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DEPARTMENT OF ENERGY

2020

Annual Technical Report

For the Water, Wastewater and Electricity Sector in the Emirate of Abu Dhabi

Contents

1.

Introduction

1 Introduction

Welcome to the Department of Energy's (DoE) 2020 Annual Technical Report for the water, wastewater, electricity, and District Cooling (DC) sectors in the Emirate of Abu Dhabi.

This report is issued every year by the DoE using information and data gathered from a range of regulatory submissions provided by our licensees . The aim is to highlight major milestones such as our sector's role in delivering the Emirate's strategic objectives as well as providing an overview on performance metrics we use to measure how our sector is creating value for our communities, customers, investors, and the environment.

2020 has been an exceptional year worldwide due to the outbreak of COVID-19. Since March 2020, the DoE worked closely with various authorities and stakeholders in the Emirate to implement all necessary prevention and safety measures in the sector to safeguard the workforce and ensure the security and continuity of services to all residents and business in Abu Dhabi. The DoE was also actively engaged in various initiatives supporting the Abu Dhabi Governments COVID -19 response plan such as the collaboration with Khalifa University and other strategic stakeholders in monitoring and tracing wastewater for the virus that causes COVID -19.

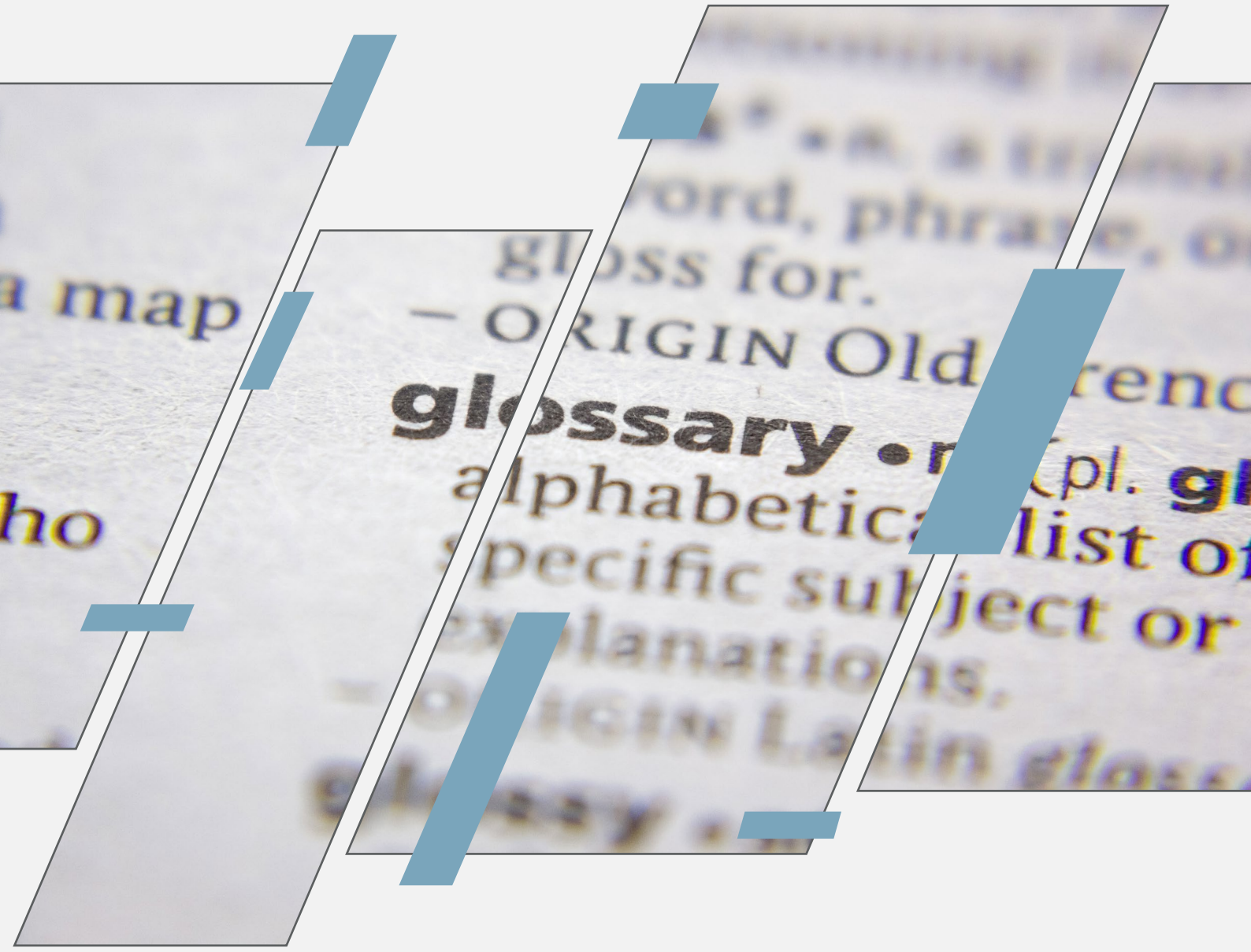
Moreover, despite the extraordinary impact of the pandemic and the preventative lockdown measures, Abu Dhabi Emirate's global electricity peak demand recorded a peak of 16,040 MW on the 20th of July 2020, exceeding the peak of 2019. This is mainly attributed to the increase in demand from the residential sector, during the hot summer months due to global travel restrictions and lockdown measures, compensating for the decrease in demand from the commercial sector caused by the same measures. On the other hand, water demand remained stable and consistent with no significant changes witnessed during the year.

2020 was also a significant year in delivering key and strategic milestones. The 2020 Edition of the Electricity Wiring Regulations was issued in April 2020. The new revision offers updates such as revised requirements on the allocation of electrical distribution boards in residential villas. Owners of new residential villas that meet the requirements are able to install wall distribution panels of maximum 399 amps, as an alternative to electric rooms. This will result savings in construction costs and better utilisation of plot areas.

The DoE Chairman Decision No (16) of 2020 concerning Water and Wastewater Tankering Regulations was also issued in June 2020. The Regulations establish a regulatory framework for the management and transportation of drinking water, non-drinking water and wastewater tankers in the Emirate of Abu Dhabi. The main objective of the Regulations is to enhance service quality standards, protect the environment, safeguard public health and ensure the security of water and wastewater services. The DoE granted the tankering sector 18 months grace period to comply with the regulations.

The DoE also engaged in consultation with the sector in 2020 in reviewing and updating the Water Quality Regulations 2014 and the Recycled Water and Biosolids Regulations 2018.

Finally, as for the implementation of the 2019 issued DC regulations, the DoE worked closely with the DC sector in 2020 in addressing the concerns of the newly regulated sector and prioritising the licensing review process for existing DC scheme with most residential customers. The first DC license is planned to be issued in early 2021.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specific subject or
explanations.

2. Glossary

2 Glossary

AADC	Al Ain Distribution Company
ADDC	Abu Dhabi Distribution Company
ADNOC	Abu Dhabi National Oil Company
ADSSC	Abu Dhabi Sewerage and Services Company
AMPC	Al Mirfa Power Company
APC	Arabian Power Company
BOD5	(ATU) The biochemical oxygen demand of wastewater during decomposition occurring over a 5 day period.
CFU/100ml	Colony Forming Unit per 100 milliliter
CS	Carbon Steel
CSP	Concentrated Solar Power
DC	District Cooling
DEL	Dolphin Energy Limited
DI	Ductile Iron
DISCOs	Distribution Companies
DMA	District Metered Area
DMP	Distribution Metering Point
DN	Nominal Diameter
DW	Drinking Water
DWSP	Drinking Water Safety Plan
EAD	Environment Agency of Abu Dhabi
EB	Al Etihad Biwater Wastewater Company
ECPC-A2	Emirates CMS Power Company
EMAL	Emirates Aluminum
ESWPC- F1	Emirates Sembcorp Water and Power Company
EVSE	Electric Vehicle Supply Equipment

EWEC	Emirates Water and Electricity Company
FAPCO- F2	Fujairah Asia Power Company
GOR	Gained Output Ratio
GRP	Glass-fiber Reinforced Plastic
GTTPC-A1	Gulf Total Tractebel Power Company
HDPE	High-Density Polyethylene
ICAD	Industrial City of Abu Dhabi
ISTPs	Independent Sewage Treatment Plants
IWA	International Water Association
IWPP	Independent water and power producers
km	Kilometer
KPI	Key Performance Indicator
l/s	Liter per second
LDC	Load Despatch Centre
Lphd	Liters per Household per Day
LSI	Langelier Saturation Index
m	Meter
m3/day	cubic meters per day
MCM	Million Cubic Meter
MCMD	Million Cubic Meter per day
MED	Multiple Effect Distillation
mg/l	Milligrams per Liter
MIG	Million Imperial Gallons
MIGD	Million Imperial Gallons per Day
MIPCO	Mirfa International Power Company
Ml/day	Mega litre per day
MSF	Multi-Stage Flash Distillation
MWh	Mega Watt hour
NE	Northern Emirates

O&M	Operation and Maintenance
OPEX	Operational Expenditure
PCOD	Project Commercial Operation Date
PCR	Price Control Returns
PDSRS	Production Data Submission and Reporting System
PPB	Parts Per Billion
PPM	Parts Per Million
PR	Performance Ratio
PWPA	Power and Water Purchase Agreement
RIA	Regulatory Impact Assessment
RPC-S2	Ruwais Power Company
RW	Recycled Water
RWRRS	Recycled Water Regulatory Reporting System
SCIPCO-S1	Shuweihat CMS International Power Company
SEWA	Sharjah Electricity and Water Authority
SMPs	Sector Measuring Points
STEP	Strategic Tunnel Enhancement Program
SWRO/RO	Seawater Reverse Osmosis
TAPCO-B	Plant Taweelah Asia Power Company
TBT	Top Brine Temperature
TDS	Total Dissolved Solids
TEC	Trade Effluent Control
TRANSCO	Abu Dhabi Transmission and Dispatch Company
TSS	Total Suspended Solids
VB	Veolia Besix Waste Water Company
WHO	World Health Organization
WQR	Water Quality Regulations
WQRRS	Water Quality Regulations Reporting System
WTC	Water Transmission Code

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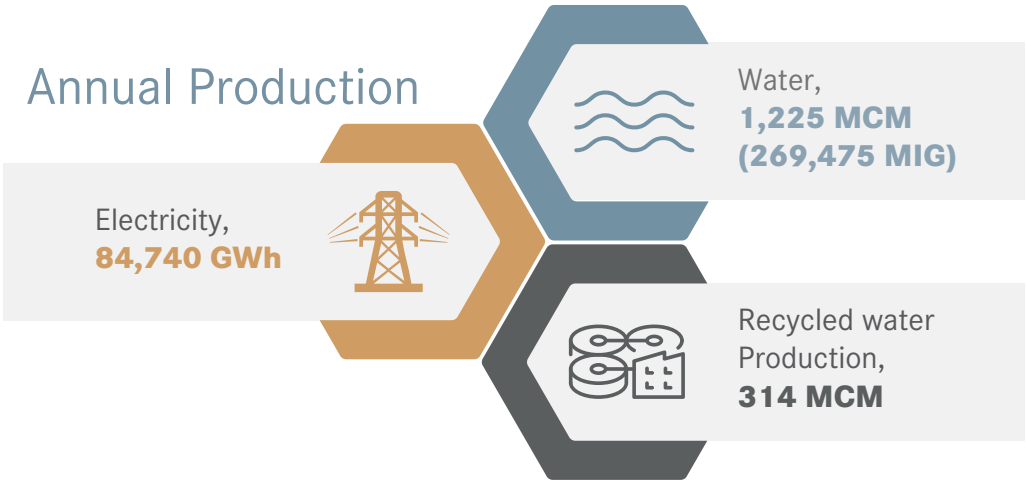
3.

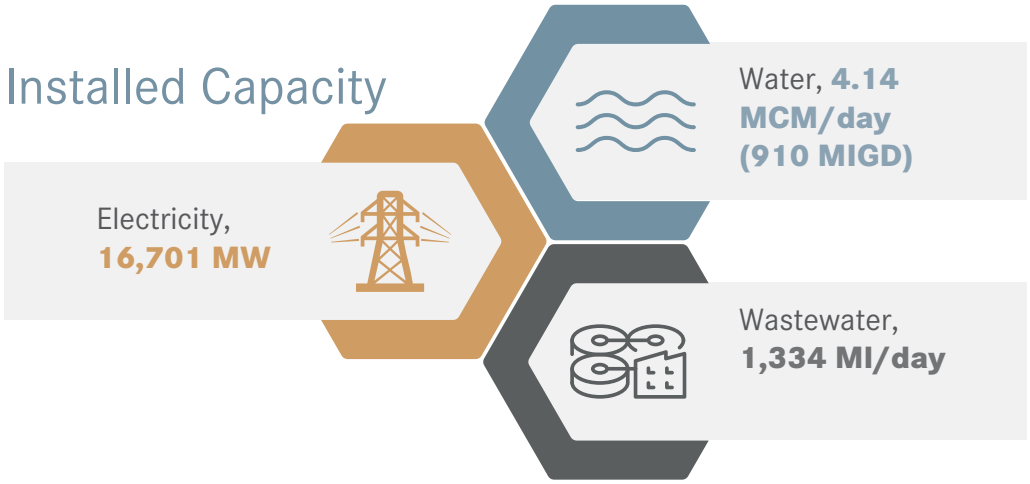
Sector Highlights

3 Sector Highlights

Annual Production



Installed Capacity



System Demand

Electricity Peak Demand
Abu Dhabi System peak **11,757 MW** Exports to NE peak **4,451 MW**

Water (Transmission Peak),
3.81 MCMD (839 MIGD)

Recycled water reuse
percentage: **60%**

Water Quality Tests Conducted

Water	153,907
Recycled water	79,003
Total testing	232,910

Number of Connected Customers

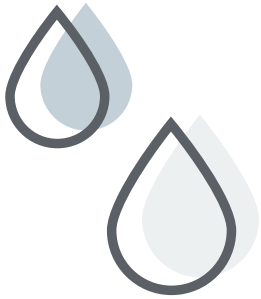
Electricity customers	563,689
Water customers	423,089
Wastewater customers	425,576

4. Timeline

4 Timeline

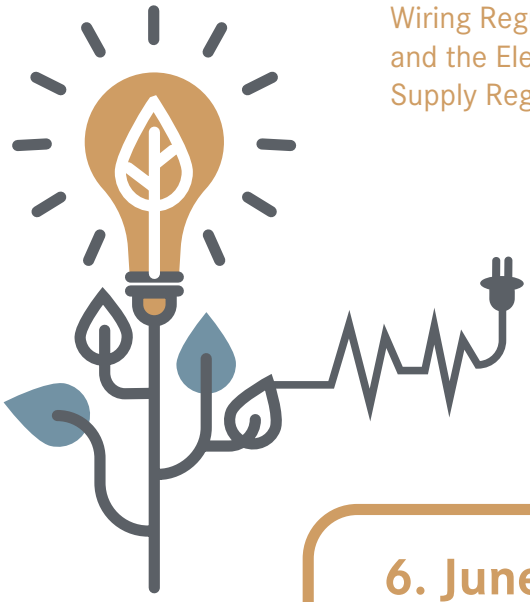
2. February

Issued consultation on the Water Quality Regulations with licensees and other relevant stakeholders



4. April

Published the 2020 Edition of Electricity Wiring Regulations and the Electricity Supply Regulations



5. May

Issued DoE COVID -19 Guidelines to the sector companies

6. June

- Issued DoE Chairman Decision No (16) of 2020 concerning Water and Wastewater Tankering Regulation

- Engaged with Khalifa University and other stakeholders to monitor wastewater for the COVID -19 virus

11. November

Issued consultation on the Recycled Water and Biosolids Regulations with licensees and relevant stakeholders

5.
Electricity and Water

5 Electricity and Water

Electricity Generation and Water Production

Generation and Production Overview

Demand Growth

Demand for electricity in the emirate of Abu Dhabi continued to grow during 2020 driven by a slight increase in Abu Dhabi's system demand and a higher increase in demand resulting from exports to the Northern Emirates, also known as the global electricity demand.

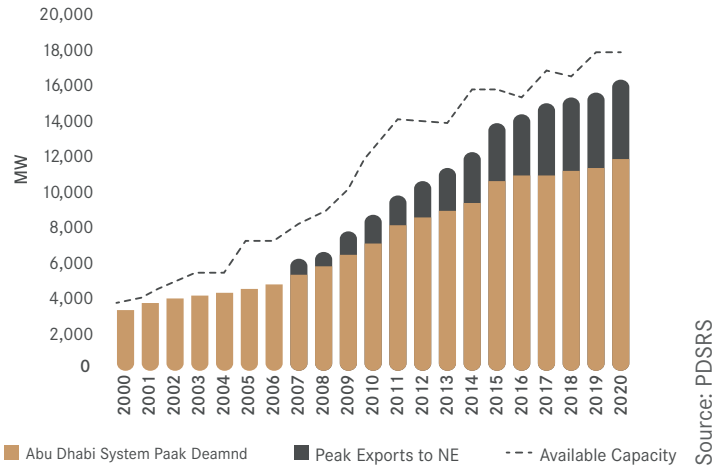


Figure 1 Electricity Demand Growth (MW)

The global electricity demand in Abu Dhabi peaked at 16,040 M W on 20th of July at 15:34 hrs. Abu Dhabi Emirate recorded a peak of 11,730 MW at the same time on 18th June with Abu Dhabi system peak reaching 11,757 MW. Exports to the Northern Emirates peaked at 4,451 MW on 16th of July.

The Global water demand in Abu Dhabi is also measured by Abu Dhabi regional system demand and the demand resulting from the exports to the Northern Emirates. In 2020, the global water demand peaked at 3.80 MCMD (836 MIGD). Water global peak demand remained stable in 2020 with a 2% increase from 2019.

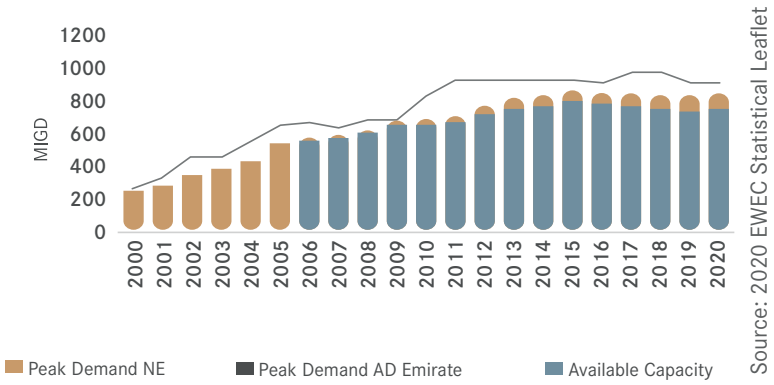


Figure 2 Water Demand Growth (MIGD)

Abu Dhabi Emirate accounted for 89% of peak demand represented by 3.37 MCMD (742 MIGD) while supply to the Northern Emirates accounted for 11% of peak demand and represented 0.4 MCMD (94 MIGD).

Global Electricity and Water Capacity and Production

To support such demand for electricity and water, Abu Dhabi's energy sector has a total available electricity generation capacity of 16,701 MW and a total water production capacity of 4.14 MCMD (910 MIGD). The total electricity generated was 84,740 GWh , while the total water produced was 1,225 MCM (269,475 MIG) in 2020. This averages to 3.35 MCMD (736 MIGD) of the water produced.

Water production and electricity generation capacities are depicted in Figures 3 and 4 respectively.

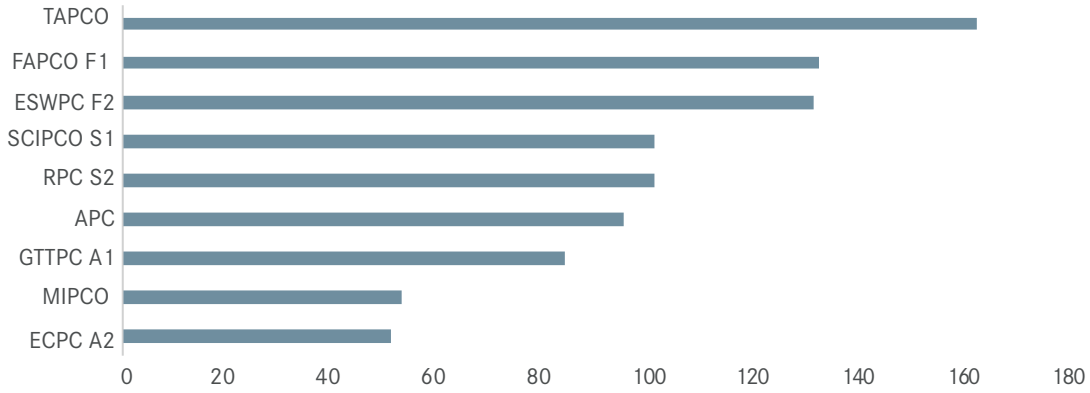
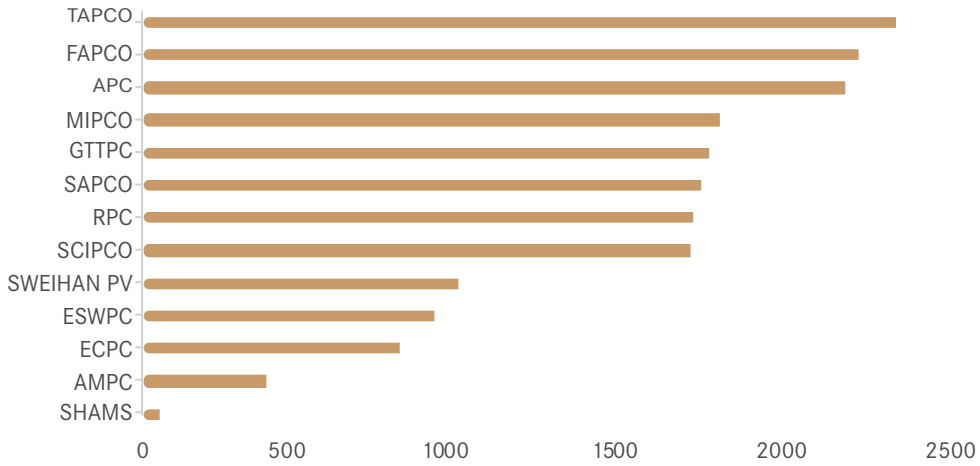


Figure 3 Water Production Capacity (MIGD)



Source: PDSRS & 2020 EWEC Statistical Leaflet

Figure 4 Electricity Generation Capacity (MW)

Electricity Generation and Water Production by Company

In terms of electricity generation markets, there are 14 power providers with electricity generation market shares ranging from 0.05 % up to 13% during 2020. TAPCO, APC and GTTPC hold the largest market share of 13% each, while AMPC is a small OCGT accounting for only 0.05% and therefore DoEs not appear in the figure below. Figure 6 below shows all IWPPs generation market shares.

In terms of water production, capacity shares vary between 9 IWPPs with market shares ranging between 18% and 5%. Nearly 18% of the overall water production share lies within TAPCO. This is followed by ESWPC and FAPCO each holding around 15 % and 14% respectively during 2020.

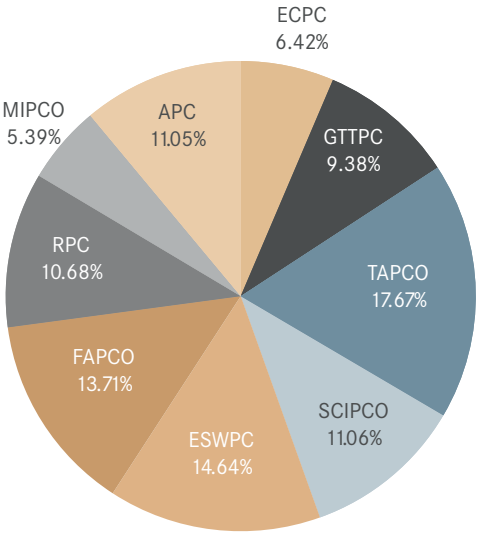


Figure 5 Water Production by Company

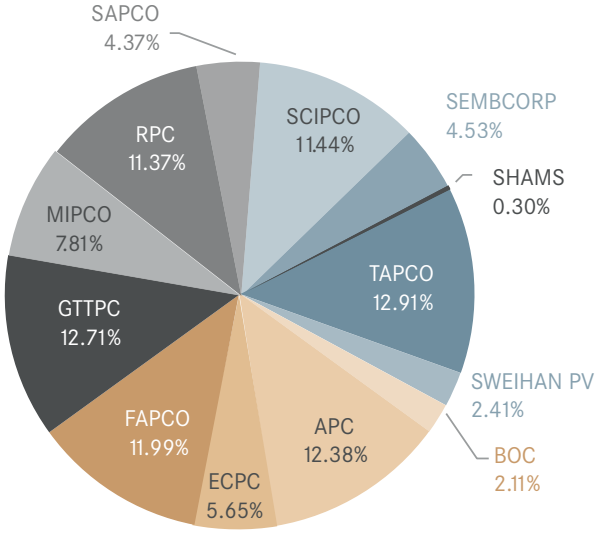


Figure 6 Electricity Generation by Company

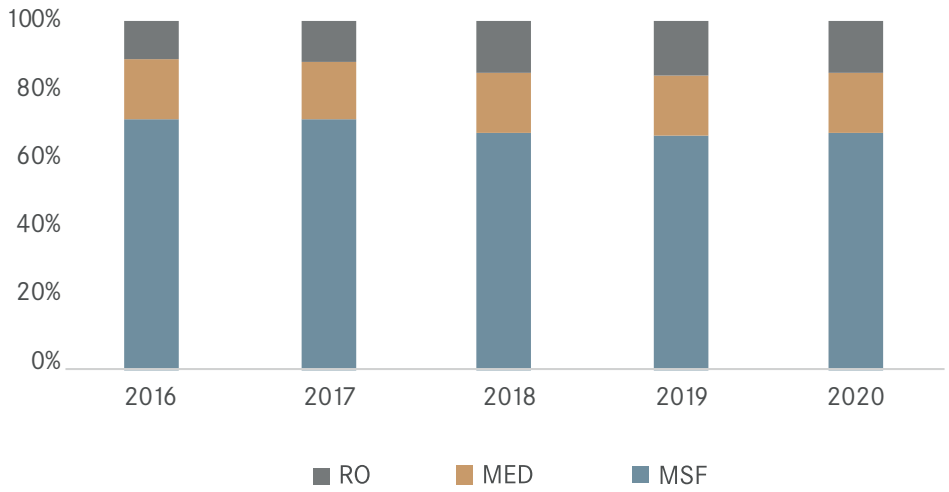
Source: PDSRS & 2020 EWEC Statistical Leaflet

Electricity Generation and Water Production by Technology

As for electricity generation technologies in Abu Dhabi, renewables from SHAMS and Noor accounted for around 2.71% of the electricity generation mix in Abu Dhabi, while CCGT accounts for the major share of 86.48 % followed by Co-gen and OCGT for 11.16%

The share of clean energy will continue to grow in the coming years with the addition of Barakah Nuclear Energy Plant, located in the Al Dhafra Region of the Emirate of Abu Dhabi. The plant will have four APR1400 reactors, adding a total of 5,600 GW of renewable energy to the grid when fully operational.

As for water production technologies, Figure 7 demonstrates a five year overview of the IWPPs annual gross production contribution percentage by technology. MSF production capacity has decreased mainly due to APC UAN East and West water capacity retirement in 2019. Moreover, RO desalination contribution is anticipated to significantly grow over the coming years. The Taweelah RO Independent Water Plant (IWP), will increase RO production capacity by adding 0.91 MCMD (200 MIGD) when completed in 2022.



Source: PDSRS & 2020 EWEC Statistical Leaflet

Figure 7 Water Production by Technology

Figure 8 shows the daily electricity generation at peak time in MWh for the last two years. It reflects the annual variation in demand which is seasonal in that it closely follows the weather and is consistent year on year. the annual peak coincides with the mid-June summer peak demand mentioned above.

Global demand has grown by 5.4% in 2020. Exports to the Northern Emirates grew by 5.5% and demand from Abu Dhabi Emirate has also grown by 5.5%.

A summary of observed growth rates in 2020 against 2019, due to the fact that travel restriction due to Covid-19 prevented many residents who would have otherwise been travelling over the summer holidays period increasing the population above the underlying summer assumptions and changed the consumption patterns since working from home became a new norm and people could not spend time socializing in commercial facilities especially in the second half of the year.

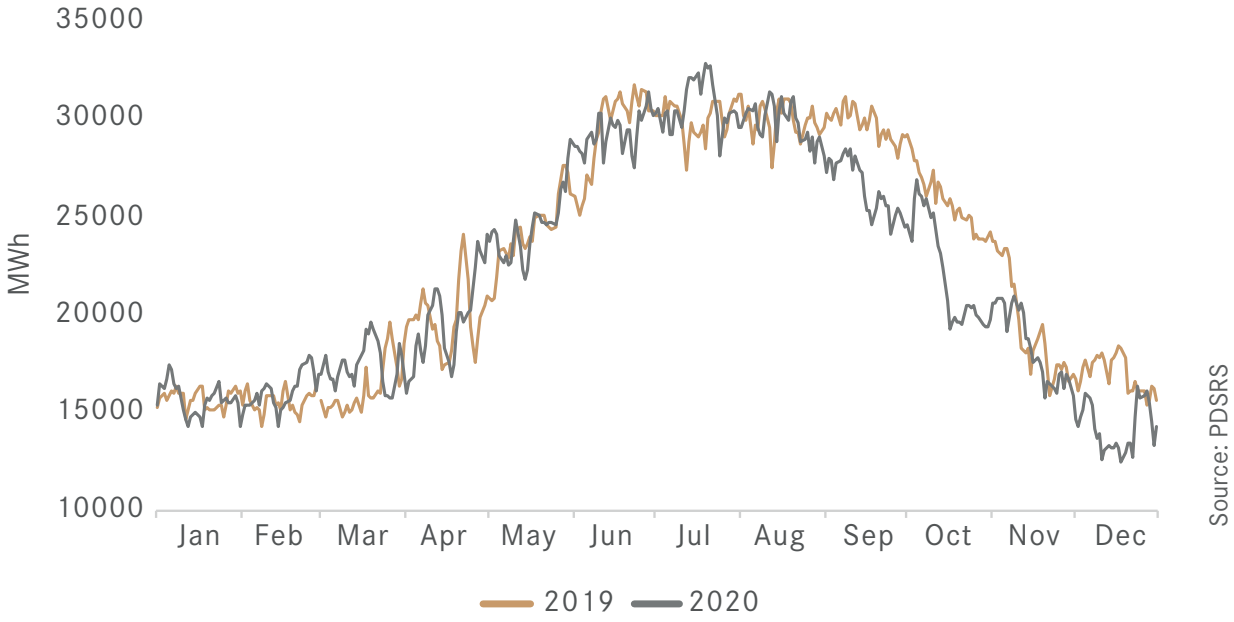


Figure 8: Daily Energy Generation at peak (MWh)

Unlike electricity, water demand in the Emirate of Abu Dhabi exhibits moderate seasonal fluctuations throughout the year. The weekly average water production in 2020 is provided in Figure 9 below. The global water demand reached its peak of 3.80 MCMD (836 MIGD) on June 07, 2020 , which comprises a 2% increase compared to last year's peak of 3.73 MCMD (820 MIGD) on July 10, 2019. Minimum production of 2.31 MCMD (508 MIGD) occurred on Jan 12, 2020.

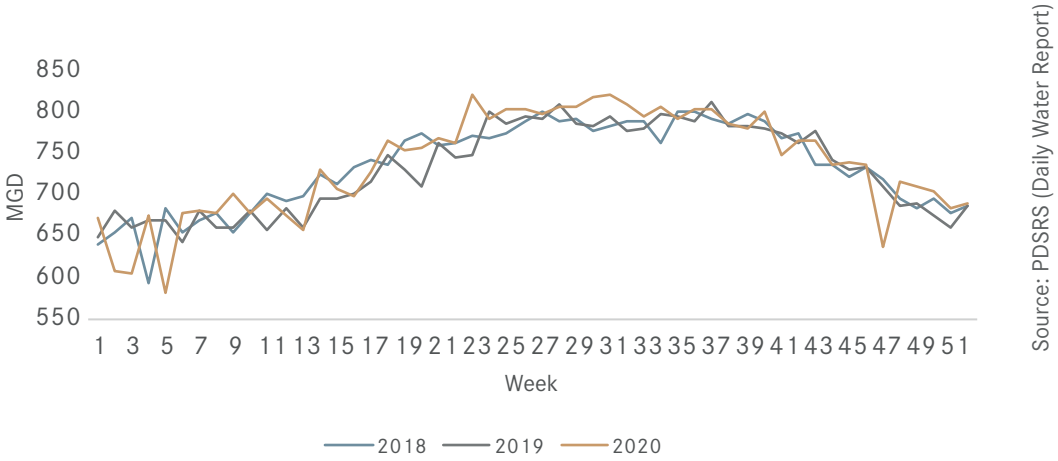


Figure 9: Average Weekly Water Supply by IWPPs (2018-2020)

Natural Gas remained the predominant fuel type used within the sector to generate electricity and produce water in Abu Dhabi. Both ADNOC and DEL continued supplying the sector with natural gas throughout the year without the need to burn any back-up fuel more than the regular amounts used to carry out operational tests to maintain liquid fuel supply system ready on standby if needed. It is reported that both ADNOC and DEL have delivered around 782,755,804 MBTU of natural gas to the sector, which is 1.7% less than last year (796,289,326 MBTU)

Electricity Generation System Performance

In terms of the performance of the generation plants, the available plant capacity was maintained with reasonable capacity margins throughout the year. Figure 10 shows the plants average reliability percentage for 2020 as reported by each plant. Overall, most of the generation plants reported high reliability index. APC, TAPCO and ECPC results are mainly influenced by the lower performance of the aging of the assets.

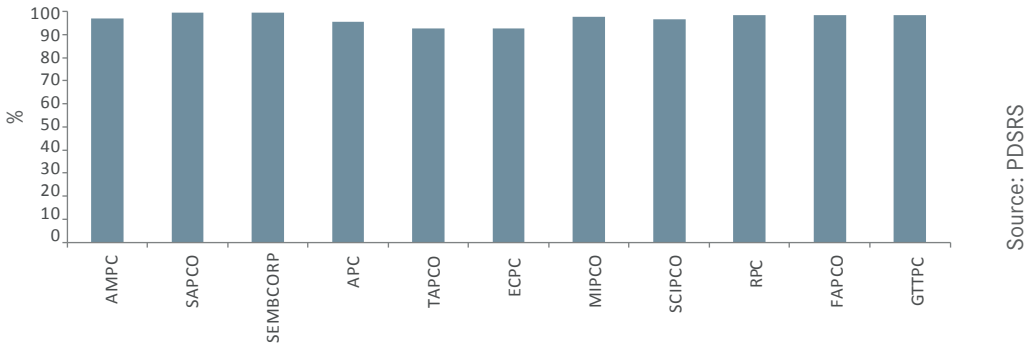


Figure 10: Plants Reliability

Water Production System Performance

Thermal water production efficiency can be measured by performance ratios. Performance ratios are stipulated in the PWPAs and defined as the mass of distillate produced per heat input.

Desalination Process - Thermal Water Production Performance

Performance ratios provides an overview of the desalination process efficiency measurement. It defines the relationship between two mass flows i.e. the distillate and the flow of the heating steam.

The sector has maintained steady performance ratios. Its calculation is influenced by factors such as, analysers accuracy and calibration, operation and maintenance, assets ageing and chemical dosing. Figures 11 and 12 below depict five years overview of the average performance ratio for MSF and MED thermal desalination technologies for water production.

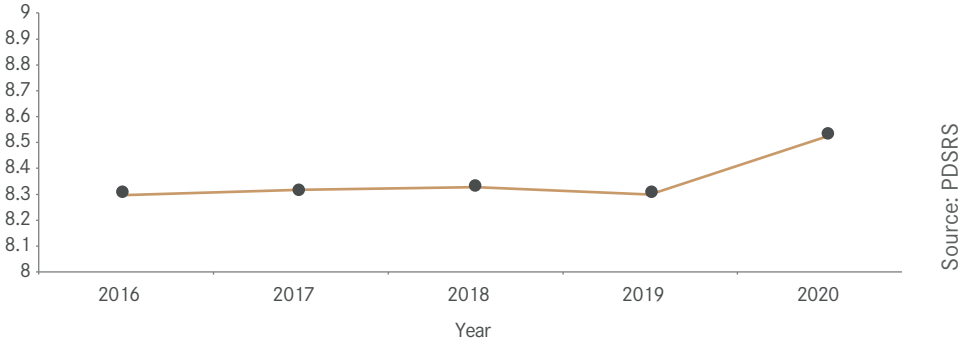


Figure 11: IWPPs Desalination Technology Performance- MSF Average Performance Ratio

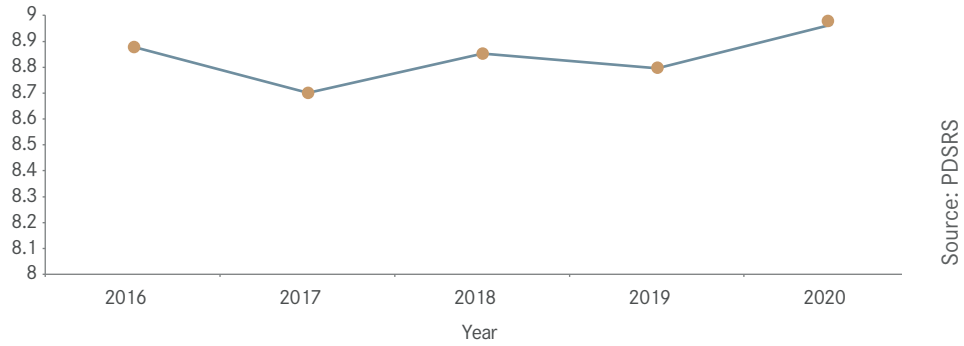


Figure 12 IWPPs Desalination Technology Performance- MED Average Performance Ratio

Water Quality Regulatory Performance - Production

The production water quality sampling and testing is conducted as per the WQR prerequisites. The sample must be representative of the water quality at the time of sampling, its collection program is made with sampling frequency from predetermined locations at equal intervals over the year and it must be analysed as soon as practicable after it has been taken.

The total number of tests completed by the IWPPs in 2020 was 51,158, with 64 water quality parameters examined for RO and 51 water quality parameters examined for thermal desalination respectively. The overall water quality testing frequency compliance (measure of the number of tests conducted against those required) for the production companies was 99.79%.

The overall average water quality compliance for 2020 was 99.95%, with Physical Parameters and Microbial Parameters compliance at 99.91% and 100% respectively.

Figure 13 depicts five years overview of the IWPPs consistent overall water quality compliance

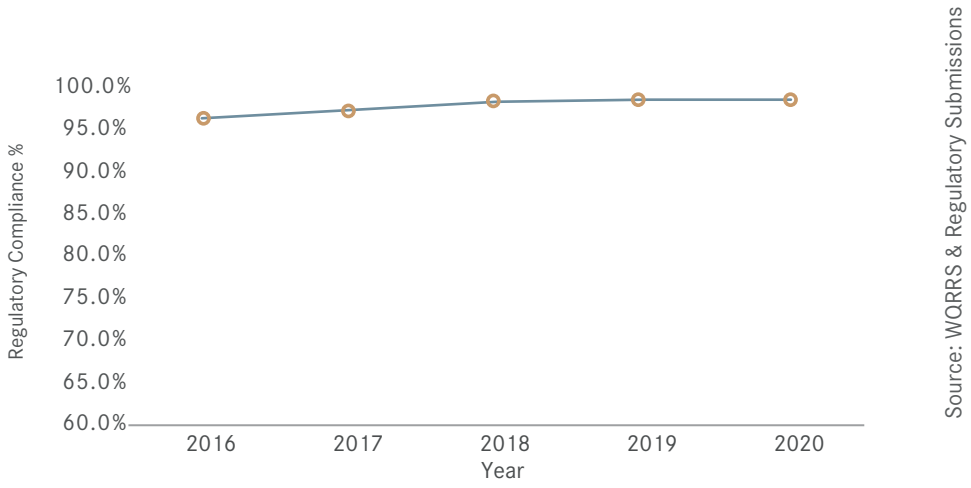


Figure 13: IWPPs Water Quality Regulatory Compliance %

Desalination Process- Chemicals and Products that come in contact with Water- Regulatory Overview

To ensure regulatory compliance, maintain security of supply and optimize process operation, production licensees submit to the DoE applications to put in use chemicals in the desalination process. These chemicals are administered under the Water Quality Regulations. The requirements also apply to the transmission and distribution licensees.

Improvements in desalination chemicals like anti-scalants and using more durable and reliable material of construction are best practices that have reduced the cost of desalination in particular the investment cost and unit water cost. Performance improvements have also driven down the operating cost.

Figure 14 below depicts five years overview of the chemicals and products that come in contact with water for RO, MSF and MED. The number of no objections to use new chemicals have increased steadily. Chemical trials have been conducted in thermal, RO, remineralisation and disinfection processes. The regulatory framework underpins the desalination production security of supply .

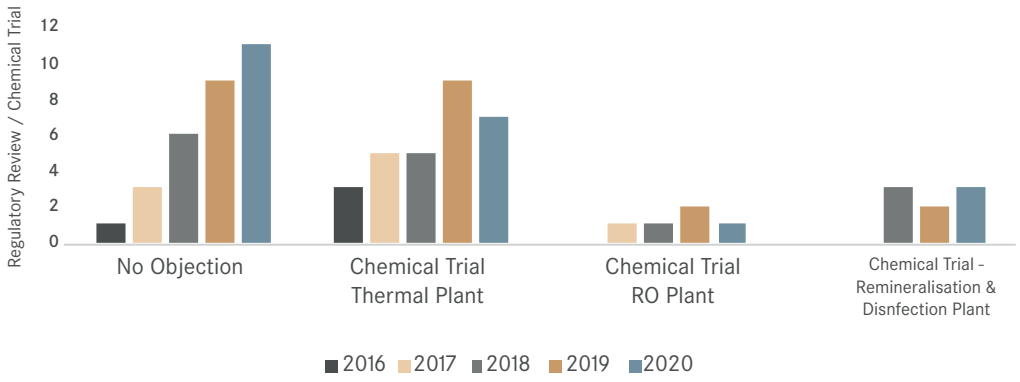


Figure 14 Five Years Regulatory Overview of the Chemicals and Products that come in contact with water.

Desalination Process- Thermal and Membrane Water Production Quality Performance

The DoE developed certain chlorination related KPIs to enhance efficiencies. KPI 1 has been implemented to measure and optimise the efficiency of chlorine consumption. It is an indicator of the total amount of chlorine consumed by IWPPs per unit of water produced. Chlorination system efficiency performance is used to evaluate the efficiency of the chlorination system at the desalination stage, to ensure the system will use the optimum amount of chlorine at the point of dosing to deliver the desired chlorine residual. Figure 15 demonstrates a progressive course towards the optimum target value.

KPI 1 is governed by factors such as dosing regime and process, chlorine demand of the desalinated water produced by each licensee and transmission and distribution residual chlorine requirements

Figures 15 and 16 depicts five years overview of the IWPPs desalination chlorination KPI 1 and 2. The DoE has been working with its Licensees to steadily optimise the KPIs shown below towards the optimum values.

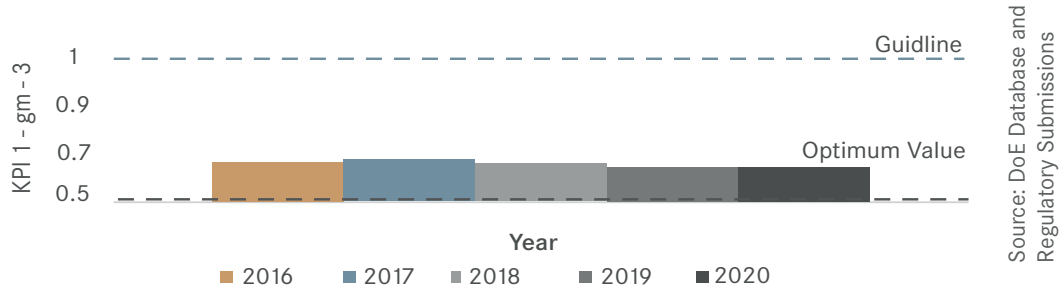


Figure 15 IWPPs Desalination Chlorination KPI 1- Overview

KPI 2 has been implemented to measure the residual chlorine regulatory compliance. KPI 2 is an indicator of the proportion of the residual chorine samples that fall outside the regulatory limit. Figure 16 demonstrates a progressive course towards the optimum target value. KPI 2 is impacted mainly by transmission and distribution residual chlorine requirements.

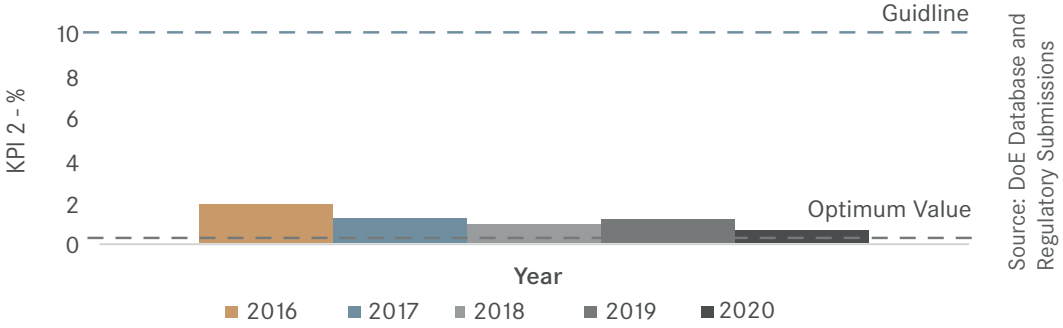


Figure 16 I(W)PPs Desalination Chlorination KPI 2- Overview

Electricity and Water Transmission

Transmission Overview

TRANSCO is the sole electricity and water transmission licensee in the Emirate of Abu Dhabi.

It operates the high voltage network (400 – 132 KV) transmitting electricity from production companies to DISCOs, high demand customers connected at the transmission system and to the northern emirates. TRANSCO is also connected with the 400 kV GCC interconnection.

On the water side, TRANSCO transports large volumes of water from the production companies to the distribution companies. In 2020, the 3,495 km water transmission system carried a peak of 3.81 MCMD (839 MIGD) of desalinated water via mains pipelines. These pipelines range in size from 500 to 1,600 mm in diameter and are made predominantly of cement-lined ductile iron & Carbon Steel and partly Glass Reinforced Plastic.

The total quantity of water leaving the network amounted to 1,186.87 MCM (261,075 MIG).

Tables below provide a summary of transmission system water and electricity assets

Table 1 Electricity Transmission Network Assets

Grid Substations	Capacity	Underground Cables	Overhead lines
161(220, 400 AND 132 KV)	70,345MVA	993 km	8,695 km

Table 2 Water Transmission System Assets

Pipeline length	Pumping Stations	Capacity	Reservoirs	Capacity
3,495 km	51	11.74 MCMD 2,583 (MIGD)	126	3.02 MCM (664 MIG)

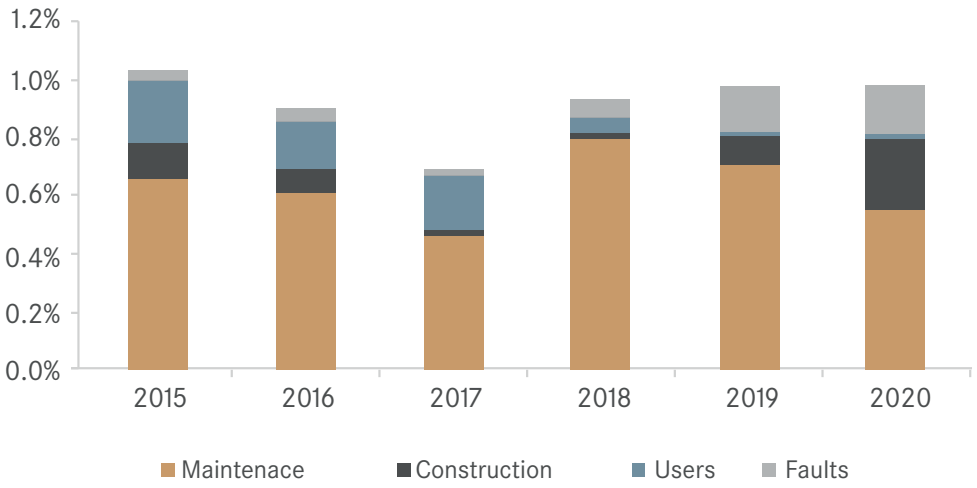
Electricity Transmission System Performance

Transmission system performance is monitored through a number of Key Performance Indicators (KPIs) including:

- Transmission network unavailability
- Unsupplied energy
- Transmission system losses

Transmission Network Unavailability

System unavailability is defined as the ratio of the unavailable circuit hours and the total system circuit hours. The total unavailability increased slightly from 0.99 in 2019 to 0.98 in 2020 as shown in Figure 17 below. Analysis of the data indicates that there was an increase in construction outages in 2020 compared to 2019, which also follows the previous year's trend. However, overall system availability (1-unavailability) remains above 99%.



Source: TRANSCO Performance Report

Figure 17 Transmission System Unavailability

Unsupplied Energy

The impact of loss of supply resulting from transmission incidents is quantified in terms of energy lost "unsupplied energy" which is calculated by taking into account the size and duration of the demand lost, expressed in MWh. In 2020, there were 3 transmission incidents, which resulted in the loss of 22.71 MWh of unsupplied energy (which is a significant decrease compared to 327.2 MWh in 2019). This however DoEs indicate a trend as such as the unsupplied energy generally fluctuates as shown in Figure 18 below. This is expected and acceptable for a transmission network as long as it remains within this range.

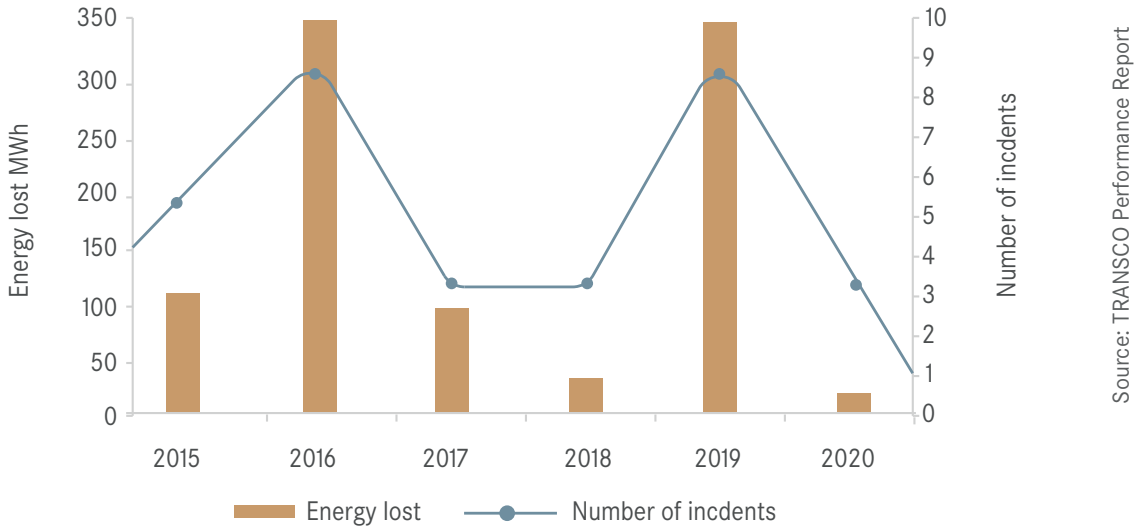


Figure 18 : Transmission System Incidents and Energy Lost (Unsupplied)

Transmission system losses

Energy loss in the transmission system is mainly due to heat dissipation as a result of electricity flow in the different parts of the network “overhead lines, cables and transformers”. System losses are measured as the difference between the total energy input to the transmission system and total energy output from the transmission system.

Transmission losses were consistent, decreasing slightly from 2.18% in 2019 to 2.16% in 2020. It is also below the average historical losses 2013-2020 (2.23%) and has been for the last 5 years which is a positive indication.

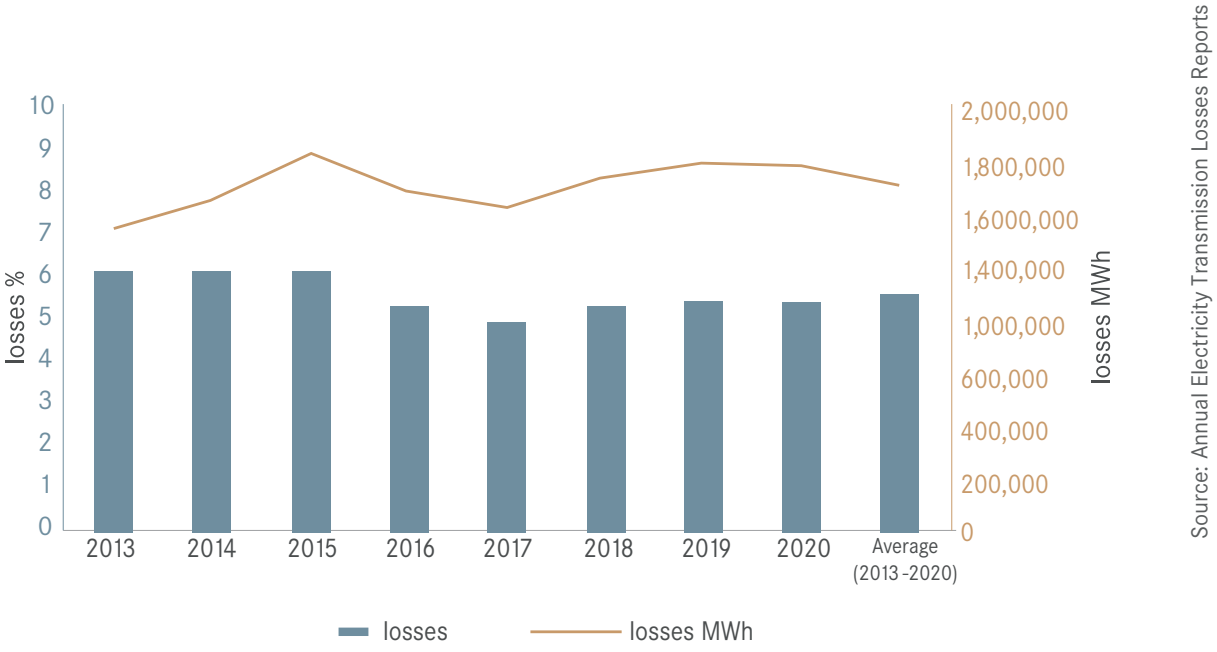


Figure 19 Transmission System Losses

Water Transmission System Performance

The performance of the water transmission system is monitored through several KPIs including:

- Water Transmission losses
- Security of supply
- System availability

Water Transmission Losses

This indicator seeks to monitor and reduce water losses, including both "real losses (physical losses) and operational losses (metering inaccuracies).

Water transmission loss is measured as the net difference between dispatched water from all producers, at the defined entry points (Transmission System Inflow) and the water delivered to distribution at the defined exit points (Transmission System Outflow). This method also takes into consideration the change in TRANSCO's reservoir water levels.

Figure 20 shows the percentage of water transmission losses from 2011 to 2020, which remained below the 2% tolerance threshold

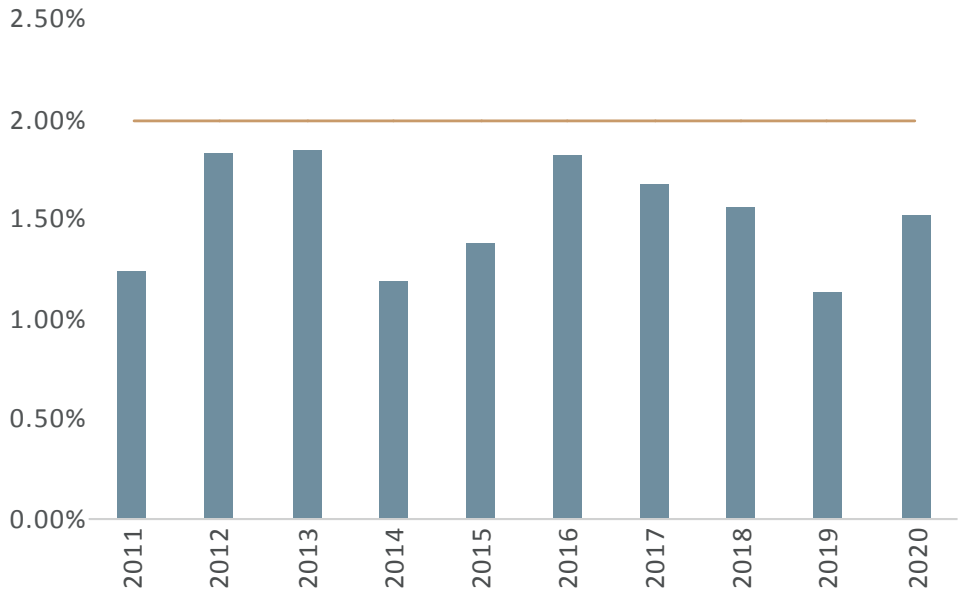


Figure 20: Water Transmission Loss (%)

Security of Supply

The security of supply indicator investigates any supply shortfalls in meeting the scheduled water quantities. This indicator measure's reliability and efficiency, as well as flexibility in reacting to unforeseen demand events. It measures TRANSCO's system ability to cope with unexpected situations that can impact water supply. Scheduled water demands by the distribution companies may not be fully met by TRANSCO due to 2 main reasons:

1. Unpredictable demand events.
2. Supply interruptions

Unpredictable demand events

This happens when DISCO's actual demand deviated from the scheduled quantity by a certain threshold. This deviation could be attributed to DISCO's forecasting errors, non-availability of metering data at some data management platforms, or insufficient consumption profiling.

Figures 21 and 22 below show the unpredictable demand events for both ADDC and AADC respectively from 2010 to 2020. There are inherent difficulties in generating highly accurate demand forecasts, which requires further progress with data collection and validation, as well as network operational management. The number of such events is seeing a drop with AADC since 2015, with a slight increase in 2020, while there are remaining issues with ADDC which operates a larger network.

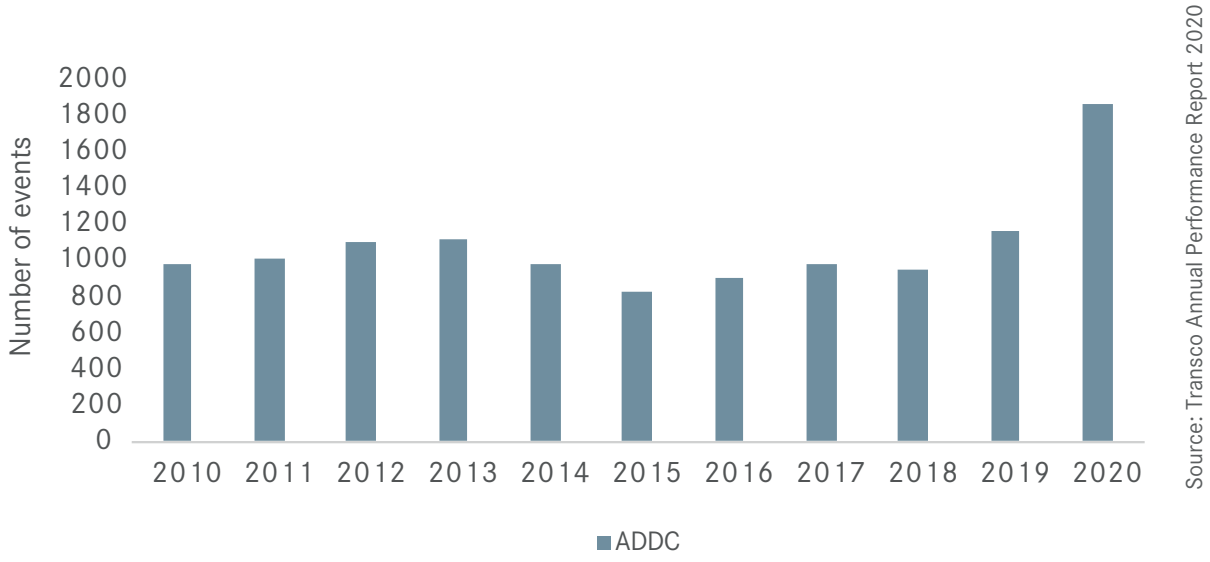


Figure 21: ADDC Unpredictable Demand Events

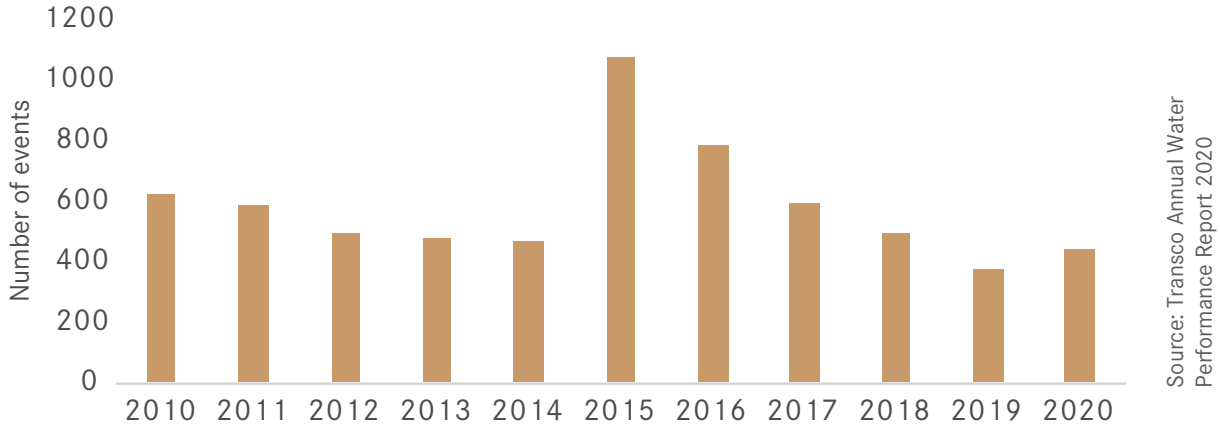


Figure 22: AADC Unpredictable Demand Events

Supply interruptions

Supply interruptions result from incidents or constraints within the production, transmission, or distribution system. Figure 23 below shows the unsupplied quantities and interruptions caused by TRANSCO. A significant drop in unsupplied quantities and number of interruptions were achieved after 2015 by TRANSCO. However, 2018 witnessed an increase again primarily due to operational challenges resulting from the shutdown of some pumping stations. The DoE continues to work closely with TRANSCO to enhance their operations to minimize such events and reduce the unsupplied quantities.

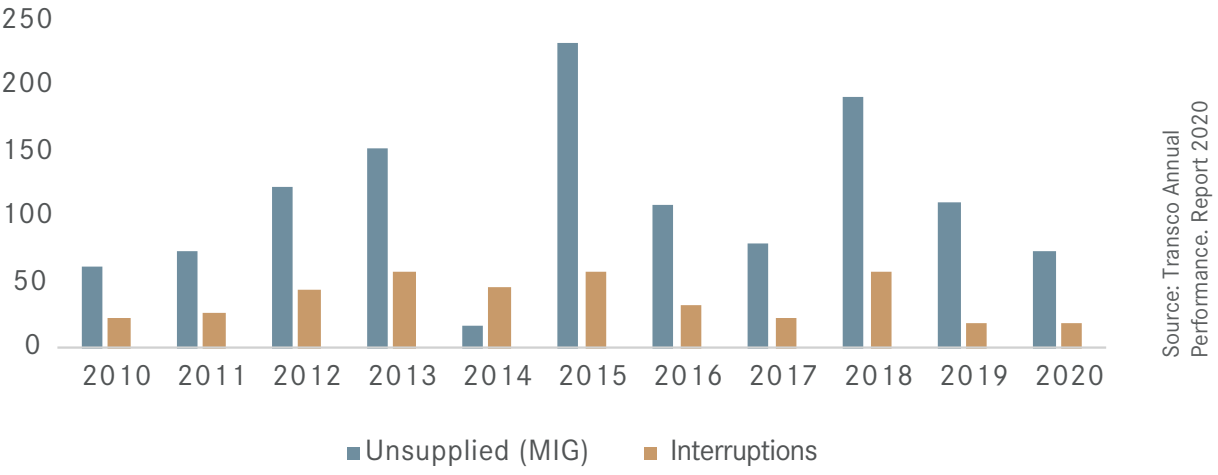


Figure 23: Unsupplied Quantities vs. Interruptions

System availability

This indicator determines the main transmission system components/assets (pumps, transmission lines, storage tanks, or combination thereof) that are either operational or in standby mode. Components that do not meet this definition are classed as "unavailable".

Transmission System Availability has remained relatively steady and positive since 2010; TRANSCO's overall system availability in 2020 is 97.75%, as illustrated in Figure 24 below. The component most often found to be responsible for unavailability was pumps. The DoE works closely with TRANSCO to enhance the assets condition and performance monitoring activities.

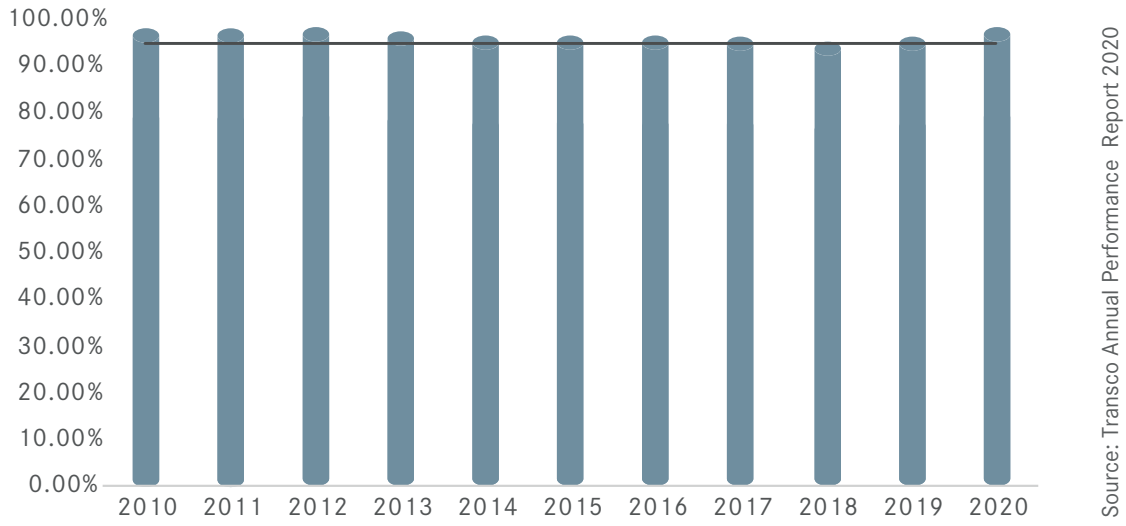


Figure 24: Transmission System Availability

Water Quality Regulatory Performance-Transmission

The transmission water quality sampling and testing is conducted as per the WQR regulatory prerequisites. The sample must be representative of the water quality at the time of sampling, its collection program is made with sampling frequency from predetermined locations at equal intervals over the year and it must be analysed as soon as practicable after it has been taken.

The total number of tests completed by TRANSCO in 2020 was 42,029 with 62 water quality parameters tested in TRANSCO transmission network. The overall water quality testing frequency compliance (measure of the number of tests conducted against those required) for TRANSCO was 100%.

The overall average water quality compliance for 2020 was 96.41%, with Physical Parameters and Microbial Parameters compliance at 92.27% and 100% respectively.

Figure 25 below depicts five years overview of the transmission consistent overall water quality compliance.

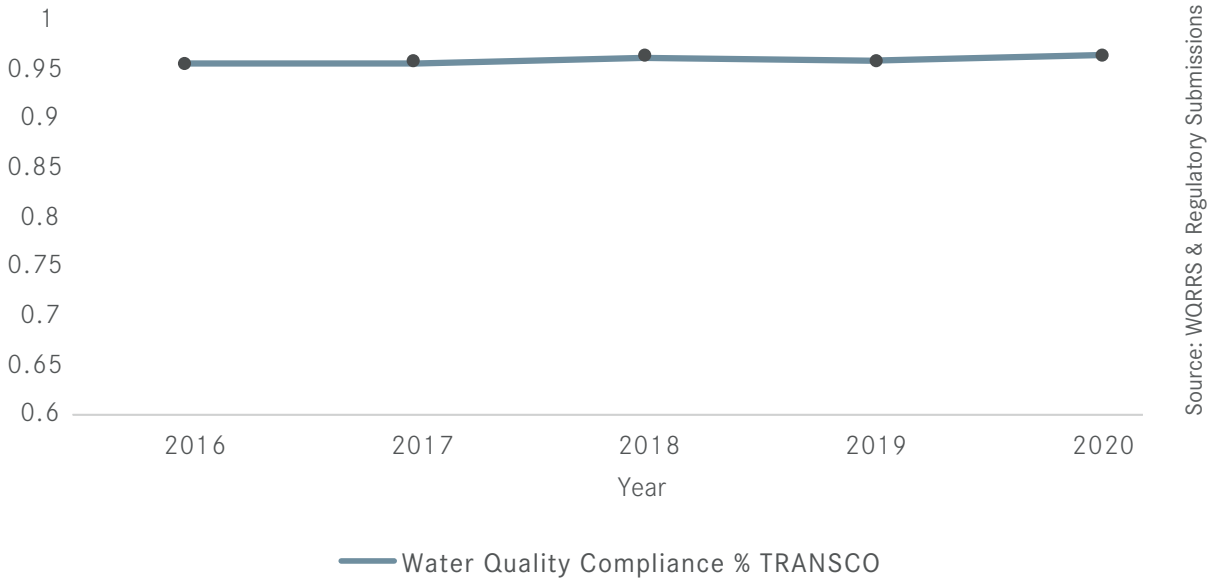


Figure 25: TRANSCO Water Quality Regulatory Compliance %

Electricity and Water Distribution

Distribution Overview

ADDC and AADC own and operate electricity and water distribution and supply networks in their respective geographical areas. Both companies own and operate the low voltage electricity network (33 - 22- 11 KV), as well as a water distribution network with a total length of 14,146 (km) transporting electricity and water from the transmission system to homes and businesses across the Emirate of Abu Dhabi.

The tables below provide an overview of the electricity and water distribution customers and asset base in 2020.

Table 3 Number of Customers

	ADDC	AADC	TOTAL
Number of Electricity customers	405,757	157,932	563,689
Number of Water customers	327,760	95,329	423,089

Table 4: Electricity and Water distribution network assets

	ADDC	AADC	TOTAL
Electricity Distribution Network Assets			
Number of Primary Substations	299	175	474
Number of Distribution Substations	20,326	16,324	36,650
km of cable/overhead lines	46,278	28,701	74,979
Water Distribution Network Assets			
Water Pipelines (km)	9,148	4,998.53	14,146.53
Pumping Stations	33	7	40
Capacity	0.27 MCMD	0.23 MCMD	0.5 MCMD
	(59 MIGD)	(51.19 MIGD)	(110.19 MIGD)
Reservoirs	51	16	67
Reservoirs Capacity	0.14 MCM	0.13 MCM	0.27 MCM
	(31.5 MIG)	(28.5 MIG)	(60MIGD)

Electricity Peak Demand

The peak demand load of ADDC grew by 8% from 2019 to reach 6,568 MW in 2020, while that of AADC grew by 2.9% to reach 2,444 MW.

Figure 26 below shows the peak demand growth for the last 15 years for each of the Distribution Companies.

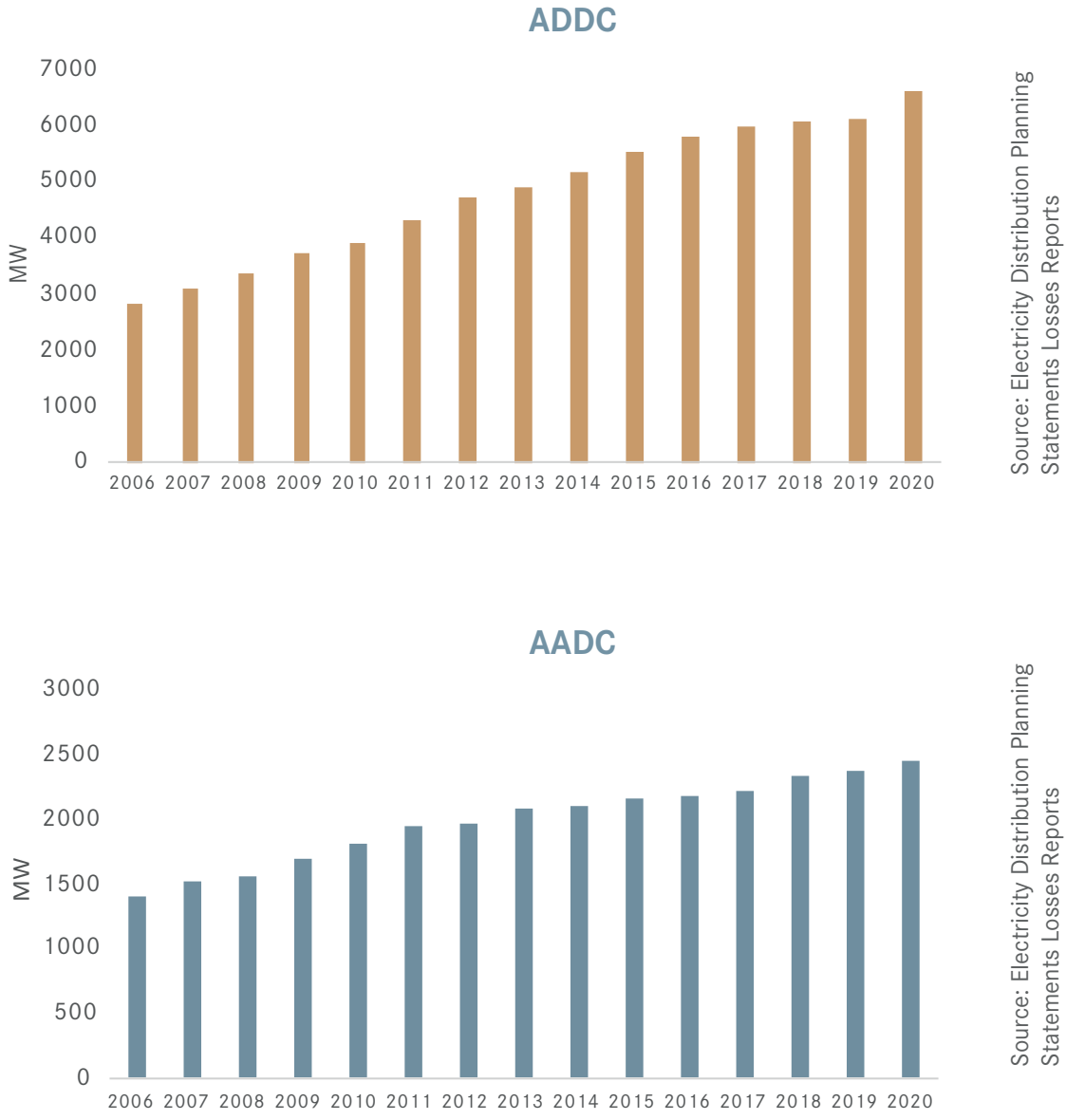


Figure 26 : Peak demand growth

Water Average Weekly Supply

In 2020, the average daily water supplied by TRANSCO to Abu Dhabi was 2.10 MCMD (461 MIGD) and to Al Ain was 0.79 MCMD (173 MIGD), based on weekly averages, as illustrated in the graphs below. This has been consistent with the weekly water supplied in 2019.

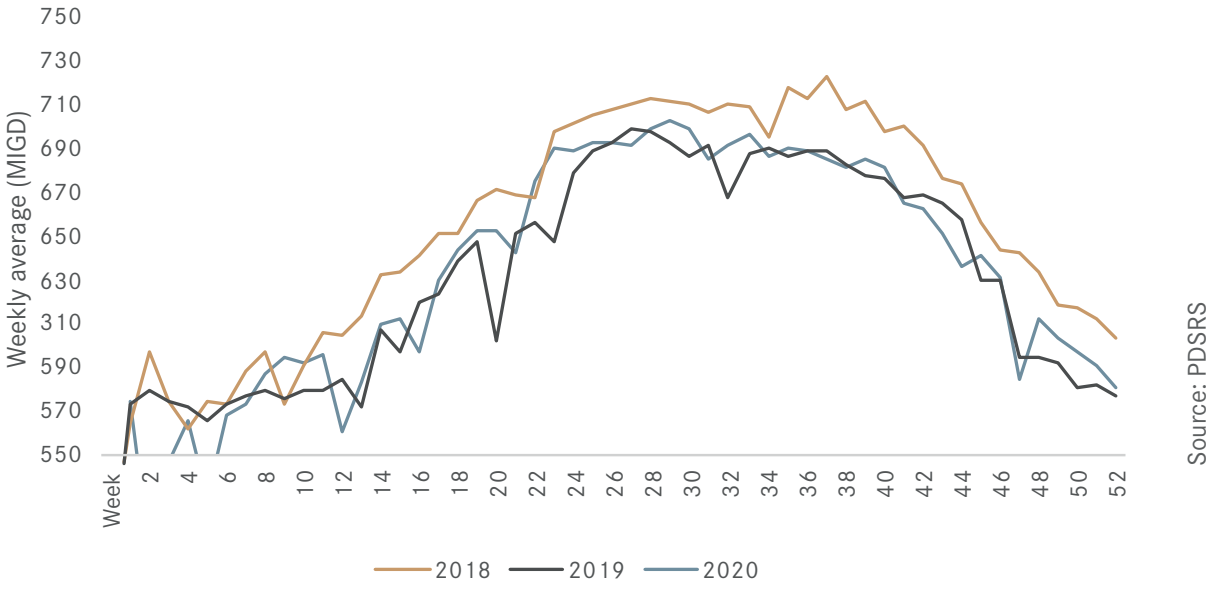


Figure 27: Water supply – Abu Dhabi Emirate

Electricity Distribution Network Performance

Similar to the transmission system, the performance of the distribution system in terms of efficiency and quality is monitored through KPIs measuring parameters such as customer interruptions and system losses.

Customer Interruptions

SAIDI, the System Average Interruption Duration Index is calculated as the sum of customer minutes lost experienced during the year due to interruptions in the network divided by the number of customers. It gives an indication of the average duration of interruption experienced by a customer over the year.

SAIFI, the System Average Interruption Frequency Index is calculated as the sum of the number of customers affected by interruptions during the year divided by the number of customers. It gives an indication of the average number of interruptions experienced by a customer over the year.

While these two KPIs measure averages over the year, any major interruptions, which have a large contribution to SAIDI and SAIFI, are reportable under the Incident Reporting Regulations are investigated accordingly. These incidents, and reporting requirements, are elaborated in Chapter 7 of this report.

The 2020 ADDC SAIDI and SAIFI figures decreased significantly, in the order of 30% and 20% respectively, thereby compensating for the regression which occurred in 2019. AADC's figures similarly increased by 1.5% and 8% from the 2019 figures reaching the same levels as the 2018 .

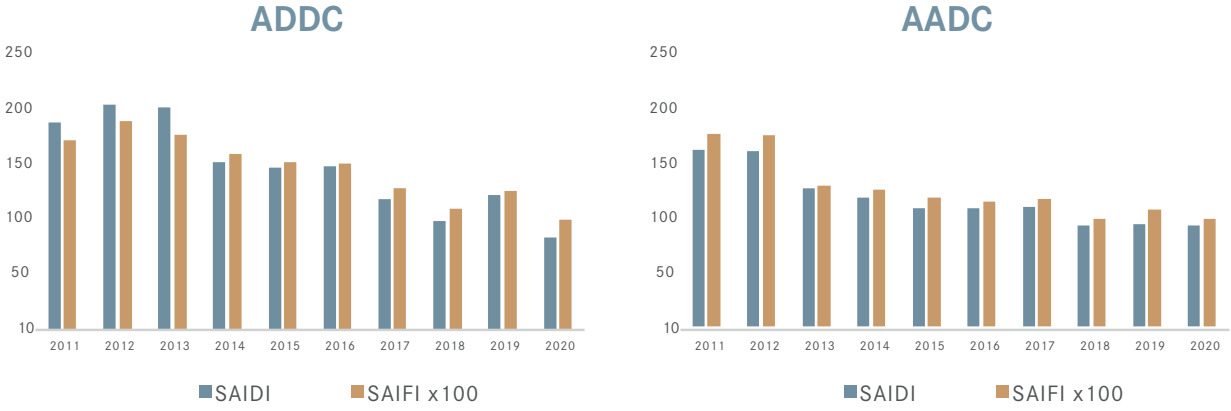


Figure 28 ADDC and AADC Power Interruptions

In 2018 the Council of European Energy Regulators (CEER) conducted a benchmarking study and published a report on the quality of supply for its members in 2016 , and SAIDI and SAIFI were the main indices used for electricity

It is apparent that Abu Dhabi emirate overall fares reasonably well in comparison with the top-ranking European countries. This is due to the continuous efforts of the DISCOs over the years to improve the performance of the network in terms of capital investment and operational practices.

Losses

Electricity losses are measured by the difference between the units entering the system and those leaving it. In the case of distribution, the measurement is distorted by the billing and meter-reading cycle of both AADC/ADDC customers and therefore show significant year-on-year variations.

The slight increase in losses in 2020 for both AADC and ADDC is therefore not significant, as it is within said year-on-on year variations.

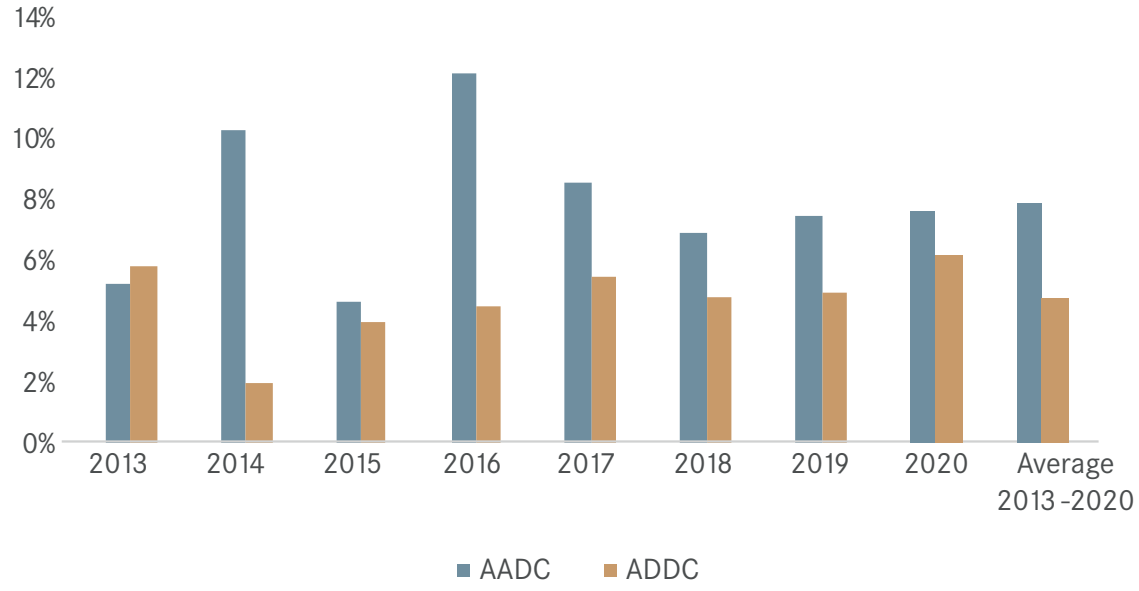


Figure 29 Distribution Losses

Water Distribution System Performance

Similarly, the performance of the water distribution system is measured using various indicators developed by the DoE, including:

- Pressure of Supply
- Type of supply

Pressure of Supply

Pressure of Supply measures supply pressure with a view to achieving a standardized level sufficient to supply low-rise buildings, thereby reducing reliance on ground storage tanks and preventing infiltration by ground water contaminants.

In line with the Water Supply Regulations the minimum required pressure in the distribution network is 1.25 bar. In 2020, compliance with this requirement increased to nearly 99% in Abu Dhabi and stayed the same at 93% in Al Ain, as shown respectively in Figures 30 and 31 below.

With respect to ADDC, the majority of the noncompliant cases were in the Central Region and some in Eastern Region. As for the Central Region, ADDC restricted pressure at the interface points with TRANSCO. This is because of the aged assets in some areas on Abu Dhabi Island. Replacement projects are ongoing to replace these assets (some Pressurized Ring Mains and Sector Mains).

With respect to AADC, the noncompliant cases were in Abu Samra and in Al Yahar (Wahat Al Amirah) due to the pressure management/reduction required there, to avoid breakages on the aged networks. With the completion of TRANSCO's projects in Al Ain, all transmission constraints have been lifted. On the other hand, AADC are progressing well with their asset replacement scheme and the situation should improve further.

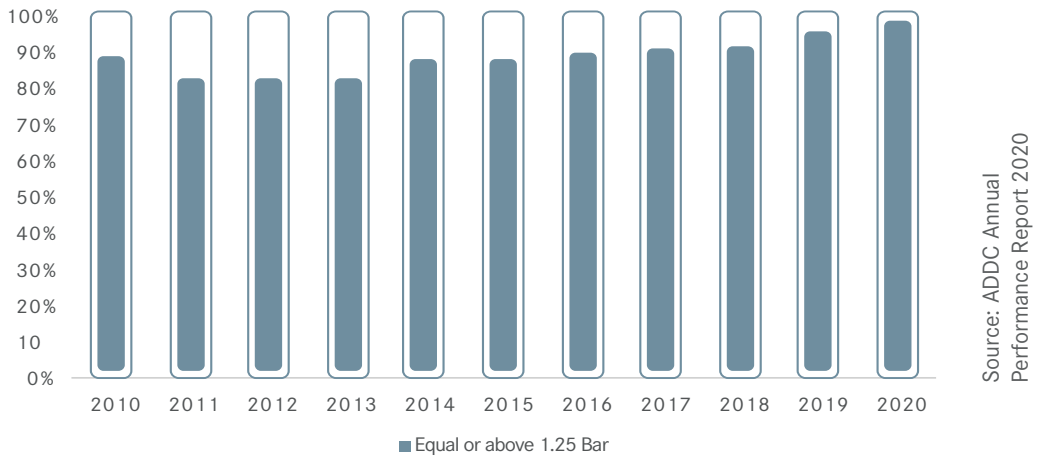


Figure 30: Pressure of Supply ADDC

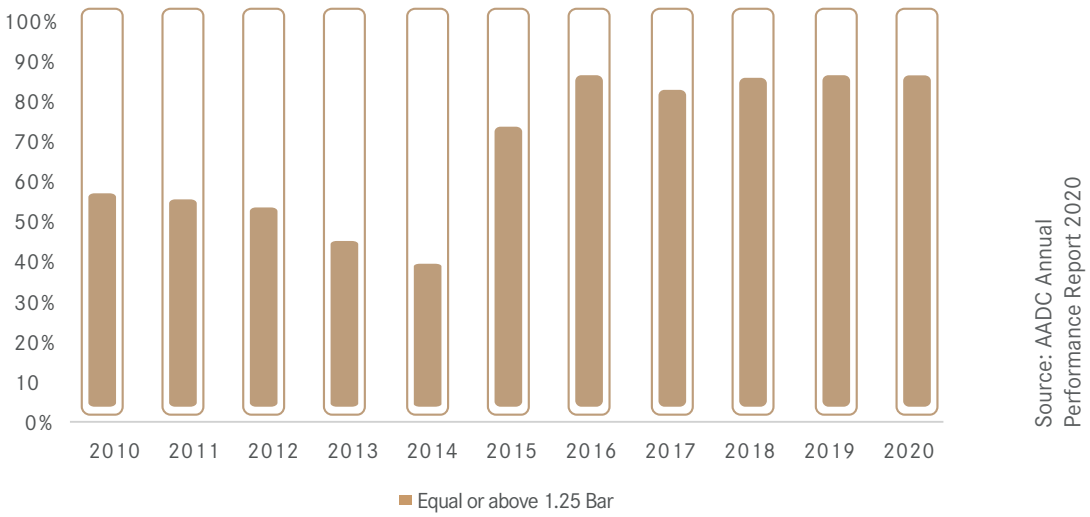


Figure 31: Pressure of Supply AADC

Type of Supply

This indicator measures the progress made towards reducing the number of customers dependent on tankers and intermittent supply.

For ADDC the proportion of customers connected to the network stands at 99.44%, with 99.17% on continuous supply and 0.27% on intermittent supply, while the remaining customers (0.56 %) are supplied with water by tankers.

The situation in AADC has been steadily improving and around 99.10% of AADC's customers are now connected to the network with 99.12% on continuous supply and only 1.98% on intermittent supply, a notable improvement since last year (3.87%). The remaining customers (0.9%) are supplied with water by tankers.

Figure 32 below shows the increase in unrestricted supply in Al Ain during 2020.

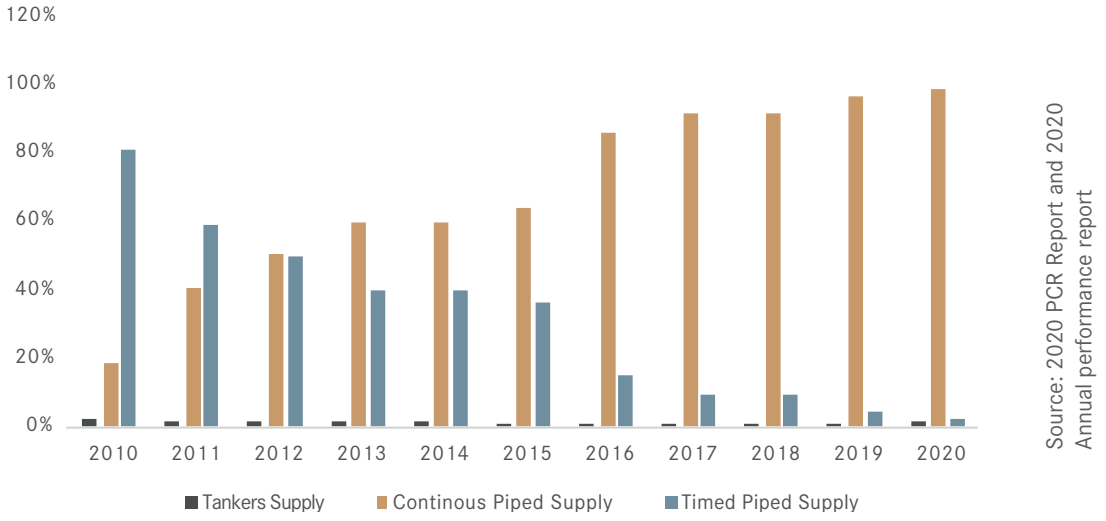


Figure 32: Unrestricted Supply in AADC

Water Quality Regulatory Performance - Distribution

The distribution water quality sampling and testing is conducted as per the WQR prerequisites. The sample must be representative of the water quality at the time of sampling, its collection program is made with sampling frequency from predetermined locations at equal intervals over the year and it must be analysed as soon as practicable after it has been taken.

Distribution- ADDC

The total number of tests completed by ADDC in 2020 was 45,361, with 64 water quality parameters examined for the ADDC distribution network. The overall water quality testing frequency compliance (measure of the number of tests conducted against those required) for ADDC was 100%.

The overall average water quality compliance for 2020 was 97.31%, with Physical Parameters and Microbial Parameters compliance at 99.97% and 100% respectively.

Figure 33 depicts five years overview of ADDC consistent overall water quality compliance.

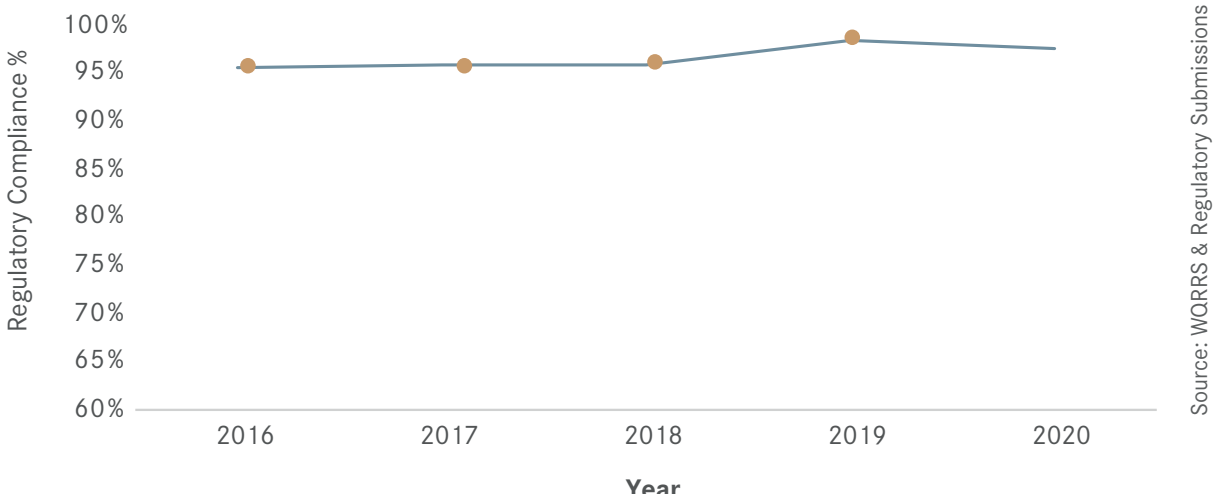


Figure 33: ADDC Water Quality Regulatory Compliance

Distribution- AADC

The total number of tests completed by AADC in 2020 was 14,704, with 64 water quality parameters examined for the AADC distribution network. The overall water quality testing frequency compliance (measure of the number of tests conducted against those required) for AADC was 100%.

The overall average water quality compliance for 2020 was 98.21%, with Physical Parameters and Microbial Parameters compliance at 99.99% and 100% respectively.

Figure 34 depicts five years overview of AADC consistent overall water quality compliance

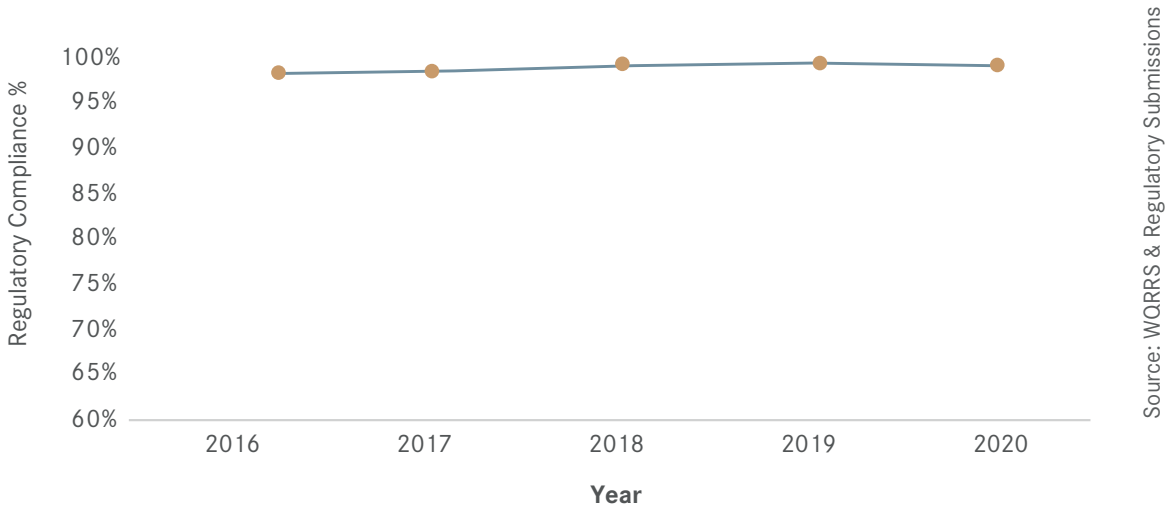


Figure 34: AADC Water Quality Regulatory Compliance %

6. Wastewater and Recycled Water

6 Wastewater and Recycled Water

Wastewater Collection

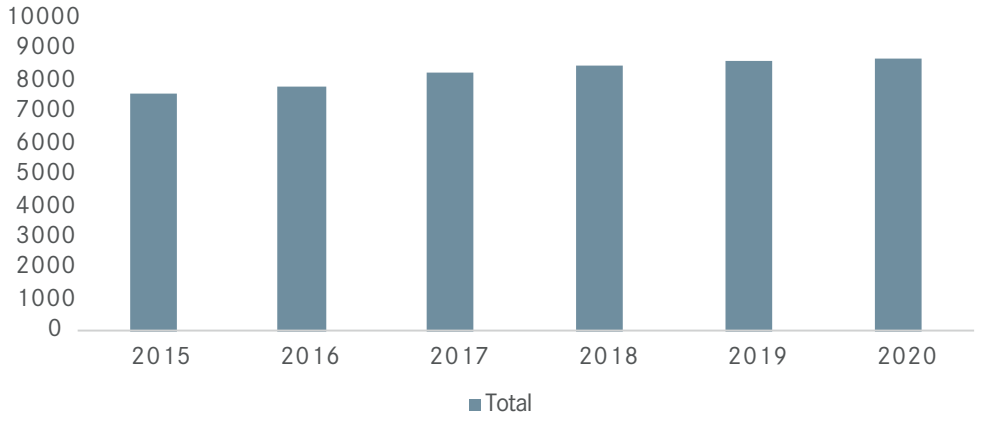
Wastewater collection is defined as the connection of premises to the sewerage system and the transportation of wastewater from premises or customers to the wastewater treatment system. The key components of the collection systems operated in the Emirate are:

- Deep tunnel sewer;
- Conventional gravity sewers;
- Pumping stations; and
- Pumping mains.

The Strategic Tunnel Enhancement Programme (STEP) project in 2017 enabled ADSSC to use link sewers to intercept the wastewater flows in existing gravity sewers just upstream of the existing pumping stations and transfer these flows into the Deep tunnel sewer. The wastewater is then conveyed by gravity via the Deep tunnel sewer to the Al Wathba 1 and Al Wathba 2 treatment plants.

Currently, flows from catchments of main pumping stations in Abu Dhabi MPS1, MPS2, MPS3, MPS4, MPS13, MPS14, MPS6, MPS17, MPS8N and many smaller pumping stations are diverted to the Deep tunnel. Several asset enhancement and link sewer projects continued in 2020 with further enhancement projects planned through to 2024.

In 2020 ADSSC operated a total of 300 pumping stations which ranged in size from small local stations to large terminal pumping stations rated at over 300l/s. Additionally, the total network length operated by ADSSC in 2020 was 8,706 km. Figure 35 illustrates the year on year change in the length of sewer network operated by ADSSC.



Source: Security Standard Report 2020

Figure 35: Collection network length (km)

The network length has increased steadily since 2015 due to new network projects and networks adoption from developers.

Collection Network Performance

ADSSC's sewerage collection network is monitored by several KPIs set by the DoE, including:

Sewer collapses per 100km

A sewer collapse is a break or collapse in any gravity sewer, pumping main or vacuum system main which forms part of the licensee's sewerage system and causes an interruption to the service.

The number of collapses per 100km of sewer is a good indicator of the effectiveness of collection system asset management activities and the performance of the operator in managing third party activities close to sewer systems.

Sewer blockages per 100km

A sewer blockage is any partial or total blockage in any gravity sewer, pumping main or vacuum system main which forms part of the licensee's sewerage system and causes an interruption to the service.

The frequency of blockages per 100km is a good indicator of the effectiveness of operation and maintenance activities in the collection system.

Figure 36 shows ADSSC's sewer collapses and blockages rate between 2015 and 2020.

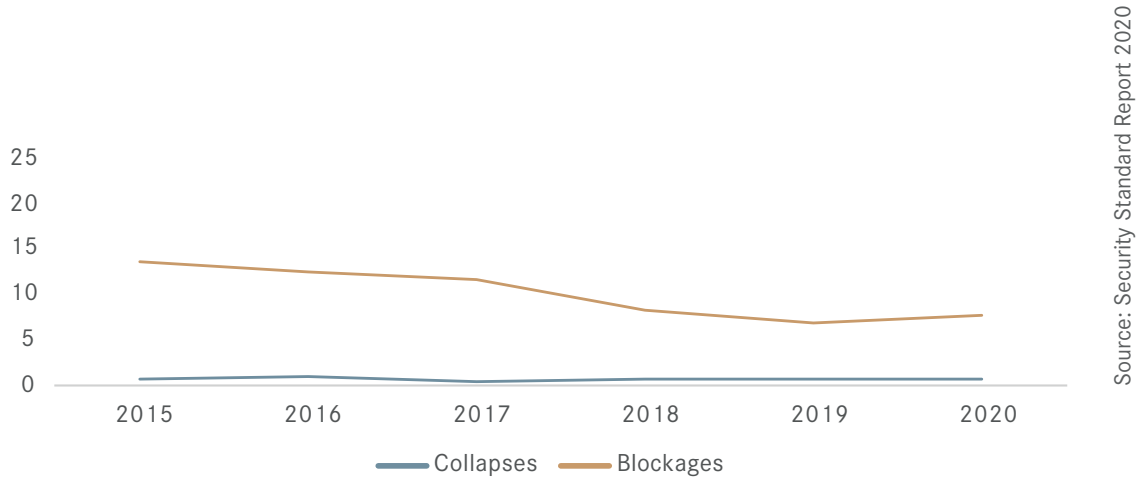


Figure 36: Sewer collapses & blockages per 100km

The primary contributor to the blockages was reported to be the fibre optic cables installed in the sewer system in Abu Dhabi City. ADSSC reported that many overloaded catchments were relieved after 2017 due to the commissioning of STEP which reduced the wastewater levels in the conventional gravity sewers. Additionally, ADSSC continued their network maintenance activities to further reduce the number of public blockages.

It should be noted that the above numbers do not include data on the blockages cleared from private sewer systems which totalled a further 69,838 incidents in 2020.

The rate of sewer collapses demonstrated no appreciable change from 2015 to 2020.

Quality Performance

Trade Effluent Control

The discharge of Trade Effluent poses a significant operational challenge to wastewater collection, treatment and disposal systems. In order to manage these risks, ADSSC is empowered to issue and enforce consents that define the terms and conditions under which the discharge can be made.

Aside from expirations, there were no new consents issued or terminated by ADSSC in 2020, primarily due to the impact of COVID-19. At the close of 2020 there were 109 consented entities. Figure 37 illustrates the change in number of consented entities between 2015 and 2020.

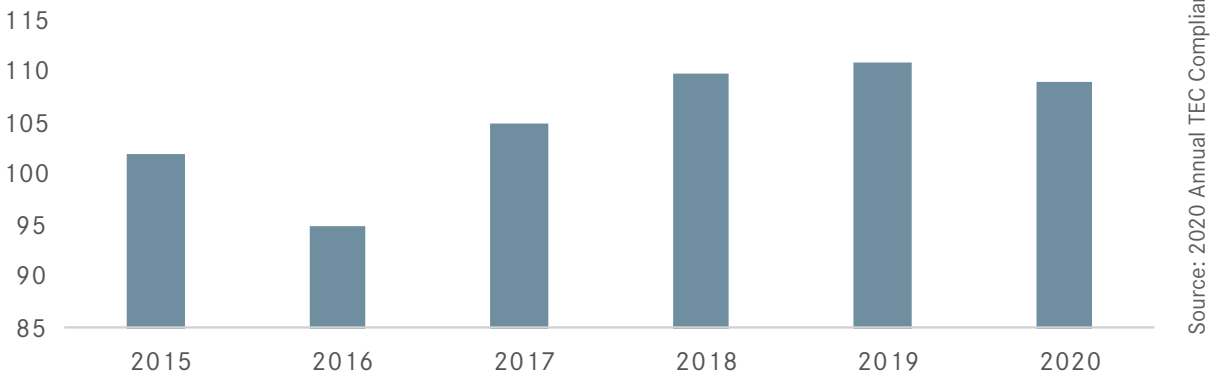
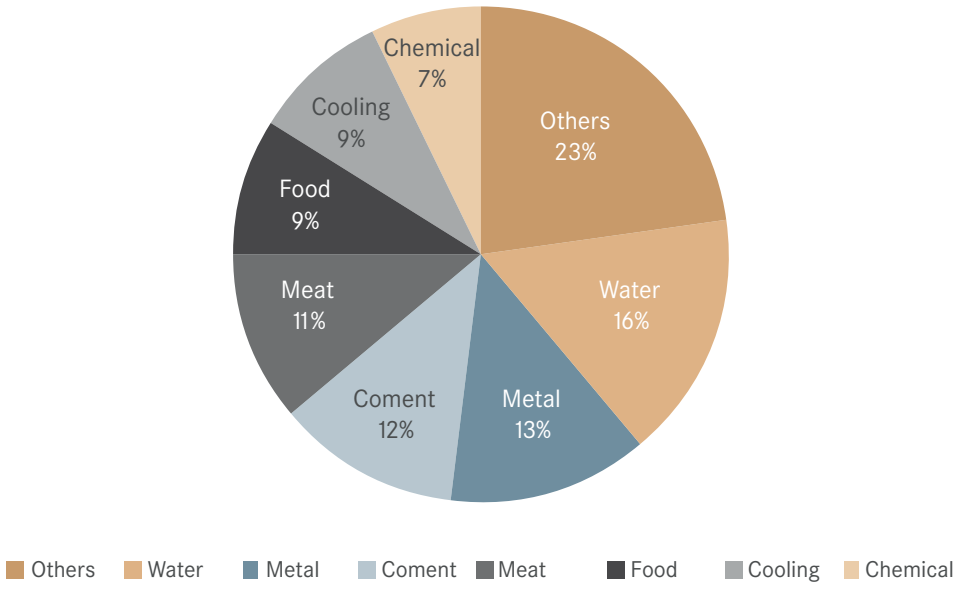


Figure 37: Number of Consented Entities

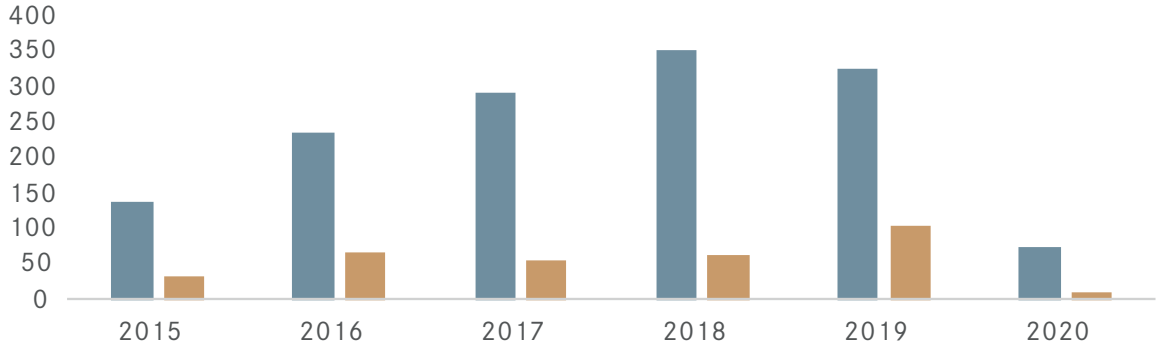
The largest contributors to the trade effluent flow were found to be the water, food and beverage, metal finishing and cement industries. A breakdown of consent holders by industry type is shown in Figure 38 below.



Source: 2020 Annual TEC Compliance Report

Figure 38: Consent Holders by Industry Type

ADSSC categorises its consent holders as high, medium, or low risk according to the size, nature of discharge, and consent holder performance history. This categorisation is used to define the sampling and inspection frequencies for each consent holder. Based on this ADSSC conducted 75 sampling and inspection assessments of consent holders in 2020. Figure 39 illustrates the number of sampling events since 2015. Sampling was suspended in the second quarter of 2020 following the COVID-19 outbreak and the associated health and safety concerns regarding sampling of trade effluent.



Source: 2020 Annual TEC Compliance Report

Figure 39: Number of Sampling Events

The most commonly exceeded parameters were pH, TSS and COD. These exceedances were related primarily to the slaughterhouses, cement and water factories.

ADSSC issued 3 observation notices which required consent holders to address issues associated with sample failures or issues identified during inspections.

The DoE recognises that the technical and financial effort involved with issuing and monitoring Trade Effluent consents for certain types of Trade Effluent is disproportionate to the risks posed to the receiving sewerage systems. Accordingly, these discharge types are designated as Low Risk Trade Effluent and are managed by ADSSC through Codes of Practice.

There are currently three Codes of Practice in place covering restaurants and cafes, small-scale laundries, and vehicle washes. Figure 40 below shows the number LRTE entities inspected from 2015 through 2020 and the corresponding number of issues encountered during the inspections.

Restaurants and cafes continue to constitute the bulk of ADSSC's inspection workload and a decrease in the number of registered restaurants and cafes was noted in 2020. The main issues encountered by ADSSC inspectors were related to grease trap maintenance.

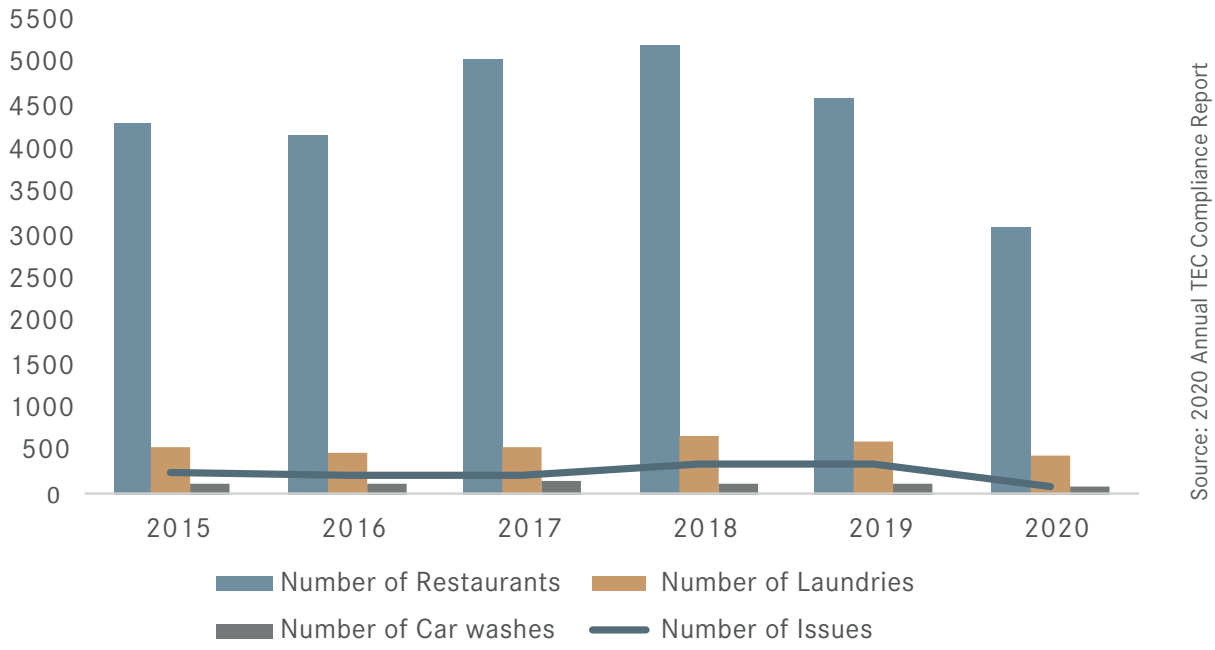


Figure 40: Breakdown of low-risk Entities by Type of Business

Wastewater Treatment

Wastewater treatment is defined as the reception of wastewater from the collection system, the treatment of the wastewater and delivery of the resulting products to the disposal system. In 2020, a new treatment plant was commissioned in Razeen bringing the total number of treatment plants operated by ADSSC to 40 with a corresponding overall installed capacity of 1,334 ML/day.

Over 90% of the total flow in the Emirate of Abu Dhabi continues to be handled by 5 treatment plants; Mafraq, Al Wathba 1 and Al Wathba 2 in Abu Dhabi, and Saih Al Hamah and Al Saad treatment plants in Al Ain.

Figure 41 below depicts the capacities of the 5 largest plants and their average daily flows in 2020. The figure demonstrates that the treatment plants continue to have sufficient capacity to absorb further flows. Although the average daily flow at Al Saad treatment plant is the closest to capacity, the 2020 flows have decreased 7% since 2016 reducing the urgency for a treatment plant upgrade.

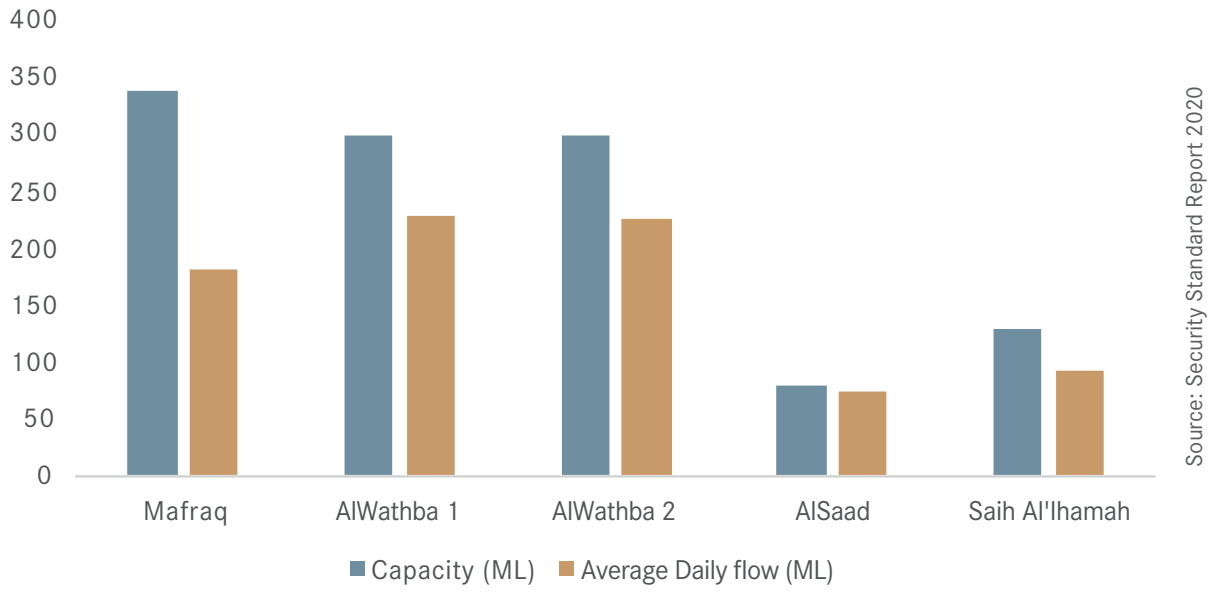


Figure 41: Production and Capacity (ML)

Figure 42 illustrates the total annual flow in the Emirate of Abu Dhabi, and the corresponding flows in each region from 2015 and 2020. A cumulative reduction in flow of 9% was recorded between 2015 and 2020. In 2020 the annual flow flattened out with just a 1% increase noted.

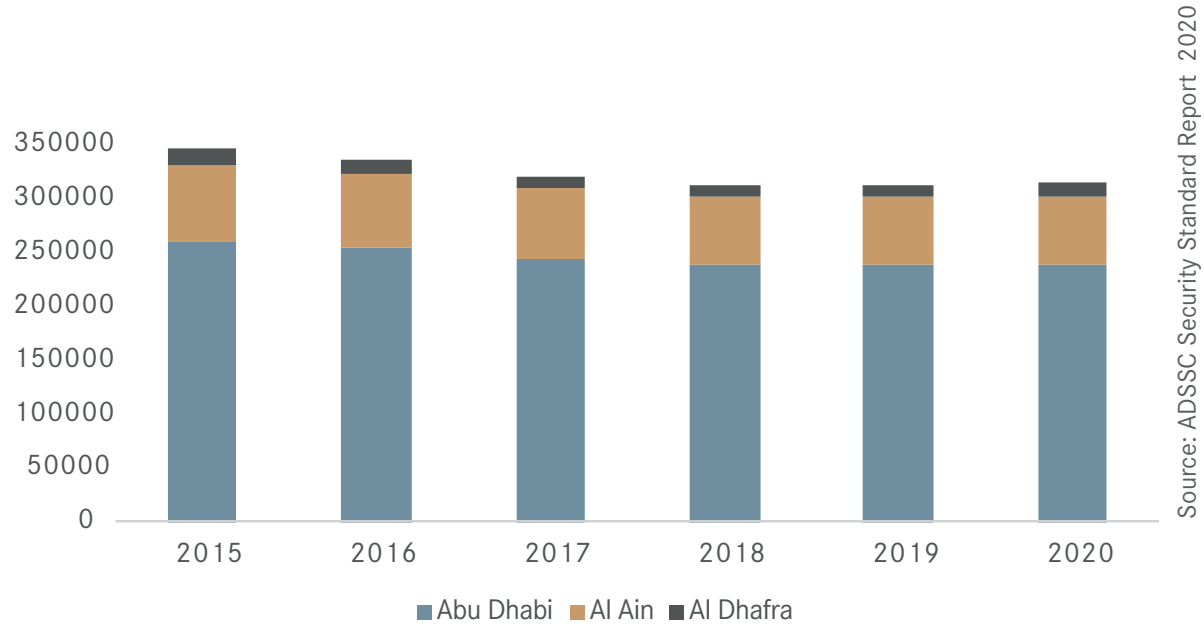


Figure 42: Annual flow data (ML)

Figure 43 illustrates the proportion of wastewater managed by each of the major licensees in 2020 and highlights the role played by the Independent Sewage Treatment Providers Etihad Biwater and Veolia Besix who manage approximately 70% of the total wastewater treated in the Emirate.

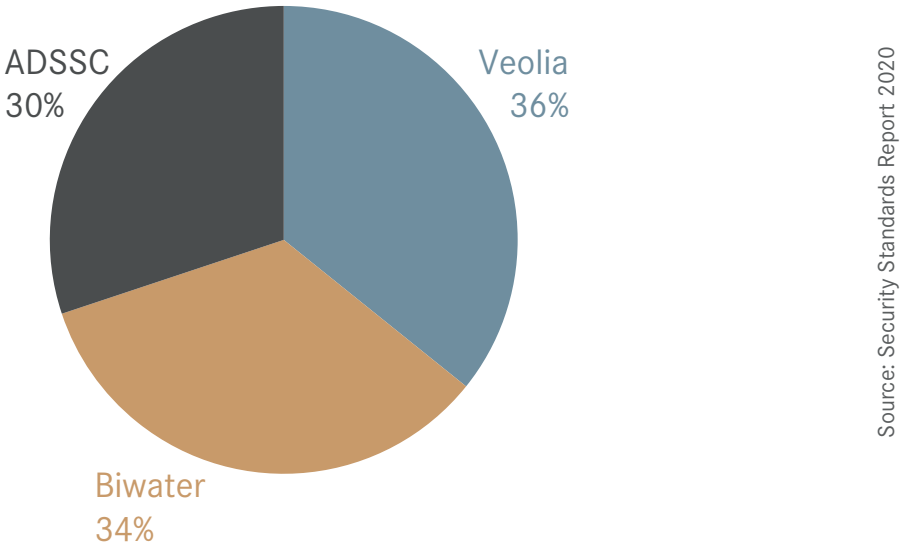


Figure 43: Proportion of Flow Handled by Major Licensees

Quality of Recycled Water

The Recycled Water and Biosolids (RW&B) Regulations establish a legal framework for the safe and economic reuse and management of recycled water and biosolids throughout the Emirate of Abu Dhabi. Developing relevant information on the quality of these important products and robust, transparent reporting will highlight compliance difficulties and allow licensees to develop effective operational or project-based solutions to drive year-on-year improvements.

Figure 44 below summarises the recycled water quality compliance for the five major treatment plants operated by large scale licensees from 2015 to 2020 against the sanitary, microbiological and trace elements parameters outlined in the RW&B Regulations. Compliance was assessed by establishing the proportion of samples that passed the relevant standards for the three key parameter groups.

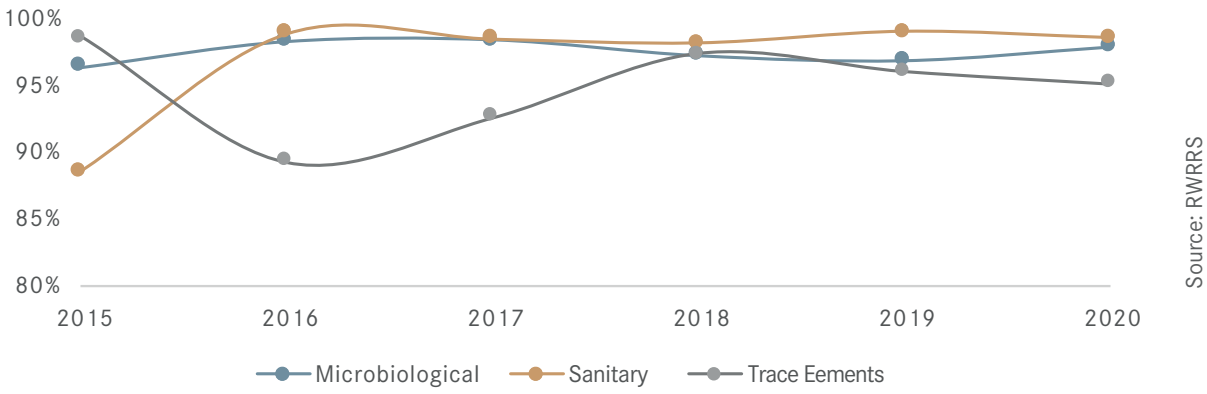


Figure 44: Recycled Water Quality

The data shows significant improvements in compliance against the three key parameter groups over the time period, with excellent compliance reported throughout 2020 for sanitary and microbiological parameters. There was a slight decrease in trace elements parameters compliance which is being investigated by ADSSC.

Additionally, it was noted that salinity continues to be an issue in the raw wastewater entering the Abu Dhabi treatment facilities. This is caused primarily by groundwater infiltration entering the sewerage network through defective pipes, pipe joints, connections, or manholes. Network rehabilitation schemes on Abu Dhabi Island, Mainland and in Musaffah are ongoing to decrease the infiltration affecting the Mafraq, Wathba 1 and Wathba 2 treatment plants.

Quality of Biosolids

Figure 45 below summarises the biosolids quality compliance for the five major treatment plants operated by large scale licensees from 2015 to 2020 against the microbiological and trace elements parameters outlined in the RW&B Regulations.

Trace elements quality was found to be consistent from 2015 to 2020, with any trace elements related issues being followed up by ADSSC as part of their trade effluent control programme. A decrease in microbiological quality from 2019 to 2020 was noted, albeit with significantly reduced sampling due to the COVID -19 virus. The DoE granted a temporary relaxation of some of the regulatory limits whilst ADSSC investigates treatment processes and process efficiencies in removing microbiological contaminants.

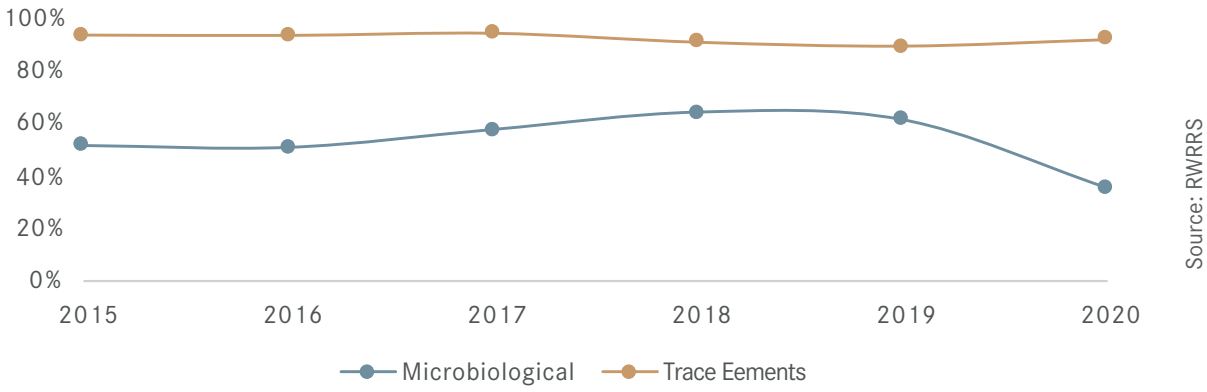


Figure 45: Biosolids Quality

Recycled water Distribution & supply

Recycled Water Distribution and Supply Assets

The DoE issued Licenses to both ADDC and ADDC for the distribution and supply of recycled water effective 1 January 2018. Accordingly, the entire recycled water distribution and supply network has been transferred to the distribution companies from ADSSC and from the municipalities. Distribution companies operate the recycled water network to transport recycled water from ADSSC to customers such as municipalities and several commercial entities. Currently recycled water is being used as a valuable source of water for landscape irrigation and beautification of the city.

Table 5 below provides an overview of the existing recycled water asset base. ADDC and AADC are continuing with projects to enumerate the quantity of assets that were handed over, assess the asset condition of the transferred network, expand their networks, and enhance metering at the connection points with their customers.

Table 5 Recycled water assets

	ADDC	AADC	TOTAL
Total Pipeline Length (km)	1088	549	1,637
Number of Existing Interface Points with ADSCC	14	25	39
Number of Connections with Customer	149	651	800

Recycled Water Reuse

The products of wastewater treatment are a valuable source of water, nutrients and energy. The DoE believes that the wastewater sector must promote the reuse of recycled water and biosolids to support the Emirate's sustainable development goals.

The Recycled Water & Biosolids Regulations have been developed to maximise the social and economic benefits associated with recycled water and biosolids reuse and to minimise the risk to public health and the environment.

The Regulations outline the prohibitions for recycled water use, and the standards to be followed depending on the level of exposure to the general public. The predominant use for recycled water currently in the Emirate of Abu Dhabi is landscape irrigation. The DoE supports further end-use activities (e.g. industry, agriculture) whilst noting that further polishing or processing of the recycled water may be necessary and is the commercial choice and responsibility of the End-user.

A total of approximately 60% of the recycled water is currently used in the Emirate of Abu Dhabi. Figure 46 below shows the change in recycled water usage in each of the 3 regions, and the overall recycled water reuse in the Emirate of Abu Dhabi. Whilst almost all of the recycled water produced in Al Ain and Al Dhafra regions is used every year, Abu Dhabi region has shown a steady increase since 2015. ADDC has initiated infrastructure projects to convey the excess recycled water to farms thereby increasing the reuse percentage in Abu Dhabi.

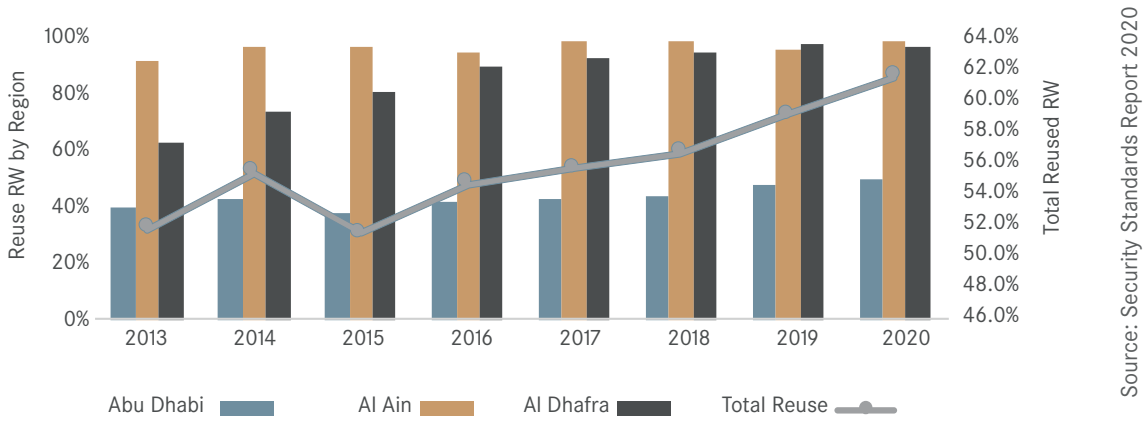


Figure 46: Recycled water Reuse

Biosolids

Only the five large treatment plants have treatment systems that can stabilise sewage sludge sufficiently for reuse as biosolids. All of the biosolids are currently being disposed to landfill subject to the regulation of the Environment Agency Abu Dhabi and the operation of The Centre of Waste Management. To divert the disposal away from landfill, ADSSC is actively seeking reuse outlets such as land application in forest preserves and potential industrial applications.

Figure 47 shows the amount of biosolids produced from 2015 to 2020. The production has remained relatively stable during the time period with annual fluctuations noted due to biosolids storage at the treatment plants. The total dry mass of biosolids produced in the Emirate in 2020 was 63,899 tons.

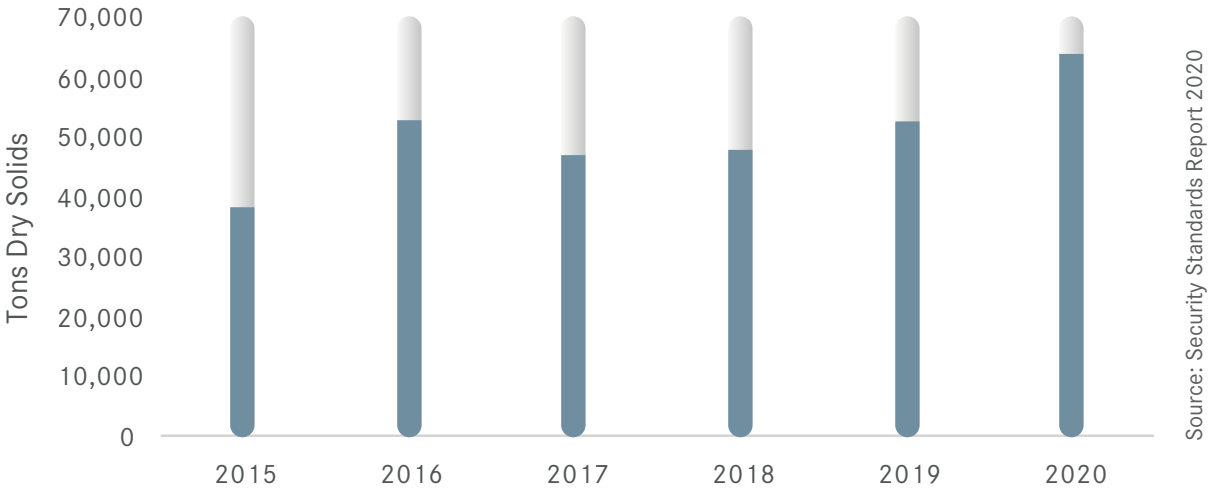


Figure 47: Biosolids Production

Small Scale licensees

In recent years, the DoE has observed several companies operating small scale sewerage systems throughout Abu Dhabi Emirate and has managed to bring many of these companies into compliance with the DoE's Regulations by issuing licences to unlicensed facilities. Treatment capacities of these small-scale sewerage systems are 10,000 m3/day and below.

There were a total of 44 small scale wastewater, treatment and disposal entities with licenses in 2020. Although none of the licensees provide recycled water quality to customers outside of their boundaries, the DoE has worked to improve compliance through organising education and awareness workshops with the licensees. Additionally, those licensees that do not provide demonstrable improvement in performance are referred to the DoE's licensing and compliance department for further actions.

7.

Health and Safety

7 Health and Safety

Introduction

The DoE is the Sector Regulatory Authority (SRA) for the energy sector in the Emirate of Abu Dhabi. The DoE has been entrusted as the point of contact with the government to update them with any matters related to the sector, including the management of operational and HSE incidents.

To fulfil this mandate, the DoE is managing HSE through two workstreams:

1. License requirements: DoE is responsible for licensing the activities of power generation, water desalination, wastewater collection, treatment and disposal, and district cooling, and HSE requirements are part of the license conditions.
2. SRA requirements: DoE is the Sector Regulatory Authority for the Energy sector and is responsible for supervising the Abu Dhabi Occupational Health and Safety Framework implementation.

HSE Performance

The DoE monitors the licensee's HSE performance through multiple tools including:

1. Incident Reporting System (IRS), enables DoE to monitor the operational incidents and the corrective actions taken by the Licensees to ensure that all corrective actions are implemented, and the best practices are used to prevent recurrences.
2. HSE Monthly performance reports, designed by DoE experts to monitor 33 KPIs that relate to different HSE matters related directly to the health being of the working power in the energy sector as well as those related to asset safety and environment issues. This report is submitted periodically by the Licensees to the DoE.
3. Al Adaa Soft link, which represents the reporting tool to ensure the implementation of OSHAD-SF that enables DoE to monitor the OSH Incidents and the quarterly performance of all registered Licensees in Al Adaa.
4. HSE Audit and Inspection process through site visits to test system implementation and identify improvement opportunities for the audited entities.

Incident Reporting

Incident reports are classified into three broad categories

- Occupational Health & Safety (OSH);
- Operational; and
- Environmental.

OSH Incidents

OSH incidents are defined as a single event or chain of events which has caused or has the potential to cause a fatality, injury or illness to a person, or damage to assets, or the reputation of any Entity.

The categories of these incidents include:

- Work-Related Fatality which is a death resulting from a work related injury or illness, regardless of the time intervening between injury and death.
- Lost Time Injury which is any absence from work resulting from work-related Fatalities, Permanent Total Disabilities, Permanent Partial Disabilities and Lost Workday Cases. The Lost Time Injuries were further broken down into the below:
    - o Lost Time Injury Frequency Rate (LTIFR): The total number of Lost Time Injuries per million hours worked during the period. Calculation: No. of LTI's x 1,000,000 / Working Hours
    - o Lost Time Injury Severity Rate (LTISR): The total number of lost work days per million hours of working. Calculation: No. of Work Days Lost x 1,000,000 / Working Hours

There were 20 total OSH incidents reported in 2020. The breakdown of these incidents by sector is shown in Figure 48 below.

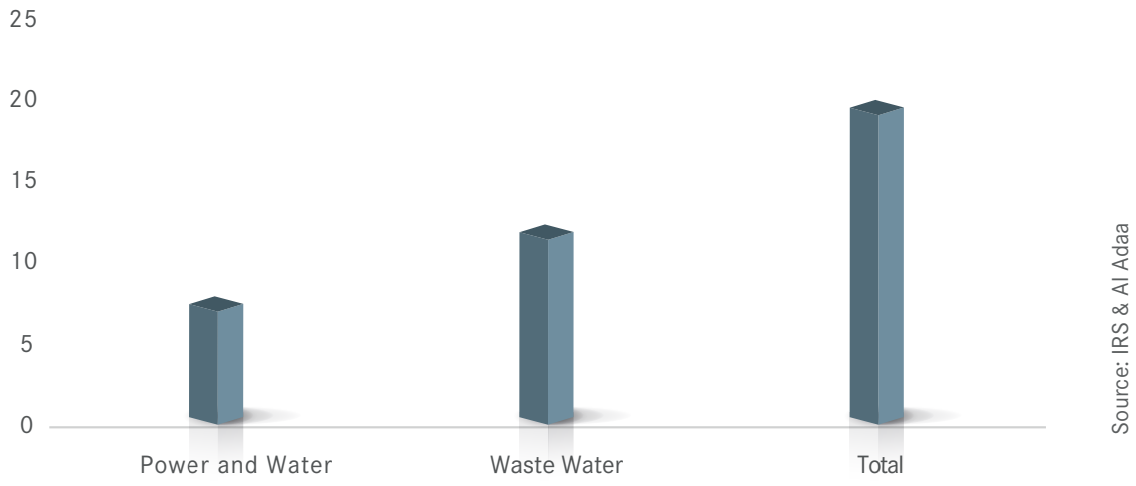


Figure 48: OSH Incidents by sector

The OSH incidents that occurred during 2020 were classified into 4 categories: serious injury, serious dangerous occurrence, lost working days due to occupational illness and fatality. These are shown on Figure 49 below.

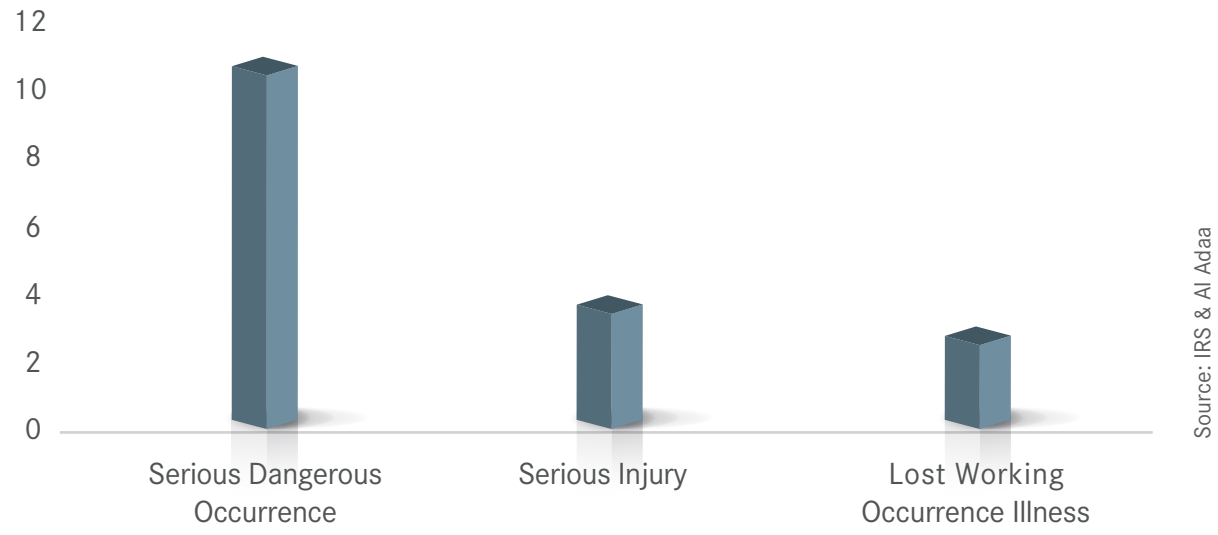


Figure 49: OSH incidents by category

Operational Incidents:

Operational incidents are defined as events that result in an interruption of service provided by the Licensee.

Operational incidents are classified based on the activities to:

- Power operational incidents (including power generation, transmission, and distribution)
- Water operational incidents (including water desalination, transmission and distribution)
- Wastewater operational incidents (including the wastewater collection, treatment, and recycled water distribution and supply)

In 2020 the DoE received and processed 429 operational incident reports; 23 of which were considered critical and required reporting within 5 hours. The remaining incidents are reported under the 12 hours or 24 hours reporting category. The breakdown of the incidents by sector is shown in Figure 50 below :

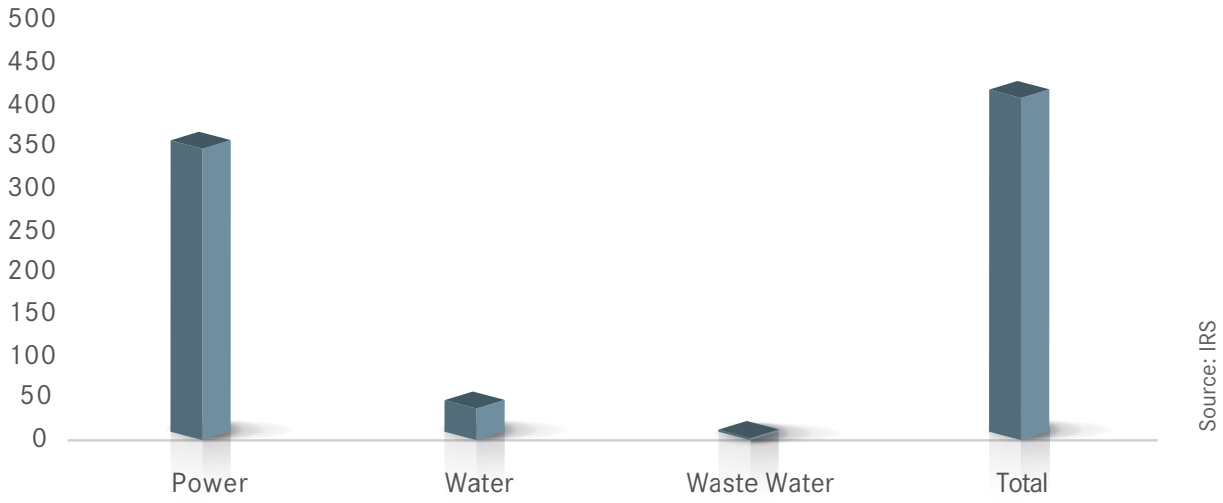


Figure 50: Operational Incidents in 2020

Operational Power Incidents:

A total of 367 operational power incidents were reported in 2020.

The 10 most critical operational power related incidents fell into two specific categories:

- An interruption on any 33kV, 22kV and 11kV bus bar section at any grid station (220/33, 132/33, 132/22, 132/11kV) – 6 incidents reported in 2020
- Total Plant trips – 4 incidents reported in 2020

The DoE reviewed all the incidents, the reported root causes and ensured that the proposed action plans were fit for purpose. Furthermore, the DoE conducted an annual meeting with all of the Licensees to discuss the most serious operational incidents and the necessary actions to prevent recurrence.

Operational Water Incidents

There were 58 operational incidents reported in the production, transmission and distribution networks in 2020. None of the incidents affected the security of supply.

There were 56 operational incidents from production side reported under the criteria of "The simultaneous outage of any two distillers and/ or two reverse osmosis racks and/ or one reverse osmosis pass line." the remaining 5 operational incidents in the Transmission network were reported under the criteria of " A failure in the transmission system that causes a shutdown to either 50% of the desalination capacity or production loss of more than 25 MGD (113,500 m3/day) at a production plant."

Operational Wastewater Incidents

There were 5 operational incidents reported in the wastewater sector. The majority of these incidents were reported under the criteria of "An unplanned event or chain of unplanned events that results in detection of any cross connection, backflow or other fault which has the potential to contaminate any other third party water network (potable, recycled, or stormwater etc.)"

In all cases no disruption was caused to the public.

Environmental Incidents

Environmental Incidents are defined as events resulting in an unplanned or uncontrolled release of a product or chemical with negative impact to the environment – water, air, soil, animals, plants, ecology and social life. There were no significant environmental incidents reported by the sector in 2020.

8.

Environment

8 Environment

The DoE ensures that environmental protection is a priority in all operations within the energy sector. A dedicated team is assigned to oversee the environmental performance in the sector as well as to ensure all operations are aligned with the Emirate's legal requirements.

The DoE works closely with the Environment Agency- Abu Dhabi to ensure compliance with all Regulations and agreed protocols for the energy sector. Also, the DoE is a part of the consultation process for all environmental matters related to the energy sector through participating in working committees and groups, and reviewing environmental Regulations and guidelines.

Each quarter, 12 sector companies submit their environment reports including Marine Water Quality, Air Quality and Waste management to DoE for monitoring and review. The DoE HSE team have reviewed 149 environment reports in 2020.

The DoE monitors the environmental performance of all licensees on a quarterly basis. The licensees submit an environmental report summarizing the data collected in regards to air quality emissions, sea water inlet and outfall discharge, and the waste register throughout the reporting period.

Additionally, the CO2 emissions in the energy sector is monitored on a regular basis. The total CO2 emissions in 2020 was 41,699,199 tons. The breakdown of the emissions by Licensee is shown in Figure 51 below.

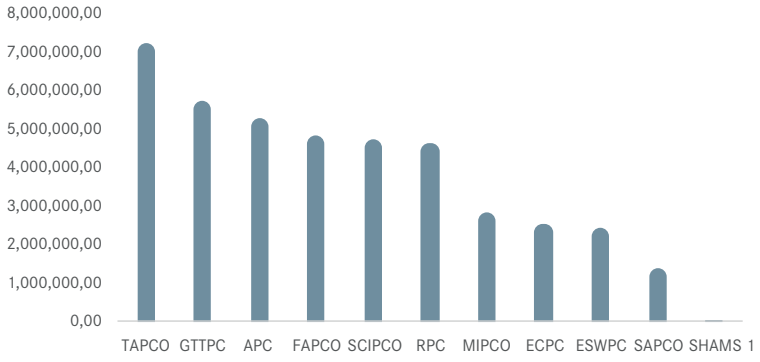


Figure 51: CO2 Emissions

Source: Licensees Quarterly Environmental Report

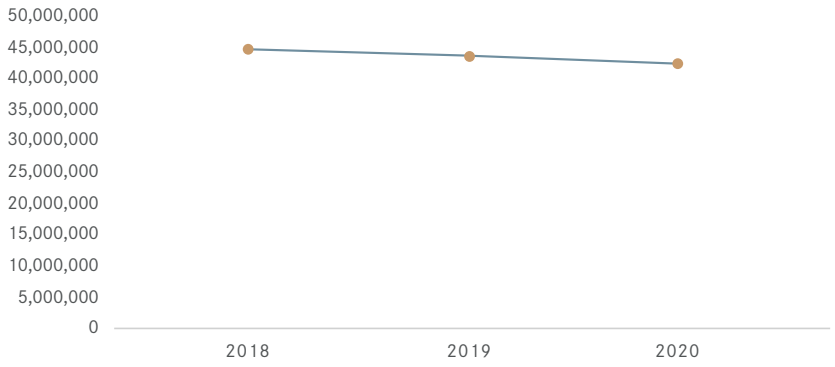


Figure 52: CO2 emissions in Tons (2018 - 2020)

9.

District Cooling

9 District Cooling

The DoE issued the District Cooling Regulation and the District Cooling Applicability Regulation which have been in effect since September 2019.

The Abu Dhabi Government thus becomes the first administration in the Middle East and North Africa region to set up a complete integrated system for district cooling. This, in turn, reflects the DoE's commitment to taking the lead in regional and global energy sector, highlighting its focus on developing infrastructure, ensuring energy efficiency, and promoting sustainable solutions.

The new Regulations aim to unify standards, integrate efforts to regulate the sector, ensure the highest quality and competitiveness for energy services, and protect consumer rights. The Regulations also include clauses to enhance energy efficiency, protect the environment, and encourage investments in the sector.

The District Cooling Regulation, and the DC Applicability Regulation, provide a regulatory framework for these activities in the Emirate of Abu Dhabi, offering investors, consumers, and the public safe, efficient, and economical cooling services.

The District Cooling Regulations covers technical performance standards and minimum guidelines, market competition and price regulation, minimum contractual requirements, and requirements for licensing.

The District Cooling Applicability Regulation aims to ensure developers study the feasibility of district cooling at the master planning stage to ensure the optimal use of energy infrastructure, and to promote more efficient cooling systems for areas where it can be applied efficiently. In addition, it supports expanding the scope of the district cooling system in the emirate by managing demand for it and encouraging the use of this technology.

District Cooling Regulations Implementation

Since the issuance of the DC regulations, DoE is working closely with the sector stakeholders to manage their expectations and address their concerns.

During 2020, DoE has prioritized the licensing of the sector companies starting with the DC Providers. It is anticipated to license the DC Providers first before licensing the downstream DC Retailers.

Due to the nature of the licensing process, where DoE issues a license per company instead of per DC scheme, close coordination with the DC providers took place to agree

on a licensing schedule prioritizing schemes with the most residential end users. This strategy is adopted to ensure immediate benefits to this critical customer category.

In 2020, DoE received 5 licensing application for 5 DC schemes :

- Saadiyat Beach and Saadiyat Cultural District by Saadiyat Cooling L.L.C
- NYU Abu Dhabi by Saadiyat District Cooling L.L.C
- Saraya Development by PAL Cooling
- Al Maryah Island by Al Wajeez Development CO. PJSC
- Shams 5 and 6 area (Al Reem Island) by S&T Cool District Cooling Company LLC

A grandfathering review process was initiated for the mentioned schemes as they have existed prior to the enactment of the regulations. The grandfather review process assesses the legal, financial, and technical compliance of the scheme against the DC Regulations and the DC Technical Codes.

There are over 25 existing DC schemes in Abu Dhabi that will have to undergo this detailed grandfathering review. Licensing of all DC existing DC scheme will extend over the coming few years with the first DC license anticipated to be issued in early 2021.

Together with the detailed assessment required for the grandfathering review, the license submission grace period is currently extended to October 2021 (and potentially, additional extensions may be granted at the request of the sector) due to the situation surrounding COVID-19 which requires their attention on more pressing operational issues.

In 2020, HSE department of DoE has coordinated with the District Cooling companies and registered 4 companies with OSHAD which is a requirement by the new licensing scheme of the DC sector companies under the District cooling Regulations.

10.

Acknowledgments

10 Acknowledgments

The DoE has prepared this 2020 Technical Report in collaboration with Abu Dhabi energy sector's stakeholders. The DoE extends its gratitude and appreciation to all participating entities for their cooperation, transparency and integrity in submitting the required reports and data as per the applicable regulations.

Participating Entities:

- EWEC
- ADDC
- AADC
- TRANSCO
- ADSSC
- AMPC
- APC
- ECPC
- FAPCO
- GTTPC
- MIPCO
- RPC
- SAPCO
- SCIPCO
- SEMBCORP
- SHAMS
- TAPCO
- Al Etihad Biwater Wastewater Company (EB)
- Al Wathba Veolia Besix Wastewater Company (VeBes)