SDG 6 MONITORING IN THE KINGDOM OF BAHRAIN

WSTA 13th Gulf Water Conference

Water in the GCC: Challenges and Innovative Solutions

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OUTLINE

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2. SDG 6 Targets and Indicators
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4. Progress on the Monitoring of SDG 6 Targets and Indicators
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1. The 2030 Agenda for Sustainable Development

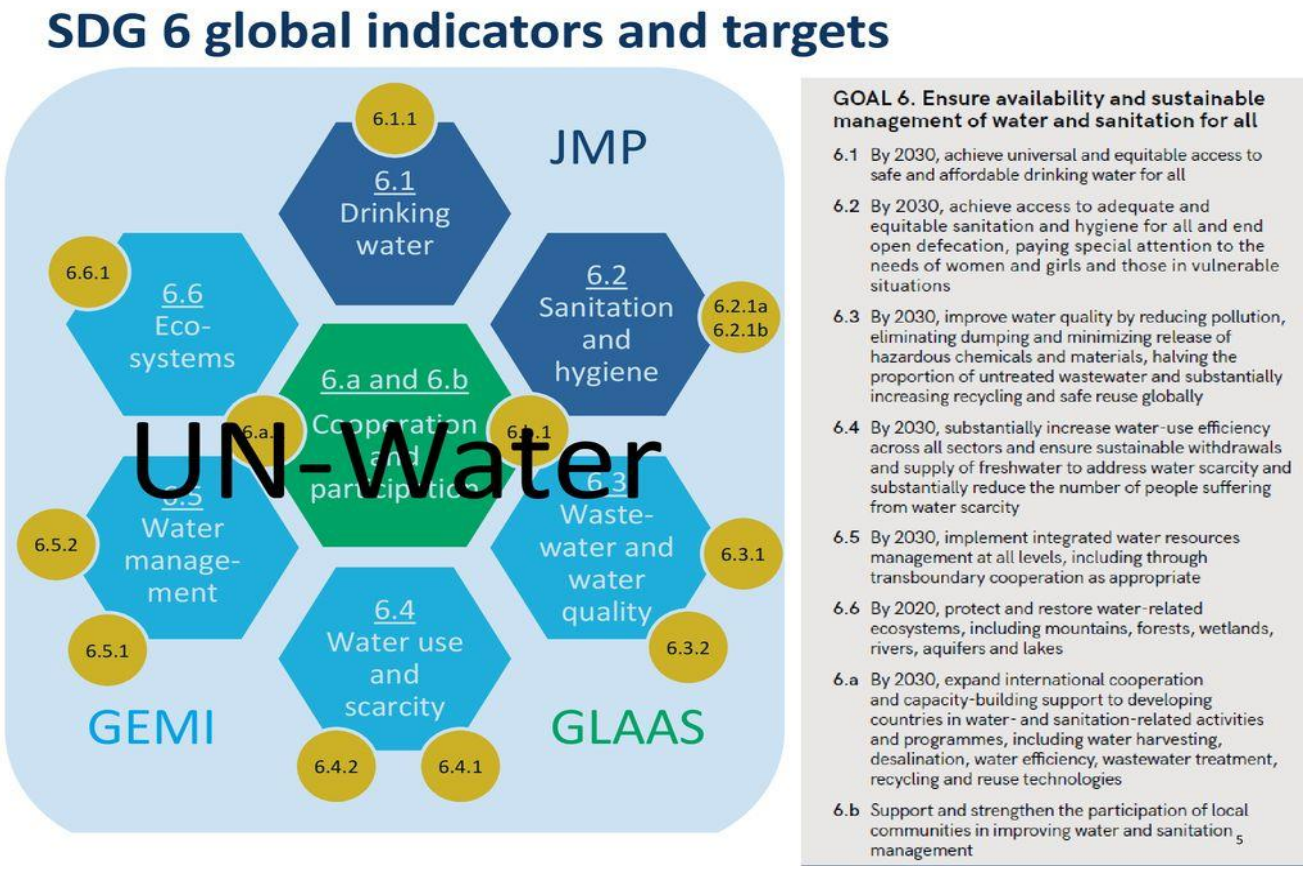
- Ambitious, aspirational, and **country-led** global development plan 2015 – 2030
- **A plan of action** for people, planet and prosperity – no one will be left behind
- **17 holistic**, **indivisible,** and **universally applicable**, development goals
- **Integrated approach** to the social, economic, and environmental dimensions of development
- **169 integrated** targets and **232** global indicators to enable global monitoring and reporting
- "Bahrain Economic Vision 2030" and "National Economic Strategy 2009 - 2014" are **in line with** Agenda 2030

2. SDG 6 Targets and Indicators

Source: UN - Water.

- SDG 6 - **water and sanitation** goal
- SDG 6 **covers** the entire **water cycle** in an integrated manner
- Water and sanitation services at the **core** of sustainable development
- SDG 6 **cutting across** all the other goals on both **targets** and **indicators** levels
- Achieving SDG 6 is **essential for progress** in all other **SDGs** and vice versa
- Conflict or trade-off relationships with other SDGs offer opportunities for improving **policies** and **decision-making** processes

SDG 6 Targets and Indicators … Cont.



GOAL 6. Ensure availability and sustainable management of water and sanitation for all

6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all

6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

6.b Support and strengthen the participation of local communities in improving water and sanitation management

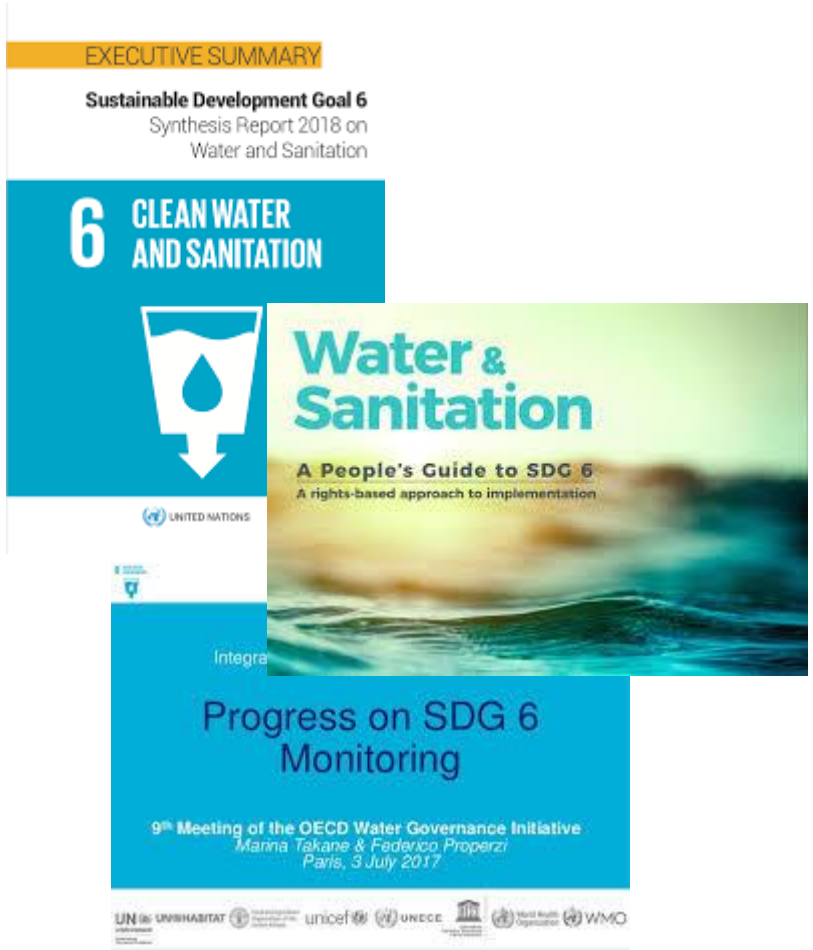
SDG Goal 6 Targets

- **Six** technical targets
- **Two** means of implementation targets

SDG Goal 6 Indicators

- **Nine** core indicators to monitor the technical targets.
- **Two** additional indicators to monitor each of the means of implementation targets

3. Objectives and Methodology



Source: UN - Water.

- **Compile country data** and report on progress towards SDG 6
- Establish a **baseline** for SDG 6 progressive mentoring
- Set out a **methodological mechanism** and **tools** to monitor SDG 6
- **Contribute in testing** the SDG 6 methodologies at global level and **share** experience
- **Comprehensive data collection programme**/ Bahrain Water Resources Database (BWRDB)
- **A trend analysis approach** coupled with analysis of changes **over time** for time series data 2000 - 2016/ **baseline data 2016** for progressive monitoring during the SDG era

4. Progress on the Monitoring of SDG 6 Targets and Indicators

Target 6.1 *By 2030, achieve universal and equitable access to safe and affordable drinking water for all*

Aerial view of the Sitra Power and Desalination Plant. **Photo Credit:** Khalid Hashim, Ras Abu-Jarjur Desalination Plant, Electricity and Water Authority.

- Target 6.1 **builds** on the MDGs Target 7.C on drinking water and sanitation/ takes more **ambitious** approach/ moving from improved to **safely managed**
- Seeks to secure **safe** and **affordable** drinking water for all
- **Integrates with** and **prerequisite for** SDG 1 (Poverty), SDG 11 (Universal access to basic services), SDG 2 (Food security), SDG 3 (Health), SDG 4 (Education), and SDG 8 (Economic growth)
- Progress on this target is measured by one global indicator: Indicator 6.1.1 Proportion of population using **safely managed** drinking water services

Target 6.1 … Cont.

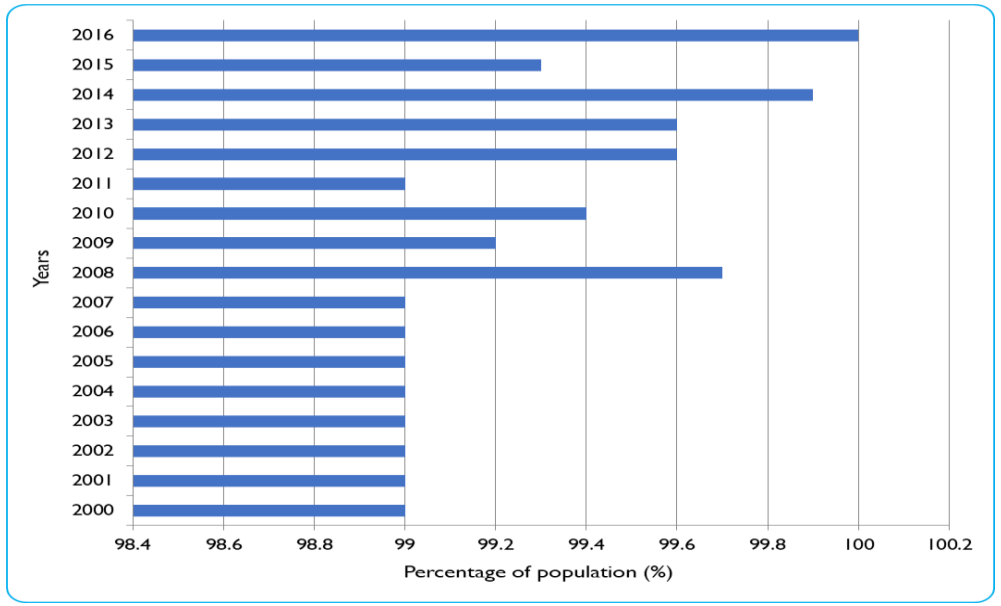
Indicator 6.1.1 Proportion of population using safely managed drinking water services

Source: UN - Water.

- This indicator **builds** on the MDG indicator "Proportion of population using an improved drinking water source"
- **Disaggregates** population into urban and rural population/ not **applicable** to Bahrain
- **Drinking water coverage** is evaluated based on the JMP new service ladder for global monitoring of Target 6.1: **Safely managed**, Basic, Limited, Unimproved, and Surface water
- **Elements of safely managed**: accessibility, availability, and quality
- **No internationally** agreed-upon benchmark for affordability

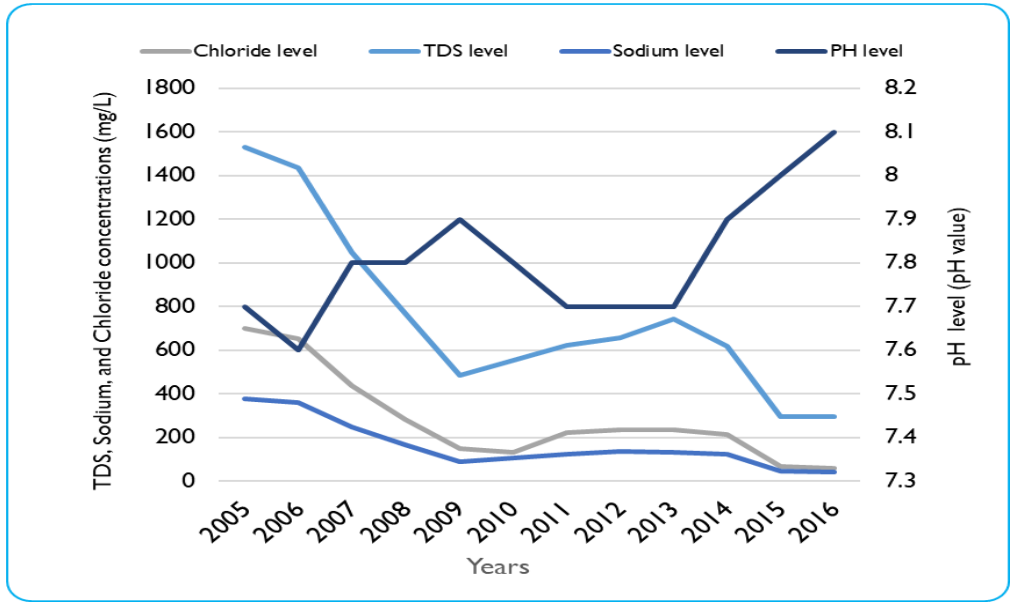
Target 6.1 … Cont.

Proportion of population using safely managed drinking water services



- Population coverage increased from **98.4%** in 2000 to **99.8%** in 2015, and reached **100%** in 2016
- Drinking water coverages below **100%** are due to pending connection applications

Drinking water quality for selected parameters: TDS, Sodium, Chloride, and pH



- TDS level decreased from **1528 mg/l** in 2000 to **294 mg/l** in 2016
- Quality results of the **main** chemical parameters are within **WHO Standards**

Target 6.1 … Cont.

Average concentrations of the minor elements and trace metals in drinking water 2008 - 2017

Parameters	Annual averages concentrations										Guidelines values
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Aluminium (Al)	0.0033	---	0.0092	0.0100	0.0092	0.0013	0.0176	0.0290	0.0291	0.0291	0.2
Boron (B)	0.2781	---	0.1100	0.3087	0.2087	0.2125	0.1892	0.0290	0.1400	0.1852	0.5 (P)
Iron (Fe)	0.0230	---	0.0877	0.0039	0.0138	0.0044	0.0204	0.0290	0.0292	0.0014	
Manganese (Mn)	0.0018	---	0.0024	0.0014	0.0008	0.0003	0.0024	0.0031	0.0031	0.0030	0.4
Copper (Cu)	0.0248	---	0.0108	0.0358	0.0339	0.0319	0.0339	0.0290	0.0327	0.0072	2000 (µ/litre) (P)
Zinc (Zn)	0.0085	---	0.0038	0.0084	0.0231	0.0013	0.0199	0.0290	0.0291	0.0290	
Lead (Pb)	0.0019	---	0.0033	0.0006	0.0021	0.0001	0.0017	0.0031	0.0030	0.0032	10 (µ/litre)
Nickel (Ni)	0.0046	---	0.0046	0.0049	0.0027	0.0038	0.0037	0.0036	0.0037	0.0034	20 (µ/litre) (P)
Cadmium (Cd)	0.0000	---	0.0002	0.0001	0.0002	0.0002	0.0017	0.0031	0.0030	0.0035	0.003
Chromium (Cr)	0.0015	---	0.0008	0.0013	0.0011	0.0016	0.0019	0.0031	0.0030	0.0030	0.05 (P)
Barium (Ba)	0.0000	---	0.0000	0.0000	0.0092	0.0056	0.0171	0.0290	0.0290	0.0290	0.7

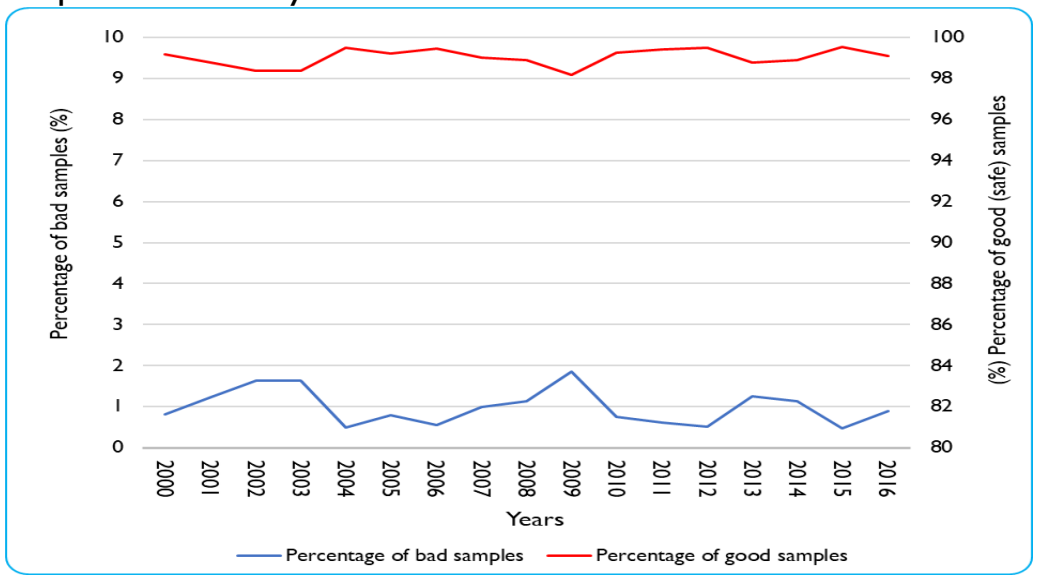
Notes:

1 - All the units are in mg/L, unless otherwise stated.
2 - A dash indicates no data.
3 - Guidelines values are based on the WHO Standards (2004, Third Edition).
4 - (P) indicates **Provisional** guideline values.
5 - Empty boxes indicate no-health-based guidelines values have been established.

- Quality results of the main minor elements and trace metals are within the **WHO Standards**
- **Arsenic, mercury, and fluoride** not included in the regular quality monitoring programme.
- **Fluoride** irregularly monitored. Concentration level in 2016 **<0.1** mg/l
- **Arsenic and mercury** will be part of the water quality module starting from **2018**
- Neither **surveillance independent** monitoring nor **water safety plan** exist

Target 6.1 … Cont.

Percentages of good (safe) and bad samples of drinking water at the point of delivery



- Water distribution network: Percentage of bad samples ranged from **0.48%** (2015) to **1.85%** (2009), and averaged at **0.99%** (2000 - 2016)
- Compliance rate: **98.2% - 99.5%**
- WHO guidelines value: level of bad samples of up to a maximum of **5%** can be tolerated

Percentages of good (safe) and bad samples of drinking water at the point of consumption

Years	Total samples	Sample status		Percentage of the good (safe) and bad samples	
		Safe	Bad	Safe	Bad
2000	1340	1318	22	98.4	1.6
2001	1665	1617	48	97.1	2.9
2002	1666	1630	36	97.8	2.2
2003	1704	1673	31	98.2	1.8
2004	1565	1544	21	98.7	1.3
2005	1188	1154	34	97.2	2.8
2006	1134	1083	51	95.5	4.5
2007	601	580	21	95.5	3.5
2008	447	421	26	94.2	5.8
2009	570	552	18	96.8	3.2
2010	502	484	18	96.4	3.6
2011	319	314	5	98.4	1.6
2012	674	662	12	98.2	1.8
Total	**13375**	**13032**	**343**	**97.4**	**2.6**

- End users: Percentage of bad samples ranged from **1.6%** (2000 and 2011) to **5.8%** (2008), and averaged at **2.6%** (2000 - 2012)
- Compliance rate: **94% - 98%**
- Number of samples analysed: Decreased from **1704** samples in 2003 to **674** samples in 2012

Target 6.1 … Cont.

Drinking water laboratory at Ras Abu-Jarjur Desalination Plant. **Photo Credit:** Khalid Hashim, Ras Abu-Jarjur Desalination Plant, Electricity and Water Authority.

- Before water tariff **restructuring** (2017) **average price** of piped drinking water about **0.30** US$/$m^3$ - affordability met/ defining and measuring "affordability" still a debatable issue at global level
- In 2016, **all the population 100%** (national figure) are using improved, affordable, and **safely managed** drinking water service
- **Safely managed drinking water** refers to piped drinking water located at premises - beyond households - available when needed, and free of faecal and elevated levels of harmful substances at all times

Progress on the Monitoring … Cont.

Target 6.2 *By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations*

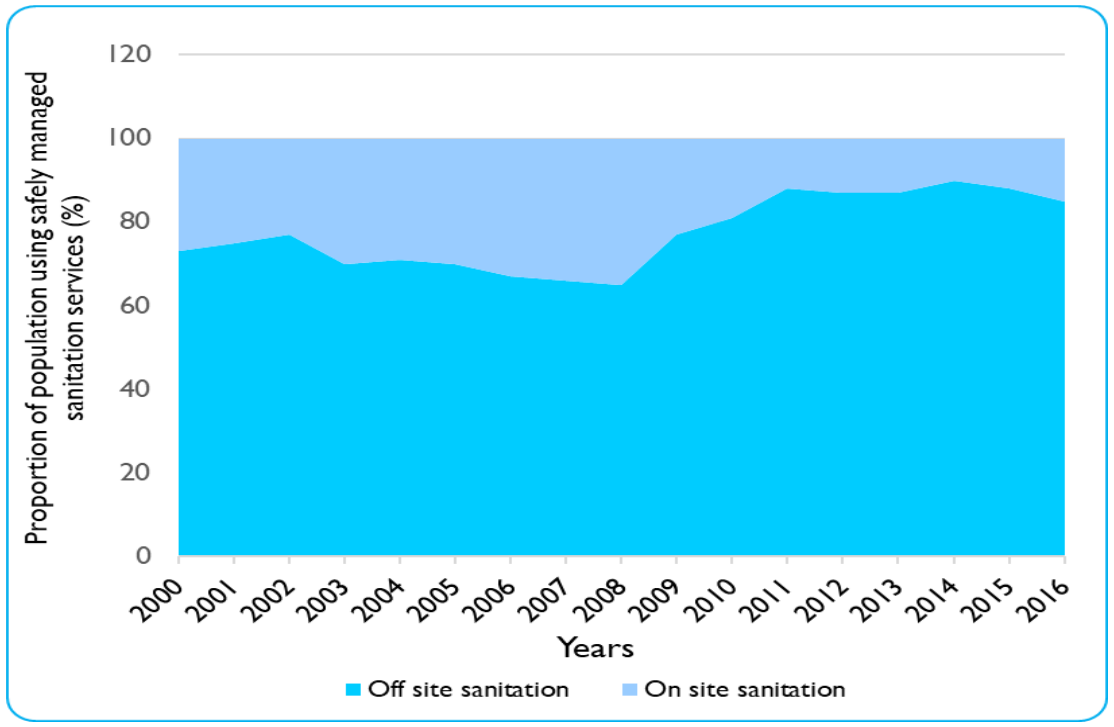
Photo: Tubli Water Pollution Control Centre (TWPCC), Curtsy Public Relation Directorate, Ministry of Works, Municipalities Affairs, and Urban Planning

- **Builds** on Target 7 Indicator 7.C of the MDGs
- **Safely managed** sanitation services and hygiene are essential to protect health of people and environment
- This target aims for **adequate** and **equitable** sanitation and hygiene for all
- **Progress** towards this target is monitored through one indicator having **two** components:
  - Indicator 6.2.1a Proportion of population using safely managed sanitation services (sanitation component)
  - Indicator 6.2.1b Proportion of population using handwashing facility with soap and water (hygiene component)

Target 6.2 … Cont.

Indicator 6.2.1a Percentage of population using safely managed sanitation services

Proportion of population having access to safely managed sanitation services 2000 - 2016



- The indicator measures the **proportion** of population using **safely managed** sanitation services

- **Disaggregates** population into urban and rural population/ not **applicable** to Bahrain
- **Sanitation Coverage** assessed based on JMP updated ladder for sanitation services for global monitoring of Target 6.2: **Safely managed**, Basic, Limited, Unimproved, and Open defecation
- **100%** of the population are using improved and **safely managed** sanitation services (including on site and off site sanitation)/ target **met** before the SDG deadline
- Population with on site sanitation services are connected to **sealed septic tanks**/ in 2016, **85%** using off site sanitation and **15%** on site sanitation
- **No** pollution charge (Polluter pay) is imposed

Target 6.2 … Cont.

Indicator 6.2.1b Proportion of population using a handwashing facility with soap and water

Source: USAID, 2018, Water currents: Annual State of Handwashing Research.

- Evaluated based on JMP ladder for **hygiene** and **handwashing** facility on premises: **basic**, limited, and no facility
- Progress not monitored - possibly **not applicable** to the Bahrain situation considering the level of **socio-economic** development
- **No** household survey instruments data available to track progress
- **Methodology being reviewed** at global level for **middle** and **high** income countries
- **Possible progressive monitoring** may require inter - ministerial/inter-sectoral **coordinated** monitoring efforts

Progress on the Monitoring … Cont.

Target 6.3 *By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally*

Photo Credit: Trey Ratcliff, Creative Commons Attribution

Photo Credit: Maria Shade

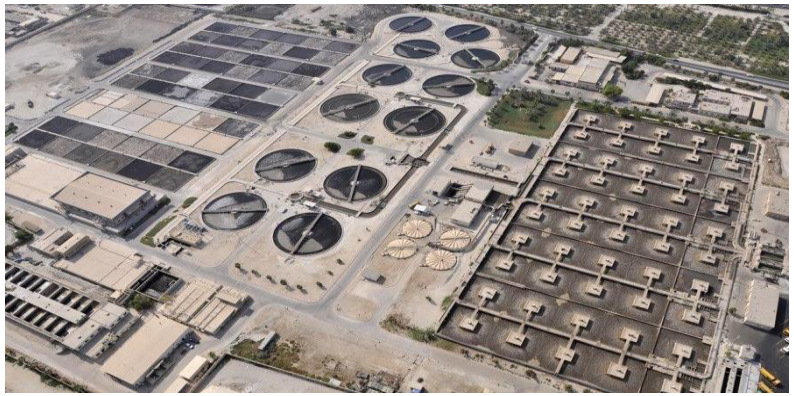
- **Focuses** on the **protection** of water-related ecosystems and human health
- Concerns with **safe reuse** of wastewater, and increasing of **recycling** in manufacturing
- **Strongly** interlinked with SDG 6 Targets 6.4 and 6.6

- **Progress** on this target is **linked** to that of indicator 6.2.1 as part of the sanitary chain
- **Progress** measured by **two** global indicators:
  - Indicator 6.3.1 Wastewater safely treated
  - Indicator 6.3.2 Ambient water quality

Target 6.3 … Cont.

TARGET 6·3
IMPROVE WATER QUALITY, WASTEWATER TREATMENT AND SAFE REUSE

Indicator 6.3.1 Proportion of wastewater safely treated



Aerial view of TWPCC/ Wastewater generated by households. Curtesy Ministry of Works, Municipalities Affairs and urban Planning

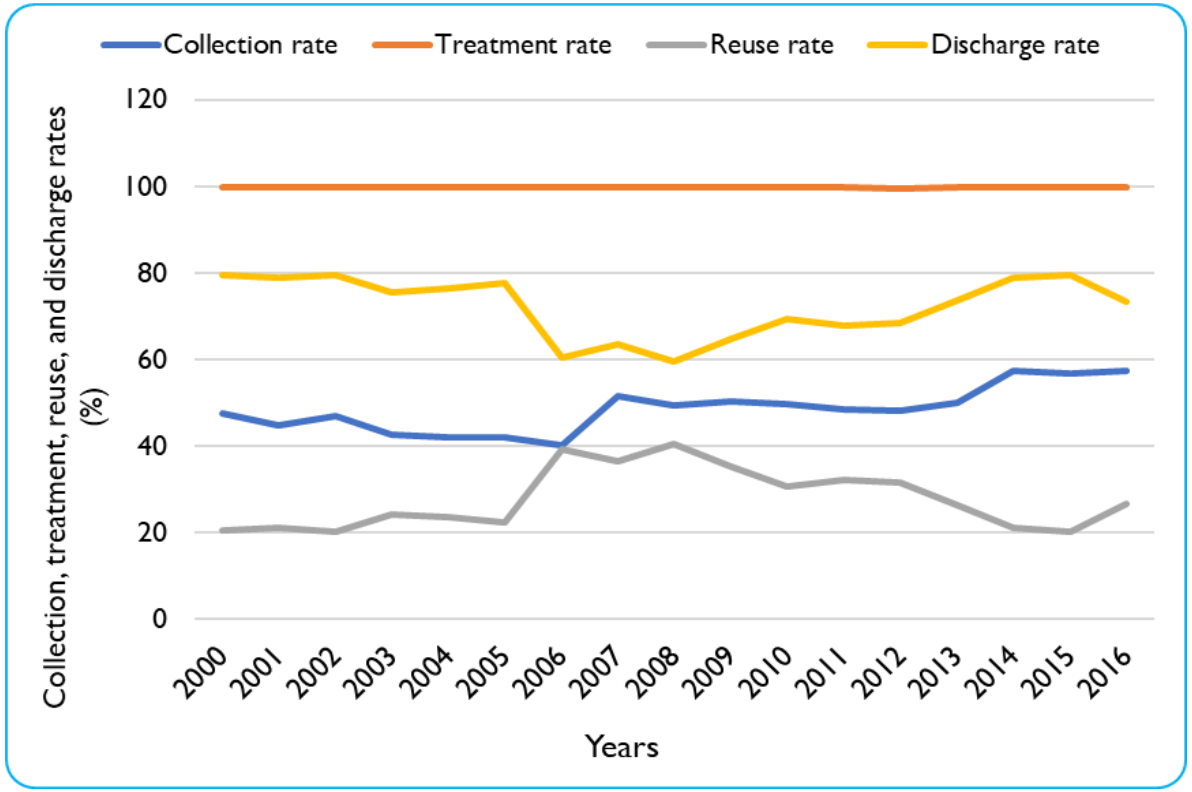
Wastewater Treatment Plant at Gulf Petrochemical Industries Company (GPIC)/ Wastewater generated by economic activities. Curtesy GPIC

- The indicator tracks the percentages of wastewater generated by **households** and **economic activities** that are safely treated. For global monitoring divided to:
  - Indicator 6.3.1a Proportion of wastewater generated by households that is safely treated
  - Indicator 6.3.1b Proportion of wastewater generated by economic activities (ISIC categories) that is safely treated
- Directly **linked** with SDG 6 indicator 6.2.1 as part of the so-called sanitation chain
- **Synergies** with SDG 6 Indicators 6.3.2, 6.4.1, and 6.4.2 in relation to diffuse pollution, and reuse and recycling, respectively

Target 6.3 … Cont.

Indicator 6.3.1a Proportion of wastewater generated by households (sewage and faecal sludge) that is safely treated

Proportions of wastewater collection, treatment, reuse, and discharge rates 2000 - 2016



- **Collection Rate:** Increased from **47.5%** in 2000 to **58%** in 2016. Averaged at **49%**. (recommended global rate **60%**)
- **Treatment Rate: 100%** of wastewater collected is treated to both secondary and tertiary levels
- **Reuse Rate:** Decreased from **40.5%** in 2008 to **26.5%** in 2016. On average, only **28%** of wastewater treated is reused. Very low/ represents lost opportunity from the water management point of view
- **Rate of Discharge**: On average, **72%** of treated wastewater (to both secondary and tertiary levels) is disposed of to the marine environment. Sub-indicator **very high**/ A true reflection of the low reuse rate

Target 6.3 … Cont.

Wastewater collected, treated, reused, and disposed of to the marine environment, together with municipal water use

Years	Municipal water use[1]	Wastewater collected[2]	Wastewater treated[2]	Wastewater treated and reused[3]	Wastewater treated and disposed of to the sea[4]	Percentage of wastewater collected to the municipal water use	Percentage of wastewater treated to wastewater collected	Percentage of wastewater reused to wastewater treated	Percentage of wastewater treated and disposed of to sea to wastewater collected
2000	128.0	60.8	60.8	12.4	48.4	47.5	100	20.4	79.6
2001	136.1	61.1	61.1	12.8	48.3	44.9	100	21.0	79.0
2002	138.1	64.7	64.7	13.1	51.6	46.9	100	20.3	79.7
2003	146.0	62.2	62.2	15.1	47.1	42.6	100	24.3	75.7
2004	152.6	64.1	64.1	15.1	49.0	42.0	100	23.6	76.4
2005	157.4	66.1	66.1	14.8	51.3	42.0	100	22.4	77.6
2006	164.7	66.3	66.3	26.1	40.2	40.3	100	39.4	60.6
2007	169.0	86.8	86.8	31.6	55.2	51.4	100	36.4	63.6
2008	197.4	97.7	97.7	39.6	58.1	49.5	100	40.5	59.5
2009	216.0	108.4	108.4	38.2	70.2	50.2	100	35.2	64.8
2010	231.5	115.2	115.2	35.4	79.8	49.8	100	30.7	69.3
2011	240.8	116.9	116.9	37.6	79.3	48.6	100	32.2	67.8
2012	242.4	116.7	116.6	36.7	79.9	48.1	[5]99.9	31.5	68.5
2013	248.6	124.0	123.9	32.4	91.55	49.9	99.95	26.2	73.8
2014	258.6	148.6	148.4	31.4	117.13	57.5	99.95	21.1	78.9
2015	256.7	145.7	145.7	29.6	116.1	56.8	100	20.3	79.7
2016	257.8	148.2	148.2	39.2	109.0	57.5	100	26.5	73.5
Average values for wastewater indicators (in percentage)						**48.6**	**99.99**	**27.8**	**72.2**

Notes:

1. All in Mm^3/year, unless otherwise stated.
2. Not includes municipal water used for agriculture.
3. Not includes wastewater collected and treated in other plants (industrial).
4. Not includes wastewater reused in other plants, wastewater reused within premises at TWPCC, as well as sea outfall or TSE surplus quantities.
5. Includes secondary and tertiary treated wastewaters.
6. The difference represents wastewater lost within plants operations.

Target 6.3 … Cont.

Analysis results of selected parameters for the secondary and tertiary treated effluent from Tubli Water Pollution control Centre (TWPCC) for selected years

Parameters	Secondary treated effluent			Tertiary treated effluent		
	2004	**2011**	**2016**	**2004**	**2011**	**2016**
Total dissolved solids (TDS)	3641	2200	1352	3423	2407	1060
Total suspended solids (TSS)	11.8	11.7	**90.4**	11.0	4.0	5.1
Turbidity (NTU)	23	1.3	36.1	2.2	0.8	0.5
Volatile suspended solids (VSS)	**109**	7.9	**58.2**	2.0	1.3	1.9
Biological oxygen demand (BOD)	1.0	6.8	**38.4**	0.9	5.0	3.0
Chemical oxygen demand (COD)	---	23	**91.6**	29.0	16.0	19.6
Nitrite (NO_2)	1.9	2.4	2.8	1.46	1.0	2.4
Phosphate (PO_4)	---	3.2	2.3	---	1.25	1.77
Total Coliform (count/100ml)	---	**$0.62x10^6$**	**$3x10^6$**	1.0	13.2	18.0
E. Coli (Count/100ml)	---	**$0.32x10^6$**	**$2.6x10^6$**	---	2.2	3.2
Parasite (worm) (Worm/Litre)	---	**815**	**333***	---	1.2	1.3

Notes:

1. All in milligram/Litre, unless otherwise stated.
2. All are annual average values.
3. A dash indicates no data.
4. *Data of 2015.

- Secondary treated effluent showed elevated levels with respects to **TSS**, **VSS**, ***Total Coliforms***, ***E. Coli***, and ***Parasites***.
- Secondary effluents quality problems attributed to **over loading** of the plant. Quality of secondary treated effluent pose a risk to the marine and coastal environment/ Progress lagging behind
- Generally, the tertiary effluent is of better quality, but elevated levels also noted in some years with respect to ***Total Coliforms, E. Coli, and Parasites***
- As far as the reuse is concerned, TDS level of the TSE remarkably reduced from **3423** mg/L in 2004 to **1060** mg/L in 2016

Target 6.3 … Cont.

Indicator 6.3.1b Proportion of wastewater generated by economic activities (ISIC categories) that is safely treated

Volumes of wastewater collected, treated, reused, and disposed of to the marine environment for selected years for wastewater generated from economic activities (industrial plants)

Description	Years		
	2005	2013	2016
Wastewater collected	0.192	0.71	9.6
Wastewater treated	0.175	0.691	7.42
Of which:			
- Treated to the secondary level	0.011	0.149	6.82
- Treated to the tertiary level	0.164	0.542	0.60
Wastewater treated and reused	0.175	0.68	0.76
Wastewater disposed of to the sea	0.0	0.012	6.7

Notes:

1. All in Mm^3.
2. The difference between the collected and treated wastewater quantities represents wastewater lost within plant operation.
3. Total wastewater treated do not equal the volumes of wastewater reused and wastewater discharged to the sea due to rounding.

- Sufficient data were made available from five industrial plants (**all** the industrial firms having wastewater treatment plants)
- Volume of wastewater generated by economic activities increased from **0.2 Mm^3** in 2005 to **9.6 Mm^3** in 2016
- Volume of wastewater treated increased from **0.18 Mm^3** in 2005 to **7.8 Mm^3** in 2016
- In 2016, **6.8 Mm^3** of treated effluent, or almost **71%** is treated to the secondary level
- In 2016, only **0.8 Mm^3** (about 11% of the total volume treated) is reused for landscaping

Target 6.3 … Cont.

Analysis results of selected chemical, nutrients, and microbiological parameters from wastewater plants of three major industries 2016

Parameters	BAPCO	ALBA	FOULATH	Guideline values
Temperature (C°)	33.6	---	28.7	**3+TRW**
Acidity (pH - Unit)	7.7	7.2	8.1	**6 - 9**
Total Dissolved Solids (TDS)	30,948	---	491	**NGV**
Total Suspended Solids (TSS)	1.1	0.3	4.5	**35**
Turbidity (NTU)	0.6	0.6	4.4	**75**
Residual Chlorine (RC)	0.02	0.002	<0.05	**2**
Biological Oxygen Demand (BOD)	4.8	8.0	8.2	**50**
Chemical Oxygen Demand (COD)	91.1	18.8	26.2	**350**
Ammonia - Nitrogen (NH_3 - N)	0.74	0.16	0.44	**3**
Phosphate (PO_4)	0.58	0.08	0.83	**2**
Total Kjeldahi Nitrogen (TKN)	2.63	2.2	1.4	**10**
Total Organic Carbon (TOC)	---	1.8	5.5	**50**
Oil & Grease	5.8	0.2	<1	**15**
Phenols	0.06	0.01	<0.002	**1**
Lead (Pb)	0.03	0.001	<0.05	**1**
Total Coliform (MPN/100ml)	12	ND	<1.8	**1000**

Notes:

1. All values are in mg/l, unless otherwise stated.
2. A dash indicates no data, ND not detected, and NGV indicates no guideline value suggested.
3. TWR = temperature of receiving water.
4. BAPCO is Bahrain Petroleum Company (Oil industry), ALBA is Bahrain Aluminium Company (Aluminium industry), FOULATH is Bahrain Steel Company (Steel industry).
5. Guideline values are based on Table 4 "Standards for Effluent Discharge from Industry" of the Resolution No. 3 (2001) regarding the amendments to the tables attached to Resolution (10) /1999 regarding the Environmental Standards (Air and Water) amended by Resolution No.2 (2001).

- Treated effluents generated from economic activities are of **good quality**
- In compliance with the international guideline values for both **reuse** and **disposing of**/ Environmental standards set in Resolution **No.3/2001** Regarding the Environmental Standards (Air and Water)
- **More** industries are in the process of constructing their own wastewater treatment plants

Target 6.3 … Cont.

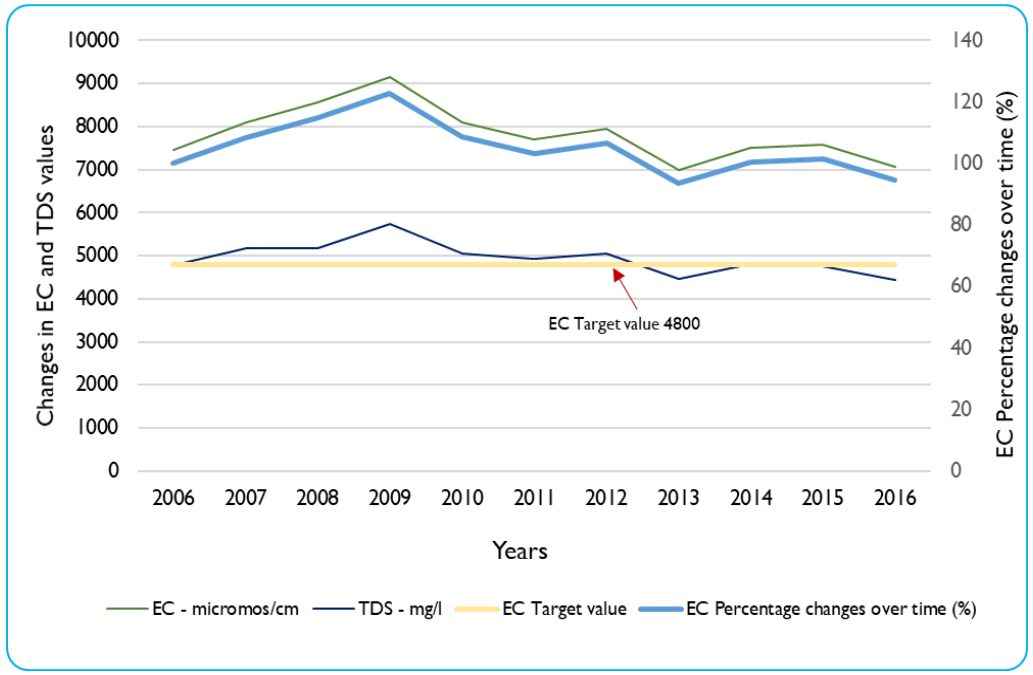
Indicator 6.3.2 Proportion of bodies of water with good ambient water quality

Source: UN environment, 2017.

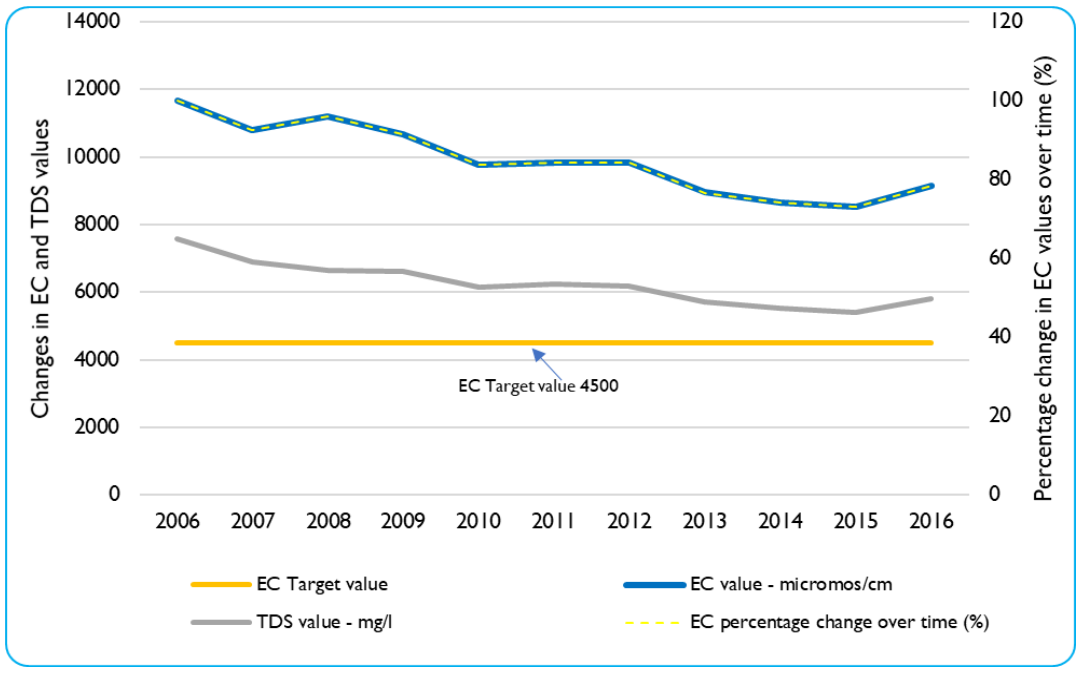
- **Closely related** to indicators 6.3.1 and 6.6.1
- **Evaluates** human and development impacts on ambient water quality and **identifies** water bodies at risk
- **Ambient water quality** refers to natural untreated water in these water bodies
- **Water bodies:** rivers, lake, and groundwater water bodies
- **Core** monitoring water quality **parameters** are selected to examine each of the water bodies/ additional **progressive** parameters when able and needed
- **Threshold target values** to be defined for each core parameters
- **Shallow groundwater** bodies are the only water bodies applicable to Bahrain
- **Three core parameters** selected for groundwater bodies: EC, Nitrate, and pH

Target 6.3 … Cont.

Changes in the EC and TDS values in the Alat Limestone aquifer and percentage changes over time in the EC values 2000 – 2016, together with the EC target value



Changes in the EC and TDS values in the Khobar aquifer and percentage changes over time in the EC values 2000 – 2016, together with the EC target value



- Trends and changes **over time** analysed for the **Alat Limestone** (left) and **Khobar** (right) aquifers
- Historical **target values** set for the core parameters
- Progress in **EC** improvement is **lagging behind**/ unlikely to meet the target values by 2030

Progress on the Monitoring … Cont.

Target 6.4 *By 2030, substantially increase water use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity*

Photo Credit: Neil Palmer CIAT, Creative Commons Attribution

- Aims to **ensure** that there is sufficient water for the people, the economy, and the environment
- **Strongly related** to SDG 6 targets 6.1, 6.2, 6.3, and 6.5
- **Measured** by **two** indicators:
  - Indicator 6.4.1 Change in water use efficiency over time
  - Indicator 6.4.2 Level of water stress
- Being a new indicator, **monitoring methodologies** and other **support tools** were developed to monitor progress towards Indicator 6.4.1.
- From the MDGs, Indicator 6.4.2 **methodologies** were modified to include a factor signifying **environmental flow requirements**

Progress on the Monitoring … Cont.

Indicator 6.4.1 Change in water use efficiency over time

Methods of Computation

Agriculture $A_{we} = \frac{GVAa\ x\ (1 - Cr)}{Va}$

Industry $M_{we} = \frac{GVAm}{Vm}$

Services $S_{we} = \frac{GVAs}{Vs}$

Water use efficiency $WUE = A_{we} \text{ x } P_A + M_{we} \text{ x } P_M + S_{we} \text{ x } P_S$

- **Closely integrated** with Indicators 6.4.2 (water scarcity) and Indicator 6.5.1 (IWRM implementation). Has strong synergies with SDG 2, SDG 8, SDG 9, SDG 11, and SDG 12

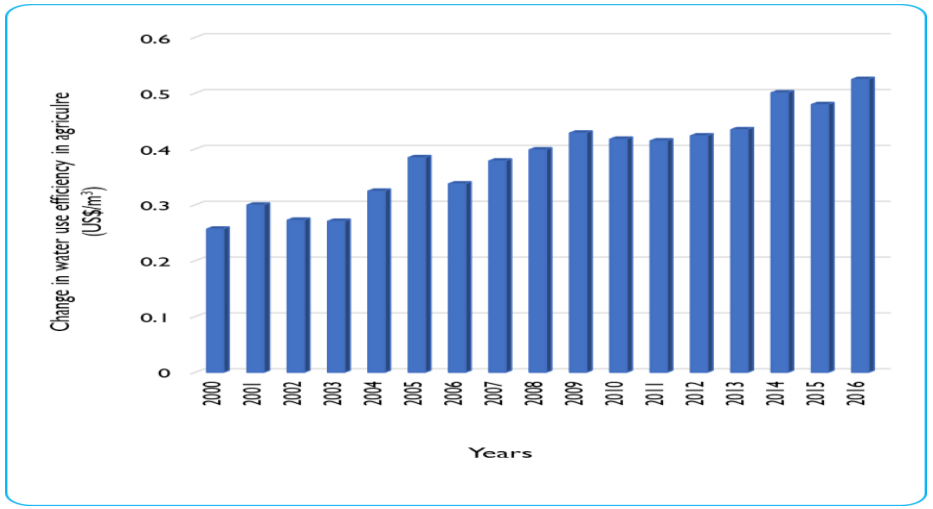
- **Addresses** the **economic component** of Target 6.4/ assessing the impact of economic growth on water use
- **Defined** as change in **gross value added** in a given sector of economy divided by the **volume of water used** by this sector over time, expressed in US$/m^3
- **Not a measure of productivity/** increase of value added produced by the economy in relation to the increase in water use/ concerns with the decoupling relationship of value added and efficiency over time
- **Following ISIC Rev.4**, major sectors are defined as agriculture, industry, and services
- **Water use efficiency:** sum of the three sectors **weighted** by their proportionate use from total water use

Target 6.4 … Cont.

TARGET 6-4
INCREASE WATER-USE EFFICIENCY AND ENSURE FRESHWATER SUPPLIES

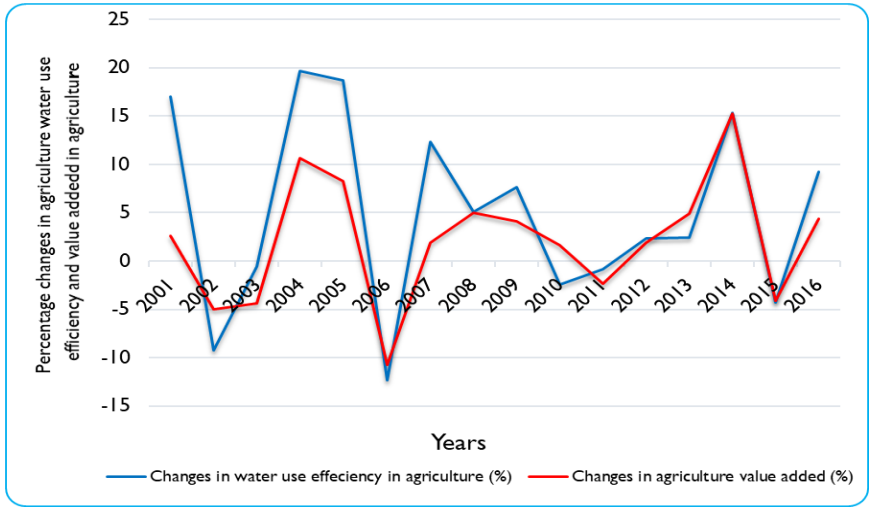
Change in water use efficiency in agriculture

Change in water use efficiency in agriculture 2000 – 2016 (US$/m³)



- Calculated as **irrigated** agricultural value added per unit agriculture water withdrawn, expressed in **US$/m³**
- Agriculture water use efficiency ranges from **0.26 – 0.53 US$/m³**
- Average water use efficiency in agriculture **0.39 US$/m³**
- Water use efficiency in agriculture increased by **104%** from 2000 - 2016

Percentage change in water use efficiency in agriculture and agriculture value added 2000 - 2016 (in percentage)

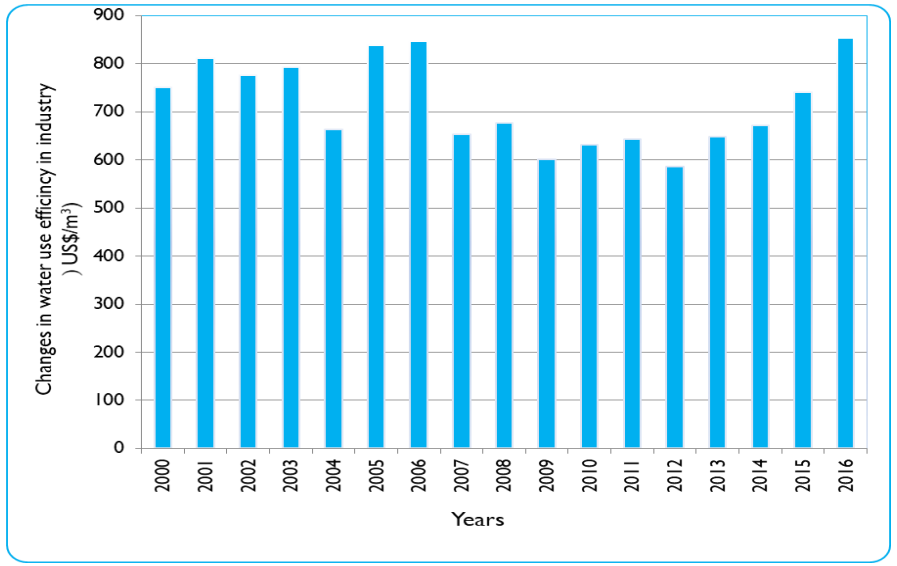


- **Average percentage** change in water use efficiency in agriculture **5%**
- **Average percentage** change in value added in agriculture **2.1%**
- Water use efficiency in agriculture **grows** more than the value added/ both are **growing/ the strongest sector**

TARGET 6·4
INCREASE WATER-USE EFFICIENCY AND ENSURE FRESHWATER SUPPLIES

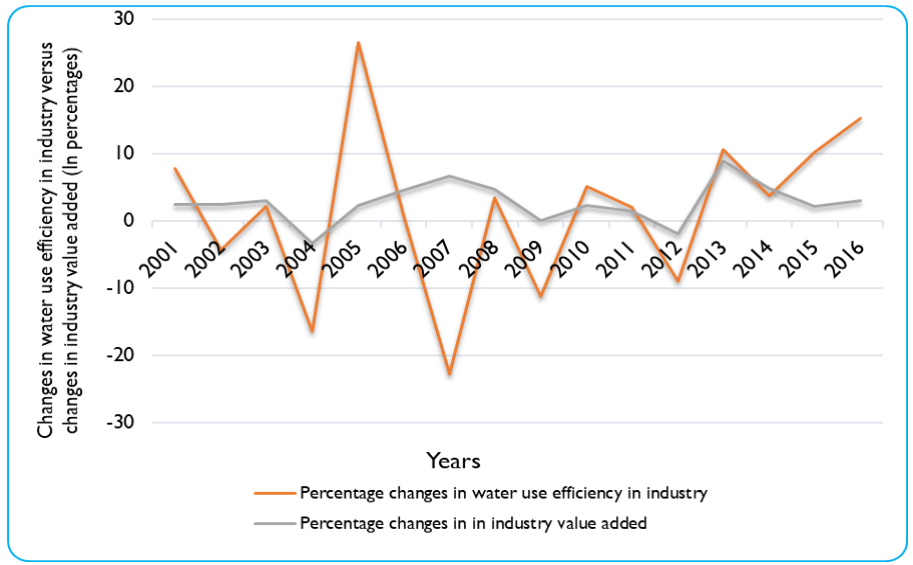
Change in water use efficiency in industry

Change in water use efficiency in industry 2000 - 2016 (US$/m³)



- Calculated as the industrial value added per unit of industrial water withdrawn, expressed in **US$/m³**
- Water use efficiency in industry varies widely from **585.87 – 853.75 US$/m3**
- Average water use efficiency in industry **716.78 US$/m³**

Percentage change in water use efficiency in industry and industry value added 2000 - 2016 (in percentage)

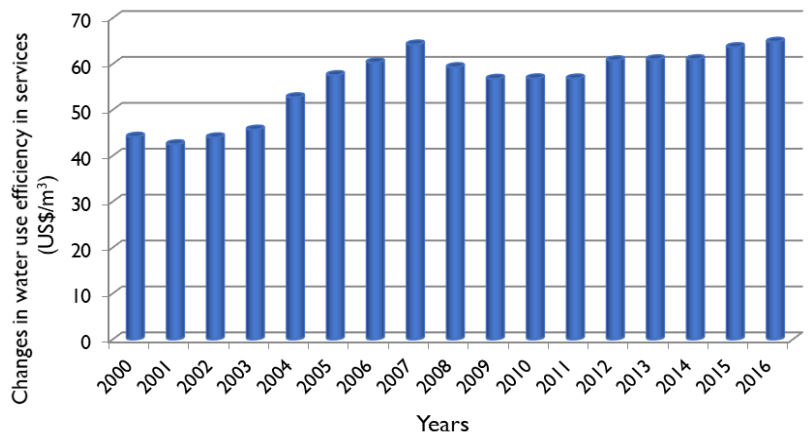


- Average percentage change in water use efficiency in industry **1.5%**
- Average percentage change in value added in industry **2.7%/**. Possibly reflects modest performance
- Value added in industry **outpace** the sector water use efficiency

Target 6.4 … Cont.

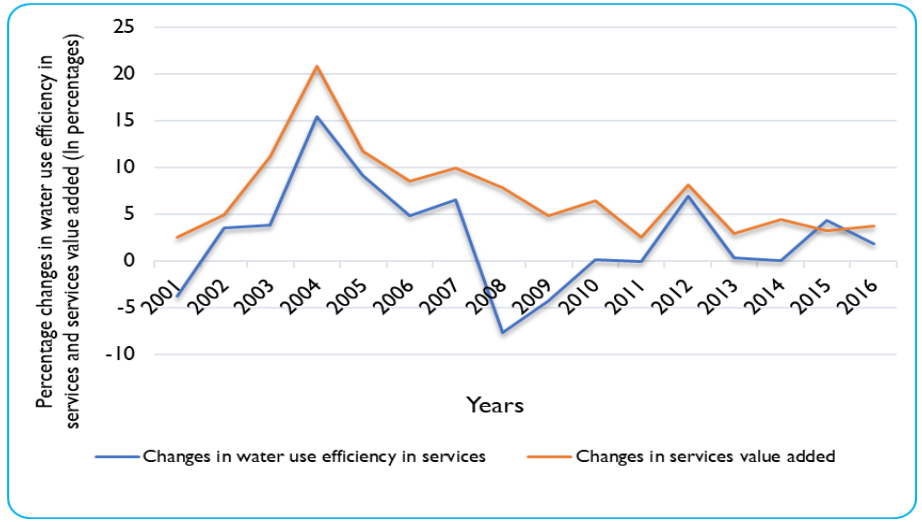
Change in water use efficiency in services

Change in water use efficiency in services 2000 - 2016 (US$/m³)



- Calculated as the services sector value added divided by water withdrawn for services, expressed in **US$/m³**
- Water use efficiency in services ranges from **42.50 – 64.83 US$/m³**
- Average water use efficiency in services **56.02 US$/m³**

Percentage change in water use efficiency in services and services value added 2000 - 2016 (in percentage)

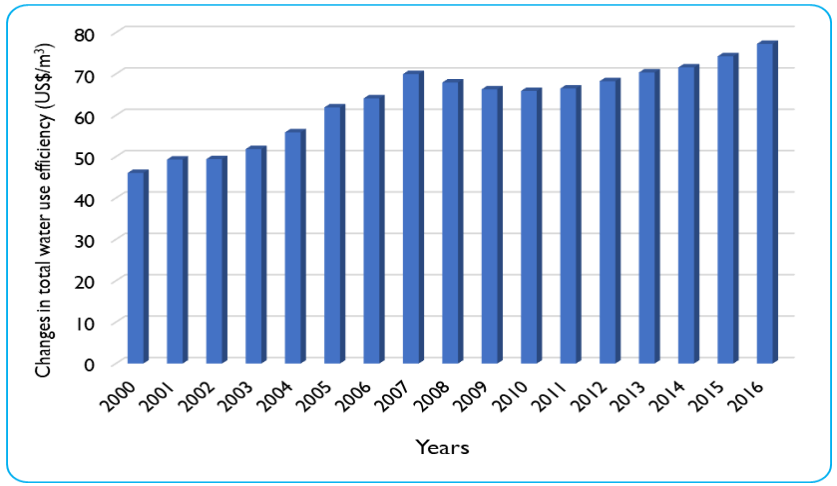


- Average percentage change in water use efficiency in services **2.6%**
- Average percentage change in value added in services **7.1%**
- The **weakest sector**/ high growth of value added and low growth in water use efficiency

TARGET 6·4
INCREASE WATER-USE EFFICIENCY AND ENSURE FRESHWATER SUPPLIES

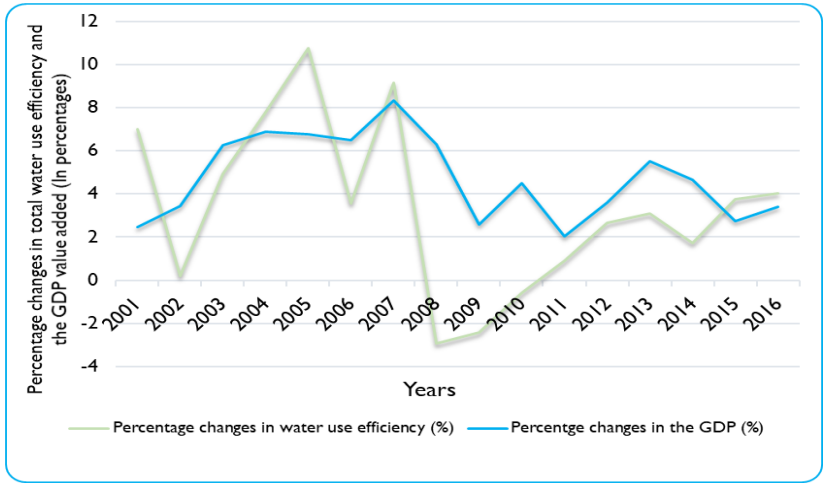
Change in water use efficiency

Change in water use efficiency 2000 - 2016 (US$/m³)



- Computed as the sum of the three major sectors, weighted according to the proportion of water withdrawn by each sector over the total withdrawal, expressed in **US$/m³**
- Water use efficiency ranges from **46.07 – 77.26 US$/m³**
- **Average** water use efficiency **63.34 US$/m³**

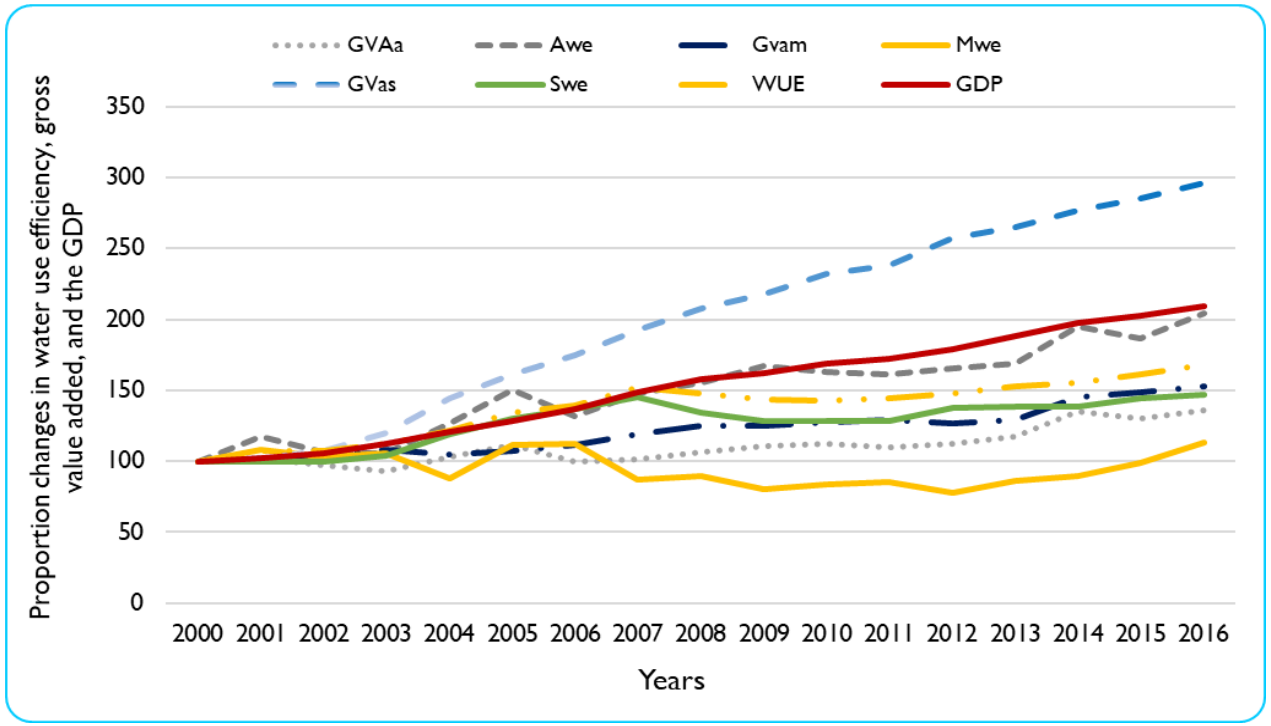
Percentage change in water use efficiency and percentage change in the Gross Domestic Product (GDP) 2000 - 2016



- Globally, average water use efficiency **15 US$/m³**. Global efficiency values range from **2** to **1000** US$/m³
- Average percentage change in water use efficiency **3.4%**
- Average percentage change in the GDP **4.8%**
- **More water** is **proportionally** needed by the growing economy

Target 6.4 … Cont.

The decoupling relationship between percentage changes over time in water use efficiencies, gross values added in the major economic sectors and the percentage changes between total water use efficiency and the GDP 2000 - 2016 (%)



Notes:
GVAa = Gross valued added in agriculture, Awe = Water use efficiency in agriculture sector, Gvam = Gross value added in industry industry, Mwe = Water use efficiency in industry, Gvas = Grossvalue added in services, Swe = Water use effeciency in services, WUE =Total water use efficiency, GDP = Gross Domestic Product. Value added are at the constant prices

- The **decoupling** relationships over time coincide with the detailed trend analysis for each economic sector and the economy as a whole
- Possibly indicates **limited** effects of the external factors
- Agriculture sector is the **strongest** sector. Services is the **weakest** sector, and industry recorded more or less **modest** performance
- The **GDP** is growing more than the **water use efficiency**/ water is obstacle to the economy

Target 6.4 … Cont.

Indicator 6.4.2 Level of water stress: Freshwater withdrawal as percentage of available renewable freshwater

Method of computation

$$\textit{Water Stress (\%)} = \frac{TFWW}{TRWR - EFR} * 100$$

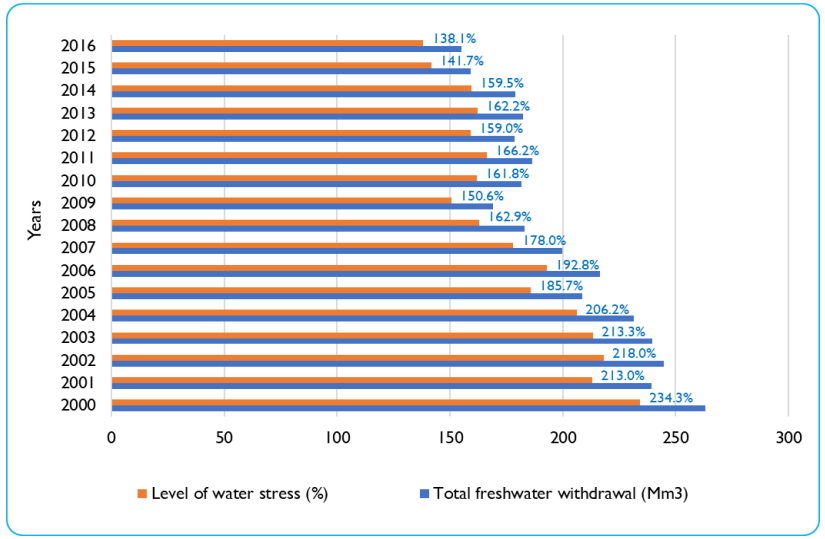
Source: UN – Water/FAO

- **Builds** on MDG Target 7.A Indicator 7.5 on water stress/ but takes into consideration the **Environmental Flow Requirement** (EFR)
- **Measures** the degree of **pressure** placed on the available renewable freshwater resources
- Computed as the **ratio** between total freshwater withdrawn by all major sectors (**TFWW**) and total renewable freshwater resources (**TRWR**) minus (**EFR**), expressed in Km^3/year or Mm^3/year
- **Three threshold** levels of stress considered: Low stress **0 – 25%**, High stress **25 – 70%**, and Very High stress **> 70%**
- **Country-specific threshold values** may be considered for some water scarce countries
- For this analysis: **two** indicators were computed: **global** indicator and **national** indicator

Target 6.4 … Cont.

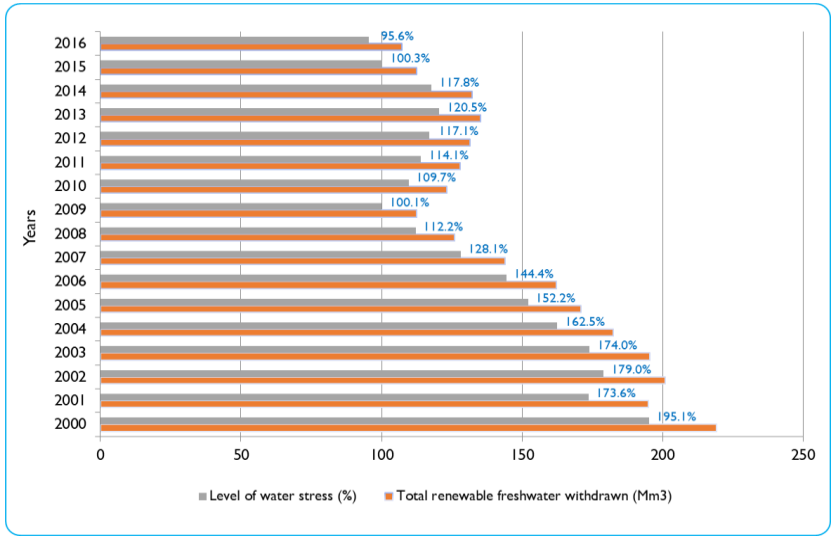
TARGET 6-4
INCREASE WATER-USE EFFICIENCY AND ENSURE FRESHWATER SUPPLIES

Global Indicator 6.4.2 Level of water stress 2000 - 2016



- Demand for freshwater is largely met by **non-traditional** water resources
- Sufficient **time series** data were available on total freshwater withdrawals/ Time serious data on the renewable freshwater resources not available
- TRWR assumed to be **constant** over the analysis period as of 1990/ EFR not considered in the calculations

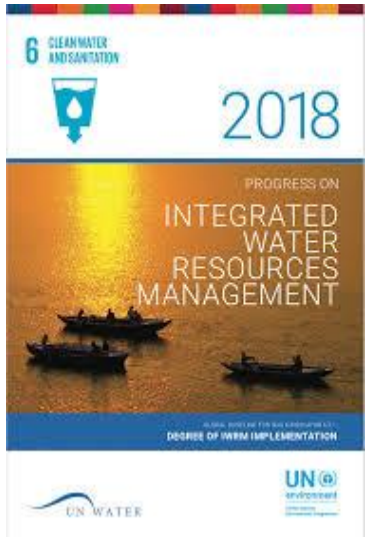
National Indicator 6.4.2 Level of water stress 2000 – 2016



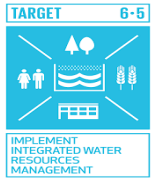
- Between 2000 – 2016, levels of water stress remarkably reduced/ thanks to the availability of non-traditional water resources/ from **234%** to **138%**, and from **195%** to **96%**, respectively, for the global and national indicators
- Averages water stress are **179%** and **135%**, respectively. Bahrain is a **seriously water stressed** country
- Progress **insufficient** to reduce water stress to **appreciable** levels during the SDG reporting period

Progress on the Monitoring … Cont.

Target 6.5 *By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate*



- Target 6.5 highlights the great importance of **sound** water resources management, including **transboundary cooperation** in solving water resources problems
- Sound water resources management is the core of sustainable development/ target 6.5 has **strong interlinkages** with all the SDGs, including SDG 6 targets
- Tracking progress towards this target is through **two** global indicators**:**
  - Indicator 6.5.1 Degree of integrated water resources management (IWRM) implementation
  - Indicator 6.5.2 Transboundary water basins with an operational agreement for water cooperation
- The two indicators **combined** to address IWRM **at all levels**

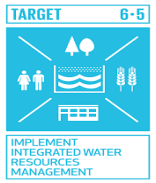


Indicator 6.5.1 Degree of water resources management implementation (0 – 100)

Indicator 6.5.1 Degree of water integrated water resources implementation (0 – 100)

Section	Definition	Average Score
Enabling Environment	Creating the conditions that help to support the implementation of IWRM, which includes the most typical policy, legal and strategic planning tools for IWRM.	**28.0**
Institution and Participation	The range and roles of political, social, economic and administrative institutions and other stakeholder groups that help to support the implementation of IWRM.	**48.3**
Management Instrument	The tools and activities that enable decision-makers and users to make rational and informed choices between alternative actions.	**42.5**
Financing	Budgeting and financing made available and used for water resources development and management from various sources	**40.0**
Indicator 6.5.1 Degree of integrated water resources management implementation (0 - 100)		**39.7**

- The indicator measures the degree of IWRM implementation at different stages, expressed in percentages
- **Reflects** the **extent** to which IWRM is implemented as scores between 0 to 100. Zero "0" not implemented and "100" fully implemented
- Bahrain **contributed** to the 2017/2018 UNSD/UNEP IWRM Survey
- Reported **medium - low** (40) level of IWRM implementation/ section scores ranging from **28%** to **48%**
- Progress achieved is **insufficient** to reach the global target of very high implementation



Target 6.5 … Cont.

Indicator 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation

Summary results of questions in the UNSD/UNEP Questionnaire related to Indicator 6.5.2

Section	Question	Question Statement	Score
Enabling Environment	1.2.c	Arrangements for transboundary water management in most important aquifers.	(0) very low[1]
Institution and Participation	2.2.d	Gender-specific objectives and plans at transboundary level.	Not Applicable[2]
Institution and Participation	2.2.e	Availability of an organisational framework for transboundary water management for most important aquifers.	Not Applicable[2]
Management Instruments	3.2.d	Transboundary data and information sharing between countries.	(30) Low – medium low[3]
Financing	4.2.c	Financing for transboundary cooperation	Not applicable[4]

[1] Development in this aspect was not started and not progressing. [2] Organisational frameworks for transboundary water management not exist. [3] Limited data and information sharing exist through some regional mechanisms, mutual groundwater studies, and on an ad-hoc or informal basis. [4] Frameworks for transboundary water management do not exist.

- This indicator measures and monitors transboundary water cooperation covered by an **operational arrangement**, expressed in percentage **share** of the transboundary surface area
- **Integrates** with Indicator 6.5.1 to provide full coverage of elements of IWRM implementation
- The **Dammam Aquifer System** in Bahrain is a transboundary aquifer/ **No** operational arrangement for the aquifer development and management exists
- Some transboundary issues are **captured** in the 2017/2018 UNSD/UNEP IWRM Survey

Progress on the Monitoring … Cont.

Target 6.6 *By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes*

Photo Credit: Mubarak Al-Noaimi: A degraded and destructed water-related ecosystem in Bahrain (Natural spring)

- Target 6.6 seeks to halt the **degradation** and destruction of **water-related ecosystems** which play a special role in storing freshwater and maintaining water quality
- **Addresses** ecosystems related to vegetated wetlands, rivers, lakes, reservoirs, and groundwater as well as forests and mountains
- Global progress towards this target is monitored through the global **Indicator 6.6.1**

Target 6.6 … Cont.

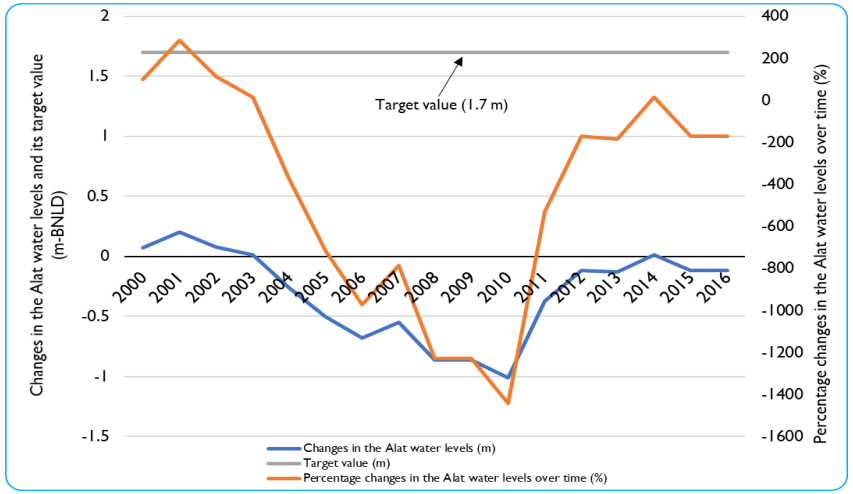
Indicator 6.6.1 Change in the extent of water-related ecosystems over time

Source: UN – Water.

- This indicator is a measure of change in the **extent** of water-related ecosystems over time, expressed in % change/year
- Divided into **four sub-indicators** to capture the complex nature of water-related ecosystems
- Sub-indicator **6.6.1a** (extent of ecosystems), sub-indicator **6.6.1b** (quantity of water contained), sub-indicator **6.6.1c** (the quality of water in ecosystems), and sub-indicator **6.6.1d** (the state/health of ecosystems)
- Closely **integrated** with Indicator 6.3.2 to address the aspects of water-related ecosystems in both **qualitative** and **quantitative** terms
- Directly interlinked with **SDG 13** (climate change) and **SDG 15** (terrestrial ecosystems)
- Changes are assessed based on **reference conditions**

Target 6.6 … Cont.

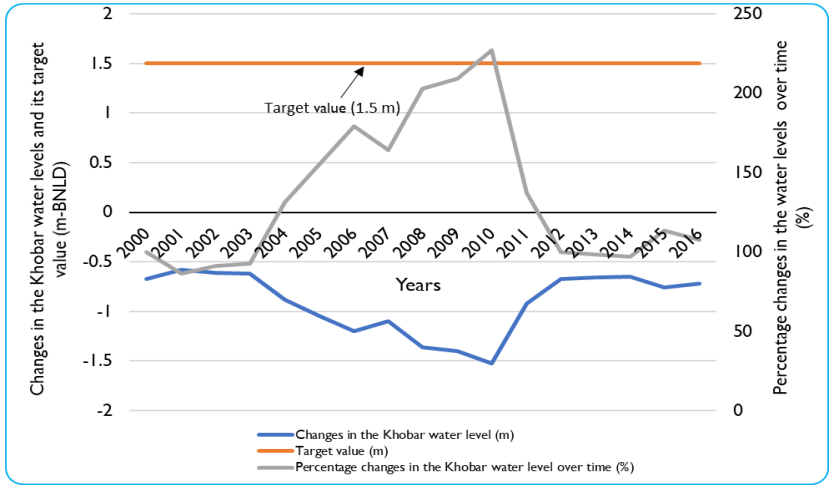
Changes and percentage changes over time in the Alat aquifer water level 2000 – 2016, together with the aquifer target value



Note: The measuring point is the Bahrain National Level Datum (BNLD).

- Groundwater ecosystem is the only ecosystem applicable to Bahrain/ two shallow aquifers
- For global monitoring of Indicator 6.6.1, changes in groundwater volume may be **inferred** from changes in **groundwater levels**
- Progress monitored in terms of trends and **percentage changes** analysis over time for both aquifers

Changes and percentage changes over time in the Khobar aquifer water level 2000 – 2016, together with the aquifer target value



Note: The measuring point is the Bahrain National Level Datum (BNLD).

- Historical target values set at **1.7m** and **1.5m** for the Alat and Khobar aquifers, respectively
- Progress achieved **insufficient** to meet the target values by 2030
- Issues related to indicator 6.6.1 in the UNSD/UNEP Questionnaire/ Recorded score: (50) Medium low – Medium high on 3.1.c protection of pollution at national level, and (40) Medium low on 3.1.d. Management of water-related ecosystems at national level

Progress on the Monitoring … Cont.

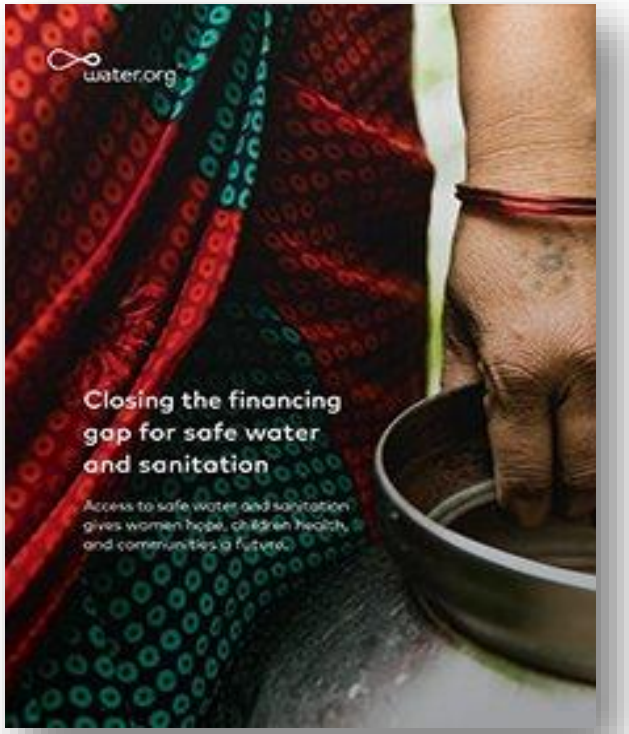
Target 6.a *By 2030, expand international cooperation and capacity-building support to developing countries in water-and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies*

Source: Infrastructure News, 2017

- Means of implementation target **directly linked** with SDG 17
- Aims to expand international cooperation and capacity building **support** to developing countries to **accelerate** progress in achieving SDG 6 targets
- Global progress towards this target is monitored by the global **Indicator 6.a.1**

Target 6.a … Cont.

Indicator 6.a.1 Amount of water-and sanitation-related official development assistance that is part of a government-coordinated spending plan



- Focuses on the external financial and capacity building support for **developing countries** in water and sanitation
- A low indicator value indicate aids not properly aligned with government spending and vice versa
- **ODA** aids used as proxy
- Applicability of indicator to Bahrain situation is questionable
- **Gulf Development Programme/** Major part directed to water and sanitation/ part of the government spending
- Official data not available/ progress not monitored

Progress on the Monitoring … Cont.

Target 6.b *Support and strengthen the participation of local communities in improving water and sanitation management*

Photo Credit: Roger Vernon, IPTC Photo.

- Means of implementation target **directly linked** with SDG 17
- Seeks to provide mechanisms to enable affected individuals and communities to **contribute meaningfully** in the planning and management decisions related to water and sanitation
- Indicator 6.b.1 proposed to **evaluate** progress towards target 6.b at global level

Target 6.b … Cont.

Indicator 6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management

Summary results of questions in the UNSD/UNEP Questionnaire related to Indicator 6.b.1

Section	Sub-question	Question	Score
2 - Institution and participation	2.1.c Public participation in water resources Policy, planning and management at national level	2.1	(40) Medium - low
2 - Institution and participation	2.1.d Business participation on water resources development, management and use at national level	2.1	(0) Very low
2 - Institution and participation	2.2.b Participation of local communities on policy formulation on water resources planning and management at local level	2.2	Not applicable

- Addresses the need for the effective participation of **stakeholders** on matters associated with water and sanitation
- A low **proportionate value** of this indicator would indicate **marginal** participation, and vice versa
- **Strongly interlinked** with Indicators 6.1.1 and 6.2.1. More importantly with Indicator 6.5.1 on IWRM implementation
- In Bahrain, **stakeholders participation** in planning and management of issues related to water and sanitation is **marginal**
- UNSD/UNEP Questionnaire includes questions related to stakeholders participation

5. Conclusions and Final Remarks

- The current monitoring endeavour provided sufficient country data on baseline status of SDG 6
- It offered sound methodological mechanism and tools for monitoring and reporting on SDG 6 targets
- It also offered policy perspectives and ways to accelerate achieving SDG 6
- Our efforts identified important policy linkages between SDG 6 and other SDGs necessary for planning purposes
- The monitoring efforts indicate that progress towards achieving SDG 6 targets varies significantly
- Bahrain has fully achieved targets 6.1 and 6.2 well ahead of the SDGs deadline
- Although the sub-component of halving the proportion of untreated wastewater was completely achieved, progress on other sub-components related to Indicator 6.3.1 are lagging behind
- Progress towards the targets associated with protection and restoring of water-related ecosystems are also falling short at varies degrees of implementation
- The decoupling relationships between water use efficiencies in the major economic sectors and their value added, generally indicate that the economy is growing more than the water use efficiency, implying that more water is needed for the economy to grow
- In spite of the rather ambitious water supply augmentation policy, Bahrain is still experiencing very high water stress

Conclusions and Final Remarks … Cont.

- The reported scores on the degree of IWRM implementation suggest that water policy processes and management perspectives are still fragmental, though significant progress is recently attained on the institutional and enabling environment elements. Other IWRM elements, including transboundary issues; stakeholder participation; capacity building; financing, …etc are considerably lacking

Some final remarks may be briefed as follows:

- It remains a challenge to enhance the national capacity on data collection, classification, processing and dissemination, including development of sound water information systems and establishing of intersectoral national monitoring teams to determine data needs and coordinate data collection and management
- One important problem is the over loading at the TWPCC which led to disposing of secondary treated effluents of inferior quality as well as significant reduction in the reuse rate. It becomes necessary to upgrade the existing plant capacity and to establish an efficient wastewater reuse programme to coordinate and promote safe wastewater reuse and sludge management
- Much more remains to be done in strengthening of the technical and institutional capacities and enhancement of the legal and policy instruments to optimise IWRM implementation
- It is also a challenge to enhance water use efficiencies in the major economic activities and promote safe wastewater reuse and recycling in order to reduce the level of water stress

ACKNOWLEDGEMENTS

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