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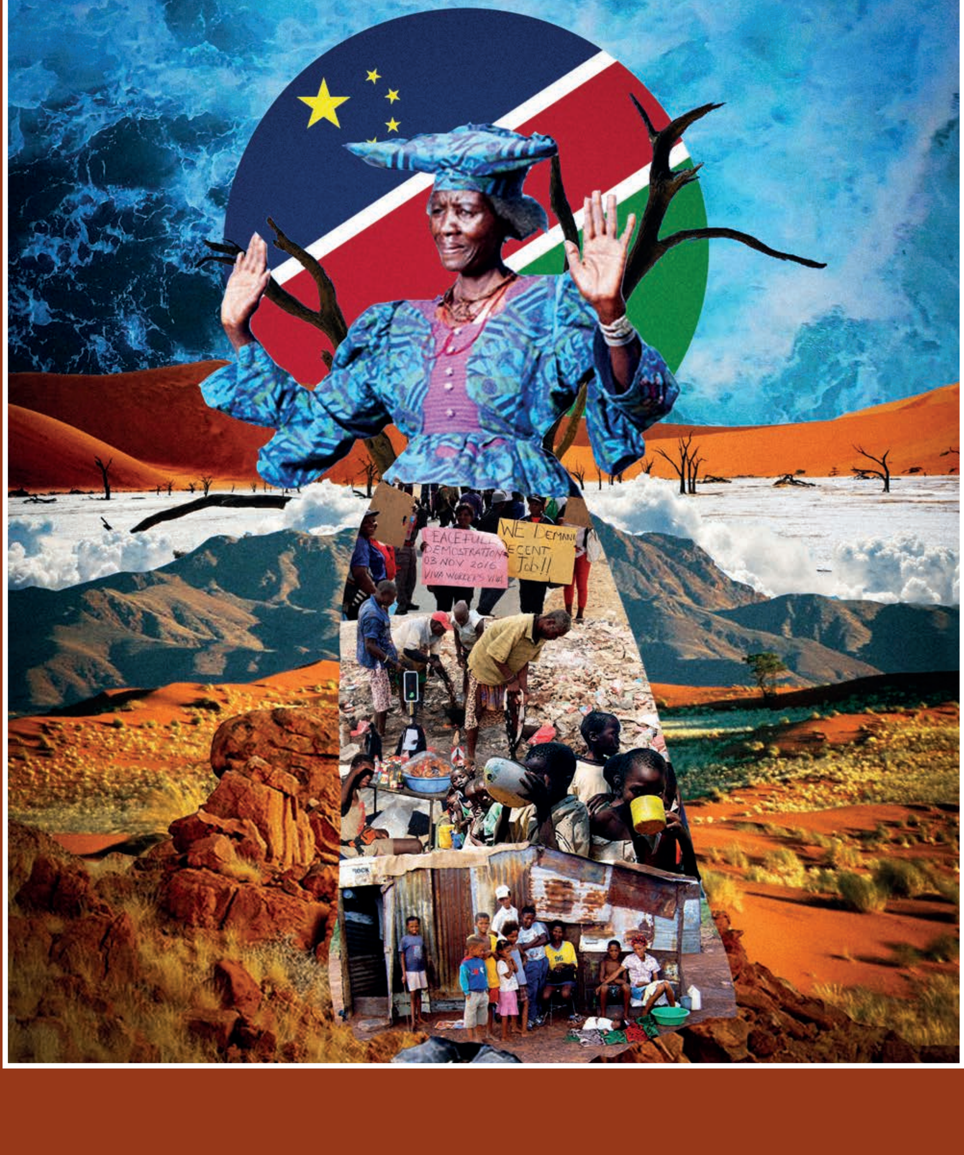
Employment, Livelihoods and the World of Work



Employment, Livelihoods and the World of Work

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Green Hydrogen: Reality or Fantasy?

Bertchen Kohrs

A worldwide hydrogen hype has started. The champagne of the energy transition – that's what enthusiasts like to call green hydrogen (GH2) because it is rare, and expensive. Others call it the magic weapon for the decarbonisation of our planet, the saviour of the climate. GH2 is also being called the energy source that will usher in a new industrial revolution. But scientists warn that GH2 may not be the silver bullet that will solve all climate problems.

Actually, what is GH2? Hydrogen (H2) is the lightest element in the periodic table. Produced from renewable sources, it is suitable for energy storage, as it can be used as an energy source in the place of fossil fuels. Under normal conditions, H2 takes up too much space to be suitable as a fuel. However, H2 can be compressed – under 700-times atmospheric pressure, H2 reaches an energy density of 1.5 kWh per litre, which is about one-

Source: https://economist.com.na/65568/education/unam-to-open-green-hydrogen-institute/

ninth the energy density of gasoline (Hossenfelder, 2022)

H2 is a colourless gas. The only by-product of burning hydrogen is the creation of H2O – water. However, the production of H2 requires an energy source, and that is where (part of) the problem lies. A hydrogen colour-scale is used to classify the ecological consequences of the production of H2. The most commonly utilised is **grey** hydrogen, which is produced from natural gas like methane (CH4) or coal by expelling, but not capturing, the greenhouse gases it contains (the other part of the problem). Namibia annually imports about 40 tons of climate-harmful grey hydrogen from Sasol in South Africa. **Blue** hydrogen is also made from natural gas or coal, while the resulting CO2 is sequestered and stored in the ground. **Pink** hydrogen is made with energy from nuclear power – an energy source that is fraught with environmental risks. **White** H2 is naturally occurring, and research is in full swing to develop methods of capturing it safely and cost-effectively (Institute for Public Policy Research (IPPR), 2021).

Green hydrogen, the "type" of H2 at issue here, is supposedly climate-friendly because it is generated using 100% renewable energy. How environmentally responsible and climate-friendly H2 really is depends on how it is produced (whether or not resulting greenhouse gases are sequestered) and the source of energy used in its production. Green hydrogen is also no longer "green" if it is blended with hydrogen from other sources.

Namibia wants to contribute to solving the global climate crisis while achieving the desired level of prosperity for the Namibian populace – a pressing goal in light of the poverty and inequality afflicting the country. The Gini-coefficient is a statistical measure of a population's income distribution, with higher numbers (on a scale of 0 to 100) equating to greater inequality of income distribution. After 33 years of independence, Namibia's Gini-coefficient of 59.1 (measured in 2015) (World Bank, n.d.) is still the world's second highest, despite improving from 63.3 in 2003. The 2023 unemployment rate is still in the order of 50%. (Namibia Statistics Agency, 2021)

By 2030, Namibia aims to reduce national CO2 emissions by 90% and become independent of expensive electricity imports from neighbouring countries. With the production of GH2, Namibia sees new opportunities for its modest economy. The government hopes to make Namibia one of the world's most important locations for GH2 production.

The Minister of Mines and Energy, Tom Alweendo said in an interview, "As the world moves towards net zero emissions by 2050, Namibia's vast natural renewable energy resources offer a unique opportunity to produce the energy of the future – green hydrogen. Our past collaboration with Hyphen has proven that better results are guaranteed when partners work together on a shared vision. For us, the time for planning is over, now it's time for implementation. We now have a clear opportunity to be at the forefront as a continental centre for green hydrogen production." (Allgemeine Zeitung, 2022)

During the bidding process, 4 000 km^2 of land was allocated for Phase 1 in the Tsau ǁKhaeb National Park, formerly known as the Sperrgebiet, for the gigantic project. International and regional bidders applied. A Green Hydrogen Council was formed and, with Cabinet consensus, Hyphen Hydrogen Energy (Hyphen) was selected in November 2021 as the preferred bidder for the project. Hyphen is a consortium of Enertrag, a German company based in Brandenburg, and Nicholas Holdings, an infrastructure investor in sub-Saharan Africa. In May 2023, Hyphen was finally awarded the contract (Hyphen Hydrogen Energy, Undated).

Production is estimated at 300 000 tons of GH2 and 1.7 million tons of ammonia (NH3) per year, to be generated from 5–6 GW of renewable energy, of which 3 GW will be used in electrolysers. (Hyphen Hydrogen Energy, 2022)

According to the government, the total investment amounts to US$10 billion, which is roughly equivalent to Namibia's gross domestic product. Some describe the project as an economic tsunami for Namibia.

In March 2022, a cooperation agreement was signed between Alweendo and the German Federal Minister for Economic Affairs and Climate Action, Dr Robert Habeck, about the hydrogen industry. In November 2022, the President of the European Commission, Dr Ursula von der Leyen, and the President of Namibia, Dr Hage Geingob, signed an MoU at COP27 in Egypt on the establishment of a strategic partnership between the European Union (EU) and Namibia with regard to sustainable raw materials and renewable hydrogen. During the visit of Habeck in December 2022, Geingob signed a document of intent to supply GH2 to Germany. "There would hardly be a better place in the world to produce GH2 using wind and solar energy," Habeck said at a press conference. He further said that negotiations would be conducted on an eye-to-eye and respectful level, and not a top-down one, as in the past.

Many unsolved questions

The green energy project has raised many questions. How realistic are the expectations? And how do Namibians feel about the fact that valued domestic resources are to be exported, while the country imports up to 70% of coal-produced dirty electricity at high cost? Will Namibia be supplied countrywide with electricity? And will the electricity cost be affordable for all? Will Namibians participate in the promised fortune? Or will the profits disappear into the pockets of a few? Will Lüderitz and possibly Aus be capable of accommodating and providing for the influx of 15 000 workers and their families, or will a new town with all the necessary infrastructure have to emerge? Will the recruitment of workers be just and 90% local as promised? What will happen to the workers when the hype is over? Will Namibia enter into a new dependency of the former colonial power, Germany? Who will determine the GH2 strategies – Namibia? Germany? Hyphen? Or will the strategies be developed jointly? Will the future demand for GH2 remain stable? Or will the market one day be saturated, and Namibia be left alone with all the infrastructure? How will the project be financed? How will corruption that usually accompanies large projects be prevented? These and many more are unsolved questions that have yet to be addressed – but will they be addressed?

There is still no infrastructure for this huge project. The legal framework and regulations for the production, transport, storage and use of GH2 have yet to be fashioned. 15 000 workers will be required during the four to five years of the construction phase, and 3 000 highly skilled workers will be necessary in the production phase. Ninety percent of the workforce should be local people. Although the workers required for the construction phase are locally available, specially qualified workers and scientists must be trained for the highly technical aspects of the construction work, and for the GH2 production phase. Such training will indeed contribute positively and provide income for thousands of families as long as GH2 is generated in Namibia.

Manufacture of GH2

The manufacture of GH2 will require many wind turbines and solar panels, a desalination plant (which will simultaneously supply local people with clean drinking water), electrolysers to produce H2, plants to liquify the hydrogen for transport, pipelines to South Africa, mainly to Sasol in Secunda and to Cape Town, railway lines, etc. The energy loss will be substantial, and increase with each transformation, as will the costs.

GH2 is produced from water by electrolysis. Water molecules are split into hydrogen and oxygen. For a good quality of water, a desalination plant must be constructed. Normal drinking water is not suitable, as it contains various minerals that would interfere with the process. Nine kilogrammes of seawater are required to produce one kilogram of GH2. Current electrolysis technologies leave behind a caustic solution that should not be disposed of into the sea. The desalination process also produces a highly concentrated toxic residue called brine. The noxious waste from both desalination and electrolysis must be disposed of safely. (For more information on desalination: Desalination - Wikipedia)

GH2 must be generated in a carbon-neutral manner from renewable resources. However, during the construction of the plants, the fabrication of solar panels and wind turbines, the transport of GH2 and NH3 over long distances, CO2 will be released into the air. Additionally, the escape of H2 during production, storage, transport and use cannot be entirely prevented; H2 in the atmosphere is 11 times more harmful to the climate than CO2. (Blain, 2022)

Transport

GH2 is stored in high-pressure containers. For safe transport, it must be cooled to minus 250 degrees Celsius and liquefied – a costly and energy-intensive process. GH2 can also be converted to green ammonia (NH3) by absorbing nitrogen from the air and as such transported safely by ship to other venues. In the country of destination, NH3 can either be used directly or reconverted into GH2 and nitrogen. Each step requires appropriate facilities, which entails energy loss and an increase in cost, particular port and shipping infrastructure. Ammonia does have the advantage of being well-suited for fertilizer production.

Ships capable of carrying GH2 must be designed and built. So far, there is only one ship of this type, flying the Japanese flag. Currently there are no terminals suited for GH2 storage. There are still many unanswered questions in both the production and application of GH2, especially in the technical field. In addition to financing, there must be a guarantee for long-term customers and solid rates.

Application of GH2

GH2 has the potential to be a valuable, albeit expensive, energy resource that should be used wisely to achieve the greatest possible reduction in CO2 emissions. As an efficient energy carrier, GH2 can be produced using electricity for later conversion back to electricity. GH2 should be used where complete electrification is not possible, for example in voracious industries like steel making, cement and glass manufacturing, and chemical production.

In the mobility sector, especially in heavy trucks and transport vehicles, long-range fuel cells powered by GH2 can be used to replace batteries in electric vehicles. Fuel cells fuse hydrogen and oxygen to form water, creating electricity.

GH2 can be converted to ammonia, methanol, biodiesel, kerosene and synthetic fuel such as e-fuel, but each step is accompanied by an enormous loss of energy. E-fuel is intended to serve as a substitute for fossil fuels. During production of e-fuel, GH2 is bound with CO2 extracted from the air; during combustion, about the same amount of CO2 is released into the atmosphere, so that the overall CO2 balance is lower than for fossil fuels. E-fuels are therefore an option for reducing greenhouse gas emissions in transport, especially in long-distance freight transport and in maritime and air transport. A major drawback is the enormous energy loss that occurs during conversion. Only about 13% of the energy input can finally be utilised as e-fuel. (For more information see Green Hydrogen Derivates for Deep Decarbonisation (State of Green, 2023)

Other GH2 projects in Namibia

One of the main objectives of GH2 pilot projects is to gain experience in the field of GH2 production. The lessons learnt can be applied when setting up the planned GH2 project in the Tsau ǁKhaeb National Park. It seems wise to await the acquisition of know-how before committing to the huge Hyphen project.

Renewstable Swakopmund:

HDF Energy, a French company, has launched the Renewstable Swakopmund project. Plans are to build an 85 MW solar park and a GH2 plant based on electrolysers, fuel cells and 90 MWh of battery storage, a transport pipeline and a hydrogen refuelling station. The site will have a desalination plant employing reverse osmosis, for which a water pipeline must be laid. The project was designed in 2021, when Namibia launched the Harambee Prosperity Plan II, aiming to diversify the country's energy mix. Energy will be supplied to the Namibian power grid (HDF Energy, 2022).

Cleanergy Green Hydrogen Demonstration Plant

Cleanergy Solutions Namibia announced plans to build a power supply line for a GH2 pilot project in the Walvis Bay region. Cleanergy is a joint venture between Ohlthaver & List and CMB.TECH, a subsidiary of Belgium's Compagnie Maritime Belge, aimed primarily at building a pilot/demonstration plant for GH2, a refuelling station, and a GH2 training centre. The project will consist of a 5 MW solar park, a 4 MW electrolyser, and an H2 refuelling station. Demonstration applications in heavy-duty transport are intended. The project is scheduled to start in the third quarter of 2023, or as soon as an Environmental Clearance Certificate (ECC) has been issued (Matthys, 2023).

Daures Village

The Daures Green Hydrogen Consortium has just launched the Daures Green Hydrogen Village, which will produce GH2, green NH3, and its derivatives. Daures is the largest conservancy in Erongo Region and is home to about 11 350 people. Phase 1 will produce 31 tons of GH2 and 109 tons of ammonia per year, using 0.99 MW of renewable energy from solar power and wind. The plan is to create an environmentally friendly, completely self-sufficient green village. The energy supply will benefit local consumption on the project site, power a fuel cell plant, and serve research purposes on GH2. A huge greenhouse will produce agricultural produce (Movirongo, 2022). It remains to be seen whether the pledges for the people of the Green Hydrogen Village will be accomplished and not only result in quick land acquisition.

Purros GH2 project

This project by Kaoko Green Energy Solutions is to be based in Kunene Region, and a port for NH3 export has recently been mentioned. The green ammonia produced will be exported to China, Europe and South Africa. A feasibility study was due to commence in October 20023 (The Brief, 2023).

Environment and Biodiversity

Unfortunately, the location chosen for the Hyphen Project is the Tsau ǁKhaeb National Park, formerly the highly restricted Sperrgebiet, where exceptional endemic biodiversity was able to grow undisturbed. For Phase 1, 4 000 km^2 will be used, while for the proposed Phase 2, an additional 14 000 km^2 of the Tsau ǁKhaeb National Park will be utilised.

Will this unique hotspot of fauna and flora be turned into a huge industrial park?

Undoubtedly, the project will seriously affect the unique biodiversity of Tsau ǁKhaeb, especially during the construction phase, when 15 000 workers will be busy in the area. Heavy machinery and new infrastructure, roads and pipelines, railway lines, and solar and wind power plants will severely threaten the distinctive fauna and flora, which might be lost forever.

Initially the impact on the environment was rarely raised in any of the debates. No environmental activist was consulted; only after scientists and NGOs had explicitly expressed concerns was the protection of biodiversity included in the agenda.

The legally required feasibility and environmental impact studies, which examine negative and positive impacts on behalf of Hyphen, are still pending. As an I&AP (interested and affected party), one can register at hyphen@slrconsulting.com. This entitles one to submit objections and proposals and ask questions. Hyphen is required by law to provide information about any development through the consulting firm SLR. This gives the interested public the opportunity and responsibility to follow the project closely and to have a decisive influence before the government either issues or withholds an ECC.

Detailed and independent environmental impact studies, in which citizens, scientists and NGOs should be involved, are important. The Tsau ǁKhaeb National Park is part of the Namib Desert, which is highly valued for its exceptional biodiversity and rare plants. Scientists and botanists, in particular, fear irreparable destruction being caused if this species-rich area is designated for GH2 production.

The question is justified: Can GH2 be called green and environmental-friendly while unique biodiversity is being destroyed for a temporary and debatable project? Is Namibia not making too great a sacrifice?

Finally, an Environmental and Social Impact Assessment that only examines the Hyphen project seems to be insufficient. While preparations for the GH2 project are underway, exploration for oil and gas is taking place, minerals are being exploited, several maritime activities projects are being conducted in the south of Namibia, and probably more plans are in the pipeline, which all have the potential to contribute to accumulated environmental losses. It is therefore recommended that a Strategic Environmental Assessment (SEA) be conducted in order to evaluate the overall impact of all activities on the economic, ecologic, and social effects.

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