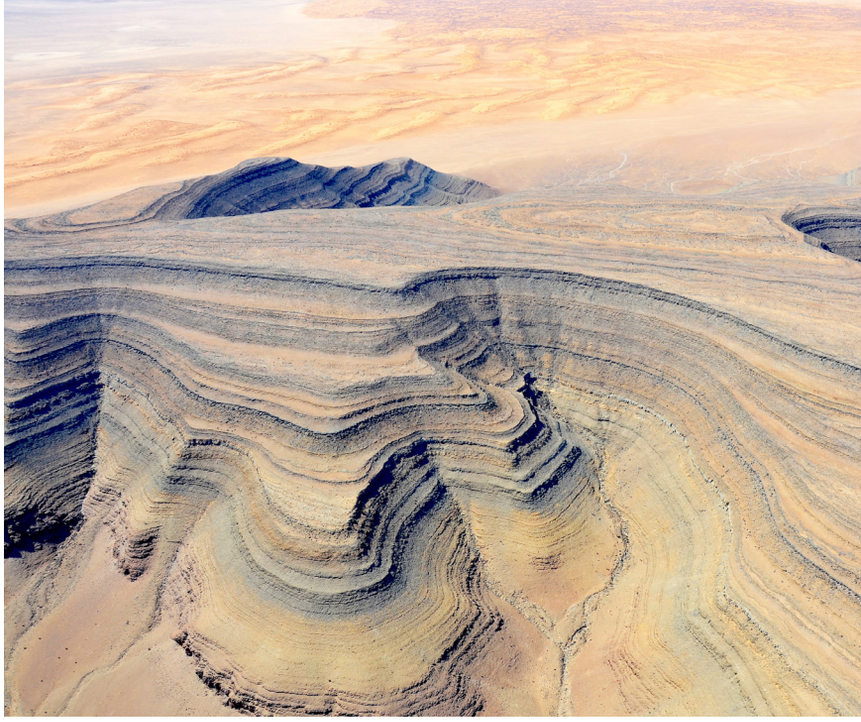


Photo: Olga Ernst & HP Baumeler

This was a knee-jerk reaction to the unfortunate impact of a tsunami on a nuclear power station in Japan. Independent data show that nuclear power is the safest and has amongst the lowest environmental impact of all bulk and baseline energy sources globally. The Russia-Ukraine war and subsequent sanctions on Russia have exposed the vulnerability of Germany's energy sector and need for alternative sources of energy.

If Germany decides to invest in nuclear energy again, or if cheap methods of producing green ammonia17 and kerosene are developed that do not require initial hydrogen production, or if the current work on fusion energy by the USA results in commercially viable energy sources, Namibia's market will shrink and its profitability will collapse. Yet the damage to the TKNP will most certainly remain.

The third assumption is that hydrogen production geared for export is more beneficial to Namibian citizens than the development of other energy production options. Hydrogen projects in almost any other part of Namibia would have lower biodiversity costs, while projects that focus on developing Namibian industries that use hydrogen or its derivatives could contribute substantially to local economic development. Hydrogen projects following this local development model are already operational near Walvis Bay, on a part of the Namibian coastline that is far less biologically sensitive than the TKNP. Long-term, local sustainable development such as this should be encouraged and welcomed rather than high-risk, export-focused projects that could fail if global markets shift or new technologies supersede hydrogen as a source of energy.

Alternatives worth exploring

Development projects in the energy sector should aim to have broad-based economic impacts, with increased access to cheaper energy for households and a share in the profits of these enterprises.

For example, many inland parts of the //Kharas Region (the same region as the TKNP and Hyphen's proposed project) are ideal for solar farms, as extended droughts and degraded rangelands have greatly reduced the livestock production potential of this area, which supports some of the poorest and most marginalised communities in Namibia. These communities experience multidimensional poverty and would benefit directly from the construction of solar farms on parts of their land in return for a share in the sale of this energy into the national grid and access to electricity for their own households.

If developed prudently, Namibia's energy sector has great potential for alleviating poverty and reducing the nation's reliance on imported electricity. Indeed, Namibia would be in an ideal position to export renewable energy to the regional grid and thereby contribute significantly to decarbonising the energy sector in the SADC region. We therefore recommend a national strategic assessment of Namibia's current and potential energy sector by recognised, independent experts in this field. This study would take a systems approach to assessing different energy production options, focusing on the benefit flows relating to each option and forecasting changes in markets and technologies that could present risks or opportunities for different energy sources.

The production of hydrogen and its derivatives from all potential sites in Namibia should be included in the above national study, with full consideration of the biodiversity impacts associated with each site. The site in the TKNP was selected based on abiotic and logistical factors, such as windiness, solar irradiation, accessibility to a harbour, etc., but did not consider the biodiversity value of the area. A holistic evaluation of Namibia's hydrogen potential that takes into account sustainable development would consider abiotic factors, broad-based socioeconomic benefits and negative ecological and biodiversity impacts.

The TKNP is a global biodiversity treasure chest and one of the largest remaining areas of near-pristine wilderness in the world. The extensive industrial development planned for one of the world's few arid biodiversity hotspots could only produce 'red' hydrogen, as it would threaten the persistence of many endemic plant and animal species.■

Photo: Hylron groundbreaking from Namibia Investment Promotion & Development Board

Building a green economy: The progress of Namibia's hydrogen projects

• SUZIE SHEFENI

To date, six pilot projects have made progress, ranging from securing environmental clearance certificates to the construction of preliminary infrastructure. Following are brief overviews of the six projects.

1. Cleanergy Solutions Namibia

Cleanergy Solutions Namibia is a joint venture between the Belgian firm, CMB.TECH and the Ohlthaver & List (O&L) Group. The project has received funding from the German Federal Ministry of Education and Research's JCOI / PTX grant. The grant awards 4 pilot projects a share of N$619 million (€30 million).

The Cleanergy project is a 5 year plan which will feature several projects at different locations, the first phase of which is a hydrogen production plant and refuelling station located at Walvis Bay. The hydrogen plant includes a 10 hectare solar park, 5 MW Proton Exchange Membrane electrolyser and 5 MW Battery Energy Storage System (BESS) – allowing the plant to use solar energy and energy stored in the BESS to produce hydrogen. This hydrogen will be fed to the refuelling station, which was inaugurated with the ceremonial fuelling of two dual-fuel trucks in early May 2024. The station which is expected to be fully operational in the fourth quarter of 2024 will be used for hydrogen-powered trucks, small ships, port equipment and railway applications. The project's environmental impact assessment is still underway and closed for inputs from interested and affected parties in March 2024.

The project deliverables also include the development of a hydrogen academy which will train local professionals in hydrogen production and its applications. The venture has listed the production and usage of fuel for heavy duty equipment including trucks and gensets as key training areas.

In September 2023 Cleanergy announced that it had earmarked the potential construction of a green ammonia plant next to the hydrogen production plant. Reports indicate that Cleanergy is exploring a green ammonia joint venture partnership with the Australian mining and green energy company, Fortescue Energy.

>

2. HyIron Oshivela project

HyIron Green Technologies is owned by a consortium of German and Namibian companies. The group of companies include the TS Group, LSF Energy and CO2Grab. The project received financing of N$280 million (€13.6 million) from the German Federal Ministry of Economics and Climate Protection.[1]
Located at farm Bloemfontein 109 near Arandis, the green iron project broke ground in early November 2023. It received its Environmental Clearance Certificate in early 2024 and is expected to be fully operational in the third quarter of 2024. It will procure iron ore and use a proprietary gas-tight rotary kiln to reduce the iron, producing water vapour as a waste material instead of carbon dioxide. The project will feature a 25 MW solar plant to produce power for the electrolysis process producing hydrogen. The plant seeks to scale up to an 18 MW wind and 140 MW solar plant. In April, the project procured its first supply of N-type TOPCon solar panels from the Chinese firm JinkoSolar. The firm has signed a memorandum of agreement with HyIron to supply panels for the second and third phase of the green iron project.
The facility aims to produce 15,000 tonnes of direct reduced iron per year in its first phase. According to one of the managing partners of HyIron, project Oshivela's long term aims also include the production of up to two million tonnes of iron for the German steel industry[2].

3. HyRail project

The HyRail project is a Hydrogen-Diesel Dual Fuel Locomotive project being developed by CMB.TECH, Hyphen Technical and TransNamib. The University of Namibia is also included as an academic project partner. The project anticipates a total investment of N$185 million (€9.17 million) which will be funded through grants, secured loans, and shareholder equity[3]. In 2022, the project also received funding from the German government's JCOI / PTX grant.
The project's contract was finalised in March and is set to begin later this year. It aims to convert two diesel locomotives and a hydrogen tender wagon to dual fuel capacity, using both diesel and hydrogen gas. The locomotives will be sourced from TransNamib and the South African firm, Traxion Sheltam. The initial phase of the project will involve the individual designing, building and assembly of components. This will be followed by the system combination and testing and, finally, the homologation of the locomotives for trial service.
The project will source hydrogen fuel from Cleanergy and will target the transport of copper concentrate, sulfuric acid, grain and smaller volume commodities between Kranzberg and Walvis Bay. The project's overarching goal is to demonstrate the environmental, safety and performance viability of hydrogen fuel cells as an option to power trains. The locomotives are expected to be in trial service in the last quarter of 2025.

4. HDF Renewstable project

The Renewstable project is owned and operated by HDF Energy Namibia, a subsidiary of Hydrogène De France (HDF), a French independent power producer. HDF Namibia signed an agreement with the European Investment Bank on the sidelines of COP27 in 2022. This agreement secured a N$179 million (€10 million) grant to finance the project.[4]
The project, which will be located at Swakopmund, received its Environmental Clearance Certificate from the Ministry of Environment, Forestry and Tourism in January 2024. Renewstable intends to install a 85 MW capacity solar plant and a hydrogen production plant that will use the solar energy to produce hydrogen through electrolysis. The project will also feature a reverse osmosis desalination and demineralisation plant, a water pipeline connecting the desalination and power plants and a hydrogen refuelling station.
The Renewstable Swakopmund project aims to combine solar photovoltaic (PV) power and hydrogen production to generate power for the national grid. Recent reports indicate that HDF is currently engaged in negotiations for a power purchase agreement with NamPower, the national power utility.

5. Daures Green Hydrogen Village

The Daures Green Hydrogen Village is perhaps one of the most recognised projects in the country. The project is run by the Daures Green Hydrogen Consortium with a local firm, Enersense Energy Namibia, holding a 90% stake. The remaining 10% of project shares are owned by the Daure Daman Traditional Authority (7.5%) and Tsiseb Conservancy (2.5%). Additionally, the University of Namibia and the University of Stuttgart are co-research project partners[5].
>

1. Germany funds Africa's first green ironworks in Namibia, 7 November 2023. Accessed at: https://www.cleanenergywire.org/news/germany-funds-africas-first-green-ironworks-namibia
2. HyIron opens direct reduction plant for green iron, 23 August 2023. Accessed at: https://www.greencarcongress.com/2023/08/hyiron-opens-direct-reduction-plant-for-green-iron.html
3. Namibia set for Hydrogen locomotive conversion, 26 April 2024. Accessed at: https://www.railjournal.com/africa/namibia-set-for-hydrogen-locomotive-conversion/
4. HDF Energy secures N$179m green hydrogen funding, 9 November 2022. Accessed at: https://miningandenergy.com.na/hdf-energy-secures-n-179m-green-hydrogen-funding-boost/
5. Project documentation lists the aforementioned partners in a list of 12 shareholders, however, the details of the remaining shareholders have been redacted from the public version for confidentiality reasons. (Pre-Feasibility Study (Public Version), 2022. Accessed at: https://daures.green/wp-content/uploads/2023/01/Daures-Green-Hydrogen-PFS-v6-publicshort.pdf)

The Daures Green Hydrogen Village site in 2024.

The project received N$248 million (€12.1 million) in funding from the JCOI / PTX grant.

Located on 15,000 hectares in the Daures constituency on the periphery of Dorob National Park, the village will primarily be a hydrogen and ammonia production facility. It will feature a solar and wind plant for off-grid power generation, greenhouses and an electrolyser. In May, Fichtner GmbH, the firm completing the pre-feasibility and feasibility studies, reported that wind turbine assessments found 4 MW turbines more suitable for the project.

The project missed its initial intended deadline to produce Namibia's first green hydrogen by the end of 2023. It is now expected that the pilot facility will launch in July and will produce 182 tonnes of green ammonia from 1.5 MW of renewable energy during phase 1. As part of its agricultural production prospects, the village also aims to produce 500 tonnes of tomatoes and 600 tonnes of carrots during this phase through the use of nitrogen fertilisers. By phase 4, the project anticipates a 352,000 tonne green ammonia output from 1 GW renewable energy and a 420 MW electrolyzer.

The consortium has signed memoranda of understanding with several firms. This includes an agreement with Fortescue Future Industries to explore the possible co-development of the village. Further memoranda have been signed with the Zimbabwean fertiliser manufacturer Sable Chemicals, the United Nations World Food Programme and Andrada Mining for ammonia offtake.

Southern Corridor Development Initiative (SCDI)

The Southern Corridor Development Initiative (SCDI) is the largest green hydrogen project to date. The project is owned by Hyphen Hydrogen Energy, a joint venture between British investment firm, Nicholas Holdings and German energy company, Enertrag. The Namibian government has a 24% equity interest stake.

The project is located in the Tsau ǁKhaeb National Park. The vertically integrated green hydrogen project will stretch from Lüderitz port across two plots called Springbok and Dolphin. It will feature a portfolio of complimentary infrastructure including an electrolysis site on the Springbok, housing wind and solar plants, hydrogen and water pipelines, a desalination plant, parallel electricity transmission lines, an industrial site for ammonia synthesis and storage and an offshore multi-buoy mooring site for international ammonia export. During Phase I the project anticipates the generation of 2 GW of renewable energy to produce green hydrogen and green ammonia.

In 2021, the Namibian government awarded Hyphen the preferred bidding position for the SCDI. The project is still in its nascent stages and aims to submit its feasibility report in 2025. Hyphen has already signed off-taker memoranda with German energy firm RWE and South Korean firm Approtium. It received a 3-year environmental clearance certificate in May 2023. In March 2024, the German government presented Enertrag with a letter of intent that may designate the project as a "strategic foreign project" pending final approval. The project is expected to be fully operational by 2028.

In a position paper launched in May, the Namibian Chamber of Environment dubbed any hydrogen produced in the national park as red hydrogen citing the threat to species in the area on the International Union for Conservation of Nature's Red List of Threatened Species.

■

Fostering local community participation and consultation in the green hydrogen projects

Local community participation and consultation are essential for the success and sustainability of hydrogen projects, as they can help maximise benefits for all stakeholders involved.

• CORRINA VAN WYK

The global push towards sustainable energy solutions has seen an increasing focus on green hydrogen as a clean and renewable energy source with the potential to transform various sectors.
As governments and industries worldwide invest in green hydrogen projects to decarbonize their economies, it is crucial to ensure that local communities are actively engaged and consulted.

Importance of community participation

Local community participation in green hydrogen projects goes beyond mere compliance with regulations – it is about fostering a sense of ownership, empowerment, and collaboration among those directly affected by the project. By involving local communities in the decision-making process, project developers can tap into valuable local knowledge, identify potential challenges early on, and co-create solutions that are socially, economically, and environmentally sustainable.
Furthermore, engaging local communities in green hydrogen projects can help build support and create a positive narrative around the benefits of transitioning to a green economy.

>

When communities feel heard, respected, and included in the planning and implementation of such projects, they are more likely to embrace the changes and become champions for sustainable development in their region.

Some challenges and opportunities

While the benefits of local community participation in green hydrogen projects are clear, there are several challenges that project developers may face in effectively engaging with local stakeholders. These challenges include:

1. Lack of awareness and understanding:
   Many community members may not be familiar with green hydrogen technology and its potential benefits and how it may impact the environment, leading to scepticism towards the project.

2. Power imbalances:
   Communities often perceive project developers as having more resources and influence, which can create distrust and hinder open communication.

3. Conflicting interests:
   Local communities may have diverse interests and priorities, making it challenging to align their expectations with the project goals.

4. Communication barriers:
   Effective communication is essential for meaningful engagement, but language barriers, technical jargon, or limited access to information can impede dialogue between project developers and community members.
   Despite these challenges, there are also significant opportunities to enhance local community participation and consultation in green hydrogen projects. By adopting a proactive and inclusive approach, project developers can turn these challenges into opportunities for building strong partnerships, fostering social cohesion, and driving sustainable development at local level.

Namibia

"Namibia adopted decentralisation as a state policy with the overall aim of ensuring economic, cultural and socio-economic development and providing the people at grassroots level the opportunity to participate in their own decisions and extending democracy to them as a right based on national ideas and values."[1]
The Constitution of Namibia, being the supreme law, makes provision for community participation by providing for freedom of expression, capacity building through education, and sustainable uses of indigenous knowledge. Namibia's Vision 2030 calls for an integrated development planning process, through which local communities are given a chance to voice their needs and aspirations as they look towards 2030. In the Namibian context, local community participation and consultation around green hydrogen projects are particularly crucial for the following reasons:

1. Environmental impact:
   Namibia is known for its unique and fragile ecosystems, including the Namib Desert and the diverse wildlife in the regions. Green hydrogen projects have the potential to impact local ecosystems through land use, water consumption, and waste management. Involving local communities in the decision-making process can help identify potential environmental risks, mitigate negative impacts, and ensure that conservation efforts are prioritised.

2. Socio-economic Development:
   Namibia faces challenges such as high unemployment rates, income inequality, and limited access to basic services in many rural areas. Green hydrogen projects have the potential to create new job opportunities, stimulate economic growth, and improve infrastructure in local communities. Engaging with residents to understand their needs, priorities, and aspirations can help tailor project benefits to meet the socio-economic development goals of the region.

3. Cultural Heritage Preservation:
   Namibia is home to diverse ethnic groups with rich cultural traditions and ancestral lands. Green hydrogen projects may intersect with areas of cultural significance, traditional livelihoods, and communal land tenure systems. Consulting with local communities can help safeguard cultural heritage, respect indigenous knowledge, and ensure that project activities are culturally sensitive and socially inclusive.

4. Energy Access and Affordability
   Access to reliable and affordable energy services remains a challenge for many rural communities in Namibia. Green hydrogen projects have the potential to expand energy access, reduce dependency on fossil fuels, and enhance energy security in remote areas. By involving local communities in project planning, developers can better understand energy needs, preferences, and challenges faced by residents, and tailor solutions to meet their specific requirements.

>

[1] Environmental impact: (Fuller, 2005)

5. Governance and Accountability:
   Namibia is committed to promoting good governance, transparency, and accountability in the management of natural resources and infrastructure development. Engaging local communities in green hydrogen projects can help strengthen democratic processes, build trust in public institutions, and ensure that decision-making is participatory and responsive to community needs and concerns.

6. Knowledge Sharing and Capacity Building:
   Local communities in Namibia possess valuable knowledge of their environment, resources, and traditional practices that can inform sustainable project design and implementation. By fostering knowledge sharing and capacity building initiatives, project developers can empower communities to actively participate in and benefit from green hydrogen projects, leading to more inclusive and resilient outcomes.
   In conclusion, local community participation and consultation are vital in the Namibian context to ensure that green hydrogen projects are environmentally sustainable, socially inclusive, economically beneficial, and culturally sensitive. By engaging with local stakeholders in a collaborative and respectful manner, project developers can build strong partnerships, foster community ownership, and create lasting positive impacts that benefit both current and future generations in Namibia.

Some best practices

To ensure successful community participation and consultation around green hydrogen projects, project developers should consider implementing the following best practices:

1. Early engagement and participatory approach:
   Involve communities from the early stages of project planning to build trust, set clear stages of project planning to build trust, set clear expectations, and address concerns proactively. Consultations should take place during project planning, design, and implementation. Communities' needs and insights should guide decision-making.

2. Transparent communication:
   Provide accessible and accurate information about the project, its benefits, risks, and potential impacts in a language that is understood by all stakeholders.

3. Meaningful Dialogue:
   Create opportunities for two-way communication through public meetings, workshops, surveys, and other engagement activities to gather feedback, address questions, and incorporate community input into decision-making.

4. Stakeholder mapping:
   Identifying relevant stakeholders, including community members, local leaders, NGOs, and government agencies. To understand their interests, concerns and capacities is of vital importance. No concern is less important than the other.

5. Capacity building:
   Empower local communities by providing relevant training, education, and resources to enhance their understanding of green hydrogen technology, sustainable practices, project benefits, and its implications.

6. Collaboration and partnerships:
   Foster collaboration with local governments, non-profit organisations, academic institutions, and other stakeholders to leverage their expertise, networks, and resources for community engagement.

7. Communication Channels:
   Establish effective communication channels. Use local languages, community meetings, radio, and other accessible platforms to share project updates, progress, and opportunities.

>

8. Benefit Sharing:
   Clearly define how project benefits (such as improved crop yields, income, or employment) will be shared among community members. Ensure equitable distribution.

9. Inclusivity:
   Engage women, youth, and marginalised communities. Their perspectives are essential for holistic project success.

10. Implementation of grievance mechanisms
    It is important that these discussions not only design codes of conduct but that it implements holistic grievance mechanisms that address community concerns and ensure transparency. This includes institutional arrangements, staffing, training, monitoring, reporting, and grievance management. Although the Environmental Management Act provides some measure of public participation during environment clearance procedures, it is hardly sufficient to say that the community directly affected by certain industrial activities has had the opportunity to participate wholly in such a project.

Case studies of successful community Engagement

Several green hydrogen projects around the world have successfully implemented strategies to engage and consult with local communities, resulting in positive outcomes for all stakeholders involved. One such example is the Orkney Surf 'n' Turf project in Scotland, which integrates wind and tidal energy to produce green hydrogen for local transportation and heating. The project team actively involved residents, businesses, and community groups in the planning process, leading to widespread support and enthusiasm for the initiative.
In Australia, the H2-Hub Gladstone project in Queensland has embraced a community-led approach by establishing a Community Reference Group comprising local residents, industry representatives, and environmental organisations. This collaborative effort has facilitated open dialogue, knowledge sharing, and trust-building between the project developers and the community, paving the way for a more inclusive and sustainable green hydrogen development.

Lessons learned and future directions

As green hydrogen projects continue to proliferate globally, it is essential for project developers, policymakers, and community leaders to learn from past experiences and continuously improve their approaches to community participation and consultation. Some key lessons learned from successful initiatives include:

1. Tailoring engagement strategies to the local context:
   Recognizing the unique characteristics, needs, and priorities of each community is crucial for designing effective engagement strategies that resonate with the local stakeholders.

2. Building long-term relationships:
   Establishing trust, respect, and mutual understanding through ongoing engagement can foster a sense of shared responsibility and commitment to the project's success.

3. Addressing social equity and inclusion:
   Ensuring that all community members, including marginalised groups, have a voice in the decision-making process is essential for promoting social equity and inclusivity in green hydrogen projects.

4. Monitoring and evaluation:
   Implementing robust monitoring and evaluation mechanisms can help track the progress of the community engagement efforts, identify areas for improvement, and measure the impact for these initiatives on project outcomes.

Looking ahead, the future of green hydrogen development lies in fostering deeper partnerships with local communities, integrating social considerations into project planning, and prioritising sustainability and inclusivity in all aspects of project implementation. By embracing a collaborative and participatory approach to community engagement, green hydrogen projects can not only achieve their environmental and economic objectives, but also contribute to social well-being, resilience, and prosperity in the communities they serve.

Conclusion

In conclusion, local community participation and consultations are essential pillars of sustainable development in the context of green hydrogen projects. By engaging with local stakeholders in a meaningful and inclusive manner, project developers can build trust, enhance transparency, and create shared value for all parties involved. Through proactive communication, collaboration, and capacity building, green hydrogen projects can harness the collective wisdom, creativity, and energy of local communities to drive positive change and pave the way towards a more sustainable and resilient future.
As we navigate the complex challenges of decarbonisation and energy transition, let us remember that a path to a greener, more prosperous world begins with listening to and learning from the diverse voices and perspectives of local communities around the globe. Together, we can harness the power of green hydrogen technology to create a more sustainable, equitable and thriving future for all.■

**Corrina van Wyk is a lawyer and project coordinator at the Legal Assistance Centre (LAC).*

These remarks were made on 9 April 2024 at a two-day meeting titled 'Indigenous reflections on Green Hydrogen production in southern Namibia', that took place at Lüderitz, in the ||Kharas Region.

REMARKS BY GAOB JOHANNES ISAACK GAOB OF THE /HAI /KHAUA TRADITIONAL AUTHORITY AND CHAIRPERSON OF NAMA TRADITIONAL LEADERS' ASSOCIATION

9 April 2023, Lüderitz Waterfront Auditorium

Ladies and Gentlemen

I stand by all protocol as observed.

First of all, I would like to thank you for allowing us to come together here today to talk about a topic that concerns us all: the future of hydrogen projects in and around Lüderitz and the associated rights and needs of the Nama Nation.

Dear government representatives, ministers, economic and scientific actors, it is clear that we are at the beginning of a technological revolution that has the potential to transform our country and our world. But as promising as this future seems, we must remember that technology is never neutral. It's not just about what we build, but also how we build it and who we involve indigenous people in the process.

I stand before you today not only as a representative but also as a guardian of the interests and heritage of the Nama Nation. This symposium deals with a topic of such great importance. At the heart of this discussion lies a burning question that goes beyond mere technological and economic progress - the question of inclusion and respect for the rights of indigenous peoples, the question of informed consent and colonial land dispossession.

This not only violates our deep understanding of justice and cooperative dialogue, but also the principle "Nothing about us without us!", which should be of central importance to all of us.

This symposium is not the result of a government draft, it is an initiative of our own - an act of coming together and the desire to understand. The fact that no concrete action has been taken by the government to date shows a mismatch between the importance of this project and the involvement of those it most affects. No strategy can be complete without including the voices and perspectives of those most directly affected.

> **"For too long, the Nama Nation has seen decisions affecting our land, our heritage, and our future being made without our input. The principle "Nothing about us without us" is central to every discussion that concerns our collective well-being, and yet it has not been truly taken into account in the context of current hydrogen projects.**

We called on our technical team to seek funding so that the Nama leaders can have a deeper understanding of what hydrogen energy is, and what the long-term implications would be in our fight for justice. For this, we would like to thank our German partners, the Society for Threatened Peoples and the Hering Foundation, who made it possible to hold this workshop.

Our goal must be to develop an informed, sustainable and equitable hydrogen strategy that respects and prioritizes the rights and needs of the Nama. It is about establishing clear and transparent mechanisms that include the Nama Nation and other indigenous peoples in all phases of planning, development and ultimately the implementation of the projects.

I stand here today to tell you: It is time that we not only accept this principle, but also actively implement it. The initiative of this symposium demonstrates the will and the need to create an informed dialogue. It's about developing a strategy that is not only technically or financially viable, but also culturally and socially sustainable.

My message to you today is a call to action. It is time for us to unite and build an inclusive future where every voice is heard and every contribution is valued. The Nama Nation is ready for dialogue, ready to sit at the table of decision-makers, ready to lead and be led. Are you ready to meet us there? Not as supplicants, not as an expression of the mood of politicians and government officials, but as equal partners in a project that affects us all and from which we can all benefit.

I appeal to everyone present here: let us work together to make the hydrogen initiative a model project for sustainability and inclusion. It's not just about the energy industry, it's about human rights, environmental protection, social justice and a future worth living for everyone.

We are the Nama. Our knowledge and experience are deeply rooted in the country, which is now at the centre of the energy transition. We request that all concerns that concern us be discussed openly and honestly with the umbrella organization of Nama Traditional Authorities, the NTLA, to ensure that the entire Namas community is fully involved.

Let us enter into a process together where transparency, respect and true partnership come first. We don't want to just be spectators; we demand to be viewed as equal partners. Only if we work together can we ensure that the hydrogen projects not only follow a sustainable development model, but also protect the rights and needs of the Nama nation.

We have the opportunity to make history - a history in which everyone's voices are heard and honoured. Let us choose this path of inclusion and respect today and shape a future where progress and tradition go hand in hand.

Before I conclude, I want to register the lack of participation at high level despite the invitations sent two months in advance. We invited the Chairperson of the Green Hydrogen Council, the Director-General of the National Planning Commission and Ministers and EDS of relevant line Ministries. Despite these letters having gone out on very early notice, they were not even graced by any final commitment, but then we make political noise about INCLUSIVITY.

Despite this, I look forward to the upcoming discussions and the common effort to leave a fair, respectful and sustainable world to our children and grandchildren.

Thank you.

Government of the Republic of Namibia and Hyphen Hydrogen Energy

Feasibility and Implementation Agreement

What is the Feasibility and Implementation Agreement?

The pioneering Feasibility and Implementation Agreement (FIA) that the Government of the Republic of Namibia (GRN) and Hyphen have agreed to sign governs the process for the development, implementation and operation of **Namibia's first green hydrogen project.**

- GRN and Hyphen believe that the FIA will set a new global benchmark, creating a template for the sustainable and equitable development of other green hydrogen projects.
- GRN has the opportunity to be a co-investor in the project with the right to take up to a 24% equity interest at cost. Thanks to its partnership with the European Union and the Global Gateway Initiative, Namibia has mobilised donor and concessional funding from Invest International and the European Investment Bank in excess of EUR540 million/ NAD 11,167 million to finance the development of the green hydrogen industry and to fund its equity participation in the project.
- Under the FIA:
  - GRN is responsible for ensuring that Namibia is equipped with the necessary legal, fiscal and regulatory environment to enable the implementation of the project.
  - Hyphen is responsible for the technical, financial, environmental, social and commercial delivery of the project which, if finally approved by GRN, will then be implemented by Hyphen.

Hyphen Hydrogen Energy | info@hyphenafrica.com | www.hyphenafrica.com

Progression to conclusion of the FIA

The process that GRN has run to arrive at the appointment of Hyphen as the preferred bidder to develop the project is documented in detail in the GRN publication **"Traction – Namibia's Green Hydrogen Overview".**

2020

GRN commenced the development of its green hydrogen strategy, with green hydrogen forming a key part of Namibia's long term national planning.

18 March **2021**

The Harambee Prosperity Plan II was launched by H.E The President of Namibia setting out ambitious targets to support the regional and global decarbonization with the Southern Corridor Development Initiative (SCDI) as part of the Economic Advancement Pillar.

23 May **2021**

The Green Hydrogen Council, an inter-ministerial body to oversee the development of the green hydrogen opportunity, was established by H.E. The President of Namibia.

The SCDI located within the Tsau ǁKhaeb (Sperrgebiet) National Park was selected for Namibia's first project.

23 June **2021**

GRN launched a market sounding process that provided valuable inputs on what would attract developers and recommendations on how to structure the project so Namibia and its people are at the heart of the project.

3 August **2021**

Launch of request for proposal (RFP) in respect of the first two land parcels in the SCDI.

September **2021**

GRN's RFP process, which closed on 16 September, was open to all bidders with 6 individual bidders submitting 9 separate bids across the two land parcels.

A Governmental bid adjudication committee administered the adjudication process and was supported by two independent expert organisations: NREL (National Renewable Energy Laboratory), a national laboratory of the U.S. Department of Energy and two technical experts appointed by the European Union Global Technical Assistance Facility on Sustainable Energy.

The subsequent findings and recommendations were presented to the Green Hydrogen Council (GHC) which in turn presented its recommendations to Cabinet for approval.

The Green Hydrogen Research Institute was established at the University of Namibia following Cabinet approval.

02 November **2021**

GRN announced Hyphen as preferred bidder in respect of two land concessions in the Tsau ǁKhaeb National Park and commencement of the process between GRN and Hyphen to prepare the FIA.

01 June **2022**

GRN approved the composition and appointment of the Government Negotiations Team assembled to finalise the FIA.

September **2022**

GRN undertook a market sounding process on the proposed development as part of the first project of common use infrastructure to be utilised by subsequent projects in SCDI as part of GRN's plans to enable the rapid scalability of green hydrogen production in the SCDI.

September **2022** to May **2023**

During this period Hyphen has signed Memorandums of Understanding (MoUs) with a number of potential customers in Europe and Korea, targeting the supply of over 1,000,000 tonnes of green ammonia annually.

23 May **2023**

Cabinet of GRN approves FIA.

2027 Targeting annual production of one million tonnes of green ammonia by the end of 2027.

2029 Targeting annual production of two million tonnes of green ammonia by the end of 2029.

Process under the FIA for the development of the project

- The FIA sets out the process under which the project will be developed and the roles and responsibilities of each of GRN and Hyphen.
- Hyphen's principal task under the FIA is to investigate the feasibility of developing the project, and if feasible and approved by GRN, to then proceed with the implementation of the project.
- The FIA is broadly split in five sequential phases, summarised below, and each phase can only commence if the previous phase has successfully been completed and approved by GRN.

1 Preliminary Phase

Covers the period from the signature of the FIA until the date on which both the GRN and Hyphen are satisfied that all conditions for the FIA to become "effective" are met. It is envisaged that this phase will last up to six months.

It is during this preliminary phase that the GRN can choose whether or not to exercise its option to acquire up to 24% of Hyphen's share capital.

2 Feasibility Phase

Period in which Hyphen is tasked with assessing the technical, financial, environmental, social and commercial viability of undertaking the project, including the potential establishment of common user infrastructure.

Socio-economic development targets will also be assessed and agreed to ensure that this project benefits all of Namibia through training, education, job opportunities and localisation.

- During this period Hyphen will pay land rentals to GRN totalling EUR12.12 million.
- It is Hyphen's responsibility to fund these feasibility activities.
- At the completion of the feasibility phase, Hyphen is to produce a comprehensive feasibility report setting out its proposed project design and commercial structure, for the GRN's consideration.
- GRN is responsible for providing the land on which the project will be established and developing and implementing the required legal, fiscal and regulatory environment necessary for the establishment and sustainable operation of Namibia's green hydrogen industry.

3 Validation Phase

GRN is required to consider whether to validate the project or not against certain pre-agreed conditions as contained in Hyphen's bid per the RFP.

4 Financing and Construction Phase

Upon project validation, Hyphen is responsible for:

- Raising the necessary finance for the project.
- Constructing the project.
- Complying with the agreed socio-economic development targets applicable during construction.
- Paying land rentals to GRN equivalent to EUR10 million per year (increasing at 2% per annum).

5 Operational Phase

Upon commissioning of the project, Hyphen will be responsible for:

- The maintenance and operation of the project.
- Complying with the agreed socio-economic development targets applicable during operation.
- Paying land rentals and environmental levies to GRN equivalent to EUR26 million per annum (increasing at 2% per annum).
- Paying royalties equivalent to 5% of gross revenues.
- Paying corporate income tax and other Namibian taxes in accordance with the requirements put in place by GRN for the wider green hydrogen industry.

For more information please visit our website

www.hyphenafrica.com