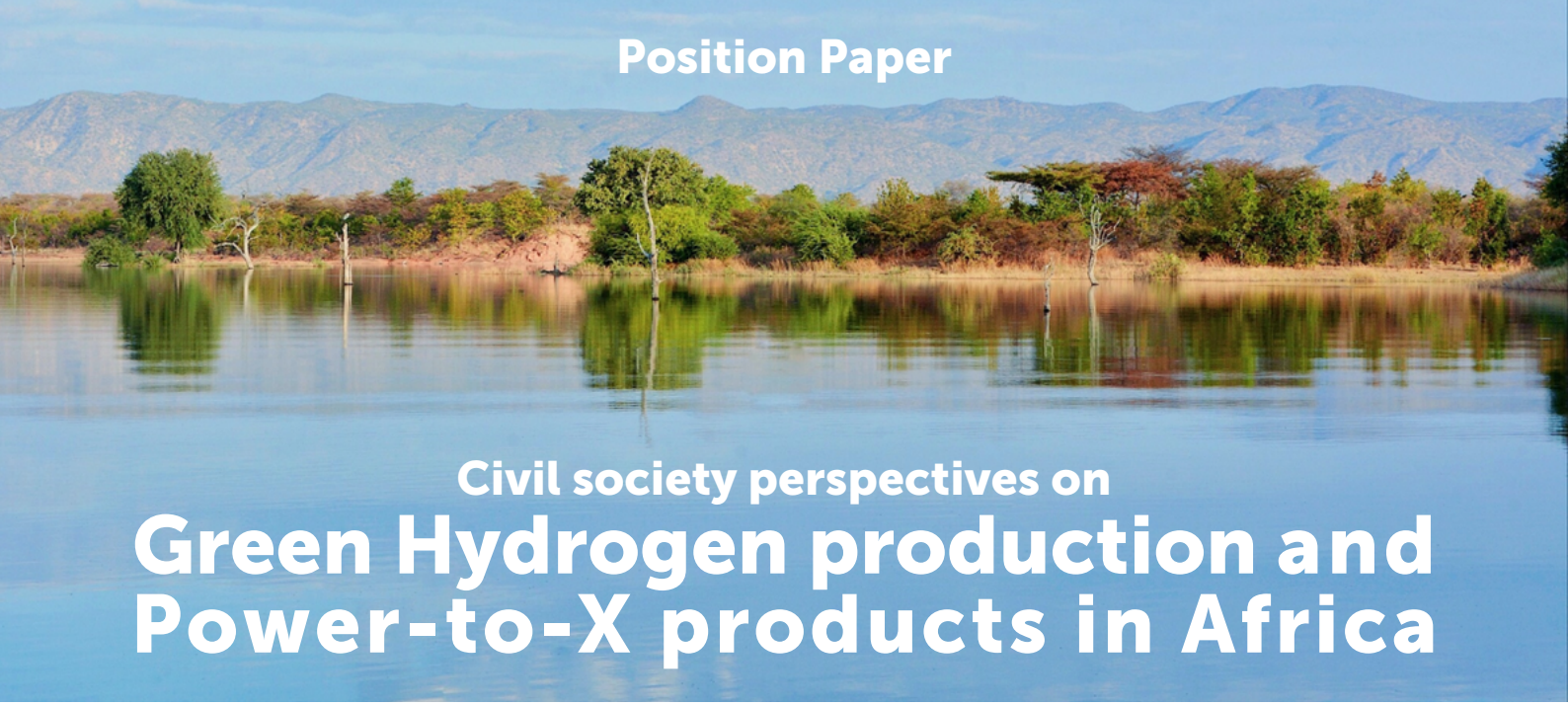
Position Paper



Civil society perspectives on

Green Hydrogen production and Power-to-X products in Africa

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1. Green Hydrogen for Climate Change Mitigation and Energy Transition

Climate change and extreme weather events are inflicting unprecedented damage on African countries, obliterating socio-ecological systems, and threatening lives and livelihoods.[1] The world has a clear and urgent need to take concrete steps towards limiting global temperature rise to well below 1.5°C. The World Resources Institute recognised that energy consumption accounts for 76% of global greenhouse gas (GHG) emissions.[2] Although Africa is only a minor contributor to climate change (accounting for 3-5% of global GHGs), it bears the brunt of adverse impacts across all sectors of its economy. The continent faces severe environmental challenges, including land degradation, deforestation, biodiversity loss, and extreme vulnerability to climate change. At the same time, Africa struggles to address immediate challenges, such as universal energy access. Nearly 600 million people on the continent continue to live without access to electricity, and more than 900 million lack access to clean cooking solutions. COVID-19's economic impact on Africa has also rolled back some of the gains made in recent years towards reducing Africa's energy access deficit. Yet at the same time, energy demand in Africa is expected to nearly double by 2040.[3] Without significant energy efficiency improvements for existing and new infrastructure the demand for necessary energy services might be considerably higher. Thus, meeting this expected and necessary growth in energy services, eliminating energy and other poverty, and building a green, renewable-based economy must be the main priorities in determining Africa's future energy mix.

Great opportunities also lie amongst these massive challenges. Africa benefits from being a latecomer in building foundational infrastructure for development. African countries can leapfrog to modern energy systems that are based on 100% renewables, and they can build green economies without locking themselves into stranded fossil fuel assets and overly centralised energy systems. Green hydrogen, referring only to renewable-based hydrogen, can bring intersecting benefits for countries' sustainable socio-economic development and provide leapfrogging opportunities.[4]

1 https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap22_FINAL.pdf
2 https://www.wri.org/insights/4-charts-explain-greenhouse-gas-emissions-countries-and-sectors
3 https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/March/Renewable_Energy_Transition_Africa_2021.pdf
4 https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Sep/IRENA_Hydrogen_2019.pdf

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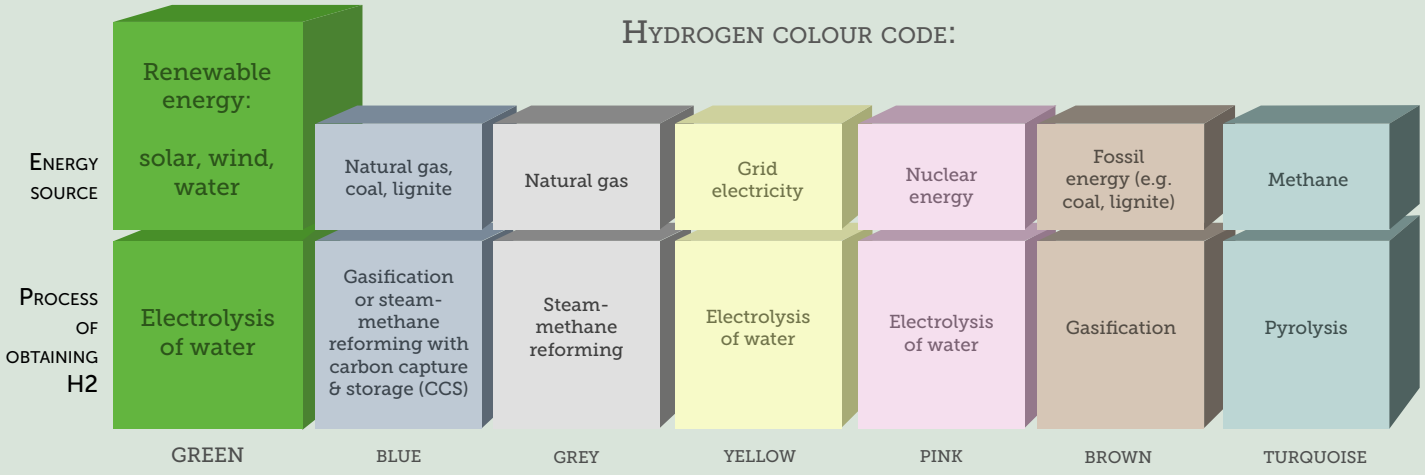
While African countries look to green hydrogen as a catalyst for socio-economic development and a building block for their green economies, in developed countries, green hydrogen and its related technologies for production and application have gained a great deal of attention. This owes to the vital role it can play in decarbonising hard-to-abate sectors (e.g. steel, aluminium, cement, chemical industries, aviation, and shipping) but also in providing seasonal storage for effectively bridging supply gaps in renewable power provision in a growingly electrified economy. Germany and other European Union countries, in addition to other major economies, are acknowledging the importance of hydrogen for achieving their climate targets, and have enacted strategies for and investments in green hydrogen production, nationally and abroad.

Considering Africa's abundant renewable energy (RE) potential, the African continent's stance as a potential cost-effective supplier of green hydrogen and PtX (explained below) products has begun to gain attention. Germany, for example, has started energy and hydrogen partnerships with several African countries, including South Africa, Morocco, Namibia, and Nigeria.

Given the increasing interest in green hydrogen from Africa, the questions about which conditions these countries must be under to achieve their potential in renewables and provide green hydrogen and PtX products for domestic use, as well as to export surpluses at a large scale for the German and European market, remain largely open. This situation presents a mix of outstanding opportunities and major risks.

Info Box: Green Hydrogen

Green hydrogen is produced via electrolysis using RE-derived electricity. The many other hydrogen colour codes include grey (produced through steam reforming of natural gas), brown (from coal gasification), and blue (from fossil fuels with carbon capture and storage [CCS]). Currently, the different ways of obtaining hydrogen are labelled and identified by colour in this way – a procedure that tends to soften the lines between the options and that is becoming one of the clearest greenwashing instruments. It is therefore crucial that only green hydrogen as defined above is considered for Africa.



Of the 120 million tonnes of hydrogen now produced globally each year, only about 0.02% is green,[5] leaving the remaining global hydrogen production industry as a major emitter of GHGs, especially carbon dioxide and methane.[6] Considering the increasing should move away from fossil fuels and decarbonise industries, green hydrogen is quickly becoming envisioned as the energy of the future. While it has its role to play in decarbonisation and a move to net-zero by 2050, studies show that its share will be between 5% and 20% of all energy used globally by 2050 in a fully decarbonised economy. Hydrogen alone, unless used in fuel cells or added to highly-isolated fossil gas pipelines for end-use, however, is merely energy storage. Hydrogen needs to be transformed into either a gas, a liquid, or a solid substance in order to access its full potential for sector-wide decarbonisation. This process is called Power-to-X (PtX), where 'X' stands for gases such as methane and ammonia (Power-to-Gas) or liquid fuels such as diesel, gasoline (petrol), and kerosene (Power-to-Liquid), or solid synthetic fuels (Power-to-Solid). These options require the addition of carbon and nitrogen from atmospheric capture.

5 https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Dec/IRENA_Green_hydrogen_cost_2020.pdf
6 https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Sep/IRENA_Hydrogen_2019.pdf

2. Africa's Readiness and Trends

According to Frauenhofer IEE's PtX-Atlas, countries' readiness to produce renewable hydrogen depends on the availability of freshwater, land, RE resources, and on technical and socio-economic factors.[7] Africa has abundant human resources and a young and growing population that is seeking jobs. This suggests excellent opportunities for a hydrogen-supported, electrified economy.[8] Furthermore, Africa's diverse and abundant RE potential provides opportunities for affordable green hydrogen production. Additionally, Africa's large land area of about 30.37 million m2 can, in theory, facilitate the development of RE projects such as wind and solar for green hydrogen generation. In practice, land is a highly contested resource in Africa, and land use and land tenure rights often are not well defined. Similarly, Africa has vast water resources (e.g. lakes, rivers with catchment areas, and water basins), which could potentially be used for electrolysis. These resources are, however, extremely valuable for local communities, culture, and wildlife, and will become scarcer and more vulnerable as temperatures increase. In the medium term, not only for Africa, renewable hydrogen production might be derived substantively from desalinated seawater.

Germany and other EU and non-EU countries have acknowledged the potential to produce cost-effective hydrogen in Africa, owing to the abundant RE potential. In its hydrogen strategy, the EU sets an ambitious goal of realizing 2×40 GW in 2030. The strategy also explicitly identifies Africa as a desired supplier of renewable hydrogen to the EU. Germany and Portugal have already launched national hydrogen strategies, indicating the intended installation of green hydrogen production capacities and recognising the African continent's importance in line with the EU strategy. Both Portugal and Germany are eager to position themselves as relevant players in international hydrogen and biotech markets (e.g. Portugal as green hydrogen producer and export/import hub via its port in Sines and Germany as green technology provider and large-scale green hydrogen consumer). Accordingly, both countries are setting up partnerships with African nations.

Germany, for instance, is already engaging with coal, oil- and gas-dependent economies such as Nigeria, South Africa, and Angola about shifting their existing fossil fuel economies towards RE, and leveraging their potential to produce, use, and export green hydrogen. Additionally, Germany and Morocco have established a green hydrogen partnership aimed at developing production of green hydrogen and implementation of research and investment projects themed on using this clean energy source.

European countries are not the only ones exploring green hydrogen's potential. Many countries across Africa are now developing their own hydrogen strategies. South Africa and Morocco are pioneering this development, and many others are expected to follow. South Africa has, for instance, developed its National Hydrogen Strategy, which develops and guides innovation along the value chain of hydrogen and fuel cell technology, especially in platinum group metals, an area in which it is abundantly endowed. There are also ongoing and capacity-building activities and research initiatives for green hydrogen, such as the H2 ATLAS-AFRICA project carried out by the research centre Jülich together with African partners in the South African Development Community and Economic Community of West African States, and funded by the German Federal Ministry of Education and Research.[9] Other research and academic initiatives include the Ecole Supérieure des Métiers des Energies Renouvelables in Benin, which has developed both a research programme in hydrogen technology and a training programme for future engineers.[10]

7 https://www.iee.fraunhofer.de/content/dam/iee/energiesystemtechnik/de/Dokumente/Veroeffentlichungen/FraunhoferIEE-PtX-Atlas_Hintergrundpapier_final.pdf
8 https://www.investmentmonitor.ai/insights/opinion-sub-saharan-africa-youth-economic-lift-off
9 https://wascal.org/v3/wp-content/uploads/2020/08/H2-Atlas-project-flier.pdf
10 https://www.cliffordchance.com/content/dam/cliffordchance/briefings/2021/01/focus-on-hydrogen-a-new-energy-frontier-for-africa.pdf

3. Opportunities and Risks of Green Hydrogen and PtX for Africa

Green hydrogen and PtX products present both opportunities and challenges in Africa. The following explores both.

Opportunities

Green hydrogen producible at a low cost can be a catalyst for accelerating energy access and leapfrogging towards 100% RE on the continent, because it provides a potential storage solution for mitigating RE systems' variability. This will provide more permanent energy access, using cleaner RE sources. In Uganda, for instance, a solar–hydrogen powered mini-grid has already been successfully deployed to power 3,000 households and businesses. The pursuit of green hydrogen development could also impel greater deployment of RE systems that serve as additional RE generation capacity for communities.

A hydrogen-supported, electrified economy could contribute to development and prosperity in producing countries, as it could promote local value creation throughout the value chain, increase and create new green jobs for local communities, build new skills through transfers of technology know-how, and strengthen local economic actors. Development of a green infrastructure for energy and hydrogen production, as well as transport and storage, development of long-term partnerships with potential importing countries such as European and Asian countries, earning of foreign revenues from exports, and satisfaction of local hydrogen demands to decarbonise local industries, such as in the production of fertiliser using green ammonia, are other valuable opportunities.

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»Green hydrogen can bring intersecting benefits for countries' sustainable socio-economic development and provide leapfrogging opportunities for Africa. Other colours of hydrogen must be strictly excluded.«

Risks

Production of renewable hydrogen and its derived PtX products, however, brings extensive risks. Development of green hydrogen production in Africa is placed in a global context wherein most value chains still primarily favour wealthy countries of the Global North. There is a considerable risk that hydrogen pursuit being driven by the Global North countries' decarbonisation agendas will worsen injustice and poverty in the Global South's developing countries, especially in Africa. This could create situations in which African producer countries do not reap the full benefits of their own production because developed countries view them solely as raw material providers. Meanwhile, most parts of the value added in the production value chain would remain in the Global North. There is also a risk, in particular for poorer Sub-Saharan countries, of green hydrogen being largely produced for export without satisfying local renewable energy and hydrogen demand.

Green hydrogen/PtX production requires large amounts of renewable electricity, land, and water. Experience has shown that corruption often affects large-scale renewable power projects, which are set up to exclude important stakeholders, and thus negatively impact local communities. Many previous renewable power generation projects have experienced land-use conflicts, forced resettlement, and expropriation.[11] Green hydrogen production could exacerbate this.

Another factor is that electrolysis currently requires freshwater, which is not readily available at every potential production site and may become even scarcer amidst climate change. One in three Africans faces water scarcity and approximately 400 million people in Sub-Saharan Africa lack access to basic drinking water.[12] Especially in arid regions on the African continent, water scarcity hampers social and economic development, prompts competition for water, and correlates with the prevalence of poverty, hunger, disease, and conflict. Clashes between farmers and herders in the Horn of

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Africa, disputes over large dam projects in the Nile River Basin, and violence in the Lake Chad region are among examples of these problems. The links between water and conflict are far more complex, diffuse, and dependent on several intervening factors. This mix determines whether, how, and to what extent water-related risks indeed become security issues; for example, by intensifying conflict or sparking destabilising migration.[13] Using scarce water for electrolysis, if not well managed, can further impoverish destitute communities and could increase insecurity and conflicts in the African continent's fragile states and regions.

Many African countries, especially in Sub-Saharan Africa, also still suffer from severe energy poverty. Investing in export projects for producing green hydrogen and its derivatives could potentially cement existing poverty of this sort if investments in decentralised renewables are pushed back, and newly built renewable capacities are not also used for the local population's energy supply. There is also a risk of locking in existing fossil fuel structures if RE expansion proceeds too slowly and renewable electricity is only used for producing green hydrogen. This could lead to local electricity demand being covered by extending the lifetime of fossil power plants.

11 https://issafrica.org/iss-today/kenyas-ambitious-wind-turbines-battle-community-land-crosswinds
12 https://www.brookings.edu/blog/africa-in-focus/2021/07/23/addressing-africas-extreme-water-insecurity/
13 https://ecdpm.org/great-insights/complex-link-climate-change-conflict/water-scarcity-conflict/

Opportunities	Risks
Accelerating energy leapfrogging towards 100% RE and building a green economy in African countries	Locking in of existing fossil structures and increased carbon dioxide emissions
Improving and fast-tracking energy access	Cementing energy poverty
Building long-term, equal partnerships on an eye level with importing countries such as Germany and other EU countries	Resource curse*, injustice, and exploitation
Satisfying local hydrogen demand (e.g. fertiliser, seasonal storage, and local industry)	
Creating local value and jobs	Corruption, exclusion of stakeholders, lack of transparency and good governance
Giving access to skills training, capacity building, and education	Resource conflicts for land, water, and renewable energy
Developing green infrastructure	Environmental impacts via ecosystem destruction and lack of recycling/waste management

* Resource curse is the phenomenon of countries with an abundance of natural resources having less economic growth, less democracy, or worse development outcomes than countries with fewer natural resources.

Assessment of opportunities and risks clearly shows that each potential benefit of a green hydrogen production can turn into a major risk if comprehensive policies and strict social and environmental safeguards do not guide implementation. The focus therefore should not be **if** green hydrogen and PtX should be part of Africa's green, renewable-based economy but **how**. The next section provides civil society positions and recommendations.

4. Position Statement

From an African perspective, green hydrogen and PtX have vast potential to drive a broad socio-economic evolution towards a green economy and to leapfrog to 100% RE systems of the future. Additionally, they also can offer opportunities for decarbonising economies of the Global North. **Other colours of hydrogen must be strictly excluded.** Green hydrogen and PtX development must be guided by comprehensive policies, which should be based on the Agenda 2063, the Paris Agreement and respective Nationally Determined Contributions, and the Sustainable Development Goals and respective development plans, rather than being led by developed countries' interests. This includes ensuring ecosystem integrity, economic prosperity, social inclusion and cohesion, decent work and human rights, public acceptance, multi-stakeholder participation, good governance, and transparency.

Energy strategy integration

The African continent, generally speaking, benefits from being a latecomer in building foundational infrastructure for development. African countries, however, are at different stages of energy leapfrogging processes. Policies, frameworks, strategies, and visions for energy decarbonisation and leapfrogging differ (and are differently advanced) from country to country. While countries such as South Africa and Morocco have achieved nearly 100% access but heavily depend on fossil fuel infrastructure, other countries still should build basic infrastructure and create energy access for the local population. Green hydrogen development needs to factor in existing energy access and electrification agendas in respective African countries. For example, in countries with existing energy infrastructure, creation of a hydrogen-supported, electrified economy will need conversion of existing fossil fuel systems, such as fossil gas pipeline systems, which might require cross-border cooperation.

Despite these country-specific differences, the questions of 'whom the sun is shining for' and 'power for whom' should guide policy plans for investing in green hydrogen in every African country.
Every hydrogen strategy, therefore, needs to be embedded in a broader, country-specific energy strategy focussed on the needs of African people through:

(1) ending energy poverty and creating energy access,

(2) accelerating RE deployment,

(3) powering key industries and sectors for Africa's socio-economic transformation, and

(4) maximising energy efficiency.

New infrastructure and additional renewables

In all African countries, irrespective of their energy system development, creation of green hydrogen supply and demand chains will need investments in new infrastructure (e.g. transport and storage), as well as large-scale RE production projects and electrolysis plants. To avoid possible water resource conflicts, additional seawater desalination plants should accompany the construction of electrolysis plants. Those are already part of the water policies in many coastal countries; PtX plants might make these investments even more profitable. Communities in water-stressed areas should have access to the freshwater produced. At the same time, companies may extract minerals and salts from the brine, the residual "sludge" of the seawater used, for industrial uses.

It is also imperative that the development of green hydrogen does not impede, but rather supports, ongoing energy leapfrogging efforts on the continent. Therefore, only additional renewable electricity should be used for electrolysis and desalination. Moreover, all hydrogen projects should demonstrably contribute to overcoming energy poverty, such as by making parts of the additional RE-generation capacity used available to the local population.

»Green hydrogen production should contribute to achieving national implementation of the 17 SDGs and must be firmly embedded in national energy strategies, the country's respective NDCs, and the development plans of the producing country.«

Changes in the global value chain and energy power reshuffle

Green hydrogen production has the potential to redraw power relations between developed countries and Africa by creating new inclusive energy relationships and equal partnerships. New international partnerships with African countries should consider the continent's priorities first. Producer countries in Africa must benefit from their own green hydrogen production. In this sense, export strategies should be jointly and transparently agreed upon, and they should carefully consider the balance between hydrogen for local use and external revenue creation from hydrogen for export.

Special care also needs to be taken to ensure that African countries benefit from the full value chain of the green hydrogen production and that these countries are not merely restricted to being raw material providers. To address this, African countries should pursue opportunities for upstream and downstream processing in the regions. Additionally, strategies should promote economic progress and job creation opportunities resulting from green hydrogen. Such pursuit, in turn, requires capacity and skills training to ensure that local communities are qualified to fulfil labour market requirements to access these jobs. To this end, targeted investment and new competencies built up through training and innovation programs should strengthen existing economic players.

Systemic approach fostering climate action and sustainable development

Rich resource endowments have been found to adversely impact African people's socio-economic well-being, good governance, and development. Green hydrogen should therefore be produced so that it does not jeopardise national development efforts, leading to a resource curse. Green hydrogen production should, however, contribute to achieving national implementation of the 17 Sustainable Development Goals (SDGs) and must be firmly embedded in national energy strategies, the country's respective NDCs, and the development plans of the producing country. Ensuring that broader socio-economic benefits trickle from Africa's green hydrogen to the rightfully due people – including enabling access to reliable, affordable, people-owned power – will require careful custodianship of the process. This should be ensured through active local participation, involvement of civil society groups, and measures to guarantee that all human, environmental, and socio-economic rights are safeguarded. In addition, many African countries and densely populated cities need large amounts of affordable, high voltage, and reliable energy for commercial use, businesses, and manufacturing. This requires larger and utility scale renewable energy supply and grid infrastructure like emerging ever-cheaper offshore wind power parks.

»All hydrogen projects should demonstrably contribute to overcoming energy poverty.«

Multi-stakeholder partnerships and community participation

Energy policies and plans are often made at the international and national levels, wherein the government, in cooperation with large companies and partners from donor countries, implements large-scale RE projects without due and extensive inclusion of local stakeholders at the community level. However, like with all policy issues, community needs often differ from government priorities. Diverse and meaningful public input in policymaking is therefore necessary to ensure that decision-makers consider different issues, perspectives, and options when developing hydrogen strategies, and to guarantee that all social and environmental concerns are thoroughly considered and integrated in the planning. At the local level, this means frontline communities should be involved in decision-making processes for RE and hydrogen projects,[14] – including planning, implementation, and monitoring of projects – and should benefit financially. Such multi-stakeholder engagement and civil society participation can potentially ensure buy-in and ownership, prevent external interests from driving development, and guarantee a thorough understanding of the local social and environmental contexts. Deliberate effort is needed to assess and remove barriers to participation and create relationships with communities, civil society, and all relevant stakeholders. To optimise this participation, it is essential to invest in appropriate capacity building for local actors, establish transparent grievance mechanisms, and create formats in which citizens can actively participate in decision-making.

14 https://germanwatch.org/sites/default/files/Reviewing%20Africas%20RE%20Initiatives_A4.pdf

Good governance and transparency on all sides

Strategies and roadmaps for developing green hydrogen in Africa should be based on the ethos of good governance and transparency, both in producer and importer countries. Actions in this direction may involve use of learnings from the failures of similar previously attempted initiatives and projects, such as DESERTEC, to enable the development of plans that deliver rightful energy leapfrogging for Africa that prioritises Africa's sustainable development needs and goals, including SDG 7 on universal energy access. Furthermore, working towards compliance with human rights, anti-corruption standards, and promotion of good governance on all sides should be a prerequisite. This aim may require institutions and bodies that support relevant national and international government agencies, and appropriate transparency mechanisms such as the Extractive Industries Transparency Initiative.[15]

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Strict social and environmental safeguards

Production of green hydrogen requires resources such as land, water, and energy, which are all highly contested in Africa. This is true for all other energy, agricultural, and mining commodities. In particular, in times of progressively enhanced and continued land grabbing by certain nations in Sub-Saharan Africa,[16] green hydrogen needs to be done right. Africa's competing needs for key resources such as access to RE, land tenure security, and potable water, as well as water for domestic and agricultural use, must be met. Green hydrogen and PtX development should not come at the expense of local producing communities and the environment but rather should provide broader socio-economic benefits to local African communities.[17] Hydrogen and PtX production (including desalination) on the continent will therefore require strict social and environmental safeguards; inclusive, transparent, and accountable governance structures; local participation; multi-stakeholder involvement;[18] and safeguarding of all rights, including socio-economic rights. Lighthouse projects in well-prepared countries, open for CSO participation and input, might help to establish such standards.

15 https://www.wasserstoffrat.de/fileadmin/wasserstoffrat/media/Dokumente/NWR_Positionspapier_Nachhaltigkeitskriterien.pdf
16 https://guardian.ng/sunday-magazine/newsfeature/african-land-grabbing-whose-interests-are-served/
17 https://www.e3g.org/news/will-the-dash-for-hydrogen-benefit-sub-saharan-africa/
18 https://germanwatch.org/sites/default/files/Reviewing%20Africas%20RE%20Initiatives_A4.pdf

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