

## What Role Can Renewable Energy and Water and Food Securities Play for North Africa and the Middle East?

By Rabi Mohtar

### Summary

Renewable energy technologies are projected to have substantial growth in the coming decades, especially given the environmental, social and economic drivers observed globally. The Middle East and North Africa (MENA) region encloses abundant alternative energy sources such as solar, wind and hydropower. The concern is more whether the Arab region will be able to respond to and manage the growth opportunities in this emerging sector. This Policy Brief explores opportunities and challenges for the MENA region to adopt and increase the production of alternative energy in an existing national portfolio and the role this renewable sources of energy can help in water and food securities in remote areas that are not serviced by the electric grid. As such renewable energy can help the MENA region towards its quest to achieve the Sustainable Development Goals and in particular Water, Energy, climate goals.

After the historical commitment to the climate agreement in Paris (COP21), countries can deliver and contribute to the global target of scaling up of wind and solar power to 36 per cent of the global energy mix by 2030. The economic impact of a more aggressive adoption of renewable energy technologies is projected to increase national GDPs by around 1%, global welfare by 3.7% and create more than 24 million job opportunities in the renewable energy sector<sup>1</sup>.

To adopt and increase the production of alternative energy in an existing national portfolio, MENA countries need to consider some important pre-requisites:

1. Recognize the impact of new energy portfolios on other primary resources (i.e. water, land, and agriculture). A Water-Energy-Food nexus approach can help decision makers understand this complex energy system and integrate resources planning with sound technical

understanding, governance and financing trade-offs. Also, it is important that external environmental and socio-economic factors are included in such a holistic nexus platform.

2. Assess the importance of renewable energy technologies in providing energy access to remote areas. The Sustainable Development Goals (SDGs) defined by the United Nations lay out an important structure to linking renewable energy to being a catalyst to alleviate poverty and improve access to resources (water-energy-food), especially in areas that did not have equal opportunities in the past.
3. Develop a renewable energy readiness plan, taking into consideration financial, technological, social, and policy readiness factors.

These issues among others will be explored in this article.

1. IRENA, 2016.

## Role of Renewable Energy in Water and Food Securities

It has been widely recognized that the growth in renewable energy deployment has to consider the broader impacts on other development sectors. Biofuels, for example, gained a lot of attention and investment as possible ways of transitioning out of fossil fuels; they make sense especially in rural agro-economies. Nevertheless, when considering the impacts on water and land use, competition with food crops and broader sustainability issues, the production of biofuels from agricultural sources needs to be carefully studied. Impacts of individual technology solutions should be considered at a local and regional level.

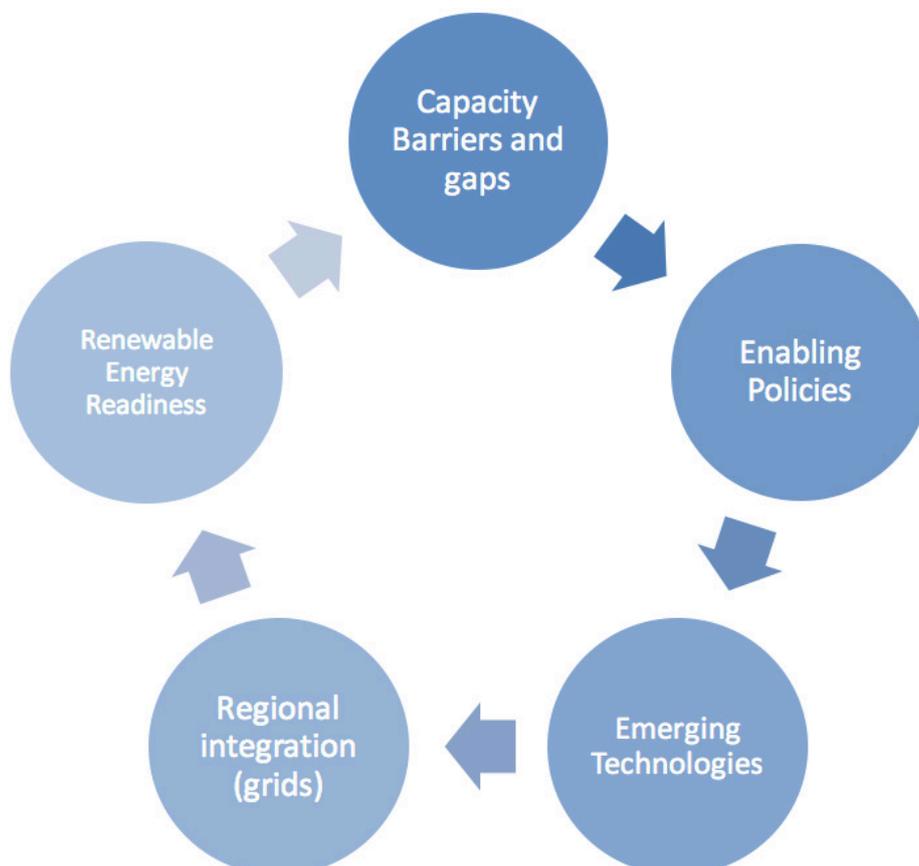
The use of modelling tools and decision support systems can give a clear quantitative projection of the impact of a specific energy production technology into the water and food sectors. For example, the water footprint of solar photo voltaic technologies and wind energy technologies is minimal; on the other side, technologies such as concentrated solar power and bioenergy might make sense in certain aspects but they have a significantly high water

footprint that needs to be considered adequately in energy sector planning for the region. These assessments cannot be generalized and must be localized to each country based on the local conditions since water availability and environmental and socioeconomic conditions vary.

Renewable energy can deliver off-the-grid access to energy intensive food production unit operations such as water pumping and distribution, water treatment and other processes in the supply chain. This provides wider opportunities to implement sustainable manufacturing practices and create bridges to reduce losses and enhance food productivity along the food production chain. Renewable energy can improve access to water in remote areas through water pumping, production and delivery and increase availability for irrigation, thus impacting food security.

Moving towards a diversified national energy portfolio and the implementation of renewable energy production, we suggest the following areas to be taken into consideration as critical elements for countries to achieve their renewable energy national targets (figure 1):

**Figure 1. A framework for Achieving National Renewable Energy Targets**



## Barriers to adopting renewable energy in national energy portfolios: capacity building and manufacturing capacity.

In terms of investments in research for science and technology, the MENA region is generally lacking or needs substantial improvement. This has resulted in countries adopting expensive technologies at high capital costs and with high maintenance and operating costs (mainly because the lack of local capacity and the dependence on outside expensive expertise). The process for overcoming these deficiencies requires public, private and civil involvement; for example:

- It is of utmost importance that renewable technologies be developed and improved locally, taking into consideration geographic, economic and social aspects. Investing in capacity building for local technical workforce is a determining factor to keep costs of renewable technologies at a competitive level and push the supply chain into ideas that make sense to the local needs and reality.
- In order to create local capacity to further develop this sector, renewable energy and sustainability must be embedded in the educational systems in North Africa and the rest of the region. Multidisciplinary programs are needed that include areas such as social sciences, economics, policy, urban planning and management, among others<sup>2</sup>. Also, training at the supply chain (industry) and government agencies is needed in order to transition to a more diverse energy mix.
- Civil society can also play an important role in deployment of renewable energy. Launching awareness campaigns can have an impact at promoting renewable energy technology (RET) in local communities and can improve the society's ability to represent their interests in the national renewable energy action plan process<sup>3</sup>.
- The creation of a culture of innovation is equally important. Besides investing in technology and infrastructure for the adoption of renewable energy, it is essential to deliberately invest in human capital and promote a free society that upholds and values science and creativity.

## Enabling Policies

Clear laws and regulations are a fundamental requirement to encourage investors (whether from the public or private sectors) to adopt renewable energy into the national energy portfolio. Countries like Algeria, Jordan, Morocco, Palestine, Syria and Tunisia have passed renewable energy laws. In Egypt, for example, policies that target to achieve a 20% of the total national energy to be produced from renewable sources by 2020 have been approved and adopted in 2009.<sup>4</sup> The Paris agreement on Climate Change at COP21 is expected to release interesting financial aid opportunities to developing countries that show political willingness to integrate renewable energy.

*"Investing in capacity building for local technical workforce is a determining factor to keep costs of renewable technologies at a competitive level and push the supply chain into ideas that make sense to the local needs and reality."*

National policies and strategies must describe their targets and objectives for adopting renewable energy, taking into consideration national security, environmental, social and economic aspects. Also, setting a legal framework without a clear strategic plan and actions will lead to stagnation and barriers to growth of national economies. The National Renewable Energy Action Plans (NREAP) requires countries to set targets for 2020 or 2030.<sup>5</sup>

A very important aspect of public policies in the energy sector is pricing and the actual value of the energy delivered. It has been widely proved that energy subsidies have negatively impacted national economies and the environment and they are slowly fading away. Energy efficiency and energy productivity are concepts that are driving the development of the energy sector and it is imperative to create a platform of enabling policies as a driving force of the private and public production of energy. It is important to emphasize that the limited involvement of the private sector in power production has been a limitation in the growth of the renewable energy production. A market deregulation, along with strong enabling policies, can create competitive markets and pricing.

2. IRENA, 2016.

3. IRENA, 2016.

4. New and Renewable Energy Authority Egypt (n.d.).

5. ESCWA, 2016

## Emerging Technologies.

As mentioned earlier, the effectiveness and reliability of renewable energy technologies is highly affected by site specific and local conditions. These conditions are classified as environmental (solar energy potential, wind currents potential, surface water potential, energy, weather, geographical location, and position, etc.), socio economic (financial capital to invest in the renewable infrastructure, human capital to adapt and adopt technologies for local conditions), human factors (local capacity to develop, manufacture, deploy, and maintain these energy systems), and policies (subsidies for traditional energy sources and incentives for new energy sources). To adapt existing technologies and develop new ones at low costs locally will still remain the main obstacle in wider deployment of renewable energy and reaching national targets.

*"Integrating regional electricity markets not only increases energy security and facilitates a more efficient use of infrastructure, but it also allows for greater renewable energy penetration and reduces costs for consumers."*

The choice between technologies (i.e. solar thermal or photovoltaic systems) depends on a wide array of factors, most importantly on both the environmental conditions and end-user needs. For example, while photovoltaic is very useful if the end-user need is electricity, thermal technologies are very appropriate heating water for residential, domestic and industrial sectors usage and for steam-based energy uses such as turbines and power plants.

Considering the case of Africa in particular, where the electrification rates in some regions are significantly low, it is crucial to introduce off-the-grid technologies for rural electrification. Hydroelectric power production, and in particular mini-hydro technologies have been considered as a viable option in view of its lower financing requirements and minimal impact on water and land resources. Making this and other RE technologies available to rural Africa (and building know-how capacity), the World Bank estimates that Africa can generate a \$1 trillion agribusiness market.<sup>6</sup>

6. Geman, 2017

## Regional Integration and Infrastructure.

Integrating regional electricity markets not only increases energy security and facilitates a more efficient use of infrastructure, but it also allows for greater renewable energy penetration and reduces costs for consumers. For example, the Maghreb regional interconnection grid connects Algeria, Morocco, and Tunisia (since 1950). These three countries are now all synchronized with the European high-voltage transmission network.

The financing of such local and regional infrastructure projects should come integrated from regional as well as local sources. Governments should put in place incentives and policies to promote distributed solar investment locally. This might create conflict with local power generation utilities but long term benefits and a water-energy nexus approach can create negotiation platforms to deal with this challenge.

## Financing and the Adaptation Fund

The UNFCCC Adaptation Fund constitutes a valuable provision for the financing of renewable energy projects in developing countries. Currently there is a cap of \$10 million per country although discussions are on their way. It is important to develop skills in project finance to attract funding. National implementing entities can either identify key projects with the national authorities, or they can open a call for proposals and select the most relevant project. The Africa Climate Change Fund (ACCF) also provides small grants to support developing economies transition into low carbon development; this fund also provides support for elaborating strong project proposals.<sup>7</sup>

## Renewable energy readiness

With every strategic plan and framework to develop national strategies and targets, it is imperative to have a qualitative system to measure progress and identify gaps. The World Economic Forum developed a set of criteria and a score range to evaluate the readiness of countries for development in their Global Competitiveness Report (GCR). Renewable energy readiness is based on evaluating countries in the following aspects: basic requirements, institutions, infrastructure, macroeconomic environment, higher education and training, goods market efficiency, financial market development, technology readiness and innovation<sup>8</sup>.

7. UNFCCC, 2014

8. WEF, 2011

The EU-GCC network has developed a Renewable Energy Readiness score which includes the following pillars<sup>9</sup>:

- **Infrastructure:** including natural resources, country overall infrastructure, grid capacity, market infrastructure, electricity access rate and projected demand.
- **Institutions:** public and private institutions related on renewable energy, key policies, access to renewable energy finance, macroeconomic environment.
- **Human capital:** technical and commercial skills, technology adoption and diffusion and awareness among consumers, investors and decision makers.

*"In conclusion, a well-planned renewable energy portfolio of MENA countries can be competitive and alleviate water shortages for food and human consumption."*

Such a readiness score can be generalized for the Arab region and be used as a benchmarking tool to help further develop national action plans in other regions. Overall, it was shown that the human capital factors for the implementation of renewable energy is the weakest factor; the infrastructure factor is relatively strong in many countries of the region while the policy aspect needs important improvement. A detailed analysis of the results of such study is highly valuable in identifying gaps and barriers in the adoption of renewable energy in the region, as well as providing a quantitative system for measuring progress in the deployment of RE.

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9. Masdar Institute, (nd).

In most developing countries, the main issues that limit renewable energy competitiveness are bureaucracy and inefficient institutional structures, lack of policy support, and fossil fuel/electricity subsidies.

In conclusion, a well-planned renewable energy portfolio of MENA countries can be competitive and alleviate water shortages for food and human consumption. However, this requires financial and human capital. These investments not only provide opportunities in remote areas where water infrastructure may not be available, but also for cities where the increasing demand for water is threatening economic development and opportunities in our growing population; in addition, investing in renewable energy can help combat climate change impact on our water and food securities.

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Rabi H. Mohtar is a Senior Fellow at OCP Policy Center and TEES Endowed Professor at Texas A&M University, College Station, Texas. He is also an Adjunct Professor at Purdue University. He is the Founding Director of Qatar Environment and Energy Research Institute (QEERI) a member of Qatar Foundation, Research and Development and the Founding Director Strategic Projects at Qatar Foundation Research and Development. He was also the inaugural Director of the Global Engineering Programs at Purdue University, West Lafayette, Indiana.

Mohtar's research addresses global resource challenges: developing the Water-Energy-Food Nexus framework linking science to policy, characterizing soil-water medium using thermodynamic modeling and nontraditional water applications for sustainable integrated water management. He is a distinguished alumni of American University of Beirut (2014), recipient of the Ven Te Chow memorial award, International Water Resources association (2015) and Kishida International Award (2010). Mohtar served on the World Economic Forum Global Agenda Councils on Water Security and on Climate Change (2009-2014). He is a governor of World Water Council since 2012. He has published over 200 published manuscripts include peer-reviewed journals, refereed conference proceedings, books and chapters.

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