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TAKING BACK CONTROL

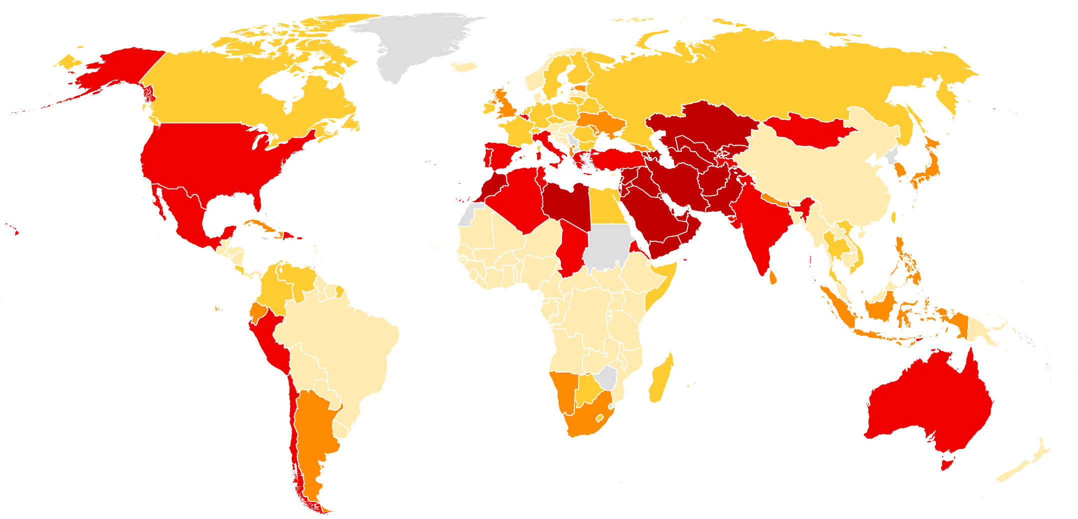
Opportunities for integrated water management

Bruno Sousa
Arnaud Delamare
Saji Sam
Eric Confais
Bruno Despujol

Consistently listed as one of the top five global risks by severity of impact since 2012, the global water crisis has become a reality for countries globally. Twenty-five percent of the world is currently living in areas of extremely high water stress, and by 2050 that portion of the population will more than double. At the same time, population growth is driving urbanization around the world, resulting in higher needs for water supply and wastewater treatment services. And with climate change spurring heavier precipitation and associated flooding as well as frequently occurring droughts, adequate infrastructure is required to tackle the disrupted water cycle.

To tackle the objectives of SDG 6 — the United Nations' Sustainable Development Goal to provide availability and sustainable management of water and sanitation for all — countries have defined water strategies and objectives. As a result, initiatives have been launched with defined targets related to water efficiency, from developing technology that cleans water to simply cutting back on water usage. And SDG 6 is just part of the challenge, as the need for sanitation has been further amplified by the COVID-19 pandemic.

Exhibit 1: Key water stress hot spots

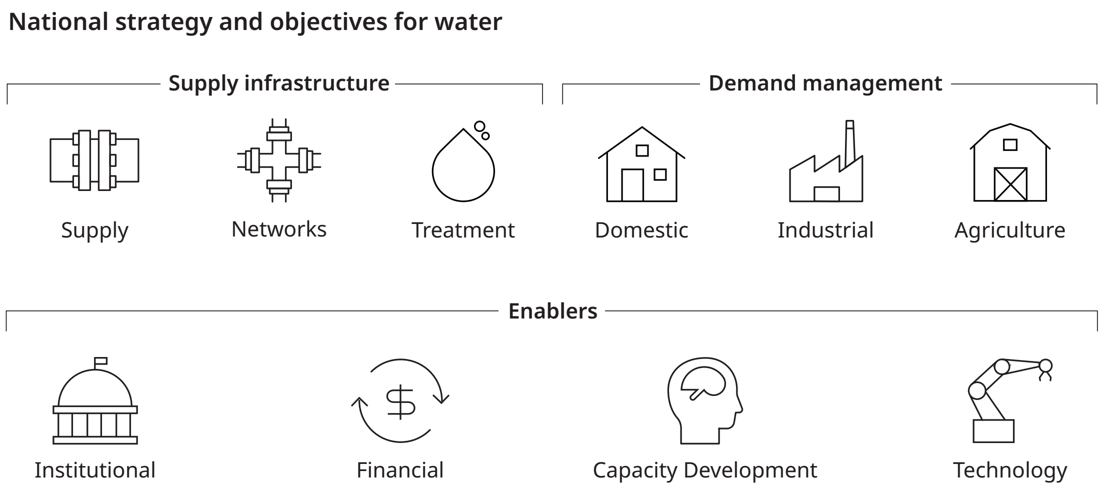


Low (<10%) | Low to medium (10-20%) | Medium to high (20-40%) | High (40-80%) | Extremely high (>80%)

Source: World Resources Institute, Aqueduct Country Rankings 2020

Addressing sustainable water management is a complex feat in and of itself. Water a primarily scarce resource, is used by virtually all sectors of the economy and part of a very dynamic and unpredictable natural cycle, with continuous disruption on availability. Therefore, countries need to consider an integrated approach that considers their unique objectives, financial situation, and other factors. To support the decision-making process, Exhibit 2 outlines an approach that countries can leverage to make informed choices that take the future state of the water sector and anticipated changes in demand into account.

Exhibit 2: Integrated water management approach



Source: Oliver Wyman analysis

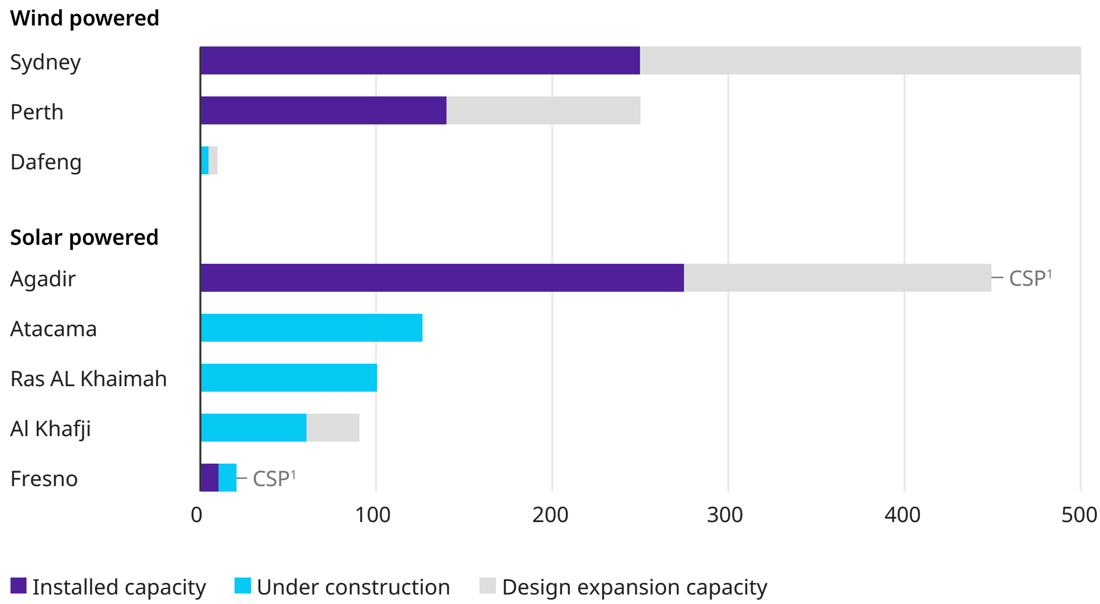
DEVELOPING AN EFFICIENT WATER SUPPLY INFRASTRUCTURE

Supplying water to consumers requires a complex and sophisticated infrastructure, including water production, networks such as transmission and storage to transport water over long distances, and wastewater treatment. Each infrastructure element across the water value chain plays a key role in supporting sustainable water systems by fostering alternative sources of water, optimizing costs, and developing the reuse of wastewater effluents. Cost optimization may consider the rightsizing of services, the renegotiation of sourced products, and the reduction of water network inefficiencies.

EXPANDING WATER SUPPLY WITH SUSTAINABLE DESALINATION

Lacking renewable water resources, countries where water supply is scarce increasingly rely on desalination to cope with water demand. Therefore, more efficient solutions are deployed to reduce production costs and increase the amount of usable water that results from the process. And combining desalination with renewable energy provides lower cost desalination powered by clean energy.

Exhibit 3: Global operating desalination capacity by power source, 2017
Percent of total cubic meters per day



1. Concentrated solar power, no information about solar technology used in Atacama and Ras AL Khaimah
Source: SWCC; AWT: Water Technology; ECRA; GWI; IJ Global; BMI; Companies data; Expert interview

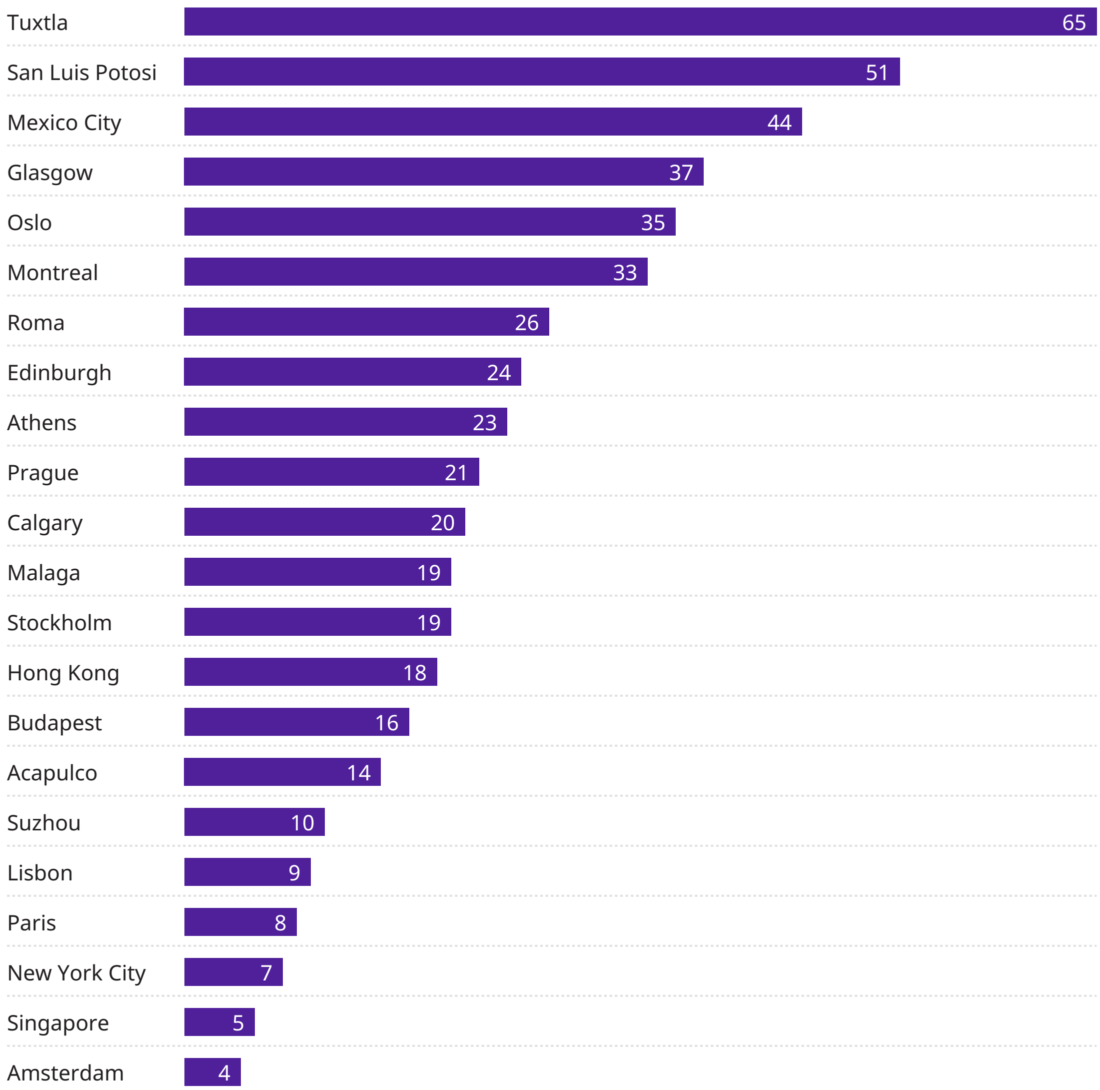
Countries can look to places like Saudi Arabia's NEOM megacity for examples of successful desalination initiatives. This effort will provide 100 percent of the water into a water distribution network with solar desalination and no liquid discharge, which is the absence of liquid waste through high levels of water and solid recovery.

ENHANCING NETWORK EFFICIENCY WITH SMART WATER

For water networks, efficiency is key, and in most cases aging infrastructure translates into higher levels of water losses. The resulting lost water not only increases costs, but also poses more of an environmental risk as it takes away resources that could instead be used later on. While smart water technology does involve investment up front, it pays off in dividends over time through lower costs, improved billing systems, and being more environmentally-friendly.

Exhibit 4: Share of water losses in selected cities

Percent



Source OECD 2016, US EPA

Examples of efficiency achieved using smart water technology can be seen around the world. In Singapore, for instance, the Public Utilities Board's use of network sensors provided faster detection of water leakage events, reducing water losses to less than five percent along with improved response times. Likewise, a European water utility was able to reduce water losses by 22 percent and energy consumption by 18 percent with advanced pressure control, optimizing network pressure to meet demand.

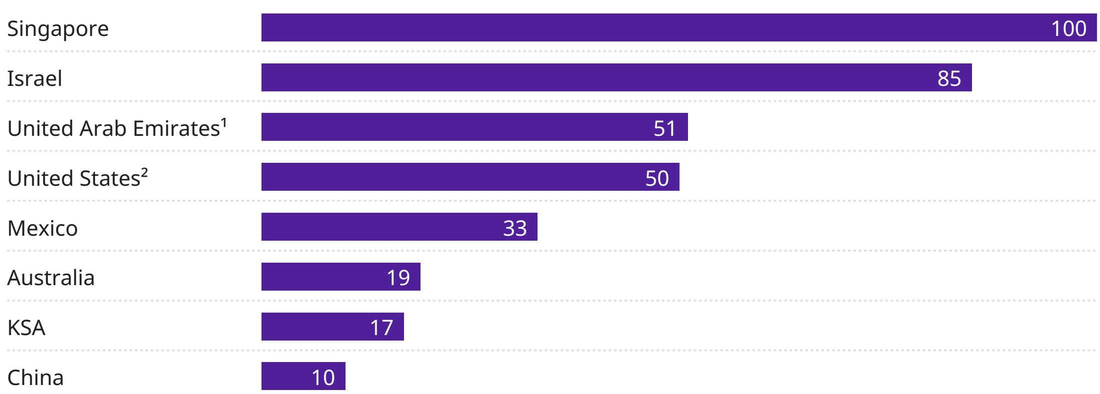
REUSING WATER AND MANAGING DEMAND TO CONSERVE WATER RESOURCES

Decision-makers have historically prioritized wastewater treatment lower than water supply services, ultimately resulting in untreated waste being discharged into the environment. The use of treatment technology has enabled higher levels of reuse and essentially provides more water at lower costs.

In Singapore and Israel, for instance, levels of reuse of treated wastewater have reached an all-time high of 100 percent and 85 percent respectively. While Israel recycles water mostly in agriculture all wastewater in Singapore is treated and sent back for industrial reuse.

Exhibit 5: Share of treated sewage effluent reused in selected countries

Percent



1. Reuse data for Abu Dhabi, data for renewable water resources for UAE
2. Reuse data for the state of Arizona

Source: GWI, GE Reports, 7th World Water Forum 2015, FAO, KSA National Transformation Program 2020 Abu Dhabi State of Environment Report, Arizona Department of Environment Quality, expert interviews, Oliver Wyman analysis

MANAGING WATER DEMAND

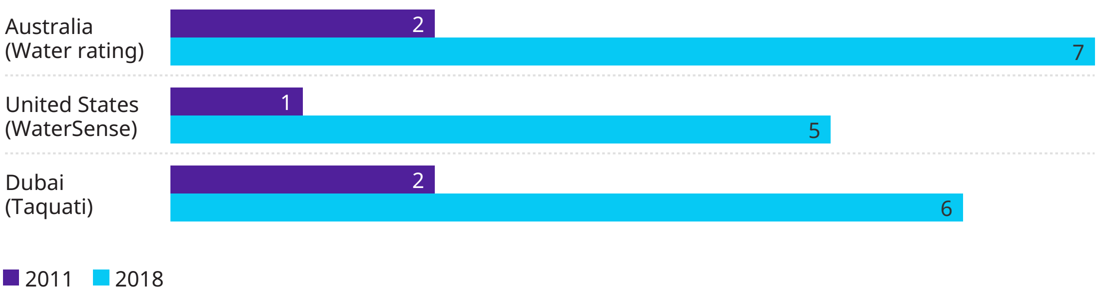
Aside from reusing water and reducing waste, managing water demand is another way for countries to reduce costs and their overall environmental impact.

Although demand management practices have resulted in lower costs and a positive environmental impact, residential water only accounts for approximately 10 percent of global water withdrawals. With a wide range of potential initiatives available, agriculture and industrial water management initiatives should be leveraged to maximize the impact of integrated approaches to water management.

CONSERVING WATER DOMESTICALLY

Most approaches to demand management focus on influencing consumer behavior. These are carried out by creating water tariff structures following the user-pays principle — where the user pays for the privilege of using the resource and bears the cost of the actual service provided. Awareness campaigns, such as those on television, on the radio, and in public places such as schools, are also used.

Exhibit 6: Annual water savings in selected domestic water conservation initiatives
Percent



Note: Australia and USA yearly savings from water efficient products only on residential demand, not including impact on other initiatives. Dubai yearly water savings from all initiatives deployed
Source: Water rating; Australia's Bureau of Meteorology; WaterSense; US Geological Survey; Taqati

Primarily adopted by developed countries, water efficiency label schemes facilitate the general adoption of domestic water-efficient fixtures and appliances, reducing the demand for household water. These water savings can be translated across the water value chain and converted to financial savings for consumers and water savings for service providers, while supporting cost reduction for operation and maintenance.

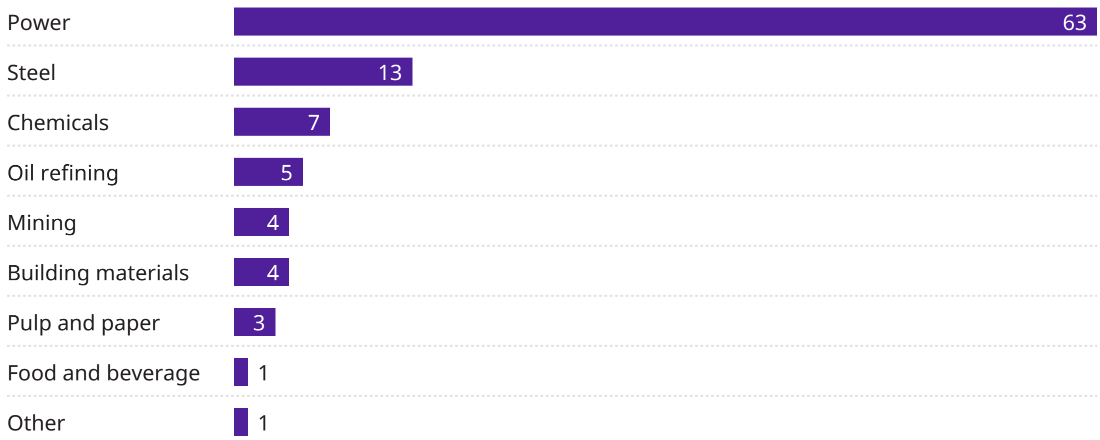
EMPOWERING INDUSTRIES TO REDUCE FRESHWATER WITHDRAWALS

Industrial water demand accounts for approximately 20 percent of the world's water withdrawals, primarily driven by power generation and steel production, both combined accounting for approximately 75 percent[1] of the total.

1 GWI (2017)

Exhibit 7: Water withdrawals by industry

In billion cubic meters per year



Source: GWI (2017)

From an industrial standpoint, water withdrawals are primarily established by processes, equipment standards, and operational practices — outside of withdrawals, of course. To improve water conservation alongside industrial use, countries around the world have begun enforcing new water standards. In Singapore, for instance, the NEWater initiative was implemented to reduce water consumption and encourage reuse. And in an effort to minimize withdrawals of freshwater, Singapore also uses seawater in cooling systems. The Chinese government has similarly imposed zero-liquid discharge for new coal-to-chemicals plants in water-stressed provinces.

WATER CONSERVATION THROUGH ENHANCING IRRIGATION AND CROP OPTIMIZATION

Agriculture is responsible for approximately 70 percent of the world's water withdrawals. To overcome this, several initiatives to reduce water demand through sustainable and efficient agricultural practices are gaining traction globally to save water.

For instance, smart irrigation is being adopted worldwide, resulting in water savings from irrigation scheduling to reduction of evapotranspiration losses to drip irrigation, with targeted and concentrated irrigation of crops. Appropriate selection of crops can also result in significant water savings, with less water intensive crops reducing the overall water demand and impact on water resources.

Exhibit 8: Potential actions for agricultural water demand management

Improve irrigation techniques and farmers awareness	Crop selection • Restrictions on crop selection • Subsidies for crop switch • Adjustment of planting date Water tariffs • Cost-reflective water tariffs • Pricing structure (uniform, tiered …) • Seasonally-adjusted tariffs (e.g., drought) • Water market (exchange of water allocations) Sustainable use financial aid • Grants for sustainable agriculture • Grants for water conservation innovation • Drought/climate change financial support Irrigation techniques • Irrigation scheduling • Deficit irrigation strategies • Decrease of soil evaporation and erosion • Restrictions on water consumption (e.g., drought) Farmers awareness • Farmers awareness campaigns • Conservation demonstration projects Training and licensing • Farmers technical/vocational training • Certification of irrigation professionals • Qualification of irrigation professionals
Deploy water efficient irrigation tools and infrastructure	Irrigation best practices • Standards for irrigation equipment/infrastructure • Reduction of evaporation during storage • Reduction of runoff water • Water table management (drainage water) Irrigation systems financial aid • Funding for improvement of irrigation systems • Funding for new irrigation system or technology • Emergency water infrastructure rebate scheme Water metering • Mandatory metering of water abstraction • Satellite monitoring of soil moisture
Support alternative sources utilization (mainly TSE reuse)	TSE reuse • Standards for TSE reuse for agriculture • Pricing of water reuse (vs. fresh water)

Source: Oliver Wyman analysis

To improve water conservation in the Murray-Darling basin, the Australian government is funding efficient irrigation programs. Approximately AUD 500 million will fund the installation of smart irrigation and drip irrigation devices to achieve savings of 187 million liters in the long term for the basin. Likewise, Saudi Arabia has succeeded in reducing water consumption by restricting agriculture, wheat cultivation, and green fodder production. The latter is expected to lead to nine billion cubic meters in water savings, equivalent to more than 50 percent of water consumption required for production.

IDENTIFYING ENABLERS FOR SUCCESS

While programs and initiatives are essential to develop sustainable water supply infrastructure and demand management practices, these require the proper enablers to succeed.

Implementing policies to provide water security and increase performance efficiency of systems requires adequate water governance through effective and efficient institutions. Financial investment is required to develop infrastructure that requires high capital. In addition, financial incentives must be in place for water efficiency and conservation initiatives. Likewise, capacity development and technology will create the knowledge and tools to ensure that future challenges are properly met, and that program and initiative objectives will be sustainable in the long-term.

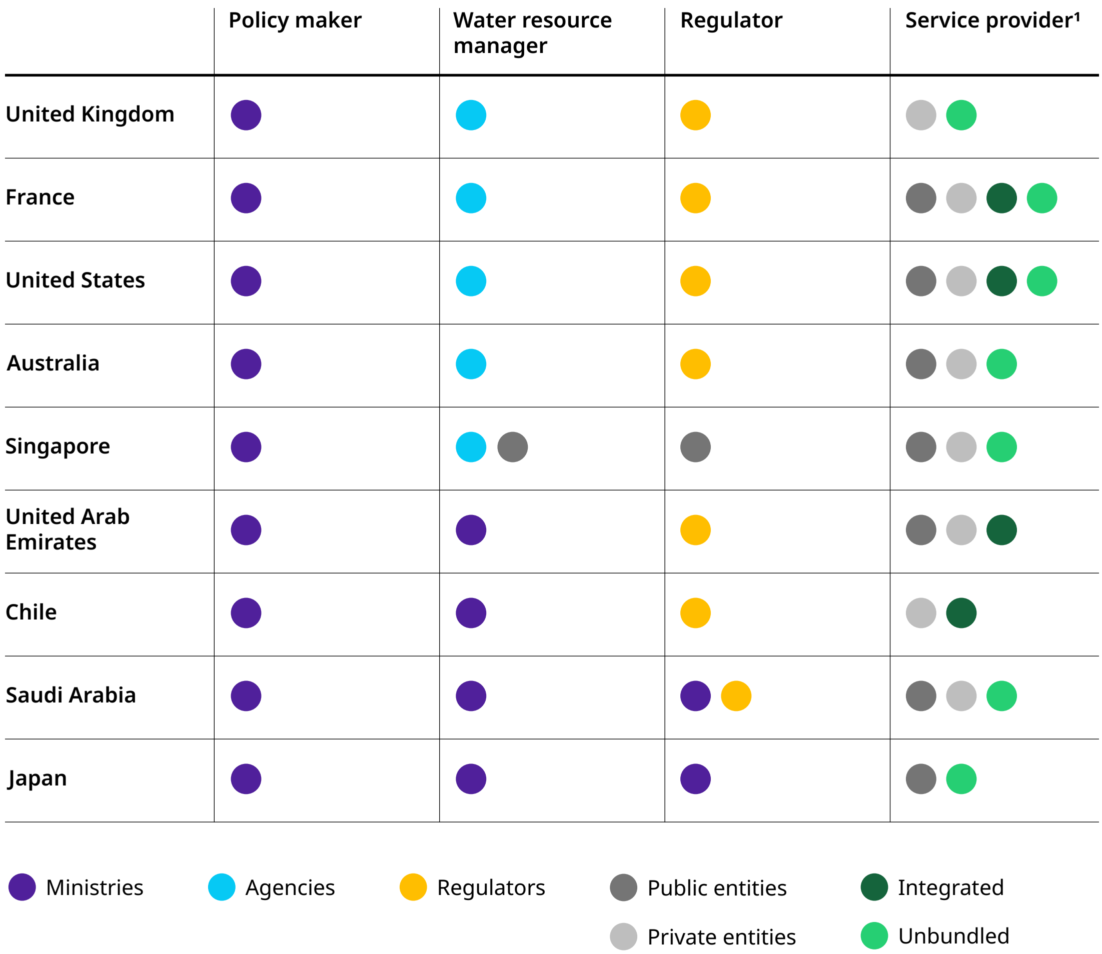
ESTABLISHING A ROBUST INSTITUTIONAL SET UP

The institutional setup of the water sector is intrinsically connected to the governments of individual countries and regions, the pressure on water resources, and the degree of corporatization and commercialization of the sector. As a result, four key roles — policy maker, water resources manager, regulator and service provider — may be separated or merged, sometimes with several institutions taking care of the role.

Despite this complexity, there are some common principles that can ensure effective collaboration and support for strategic objectives in the water sector, as for instance the Organization for Economic Cooperation and Development (OECD) Principles on Water Governance.

Effective and efficient institutions will enable adequate incentives to investment in sustainable practices. And clear roles and responsibilities must be established for accountability purposes, to ensure that the control and monitoring of services provided to enhance performance. Institutions must be transparent, with cost of service and tariff rationale visible to populations. Similarly, public participation will drive sector improvements and establish trustworthy relationships.

Exhibit 9: Institutional set up in selected countries



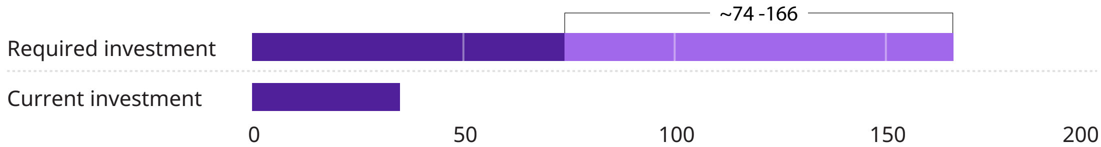
1. Integrated entities are those that serve entire water value chain, unbundled entities are those that serve a select portion of the water value chain or select end clients
Note: Reference to Ministry as policy maker can vary with country (e.g., Departments in the US)
Source: Oliver Wyman analysis

INCREASING INVESTMENT IN PERFORMANCE

Most of the solutions mentioned previously are capital-intensive and require adequate allocation of financial resources.

It is estimated that to achieve SDG Targets 6.1 and 6.2 on the global access to safe and affordable drinking water and sanitation by 2030, an investment between $74 billion to $166 billion per year is required, between two to five times the amount currently invested. High sunk costs and very long payback periods have resulted in a perceived investment gap, and, financiers are not attracted to the usual low-cost recovery of water investments combined with the lack of analytical tools and data for complex investment assessment.

Exhibit 10: Annual investment required to achieve SDG targets 6.1 and 6.2
$US billions



Source: Hutton & Varughese — World Bank (2016); Oliver Wyman analysis

A lack of financing to address water-related challenges will further exacerbate economic losses caused by water-related issues. Losses in agriculture, health, and income from similar issues can result in up to a six percent reduction in GDP in the Middle East by 2050[2]. Likewise, flood damages to urban properties result in annual losses of up to $120 billion[3].

BUILDING CAPACITY TO ENSURE LONG-TERM VISION

Recognizing the complexity of water-related challenges will require creative solutions. Capacity development programs are therefore required to systematically identify required knowledge, assess knowledge gaps, and ensure that such gaps are closed so that professionals can address challenges.

And while programs and initiatives may create immediate and short-term impact, the long-term sustainability of such initiatives must be ensured by developing required capacity. This may encompass professional on-the-job training, as well as involvement in water education networks, universities, research programs, and e-learning programs.

Organizations and institutions must enhance their knowledge transfer mechanisms, including processes and procedures, to promote both explicit and tacit knowledge required to solve water-related problems.

DEVELOP INNOVATIVE AND EFFICIENT TECHNOLOGY

The water sector has experienced many technological advancements in recent years. These developments were able to improve the performance of assets and enhance decision-making with better information. To ensure the long-term success of programs and initiatives, investment in innovative and efficient technologies is required.

2 World Bank (2015)
3 Sadoff et al. (2015)

Recently, the adoption of digital technologies such as the internet of things and big data by professionals has enabled further enhancement of water system efficiency. Leveraging the potential of innovative technology is critical to address water-related challenges. Through the maintenance costs are reduced, and performance is subsequently enhanced.

The creation of clusters to drive research and development has been a key success factor, as seen in Singapore. It will require a balanced investment between public and private entities, including universities and start-ups, to name a few. Such clusters will advance technology to increase water system efficiency and reduce costs.

THE ROAD AHEAD

While an overwhelmingly large number of approaches to water management exist which can be challenging to adopt on their own, an integrated approach is necessary to deliver impactful results. Water stress is an increasing reality worldwide, and coupled with climate change, poses significant challenges to achieving sustainable development that will only amplify in the years to come.

For an integrated water management plan to be successful, countries need to establish multi-year objectives that leverage global best practices and are tailored to their unique challenges. Beginning with determining the financial investment and institutional setup required, particular attention should be given to leveraging the latest water supply technologies, implementing water demand management programs for all sectors, and establishing the right enablers.

In water-stressed regions — which are becoming the norm in many places — this means accelerating the national water reform agenda and avoiding siloed approaches in favor of an integrated approach across the whole water cycle. The same can be said for countries with aging infrastructure, as expecting service disruptions in the coming years require an approach to system efficiency, water conservation, and effective governance. Ambitious, comprehensive programs will need to be established to drive the changes required, so that regions can meet their water challenges and ensure long-term success.

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For more information, please contact the marketing department by phone at one of the following locations:

EMEA	Americas	Asia Pacific
+44 20 7333 8333	+1 212 541 8100	+65 6510 9700

AUTHORS

Bruno Sousa

Partner
bruno.sousa@oliverwyman.com

Saji Sam

Partner
saji.sam@oliverwyman.com

Bruno Despujol

Partner
bruno.despujol@oliverwyman.com

Arnaud Delamare

Principal
arnaud.delamare@oliverwyman.com

Eric Confais

Partner
eric.confais@oliverwyman.com