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الإستراتيجية المغربية للهيدروجين الأخضر النموذج الإقليمي للانتقال الطاقي في شمال إفريقيا

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الملخص

فكرة البحث: *تقدم هذه الدراسة تحليلًا للإستراتيجية المغربية في مجال الهيدروجين الأخضر، مبرزة التناقض الجوهري للسياسة المغربية. فمن جهة، تسعى الدولة لجذب المزيد من الاستثمارات لكونها المحرك الأساسي لمسار هذه الاستراتيجية الطموحة، ومن جهة أخرى يترتب عليها الحفاظ على السيادة الطاقية والاقتصادية للمملكة.*

الهدف: *يهدف هذا البحث إلى تسليط الضوء على الكيفية التي تشكلت بها الأطر القانونية والاستراتيجية بشكل يخدم بالدرجة الأولى انفتاح المغرب على الأسواق العالمية كمصدر أساسي للطاقة الخضراء، مع تراجع التركيز على النهوض بسوق محلية سيادية طاقية، كما يأخذ بعين الاعتبار مختلف الفرص على المستوى الاقتصادي والاجتماعي والبيئي والتكنولوجي التي تميل نحو تغزيز المصالح الأجنبية، فيما يستفيد المغرب محقًّقا تقدما محدودًا في مؤشرات البطالة والطاقة النظيفة والتدفقات الاستثمارية، وتطوير المُعِّدات التكنولوجية.*

المنهجية: *اعتمدت المنهجية على المقاربة النوعية والكمية معا استنادًا إلى دراسة الأطر القانونية والرسمية وبيانات الاستثمار.*

النتائج: *إن الاستراتيجية الحالية ساهمت بشكل كبير في تسهيل ولوج الاستثمارات الأجنبية مما يقود إلى إعادة أنماط التبعية من خلال تحويل المغرب إلى منصة لاستخراج شتى الموارد الخضراء لخدمة المصالح الأجنبية، مع محدودية قدرتها على تشييد قواعد صناعية وطنية متكاملة، وتحقيق سيادة طاقية فعلية.*

الخلاصة: *الهيدروجين الأخضر فرصة استراتيجية هامة للمغرب على الرغم من التحديات الهيكلية. كما يظل تحقيق هذا الطموح مرهون بتحول جذري برسخ لنموذج سيادي عادل قائم على الموازنة بين الاندماج في الاقتصاد العالمي مع الحفاظ على المصلحة الوطنية بدلا من الخضوع لنموذج تبعي استخراجي يستغل ثروات البلاد، مما سيؤدي إلى وضع معيار جديد في الاقتصادات العالمية الناشئة تمكن الدول النامية من الاستفادة من ثرواتها ليس فقط لخدمة السوق الوطنية، بل أيضًا لبناء اقتصاد طاقي قوي ومبتكر ذو رؤية مستقبلية.*

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Morocco's Green Hydrogen Strategy: A Regional Model for Energy Transition in North Africa

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Abstract

Research Idea: *This research provides an analytical examination of Morocco's green hydrogen strategy, highlighting a central tension within national policy. On one hand, the state seeks to attract substantial foreign investment, which serves as the principal driving force behind this ambitious strategy. On the other hand, the approach requires safeguarding the country's energy and economic sovereignty.*

Objectives: *The research aims to clarify how Morocco's legal and strategic frameworks have been shaped in ways that primarily facilitate the country's integration into global markets as a key supplier of green energy, while placing comparatively less emphasis on developing a sovereign domestic energy market. It also evaluates the economic, social, environmental, and technological dimensions of the strategy, dimensions that often reinforce external interests, whereas Morocco's gains remain modest in terms of employment, clean-energy uptake, investment inflows, and the development of technological capabilities.*

Methods: *The research employs a mixed-methods approach that integrates qualitative and quantitative analysis, drawing on official legal and strategic documents as well as investment data.*

Results: *The current strategy has significantly facilitated the influx of foreign investment, thereby reproducing dependency patterns by positioning Morocco as a platform for extracting various green resources in service of external interests. At the same time, its capacity to establish integrated national industrial bases and to achieve genuine energy sovereignty remains limited.*

Conclusion: *Green hydrogen represents a major strategic opportunity for Morocco despite persistent structural constraints. Realizing this potential, however, requires a fundamental shift toward a sovereign and equitable development model, one that balances global economic integration with the protection of national interests, rather than perpetuating an extractivist and dependency-driven paradigm. Such a shift would set a new benchmark for emerging economies, enabling developing countries to harness their resources not only to address domestic needs but also to build a strong, innovative, and future-oriented energy economy.*

Introduction

As the urgency of climate change and energy security increases simultaneously, it has become essential for all countries to thoroughly re-evaluate their approaches to energy production, consumption, and trade. Consumption of fossil fuels, including oil, coal, and natural gas, has long been acknowledged as contributing to economic growth, but it is now agreed to be one of the key factors of environmental degradation, greenhouse gas emissions, and ecosystem destruction. In addition to this, consumption of such energy exposes countries to unpredictable energy market fluctuations and geopolitical conflicts and warring that necessitate identification of viable and reliable energy sources. In these regards, green hydrogen has proven to be a versatile, clean, and low-carbon energy carrier that can eventually become a significant source of decarbonization, energy storage, and energy trade.

Scientifically, green hydrogen is produced by electrolyzing water using renewable electricity to generate hydrogen (H_2) and oxygen (O_2) without carbon emissions (Amini Horri & Ozcan, 2024; Hou & Yang, 2024). Even though the basic chemical mechanism is not too complicated, the type of electrolysis technology (alkaline, proton exchange membrane (PEM, or solid oxide) implies varying efficiency, costs, and scalability. Similarly, storage and transportation are also noted to be a major issue, since hydrogen has to be compressed, liquefied, or converted into chemical carriers, including ammonia or methanol, which require a lot of energy and also incur economic implications (Broom, 2011; IRENA, 2021). As a result, achieving a competitive hydrogen economy does not only entail a large availability of renewable resources but also a significant investment, innovative research, and aligned policy frameworks.

To this extent, Morocco is an interesting case study. Granted with outstanding solar and wind resources and strategic proximity to European markets, the country has positioned itself as a future regional hub of green hydrogen by the implementation of a national strategy, industrialization, and international cooperation.

Research Objectives:

This research aims to achieve the following:

1. Evaluate Morocco's green hydrogen strategy, based on an analysis of the extent to which the legal and strategic framework contributes to providing a favorable environment in line with the interests of export-oriented foreign investments.
2. The research seeks to analyze the multidimensional opportunities, which are primarily for multinational companies and foreign markets, with the emergence of Morocco's role as a gateway to Africa and some of the local benefits that remain limited.
3. Uncover the mechanisms that transform Morocco's energy ambition into a subsidiary model subject to a neocolonial extractivist approach.

4. Identify pathways for future research with the aim of deepening the analysis and guiding energy transition policies in order to ensure energy justice and sovereignty.

Research significance:

The study of Morocco's Green Hydrogen Strategy is of great importance in bridging a critical knowledge research gap, as most previous studies have focused more on the technical and economic aspects of the Green Hydrogen Strategy, highlighting its role in presenting Morocco as a continental development model. However, they have neglected to analyze this ambition from the perspective of political economy and the critical angle that highlights how the legislative and strategic framework has contributed to the consolidation of a neoliberal paradigm, which may transform the Kingdom's ambition from a strategy to advance its economy in the field of energy transition at the regional level into a mere platform for neo-colonial extractive policy and a means for countries with strong economies to enter Africa. This reveals the actual contradiction between the discourse of energy sovereignty and policies based on the perpetuation of dependency, thus negatively impacting the hidden social, environmental, and economic aspects. Furthermore, this study will contribute to enriching the scientific debate by providing policymakers in Morocco and African countries in particular with a more accurate diagnosis of the structural threats inherent in the export-focused development model and the preference for foreign interests, which will make it possible to develop equitable policies to achieve a balance between economic growth and national sovereignty on the one hand, and the export-oriented strategy and South-South cooperation on the other hand.

Research Problem:

The central problem of the research is the fundamental contradiction reflected in Morocco's green hydrogen strategy. On the one hand, the state promotes an ambitious discourse aimed at achieving energy sovereignty and sustainable development. On the other hand, both legal and strategic frameworks, as well as unevenly distributed opportunities, reveal that Morocco's approach will reproduce neocolonial extractivist dynamics, so that the state will become a platform for the production of green resources to serve the foreign market, while the benefits at the local level remain very limited, negatively impacting several aspects, including the social, economic, and environmental aspects.

Literature review:

The recent research has put Morocco's green hydrogen strategy at the central point of the intersection of renewable energy, economic reforms, and environmental control. The studies between 2024–2025 focused on the country's transition from its reliance on fossil fuels to a clean, export-oriented system with

an emphasis on the technological potential, legal, and socio-political factors that are going to influence it.

1. The research done by Adraoui and Jaafar "Sustainable management of water resources and assessment of the vulnerability of Moroccan oases to climate change" (2024), Environmental Science and Pollution Research journal, have shown the scope of the effects of global warming on the Moroccan oases, with the overall finding that the water scarcity will not only influence but also directly hinder the hydrogen projects relying on renewable resources, implying the need to have an integrated water-energy governance policy. In a complementary viewpoint, Amini Horri and Ozcan "Green hydrogen production by water electrolysis: Current status and challenges" (2024), Current Opinion in Green and Sustainable Chemistry journal, critically analyzed the efficiency and cost of electrolyzers, signifying the capacity of Morocco to connect with global tech through local R&D and infrastructure further investment.
2. From the standpoint of regional policy, Bayssi, Nabil,Azaroual, Bousselamti, Boutammachte, Rachidi, and Barberis, in their research"Green hydrogen landscape in North African countries: Strengths, challenges, and future prospects" (2024), International Journal of Hydrogen Energy, assessed the hydrogen policies of North African countries, referring to the localized comparative advantage of renewable resources of Morocco, but highlighted the disadvantage of financing and industrial partnership as the primary obstacles. Also, Ayed, Fortes & Al Afif in the article "Assessing the competitiveness and trade-offs of national hydrogen strategies in the Maghreb: TIMES scenario-based analysis" (2025), International Journal of Hydrogen Energy, by using a TIMES model scenario-based analysis, which depicted Morocco as a competitively strategic player, shed light on the feasibility of the export-oriented strategies, and the significant resources and economic challenges. While the research of Ouchani & Ghennioui "An integrated geospatial techno-economic multi-scenario mapping assessment of PV-based green hydrogen development opportunities: A vision to support its deployment in Morocco". (2025), Energy Conversion and Management journal, offered a spatial-economic perspective to the issue through the use of GIS modeling to identify optimal locations to deploy hydrogen production considering environmental and hydrological constraints.
3. On the side of technological innovation, El-Maaroufi, Daoudi & Laamara in the research "Hydrogen production for SDG 13 using hybrid renewables energies in southern Morocco" (2025), Energy journal, analyzed the simulations of hybrid renewable systems (solar-wind) compared with SDG 13 and showing the potential to produce sustainable hydrogen when the two processes are combined. At the same time, Boutracheh and Moumen, "Scientific peripheralism in Green Hydrogen: Morocco's collaboration patterns and strategic misalignment." (2025),

Regional Studies Journal, Vol. 20, No.67, January 2026 (123-156)
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International Journal of Hydrogen Energy, revealed the epistemic dependency, and that Morocco is still reliant on European know-how and requires self-sufficient scientific capacity.

4. Importantly, the French research presented by El Youssoufi Attou and Nadir "Émergence de l'hydrogène vert au Maroc: Perspectives juridiques." (2024), Revue Internationale du Chercheur, cleared the legal and institutional aspects revealing that the existing Moroccan framework albeit an alignment with investment promotion still lacks the strength to apply the local benefit-sharing mechanisms. Moreover, one of the issues highlighted by the research is the disparity between the regulatory environment accommodating the foreign investors and the lack of mandatory conditions for the transfer of technology or industrial localization.

The combination of these studies reflects two main lines of research: on the one hand, a techno-economic line focused on matters of efficiency, feasibility, and spatial optimization; on the other hand, a critical-institutional line questioning the governance, dependence, and equity aspects in the hydrogen transition. In this regard, this research is positioned at the intersection of techno-economic and critical-institutional studies related to Morocco's green hydrogen strategy. It takes a different approach from Adraoui & Jaafar (2024) by introducing environmental governance alongside legal analysis; it goes further than Amini Horri & Ozcan (2024) by pointing out socio-political asymmetries in the adoption of technology; compared to Bayssi et al. (2024) and Ayed, Fortes and Al Afif (2025), it asks who is benefiting with the transition, compared to Ouchani and Ghennioui (2025) and El-Maaroufi, Daoudi and Laamara (2025), it fuses the spatial and technological aspects and the equity dimension with the neo-colonial dimension; and unlike Boutracheh and Moumen (2025) and El Youssoufi Attou and Nadir (2024) it shows how the legal-institutional framework is proactively supporting foreign investments in a manner that can replicate a new extractivist neo-colonial order. By addressing the knowledge gap left by previous studies, this research provides a critical examination of the both strategic and legal framework of green hydrogen policy of Morocco, along with the manner of the distribution of benefits between Morocco and foreign investments, which in fact, may be the producer of dependence and unequal exchange patterns in the context of the "green transition."

Research Questions:

To comprehend this study, the following questions will be highlighted:

1. To what extent has the Moroccan legal and strategic framework contributed to attracting and facilitating the entry of foreign investments into the local market?
2. What are the various technological, environmental, social, economic, and geopolitical opportunities for green hydrogen that contribute to the consolidation

of the interests of foreign investments in mainstream, with limited gains for Morocco?

3. How does the existing model produce a new approach to the extractivist neo-colonial politics?
4. What research pathways are necessary in order to achieve the energy sovereignty model and ensure a balance between the domestic economy and export policy?

Conceptual framework

This study is grounded on a synthetic conceptual framework that connects the national green hydrogen policies of Morocco to their energy and economic sovereignty gains, underlining the gaps between the proclaimed advantages and the actual gains favoring foreign actors. It brings into consideration the dependent, extractivist neocolonial outcome, integrating legal, strategic, and multidimensional factors together for assessing the long-term structural and power dynamics in the energy transition of the country (Figure1). This framework comprises three main interrelated groups of concepts:

1. Legal and Strategic Framework: this is the main variable which comprises the legal and public policies implemented by the state to attract foreign investment in the green energy sector. Although the framework's purpose aims to advance the energy transition, it actually unlocks the Moroccan market for foreign countries, setting affordable rules to the benefit of the foreign investments.
2. Multidimensional Opportunities: this symbolizes the intermediate variable that includes the economic, environmental, technological, social, and geopolitical aspects. These opportunities portray the interaction between national measures, along with international and regional dynamics, thereby showing the gap between the declared advantages like investment, development, and job creation, and the real profits, which are often in favor of foreign actors.
3. Structural outcome epitomized in Neo-colonial Extractivist Model: this represents the dependent variable, and manifests through the emergence of a dependent neo-colonial approach that transforms Morocco into a foundation for exporting green resources without preserving it national energy sovereignty. This disparity in energy power relations between the Global North and South is encompassed by the idea of extractive neocolonialism.

Regional Studies Journal, Vol. 20, No.67, January 2026 (123-156)
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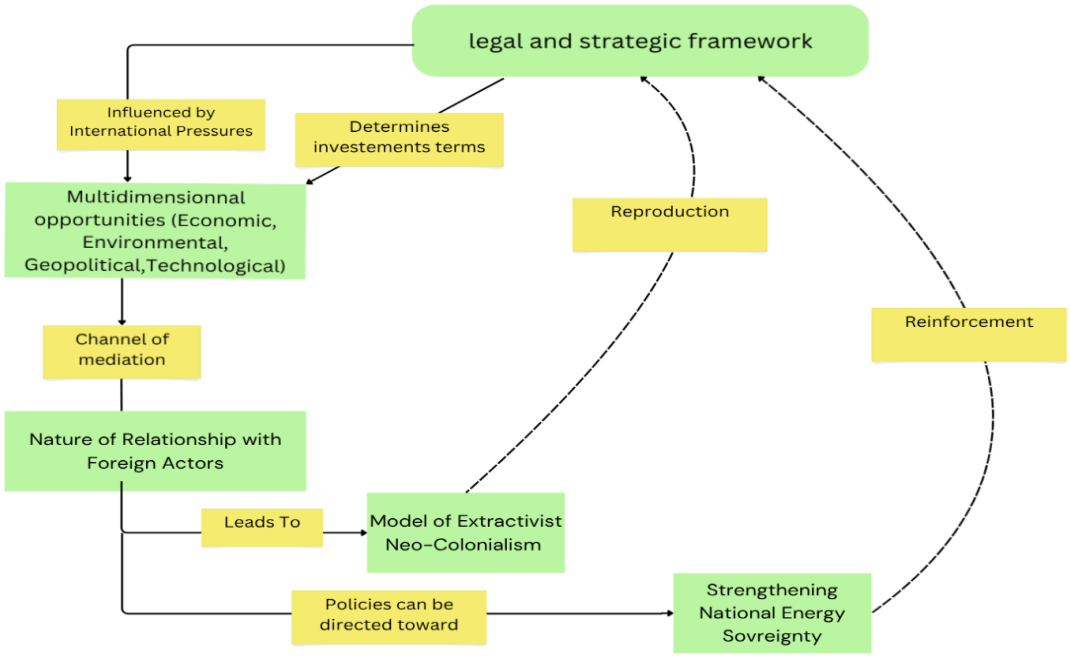
Figure1: conceptual Framework of research variables and their intersection.



Source: Author's analysis

Hypothesis:

based on this conceptual framework, the analysis is structured through a central hypothesis, that Morocco's green hydrogen project while ambitious and technically viable, it implies a dependency approach. The absolute priority given to the policy of attracting foreign investments, which is oriented towards export, has led to the introduction of legislation and policies that are designed to consolidate the economic presence of foreign countries, which puts the energy sovereignty of the country at the risk. In addition, the declared opportunities disproportionately provide a fertile base to serve the geopolitical interests of foreign countries, while national benefits such as job creation, sustainable development, real technological partnerships remain too limited, which may lead to a re-enactment of a history characterized by the depletion of Morocco's resources, under the cover of "green transition".

Research Methodology:

This study used a mixed methodology that relies heavily on secondary data, especially government reports, legal document, strategic and institutional framework, and relevant statistical sources. Therefore, it is placed within a critical-

reflective epistemological framework that combines interpretative qualitative analysis with systematic quantitative assessment. Which guarantees methodological rigor, maintains objectivity, and gives a complete picture of the phenomena being studied.

1.Qualitative Approach:

a. An analytical methodology, which is based on the critical analysis of official documents, especially legal documents (Law No. 13-09, Law No. 48-15, and Law No. 47-09), strategic frameworks (National Energy Efficiency Strategy 2030, Green Hydrogen Roadmap, New Investment Plan), in addition to investment reports and government reports. The instruments of analysis deployed in this stage are Documentary Analysis and Qualitative Content Analysis with the assistance of Open Coding to identify categories and patterns of regulations embedded in the legal and strategic texts.

b. A multidimensional analysis that combines the social, economic, technological, environmental and geopolitical dimensions to understand the multiple opportunities of the Green Hydrogen Strategy, in order to provide a comprehensive and integrated assessment of the mechanism of benefit distribution between Morocco and the foreign countries investing in this project. This step is based on Thematic Analysis with Axial Coding which would unveil interactions and interdependencies between the dimensions identified.

c. A critical approach, using the lens of an exploitative approach to dissect the unbalanced relations between Morocco and foreign partners. The analytical tool employed in this case is the Critical Discourse Analysis (CDA) that allows determining the power imbalances, discursive practices, and ideological framings involved in policy discourse and institutional discourse.

d. Secondary analysis based on references from NGOs and international think tanks, as well as press releases. This section will provide evaluation of credibility, coherence and divergence of external perspective using Secondary Data Analysis and Directed Content Analysis and triangulating them to the primary documentary base.

2.Quantitative Approach

Besides the qualitative elements, the quantitative approach was also incorporated into the research in the form of numerical processing of the data obtained on the basis of the National Roadmap on Green Hydrogen in Morocco. The tools of quantitative analysis used are:

a. Descriptive Statistical Analysis to compute the numerical values given in the table National and Export Expectations of Green Hydrogen and its Derivatives (2030-2050).

b. Trend Analysis and Sectoral Quantification Methods to create and interpret Figure 2 on "Sectoral Reduction of Greenhouse Gas Emissions by 2050).

These tools allowed converting the projections of the national roadmap into Quantifiable indicators that could be measured to help assess the Moroccan green hydrogen path empirically.

Research Structure:

The study is organized according to four main axes: the first axis deals with the dissection of the legal and strategic framework of Morocco's green hydrogen policy, which has served as an engine to attract the largest possible number of foreign investments. The second axis deals with the multidimensional opportunities offered by Morocco's transition to green hydrogen in terms of social, economic, geopolitical, technological and environmental aspects. The third axis discusses the problem of green hydrogen in Morocco within an extractive neo-colonialist framework as a critical challenge, while the fourth axis focuses on identifying pathways to guide future research towards the development of alternative policies aimed at ensuring an energy sovereignty and just transition.

1.Green Hydrogen in Morocco: Legal and Strategic Governance

Morocco has a strong and well-established legal and strategic framework to improve the foundations of its energy transition ambitions, facilitate access to foreign investments, and promote sustainable development. The Kingdom has worked hard to implement a legislative approach that keeps pace with external energy ambitions, with a careful focus on overcoming legal, and administrative obstacles to stimulate foreign investments and create a competitive environment characterized by transparency and integrity.

1.1 Legal framework for Morocco's green hydrogen policy

The results of the study show that although the details of the legislative framework related to green hydrogen are not yet fully defined. The current foundations include a series of laws and regulatory instruments that have been downloaded in relation to renewable energy and energy efficiency, establishing a safe pattern and a proactive approach that facilitates the gradual integration of major foreign investments.

In this regard, an analysis of Law **No. 13-09** (*MEM, 2010*) on renewable energies, enacted in 2010, reveals that Morocco has adopted a basic legislative framework aimed at maintaining sustainable energy development through the use of renewable sources, including solar, wind, biomass, geothermal and wave energy. The law clearly outlines its strategic objectives, one of which is to encourage the production of export-oriented electricity, as a proactive liberalization tool for the sector, with a primary focus on ensuring security of supply, universal access to energy, enhancing economic competitiveness, and reducing greenhouse gas emissions. In this regard, **Article 24** stipulates that: **"The electrical energy produced by the exploiter shall be directed to one or more facilities for the production of electrical energy from renewable energy**

sources for the national market and for export. Article 27 also specifies the following: **"An operator of a facility that produces electricity from renewable energy sources, connected to the national grid of medium-voltage, high-voltage or very high voltage, may export the electricity produced after technical consultation of the route of the national transmission electrical grid."**

To achieve these objectives, Law No. 40-19 (*MEM,2023*) of 2020 has extended this strategy to small-scale enterprises, not only simplifying administrative procedures, legitimizing the implementation of pilot projects, but also stimulating the development of innovative procedures. This legislative development, even if it appears on the surface to encourage innovative initiatives, is, in reality, a response to the pressures and practical requirements of foreign investors, which contributes to the sector's openness to international financing and allows the participation of actors with vast experience and financial capabilities in the advanced stages of the green hydrogen value chain, while ensuring operational security and reliability and enhancing Morocco's integration into international markets, thus achieving the consolidation of exports as a priority for the renewable energy sector in Morocco.

In parallel with Law No. 13-09 (2010) and 40-19 (2020), the analysis of Law **No. 48-15** (MEM, 2016**),** which regulates the liberalized electricity market, shows that Morocco aims to promote fair competition, the integration of renewable energies, and the equitable coordination of access for consumers and producers of energy. At the heart of this restructure, The National Electricity Regulatory Authority (ANRE) shall regulate the technical grid rules for investment programs that will extend for many years, thereby defining the definitions of network use, ensuring compliance with the Codes of Conduct, as well as adjudicating disputes related to network connectivity. **Article 18** provides as follows **‘‘National Electricity Regulatory Authority (ANRE) is obliged to ensure the correct operation of the liberalized electricity market and regulate the access of self-producers to the national transmission grid,’’** whereas **Article 19** gives it the potential **“to propose draft legislative or regulatory texts or publish information aiming at guiding stakeholders in the electricity sector, including consumers.” ".** Thanks to this framework, the law in question provides a guarantee for the foreign investor, enabling the establishment of transparent conditions that ensure equal access to the local market and competition**,** while ensuring a balanced regulation of the electricity market, supporting innovation, and protecting the rights of consumers.

From this perspective**, the Energy Efficiency Law No**. **47-09** (*MEM,2011*)**,** which was enacted in 2011, indicate Morocco's rapid response to the steady increase in energy demand, due to advances in the economic and social sectors.

Regional Studies Journal, Vol. 20, No.67, January 2026 (123-156)
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The in-depth analysis also indicates that this law has developed the concept of energy efficiency as a strategic tool to minimize energy waste in order to enhance the competitiveness of economic operations and ensure sustainable development.

This provides foreign investors with clear legislative guarantees, a rigorous institutional regulatory framework for energy performance standards, and urge the commitment to conduct audits involving equipment, buildings, and vehicles to ensure the optimal utilization of energy resources, and to adopt high-quality economical technologies to reduce operational risks for foreign investors and ensure the transparency of the applicable standards. In this context, **Article 12** demands **''that establishments and enterprises whose energy use surpasses a regulatory limit should conduct energy emission checks that are defaulted and regular,''** while **Article 2** provides **that "all energy-using appliances and facilities that are put on sale on the national market must possess minimum energy consumption standards and be labelled in accordance with consumption norms.''.**

Such steps are part of a more complex strategy that involves on the one hand rationalizing the consumption of traditional energy and, on the other hand, calls for preparing the country to integrate innovative solutions, by adopting high-efficiency technologies and opening new horizons for partnerships with foreign investments, especially in the field of green hydrogen, while at the same time helping to increase the potential of renewables and improve Sustainability of industrial and economic projects, providing a declared future market and a consistent environment for the development of an energy-efficient and export-oriented economy.

- ✓ **Key findings:** The results of our analysis of the legal frameworks confirms that Moroccan lawmakers aimed to establish a coherent and well-thought-out system, starting with the liberalization of production, moving on to market regulation, and ending with the creation of local demand geared towards exports. They even sought to equip the Moroccan economy, from production to consumption, to facilitate the absorption of foreign capital and technology. On the one hand, the legal framework ensures unparalleled flexibility in the drafting of various long-term contracts in favour of foreign investors, providing them with the opportunity to control the local market, which enables them to exploit it by virtue of their production capacity. This conclusion is supported by the leniency of legislative texts in strictly defining legal liability or compensation in future incidents, or the obligation to protect critical infrastructure from cyber-attacks, or at least to ensure parliamentary oversight of strategic partnerships. This enabling legislative policy of making investment attraction one of the fundamental pillars relied upon to enhance Morocco's attractiveness as a regional destination for investment in clean energy.

1.1.1 Strategic Framework of Morocco's Green Hydrogen policy

Morocco has adopted a set of ambitious national strategies to achieve its energy transition and join the global green hydrogen market. The analysis shows that Moroccan policy has formulated **the National Energy Efficiency Strategy 2030** (*MEM,2020*), as one of the main pillars of Morocco's energy model that attracts foreign investment. It stems from an initiative launched by His Majesty King Mohammed VI in March 2009, which placed energy efficiency at the same level as renewable energies as a national priority. This plan is in line with the national energy goals of increasing security of supply and universal access to affordable energy, demand control, and environmental preservation, as key and crucial factors in boosting the confidence of international investors.

In terms of investment, the results indicate that the main goal of the National Energy Efficiency Strategy is to provide 20% of energy by 2030, based on a mechanism to release a pre-prepared energy surplus directed at the productive sectors. To this end, the plan aims to achieve four endeavors that provide investors with a clear market for future demand for their products:

- Transportation, which is estimated at least 38% of total consumption, and the goal is to achieve a 24% reduction by 2030, as the reduction in the consumption of conventional fuels will create an energy vacuum, which will enhance the consumption of green fuels produced through foreign projects that will ensure a stable market for investing companies.
- The construction sector, which contributes a third of energy consumption with a 14% reduction. This will help create a consumer base ready for the transition to hydrogen heating, thereby stimulating the demand for products from foreign companies, and transforming the residential sector into a market where imported technologies are active.
- Industry, which accounts for 21%, with a target of a reduction of 22%. This is to ensure the trust of foreign investors, as reducing the consumption of heavy industries such as cement and phosphate will create an urgent need for green hydrogen that foreign projects are working on.
- The agriculture and public lighting sectors, which account for 8% of consumption, with a reduction of up to 13%. The strategy's focus on agriculture in particular will broaden the base of future demand for hydrogen**,** as farmers will resort to abandoning irrigation pumps and agricultural machinery to work with green hydrogen**,** then injecting more earnings into the accounts of foreign companies investing in Morocco.

On the other hand, the implementation of the strategy is based on five main directions:

Regional Studies Journal, Vol. 20, No.67, January 2026 (123-156)
Print ISSN: 1813-4610 Online ISSN: 2664-2948

A. Consideration of the principles of energy efficiency in each new investment:
This means gradual enforcement of energy efficiency laws, standards and standards; dissemination of innovative research and projects; equitable risk management; strict control over the entry of energy efficient equipment into the national territory. This will help create a regulatory environment conducive to the technical models of multinational corporations.

B. Ensuring energy efficiency in all government expenditures and state-supported initiatives:
This approach aims to integrate energy efficiency requirements into all public procurement, making them widely applicable in government services, public institutions and territorial communities as a model for effective management practices**,** as well as encouraging public-private partnerships. The state will thus become an official sponsor and an intermediary development actor for the imposition of green technologies through the Public Procurement Authority**,** thereby raising the profits of international projects.

C. Regulation and professionalization of the energy saving industry:
This approach aims to strengthen the institutional framework, encourage energy services companies (ESCOs) and vocational training such as training institutes in the field of renewable energy and energy efficiency (IFMEREE), stimulate research and development (R&D), encourage innovation through initiatives such as the Green Energy Park, and establish regulatory control mechanisms. This pragmatic approach will be an effective tool for encouraging foreign investments. It will contribute to unifying the local market according to pure international standards**,** and creating a qualified human base according to foreign regulations, which creates qualifications ready to absorb advanced technology.

In this context, a gradual mechanism has been adopted to achieve this ambitious strategy. The first years will focus on low-cost solutions that achieve quick returns on investment (so-called quick gains), which will enhance the position of multinational companies in the local market, while the more costly or demanding solutions will be planned in the medium and long term to allow the creation of the necessary conditions and resources, and to take advantage of lower technological costs, as a mechanism for the Moroccan economy to be commensurate with the needs and interests of the markets International.

According to this strategy, the results reveal that Morocco has relied on the formulation **of the Green Hydrogen Roadmap** (*Mem,2020*) the main objectives of which are to advance the Kingdom's role as a primary platform for carbon processing on behalf of industrialized countries and mainly for the benefit of European economies.

It was outlined according to three stages:

- **Short term (2020-2030):** Dedicated to supplying raw materials for domestic consumption, like green ammonia in the fertilizer industry, and the export of green hydrogen fuel to countries that aim to decarbonize, through pilot projects funded by the public and private sectors. This stage serves as a market test aimed at minimizing the risks that foreign investors may face, the state bears to absorb risks before privatizing profits.
- **Medium Term (2030-2040):** With lower costs and the definition of ecosystems, economically viable green hydrogen and ammonia projects will become possible. Moreover, the export of synthetic liquid fuels (white oil, petroleum, diesel) will become a very important opportunity, as it will be possible to use green hydrogen as a form of energy and fuel storage in maritime and air transport. Morocco will become a major source of green energy carriers, much like its role in phosphates, and this phase will be characterized by the privatization of the sector.
- **Long-term (2040-2050 onwards):** This is the period in which domestic production of green hydrogen is supposed to increase significantly to meet the needs of domestic industry (heating), housing, urban mobility, and air transport, with a particular focus on heavy ground transportation and the aerospace industry. This will increase the chances of stabilizing foreign projects and increasing their productivity, and in turn, increasing the percentage of Moroccan consumption.

From another perspective, we conclude that the map relied on three important foundations:

- **Technology**: The mission is to reduce the costs of establishing Moroccan and regional research and innovation facilities, as well as to ensure industrial integration at the local level.
- **Investment and supply:** This requires the establishment of an industrial cluster, the development of a detailed plan for the provision of infrastructure, and the necessary financing for the construction and equipment sector.
- **Markets and demand:** Focus on adopting an action plan focused on the export of green molecules, developing a plan for storage, and promotion in local markets.

In this spirit, on October 14, 2022, the government adopted the "**New Investment Plan**" as a step to strengthen the Green Hydrogen Roadmap at the financing and regulatory levels (*AMDIE, 2022*). with the aim of attracting private investment, by granting tax and customs benefits, encouraging public-private partnerships, and ensuring the long-term sustainability of these mega projects, as the state will provide government guarantees and soft loans, in addition to long-term energy purchase contracts at attractive prices.

It is clear that this plan will be achieved according to three main axes that will increase the opportunities to attract investments, so the results are shown as follows:

- **First axis:** Four investment support mechanisms will be provided to cover different types of projects and stakeholders. The main device applies to foreign investment projects, especially those with a value of 50 million Moroccan dirhams (MDH) to more than 150 million Moroccan dirhams. This system also includes co-remuneration (creating stable job opportunities, achieving gender equality and sustainable enterprises, and local integration), and regional remuneration (10% or 15% depending on the region's classification, with exceptions). such as tourism, digital technology and industry), and a sectoral bonus of 5% for strategic sectors, namely tourism, digital technology and industry. This reflects Morocco's efforts to provide a fertile base for attracting foreign investment.
- **The second axis:** is related to improving the business environment through seven high-priority programs: simplifying procedures, improving logistics, customizing training services, diversifying the financing strategy, facilitating access to land and green energy, and promoting research and development and innovative technologies, according to the needs of investors.
- **The third axis:** based on unified and local investment governance. This includes the establishment of a Ministry of Investment, a National Investment Committee (chaired by the Prime Minister and the Moroccan Agency for the Development of Investments and Exports (AMDIE), which is in charge of receiving investment agreements, nominating strategic projects, and supporting regional investment centers (CRIs). In this context, the principle of decentralization in decision-making is highlighted: investment projects worth 250 million dirhams, which will often be foreign, will be managed at the central level to speed up their rollout, while investments worth less than 250 million dirhams, which are mostly local, will be managed at the regional level. The future goals are to increase total investments to 550 billion dirhams by 2026.

✓ **Key findings:**

From all this, it can be concluded that the whole strategic framework implementation mechanism clearly encourages the attraction of investments to Morocco, while adjusting all mechanisms to align with export priorities, and we can summarize this policy in three main results:

- **Adopting a risk-return allocation model**, so that the state will bear most of the infrastructure costs and early risks, which reduces the risks that may threaten foreign investors and increases the chance of obtaining profits in their favor.
- **Strategic exploitation of public assets**, so that public assets such as land and water are used as tractors in commissions, which can promote the conclusion of multiple international partnerships and immediate practical use of natural resources.

- **Ensuring long-term investment stability**, as concluding long-term partnerships and agreements with investors will ensure the continuity of projects and the development of energy infrastructure

Accordingly, the inevitable outcome of these policies is to consolidate Morocco's role as a supplier of raw materials and an importer of technology and value-added, which will help strengthen its position as a reliable partner in the global clean energy supply chains.

2.**Multidimensional opportunities of Moroccan green hydrogen strategy**

Morocco's transition to green hydrogen production represents a multidimensional opportunity. Accordingly, through the analysis of various aspects, it becomes clear that these opportunities have unprecedented dimensions, so that these benefits are mainly directed at foreign companies, especially Europe. The results thus provide a model of the hidden opportunities of the green hydrogen project, but also shed light on the true structure of its benefit distribution, which is a knowledge addition to this research.

2.1 Socio-economic and Geopolitical Dimensions

a.Socio-economic opportunities

The results showed that the demand for green hydrogen and its derivatives at the national and external levels in the medium and long term has increased significantly. External demand is expected to double faster than domestic demand due to the growth of renewable energy production capacity. **Table 1** shows the quantitative estimates related to the demand for green hydrogen and its derivatives, and its related capacities from renewable energy sources, in addition to the volume of cumulative investments expected in the horizon of 2050 and 2030.

Table 1: National and export expectations of green hydrogen and its derivatives (2050-2030).

Categories	Years	Demand for Hydrogen (TWh)	Renewable Energy Capacity (GW)	Global demand (TWh)	Share of Global Demand (%)	Estimated cumulative investments (Moroccan dirhams)
Export Demand	2030	10	6	13.9	71.9	90
	2050	115	60	153.9	74.7	760
National Demand	2030	4	2	13.9	28.8	90
	2050	40	20	153.9	25.9	760

Share of global demand calculated: Share (%) = National or Export Demand / Global Demand *100

Source: Author's calculating based on Morocco's National Roadmap of green Hydrogen (Mem,2020)

Regional Studies Journal, Vol. 20, No.67, January 2026 (123-156)
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The data presented in the table (1) indicate a significant increase in national and export demand for green hydrogen over the next three decades, and export-oriented demand is expected to dominate by about three-quarters of global demand by 2050. In addition, cumulative investments are expected to reach about 90 billion dirhams in 2030 to reach 760 billion dirhams in 2050, highlighting the volume of investments required in renewable energies to serve the interests of foreign investors and consolidate Morocco's role as a strategic supplier at the international level.

Alongside these high export opportunities, the study shows more important economic dimensions of transforming the Kingdom's economic stability into an effective financial asset. Diversification of the economy and enhanced energy security are direct reasons for the improvement of the Kingdom's credit rating, directly reducing the risk premium that is a key demand for foreign investors. In this regard, Stanford & Poor's (S&P) decision to reclassify Morocco in the investment grade of "BBB- / A-3" comes with an emphasis on its future stability. In the same vein, the BMCE Capital Global Research report (February 2025) confirmed a revision in the risk premium for Moroccan markets by up to 6.5 percent (7newsMorocco, 2025), showing a significant reduction in investment-related risks, making investing in green hydrogen projects more profitable and attractive in the long term, and thus classifying Morocco as a safe green asset that attracts pension funds and large low-end financing Cost.

In this regard, the analysis shows that the economic results extend to Morocco becoming a pivotal intermediary for trading African carbon credits in partnership with the European Union, especially through the development of a regional carbon market in North and West Africa, as this opportunity enables foreign investments to obtain high-quality carbon credits at competitive prices, which would lead to the creation of a new financial market with common standards, generating multi-source financial flows and attract the largest number of global investments and investment funds. In this regard, on March 11, 2024, the government launched **the Moroccan Green Hydrogen Offering** (*MEM, 2024*), which provided investors with a coherent and attractive system that encompasses the entire value chain, including the production of electricity from renewable sources and the conversion of hydrogen into high derivatives that can be sold in national and international markets. The state has already allocated one million hectares of its government land, of which 300,000 hectares are ready for use, and has also worked on the construction of infrastructure, such as ports, electric power grids, and hydrogen pipelines. The project received a boost on March 6, 2025, when five investors and companies were selected to implement six mega projects: the Ornx Green Hydrogen joint venture (US-Spanish-German), the green ammonia production companies Taqa (UAE) and Cepsa (Spain), the Saudi green steel giant

ACWA Power, as well as the Chinese consortium of United Energy Group and China Three Gorges in collaboration with Nareva Moroccan (Al Mada Group) (Africa Energy Portal, 2025, greentimes, 2025).

b. Geopolitical opportunities

On the geopolitical scale, Morocco's opportunity to become an African standards center for green hydrogen is evident by unifying technical specifications and protocols at the continental level. Morocco will provide an important geopolitical service to the foreign partner, thereby ensuring a unified and smooth market, and contributing to reducing the costs of adaptation to different African regimes. In the same context, Morocco's huge investments in the field of logistics, such as the port of "Tanger Med", which is capable of handling approximately 10,241,392 containers in 2024 with an estimated growth of 18.8 percent, provide an opportunity to make Morocco a logistical link between Africa and Europe in particular (*Tangermedport, 2024*), providing Europeans with an opportunity to diversify their energy supply sources, benefit from low costs and deal with a single reliable logistics node.

In the same analytical framework, geopolitical opportunities go beyond the structure of relations within the African Union, providing Morocco with the opportunity to lead an energy agenda through a comprehensive African initiative that enables Morocco to neutralize geopolitical opponents, especially on the issue of the Moroccan Sahara, thus becoming a country with a strong economic system and ambitious projects that opponents are unable to oppose. Morocco's production is expected to reach between 13.9TWh and 30.1 TWh by 2030 (*Res4africa, 2022*), with an initial benefit for the European market, through multiple projects such as the French project called "Chbika", which is tasked with producing 200,000 tons of green ammonia per year using 1GW of renewable energy (the electricityhub, 2024) This will give both Morocco and foreign countries continental legitimacy based on the service of an entire continent.

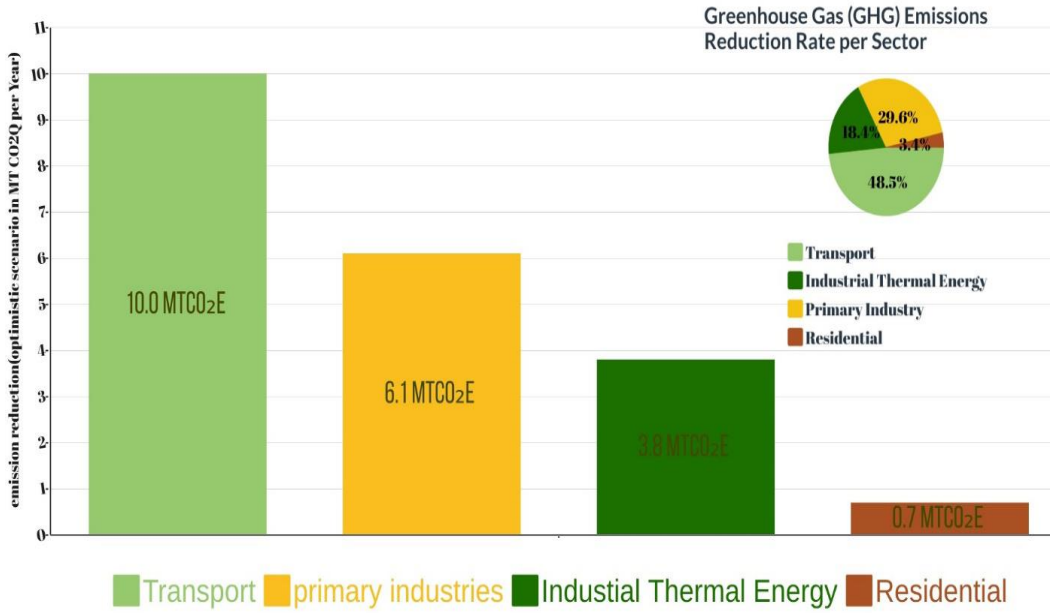
2.1.1 Technological and environmental dimensions

a. Environmental opportunities :

In parallel with the social, economic and geopolitical opportunities, the results show that the green hydrogen strategy will contribute to the realization of vital environmental benefits, first, the quantitative reduction of greenhouse gas emissions. Figure 2 shows that Morocco's green hydrogen sector will achieve a cumulative reduction in greenhouse gas emissions by 20.6 MtCO2e/year by 2050.It is also clear that the transport sector will be the top contributor with 48.5 per cent of the total reduction in 2050. In contrast, the contribution of green hydrogen to the primary industry sector will reach 29.6%. This is followed by the thermal energy sector with 18.4%. The residential sector remains a secondary contributor of 3.4%. Together, all of these sectors will achieve 99% of the total

reduction by 2050 in the positive scenario (*MEM, 2020*). This will directly affect air quality, thus reducing the intensity of polluting particles such as fine particulate matter (PM2.5), nitrogen oxides (NOx) and sulfur dioxide (SO2), which cause respiratory diseases, heart diseases, and cancers, in addition to improving the productivity of agricultural crops, and reducing acid rain, which will preserve the soil and increase productivity.

Figure. 2 Sectoral reduction of greenhouse gas emissions by 2050 (CO2eq/year and percentage)



Source: Author's analysis using Morocco's National Roadmap for green Hydrogen (Mem,2020)

Secondly, relying on green hydrogen will help meet the challenge of the water scarcity, through the integration of water and energy, Morocco will be able to address the structural water stress, which is represented in the decline in the average per capita renewable water resources from 2,560 cubic meters in 1960 to approximately 620 cubic meters 2020(TEL QUEL, 2024). In this context, analysis confirm that green hydrogen produced from renewable energies will help in Operation of large desalination plants. Contributing to a transformative role by integrating desalination, which has long been a traditional energy-consuming process in a closed green loop (**renewable energy →green hydrogen → desalination →supporting agriculture and industry)** which can be summarized as follows:

E Solar/Wind → **E** Electric → **H2** Green →**O2** → (**E** Thermal/Electric → **D** Desalination → **H2O**fresh water → (**A** Agriculture +**I** Industry) → **R** reuse → **Green Sustainability**

In the same context, this sustainable circular model will promote the treatment of water stress in the southern and eastern regions of the Kingdom of Morocco, and will create a domestic market that encourages foreign investment to implement large-scale projects.

Third, the results reveal that the opportunities extend to blue carbon management, where the green hydrogen project will become a key driver of a comprehensive environmental transition. The combination of desalination plants used to produce green hydrogen with mangroves tree on the southern coast of the Kingdom of Morocco between the cities of Dakhla and Laayoune will enable carbon storage to be as high as eight tons of carbon dioxide equivalent, four times the capacity of tropical forests, and the possibility of storing 688 million tons of carbon within 40 years (ClearPath, 2024). Instead of draining the water of desalination process, it will be directed directly to water these trees, avoiding damage to the marine ecosystem and fighting desertification and coastal erosion. In the same context, this opportunity represents the possibility for the foreign investor to convert the carbon stored from these trees into financial revenues through the carbon offsets market, where the price of one-ton ranges between 13 USD and 40 USD, transforming them from mere investor in an industrial facility for the production of clean energy to major actor in achieving sustainable development (BeZero, 2024; Cloverly, 2025).

a. Technological opportunities

Besides these environmental advantages, Morocco has a promising future at the technological level. The analysis reveals that Morocco could be turned into a "living laboratory" for the development of a new generation of specialized equipment. The Green H2A platform, developed by the Solar and Renewable Energy Research Institute (IRESEN), the Mohammed VI Multidisciplinary University (UM6P) and the Sharif Office of Phosphates (OCP), is an important technological platform for conducting research and pilot projects (OCP, 2021). One of the most important projects in this framework is the green ammonia pilot project platform in partnership with the Dutch company Proton Ventures.in addition to that, the partnership between the OCP and the French energy company Engie, which amounts to €4 billion and could rise to €15-17 billion (Reuters, 2025), in collaboration with the Californian startup Peregrine Hydrogen (Chemanalyst, 2025), could lead to the possibility of developing a desert electrolyzer specifically designed to withstand extreme conditions related to high temperature, dust and rapid fluctuations of energy production. By adopting these

technologies, the giants' companies will have thin structures to improve their durability and efficiency.

This study also illustrates a technological opportunity to "develop a test platform for advanced storage and transportation technologies such as advanced porous materials or liquid organic hydrogen carriers (LOHC). Based on that, global shipping companies will have the opportunity to obtain real performance data that will contribute to reducing their various technical and commercial risks to include advanced modes of transportation. This is exemplified by HIF Global, which plans to produce e-methanol destined for use in air, sea and land transport based on green hydrogen and recycled carbon dioxide (Hifglobal, 2024).

In addition, the analysis identifies an opportunity for Morocco to develop a smart platform based on artificial intelligence algorithms that integrates accurate weather forecasts with dynamic demand analysis in the European market. In this sense, only predictive models, such as RNN-GRU networks, have shown the ability to reduce hydrogen production costs by 15% to 20% compared to traditional methods (Allan John Butler, Akhtar Kalam, 2025). Furthermore, this technology could enable foreign investors in Morocco to evolve from being energy producers to becoming energy traders (Saxena, 2024).

3. The Fundamental Challenges of Green Hydrogen in Morocco: The Cost of Dependency under a Neo-colonial Extractive System

Through the analysis of all discoveries, it becomes clear that the most appropriate explanation for these results is manifested in the real test that lies in the structural contradictions inherent in the green hydrogen project, which turns it from an ambitious strategic goal to a mere rhetorical tool that masks the erosion of the Kingdom's energy sovereignty, which supports the hypothesis of the study. It highlights the cost of Morocco's policy, which seeks to attract various types of investments in this field, with a clear marginalization of the promotion of the domestic energy economy. Since the beginning of the 21st century, Morocco has found itself torn between two opposing forces: on the one hand, energy demand is growing steadily as a result of economic development, agricultural exports, and increasing trade volume at the continental level. On the other hand, the country remains structurally fragile, importing nearly 90% of its energy, mainly in the form of fossil fuels. For this reason, Morocco has created a narrative that describes it as a pioneer in renewable energy and, more recently, in the field of green hydrogen. But at the heart of this discourse about modernization and environmental transformation lies a deeper truth: energy extraction is tied to a neo-colonial relationship with Europe and foreign capital.

a. Economic and financial challenges:

Moving to the economic and financial issues, the financial dimension of the constraints facing Morocco is reflected in the ambitious roadmap, which reflects

the number of investments needed to achieve this project. Consistent with the findings of the study (Caillard et al., 2024), the creation of the entire green hydrogen value chain, including renewable energy generation, a substation and export infrastructure, requires massive investments beyond national capacities. In this regard, national projections indicate that in the next five years (2030), Morocco will need to mobilize between 143 billion dirhams (according to optimistic assumptions) and approximately 1024 billion dirhams (94 billion euros) per year. These estimates encompass not only the direct expenditures of solar, wind and electrolytic farms, but also the indirect costs of desalination plants, ammonia processing facilities, synthetic fuel lines, strengthening electrical grids, and port modernization. Morocco's ability to raise these funds is thus highly dependent on foreign capital and foreign investors, with a particular focus on an export-based strategy.

Furthermore, this export strategy which was implemented and enabled by the legal and strategic framework as shown in the results, reflects historical trends dating back to the 1980s, when structural adjustment programs were implemented. During this period, the IMF's decision led to a policy of liberalization of the energy sector, which led to the transformation of energy security into a tool for the accumulation of foreign capital. Moreover, this trend is reinforced by the growing volume of public debt, which reached record levels of 83.6% of GDP in 2022 according to the 2023 report of the High Commission for Planning (HCP), as well as the very high rate of foreign direct investment from European markets.

A clear illustration of this dynamic is the energy cooperation agreement signed between Morocco and Germany in 2012, in which Morocco used the expertise of the German Agency for International Cooperation (GIZ) to formulate policies that encourage export-oriented, as part of the goals set to increase energy contributions to energy production to 52% by 2030(GIZ, 2020).

In practical terms, the X links project exemplifies this approach. It is a British company leading the development of a project along 150,000 hectares of public land in the province of Tan Tan to create a solar and wind park linked to the UK via four 3,800km of submarine cables. Although this €23 billion project will provide the UK with 8% by 2030, it will provide only limited direct benefits to local communities (*Xlinks,2024*).

b. Environmental and Technological Challenges:

To go into more details about environmental challenges, the Guelmim-Oued Noun region is an example of these contradictions, as it has been defined as a vital energy hub despite the water stress it suffers from and the drought that makes it unfit for hydrogen production. This is in stark contrast to previous studies that

Regional Studies Journal, Vol. 20, No.67, January 2026 (123-156)
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have confirmed that southern Morocco will contribute significantly to the production of green hydrogen from renewable sources (El-Maaroufi et al., 2025).

In the period between 2020-2021, an additional 160,000 hectares of public land were re-allocated, 98% of which was directed to energy projects, especially green hydrogen and ammonia, according to the report of the Ministry of Economy and Finance for the year2022-2023, such as Total Eren, which acquired 170,000 hectares of land for the construction of green hydrogen and ammonia facilities with an investment of more than 9 billion euros(LE Desk, 2022), along with CWP global, which is working on a project with a capacity of 15 GWh of green hydrogen (Ammonia Energy, 2022). These projects highlighted the fact that there are stark disparities between the flow of foreign capital and the marginalization of the local population, as the regional GDP did not exceed 17 254 million dirhams in 2019, highlighting the negative development impact of these investments (*HCP, 2022*). To develop projects on these lands, investors have ignored the presence of residents in these areas, exacerbating the social and environmental crisis. For example, the Israeli company Mehadrin has planted 455 hectares of avocado trees in the Guelmim region, where it planned to produce 10,000 tons, while the demand for water to produce green hydrogen is expected to increase in these drought-prone areas, which will exceed 95 million cubic meters by 2050 (Globes, 2021).

To alleviate this worsening problem, the state has resorted to desalination, which requires very high amounts of energy, leaving harmful salt brine and multiple environmental burdens in the future. In this regard, although the results suggest that mangroves could help address challenges related to desalination and blue carbon absorption and storage, their limited natural availability, and the absence of national data, in addition to industrial pollution and urbanization, make effective planning extremely difficult. In addition to that, the total lack of a national framework for measuring blue carbon and the significant increase in technical processing costs makes the integration of mangroves and desalination an operational challenge that requires multiple investments and foreign expertise to measure, recycle and monitor blue carbon stocks, which will transform these trees again from a living ecosystem into a tradable tool in global markets for the benefit of multinational corporations.

There is also a fundamental paradox in Morocco's energy transition model epitomized in technological challenges: while AI is presented as a tool for enhancing efficiency, it is becoming a vector of dependency in practice. Morocco's lack of local companies in this field makes it entirely reliant on foreign

firms, leading to a ceding of digital sovereignty to global market powers that control the algorithms for weather, demand, and energy price data, thereby serving European interests as a priority. This enshrines a new form of technological dependence that threatens energy sovereignty.

c. Key Challenges in Governance and Employment:

In terms of job opportunities, these projects appear to provide more jobs, but the data prove otherwise. For example, the Noor solar power plant in the city of Ouarzazate shows that job opportunities are temporary and limited to the construction period, and that jobs are usually filled by foreign experts to work in official technical positions (ALJAZEERA, 2022). The situation is further deteriorating in the Guelmim Oued Noun region, where the unemployment rate is 24.3% in urban areas and 8.2% in rural areas (*HCP, 2022*). As a result, local residents may end up being bystanders to an extractive policy that threatens their livelihoods.

Alongside the employment crisis, a lack of transparency is a key problem facing development in the region. Negotiations between political and economic elites take place behind closed doors, effectively excluding the participation of the local population. A prime example is the Total Eren project, which has been officially announced, but is still shrouded in official silence (Le Desk, 2023). The Minister of Energy Transition and Sustainable Development, Dr. Leila Ben Ali, admitted in an interview with Telquel magazine in 2022 that she knew nothing about the details of this project. To justify this, companies invoke so-called "trade secrecy" to avoid disclosing information, while regional authorities focus on investments estimated to create jobs without opening a public debate.

d. Geopolitical and Diplomatic Implications:

In addition to these internal governance and employment concerns, Morocco is also exacerbating its geopolitical dependence by aligning its energy goals with those of Europe. It is employing its energy resources to strengthen its position on sensitive issues, particularly the issue of the Moroccan Sahara. In this sense, the fisheries agreements with the European Union of October 25, 2018 are supposed to legitimize territorial sovereignty. This is clearly reflected in the statements of Nasser Bourita, Minister of Foreign Affairs and International Cooperation, after the signing of the fisheries' agreement: "The negotiations on the renewal of the fishing partnership agreement [...] This is a new step towards strengthening Morocco's role as a key negotiator in international conventions related to the Sahara." Similarly, the normalization with Israel in December 2020, mediated by

Regional Studies Journal, Vol. 20, No.67, January 2026 (123-156)
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the United States of America, has strengthened cooperation in the field of energy. This includes an agreement between Morocco's Gaia Energy and Israel's H2Pro to import and install the world's most efficient electrolyzer to produce large quantities of green hydrogen, and this alliance comes with increased military coordination between the two sides. These trends thus further underscore the intersection between extractive economic policy and environmental diplomatic normalization, where energy resources are used as tools of geopolitical power.

In conclusion, the discussion of all these results highlights the fact that the green hydrogen project is a true embodiment of neoliberal logic. Transforming the Moroccan economy into an export-oriented economy, reinforcing the model of cost nationalization (the state bears the burden of environmental, social and legal costs) and privatizing profits for the benefit of foreign investors. Rather than making Morocco an economically independent country, these projects make it a dependent state subject to the global hierarchy by exporting its solar, wind, and hydro power are all at the lowest prices, while high-value resources such as technology and knowledge remain the preserve of Western countries. In this way, a new form of neocolonial extractivism is embodied, hidden by the discourses of energy transition (*Green Peace MENA, 2025*).

4.Limits of the Study and Future Prospects

As already mentioned, Morocco's energy transition faces critical issues, such as the continuation of neocolonial extractive activities, and the increasing dependence on foreign markets and investors. In this regard, this study is subject to several methodological and fundamental limitations that have directly affected the depth and comprehensiveness of the analysis. First, the study was based primarily on strategic documents and legal frameworks that do not reflect the full operational details of green hydrogen projects, and secondly, detailed official data of partnerships and contracts concluded with foreign investors remain difficult to access, due to the confidentiality of the information. Third, the rapid pace at which the project is proceeding limits the ability to respond to changing outcomes and new data. In order to overcome these constraints, it is necessary to identify future research paths to guide this ambitious strategic project:

a. Developing analytical models of sovereign contracts to ensure financial independence

There is an urgent need for in-depth studies comparing international contracts in the green hydrogen sector, and developing an analytical framework to measure the extent to which these contracts guarantee energy sovereignty, with a focus on an in-depth and critical analysis of the distribution of benefits and challenges.

b. Comparative studies related to the governance

Future studies should focus on making comparisons of participatory governance mechanisms in the energy and green hydrogen sector in particular, taking into account the impact of transparency in contracts on social justice and local development.

c. Research about regional cooperation networks in the field of green hydrogen

The lack of regional integration has led to high costs that have deepened the negative competition between the countries of the region, as the emergence of Egypt, Mauritania, and Algeria deepens conflict, increases dependence on the European market, and weakens local economies. Therefore, future research should study the prospects of regional integration between the countries of the South, in addition to deepening research on mechanisms to enhance negotiating power and achieve energy sovereignty at the African level in particular.

d. Research related to social effects

The research lacks multidisciplinary field studies that measure the real social impacts of the green hydrogen project, at the functional and developmental levels, in addition to research analyzing the prospects and possibilities of the development of local industries and integrated water resources management models in drought-threatened areas.

e. Studies of Technology Transfer Mechanisms

Research is recommended to ensure real transfer of technology and knowledge through international partnerships such as the GREEN H2A platform, as well as proposals related to mechanisms linking the export process to technology transfer.

Conclusion

This study addressed a fundamental problem related to Morocco's green hydrogen strategy, which oscillates between Morocco's ambition to achieve energy sovereignty on the one hand, and the policy of attracting foreign investments that is oriented towards exports, on the other. The importance of the research lies in revealing this stark contradiction between the official discourse in

Regional Studies Journal, Vol. 20, No.67, January 2026 (123-156)
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support of sovereignty and the reality based on the production of relations of dependency within the framework of a neo-colonialist extractive system. The results revealed that the legal and strategic framework is mainly prepared to serve the interests of foreign investors, in a way that facilitates them to integrate into the local market and direct production specifically towards export rather than strengthening the Moroccan market. The analysis also highlighted that multidimensional opportunities are unfairly distributed, as enjoyed by foreign companies and European markets, while domestic benefits are very limited and temporary, positioning Morocco as a conduit for achieving external interests and a gateway to Africa. These findings have entrenched structural dependence, which deepens the multiple challenges of economic deficits and social, environmental, and political constraints.

This study contributed to shedding light on the hidden mechanisms that make Moroccan ambition a tool for reproducing a new neocolonial model, which calls for effective policies to reorient strategies towards a promising sovereign development model, and providing a new methodological process that combines the analysis of legal and strategic frameworks and linking them to the theoretical dimensions of colonialism geopolitics. This research acknowledges limitations, including uncertainties about the long-term effects of this policy on the Moroccan economy, the lack of detailed quantitative data on the value added between foreign companies and the Moroccan economy, and the limited analysis of the political networks that control decision-making and the distribution of privileges. Hence, future research must focus on a precise quantitative analysis of the real distribution of added value, the extent to which the green hydrogen strategy is related to sensitive political files related to the Moroccan Sahara, and the research of mechanisms for consolidating transparent decentralized negotiations that ensure the participation of local communities and the protection of the environment.

In conclusion, green hydrogen remains an exceptional strategic opportunity for Morocco despite its structural challenges. The realization of this ambition also depends on a radical transformation that establishes a just sovereign model based on balancing integration into the global economy, with adherence to the national interest rather than submitting to an extractive subsidiary model that exploits the country's wealth, which would set a new standard in emerging global economies enabling developing countries to leverage their wealth not only to serve the national market, but also to build a strong and innovative energy economy with a vision for the future.

References:

Adraoui, I., & Jaafar, B. (2024). Sustainable management of water resources and assessment of the vulnerability of Moroccan oases to climate change. *Environmental Science and Pollution Research*, *31*(12), 17981–17993. https://doi.org/10.1007/s11356-023-25498-4

Africa Energy Portal. (2018, June 25). *TotalEnergies, Morocco Team Up for Green Hydrogen Breakthrough*. Africa Energy Portal. https://africa-energy-portal.org/news/totalenergies-morocco-team-green-hydrogen-breakthrough

Africa Energy Portal. (2025). *Morocco Approves $32.5B Green Hydrogen Mega Projects | Africa Energy Portal*. https://africa-energy-portal.org/news/morocco-approves-325b-green-hydrogen-mega-projects

Alarabiya. (n.d.). Morocco: Tangier Med port revenues jump 18.3% in first quarter. Link.

Ali, S., Dey, G., Nuong, N. H. K., Rahman, A., Wang, L.-C., Sukul, U., Das, K., Sharma, R. K., Wang, S.-L., & Chen, C. Y. (2025). Carbon sequestration in mangrove ecosystems: Sources, transportation pathways, influencing factors, and its role in the carbon budget. *Earth-Science Reviews*, *269*, 105184. https://doi.org/10.1016/j.earscirev.2025.105184

Aloqini, H. (2025). Green hydrogen: a leading option for green energy: Morocco as a model. QSpace. http://qspace.qu.edu.qa/handle/10576/62540

Alreemi, A. (2022). With the energy crisis continuing, could Morocco's desert light up Britain?. Aljazeera. Net. https://www.aljazeera.net/ebusiness/2022/10/12/%d9%85%d8%b9-%d8%a7%d8%b3%d8%aa%d9%85%d8%b1%d8%a7%d8%b1-%d8%a3%d8%b2%d9%85%d8%a9-%d8%a7%d9%84%d8%b7%d8%a7%d9%82%d8%a9-%d9%87%d9%84-%d8%b3%d8%aa%d8%b6%d9%8a%d8%a1-%d8%b5%d8%ad%d8%b1%d8%a7%d8%a1

Butler, A. J., Kalam, A. (2025). *AI Predictive Simulation for Low-Cost Hydrogen Production*. https://www.mdpi.com/3042-4011/2/3/9

AMDIE. (2023). UN CADRE TRANSPARENT ET LISIBLE POUR ENCOURAGER L'ACTE D'INVESTIR https://casainvest.ma/sites/default/files/Charte_Investissement_vFR.pdf

Ammonia Energy. (November 25, 2022,). *Gigawatt-scale renewable ammonia in Northwest Africa*. Ammonia Energy Association. https://ammoniaenergy.org/articles/gigawatt-scale-renewable-ammonia-in-northwest-africa/

Amrani, S.-E., Alami Merrouni, A., Touili, S., & Dekhissi, H. (2023). A multi-scenario site suitability analysis to assess the installation of large scale photovoltaic-hydrogen production units. Case study: Eastern Morocco. *Energy Conversion and Management*, *295*, 117615. https://doi.org/10.1016/j.enconman.2023.117615

Attou, S. E. Y., & Nadir, B. (2024). Émergence de l'hydrogène vert au Maroc : Perspectives juridiques. *Revue Internationale du Chercheur*, *5*(1). https://www.revuechercheur.com/index.php/home/article/view/884

Ayed, Y., Fortes, P., & Al Afif, R. (2025). Assessing the competitiveness and trade-offs of national hydrogen strategies in the Maghreb: TIMES scenario-based analysis. *International Journal of Hydrogen Energy*, *151*, 150193. https://doi.org/10.1016/j.ijhydene.2025.150193

Bacaoui Mostafa1*, Jazouli Taleb1, Marwan Houssain. (2025). *View of Technological and Economic Challenges of Green Hydrogen Production in Morocco for the European Market*.

https://lamintang.org/journal/index.php/ijortas/article/view/803/547
Bachir, H. (1987). *7 Adjustment and Development: The Case of Morocco in: Adjustment Policies and Development Strategies in the Arab World*.
https://www.elibrary.imf.org/display/book/9780939934966/ch012.xml
Bayssi, O., Nabil, N., Azaroual, M., Bousselamti, L., Boutammachte, N., Rachidi, S., & Barberis, S. (2024b). Green hydrogen landscape in North African countries: Strengths, challenges, and future prospects. *International Journal of Hydrogen Energy*, *84*.
https://doi.org/10.1016/j.ijhydene.2024.08.277
BeZero. (2024, January 11). *How the VCM can turn the tide for blue carbon*. BeZero Carbon.
https://bezerocarbon.com/insights/how-the-vcm-can-turn-the-tide-for-blue-carbon
Bousalah, A. (2025, September 18). Le Maroc franchit une nouvelle étape dans sa stratégie de l'hydrogène vert. *InfoMaroc*. https://www.infomaroc.net/le-maroc-franchit-une-nouvelle-etape-dans-sa-strategie-de-lhydrogene-vert/
Boutracheh, H., & Moumen, A. (2025). Scientific peripheralism in Green Hydrogen: Morocco's collaboration patterns and strategic misalignment. *International Journal of Hydrogen Energy*, *177*, 151526. https://doi.org/10.1016/j.ijhydene.2025.151526
Broom, D. P. (2011). *Hydrogen Storage Materials: The Characterisation of Their Storage Properties*. Springer London. https://doi.org/10.1007/978-0-85729-221-6
Caillard, A., Yeganyan, R., Cannone, C., Plazas-Niño, F., & Howells, M. (2024). A Critical Analysis of Morocco's Green Hydrogen Roadmap: A Modelling Approach to Assess Country Readiness from the Energy Trilemma Perspective. *Climate*, *12*(5), 61.
https://doi.org/10.3390/cli12050061
CEPR. (2020). *Extractive colonial economies and legacies of spatial inequality: Evidence from Africa*. CEPR.
https://cepr.org/voxeu/columns/extractive-colonial-economies-and-legacies-spatial-inequality-evidence-africa
Chatzimarkakis, J. (2020). *Green Hydrogen for a European Green Deal*.
https://hydrogeneurope.eu/wp-content/uploads/2021/11/Hydrogen-Europe_2x40-GW-Green-H2-Initative-Paper.pdf
Chemanalyst. (2025). *Peregrine Hydrogen and OCP Group Partner to Decarbonize the Fertilizer Industry*.
https://www.chemanalyst.com/NewsAndDeals/NewsDetails/peregrine-hydrogen-and-ocp-group-partner-to-decarbonize-the-fertilizer-39149
Choudhary, B., Dhar, V., & Pawase, A. S. (2024). Blue carbon and the role of mangroves in carbon sequestration: Its mechanisms, estimation, human impacts and conservation strategies for economic incentives. *Journal of Sea Research*, *199*, 102504.
https://doi.org/10.1016/j.seares.2024.102504
ClearPath. (2024). *Coastal Blue Carbon 101 | ClearPath*.
https://clearpath.org/tech-101/coastal-blue-carbon-101/
Cloverly. (2025). *The Ultimate Guide to Blue Carbon | Cloverly*.
https://cloverly.com/blog/the-ultimate-guide-to-blue-carbon _
Dietz, K. (2024). Global Energy Transitions and Green Extractivism. In M. Lang, M. A. Manahan, & B. Bringel (Eds.), *The Geopolitics of Green Colonialism* (1st ed., pp. 27–39). Pluto Press.
https://doi.org/10.2307/jj.12865310.6
EBI. (2022). *La BEI renforce le financement des énergies propres dans le cadre du plan REPowerEU*.
https://www.eib.org/fr/press/all/2022-450-eib-boosts-clean-energy-financing-in-support-of-repowereu-plan

El Hafdaoui, H., Khallaayoun, A., & Al-Majeed, S. (2025). Renewable energies in Morocco: A comprehensive review and analysis of current status, policy framework, and prospective potential. *Energy Conversion and Management: X*, *26*, 100967. https://doi.org/10.1016/j.ecmx.2025.100967
El-Maaroufi, A., Daoudi, M., & Laamara, R. A. (2025). Hydrogen production for SDG 13 using hybrid renewables energies in southern Morocco. *Energy*, *319*, 134986. https://doi.org/10.1016/j.energy.2025.134986
Energy Federation.(2020). https://www.fedenerg.ma/wp-content/uploads/2020/10/ES_55.pdf
European Investment Bank. (2022). *EIB boosts clean energy financing in support of REPowerEU Plan*. https://www.eib.org/en/press/all/2022-450-eib-boosts-clean-energy-financing-in-support-of-repowereu-plan
Farnan, M. (2024). Omega Center: Agriculture consumes 80 percent of water but contributes only 10.7 percent to national wealth. TEL QUEL https://ar.telquel.ma/%D9%85%D8%B1%D9%83%D8%B2-%D8%A3%D9%88%D9%85%D9%8A%D8%BA%D8%A7-%D8%A7%D9%84%D9%81%D9%84%D8%A7%D8%AD%D8%A9-%D8%AA%D8%B3%D8%AA%D9%87%D9%84%D9%83-80-%D9%81%D9%8A-%D8%A7%D9%84%D9%85%D8%A7%D8%A6%D8%A9/
Giz.de. (2017, September 28). *Support of the Moroccan Energy Policy | GIZ*. https://www.giz.de/en/projects/support-moroccan-energy-policy-1
GIZ. (2020, January 1). *Support of the Moroccan Energy Policy | GIZ*. https://www.giz.de/en/projects/support-moroccan-energy-policy
Globes. (2021). *Israel's Mehadrin to grow avocados in Morocco—Globes*. https://en.globes.co.il/en/article-israels-mehadrin-to-grow-avocados-in-morocco-1001368321
GreenH2 Cluster. (n.d.). *GreenH2 | Cluster Marocain de l'Hydrogène Vert*. Retrieved September 27, 2025, from https://greenh2.ma/en/home/
Green peace MENA. (2025). Retrieved September 27, 2025, from https://www.greenpeace.org/static/planet4-mena-stateless/2025/02/ce97182f-beyond-extractivism_-towards-a-feminist-and-just-economic-transition-in-morocco-and-egypt-report-eng.pdf
greentimes. (2025). *Green Hydrogen: Morocco Launches Six Major Projects Worth 319 Billion Dirhams—Greentimes*. https://en.greentimes.ma/green-hydrogen-morocco-launches-six-major-projects-worth-319-billion-dirhams/
Guillot, V., & Assoumou, E. (2025). Power and green hydrogen trade potential between North African and European countries: Conditions, challenges, and sustainability prospects. *Applied Energy*, *382*, 125209. https://doi.org/10.1016/j.apenergy.2024.125209
Hamouchene, H. (2023). The Energy Transition in North Africa: Neocolonialism Again! In H. Hamouchene & K. Sandwell (Eds.), *Dismantling Green Colonialism* (1st ed., pp. 29–48). Pluto Press. https://doi.org/10.2307/jj.7583922.7
Hamouchene, H. (2024). Decolonising the Energy Transition in North Africa. In M. Lang, M. A. Manahan, & B. Bringel (Eds.), *The Geopolitics of Green Colonialism* (1st ed., pp. 52–63). Pluto Press. https://doi.org/10.2307/jj.12865310.8
Hamouchene, H. (2025, September 17). *The energy transition in North Africa | Transnational Institute*. https://www.tni.org/en/article/the-energy-transition-in-north-africa
HCP. (2022). https://www.hcp.ma/region-guelmim/docs/docs/monographie_regionale_2022.pdf
Hifglobal. (2024). *HIF Global to be part of Morocco's Green Hydrogen and e-Fuels development*. https://hifglobal.com/media/news-description/2024/05/24/hif-global-to-be-part-of-morocco-s-green-hydrogen-and-e-fuels-development

Hill, J. W., Bennion, V., & Lovelock, C. E. (2024). Mangrove tree strength estimated with field experiments. *Ecological Engineering*, *203*, 107259. https://doi.org/10.1016/j.ecoleng.2024.107259
Horri, A. B., & Ozcan, H. (2024). Green hydrogen production by water electrolysis: Current status and challenges. *Current Opinion in Green and Sustainable Chemistry*, *47*, 100932. https://doi.org/10.1016/j.cogsc.2024.100932
Hou, J., & Yang, M. (2024). *Green Hydrogen Production by Water Electrolysis* (1st ed.). CRC Press. https://doi.org/10.1201/9781003368939
International Energy Agency. (2019). *Energy Policies Beyond IEA Countries: Morocco 2019*. OECD. https://doi.org/10.1787/10f93028-en
IRESEN. (n.d.). *IRESEN*. Retrieved September 27, 2025, from https://iresen.org/
Kevin Rouwenhorst. (2022). *Gigawatt-scale renewable ammonia in Northwest Africa*. https://ammoniaenergy.org/articles/gigawatt-scale-renewable-ammonia-in-northwest-africa/
Kumar, S., & Lim, H. (2022). An overview of water electrolysis technologies for green hydrogen production. *Energy Reports*, *8*, 13793–13813. https://doi.org/10.1016/j.egyr.2022.10.127
Lebrouhi, B. E., Lamrani, B., Zeraouli, Y., & Kousksou, T. (2024). Key challenges to ensure Morocco's sustainable transition to a green hydrogen economy. *International Journal of Hydrogen Energy*, *49*, 488–508. https://doi.org/10.1016/j.ijhydene.2023.09.178
LE Desk. (2022). Hydrogène vert au Maroc: Les détails du méga-projet de Total Eren à Tilemzoune. *Le Desk*. https://ledesk.ma/grandangle/hydrogene-vert-au-maroc-les-details-du-mega-projet-de-total-eren-a-tilemzoune/
Le Desk. (2023). *H2: Pouyanné confirme le projet Tilemzoune révélé par Le Desk—Le Desk*. https://ledesk.ma/enoff/h2-pouyanne-confirme-le-projet-tilemzoune-revele-par-le-desk/
Le point. (2023). *« Le Maroc a adopté une stratégie nationale sur l'hydrogène vert »*. https://www.lepoint.fr/afrique/le-maroc-a-adopte-une-strategie-nationale-sur-l-hydrogene-vert-23-05-2023-2521389_3826.
Mahmood, A. M., Anbar, M. A., and Saadawi, M. H. (2024). Environmental criteria for identifying the most suitable locations for green hydrogen production in the Kingdom of Morocco using remote sensing techniques in a geographic information system environment. https://journals.ekb.eg/article_413088.html
Masen. (n.d.). *MASEN - Green Hydrogen Moroccan Offer*. Retrieved September 27, 2025, from https://www.masen.ma/en/green-hydrogen-moroccan-offer
Masen. (2025, May 27). *Masen*. https://www.masen.ma/fr
Mayaux, P.-L., & Fernandez, S. (2024). Blinded like a state: Water scarcity and the quantification dilemma in Morocco. *Geoforum*, *155*, 104093. https://doi.org/10.1016/j.geoforum.2024.104093
MEM. (2010). https://www.mem.gov.ma/Lists/Lst_Textes_Reglementaires/Attachments/51/13-09%20energies%20renv.pdf
MEM. (2011). https://www.amee.ma/sites/default/files/2019-07/Loi%2047-09.pdf
MEM. (2016). https://www.mem.gov.ma/Lists/Lst_Textes_Reglementaires/Attachments/4/2016%20BO_6480_Fr%20Loi%2048-15%20r%C3%A9gulation%20du%20secteur%20de%20l'%C3%A9lectricit%C3%A9%20.pdf
MEM. (2020). https://www.mem.gov.ma/Lists/Lst_rapports/Attachments/33/Strat%C3%A9gue%20Nationale%20de%20l'Efficacit%C3%A9%20%C3%A9nerg%C3%A9tique%20%C3%A0%20l'horizon%202030.pdf
Mem. (2020).

https://www.mem.gov.ma/Lists/Lst_rapports/Attachments/36/Feuille%20de%20route%20de%20hydrog%C3%A8ne%20vert.pdf
MEM. (2023). https://anre.ma/wp-content/uploads/2023/07/loi-40.19.pdf
MEM. (2024). https://www.rabatinvest.ma/wp-content/uploads/2024/03/Circulaire-H-vert-Fr.pdf
MKHAITARI, R., MIR, Y., ZAZOUI, M., & ELRHEZOUANI, F. (2025). Technical sizing of renewable energy capacity for large-scale green hydrogen production. *Energy for Sustainable Development*, *84*, 101595. https://doi.org/10.1016/j.esd.2024.101595
Mouline, M. T. (2012). *Energy Security in Morocco: Current Situation and Perspectives,IRES*. https://www.ires.ma/images/pdfs/Forums/Activites_externes/pdf_presentation_dg_ires_energie_vff-2.pdf
Mustafa, S. M. (2024). The role of green hydrogen in achieving economic development. https://jces.journals.ekb.eg/article_412918.html
Namx. (n.d.). *NAMX - The 1st premium HUV*. Retrieved September 28, 2025, from https://www.namx-hydrogen.com/en/
OCP. (2021). *IRESEN, UM6P, and OCP Group have signed an agreement to set up the GREEN H2A platform | OCP Group*. https://www.ocpgroup.ma/press-release-article/iresen-um6p-and-ocp-group-have-signed-agreement-set-green-h2a-platform
Ouchani, F., & Ghennioui, A. (2025). An integrated geospatial techno-economic multi-scenario mapping assessment of PV-based green hydrogen development opportunities: A vision to support its deployment in Morocco. *Energy Conversion and Management*, *324*, 119296. https://doi.org/10.1016/j.enconman.2024.119296
Ourya, I., Nabil, N., Abderafi, S., Boutammachte, N., & Rachidi, S. (2023). Assessment of green hydrogen production in Morocco, using hybrid renewable sources (PV and wind). *Materials and Methods for Hydrogen Energy*, *48*(96), 37428–37442. https://doi.org/10.1016/j.ijhydene.2022.12.362
Plank, F., Daum, B., Muntschick, J., Knodt, M., Hasse, C., Ott, I., & Niemann, A. (2023). Hydrogen: Fueling EU-Morocco Energy Cooperation? *Middle East Policy*, *30*(3), 37–52. https://doi.org/10.1111/mepo.12699
Remme, U. (2025). *Global Hydrogen Review 2025*. https://iea.blob.core.windows.net/assets/12d92ecc-e960-40f3-aff5-b2de6690ab6b/GlobalHydrogenReview2025.pdf
Res4africa, (2022). https://res4africa.org/wp-content/uploads/2023/04/GreenHydrogenMorocco_RES4Med_July2022.pdf
Reuters. (2024). *Engie and Morocco's OCP renewables deal worth billions, says source | Reuters*. https://www.reuters.com/markets/deals/engie-moroccos-ocp-renewables-deal-worth-billions-says-source-2024-10-29/
Reuters. (2025, March 6). Morocco approves green hydrogen projects worth $32.5 bln. *Reuters*. https://www.reuters.com/sustainability/sustainable-finance-reporting/morocco-approves-green-hydrogen-projects-worth-325-bln-2025-03-06/
Saxena, A. K. (2024). AI-Driven Optimization for Green Hydrogen Production Efficiency. *Journal of Scientific and Engineering Research*, *Volume 11*(Issue 6), 145–155. https://jsaer.com/download/vol-11-iss-6-2024/JSAER2024-11-6-145-155.pdf
Scita, R., Raimondi, P. P., & Noussan, M. (2020). *Geopolitical implications of the future hydrogen economy* (Green Hydrogen:, pp. 16–28). Fondazione Eni Enrico Mattei (FEEM). https://www.jstor.org/stable/resrep26335.6
7news Morocco. (February 27, 2025). BKGR adjusts risk premium as Moroccan stocks continue to soar. *7news Morocco*.

https://en.7news.ma/bkgr-adjusts-risk-premium-as-moroccan-stocks-continue-to-soar/
Siyi, W. (2024). *Social and Economic Impacts of Renewable Energy Development in Morocco in the Context of International Relations: Opportunities and Challenges*. 39–45. https://doi.org/10.2991/978-94-6463-459-4_5
Taheripour, F., Tyner, W. E., Haqiqi, I., & Sajedinia, E. (2020). *Water Scarcity in Morocco*. World Bank, Washington, DC. https://doi.org/10.1596/33306
Taroual, K., Nachtane, M., Rouway, M., Tarfaoui, M., Faik, A., Mînzu, V., Hilmi, K., & Saifaoui, D. (2024). Marine Renewable-Driven Green Hydrogen Production toward a Sustainable Solution and a Low-Carbon Future in Morocco. *Journal of Marine Science and Engineering*, *12*(5), 774. https://doi.org/10.3390/jmse12050774
The Electricity Hub. (2024). *TotalEnergies, Morocco Team Up for Green Hydrogen Breakthrough*. https://theelectricityhub.com/totalenergies-morocco-team-up-for-green-hydrogen-breakthrough/
The International Renewable Energy Agency. (2021). *Green hydrogen supply: A guide to policy making*. https://h2chile.cl/wp-content/uploads/2024/02/IRENA_Green_Hydrogen_Supply_2021.pdf
The Wall Street Journal. (2016). *A Solar Project Worth Watching in Morocco—WSJ*. https://www.wsj.com/articles/a-solar-project-worth-watching-in-morocco-1473818401
Transnational Institute. (2022). *Morocco, Algeria, Egypt assessing EU plan to import Hydrogen from North Africa*. https://www.tni.org/files/publication-downloads/assessing_eu_plans_to_import_hydrogen.pdf
World Bank Group, Morocco 2022. (n.d.). Retrieved September 27, 2025, from https://openknowledge.worldbank.org/server/api/core/bitstreams/c5c11886-30bf-5350-8e5f-df9722b85fe0/content
Xlinks. (2024).Retrieved September 27, 2025, from https://xlinks.co/wp_content/uploads/2024/05/Morocco-UK-Power-Project-Statement-of-Community-Consultation-SoCC.pdf