SUSTAINABLE BRACKISH GROUNDWATER USE IN THE ARAB REGION

POLICY BRIEF

المجلس العربي للمياه
Arab Water Council

United Nations Educational, Scientific and Cultural Organization
منظمة الأمم المتحدة للتربية والعلم والثقافة
Cairo Office
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Key Messages

- The use of brackish groundwater (BGW) could supplement the use of scarce freshwater sources in the Arab region. Multiple uses of brackish groundwater include irrigation of salt tolerant plants; cooling systems in power generation plants; oil and gas drilling; and municipal supplies after desalination. Brackish groundwater utilization also allows the preservation of freshwater resources for higher water quality uses and postpones more costly water supply interventions including water transfer and expensive desalination schemes.

- In addition to climate change negative impacts, there are many practical challenges and risks facing the wide use of brackish groundwater including accumulation of salts in root zone and salt impacts on the well materials and pump lifetime. Disposal of waste brine in case of desalination is also another challenge for the fragile ecosystem.

- Better understanding of the location, potentiality and characterization of brackish groundwater reserves is needed to expand their development. Feasible BGW potentials would provide technical, economic and environmental bases for better policy-making and investment decisions.

- Taking stock of the availability and potentiality of brackish groundwater should be coupled with developing knowledge base, and technical capacity in BGW development and utilization. Efforts should also target innovations in climate change adaptation measures, aquaculture technologies, irrigation saving technologies and crop varieties that are tolerant to drought and salinity stresses.

This policy brief recommends developing sound policies, strategies, regulatory framework, streamlining research and development programs, financed action plans and cooperation platforms in relation to brackish groundwater utilization in the Arab region.

Context

Renewable groundwater resources in the Arab region are in general quite limited, estimated to be about 45 billion cubic meters annually, mostly in the form of shallow aquifers recharged from rainfall and different surrounding surface water activities (FAO, 2011). Non-renewable groundwater sources (or fossil groundwater) are available in relatively wide areas in the Arab region and at rather larger depths, particularly in the Sahara and the Arabian Peninsula, and are shared among many countries in the region (Al-Zubari, 2014). Due to over-abstraction, most of the groundwater reserve in the Arab region has deteriorated and has become brackish according to its salinity levels classification.

Brackish water or briny water is water that has more salinity than freshwater, but not as much as seawater. Brackish groundwater usually has dissolved solids concentrations between 3,000 and 10,000 mg/L (USGS, 2014). Brackish groundwater is directly used for purposes such as saline agriculture, aquaculture, cooling water for power generation, and for a variety of uses in the oil and gas industry such as drilling, enhancing recovery, and hydraulic fracturing. Brackish water aquaculture, also known as coastal aquaculture, is a rapidly expanding farming activity and could play an important role in the overall fisheries development and food security in the region. As such, brackish groundwater use is emerging as a high potential source of non-conventional water in the Arab water-stressed countries (see Box 1).

Box 1: Brackish Groundwater Reserve and Use in Egypt, Tunisia, UAE and Yemen

Recent studies in **EGYPT** is indicating that brackish groundwater exists in all aquifer systems with potential of about 325 million cubic meters (MCM). Using these resources is still limited to small-scale agricultural activities and as a drinking source for people and for cattle. Recently, medium to large farmers in the northern part of the Nile Delta started to transfer their agricultural land to fish farms based on brackish groundwater as a result of freshwater shortage (Attia et al., 2010).

In the South of **TUNISIA**, the authorities have been able to use reverse osmosis technology to convert brackish groundwater into drinking water. The government subsidizes the private sector to invest in desalination and considers this technology a key part of the long-term national water management strategy. Meanwhile, the government plans to increase public sector installed capacity from 44 MCM/day in 2009 to 50 MCM/day by 2030, (World Bank 2009).

In **UAE,** the brackish to saline groundwater aquifer potentiality is about 650 billion cubic meters. At present the brackish groundwater use contributes with about 50% of the total water use. It is used directly for irrigation of farms and forests and for domestic sector after using membrane desalination technology (Dawoud, 2014).

In **YEMEN**, the usable brackish water for agriculture in Yemen is about 300 MCM/year, mostly for irrigating some tolerant crops in the coastal areas. The total irrigated area by brackish water is about 38,500 ha. In highlands, brackish water is mainly used for rock cutting industry, In Taiz city, brackish water with high salinity is used for water supply by mixing with freshwater for domestic use without any desalination.

Better understanding of the location, potentiality and characterization of the brackish groundwater reserve is needed to expand the development of the resource and provide technical, economic and environmental bases for educated sound policy making-decisions and sustainable development interventions.

This policy brief discusses the brackish groundwater potentials, challenges, and its sustainable development in the Arab region. The brief also provides recommendations to meet the increasing demand for brackish groundwater, and to build necessary capacity and institutional structure. Ecosystem and environmental protection measures were also addressed in relation to brackish groundwater use in agriculture and aquaculture.

This effort is part of the mandate of the Arab Water Council and UNESCO to establish an Arab Regional Initiative in support of the non-conventional water resources (NCWR) development. The initiative aims to support the sustainable development of NCWR, including brackish groundwater. Support would include financial, legal and technical measures to adopt proper policies and build up appropriate structures and human capacities.

Brackish Groundwater Use : Challenges and Opportunities

There are many practical challenges facing the wide use of brackish groundwater such as accumulation of salts in the root zone and salt impacts on the well materials and pump lifetime. Disposal of waste brine in case of desalination is also another challenge. Brackish groundwater irrigation effect includes yield reductions due to salt accumulation, high cost of agricultural inputs due to the need for deeper plowing and pumping costs to cover the additional water requirement for leaching. However, in arid countries, it is not whether to use brackish/saline water to irrigate, but rather how best to use this “resource” in a sustainable manner and with as little detrimental effect as possible on the natural resource base (Box 2).

Box 2: Relevant and Creditable Guidelines for Brackish Water Irrigation

When brackish water is to be used at a large scale for irrigation, the interaction of the water, soil and crop must be well understood beforehand. Equally, suitable technology for using and managing brackish water for irrigation should be adopted. AWC, therefore, jointly with FAO, developed in 2015 "Guidelines for Brackish Water Use for Agricultural Production in the NENA Region"(FAO, 2015).
Algeria, Egypt, Iraq, Iran, Jordan, Saudi Arabia, Morocco, Tunisia and Yemen were involved in preparing the guidelines that were based on field data and best practices gathered from the participating countries. Field applications of the current knowledge and developed guidelines would be of great importance for further expansion in brackish water use in agriculture.

For purposes requiring lower dissolved-salt content, especially drinking water, brackish water is treated through reverse osmosis (RO) or other desalination processes. The energy, materials and equipment used for RO desalination of brackish groundwater is far less than those used for desalinating seawater. RO desalination technology has recovery efficiency of 60 to 85% for brackish groundwater.

Disposal of waste brine in case of using desalination with RO is also another challenge. Negative effects on the marine environment can occur especially when high wastewater discharges coincide with sensitive ecosystems. Improving recovery efficiencies to 90 or 95% would significantly reduce brine disposal volumes, extend the supply of brackish resources, and potentially reduce overall desalination costs.

Meanwhile, with climate change, there are fears of serious impacts on social and economic stability, biodiversity and sustainable development in general. Lands and people using marginal water –brackish groundwater- are considered the most vulnerable. As the quality of this water becomes degraded, the impact on people and the environment can be dreadful.

Brackish Groundwater Governance and Regional Cooperation

Water governance is the business of all levels of the government and is very sensitive to prevailing norms. Principles of good governance include transparency, accountability and participation. Several factors affect the success of governing brackish groundwater at the national level including political will, regulatory frameworks, and technical and institutional capacities. Developing regional cooperation programs will help exchange accumulated knowledge, experiences, education and awareness programs in brackish groundwater management. Participants include government staff in implementing agencies, private sector firms and individuals, civil society, and especially project beneficiaries in affected communities.

Policy Recommendations

Brackish groundwater resources represent a complementary source of the current and future water supply in the Arab region. BGW development requires careful planning and management to ensure their longevity in serving socio-economic development in the region. The following are recommendations for policy actions:

1. Governments should consider brackish groundwater irrigation as good agricultural practices. BGW therefore should be part of the governments' national policies and strategic integrated lands and water resources development plans.

2. Governments should map areas with high BGW potential identifying their economic feasibility and taking into account different hydrological and environmental factors. This should be coupled with developing knowledge base and technical and institutional capacity building.

3. Concerted efforts by regional organizations are needed to strengthen regional cooperation and applied research in BGW development. Possible areas of cooperation include capacity building activities, data and information sharing, and establishing knowledge hubs to support individuals and organizations working in BGW management and utilization.

4. Pilot scale BGW projects could be financed and constructed at potential areas to demonstrate new technologies utilizing indigenous regional knowledge.

For Further Reading

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