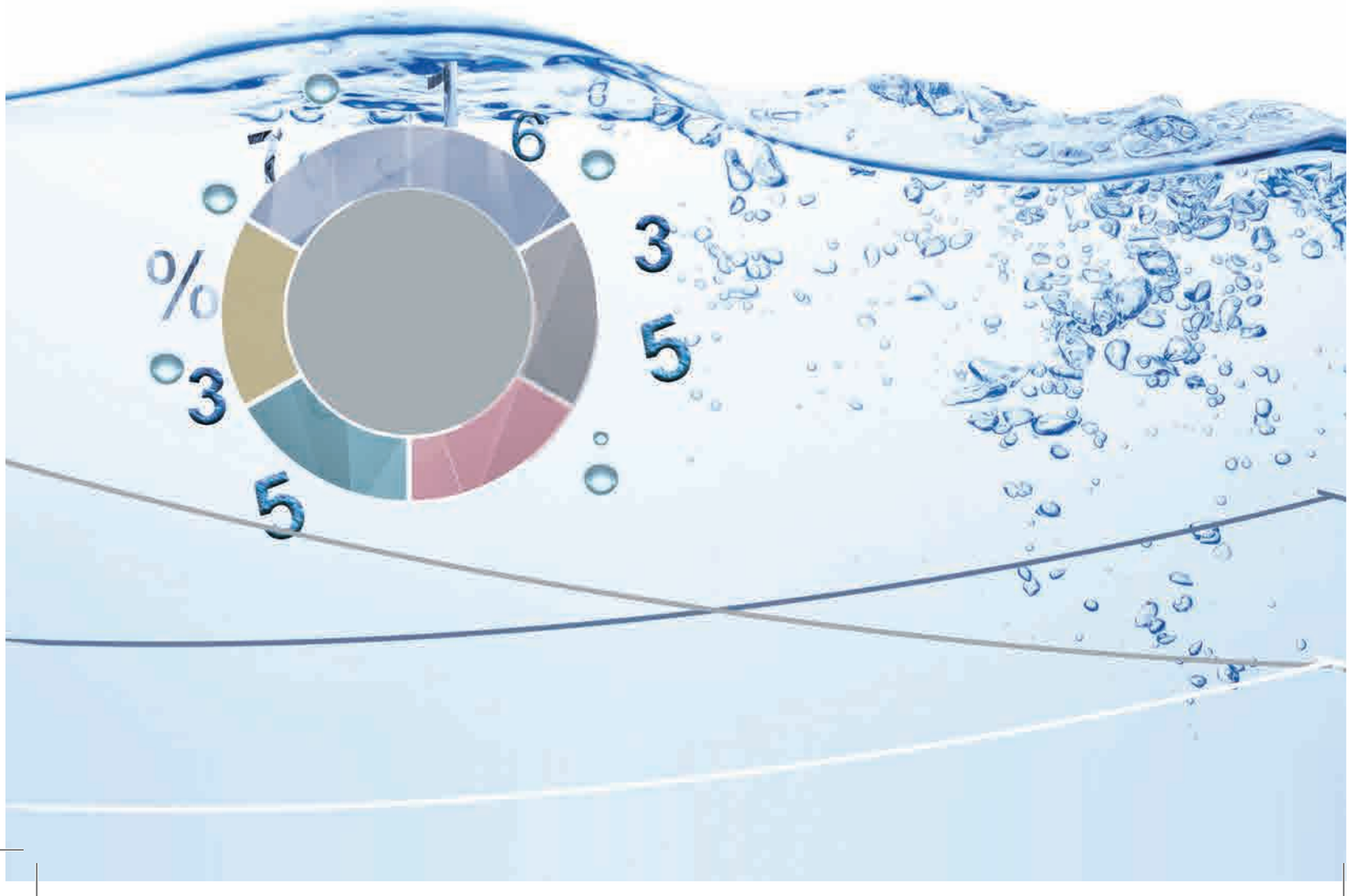
المركز الإحصائي
لدول مجلس التعاون لدول الخليج العربية
GCC-STAT

Water Statistics Report
in GCC Countries
Data of 2016

Issue No. 3 |April, 2018|

This report has been prepared in accordance to the
GCC-STAT publishing guidance standards

In case of quotation please refer to this edition as follows:
GCC-STAT (2018), (Water Statistics report in GCC Countries),
Muscat – Sultanate of Oman



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Symbol use:

Not available	...
m^3	Cubic meter
mm	millimeter
$1000m^3/d$	1000 Cubic meter per day
Million m^3/yr	million cubic meter per year
billion m^3	billion cubic meter
Ltr / day	liter per day
MSF	Multi-Stage Flash
RO	Reverse Osmosis
MED	Multiple-Effect Distillation
WSI	Water Supply Industry
DWS	Desalination Water Stations
WWTP	Wastewater Treatment Plants
GCC	Gulf Cooperation Council
UAE	United Arab Emirates
BH	Kingdom of Bahrain
KSA	Kingdom of Saudi Arabia
Om	Sultanate of Oman
QAT	State of Qatar
KW	State of Kuwait

Note to Users:

Concepts and Definitions Source: International Recommendation for Water Statistics, UNSD/UNEP Questionnaire 2013 on Environment Statistics-Water Section-p.3 and Framework Development Environmental Statistics (FDES).

Primary data on Sultanate of Oman does not include water statistics of Dhofar region and dams' statistics exclude Muscat Municipality.

Data in the report are preliminary data, and are subject to modification.

INTRODUCTION

It is with great pleasure that GCC-STAT presents the analysis report for third issue of water statistics bulletin in GCC countries. This report is a presentation of the most up-to-data. Water statistics that would be invaluable in informing decision making and assisting in shaping the future water policies in the region.

The significance of water statistics is an outcome of the significance of water itself as a vital strategic resource that plays an essential role in the sustainable development in countries in addition to its role in maintaining and ensuring the environmental safety in them. Considering the fact that the GCC countries are located in a region generally characterized by its aridity, and taking into account the factors of population growth and continuous urbanization, the increasing demand on water sources becomes a pressing need that cannot be overlooked nor undermined. It becomes an issue that should be prioritized and addressed with high urgency. Thus, water statistics as presented in this report are necessary tools to shape policies and inform decisions in order to face future challenges.

This report presents detailed statistics in a number of tables and graphs at different levels: holistically at the level of the council and individually at the level of countries. The report also makes comparisons where appropriate and highlights trends worthy of noting.

In addition to the print version, this report and all the other publications are available on the GCC-STAT website in an endeavor to facilitate the accessibility of information of all concerned parties. Our website is www.gccstat.org

We at GCC-STAT would like to express our sincere thanks and gratitude to the national statistical centers in the member states for their efforts in the compilation and provision data in a timely, professional manner.

This report would have never been materialized without their cooperation. We would also like to extend our thanks and appreciation to the team at GCC-STAT who have not spared any efforts in preparing and issuing this report with commendable commitment to quality and specified time frame.

Statistical Centre of the Cooperation Council for

the Arab Countries of the Gulf

Concepts and Definitions

Precipitation:
Total volume of atmospheric wet precipitation (rain, snow, hail, dew, etc.) falling on the territory of the country over one year, in millions of cubic meters.

Surface Water Abstracted:
The volume of water removed by economic units from artificial reservoirs, lakes, rivers, wetlands and snow, ice and glaciers within the territory of reference, per year. Bank filtration is considered an abstraction of surface water.

Groundwater Abstracted:
The volume of water removed by economic units from aquifers and springs within the territory of reference, per year.

Non-renewable water abstracted:
Groundwater bodies (deep aquifers) that have a negligible rate of recharge on the human time-scale and thus can be considered non-renewable.

Non-Conventional water resources:
Total volume of water obtained through the development of new technologies. They are water generations (productions) that come either from desalination of sea and brackish water or from wastewater regeneration for reuse.

Desalinated Water:
The volume of water produced by an economic unit through the process of desalination, within the territory of reference, per year. This includes desalinated seawater and desalinated brackish waters from estuaries, rivers and aquifers.

Reused Water:
Used water directly received from another user with or without treatment for further use. It also includes treated wastewater received for further use from treatment plants. Excludes water discharged into a watercourse and used again downstream. Excludes recycling of water within industrial sites.

Total Freshwater Available for use:
Water use is the total volume of water, either self-abstracted or received from a water supplier, which is used by final users, such as households or economic activities for their production or consumption processes. The volume of water used

is broken down by main groups of economic activity of the final users (according to ISIC Rev. 4) and households (Surface water and Groundwater abstracted+ Desalinated water+ Reused water +Import- Export).

Gross / Production of Freshwater Provided by Water Supply Industry:
Water supplied by water supply industry to the user. Includes losses during transport. The water supplied by water supply industry for the operation of irrigation canals is excluded.

Losses during Transport:
The volume of water lost during transport between a point of abstraction and a point of use, and between points of use and reuse. Includes leakages and evaporation.

Net Freshwater provided by Water Supply Industry:
Gross freshwater supplied by water supply industry minus freshwater losses during transport. The net volume of freshwater supplied by the water supply industry to final users is broken down by households and by main groups of the economic activity of the final users.

Water consumption by Households:
The volume of water used by households supplied by the water supply industry. Water used in the normal functioning of households (e.g., drinking or washing). It includes watering of household gardens but should not include water used for commercial agriculture.

Water consumption by Agriculture, forestry and fishing:
The volume of water used for economic activities belonging to agriculture, forestry and fishing, from water sources provided by water supply industry.

Water consumption by Manufacturing/Industry:
The volume of water used for economic activities belonging to manufacturing or industry, from water sources provided by water supply industry.

Water consumption by Other Economic Activities:
The volume of water used for all other economic activities not specified in the above sectors, from water sources provided by water supply industry.

Volume of Wastewater Collected:
Total volume of wastewater collected from economic activities by wastewater collected system or Truck.

Volume of Wastewater Treatment:
It includes wastewater treatment process to generate, collect, treat and dispose wastewater even it was treated or not. It also includes Sewage sludge production and disposal.

Population supplied/provided by Water Supplied Industry (WSI):
Percentage of the total resident population using water supplied by WSI.

Population connected to wastewater collecting system:
The percentage of people belonging to households or institutions with wastewater removed by sewer connection, truck or some other means, from the resident population.

Population connected to wastewater treatment:
The percentage of people belonging to households or institutions with wastewater collected by economic units engaged in sewerage as a primary activity (i.e., by the sewerage industry, ISIC 37), from the resident population.

Design capacity - Desalinated Plants:
Design Capacity of Desalinated plants to the removal of salt and mineral from water.

Reverse Osmosis (RO):
A water desalination process in which pressure greater than the natural osmotic pressure is applied on the higher concentration side of the membrane, forcing the water to travel through the membrane from the higher TDS to lower TDS chamber, thus ‘reversing’ the natural tendency of water flow .

Multi-Stage Flash distillation (MSF):
A water desalination process that distills seawater by flashing a portion of water into steam in multiple stages of what are essentially countercurrent heat exchanger.

Multi-effect distillation (MED):
It is an evaporation process going through a series of chambers (also known as "effects'), with each successive chamber operating at a progressively lower pressure

Design capacity - Wastewater Treatment Plants (WWTP):
The maximum volume of wastewater that can be effectively and safely treated (i.e., purified to some extent) by wastewater treatment infrastructure, within the territory of reference, per year.

Design Capacity – Dams:
The largest volume of water that can be stored in man-made surface water islands used for storage, management and control of water within the boundaries of the reference region at the end of the year.

Methodology

Methodology of Data collected

For the purposes of this report, the main tool used for data collection was the water transmission tables that were sent to the national statistical centers in the member states to be filled with the required information. In addition to the water transmission tables, the official websites of national statistical centers of the member states were referred to for further details and extra information.

Timeframe/ Span

Statistics aggregates of all variables and indicators of the GCC countries as a whole cover the years from 2007 to 2016 with exception of precipitation as data available covered the period from 2004 to 2016. However, country statistics presented in this report cover periods that vary with individual countries depending on the availability of data for different countries.

Verification mechanism and Quality assurance

Verification of statistics was conducted using different tools. For one thing, equations were used to verify the accuracy of data and numbers. In addition, metadata integrated in the water transmission tables allowed for more detailed clarifications on methodology of calculation and source and methods of compilation of data. Metadata was particularly useful in revealing the description of variables and types of collecting data (e.g. Survey or administrative). Terminologies and definitions used by individual countries were also considered in the process of data verification.

General Observation

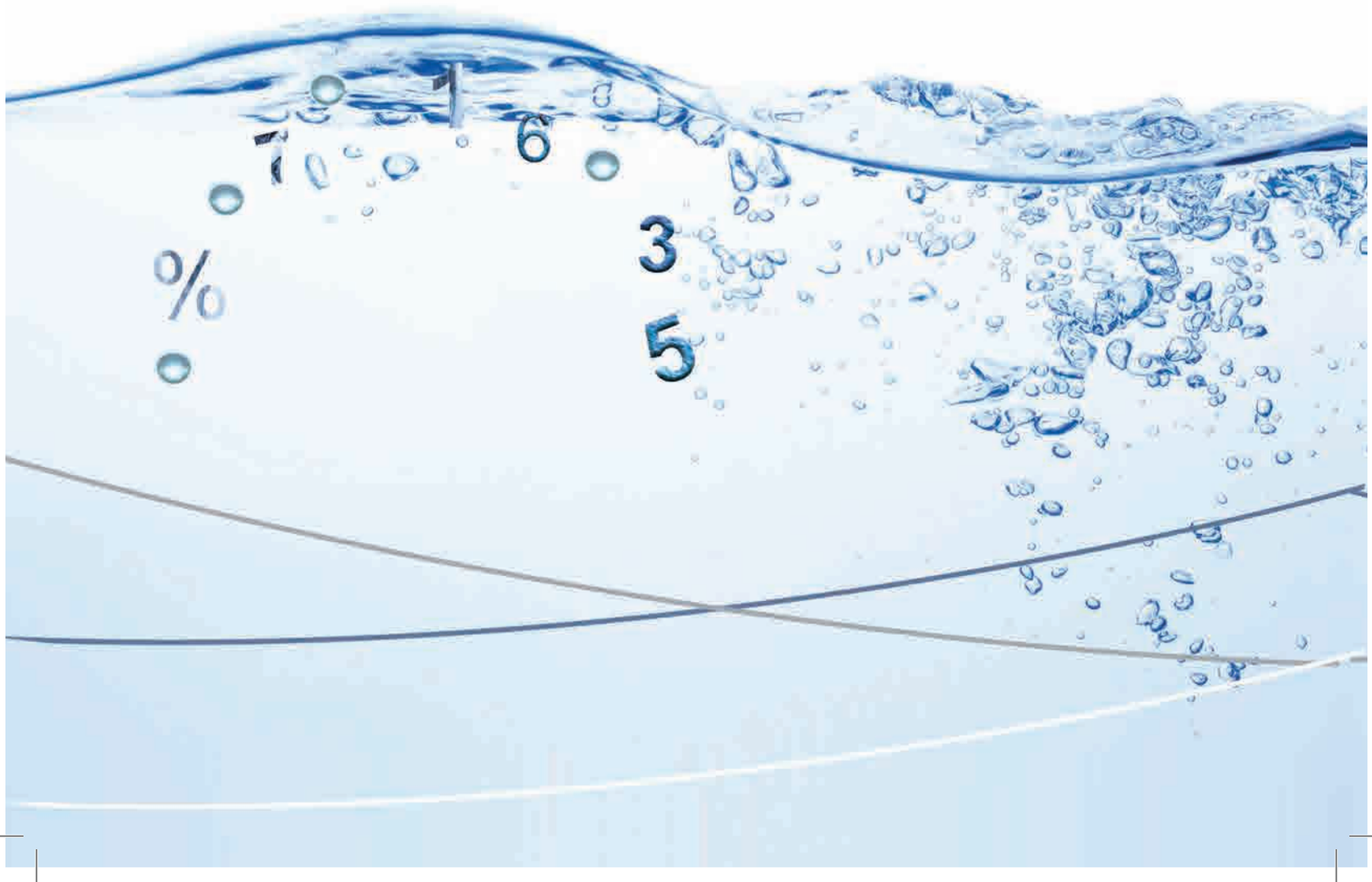
Certain measures were taken by the GCC-STAT team in preparation of this report in order to resolve issues related to the unavailability of required data.

For example, the data on precipitation of the state of Qatar of 2014 were used for 2015 and 2016 due to the unavailability of data on the latter years. Similarly, data on precipitation in UAE for 2016 were not available. Consequently, the data for 2015 were used.

In Sultanate of Oman, amounts of surface water abstracted were calculated through modelling where the average was considered for years from 1985 to 2012. Therefore, this same average quantity was used in this report for the period from 2012 to 2016.

As for groundwater abstracted, no statistics were available in Qatar for the years beyond 2014, so statistics for 2014 were used for the two subsequent years, 2015 and 2016. The same case applied to UAE where data of 2015 were used for 2016 due to lack of statistics on groundwater abstracted for that year. The last statistics provided by KSA on groundwater abstracted, both renewable and non-renewable, were on 2015, so these statistics were used for 2016. In Oman, data on groundwater abstracted depended mainly on two sectors: Water Supply Industry (WSI) and agriculture. Data on the amounts abstracted by the WSI were accurate and annually traced in a time series while quantities of groundwater abstracted by agriculture were estimated by the Ministry of Agriculture and Fishers at 85.0% from 2011 to 2016.

Water consumption of net water by WSI in UAE was discussed as per available data from individual emirates.



Chapter one:
Regional Level Statistics

1.1 Main Water Statistics in GCC region in 2016

The six member countries of GCC have a total area of 2.4 million km^2 of the Arab Peninsula. The total population of all is 53.4 million people. The GCC countries share some major climatic characteristics being located in the same region. They are all characterized by hot, arid climate with scanty rainfall. Humidity is also a notable feature especially in coastal areas. However, there are still some variations in climate in the individual countries particular in larger countries such as Kingdom of Saudi Arabia, Sultanate of Oman and United Arab Emirates.

Table 1 present the main water statistics variables available in GCC region for 2016. It includes precipitation, surface and ground water abstraction, desalinated water, reused water, water supply industry, collected, and treated wastewater.

Table 1: Main water statistics in GCC region in 2016

Variables (in million cubic meters**)**	**2016**
Precipitation	225,743.9
Surface water abstracted (1)	277.0
Ground water abstracted (2)	26,705.2
Desalinated water (3)	5,745.7
Reused water (4)	907.1
Total Freshwater available for Use (1+2+3+4)	33,685.1
Gross freshwater provided by WSI	7,001.6
Loss During Transport	481.0
Net Freshwater provided by WSI	6,520.6
Volume of Wastewater collected	4,002.0
Volume of Wastewater Treated	2,924.1

The total amount of freshwater available for use refers to water that is actually used by end users for a specific purpose within a territory, such as for domestic use, irrigation or industrial processing. It excludes returned water. The total amount for 2016 is 33,685.1 Million m³; which correspond to 1,726.7 liter /day per capita. It is based on 80.2% of conventional water sources and 19.8% of non-conventional water sources. The conventional sources include the total abstraction of surface and ground water while non-conventional water sources cover the desalinated water and the reused water. In addition, the conventional sources is composed of 32.6% of renewable sources and 67.4% of non-renewable groundwater.

The non-renewable water sources, deep aquifers not recharged, represent 54.1% of the total freshwater available for use (The major contribution comes from Kingdom of Saudi Arabia where non-renewable sources are mainly used for agriculture). The rest 26.1% of renewable sources, are composed by 0.8% the surface water and 25.3% of groundwater that are naturally recharged, depending on precipitation. The total precipitation reached 225,743.9 Million m^3 in 2016 in the GCC region.

The total amount of surface water abstracted is 277.0 Million m³. This figure show in table 1 includes Kingdom of Saudi Arabia and Sultanate of Oman; the only two countries that use surface water, mainly from dams. Dams are also available in United Arab Emirates but they are mainly used for protection from floods and for recharging purposes. The total number of dams in GCC countries mounts to 764 with design capacity of 2,640.2 Million m³. The 26,705.2 Million m³ amount of abstracted groundwater, are mostly used for agriculture and households.

In order to face the water demand due to population growth and urbanization and to reduce depletion of conventional water sources, GCC countries resort to the non-conventional water

sources, desalination and reused water. The total amount of desalinated water is 5,745.7 Million m³. Equivalent to 294.5 liter/day per capita. It is produced by 167 desalination water stations (DWS) with a design capacity of 7,824.8 Mm³. The water supply industry produce 7,001.6 Million m³. It represent 358.9 liter/day per capita. The net distributed to final consumers is 6,520.6 Million m³. The losses during transport is around 7.4% of total distributed water.

Concerning the wastewater treatment, the total number of Waste Water Treatment Plants (WWTP) is 295 plants with a design capacity of 10.1 Million m³/day. The collected wastewater correspond to 4,002.0 Million m³, while the treated wastewater is 2,924.1 Million m³ (73.1% of collected wastewater). The remaining 26.9% is released into nature. Furthermore, 907.1 Million m³ from the treated wastewater, which represent 31.0%, are used for landscaping purposes.

1.2 Water Statistics in GCC in 2015 and 2016

Table 2 compares water statistics in GCC countries in 2015 and 2016. There is an increase in variables in 2016 as compared to 2015 with exception of total freshwater available for use and groundwater abstracted and total Freshwater available for use.

Table 2: Water Statistics in GCC Countries in 2015 and 2016

Variables (in million cubic meters)	**2015**	**2016**	**Growth Rate (%)**
Precipitation	172,853.4	225,743.9	30.6
Surface water abstracted (1)	225.4	277.0	22.9
Ground water abstracted (2)	27,771.0	26,705.2	-3.8
Desalinated water (3)	5,530.9	5,745.7	3.9
Reused water (4)	884.0	907.1	2.6
Total Freshwater available for Use (1+2+3+4)	34,472.7	33,685.1	-2.3
Gross Freshwater provided by WSI	6,811.4	7,001.6	2.8
Loss During Transport	442.4	481.0	8.7
Net Freshwater provided by WSI	6,369.0	6,520.6	2.4
Volume of Wastewater collected	3,867.4	4,002.0	3.5
Volume of Wastewater Treated	2,765.1	2,924.1	5.8

More precipitation in 2016

The highest increase is in precipitation with a 30.6% growth as compared to 2015. The second highest significant increase is the number of rainfall stations that rose by 27.4% in 2016, where the number was 209 stations compared to 164 stations in 2015.

Decrease in groundwater abstracted in 2016

Then comes the growth in the surface water abstracted which grew by 22.9%. Number of dams increased by 1.2% and their design capacity increased by 3.2%, reused water increases by 2.8%, gross water produced by supply industry by 2.8% and losses during transport by 8.7%. However, the total freshwater available for use declined by 2.3% due to reduction of non-renewable groundwater abstraction by countries.

Increase in desalinated water in 2016

The desalinated water produced grow up by 3.9% and the number of desalination water stations increased by 8.4% in 2016 comparing to previous year, where the number of desalination plants in 2015, 154 stations comparing 167 stations in 2016. While the quantities of fresh water abstracted decreased by 3.6%.

More reused water in 2016

Wastewater collected increased by 3.5% while Waste Water Treatment Plants (WWTP) by 2.8% where the number of WWTP number was 287 stations in 2015 comparing with 295 stations in 2016. The increase in the wastewater treatment plant design capacity is less significant; it is around 1.0%. Reused water from wastewater treated rose by 2.6%.

3.1 Key Results Indicators

Certain trends can be observed from aggregates from water statistics in GCC countries. Statistics aggregated in 2004 to 2016 figure 1 shows fluctuations in precipitation with 2013 having the highest level followed by 2005. However, precipitation increased in 2016 compared to 2015.

Figure 1: Precipitation in GCC Countries from 2004 to 2016

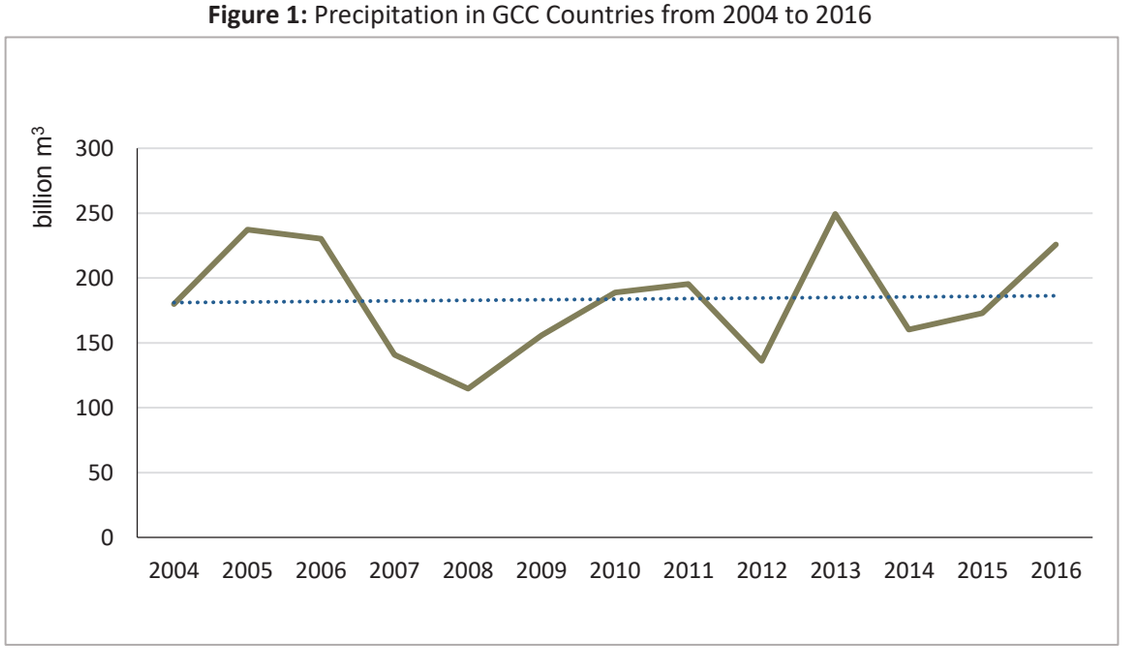


Figure 2 demonstrates trends of the total freshwater available for use from 2012 to 2016. It can be observed that there was a drop in the amount of renewable water sources by 22.7%, from 7,303.4 Million m³ in 2012 to 7,235.1 Million m³ in 2013. Then it decreases slightly by 0.3% in 2014 and the amount increases in 2016 by 8,963.9 Million m^3. Amounts of non-renewable water source increased continuously from 15,450.0 Million m³ in 2012 to 19,071.0 Million m^3 in 2015 with a growth rate 4.6% in 2016. Similarly, variables of desalinated water and reused water showed growth between 2012 and 2016. In 2012, the total amount of desalinated water was 4,831.7 Million m^3, which went up to 5,745.7 Million m³ in 2016. Amount of reused water increased from 681.4 Million m³ in 2012 to 907.1 Million m³ in 2016.

Figure 2: Total Freshwater Available for Use in GCC Countries from 2012 to 2016

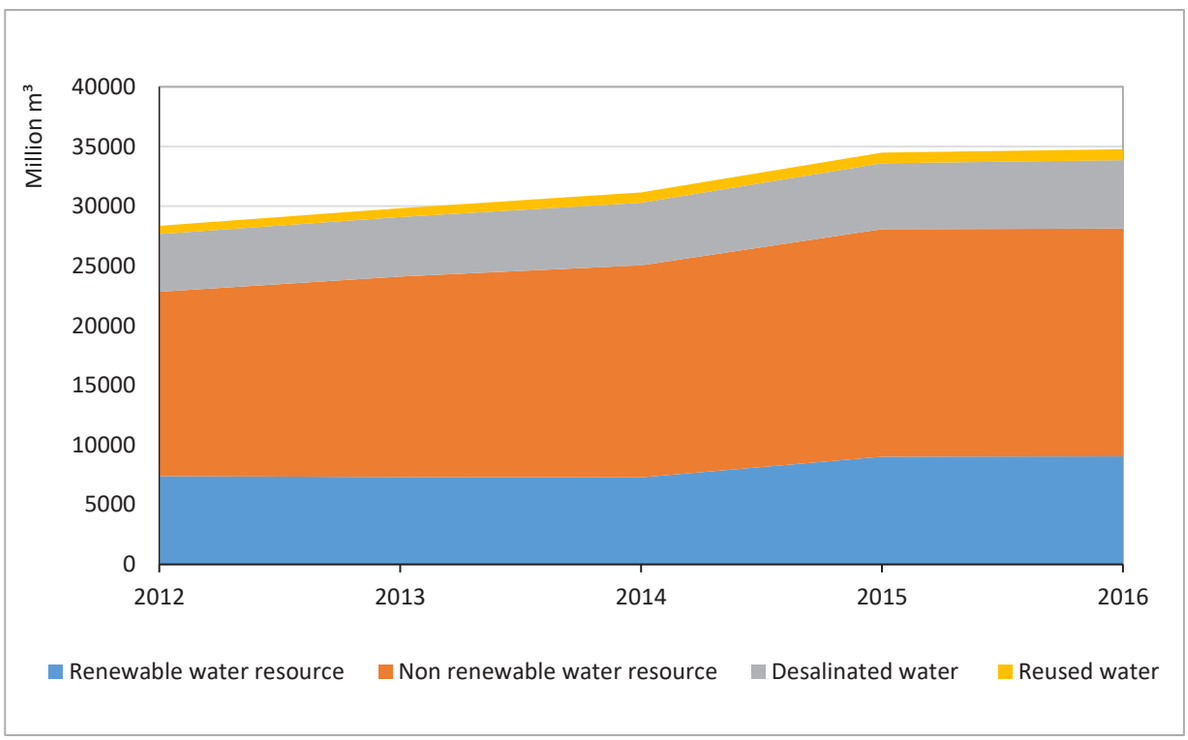
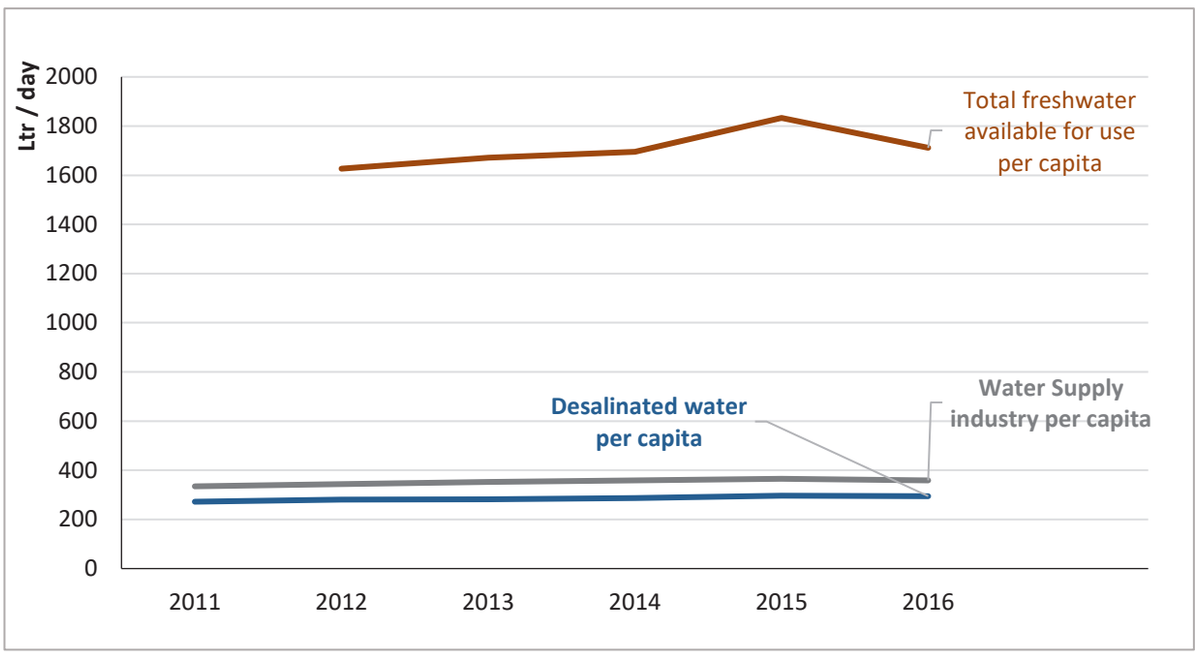
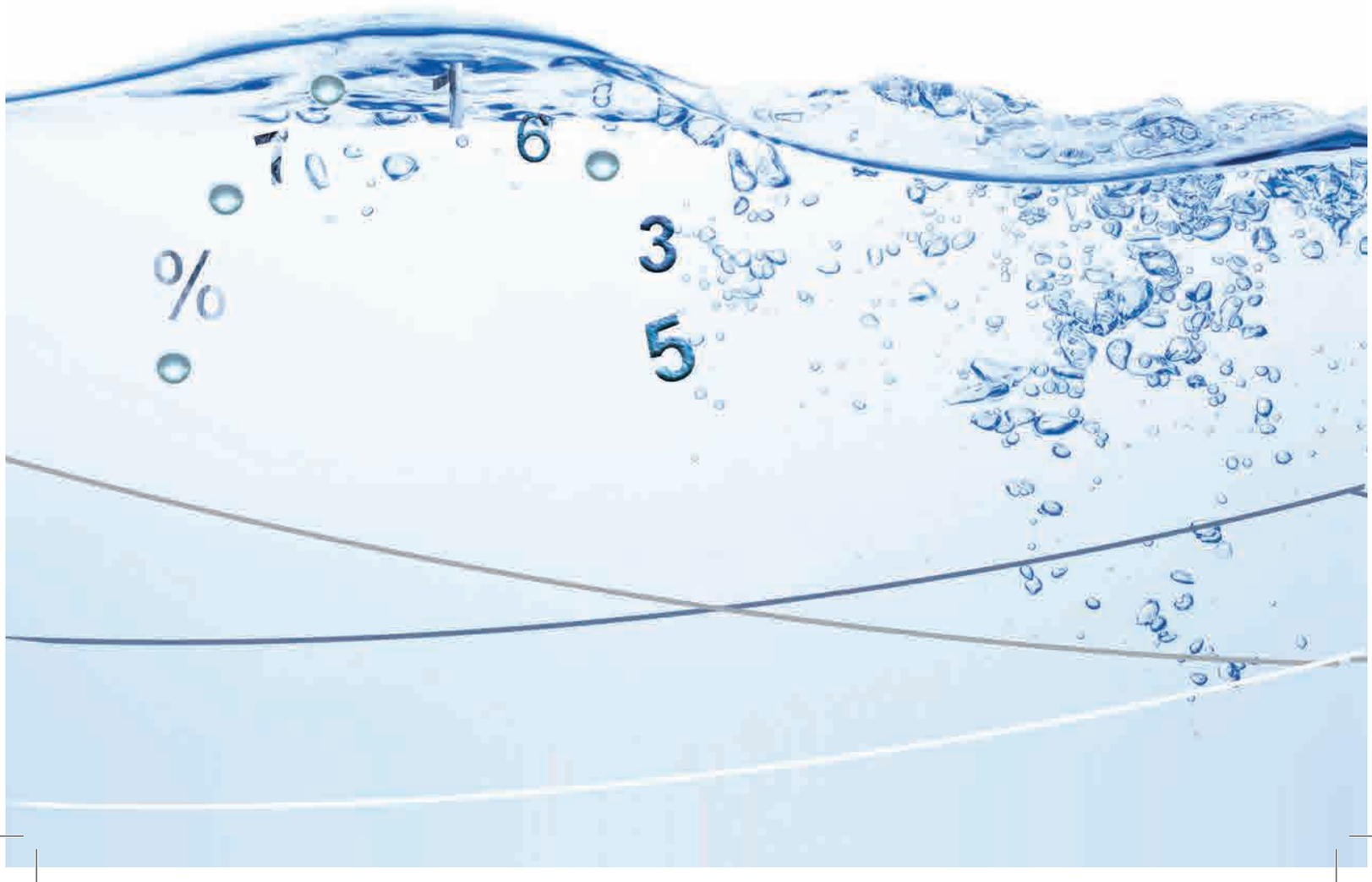


Figure 3 shows trends in the per capita of the various water sources. Similar trends can be noted in per capita of desalinated water, total freshwater available for use and water supply industry. There was growth from 2012 to 2015 followed by slight decreases in 2016. The desalinated water per capita was 294.5 Ltr / day in 2016 comparing with 295.6 Ltr / day in 2015. The second type is total freshwater available for use per capita, it was decreased from 1,839.0 Ltr / day in 2015 to reach 1,711.4 Ltr /day. The last type is water supply industry per capita; it decreases from 364 Ltr / day in 2015 to be 356.2 Ltr / day in 2016.

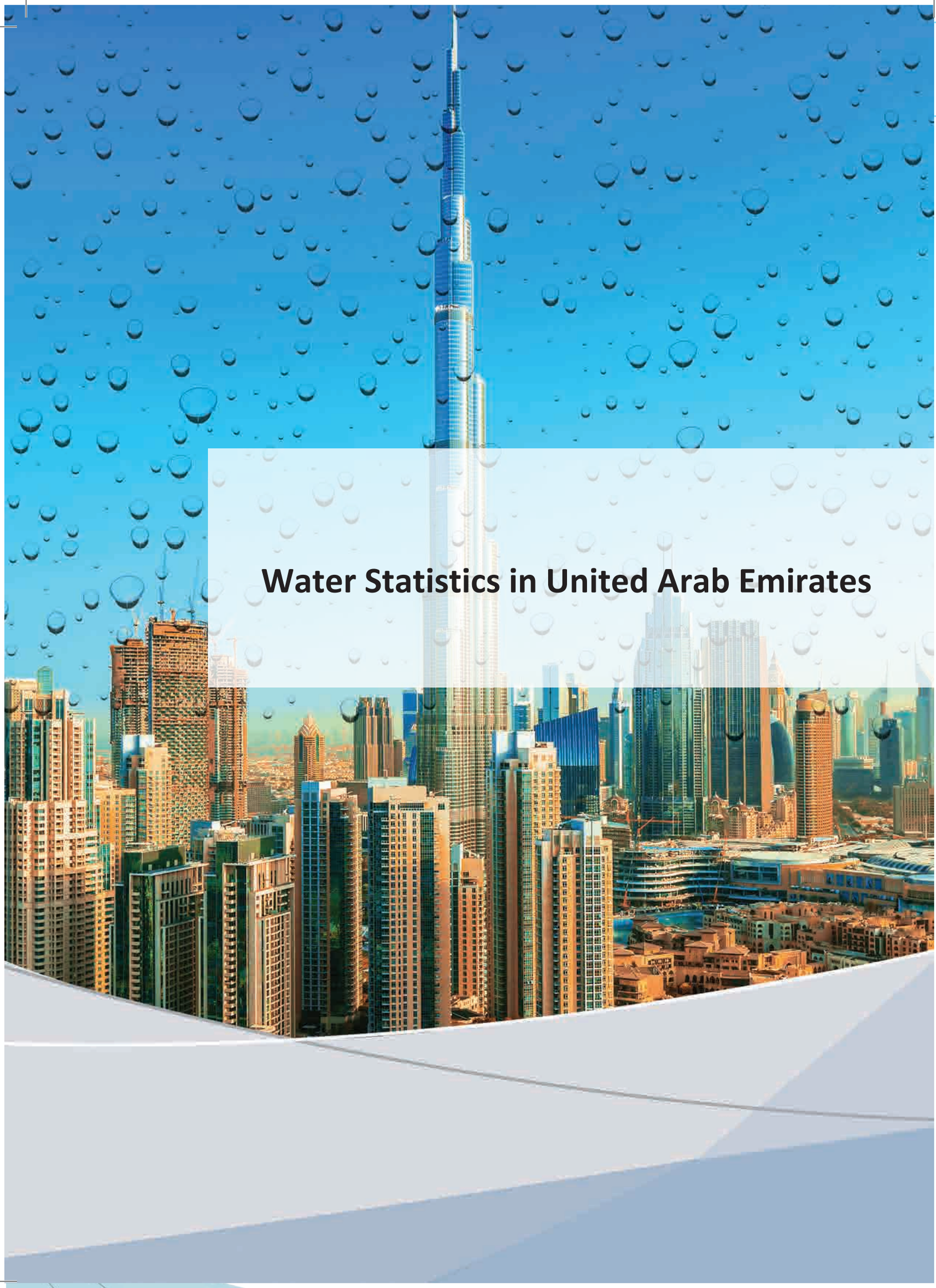
Figure 3: Water Quantity per capita in GCC countries from 2011 to 2016





Chapter Two

National Level Statistics



Water Statistics in United Arab Emirates

2.1 Water Statistics in United Arab Emirates

United Arab Emirates has an area of 71,023.6 km² with a total population of 9.1 million (2016). The climate in United Arab Emirates is generally hot and dry with very high temperatures in the summer. The average of rainfall in 2016 was 95.8 mm with an increase of 95.8% compared to 2015 when the average of rainfall was 48.9 mm. This increase in average rainfall reflected on the amount of surface water collected as the total amount of surface water collected in 2016 was 25.0 Million m³, whereas total amount of surface water collected was 0.3 Million m³ in 2015. In 2016, 104 dams are used to collect surface water with a capacity of 91.0 Million m³. These dams are used for recharging purpose as well as for protection against floods.

Table 3: Water Statistics in United Arab Emirates in 2015 and 2016

Variables (in million cubic meters)	**2016**	**2015**	**Growth Rate (%)**
Precipitation	...	1,495.6	...
Surface water **collected**	25.0	0.30	82233.3
Groundwater abstracted	...	3,536.0	...
Desalinated water	2,004.9	2,004.7	0.01
Reused water	470.0	451.7	4.1
Total Freshwater available for Use	[1]6,010.9	5,992.7	0.3
Gross Freshwater provide by WSI	2,004.9	2,004.7	0.01
Loss During Transport	141.9	119.0	19.2
Net Freshwater supplied by WSI	1,862.9	1,885.7	-1.2
Volume of Wastewater collected	746.4	724.4	3.0
Volume of Wastewater Treated	733.1	711.0	3.1

The total amount of groundwater abstracted as table 3 indicates in 2015 was 3,536.0 Million m³ compared to 2014; this figure is 97.9% higher. Renewable water sources (surface water not included) comprise 58.8% of the total freshwater available for use. As for desalinated water produced, the total amount in 2016 was 2,004.9 Million m³. It represents 602 Ltr / day per capita. It came mainly from three sources with the following contributions; water abstracted from sea 1,932.7 Million m³, brackish ground water 43.3 Million m³ and Fresh groundwater 28.8 Million m³.

In 2016, the total capacity of desalination water stations was 2,660.7 Million m³. This total design capacity is lower by 2.4% as opposed to that of 2015 when the design capacity of stations was 2,726.2 Million m³. In contrast, the number of desalination water stations rose from 46 in 2015 to 50 in 2016. With regard to technologies used, there was 28.6% growth in the stations using MSF, 4.8% in those using RO and 33.3% in stations using MED, while stations using other technologies

[1] Data include groundwater abstracted in 2015

dropped by 25.0%. The total amount of freshwater available for use in 2015 was 5,992.7 Million m³, 43.8% higher than 2014 when it was 4,166.8 Million m³.

More Quantity of reused of water in 2016

The other non-conventional water source is reused water. The amount of reused water in 2016 is 470.0 Million m³, 4.0% higher than 2015. Both desalinated water and reused water account for 41.2% of total freshwater available for use in 2016.

In 2016, the water production by WSI increased by 0.01% to reach 2,004.9 Million m³ compared to the previous year. The main source of water in WSI is desalinated water. 19.2% from water provided by water supply industry Lost during transport. It makes the net water 1,862.6 Million m³. The decrease rate in the net water between 2015 and 2016 was approximately 1.2%.

UAE comprised in seven emirates, Abu Dhabi and Dubai are the largest among the seven emirates of the union. They represent around 90.7% of the total area of UAE whereas the other five emirates (Sharjah, Fujairah, Ras Al-Khaima, Ajman and Umm Al Quwain) represent 9.3%. The population of Abu Dhabi and Dubai is around 61.5% of the country and 38.5% for 5 emirates as of 2016.

In 2016, the two emirates consume 85.7% of the total net amount of water-by-water supply industry. While the five emirates consumed 14.3% of the total net water by WSI. The total consumption of households in both emirates was 763.1 Million m³ in 2016 with 8.1% decrease compared to the consumption in 2015. The consumption of the commercial sector in 2016 was 388.5 Million m³ with a growth rate of 13.0% compared to that of 2015. Other sectors consumed 48.1Million m³ which is 3.4% lower than the year before. The agriculture sector consumed 229.9 Mm³ in 2016. It represents 17.2% growth rate compared to 2015. The governmental sector consumption decreased by 23.1% from 2015 to 2016 when it reached 121.6 Million m³.

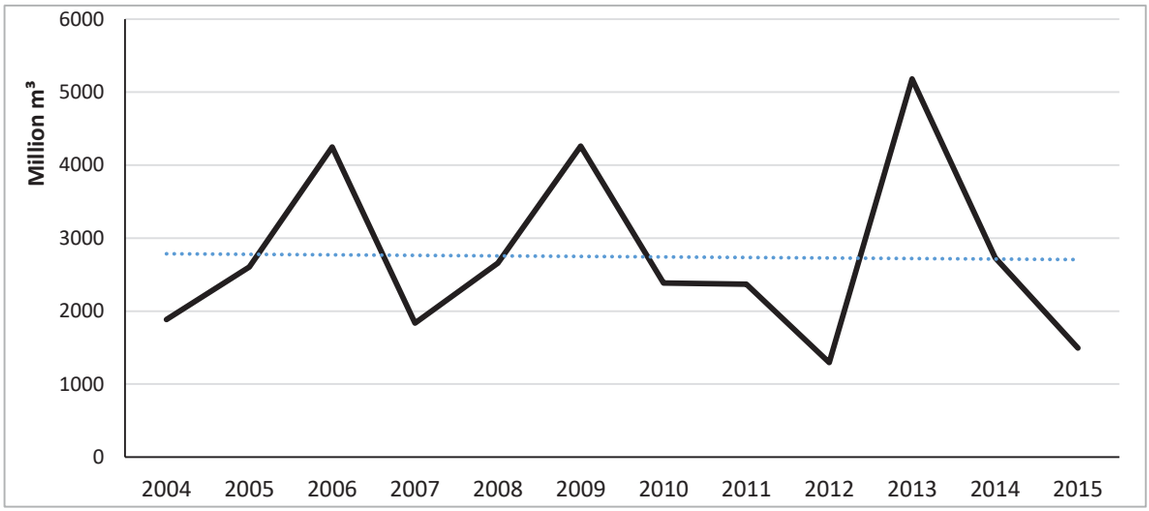
Wastewater treated increased in 2016

Wastewater collected in 2016 is 746.4 Million m³ which is 3.0% higher than 2015. Similarly, wastewater treated increased by 3.1% in 2016 to 733.1 Million m³. Eight Waste Water Treatment Plants (WWTP) constituting a growth rate of 10.3% were added in 2016 to make the total number 86 plants. The numbers of plants using primary, secondary and tertiary technologies are 2, 16 and 68 respectively. The total design capacity of all the 86 WWTP reached 2.3 Million m³/day in 2016. This figure is higher than that of 2015 by 2.2%.

2.1.1 Key Results Indicators

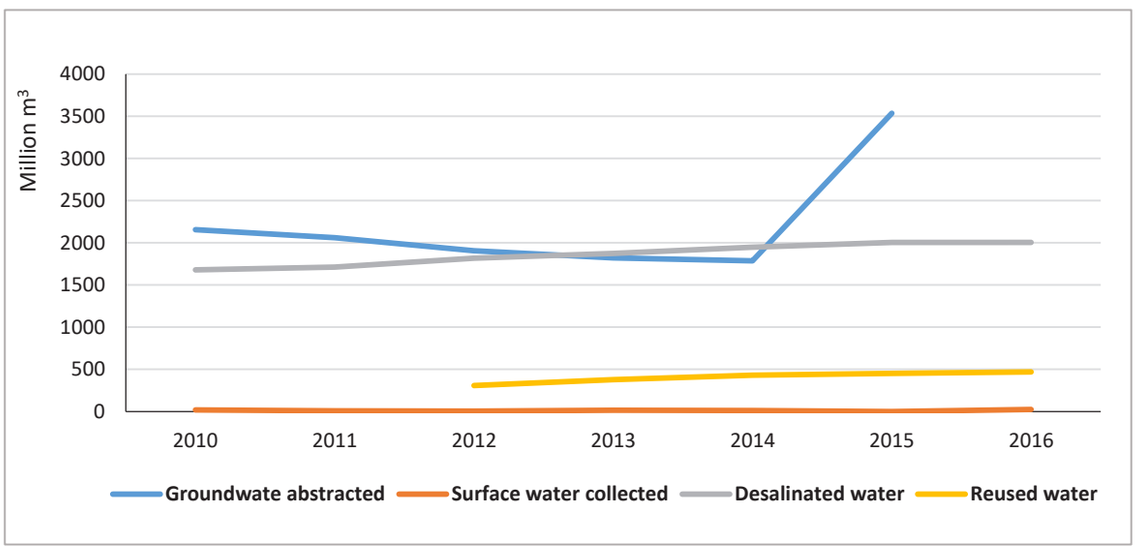
Figures 4, 5, 6 and 7 demonstrates the trends of various water variables in United Arab Emirates. Precipitation levels fluctuated over the period from 2004 to 2015. The highest precipitation level was in 2013 followed by 2009 whereas the lowest level was in 2012. Precipitation level in 2015 decreased compared to that in 2014.

Figure 4: Precipitation in United Arab Emirates from 2004 to 2016



It can be seen from figure 5 statistics for United Arab Emirates shows fluctuation in the amounts of groundwater in the period between 2010 and 2015. Amounts of groundwater abstracted decreased gradually from 2,157.0 Million m³ in 2010 to 1,786.5 Million m³ in 2014. However, the figure rose significantly to 3,536.0 Million m³ in 2015.

Figure 5: Total Freshwater available for use in United Arab Emirates from 2004 to 2016

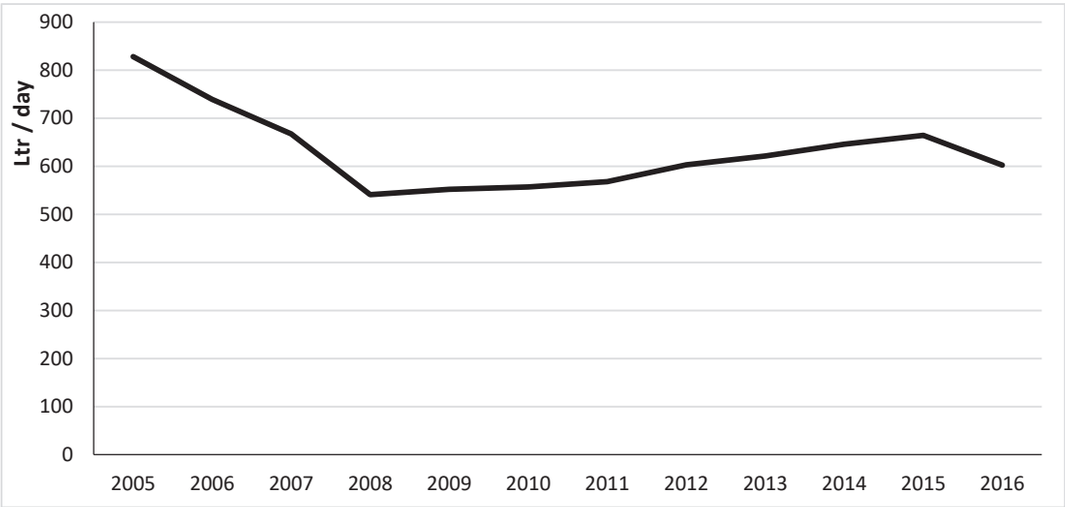


As surface water collected, the amount increased from 2007 to 2010 when it was 2.7 Million m^3 in 2007 to reach 20.0 Million m^3 in 2010. Then, it declined in the subsequent years of 2011 and 2012. There was significant growth in 2013 when the total amount was 16.1 Million m^3. However, this was followed by a decrease in 2014 and again in 2015 when the amount was at its lowest at 0.3 Million m^3. Then, it rises rapidly to reach 25.0 Million m^3 in 2016.

Another observation is regarding the capacity of desalination water stations. Despite the fact that the number of stations increased continuously from 2011 to 2016, the capacity reached its highest in 2015, but then went down in 2016. The data population provided by WSI reached 99.0% in 2015 from the total population in UAE. This is 26.4% higher than 2008, when it was 78.3%.

In Figure 6, the desalinated water per capita in United Arab Emirates was at its highest, 828.2 ltr / day, in 2005. It decreased gradually until 2008 when it reached 540.9 L/day, which is the lowest point in the time period covered (2005 to 2016). However, the slump in 2008 was followed by a continuous growth until 2015 when it was 664.6 ltr / day. In 2016, there is a slight decrease to be 602.2 ltr / day[(2)]

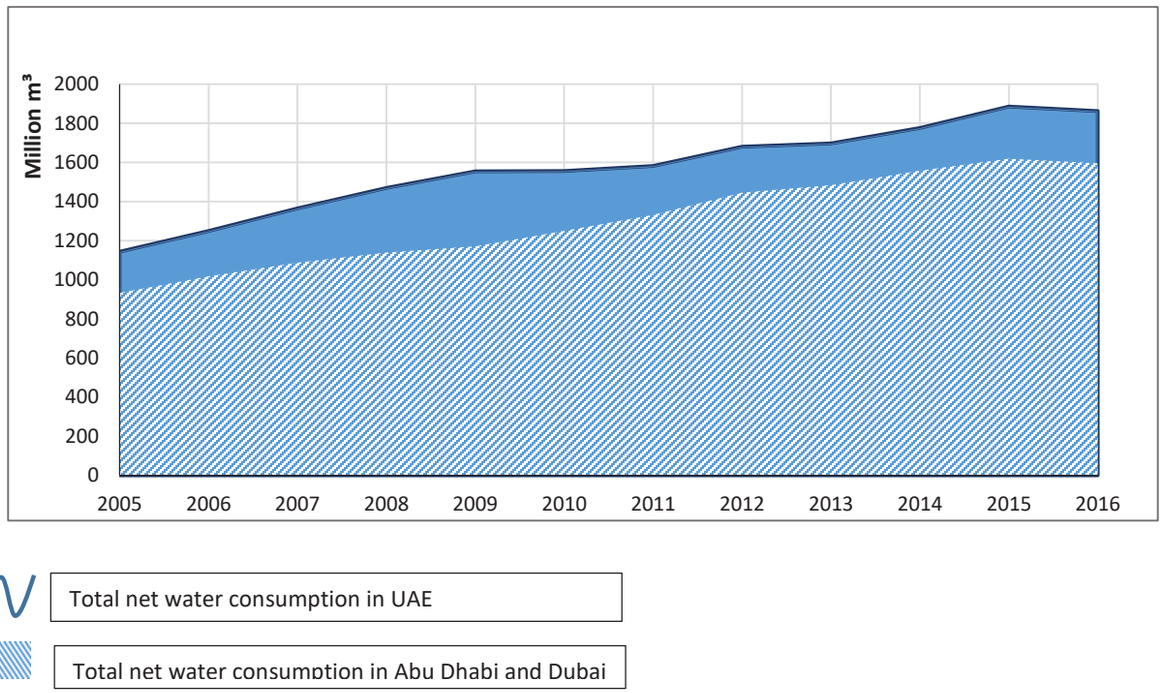
Figure 6: Desalinated water per capita in United Arab Emirates from 2005 to 2016



The total net water provided by WSI as showing in figure 7 illustrates in United Arab Emirates grew continuously from 1,144.1 Million m^3 in 2005 to 1,885.7 Million m^3 in 2015, but dropped by 1.2% in 2016. The water consumption of net freshwater by WSI of the five emirates varied over the period from 2005 to 2016. It was 18.5% in both years of 2005 and 2006. Then it rose gradually to reach its peak at 24.7% in 2009. After that, there was a continuous decline until 2014 when it was at its lowest at 12.3%. However, a slight increase occurred in 2015 and again in 2016 when the water consumption reached 14.3%.

[(2)] Desalinated water per capita was calculated for the year 2011 and 2015 by using the number of population in UAE in 2010.

Figure 7: Net Freshwater provided by WSI in United Arab Emirates and water consumption per sector from 2005 to 2016



The consumption of Abu Dhabi and Dubai of this total was 81.5% in 2005 and 2006. Then it reduced gradually until 2009, but went up again in 2010 and continued to rise until 2014. When it was at its peak at 87.7%. However, there was a slight decrease in 2015, 85.9%, which remained stable in 2016.

The highest water consumption was by households in the period from 2005 to 2016 ranging between 47.8% and 65.9%. The consumption of the commercial ranged between 13.3% in 2005 to 24.3% in 2016. This sector was second largest consumer of net water with the exception of 2012, 2013 and 2014 when the consumption of the government was higher. The industrial, agricultural and other sectors consumed less substantial amounts of 1.4% to 5.2% of the total. However, the agricultural sector witnessed a significant growth to 12.1% in 2015 and 14.4% in 2016.

Kingdom of Bahrain

2.2 Water Statistics in Kingdom of Bahrain

The Kingdom of Bahrain is an archipelago of 40 islands with a total area of 779.4 Km². The population of Bahrain was 1.4 million in 2016, 3.3% higher than the previous year. The climate of Bahrain is characterized by aridity, high temperatures, scanty rainfall and high rates of evapotranspiration.

Table 4: Water Statistics in Bahrain in 2015 and 2016

Variables (in million cubic meters)	**2015**	**2016**	**Growth Rate** (%)
Precipitation	50.6	48.3	-4.5
Ground water abstracted	159.1	155.1	-2.5
Desalinated water	241.6	241.9	0.1
Reused water	29.6	39.2	32.4
Total Freshwater available for Use	430.3	436.2	1.4
Gross Freshwater provide by WSI	267.9	265.3	-1.0
Loss During Transport	7.4	5.1	-31.1
Net Freshwater supplied by WSI	260.5	260.2	-0.1
Wastewater collected	155.3	157.8	1.6
Wastewater Treated (Tertiary only)	69.9	[3] 69	...

Less precipitation in 2016

In 2016, precipitation recorded was 48.3 Million m^3 in Kingdom of Bahrain in 2016, which was 4.5% lower than the previous year when precipitation was 50.6 Million m^3.The number of rainfall stations was 6 in 2016.

Total Freshwater Available for use increasing in 2016

The total Freshwater available for use grew by 1.4% to reach 436.2 Million m³ in 2016. It represents 839.4 L/day. The total amount of groundwater abstracted declined from 159.1 Million m³ in 2015 to 155.1 Million m³ in 2016 with a decrease rate of 2.5%. It was abstracted directly by water supply industry, household, agriculture and fishery and manufacturing by 22.1%, 1.3%, 65.3% and 11.3% respectively. This includes the non-renewable high-salinity water abstracted for the desalination purposes at Abu Gargoor station.

Desalinated water per capita dropped in 2016

Desalinated water produced in 2016 is 241.9 Million m³ as compared to 241.6 Million m³ in 2015 with 0.1% growth rate. The total number of desalination water stations in 2016 was five stations with a capacity of 312.7 Million m^3. The total number of stations remained stable in 2015 and 2016 but their design capacity in 2016 increased by 1.0% comparing to the previous year. Technologies

[3] Data of 2015

used by these stations included MSF by one station with a capacity of 91.3 Million m^3, RO by two stations with a capacity of 107.0 Million m^3 and MED by two stations with a capacity of 114.5 Million m^3. The desalinated water per capita dropped by 3.6% from 483.0 Ltr / day in 2015 to 465.5 L /day in 2016.

More reused water in 2016

Reused Water is 39.2 Million m³ in 2016, 32.4% higher than 2015. Both desalinated water and reused water account for 64.4% of total freshwater available for use in 2016. It wants up by 2.2% compared to 2015.

The gross freshwater produced by WSI in 2016 is 265.3 Million m³, which was 1.0% less than the previous year. The net freshwater provided by WSI is 260.2 Mm³ in 2016, which is less by 0.1% than 2015. Water lost during transport decreased from 2015 to 2016 by 31.1%. WSI distributes water to mainly three sectors, household, agriculture and manufacturing industries. In 2016, 99.5% of total population in Bahrain were connected to WSI net freshwater, which is higher by 0.2 than 2015. The consumption of household decreased to 239.4 Mm³ in 2015 and 2016. The per capita of WSI is 510.5 Ltr / day in 2016, 4.7% lower than 2015.

Wastewater collected increasing in 2016

Wastewater collected increased from 155.3 Million m³ in 2015 to 157.8 Million m³ in 2016. The total amount of wastewater treated using tertiary technology was 69.9 Million m³ in 2015. 42.4% of wastewater treated was reused in 2015 while the percentage was 56.1%[(4)] in 2016. The number of wastewater treated plants is 22 in 2016 compared to 21 in 2015.

Their design capacity also increased to reach 369.9 (1000m³/d) in 2016. This figure was 1.9% higher than of 2015.

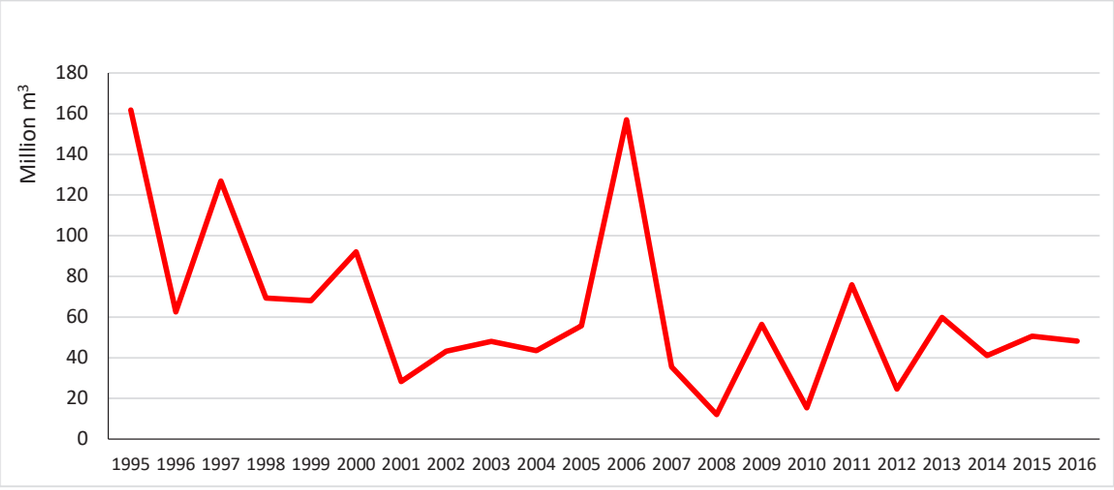
In 2016, 8 plants used the secondary technology with a capacity of 35.9 (1000m³/d). The remaining fourteen plants used the tertiary technology with a total capacity of 334.0 (1000m³/d). In 2015, when the total number of plants was 21, eight plants used the secondary technology with a capacity of 35.9 (1000m³/d) while the tertiary technology was used in the other fourteen plants with a capacity of 327.0 (1000m³/d). In 2016, 85.0% of population were connected to the facilities of wastewater collected while in 2015 the percentage was 88.0%. It drops by 3.4% in 2016 compared to 2015.

1.2.1 Key Results Indicators

The following trends can generally be observed in Figure 8. Data covering the period from 1995 to 2016 show fluctuations in precipitation levels. The lowest level was in 2008 with 12.1 Million m³ and the highest was in 1995 when Kingdom of Bahrain received 161.8 Million m³ precipitation.

(4) Primary data: volume of wastewater treated for 2015.

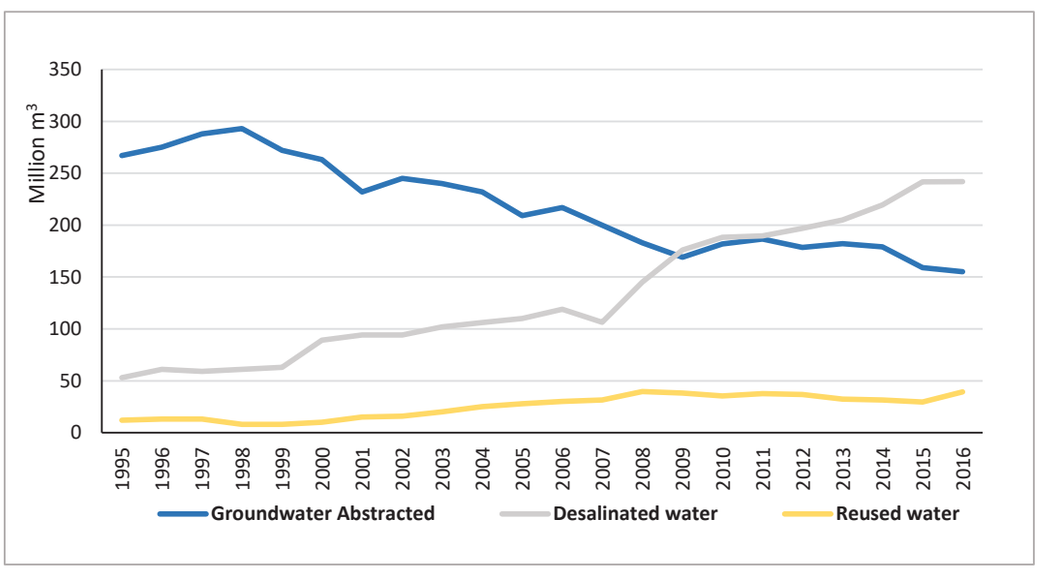
Figure 8: Precipitation in Kingdom of Bahrain from 1995 to 2016



Precipitation in 2010 was also relatively low with 15.4 Million m³, which is considered the second lowest in the period covered. In 2016, precipitation was 48.2 Million m³. Kingdom of Bahrain had two rainfall stations over the period from 2007 to 2014. In 2015, the number rose to six stations in total and the number of rainfall stations remained similar in 2016.

Amounts of groundwater abstracted fluctuated as shown in figure 9 from 1995 to 2016. From the figure it is clear that amount of groundwater decreases lowest in 2016 by 41.9% comparing to the amount that abstracted in 1995. Agriculture consumed the most amounts of groundwater over the same period through direct abstraction.

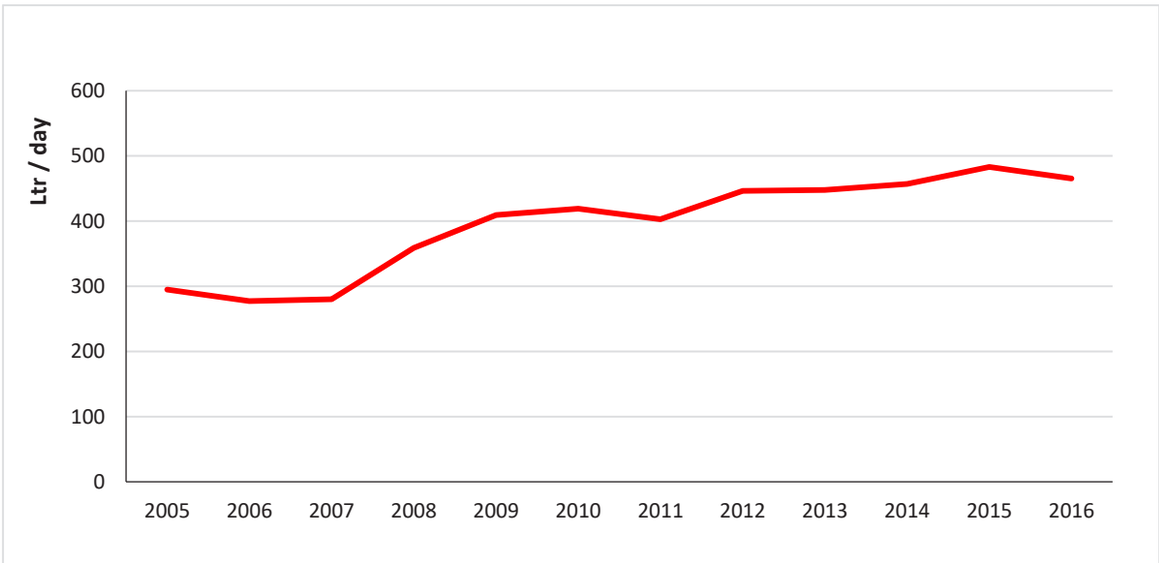
Figure 9: Total Freshwater Available for use in Kingdom Bahrain from 1995 to 2016



Total amount of desalinated water grew constantly from 52.7 Million m³ in 1995 to 241.9 Million m³ in 2016. The number of water desalination stations was five in total in the same period except for 2012 when the total was six stations. The design capacity of the stations was at its highest and reached 325.9 Million m^3 in 2012, but this was followed by decline to 309.5 Million m^3 in 2013 and stability until 2015 then slightly increases around 1.0% in 2016. Reused water was the highest in 2008 as it reached 39.6 Million m³ while the lowest was in 1999 when the amount was 8.0 Million m³ only.

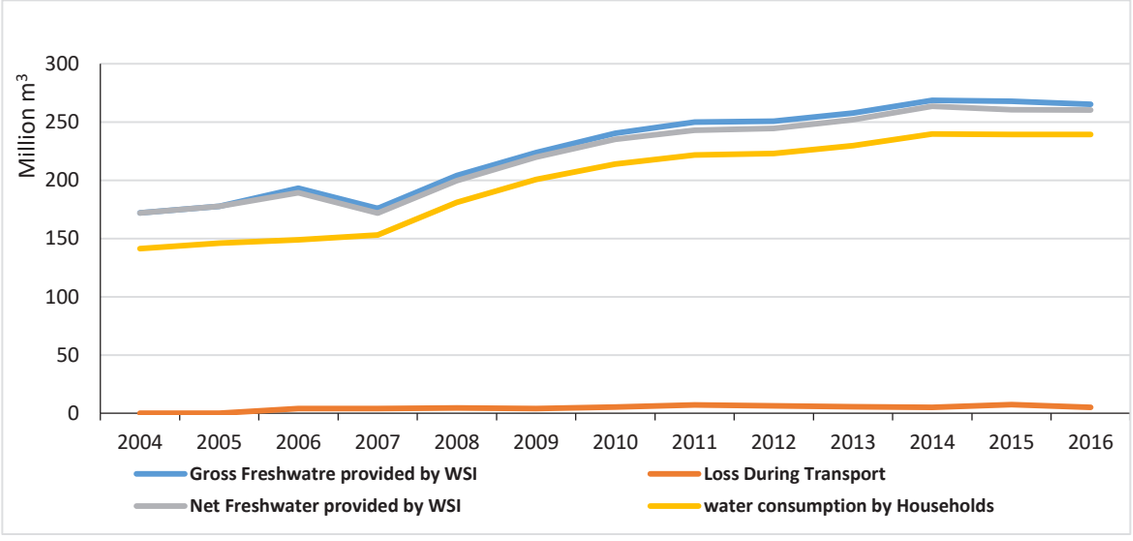
Figure 10 illustrates that the desalinated water per capita was 295.0 Ltr / day in 2005. This figure declined slightly to 277.3 Ltr / day in 2006, which is the lowest in the time series covered. Nevertheless, there was a continuous growth starting from 2007 until 2010, as the amount was 419.0 L/day. In 2011, it declined to 402.8 L/day. Another growth followed started from 2012 until 2015 when desalinated water per capita was at its peak at 483.0 Ltr / day in 2015. Than it decreases slightly to be 465.5 Ltr / day in 2016.

Figure 10: Desalinated water per capita in Kingdom of Bahrain from 2005 to 2016



The gross amount of freshwater produced by the water supply industry witnessed continuous growth as indicates in figure 11 from 2004 to 2015 with the exception 2007 and 2016 when the amount slightly slumped whereas the growth in net freshwater supplied was interrupted by stability in 2011 and 2012. As can be seen from figure the households' consumption from WSI increases from 141.3 Million m^3 in 2004 to reach 239.4 Million m^3 in 2016 with growth rate 69.4%.

Figure 11: Water Provided by WSI and water consumption in Kingdom of Bahrain from 2004 to 2016



The percentage of reused water compared to overall wastewater treated went down gradually from 84.2% in 2007 to 67.1% in 2010. It rose again in 2011 but declined continuously until 2015. Then it increases 56.1% in 2016 comparing to 2015. Despite the continuous increase in the number of wastewater treatment plants and their design capacity from 2007 to 2016, the amounts of wastewater collected and wastewater treated fluctuated in the same period. The highest for both was 2014. Wastewater treated from wastewater collected was 43.2% in 2007. It rose in 2008 to 52.6% but then dropped continuously until 2013 when it was 43.0%. However, it grew and stabilized at 45.0% in 2014 and 2015. There was a marginal drop in 2016, 44.3%.

Kingdom of Saudi Arabia

2.3 Water statistics in Kingdom of Saudi Arabia

Kingdom of Saudi Arabia is the largest country in the Arabian Peninsula. It has an area of 2.0 million km².The population of Saudi Arabia is 31.8 million people. Almost all the area of Saudi Arabia is dry as the country is located in the tropical and subtropical desert climate. Temperatures are extreme and there are a lot of variations in the country in terms of seasons and regions due to its huge area. The average per capita of water consumption in 2016 is 270.0 Ltr / day which is seven liters higher than 2015.

More precipitation in 2016

In 2016 as table 5 shows precipitation was 192,795.6 Million m³. This figure is 36.0% higher than the previous year. The total number of rainfall stations is 26 and this number is the same as that in 2015. The total freshwater available for use in 2016 is 23,933.0 Million m³, 3.6% lower than 2015. The per capita also decreased by 5.8% from 2,190.3 Ltr / day in 2015 to 2,062.8 Ltr / day in 2016.

The amount of surface water abstracted increased from 123.4 Million m³ in 2015 to 175.0 Million m³ in 2016 with a growth rate of 41.8%. Saudi Arabia has the highest number of dams among the GCC countries. The total number of dams in 2016 is 508 with a design capacity of 2,250.0 Million m³. These figures shows a growth rate of 1.2% in the number of dams and 3.8% in the design capacity in 2016 compared to 2015.

Table 5: Water Statistics in Kingdom of Saudi Arabia in 2015 and 2016

Variables (in million cubic meters)	**2015**	**2016**	**Growth Rate (%)**
Precipitation	141,734.5	192,795.6	36.0
Surface water Abstracted	123.0	175.0	41.8
Total Groundwater of which abstracted from:	22,647.6	21,595.0	-4.6
Renewable Groundwater	3,576.6	...	...
Non-Renewable Groundwater	19,071.0	...	...
Desalinated water	1,833.0	1,947.0	6.2
Reused water	229.0	216.0	-5.7
Total freshwater available for Use	24,833.0	23,933.0	-3.6
Gross freshwater provide by WSI[(5)]	3,026.0	3,129.0	3.4
Loss During Transport	149.3	143.0	-4.2
Net Freshwater supplied by WSI	2,876.8	2,986.0	3.8
Volume of Wastewater collected	2,420.8	2,503.2	3.4
Volume of Wastewater Treated	1,468.2	1,604.3	9.3

[(5)] Includes the amount of reused water for agriculture

Less Groundwater abstraction of water in 2016

The amount of groundwater abstracted is 21,595.0 Million m³ in 2016 while it was 22,648.6 Million m³ in 2015, which indicates around 4.6% decrease. In 2016, groundwater was abstracted directly by three main sectors, the water supply industry, agriculture, forestry, fisheries, and the manufacturing industry by 5.5 %, 90.6% and 4.7% respectively with growth rates to 3.9%, 91.0% and 4.3% in 2015. Despite the variations in the percentages, agriculture, forestry and fisheries industry remained at the top followed by WSI and then by the manufacturing industry.

Additional desalination water stations in 2016

The total amount of desalinated water produced in 2016 is 1,947.0 Million m³, 6.2% higher than the amount in 2015, which was 1,833.0 Million m³. Statistics of 2016 indicate the number of desalination water stations to be 43 stations with a design capacity of 2,812.3 Million m³ while in 2015 the number of stations was 38 with design capacity of 2,793.6 Million m³. Thus, the growth rate in the number of station is 13.2% while the growth rate in the capacity is 0.67%. Technologies used in the desalination water stations included MSF, RO, MED and others. In 2015, 10 stations with capacity of 520 Million m³ used MSF, while 16 with capacity of 641.3 Million m³ used RO, 11 with capacity 1630.7 Million m³ used MED and one with a capacity around 1.6 Million m³ used other technologies. In 2016, per capita of desalinated water is 167.8 L /day.

Decrease in the quantity of reused water

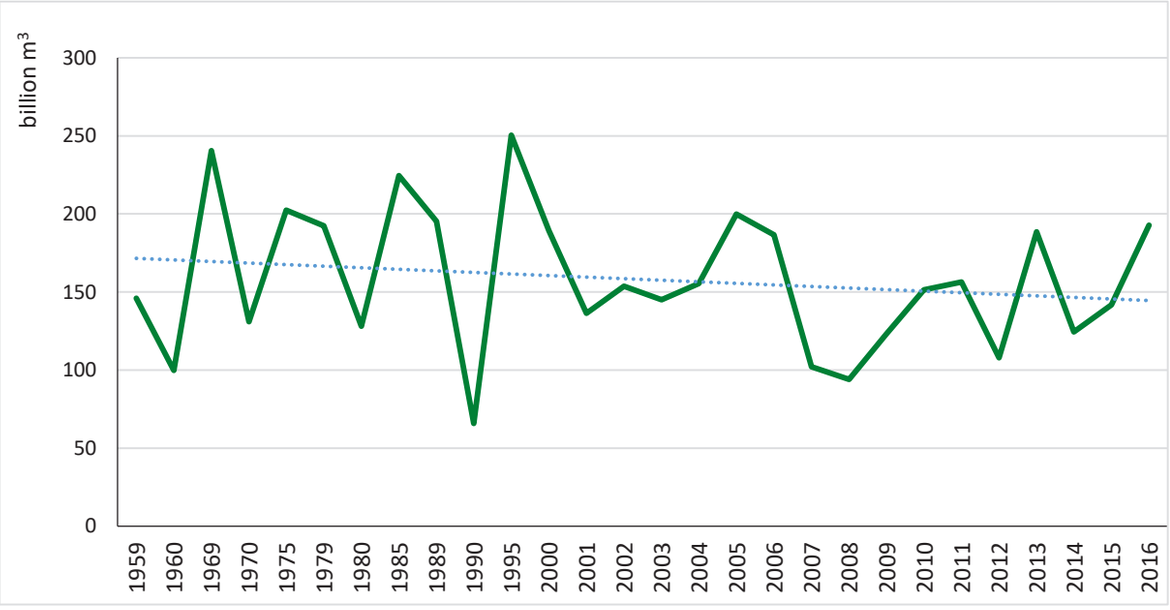
In 2016, there was 5.7% decrease in the quantity of reused water as the total amount in 2015 was 229.0 Million m³ in contrast to 216.0 Million m³ in 2016. This amount of reused water in 2016 constitutes 13.5% of the amount of wastewater treated.
The gross freshwater produced by the water supply industry is 3,129.0 Million m³ in 2016, 3.4% higher than the amount produced in 2015. In 2016, per capita of WSI is 269.7 L/day, 1.0% higher than 2015. Losses during transport decreases from 149.3 Million m³ in 2015 to 143.0 Million m^3 in 2016. The net freshwater produced in 2016 by the WSI was 2,986.0 Million m³ which was 3.8% higher than 2015. Water provided by water supply industry is mainly used by households and agriculture sectors. Households' share in 2016 is 2,770.0 Million m³ it growth by 4.6% from 2015. Water used by agriculture in 2016 is 216.0 Million m³ while it was 229.0 Million m³ in 2015 with a decrease equal to 5.7%. This water used by agriculture is reused water.

Total amount of wastewater collected in 2016 is 2,503.2 Million m^3, 3.4% higher than the amount of 2015, which was 2,420.8 Million m^3. Wastewater collected comes mainly from WSI as 80.0% of gross freshwater produced by the WSI turns into wastewater. Wastewater treated rose from 58.0% in 2011 to be 64.1%in 2016 of wastewater collected. The amount of wastewater treated in 2016 is 1,604.3 Million m^3 compared to 1,468.2 Million m^3 in 2015. Thus, in 2016, the growth rate is 9.3%. In 2016, the reused water from wastewater treated is 13.5% compared to 15.6% in 2015. The number of wastewater treatment plants was 97 plants in 2015 with a design capacity of 5,404.7(1000 m³/d).Though the number of plants in 2014 was higher than 2015 and reached 102 plants, but the design capacity in 2015 was higher by 2.0% than the design capacity of stations in 2014.

2.3.1 Key Results Indicators

Data in Figure 12 illustrates the period from 1959 to 2016 demonstrate fluctuations in precipitation levels. The peak is in 1995 and the lowest point was in 1990. Amounts of surface water abstracted increased continuously from 2008 to reach their highest in 2012. This was followed by a decline in 2013, then by a continuous growth. Number of dams kept growing from 237 dams in 2007 to 508 dams in 2016.

Figure 12: Precipitation in Kingdom of Saudi Arabia from 1959 to 2016



Fluctuations are also observed in amounts of groundwater abstracted as indicated in figure 13, which decreased gradually from 2005 to 2010, then rose in 2011, and continued to rise to 2015. However, there was a decline in 2016. There was a continuous growth in the amounts of desalinated water produced from 2004 to 2016, only interrupted by a slight decrease in 2008. Statistics of reused water show no particular trend as they fluctuated over the period. The highest amounts of reused water were recorded in 2014 as 256.0 Million m^3 whereas the lowest were in 2005 with 120.0 Million m^3.

Figure 13: Desalinated water per Capita in KSA from 2005 to 2016

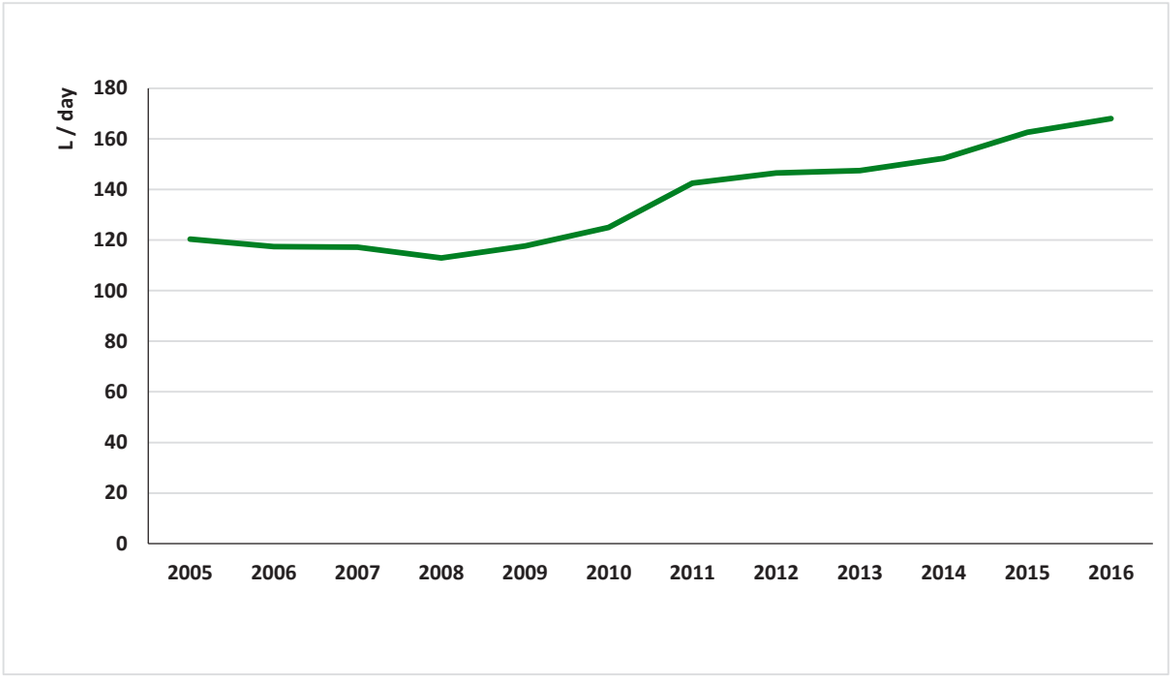
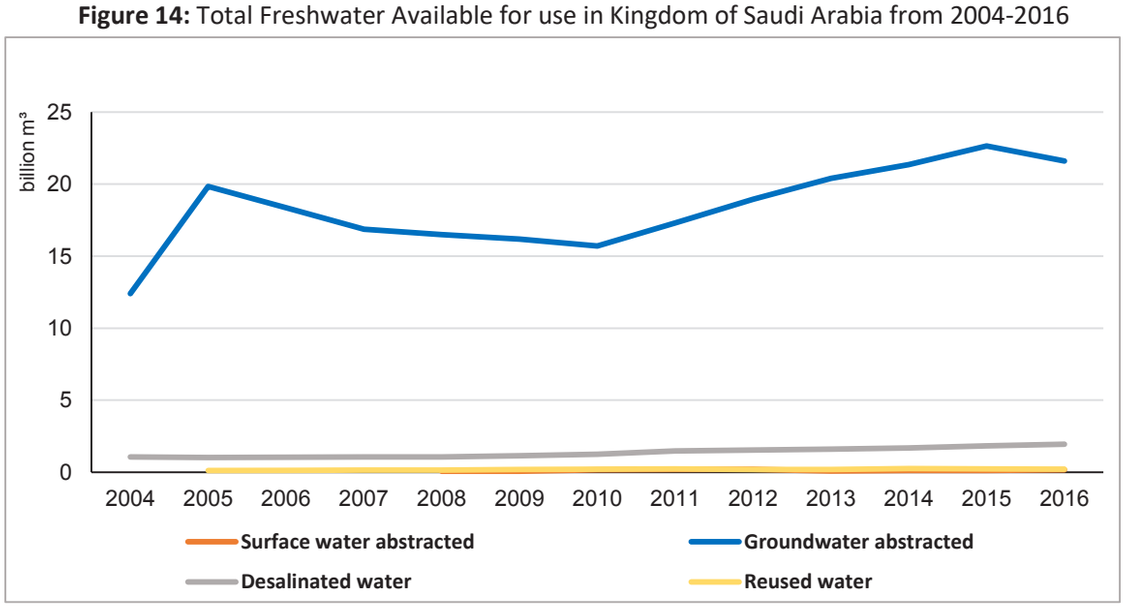


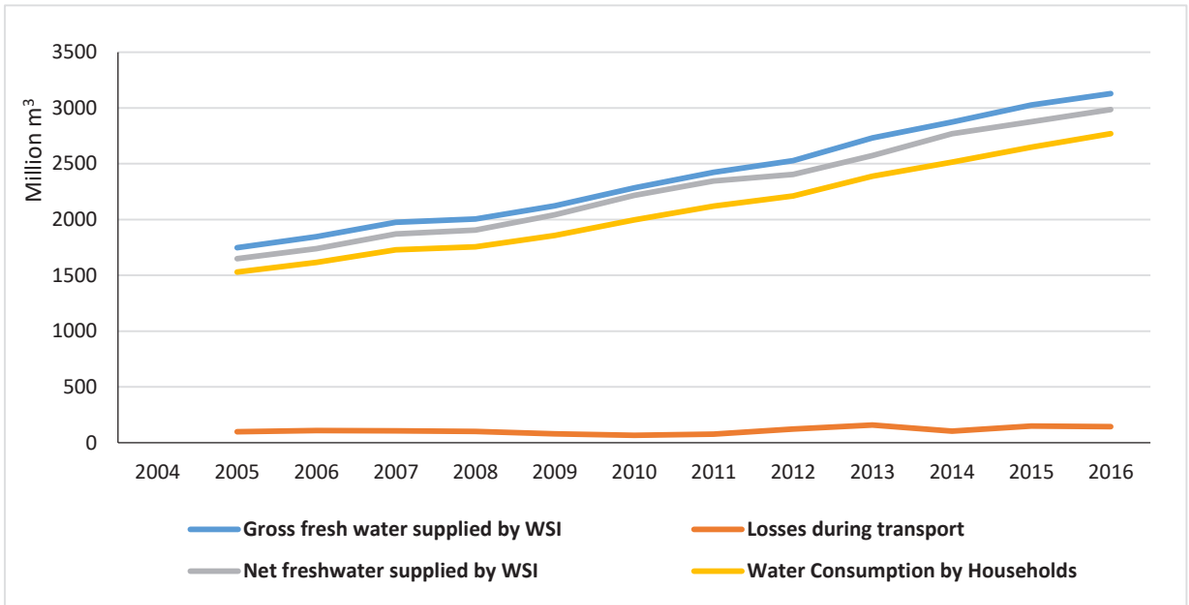
Figure 14 shows the desalinated water per capita in Kingdom of Saudi Arabia was 120.4 Ltr / day in 2005. It reduced gradually until 2008 when it was at its lowest, 112.9 L /day. However, the amount rose continuously since then to reach 168.0 L /day in 2016, which is the highest amount in the series (2005-2016).

Figure 14: Total Freshwater Available for use in Kingdom of Saudi Arabia from 2004-2016

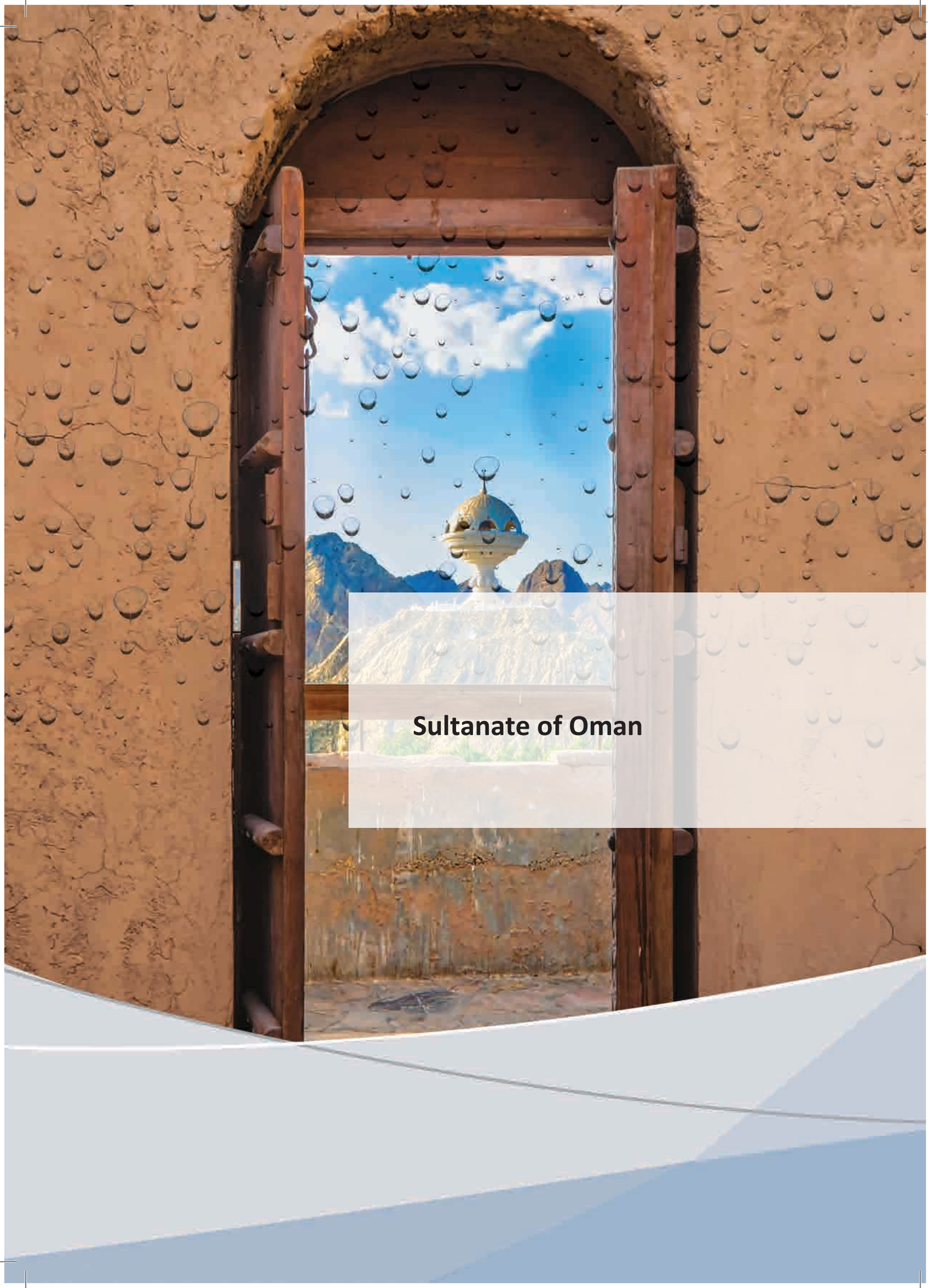


Gross freshwater supplied by the WSI witnessed continuous growth from 2004 to 2016, figure 15 and so did the amount of net freshwater by the WSI and the consumption of households.

Figure 15: Water provided by WSI and water consumption in Kingdom of Saudi Arabia from 2004 to 2016



Amounts of wastewater collected and wastewater treated grew gradually and continuously over the period from 2007 to 2016 and the same applies to the design capacity of wastewater treatment plants despite the fact that their number fell in 2015. Wastewater treated from wastewater collected fluctuated in the same period within the range of 44.4% to 64.1%. Amounts of reused water from the total amounts of wastewater treated changed over the year from 2007 to 2016. They never exceeded 21.1% whereas the lowest is 13.5% records in 2016.



Sultanate of Oman

2.4 Water Statistics in Sultanate of Oman

Sultanate of Oman is located in the south east of the Arabian Peninsula. The total area of Sultanate of Oman is 309,500 km². It has a population 4.4 million people. Though the climate is generally arid and semi-arid, there are differences between regions. For example, it is hot and humid in summer in the coastal areas, hot, dry in the interior, and moderate all year long in high lands and Dhofar region in the south.

Table 6: Water Statistics in Sultanate of Oman in 2015 and 2016 [6]

Variables (in million cubic meters)	**2015**	**2016**	**Growth Rate (%)**
Precipitation	27,506.8	29,495.4	7.2
Surface water Abstracted	102.0	102.0	0.0
Ground water abstracted	1,095.0	1,083.7	-1.0
Desalinated water	239.6	279.6	16.7
Reused water	31.8	33.0	3.8
Total Freshwater available for Use	1,468.4	1,498.3	2.0
Gross Freshwater Provide by WSI	300.8	330.0	9.7
Loss During Transport	103.0	129.1	25.3
Net Freshwater Provided by WSI	197.8	201	1.6
Volume of Wastewater collected	60.4	67.5	11.8
Volume of Wastewater Treated	59.0	66.9	13.4

More Precipitation in 2016

Precipitation increased from 27, 506.8 Million m³ in 2015 to 29,495.4 Million m³ in 2016, which indicates in table 6. This is equal to 7.2% growth.

Additional storing dams in 2016

Surface water abstracted remained constant in 2015 and 2016 at 102.0 Million m^3. While total surface water collected in dams increased from 53.7 million m^3 in 2015 to 280.8 million m^3 in 2016. The number of dams grew by 2.0% from 149 in 2015 to 152 in 2016. The total number of dams comprises the three types: flood protection dams, groundwater recharge dam and storing dams. However, the only increase was in the last type as number grew by 2.9% from 103 to 106. Number of flood protection and groundwater recharge dams remained the same at 2 and 44 respectively. There was no change in the design capacity of dams, stabilized at 299.1 Million m^3.

[6] Not all variables includes Dhofar Governorate data except precipitation.

Less Groundwater abstracted in 2016

The total freshwater available for use in 2016 is 1,498.3 Million m^3, 2.0% higher than 2015 due to the increasing in desalinated water production by WSI. The per capita of total freshwater available for use decreases by 3.9% from 967.3 Ltr / dayin 2015 to 930.0 L /day in 2016.

Groundwater abstracted dropped from 1,095.0 Million m^3 to 1,083.7 Million m^3 by 1.0% in 2016. This amount comprises only abstraction by agriculture and water supply industry. Renewable water sources represent 3.7% of the total precipitation of 2016.

More desalinated water production in 2016

Total amounts of desalinated water recorded in 2016 are 279.6 Million m^3. This is higher than 2015 by 16.7%. The number of water desalination stations rose as well by 4.0% to reach 52 stations in 2016, but the growth in their capacity was only 0.1% in 2016. The majority of desalination stations use RO technology with the exception of Existing Ghubrah, Barka1 and Sohar, which use other technologies. In 2016, per capita of desalinated water is 173.5 L/day, 10.0% higher than 2015.

Increasing in amount of reused water in 2016

There was a 3.8% increase in amounts of reused water from 31.8 Million m^3 in 2015 to 33.0 Million m^3 in 2016. Both desalinated water and reused water account for 20.9% of total freshwater available for use in 2016.

Total amounts of gross freshwater produced by the WSI grew by 9.7% in 2016 and reached 330.0 Million m^3 where the number was 300.8 Million m^3 in 2015. Per capita of water production by WSI is 204.8 Ltr / day, 3.4% more than 2015.The increase in water lost during transport witnessed 25.3% growth while the increase in amounts of net freshwater by WSI was marginal, only 1.6%. Households whose consumption rose by 3.2% in 2016 mainly consume this water. The percentage of population served by the water supply network rose from 56.0% in 2012 to 60.0% in 2016 from the total population in Sultanate of Oman.

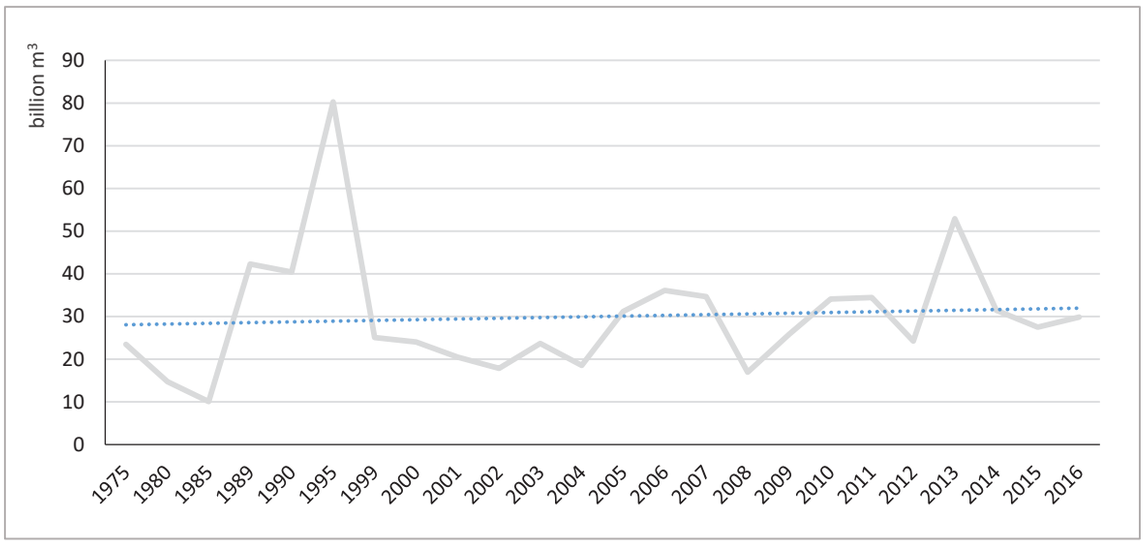
There was 11.8% growth in the amounts of wastewater collected and 13.4% growth in the amounts of wastewater treated. In 2016, wastewater treated represents 99.1% of wastewater collected, 0.2% higher than 2015. The total number of wastewater treatment plants was 66 in 2016 with a 6.5% growth rate in comparison to 62 plants in 2015. Reused water in 2016 is 49.4% of the total of wastewater treated compared to 53.9% in 2015. This decrease is equal to 8.4%. The design capacity grew as well by 6.9% in 2016 and reached 271.8 ($1000m^3/d$). 13.9% of population are connected to wastewater treatment in 2016.

2.4.1 Key Results Indicators

Data available on precipitation as shows in figure 16 in Sultanate of Oman from 1975 to 2016 demonstrates the following general trends. Precipitation levels fluctuated. The highest level was 87,781.9 Million m^3 in 1997 while the lowest was 10,071.4 Million m^3 in 1985. There was also a

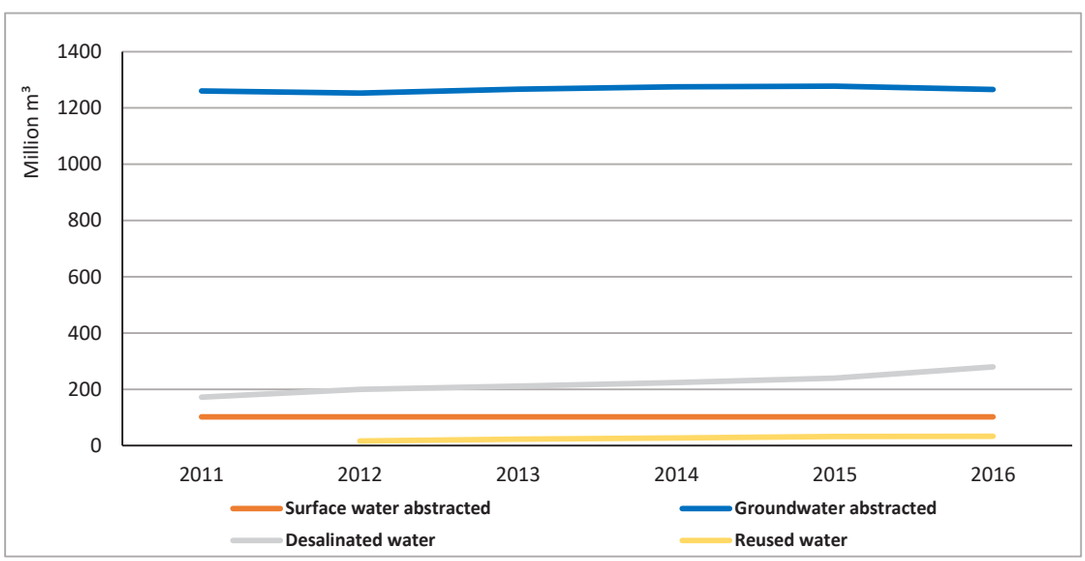
fluctuation in the number of rainfall stations with the peak in 2016 as their number mounted to 63 stations.

Figure 16: Precipitation in Sultanate of Oman from 1975 to 2016



The figure 17 illustrates that amounts of surface water abstracted remained unchanged at 102.0 Million m³ from 2012-2016. The number of dams rose constantly from 49 dams in 1996 to 152 in 2016.

Figure 17: Total Freshwater Available for use in Sultanate of Oman from 2011- 2016



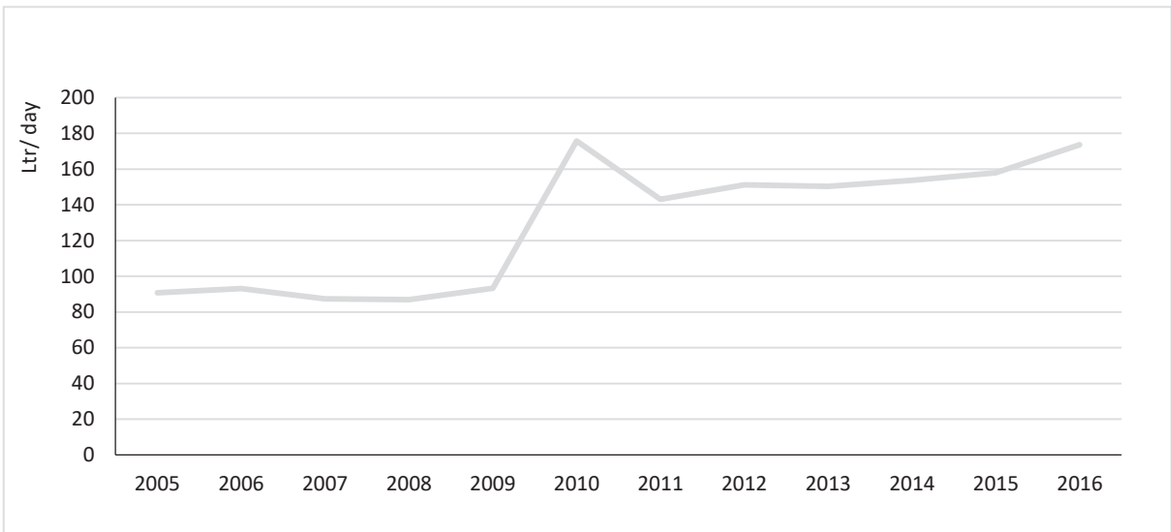
*

Oman data does not include Dhofar Governorate

The design capacity of dams remained the same at 74.7 Million m^3 from 1996 to 2001. Then it rose slightly until 2008. The most dramatic increase in the design capacity of dams was in 2009 as it reached 265.1 Million m^3 compared to 87.6 Million m^3 in the year before. Nevertheless, the period from 2014 to 2016 witnessed no changes in dams' design capacity.[7]

Data available on groundwater abstracted from 2011 to 2016 show no stability nor a specific trend, as there were fluctuations in amounts. Amounts of groundwater abstracted by agriculture remained constant at 1,033.6 Million m^3 from 2011 to 2016 whereas amounts of groundwater abstracted by WSI fluctuated over the same period. Total amounts of desalinated water went up gradually from 87.5 Million m^3 in 2007 to 279.6 Million m^3 in 2016.

Figure 18: Desalinated water per capita in Sultanate of Oman from 2005 to 2016



* Oman data does not include Dhofar Governorate

Figure 18 indicates that the desalinated water per capita in Sultanate of Oman was 90.8 Ltr / day in 2005. It rose slightly to 93.1 Ltr / day in 2006. It decreased and stabilized at 86.9 Ltr / day in 2007 and 2008. The most significant increase was in 2010 as it almost doubled to reach 175.7 Ltr / day, which is the highest in the time series. It slumped to 143.0 Ltr / day in 2011. Then, there was a continuous rise from 151.2 Ltr / day in 2012 to 173.5 Ltr / day in 2016.

The number of water desalination stations grew from 32 in 2007 to 52 in 2016. However, this growth was interrupted by periods of stability from 2009 to 2011 and again in 2012 and 2013. The design capacity of water desalination stations also increased constantly between 2007 and 2016. Concerning reused water, statistics available from 2011 to 2016 show a constant increase.

The gross amounts of freshwater produced by WSI increased annually from 68.0 Million m^3 in 1996 to 330.0 Million m^3 in 2016. Water produces by WSI per capita grew continuously from 84.1 Ltr / day in 1996 to 204.8 Ltr / day in 2016. There was also an annual increase in the amounts of water lost during transport from 2006 to 2008.

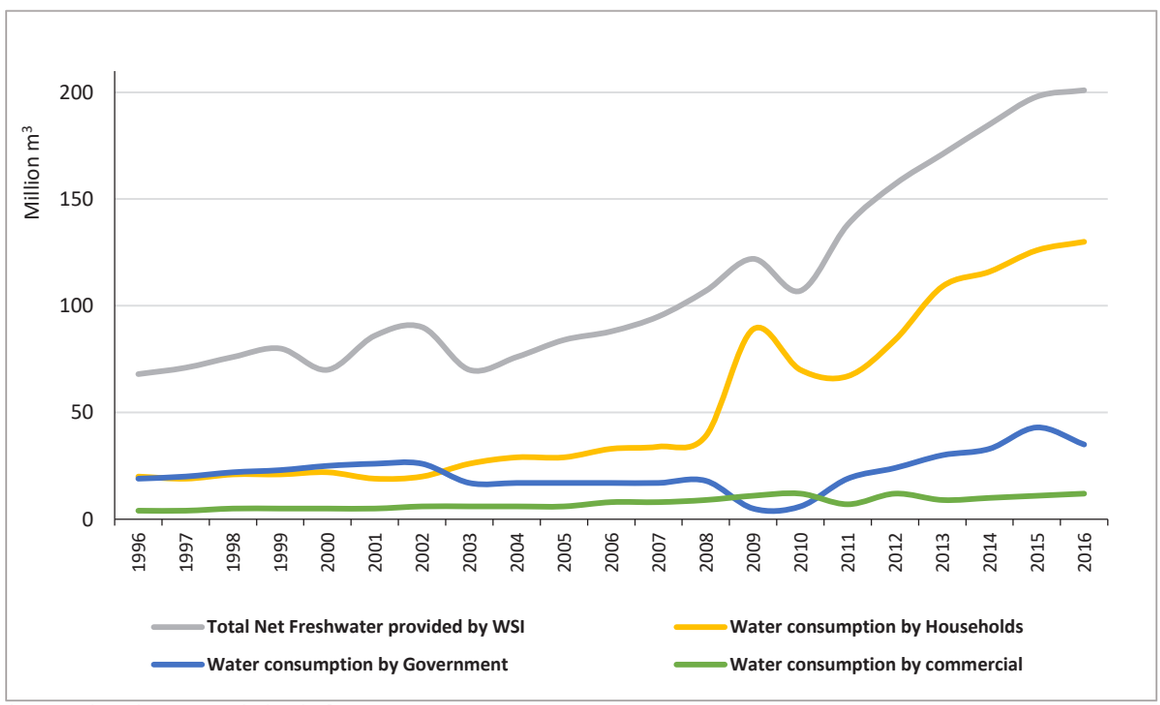
[7] Data in Figure. 17, 18 and 19 do not include water quantities in Dhofar Governorate.

Figure 19 shows the increase in net fresh water supply from WSI from 1996 to 1999, followed by a fluctuation in net fresh water from 2000 to 2004 and then increased until 2009, followed by a decrease in 2010, 2011 witnessed a rise and continued until 2016

Water consumption by households from net freshwater by the WSI varied considerably in the period from 1996 to 2016. The peak was 73.0% in 2009 while the lowest was 22.2% in 2001 and 2002. Consumption by government was at its top at 35.7% in 2000 whereas it slumped to 4.1% in 2009.

The highest commercial, water consumption was 11.2% in 2010. The lowest was 5.3% in 2011, 2013 until 2015. Water supplied by tankers was at its highest 43.3% in 2002 and its lowest was 11.4% in 2016.

Figure 19: Water provided by WSI and water consumption per sectors in Sultanate of Oman from 1996 to 2016



* Oman data does not include Dhofar Governorate

Both indicators of wastewater collected and wastewater treated demonstrate an annual increase from 2010 to 2016. Reused water from wastewater treated increased from 41.0% in 2012 to 58.6% in 2014, but fell slightly in 2015 and again in 2016 to reach 49.4%. However, wastewater treated from wastewater collected rose annually from 89.5% in 2010 to 99.1% in 2016.The same does not apply to the numbers of wastewater treatment plants as their numbers rose from 63 in 2010 to 64 in 2011, but then dropped to 61 plants in 2012 and 2013. Another drop followed this in 2014. However, numbers rose again in 2015 and 2016 to reach 66 plants, which is the highest. The design capacity of plants increased from 185.6 (1000m³/d) in 2010 to 271.8(1000m³/d) in 2016.

Qatar State

2.5 Water Statistics in Qatar State

Qatar State has an area of about 11,627.0 Km^2. This area includes a number of small islands as well. The total population of Qatar is 2.6 million people. Qatar State has an arid desert climate with scanty rainfall. This climate is also characterized by high summer temperatures, very strong winds, high evaporation rates and high humidity.

Data available on precipitation and groundwater abstracted cover the period from 2004 to 2014. Precipitation in 2014 was 323.3 Million m^3 with 29.5% decrease compared to the year before 2013 when precipitation was 458.5 Million m^3. Number of stations was the same in both years, 13 stations. Total freshwater available for use grew by 3.6% to reach 914.3 Million m^3 in 2016 which corresponds to 956.9 Ltr / day per capita.

Amounts of groundwater abstracted levelled at about 249.5 Million m^3 in 2011 until 2013 with a minimal growth rate of 0.1% in 2014. In 2014, renewable water sources represented 77.4% of total precipitation and 29.8% of total freshwater available for use.

Desalinated water produced in 2016 is 560.0 Million m^3 as shows in table 7, which is higher than the production of 2015 by 4.7%. One more desalination water station is added in 2016 corresponding to a growth rate of 12.5% and thus the total of stations reaches nine stations.

Table 7: Water Statistics in Qatar State in 2015 and 2016

Variables (in million cubic meters**)**	**2016**	**2015**	**Growth Rate (%)**
Precipitation	…	…	…
Ground water abstracted	…	…	…
Desalinated water	560.0	535.0	4.7
Reused water	104.0	97.0	7.2
Total Freshwater available for Use[8]	914.3	882.3	3.6
Gross Freshwater provide by WSI	560.0	535.0	4.7
Loss During Transport	22.6	26.3	-14.0
Net Freshwater supplied by WSI	537.4	508.7	5.6
Volume of Wastewater collected	208.1	197.5	5.4
Volume of Wastewater Treated	203.3	193.8	4.9

The design capacity of the nine stations is 1.7 Million m^3/d while that of the eight stations in 2015 was 1.6 Million m^3/d. The growth rate in design capacity of the station is 6.0%.

As for the technologies used in the desalination water stations, in 2016 seven stations use MSF with a design capacity of 491.1 Million m^3, 1 station uses RO with design capacity of 36.5 Million

[8] Total freshwater available for use in Qatar includes the amount of groundwater abstracted in 2014

m^3 and one station used MED with a capacity of 104.5 Million m^3. The station using RO is the new addition to the stations in 2016.

More non-conventional water produced in 2016

Figure 7 indicates that total amount of reused water increased from 97.0 Million m³ in 2015 to 104.0 Million m³ in 2016 with 7.2% growth rate. This figure of reused water represents 51.2% of the overall amounts of wastewater treated in 2016. Both desalinated water and reused water represent 72.6% of total freshwater available for use in 2016.

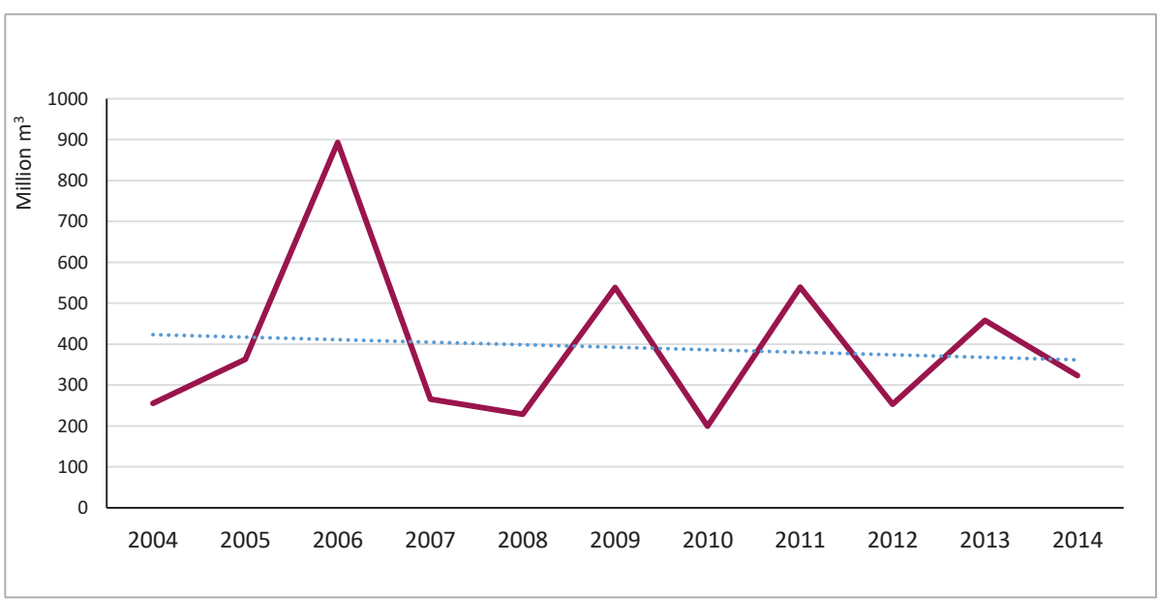
Water produced by WSI in 2016 is 560.0 Million m^3, 4.7% higher than that of 2015 when it was 535.0 Million m^3. The per capita of water produced by WSI is 586.1 Ltr / day in 2016, 2.5% less than 2015.Losses during transport fell by 14.0% from 26.3 Million m³ in 2015 to 22.6 Million m³ in 2016 and the net freshwater amount of water by the supply industry rose in 2016 to reach 537.4 Million m³ which is higher than 2015 by 5.6%.

Additional WWTP design capacity in 2016

Wastewater collected in 2016 is 208.1 Million m^3. This figure is higher than the figure of 2015 by 5.4%. The growth rate in wastewater treated in 2016 is 4.9% as 203.3 Million m^3 treated in 2016 compared to 193.8 Million m^3 in 2015. The total number of wastewater treatment plants remained unchanged at 23; but the design capacity increased from 295.3 Million m^3 in 2015 to 301.9 Million m^3 in 2016, which is equal to 2.2% growth rate. This increase in capacity is totally in the tertiary treatment technology. In 2016, 5 plants used the secondary treatment while 18 used the tertiary treatment.

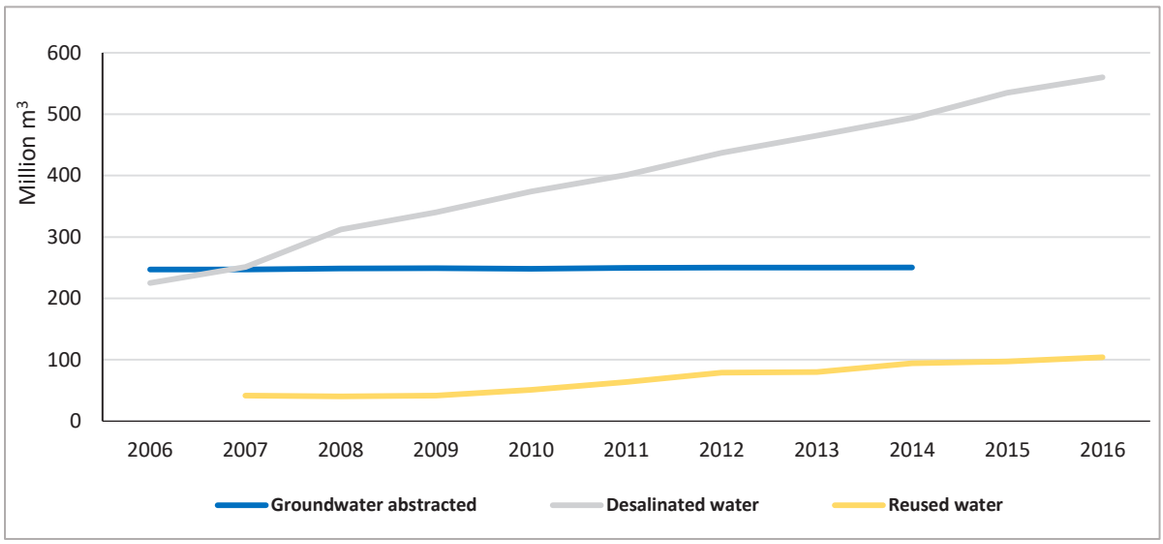
2.5.1 Key Results Indicators

Figure 20: Precipitation in Qatar State from 2004 to 2014



Statistics show in figure 20 the following trends and observations. Precipitation levels fluctuated over the period from 2004 to 2014. The number of rainfall stations decreased by one station in 2015, but then rose significantly by 50.0% in 2016 and continued to grow from six stations in 2004 to 13 stations in 2014. The number reached 18 stations.

Figure 21: Total Freshwater Available for use Qatar State from 2006 to 2016



Minimal changes occurred in the amounts of groundwater abstracted as the amounts ranged between 247.0 Million m³ and 250.3 Million m³ in the years between 2006 and 2014. It is noted in figure 21 that the amounts stabilized at 250.2 Million m³ from 2011 to 2014. There is a continuous growth in the amounts of desalinated water from 178.0 Million m³ in 2004 to 560.0 Million m³ in 2016 as well as in the desalinated water per capita.

Though the number of water desalination stations generally grew from 2007 to 2016, there was a period of stagnation from 2008 to 2014.The design capacity of the stations also grew from 2007 to 2011 and then stabilized from 2011 to 2014. A significant increase occurred in 2015 and again in 2016.

Figure 22: Desalinated water per capita in Qatar State from 2005 to 2016

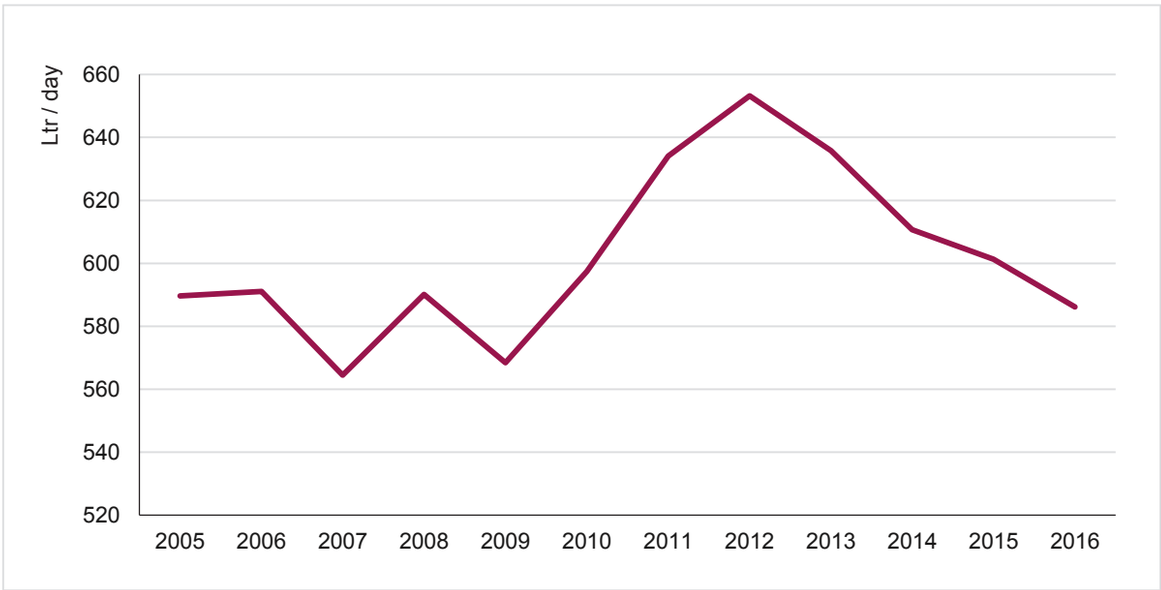


Figure 22 shows, the desalinated water per capita in Qatar State fluctuated from 2005 to 2009. Then, it started its rise in 2010 and it reached its highest 653.2 Ltr / day in 2012. However, the amounts declined gradually after that to reach 586.1 Ltr / day in 2016.

Despite the slight decrease in the quantities of reused water in 2008, which amounted to 46% compared with the year 2007, which amounted to 60%. The percentage of reused wastewater from treated wastewater remained stable between 2009 and 2016, reaching its peak in 2012 when 61% of treated water was reused, 51% in 2016.

Amounts of gross freshwater produced by the WSI show the same trend observed about the mounts of net water supplied as both grew constantly from 2007 to 2016. There was a constant drop in amounts lost during transport from 34.1% in 2007 to 4.0% in 2016. All indicators related to wastewater, including wastewater collected, wastewater treated, number of wastewater treatment plants and their design capacity, went up from 2007 to 2016.

Kuwait State

2.6 Water Statistics in Kuwait State

Kuwait State is located at the head of the Gulf. It has an area of 17,818 Km². it has a population of 4.1 million people. Kuwait State has a desert climate with long, hot summer and a cooler short winter. Climate is also characterized by sandstorms in the hot season.

Table 8: Water Statistics in Kuwait State in 2015 and 2016

Variables (in million cubic meters)	**2015**	**2016**	**Growth Rate (%)**
Precipitation	1,742.6	1,585.8	-9.0
Ground water abstracted	83.0	85.2	2.7
Desalinated water	677.0	712.4	5.2
Reused water	44.9	...	…
Total Freshwater available for Use	804.9	[9]842.4	4.7
Gross Freshwater provide by WSI	677.0	712.4	5.2
Loss during transport	37.4	39.3	5.1
Net Freshwater supplied by WSI	639.6	673.1	5.2
Volume of wastewater collected	309.2	319.0	3.2
Volume of wastewater Treated	263.2	246.7	-6.3

Precipitation decreases in 2016

Precipitation in 2016 is 1,585.8 Million m³, which is 9.0% less than 2015 when it was 1,742.6 Million m^3. The number of rainfall stations was 24 in 2015 and 2016. In 2016, renewable water sources represent 5% of total precipitation and 10% from total freshwater available for use. It increases by 4.7% from 804.9 Million m^3 in 2015 to 842.4 Million m^3 in 2016, which represents 565.3 Ltr / day per capita , 1.8% higher than 2015.

More desalinated water produced in 2016

Total amounts of desalinated water in 2016 is 712.4 Million m³, 5.2 % higher than 2015. Number of water desalination plants increased by 11.1% in 2016 and the total number was 10 stations with a design capacity of 1,035.9 Million m^3, which is 18.3% higher than the total design capacity of the nine stations operating in 2015. In 2016, stations used the three technologies as follows. Seven stations used MSF with a design capacity 758.5 Million m^3, two stations used RO with a design capacity of 99.3 Million m^3 and the new station that started operating in 2016 used MED with a design capacity of 177.4 Million m^3.

Reused water quantities rose by 12.5%, as they were 44.9 Million m^3 in 2015 compared to 39.9 Million m^3 in 2014. Reused water amounts consisted 18.2% of the amounts of wastewater treated in both years 2014 and 2015. Both desalinated water and reused water represent 89.9% of total freshwater available for use.

[9]Total water available for use include the amount of reused water in 2015

Water produced by the WSI in 2016 is 712.4 Million m^3, which is higher than that of 2015 by 5.2%. Similarly, the net water amount of water supplied by the water supply industry went up by 5.2%. Loss during transport increased by 5.1%. Net freshwater is distributed to the sectors as per the following predetermined ratio, 75.0% for households, 4.0% for agriculture, forestry and fisheries, 8.0% for the manufacturing industry, 2.0% for the electricity industry and 11.0% for the other economic activities.

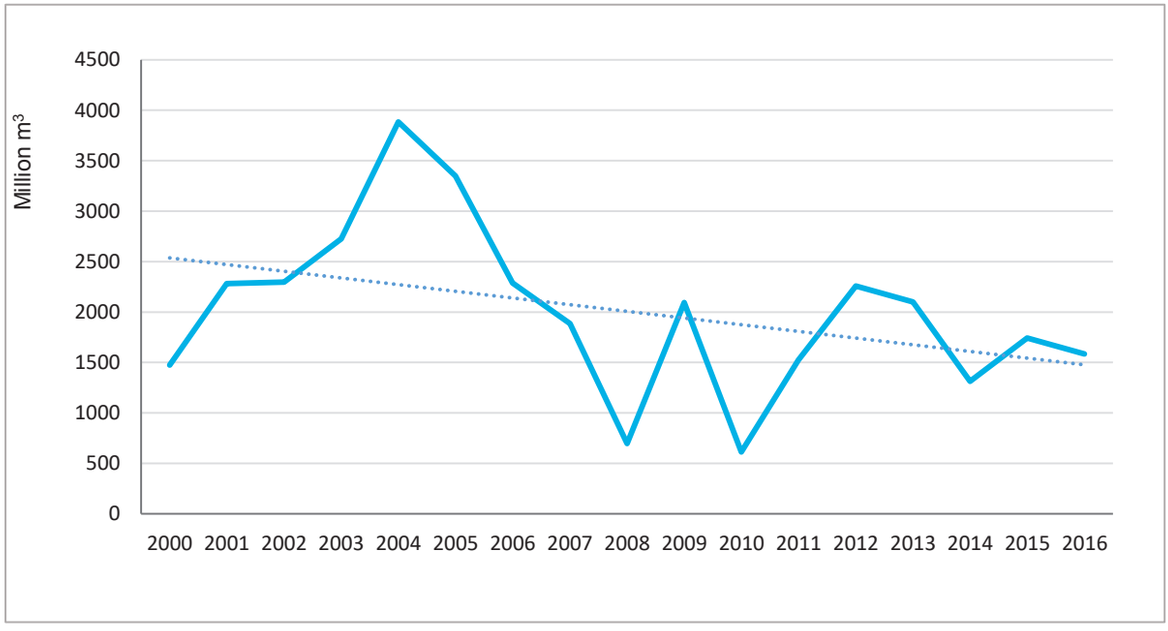
Increase in the volume of wastewater collected and treated in 2016

Total amounts of wastewater collected increased from 309.2 Million m^3 in 2015 to 319.0 Million m^3 in 2016, with a growth rate of 3.2%. However, total amounts of wastewater treated dropped by 6.3% in 2016 compared to 2015. Reused water from wastewater treated grow slightly from 17.0% in 2015 to 18.2% in 2016. Wastewater treated from wastewater collected decreased from 85.1% in 2015 to 77.3% in 2016.The number of wastewater treatment plants was six in 2014 and remained stable in 2015 and so did the design capacity, which was 823.6 (1000m^3/d) in both years. Wastewater treatment plants used only one technology, which was the tertiary treatment.

2.6.1 Key Results Indicators

General observation about the indicators provided are as follows. Precipitation levels fluctuated with the highest being recorded in 2004 and the lowest in 2010. Rainfall stations rose from 20 stations in 2007 to 24 stations in 2016.

Figure 23: Precipitation in Kuwait State from 2000 to 2016



Renewable water from total freshwater available for use decreased from 13.0% in 2012 to 10.1% in 2016. Amounts of groundwater abstracted decreased constantly from 2000 to 2015, but went up in 2016 as figure 24 demonstrated. Indicators of total amounts of desalinated water, stations and their capacity all show constant increase in the period of 2000 to 2016.

Figure 24: Total Freshwater Available for use in Kuwait State from 2000 to 2016

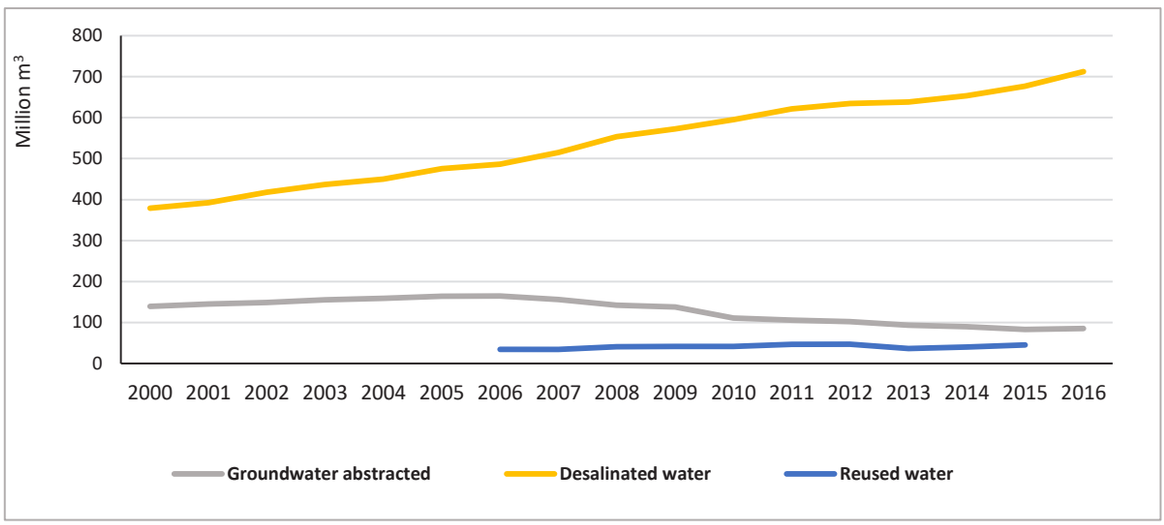
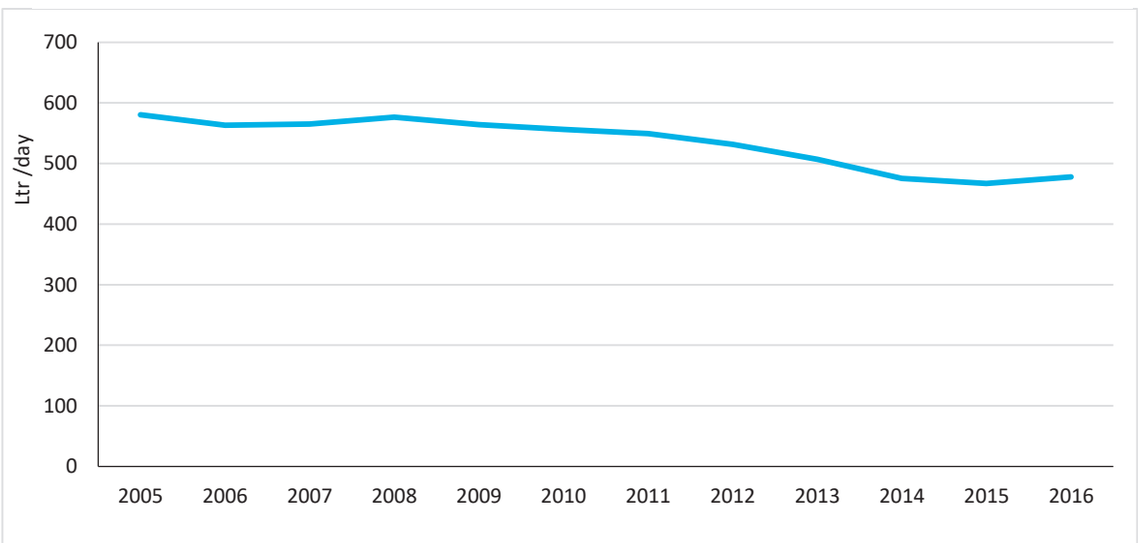


Figure 25 demonstrates that the desalinated water per capita in Kuwait was 580 Ltr / day in 2005, which was the highest of all in the period covered (2005-2016). This was followed by slight decrease in 2005 when it was 580.4 Ltr /day. Nevertheless, the amounts went up in 2007 and again in 2008 when it reached 576.5 Ltr / day. A continuous decrease followed from 2009 to 2015 when the amount of 467.1 Ltr / day was the lowest in the time series. In 2016, it rose to 478.0 Ltr / day.

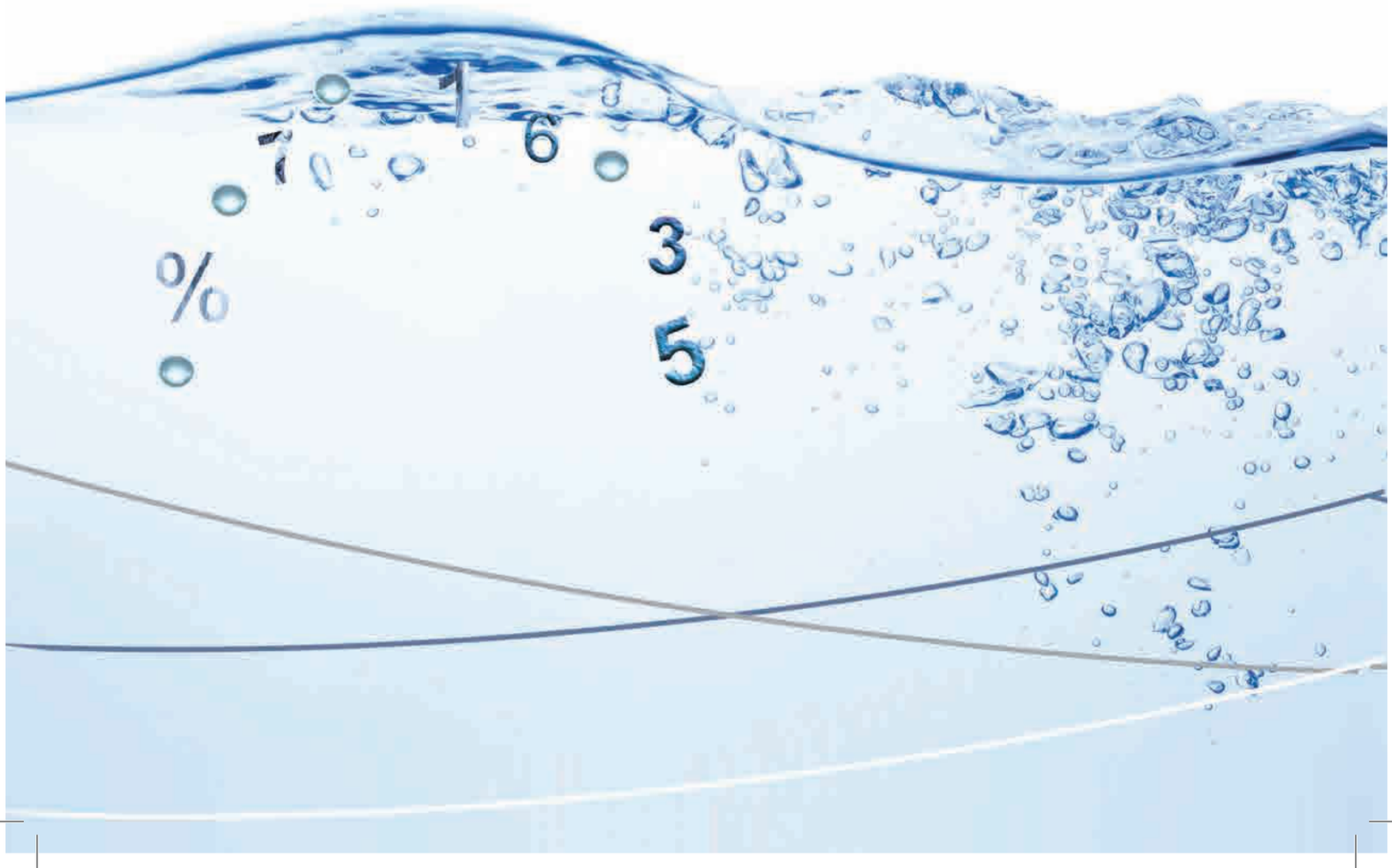
Figure 25: Desalinated water per capita in Kuwait State from 2005 to 2016



One new technology, MED was introduced in 2016. Total amounts of reused water grew constantly from 2006 to 2012 and then declined in 2013, but continued to rise in the subsequent years. Percentage of reused water to the overall treated wastewater ranged between 4.7% to 6.0% in same period. Non- conventional water sources from total freshwater available for use continued to grow from 76.0% in 2006 to 89.9% in 2016.

Total amounts of gross freshwater and net freshwater produced by the WSI went up over the period 2000-2016 while figures of water lost during transport demonstrate stability at (5.5-6.6)% in the same period.

Wastewater collected increased from 2007 to 2009. Nevertheless, there was a drop in 2010, which was followed by a continuous growth from 2011 to 2016. A mounts of wastewater treated rose from 2007 to 2009 and then dropped in 2010. This was followed by constant increase, which was interrupted by a decline in 2016. Number of wastewater treatment plants went up slowly from five plants in 2007 to 7 plants in 2011. There was a stability for three years and a decline in 2014 when the number of plants was six and stayed the same in 2015. The design capacity's behavior was the same as that of number of wastewater treatment plants; there was a rise from 2007 to 2011, followed by stability for three years and then a decline in 2014, which remained stable in 2015.



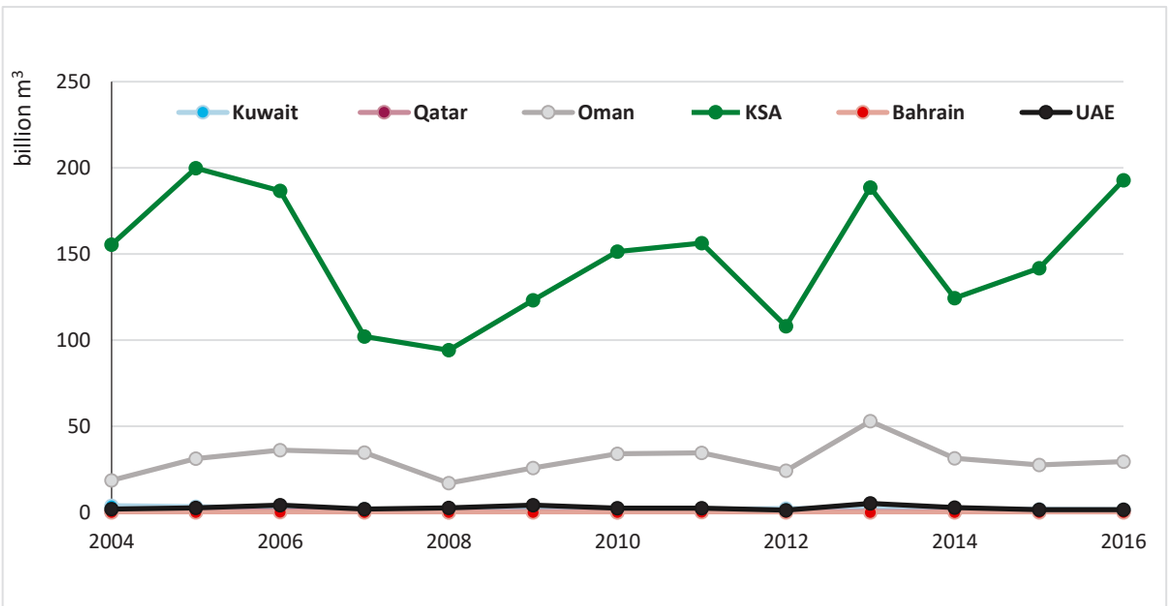
Chapter Three

Country-to-Country Comparisons

3.1 Country -to- Country Comparison

Considering statistics available in GCC countries between 2004 and 2016, precipitation levels varied considerably from one country to another and one year to another. Despite variations, general trends can be observed. In 2008, precipitation levels rose in all GCC countries with the exception of United Arab Emirates whereas Kuwait State was the exception to the decline trend in 2012. All countries had higher precipitation rates in 2013. Saudi Arabia had the highest precipitation rates over the period from 2004 to 2016 as shown in figure 26. Sultanate of Oman comes in the second place and United Arab of Emirates in the third. Kingdom of Bahrain comes in the last place as it received the lowest precipitation over the same period.

Figure 26: Precipitation in GCC countries from 2004 to 2016

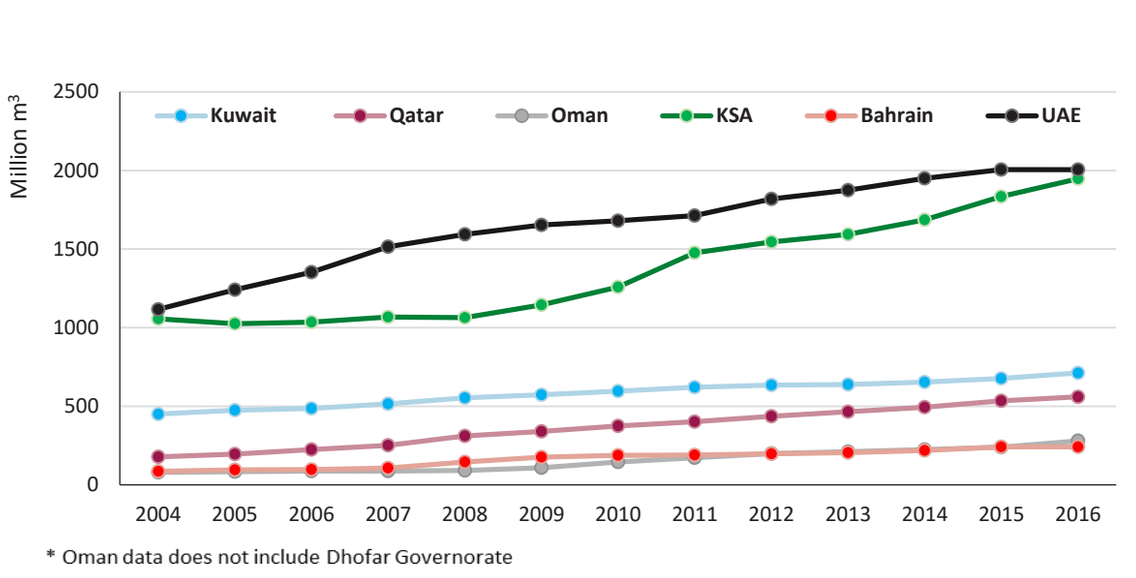


Precipitation rates have their implications on other indicators of surface water and dams. Dams are only available in three countries, which are Kingdom of Saudi Arabia, Sultanate of Oman and United Arab Emirates. Kingdom of Saudi Arabia has the highest number of dams followed by Sultanate of Oman and the United Arab Emirates. Similarly, Kingdom of Saudi Arabia has the most amounts of surface water compared to other two countries, Sultanate of Oman and United Arab Emirate. Surface water is utilized as drinking water in Kingdom of Saudi Arabia and Sultanate of Oman, whereas dams in United Arab Emirates are mainly used for protection from floods and recharge purposes.

Amounts of groundwater abstracted were the highest in Kingdom of Saudi Arabia from 2011 to 2015 while Kuwait State had the least quantities in the same period. All GCC countries use groundwater for agriculture except Kuwait State due to the fact that the most groundwater is brackish water and freshwater only accounts for 0.1 Million m³.

As the figure 27 shows, the country that depends the most on desalinated water is United Arab Emirates as total amounts of desalinated water in United Arab Emirates were the highest from 2007 to 2016. Kingdom of Saudi Arabia is the second in terms of amounts of desalinated water produced though Kingdom of Saudi Arabia has larger area and bigger populations than United Arab Emirates.

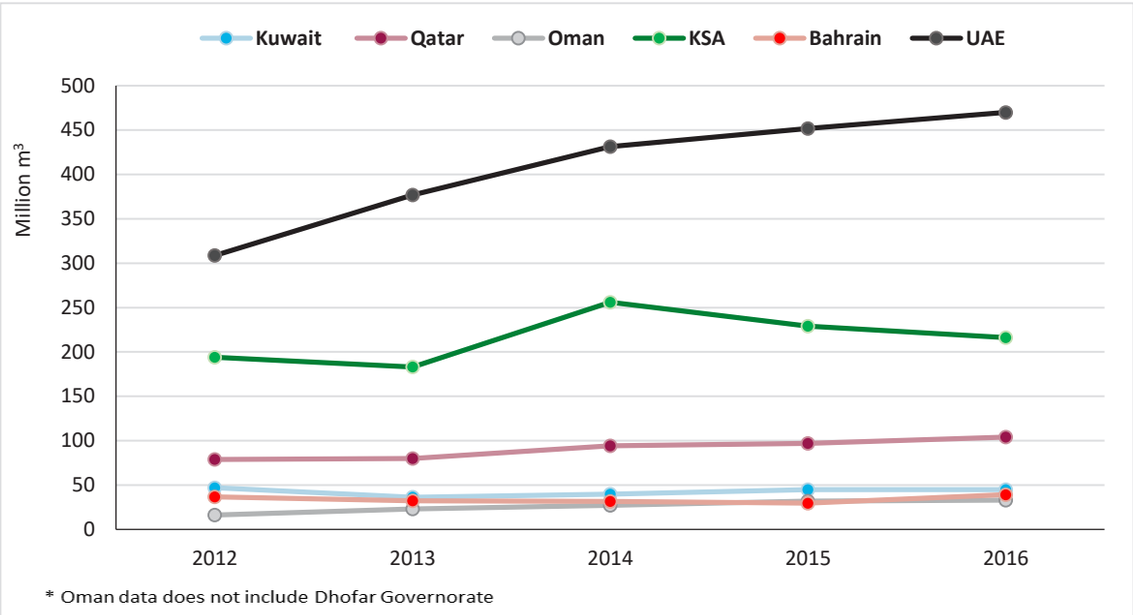
Figure 27: Desalinated water production in GCC countries from 2004 to 2016



This is attributed to the fact that Kingdom of Saudi Arabia depends to a great extent on surface water and groundwater resources. Due to the lack of surface water resources in Kuwait State and Qatar State, these two countries rely mainly on desalinated water and come in third and fourth place respectively in this regard. The least amounts of desalinated water were recorded in Sultanate of Oman from 2007 to 2012 and again in 2015 due to the availability of other conventional sources. Kingdom of Bahrain had the least quantities in 2013, 2014 and 2016.

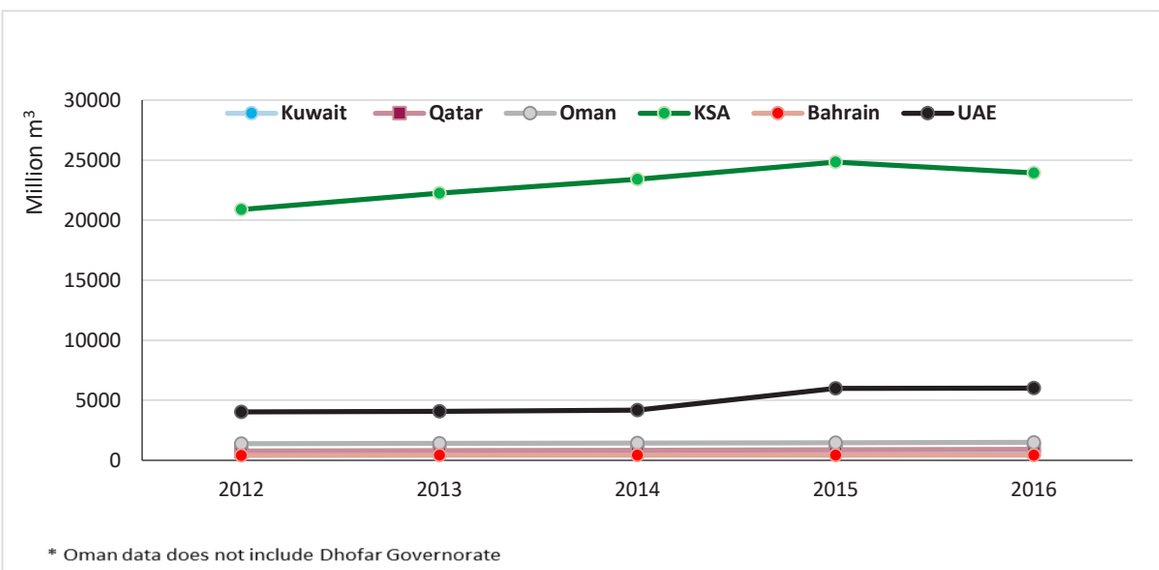
GCC countries shows no consistency in the indicator of reused water in figure 28. However, United Arab Emirates is the country that had the highest figures from 2012 to 2016 followed by Kingdom of Saudi Arabia, Qatar and Kuwait States. Sultanate of Oman and Kingdom of Bahrain had the least amounts of reused water.

Figure 28: Reused water in GCC Countries from 2012 to 2016



Total freshwater available for use was the highest is Kingdom of Saudi Arabia from 2012 to 2016 whereas Kingdom of Bahrain had the least amounts as shown in figure 29. UAE came second while Sultanate of Oman came third. Figures of total freshwater available for use in Kuwait and Qatar States were in the same range.

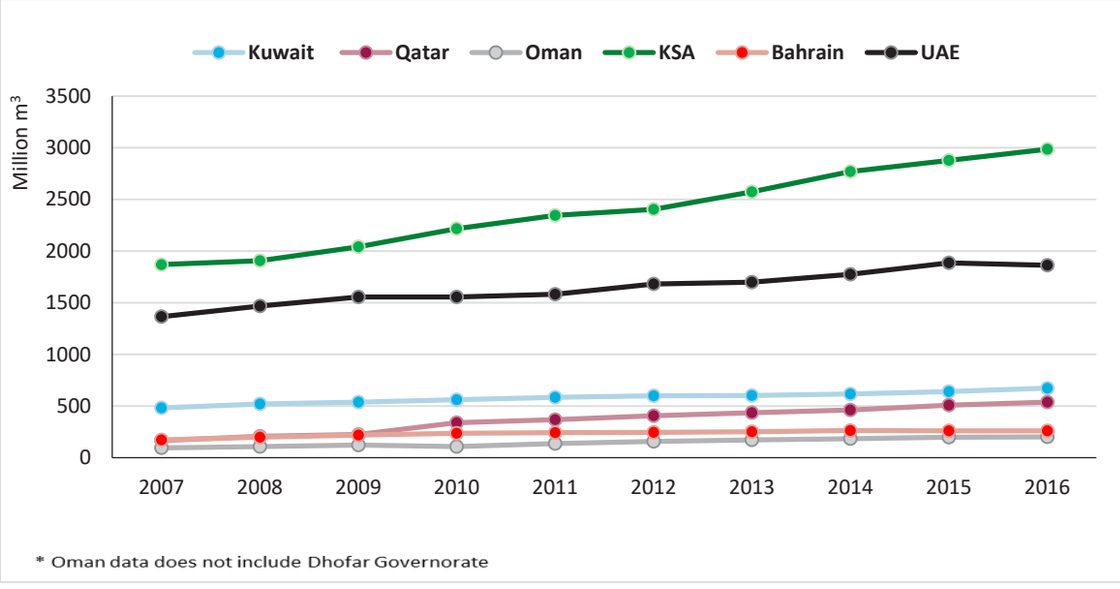
Figure 29: Total freshwater available for use in GCC Countries from 2012-2016



Amounts of gross freshwater produced by WSI declined in all countries in 2007 while the years from 2014 to 2016 witnessed growth in all of the GCC countries. Kingdom of Saudi Arabia had the largest amounts in the period from 2007 to 2016. United Arab Emirates came in the second place followed by Kuwait and the Qatar States whereas Sultanate of Oman and Kingdom of Bahrain had the least amounts.

Total amounts of water lost during transport were the highest in United Arab Emirates from 2007 to 2016 except in 2009 when Qatar State had the most amounts. The lowest quantities were in Kingdom of Bahrain ranging from 4 Million m³ to 7 Million m³. Factors impacting fluctuations in amounts of water lost during transport include condition of pipes in the water network and water meters.

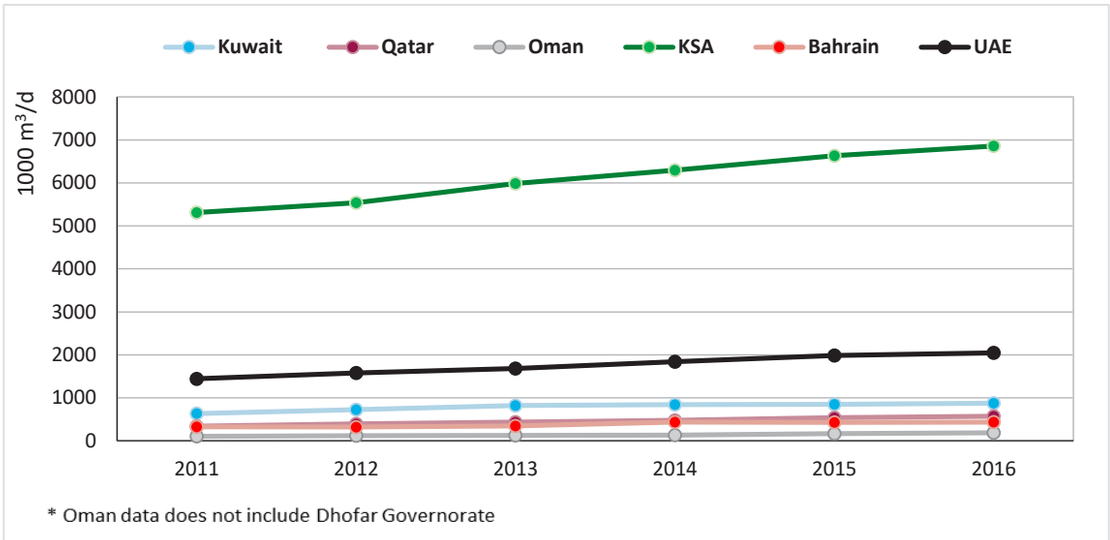
Figure 30: Net freshwater provided by WSI in GCC Countries from 2007-2016



Total quantities of net freshwater supplied by WSI as indicates in figure 30 were the highest in Kingdom of Saudi Arabia consistently from 2007 to 2016. In the second position was United Arab Emirates while Kuwait State was third. The least quantities were in Sultanate of Oman over the same period.

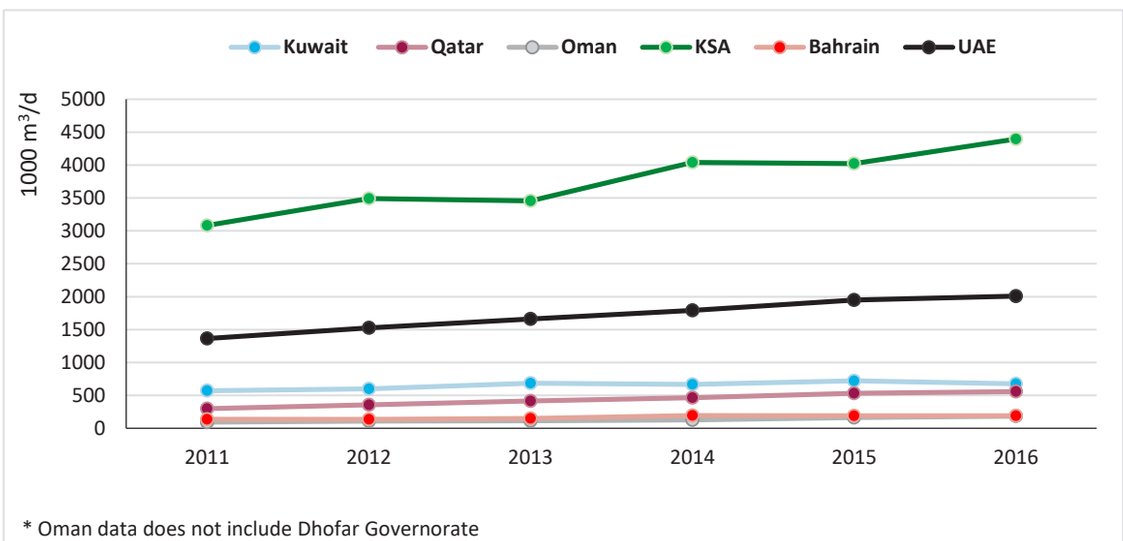
Amounts of wastewater collected and wastewater treated as shown in figure 31 & 32 increased in all countries in 2015 and 2016. Kingdom of Saudi Arabia occupied the first position followed by United Arab Emirates while Sultanate of Oman has the least quantities.

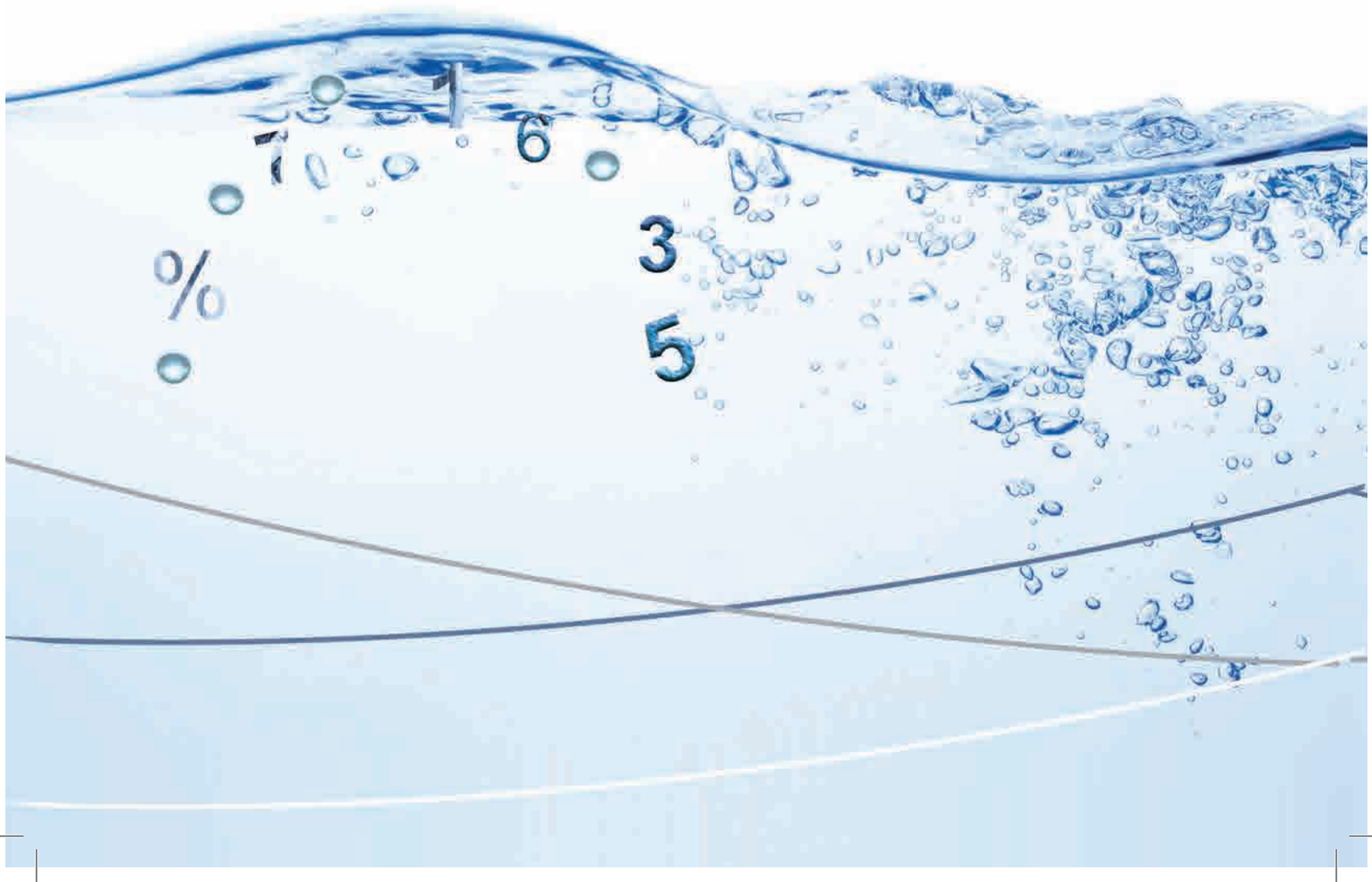
Figure 31: Wastewater collected in GCC Countries from 2011- 2016



Kingdom of Saudi Arabia had the biggest number of wastewater treatment plants and the highest capacity from 2007 to 2016. Number of plants and their design capacity increased in all countries in 2016 except in Kuwait State because one plant, Al-Jahra plant, was closed in 2014 for maintenance.

Figure 32: Wastewater treated in GCC Countries from 2011-2016





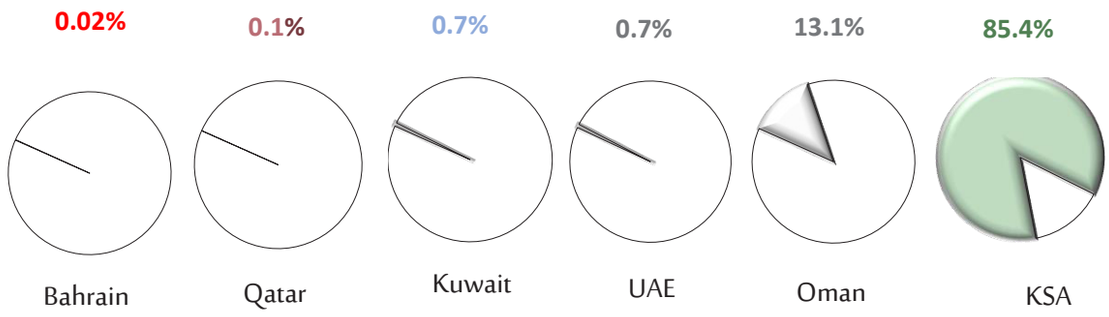
Chapter Four

Country to GCC aggregates comparison

4.1 Country to GCC aggregates comparison in 2016

Figure 33 indicates that in 2016, Kingdom of Saudi Arabia's contribution to the total precipitation in GCC was the highest, 85.4%. Sultanate of Oman was the second with 13.1%. Kingdom of Bahrain and Qatar State contributed proximately by 0.02%, which was the least among all.

Figure 33: Contribution of the GCC countries to the amount of rainfall from the total quantity in the GCC for 2016

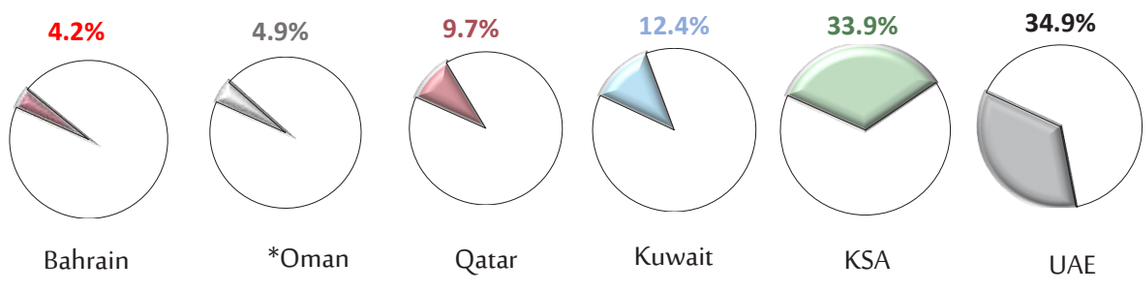


* Oman data does not include Dhofar Governorate

Kingdom of Saudi Arabia also contributed the most in the area of groundwater abstracted, as its contribution was 80.9%. The second was United Arab Emirates with 13.2% contribution. Kuwait State had the least contribution of 0.3%.

With regard to the production of desalinated water figure 34 illustrates that United Arab Emirates contributed 34.9% to total of GCC countries. Kingdom of Saudi Arabia was the second with 33.9%. Kingdom of Bahrain contributed by 4.2%, which was the least among all.

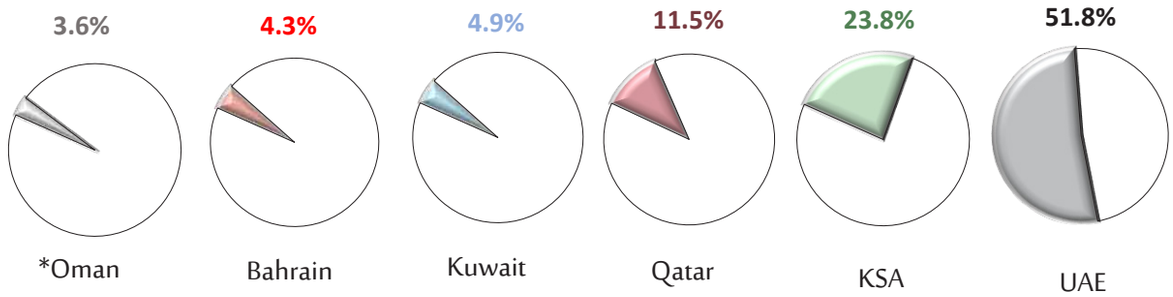
Figure 34: Contribution of the GCC countries to desalinated water production from the total amount in the GCC for 2016



* Oman data does not include Dhofar Governorate

United Arab Emirates contributed 51.8% of the total reused water in GCC as indicates in figure 35. Saudi Arabia contributed 23.8%. The least contribution was Oman, by 3.6%.

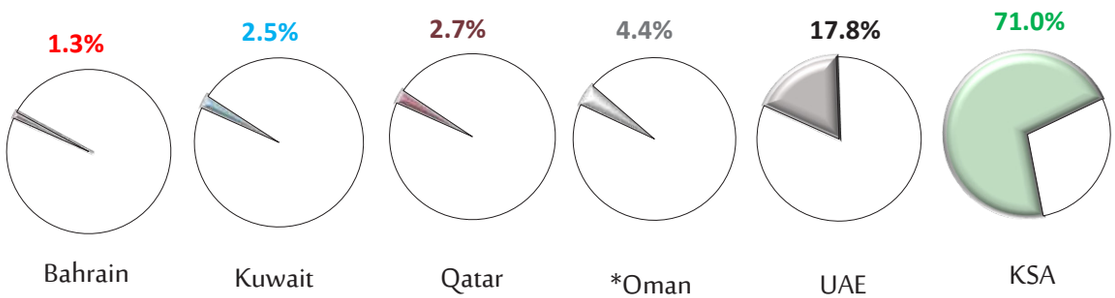
Figure 35: Contribution of the GCC countries to the reused water from the total amount in the GCC for 2016



* Oman data does not include Dhofar Governorate

Figure 36 illustrates that Kingdom of Saudi Arabia's contribution to the total Freshwater available for use in GCC in 2016 was 71.0%, which was the highest among all. United Arab Emirates was the second with 17.8% contribution. Kingdom of Bahrain contributed the least, 1.3%.

Figure 36: Contribution of the GCC countries to the total freshwater available for use from the total amount in the GCC for 2016

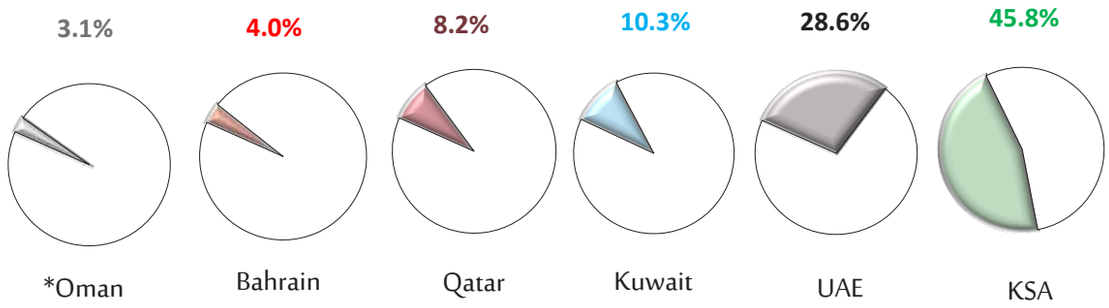


* Oman data does not include Dhofar Governorate

As for the gross freshwater produced by WSI, Kingdom of Saudi Arabia's share was 44.7%. United Arab Emirates contributed by 28.6% and then Kuwait State by 10.2%. Kingdom of Bahrain had the least contribution, 3.8%. Water lost during transport in Kingdom of Saudi Arabia accounts for 29.7% of overall amounts in GCC. The figure in United Arab Emirates was roughly the same as it was 29.5%. Water lost during transport in Kingdom of Bahrain constituted 1.1% of the overall, which is the lowest.

Kingdom of Saudi Arabia contributed 45.8% of the overall net freshwater by WSI as shown in figure 37, United Arab Emirates 28.6% and Kuwait State 10.3%. Other countries' Kingdom of Bahrain and Qatar State contributions were 12.2%.Sultanate of Oman contributing the least, 3.1%.

Figure 37: Contribution of the GCC countries to net freshwater from the total amount in the GCC for 2016

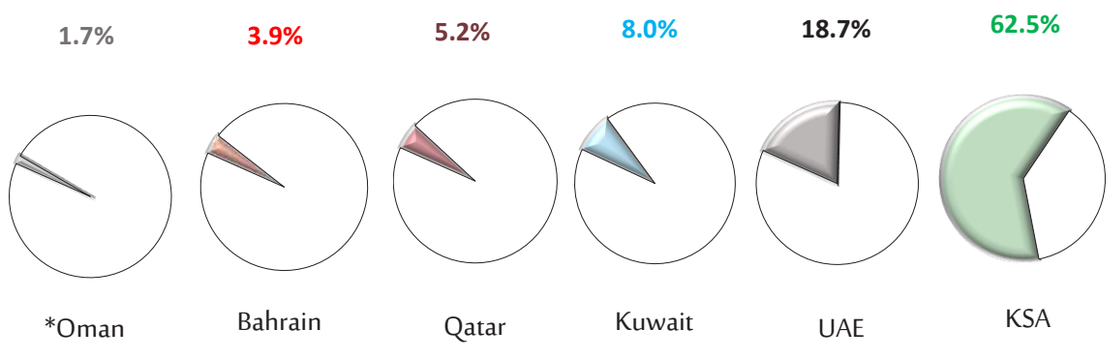


* Oman data does not include Dhofar Governorate

The same order applies to the contribution of wastewater collected. It can be seen from figure (38) Saudi Arabia has the most contribution of 62.5%, United Arab Emirates contributed 18.7% and then Kuwait State with 8.0%. Sultanate of Oman had the least contribution of 1.7%. Kingdom of Saudi Arabia also contributed the most to overall amounts of wastewater treated with 54.9%. The share of United Arab Emirates was 25.1% while that of Kuwait was 8.4%. Sultanate of Oman contributed 2.3%, which is the least. Kingdom of Saudi Arabia has the biggest number of desalination plants, which corresponds to 71.3% of the overall number. Sultanate of Oman's share is 11.8% and then United Arab Emirates with a share of 11.4%. Kingdom of Bahrain's share is the smallest with 1.1%.

The design capacity of desalination stations in Kingdom of Saudi Arabia accounts for 35.9% of the overall while United Arab Emirates accounts for 34.0%. Kingdom of Bahrain's contribution is 4.0% in this regard.

Figure 38: Contribution of the GCC countries to wastewater collected from the total amount in the GCC for 2016



* Oman data does not include Dhofar Governorate

Kingdom of Saudi Arabia has the highest contribution to the overall of wastewater treatment plants, which is 31.2%. United Arab Emirates is in the second place with contribution of 29.2%. Kuwait State contributed 2.0%. Kingdom of Saudi Arabia contributed the most to the design capacity of wastewater treatment plants in GCC, as its share was 53.5%. United Arab Emirates contributed 23.8%. Sultanate of Oman has the least share of 2.9%.

5. Conclusion

The GCC has issued some strategic directives in the field of water and can be summed up that in the following points:

- Setting up of Water Database;
- Rationalization of Water Consumption;
- Unification of the Water Technical Standards;
- Studying the Bases for Calculating the Electricity and Water Tariff in the GCC States;
- Drafting Common Water Legislation and Reference Guides (Water Resources Preservation Law, Treated Sewage Law and Water Desalination Law)
- Sustainable Development and Integrated Management of Water

In terms of rationalization of water consumption, it should be noted that the total freshwater available for use per capita witnessed growth during the period of 2012 to 2015. However, it decreased slightly in 2016, which can be attributed to the reduction of abstraction of ground water. It can be also observed that despite the increase of desalinated water per capita by 9.0% from 2011 to 2015, it dropped to 0.6% in 2016. This decrease can be taken as a positive sign of the beginning of the process of rationalization of water consumption. The same trend is observed about reused water from wastewater treated. The increasing utilization of reused water since 2012 is indicative of a higher level of awareness about the importance of this source to minimize depletion of groundwater in particular.

We also notice that there is a general trend in GCC region to unify the technologies and standards for the production of desalinated water. Indeed, most countries are increasingly using Reverse Osmose (RO) technology and developing standard programs for technical and vocational training in the field of desalination and water purification through national or regional initiatives.

Finally, in terms of water legislation, some countries already have comprehensive environmental legislation related to the desalination and purification of water. Some others are reviewing their national strategy of water. A regional initiative for the enhancement of implementation and commitment in each GCC country will be of great value for the implementation of an integrated water management system and its sustainability for the region.

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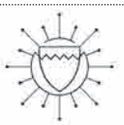

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National Center for Statistics and Information.
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