

**strategy&**

Formerly Booz & Company

---

***Achieving a  
sustainable water  
sector in the GCC***

**&**

**Managing supply  
and demand,  
building institutions**



## **Contacts**

---

### **Beirut**

#### **Tarek El Sayed**

*Partner*

+961-1-985-655

tarek.elsayed

@strategyand.pwc.com

#### **Johnny Ayoub**

*Principal*

+961-1-985-655

johnny.ayoub

@strategyand.pwc.com

## **About the authors**

---

**Tarek El Sayed** is a partner with Strategy& and a member of the firm's energy, chemicals, and utilities practice. He has over 13 years of consulting experience with a focus on the energy sector, including oil and gas, power, and water. He spearheads the firm's activities in sustainability and resource efficiency in the Middle East.

**Johnny Ayoub** is a principal with Strategy& in Beirut and a member of the energy, chemicals, and utilities practice. He has over 10 years of consulting experience focusing on strategy, restructuring and energy efficiency in the Middle East utilities sector.

Walid Fayad and Nadim Batri (former partner and principal with Booz & Company), Hoda Daniel, Marc Ziade, and Christian Abou Tayeh also contributed to this report.

# Executive summary



**For policymakers in the Gulf Cooperation Council (GCC),<sup>1</sup> water sustainability is a major challenge.** On a per capita basis, GCC countries consume considerably more water than the world average, despite the fact that most of these countries get little rain and have low levels of groundwater. The imbalance between supply and demand is not helped by policies that keep these countries' citizens from being aware of, let alone having to pay for, any wasteful water consumption habits.

To maintain their water supplies, GCC countries have become the world's biggest consumers of desalinated water. This technological feat of generating tens of millions of cubic meters of potable water each day out of seawater has come at a heavy environmental and economic cost. Because of the amount of energy it requires, desalination has contributed to the GCC's status as one of the highest CO<sub>2</sub> emitting regions in the world. The huge amounts of fuel they must use for desalination have also kept GCC countries from using this resource for more productive economic purposes, such as in exports or for the development of petrochemicals.

To move toward greater sustainability in their water sectors, GCC countries will have to address three issues: excessive water demand, inadequate water supplies, and ineffective institutional frameworks. Although some GCC countries have started to make progress in these areas, they should move faster and intensify their efforts. Steps to manage the water sector must occur in an integrated fashion because of the impact that water has on multiple industries — from energy to agriculture to recreation.

<sup>1</sup> The GCC countries are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

---

# *A challenge of sustainability*

When it comes to their water usage, the GCC countries are in a bind. On a per capita per annum (pcpa) basis, GCC countries consume about 65 percent more water than the world average — 816 cubic meters (m<sup>3</sup>) pcpa, versus 500 m<sup>3</sup> pcpa. This might not present such a problem if GCC countries had substantial renewable resources, notably from rainfall and groundwater. However, these resources are in short supply, and the chief means of supplying potable water — through desalinating seawater — is energy-intensive and places a strain on the economy and the environment.

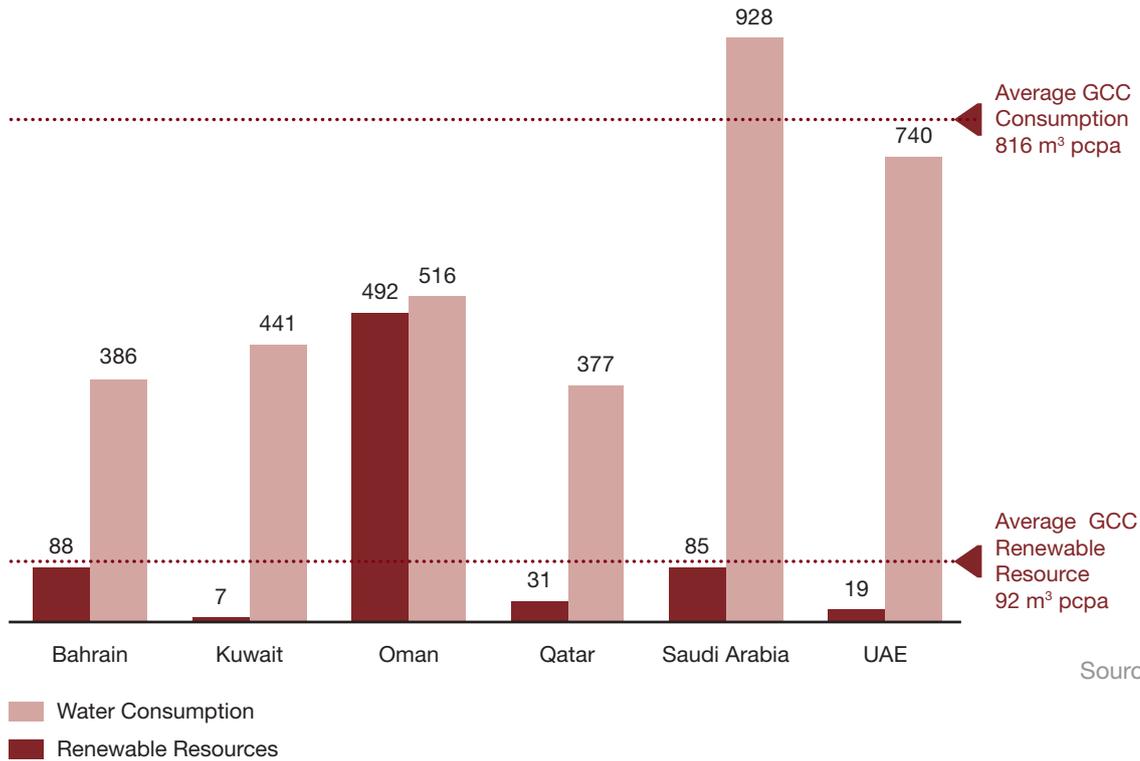
The extent of the mismatch between resources and consumption is evident in the largest consumers of water. Saudi Arabia and the United Arab Emirates (UAE) consume between 10 and 39 times the amount of renewable water available to them, depleting their aquifers at much faster rates than they can be replenished by rainfall. Only Oman comes anywhere close to having enough water from renewable sources to meet its domestic demand (*see Exhibit 1, page 5*).

*When it comes to their water usage, the GCC countries are in a bind.*

Exhibit 1

GCC countries consume too much of their water resources

Water Consumption and Renewable Water Resources, in Cubic Meters per Capita per Annum (m<sup>3</sup> Pcpa)



The region's arid climate is certainly the most significant element of the water challenge. However, there are man-made factors too, including technical problems with water supply systems, the region's fast economic and population growth, and inefficiencies in managing and regulating the water sector.

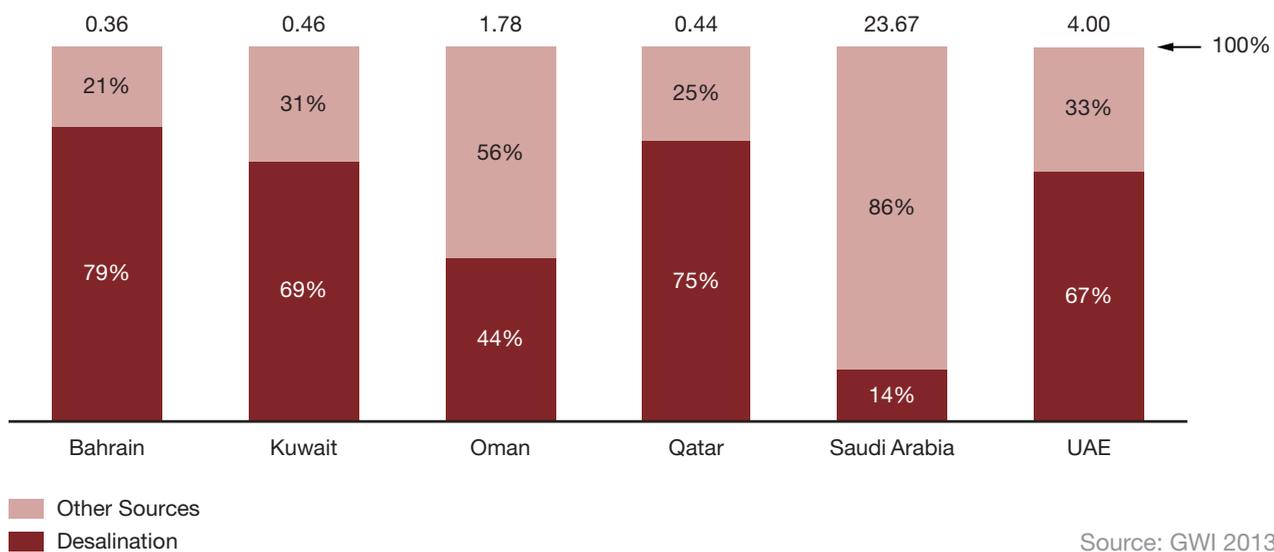
## The high cost of seawater desalination

In no other part of the world is seawater desalination technology used more heavily than in the GCC — and no other part of the world benefits as much from desalinated water (*see Exhibit 2*). On an average day, GCC countries produce more than 12 million m<sup>3</sup> of desalinated seawater, accounting for a quarter of all the water consumed in the region and 70 percent of the water used for domestic purposes.

However, this technological feat has come with significant environmental costs. Desalination plants create carbon emissions by burning fuel, and they discharge the salt left over from the process back into the sea. This has increased the temperature and salinity of the Gulf, with the latter rising by around 2 percent over the last 20 years, with a negative impact on marine life and ecosystems. The increasing salinity makes future desalination even more difficult. Extensive desalination has also increased the CO<sub>2</sub> emissions of GCC countries, contributing to their status as some of the highest per capita carbon emitters in the world. Furthermore, desalinated seawater has some practical problems, including the difficulty and expense of storing it in large strategic reserves.

### Exhibit 2 Most GCC countries depend on desalinated seawater

Percentage of Desalinated Water in Total Water Consumption (In Billion m<sup>3</sup> Annum)



As for the surface water and groundwater that exists, its quality is deteriorating due to aquifer overuse and pollution, especially from poorly managed sewage.

### ***The economic cost of water policies***

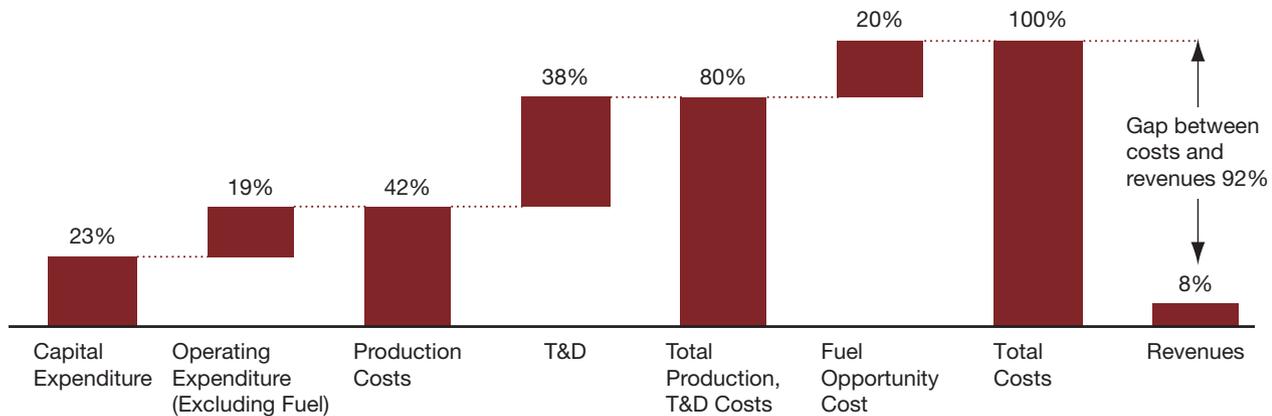
From an economic perspective, current water-sector practices are not sustainable. Indeed, academic studies indicate that seawater desalination consumes around eight times more energy than groundwater and reclaimed wastewater projects, and three times more energy than brackish water desalination projects. Desalination energy requirements consume from 10 percent to 25 percent of national power generation.

Moreover, no attempt is made to recover the costs of producing water. On the contrary, the energy sector usually provides subsidized fuel to the utilities producing water, or the cost difference is made up by the individual country's government. The net result is that those consuming water typically pay no more than a fraction of the cost of producing and distributing the water in most GCC countries (*see Exhibit 3*).

*No attempt is made to recover the costs of producing water.*

### ***Exhibit 3*** **The cost of water is heavily subsidized**

Costs Water Production, Transmission, Distribution, Revenues (%)



Note: T&D=Transmission and Distribution.

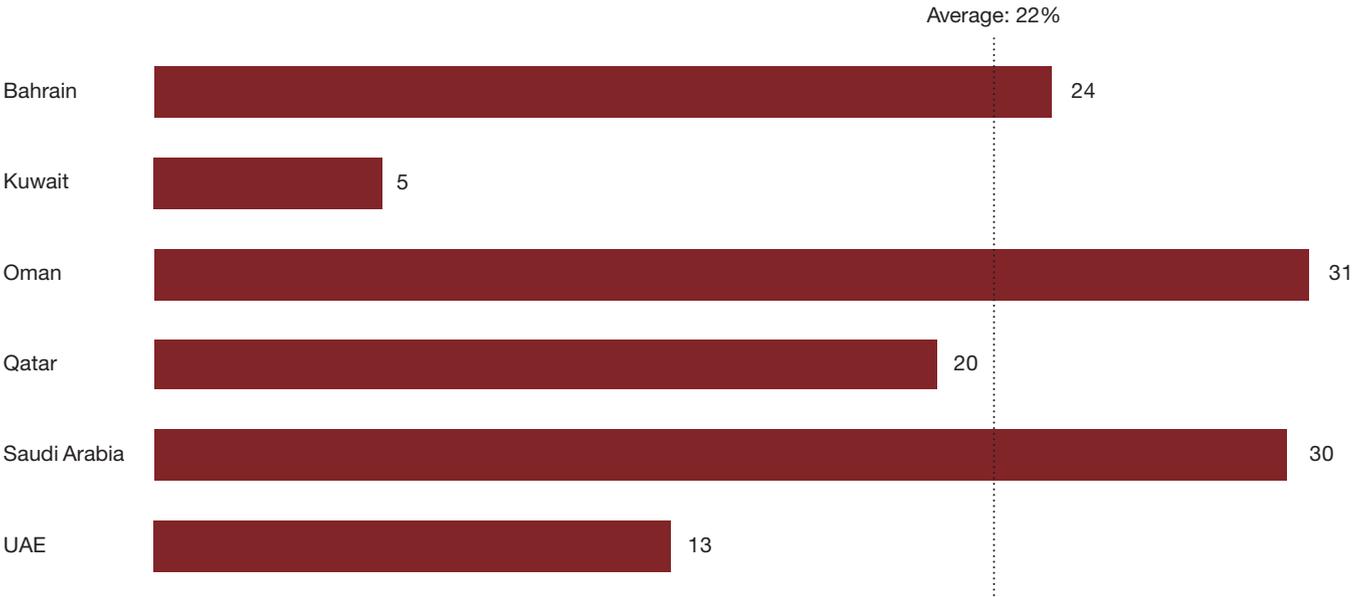
Source: Strategy&

These subsidies create important economic inefficiencies. The first is the opportunity cost. Fuel used to desalinate water is fuel that does not contribute to other parts of the economy — it cannot be used for export or as a feedstock for petrochemicals. Second, the subsidies eliminate any incentive for consumers to use water sparingly because they disguise the true cost of water.

In the GCC, these inefficiencies are aggravated by the way existing water resources are managed, mainly due to technical and commercial losses in water systems. A glaring example is that more than 80 percent of the region’s water is used for agriculture, even though agriculture does not contribute more than 2 percent of any GCC country’s GDP. Another difficulty is that 22 percent of domestic water is either lost to leakage or is not metered, and therefore produces no revenue (*see Exhibit 4*). Non-metered water is also a problem in the agricultural sector with the irrigation of crops, where there are important losses to evaporation and limited control over the abstraction level.

*Exhibit 4*  
**GCC countries should lower their water loss rates**

Unaccounted for Water Rates (%)



Source: GWI 2013;  
Strategy& analysis

---

# *The path to sustainability*

GCC policymakers can address these water challenges with policy initiatives to further three main goals that will ultimately lead to sustainability: managing water demand, increasing the supply of water, and strengthening the institutions responsible for water sustainability. GCC governments should look to make these changes in an integrated fashion, simultaneously considering the impact on all the sectors affected by water policy. This is because the water, energy, and agriculture sectors are inextricably linked in the GCC — and have a major impact on the environment. Integrated planning across these sectors by the entities responsible for them allows for a systematic analysis of all potential linkages and trade-offs and can ensure that countries' long-term economic interests are taken into account.

## ***Demand-side management***

### *Changing the tariff structure*

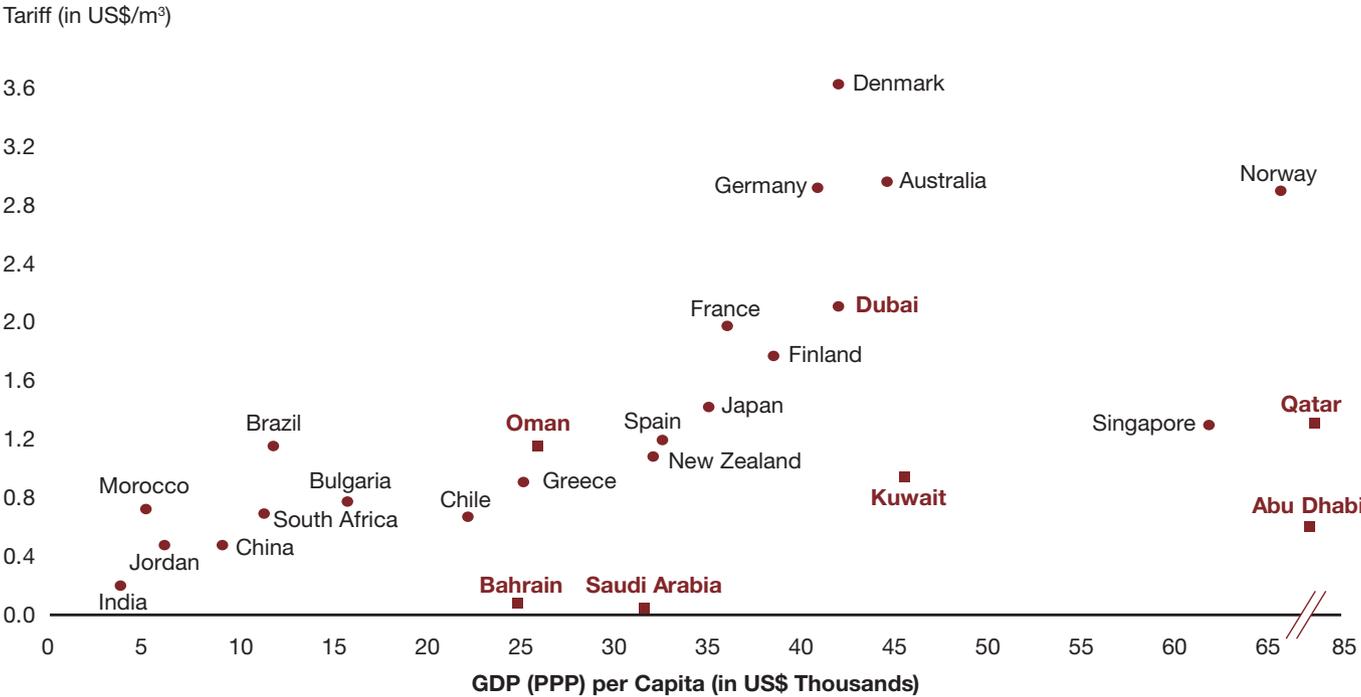
Water and wastewater tariff restructuring is a critical element in managing water demand. It is not a given that GCC governments should cover all the costs of delivering and consuming water in their countries. On the contrary, excessive and inefficient water consumption demonstrates the negative, unintended effects of such policies. Water and wastewater tariffs should be set at levels that allow utilities to recover the largest possible portion of their costs, while still providing customers

*Tariffs should not be raised randomly.*

with affordable water. International benchmarks suggest that some GCC emirates and countries, particularly Abu Dhabi, Bahrain, and Saudi Arabia, have ample room to raise prices (see Exhibit 5). Tariffs should not be raised randomly. Instead, any increase should come as part of a regulatory impact assessment study, so that the effect on consumers' needs and wallets is understood. To the extent that subsidies remain part of the tariff system, they can be used to help poorer households pay for water. Such a direct subsidy scheme was first introduced as part of a water sector reform in Chile in the early 1990s.

**Exhibit 5**  
**Some GCC countries have very low tariffs by international standards**

Water Tariff Compared to GDP per Capita (2012)



Note: Water tariff per cubic meter corresponds to a consumption of 15 m³ per month in the capital city; PPP=Purchasing Power Parity.

Source: World Bank Indicators (2012); GWI Tariff Survey (2012); Strategy& analysis

### *Behavioral change*

An important part of demand management is building awareness and changing consumer behaviors. GCC ministries and utilities have already initiated broad efforts to increase awareness about water conservation. These efforts have included media campaigns, the distribution of efficient water fixtures, themed workshops and conferences, lectures in educational institutions, and advertising the results of successful pilot projects.

There are many additional ways that governments can increase awareness of water conservation. One is by employing techniques from commercial marketing. For instance, a country could use the results of a market segmentation study to tailor messages and communications to specific audiences. Utilities could also provide their customers with information about their consumption, and encourage them to conserve. Another way is to have a more explicit labeling of water-dispensing devices such as showerheads and washing machines, to guide and inform consumer choices.

### *Regulatory enforcement*

Mandatory regulations can be effective in reducing water consumption in buildings. To avoid too much change too quickly, these regulations could be limited to new buildings and renovation projects and they could be phased in, starting with less stringent requirements. The regulations could focus on irrigation efficiency by promoting xeriscaping, which uses minimal amounts of irrigation for gardening and landscaping; on water-fixture efficiency; on the use of “grey water” (wastewater that does not contain effluent) recycling for non-potable purposes (such as greenery and fountains); and on sub-metering and leakage detection systems to increase customer awareness of high consumption.

### *Modernizing agriculture*

Policymakers will want to look at the agricultural sector, a major source of demand and one that adds little to economic output (*see Exhibit 6, page 12*). In the past there were reasons to allow agriculture to consume large amounts of water. Policymakers were concerned about food security, wanted to prevent overdependence on hydrocarbons, promote rural development, and beautify parks and green areas in major cities. Unsurprisingly, support for agricultural development discouraged efficiency. Irrigation practices are often not well monitored, leading to significant water losses through leakage, runoff, and evaporation.

To reduce this waste, governments should introduce efficiency measures and limit the production of crops locally, especially where non-renewable water or seawater desalination are used. Such measures include promoting less-water-intensive crops, mandating efficient irrigation techniques, and removing subsidies on local farming. Some GCC governments have started moving in this direction. For instance, the Saudi government has said it will stop buying wheat from local farmers

*Policymakers will want to look at the agricultural sector, a major source of demand and one that adds little to economic output.*

by 2016 to discourage wheat cultivation and to conserve non-renewable water resources. In the future, all wheat will be imported. The Abu Dhabi Food Control Authority has begun replacing Rhodes grass with more water-efficient crops, such as buffelgrass. Some GCC countries have even started to acquire farmland in other countries on which to grow crops, thereby saving their own water resources and ensuring food supply.

### Supply-side management

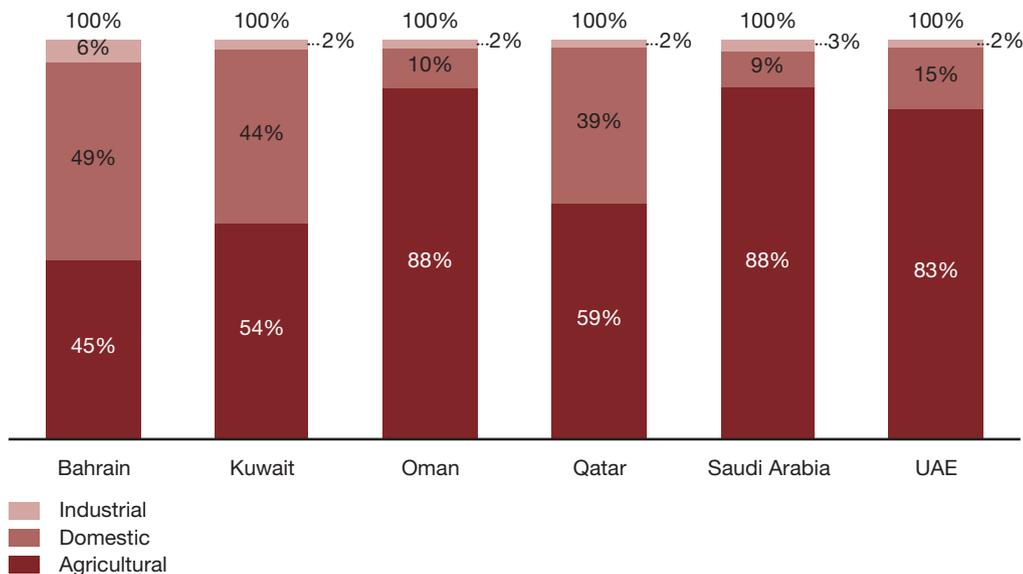
At a high level, supply-side efforts should focus on three areas: collecting more renewable water, improving the allocation of water, and stemming water loss.

#### Collecting more renewable water

The first supply-side effort involves maximizing the abstraction of renewable water. Rainwater can be collected in an effective and cheap way using channels and drains in cities, or large dams in other areas. Indeed, in Saudi Arabia and Oman, many dams are already under construction for flood prevention and agricultural and domestic water use.

### Exhibit 6 The agricultural sector consumes too much water

Breakdown of Water Consumption in GCC Countries (%)



Source: AQUASTAT 2013

### *Improving the allocation of water*

The second supply-side effort should focus on the optimal allocation of water resources. This involves minimizing the use of non-renewable groundwater, limiting desalinated water to potable uses, and maximizing the use of treated sewage effluent (TSE) and grey water for non-potable purposes.

Some years ago, when GCC governments first tried to improve the quality of their wastewater and reuse water, it was primarily a response to environmental concerns and international and regional pressure. Today, policymakers and utilities see reuse water as a valuable resource that can stand in for conventional water supply sources, especially for activities that do not require potable water, such as landscaping and industry. If the use of TSE is to be maximized, however, there must be zero risk from its usage. It is also important to identify applications whose demand patterns are relatively constant throughout the year, and to locate plants that handle TSE near sources of demand, in order to limit distribution costs.

The additional costs incurred to upgrade treated sewage quality to reuse levels are justified, in most cases, by the cost savings versus desalination. In Kuwait, the cost of treated effluent is estimated at US 66 cents per m<sup>3</sup> compared with US\$2.30 per m<sup>3</sup> of desalinated water.

### *Stemming water loss*

The third supply-side effort involves minimizing water loss. By repairing leaks in distribution networks, Bahrain, Oman, Qatar, and Saudi Arabia could save between 10 and 20 percent of water consumption. Kuwait and Dubai have already decreased water loss rates to 5 percent and 11 percent, respectively, through such measures.

## **Water-sector management**

### *Reshaping the institutional framework*

In addition to demand and supply changes, GCC governments should make institutional changes to remove the administrative barriers to improved water management and planning.

Given the national importance of achieving water sustainability, government should ensure that there is centralized administration and management of the water sector. This is in contrast to the current position in some countries, in which groundwater falls under agriculture ministries.

As part of sector reforms, governments should also establish independent regulators with strong technical and financial capabilities. Regulators would ensure that utilities' objectives are aligned with national objectives

*GCC governments should make institutional changes to remove the administrative barriers to improved water management and planning.*

and promote efficient markets both commercially and technically. They would address current difficulties in allocating costs and revenues across the value chain. They would also ensure that tariffs and government support mechanisms provide incentives for utilities to improve their costs and revenue positions while achieving conservation and service improvement targets.

In addition, experience has shown that planning in the water sector should be integrated across the government. Given that water, energy, food security, and the environment are so tightly interwoven in the GCC, ensuring coordination in policymaking and planning of these sectors is vital. For example, GCC countries are global leaders in cogeneration, with water and electricity sharing a common production process, which reinforces the need for integrated planning. Based on benchmarks, different vehicles can be used for that purpose, for example, centralized planning committees, councils, and supra ministries.

#### *Research and development*

Technology will continue to play a critical role in helping the region cut back on investments while securing the water supply. Desalination technology is continually improving, as demonstrated by the sharp drop in production costs during the last four decades, from around \$5.50 per m<sup>3</sup> in 1979 to around \$1 per m<sup>3</sup> today. However, further research is needed to make desalinated water a sustainable long-term supply source. Among the advances that would be most helpful are more efficiency in the widely used but energy-intensive multi-stage flash distillation, an improved approach to reverse osmosis, and increased use of solar thermal and deep geothermal energy in desalination to make those methods technologically and economically feasible for large-scale use.

#### *Localizing the water sector*

Governments should look at the water challenge as an opportunity to develop local suppliers of equipment and chemicals. One good place for GCC governments to start would be by earmarking a portion of their water-sector investments to develop nationally based desalination industry suppliers, as that would take advantage of the large capacity and know-how that already exists in each country. In this context, Dow will begin manufacturing reverse osmosis and nano-filtration membranes at the Sadara petrochemicals complex in Saudi Arabia. The same business case applies to wastewater treatment and reuse companies — an ecosystem of local suppliers to wastewater treatment plants would make considerable sense in the GCC

*Experience has shown that planning in the water sector should be integrated across the government.*

---

# ***Conclusion***

Water has never been an easy issue in the GCC, but with the growth of the region's populations and economies, the sustainability challenge is growing more severe. GCC governments are addressing the challenge to varying degrees, but they can do much more. Addressing water sustainability requires resources, a plan, and an integrated approach. There is a lot that GCC countries can learn from each other's experience and from the efforts of governments elsewhere around the world. Now is the time for them to formulate strategies and make changes that will safeguard the future.

Strategy& is a global team of practical strategists committed to helping you seize essential advantage.

We do that by working alongside you to solve your toughest problems and helping you capture your greatest opportunities.

These are complex and high-stakes undertakings — often game-changing transformations. We bring 100 years of strategy consulting experience and the unrivaled industry and functional capabilities of the PwC network to the task. Whether you're

charting your corporate strategy, transforming a function or business unit, or building critical capabilities, we'll help you create the value you're looking for with speed, confidence, and impact.

We are a member of the PwC network of firms in 157 countries with more than 184,000 people committed to delivering quality in assurance, tax, and advisory services. Tell us what matters to you and find out more by visiting us at [strategyand.pwc.com](http://strategyand.pwc.com).

[www.strategyand.pwc.com](http://www.strategyand.pwc.com)

© 2014 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see [www.pwc.com/structure](http://www.pwc.com/structure) for further details. Disclaimer: This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors.