

WATER, ENERGY, AND FOOD NEXUS IN THE ARAB REGION

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Addressing water scarcity, both natural and human-induced, in the Arab region is considered one of the major and most critical challenges facing the Arab countries. This challenge is expected to grow with time due to many pressing driving forces, including population growth, food demand, unsettled and politicized shared water resources, climate change, and many others, forcing more countries into more expensive water sources, such as desalination, to augment their limited fresh water supplies. The heavy financial, economic, environmental, as well as social costs and burden to be borne cannot be overemphasized.

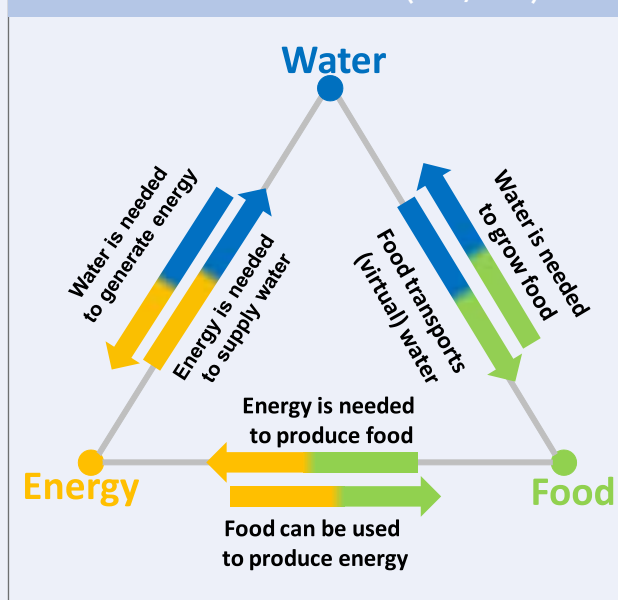
Furthermore, the water scarcity challenge in the region is being compounded by its multiple nexuses with the various development sectors, such as water and human health, water and environment, water and food, water and energy, and many other interdependencies, which carry within them many cross-cutting issues of human rights, social, economic, legal, technical, political, and security nature. It is therefore important to address much more explicitly the various linkages of the water sector with other sectors like energy, food, health, and economic development as a whole. Moreover, professionals in all sectors should think and act beyond the boundaries of their own sector, to achieve effective and integrated resources planning and management.

Based on the current trends in population growth and their associated water, food, and energy demands in the Arab region, water security, energy security and food security are inextricably linked, perhaps more than any other region in the world, and actions in one area have strong impacts on the others. Hence, a nexus approach that integrates management and governance across these three sectors can improve security issues. This can also support the transition to a green economy, which aims, among other goals, at resources use efficiency and policy coherence. A proper understanding of the nexus will allow decision-makers to develop appropriate policies, strategies, and investments to explore and exploit synergies, and to identify trade-offs among the development goals related to water, energy and food security. Moreover, a nexus perspective increases the understanding of the interdependencies across these three sectors and influences policies in other areas of concern, such as climate change and environment. Among the most important inter-dependencies in the Arab countries is the water energy nexus, where all the socio-economic development sectors rely on the sustainable

provision of these two resources. In addition to their central and strategic importance to the region, these two resources are strongly interrelated and becoming increasingly inextricably linked as the water scarcity in the region increases. In the water value chain, energy is required in all segments; energy is used in almost every stage of the water cycle: extracting groundwater, feeding desalination plants with its raw sea/brackish waters and producing freshwater, pumping, conveying, and distributing freshwater, collecting wastewater, along with treatment and reuse. In other words, without energy, mainly in the form of electricity, water availability, delivery systems, and human welfare will not function. It is estimated that in most of the Arab countries, the water cycle demands at least 15% of national electricity consumption¹ and it is continuously on the rise (Khatib, 2010). On the other hand, though less in intensity, water is also needed for energy production through hydroelectric schemes (hydropower) and through desalination (Co-generation Power Desalting Plants (CPDP)), for electricity generation and for cooling purposes, and for energy exploration, production, refining and enhanced oil recovery processes, in addition to many other applications.

The scarcity of fresh water in the Arab region promoted and intensified the technology of desalination and combined co-production of electricity and water, especially in the GCC countries. Desalination, particularly CPDPs, is an energy-intensive process. Given the large market

THE WATER-ENERGY-FOOD NEXUS (UNU, 2013)





size and the strategic role of desalination in the Arab region, the installation of new capacities will increase the overall energy consumption. As energy production is mainly based on fossil-fuels, a finite source, it is clear that development of renewable energies to power desalination plants is needed. Meanwhile, to address concerns about carbon emissions, Arab governments should link any future expansion in desalination capacity to investments in abundantly available renewable sources of energy. There is an urgent need for cooperation among the Arab countries to enhance coordination and investment in R&D in desalination and treatment technologies. Acquiring and localizing these technologies will help in reducing their cost, increasing their reliability as a water source, increasing their added value to the countries' economies, as well as reducing their environmental impacts. Special attention should be paid to renewable and environmentally safe energy sources, of which the most important is solar, which can have enormous potential as most of the Arab region is located within the "sun belt" of the world²

Despite the strong relation, the water-energy nexus and their interrelation has not been fully addressed or considered in the planning and management of both resources in many Arab countries. However, with increasing water scarcity,

many Arab countries have started to realize the growing importance of the nexus, which has now become a focal point of interest³, both in terms of problem definition and in searching for trans-disciplinary and trans-sectoral solutions.

There is an obvious scarcity of scientific research and studies in the field of water-energy nexus⁴ and the interdependencies between these two resources and their mutual values, which is leading to a knowledge gap on the nexus in the region. Moreover, with climate change deeply embedded⁵ within the water energy nexus issue, scientific research on the nexus needs to be associated with the future impacts of climate change. Research institutes and universities need to be encouraged to direct their programs towards understanding the nexus and their interdependencies and inter-linkages. Without the availability of such researches and studies, the nexus challenges cannot be faced and solved effectively, nor can these challenges be converted into opportunities in issues such as increasing water and energy use efficiency, informing technology choices, increasing water and energy policy coherence, and examining the water-energy security nexus.

The water-food linkage represents another important and vital nexus in the Arab countries. Under the current



unstable food security situation (fluctuating energy prices, poor harvests, rising demand from a growing population, the use of bio-fuels and export bans have all increased prices), the ability for the Arab countries to feed their growing population is severely challenged by competition over increasingly limited water resources. Agriculture is currently challenged by competition among sectors on available water resources. While the majority of water in the Arab region is used inefficiently in the agricultural sector (about 85% with less than 40% efficiency), which is not only crucial for food production but also employs a large labor force of rural population, the contribution of agriculture to GDP is significantly low. Hence, and using the argument of higher productivity per drop, voices are increasingly advocating for shift of water resources from agriculture to meet pressing demands of the industrial and municipal sectors. The negative repercussions of that on the agricultural sector and rural population are most evident. However, improving irrigation efficiency can release water for other uses. All of those issues have been discussed in detail in AFED report on water in the Arab region, Sustainable Management of a Scarce Resource (AFED, 2010).

The Arab countries as isolated entities are far from having enough water to grow sufficient basic food. Thus, the

obsession with the idea of self-sufficiency at any cost, which had been predominant in the 1970s and 1980s, has been abandoned. It is no longer rational or sustainable. In fact, the region has been importing more and more food to meet its need. Recent studies have shown that more than half of the food calories consumed in the region is imported and would increase to 64% over the next two decades (World Bank, 2009). An older study in the mid-1990s showed that the food imports of the region were equivalent to 83 billion m³ of virtual water, or about 12% of the region's annual renewable water resources. In fact, the same study has shown that for selected countries, this percentage was much higher: Algeria (87%), Egypt (31%), Jordan (398%), Libya (530%) and Saudi Arabia (580%) (FAO, 2001). With the rise of the population and improvement of lifestyles, one can expect these figures to be much higher today.

A better policy to address national food security can be to improve agricultural production, maximise water productivity, and rely on virtual water trade in food imports. By importing water intensive crops, not only can there be local water savings, there are also energy savings through reduction in withdrawal of irrigation water from deep aquifers (Siddiqi and Anadon, 2011), which could be significant for many Arab countries that have energy intensive groundwater withdrawals, such as the GCC countries. Many of those

challenges can be eased by augmenting pan-Arab regional cooperation in food production.

Arab food security could be achieved through regional agricultural integration that combines the relative comparative advantages of all of the Arab countries, such as land and water resources, human resources, and financial resources. Joint agricultural projects could be implemented towards achieving food security for the region as a whole, using advanced agricultural methods supported by active R&D programs in agricultural production as well as effective governance of water and land resources. In April 2008, in a unified effort to address the current food crisis, Arab countries issued the "Riyadh Declaration on Promoting Arab Cooperation to Face the Global Food Crisis"⁶ under the auspices of the Arab Organisation for Agricultural Development (AOAD). The Declaration calls for sound trade and investment schemes for enhanced food security in the short and long terms, through public private partnerships and enhanced inter-Arab agricultural trade (FAO, 2009; LAS and AOAD, 2008). Equally, consecutive AFED reports on Water (2010), Green Economy (2011) and Ecological Footprint (2012) reached similar conclusion on the benefits of boosting irrigation efficiency, increasing productivity levels of crops, in combination with regional cooperation, as means to enhance food security (AFED, 2010; 2010; 2012).

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Notes

- For example, in Saudi Arabia it is estimated that more than 9% of the total annual electric power is consumed only for water production (groundwater extraction and desalination); the additional downstream segments in the water value chain of transmission, distribution, treatment and reuse/disposal add further to this estimate (Siddiqi and Anadon, 2011).
- It is estimated that if Arab countries used only 5% of their deserts to build concentrated solar power plants, they could satisfy the energy needs of the world (Hmaidan, 2007).
- e.g., Amman-Cologne Symposium (2011), WSTA 10th Gulf Water Conference (2012), ESCWA's Inter-Governmental Consultation Meeting (2012).
- Most of the available research is concentrated on the reduction of the cost of desalination in terms of energy consumption with limited number on policy, planning and management.
- In fact, it is the discourse on global warming that has opened eyes to the much intrinsic links between both resources (Haering and Hamhaber, 2011).
- The declaration stressed the commitment to enhance Arab cooperation through actions and mechanisms which include (AOAD, 2010):
 - Launching an initiative for an "Emergency Arab Food Security Programme".
 - Encouraging the public and private sectors and Arab business to invest in joint agricultural projects.
 - Commitment of the governments of Arab countries hosting joint Arab agricultural projects to provide facilities, concessions, and promotional guarantees.
 - Adopting an "Arab Food Programme".
 - Mobilizing efforts and resources to prepare national and joint programmes and projects that help achieve the objectives of the SSAAD.
 - Preparation of a plan of action and specific time frame for the coordination of agricultural policies.
 - Urging the setting of regulations and legislations governing the use of food and feed crops in the production of bio-fuel.