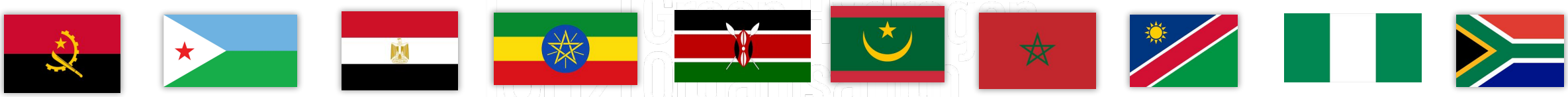
AGHA
The Africa Green Hydrogen Alliance



The Africa Green Hydrogen Alliance (AGHA)

Africa Hydrogen Transition: Where to Act? Who to First Engage

Horizon Europe JUST GREEN AFRH2ICA

14th February 2024

RACE TO RESILIENCE RACE TO ZERO

GH2 Green Hydrogen Organisation

AGHA Advisory Partners

Green Hydrogen Organisation

RACE TO RESILIENCE

RACE TO ZERO

THE WORLD BANK

Hydrogen 4 Development Partnership

AUDA-NEPAD
AFRICAN UNION DEVELOPMENT AGENCY

United Nations
Economic Commission
for Africa

GWEC
AFRICA WINDPOWER

gh2.org | @gh2org

AGHA Objectives

AGHA
The Africa Green Hydrogen Alliance

Demonstrate political leadership and ambition

Communicate domestic and continental green industrial ambitions, planning efforts, progress announcements, and urgency of collaboration.

Advance certification and standards

Define, test and procure leading edge certification standards

Establish legal and regulatory frameworks

Put in place strong regulatory and export frameworks are in place to maximize the benefits of green hydrogen development.

Accelerate & improve market development

Build and refine project development, procurement and financing models, such as green bond and fund structures, land and project tendering, to advantage local communities and economies.

Enhance technology development

Share technical insights and capabilities across RD&D to build world class domestic supply chains and infrastructure optimised for local end-uses.

Mobilise key partnerships

Make joint calls for action and requests for technical support, funding and market access to international public and private sector partners.

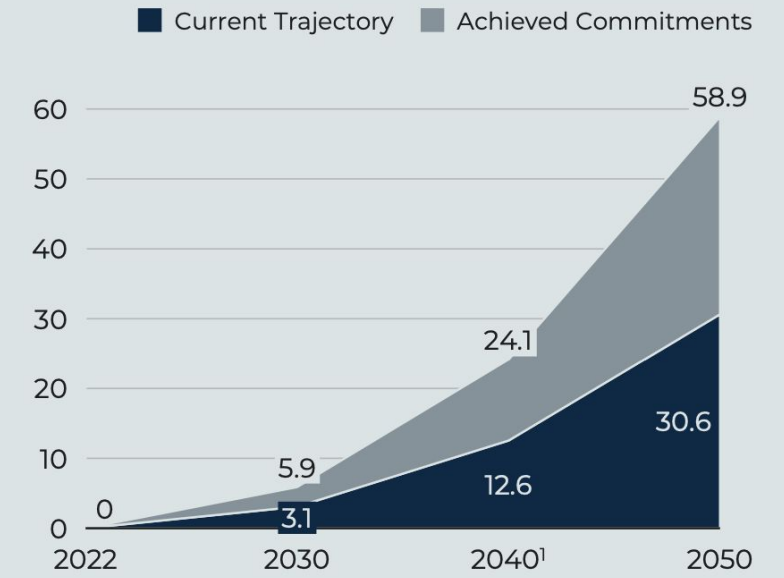
gh2.org | @AGHA

Africa's addressable market for green hydrogen could reach 30 to 60 Mt of hydrogen equivalent by 2050.

AGHA
The Africa Green Hydrogen Alliance

AGHA's addressable market for green hydrogen and its derivatives

Mt of hydrogen equivalent



Renewables capacity[2], GW	~51–97	~208–400	~507–975
Electrolyzer capacity, GW	~29–56	~119–228	~290–560

Realizing Africa's Green Hydrogen ambition will revitalize domestic economic growth, drive industrialization and create jobs and wealth

- The potential could add **$66 billion to $126 billion** to the GDP of AGHA member countries in 2050. 6-12% of current GDP with the highest value in the renewables
- The sector could create 2-4 Million jobs
- An investment of **$450 billion to $900 billion** in cumulative investment by 2050 is required to realize this potential to build **~29–56 GW of electrolyzer** capacity and **~51–97 GW of dedicated renewables** capacity by 2030

gh2.org | @AGHA

https://gh2.org/sites/default/files/2022-11/Africa%27s%20Green%20Hydrogen%20Potential.pdf

What is needed to capture the GH2 market

AGHA
The Africa Green Hydrogen Alliance

- Renewable capacity for hydrogen is built in such a way that it **supports further deployment of renewables for AGHA members' electrification needs**
- **Early offtake agreements secured**
- **Emerging early adopters** within Africa would lead green hydrogen development
- Demonstrated **cost competitiveness** and continuous focus on keeping costs in the lower quartile of the global cost curve
    - Current cost in $4-6 per kg, 2030 cost anticipated to be at $2/kg and $0.70-$1.6/kg by 2050
- **Strong bilateral ties** with Europe, Japan, South Korea, China, and India
- **Deep technical expertise and funding pool** to steeply ramp up production after 2035

Where are we at? Regional Outlook

AGHA
The Africa Green Hydrogen Alliance

Financing

Developing **fiscal policies to enable sustainable green hydrogen in Africa.** Build the capacity of AGHA member governments in **designing enabling fiscal policies for renewable energy and green hydrogen projects,** with the long-term goal of creating an enabling environment for a sustainable green hydrogen economy and green industry

RESOURCES for DEVELOPMENT CONSULTING
GH2 Green Hydrogen Organisation
November 2022

Sustainable Fiscal Regimes for the Development of Green Hydrogen:

Perspectives for Developing Country Governments

Don Hubert (PhD) – President, Resources for Development Consulting

The large-scale green hydrogen developments hold the promise of transforming global energy markets and hastening the energy transition. The top-of-mind challenge is to incentivize billion-dollar investments to turn that promise into reality. Many proposed projects – half of those announced in 2021 – are in developing countries where green hydrogen exports will be the anchor that enables the initial investments. There are unique dynamics for large-scale energy export projects with capital budgets that can rival the host government's GDP, many of which revolve around governments receiving a fair share of project revenues.

Incentivizing investment in energy projects often comes at the expense of the host country's revenue interests. It is frequently simply assumed that multi-billion-dollar investments will generate positive economic and revenue benefits in the host country. However, decades of experience in developing countries, particularly in the petroleum sector, demonstrate that governments commonly do not secure a fair share of their natural resources that wealth. In the absence of fit-for-purpose fiscal regimes for the development of green hydrogen, there is a risk that the mistakes of the past will be repeated.

Given the variation in the kinds of projects being proposed, there can be no blanket recommendations. This note seeks to set out some high-level considerations that could help developing country governments protect their country's revenue interests even while incentivizing large-scale investment. While many of these considerations have broad applicability, they are most directly targeted towards projects anchored around the export of green hydrogen / green ammonia (See Figure 1).

Figure 1: The Green Hydrogen / Green Ammonia Value Chain

Conduct Rigorous Economic Analysis

Analyze Fiscal Options through Dedicated Economic Models: Green hydrogen projects will be complex investments. With few projects, yet developed at scale, there are substantial uncertainties on most of the key variables including capital, operating and feedstock energy costs, and future market dynamics for the sale of green hydrogen. Analysis of these complex dynamics requires sophisticated economic models of each individual project, the integrated value chain, and an integrated country model. Company models should be provided to governments for careful analysis. However, dedicated project/sector models must be developed to fully understand the fiscal implications for the government of the investments under varying scenarios of production volumes, project costs and market prices.

Fiscal Regime Analysis Starts from Commercial Structure: Existing proposals for the development of green hydrogen in countries such as Egypt, Mauritania, Morocco, and Namibia suggest that there is considerable variation in company ownership along the value chain. The allocation of risks and benefits between different corporate entities, and the opportunities for the government to secure revenue benefits, differs depending on the specific commercial structure. It may be helpful to consider the three broad models that have evolved for LNG projects: integrated, tolling, and merchant (See Figure 2).

Markets

Stimulate green industrialisation in Africa through offtake commitments from multinational companies operating in the world's largest consumer markets, leveraging Africa's international trading relationships and ambitions, for products such as steel, fertiliser, maritime and aviation fuels, that can be produced using the Continent's tremendous renewable energy resources.

Standards

Enhance GH2 certification and standards in Africa. Developing a regional approach to **green hydrogen certification and standards,** reflecting the priorities of AGHA member countries. **Emissions, ESG, SDGs**

Regulations

AGHA
The Africa Green Hydrogen Alliance

- 2024 Egypt tax incentives law
  - Tax credits of between 33% and 55% of the tax payable on revenues generated from the production of green hydrogen; and
  - total exemptions from value added tax (VAT) for equipment, vehicles (other than passenger vehicles) and raw materials used in the production of green hydrogen.

    Discounts of 30% on fees for the use of seaports, maritime transport and ship servicing, 25% on the value of industrial land rights for green hydrogen production, and 20% on the value of land rights for storage at ports, for up to ten years after signing project agreements with the government.
  - International employees capped at 30% workforce on a project
  - Meeting a minimum 20% local content requirement.
- Requirement- raise 70% of the project investments from sources outside Egypt

State Supported Funding

Namibia SA Namibia SDG Namibia One will see Namibia's Environment Investment Fund partnering with two Dutch organisations, Climate Fund Managers and Invest International. 100% of the initial funding of €40 million (~N$850 million) is being provided as grant funding by Invest International. This vehicle will look to raise money from local institutional investors and investors from around the world to develop Namibian green hydrogen projects and related infrastructure. The European Investment Bank and the Government concluded a letter of intent at COP27 for the raising of €500 million, a portion of which is to be proposed to be designated for investment via SDG Namibia One.

South Africa - SA-H2 Fund' (SA-H2). SA-H2 is an innovative blended finance fund, that will facilitate and accelerate the development of a green hydrogen sector and circular economy in South Africa. The Fund is supported by Climate Fund Managers **(CFM)** and Invest International B.V. (II) of the Netherlands, Sanlam Limited of South Africa **(Sanlam)**, the Development Bank of Southern Africa **(DBSA)**, and the Industrial Development Corporation of South Africa **(IDC)**, in collaboration with other strategic partners.
private sector developers access to risk capital from an early stage of development, throughout construction and into operations," says Catherine Koffman, Group Executive: Project Preparation at the DBSA. "Further, this fund is a significant addition to national efforts to leverage our existing renewable energy infrastructure. With a national target of US$250 billion investment in green hydrogen by 2050

- Requirement- raise 70% of the project investments from sources outside Egypt

AGHA
The Africa Green Hydrogen Alliance

Egypt

Amea Power, SCZone, Sovereign Wealth Fund of Egypt
- 800,000 tonnes of green ammonia per year
- $4 billion (investment required)

Masdar, Infinity and Hassan Allam
- 2.3m tonnes per year of ammonia fed by 2 GW electrolyser
- $7 billion (investment)

Globeleq
- 2 million tonnes a year of green ammonia
- 3.6GW electrolyser
- 9GW of solar and wind
- $8.5 billion (investment required)

Total Energies
- 4.8 GW electrolyser
- $14.3 billion (investment required)

Fortescue-Egypt-gH2
- 300,000 tonnes per annum, 9.2GW RE
- $20 bn usd (investment required)

SCZONE-ReNew Power 200,000 tonnes per annum
- $6.25 billion (investment required)

Alfanar
- 500,000 tonnes per year of green ammonia
- $4 billion (investment required)

EDF
- 700MW Electrolyser capacity
- $2 billion (investment required)

SCZone and H2 Industries
- Port Said waste-to-hydrogen plant 300,000 tonnes of green hydrogen per annum
- $4 billion (investment required)

Egypt Green SPV Ain Sokhna, Scatec, OCI,Orascom, Sovereign Fund of Egypt and Fertiglobe
- 15,000 tonnes of green hydrogen per annum
- 100 MW Electrolyser, 260MW RE capacity
- $16.5 billion (investment required)

AGHA
The Africa Green Hydrogen Alliance

Angola

Sonangol, Conjuncta and Gauf Engineering

- 280,000 tonnes of green ammonia per year
- 400MW of RE

Namibia

Tsau Khaeb – Hyphen

- 300,000 tonnes per annum (tonnes per annum)
- 3GW Electrolyser, 5GW RE
- $9.4 billion (investment required)

Daures Green Hydrogen Village

- 350 000 tonnes of ammonia
- Phase 1 has the potential to provide over 50 ongoing sustainable jobs, 100 temporary jobs.

Renewstable® Swakopmund – HDF Energy and EIB

- Green Baseload Hydrogen Power Plant
- 1,400 tonnes of green hydrogen per annum (storage)
- $300 million (investment required)

*Every effort has been made

Mauritania

Project Nour – Chariot and TotalEren

- 1.2 metric tonnes per annum
- 10GW Electrolyser
- $3.5 billion (investment required)

Aman – CWP Global

- 1.7 metric tonnes per annum
- 15GW Electrolyser and 30GW RE required
- $40 billion (investment required)

Masdar-Infinity-Conjuncta

- 8 metric tonnes per annum
- 10GW Electrolyser
- 15GW of electricity
- $34 billion (investment required)

bp

- Potential production capacity of 2mt per annum, up to 30GW of electricity)

AGHA
The Africa Green Hydrogen Alliance

South Africa

Boegoebaai hydrogen cluster – Sasol, ArcelorMittal

- 40 GW
- $5.3 billion (investment required)

Freeport Saldanha Industrial Development Zone, Vanderbijlpark – Sasol, ArcelorMittal

Green Ammonia Plant – Hive hydrogen

- 780,000 tonnes per annum green ammonia
- $4.6 billion (investment required)

Renewstable® Mpumalanga – HDF Energy

- Green Baseload Hydrogen Power Plant
- 18,000 tonnes of green hydrogen per annum (storage)
- $3 billion (investment required)

Enhancing regional collaboration, coordination, and stakeholder engagement towards the realization of Africa's green hydrogen potential.

- Organise regular convenings of AGHA stakeholders to share best practices and emerging lessons. E.gTechnical Committee meetings and the Steering Committee meetings with ministers and principals.
- Organise the annual AGHA Forum in Q2 with public and private stakeholders to catalyse finance and project development.
- Reach out to other potential AGHA member countries and submit membership requests to Steering Committee.
- Link AGHA with other regional alliances that are in the formation stage, LAC, and Asia alliances.
- Enhance representation by AGHA members in regional and global for a such as the World Bank H4D Partnership.

Where are we? Project showcase

AGHA
The Africa Green Hydrogen Alliance

- Naivasha, Kenya
- 15 year offtake agreement Kenya nut company
- production capacity of 1ton per day of green ammonia for farm application
- Lower fertiliser costs by ~30% through on-site hydrogen-to-fertilizer facility.modular, containerised, autonomous production approach
- Kenya nut exports its nuts to USA, Australia, Japan and Europe
- Estimated investment of $4mn

Where to Act?

Progress

- Mauritania Green Hydrogen Code
- Kenya's green hydrogen guidelines

Who do we need to talk to ?

AGHA
The Africa Green Hydrogen Alliance

Enhancing regional collaboration, coordination, and stakeholder engagement towards the realization of Africa's green hydrogen potential.

Funders

Development finance institutions, KfW, AfDB, IFC, IDC
Private capital; Global & African commercial banks
Support credible and qualified project developers and private sector players to Africa.

Governments

Share infrastructure e.g pipelines
Aggregate production and technology needs
Showcasing of Africa's leading governments' green hydrogen strategies and projects.

members and friends fo AGHA, bilaterals e.g. Germany

Developers & Offtakers

Europe, Japan, South Korea, and Southeast Asia could account for ~65% of the import market by 2050
Establish consortiums to lower capex and risks
Global and African based
Attract energy intensive industries keen to set up shop in Africa
Fertilizer producers, aviation sector, shipping
Hydrogenandammonia import demand could largely be driven by Europe, Japan, and South Korea
 Syntheticfueldemandis expected worldwide

Development Partners &

Technical Assistance and capacity building; eg economic model l ing, designing enabling policies
Enhance local benefits and content to increase social and economic value across the supply chain
Community engagement

gh2.org | @AGHA

Developments & trends in the global GH2 sector (Production)

- **Developers get real on costs** the cost of not only electrolysers, but the wind turbines and solar panels supplying electricity to projects, which represents around 60-75% of the levelised cost of H2.

  Initially both policymakers and analysts were bullish on driving down the cost of hydrogen production below $2/kg, with the US setting its “Hydrogen Shot” target of $1/kg by 2031

- **Foot off the gas for blue hydrogen noting that most EU nations refuse to subsidize or purchase -** Aramco revealed in May that it was struggling to find European buyers for its planned blue hydrogen output.
- **First natural hydrogen explorers strike gold**- Australian start-up Gold Hydrogen found “significant concentrations” of H2 during drilling at its Ramsay 1 and 2 exploration wells and is now fast-tracking the development of a pilot project to extract and sell this H2.

https://gh2.org/sites/default/files/2022-11/Africa%27s%20Green%20Hydrogen%20Potential.pdf

Developments & trends in the GH2 sector (Part 2: Usage)

- **Cars and trucks -** Registrations of new hydrogen fuel cell vehicles (FCEVs) are flatlining across most European markets, a Hydrogen Insight investigation can reveal — despite new EU legislation that mandates the construction of hundreds of new refuelling spots by 2027. Data from every European country with at least one hydrogen refuelling station shows that in all but three, registrations of FCEV have either crashed or stagnated. Not able to compete with the economics or the shared infra build out of EVs.
- **Shipping -** great outcome at the IMO last year with a deal which sends a strong market signal, setting Shipping on a net zero by 2050 trajectory with ambitious 2030 and 2040 targets including a 5 - 10% zero emission fuel uptake by 2030 and mandatory measures will enter into force in 2027.

Safeguards: maritime sector looking to methanol as Ammonia is a highly toxic molecule and corrosive to mucus membrane. Ammonia is also potent aquatic toxicant and air pollutant as it can cause Nox (nitrous oxide) leakage.

If ammonia has a 5% market penetration of current global primary energy demand of shipping fuel use - and if 1% of ammonia leaks as N2O (nitrous dioxide) then ammonia combustion would lead to 15% of today's GHG emissions.

https://gh2.org/sites/default/files/2022-11/Africa%27s%20Green%20Hydrogen%20Potential.pdf

Developments & trends in the GH2 sector (Part 2: Usage)

- **Heating -** use of hydrogen to heat homes — long derided by analysts as dead in the water due to the massive efficiency losses compared to electric heat pumps — has massively lost political support in the UK.
- **Green steel -** International green iron trade can lower the costs of the global steel transformation.

  For steelmakers that are eyeing H2 imports from overseas, instead of importing H2 or ammonia by ship they should import embodied H2 (green iron). This will be cheaper and can still be politically viable as it protects European interests in steel production and jobs.

  Agora has come out with a study that outlines that “In steel, using GH2 instead of coking coal when extracting iron from ore, and then powering an electric-arc furnace with renewable electricity to turn iron into steel (rather than relying on a coal-fired blast furnace) would save 580kgCO2 per MWh of clean power.” The study concludes that GH2 for Green steel manufacturing has the most emissions reduction of any end us.

- **Fertilisers and chemicals -** Fertiliser and chemical companies have largely been reluctant to make the switch. This is partly because green hydrogen is the more expensive option, which would drive up the cost of their products — possibly increasing food prices beyond what customers are willing to pay — and partly due to the fear of being locked into long-term contracts.

https://gh2.org/sites/default/files/2022-11/Africa%27s%20Green%20Hydrogen%20Potential.pdf

Safeguarding Principles - Resp Deployment

AGHA
The Africa Green Hydrogen Alliance

- Leakage - Leak prevention and detection remain one of the biggest challenges in design and operation of hydrogen plants

Nox - While H2 does not generate CO2 when combusted, it goes generate Nox gas that is a potent air pollutant with significant impact on human respiratory systems

Warming Impact - the global warming impact of H2 in the short term is 12 times more potent than carbon

- No regret sectors and outcomes
- Competitiveness and subsidies - unclear if African sourced H2 can remain competitive without public subsidies, unless with preferential market access. H2 can be used as a high value commodity to be sold in USD and address debt distress and currency mismatch. I would say the one thing the EU can do is offtake African GH2 to ensure europes decarbonization benefits and goes in tandem with mitigation in Africa.

https://gh2.org/sites/default/files/2022-11/Africa%27s%20Green%20Hydrogen%20Potential.pdf

Thank you

For more information:

https://gh2.org/

Contact us:

https://gh2.org/about/staff