

7. Bahrain

7.1 Key indicators

Figure 7.1 Population indicators, Bahrain

Demographic indicator	2009	2016
Urban Population	0.69 million	0.77 million
Rural Population	0.09 million	0.10 million
Total Population	0.78 million	0.87 million
	2005-10	2010-15
Urban population growth rate	1.83%	1.63%
Rural population growth rate	1.44%	0.95%
Total population growth rate	1.85%	1.64%

Source: UN, World Population Prospects: The 2006 Revision and World Urbanization Prospects: The 2007 Revision (medium variant).

Figure 7.2 Economic indicators, Bahrain

Economic indicator (2008)	Nominal GDP	GDP at PPP
Total GDP	\$21.2 billion	\$27.0 billion
GDP per capita	\$27,248	\$34,662
GDP growth rate	6.12%	

Source: IMF, World Economic Outlook Database, October 2009.

7.2 Sector structure

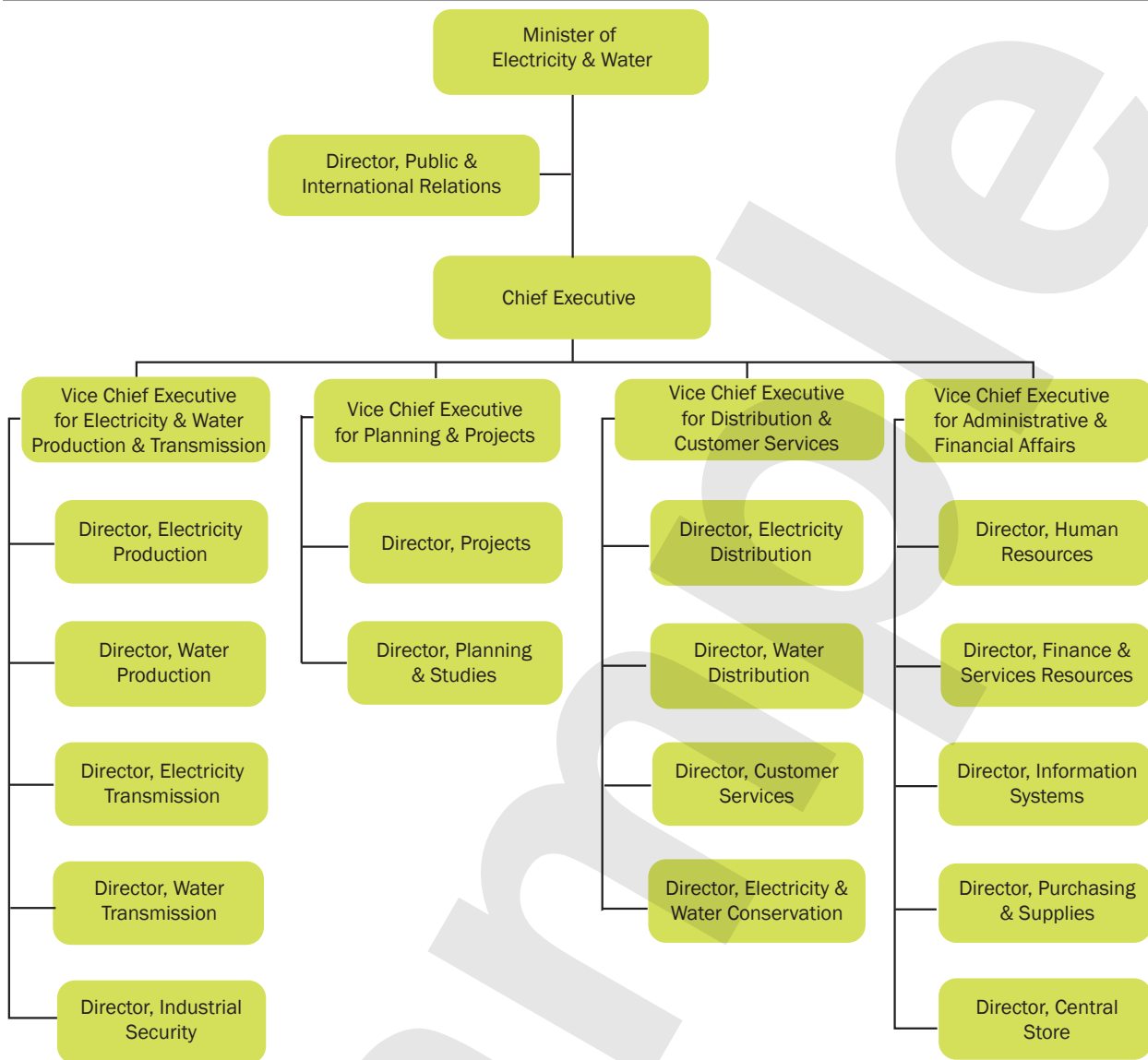
7.2.1 Government ministries and agencies

Two principal entities are responsible for governing the water and wastewater sectors in Bahrain. The first is the **Electricity and Water Authority (EWA)**, which has retained an identical structure to its predecessor, the Ministry of Electricity and Water (MEW). In addition to electricity assets and production, the EWA is responsible for water production, transmission, distribution networks, bill collection and metering. It is centrally managed from Manama.

The second principal body is the **Ministry of Works (MOW)**, which is responsible for all public work undertakings in Bahrain, including roads, drainage and wastewater. The MOW has a specific **Sanitary Affairs Directorate** which is in charge of the Tubli plant, amongst others, and coordinates the nationwide treatment and re-use of wastewater. It has also been involved in the planning and tendering process for the future Muharraq WWTP, as has the Ministry of Finance, which partly oversees the potential privatisation of state-owned assets in Bahrain.

The organisational structure of the EWA is shown in the following figure.

Figure 7.3 Organisational structure, Electricity and Water Authority (EWA)



Source: EWA, 2008

7.2.2 Desalination context

A key strategy of the authorities involves reducing the amount of brackish groundwater used in blending with distillate water and then fed into the main water network. EWA officials say that the objective is to reduce this to zero by 2010, with 100% of public potable water supply generated by desalination plants and their associated treatment stations. One of the reasons is not just the scarcity of groundwater, but also that its quality has been deteriorating markedly in recent years, becoming more salty. EWA officials have indicated that, in the future, depleted groundwater aquifers may be recharged with treated wastewater.

Bahrain has four main desalination plants, whose capacities have been progressively increased over the course of the past decades. Brief profiles of the plants are as follows:

- The **Hidd Power and Water Plant**, located to the south of the island of Muharraq and within proximity of Manama, has the largest desalination capacity in the country and uses multi-stage flash (MSF) technology. With an original production capacity of 136,000 m³/d, it underwent an expansion programme in 2006-2008 which enabled it to produce another 273,000 m³/d, bringing the total capacity to an estimated 409,000 m³/d. Officials from the EWA indicated that in late 2008 the plant was already producing 273,000 m³/d, and that the remaining 136,000 m³/d would become available in early 2009 once a final round of testing was completed. The Hidd plant now also includes a 'potabilisation' plant, which means that it will no longer require blending with brackish groundwater. The plant is operated by the Hidd Power Company (HPC), a consortium of International Power (40%), GdF Suez Energy International (30%) and Sumitomo Corporation (30%), on a build-own-operate (BOO) basis. The consortium acquired

all of the Hidd assets in 2006 in a \$1.25bn deal that included the cost of the 273,000 m³/d expansion mentioned above.

- Another desalination plant at **Ras Abu Jarjur**, also located on the eastern seaboard, currently produces around 73,000 m³/d using groundwater, not seawater.
- The **Sitra power and water plant** is the oldest in the country, having been originally commissioned in the 1970s. It produces 114,000 m³/d of distillate water, which is blended with groundwater before entering into the main supply network.
- The large **Aluminium Bahrain (Alba) plant**, located to the south of Manama, also produces some desalinated water as a by-product of its other operations. According to the EWA, production of desalination water was 9 million m³/yr in 2007, an average of 24,700 m³/d.

7.3 Desalination profile

Figure 7.4 New capacity in Bahrain, 1980-2009



Source: GWI DesaalData

Figure 7.5 Bahrain installed capacity by plant size, technology, raw water quality and user category



Source: GWI DesaalData

7.4 Demand and supply

Figure 7.6 Water resources in Bahrain

Water resource	Volume (km ³ /yr)	Source
Renewable natural resources		
Groundwater (renewable, actual)	0.11 km ³ /yr	FAO AQUASTAT, 2010
Surface water (renewable, actual)	0.00 km ³ /yr	FAO AQUASTAT, 2010
Total water resources (renewable, actual)*	0.12 km³/yr	FAO AQUASTAT, 2010
Higher quality nonconventional resources		
Desalination		Desalination Markets 2010, GWI
Reuse - tertiary or better		Global Water Market 2011, GWI
Total nonconventional resources		

* This may not be the total of groundwater + surface water because of overlap between surface water and groundwater resources, non-exploitable surface water, or irrigation water running back into rivers / aquifers to be "counted twice".

Sources: Given in table

Figure 7.7 Sectoral water use, Bahrain

Sector	% Withdrawal	Volume	Source
Agriculture	45%	0.16 km ³ /yr	FAO AQUASTAT (2010); actual data from 2003.
Industrial	6%	0.02 km ³ /yr	FAO AQUASTAT (2010); actual data from 2003.
Municipal	50%	0.18 km ³ /yr	FAO AQUASTAT (2010); actual data from 2003.
Total annual withdrawal *	100%	0.36 km³/yr	FAO AQUASTAT (2010); actual data from 2003.

* Total annual use may include contributions from sources other than groundwater and surface water, such as desalination or wastewater reuse.

Source: Given in table.

7.5 Proposed plants and opportunities

Figure 7.8 Tracked desalination projects in Bahrain

Project name	Capacity (m ³ /d)	Expected cost	Description

Source: Global dealination tracker, GWI

7.6 Market forecast

It is the Bahrain government's intention to make desalination the source of 100% of public potable water supply. The initial approach to meet this objective has been to upgrade the four existing plants and increase their capacity. The construction of the Ad Dur plant might indicate the start of a new phase of plant construction. While the Hidd expansion and the Ad Dur plant will meet medium-term needs for desalinated water supply for domestic, commercial and industrial use (and thus allowing treated wastewater to be used for groundwater recharge), Bahrain's growth will necessitate further desalination capacity.

Of particular interest should be the large-scale property and hospitality developments located in 'new' zones in the south and centre of the country, as well as those on reclaimed land along the northern shore. These are already creating opportunities for expanding desalination capacity, such as the contract awarded to the locally-based Energy Central for a desalination plant serving the Durrat al-Bahrain offshore development (30,000 m³/d). Further opportunities of this kind will depend on progress in construction and financing of these mega-projects.

A clear point of debate will be end-user tariffs for water and wastewater, and to what degree the authorities are willing to bridge the gap between low consumer rates and the cost of purchasing water or wastewater from private-sector producers. The experience of the Muharraq WWTP in 2009 may be instructive for the direction of the wider privatisation programme.

Figure 7.1 Capital expenditure, 2007-2016



Source: GWI Desalination Markets 2010

Figure 7.2 Capital expenditure breakdown, 2010



Source: GWI Desalination Markets 2010

Figure 7.3 Operating expenditure, 2007-2016



Source: GWI Desalination Markets 2010

Figure 7.4 Operating expenditure breakdown, 2010



Source: GWI Desalination Markets 2010

Figure 7.5 Capital expenditure breakdown, 2007-2016 (\$m)

Expenditure type	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Design/prof costs										
Eqpt & materials										
Thermal plant fabrication costs										
Thermal plant high grade alloys										
Membranes										
Membrane plant piping/high grade alloys										
Pressure vessels										
Pumps										
Civil engineering										
Pretreatment										
Intakes/Outfalls										
Legal/Prof costs										
Installation & services										
Total										

Source: GWI Desalination Markets 2010

Figure 7.6 Operating expenditure breakdown, 2007-2016 (\$m)

Expenditure type	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Electricity										
Membranes										
Labour										
Chemicals										
Parts & Maintenance										
Total										

Source: GWI Desalination Markets 2010

Figure 7.7 Forecast capacity growth by technology and feedwater, 2007-2016 (m³/d)

By technology	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Membrane										
MED										
MSF										
By feedwater										
Seawater										
Brackish water										
River water										
Brine										
Wastewater										
By plant size										
<1,000 m ³ /d										
1,000-9,999 m ³ /d										
10,000-49,999 m ³ /d										
≥50,000 m ³ /d										
Total										

Source: GWI Desalination Markets 2010

Figure 7.8 Historic and forecast capacity growth: Membrane and thermal, 1990-2016



Source: GWI Desalination Markets 2010

Figure 7.9 Historic and forecast capacity growth: Contracted, tracked and expected, 1990-2016



Source: GWI Desalination Markets 2010