Green Hydrogen Futures Workshop: Deliberations and Future Research Agenda

Report by PD Dr Festus Boamah (Universität Bayreuth)

The BayIntAn Green Hydrogen Futures Workshop was organised to promote academic exchanges essential for initiating a research project on Green Hydrogen Futures in the Global South. It was mainly funded by the Bavarian Research Alliance (BayIntAn), with additional support from the African Studies Institute (IAS) at the University of Bayreuth. The two-day workshop (26–27 November 2025) was attended by 24 participants from the University of Bayreuth, Moi University, Research Institute for Sustainability (RIFFS, Potsdam), University of Cologne, German University of Technology in Oman (GUtech), Technische Hochschule Deggendorf (THD), and Namibia Energy Institute (NEI)/Namibia University of Science & Technology (NUST). The workshop Day-1 began with a welcome address by the Social and Population Geography Chair, Prof. Eberhard Rothfuß, who emphasised the academic collaborations and institutional partnerships at UBT, as well as the current state of energy research at the Chair. This was followed by an introductory talk by PD Dr Festus Boamah, who highlighted the Green Hydrogen Burning Questions to set the stage for deliberations for the two-day Workshop. The first day of the Workshop featured fascinating presentations by Mr Maximillian Rischer (RIFFS, Potsdam), Prof. Dr

Charles Nzila (Moi University), and Dr Osman Barghouth (GUtech). The three presentations and subsequent deliberations shed light on Green Hydrogen and Sustainability Governance, Kenya's Hydrogen Strategy and Roadmap, and Lessons from Oman's experience with Green Hydrogen Education and Innovation. The Workshop Day 2 started with another line-up of fascinating presentations, first by Dr Nelson Otieno (former doctoral student of the UBT) and Mrs Helvi Ileka (NEI/NUST). Both presentations steered the discussions toward regulatory ambivalence and capacity-building issues in green hydrogen development in Africa, with a particular focus on Namibia. The subsequent section provides a synthesis of the Workshop deliberations and reflections on the thematic areas needing serious attention in green hydrogen technologies and studies in the Global South.

Overview of Workshop Deliberations: The green hydrogen scholarship has not thoroughly addressed how the desired green hydrogen futures are defined and can be denied through interactions between the nascent technology, the legal architecture, and domestic politics in the Global South, which serves as a prominent hub for green hydrogen and a 'solution centre' of the global decarbonisation agenda. The recent COP-30 in Brazil concluded with unequivocal commitments to the global decarbonisation agenda, including pledges to quadruple sustainable fuels, protect indigenous communities and their land rights, triple climate adaptation finance, and foster multi-scalar dialogues on climate action. However, the absence of an explicit roadmap for de-fossilisation reveals deep-rooted contradictions and uncertainties within the global decarbonisation efforts. While recognising green hydrogen's potential to decarbonise carbon-intensive industries such as steel, chemicals, and heavy transportation, a recent Green Hydrogen Futures Workshop advocated for an 'All-weather Green Hydrogen Strategy' more attuned to navigating uncertainties and the complex terrain of untested or nascent green hydrogen technologies and transitions in new geographies – usually with arid and semi-arid conditions. These regions often include predominantly customary or ancestral lands with persistent water scarcity, a notoriously fragmented regulatory framework, non-binding environmental laws, and domestic markets that are either underdeveloped or non-existent. The submissions highlighted problems such as the sufficiency of law, duplication of functions and institutions, lack of harmonisation of responsibilities, inadequate curriculum development and capacity building for domestic expertise in the emerging hydrogen economy, and complex sustainability governance mechanisms (notably the need to comply with EU certification schemes). They also emphasised the evolving regulatory frameworks that currently do not provide sufficient

incentives or explicit regulations to boost investor confidence, alongside the need for cutting-edge technologies, such as desalination plants, to efficiently utilise key resources, such as seawater and brackish water, in arid regions affected by water scarcity. See below specific deliberations from the Green Hydrogen Workshop.

1. Setting the green hydrogen agenda via regulation: Dr Nelson Otieno Okeyo highlighted key regulatory gaps that need to be addressed in the green hydrogen transition in Africa and more broadly in the Global South. Can we anticipate certain assured futures without a proper regulatory framework or legal structure to oversee the conduct of involved parties through legally binding commitments? Or without establishing an agenda based on risk-reward considerations? Other compelling legal questions include: Which aspects should act as starting points for green hydrogen legislation? If so, is the current law sufficient to guide green colonialism? Should environmental law be considered as a separate component or as an integrated whole? Should green hydrogen transitions in the Global South have transboundary effects? How do we navigate the deeply rooted, fragmented legal frameworks that characterise environmental laws in the Global South? Regulatory ambivalence and the recent withdrawal of Germany's power utility, RWE, from Namibia's USD10 billion-hyphen green hydrogen project, as a potential green ammonia offtake under the non-binding memorandum of understanding, and related socio-ecological uncertainties are a classic case in point.
2. Collaborative framework for progressive green hydrogen transition: This is important to avoid duplicating functions and institutions, as is happening in Namibia's hydrogen project. An emerging story was the need to explore and learn from Oman's 'success story', particularly the case of Hydrogen Oman (popularly known as HYDROM). The HYDROM was established in 2022 by Royal Decree in Oman, and it is the sole entity responsible for steering Oman's Green Hydrogen Agenda. The Royal Decree also guides the land areas required for the green hydrogen project. In this sense, the HYDROM serves as the one-stop shop for all matters related to Green Hydrogen innovations and production, unlike in emerging green hydrogen hubs such as Namibia, where different players and institutes perform similar or duplicative functions simultaneously. This should not be read as a call for gross imitation of Oman's approach and pathway, as the political landscape of the Absolute – where power is more consolidated – operates a land-use and governance system that is radically different from the land tenure regime in other countries in the Global South. Instead, the

core of the argument was about learning from and adapting such lessons to other contexts (where and when necessary) by making green hydrogen visions a national priority and setting strong regulations that would withstand the usual negative political influences or project interruptions resulting from political regime change.

3. Curriculum development and green hydrogen technical expertise: Exchange programmes aimed at developing a skilled labour force—comprising both students and energy sector workers—are crucial for the Green Hydrogen Transition in the Global South but face significant challenges. Apart from Oman, which is leading with a Harmonisation Strategy for Green Hydrogen Development—including land use arrangements—educational curriculum development and international institutional exchange programmes designed to build collaborative expertise and foster indigenous capacity for the green hydrogen economy, there are concerns regarding the institutional capacity and technological readiness of future green hydrogen hubs in the Global South, such as Namibia and Chile. Dr Osman Barghouth explains that GUtech, in collaboration with the Oman Hydrogen Centre, has established a Master of Science programme in Green Hydrogen Economy & Technology. GUtech maintains institutional partnerships and exchange programmes with Aachen University and the Technical University of Applied Sciences Ingolstadt (THI), providing exchange opportunities for students and technical support from international teachers to strengthen technical capacity in support of Oman's Green Hydrogen Development agenda. The goal is to create a substantial pool of skilled domestic labour in Oman, thereby avoiding over-reliance on expatriate expertise in the sector.
4. The need for cross-cutting technologies for efficient utilisation of natural resources in the production, conversion, storage and transportation of green hydrogen and its derivatives (green ammonia, methanol, etc).
5. Exploring partnerships and governance models for developing reliable offtake agreements, domestic market growth, green industrialisation, and reducing dependence on export markets. Additionally, submissions highlighted the need to reconsider sustainability governance issues in green hydrogen development, particularly the established certification schemes (e.g., the EU's), to ensure a stable market for green hydrogen and its derivatives from the Global South.
6. Discussions about inter-state and institutional dialogues and collaboration for learning to guide the green hydrogen process in the Global South.
7. Strategic utilisation of local renewable energy resources and existing infrastructure: There is another chance to utilise and monetise idle electricity generation capacity, particularly in countries like Kenya, where renewable energy resources (e.g., geothermal energy) make up a significant portion of the energy mix. Prof. Charles Nzila explained that Kenya could leverage approximately 800 MW of idle capacity and link the country's Green Hydrogen Development vision to the existing Geothermal facilities in Naivasha, where people are also accustomed to their operation. Such strategic initiatives may not result in encroachment on communal land areas or the conversion of land areas that could serve other purposes. Moreover, Prof. Dr Nzila showed that Kenya could re-strategise and judiciously use green ammonia produced from green hydrogen to reduce the expensive nitrogen fertiliser imports. According to Prof. Nzila, substituting Kenya's total

consumption of imported nitrogen fertilisers (600-700 kt per year for $325 million) with local production would require the production of 342–700 kt of ammonia and approximately 124 kt of green hydrogen per annum. This amount of green hydrogen would require electrolysers with a capacity of at least 845 MW – assuming a capacity factor of 98%. He concluded that Kenya could utilise its idle green hydrogen capacity to produce green ammonia, which could be used to make fertiliser for agricultural purposes.

The workshop concluded with discussions on unexplored themes and issues in green hydrogen studies and technologies for joint research projects among the project partners, as well as on exploring opportunities for student exchange programmes between their respective universities and research institutes.

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