

Pathways to sustainable water management

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Key takeaways

- Despite experiencing the fastest decline in water resources in the world, the MENA region has several pathways open to it that can lead to sustainable water management.
- Diversifying supplies will help to enhance water security. Wastewater treatment and reuse is a cost-effective and environmentally friendly option that can complement desalination and play a key role in meeting the water demand of MENA's rapidly growing population.
- Water security in MENA can only be achieved if consumption is rationalised, however. Reforming tariffs and subsidies, and encouraging behaviour change among consumers will moderate water demand.
- Enhancing cross-border cooperation will bring the region closer to achieving water security. Approaches beyond traditional river basin frameworks can be implemented due to desalination and wastewater treatment infrastructure networks across the MENA region.

The Middle East and North Africa region is experiencing the fastest decline in water resources per capita in the world. The World Bank predicts that by 2030 the region will fall below the absolute water scarcity threshold of 500 cu metres per person, per year.¹ MENA's water management strategies have thus far focused heavily on desalination, groundwater extraction, dam storage, and imports of virtual water to secure access to freshwater for people and industries.

However, current approaches are insufficient to meet future demand; the region is facing early onset impacts of climate change, as well as growing populations, industrialisation plans, and increasing environmental concerns. Furthermore, maintaining current policies risks disrupting economic diversification and growth plans across MENA. The World Bank report warns that continuing with current water management policies and allocation could cost the region between 6% and 15% of GDP by 2050, compared to a global average reduction of less than 1%.

Enabling long-term, sustainable water management will alleviate stresses upon urban and rural communities. There are many options available to the region: diversifying supply-side policies is one important element, and placing greater emphasis on demand side management is another.

¹ Hakimdavar, R. 'Water Is the New Oil In The Gulf', *Time*, January 18, 2024, Accessed April 2024. <https://time.com/6556469/water-new-oil-gulf/>

Supply Side Management Solutions

Making desalination more sustainable

Desalination has played, and will continue to play, a critical role in satisfying the region's – and the world's – growing need for water and mitigating against climate change impacts on water availability. The sector is booming globally, and the ten largest plants are all located in the Middle East. In fact, the GCC countries generate approximately 40% of global desalinated water from some 400 plants.² At present, 90% of Kuwait's drinkable water, 86% of Oman's, and 70% of Saudi Arabia's comes from desalination plants – and the region plans to expand its desalination capacity.³ Saudi Arabia, for example, is targeting a desalination capacity of 8.5 million cu metres per day, by 2025, a 52% increase on 2022 levels. Outside of the GCC, desalination is less widespread. For example, only 6% of Tunisia's drinking water is desalinated, and Morocco's new or planned plants are only expected to decrease reliance on surface and groundwater from 97% to 80%.⁴

Desalination in its current form is expensive, energy intensive, and reliant on fossil fuels. This makes it an unsustainable, long-term solution for the region. Treating seawater costs four to five times more than treating surface water. While MENA countries with access to cheap energy – namely the GCC – can afford to spend on this process, the cost of scaling desalination to meet water demand growth forecasts – 50% by 2050, on 2015 levels – will become prohibitive.⁵ For countries such as Morocco and Tunisia, the technology is not expected to cover more than 30% of water needs by 2030 due to the expense involved.⁶ Fossil-fuelled powered desalination plants produce significant greenhouse gas emissions, contrary to global net zero goals. They also create brine waste that has harmful effects on the local environment, the full extent of which are not yet known.⁷

Using cleaner energy alternatives such as nuclear power and solar power will address some of these concerns. The scalability of renewable energy-powered plants across the broader region is uncertain due to cost, and energy intermittence and storage concerns;

² Hakimdavar, R. "Water Is the New Oil In The Gulf." *Time*, January 18. Accessed April 2024. <https://time.com/6556469/water-new-oil-gulf/>

³ Larousserie, David, and Victoria Denys. "Le Dessalement de l'eau de Mer, Une Technologie En Plein Eessor." *Le Monde.fr*, March 7, 2024. Accessed April 2024. https://www.lemonde.fr/sciences/article/2024/03/07/le-dessalement-de-l-eau-de-mer-une-technologie-en-plein-essor_6220612_1650684.html.

⁴ France 24, "Drought-Hit N.Africa Turns to Purified Sea and Wastewater," *France 24*, July 27, 2023, Accessed April 2024. <https://www.france24.com/en/live-news/20230727-drought-hit-n-africa-turns-to-purified-sea-and-wastewater>; 1. Ahmed Eljehtimi, "New Desalination Plant Points towards Morocco's Drought Response | Reuters," *Reuters*, November 21, 2021, <https://www.reuters.com/world/new-desalination-plant-points-towards-moroccos-drought-response-2022-11-21/>.

⁵ Javier Mateo-Sagasta, Mohamed Al-Hamdi, and Khaled AbuZeid, eds., "Water Reuse in the Middle East and North Africa: A Sourcebook," *International Water Management Institute*, November 2022, <https://doi.org/10.5337/2022.225>.

⁶ 1. Rosie Frost, "Water Restrictions, Increased Prices and Imprisonment: How Is Tunisia Battling 5 Years of Drought?" *euronews.green*, March 4, 2024, <https://www.euronews.com/green/2024/03/04/water-restrictions-increased-prices-and-imprisonment-how-is-tunisia-battling-5-years-of-drought#:~:text=Could%20desalination%20and%20wastewater%20be,to%20be%20met%20by%20desalination.>

⁷ Hakimdavar, R. "Water Is the New Oil In The Gulf." *Time*, January 18. Accessed April 2024. <https://time.com/6556469/water-new-oil-gulf/>

only 1% of desalination plants use renewable sources of energy.⁸ However, some countries are pushing ahead with plans to build more. For example, Saudi Arabia's NEOM includes a plant designed to run on 100% renewable energy that will ultimately produce 1,000,000 cu metres per day of desalinated water. Brine output will be treated and used as feedstock for industries producing metals and minerals, via innovative technology that could be exported to other countries.

The high cost and technical challenges of sustainable desalination means its deployment may be limited to a subset of MENA countries. Regardless, desalination, sustainable or otherwise, should be only one of several measures adopted to ensure water supply. Condensing such a high proportion of freshwater supply in desalination plants is a vulnerability because, as critical national infrastructure, they are at risk of cyber or physical attack. Most regional states only hold several days' worth of water reserves, and the impact of a cut in desalination operations could be catastrophic.

Utilising the potential of wastewater

Another area in which innovative measures are being explored is the treatment of wastewater for reuse. The total cost of repurposing treated wastewater is considerably cheaper than desalination – less than half the cost in Saudi Arabia.⁹ It is also the only source of water that increases along with population growth. For MENA, a region whose total population is expected to reach 680 million in 2050, its potential as a cost effective and environmentally friendly approach to securing water supply is huge.

Low public awareness and acceptance of reused wastewater, inadequate public health and environmental standards, limited understanding of the different cost recovery models, and low prices for freshwater historically slowed the development of water reuse technologies and led to uneven adoption across the region. In 2022 only 10% of the region's municipal wastewater was treated to a level safe for reuse in agriculture, landscaping, and industry across MENA.^{10 11}

However, technical advancements in recent years have led to a bigger uptake of this resource. The UAE, which currently reuses 60% of the treated wastewater it produces each year but has the means to do more, plans to implement a zero-discharge policy by the end of 2024.¹² The policy will see treated wastewater used in irrigation of crops and forests, as well as in district cooling, industrial processes, and groundwater aquifer recharging. Saudi

⁸ Marc-Antoine Eyl-Mazzega and Élise Cassignol, "Géopolitique Du Dessalement d'eau de Mer," CENTRE ÉNERGIE & CLIMAT, IFRI, March 4, 2022, <https://www.euronews.com/green/2024/03/04/water-restrictions-increased-prices-and-imprisonment-how-is-tunisia-battling-5-years-of-drought#:~:text=Could%20desalination%20and%20wastewater%20be,to%20be%20met%20by%20desalination.>

⁹ Mariah Wang and Theodore Karasik, "Saudi Arabia's Water Reclamation Strategy," Gulf State Analytics, March 14, 2024, <https://gulfstateanalytics.com/saudi-arabias-water-reclamation-strategy/>

¹⁰ Javier Mateo-Sagasta, Expanding water reuse in the Middle East and North Africa, March 14, 2023, https://rewater-mena.iwmi.org/wp-content/uploads/sites/13/2023/04/Expanding_water_reuse_in_the_Middle_East_and_North_Africa-Policy_report.pdf.

¹¹ Note: Safely treated wastewater ensures the water does not spread disease, pollute freshwater or deteriorate the environment when released. In 2020 the level of safely treated water varied widely within the region, ranging from 3% in Sudan to 99% in Kuwait. Only a part of safely treated wastewater is currently treated to a level safe for reuse in irrigation.

¹² R. Keerthana, "Transforming Wastewater into a Sustainable Resource," Waste and recycling mag, October 2023, <https://www.wasterecyclingmea.com/top-stories/transforming-wastewater-into-a-sustainable-resource.>

Arabia plans to re-use 100% of treated wastewater by 2025.¹³ Morocco has instituted a national wastewater reuse programme and seeks to raise \$249 million in funding by 2027.¹⁴ It aims to treat 80% of wastewater by 2050. In 2023 Tunisia received an EUR 82 million loan from the African Development Bank to improve wastewater treatment for reuse in agriculture across 19 plants by 2028.¹⁵

Demand Side Management Solutions

While various technologies are being deployed in a bid to improve or expand the available water supply, a major component of water strategy lies in demand side management. Given the region's limited natural water resources and projected population and economic growth, controlling water usage will be critical to ensuring adequate and equitable supplies going forward.

Reforming subsidies and pricing

Generalised subsidies and low tariffs for water contribute to high consumption rates in the region; in fact, the Gulf has among the world's highest water consumption per capita.¹⁶ The current system not only leads to excessive use but disincentivises service providers from implementing efficient practices. Half of MENA's service providers – most of which are state-owned – report that over 30% of the water they produce is lost in transmission and distribution networks and not billed to consumers.¹⁷

Implementing targeted rather than generalised subsidies would significantly reduce water usage while ensuring access to water for those who need it. Raising tariffs would not only rationalise demand but also increase incentives to invest in alternative water management technologies, such as wastewater, and encourage high-consumption sectors to adopt them. In addition, revenues from increased tariffs could be channelled into infrastructure improvements and repairs, creating more efficient water networks. One country experiencing success as a result of pricing reforms is Iran.¹⁸ Since the country introduced a

¹³ "Saudi Arabia - Water," International Trade Administration | Trade.gov, March 1, 2024, Accessed May 2024,

<https://www.trade.gov/country-commercial-guides/saudi-arabia-water#:~:text=Saudi%20Arabia%20has%20set%20a,transmission%20pipelines%2C%20and%20water%20networks>;

Saeed Haider, "Saudi Arabia Aims at 100 Percent Wastewater Reuse by 2025," Alarabiya, February 2015, Accessed May 2024,

<https://english.alarabiya.net/amp/business/technology/2015/02/19/Saudi-Arabia-aims-at-100-percent-wastewater-reuse-by-2025>.

¹⁴ "Morocco Wants to Mobilize €220 Million for Wastewater Reuse by 2027," Smart Water Magazine, February 14, 2022, Accessed May 2024, <https://smartwatermagazine.com/news/smart-water-magazine/morocco-wants-mobilize-eu220-million-wastewater-reuse-2027>.

¹⁵ "Tunisia: African Development Bank Lends Nearly €82 Million for Wastewater Reuse in Agriculture, Strengthening Climate Resilience," African Development Bank Group, December 2023, Accessed May 2024, <https://www.afdb.org/en>.

¹⁶ "Advancing Water and Energy Security in Gulf Nations," World Bank Blogs, October 2023, Accessed May 2024.

<https://blogs.worldbank.org/en/arabvoices/advancing-water-and-energy-security-gulf-nations#:~:text=Gulf%20nations%20can%20significantly%20increase>.

¹⁷ De Waal, Dominick et al, 2023, *The Economics of Water Scarcity in the Middle East and North Africa: Institutional Solutions*. World Bank Open Knowledge Repository, <https://openknowledge.worldbank.org/entities/publication/ab35b03a-23fa-4457-aebd-0f4a89848be1>.

¹⁸ Zamani, Omid et al, 2021. "The Impact of Water-Pricing Policies on Water Productivity: Evidence of Agriculture Sector in Iran." *Agricultural Water Management* 245 (February): 106548. <https://doi.org/10.1016/j.agwat.2020.106548>.

policy in the early 2000s that prices water according to the level consumed, irrigation efficiency has improved, the total amount of water used has decreased, and stress on aquifers been reduced. Tunisia also introduced a tiered pricing policy in March 2024 to put an end to a five-year drought that has forced the country to ban the use of drinking water in agriculture and for certain domestic practices. Consumers can now expect to pay up to 16% more depending on their level of consumption – prices remain unchanged for small consumers.

Complementing these measures with increased metering, more accurate billing, and public awareness campaigns to encourage consumers to conserve water could further help moderate and manage water demand across the region. Awareness campaigns can also help promote a tariff increase as part of reforms as both a fair and necessary measure.

Reconsidering agriculture's water use

Some 85.3% of freshwater in the Middle East is consumed by agriculture – 15.3 percentage points over the global average.¹⁹ Continuing to develop and adopt innovative methods for efficient water use in the sector would have a sizeable impact on freshwater availability.

MENA countries have been investing heavily in agritech to increase the effectiveness of water use in agriculture. Notable solutions include the use of drones to collect data on hydration level, soil quality, and diseases, which enables farmers to implement targeted watering and pesticide spraying. This practice results in approximately 30% in water savings, 20% cost savings, and a 30% production increase.²⁰ Saudi Arabia and the UAE account for the lion's share of the region's investments in agritech globally, which in 2022 jumped from 1% to 4%. However, in 2023 Egyptian agritech start-ups raised \$45.7 million in funding, ahead of UAE and Saudi start-ups, which raised \$31.8 million and \$31.7 million respectively from both the public and private sectors.²¹ The large size of Egypt's economy and 110-million-strong population make it an attractive investment destination.

Outside of the Gulf and Egypt, however, agritech is developing on a smaller scale. North Africa and the Levant rely mostly on funding from external donors (multilateral development banks, the World Bank, or the EU) to fund research and development. Countries that have limited capacity to apply for and process funding receive very little, if any. Even in those countries that do receive funding, lack of access and awareness among

¹⁹ "Chart: Globally, 70% of Freshwater Is Used for Agriculture," World Bank Blogs, March 22, 2017, Accessed May 2024, <https://blogs.worldbank.org/en/opedata/chart-globally-70-freshwater-used-agriculture>.

²⁰ *Le Monde.fr*, 2023, "Face Aux Aléas Climatiques, Le Maghreb Mobilise Drones et High-Tech," December 6, 2023, https://www.lemonde.fr/afrique/article/2023/12/06/face-aux-aleas-climatiques-le-maghreb-mobilise-drones-et-high-tech_6204191_3212.html.

²¹ Chris Hamill-Stewart, "Agtech Startups and Egypt Are Hot Prospects for Mena Funding," January 13, 2024, AGBI, Accessed May 2024, <https://www.agbi.com/analysis/banking-finance/2023/01/egypt-and-agritech-top-december-startup-funding-drive/#:~:text=A%20joint%20report%20by%20Wamda>.

end users are barriers to uptake. Consequently, only 3% of farmers in Morocco and 10% in Tunisia currently use some form of agritech.²²

Regional governance and cooperation

At the regional level, significant economic and geological disparities affect countries' access to technological solutions to the water crisis. However, regional countries share the threat of climate change and water scarcity, and closer cooperation on research and development as well as practical cross border collaboration would serve MENA well. Progress in water desalination and wastewater treatment has led to the development of a highly networked infrastructure that allows for MENA-specific solutions, beyond the traditional river basin cooperation frameworks.²³ For example, a cap-and-trade system, like that used for carbon emissions, could be established to efficiently distribute water between countries. Its success would be dependent on prices reflecting an accurate valuation of the water resource, and constructive cooperation between states to determine national water needs, based on sustainable allocation between cities, agriculture, and the environment.

The region is facing a critical juncture in terms of its water management. It is already making progress on diversifying its supplies through wastewater treatment but will also need to implement demand management measures to prevent negative socioeconomic impacts of current policies. Reforming subsidies and tariffs, encouraging the development of agritech to support efficient water use in agriculture, and promoting regional cooperation will bring the region closer to achieving water security – increasingly imperative in the face of rising temperatures and water shortages.

²² *Le Monde.fr*, 2023, “Face Aux Aléas Climatiques, Le Maghreb Mobilise Drones et High-Tech,” December 6, 2023, https://www.lemonde.fr/afrique/article/2023/12/06/face-aux-aleas-climatiques-le-maghreb-mobilise-drones-et-high-tech_6204191_3212.html.

²³ De Waal, Dominick et al, 2023, *The Economics of Water Scarcity in the Middle East and North Africa: Institutional Solutions*. World Bank Open Knowledge Repository, <https://openknowledge.worldbank.org/entities/publication/ab35b03a-23fa-4457-aebd-0f4a89848be1>.