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# MOROCCO'S NEW CHALLENGES AS A GATEKEEPER OF THE WORLD'S FOOD SUPPLY: THE GEOPOLITICS, ECONOMICS, AND SUSTAINABILITY OF OCP'S GLOBAL FERTILIZER EXPORTS

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## Introduction

Morocco's phosphorus fertilizer industry, with its massive production capacity and international reach, has transformed the kingdom into a gatekeeper of global food supply chains. Morocco's centrality to global food security rests with the fact that all food crops, indeed all plant life, require the element phosphorus to grow and Morocco possesses [over 70% of the world's phosphate rock reserves](#), from which the phosphorus used in fertilizers is derived. Unlike other finite resources such as fossil fuels, there is no alternative to phosphorus. By becoming one of the world's leading fertilizer exporters, instead of continuing to just export the raw material, Morocco has enriched its economy and elevated its international standing. In Sub-Saharan Africa in particular, the kingdom's combination of joint venture partnerships in local fertilizer production and deft direct outreach to farmers has resulted in a remarkable boost in African agricultural yields and the notable expansion of Morocco's soft power influence across the continent.

After spending the previous decade transforming its fertilizer manufacturing sector into a global industry leader, Morocco now faces new challenges caused by the COVID-19 pandemic and the severe supply chain disruptions that have followed in its wake. These economic shocks have caused a sharp rise in

world hunger and soaring global food inflation, throwing a spotlight on Morocco's role in ensuring international food security and the stability of food prices upon which much of the global economy depends. The 2021 [Food Price Index](#), published by the U.N. Food and Agriculture Organization (FAO), reached a 10-year high, with average food prices having jumped 28% worldwide from the previous year. While supply disruptions have caused shortages and elevated levels of food inflation across more affluent countries, the current crisis has resulted in an alarming rise in hunger across the more vulnerable segments of the global population. In its 2021 annual report on the *State of Food Security and Nutrition in the World*, the FAO [warned](#) that "the world is at a critical juncture," citing its median estimate that 768 million people faced hunger in 2020. Although the increase in global hunger had been kept to a standstill from 2014-19, this changed in 2020 when the number of people facing hunger rose by an estimated 118 million. The problem is particularly acute in Africa, which among the world's regions has the highest proportion of its population, [21%](#), experiencing severe hunger. In 2020, the total undernourished population in Africa amounted to [282 million](#) people, a rise of 46 million from 2019. Morocco's growing role in enabling African nations to increase their food production is now at a critical inflection point as its fertilizer plants in West and East Africa are scheduled to become operational between 2023 and 2025.

If Morocco can succeed in helping to stem the rising tide of hunger in Africa, it will become one of the principal geopolitical actors on the continent.

As it seeks to realize these commercial and geopolitical ambitions, Morocco is facing increasingly daunting environmental and economic challenges exacerbated by the debilitating impact of climate change. Phosphate extraction and fertilizer production are highly energy- and water-intensive, making fertilizer production ground-zero for a vicious cycle in the food-energy-water nexus. Morocco's phosphate and fertilizer industry [consumes](#) about 7% of its annual energy output and 1% of its water.

The problem is further complicated because of nitrogen, the other basic fertilizer element that plants need. Natural gas is not only a manufacturing power source but also a constituent component of nitrogen production, meaning the price of natural gas accounts for [at least 80%](#) of the variable cost of nitrogen fertilizer. Diammonium phosphate (DAP), the most popular type of phosphorus fertilizer worldwide, is comprised of [46% phosphorus and 18% nitrogen](#), produced by causing a reaction between phosphoric acid and ammonia — the latter being composed of nitrogen and hydrogen. By November 2021, the spike in natural gas prices saw the [cost of producing ammonia](#) rise to \$1,000 per ton compared to

\$110 earlier in the year. Accordingly, the price of DAP rose to [its highest level](#) in 10 years.

How well Morocco manages the food-water-energy nexus amid rising energy costs and climate change-driven [challenges to its own water security](#) will impact both its own economic development and the stability of food supplies across the world. The kingdom's drive to expand power generation from its considerable solar and wind resources holds the possibility to overcome these challenges and potentially create a virtuous cycle within the food-energy-water nexus through the production of "green" hydrogen that could be used to replace natural gas to produce green ammonia. The future of Morocco's role as a gatekeeper of global food supply chains will ultimately depend on its success at home in achieving energy transition to increase the sustainability of its fertilizer industry.

## Morocco's rise as a leader in global fertilizer production

Since the start of its phosphate mining industry in 1921, Morocco has been a major source of phosphorus for synthetic fertilizers. The global use of such fertilizers has created the enormous increases in crop yields that have driven the world's population boom over the past 100 years, climbing from about

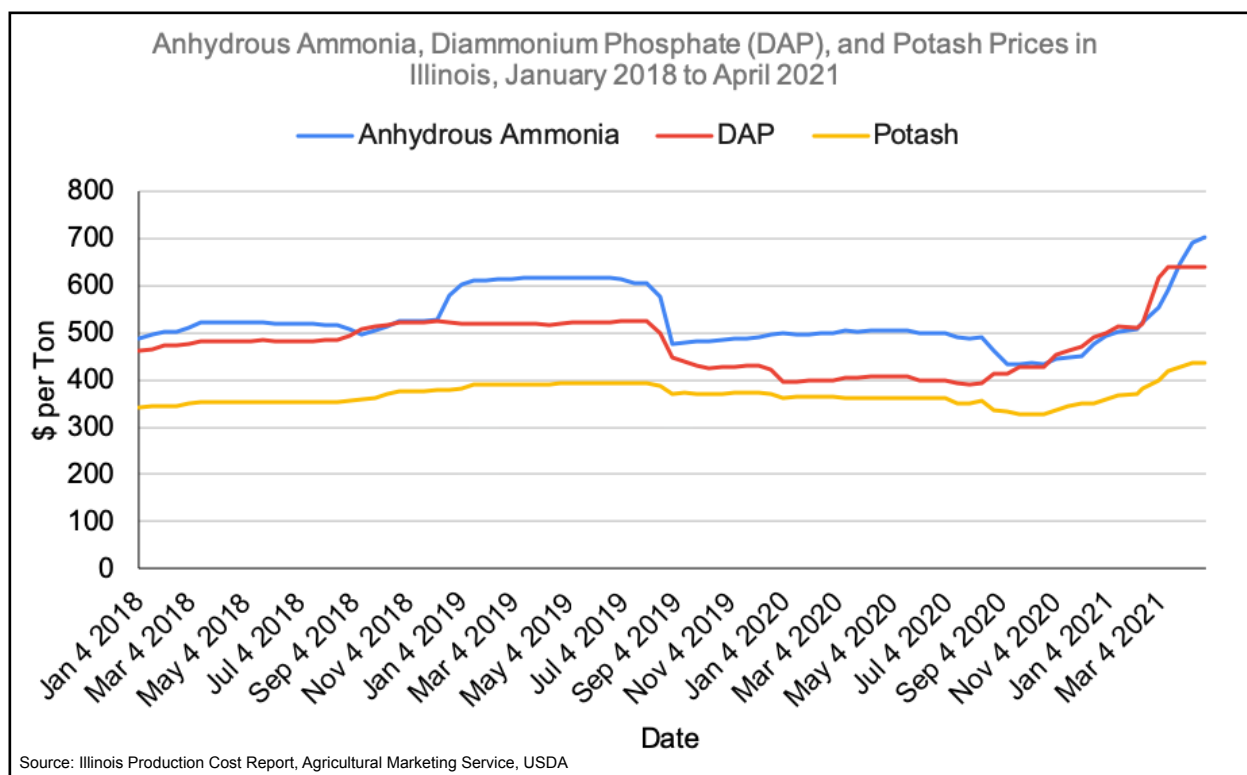




Photo above: Untreated phosphate being dropped off on a mountain at the end of a conveyor belt at the OCP's Marca factory, near Laayoune, Western Sahara. [Photo by FADEL SENNA/AFP via Getty Images](#).

[1.8 billion](#) to the current 7.9 billion people. Today, unlike a century ago, Morocco is now one of the world's [top five fertilizer exporters](#). Not content to supply foreign manufacturers the fertilizer's industry's equivalent of crude oil, the monarchy's Office Chérifien des Phosphates (OCP) began higher value-added manufacturing of the chemical inputs to fertilizer, primarily phosphoric acid, and phosphorus fertilizer itself during the 1980s and 1990s. In 2008, Morocco re-organized the OCP into the well-oiled, state-owned OCP Group corporation. The restructuring and accompanying massive infrastructure build-up transformed OCP into a global leader in all phases of the fertilizer manufacturing value chain. The centerpiece of its transformation was the construction of the world's largest fertilizer production hub in Jorf Lasfar on Morocco's Atlantic coast. By 2018, the kingdom's annual phosphate output almost doubled while its annual fertilizer production [tripled](#), achieving a gross operating surplus of more than \$1 billion. Producing at least 45 different blends of fertilizer for export, the hub ships its products via the Jorf Lasfar port, which as a consequence [overtook the port of Casablanca](#) in tonnage exported.

In 2020, OCP mining operations [produced](#) 40.7 million tons of phosphate and exported 10.3 million tons of the raw material. From its phosphate supplies, OCP [manufactured](#) 7.1 million tons of phosphoric acid — the chemical compound used in making fertilizer — while exporting 1.9 million tons of the key input. OCP's 2020 phosphorus fertilizer production totaled [11.3 million tons](#), of which [11.2 million tons](#) were exported. These exports have seen OCP become a company of global reach, helping countries from Brazil to India maintain stable food supplies. OCP dominates the market in Africa with a [54% share](#) of phosphorus products in 2020. The company is similarly strong in Europe and South America with respective 2020 [market shares](#) of 41% and 46%. Primarily due to its large presence in India, OCP holds a [32% share](#) of the Middle East and South Asia market. Even in North America, where OCP faces stiff competition from the American manufacturer Mosaic, OCP still held a [28%](#) market share, accounting for about [60%](#) of the U.S. import market, prior to the U.S. Department of Commerce's 2021 imposition of tariffs on imports from OCP.

Morocco's economy has reaped the benefits of OCP's transformation into an international fertilizer exporting giant. OCP's

total 2020 revenues amounted to [\\$5.94 billion](#) and the company accounted for [approximately 20%](#) of the kingdom's export revenues. At the heart of Morocco's economy, OCP is the country's largest employer, providing jobs for [21,000 people](#). Ensnared within the kingdom's governing apparatus, [the majority of OCP's board of directors](#) are officials from government ministries. Beyond expanding export revenues through international marketing, Rabat has used OCP's exports as a foreign policy instrument, particularly in Sub-Saharan Africa, where the company adroitly blends sales, investments in local production, and development outreach to create an expanding network of commercial connectivity.

## OCP and Morocco's expanding soft power influence across Africa

With agriculture contributing [30% of Africa's GDP and employing 55%](#) of the working population, the continent's prosperity depends on the advancement of its agricultural sector. With Africa now possessing [65% of the Earth's uncultivated arable land](#), progress in advancing its agricultural sector is becoming increasingly vital to global food security. Through OCP, Morocco has placed itself at the forefront of the effort to transform African agriculture. In 2016, OCP created its [OCP Africa](#) division to contribute to the development of integrated agricultural ecosystems on the continent. With subsidiary divisions in 12 African countries, OCP Africa focuses on empowering smallholder

farmers to better and more profitably participate in agricultural value chains. In 2018, OCP Africa launched its [Agribooster program](#) to provide African farmers with "inclusive and customized end-to-end solutions" to increase their yields, incomes, and long-term livelihoods. Beyond education and specialized training services, the program facilitates relationships with input suppliers, financial services providers, and commodity buyers to optimize the use of seed, fertilizer and other inputs, loans and insurance, mechanics, warehousing, and offtake mechanisms. Starting as a single pilot program in Ghana and then expanding to other African countries, the Agribooster program assisted [168,404 farmers](#) in its first year, creating [an additional average yield of 33%](#).

The success of OCP Africa's holistic approach demonstrates both the centrality of fertilizer to food security and the necessity of enhancing local participation in value chains for fertilizer manufacturing and food production. A decade prior to OCP Africa's creation, the African Union's (AU) [2006 Abuja Declaration](#) called for an "African Green Revolution" to increase agricultural productivity to feed the continent's rapidly growing population. With Africa's fertilizer use then [averaging only eight kilograms per hectare](#), a mere 10% of the world's average, the AU adopted the goal of raising the level of fertilizer use to an average of at least 50 kilograms per hectare. To achieve that goal, it established the [Africa Fertilizer Financing Mechanism \(AFFM\)](#), managed by the African Development Bank (AFDB), which is dedicated to [accelerating fertilizer manufacturing value chains in Africa](#) in accordance with the AFDB's own [Feed Africa](#) initiative and the food security and sustainable development goals adopted by the [AU's Agenda 2063](#).

Morocco itself only [formally rejoined the AU in 2017](#), having left the then-Organization of African Unity in 1984 after it had granted membership to the Sahrawi Arab Democratic Republic (SADR), implicitly recognizing the SADR's claim to sovereign statehood over the territory of the Western Sahara that Morocco claims as its southern provinces. By October 2021, [20 African nations](#) had opened consulates in the Moroccan-controlled part of the disputed region, recognizing the kingdom's claim to sovereignty. The success of the OCP Africa's Agribooster program has contributed to the geopolitical turnaround, with Morocco emerging as a key partner in the AU's efforts to ensure adequate food supplies for hundreds of millions of people across the continent. In 2020, for example, the AFDB's AFFM partnered with OCP Africa in a three-year project

**Morocco and OCP Africa's 12 Subsidiaries**



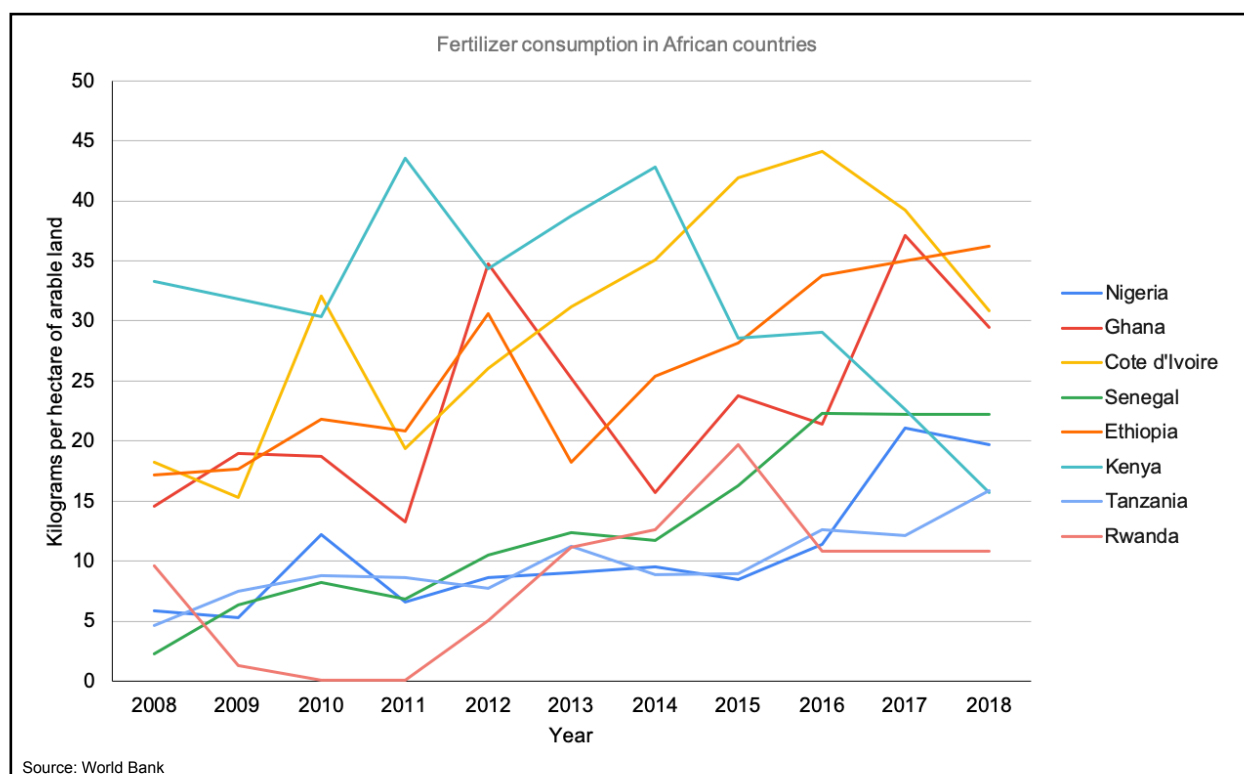
to support 430,000 smallholder farmers in Côte d'Ivoire and Ghana through the provision of a [\\$4 million partial trade credit guarantee](#). AFFM and OCP Africa are each providing a \$2 million partial trade credit guarantee for OCP fertilizer and other quality inputs as well as the Agribooster program's training in agricultural practices. Based on OCP's prior success, the AFDB [projects](#) the program will contribute to a 30% increase in rice yields in Côte d'Ivoire and a 35% yield increase in rice and corn yields in Ghana.

Operating in West Africa's four largest economies — Nigeria, Ghana, Côte d'Ivoire, and Senegal — the Agribooster program has [benefitted 630,000 farmers](#), resulting in [considerable crop yield increases](#) across the board, including a 48% rise in Nigeria's corn yield and a 63% jump in Senegal's millet yield. [OCP's School Lab](#) operates across nine countries in both western and eastern Africa using travelling schools, mobile laboratories, and digital communications to provide over 420,000 farmers multiyear support and technological solutions. But beyond these and other similar programs, OCP Africa is now involved in a new phase of engagement through joint venture investment in fertilizer manufacturing in Africa.

Morocco's most important fertilizer partnership is with Nigeria. OCP [supplies over 90% of annual fertilizer demand](#) of Africa's

most populous nation. Quite strategic for Morocco, Nigeria sits on Africa's largest natural gas reserves, totaling over [200 trillion cubic feet](#) (5,675 billion cubic meters). Since Morocco lacks sufficient gas resources of its own, Nigeria can provide the natural gas from which fertilizer's other fundamental component, nitrogen, is produced, commonly in the form of ammonia. In 2018, OCP Africa and the Nigeria Sovereign Investment Authority (NSIA) signed a protocol agreement for the construction of a now [\\$1.4 billion ammonia and fertilizer plant](#) with the aim of OCP boosting fertilizer supplies to Nigeria from [1 million to 3 million tons](#) over a period of five years. OCP's Nigeria factory will have an [annual production capacity](#) of 750,000 tons of ammonia and 1 million tons of fertilizer. The mutually beneficial match between Morocco's phosphates reserves and Nigeria's natural gas supplies gave rise to the [arrangement](#) whereby OCP's plant located in Nigeria's gas-rich Akwa Ibom State would export up to [70%](#) of its ammonia output to OCP's Jorf Lasfar complex to supply fertilizer manufacturing in Morocco while OPC Morocco would supply phosphoric acid to be used with the remainder of the ammonia in Nigeria to produce [1 million tons per year](#) of DAP and nitrogen-phosphorus-potassium (NPK) fertilizers for Nigeria's domestic market.

In March 2021, OCP and NSIA signed a [shareholders agreement](#) to form a joint venture company for the construction of





the integrated plant, which is scheduled to be operational in 2025. The agreement was part of a package of deals that included a framework agreement for the Nigerian National Petroleum Corporation (NNPC), Mobil Producing Nigeria, and the Gas Aggregation Company Nigeria to supply natural gas to the plant as well as a memorandum of understanding (MOU) to evaluate the potential for an equity investment by the NNPC in the OCP-NSIA joint venture. The agreement cements a division of labor between the joint venture partners in which the Nigerian entities will focus on the upstream component while OCP focuses on fertilizer production, creating a cost-effective Moroccan-Nigerian fertilizer manufacturing value chain.

In addition to its plant in Nigeria, OCP Africa is investing approximately [\\$1.3 billion](#) in the construction of an industrial fertilizer complex in Ghana. Combining Moroccan phosphorus products with Ghanaian natural gas, OCP will similarly [produce](#) ammonia, urea, and DAP. Like the Nigerian facility, Ghana's fertilizer plant will also have an annual fertilizer production capacity of [1 million tons](#). Since Ghana's population is only 15% of the size of Nigeria's, OCP is looking to the Ghanaian facility to [export](#) to other West African markets. For East African markets, OCP is building Africa's second-largest fertilizer production complex in Ethiopia. Using phosphoric acid supplied by Morocco and gas and potash (a key source of potassium), the \$2.4 billion [first development phase](#) will have an annual production capacity of 2.5 million tons of urea, NPK, and nitrogen-phosphorus-sulfur (NPS). In 2021, OCP [signed a joint development agreement](#) with Ethiopia's Ministry of Finance to operate the facility. OCP [expects](#) the joint venture company will start supplying the Ethiopian fertilizer market in 2023. In 2025, OCP plans to invest an additional \$1.2 billion in a phase 2 capacity expansion that will enable yearly fertilizer production to reach 3.8 million tons. Located in Dire Dawa on the Addis Ababa-Djibouti rail line connecting the plant to the Port of Djibouti, the OCP-Ethiopia joint venture will be able to export surplus fertilizer to regional markets.

In all three cases, OCP Africa developed its deep relationships with its Africa partners through developing blended fertilizers for each country and constructing local blending units. Blended fertilizer allows a country to match the fertilizer nutrients specifically to local soil conditions and plant needs. The practice can be more cost effective and avoids environmental damage from excess nutrients escaping into water sources. Working with Ethiopia's Agricultural Transformation Agency, OCP Africa

discovered that a constraint to crop growth in Ethiopia was a [soil deficiency in sulfur](#). Producing NPS and NPS+ fertilizer formulas calibrated for wheat, corn, and teff production in Ethiopia, OCP was able to contribute to yields that have increased by [up to 37%](#). In Ghana, OCP has been [testing two new fertilizer formulas](#) for cassava, vegetables, and soybean production.

In Nigeria, OCP's activities similarly began in 2016 with an agreement to partner with the Fertilizer Producers & Suppliers Association of Nigeria (FEPSAN) on blending operations. Facilitated by NSIA, the OCP-FEPSAN partnership [renovated](#) 13 blending units and packaging facilities, enabling private operators to establish new factories. Continuing to expand the manufacturing value chain in Nigeria, OCP is now constructing [three blending units in Kaduna, Ogun, and Sokoto states](#) with an aggregate capacity to turn out 500,000 tons of fertilizers per year. The units will create fertilizer blends customized to the needs of rice, corn, soybean, cassava, and tomato growers in Nigeria, increasing farmers' yields by [50-85% per hectare](#). The Kaduna facility alone is expected to benefit at least [75,000 smallholder farmers](#). Because of the powerful impact to improve conditions on the ground, OCP Africa's Nigeria division was awarded a \$1.4 million [co-investment grant by the USAID-funded West Africa Trade & Investment Hub](#). Despite the U.S. Department of Commerce's [decision](#) to impose a countervailing tariff of 20% on OCP's fertilizer exports to the United States, OCP's centrality to fertilizer production in Africa was sufficiently compelling for the U.S. government's international development agency USAID to fund its fertilizer manufacturing operations in Nigeria. In addition to manufacturing plants, fertilizer blending facilities have been one of the key infrastructure developments that OCP continues to advance in Africa. OCP is conducting other important manufacturing and blending joint ventures in Tanzania, Rwanda, and several other countries.

## Toward a more sustainable future: Green ammonia

Morocco's extensive solar and wind energy resources hold the potential to transform the current vicious cycle in the food-energy-water nexus into a virtuous cycle in which fertilizer manufacturing is not only powered by renewable energy but the ammonia itself is produced using green hydrogen as an input instead of the "gray" hydrogen derived from natural gas. OCP has committed itself to achieving [carbon neutrality by 2040](#).



Photo above: Aondohimba Abraham, a millet farmer in Eggon, Nasarawa State, Nigeria. [Photo by KOLA SULAIMON/AFP via Getty Images.](#)

In 2020, OCP covered [89%](#) of its energy needs by cogeneration and renewable energy sources. The company has set an [intermediate target](#) to cover 100% of its energy needs by 2030 with co-generation and renewables. According to the company, OCP met 31% of its water needs with unconventional [water resources](#), including treated wastewater from Khouribga, Benguerir, and Youssoufia, the three cities near which [92%](#) of OCP's mining operations are located, as well as desalinated seawater from the Jorf Lasfar and Laayoune desalination plants.

Morocco's growing reliance on sea water reverse osmosis (SWRO) desalination plants to satisfy industrial, agricultural, and residential needs will require sizeable new investments in power generation from renewable energy sources, as SWROs require [10 times the amount of energy](#) to produce the same volume of water as conventional surface water treatment. To advance the sustainability of OCP's operations and expand green ammonia production, Morocco will have to strike a careful balance between its fertilizer exports and its drive to expand its high-value agricultural exports while concurrently providing sufficient drinking water to its population.

In the same year that Morocco reorganized OCP, the kingdom launched its Green Morocco Plan (Plan Maroc Vert), which by 2020 had [raised the value of country's agricultural exports by 117%](#) to roughly \$3.5 billion and [created 342,000 new jobs](#). Rabat's new 10-year successor plan, called [Green Generation 2020-2030](#), is intended to enhance the resilience and sustainability of the country's agricultural production. To this end, Morocco has completed 65% of the construction of [a new seawater desalination plant at Agadir](#) that will supply water for agriculture through a newly constructed irrigation system as well as drinking water for underserved segments of the population. The kingdom's Water Plan 2020-2050, which includes the construction of new desalination plants and dams as well as the expansion of irrigation networks, is [estimated to cost](#) approximately \$40 billion.

With Morocco's scant natural gas resources, OCP imports [1.5 to 2 million tons of ammonia](#) per year. Instead of importing ammonia synthesized from gray hydrogen, Morocco could synthesize green ammonia from the green hydrogen produced from its domestic renewable energy resources. The bulk of





Photo above: An aerial view of the solar mirrors at the Noor 1 Concentrated Solar Power plant, some 20 km (12.5 miles) outside the central Moroccan town of Ouarzazate. Photo by FADEL SENNA/AFP via Getty Images.

green hydrogen's production costs, about 70%, come from the electricity required to split water into its hydrogen and oxygen components and could be powered by Morocco's solar energy resources. In 2018, OCP signed a [cooperation agreement with](#) a German research organization, the Fraunhofer Institute, Europe's largest applied science research institute, to develop a green hydrogen manufacturing project in Benguerir in partnership with the Moroccan Institute for Research in Solar Energy and New Energies (IRESEN). The project would replicate the Fraunhofer Institute's pilot plant in Germany but with the addition of a green ammonia synthesis unit. OCP has invested [\\$200 million](#) in the pilot plant with annual production capacity of [1,460 tons](#) of green ammonia. OCP projects that green ammonia production could be scaled up from the pilot plant to reach [600,000 tons](#) per year and is eyeing European and other export markets in addition to satisfying its input production requirements.

Upon Germany's [promulgation](#) of its "German National Hydrogen Strategy" in June 2020, Morocco became the first

country to sign a [green hydrogen agreement](#) with Berlin to create Africa's first industrial plant for green hydrogen production using Morocco's solar power infrastructure. Within the framework of that agreement the Moroccan Agency for Solar Energy (Masen), Morocco's privately owned, publicly funded integrated renewable energy projects company, undertook the creation of a [10,000-ton-per-year green hydrogen production facility](#) financed by the German development bank KfW. Masen spearheaded the development of Morocco's massive Noor solar power complex, the world's largest solar power facility, having received [€830 million](#) (about \$934 million) in German financing facilitated by KfW, amounting to 41.5% of the investment total.

However, both the IRESEN and Masen projects have faltered as a result of Morocco's March 2021 suspension of diplomatic relations with Germany over Berlin's stance on the issue of the contested Sahara region, forcing both projects to [continue without any interaction](#) with their German partners. The new government that came to power in Germany in December 2021 under Chancellor Olaf Scholz may provide an opportunity to re-



pair the breach in Moroccan-German relations, assisted by the mediation of France, which assumed of the presidency of the Council of the European Union in January 2022.

Diversifying its development partners, Morocco announced in July 2021 the launching of its HEVO Ammonia Morocco project to produce 183,000 tons of green ammonia per year by 2026. Equivalent to about 10% of OCP's current production input requirements, it will be Morocco's largest green ammonia and green hydrogen project to date. The \$850 million plant is being developed by Ireland-headquartered hydrogen technology firm [Fusion Fuel](#) using its HEVO proprietary technology in conjunction with the Consolidated Contractors Company. The trading firm Vitol has [signed an MOU](#) to manage offtake from the HEVO project to market green ammonia in Europe and other nearby markets.

How quickly Morocco actually replaces the gray ammonia in its fertilizer manufacturing with climate-friendly green ammonia will depend on the extent to which Rabat prioritizes exports of green hydrogen over domestic manufacturing use. Ultimately, the sustainability of Morocco's fertilizer industry will require considerable capital expenditures to develop its embryonic green hydrogen sector and the additional power generation capacity from renewable energy sources that it needs.

## Conclusion

With most economic indicators signaling a continuation or even worsening of the already high levels of global food inflation in 2022, Morocco's role in the international commercial system ensuring both the supply and price of fertilizer will become even more vital to the stability and affordability of food supplies. How Morocco performs its role as a gatekeeper of global food supply chains will ultimately depend on its success in achieving energy transition through the expansion of its renewable energy sector. Utilizing its large solar energy resources to power green hydrogen and green ammonia production, along with desalination, Morocco could escape the vicious cycle of the upward spiraling of prices in the food-energy water nexus. Green hydrogen and green ammonia exports could help other countries to do the same as well. With OCP's fertilizer manufacturing plants in Sub-Saharan Africa scheduled to come online over the next three years, green hydrogen and green ammonia could contribute to even more affordable, higher crop yields that would halt

the increase in hunger and fuel the long-awaited African green revolution in food production.

The matter is urgent both for Morocco and the international community. The kingdom requires additional multibillion-dollar infrastructure investments to achieve a sustainable, carbon-neutral fertilizer industry. Such investments provide the United States and Europe an opportunity to raise the level of their strategic engagement with Morocco. In the absence of such engagement, Morocco will partner with other regional and global actors, shifting the geopolitics of global food security.

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