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NATURAL RESOURCES MANAGEMENT FOR SUSTAINABLE DEVELOPMENT

THE ENERGY-WATER-FOOD NEXUS IN THE ARAB REGION

Summary

Arab countries have different natural resource endowments, particularly in terms of fresh water, fossil fuel and arable land. They also differ in their level of dependency on foreign agricultural production to attain food security. However, they face common challenges in their efforts to manage natural resources. Achieving development objectives in the Arab region can greatly benefit from the nexus approach to water, energy and food, which would also allow for the integration of important challenges associated with population growth, climate change and ecosystems management.

This report reviews the work undertaken by the Economic and Social Commission for Western Asia (ESCWA) to enhance understanding of the water, energy and food nexus as an analytical framework to support efforts towards sustainable development. It also proposes an outline for future activities to be implemented by ESCWA in collaboration with concerned national and regional stakeholders, as recommended by the Committee on Energy, the Committee on Water Resources, the Arab Ministerial Council for Electricity and the Arab Ministerial Water Council, during their respective sessions in 2013 and 2014.

This document is presented to the eleventh session of the Committee on Water Resources and the tenth Session of the Committee on Energy so that participants review mandates and activities and advise on further work that ESCWA could pursue on the water, energy and food nexus. Member States are also invited to share their experiences in using nexus analytical frameworks in their current activities and in national deliberations on the post-2015 development agenda.

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Introduction

1. Arab countries have different natural resource endowments, particularly in terms of fresh water, indigenous fossil fuel and arable land. They differ in their level of dependency on foreign agricultural production to attain food security. Large disparities also exist in the per capita annual shares of renewable water resources in the Arab region: about 75 per cent of the population fall below the level of 1,000 cubic metres (m^3) and the share of almost half of those barely reaches the level of 500 m^3 per capita annually. The levels of total energy and electrical energy consumption per year and per capita vary greatly; so does energy intensity, revealing a real problem of access to energy services of acceptable quality in many Arab countries on the one hand, and unsustainable patterns of energy consumption in most Arab countries on the other hand.

2. Water and energy are very closely linked. Water is needed in the process of extracting fossil fuels, refining crude oil, generating electricity and in many other thermal processes in industrial sectors. Energy is, in turn, needed throughout the water use cycle, from extraction, desalination, treatment and distribution to wastewater treatment. An important part of the energy consumed in the region is dedicated to desalination, with countries of the Gulf Cooperation Council (GCC) producing more than half of the world's desalinated water.[1] According to some projections, most of the Arab countries' oil production could be directed towards desalination in the near future, if water demand continues to increase at current rates.[2]

3. Arab States thus face common challenges in their efforts to manage natural resources. Freshwater scarcity remains an ever-present constraint to the achievement of development objectives throughout the region. The ineffectiveness of water use and inefficiencies in energy production, distribution and use are also impediments to these objectives. Concerns about the sustainability of the energy mix have prompted Governments to pursue new and alternative energy sources and energy efficiency programmes, in order to ensure energy security in both the short and long terms. Food security has also become an increasingly daunting challenge in the Arab region, in face of changing production and consumption patterns, land degradation and the pressures of socioeconomic disparities between rural and urban areas. The situation is further complicated by population growth and climate change, which are affecting all Arab countries and straining their natural reserves.

4. Attaining energy, water and food security is critical to achieving sustainable development. This requires the adoption of an integrated natural resource management approach. Indeed, water security cannot be achieved without the energy resources needed for desalination, water treatment or water pumping, for example. The energy and water needed to operate irrigation networks have long been a concern of farmers at the local level; this must now be an issue considered by Governments during the formulation of national and regional policies aimed at achieving food security, sustaining rural livelihoods and promoting social justice and stability in the region.

5. The water, energy and food nexus should be at the core of such an integrated approach. Related issues such as climate change, ecosystem management, demography and vulnerability can also be examined in the framework of that approach. Indeed, the scope of the framework can vary depending on the interests of the relevant stakeholders and their intention to use it to support the formulation of integrated policies and to devise plans, measures and instruments for the implementation of such policies.

6. The operationalization of the 'nexus' analytical framework largely depends upon the institutional mechanisms available for integrated planning and policymaking. Policy processes and institutional structures and procedures should be reviewed, so that planning can be pursued at the intersectoral and

[1] Omar Saif, "The future outlook of desalination in the Gulf: challenges and opportunities faced by Qatar and the United Arab Emirates", 18 December 2012. Available from http://inweh.unu.edu/wp-content/uploads/2013/11/The-Future-Outlook-of-Desalination-in-the-Gulf.pdf.

[2] Darwish and others, "Towards sustainable seawater desalting in the Gulf area", *Desalination*, vol. 235 (2009) pp. 58-87.

intergovernmental levels. Additional background information on the origins and scope of the nexus analytical framework can be found in the working paper prepared by the Economic and Social Commission for Western Asia (ESCWA) on "Conceptual frameworks for understanding the water, energy and food security nexus" (E/ESCWA/SDPD/2015/WP.2).

I. THE NEXUS FROM A REGIONAL PERSPECTIVE

A. REGIONAL PRIORITIES

7. ESCWA convened an intergovernmental consultative meeting on the water and energy nexus in the region in Beirut, on 27 and 28 June 2012. The purpose of the meeting was to initiate intersectoral and intergovernmental dialogue on water and energy issues. Discussions were based on the findings of country-level questionnaires completed by officials of energy and water ministries identified by members of the Committee on Water Resources and the Committee on Energy. More information is available in the meeting report (ESCWA/SDPD/2012/IC.1/2/Report). The consultation resulted in the identification of seven priority areas for future work, namely:

(a) Raising awareness and disseminating knowledge about the nexus;
(b) Improving the harmonization of public policies;
(c) Examining the link between water security and energy security;
(d) Improving efficiency;
(e) Increasing knowledge of technological choices;
(f) Promoting renewable energy;
(g) Integrating climate change and natural disaster factors in decision-making.

8. The recommendations of the consultative meeting were discussed at the ninth session of the Committee on Energy (Kuwait, 12-13 June 2013) and the tenth session of the Committee on Water (Beirut, 20-22 March 2013). Both committees decided to further advance work on the nexus during their upcoming sessions. Both committees also issued recommendations specifically related to the water-energy-food nexus, presented in their respective meeting reports (E/ESCWA/SDPD/2013/IG.2/7/Report and E/ESCWA/SDPD/2013/IG.1/8/Report). Specifically, the Committee on Water Resources recommended the following:

(a) *Recommendation (e): Coordinate with stakeholders to nominate focal points to participate in the working groups that will follow up on issues related to the water-energy-food nexus, in accordance with a formal note to be issued by the secretariat to the relevant ministries;*

(b) *Recommendation (u): Continue the implementation of activities focused on the water-energy-food nexus, given its importance for the Arab region.*

The Committee on Energy, in turn, recommended the following:

(a) *Recommendation (d): Expand the technical cooperation activities of ESCWA to include energy efficiency in buildings in the Arab region; investment in energy efficiency and renewable energy projects to achieve sustainable development and mitigate the effects of climate change ; development of the capacities of ESCWA member countries with regard to the water-energy-food nexus to achieve the goals of sustainable development; giving special attention to the least developed countries with regard to the preparation of bankable projects in the field of renewable energy, in coordination with regional and international organizations; supporting the strengthening of institutional frameworks and restructuring of the energy sector in countries emerging from conflict by conducting training workshops and field visits; and supporting the efforts of States in building partnerships between the public and private sectors for the development of renewable energy projects;*

(b) *Recommendation (l): Continue consultation between the Committee on Energy and the Committee on Water Resources on the water-energy nexus to achieve the objectives of sustainable development.*

These recommendations were endorsed by the twenty-eighth ESCWA ministerial session (Tunis, 17-18 September 2014).

B. Regional initiative

9. The secretariat of the League of Arab States has expressed its interest in pursuing work on the water-energy-food nexus; so did the Arab Ministerial Council for Electricity and the Arab Ministerial Water Council. A meeting session was organized by the League of Arab States and the German Agency for International Cooperation (GIZ) on the sidelines of the South-South Arab Development Expo (Doha, 20 February 2014), with the aim of fostering regional dialogue on the nexus among members of the Arab Ministerial Water Council, the Arab Ministerial Council for Electricity and the Council of Arab Ministers Responsible for the Environment. The outline of a regional initiative was subsequently drafted.

10. Both ministerial councils subsequently issued resolutions inviting ESCWA and GIZ to attract funding to implement activities and studies in the context of the regional initiative on the energy-water-food nexus, and to organize meetings for Arab experts on the related regional priorities (Arab Ministerial Water Council resolution K-103-6 of 27 May 2014 and Arab Ministerial Council for Electricity resolution 232 of 16 September 2014). Specifically, the Arab Ministerial Water Council recommended the following:

(a) *Resolution K-103-6 27/5/2014: The Arab Ministerial Water Council decides to adopt the activities and invites the Technical Secretariat of the Council, GIZ and ESCWA to attract funding to implement the activities and studies pertaining to the Regional Initiative on the Energy-Water-Food Nexus.*

The Arab Ministerial Council for Electricity, in turn, recommended the following:

(a) *Commissioning the Secretariat of the Arab Ministerial Council for Electricity to coordinate with the Technical Secretariat of the Arab Ministerial Water Council to prepare for the organization of the first meeting of Arab experts on the priorities of the energy-water-food security nexus in the Arab region;*

(b) *Commissioning the Secretariat of the Arab Ministerial Council for Electricity to work in coordination with the Technical Secretariat of the Arab Ministerial Water Council, 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 Energy-Water-Food Nexus that is proposed for implementation.*

The League of Arab States has subsequently invited ESCWA and GIZ to coordinate their support to the councils on the nexus.

II. ESCWA NEXUS-RELATED ACTIVITIES

A. Project: Developing the capacity of ESCWA member countries to address the water and energy nexus for achieving sustainable development goals

11. Based on the outcomes of the aforementioned intergovernmental consultative meeting on the water and energy nexus in the region, ESCWA secured funding from the United Nations Development Account to implement a project on developing the capacity of ESCWA member countries to address the water and energy nexus for achieving sustainable development goals, starting December 2014 and lasting until

December 2017. The project aims to build the capacity of ministries and public service providers who are responsible for water and energy in the region, so that they adopt the nexus approach and address water and energy issues in an integrated manner. The project also aims to assist ESCWA member States in bringing the nexus approach to their contributions to the global deliberations on sustainable development goals in a post-2015 development framework. Efforts have already been undertaken to coordinate project activities with those proposed under the aforementioned regional initiative.

12. The project will be pursued through two complementary capacity-building interventions. The first will target high-level officials in ministries responsible for water and energy, who will receive training on how to address and incorporate water and energy as a nexus in their strategies, policies and plans at the national and regional levels. This will be achieved through the preparation of a regional policy toolkit, two regional policy training workshops and three pilot projects. The policy toolkit will comprise seven modules focused on knowledge and awareness-raising; policy coherence; the water-energy security nexus; efficiency; technology; renewable energy; and climate change and natural disasters, which were the priorities identified during the intergovernmental consultative meeting. The second intervention will target public service providers in the water and energy sectors and tackle three technical areas, namely resource efficiency, technology transfer and renewable energy. Three technical toolkits will be prepared to inform regional discussions on these subjects.

B. Expert group meeting on the water, energy and food security nexus in the Arab region

13. In partnership with the League of Arab States, ESCWA is organizing an expert group meeting on the water, energy and food security nexus in the Arab region, to be held in Amman on 24 and 25 March 2015. The expert group meeting is organized back-to-back with the tenth session of the Committee on Energy (Amman, 22-23 March 2015) and the eleventh session of the Committee on Water Resources (Amman, 26-27 March 2015), in order to provide an opportunity for members of both intergovernmental committees to examine and discuss issues of mutual concern. The meeting will provide an overview of the various conceptual frameworks available for approaching the nexus; it will also present ways in which improved understanding and operationalization of the nexus can contribute to integrated natural resources management and efforts to achieve sustainable development.

C. ESCWA Water Development Report 6

14. The sixth issue of the ESCWA Water Development Report will focus on the water, energy and food security nexus in the Arab region. The report will specifically seek to introduce the nexus as an analytical framework for supporting the achievement of sustainable development in the region. It will apply a nexus perspective when considering shared water resources management challenges; examine energy and water interdependencies related to the delivery of basic services; and consider the water and energy challenges to food security in the Arab region. The report will also make recommendations for improving integrated water resources management. It will be issued in 2015.

D. Project: Promoting food and water security through cooperation and capacity development in the Arab region

15. 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: (a) assessing the impact of changing water availability on agricultural production; (b) coordinating the development of policies in the areas of food and water security; (c) assessing food security; and (d) achieving food production efficiency.

16. 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 Socioeconomic Vulnerability in the Arab Region (RICCAR), which is also funded by Sida.

E. SUSTAINABLE ENERGY PROJECTS

17. The Arab region remains heavily reliant on oil, coal and natural gas. The energy sector is a large consumer of water, which is needed for fuel extraction, processing, power generation, transformation processes and during final use of energy. Moreover, energy efficiency and renewable energy are seen as reliable alternatives to meet the growing energy requirements for water pumping and desalination, and for thermal needs. The dissemination of appropriate renewable energy technologies can also play a major role in the alleviation of poverty in rural areas.

18. To this end, ESCWA implemented the United Nations Development Account project on capacity-building on climate change mitigation for poverty alleviation in Western Asia (March 2011-December 2014). The project resulted in the establishment of the Clean Technologies Innovation Center in 2014, which is hosted by the American University of Beirut (AUB) and serves as a training and educational facility for renewable energy capacity-building at the national and regional levels. The purpose of the centre is to showcase operational models of appropriate renewable energy technologies (a photovoltaic system, a solar water heater, an anaerobic digester and an energy-efficient building for poultry farming, for example) and to organize educational visits to build awareness and knowledge.

19. In order to reinforce capacity in this area, ESCWA is currently implementing another Development Account project on building capacities in developing appropriate green technologies for improving the livelihood of rural communities in the region, which aims at alleviating poverty in rural areas through the use of appropriate renewable energy technologies that can improve productivity and income. The project time frame is March 2014-December 2015. A value chain analysis and input-output assessment tools are being prepared. The methodology will be tested, finalized and then disseminated through a series of workshops.

20. A survey of income-generating activities in selected rural areas of Jordan, Morocco, the Sudan and Tunisia has already been completed in the framework of that project. It mapped the use of energy inputs in key sectors in rural areas that are also dependent upon water and land resources, such as agriculture, agribusiness, fisheries, handicrafts (pottery) and tourism. The survey has revealed the current types and levels of energy use for water pumping, heating, cooling, the production of animal feed, etc. This information will help determine which sectors and processes could benefit from investing in renewable energy alternatives. An expert group meeting will be organized to vet and validate the assessment methodology once tested, and to propose an outline for a training guide for practitioners and policymakers on renewable energy options. Training workshops will then be organized.

21. ESCWA has also participated, along with the four other United Nations regional commissions, in the implementation of a Development Account project on promoting energy efficiency investments for climate change mitigation and sustainable development. The objective was to strengthen the capacities of member States in attracting investments in energy efficiency projects, in the context of climate change mitigation. Many activities were carried out as part of this project, including the organization of a regional training on technical and economic aspects for developing energy efficiency investment projects. Two other workshops were also organized to provide capacity-building on enabling policies for financing energy efficiency investments and on developing a regional energy efficiency investment pipeline. ESCWA also produced reports for three case studies on the experience of policy reforms, in cooperation with national institutions in three beneficiary countries. The three case studies covered three economic sectors in three member countries, as follows: the building sector in Kuwait; the industry sector in Tunisia; and the transportation sector in Egypt. A regional pipeline of energy efficiency projects was also initiated and a total of 18 projects

from eight member countries were received, covering six different economic branches. Many of those energy efficiency activities and projects covered issues related to the water and energy nexus.

22. Finally, ESCWA is implementing another Development Account project in the field of renewable energies, on promoting renewable energy investments for climate change mitigation and sustainable development. The project was launched during the Fifth International Forum on Energy for Sustainable Development, which took place in Hammamet (4-7 November 2014). The launching ceremony included a workshop that presented the different components of the project, lessons learned from international experiences and a brief introduction to some of the renewable energy activities undertaken in the region. Promoting renewable energy investments in the region is a means for advancing climate change mitigation, which in turn would help reduce stress on water and land resources. The project is implemented in cooperation with the United Nations Economic Commission for Europe and includes consultations with regional partners, including the Regional Center for Renewable Energy and Energy Efficiency in Egypt and the International Renewable Energy Agency (IRENA) in Abu Dhabi.

F. Study and workshop on energy productivity in Gulf Cooperation Council countries

23. ESCWA is collaborating closely with the King Abdullah Petroleum Studies and Research Center (KAPSARC), IRENA and the Masdar Institute of Science and Technology on the water-energy-food nexus and desalination issues. Activities include cooperation between ESCWA and KAPSARC on the preparation of a publication on "Energy Productivity in the Arab Region: GCC Countries". This study will highlight the social gains from energy productivity investments and pathways to achieving improved performance in this area, including the benefits to countries outside the GCC subregion. In preparation for it, a workshop on energy productivity in GCC: country and sector case studies (Riyadh, 10-11 February 2015) has been organized and included a presentation by the Masdar Institute of Science and Technology on opportunities provided by the energy-water-food nexus approach for GCC countries.

G. Contribution to global, regional and national meetings on the nexus

24. During 2013, ESCWA contributed to several meetings focused on the nexus. It co-organized, with the Hariri Foundation, the Water, Food and Energy Nexus Conference at the United Nations House (Beirut, 25 October 2013) to discuss interlinkages between these sectors with national stakeholders. ESCWA also co-convened and contributed to several sessions of the Near East and North Africa Land and Water Days (Amman, 15-18 December 2013).

25. During 2014, ESCWA organized the Seminar on the Water-Energy Nexus: Issues and Challenges, in collaboration with the Association of the Friends of Abd El Al. The event was held in commemoration of World Water Day (Beirut, 21 March 2014). A presentation was also made on the various conceptual frameworks related to the nexus at the Fifth Beirut Water Week (Louaize, 22-23 May 2014). In addition, ESCWA was a co-convener of the MENA Nexus Seminar: Regional Cooperation for Sharing Solutions (Stockholm, 1 September 2014), which was organized during World Water Week 2014. Presentations were also made on the water-energy nexus during that week, namely on the Arab region chapter of the 2014 World Water Development Report. ESCWA also contributed as a high-level speaker to the event on Renewable Energy and the Water, Energy and Food Nexus, which was held at the World Energy Future Summit (Abu Dhabi, 21 January 2015), during Abu Dhabi Sustainability Week (Abu Dhabi, 17-24 January 2015).

III. FUTURE WORK PROSPECTS

26. ESCWA kindly invites participants to the eleventh session of the Committee on Water Resources and the tenth session of the Committee on Energy, during their respective intergovernmental meetings, to advise on future work that it would like the secretariat to pursue on the water, energy and food nexus, in the light of

the recent developments and new projects implemented in the field. Guidance is specifically requested on the scope of work and whether climate change and/or ecosystem management issues should be integrated within the nexus analytical framework. Member States are also invited to share their experiences on the use of analytical frameworks in their current work on the nexus, especially with respect to national deliberations on the post-2015 development agenda.

27. Further development work can be programmed by the Energy Section of the Sustainable Development Policies Division at ESCWA within the seven priority areas determined by the previously mentioned intergovernmental consultative meeting on the water and energy nexus in the Arab region. Particular focus could be placed on the following three issues: improving efficiency; increasing knowledge of technological choices; and promoting renewable energy. Member States could contribute to that effort by undertaking the activities proposed in the below paragraphs.

28. Policies and standards should be developed or reinforced to promote efficiency improvement, particularly in the following processes and areas:

- Desalination processes;
- Water and wastewater pumping, including equipment energy efficiency requirements, and smart grid water distribution and pumping systems involving variable speed motors and appropriate monitoring and control systems;
- Aeration in biological treatment systems and operation of anaerobic digesters;
- Water loss in the water distribution systems;
- Demand-side management, including smart irrigation systems, water heating systems, other building or household equipments using or dispensing water, as well as consumer behavior.

29. Pilot projects should be developed or reinforced to promote appropriate renewable energy technologies in the following fields:

- Use of renewable energy for desalination;
- Use of renewable energy for water pumping;
- Use of renewable energy for food drying and processing.

30. Data collection procedures should be reinforced/reviewed, so that energy and water production and consumption statistics can be developed throughout the water cycle. The statistical data should allow the establishment of key performance indicators and the monitoring of consumption patterns, enabling long-term planning and a more efficient management of national natural resources. The collected data should be of sufficient quality to allow the strengthening of analytical capacity, thus facilitating evidence-based policymaking and policy assessment in the interrelated fields of water, food and energy.
