

Challenges and Prospects of Using Treated Wastewater to Manage Water Crises in the GCC countries

14th Gulf Water Conference
February 13-15, 2022, Riyadh, KSA



Dr. Asad Sarwar Qureshi

Senior Scientist – Water and Irrigation Management
International Center for Biosaline Agriculture (ICBA)
Dubai, United Arab Emirates



Introduction

- The Gulf Cooperation Council (GCC) countries are in the driest part of the world with an annual per capita water availability of 500 m³ compared to the world average of 6000 m³.
- Agricultural water demand, which is more than 80% of the total water consumption, is met through massive exploitation of GW.
- The imbalance between groundwater discharge (27.3 Bm³) and recharge (5.3 Bm³) is causing excessive lowering of GW levels.
- GCC countries are investing heavily in the production of nonconventional water resources such as desalination of seawater and treated wastewater.

Water resources in the GCC countries

Countries	Average annual precipitation (mm)	Average annual evaporation (mm)	Annual renewable freshwater resources (Mm ³)	Average annual freshwater availability (m ³ /capita)	Average water use by agriculture (% of total)	Average annual groundwater abstraction (Mm ³)	Average annual groundwater recharge (Mm ³)
Bahrain	80	1650-2050	116	70	45	155	150
Kuwait	110	1900-3500	20	5	54	496	160
Oman	50-300	1900-3000	1400	275	89	1218	900
Qatar	75	2000-2700	58	20	59	250	50
Saudi Arabia	70-500	3500-4500	2400	70	88	21595	3850
UAE	90-120	3900-4050	150	16	83	3536	190
Total	60-190	2475-3300	4144	76	70	27250	5300

Desalinated water capacity, production, and use in the GCC countries

Countries	No. of plants	Total design capacity (Mm ³)	Desalinated water produced (Mm ³)	Share of desalinated water in municipal supply (%)
Bahrain	5	313	242	90.1
Kuwait	10	1036	712	84.2
Oman	52	280	280	73.7
Qatar	9	624	560	97.3
Saudi Arabia	313	2812	1947	55.1
UAE	50	2660	2004	100
Total	439	7725	5745	

- Currently, 439 plants are annually producing 5.75 Bm³ of desalinated water.
- Total design capacity of 7.7 Bm³.
- The total investment in the desalination sector in the GCC countries is US\$ 16-20 billion, expected to reach US\$ 60 billion by 2050.

Wastewater collection, treatment, and reuse in the GCC countries

Countries	No. of plants	Annual design capacity (Mm ³)	Volume of wastewater collected (Mm ³)	Volume of wastewater treated (Mm ³)	Volume of reused of treated (Mm ³)	% of treated of collected	% of reused of treated (%)
Bahrain	22	135	158	70	63	44	90
Kuwait	6	300	320	247	151	77	61
Oman	66	100	68	67	67	99	100
Qatar	23	110	208	203	203	98	100
Saudi Arabia	97	1970	2500	1604	257	64	16
UAE	86	840	746	733	403	98	55
Total	300	3455	4000	2924	1144	73	39

- Total collection of wastewater is about 4.0 Bm³.
- Currently, 300 plants are annually treating 2.92 Bm³ of wastewater.
- Only 1.14 Bm³ (39%) is reused.
- Full utilization of TWW in the GCC countries can meet 11% of the total water demand and reduce fossil groundwater exploitation by 15%.

Conditions for TWW use

The reuse of TWW depends on the degree of its treatment, i.e., tertiary level, secondary level, and the primary level.

- ***The tertiary level TWW*** is free from all health hazards and can be used to irrigate all crops.
- ***The secondary level TWW*** is used for nursery flowers and palm trees, cotton, but should not be used for cattle rearing with milk or meat.
- ***The primary level TWW*** can only be used for timber trees after taking strict precautionary measures such as preventing direct contact of workers with the water.



Patterns of TWW use in GCC countries

- Farmers in many Arab countries such as Jordan, Syria, and Tunisia are using TWW for growing food and fodder crops.
- In other GCC countries, TWW use is limited to landscaping, forestry, and construction industry due to health and environmental safety concerns.
- TWW use in most Arab countries is also restricted due to social, cultural and religious restrictions.



Challenges of TWW use in GCC countries

- **Quality of TWW** – most wastewaters are treated at tertiary level. They are not free from heavy metals. Farmers are reluctant to use this water for food crops.
- **Lack of central transmission infrastructure** (pipes, pumping stations, channels, and storage tanks) and the distribution networks. Full utilization of wastewater in the GCC countries would require a capital investment of US\$ 2.5 billion.
- **Groundwater is highly subsidized**- This makes it difficult to convince farmers to use TWW for irrigation. Therefore, access to GW needs to be restricted through limits on withdrawals and slashing energy subsidies.
- **There is an apparent conflict** between agricultural policies and available water resources. Fodder crops are encouraged due to the large livestock population.
- **Low water use efficiency** – Flooding methods are widely practiced i.e., more than 60% of agricultural land. In the UAE, adoption of sprinkler and drip methods has helped in saving 40–60% of irrigation water

Prospects of using TWW in GCC countries

- Due to increasing demand and decreasing renewable water resources, it is essential to use TWW to its full potential instead of disposing of it in the sea. The wastewater treated at the tertiary level is considered highly safe for use in agriculture if proper soil and crop management practices are adopted.
- TWW use in the construction industry should be increased. For this purpose, quality standards may be slightly relaxed.
- Studies have shown that leafy vegetables are more susceptible to absorb heavy metal than root and fruit vegetables. Therefore, avoid these vegetables. An alternative could be agroforestry species grown for fuel and timber.
- Physical and biological characteristics of the GCC countries can help in the cleaning of trace metals from the soil-plant environment.

Making TWW use sustainable in GCC countries

- Substantial evidence exists that treated wastewater can safely be used to grow food and forage crops by adopting appropriate management measures.
- Sustainable TWW use needs a comprehensive awareness campaign to address the social and religious concerns of communities and consumers.
- Effective response mechanisms should be developed to mitigate several internal and external risks that can jeopardize the sustainable use of treated wastewater. These include climate change, increasing costs, technological and market-driven changes, and regional security issues.
- Sustainable use of TWW requires adoption of an integrated approach involving all stakeholders who are responsible for collection, treatment, distribution, and reuse of TWW for agriculture and other purposes.

Conclusions

- The GCC countries are investing heavily in desalination and treating WW to reduce stress on GW resources. Desalinated water is used for domestic and industrial purposes, whereas groundwater is used for agriculture.
- The GCC countries need to think seriously whether to continue growing fodder or shift to less water-demanding plants to reduce pressure on GW resources. Increasing WUE will be beneficial only, if the irrigated area is not increased.
- Despite massive investments, only 39% of the TWW is used for agriculture whereas the remainder is siphoned to the sea. Studies have shown that TWW can safely be used for food and forage crops in the GCC countries.
- For the optimum use of TWW for agriculture, social, health, environment, and institutional constraints need to be addressed.

Center of Excellence looking at Agriculture for Tomorrow



Thank you!



ICBA is a founding member of the Association of International Research and Development Centers for Agriculture (AIRCA)

www.biosaline.org

