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Policy Brief

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Nexus of Water-Energy-Food as an approach to face climate change

By Hind Bouhia (Global Nexus)

Summary

The Nexus of Water-Energy-Food is at the center of climate change mitigation and adaptation. In fact, the many approaches for these sectors cannot be undertaken in isolation but it has to be included as part of a holistic model.

Such a model would include all the different components related to water and energy, and be able to evaluate the impact on food security and agriculture production. Thus, food security and agriculture sustainability find its critical and complex footprint at the nexus of water, energy, food (WEF) and climate change in Morocco, and other regions of the world.

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Thus, food security and agriculture sustainability find its critical and complex footprint at the nexus of water, energy, food (WEF) and climate change in Morocco, and other regions of the world.

Food: the cornerstone of the WEF nexus

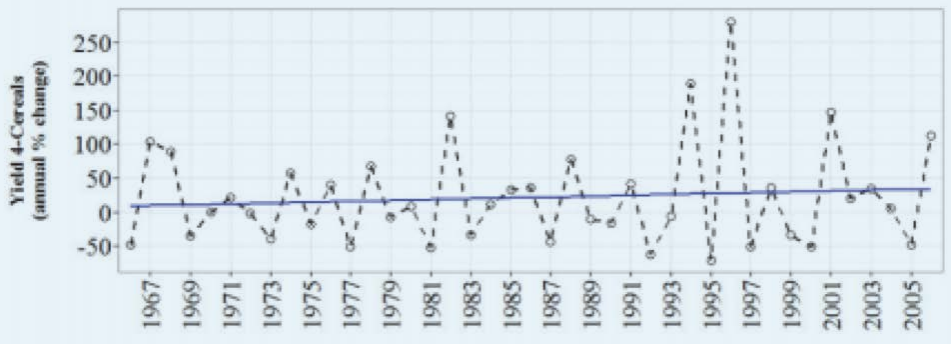
Morocco, a home to cereal, olive, and livestock cultivation, these areas have rapidly decreased in size due to desertification and climate change. In addition, with the increase in population, the value of total arable land per person (hectares per person) in Morocco stood at .342 in 1993. Twenty years later, in 2013, the same value dropped to .240.[1]

Climate change further complicates the picture. According to the Food and Agriculture Organization, Morocco will experience both a decrease of 30% in precipitation and an increase of almost 3 degrees Celsius in annual temperatures by 2050.[2] These dynamics will create further stress on a national agricultural system that is already burdened with producing more with less resources and under high levels of variability (see Box 1 below).

1. http://www.indexmundi.com/facts/morocco/indicator/AG.LND.ARBL.HA.PC
2. http://www.fao.org/fileadmin/user_upload/FAO-countries/Maroc/docs/2017-CC-FAO-EN.pdf

Box 1: Climate Change and Food Production Volatility in Morocco

In 2014, cereal crops in morocco such as wheat, durum wheat, barley, and maize occupied 65 per cent of the country's agricultural area. These four main cereal crops, however, have historically experienced continuous variations in production levels (See Figure Below). These variations may become more protracted due to inconsistent weather patterns and rising temperatures caused by climate change. All these fluctuations have direct impact on agriculture production.



OCP Group, Morocco's national phosphates company, is at the forefront of utilizing technology innovation and policy planning to produce sustainably more with less. As one of the world's largest phosphate companies, OCP Group has an important role to play in ensuring global food security through efficient and rational fertilizer use. OCP Group has partnered with the Moroccan Ministry of Agriculture to launch the Agricultural Development Program, an initiative to increase usage of the right fertilizers in the right amounts. OCP Group's goal is to increase yields without destroying critical natural resources such as water and soil. The program's agricultural caravan travels across the country to give rural farmers the opportunity to learn appropriate fertilization and soil conservation techniques. The program also produces national soil fertility maps to implement context specific fertilizer usage.

Box 2: OCP – Towards Intelligent Fertilization

OCP is the world's largest exporter of phosphate rock and phosphoric acid, as well as one of the world's largest producers of fertilizer. OCP is integrated across the entire phosphate value chain, extracting, marketing and selling phosphate and its derivatives, phosphoric acid and fertilizers.

OCP is a major actor in the global agriculture market. Its principal mission is to offer farmers around the world tools to generate more significant yields, thus allowing them to achieve better productivity and increased income. The Group is committed to providing its expertise to act as a consultant to the farming community in the process of improving yields and delivering sustainable agriculture. For OCP, therefore, increasing farmers' potential is not only limited to marketing fertilizer. It also includes creating lifecycle solutions that respond to challenges encountered by small farmers around the world.

Sources: http://www.ocpgroup.ma/

OCP Group efforts above provide an example of harnessing technology innovation and community based programming to create resilient responses to food security in light of climate change. Morocco's success in sustainably increasing agricultural yields is only part of the larger WEF challenge.

Water: efficiency has become a priority

Water is another critical piece of the resource fabric in Morocco and, similar to food production, water is under heavy stress due to climate change. According to the United Nations Economic Commission for Africa (UNECA), Morocco is already in a condition of "water stress", defined at 1000 m3 to 1700 m3 of available freshwater per person per year. By 2025, Morocco's water security will worsen bringing it into a condition of "water scarcity" with predictions of less than 1000 m3 of available freshwater per person per year.[3] In addition, the reduction of rainfall by 30% has a direct impact on groundwater availability and on agriculture production. In light of these pressures, water usage will need to reach greater levels of efficiency.

Harvard Pilot Project of Urban Water Conservation

During COP22, held in Marrakesh in 2016, the Ministry of Interior in Morocco committed to an urban water conservation pilot for Marrakesh. It was funded by the Harvard Kennedy School and conducted by Global Nexus. This pilot is the first of a series, planned for deployment in other cities in the Middle East and Africa, to promote efficient use of water through tailored incentive mechanisms. Every cubic-meter conserved, compared to a watermark that is provided at the beginning of the billing cycle, is rewarded with water conservation credits. At the end of the pilot, they are exchanged for monetary equivalent and applied to their utility bill. The credits are politically strategic, economically efficient, and not punitive to the poor. In November 2017, the first phase of the pilot concluded with 30 households conserving 408m3 of water over a period of six months. Survey of participating households show that the initiative was well received; some have actually gathered family members and discussed water conservation techniques. The second phase of the pilot is currently underway, with more than 500 participating households. The scope of the initiative may be extended to water intensive industries such as hospitality, industry, and agriculture.

Energy: harnessing renewable energy technology to mitigate climate change

Although promoting sustainable fertilizer usage and incentivizing efficient household water management can mitigate food and water scarcity, it is critical to capitalize on innovative technologies that augment water resources. With nearly 2,000 km of coastline at the junction of the Atlantic Ocean and the Mediterranean Sea, Morocco also has ample ocean water to desalinate. Desalination, however, is an energy intensive process feasible in contexts where there is a secure, cost-effective energy supply such as in the fossil fuel rich Arab Gulf.

Morocco's national energy supply is primarily driven by environmentally and financially costly oil and coal imports. In 2016, Morocco provided for majority of its energy needs with oil (67.6%) followed by coal (16.1%)[4] The Moroccan government is seeking to change its future energy mix by developing renewable energy technologies.

This shift is particularly important to face climate change and mitigate its impact, and that in line with the international community, with the objective to reduce Carbon emission and ensure sustainable sources.

Morocco plans to provide for just over 50% of its energy needs from renewables by 2030, thereby reducing its dependence on fossil fuels. The national renewable energy plan includes the development of the Noor Complex, the world's largest concentrated solar plant located in Ouarzazate, Morocco. The renewable energy industry will also provide Morocco with a vehicle to mitigate the costs associated with desalinization.

This past spring, the Moroccan government announced plans to build the world's largest seawater desalinization unit for irrigation and drinking water. The project will daily provide 150,000 (m3) of desalinated drinking water

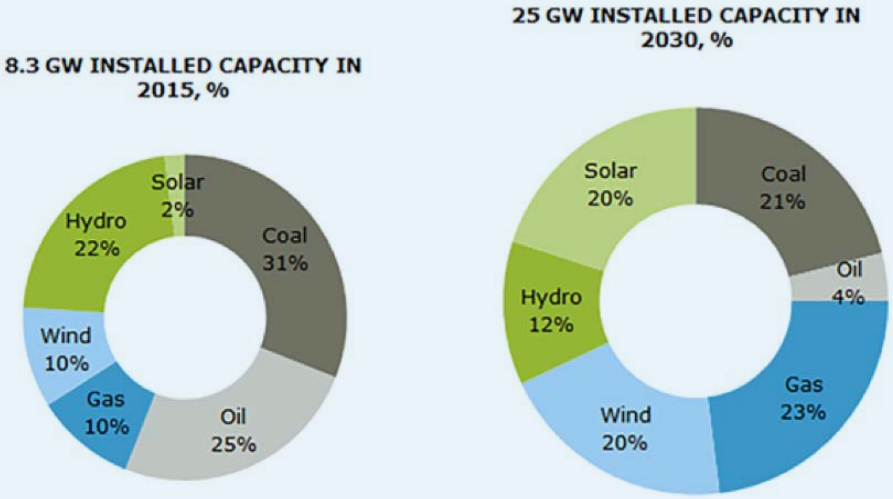
3. https://reliefweb.int/map/morocco/predicted-freshwater-stress-and-scarcity-africa-and-middle-east

4. https://germanwatch.org/en/download/15120.pdf

along with 125,000 (m3) of desalinated irrigation water. High voltage power lines transporting electricity from the Noor Complex will power the desalinization process and the project seeks to eventually increase its daily production to 450,000 (m3).[5] Desalinization is an energy intensive process that requires tradeoff analyses among alternatives such as land based freshwater transport along with evaluation of renewable vs. non-renewable alternatives to powering the desalinization process. The Agadir desalination project is pioneering integrated approaches to tradeoffs nexus of sustainable water, energy, and food management in Morocco and its success could lead to best practices for renewable energy powered desalinization across the Middle East and Africa, home to many of the world's most water insecure countries.

Box 3: Morocco's Ambitious Plans for Renewable Energy

Morocco aims to generate 52% of its electricity needs from renewable energy by 2030 (see pie chart below). Morocco has also lifted all subsidies on diesel, gasoline and heavy fuel oil to encourage more efficient use of energy and to mobilize investments in the transition to a green economy.



Source: http://www.worldbank.org/en/news/feature/2016/11/17/5-things-morocco-is-doing-about-climate-change

Utilizing an integrated WEF nexus approach is critical to mitigating and managing climate changes impacts on Morocco's critical natural resources. Without sound policy management at the WEF nexus, Morocco will face difficulty in sourcing enough water, energy, and food to meet its local demand. As evidenced above, however, these high stakes challenges create opportunities for innovative solutions pioneered by the government, public utilities, business leaders, and academic institutions. Morocco sees a future where rural farmers readily utilize sustainable fertilizer technologies, innovative incentive mechanisms encourage efficient water use, and concentrated solar energy powers desalinization. In this future, ocean water can be sustainably turned into drinking water ending up back in Moroccan homes as a critical ingredient in bread, the centerpiece of the Moroccan diet.

5. http://www.dw.com/en/making-seawater-into-drinking-water-with-the-help-of-the-sun/a-39924334

Conclusion

Integrating the WEF nexus into climate change responses is critical to sustainable economic development. The WEF nexus will become more relevant as climate change further strains critical natural resource systems in Morocco. The WEF nexus approach can also be applied at different levels – from water conservation incentives in urban households to renewable energy provisions in large-scale desalinization projects. With its recent presidency of COP22, Morocco has played a critical role in convening thought leaders on climate change challenges and, as evidenced by the projects above, Morocco is also actively utilizing insights from the WEF nexus to craft solutions. Moving forward, the WEF nexus provides an effective approach for government, industry, and academia to build natural resource resilience to climate change in Morocco and across the Middle East and Africa.

About Global Nexus

Global Nexus is a structure dedicated to investments, strategy and consulting, in sectors related to sustainable energy, water, agriculture, mobility, green development and climate change. Global Nexus is specialized in the integration of innovation and the financing of startups through its Green Innov Invest Fund both in Morocco and Africa. Global Nexus collaborates closely with international partners including the Environmental Engineering Department of Harvard University, Morocco's Sovereign Guarantee Fund, a number of highly respected Moroccan and international institutions to deliver its missions.

Through its advisory arm, Global Nexus Services support leaders in improving the performance of their organizations in a sustainable and substantial way, in sectors around the water-energy-food Nexus. With a cumulative experience of several decades, and teams based in Casablanca, Rabat, and Washington, Global Nexus has developed a multidisciplinary network of professionals to undertake its mission and support its clients in achieving their vision and goals.

About OCP Policy Center

OCP Policy Center is a Moroccan think tank whose mission is to promote knowledge sharing and contribute to enhanced thought on economic issues and international relations. Through a Southern perspective on critical issues and major regional and global strategic issues faced by developing and emerging countries, OCP Policy Center provides a veritable value added and seeks to significantly contribute to strategic decision-making through its four research programs: Agriculture, Environment and Food Security; Economic and Social Development; Conservation of Raw Materials and Finance; and Geopolitics and International Relations.

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Ryad Business Center – South, 4th Floor – Mahaj Erryad - Rabat, Morocco
Email : contact@ocppc.ma / Phone : +212 5 37 27 08 08 / Fax : +212 5 37 71 31 54
Website: www.ocppc.ma