RECLAMATION AND REUSE INFRASTRUCTURE

Water recycling is a first step towards sustainable urban water management in Qatar

By: Mohamed Alaaeldin Mohamed, Mechanical Engineer, Chair of QGBC's Water interest Group

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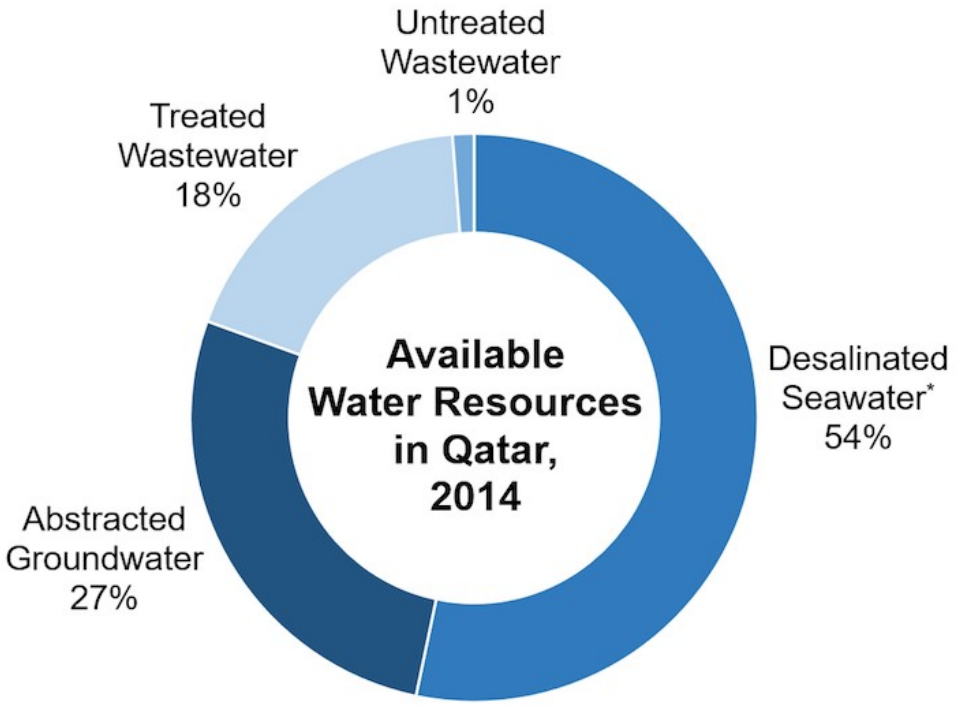
Qatar's total water production has quadrupled since 1990 in response to the nation's rapid economic and population growth. Desalinated seawater is almost the sole source of potable water available, and thus far, its development has managed to meet the increase in demand. But, should the demand continue to increase so rapidly, would the expansion of Qatar's desalination capacity be the most suitable way to meet it?

In addition to seawater desalination, groundwater abstraction and municipal wastewater treatment satisfy Qatar's total demand for water. Groundwater aquifers, however, have been overexploited with yearly withdrawal rates

surpassing 250 million m^3 per year. The current situation is unsustainable in the long term as the average natural replenishment rate of aquifers by precipitation is only 43 million m^3 per year.

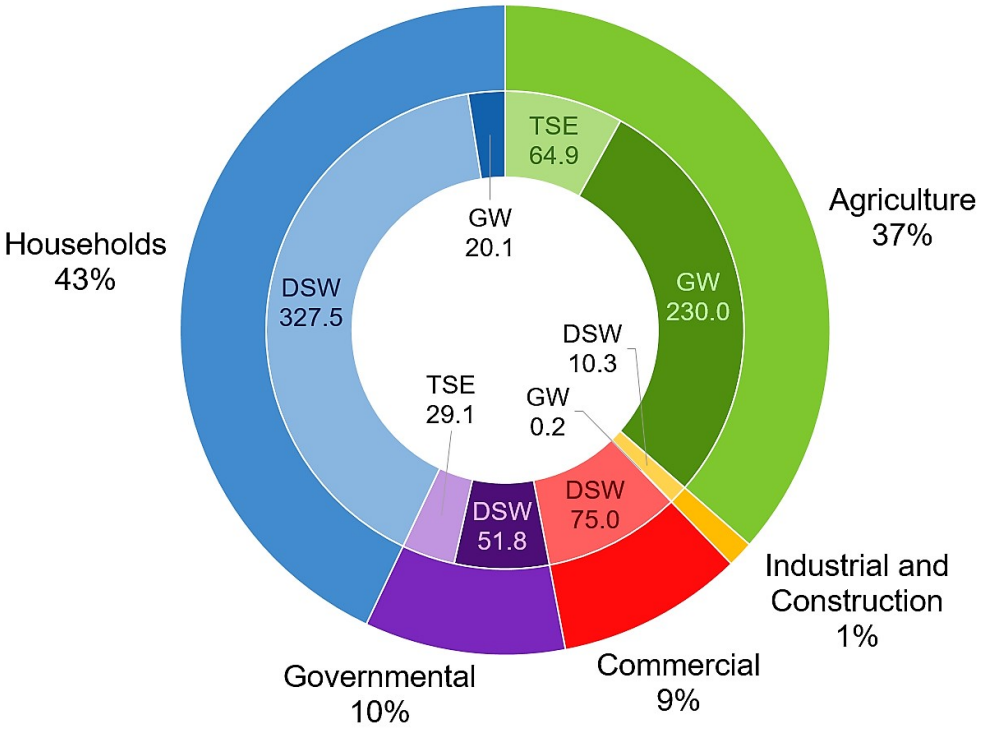


Concerns about desalination arise because it causes significant environmental impacts. Thermal desalination plants require energy, typically derived from fossil fuels, for the distillation process. Although the process is carried out quite efficiently in Qatar using the waste heat from power generation by natural gas (the least polluting of fossil fuels), there are consequent CO_2 emissions and thus embodied climate change impacts. These impacts are relatively high compared to those of potable water production from other water resources such as rainwater harvesting or groundwater abstraction. For example, in Qatar, thermal desalination typically consumes 9 – 15 kWh per distilled m^3 of potable water, whereas in the UK, fresh surface water treatment typically consumes less than 1 kWh per produced m^3.

Moreover, saltwater residue from the distillation process is discharged into the Gulf causing major environmental impacts. Over the past 20 years, brine from desalination discharged by the Gulf Countries has increased the salinity of the Arabian Gulf by 2%, negatively affecting the biodiversity of its marine ecosystems.

In addition to the environmental drawbacks of desalination, it is difficult and expensive to construct artificial reservoirs to store desalinated water. Groundwater, instead, may be a sufficient national strategic reserve of freshwater if replenished and augmented. The currently overexploited aquifers will first need recharging to alleviate their rising salinity.

Qatar's increasing water consumption together with the environmental impacts from desalination and depletion of renewable fresh groundwater signify that the case for extensive water reuse is imperative. Enacting policies that modify water consumer behaviour, on the demand side, coupled with water recycling for non-potable uses, on the supply side, present a clear, credible path toward sustainable water use in Qatar.

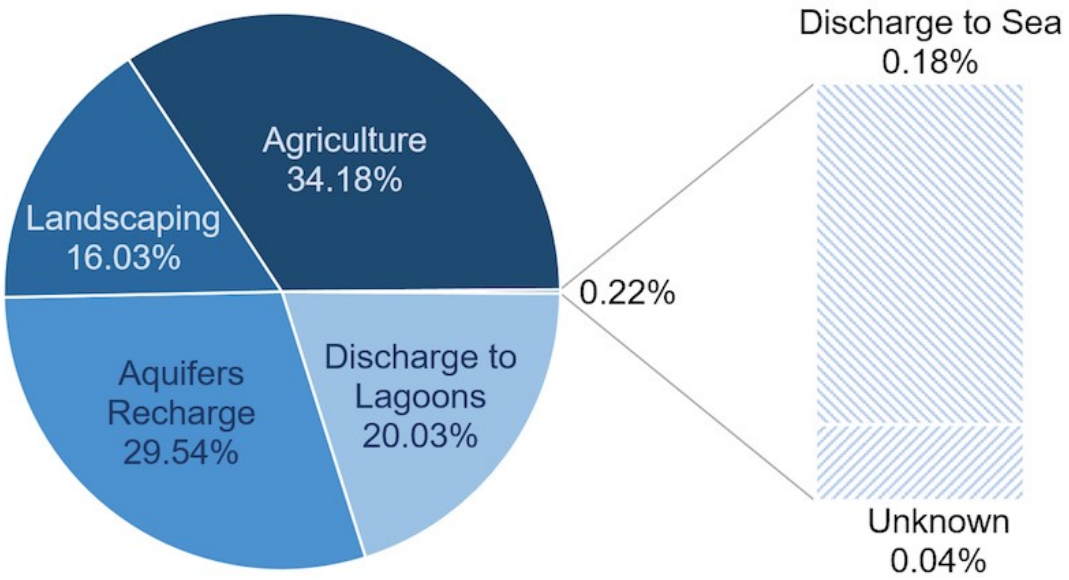


Water Consumption by Households and Economic Sectors, 2014 (Million m^3)

In water recycling, there is ample opportunity to use treated wastewater for non-potable domestic and agricultural purposes, in lieu of desalinated seawater or abstracted groundwater. Since 2004, treated sewage effluent (TSE) – salvaged water from collected municipal sewage – has been systematically produced in Qatar. Since then, TSE production has

significantly increased, from 25 million m^3 in 2004 to 194 million m^3 in 2015, as Qatar has progressively enhanced its municipal wastewater treatment plants (WWTPs) and TSE distribution infrastructure.

Qatar's municipal wastewater treatment output comes mostly from the five WWTPs that serve the greater Doha area. They produce approximately 18% of the 926 million m^3 (2014) of Qatar's total water resources potentially available for use. However, there is much scope for increasing TSE utilisation. Presently, over 40 million m^3 of produced TSE are not distributed for reuse but are simply discharged to form lagoons in the desert.



Treated Sewage Effluent (TSE) Uses in Qatar, 2015

Reclaimed wastewater can potentially satisfy a wide range of water demands when treated to the quality appropriate for the end use. Though the current use of recycled water is predominantly for agriculture and landscape irrigation, TSE can be a suitable substitute for other water demands:

- in households for applications that do not require potable-quality water such as toilet flushing, car washing, and garden watering;
- in industries as a substitute for desalinated water in applications such as cooling water for power and district cooling plants, industrial process water for oil refineries, dust control, construction site activities, concrete mixing and artificial waterbodies/water features; and

as an environmental buffer to groundwater aquifers, maintaining high groundwater quality and quantity.

Increasing availability of TSE supply to consumers would capitalise on the benefits of water recycling. Recognising the strategic importance of TSE suggests several further enlightened initiatives that would help integrate TSE into Qatar's burgeoning utilities infrastructure. In addition to expanding the existing TSE supply network, the following are further areas of development:

Outreach campaigns, especially to domestic consumers, could help changing water consumption practices and apprising the public of the need and benefits of sustainable water use good practice. Raising public awareness of the little-known water recycling projects currently underway, by underscoring the efforts and investments that authorities are making, would raise the public perception of TSE's value and thus advance sustainable water consumption behaviour.

Developing a resilient water distribution network complements wastewater collection and TSE supply networks. Leakages and infiltrations compromise both potable and TSE quality. Despite recent improvements in reducing network leaks (20% when last assessed in 2014), losses remain high for a network that is relatively new. For example, network losses from the UK's water infrastructure, now over-a-century old, are 18%.

Enhancing efficiency of TSE production may be achieved by increasing the number of buildings connected to a public sewer. Only 88% of total completed buildings in 2015 were connected.

Encouraging investment in non-centralised, 'off-grid' wastewater systems can help promote sustainable neighbourhood/community water recycling practices such as greywater reuse and 'sewer mining.'

Data analytics can provide the opportunity for water and wastewater utilities to assess and optimise services. Analysing urban hydroinformatics delivered by the digitised infrastructure help utility providers understand system performance and increase predictability of maintenance requirements which eventually reduce operational costs.

Investment in research is essential for both policymakers and utility providers as research apprises them of new technology and innovative solutions, and thus enables them to make informed decisions.

As water demand grows and expectations of utility services and their affordability heighten, water recycling will play a greater role in our overall water supply. Momentum is building up in Qatar for a robust, resilient water-

recycling infrastructure by progressive policies and initiatives led by governmental bodies such as the Public Works Authority (PWA/Ashghal), Ministry of Municipality and Environment, Qatar Water and Electricity Company (QWEC) and the Permanent Water Resources Committee (PWRC). No matter how small, in Qatar's rapidly growing economy, no water or energy saving is trivial.

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* Not including water desalinated by industries for their own uses

All data in the figures are from Ministry of Development Planning and Statistics' Water Statistics in the State of Qatar 2015.

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