

UNITED NATIONS

الاسكوا
ESCWA

The Water, Energy and Food Security Nexus in the Arab Region

Economic and Social Commission for Western Asia

The Water, Energy and Food Security Nexus in the Arab Region



UNITED NATIONS
Beirut

© 2016 United Nations
All rights reserved worldwide

Requests to reproduce excerpts or to photocopy should be addressed to the United Nations Economic and Social Commission for Western Asia (ESCWA).

All other queries on rights and licenses, including subsidiary rights, should be addressed to: ESCWA, United Nations House, Riad El Solh Square, P.O. Box: 11-8575, Beirut, Lebanon.

E-mail: publications-escwa@un.org; website: www.unescwa.org
United Nations publication issued by ESCWA.

Introduction

Arab States have much to gain from considering the linkages between water, energy and food security as they strive to achieve progress on the Sustainable Development Goals (SDGs). A nexus analytical framework helps to understand those complex relationships and can be applied at various scales of analysis, taking into consideration varying natural resource endowments and different production and consumption patterns between Arab countries.

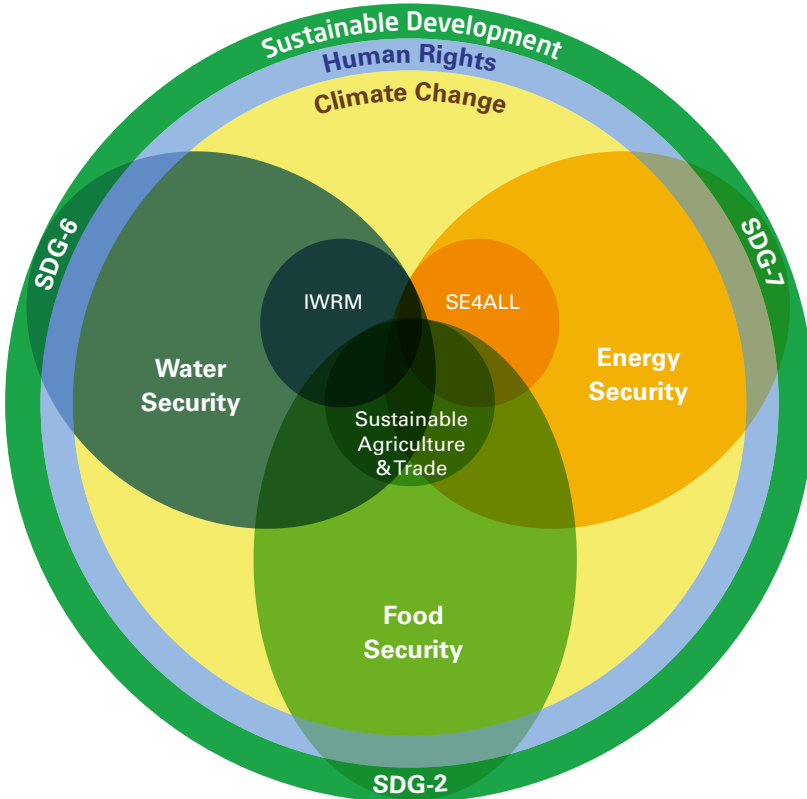
Constructing an analytical framework for examining the water-energy-food (WEF) security nexus in the Arab region requires a common vision based on shared principles acceptable to all Arab countries in spite of differences in their natural resource endowments or socioeconomic capital. This can be achieved by promoting a people-centered approach to the nexus grounded in the SDGs.

A people-centered approach to development, guided by human rights principles on access to water, food and development, can provide the

**The Arab region is one of the most arid in the world.
Two thirds of its freshwater resources cross one
or more international boundaries.**



The Water-Energy-Food Security Nexus



basis for a nexus analytical framework in the Arab region, whereby all three main components of the nexus are seen as equally important.

This conceptual framework is set out in detail in *ESCWA Water Development Report 6: The Water, Energy and Food Security Nexus in the Arab Region* (2015) and illustrates how water, energy and food security are linked. It takes a human-rights based approach to development that aims to ensure universal access to basic services for all, as set forth in the SDGs and in the face of challenges posed by climate change.

Specifically:

- **Water security** is key in the Arab region, one of the most affected by water scarcity in the world. The nexus approach aims to facilitate the achievement of SDG-6 on ensuring availability and sustainable management of water and sanitation for all. The issue of water is also reflected in other SDGs (such as 3, 11, 12 and 15). The WEF security nexus allows for implementation focused on applying and building upon lessons learned from integrated water resources management (IWRM) principles and tools.
- **Energy security** varies greatly from one country to the other in the Arab region. The nexus approach would allow for incorporation of regional efforts to support the Sustainable Energy for All (SEA4ALL) initiative as a path towards improved energy security and the achievement of SDG-7, aimed at ensuring access to affordable, reliable, sustainable and modern energy for all.
- **Food security** in the region is closely linked to the availability and steady supply of water and energy. Sustainable agriculture and reliable trade are key instruments for achieving food security and SDG-2 on ending hunger, achieving food security and improved nutrition and promoting sustainable agriculture.

States should work on policies and plans for food security and universal access to water, sanitation and energy for all not only today, but for generations to come. This conceptual framework is based on a people-centred, human rights approach to WEF security, which largely echoes the vision set forth in the SDGs.

A rights-based approach provides a common set of principles upon which to ground water, energy and food security policy across institutions and sectors, and is consonant with efforts by the United Nations to promote such an approach to development as a whole. It places the nexus in a dynamic context that takes

into account the quantity, quality and accessibility of water, energy and food for present and future generations.

This approach also takes into consideration the effects of climate change on the region's capacity to achieve water, energy and food security. The nexus analytical framework facilitates evaluation of the impact of climate change and contributes to successful integrated resource management. Climate change and extreme climate events need to be accounted for in plans for the Arab region.

The value of the nexus conceptual framework lies in its focus on interdependencies across a range of sectors and the incorporation of sustainable natural resources management. Trade-offs are to be expected, but taking a nexus view of the relationship between sectors makes it possible to identify political priorities, and the constraints and opportunities presented by those links.

The Right to Water

United Nations General Assembly resolution 64/292 (July 2010):
"Recognizes the right to safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights".

The Right to Development

Declaration on the Right to Development (1986): Article 8 asserts that: "States should undertake, at the national level, all necessary measures for the realization of the right to development and shall ensure, inter alia, equality of opportunity for all in their access to basic resources, education, health services, food, housing, employment and the fair distribution of income. Effective measures should be undertaken to ensure that women have an active role in the development process. Appropriate economic and social reforms should be carried out with a view to eradicating all social injustices".

Governments have been reticent to acknowledge that access to energy and electricity services is a prerequisite for development, although the connection has been recognized by scholars throughout the world for decades.

The Right to Food

The Human Rights Council (2008): “Reaffirms the right of everyone to have access to safe and nutritious food, consistent with the right to adequate food and the fundamental right of everyone to be free from hunger, so as to be able to fully develop and maintain his or her physical and mental capacities”.

The Arab Charter on Human Rights

Article 38: “Every person has the right to an adequate standard of living for himself and his family, which ensures their well-being and a decent life, including food, clothing, housing, services and the right to a healthy environment. The State parties shall take the necessary measures commensurate with their resources to guarantee these rights”.

Article 39, paras. 2 (e) and 2 (f): “The measures taken by States shall include the following:” [...] “Provision of basic nutrition and safe drinking water for all” and “Combating environmental pollution and providing proper sanitation systems”.



Water-Energy-Food Security

Availability of and access to water, energy and other resources needed to ensure food security vary in the Arab region. Differences exist between and within countries, and especially between rural and urban communities.

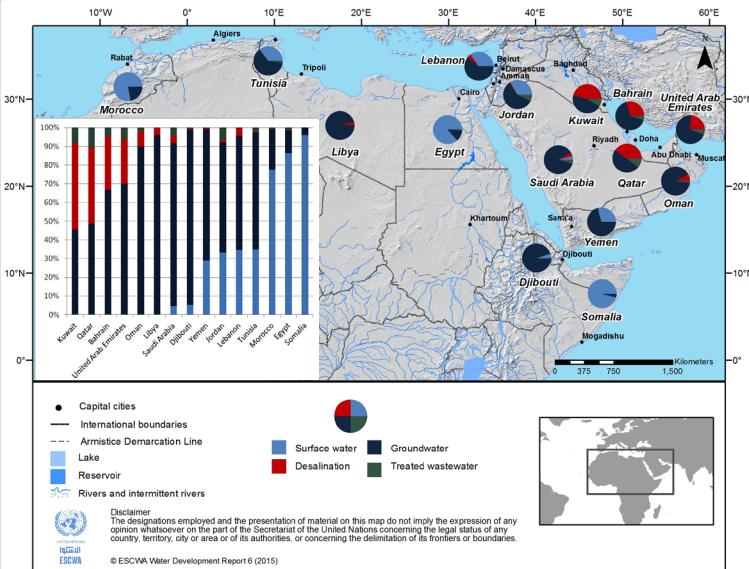
Arab countries are among the most water scarce in the world, and 18 out of 22 of them fall below the renewable water resources scarcity annual threshold of 1,000 cubic metres (m³) per capita per year. No less than 13 ESCWA member States fall below the absolute water scarcity threshold of 500 m³.

The lack of freshwater in the region is exacerbated by dependency on transboundary water resources, declining water quality, accessibility constraints due to occupation and conflict, climate change, non-revenue water losses, inefficient use of water and high population growth. Furthermore, while 56 per cent of the Arab region’s population lives in cities, water for agriculture remains a

Energy Intensive Water Sources in the Arab Region

Water production is energy intensive in most Arab countries. A few, such as Egypt, are blessed with relatively abundant sources of surface water. Countries that rely heavily on desalination, such as the Gulf States, or on groundwater pumping, such as Libya, suffer from high energy demand for the water sector. In Bahrain, desalination accounts for nearly 30 per cent of total energy use, while groundwater pumping accounts for 14 per cent of fuel consumption in Libya.

Water Sources in Selected Arab Countries



priority to ensure food supplies and maintain rural livelihoods in the region's middle and low-income countries.

That is significant, as agriculture accounts for nearly four fifths of the region's freshwater consumption. Energy expenditure for desalination and pumping water from distant sources and deep groundwater aquifers adds to the financial burden to ensure water security.



Energy-Water-Food Security

Energy security is perceived differently across the region owing to the great divergence in the availability of energy resources and consumption patterns in Arab countries. Energy consumption in the Arab region more than doubled between 1971 and 2011 and continues to rise. This has serious implications for energy security and economic growth. Sustainable consumption patterns must be promoted, especially in Gulf Cooperation Council (GCC) countries.

In most other parts of the region, more needs to be done to bring electricity to rural areas, tackle the problem of electricity outages and reduce dependency on fuel imports. All these issues hamper the delivery of reliable water services and food safety in storage and processing facilities. In the Sudan, up to 65 per cent of the population, mostly in rural areas, is not supplied with electricity. Most Arab States are thus seeking a more sustainable and diversified energy mix that includes renewable options and efforts to maximize efficiency.

The GCC countries are rich in energy resources and consume an average of 9,600 kg of oil equivalent per capita annually, compared to an average consumption in the remaining Arab countries of 1,000 kg of oil equivalent per capita in 2011.

Source: World Bank, World Development Indicators. Available from <http://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE>.

Oil and Gas Production

The extraction, production, and refining of oil and gas require significant quantities of water. This presents particular dilemmas in the Arab region, which is so desperately lacking in water. Some Gulf countries rely on non-renewable groundwater and desalination to meet the water demands of the energy sector.

- It takes between 17 and 46 litres of water to extract the equivalent of a barrel of oil. That includes water needed for drilling, flooding and treating.
- Between 200 and 800 litres of water are needed to refine a tonne of crude oil.
- Gas extraction in general is less water intense. Of greater concern is the impact of fracking and the associated chemicals injected to ensure optimal hydraulic fracturing on water quality.

An added challenge is what to do with the so-called “produced water” used in oil and gas extraction. Normally contaminated, it is traditionally either injected deep into suitable rock formations or treated to remove contaminants. Both approaches are energy intensive and costly.

- Ratios of produced water to oil vary greatly between countries and oil fields. Oman has the highest water-oil ratio of 6-10 barrels of water for every barrel of oil produced, and the United Arab Emirates have the lowest ratio, of 0.35 barrels of water to one of oil.

The high demand for already scarce water represents a potential obstacle to the continued development of the generous hydrocarbon endowments in the Arab region.



Food-Energy-Water Security

The Arab region faces food security difficulties too, particularly in countries seeking to enhance it through increased agricultural production. Such efforts are complicated by natural resource depletion



© Aswan High Dam - Sharaf Al Deen

and changing diets brought on by new cultural habits, economic development and globalization. The scarcity of freshwater, land degradation and population growth have led Arab policymakers to conclude that food security cannot be achieved through food self-sufficiency alone, in spite of technological advances in farming.

Several Arab countries have thus turned to international commodity trading and foreign land agreements to ensure food security and preserve scarce water resources. Others have sought to expand agriculture, not only to produce more, but also to generate income and support the rural livelihoods needed to ensure household food security.

The expansion of cereal production in the Arab region by 50 per cent between 1990 and 2011 failed to meet rising demand, as reflected in the 10 per cent increase in the region's cereal import dependency ratio over the same period.

Source: Food and Agriculture Organization of the United Nations (FAO), FAOSTAT. Available from <http://faostat3.Fao.org/home/E>.

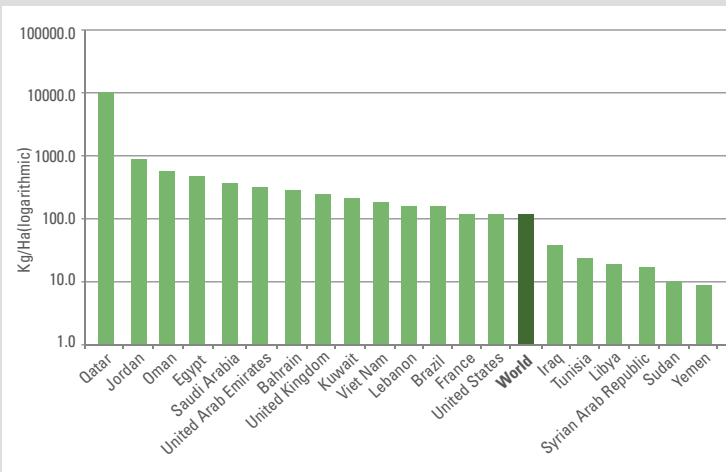
Average water-use efficiency in irrigation systems in the Arab region stands at 50-60 per cent, compared with rates above 80 per cent in Australia or the arid southwestern United States.

Source: World Bank, *Renewable Energy Desalination: An Emerging Solution to Close the Water Gap in the Middle East and North Africa* (Washington, D.C. 2012).

Energy-intensive Fertilizer Consumption in the Arab Region

Although not considered major world agricultural producers, Arab countries are nevertheless major consumers of manufactured fertilizers. Overuse of agricultural chemicals has often led to water and land pollution and contributes to land degradation and the deterioration of water quality in areas like the Nile Delta and Palestine. Energy consumption is estimated to represent about 70 per cent of the cost of manufacturing fertilizers.

NPK (nitrogen, phosphorous and potassium) fertilizer consumption per hectare of cultivated land



Arab countries are among the largest producers of phosphate-based fertilizers in the world. The industry accounts for a significant share of exports from Jordan, Morocco and Tunisia.



Priority Regional Issues for Consideration in the Nexus

At an intergovernmental consultative meeting of members of the ESCWA Committee on Water Resources and ESCWA Committee on Energy in June 2012, seven water-energy nexus priorities were singled out for examination. They were endorsed at subsequent committee sessions. The priorities are:

1. Raising awareness and disseminating knowledge;
2. Improving the harmonization of public policies;
3. Examining the link between water and energy security;
4. Improving efficiency;
5. Increasing knowledge of technological choices;
6. Promoting renewable energy;
7. Integrating climate change and natural disaster factors in to decision-making.

The League of Arab States, supported by ESCWA and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ – German

Agency for International Cooperation), is also promoting regional dialogue on the water-energy-food nexus. The Arab Ministerial Water Council (AMWC) and Arab Ministerial Council for Electricity (AMCE) have issued resolutions in support of inter-sectoral and regional exchange on the matter.

Regional Initiative on the Nexus between the Energy, Water and Food Sectors in the Arab Countries and its Activities

In its resolution K-103-6, of 27 May 2014, regarding the “Regional Initiative on the Nexus between the Energy, Water and Food Sectors in the Arab Countries and its Activities”, the AMWC declared:

- a. The AMWC decides to adopt the activities and invites the AMWC technical secretariat and the GIZ and ESCWA to attract funding to implement the activities and studies of the regional initiative on the water-energy-food nexus.

At its 30th ministerial session, held in Cairo on 16 September 2014, the AMCE recommended in resolution 232:

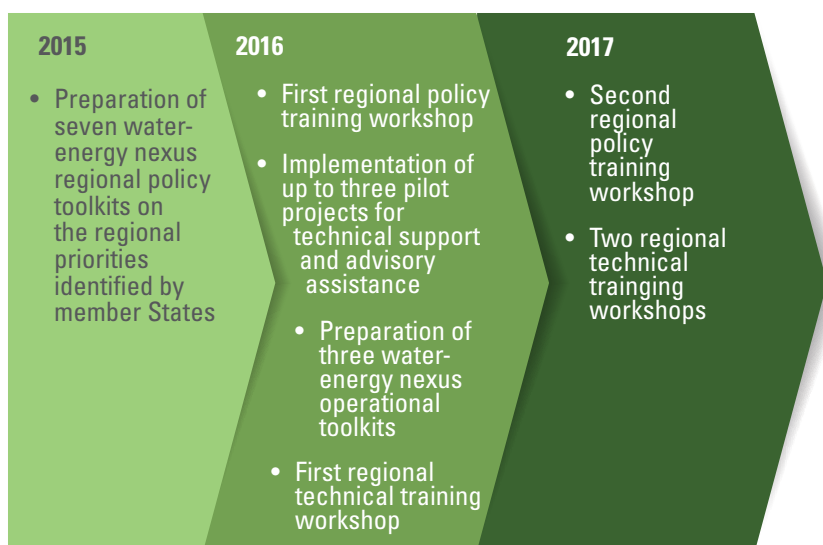
- a. Commissioning the secretariat of the AMCE to coordinate with the AMWC technical secretariat in order to prepare for the organization of the first meeting for Arab experts on the priorities of the energy-water security-food nexus in the Arab region;
- b. Commissioning the secretariat of the AMCE to coordinate with the AMWC technical secretariat, ESCWA and GIZ to support the adoption of the energy-water-food security nexus in the Arab region through suggested activities and studies, especially the regional initiative on the proposed energy-water-food nexus.

Capacity-building in the Arab Region

ESCWA is addressing recommendations by member States and the priorities outlined above through various activities, including a project funded by the United Nations Development Account to develop the capacity of member States to address the water and energy nexus for achieving the SDGs.

Launched in January 2015, the project operates on two tracks, one for senior policymakers and the other for ministerial technical staff involved in the operational aspects of water and energy resources management and service delivery. Regional policy toolkits for senior officials will cover each of the seven priorities outlined above, and technical staff will receive three technical toolkits on resource efficiency, technology transfer and renewable energy. Workshops and demand-driven pilot projects will take place.

Project Activities



Promoting food and water security through cooperation and capacity development in the Arab region

In December 2014, ESCWA and the Swedish International Development Cooperation Agency (Sida) agreed on undertaking a new project on promoting food and water security through cooperation and capacity development in the Arab region. The project is based on the premise that greater coordination is needed between agriculture and water institutions to develop more appropriate and integrated policies and plans for achieving food security in the region. It aims at enhancing the capacity of stakeholders in the Arab region in the following four areas:

1. Assessing the impact of changing water availability on agricultural production;
2. Coordinating the development of policies in the areas of food and water security;
3. Assessing food security;
4. Achieving food production efficiency.

This four-year project is led by ESCWA and implemented in consultation with the League of Arab States, its associated ministerial councils and specialized agencies, and other organizations serving the Arab region. The project will build upon findings and outputs generated under the Regional Initiative for the Assessment of the Impact of Climate Change on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR).