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The Green Hydrogen Gamble

Assessing the Risks and Realities of Large-Scale Production in North Africa

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About The Author

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Introduction

Numerous international agreements, including the Paris Agreement, aim to address the climate crisis. The European Green Deal, which targets climate neutrality by 2050, focuses on decarbonizing critical sectors such as energy, industry, and transportation. While renewable energy sources like solar and wind power are becoming increasingly prominent, hydrogen is emerging as a promising solution for decarbonizing hard-to-abate sectors. Recognizing hydrogen's potential, the EU's 2020 Green Deal prioritized its development, a focus further intensified by the Russian-Ukrainian war. The EU now aims to produce 10 million tons of green and blue hydrogen domestically and import an equivalent amount by 2030.

Recognizing Africa's abundant solar and wind resources, the EU plans to leverage the region as a key supplier of hydrogen imports. Countries like Namibia, Senegal, Algeria, Egypt, Morocco, Mauritania, and Tunisia are viewed as having "untapped potential" to produce green hydrogen at competitive costs. This article examines (or explores) the feasibility of green hydrogen as a sustainable energy source in North Africa, exploring current initiatives, identifying major obstacles and potential benefits, and critically analyzing the nature of partnerships between North African countries and the EU within the evolving hydrogen transition.

BUSTING THE HYPE: A REALISTIC LOOK AT HYDROGEN'S ROLE IN CLIMATE CHANGE

Hydrogen is a versatile energy carrier that can be produced from diverse sources, including natural gas, nuclear power, biomass, and renewable energy. Each color associated with hydrogen denotes its production pathway: green hydrogen is produced from water electrolysis using renewable energy, while grey hydrogen is derived from natural gas and has a higher carbon footprint. Blue hydrogen, similar to grey hydrogen, incorporates carbon capture and storage to reduce emissions. As an energy carrier, hydrogen plays a pivotal role in the energy transition by addressing the inherent intermittency of renewable energy sources. It acts as an energy storage medium, capturing surplus renewable energy during periods of high production and releasing it when needed to ensure a consistent energy supply. Additionally, hydrogen enables the efficient transportation of renewable energy over long distances, unlocking the potential of remote renewable energy sources and facilitating their delivery to areas with high energy demand. Hence, hydrogen's potential applications are extensive, spanning transportation, electricity generation, and portable power. It offers a promising solution for hard-to-electrify sectors such as aviation and maritime, where electric batteries may be insufficient to meet energy demands.

However, while the current energy transition positions hydrogen as a leading contender across all sectors of the energy landscape, this is not the first time such rhetoric has been employed. The concept of the 'Hydrogen Economy' first emerged in 1972 as a promising technology[1] capable of to simultaneously decarbonizing the transportation, residential, commercial and industrial sectors. Since then, waves of hydrogen hype have surfaced, notably in the 1970s and 2000s, driven by factors such as the oil crisis and advancements in fuel cell technology. But the 'Hydrogen Economy' never gained traction. These "false starts" in establishing a global hydrogen based economy has been primarily hampered by the substantial infrastructure investments required. In addition, challenges related to production, storage, transportation, distribution, and policy support have stifled the hydrogen widespread adoption[2].

1Brandon NP, Kurban Z. (2017) Clean energy and the hydrogen economy. Phil. Trans. R. Soc. A 20160400 :375. http://dx.doi.org/10.1098/rsta.2016.0400

2Yap, J.; McLellan, B. A (2023) Historical Analysis of Hydrogen Economy Research, Development, and Expectations, 1972 to 2020. Environments 10, no. 11 :1. https://doi.org/10.3390/ environments10010011

Yet, the current wave of interest, driven by global efforts to reduce carbon emissions, is presented as potentially different from past attempts. In 2020, the Hydrogen Council forecasts that hydrogen could account for 18% of Total Final Energy Consumption by 2050.[3] The IEA's Sustainable Development Scenario estimates this share at 13% by 2070[4], while the International Gas Union projects a range of 7-24% by 2050, depending on policy.[5] Similarly, The Energy Transitions Commission envisions hydrogen making up 15-20% of energy consumption by 2050.[6] By early 2020, 18 countries had published hydrogen roadmaps,[7] and several have included hydrogen investments into economic stimulus packages, aimed at supporting economic recovery from the COVID-19 global health pandemic. [8]

Unfortunately, acknowledging hydrogen's potential role in achieving ambitious climate goals not sufficient. A zero-emission hydrogen economy does not yet exist.[9] Current industrial hydrogen use is heavily reliant on fossil fuels, primarily for oil refining and chemical production. Transitioning to low-carbon or zero-carbon industrial adoption requires new production methods. These methods must either inherently avoid emissions or incorporate carbon capture technologies. Among them, only renewable-based hydrogen offers a compelling solution for economies striving for carbon neutrality.

Falling costs for renewables and advancements in electrolyzer technology have raised the possibility of commercially viable "green" hydrogen by 2030.[10]However, the lack of studies analyzing the potential expansion pathways for green hydrogen from electrolysis casts doubt on this assumption. In fact, applying green hydrogen as a technology in industrial settings is still in its early stages and requires rapid innovation and deployment to “unlock” its full potential for mitigating climate change.[11] Even if electrolysis capacity expands as rapidly as solar and wind power, green hydrogen is projected to account for less than 1% of final energy consumption until 2030 in the European Union and 2035 globally. Beyond 2030, while further growth is possible, substantial uncertainty exists. Projections estimate green hydrogen's contribution could range from 3.2-11.2% in the EU and 0.7-3.3% globally by 2040 [12] Thus, the challenges associated with achieving significant green hydrogen production levels extend beyond supply.Short-term scarcity and long-term uncertainty could hinder investment in hydrogen end uses and infrastructure,limiting its potential and jeopardizing climate targets. Moreover, establishing a large-scale hydrogen economy necessitates a shift to hydrogen carriers and the development of a dedicated transportation network. The feasibility of producing the immense amounts of green hydrogen necessary remains largely speculative, raising critical questions about how and where this production will occur.

3 Hydrogen Council, Path to Hydrogen Competitiveness: A Cost Perspective, Hydrogen Council, Belgium, 2020.
4 IEA (2020), Energy Technology Perspectives2020, International Energy Agency. Paris https://doi.org/10.1787/d07136f-0en
5 SNAM, IGU, BloombergNEF, Global Gas Report 2020, BloombergNEF, 2020.
6 Energy Transitions Commission, Making Mission Possible – Delivering a Net-Zero Economy, Energy Transitions Commission, 2020
7 Hydrogen Council, Path to Hydrogen Competitiveness: A Cost Perspective, Hydrogen Council, Belgium, 2020.
8 Hydrogen Europe, Clean Hydrogen Monitor 2020, Hydrogen Europe, Brussels, 2020.
9 Terlouw, T., Rosa, L., Bauer, C. et al. (2024) Future hydrogen economies imply environmental trade-offs and a supply-demand mismatch. Nat Commun 7043 ,15. https://doi.org/10.1038/s7-51251-024-41467
10 Griffiths, S.; Sovacool, B.K.; Kim, J.; Bazilian, M.; Uratani, J.M. (2021) Industrial decarbonization via hydrogen: A critical and systematic review of developments, socio-technical systems and policy options. Energy Res. Soc. Sci., 102208 ,80. https://doi.org/10.1016/j.erss.2021.102208
11 IRENA (2020), Green Hydrogen Cost Reduction: Scaling up Electrolysers to Meet the 1.5°C Climate Goal, International Renewable Energy Agency, Abu Dhabi.
12Odenweller, A., Ueckerdt, F., Nemet, G.F. et al. (2022) Probabilistic feasibility space of scaling up green hydrogen supply. Nat Energy 865–854 ,7. https://doi.org/10.1038/s4-01097-022-41560

THE PURSUIT OF GREEN HYDROGEN IN EUROPE: A CATALYST FOR COMPETITION AMONG NORTH AFRICAN COUNTRIES

Along with the discussions around real hydrogen's potential to decarbonize various sectors, a significant gap between supply and demand countries have been identified.[13] While regions like the West Asia, South America, and North Africa possess abundant renewable resources capable of producing cost-competitive hydrogen (approximately 1.20-1.00/kg), they lack substantial domestic demand. Conversely, regions like Europe, Japan, and South Korea, with high hydrogen demand, face challenges in producing hydrogen cost-effectively (at least 1.80$ per kg to even more than 2.50$ per kg) due to land constraints and the need to decarbonize existing power systems.[14] This mismatch creates an opportunity for hydrogen trade, particularly between North Africa and Europe. By leveraging its abundant solar and wind resources, North Africa can produce and export competitively priced hydrogen to Europe by shipment or pipelines, at least in theory.

Hence, North African countries, initially unconcerned with the hydrogen hype, have swiftly adopted production strategies, particularly following **RePowerEU communiqué**, which announced a doubling of the hydrogen import target from neighbouring countries. Morocco, Algeria, Tunisia, Mauritania, and Egypt are now actively seeking to attract direct foreign investment in their developing export-oriented hydrogen industries. While Tunisia, Morocco, Algeria, and Egypt share a common ambition to develop green hydrogen capabilities, their strategies diverge significantly, shaped by their distinct economic, geographic, and political contexts.

Algeria and Egypt, with their existing natural gas infrastructure, are well-positioned to capitalize on the hydrogen opportunity. Algeria, a major natural gas producer, is actively exploring both green and blue hydrogen production.[15] With its abundant natural gas resources, Algeria has the capacity to produce blue hydrogen. However, the country needs to invest in renewable energy technologies to reduce its carbon footprint. Notably, over 43.55% of its land is highly suitable for hydrogen production,[16]with solar-based hydrogen emerging as the most cost-effective option.

On the other side, Egypt's competitive advantage lies in its supportive regulatory framework, which fosters investments in renewable energy, a crucial component for green hydrogen production. The country has adopted an aggressive strategy to position itself as a regional energy hub, focusing on large-scale projects and foreign investment. However, both Egypt and Algeria face significant challenges related to inadequate renewable energy production, which currently hinders the development of large-scale green hydrogen export infrastructure. As of 2023, renewable energy sources contributed just 4% and 3% to the primary energy generation in Egypt and Algeria, respectively.[17]

In contrast, Morocco, holds a competitive advantage in renewable energy costs, supported by its existing infrastructure. Energy generated by renewable sources has experienced remarkable growth in recent years, positioning Morocco among the top five of African countries in this sector.[18] The country heavily invested in renewable energy infrastructure, including the Noor Ouarzazate complex, a concentrated solar power (CSP) plant with a capacity of 580 MW, which ranks among the largest in the world.[19]

13 Ibid.

14 Hydrogen Council and McKinsey & Company(2022).Global Hydrogen Flows: Hydrogen trade as a key enabler for efficient decarbonization.

15 Tiar B., Fadlallah S. O., Benhadji, S. D. E., Graham P., Aagela H.; (2024). Navigating Algeria towards a sustainable green hydrogen future to empower North Africa and Europe's clean hydrogen transition. International Journal of Hydrogen Energy, Volume 783:802 ,61, ISSN 3199-0360.
doi: 10.1016/j.ijhydene.2024.02.328

16 Roberto C., (2023). From natural gas to green hydrogen: Developing and repurposing transnational energy infrastructure connecting North Africa to Europe. Energy Policy,Volume 113623 ,181, ISSN 4215-0301.
doi: 10.1016/j.enpol.2023.113623

17 International Trade Administration – Countries Commercial Guide

18 Ibid.

19 Benbba, R., Barhdadi, M., Ficarella, A.,Manente, G., Romano, M.P., El Hachemi, N., Barhdadi, A., Al-Salaymeh, A.,Outzourhit, (2024) A. Solar Energy Resource and Power Generation in Morocco: Current Situation, Potential, and Future Perspective. Resources, 140 ,13.
https://doi.org/10.3390/resources13100140

The renewable energy sector has increasingly become a focal point of strategic investment and policy discussions in Morocco. These efforts have been bolstered by the acceleration of the energy transition, driven by the deployment of various reliable and competitive technologies. Given its abundant solar and wind resources and its geographical proximity to Europe, Morocco is well-placed to become a key supplier of green hydrogen to Europe.[20]

In the other hand, Tunisia prioritizes export-oriented projects, capitalizing on its strategic location to supply the European market. By blending green hydrogen into its natural gas network, Tunisia aims to use its existing natural gas pipelines and position itself as a pivotal player in developing a hydrogen distribution network [21] for the EU.

In terms of regulatory frameworks, Morocco and Tunisia have established dedicated agencies to promote renewable energy and hydrogen development, while Algeria and Egypt are still in the process of enhancing their regulatory environments.

Pilot projects, and bilateral partnerships, collectively valued at billions of dollars, are being explored across North Africa. For instance, a German developer and Mauritania have recently signed a memorandum of understanding (MoU) with a consortium for a 34$ billion project, aimed at producing 8 million tons of green hydrogen and related products annually.[22]Similarly,Egypt's has introduced its 40$B Green Hydrogen Strategy through various agreements, including a 549$ million project, backed by German funding, the Sovereign Fund of Egypt and the Egyptian Electricity Transmission Company, aiming to produce 13,000 tons of green hydrogen annually.[23] Algeria has signed memorandums of understanding (MoUs) with Austrian, German, Italian, and Spanish partners to initiate feasibility studies for two green hydrogen projects. Meanwhile, Tunisia has signed six MoUs with European companies for the production of green hydrogen[24] and has spearheaded one of the most ambitious green hydrogen development initiatives in Africa, aiming to integrate it with existing electric power export schemes.[25] On the other hand, Morocco is engaging in a transactional diplomacy by signing a significant hydrogen and renewables agreements, worth over 10$B with French energy and infrastructure companies, following France's public reaffirmation of its support for Morocco's position on Western Sahara. In fact, the first round of land allocations in Morocco's green hydrogen investment process is nearing completion and may include substantial areas within the contested territory of Western Sahara.[26]

18 Ibid.

19 Benbba, R., Barhdadi, M., Ficarella, A.,Manente, G., Romano, M.P., El Hachemi, N., Barhdadi, A., Al-Salaymeh, A.,Outzourhit, (2024) A. Solar Energy Resource and Power Generation in Morocco: Current Situation, Potential, and Future Perspective. Resources, 140 ,13. https://doi.org/10.3390/resources13100140

20 Noussan, M., Raimondi, P. P., Scita, R., & Hafner, M. (2021). The Role of Green and Blue Hydrogen in the Energy Transition—A Technological and Geopolitical Perspective. Sustainability, 298 ,(1)13. https://doi.org/10.3390/su13010298

21 Bdioui, H., Touati, H., Ben Chiekh, M., Agüera, A. L., Ben Amor, O., Ennine, G., &Nietsch, T. (2023). Feasibility Study on Hydrogen Blending into Tunisian Natural Gas Distributing System. Preprints. https://doi.org/10.20944/preprints202312.0662.v1

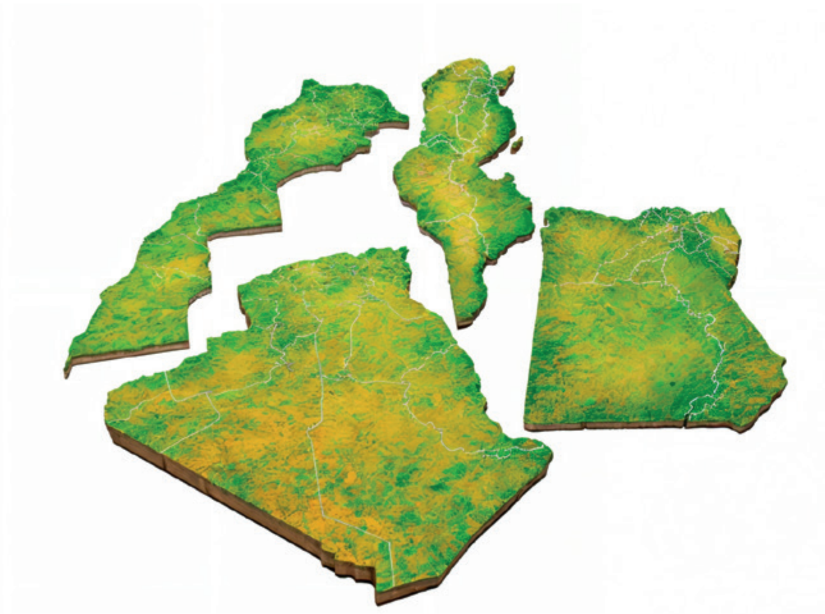
22 Reuters - Consortium signs 34$ billion MoU for hydrogen project in Mauritania

23 Energy Capital & Power - Egypt's 40$B Green Hydrogen Strategy: Major Projects to Watch

24 Hydrogen Europe - Six hydrogen production deals concluded in Tunisia

25 African Energy – Tunisia pins its hopes on green energy export schemes

26 African Energy - Morocco gears up for green hydrogen push in disputed Western Sahara



The rise of the hydrogen economy has intensified geo-economic competition. North African countries have not consistently prioritized coalition-building or coordinated efforts to enhance financing access or negotiate favourable trade agreements for green or blue hydrogen production and export. Instead, competition to secure foreign investment has intensified, with each country emphasizing distinct advantages: Egypt highlights its supportive legal framework for foreign investors, Algeria emphasizes its natural resource endowments, Tunisia leverages its strategic location, and Morocco showcases its advanced renewable energy or infrastructure.

For Algeria and Egypt, green hydrogen offers a crucial opportunity to diversify their economies, reducing dependence on oil and gas exports. While Morocco appears to be pursuing a more strategic regional role, Tunisia's focus is on capitalizing on its position within existing energy corridors connecting Europe and Africa, and securing its Balance of payments by mitigating vulnerabilities to oil and Gaz price fluctuations.

Ultimately, the selection of specific pathways to scale up hydrogen production will depend not only on cost-effectiveness and technological efficiency but also on geopolitical considerations.[27]

Given North Africa's abundant renewable resources, a critical question arises: is large-scale green hydrogen production truly feasible? Despite significant hype, the region lacks concrete evidence of commercially viable large-scale projects. While small pilot project exists worldwide, its success does not guarantee the bankability of gigawatt scale ventures. This uncertainty poses a considerable risk, given the substantial investments already made by major global stakeholders. If these ambitions prove unrealistic, the repercussions could be severe.

GREEN HYDROGEN: A MIRAGE MASKING DEBT AND UNEQUAL EXCHANGE?

THE LOOMING THREAT OF UNSUSTAINABLE DEBT

While cost competitiveness varies across North African countries due to factors such as renewable energy resources and infrastructure development, access to financing remain a critical determinant. Significantly, all planned financing mechanisms for North African countries are heavily dependent on foreign investment and international cooperation to realize their hydrogen strategies. Despite numerous announcements of MoUs, consortiums and new legislative framework intended to facilitate the implementation of hydrogen production projects, financing remains constrained. Even though the green hydrogen economy is often presented as a lucrative opportunity for global financial capital, significant challenges persist, including infrastructure investment, technological uncertainties, and unclear economic returns. Economic gains remain unclear and private finance perceives severe investment risks. Private finance perceives substantial investment risks and, in collaboration with governments and organizations from the Global North, seeks to shift these risks to host governments through public financial support mechanisms. For instance, in June 2021, Germany played a pivotal role to establish the **H2Global initiative**, a financial instrument designed to promote s both hydrogen production in the EU and foster import partnerships with future producer countries. This initiative aims to mitigate investment risks and ensure the viability of hydrogen-related projects. Mitigating these risks by transferring them to host governments through public financial support is not a novel concept; it has become more systematic through de-risking initiatives. De-risking has emerged as a central pillar of climate finance, emphasized in policy recommendations by major institutions like the World Bank, IMF, and the United Nations. These institutions, highlight the importance of risk reduction. Large-scale infrastructure and renewable energy projects aligned with the Sustainable Development Goals (SDGs) and the 2030 Agenda are increasingly viewed as attractive investment opportunities for international capital seeking profitable ventures.[28]

27 Van de Graaf T., Overland I., Scholten D., Westphal K.; (2020). The new oil? The geopolitics and international governance of hydrogen. Energy research and social science, -70:101667. doi: 10.1016/J.ERSS.2020.101667

28 Haag, S., Tunn, J., Kalt, T., Müller, F., and Simon, J. (2024) Who profits from the green energy rush? Derisking and power relations in Africa's renewable energy finance," Transnational Institute.

While finance for public infrastructure has always entailed a blend of private and public funding, de-risking, aims to reorganise energy economies, is touted as an ultimate solution for mobilizing necessary resources, particularly in the Global South. [29] Emerging economies face the risk of becoming mere consumers of green hydrogen technology and primary beneficiaries for international investors under the current framework of green energy regulations, which are predominantly shaped by powerful investors and governments from developed nations. This dynamic could exacerbate existing external debt vulnerabilities in these countries. The World Bank has reported that by 2023, two-thirds of middle- and low-income countries were facing a heightened risk of debt distress, underscoring the urgency of addressing these concerns.[30] The significant investments required for green hydrogen production can lead to a substantial increase in public debt, which may become unsustainable if project revenues fail to meet expectations.In addition, high-interest rates and foreign currency-denominated loans increases the cost of projects and expose African countries to exchange rate risks. As an example, **the Hyphen green hydrogen mega-project**, a German-led consortium aims to establish a large-scale green hydrogen production facility in Namibia, spanning an area three times larger than New York City. While presented as a collaborative venture, this heavily debt-financed project carries the inherent risk of substantially increasing Namibia's public debt burden.[31]

This development finance model, heavily reliant on market forces and prioritizing the interests of private capital, promises long-term profits for investors. However, it exposes host nations to significant commercial risks. By providing sovereign guarantees for private investments, these countries assume responsibility for potential losses, potentially exacerbating their foreign debt burdens.

THE UNSUSTAINABLE REALITY OF GREEN HYDROGEN

Encompassing a specific set of de-risking instruments is often framed within a common narrative: countries in the Global South are positioned as suppliers of green hydrogen to the Global North, expecting investments, job opportunities, and advanced technologies in return. This arrangement is frequently portrayed as a 'win-win' scenario. However, it's widely recognized that 'green projects' only generate temporary jobs during the construction phase, with employment rates dropping drastically afterward.[32] Moreover, market-based policies, as demonstrated in climate negotiations, do not facilitate the transfer of technologies that are both ecologically sustainable and socially equitable for developing nations. This dynamic ultimately fosters dependency on foreign technologies.[33] As a result, North African countries may become excessively reliant on the EU market for hydrogen, exposing them to market volatility and geopolitical risks.

While green hydrogen offers a significant reduction in greenhouse gas (GHG) emissions compared to traditional methods, a recent study[34] highlights potential drawbacks to its large-scale implementation. Although green hydrogen emits 50–90% less GHG emissions compared to hydrogen produced through steam methane reforming from natural gas, it can still contribute to substantial emissions and environmental burdens for a large-scale hydrogen economy due to embodied emissions of energy technologies and the global warming potential associated with hydrogen leakage. Furthermore, the high costs of transporting hydrogen over long distances—from production sites to consumption areas—, can potentially undermine its economic viability, and increase its environmental risks. Hence, African countries are likely to face not only mounting foreign debt but also significant environmental costs.

29 Gabor, D. and Sylla, N.S. (2023), Derisking Developmentalism: A Tale of Green Hydrogen. Dev Change, 1196-1169 :54. https://doi.org/10.1111/dech.12779

30 Ibid.

31 Haag, S., Tunn, J., Kalt, T., Müller, F., and Simon, J. (2024) Who profits from the green energy rush? Derisking and power relations in Africa's renewable energy finance," Transnational Institute.

32 Winter, J., &Michal C. M., (2013) The 'Green Jobs' Fantasy: Why the Economic and Environmental Reality Can Never Live Up to the Political Promise." The School of Public Policy. Publications 6.doi: http://dx.doi.org/10.11575/sppp.v6i0.42444

33 Amroune, A., &Dib, K., (2024). clean technology transfer for climate change mitigation: mechanisms and barriers -with reference to Algeria-. les cahiers du cread. https://doi.org/10.4314/cread.v39i4.2

34 Terlouw, T., Rosa, L., Bauer, C. et al. (2024) Future hydrogen economies imply environmental trade-offs and a supply-demand mismatch. Nat Commun 7043 ,15. https://doi.org/10.1038/s7-51251-024-41467

Regional limitations add another layer of complexity. Areas with high green hydrogen production potential often overlap with being water-scarce regions. This is particularly relevant in North Africa, where countries like Tunisia, Algeria, and Morocco already face severe water stress due to limited renewable freshwater resources and a hot, arid climate. Climate change further exacerbates this issue through rising temperatures, prolonged droughts, and altered rainfall patterns, making water scarcity a critical factor with profound social, economic, and environmental consequences.[35] Hence, diverting significant amounts of freshwater for hydrogen production in these already water-stressed regions would exacerbate existing water shortages, potentially impacting agriculture, human consumption, and ecological systems in North Africa.

Scaling up production must consider not only water availability but also the substantial renewable energy resources and extensive land areas required. For example, with an area of 8,500km, the Aman project in Mauritania –one of the biggest planned green hydrogen projects in the world – covers more land than many global megacities, including Tokyo, Moscow, or Beijing.[36] In addition, the discourses that turn green hydrogen into a sustainable low-carbon solution, and examine legitimisation narratives about climate mitigation, developmental benefits and higher productivity of seemingly empty, degraded or underutilized lands is completely misleading[37] and recall histories of unequal resource exchange.[38] This is exemplified by the German government-funded **H2Atlas-Africa**, which assesses West Africa's hydrogen potential using technical and supposedly "objective" classification. However, it fails to address existing global or local inequalities or to adequately consider local socio-economic and environmental conditions.[39]

Furthermore, some joint hydrogen initiatives, like Germany's Go Green Go Africa program, exhibit Eurocentric development paradigms. These frameworks perpetuate the narrative that African energy transitions require European expertise and models disregards the continent's capacity for self-determined development.[40]

Considering the lack of concrete evidence regarding the effectiveness and potential risks of those projects, relying on such speculative and potentially unsustainable technologies could worsen the socio-economic and environmental crisis in North African countries. Current research predominantly emphasizes the technical and economic feasibility of green hydrogen production in the Global South. However, a critical gap exists in understanding the potential socio-ecological risks and the power asymmetries embedded in these South-North resource flows. While social science research has begun to explore governance challenges and the geopolitics of green hydrogen, [41] a significant knowledge gap remains concerning the potential for social and environmental harm.[42]Another critical aspect of evaluating green hydrogen production in North Africa lies in assessing its potential to meet domestic energy needs. These countries possess abundant renewable energy resources that could be effectively utilized to displace existing fossil fuel-based power generation. Moreover, regional interconnections with neighbouring countries, and eventually with the EU, could enhance grid stability and facilitate energy sharing.

35 Mahmoud M., (2024) The Looming Climate and Water Crisis in the Middle East and North Africa. Carnegie endowment for international peace.

36 Recharge - Wind and solar powered 30GW green hydrogen giant on horizon for Mauritania

37 Hamza H., (2022) The energy transition in North Africa: Neocolonialism again! Transnational institute

38 Hickel J., Dorninger C., Wieland H., Suwandi I., (2022) Imperialist appropriation in the world economy: drain from the global south through unequal exchange, 2015–1990. Glob. Environ. Change, 102467 ,73.

39 Kalt T., &Tunn J. (2022) Shipping the sunshine? A critical research agenda on the global hydrogen transition. GAIA - Ecological Perspectives for Science and Society. 6–31:72. https://doi.org/10.14512/gaia.31.2.2

40 Ibid.

41 Van de Graaf T., Overland I., Scholten D., Westphal K.; (2020). The new oil? The geopolitics and international governance of hydrogen. Energy research and social science, -70:101667. doi: 10.1016/J.ERSS.2020.101667

42 Kalt T, Tunn J. (2022) Shipping the sunshine? A critical research agenda on the global hydrogen transition. GAIA - Ecological Perspectives for Science and Society. 6–31:72. https://doi.org/10.14512/gaia.31.2.2

However, exporting substantial amounts of renewable electricity in the form of hydrogen to Europe, entails a significant opportunity cost. Prioritizing domestic utilization of renewable energy would more effectively decarbonize local energy systems and support national climate goals. Exporting hydrogen to Europe to fulfil their climate targets, while neglecting their own domestic energy needs, seems counterintuitive and potentially detrimental to their own sustainable development.[43]

Therefore, a critical examination of green hydrogen production in North African countries reveals significant concerns. These include the potential for large-scale production to exacerbate existing environmental and social inequalities, and the risk of replicating historical patterns of resource extraction, echoing concerns about "green colonialism".

GREEN HYDROGEN DEVELOPMENT IN NORTH AFRICA: A CLASH OF INTERESTS?

While green hydrogen offers a promising pathway to decarbonization for the EU, its development requires a nuanced and balanced approach that prioritizes sustainability and equity. Techno-economic factors alone cannot determine the feasibility of green hydrogen projects. Social and environmental considerations must be integrated throughout the entire value chain, from production to distribution. By prioritizing social and environmental well-being at the forefront, project developers can mitigate potential risks and ensure that the benefits of the hydrogen economy are equitably distributed.[44]

Furthermore, the environmental impact of hydrogen production must be carefully considered. Water scarcity is a major concern in North Africa, and diverting significant volumes of freshwater for hydrogen production could exacerbate existing water crises. While desalination is often touted as the ultimate solution by countries' green hydrogen production strategies, it is a highly energy-intensive and carries its own environmental costs. Exploring innovative water-efficient technologies is crucial for mitigating these risks. It is crucial to avoid prioritizing large-scale hydrogen exports to Europe at the expense of domestic water needs in North Africa.

In the same vein, renewable energy resources should be prioritized for local use and development, not solely for export markets. As highlighted by **the African People's Climate** and Development Declaration, green hydrogen for export should not come at the expense of domestic energy access for millions of Africans.

North African renewable energy resources could be more effectively harnessed to displace fossil fuels domestically, thereby enhance energy security and advancing sustainable development. Conversely, rather than perpetuating its neocolonial energy model based on exploiting countries in the global South, the EU should immediately revise its RePowerEU strategy, scrap its unrealistic hydrogen import and production targets and instead vastly increase investment in energy efficiency and renewables to reduce dependency on gas.[45]

Ultimately, a just and sustainable green hydrogen transition requires a shift away from a solely export-oriented model. Prioritizing domestic energy, water and land needs, fostering equitable partnerships, and ensuring environmental sustainability are crucial for realizing the potential benefits of this emerging technology, if any, be realized.

43 Michael Barnard (2022) Morocco, Algeria, Egypt: Assessing EU plans to import hydrogen from North Africa. Corporate Europe Observatory and Transnational Institute.
44 Blohm M., Dettner F., (2023) Green hydrogen production: integrating environmental and social criteria to ensure sustainability. Smart Energy, .100112 ,11 10.1016/j.segy.2023.100112
45 Michael Barnard (2022) Morocco, Algeria, Egypt: Assessing EU plans to import hydrogen from North Africa. Corporate Europe Observatory and Transnational Institute.

CONCLUSION

Despite its potential drawbacks, hydrogen hype continues to grow, captivating policymakers and investors as perceived ultimate solution to the pressing challenges of climate change and energy security. However, its widespread adoption remains fraught with risks, including the perpetuation of green colonialism and the deepening of dependencies on resource extraction in the Global South.

Ultimately, the success of green hydrogen will depend on a combination of factors, including technological innovation, robust policy support, and sustained market demand. If these factors align, green hydrogen could contribute meaningfully to the transition toward a clean energy economy. [46] However, it is essential to approach this technology with realistic expectations and to carefully consider the environmental, economic, and social implications of its widespread adoption.

For instance, the EU's pilot certification scheme, **CertifHy,** which classifies hydrogen as "low-carbon" or "clean",[47] highlights a key limitation: carbon certification alone will not be sufficient to address conflicts around land, water and energy justice. A more holistic approach is needed—one that considers the ecological conditions underpinning human economies —to conceptualize the mechanisms driving inequality in resource distribution.

In addition, the focus on large-scale green hydrogen project could distract from more urgent and effective climate action measures, such as investing in locally adapted renewable energy projects and energy efficiency.[48]

46 Yap, J.; McLellan, B. A (2023) Historical Analysis of Hydrogen Economy Research, Development, and Expectations, 1972 to 2020. Environments 10, no. 11 :1. https://doi.org/10.3390/ environments10010011

47 Cheng W, Lee S. (2022) How Green Are the National Hydrogen Strategies? Sustainability. 1930:(3)14. https://doi.org/10.3390/su14031930

48 Michael Barnard (2022) Morocco, Algeria, Egypt: Assessing EU plans to import hydrogen from North Africa. Corporate Europe Observatory and Transnational Institute.

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