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DECARBONIZATION FOR COMPETITIVENESS

Renewable Energy and Morocco's Adaptation to the EU CBAM

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About the Mentorship Program

The Mentorship Program, jointly organized by the Policy Center for the New South (PCNS) and the Youth Policy Center (YPC), was launched to support master's students in developing policy-oriented research and writing skills, and to strengthen their contribution to public policy debates.

Implemented from March to June 2026, the pilot edition brought together six selected master's students from universities across Morocco, each paired with a mentor duo composed of a PCNS Senior Fellow and a PCNS Expert. The policy briefs developed during the program covered key themes including geopolitics and conflict dynamics, international cooperation, energy and sustainable development, macroeconomic and trade policies, labor market and human capital, and equality and inclusion.

Through methodological workshops, individual mentorship, and continuous feedback, participants were guided in transforming their research ideas into concise, evidence-based policy briefs. The program fostered intergenerational dialogue and knowledge exchange between emerging researchers and experienced policy experts, while providing participants with practical tools to define policy-relevant problems, structure their analysis, formulate actionable recommendations, and communicate their research to policy audiences.

This policy brief is the result of the mentorship and research process undertaken as part of the program's first cohort. It reflects the program's ambition to amplify youth-led policy research while nurturing a new generation of researchers committed to evidence-based policymaking.

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Executive Summary

The European Union's (EU) Carbon Border Adjustment Mechanism (CBAM), fully operational since January 2026, taxes carbon embedded in imports across six sectors, including fertilizers; with the EU serving as Morocco's largest trading partner absorbing 63.3% of its total exports; and while often seen as a burden on developing economies, this brief argues it represents an opportunity for Morocco if the country leverages its renewable energy (RE) potential for both compliance and competitiveness. Morocco's RE share reached about 21% in 2023, with a 2030 target of 52%, and its wind energy costs are already lower than those of Germany, Turkey, or South Africa, positioning it well for low-carbon exports. In fertilizers specifically, Morocco's low Trade Exposure Index (-0.0403) suggests a competitive edge over EU producers, reinforced by Office Chérifien des Phosphates' (OCP) strong decarbonization efforts, though compliance costs and green hydrogen's higher price remain challenges. The brief recommends expanding green tax incentives, creating Green Industrial Zones, conditioning subsidies on decarbonization commitments, introducing a Carbon Contracts for Difference (CCfD) mechanism. It concludes that Morocco's early RE investment can turn CBAM compliance into lasting competitive advantage.

Introduction

Over the years, the European Union (EU) has made considerable efforts to lower its greenhouse gas (GHG) emissions by at least 55% by 2030, compared with 1990 levels, and to achieve its ambitious climate goals set out in the Green Deal. One of the introduced reforms within this context is the Carbon Border Adjustment Mechanism (CBAM). As its name indicates, CBAM acts as an adjuster and regulator of the carbon emissions that enter the EU through imported goods, limiting, therefore, any risks of "carbon leakage". Practically speaking, importers are under obligation to report the GHG emissions embedded in the production process, and to then purchase certificates corresponding to this amount. The mechanism targets six sectors: cement, aluminum, fertilizers, iron and steel, electricity, and hydrogen, with the intention to extend to more sectors and products in the future. Moreover, the CBAM entered its transitional phase on October 1, 2023, and became fully operational in January 2026, with the goal of reducing emissions internally and externally; thus, creating an incentive for other countries to adopt similar systems.

Despite its noble cause, the CBAM is perceived by many as a disguised protectionist measure that is applied to economies with very different industrial structures, historical emissions, and financial capacities. Consequently, this shifts the cost of decarbonization to both developing and the least developed nations.

Existing studies such as Eicke et al. (2021) and Jakob et al. (2024) suggest that, in the long term, the CBAM may increase trade-related, carbon-compliance costs for Moroccan exporters, potentially affecting the competitiveness of carbon-intensive sectors and, indirectly, employment and income. However, this exposure does not necessarily imply a competitive disadvantage. As these studies also highlight, Morocco's significant renewable energy potential, and its ongoing industrial decarbonization efforts position it more favorably than many regional peers, such as Egypt and Turkey.

In this context, an important question arises as to whether decarbonization can constitute an effective adaptation strategy for Morocco in response to the EU CBAM. This option could be a promising pathway for Morocco from two perspectives: compliance and competitiveness. Decarbonization can be achieved through the use of renewable energy (RE) forms in the production process, thus reducing the reliance on fossil fuels, the products' carbon footprint, and the carbon price paid by EU importers, while also meeting EU import rules. This is significant, as early decarbonization may yield broader and easier market access in the long term.

In light of this, we provide in this policy brief an immersive analysis of the extent to which the use of RE could constitute both a lever for competitiveness, and a tool for compliance with the CBAM in Morocco.

The first section aims at evaluating Morocco's RE transition from three perspectives. First, we consider RE's current contribution to the electricity mix and potential for industrial decarbonization, then the technical and infrastructural challenges of integrating solar and wind power into the grid, and finally, the economic dimension, including investment risks and RE costs. In the second section, particular focus is given to the fertilizer sector, considering that, in 2023, 14.1% of the country's fertilizer exports were oriented toward the EU; an important market share that should not be overlooked. We examine more precisely the sector's degree of

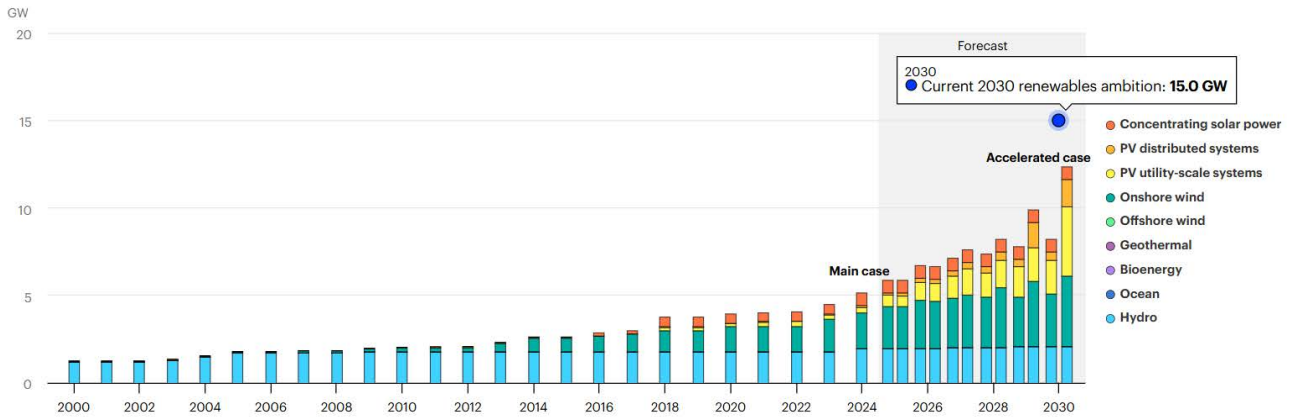
exposure to the European market and its relative carbon competitiveness compared with EU producers. We then look into the carbon intensity of Morocco's main fertilizer exports in order to assess the potential costs and opportunities associated with CBAM implementation, and end the section by investigating the role of renewable energy and green hydrogen as strategic decarbonization pathways, capable of reducing embedded emissions and strengthening long-term competitiveness. Finally, the third section presents a set of policy recommendations and reforms aimed at strengthening Morocco's response to the CBAM.

01. Assessing Renewable Energy Development in Morocco

The development of renewable energy represents one of the main pathways through which Morocco can strengthen the competitiveness of its exports under the CBAM. Assessing the country's RE transition is, therefore, essential not only from a climate perspective, but also to understand how Morocco can improve the carbon competitiveness of its exports and adapt to evolving trade requirements in the European market.

First, it is interesting to assess the current level of renewables in Morocco and its energy mix overall. Based on data derived from the International Energy Agency (IEA), and as shown in Figure 1, in 2023 the observed share of RE in power generation amounted to approximately 21%, with variable renewable energy forms (VRE), representing nearly 20% of it. Morocco has set an ambitious target of achieving 52% of its installed electricity capacity from renewable energy sources by 2030, comprising 20% solar energy, 20% wind energy, and 12% hydropower. In order to support this objective, Morocco plans to substantially increase its installed RE capacity, and believes it can bring it to over 15GW by 2030, if the necessary international support and financial resources are effectively mobilized.

Figure 1: Projected renewable electricity capacity in Morocco, 2000-2030



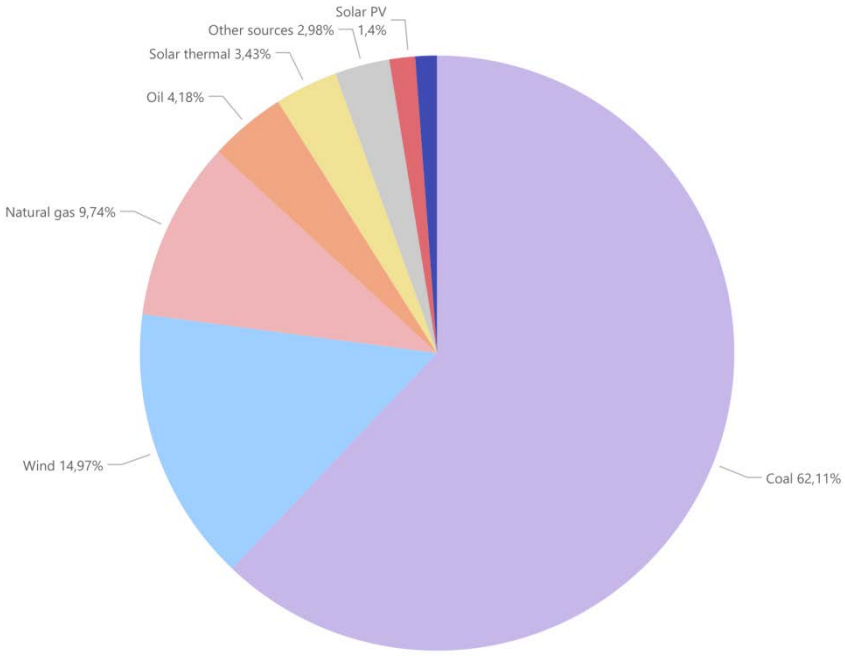
Sources: IEA (2025), Renewables 2025, International Energy Agency, https://www.iea.org/reports/renewables-2025, License: CC BY 4.0.

Electricity, as one of the main sectors targeted, directly and indirectly (through cement and fertilizers), by the CBAM, in 2023 represented (alongside heat producers) 45% of total energy-related emissions, after the transport and industry sectors, with a share of 28% and 9.7%

respectively. This finding is not surprising since the largest source of electricity generation in 2023 was coal, with a share of 62%, while RE accounted for only 20.7%. Although Morocco is not currently a major exporter of electricity to the EU or other global markets, the embedded carbon emissions of both fertilizers and cement products could increase, bearing in mind that the industry is indeed the largest electricity-consuming sector, representing 36% of total final consumption. Therefore, RE could help reduce the carbon footprint of these exports and lower their CBAM exposure.

For the fertilizer sector, however, achieving substantial emission reductions will also require the decarbonization of natural gas and hydrogen inputs, as well as improvements in production processes, particularly in ammonia manufacturing, which will be discussed in the second section of this paper.

Figure 2: Electricity generation sources, Morocco, 2023



Source: Author's elaboration using data from the International Energy Agency.

The low level of RE integration shown in Figure 2 can be explained through different factors, notably the complications and risks associated with its implementation. When it comes to VRE integration, their impact on Morocco's power system remains relatively low, and is only in its third phase, among the six phases of VRE integration.

According to the IEA framework, power systems typically progress through six phases of VRE integration, ranging from very limited impacts on system operations (Phase 1), to situations where renewables become the dominant source of electricity generation and require extensive system flexibility measures (Phase 6). These six phases can, therefore, be understood as a scale measuring how much wind and solar power influence the operation of a country's electricity system.

The third phase, in which Morocco is currently situated, is especially characterized by high

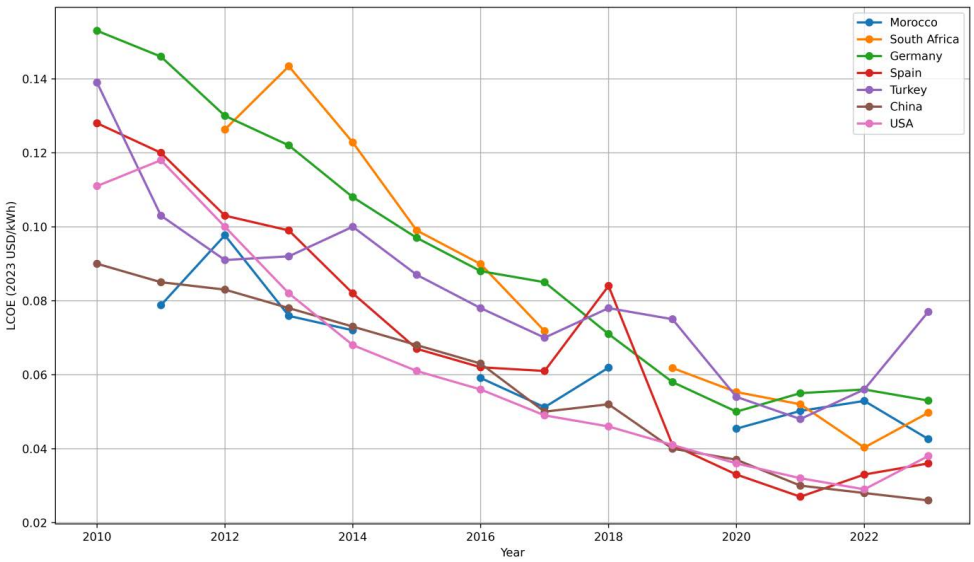
uncertainty and variability in wind and solar outputs, and a high reliance on non-renewable sources in order to meet demand during certain periods, which is also referred to as the "duck curve". As a result, the primary challenge is ensuring that the electricity system can reliably integrate a growing share of VRE.

This requires an enhancement in grid infrastructure, system flexibility, and VRE-demand forecasting. The most suitable solutions to tackle this challenge depend, of course, on the specific circumstances of individual countries. We could, however, examine some measures adopted during the early phases of VRE integration in countries with more advanced RE systems, notably Denmark. To ensure sufficient generation capacity when it was not windy, for example, battery-storage systems were exploited to store excess electricity generated during windy periods and supply it when production increased, alongside gas turbines that could generate electricity on demand and provide reliable power for longer periods. Options that Morocco is currently considering include the *Office National de l'Électricité et de l'Eau Potable* (ONEE)'s 2025 announcement of a program to install 1,600 MWh of battery storage at multiple sites nationwide, alongside the launch by the Moroccan Agency for Sustainable Energy (MASEN) of a World Bank-supported battery-storage-test platform at Noor Ouarzazate, in order to enhance its grid stability.

Other long-term measures involve reinforcing cross-border grid interconnections and importing electricity from neighboring regions when necessary, as well as considering emerging generators that can provide backup power when needed. In this regard, Morocco is already interconnected with Spain through two submarine electricity links, while additional interconnection projects, including a potential link with Portugal, are currently under consideration.

These findings highlight that renewable energy integration involves challenges that extend beyond the construction of generation facilities, and from the investor's perspective, these risks are directly quantified and benchmarked against more competitive, lower-cost alternatives, notably fossil fuels.

Figure 3: Onshore wind weighted-average LCOE by country (2010-2023)



Source: Author's elaboration using data from the IRENA "Renewable Power Generation Costs in 2023" report.

The levelized cost of electricity (LCOE) can be used as a useful indicator of the costs of RE, and as a comparison tool with other countries. While solar PV represents an important component of Morocco's RE strategy, comparable country-level LCOE data were not consistently available for all countries included in the analysis. The comparison, therefore, focuses on onshore wind technology.

Furthermore, Figure 3 shows the evolution of the weighted-average LCOE from newly commissioned onshore wind projects, and where Morocco has clearly experienced a significant reduction in generation costs over the last decade, reaching approximately US$0.043/kWh in 2023. This level is lower than that observed in several major industrial and trading partners, including Germany, South Africa, and Turkey. The declining cost of renewable electricity suggests that Morocco possesses favorable conditions for RE deployment that could support the production of lower-carbon industrial goods and strengthen the country's competitiveness under the CBAM framework.

02. The Moroccan Fertilizer Sector under CBAM: Risks, Costs and Strategic Responses

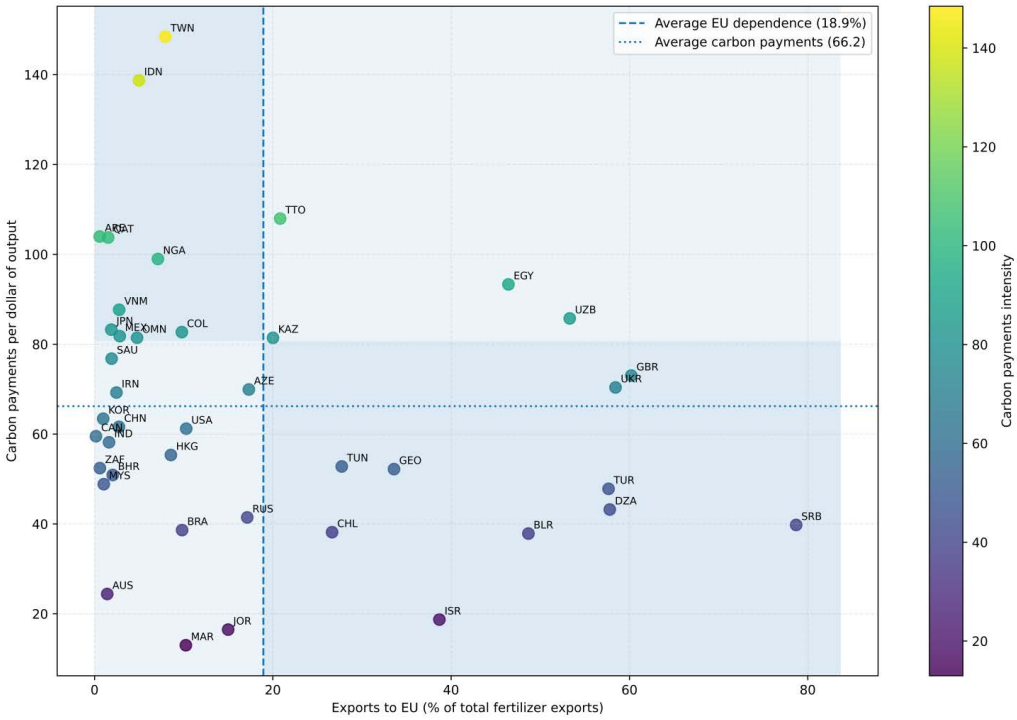
In order to understand how the country's economy is exposed to the CBAM, it may be analyzed from various perspectives. First, the importance of the EU market in Morocco's annual exports. In 2023, Moroccan exports to the EU accounted for 63.3% of the country's total exports, making the EU Morocco's largest trading partner, while natural and chemical fertilizers represented 2.9% of these exports.

Now, given the importance of these transactions, and if no decarbonization measures are put in place, EU importers will have to turn to less carbon-intensive products from competitive partners in order to reduce the costs associated with carbon certificates.

Given all these implications, and in order to assess whether the country will suffer or gain a potential competitive advantage relative to an average EU producer, we refer to the CBAM Aggregate Trade Exposure Index constructed by the World Bank, using 2022 trade flows and 2017 sectorial emission intensities. In simple terms, it indicates how much more carbon-intensive a country's production is compared with the average EU producer, and how important all CBAM-covered sectors are on that country's exports.

For Morocco, this index is significantly less than zero, and its position lies directly after Israel and Jordan. This may indicate that Morocco's exports are, on average, less carbon-intensive than those of EU producers, and consequently, the additional costs associated with the CBAM could be lower, which may provide some competitive advantages in certain market segments.

Figure 4: CBAM trade exposure in fertilizer exports



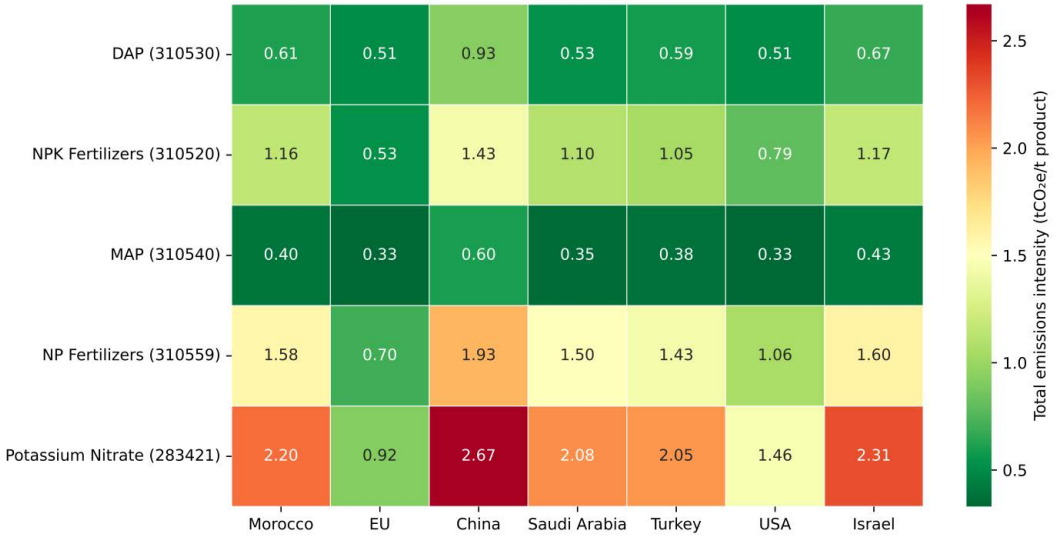
Source: Author's elaboration using data from the World Bank's Relative CBAM Exposure Index (2025)

Moreover, if we focus on the fertilizer industry and its level of exposure to the mechanism, Morocco records a CBAM trade exposure index of -0.0403, with lower carbon-payment exposure than the average EU producer. This implies a potential competitive advantage under the instrument, where the country could potentially increase its market share. This finding is also broadly consistent with the emission intensities of CBAM-covered products in the fertilizer industry. By comparing the most dominant products in Morocco's fertilizer export basket with other major exporters, we can attest that the products with the highest EU market exposure-notably Diammonium hydrogenorthophosphate (Diammonium phosphate, DAP), Ammonium dihydrogenorthophosphate (Monoammonium phosphate, MAP) and Mineral or chemical fertilizers containing the three fertilizing elements nitrogen, phosphorus and potassium (NPK) fertilizers display smaller emissions gaps relative to EU producers and so remain competitive alongside distinct distributors.

While Morocco's fertilizer sector appears to face relatively limited direct exposure to the CBAM according to the World Bank's Relative CBAM Exposure Index, this indicator does not capture the administrative and compliance challenges associated with the mechanism. Beyond the carbon content of exported products, the state-owned Office Chérifien des Phosphates (OCP) group must establish robust monitoring, reporting and verification (MRV) systems capable of accurately measuring embedded greenhouse gas emissions throughout the production process. Under the CBAM framework, exporters are required to provide detailed emissions data that comply with EU methodologies and reporting standards. Any failure to provide reliable information may result in the use of default values, which could overestimate the actual carbon intensity of products and potentially increase the financial burden borne by importers. Consequently, even sectors that appear relatively competitive from an emissions perspective may face significant compliance costs related to data collection, emissions accounting, third-

party verification, staff training, and the adaptation of internal reporting systems. For Morocco's fertilizer industry, ensuring accurate and transparent emissions reporting may, therefore, become as important as reducing emissions themselves in preserving competitiveness within the European market.

Figure 5: Total emissions intensity of Morocco's main CBAM-covered fertilizer exports



Source: Author's elaboration using data from the JRC Technical Report (2023).

On the other hand, one factor that may contribute to the low observed emissions (Figure 5), is the country's growing reliance on RE in its power generation and production process; in 2024, 80% of OCP's electrical needs were met by clean energy (co-generation and wind energy). This integration was initiated through various and significant investments such as the Noor Ouarzazate Solar Complex, with an installed power of 160 MW and a total of CO2 avoided of 280,000 t/year; and the famous Tarfaya wind farm with an installed capacity of 301.3 MW that helps Morocco achieve its energy independence goal, with approximately 900,000 tons of CO2 avoided per year. These investments have gradually expanded renewable electricity-generation capacity, providing a growing source of low-carbon energy that can support industrial development, while also contributing to national climate objectives.

Furthermore, in order to counter any loss of market share in the EU region and increase its competitiveness, Morocco can use the energy transition as its primary response to the mechanism. This can be achieved by exploiting the country's renewable energy endowments in the Mediterranean region and investing in projects that exploit its solar irradiation levels, its southern and inland regions, and finally, its wind potential along the Atlantic coastline.

Moreover, since the CBAM calculations are based on embedded GHG emissions in imported products, industries that rely on RE can lower their exposure to future carbon-related trade barriers and reduce any potential financial burden associated with CBAM compliance.

The current and most promising opportunity emerging from the country's RE transition is the development of green hydrogen. This can replace hydrogen produced from natural gas during the manufacturing of fertilizers, which will help reduce carbon emissions associated with ammonia production.

In this regard, OCP's strategy includes the progressive substitution of conventional ammonia with green ammonia produced from renewable hydrogen. This transition is important as ammonia production represents one of the most carbon-intensive stages of fertilizer manufacturing, and, unlike many competing producers, Morocco possesses limited natural gas resources and has historically relied on imported grey ammonia derived from fossil fuels.

To address these challenges, OCP has launched an ambitious Green Investment Program aimed at reducing its carbon emissions in direct emissions, indirect emissions from purchased energy and value-chain emissions by 2040. To this end, in 2023 OCP announced a US$7 billion investment program dedicated to the development of on-site green ammonia production facilities, while in 2024 the group successfully raised US$2 billion through a corporate bond issuance to support its broader green investment strategy.

These investments are on the other hand complemented by large-scale RE deployment, where the group aims to supply all of its industrial operations with clean energy by 2027, thereby supporting both its production activities and future hydrogen and ammonia facilities. This is highly relevant in the context of CBAM, where green hydrogen and green ammonia have significant potential to reduce the carbon footprint of the fertilizer products discussed.

Despite its significant potential, the transition toward green hydrogen and green ammonia remains associated with considerable financial and technological challenges. One of the main challenges associated with green hydrogen is its production cost, which remains significantly higher than that of conventional hydrogen produced from natural gas. Recent estimates (Curcio, 2024) indicate that green hydrogen typically costs between US$3.5 and US$6 per kilogram, whereas grey hydrogen can often be produced for between US$1.5 and US$2.5 per kilogram under current market conditions. As a result, green ammonia produced from renewable hydrogen remains less cost-competitive than conventional ammonia and generally requires continued technological progress, declining renewable electricity costs, or policy support to achieve parity.

Regarding the scale of investment and financial resources needed, the latter depends on the extent to which the fertilizer industry seeks to substitute conventional ammonia production with green ammonia. As explored in the first section, the costs associated with these large-scale investments go beyond the initial installation phase and require continuous modernization to improve energy efficiency, such as replacing obsolete equipment, upgrading production lines, integrating digital monitoring systems, or again adapting industrial processes to new energy sources. While these investments entail substantial upfront and ongoing costs, they present long-term benefits and help mitigate future environmental regulations, such as the CBAM or energy crises due to various reasons such as the 2026 conflict in the Middle East.

03. Recommendations and Reforms

Given the magnitude of efforts that should be implemented in order to support the development of RE, while ensuring a level of compliance and competitiveness with the CBAM, the following recommendations are suggested:

- While Morocco currently provides tax support for certain renewable energy assets and photovoltaic manufacturing inputs, similar incentives do not yet cover essential decarbonization technologies, such as electrolyzers, hydrogen storage equipment, ammonia synthesis units, and carbon-monitoring systems. The government could expand the scope of existing renewable-energy tax incentives to include these.
- Given the concentration of renewable energy resources and industrial infrastructure in regions such as Jorf Lasfar, Tarfaya, Dakhla, and Guelmim-Oued Noun, Morocco could establish dedicated Green Industrial Zones focused on hydrogen, green ammonia, and low-carbon fertilizer production.
- To ensure full policy coherence, all public subsidies, tax incentives, and financing mechanisms should be conditional on measurable decarbonization commitments. For example, beneficiary firms could be required to measure and report their carbon emissions, publish decarbonization roadmaps, and meet specific emissions reduction targets.
- Morocco could adapt the German Carbon Contracts for Difference (CCfD) mechanism to support the production of green ammonia and low-carbon fertilizers, thereby reducing investment risks associated with large-scale hydrogen projects. For example, if green ammonia remains more expensive than ammonia produced from natural gas, public authorities could temporarily cover part of the cost difference, thereby reducing financial uncertainty for investors. This could be relevant for Morocco as the production of green hydrogen and green ammonia requires substantial upfront investment and remains less cost-competitive than conventional technologies. Therefore, by reducing investment risks, a Moroccan CCfD scheme could accelerate OCP's decarbonization efforts, support the development of low-carbon fertilizers, and strengthen the sector's competitiveness under carbon-related trade measures such as the CBAM.

04. Conclusion

Overall, Morocco's exposure to the EU CBAM represents more of an opportunity to accelerate its green industrial transformation than a regulatory burden. While the mechanism introduces new compliance costs and reporting requirements, Morocco's relatively low carbon intensity in key export sectors, and particularly in its fertilizer industry, places it in a comparatively favorable position.

A key factor underlying this outcome is Morocco's early investment in and deployment of renewable energy technologies. Specifically, by reducing the carbon intensity of electricity and especially in industries where indirect emissions are counted, as in fertilizers and cement, Morocco can be carbon competitive and ensure long-term access to the EU market.

However, the country still faces various structural limitations related to grid integration and fossil-fuel dependence which require sustained investment in storage, infrastructure, and

system flexibility. In this context, deeper decarbonization through renewables, green hydrogen, and the selective use of CCfD represent additional reforms that the country could consider in order to remain competitive and, perhaps, become a low-carbon industrial hub.

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