**GREEN HYDROGEN AND SKILLS DEVELOPMENT IN NAMIBIA**
**The Namibia Training Authority's Role in Attracting Talent and Knowledge to the Green Hydrogen Industry; and in Strengthening the Development of Career Trajectories**

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## Background

Green Hydrogen (GH) is part of the 'Breakthrough Agenda' launched at the 2021 UN Climate Change Conference, held in Glasgow, Scotland, United Kingdom, through which countries committed to work together to make clean technologies and sustainable solutions the most affordable, accessible and attractive option in each emitting sector globally, before 2030.

The solid traction gained to date in tapping into GH's enormous potential to support countries in cutting down on their CO2 emissions rightfully positions this as the new energy storage solution.

Hydrogen is extracted from water through a process of electrolysis. This happens when an electric current is passed through water (H20), breaking it down to its component parts, namely hydrogen and oxygen. Should the electric current be powered by renewable energy, either by solar or wind power, then the result is called GH.

Hydrogen itself, or its derivatives, such as ammonia and methanol can be used as fuel for transportation or generate electricity, or heat. It is said to be useful in sectors that are hard to decarbonise, like long distance transport, chemical manufacturing and power high-temperature industries.

## Africa's Potential

Africa's potential to become a key GH hub is especially pronounced in countries with existing renewable energy policy and regulations, skilled workforces, local demand markets and established infrastructure that can be utilised for export of the sustainable resource. GH projects are in the planning phase in Egypt, Mauritania and Tunisia, South Africa is planning a 'hydrogen valley' cluster of projects, whereas ammonia production sites are being asset up in Morocco and Kenya.

Namibia too, albeit one of Africa's smaller economies, is joining the fray. Our Government has set itself ambitious targets to support the regional and global decarbonization agenda. Under the visionary leadership of His Excellency, President Hage Geingob, a National Task Force on GH has been established. A coordinated and focused international campaign has allowed us to gain solid traction towards giving effect top our national GH ambitions.

## Global Developments and Trends

a) Oil and Gas Industry countries of the Gulf Cooperation Council (GCC

Other smaller players in the Oil and Gas Industry countries of the Gulf Cooperation Council (GCC) have pointed out that demand for GH produced with minimal carbon dioxide (CO2)

emissions could reach 530 million tons (Mt) by 2050, replacing about 10.4 billion barrels equivalent or 37% of pre-pandemic global oil production. It is further argued that GH represents a promising opportunity for the GCC not only for stimulating domestic industries, but also for export. These countries are mindful of the heavy investments China and the United States have made in this area, albeit that the latter, due to their own large domestic market, would consume most of their produce. By contrast, it is said that the GCC countries could export much of their GH and still have enough low-cost renewable energy for their local market, should they subscribe to a three-phased approach through which they would:

(i) Launch a commercial-scale pilot in partnership with a leading electrolysis operating company to build the necessary capabilities and identify challenges and start research and development (R&D) within a government department or universities.
(ii) Develop the right policies and regulations to support the domestic market, define the governance and institutional framework and develop the funding model.
(iii) Build the export infrastructure and secure supply agreements with export markets.

b) United Kingdom

The same argument was advanced by the UK Hydrogen and Fuel Cell Association (UKHFCA) in a position paper, in which they criticised the UK Treasury for its lack of foresight in not having invested in wind energy in the early days of its introduction, which they claim resulted in large-scale offshoring of manufacturing jobs and consequently ensured a continued reliance on imports, much to the frustrations of the public and private sector. Through support for low-cost GH supply, they pointed out that the UK government could have enabled further developments in manufacturing and supply chain capabilities in utilising skills and sites, arguing that that could have resulted in jobs and applications across sectors, including fuel cells for mobility and remote power; fuel for planes, ships, buses, commercial vehicles and rail; mobile generators; as well as thermal and hybrid energy systems such as dual fuel burners and boilers. In summary, the UKHFCA maintains that GH offers a pathway to revitalise local manufacturing capabilities and enhancing the skill base of workers, repositioning the UK to its former glories of the industrial revolution.

c) United States

GH has a wide range of applications where its use is either growing or has the potential for future demand. These diverse applications point to the scale of the technical potential for GH and related technologies. Industry has projected a potential US$ 2.5 trillion global market for GH technologies by 2050 and an annual shipments of fuel cells that has increased 15-fold since 2015, currently standing at over gigawatt (1GW). To that end, the US Roadmap Report concluded that by 2050, the US hydrogen economy could lead to an estimated US$ 750 billion per year in revenue and a cumulative 3.4 million jobs. In the case of the US that meant large-scale investment in multiple hydrogen projects. Examples may include hydrogen production, storage and turbines.

d) South Africa

As pointed out earlier, GH has applications in Transportation; Chemicals and Industrial; Stationary and Power Generations and Integrated/Hybrid Energy Systems. South Africa's GH

agenda is being championed by the Hydrogen Society Roadmap (HSRM) which targets to deploy 10 gigawatts (GW) of electrolysis capacity in the Northern Cape by 2030, and to produce about 500 kilotons of GH annually by 2030. This development is projected to generate 20,000 jobs annually by 2030, and 30,000 by 2040. This programme would rely on SA's deep expertise in the Fisher-Tropsch process which was used in the production of power fuels. Furthermore, South Africa, is the world's largest producer of platinum group metals (PGM) - one of the key ingredients in the production of GH, and platinum currently making a paltry contribution to its Gross Domestic Product (GDP), for most of the raw materials are exported. However, with the creation of a more integrated domestic value chain, that could be reversed and kick-start SA's GH economy. It is estimated that SA could be the cheapest GH producer in the world at about US$ 1.60 per kg by 2030 and that could propel that country to claim a 4 per cent share of the world GH production by 2050. This would also assist SA to decarbonise, since it is the 14$^{th}$ largest emitter of greenhouse gasses. The SA government is also to embark on a strategy that creates local demand for GH and related products, through the following catalytic projects:

- Conversion of trucks from diesel fuel to fuel cell. This would increase hydrogen demand in the mining valley of Limpopo, Johannesburg and Durban port to about 80 per cent by 2030.
- Capturing of pollutants from coal-fired boilers to produce value-added products such as green ammonia, fertilisers and synthetic acid thereby increasing local GH demand.
- Sustainable Aviation Fuels (SAF) will provide low-carbon alternative fuels to help decarbonise the aviation sector. A 2021 study argued for the upscaling of production of SAF with a view to creating 55 000 jobs in the rural areas and at the same time adding 2 billion to the country's GDP, annually.
- The Boegoebaai Industrial Hub that is to host seven key facilities including an electrolyser park; a green ammonia production plant; a desalination plant; a storage facility; a solar, wind, and battery park; and a giga factory to level up the production of electrolysers; and a supplier park. This project is expected to create 6,000 jobs. This will allow South Africa to become mass exporter of green hydrogen.

## Possible Areas of Application

Malamatenios (2016) maintains that renewable energy sources create more jobs than the fossil fuels they are displacing. Research has it that in 2013, globally, 6.5 million people were working directly in the renewable energy sector. China, Brazil, USA, India and Germany were the top largest employers for renewable energy (RE). This was more dominated by solar voltaic and wind power energy. Other job profiles, professions and skills requirements in the renewable energy sources (RES) were not located in the energy producing facility only, but in the following sub-sectors, as well:

- Manufacture and distribution of renewable energy equipment, including the necessary research and development (R&D);
- Project Development;
- Construction and Installation works for the development of renewable energy projects; and
- Operation and Maintenance (O&M) of RE facilities

There are of course cross-cutting activities contributing to more than one sub-sector including the policy, planning, advisory, energy consultancy, training, business development, and marketing sectors, amongst others. Moreso, employment patterns in RE equipment manufacturing and distribution are similar to those in other capital investment goods industries. What is however different are the patterns in project development and in construction and installation, as this work is project-based, while in the operations and maintenance (O&M) field, employment is more stable.

## Vocations/Professions (Direct & Indirect)

There exists a great variety of professions that are directly, or indirectly, associated with renewable energy (RE) sources.

Technicians are said to be the *"…action men of the RE world: they work with their hands and with tools and machinery, special equipment and vehicles..."*

***Technicians*** ensure that RE products are manufactured to high standards, plants are assembled according specifications, and RE devices are installed properly in buildings. They may work in the day-to-day operations and maintenance (O&M) of RE facilities. In these categories, a wide range of vocations can be placed, including electricians, plumbers, drilling technicians, construction specialists, manufacturing processes operators, wind farm O&M technicians, PV modules installers, logistics operators, automation and control technicians, chemical laboratory assistants etc.

On the other hand, ***Technical Designers and Consultants*** are the 'technical brains' behind all renewable energy (RE) operations. They spot the technical opportunities, come up with new ideas, solve problems, execute planning and ensure that new RE developments are sustainable in terms of national needs, economics and environmental laws. They may specialise in research and development (R&D) to test out innovations, which are likely to improve on the outputs and cost-effectiveness of RE technologies. This may include engineers from mechanical, electrical, civil, power systems and software backgrounds, process manufacturing engineers, landscape architects, geotechnical engineers, measurement and control engineers, environmentalists, material scientists, biochemists, hydrologists, geologists, physicists

Another category is that of ***Energy Advisors***. They are supporters and knowledge providers to individuals and companies involved in RE. They advise on national policies as they relate to RE planning, operations and management and may specialise in training ranging from the provision of general guidance for companies on new developments in RE to specific subject matter training such as installer accreditation. This category includes planning consultants, land development advisors, environmental legal consultants, policy developers/local development officers, teachers/ trainers, energy officers, and energy advisors, including health and safety consultants.

A last group is that of ***Business Development Executives***. These are the 'business brains' behind all RE operations. They identify the new business opportunities, compile proposals, identify the customers and ensure that customer's needs are met all along the RE supply chain. They could

be specialists in business communications thereby affording them the opportunity to do marketing and media campaigns for business uptake of the RE sources. This category includes professionals like business developers/analysts, marketing executive, financial, human resources and administration managers, technical sales representatives, public relations officers.

In addition to those categories, managers and consultants require dynamism, leadership, innovation, negotiation and strategic skills to get the best out of every market opportunity.

More importantly, it must be noted that basic occupational skills required for many jobs in the RE industry are delivered through existing education and training programmes, i.e., our universities and (Technical and Vocational Education and Training (TVET) institutions should be able to meet expectations. In instances where they do not offer the required courses and qualifications, they must reprioritise and respond accordingly.

Furthermore, it must be emphasised that while most of the possible job categories are already identified, we need to appreciate that the jobs that are going to be created are disproportionate for highly skilled, well-paid, technical and professional workers, who provide the foundation for entrepreneurship and economic growth.

The Table below shows examples of emerging jobs and education and training requirements in the hydrogen and fuel cells industries in the USA.

| Occupational Title | Minimum Educational Requirements |
|---|---|
| Director Of Hydrogen Energy Development | Bachelor's (Business) |
| Hydrogen Fuelling Station Manager | Bachelor's (CE) |
| Hydrogen/Fuel Cell R&D Director | Doctoral |
| Hydrogen Fuel Cell System Technician | HSD/GED/OJT/TS/Apprenticeship |
| Junior Hydrogen Energy Technician | HSD/GED/OJT/TS/Apprenticeship |
| Fuel Cell Engineering Intern | HSD/GED/OJT/Apprenticeship |
| Fuel Cell Manufacturing Technician | Associate's |
| Fuel Cell Fabrication and Testing Technician | Associate's |
| Hydrogen Power Plant Installation, Operations, Engineering and Management | Bachelor's (EE, ME, CE) |
| Hydrogen Energy Systems Designer | Apprenticeship/TS |
| Fuel Cell Plant Manager | Bachelor's (EE, ME) |
| Hydrogen Energy System Operations Engineer | HSD/GED |
| Hydrogen Fuelling Station Designer & Project Engineer | Bachelor's (Engineer) |
| Hydrogen Fuel Transporter – Trucker | OJT |
| Hydrogen Fuelling Station Operator | OJT |
| Hydrogen Fuels Policy Analyst & Business Sales | Bachelor's (Business) |
| Hydrogen Systems Program Manager | Bachelor's (Engineer) |
| Emissions Accounting & Reporting Consultant | Bachelor's (Various) |
| Fuel Cell Quality Control Manager | Master's (Science/Engineering) |
| Hydrogen Pipeline Construction Worker | HSD/GED/OJT/TS/Apprenticeship |
| Fuel Cell Designer | Master's (Science) |
| Hydrogen Energy Engineer | Bachelor's (Engineer) |
| Fuel Cell Power Systems Engineer | Master's (EE) |
| Fuel Cell Fabrication Technician | HSD/GED/OJT/TS/Apprenticeship |

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|---|---|
| Hydrogen Systems & Retrofit Designer | Bachelor's |
| Fuel Cell Retrofit Installer | HSD/GED/OJT/TS Apprenticeship |
| Fuel Cell Retrofit Manufacturer Plant Labour | HSD/GED |
| Hydrogen Vehicle Electrician | HSD/GED/OJT/TS Apprenticeship |
| Fuel Cell Vehicle Development Engineer | Bachelor's (Engineer) |
| Hydrogen Systems Safety Investigator – Cause Analyst | Bachelor's (Various) |
| Hydrogen Lab Technician | Associate's |
| Hydrogen Energy System Installer Helper | HSD/GED |
| Hazardous Materials Management Specialist | Bachelor's (Science) |
| Hydrogen Energy System Installer | HSD/GED/OJT/TS Apprenticeship |
| Fuel Cell Power Systems Operator and Instructor | HSD/GED/OJT/TS Apprenticeship |
| Fuel Cell Backup Power System Technician | HSD/GED/OJT/TS Apprenticeship |
| Senior Automotive Fuel Cell Power Electronics Engineer | Bachelor's (EE) |
| Emissions Reduction Credit Portfolio Manager | Bachelor's (Business) |
| Emissions Reduction Project Developer Specialist | Bachelor's (Various) |
| Emissions Reduction Project Manager | Bachelor's (Various) |
| Hydrogen Systems Sales Consultant | Bachelor's (Business) |
| Hydrogen Plant Operations Manager | Bachelor's (EE, ME) |

*Source: Cavendish Energy LLC*

It must, however, be noted that this was the USA market with their heavy industries of which some are reliant on nuclear technology. This is reflected upon as indicative of possible opportunities in any other market that may venture in the development of Green Hydrogen energy production.

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