



REPORT



Green Hydrogen Project Financing in Nigeria: *Findings from Workshop session*

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The International Hydrogen Ramp UP Program (H2Uppp):

“Workshop Session on Green Hydrogen Project Financing in Nigeria”

DATE: 15th February 2023

TIME: 10 am – 3 pm WAT

VENUE: MS Teams (Link)

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1. Context



As the world, transitions from traditional fuels and energy sources to clean and sustainable sources to combat the adverse effects of climate change, Nigeria is also working hard to reduce carbon emissions and has pledged to achieve net-zero emissions by 2060. However, to fully achieve the net zero target, an assortment of clean technology options must be deployed including green hydrogen.

While the green hydrogen economy continues developing around the world, including in Africa, Nigeria retains a geographical advantage for the availability of vast renewable energy resources, which is the basic energy source to produce green hydrogen. Also, with the successes in Nigeria's off-grid renewable energy sector, several developers are now looking the way of green hydrogen with a focus on local consumption and exports.

2. Rationale and Scope



Green hydrogen is still in its infancy, or rather incubation in Nigeria, as the sector is still working to create awareness, establish potent use cases and applications, develop business models, and optimize service pathways. Additionally, there are a handful of developers/players in the sector, some from the oil and gas sector who have made a pivot to sustainable energy, while others are start-ups and renewable energy companies interested in green hydrogen.

One thing common to these stakeholders is the need for financing to implement green hydrogen initiatives. However, because of the nascence of green hydrogen in the country, there is little/no understanding of the financial aspects of green hydrogen projects. It is against this backdrop that the H2Uppp Program is conducting this finance workshop session targeted at green hydrogen project developers, local banks and other relevant financial institutions.

The session will focus on the project financing aspects of green hydrogen project development including:

- a) Green hydrogen basics, its applications, and its importance in decarbonization
- b) Green hydrogen business models (local and export market outlook of green hydrogen and its derivatives)
- c) Green hydrogen project finance structuring and sources of financing
- d) CAPEX and OPEX elements
- e) Financial modelling and Risk analysis

3. Goals and Objectives



The primary goal of the session is to help stakeholders understand the financing landscape for potential green hydrogen projects in Nigeria. Participants are at different levels in terms of knowledge of green hydrogen and its financing, therefore, the workshop will i) create awareness, ii) help existing project developers and enthusiasts make informed financial and business decisions, and iii) encourage the aggregation of knowledge and networking among stakeholders.

4. Expected Outcomes



At the end of the workshop, participants will gain an understanding of the following:

- a) Green hydrogen basics, its applications and its importance in decarbonization
- b) Policy and regulatory frameworks for green hydrogen
- c) Green hydrogen business models (local and export market outlook of green hydrogen and its derivatives)
- d) Off-taker demand forecasting
- e) Green hydrogen project finance structuring and sources of financing
- f) CAPEX elements
- g) OPEX elements
- h) Financial modelling

5. Resource persons



5.1 Chigozie Nweke-Eze (IAP) – Lead

Chigozie Nweke-Eze is the founder of the multi-unit firm, Integrated Africa Power (IAP). He is an economist and a geographer with several years of experience in research, teaching, and consulting experience in the field of energy transition and green hydrogen development. His specific interests are in financing, governance, and infrastructure, with a special focus on Africa. He periodically lends analytical insights on energy transition and hydrogen governance and financing to media outlets like the PV Magazine, Deutsche Welle, African Business, and the Times.

5.2 Christoph Michel (PtX Hub)

Christoph is Advisor in Funding and Investments at PtX Hub. He is part of the highly competent and creative start-up team of the PtX Hub, whose mission is to catalyse green hydrogen solutions on a global scale and focusing in particular on sustainable finance along the entire value chain with a holistic end-to-end approach. Part of his role as Advisor in Funding and Investments is to liaise and partner with international institutions, initiatives, financial industry and individuals engaged in financing in Power-to-X projects or R&D from end-to-end. Prior to working with GIZ, he was Senior Partner at KPMG providing global advice to the financial industry. His educational background is financial engineering and Socially Responsible Investment Advisor (SRI-Advisor).

5.3 Paul Van Aalst (GET.invest)

Paul has over 20 years of experience with investing in the clean energy sector in emerging markets. He has been engaged in investing seed capital and growth

capital in solar, wind, hydro and biomass and has developed and managed several investment funds in the sector. Specific sectors of experience include clean energy, the blue economy and other climate related sectors, as well as sectors with a public component such as health, housing and education. As a consultant, his themes are financing of innovative businesses in emerging markets, leading complex projects and coaching his clients. Paul uses his extensive experience in investing in innovative business models to include trends and developments in concrete implementation. He operates out of Amsterdam, the Netherlands. Paul leads the GET.invest Finance Catalyst team.

5.4 Andrew Aryee (DGIC)

Head of Competence Centre for Energy & Environment at Delegation of German Industry and Commerce in Nigeria. He works with scaling the wealth of investment opportunities in Nigeria and West Africa by promoting sustainable energy solutions and pioneering environmental technologies in the solar, wind, bioenergy, waste management, water and energy efficiency sectors. He is experienced and a strong administrative professional with a demonstrated history of working in the international trade and development industry. Skilled in Sustainable Environment Technologies, Renewable Energy, Educational Technology, and Energy Efficiency.

5.5 Karimould Chih (KfW)

Karim is Principal Portfolio Manager for Energy North Africa at KfW Development Bank's headquarter in Frankfurt. He joined KfW in 2002 and held positions with the bank working in the Sub-Saharan African region, Latin America and the Caribbean and since 2020 North Africa. Most of the time Frankfurt-based, but also from 2005 to 2008 in Maputo, Mozambique, where he was coordinating the activities of the German development cooperation in private sector development. Next to private sector development, Karim has mostly worked in renewable energy, but also biodiversity protection and organic agriculture. He held several positions as Board Member or Chair of Investment



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Committees in banks, microbanks and funds supported by KfW. His all-time favorite project is the “Solar World Cup 2014” in Brazil, where he financed the first PV plant on a World Cup soccer stadium in the Americas on behalf of BMZ. It turned out to be the stadium, where Germany played Brazil. Since 2020, Karim is getting involved with green hydrogen and the setting up of two global funds to support the ramp-up a green hydrogen economy. Before joining KfW, Karim studied International Economics in Maastricht, Politics in Paris and did a post-graduation in Development Politics in Bonn.

6. Training Program and Plan



Agenda		
10:00	Welcome	
10:05	GIZ Overview	Duke Benjamin, GIZ
10:15	Nigeria Hydrogen Office (H2-Diplo) Brief	Gina Lagunes, GIZ
10:20	International Hydrogen Ramp Up Program (H2Uppp) Introduction	Ofonama Archibong, GIZ
10:25	Workshop Agenda, Goals, and Objectives	Chigozie Nweke-Eze,, IAP
10:30	Opinion Poll (Mentimeter)	Chigozie Nweke-Eze, IAP
10:35	Green Hydrogen Landscape in Nigeria – Production and Project Financing <ul style="list-style-type: none"> • Presentation • Q&A • Discussions 	Chigozie Nweke-Eze, IAP
11:15	Coffee Break (5 mins)	
11:20	Green Hydrogen Production in Nigeria – Best Applications and Business Cases <ul style="list-style-type: none"> • Presentation • Q&A • Discussions 	Christoph Michel, PtX Hub

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12:05	Lunch Break (30 mins)	
12:35	Green Hydrogen Project Financing – financial planning, forecasting, sourcing finance and success factors <ul style="list-style-type: none"> • Presentation • Q&A • Discussions 	Paul Van Aalst, GET.invest
13:20	Green Hydrogen Project Cost Elements and Risk Analysis	Chigozie Nweke-Eze, IAP
13:40	Discussion Session – Key Take-Aways for Green Hydrogen Project Financing in Nigeria and Further Questions	Chigozie Nweke-Eze, IAP
14:00	Green Hydrogen Project Financing Opportunities <ul style="list-style-type: none"> • Q&A 	Andrew Aryee, DGIC Karim ould Chih, KfW
14:45	Feedback Poll (Mentimeter)	Chigozie Nweke-Eze, IAP
14:55	Closing Remarks	Ofonama Archibong, GIZ
15:00	THE END	

7. Participants



Constitution of participants

Overall, 43 participants were attended the workshop reflecting the mix of participants already envisaged beforehand. Hydrogen Developers (Donatos Tech, Artery Resources), Oil/Gas Entities with Hydrogen Interests (NNPC, Newcross etc), Renewable Energy Companies (Mabik Union), Local Banks and other Financial Partners (KfW, Bank of Industry), International Development institutions (GIZ, AHK Nigeria, UNIDO).

A detailed run-down of participants and sectors are below:

Organization	Sector
Federal Ministry of Power	Public
UNIDO	Development - Technology Transfer
Bosch	Private -Technology Provider
Quadrant Engineering (Ossiomo Power)	Private - Developer
Dunatos tech	Private - Developer
ILF	Private -Technology Consulting
Julius Berger Plc	Private - Developer
Artery Resources	Private - Developer

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Tekinologi	Private - Developer
HDF Energy	Private - Developer
Mabik Union	Private - Developer
Green Power Canada Ventures	Private - Developer
Siemens Energy	Private - Technology Provider
Meiracorp	Private - Developer
Newcross Energy (Oil & Gas)	Private - Developer
NNPC New Energy Limited (Oil & Gas)	Private - Developer
Genesis Energy (Oil & Gas)	Private - Developer
Financial Centre for Sustainability (FC4S)	Private - Finance
FMDQ Group	Private - Finance
Deutsche Energy GmbH	Private - Finance
United Capital	Private - Finance
Bank of Industry	Public - Finance
Wema Bank	Commercial Bank
Infracredit	Private - Finance
World Bank	Development - Finance
African Development Bank	Development - Finance

8. Participants' knowledge stance and expectations before Workshop



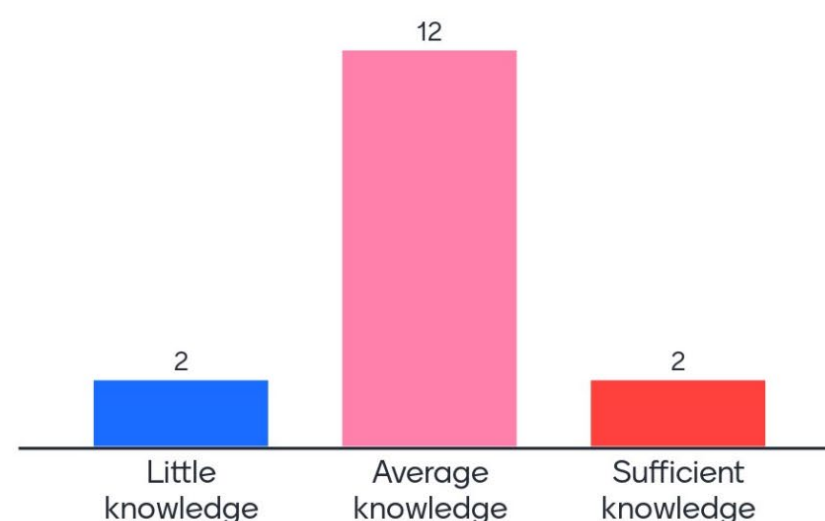
8.1 Knowledge stance of participants before Workshop

When asked how much they knew about hydrogen and its applications, most of the participants indicated that they had average and sufficient knowledge. This response informed the delivery approach and style of the training in workshop. The trainers spent rather less time on the basics of hydrogen and focused more on the financing, governance, applications, and business cases of hydrogen in Nigeria.

Fig 1: Prior knowledge on hydrogen in Nigeria and its applications

How much do you know about hydrogen and its applications?

Mentimeter



Source: Mentimeter Poll

16

The above (Fig 1) shows the results of the poll on prior knowledge of hydrogen in Nigeria and its applications. A total of 16 participants participated in the poll. Only 2 participants indicated that they had little knowledge of the hydrogen and its applications. 12 of the participants indicated average knowledge on the subject matter, while 2 indicated that they had sufficient knowledge.

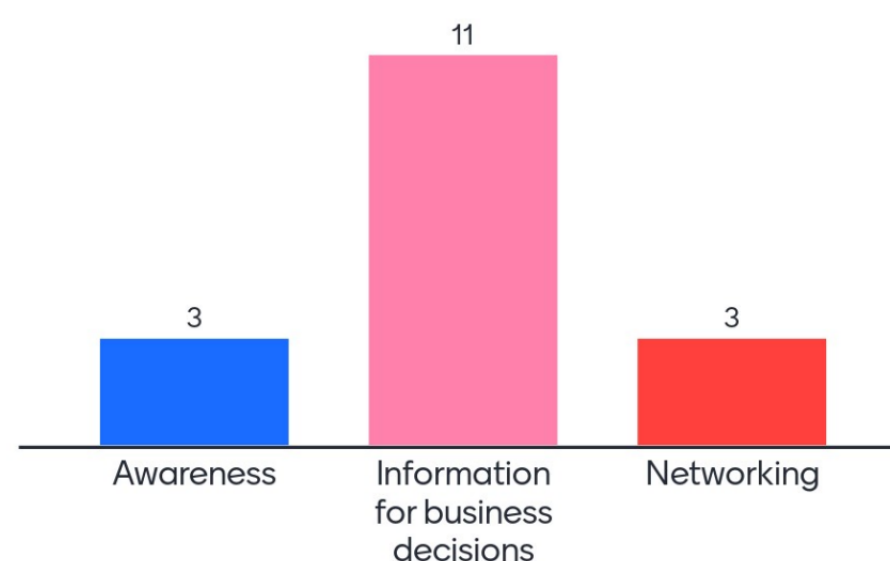
8.2 Participants expectations from the Workshop

When asked the expectations from the workshop, most of the participants indicated that they hope the workshop will give them information for making business decisions. This response also informed the delivery approach and style of the training in workshop. The trainers spent more time giving participants information for making informed decisions on the financing (sourcing and structuring), governance (policies, incentive and sustainability), applications (low-hanging fruits), and feasible business cases of hydrogen in Nigeria.

Fig 2. Expectations from the workshop

What do you hope to gain from today's Workshop

Mentimeter



Source: Mentimeter Poll

17

The above (Fig 2) shows the results of the poll on expectations of participants prior to the workshop. A total of 17 participants participated in the poll. Most of the participants (11) indicated they were participating mainly with the sole purpose of getting formation for informed business decisions in hydrogen production in Nigeria. 3 participants indicated that they were participating to be aware of the opportunities in financing and investments in hydrogen. 3 more were mainly interested in getting to know the market ecosystem and were there to network.

9. Key Messages of the Workshop



9.1 Green Hydrogen Landscape in Nigeria – Production and Project Financing

This session discussed the landscape of Hydrogen Production and Project Finance in Nigeria, discussing opportunities, challenges, and prospects.

Key messages

- Green hydrogen pursuits and trade are propelled by desires for climate mitigation, energy security and geopolitical interests.
- Extent of green hydrogen project development and financing are determined by resources and costs of production and are operationalized through cross-border and cross-sector partnerships.
- Nigeria's green hydrogen economy will be driven by international development finance, government equity and incentives and private sector investments.
- Adherence and demonstration of key sustainability criteria will be key to these projects.

9.2 Green hydrogen best business applications and cases

This session discussed various business applications and options for green hydrogen, while emphasizing on sustainability.

Key messages

Sustainability in the entire value chain is required:

- Sustainability concerns with regard to PtX must be considered at different

assessment levels

- Analysis in the environmental, economic, social and governance dimension of PtX applications

Under consideration of the following assessment levels, PtX helps achieve these goals:

- The various environmental dimensions are essential to determine the level of sustainability
- The transformation of energy systems must become a “Just transition”
- Leap-frogging potentials should be tapped
- Renewability and additionality for the production of additional renewable power are a must

Potential points of action:

- Cooperation on aspects of sustainability and certification in context of Power-to-X (PtX sustainability & certification)

9.3 Finance Catalyst Green Hydrogen: Success Criteria

This session discussed more financial requirements and considerations, addressing critical success factors for investors in green hydrogen in Nigeria and sharing optimal assessment scores.

Key messages

Green Hydrogen Optimal Assessment Scores

- The project connects these quasi-separate stages of the value chain into an integrated early-stage business plan of some sort.
- The promoters aim for the actual realisation of the project (and not just for consulting opportunities) and this should be clear from credentials and other support documents.
- Proof of concept for the production of GH2 at modest volumes as proof that

promoters can do it.

- Commitment of funds by promoters towards the project e.g. for obtaining licences and permits.

Green Hydrogen: Critical Success Factors

- power generation via locally available clean electricity;
 - o basic technical and financial analysis of the availability of power,
 - o provisional clarity about e.g. permits and land titles;
- production, storage and distribution of hydrogen;
 - o description of hydrogen production in the bespoke project context: technology, risks, processes;
 - o logistics of storage and/or distribution
- offtake by specific sectors and identified (potential) clients
 - o substantiated off-take needs
 - o willingness to off-take (e.g. Letters of Interest).
 - o estimates of conversion costs for (potential) clients

9.4 Green Hydrogen Project Cost Elements and Risk analysis

This session discussing financial planning, risks and financial prospects of hydrogen projects in Nigeria. It discussed in detail issuing regarding CAPEX, OPEX and and Risks analysis. It offers recommendation and prospects for financial planning.

Key messages

- Follow progresses on Hydrogen development regionally, continent-wide and globally, for lessons and best practices.
- Develop own unique Hydrogen strategies and plans tailored to the country context.

- Maximize the use of both green hydrogen wherever feasible (considering CAPEX, OPEX and Risks) in agricultural,, industrial, transport and electricity sectors.
- Seek and build relevant alliances and cooperations for hydrogen development.
- There is potential for the Nigerian government to play more incentivizing and de-risking roles

9.5 Financing governance considerations for hydrogen projects preparation

Overall, there are factors influencing local and foreign investors to invest in hydrogen for the Nigerian context. These factors include:

- Political stability and security
- Legal and regulatory environment
- Large domestic market size
- Macroeconomic stability and favourable exchange rates
- Available talent and skill of labor
- Good physical infrastructure
- Low tax rate
- Low cost of labor and inputs
- Access to land and real estate
- Financing in the domestic market

9.6 PtX Growth Fund and PtX Development Fund

- Funds as global instruments that are better manageable and more efficient as individual support to projects
- Substantial leverage through KfW mobilization of additional capital (PPP)

- South-South-North exchange and realization of synergies from resulting project network; connection to BMZ climate partnerships and BMWK energy partnerships
- Launch at COP 27 allowed Germany to set a signal with high visibility to encourage other partners to engage in H2 support (PtX-Platform can house other initiatives if suitable).
- Policy coherence through PtX-Platform (BMz, BMWK plus others in future) and common appearance (website, events,..) and future PtX-Platform Council

9.7 Financing Opportunities for Green Hydrogen Projects in Nigeria

- Export Initiative Environmental Protection
 - o In the Export Initiative for Environmental Protection (EXI) program, the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) supports measures in exporting green and sustainable environmental infrastructure.
- Sustainable Energy Fund for Africa (SEFA)
 - o The Sustainable Energy Fund for Africa (SEFA) provides financing for alternatives to fossil-fuel baseload generation sources like hydrogen.
- Sustainable Use of Natural Resources and Energy Finance (SUNREF) Nigeria
 - o SUNREF Nigeria is focused on increasing access to low-cost financing for energy projects in Nigeria.
- Green Climate Fund (GCF)
 - o The Green Climate Fund provides financial support through a flexible combination of grants, concessional debt, guarantees or equity instruments for private sector investment in energy projects in Nigeria.
- Nigeria Sovereign Green Bond
 - o The Nigeria Sovereign Green Bond is promoted by a partnership between International Finance Corporation (IFC) and the Nigerian Exchange Group (NGX Group).

10. Participants feedback and optimism for hydrogen projects in Nigeria after Workshop



It was pertinent to gauge participants feedback, reactions and level of confidence about hydrogen projects in Nigeria after the workshop. This comes at a time when all financing and governance opportunities and challenges were well spelt out. So that the participants' view about the projects are more realistic.

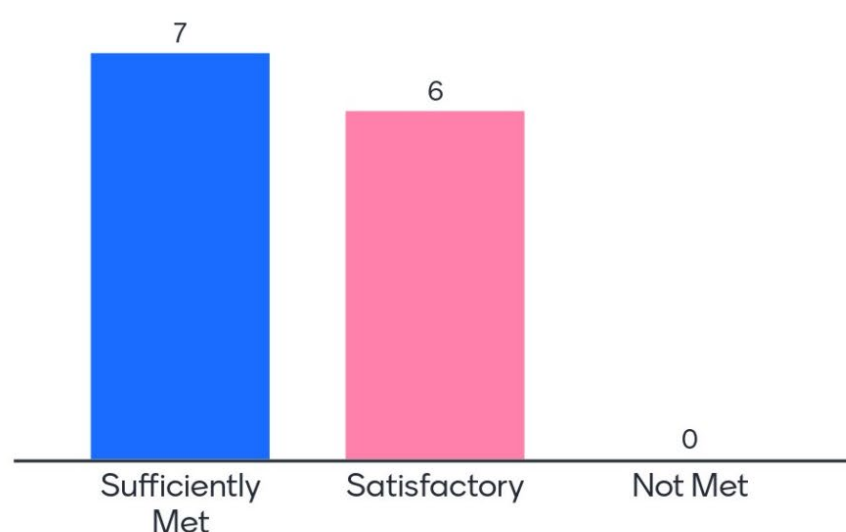
10.1 Meeting expectations after Workshop

Seeing that most of the participants felt that their expectations were sufficiently and satisfactorily met was satisfying and indicates that the intentions of the workshop was met.

Fig 3. Meeting expectations after Workshop

To what extent were your expectations for this Workshop met?

Mentimeter



Source: Mentimeter Poll

13

The above (Fig 3) shows the results of the poll on expectations of participants after the workshop. A total of 17 participants participated in the poll. Most of the participants (7) indicated that they were sufficiently satisfied with the workshop. 6 participants indicated that the outcome was satisfactory. This

points to the need for further workshops of this nature. None of the participants indicated that their expectations were not met.

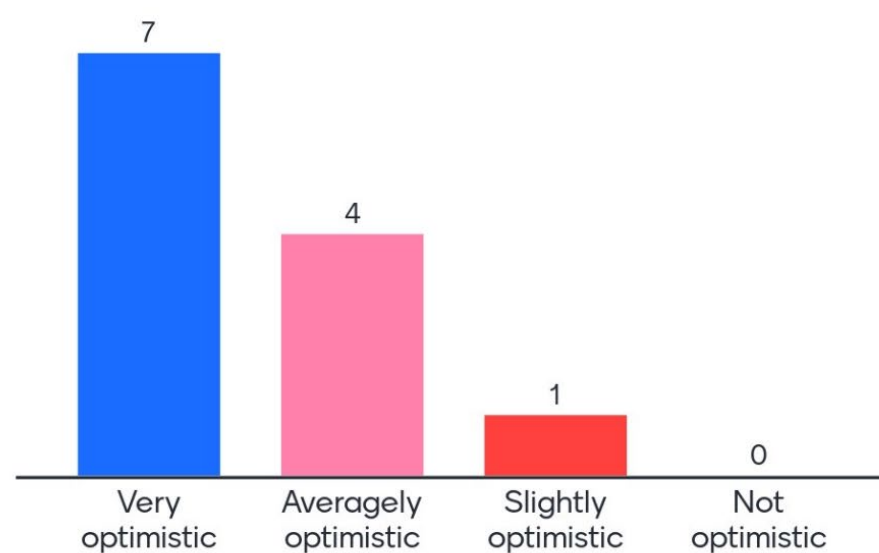
10.2 Optimism about hydrogen projects

One of the implicit agenda of the Workshop was to increase the familiarity and confidence of the participants about hydrogen projects in Nigeria. At the end of the workshop, we see from our poll that most people were very optimistic about green hydrogen projects in Nigeria.

Fig 4. Optimism about hydrogen projects

How optimistic are you about Green hydrogen Projects in Nigeria?

Mentimeter



Source: Mentimeter Poll

12

The above (Fig 4) shows the results of the poll on how optimistic participant were about hydrogen projects after the workshop. A total of 12 participants participated in the poll. Most of the participants (7) indicated they were highly optimistic about hydrogen production in Nigeria. 4 participants were averagely optimistic and only 1 participant was slightly optimistic. None of the participants indicated that they were not optimistic about hydrogen projects in Nigeria.

10.3 Summary of Participants' Commentary Feedback

What did you like the most about the session?

- The session had wholistic topic coverage, informative, interactive, and relevant.

Were you satisfied with the learning content and material? What could be added or improved?

- Very satisfied with the content as an early-stage prospector into the Nigerian energy market. with a solution that is ready to start implementation

What are the key specific topics you want to learn more about?

Information on:

- the structure of the Nigeria energy market (generation, distribution, transmission)
- relevant stakeholders and interlinkages in the energy sector
- relevant electricity market policies and renewable energy policies
- references to any studies done on the hydrogen market, transmission studies etc
- further information on grant and development funding to support market studies, project feasibility studies pilot programs etc.

Other general comments

- The initiative to co-ordinate capacity building, networking and knowledge sharing in the emerging Hydrogen economy is critical. Nigeria in particular is considered to be a complex market to understand, bank and succeed in but the potential is massive, so we remain interested. Keep up the great work and please loop us in to future events and opportunities

11. Conclusions and recommendations



The main objective of the training was to strengthen the technical capacity of the project developers around financing for green hydrogen projects. As already established, the green hydrogen economy in Nigeria is still in its incubation phase and most developers are looking to fund pilot projects, although there is one outlier that is already working towards developing commercial hydrogen projects. Therefore, the financing needs of these players are more foundational like development grants and a good understanding of the project set-up and financing process, including a grasp of how the regulatory landscape affects project financing.

The workshop met the overall objectives and in some ways even exceeded expectation. The participants were keen till the end. There is need to plan further workshops to dive even deeper in the subject matter handled in the work, especially as more projects continue to advance in the hydrogen space in Nigeria.

The trainers were faced with the challenge of being thorough while at the same time being brief in order to adhere to timing restrictions. For further workshops and as hydrogen projects continue to advance in Nigeria, it is worthwhile to spread the workshop over 2-3 days for even deeper engagement of an already enthusiastic audience.

Further, it is advised that the GIZ H2-UPPP team keep in touch with the participants of the workshop in order to gauge their progress in the hydrogen pursuits, for which they were largely optimistic about. This will help to streamline areas for further technical engagement with them.

About IAP

Integrated Africa Power (IAP) is a multi-unit enterprise specialized in energy and infrastructure development on the African continent. We seek to solve Africa's energy deficits, through integrated systems solutions, resource pooling and cross-border cooperation. Our approach is based on our philosophies of tailored suitability, cost-effectiveness, sustainability and energy-development linkages.

Author: Chigozie Nweke-Eze
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September, 2023

