



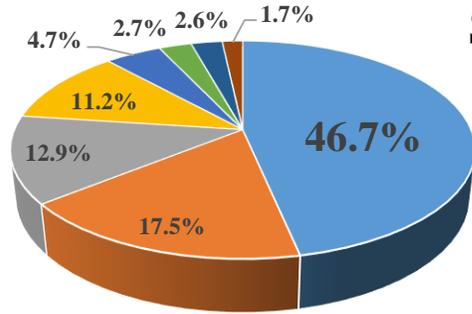
Desalination in the Arab region: Status, Challenges, and Prospects

The fourth meeting of the High-Level Joint Water-Agriculture Technical Committee

Tuesday, 18 October 2022, Cairo, Egypt

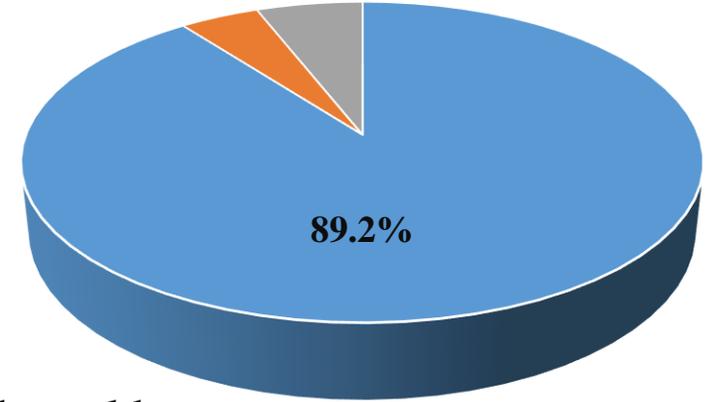
Mohammed Al-Abri





- Arab region
- East Asia and Pacific
- North America
- Western Europe
- Latin America and Caribbean
- South Asia
- Europe and Central Asia
- Sub-Saharan Africa

Share of global desalination capacity

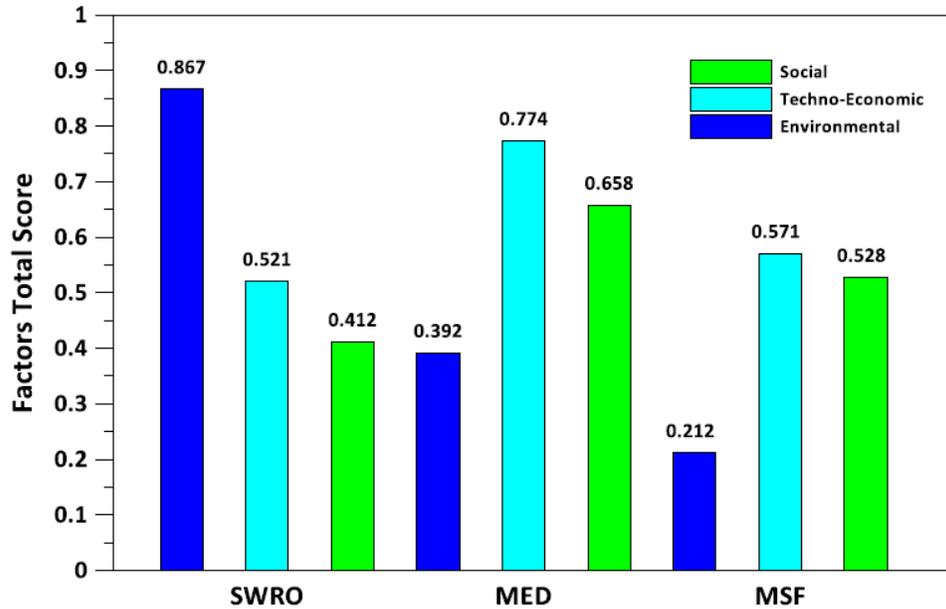


- Agriculture
- Industry
- Domestic

Water consumption per sector in the Arab world

- Sustainable water resources of 1,000 m³/year per capita
- Minimum renewable water resources threshold of 1,700 m³/year per capita

- The most water-scarce area in the world
- Water availability per capita might decrease by half by 2050



UAE: SWRO is the most sustainable desalination Process

RO main advantages are:

- Easily adapts to changing conditions
- Flexible production capacity
- Significant cost savings in brackish groundwater desalination
- Modular and occupies less land space.

➤ Environmental:

- ✓ Water extraction
- ✓ Discharged brine impacts
- ✓ CO₂ & other gases emission
- ✓ Land use
- ✓ Other factors

➤ Techno-economic

- ✓ Reliability
- ✓ Quality of produced water
- ✓ Scaling & fouling
- ✓ Cost of water & Cost sensitivity

➤ Social:

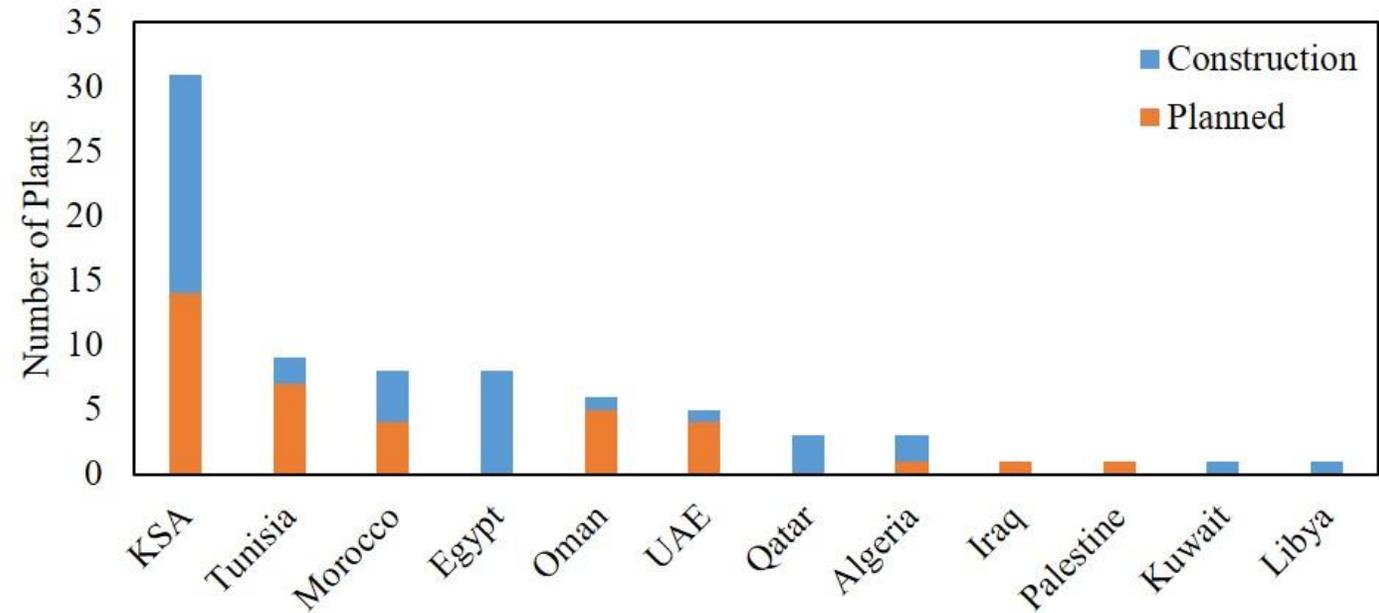
- ✓ Aesthetics
- ✓ Noise level
- ✓ Employment
- ✓ Technology Safety

7-9 % annual growth

78 desalination projects operating or planned for construction

5 projects account for >40% of the total daily capacity located in KSA

In 2022, record expansion awarded totaling 1.16 million m³/day



Arab desalination plants distribution (2020-2030)

GWIDesalData / IDA



- 21 desalination plants being constructed or planned for industrial use
- Mainly in KSA and UAE

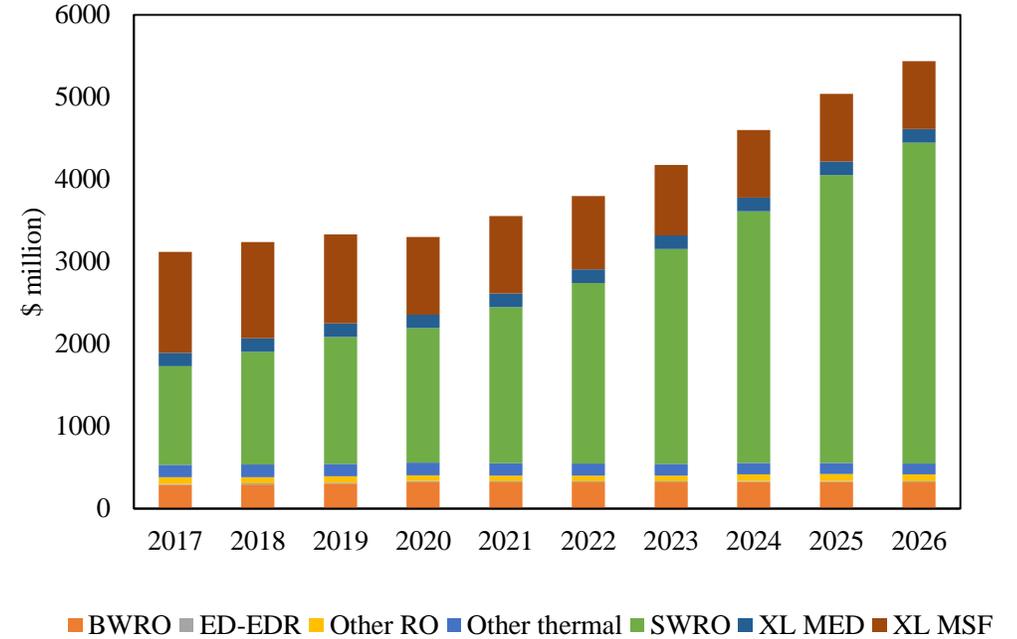
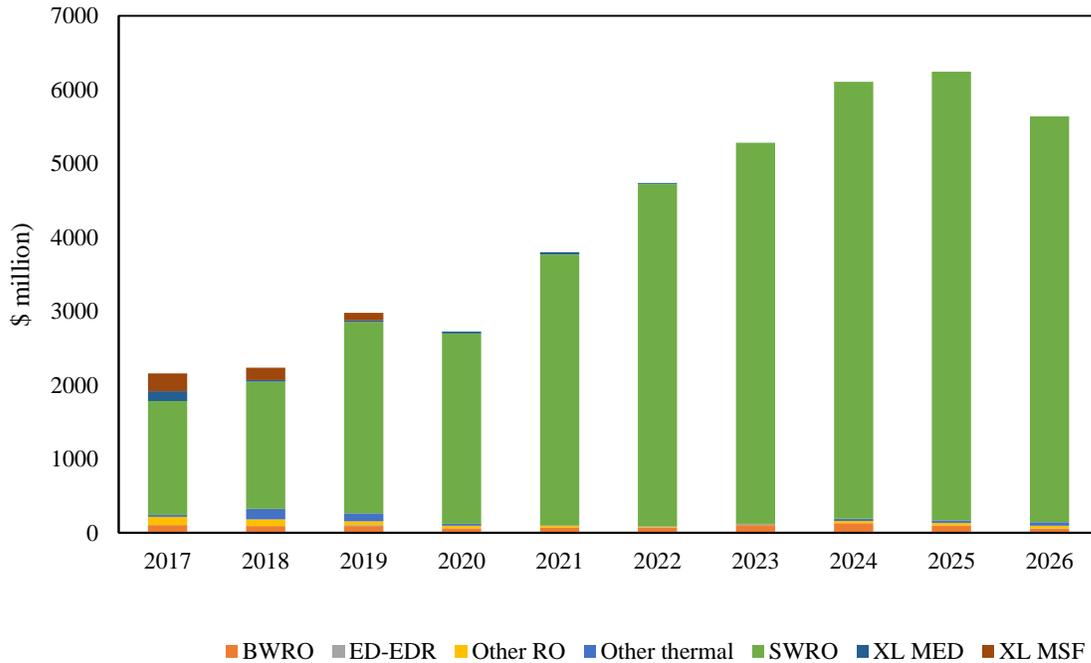


- 55 desalination plants are planned for domestic use
- Largest produce 1,000,000 m³/day, in KSA



- 1 project is planned for irrigation purposes
- Mirfa 2 IWP project in UAE operation expected in 2024
- RO desalination plant with 363,680 m³/day capacity
- Agadir desalination plant, 275,000 m³/day hybrid use

- RO desalination produce water unsuitable for domestic or agricultural purposes.
- Post-treatment is compulsory
- Remixing with groundwater is the most common practice currently used
- No desalinated water quality standard for agricultural use
- Brine disposal is a major issue for groundwater desalination



CAPEX breakdown of desalination plants in Arab region (2017-2026)

OPEX breakdown of desalination plants in Arab region (2017-2026)

- ✓ 150,000 m³/day Capacity
- ✓ 35,000 ppm TDS

- Total SWRO CAPEX = \$169,684,851
- Total MSF CAPEX = \$344,796,409

- Total SWRO OPEX = \$24,794,600
- Total MSF OPEX = \$37,431,545



Tariffs



- Cost of producing desalinated water in the Arab region has dropped by nearly half.
- Contributing key factors are:
 - Enhanced energy efficiency
 - Low-interest rates, making desalination project financing appealing.
- The tariff is between US\$ 0.5 and US\$ 0.9 per m³ of desalinated water.
- Cost can rise to \$1.50 per delivered m³ depending on the country
- From 2023, Dubai Electricity & Water will charge \$0.306 per m³ of water
- Desalinated water cost highly dependent on energy costs

- Private Public Partnership (PPP)
- Concessions or utility outsourcing transactions
- Independent Water and Power Project (IWPP)

Desalination projects

- Engineering, Procurement & Construction Contract (EPC)
- Design-Build-Operate (DBO)
- Build-Operate-Transfer (BOT)
- Build-Own-Operate-Transfer (BOOT)

Primary Contract Models

- Infrastructure constraints
- Institutional constraints
- Public perception constraints

Environmental impact

- Intake Impact
- Brine Discharge
- Chemicals Impact
- Corrosion

Air Quality & Carbon Footprint

- Atmospheric Pollution
- Nitrogen oxide emissions
- SWRO 0.4 – 6.7 kg CO₂ eq/m³

Construction

- Subsurface condition
- Delays
- Errors & Omissions
- Reliability
- Intake & Discharge



Capacity Development Challenges



- Urgent need for training and capacity-building
- Regional education is dominated by private sector initiatives and specialized courses by regional universities
- Low investment in R&D
- Limited resources, facilities, and staffing in Universities and related institutes
- Low plants performance improvements
- Most contractors and consultants are not locals



Legislations and Laws Challenges



Some Arab countries are yet to achieve balance in water policies

If water policies exist, the frameworks are not ideally practiced for their assigned purposes

Laws and legislation do not adequately address all the issues

Implementation failure and lack of enforcement

Lack of cooperation with Arab and international peers

➤ New visions for innovative technologies

Innovative desalination technologies for non-conventional wastewater

Environmentally friendly pretreatment & ZLD processes

Advanced research in agriculture focused desalination technologies

Localizing technologies and manufacturing

Comprehensive legal, legislative & regulatory frameworks

Incentive programs to support environmentally friendly practices

Adopt stricter environmental regulations

Advanced research in saline agriculture, aquaponics, and hydroponics



Use renewable energy to reduce GHG emissions

Mixing different grades of natural and treated water for agriculture purposes

Encourage farmers to use non-conventional water for irrigation
Public awareness, legislation, providing training & modern tools

Nanotechnology

- Wide range of potential applications
- Pioneer new materials, systems, and technologies
- The sector is expected to exceed \$125 billion by 2024

Renewable Energy

- Capable of replacing energy-intensive pretreatment & harmful chemicals
- Reduces energy costs & offsets energy demand during peak hours
- Highly environmentally friendly

Net Zero Emissions & Green Hydrogen

- **Nine** liters of water are needed to produce **One** kg hydrogen
- Lead to **fivefold** increase in desalination demand by 2040
- Neom, KSA, to develop first large-scale green hydrogen projects in the ME