Environmental Statistics 2010

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Foreword

In the midst of the growing interest in the environmental issues at international level, environmental indicators have become one of the forefronts priorities of the developed statistical systems in the world. Therefore, the Statistics Centre – Abu Dhabi seeks to build a modern comprehensive environmental database that contributes effectively to promoting environmental knowledge and providing the necessary indicators to monitor and evaluate the sustainable development programs in the Emirate of Abu Dhabi at all levels.

In this context, the Statistics Centre – Abu Dhabi is pleased to provide decision and policy makers, businessmen, researchers, and all those concerned with environmental statistics and indicators in the Emirate of Abu Dhabi with the third issue of "Environmental Statistics", which accurately present environmental indicators of the Emirate of Abu Dhabi in 2010.

The publication deals in details with various environmental-related aspects, and its importance lies in containing a large number of indicators and analytical measurements that help monitor, evaluate, and study the environmental situation in a more specialized manner as well as in in-depth analysis of the impacts. Thus, the publication helps in developing integrated development plans and strategies to achieve the programs of sustainable development included in Abu Dhabi 2030 vision.

This publication is based on the belief of the Statistics Centre – Abu Dhabi that the preservation of the environment is a collective responsibility and a national duty, and that the natural resources and wildlife in Abu Dhabi reveals its identity and civilization.

As we provide you with the third issue of the "Environmental Statistics" of the Emirate of Abu Dhabi, we would like to extend our sincere thanks and appreciation to authorities and institutions which save no effort to provide us with data and information requested by the Centre. We would also like to say that we welcome all remarks and suggestions that aim at developing this bulletin and issuing it in the best way possible in its future issues.

All the Best,

Butti Ahmed Mohammed Butti Al Qubaisi

Director - General

Glossary of Abbreviations

AADC	Al Ain Distribution Company
ADDC	Abu Dhabi Distribution Company
ADNOC	Abu Dhabi National Oil Company
ADWEA	Abu Dhabi Water and Electricity Authority
BOD	Biochemical Oxygen Demand
EAD	Environment Agency - Abu Dhabi
GWH	Gega Watt Hour
L	Litre
mcg	Microgram
MCM	Million Cubic Metres
mg	Milligram
mm	Millimetre
MWH	Mega Watt Hour
na	Not Available
RH	Relative Humidity
SAIDI	System Average Interruption Duration
SAIFI	System Average Interruption Frequency Index

- Due to rounding, totals may not equal the sum of component parts.
- Unless otherwise indicated, all tables in this publication relate to the Emirate of AbuDhabi. However, when mentioned in table titles or within table cells " Abu Dhabi" refers only to the Region of Abu Dhabi and not the whole Emirate.

Summary of Environmental Indicators

The publication includes 2010 environmental indicators related to Abu Dhabi Emirate, and the following are the key indicators:

Climate Statistics

Indicator	Value	Unit
Average Minimum Temperature	23.0	Centigrade Celsius
Average Minimum Relative Humidity	33.1	Percentage
Average Rainfall Amount	23.2	Millimetres
Average Maximum Temperature	34.8	Centigrade Celsius
Average Maximum Relative Humidity	78.1	Percentage
Average Atmospheric Pressure	1,008.7	Hectopascal

Air Statistics

Indicator	Value	Unit
Air Pollutant Total Emissions- Oil and Gas Sector	340,093	Tons
Carbon Dioxide Emissions – Oil and Gas Sector	23.0	Million Tons
Per Capita Carbon Dioxide Emissions – Oil and Gas Sector	11.68	Tons

Energy Statistics

Indicator	Value	Unit
Total Consumption of Electricity	40,644	Gegawatt/ Hour
Number of Interruptions in Electricity Supply	32,246	Interruption
Duration of Interruptions in Electricity Supply	86,555	Thousand Minutes

Water Statistics

Indicator	Value	Unit
Desalinated Water Consumption	873.0	Million Cubic Metres
Average Withdrawal of Groundwater	2,250.90	Million Cubic Metres
Average Water Consumption per Agricultural Hectare	32,227.70	Cubic Metres
Quantity of Treated Wastewater	246.6	Million Cubic Metres
Total Non-Conventional Water Resources	999.3	Million Cubic Metres

Health and Safety Statistics

Indicator	Value	Unit
Number of Food Poisoning and Foodborne illnesses	1,259	Case
Total Reportable Case Frequency – Water and Electricity ProductionSector	11.30	Case per Million Hours Worked
Total Reportable Case Frequency – Oil and Gas Sector	0.76	Case per Million Hours Worked

Waste Statistics

Indicator	Value	Unit
Amount of Waste Generated	9,974,190	Tons
Daily Average of Waste Generated	27,326.55	Tons

Introduction

Environmental issues have been on top of the world issues raised for discussion in the international community and they even surpass other issues in priority, giving more attention for countries to protect the environment and monitor the current environmental statuses and changes.

As a result of the industrial revolution, technological development, accelerated development in all aspects of life, and the increase in consumption, the world witnesses a continuous increase in the rates of energy consumption of various types and the depletion of natural resources, the matter which has led to the increase of pollution rates resulting from gas emissions and wastes, and therefore causing the phenomenon of climate change and other environmental problems. Consequently, new obstacles and constraints for sustainable economic development have appeared. The deterioration of the environment does not only affect human beings, but also the whole ecosystem and biological systems including plants and animals.

In this context, it was necessary to provide environmental statistics data in an annual publication which includes detailed tables covering many indicators related to climate, air, energy, water, health and safety, and waste. The availability of such indicators is an integral part of statistical institutions and therefore Statistics Centre - Abu Dhabi seeks to build an environmental database that plays important roles in assisting researchers and decision makers for drawing future polices and projects.

Chapter One

1. Climate Statistics

The climate of the Emirate of Abu Dhabi features an arid nature characterised by relatively high temperatures especially in summer. The Emirate is located in the tropical dry region and the Tropic of Cancer runs through its southern part. The extreme summer temperatures of the Emirate are associated with high relative humidity, especially in coastal areas. Abu Dhabi has a warm winter with occasionally low temperatures and little amount of rain during the year. Coastal strip, the desert interior and areas of higher elevation all together form up the topography of the Emirate with a variation in temperatures between the areas. Seasonal northerly winds blow across the country and help improve the weather when they are not laden with dust, in addition to the brief moisture-laden south-easterly winds. The winds often vary between southerly, south-easterly, westerly, northerly and north westerly. Also, high rates of of water evaporation is another characteristic of the Emirate's weather, due to several factors, namely wind speed, high temperature and low rainfall.

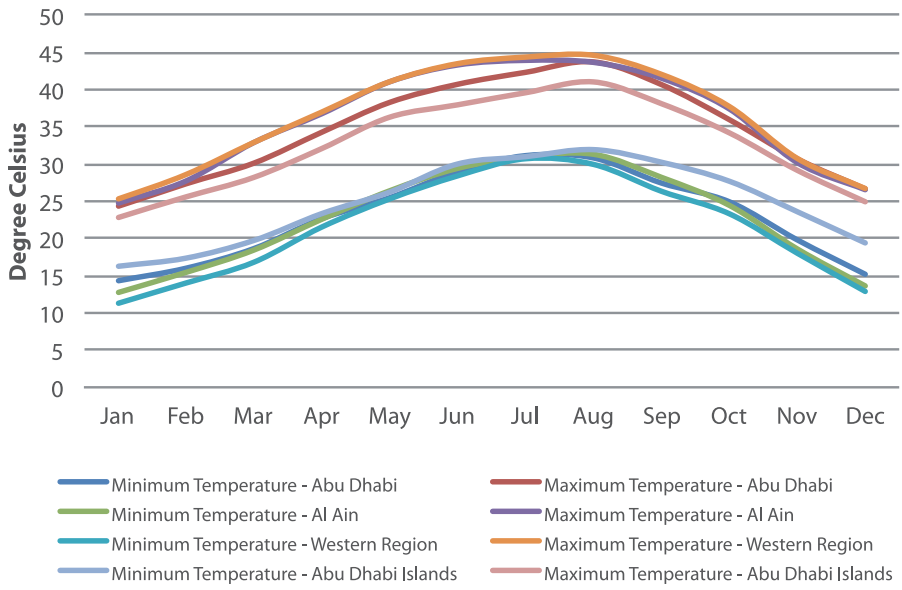
The average minimum temperature of the Abu Dhabi Emirate was 23^{0}C in 2010, while the average maximum temperature was 34.8^{0}C. Average annual rainfall decreased from 81.8 mm in 2009 to 23.2 mm in 2010. Average minimum relative humidity was 33.1% while average maximum relative humidity was 78.1%. Average atmospheric pressure was 1,008.7 hectopascal and the maximum daily solar radiation exceeded 8,000 Watt / m^2/h in some regions.

1.1 Air Temperature

1.1.1 Air Temperature in Abu Dhabi Emirate

The emirate of Abu Dhabi is characterized by dry and sunny subtropical climate, all the year round. In summer, temperature and humidity rise due to the emirate's proximity to the Arabian Gulf, while winter is warm but tends to be cold at times. Although the climate of Abu Dhabi is extremely hot in general, it exhibits wide variations throughout the year.

Figure: 1.1. Average Maximum and Minimum Air Temperature by Month and Region, 2010



1.1.1.1 Air Temperature in Abu Dhabi Region

In 2010, monthly average maximum temperature in Abu Dhabi region ranged from 24.3 °C in January to 43.7 °C in August, whereas monthly average minimum temperature ranged between 14.3 °C in January and 31.1 °C in July. The maximum temperature was 49.0 °C, while the minimum temperature was 5.9 °C in the same year.

1.1. Air Temperature by Month - Abu Dhabi , 2010

(Degree Celsius)

Month	Monthly Average	Absolute Minimum	Average Minimum	Absolute Maximum	Average Maximum
January	19.3	8.0	14.3	30.2	24.3
February	21.5	7.3	16.0	36.6	27.3
March	24.2	11.9	18.6	41.3	30.1
April	28.2	15.8	22.7	44.3	34.3
May	31.6	18.8	25.5	45.9	38.3
June	34.5	19.3	29.0	49.0	40.7
July	36.0	25.3	31.1	49.0	42.3
August	36.3	26.1	30.8	48.4	43.7
September	33.3	21.7	27.4	47.5	40.7
October	30.3	18.0	24.9	42.2	36.0
November	25.4	10.2	19.8	39.9	30.7
December	21.0	5.9	15.2	32.3	26.7

Source: National Centre for Meteorology and Seismology

1.1.1.2 Air Temperature in Al Ain Region

Monthly average maximum temperature in Al Ain region ranged from 24.8 °C in January to 43.9 °C in July, whereas monthly average minimum temperature ranged between 12.7 °C in January and 31.3 °C in August in the year 2010. Maximum temperature in the same year reached 49.9 °C while minimum temperature dropped to 4.1 °C.

1.2. Air Temperature by Month - Al Ain, 2010

(Degree Celsius)

Month	Monthly Average	Absolute Minimum	Average Minimum	Absolute Maximum	Average Maximum
January	16.9	7.5	12.7	30.6	24.8
February	19.7	4.1	15.4	35.6	27.7
March	23.7	8.6	18.4	39.9	32.9
April	27.7	14.8	22.6	44.5	36.8
May	31.5	17.6	26.4	47.7	41.1
June	34.2	20.7	29.4	49.9	43.3
July	35.5	21.5	30.9	49.9	43.9
August	35.4	22.9	31.3	49.8	43.7
September	33.0	23.0	28.2	48.1	41.5
October	28.9	17.9	24.4	43.8	37.4
November	22.3	11.1	18.6	37.3	30.2
December	18.5	5.6	13.6	33.5	26.6

Source: National Centre for Meteorology and Seismology

1.1.1.3 Air Temperature in Western Region

Monthly average maximum temperature in Western Region ranged from 25.2 °C in January to 44.6 °C in August 2010, whereas monthly average minimum temperature ranged between 11.3 °C in January and 30.7 °C in July. The maximum temperature was 49.9 °C, while the minimum temperature was 4.2 °C during the same year.

1.3. Air Temperature by Month - Western Region, 2010

(Degree Celsius)

Month	Monthly Average	Absolute Minimum	Average Minimum	Absolute Maximum	Average Maximum
January	18.2	4.8	11.3	31.1	25.2
February	21.3	5.9	14.0	38.6	28.6
March	24.9	10.0	16.8	41.8	32.9
April	29.4	12.3	21.5	45.4	37.0
May	33.3	18.8	25.3	47.0	41.1
June	35.9	23.4	28.4	49.2	43.5
July	37.2	23.0	30.7	49.9	44.4
August	37.0	25.1	30.0	49.0	44.6
September	34.2	21.2	26.3	47.1	42.1
October	30.5	18.5	23.3	43.4	37.7
November	24.5	11.3	18.0	36.1	30.8
December	19.6	4.2	12.9	33.4	26.7

Source: National Centre for Meteorology and Seismology

1.1.1.4 Air Temperature in Abu Dhabi Islands

In 2010, monthly average maximum temperature in Abu Dhabi Islands ranged from 22.8 °C in January to 41.0 °C in August, whereas monthly average minimum temperature ranged between 16.3 °C in January and 31.9 °C in August. The maximum temperature in 2010 reached 47.7 °C while the minimum temperature dropped to 8.0 °C.

1.4. Air Temperature by Month - Abu Dhabi Islands, 2010

(Degree Celsius)

Month	Monthly Average	Absolute Minimum	Average Minimum	Absolute Maximum	Average Maximum
January	19.3	8.0	16.3	29.4	22.8
February	21.2	10.7	17.4	36.5	25.6
March	23.7	13.1	19.7	41.9	28.2
April	27.3	14.0	23.3	42.0	32.1
May	30.8	19.9	26.2	45.0	36.3
June	33.3	24.7	30.0	46.9	38.0
July	35.1	24.7	31.0	47.7	39.6
August	35.5	26.9	31.9	47.0	41.0
September	33.5	23.3	30.2	44.8	38.1
October	30.9	21.4	27.7	38.8	34.2
November	26.5	17.4	23.6	35.6	29.2
December	22.5	9.5	19.4	30.3	24.9

Source: National Centre for Meteorology and Seismology

1.2 Rainfall

Rainfall in the Emirate of Abu Dhabi is scanty and abrupt, with the bulk falling within short periods of rainy days in winter, which is the typical pattern of rainfall in desert regions. Average annual rainfall in the Emirate of Abu Dhabi dropped from 81.8 millimetres in 2009 to 23.2 millimetres in 2010 with some bouts of rain in spring, especially in March and April.

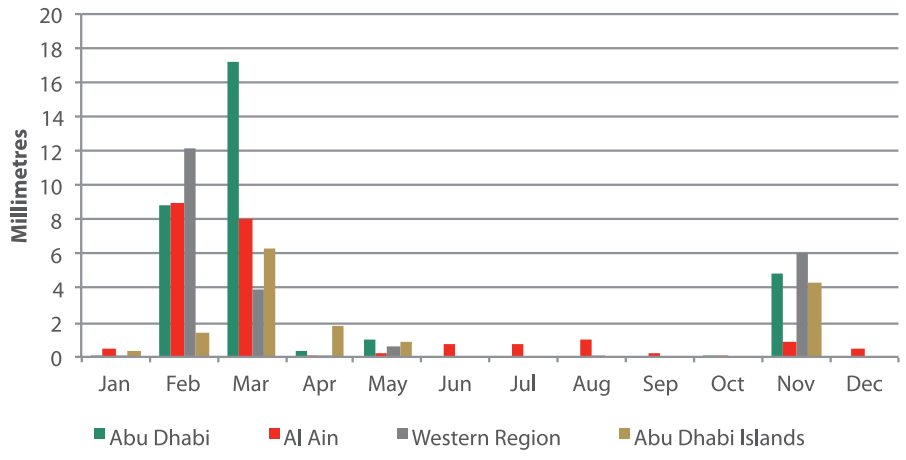
1.5. Average Rainfall by Month and Region, 2010

(Millimetres)

Month	Abu Dhabi	Al Ain	Western Region	Abu Dhabi Islands
January	Trace	Trace	Trace	Trace
February	8.9	9.0	12.1	1.5
March	17.2	8.0	4.0	6.4
April	Trace	Trace	Trace	1.9
May	1.0	Trace	Trace	Trace
June	0.0	Trace	0.0	0.0
July	0.0	Trace	0.0	0.0
August	0.0	1.1	Trace	0.0
September	0.0	Trace	0.0	0.0
October	Trace	Trace	0.0	0.0
November	4.8	Trace	6.1	4.4
December	0.0	Trace	0.0	0.0

Source: National Centre for Meteorology and Seismology

Figure: 1.2. Average Rainfall by Month and Region, 2010



1.6. Rainfall in Abu Dhabi and Al Ain Regions by Month, 2010

(Millimetres)

Month	Abu Dhabi		Al Ain	
	Heaviest Fall in one Day	Total for Month	Heaviest Fall in one Day	Total for Month
January	Trace	Trace	1.4	4.2
February	18.6	35.6	26.4	81.1
March	42.8	68.6	24.4	72.4
April	1.6	1.6	Trace	Trace
May	1.6	3.0	Trace	2.4
June	0.0	0.0	6.2	6.8
July	0.0	0.0	1.8	7.1
August	0.0	0.0	3.8	8.6
September	0.0	0.0	1.6	1.6
October	Trace	Trace	0.0	Trace
November	17.2	19.2	4.8	7.0
December	0.0	0.0	2.6	4.2

Source: National Centre for Meteorology and Seismology

1.7. Rainfall in Western Region and Abu Dhabi Islands by Month, 2010

(Millimetres)

Month	Western Region		Abu Dhabi Islands	
	Heaviest Fall in one Day	Total for Month	Heaviest Fall in one Day	Total for Month
January	Trace	Trace	1.2	1.2
February	25.6	72.8	2.6	5.8
March	13.0	23.8	14.0	25.4
April	Trace	Trace	2.8	7.4
May	2.8	3.4	2.8	3.6
June	0.0	0.0	0.0	0.0
July	0.0	0.0	0.0	0.0
August	Trace	Trace	0.0	0.0
September	0.0	0.0	0.0	0.0
October	0.0	0.0	0.0	0.0
November	36.4	36.6	14.0	17.4
December	0.0	0.0	0.0	0.0

Source: National Centre for Meteorology and Seismology

1.3 Relative Humidity

1.3.1 Relative Humidity in Abu Dhabi Emirate

Humidity in the Abu Dhabi Emirate is relatively high in coastal areas and Islands compared to the inland regions of the Emirate. In 2010, average annual relative humidity was 53.9%, and the average monthly relative humdity ranged between 27.3% recorded Al Ain and 73.3% recorded Abu Dhabi Islands%.

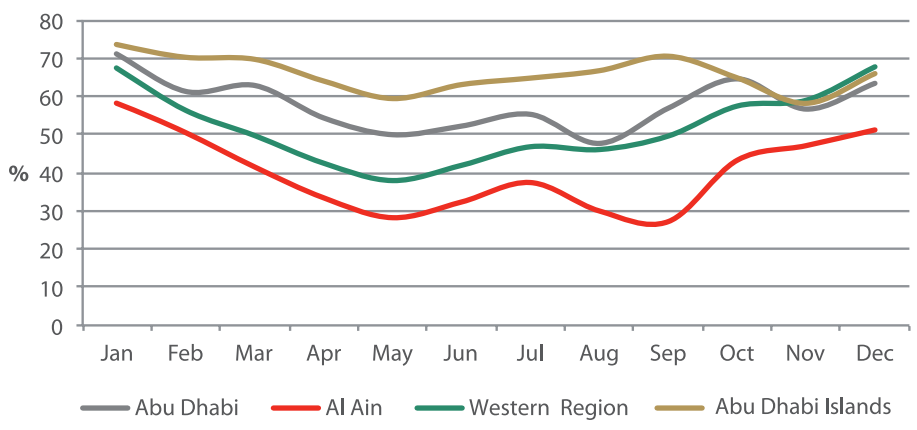
1.8. Average Relative Humidity by Month and Region, 2010

(%)

Month	Abu Dhabi	Al Ain	Western Region	Abu Dhabi Islands
January	70.9	58.5	67.2	73.3
February	61.2	50.4	56.3	70.2
March	62.8	41.5	49.7	69.7
April	54.3	33.4	42.5	64.0
May	49.9	28.2	37.9	59.4
June	52.2	32.3	41.9	63.1
July	55.3	37.4	46.8	64.8
August	47.7	30.0	46.0	66.7
September	56.9	27.2	49.6	70.5
October	64.5	43.2	57.4	64.8
November	56.6	47.1	58.9	58.1
December	63.4	51.2	67.7	65.9

Source: National Centre for Meteorology and Seismology

Figure: 1.3. Average Relative Humidity by Month and Region, 2010



1.3.1.1. Relative Humidity in Abu Dhabi Region

In 2010, Abu Dhabi region did not witness a significant change in average maximum relative humidity throughout the months. Average maximum relative humidity reached 87.9% in winter months and decreased to 71.0% in summer months, unlike average minimum relative humidity which showed noticeable monthly variations, reaching a peak of 46.2% in winter and dropping to 19.6% in summer.

1.9. Relative Humidity by Month - Abu Dhabi, 2010

(%)

Month	Monthly Average	Absolute Minimum	Average Minimum	Absolute Maximum	Average Maximum
January	70.9	15.0	46.2	100.0	87.9
February	61.2	7.4	36.4	100.0	81.7
March	62.8	4.2	33.0	100.0	85.4
April	54.3	8.0	27.4	99.9	76.1
May	49.9	6.0	22.6	96.4	72.9
June	52.2	7.2	29.5	93.8	73.4
July	55.3	11.6	30.1	91.5	75.7
August	47.7	5.2	19.6	98.5	71.0
September	56.9	6.5	24.6	100.0	83.7
October	64.5	10.0	37.1	100.0	83.7
November	56.6	9.4	34.3	99.8	75.7
December	63.4	9.7	39.5	99.9	81.7

Source: National Centre for Meteorology and Seismology

1.3.1.2. Relative Humidity in Al Ain Region

Averages of maximum and minimum relative humidity differed markedly throughout the months of 2010 in Al Ain region. Average maximum relative humidity reached 88.9% in winter and 49.6% in summer, while the average minimum relative humidity fell from 28.8% in winter to 10.5% in summer.

1.10. Relative Humidity by Month - Al Ain, 2010

(%)

Month	Monthly Average	Absolute Minimum	Average Minimum	Absolute Maximum	Average Maximum
January	58.5	1.1	28.8	100.0	88.9
February	50.4	2.0	25.1	100.0	79.6
March	41.5	1.0	16.6	100.0	70.7
April	33.4	1.5	14.1	99.9	59.4
May	28.2	1.0	11.3	100.0	52.2
June	32.3	1.1	14.0	100.0	58.6
July	37.4	1.1	18.8	100.0	61.9
August	30.0	4.0	14.0	95.3	49.6
September	27.2	2.0	10.5	100.0	59.2
October	43.2	4.8	16.3	100.0	74.6
November	47.1	3.0	23.4	100.0	73.5
December	51.2	1.6	22.6	100.0	79.1

Source: National Centre for Meteorology and Seismology

1.3.1.3. Relative Humidity in Western Region

In 2010, average maximum relative humidity in the Western Region reached 94.2% in winter and 72.7% in May, while average minimum relative humidity, fell from 34.6% in December to 15.6% in May, which shows a noticeable seasonal variation in RH.

1.11. Relative Humidity by Month - Western Region, 2010

(%)

Month	Monthly Average	Absolute Minimum	Average Minimum	Absolute Maximum	Average Maximum
January	67.2	9.2	34.2	100.0	94.2
February	56.3	2.3	27.5	100.0	85.3
March	49.7	1.0	20.8	100.0	82.5
April	42.5	4.3	18.7	100.0	72.5
May	37.9	1.0	15.6	100.0	65.9
June	41.9	1.6	17.9	100.0	71.6
July	46.8	2.1	21.9	100.0	72.7
August	46.0	4.6	19.3	100.0	72.2
September	49.6	2.1	19.1	100.0	81.6
October	57.4	6.6	24.2	100.0	88.9
November	58.9	5.6	30.4	100.0	87.1
December	67.7	8.3	34.6	100.0	93.6

Source: National Centre for Meteorology and Seismology

1.3.1.4 Relative Humidity in Abu Dhabi Islands

In 2010 Abu Dhabi Islands recorded highe levels of relative humidity in winter and summer where average maximum relative humidity reached 89.4% and 85.9% respectively while minimum relative humidity ranged between 53.1% in winter and 30.3% in summer.

1.12. Relative Humidity by Month - Abu Dhabi Islands, 2010

(%)

Month	Monthly Average	Absolute Minimum	Average Minimum	Absolute Maximum	Average Maximum
January	73.3	21.6	53.1	100.0	89.4
February	70.2	5.6	45.4	100.0	89.4
March	69.7	5.9	43.4	100.0	91.6
April	64.0	8.5	36.0	100.0	87.4
May	59.4	6.5	30.3	99.9	86.1
June	63.1	3.9	35.9	100.0	85.8
July	64.8	11.4	38.2	100.0	85.9
August	66.7	11.4	34.7	99.9	84.7
September	70.5	10.3	39.4	100.0	85.1
October	64.8	9.4	47.4	100.0	80.8
November	58.1	15.5	42.5	99.5	73.5
December	65.9	15.9	50.9	99.9	82.7

Source: National Centre for Meteorology and Seismology

1.4. Atmospheric Pressure

1.4.1. Atmospheric Pressure in Abu Dhabi Emirate

Abu Dhabi winter is characterized by high average atmospheric pressure, unlike its summer, during which pressure levels drop due to the increase in air temperatures. Atmospheric pressure in 2010 reached its peak levels in winter, especially in January, where pressure readings climbed to 1020 hectopascal, thereafter decreasing gradually, reaching a minimum of 997 hectopascal in July, at which point the downward trend reverses and pressure readings start to increase gradually once again.

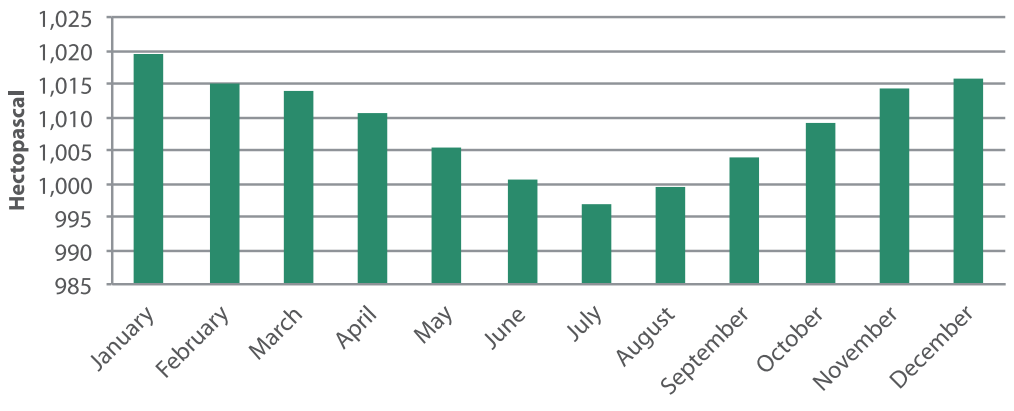
1.13. Average Atmospheric Pressure by Month and Region, 2010

(Hectopascal)

Month	Abu Dhabi	Al Ain	Western Region	Abu Dhabi Islands
January	1,018.7	1,019.3	1,019.5	1,020.0
February	1,014.3	1,015.1	1,015.1	1,015.2
March	1,013.5	1,014.1	1,014.3	1,014.4
April	1,010.2	1,010.7	1,010.9	1,010.9
May	1,005.1	1,005.5	1,005.8	1,005.9
June	1,000.0	1,000.6	1,000.5	1,000.9
July	996.7	996.9	997.1	997.5
August	999.2	999.1	999.7	999.7
September	1,003.8	1,003.8	1,004.3	1,004.5
October	1,008.9	1,008.5	1,009.6	1,009.8
November	1,014.0	1,013.7	1,014.8	1,014.7
December	1,015.4	1,015.1	1,016.0	1,016.7

Source: National Centre for Meteorology and Seismology

Figure: 1.4. Average Atmospheric Pressure by Month - Emirate of Abu Dhabi , 2010



1.5. Wind Speed

1.5.1. Wind Speed in Abu Dhabi Emirate

Two types of winds blow over the Emirate of Abu Dhabi, namely, dry northerly winds often loaded with dust but sometimes ameliorate the weather, and the easterly brief and extremely hot winds coming from the Al-Rub' Al Khali (the Empty Quarter) from the Kingdom of Saudi Arabia. Non-seasonal southerly, south easterly, westerly and north westerly winds blow occasionally across the Emirate. Average wind speed is obviously higher in the open areas of Western Region and Abu Dhabi Islands than in the city of Abu Dhabi where high rise buildings and trees act as winds breaks, a phenomenon observed also in the case of the mountainous terrain of Al Ain. The highest average wind speed recorded in 2010 was 8.7 knots in April in Abu Dhabi Islands, whereas the lowest wind speed was 4.4 knot recorded in January in the city of Al Ain.

1.14. Average Wind Speed by Month and Region, 2010

(Knot)*

Month	Abu Dhabi	Al Ain	Western Region	Abu Dhabi Islands
January	5.2	4.4	5.8	7.1
February	6.4	5.5	6.8	7.6
March	6.0	5.1	6.9	8.1
April	6.8	6.0	7.7	8.7
May	6.4	6.0	7.1	7.6
June	6.8	6.2	7.7	7.9
July	6.6	6.7	7.2	8.3
August	6.6	6.5	6.7	7.4
September	6.1	5.7	5.8	6.3
October	5.4	5.4	5.4	6.8
November	5.3	4.8	5.7	6.9
December	5.3	4.9	5.9	7.4

Source: National Centre for Meteorology and Seismology

*Knot = 1.15 mph

1.15. Wind Speed by Month - Abu Dhabi , 2010

(Knot)*

Month	Average	Absolute Maximum	Average Maximum
January	5.2	20.9	9.9
February	6.4	24.7	12.2
March	6.0	26.8	12.1
April	6.8	30.0	14.3
May	6.4	27.0	13.7
June	6.8	21.9	13.1
July	6.6	18.0	12.9
August	6.6	19.2	13.2
September	6.1	18.0	12.6
October	5.4	16.4	11.2
November	5.3	28.0	10.9
December	5.3	21.8	10.5

Source: National Centre for Meteorology and Seismology

*Knot = 1.15 mph

1.16. Wind Speed by Month - Al Ain, 2010

(Knot)*

Month	Average	Absolute Maximum	Average Maximum
January	4.4	19.6	10.0
February	5.5	31.4	12.4
March	5.1	29.5	12.5
April	6.0	29.0	14.4
May	6.0	30.2	14.7
June	6.2	33.3	14.2
July	6.7	36.5	14.8
August	6.5	32.8	14.8
September	5.7	30.1	13.9
October	5.4	28.4	12.5
November	4.8	25.0	11.4
December	4.9	30.7	11.0

Source: National Centre for Meteorology and Seismology

*Knot = 1.15 mph

1.17. Wind Speed by Month - Western Region, 2010

(Knot)*

Month	Average	Absolute Maximum	Average Maximum
January	5.8	28.3	11.4
February	6.8	30.1	13.5
March	6.9	33.8	14.1
April	7.7	31.0	16.7
May	7.1	32.1	16.2
June	7.7	33.7	15.9
July	7.2	31.1	14.8
August	6.7	33.0	14.7
September	5.8	21.5	13.3
October	5.4	19.6	11.2
November	5.7	29.0	12.0
December	5.9	33.5	12.0

Source: National Centre for Meteorology and Seismology

*Knot = 1.15 mph

1.18. Wind Speed by Month - Abu Dhabi Islands, 2010

(Knot)*

Month	Average	Absolute Maximum	Average Maximum
January	7.1	24.1	12.2
February	7.6	30.5	13.8
March	8.1	38.8	14.2
April	8.7	30.8	17.0
May	7.6	29.6	15.0
June	7.9	28.8	14.2
July	8.3	24.6	13.9
August	7.4	22.1	12.7
September	6.3	24.7	12.2
October	6.8	20.1	11.5
November	6.9	49.6	12.7
December	7.4	24.4	12.6

Source: National Centre for Meteorology and Seismology

*Knot = 1.15 mph

1.1 Solar Radiation

The sky of Abu Dhabi Emirate is cloudless almost all year around, which prolongs the hours of sunshine and increases the amount of solar radiation per unit area, leading to an increase in temperatures and evaporation rates. By providing data about sunshine hours, we can have information on day lengths and cloudy periods when sunshine decreases to a certain level. In the summer of 2010, average sunshine hours were 11.0 and 10.5 in the regions of Abu Dhabi and Al Ain respectively, compared to 8.4 and 8.6 hours in the winter of the same year, respectively.

1.19. Average Daily Sunshine in Abu Dhabi and Al Ain Regions by Month, 2010

(Hours)

Month	Abu Dhabi	Al Ain
January	8.4	9.4
February	8.6	9.0
March	9.6	9.6
April	9.8	9.8
May	10.2	9.8
June	11.0	10.5
July	10.0	9.3
August	10.3	9.8
September	10.0	10.4
October	9.6	9.8
November	8.6	9.1
December	8.6	8.6

Source: National Centre for Meteorology and Seismology

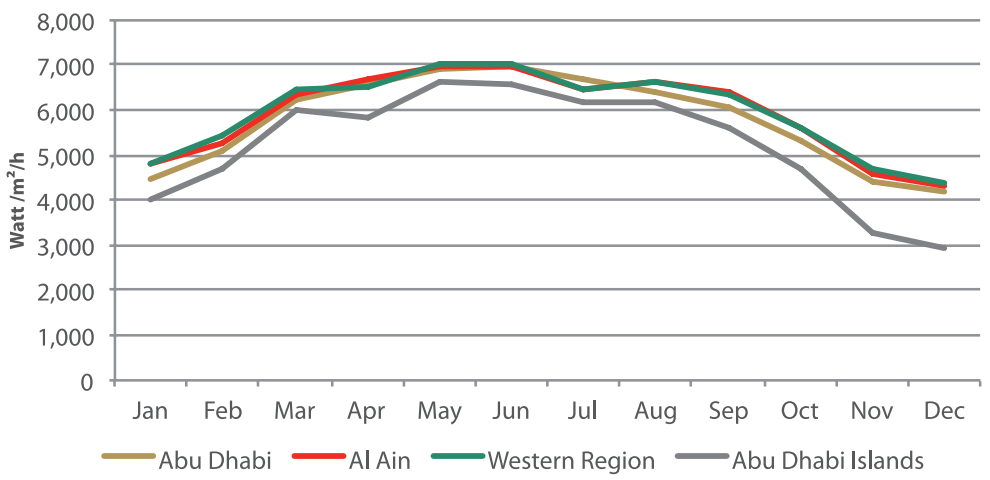
1.20. Average Daily Total Solar Radiation by Month and Region, 2010

(Watt /m²/h)

Month	Abu Dhabi	Al Ain	Western Region	Abu Dhabi Islands
January	4,473	4,797	4,793	4,041
February	5,097	5,244	5,417	4,723
March	6,252	6,348	6,480	6,001
April	6,573	6,675	6,501	5,808
May	6,895	6,945	7,002	6,630
June	6,955	6,977	7,021	6,570
July	6,676	6,452	6,444	6,168
August	6,380	6,617	6,621	6,185
September	6,034	6,398	6,343	5,614
October	5,320	5,615	5,630	4,676
November	4,396	4,606	4,674	3,248
December	4,191	4,317	4,383	2,936

Source: National Centre for Meteorology and Seismology

Figure: 1.5. Average Daily Total Solar Radiation by Month and Region, 2010



1.21. Daily Total Solar Radiation by Month - Abu Dhabi, 2010

(Watt /m²/h)

Month	Average	Minimum	Maximum
January	4,473	2,763	5,418
February	5,097	1,937	6,200
March	6,252	3,103	7,150
April	6,573	2,830	7,800
May	6,895	3,268	8,280
June	6,955	5,629	7,930
July	6,676	4,178	8,279
August	6,380	1,942	7,518
September	6,034	4,714	7,170
October	5,320	4,336	6,357
November	4,396	2,875	5,220
December	4,191	3,361	4,810

Source: National Centre for Meteorology and Seismology

1.22. Daily Total Solar Radiation by Month - Al Ain, 2010

(Watt /m²/h)

Month	Average	Minimum	Maximum
January	4,797	1,281	5,809
February	5,244	1,554	6,446
March	6,348	2,281	7,472
April	6,675	4,922	7,842
May	6,945	3,589	8,265
June	6,977	4,816	8,326
July	6,452	4,294	7,750
August	6,617	4,932	7,631
September	6,398	5,011	7,192
October	5,615	4,459	6,962
November	4,606	2,750	5,805
December	4,317	2,304	5,553

Source: National Centre for Meteorology and Seismology

1.23. Daily Total Solar Radiation by Month - Western Region, 2010

(Watt /m²/h)

Month	Average	Minimum	Maximum
January	4,793	2,953	5,972
February	5,417	1,165	6,662
March	6,480	1,856	7,639
April	6,501	2,018	7,818
May	7,002	2,697	8,288
June	7,021	3,920	7,865
July	6,444	3,854	7,513
August	6,621	3,631	7,515
September	6,343	4,464	7,317
October	5,630	4,417	8,913
November	4,674	2,161	5,562
December	4,383	3,121	5,139

Source: National Centre for Meteorology and Seismology

1.24. Daily Total Solar Radiation by Month - Abu Dhabi Islands, 2010

(Watt /m²/h)

Month	Average	Minimum	Maximum
January	4,041	1,545	5,695
February	4,723	1,492	6,506
March	6,001	2,884	7,636
April	5,808	1,682	7,877
May	6,630	2,329	8,148
June	6,570	3,611	8,010
July	6,168	4,347	7,720
August	6,185	4,732	6,941
September	5,614	3,682	6,803
October	4,676	2,125	6,665
November	3,248	1,612	5,937
December	2,936	1,523	4,898

Source: National Centre for Meteorology and Seismology

Chapter Two

2. Air Statistics

In recent years there has been a significant improve in the quality of ambient air at local and regional levels for many of the air pollutants, despite the increased worries regarding the recent increase in the concentration of ground-level ozone and Particulate Matter in the midst of the economic development and the increasing demand on fuel consumption.

In the context of its efforts to enhance environment protection and control, the Federal Government of the United Arab Emirates and the Government of Abu Dhabi Emirate have issued strict laws and legislation to help reduce air pollution and emissions and mitigate their impacts. In this regard, the Council of Ministers issued Decree No. 12 of 2006 on Regulation Concerning Protection of Air from Pollution which binding on both entities and individuals with pollutant types and maximum limits permitted.

Air pollution figures in the Emirate of Abu Dhabi are generally within the accepted range locally and internationally. However the readings vary with different locations and activities. Stations close to roads record high rates of pollution due to emissions from vehicle exhausts. Likewise, readings taken within the vicinity of oil and industrial activities, for example the industrial area of Mussafaf, are the highest in the Emirate.

2.1 Sulphur Dioxide

2.1.1 Sulphur Dioxide Concentration in Ambient Air

The average concentration of sulphur dioxide did not exceed the permitted limit in 2010. The maximum value of the average concentration reached 12.9 mcg/ m^3 in the urban and residential areas of Abu Dhabi region.

2.1. Sulphur Dioxide Concentration in Ambient Air by Region

(Microgram/m^3)

Station Location	Objective (WHO)	Objective (EAD)	2009			2010		
			Average	Maximum	Minimum	Average	Maximum	Minimum
Abu Dhabi	500 mcg/m^3 / 10 minutes	350 mcg/m^3 / hour						
City Centre - Khadija School			9.0	86.0	0.3	9.5	98.5	0.2
Urban/ Residential - Khalifa School			6.0	31.0	0.2	8.2	76.0	0.1
Road Side - Hamdan Street			7.0	112.0	0.2	9.8	128.4	0.2
Urban/ Residential - Baniyas School			7.0	37.0	0.03	12.9	68.4	0.3
Industrial - Mussafah			19.0	330.0	0.3	6.5	89.2	0.3
Al Ain								
Urban/ Residential - Al Ain School			3.0	19.0	0.2	5.2	70.1	0.3
Road Side - Al Ain Street			4.0	31.0	0.1	5.9	74.2	0.1
Western Region								
Urban/ Residential - Bida Zayed			3.0	38.0	0.1	8.0	240.1	0.3
City Centre - Gayathi School			7.0	179.0	0.1	6.0	66.3	0.2
Regional Background - Liwa Oasis			3.0	66.0	0.1	4.7	105.1	0.1

Source: Environment Agency - Abu Dhabi

2.1.2 Sulphur Dioxide Emissions – Oil and Gas Sector

Abu Dhabi National Oil Company's total emissions of sulphur dioxide in 2010 reached 219,022 tons. Business sectors in oil and gas sector was reclassified in 2010 according to the company activity e.g. gas processing sector is now included in exploration and production. Another two new classifications of business sectors were introduced, namely, independent operators and shared services.

2.2. Sulphur Dioxide Emissions - Oil and Gas Sector

(Tons)

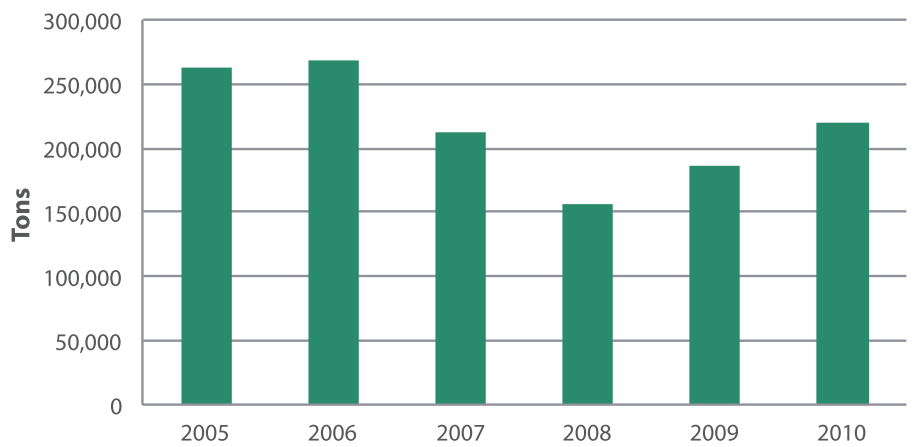
Business Sector	2005	2006	2007	2008	2009	2010
Total	**262,539**	**267,739**	**212,722**	**156,674**	**185,870**	**219,022**
Exploration and Production	103,516	103,415	88,390	45,619	76,641	153,500
Independent Operators**	*	*	*	*	*	52,790
Shared Services**	**	**	**	**	**	74
Marketing and Refining	10,040	10,185	10,075	11,506	11,271	12,318
Gas Processing	148,743	153,900	114,045	99,349	97,780	*
Petrochemicals	240	239	212	200	178	340

Source : Abu Dhabi National Oil Company - ADNOC

* Included with exploration and production

** New business sector

Figure: 2.1 Sulphur Dioxide Emissions - Oil and Gas Sector



2.2 Nitrogen Oxides

2.2.1 Nitrogen Dioxide Concentration in Ambient Air

The average concentrations of nitrogen dioxide in 2010 were within the permitted limit, however elevated levels in industrial and traffic congestion areas were montitored. Peak readings of the gas were taken at Mussafah industrial area (355.7 mcg/ m^3) and Hamdan Street (304.3 mcg/ m^3), both located in Abu Dhabi Region.

2.3. Nitrogen Dioxide Concentration in Ambient Air by Region

(Microgram/m3)

Station Location	Objective (WHO)	Objective (EAD)	2009			2010		
			Average	Maximum	Minimum	Average	Maximum	Minimum
Abu Dhabi	200 mcg/m^3/ hour	400 mcg/m^3/ hour						
City Centre - Khadija School			36.0	159.0	0.4	52.6	292.5	0.4
Urban/ Residential - Khalifa School			41.0	240.0	0.2	39.7	232.4	0.2
Road Side-Hamdan Street			49.0	270.0	0.9	59.1	304.3	0.9
Urban/ Residential - Baniyas School			27.0	132.0	0.2	30.7	154	0.2
Industrial-Mussafah			53.0	321.0	1.5	59.3	355.7	0.9
Al Ain								
Urban/ Residential - Al Ain School			na	na	na	29.3	95.4	4.7
Road Side - Al Ain Street			45.0	234.0	1.6	35.3	147.2	0.1
Western Region								
Urban/ Residential - Bida Zayed			16.0	289.0	0.20	17.4	225.7	0.0
City Centre - Gayathi School			17.0	282.0	0.01	11.4	125.1	0.2
Regional Background - Liwa Oasis			3.0	33.0	0.01	3.6	35.9	0.2

Source: Environment Agency - Abu Dhabi

2.2.2 Nitrogen Oxides Emissions – Oil and Gas Sector

Air polluting emissions of nitrogen oxides from oil and gas sector increased by 7.5% in 2010 compared to the previous year reaching a total emissions of 58,901 tons. This increase in total emissions is due to the increase in fossil fuels combustion in all business sectors of Abu Dhabi National Oil Company.

2.4. Nitrogen Oxides Emissions - Oil and Gas Sector

(Tons)

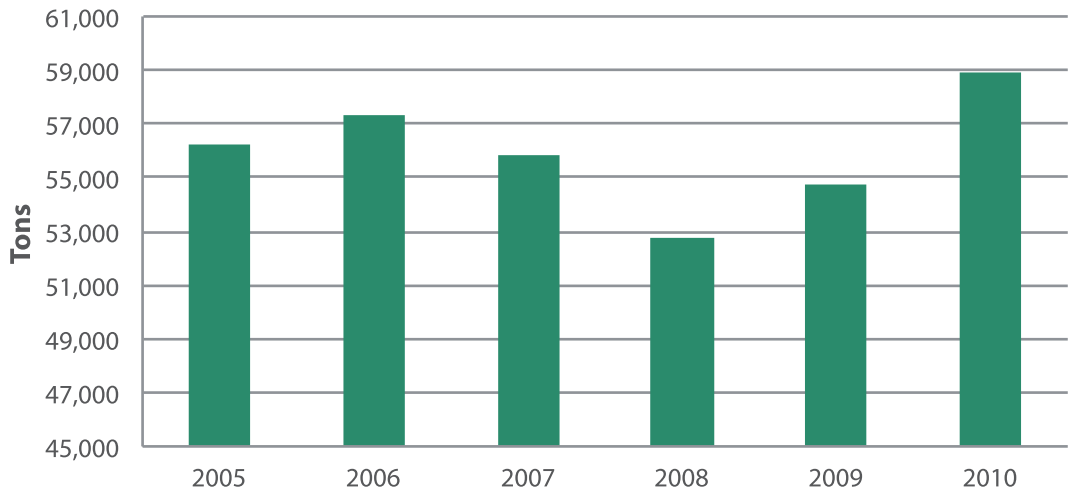
Business Sector	2005	2006	2007	2008	2009	2010
Total	**56,225**	**57,332**	**55,881**	**52,755**	**54,782**	**58,901**
Exploration and Production	16,655	17,359	16,287	15,045	17,670	29,288
Independent Operators**	*	*	*	*	*	2,336
Shared Services**	**	**	**	**	**	802
Marketing and Refining	17,795	18,523	19,596	20,253	20,031	23,430
Gas Processing	20,263	19,956	18,473	16,004	15,696	*
Petrochemicals	1,512	1,494	1,525	1,453	1,385	3,045

Source: Abu Dhabi National Oil Company - ADNOC

* Included with exploration and production

** New business sector

Figure: 2.2 Nitrogen Oxides Emissions - Oil and Gas Sector



2.3 Volatile Organic Compounds

2.3.1 Methane Concentration in Ambient Air

Methane concentrations in ambient air usually increase in urban and residential areas. In 2010, maximum reading of methane gas reached 11.53 mcg/ m^3 in Abu Dhabi region, while the highest value of the average concentration of the gas was recorded in the area of Bida Zayed of the Western Region with a concentration of 5.16 mcg/m^3.

2.5. Methane Concentration in Ambient Air by Region

(Microgram/m^3)

Station Location	2009			2010		
	Average	Maximum	Minimum	Average	Maximum	Minimum
Abu Dhabi						
City Centre - Khadija School	0.73	3.50	0.01	1.22	11.53	0.01
Urban/ Residential - Khalifa School	na	na	na	0.45	3.45	0.01
Road Side - Hamdan Street	1.14	2.71	0.28	0.76	2.98	0.01
Urban/ Residential - Baniyas School	na	na	na	0.30	2.14	0.01
Industrial - Mussafah	na	na	na	na	na	na
Al Ain						
Urban/ Residential - Al Ain School	na	na	na	2.37	6.82	0.06
Road Side - Al Ain Street	0.67	1.58	0.01	1.34	3.27	0.07
Western Region						
Urban/ Residential - Bida Zayed	na	na	na	5.16	9.42	0.30
City Centre - Gayathi School	0.63	1.3	0.14	0.21	1.48	0.01
Regional Background - Liwa Oasis	na	na	na	1.26	3.57	0.07

Source: Environment Agency - Abu Dhabi

2.3.2 Volatile Organic Compounds Emissions – Oil and Gas Sector

The following table shows that volatile organic compounds emissions from oil and gas sector in 2010 decreased by 10.3% from 2006 reaching 62,170 tons. Total emissions of volatile organic compounds from the business sectors of exploration and production and gas processing decreased by 8% during the same period.

2.6. Volatile Organic Compounds Emissions - Oil and Gas Sector

(Tons)

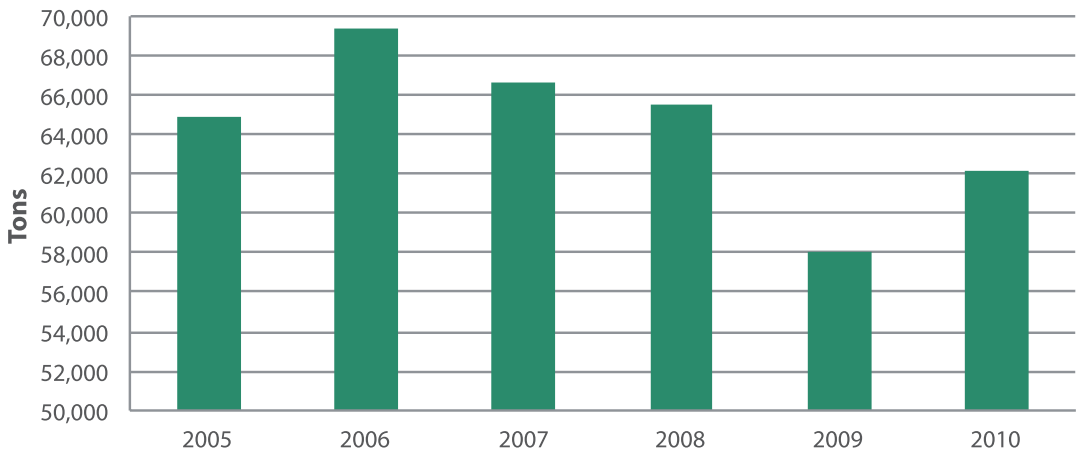
Business Sector	2005	2006	2007	2008	2009	2010
Total	**64,915**	**69,339**	**66,698**	**65,475**	**57,999**	**62,170**
Exploration and Production	47,490	51,476	50,532	50,404	42,835	51,464
Independent Operators**	*	*	*	*	*	1,166
Marketing and Refining	8,222	8,401	8,430	8,310	8,343	7,808
Gas Processing	8,503	8,754	7,027	5,978	6,206	*
Petrochemicals	700	708	709	783	615	1,732

Source: Abu Dhabi National Oil Company - ADNOC

* Included with exploration and production

** New business sector

Figure: 2.3 Volatile Organic Compounds Emissions - Oil and Gas Sector



2.4 Ground Level Ozone Concentration in Ambient Air

In 2010, the average concentration of ground level ozone reached 53.5 mcg/m^3 in the urban areas of Abu Dhabi region, whereas in the Western Region the average concentration reached 68.4 mcg/m^3 and these two readings are within international and local permissible limits.

2.7. Ground level Ozone Concentration in Ambient Air by Region

(Microgram/m^3)

Station Location	Objective (WHO)	Objective (EAD)	2009			2010		
			Average	Maximum	Minimum	Average	Maximum	Minimum
Abu Dhabi	100 mcg/ m^3 / hour	200 mcg/m^3 / hour						
City Centre - Khadija School			45.0	184.0	0.3	59.0	169.7	0.2
Urban/ Residential - Khalifa School			34.0	129.0	0.8	53.5	181.0	0.1
Urban/ Residential - Baniyas School			33.0	149.0	0.7	52.1	176.3	0.2
Al Ain								
Urban/ Residential - Al Ain School			27.0	140.0	0.2	37.9	143.6	0.2
Western Region								
Urban/ Residential - Bida Zayed			47.0	120.0	0.6	68.4	294.6	1.2
City Centre - Gayathi School			54.0	156.0	2.3	87.9	270.4	1.5
Regional background - Liwa Oasis			44.0	107.0	22.3	81.5	223.1	15.7

Source: Environment Agency - Abu Dhabi

2.5 Particulate Matter Concentration in Ambient Air

In 2010, the average concentration of particulate matter, with 10 or less microns, was 132.8 mcg/m^3 in Abu Dhabi's city centre, and the average concentration in the urban area of Al Ain decreased by 37.4% from 2009 reaching to 72 mcg/m^3.

2.8. Particulate Matter (PM10) Concentration in Ambient Air by Region

(Microgram/m^3)

Station Location	Objective (WHO)	Objective (EAD)	2009			2010		
			Average	Maximum	Minimum	Average	Maximum	Minimum
Abu Dhabi	50 mcg/m3/ hour	150 mcg/m3/ hour						
City Centre - Khadija School			152.0	1862.0	6.5	132.8	814.1	20.4
Urban/ Residential - Khalifa School			98.0	666.0	10.2	71.6	528.2	11.8
Road Side - Hamdan Street			148.0	1902.0	6.0	143.2	785.5	30.6
Urban/ Residential - Baniyas School			71.0	580.0	9.4	189.3	796.3	18.2
Industrial - Mussafah			209.0	1060.0	7.4	226.6	835.6	7.9
Al Ain								
Urban/ Residential -Al Ain School			115.0	825.0	8.2	72.0	375.3	14.0
Road Side - Al Ain Street			147.0	1039.0	18.6	151.3	815.7	51.5
Western Region								
Urban/ Residential - Bida Zayed			149.0	1359.0	11.2	102.3	629.9	14.4
City Centre - Gayathi School			143.0	1624.0	11.9	128.4	786.5	21.6
Regional Background - Liwa Oasis			147.0	828.0	10.5	153	892.9	28.6

Source: Environment Agency - Abu Dhabi

2.6 Hydrogen Sulphide Concentration in Ambient Air

The average concentration of hydrogen sulphide in 2010 reached about 5.55 mcg/m^3 in the residential areas of Abu Dhabi region, while the average concentration in the residential area of Al Ain region was about 1.88 mcg/m^3.

2.9. Hydrogen Sulphide Concentration in Ambient Air by Region

(Microgram/m^3)

Station Location	2009			2010		
	Average	Maximum	Minimum	Average	Maximum	Minimum
Abu Dhabi						
City Centre - Khadija School	0.87	7.67	0.10	2.81	13.19	0.05
Urban/ Residential - Khalifa School	5.24	49.35	0.04	2.62	29.27	0.14
Urban/ Residential - Baniyas School	0.73	2.30	0.01	5.55	57.28	0.03
Industrial - Mussafah	na	na	na	6.95	41.00	0.14
Al Ain						
Urban/ Residential - Al Ain School	1.75	13.36	0.07	1.88	19.55	0.13
Western Region						
Urban/ Residential - Bida Zayed	1.83	9.35	0.08	2.49	12.82	0.13
City Centre - Gayathi School	na	na	na	2.14	29.42	0.14
Regional Background - Liwa Oasis	1.75	13.36	0.07	na	na	na

Source: Environment Agency - Abu Dhabi

2.7 Carbon Monoxide Concentration in Ambient Air

The average concentrations of carbon monoxide in the streets of Abu Dhabi and Al Ain cities reached 1.04 and 0.85 mg/ m^3 in Hamdan Street and Al Ain Street, respectively in 2010 compared to 1.1 and 1.4 mg/ m^3 in 2009.

2.10. Carbon Monoxide Concentration in Ambient Air by Region, 2010

(Milligram/m^3)

Station Location	Objective (EAD)	2009			2010		
		Average	Maximum	Minimum	Average	Maximum	Minimum
Abu Dhabi	30 mg/ m^3/ hour						
Road Side - Hamdan Street		1.10	5.40	0.07	1.04	5.28	0.01
Al Ain							
Road Side - Al Ain Street		1.40	7.90	0.11	0.85	3.99	0.02

Source: Environment Agency - Abu Dhabi

2.8 Noise Pollution

The following table shows the permissible noise levels in the Emirate of Abu Dhabi according to area type and activity:

2.11. Noise Level Guideline in Abu Dhabi Emirate by Area Type

(Decibels)

Area Type	Limits Allowed	
	Day (7 a.m. – 8 p.m.)	Night (8 p.m. – 7 a.m.)
Residential areas with light traffic congestion	40-50	30-40
Residential areas in downtown	45-55	35-45
Residential areas with commercial establishments or residential areas near highways	50-60	40-50
Commercial Area and Downtown	55-65	45-55
Industrial Areas (Heavy Industry)	60-70	50-60

Source: Environment Agency – Abu Dhabi

2.8.1 Noise in Ambient Air

In 2010, Noise levels Abu Dhabi Emirate decreases generally in comparison with 2009. There is an evident decrease in 2010 maximum readings in most areas of the emirate. In 2010, the average noise level in Mussafah area was 48.3 decibels and in Al Ain Street in Al Ain city, the average noise level reached 61.6 decibles.

2.12. Noise Level by Region, 2010

(Decibels)

Station Location	2009			2010		
	Average	Maximum	Minimum	Average	Maximum	Minimum
Abu Dhabi						
City Centre - Khadija School	58.0	65.0	52.0	57.4	63.1	51.7
Urban/ Residential - Khalifa School	52.0	66.0	46.0	53.0	74.0	44.7
Road Side - Hamdan Street	66.0	69.0	59.0	66.6	76.6	59.5
Urban/ Residential - Baniyas School	51.0	79.0	40.0	53.7	78.5	43.7
Industrial - Mussafah	50.0	79.0	40.0	48.3	54.1	38.8
Al Ain						
Urban/ Residential - Al Ain School	50.0	67.0	43.0	48.9	60.3	41.9
Road Side - Al Ain Street	62.0	80.0	52.0	61.6	72.5	53.3
Western Region						
Urban/ Residential - Bida Zayed	54.0	70.0	50.0	na	na	na
City Centre - Gayathi School	51.0	67.0	43.0	50.6	66.6	41.2
Regional Background - Liwa Oasis	54.0	68.0	42.0	50.6	75.7	36.4

Source: Environment Agency – Abu Dhabi

2.9 Air Pollutant Total Emissions - Oil and Gas Sector

The trend of air pollutant total emissions shows a decrease during the period (2006 -2010), and in 2010 the total emissions reached 340,093 tons. Air pollutant total emissions sum up together the emissions of sulphur dioxide, nitrogen oxides and volatile organic compounds from the oil and gas sector.

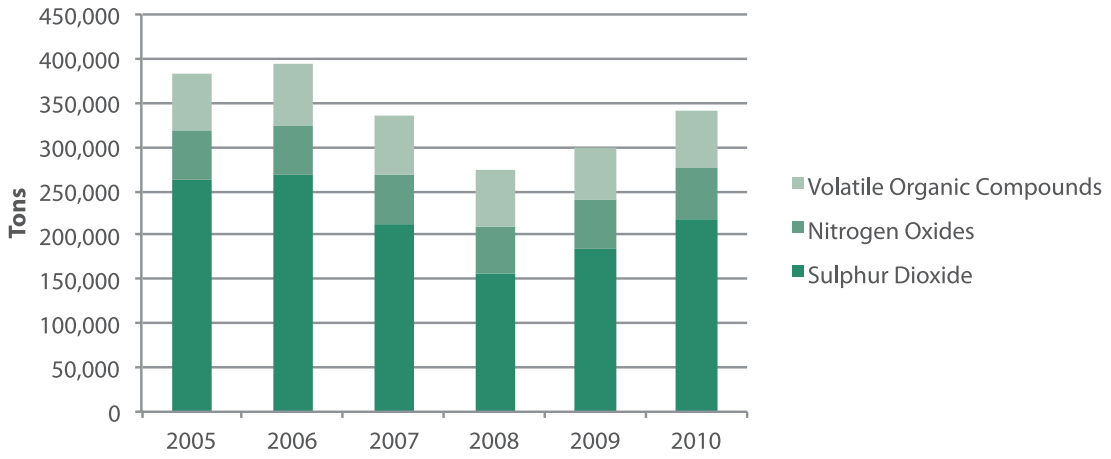
2.13. Air Pollutant Total Emissions - Oil and Gas Sector

(Tons)

Pollutant	2005	2006	2007	2008	2009	2010
Total	**383,679**	**394,410**	**335,301**	**274,904**	**298,651**	**340,093**
Sulphur Dioxide (SO2)	262,539	267,739	212,722	156,674	185,870	219,022
Nitrogen Oxides (NOx)	56,225	57,332	55,881	52,755	54,782	58,901
Volatile Organic Compounds (VOC)	64,915	69,339	66,698	65,475	57,999	62,170

Source: Abu Dhabi National Oil Company - ADNOC

Figure: 2.4 Air Pollutant Total Emissions - Oil and Gas Sector



2.14. Per Capita Air Pollutant Total Emissions - Oil and Gas Sector

(Tons)

Pollutant	2005	2006	2007	2008	2009	2010
Total	**0.279**	**0.270**	**0.213**	**0.162**	**0.164**	**0.173**
Sulphur Dioxide (SO2)	0.191	0.183	0.135	0.092	0.102	0.111
Nitrogen Oxides (NOx)	0.041	0.039	0.035	0.031	0.030	0.030
Volatile Organic Compounds (VOC)	0.047	0.047	0.042	0.039	0.032	0.032

Source: Statistics Centre- Abu Dhabi

2.10 Carbon Dioxide Emissions – Oil and Gas Sector

Since 2006, the oil and gas sector maintained its emissions of the gas around the same level, and in 2010 per capita carbon dioxide emissions decreased by 25.7% reaching a total of 11.68 tons in comparison to 2006.

2.15. Carbon Dioxide Emissions - Oil and Gas Sector

(Million Tons)

Business Sector	2006	2007	2008	2009	2010
Total	**23.0**	**22.0**	**21.0**	**21.0**	**23.0**
Exploration and Production	16.0	15.0	15.0	14.0	15.0
Independent Operators	1.0	1.0	1.0	1.0	1.0
Marketing & Refining	5.0	5.0	4.0	5.0	4.0
Petrochemicals	1.0	1.0	1.0	1.0	3.0

Source: Abu Dhabi National Oil Company - ADNOC

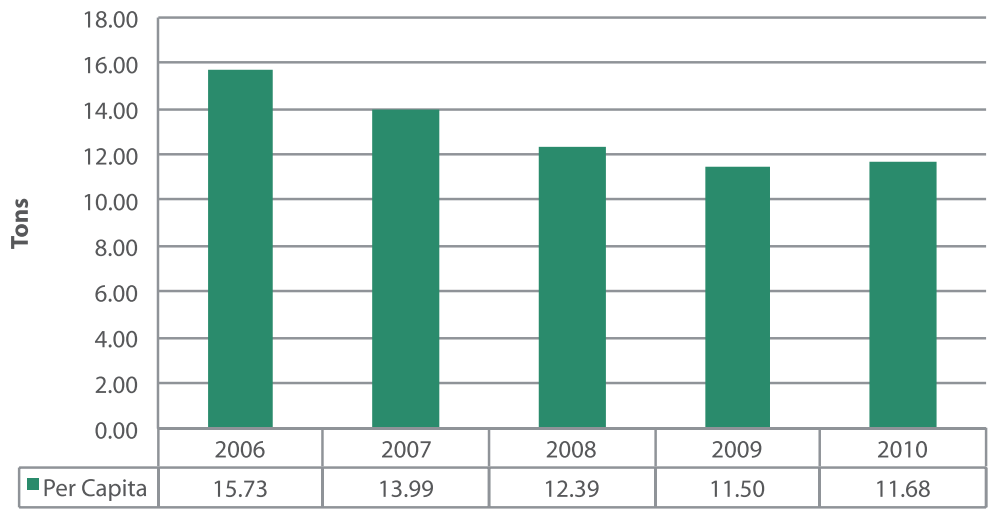
2.16. Per Capita Carbon Dioxide Emissions - Oil and Gas Sector

(Tons)

Business Sector	2006	2007	2008	2009	2010
Total	**15.73**	**13.99**	**12.39**	**11.50**	**11.68**
Exploration and Production	10.95	9.53	8.85	7.66	7.62
Independent Operators	0.68	0.64	0.59	0.55	0.51
Marketing & Refining	3.42	3.18	2.36	2.74	2.03
Petrochemicals	0.68	0.64	0.59	0.55	1.52

Source: Statistics Centre- Abu Dhabi

Figure: 2.5 Per Capita Carbon Dioxide Emissions - Oil and Gas Sector



Chapter Three

3. Energy Statistics

Power production and consumption are important components of environmental statistics since energy plays a vital role in fulfilling essential human needs. Electricity consumption in the Abu Dhabi Emirate in 2010 increased by 17% reaching about 39,173 GWH.The total number of customers in electricity network also increased by 7% from 368,941 customers in December 2009 to 394,541 customers in December 2010. The annual and summer power transmission system availability in the Emirate of Abu Dhabi reached 98.64% and 99.02% respectively during the same year.

3.1 Electricity Consumption in Abu Dhabi Emirate

According to 2010 estimates, electricity consumption in Abu Dhabi Emirate reached 39,173 GWH where Abu Dhabi consumed about 63% of total consumption and Al Ain and Western Region consumed 23% and 13% respectively. By sector, the domestic sector accounted for the largest share (39%) of total electricity consumption, followed by the commercial sector (31%). The industrial sector came last with only 3% of the total electricity consumption in the Emirate.

3.1. Electricity Consumption by Region

(MWH)

Region	2005	2006	2007	2008	2009	2010
Total Consumption*	**25,423,862**	**27,323,017**	**29,342,214**	**31,480,854**	**34,716,166**	**39,173,140**
Abu Dhabi	16,158,411	17,376,073	18,577,267	19,803,499	22,062,262	24,850,010
Al Ain	6,849,131	7,091,412	7,528,700	7,881,926	8,474,342	9,081,380
Western Region	2,416,320	2,855,532	3,236,247	3,795,429	4,179,562	5,241,750

Source: Abu Dhabi Water and Electricity Company (ADWEC)

*Consumption includes internal electrical consumption by power stations and technical losses through the network

3.2. Electricity Consumption by Sector

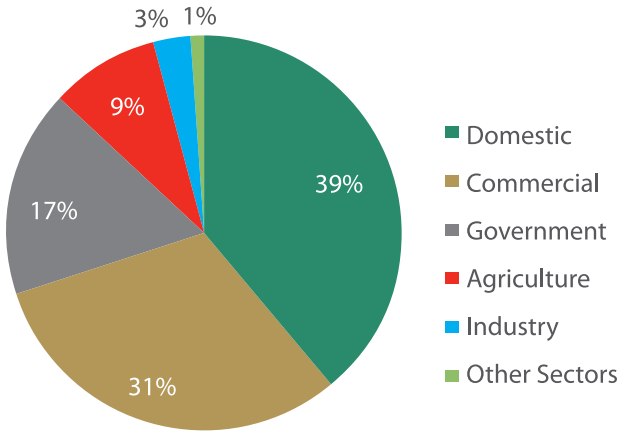
(MWH)

Sector	2005	2006	2007	2008	2009	2010
Total*	**25,423,862**	**27,323,017**	**29,342,214**	**31,480,854**	**34,716,166**	**39,173,140**
Domestic	9,919,427	10,660,405	11,448,220	12,281,327	13,544,932	15,283,875
Commercial	7,917,862	8,509,324	9,138,171	9,803,173	10,811,804	12,199,858
Government	4,326,170	4,649,333	4,992,923	5,356,267	5,907,364	6,665,771
Agriculture	2,292,501	2,463,750	2,645,824	2,838,365	3,130,400	3,532,291
Industry	752,456	808,664	868,425	934,976	1,027,475	1,159,385
Other Sectors	215,447	231,540	248,651	266,746	294,191	331,960

Source: Abu Dhabi Distribution Company, Al Ain Distribution Company

*Consumption includes internal electrical consumption by power stations and technical losses through the network

Figure: 3.1 Percentage Distribution of Electricity Consumption by Sector, 2010



3.2 Number of Customers in Electricity Network in Abu Dhabi Emirate

The number of customers in the electricity network increased by 7% by the end of 2010 in the Emirate of Abu Dhabi. This growth is highly related to the increase in the number of customers in the Abu Dhabi city where the number of customers increased by 8% from 2009. The numbers of customers in Al Ain and Western Region also increased by 5.4% and 3% respectively in the same year.

3.3. Number of Customers in Electricity Network - Abu Dhabi Emirate

Month	2008	2009	2010
January	313,929	347,314	370,099
February	314,928	349,823	372,055
March	315,745	351,994	374,677
April	316,811	356,005	376,891
May	318,450	357,944	378,687
June	319,392	359,440	381,531
July	320,627	361,124	383,109
August	321,859	362,764	384,958
September	322,846	364,517	387,763
October	324,293	365,037	390,564
November	325,579	368,032	392,567
December	326,077	368,941	394,541

Source: Abu Dhabi Water and Electricity Authority

3.4. Number of Customers in Electricity Network - Abu Dhabi

Month	2008	2009	2010
January	196,383	226,112	240,067
February	197,079	227,985	241,555
March	197,535	229,280	243,346
April	198,197	232,698	245,341
May	199,485	234,138	246,768
June	200,101	234,989	248,817
July	200,987	235,426	250,097
August	201,833	236,448	251,397
September	202,397	237,437	253,785
October	203,675	237,769	255,822
November	204,708	238,583	256,933
December	204,912	239,197	258,300

Source: Abu Dhabi Water and Electricity Authority

3.5. Number of Customers in Electricity Network - Al Ain

Month	2008	2009	2010
January	97,171	100,863	109,056
February	97,480	101,391	109,501
March	97,841	101,903	110,188
April	98,231	102,414	110,440
May	98,556	102,808	110,793
June	98,861	103,451	111,422
July	99,206	104,763	111,806
August	99,613	105,116	112,286
September	99,973	105,850	112,705
October	100,130	106,196	113,363
November	100,365	108,373	114,128
December	100,641	108,716	114,577

Source: Abu Dhabi Water and Electricity Authority

3.6. Number of Customers in Electricity Network - Western Region

Month	2008	2009	2010
January	20,375	20,339	20,976
February	20,369	20,447	20,999
March	20,369	20,811	21,143
April	20,383	20,893	21,110
May	20,409	20,998	21,126
June	20,430	21,000	21,292
July	20,434	20,935	21,206
August	20,413	21,200	21,275
September	20,476	21,230	21,273
October	20,488	21,072	21,379
November	20,506	21,076	21,506
December	20,524	21,028	21,664

Source: Abu Dhabi Water and Electricity Authority

3.3 Interruptions in Electricity Supply Network in Abu Dhabi Emirate

The number of electricity interruptions increased during the summer period of 2010 especially in July and August. In July 2010, about 87,996 customers experienced 4,519 interruptions in the Emirate of Abu Dhabi. However, the duration of interruptions for July was not quite long as it was in March, where about 75,548 customers experienced 2,864 interruptions with a total duration that exceeded 9,400 thousand minutes. These interruptions might recur several times for the same customers.

3.7. Number and Duration of Interruptions in Electricity Supply - Abu Dhabi Emirate, 2010

Month	Number of Interruptions	Interruption Duration (Thousand minutes)	Number of Customers with Interruption in Electricity Supply
January	1,778	5,631	48,743
February	2,021	8,778	76,552
March	2,864	9,426	75,548
April	2,146	5,940	52,055
May	3,149	7,110	76,338
June	3,679	5,762	69,066
July	4,519	7,405	87,996
August	4,142	7,047	81,636
September	2,431	5,339	62,539
October	2,037	8,236	73,708
November	1,767	6,776	63,416
December	1,713	9,104	80,259
Total	**32,246**	**86,555**	**847,856**

Source: Abu Dhabi Water and Electricity Authority

3.8. Number and Duration of Interruptions in Electricity Supply - Abu Dhabi, 2010

Month	Number of Interruptions	Interruption Duration (Thousand minutes)	Number of Customers with Interruption in Electricity Supply
January	928	3,558	28,888
February	1,032	4,866	44,558
March	1,592	5,671	41,754
April	1,101	3,764	32,282
May	1,541	4,187	42,534
June	1,889	3,443	39,049
July	2,198	4,262	53,685
August	2,121	3,948	51,024
September	1,150	3,087	34,341
October	1,098	5,709	47,147
November	997	4,360	41,125
December	952	6,302	56,667
Total	**16,599**	**53,157**	**513,054**

Source: Abu Dhabi Water and Electricity Authority

3.9. Number and Duration of Interruptions in Electricity Supply - Al Ain, 2010

Month	Number of Interruptions	Interruption Duration (Thousand minutes)	Number of Customers with Interruption in Electricity Supply
January	713	1,679	15,114
February	807	2,711	22,103
March	1,038	2,547	24,551
April	843	1,446	13,524
May	1,292	1,713	22,295
June	1,522	1,786	24,400
July	1,937	1,950	22,324
August	1,573	1,614	15,606
September	1,024	1,309	16,435
October	742	1,190	14,786
November	528	1,168	9,992
December	591	1,216	14,856
Total	**12,610**	**20,329**	**215,986**

Source: Abu Dhabi Water and Electricity Authority

3.10. Number and Duration of Interruptions in Electricity Supply - Western Region, 2010

Month	Number of Interruptions	Interruption Duration (Thousand minutes)	Number of Customers with Interruption in Electricity Supply
January	137	395	4,741
February	182	1,201	9,891
March	234	1,208	9,243
April	202	731	6,249
May	316	1,210	11,509
June	268	533	5,617
July	384	1,193	11,987
August	448	1,485	15,006
September	257	943	11,763
October	197	1,337	11,775
November	242	1,248	12,299
December	170	1,586	8,736
Total	**3,037**	**13,069**	**118,816**

Source: Abu Dhabi Water and Electricity Authority

3.4 Performance Indicators of Power System Reliability

Electricity transmission companies usually measure their performance trough qualitative and quantitative criteria and evaluate their projects based on performance indicators, known as Key Performance Indicators (KPIs). Once companies clearly define their operational objectives, KPIs can be used to measure their achievements level. When electricity is generated and distributed through distribution systems, its performance and efficiency are measured via two key indices:

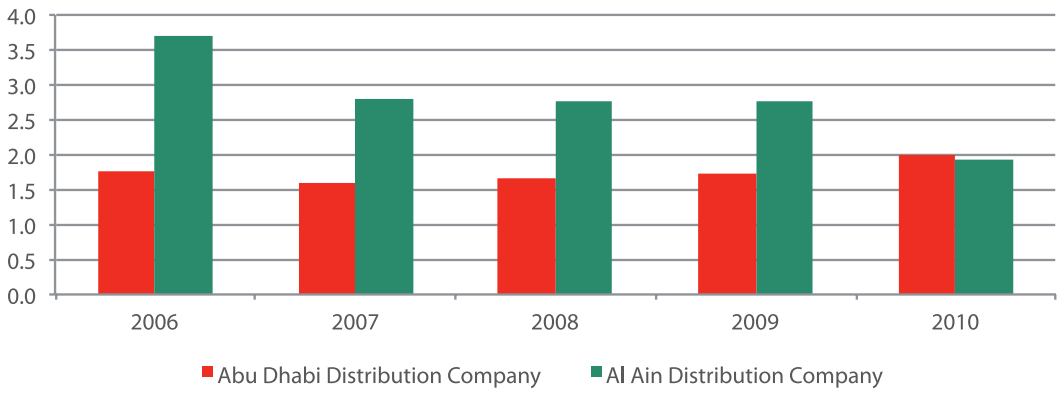
3.4.1 System Reliability KPI's

This system includes a number of elements that are useful for all plans used in estimating annual electricity demand so as to draw up development plans for electricity production and distribution in the Emirate.

3.4.1.1 System Average Interruption Frequency Index (SAIFI)

The System Average Interruption Frequency Index is a factor that measures the average number of interruptions experienced by each customer in the electricity supply service. In 2010, Abu Dhabi Distribution Company's SAIFI increased by 14.9% while Al Ain Distribution Company's SAIFI decreased by 30.9%.

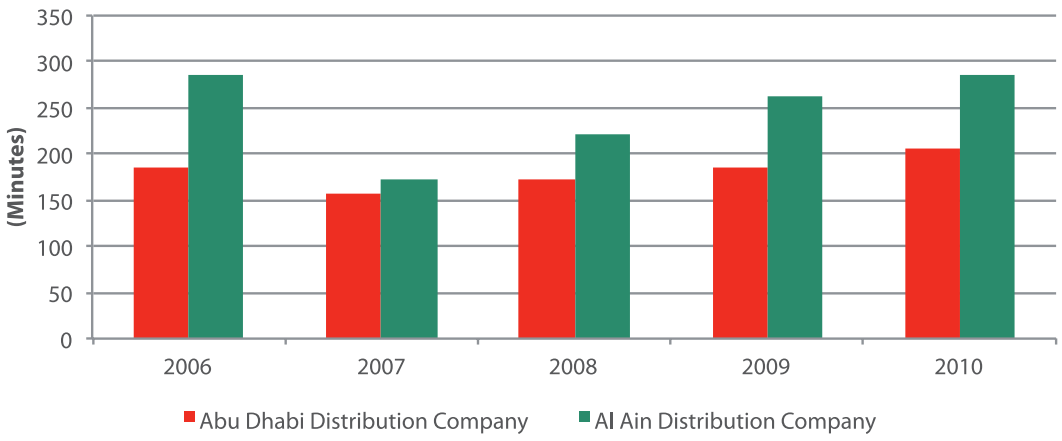
Figure: 3.2 SAIFI by Electricity Distribution Company - Abu Dhabi Emirate



3.4.1.2. System Average Interruption Duration Index (SAIDI)

This index measures the annual average interruption durations in minutes per costumer in the electricity supply service. In 2010, Abu Dhabi Distribution Company's SAIDI increased by 11.2% while Al Ain Distribution Company's SAIDI increased by 9.7%.

Figure: 3.3 SAIDI by Electricity Distribution Company - Abu Dhabi Emirate



3.4.2 Power Transmission System Availability in Abu Dhabi Emirate

Transmission System Availability is the summation of the availabilities of individual circuits of the main interconnected transmission system expressed as a percentage of the total number of circuits. A circuit is defined as an overhead line, cable, transformer, or any combination of these plant items controlled by one or more circuit breakers.

The table below displays the monthly power transmission system availability in Abu Dhabi Emirate from 2005 to 2010. Unlike the past two years, power availability started high in 2010 and it reached above 99% in the months from July - October. A maximum of 99.44% was recorded in September.

3.11. Power Transmission System Availability by Month - Abu Dhabi Emirate

(%)

Month	2005	2006	2007	2008	2009	2010
January	97.55	97.36	98.71	97.93	96.09	98.13
February	96.78	97.36	98.45	98.00	96.05	98.30
March	96.64	97.32	98.62	98.42	96.84	98.08
April	97.23	98.38	98.50	98.16	97.21	98.35
May	98.23	99.14	99.20	98.70	96.67	98.14
June	99.37	99.09	98.99	98.33	97.54	98.70
July	99.83	99.67	99.11	99.30	98.32	99.06
August	99.92	99.63	99.52	99.34	99.63	99.30
September	99.86	99.54	99.61	99.18	99.31	99.44
October	99.48	99.49	99.09	99.03	99.67	99.24
November	98.84	98.97	98.51	97.17	99.57	98.47
December	98.09	99.12	98.33	97.91	99.23	98.44

Source: Abu Dhabi Water and Electricity Authority

The table below presents both annual and summer power transmission system availability. Electricity consumption reaches its peak levels in summer, and in order to meet the increasing demand, electricity distribution companies in the Emirate of Abu Dhabi increase their summer power transmission system availability.

3.12. Annual and Summer Power Transmission System Availability - Abu Dhabi Emirate

(%)

Item	2005	2006	2007	2008	2009	2010
Summer Availability	99.92	99.63	99.52	99.34	99.63	99.02
Annual Availability	98.56	98.88	98.90	98.46	98.10	98.64

Source: Abu Dhabi Water and Electricity Authority

Chapter Four

4. Water Statistics

Water receives a very great deal of international and local attention due to the increase in water demand that accompanies the increase in population along with the issues of water scarcity and irrational use of water. Water resources in the Emirate of Abu Dhabi come from Aflaj (springs), wells, desalinated water plants, and sewage treatment. In 2010, total production of desalinated water in the Emirate of Abu Dhabi reached about 962.8 MCM out of which 873 MCM were consumed.

In 2010, the number of working wells in the Emirate of Abu Dhabi was 68,200 compared to 21,800 non-working wells according to estimations made by the Environment Agency - Abu Dhabi. The average withdrawal of groundwater reached about 2,250.9 MCM in 2010, whereas the amount of groundwater reserves reached 636,620 MCM during the same year.

The Western Region was the lowest producer of treated wastewater in 2010 accounting for only 3.6% of the Emirate's total treated wastewater, while Abu Dhabi region ranked top in this regard, producing 74% of the total.

4.1 Water Production and Consumption in Abu Dhabi Emirate

The Emirate of Abu Dhabi is witnessing an obvious increase since 2005 in the production and consumption of desalinated water. The annual consumption of desalinated water in 2010 increased by 10.5% and reached a total of 873 MCM.

4.1 Production and Consumption of Desalinated Water- Abu Dhabi Emirate

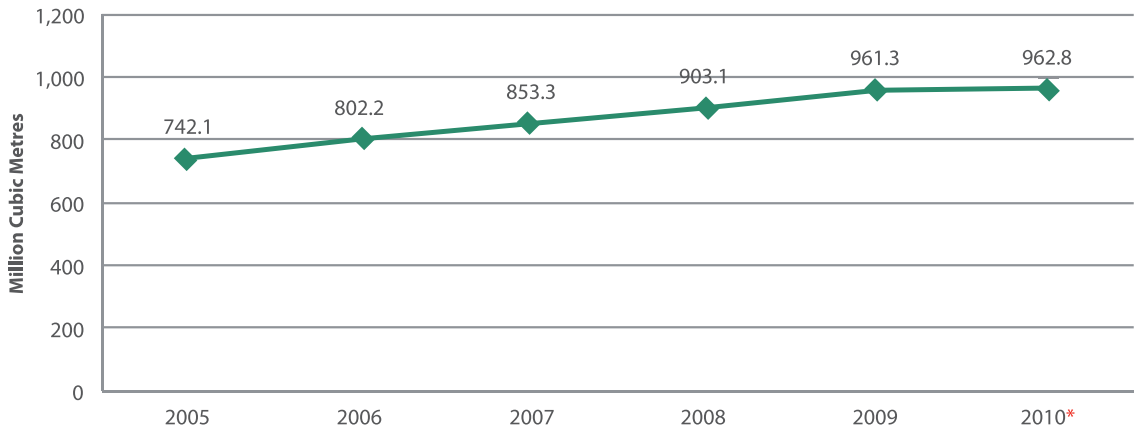
(Million Cubic Metres)

Item	2005	2006	2007	2008	2009	2010*
Total of Available Desalinated Water	**742.1**	**802.2**	**853.3**	**903.1**	**961.3**	**962.8**
Production	636.9	670.5	719.4	784.5	845.4	834.5
Supply from Al - Fujairah Station	105.2	131.7	133.9	118.6	115.9	128.3
Consumption	667.0	722.1	756.7	773.8	790.0	873.0
Daily Consumption	1.8	2.0	2.1	2.1	2.2	2.4
Daily Average per Capita (Cubic Metres)	1.3	1.4	1.3	1.2	1.2	1.2

Source: Abu Dhabi Water and Electricity Company (ADWEC)

* Preliminary estimates

Figure: 4.1 Total of Available Desalinated Water - Abu Dhabi Emirate



* Preliminary estimates

4.2 Consumption of Desalinated Water by Sector in Abu Dhabi Emirate

The domestic sector has high levels of desalinated water consumption and its proportion from 2010 total consumption reached 68.3%, followed by the government sector with 16.8%, the commercial sector with 9.4%, and the agriculture sector with 3.7%, whereas the least consumption was recorded for the industrial sector with 0.7% of the total consumption.

4.2. Consumption of Desalinated Water by Region

(Million Cubic Metres)

Region	2005	2006	2007	2008	2009	2010*
Total Consumption	**667.0**	**722.1**	**756.7**	**773.8**	**790.0**	**873.0**
Abu Dhabi	413.9	481.1	469.5	480.1	490.2	529.0
Al Ain	161.2	153.5	182.8	186.9	190.9	232.2
Western Region	92.0	87.6	104.3	106.7	108.9	111.7

Source: Abu Dhabi Water and Electricity Company (ADWEC)

* Preliminary estimates

4.3. Consumption of Desalinated Water by Sector

(Million Cubic Metres)

Sector	2005	2006	2007	2008	2009	2010*
Total	**667.0**	**722.1**	**756.7**	**773.8**	**790.0**	**873.0**
Domestic Sector	456.0	493.7	517.2	528.9	540.1	596.2
Commercial	63.7	69.0	72.3	73.9	75.5	82.3
Government	112.3	121.6	127.4	130.3	133.0	146.3
Agriculture	22.8	24.7	25.9	26.5	27.0	32.4
Industry	4.5	4.9	5.1	5.2	5.3	5.7
Other Sectors	7.7	8.4	8.8	9.0	9.1	10.1

Source: Abu Dhabi Distribution Company, Al Ain Distribution Company

* Preliminary estimates

4.3 Water Transmission System Availability in Abu Dhabi Emirate

Water Transmission System Availability is calculated in percentage in terms of the summation of the availabilities of transmission system components, such as pumps, water transmission lines, storage tanks, and surge vessels. The following table presents water transmission system availability in the Emirate of Abu Dhabi by month from 2005 to 2010. The availability in 2010 started high unlike the previous years, and it reached the maximum in May with 99.58%, the highest percentage since 2005.

4.4. Water Transmission System Availability by Month - Abu Dhabi Emirate

(%)

Month	2005	2006	2007	2008	2009	2010
January	95.80	95.80	95.75	95.84	94.88	97.28
February	94.69	95.72	95.54	95.86	94.50	97.43
March	95.91	95.62	95.55	95.31	94.52	96.98
April	95.51	95.80	95.57	94.69	95.15	99.24
May	95.83	95.97	95.69	94.60	96.24	99.58
June	96.28	95.60	96.97	94.99	96.17	99.34
July	96.02	95.74	96.88	93.32	96.51	97.74
August	95.57	95.60	96.90	93.78	96.74	97.33
September	95.82	95.69	96.59	93.82	97.01	97.55
October	95.76	95.46	96.89	93.76	96.87	96.70
November	95.60	95.47	96.49	94.10	96.88	96.86
December	95.80	95.72	96.68	94.53	96.75	96.56

Source: Abu Dhabi Water and Electricity Authority

4.5. Annual and summer Water Transmission System Availability - Abu Dhabi Emirate

(%)

Item	2005	2006	2007	2008	2009	2010
Summer Availability	95.57	95.60	96.90	93.78	96.74	99.02
Annual Availability	95.72	95.68	96.29	94.55	96.02	98.64

Source: Abu Dhabi Water and Electricity Authority

4.4 Groundwater

4.4.1 Groundwater Wells in Abu Dhabi Emirate

The total number of wells in the Emirate of Abu Dhabi reached 90,000 in 2010 out of which 21,800 were non-working wells. Al Ain city constituted about 47% of Abu Dhabi Emirate's total working wells, followed by Western Region with 41%, and Abu Dhabi city came last with12%.

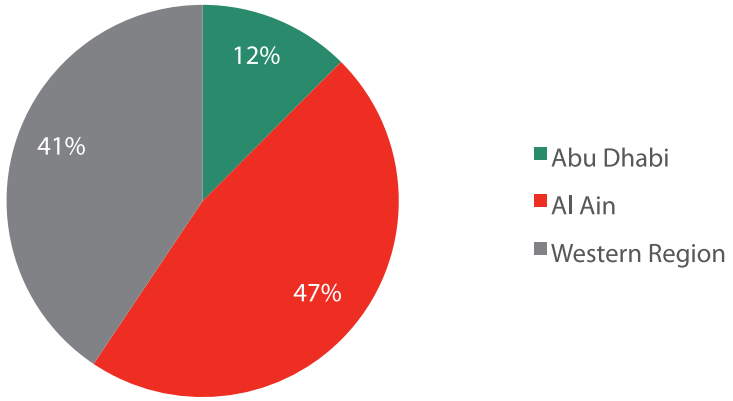
4.6. Number of Working and Non-Working Wells by Region

Region	2005	2006	2007	2008	2009	2010*
Total						
Working Wells	**74,870**	**72,040**	**71,290**	**69,250**	**65,290**	**68,200**
Non-Working Wells	**41,050**	**38,140**	**36,270**	**34,840**	**31,330**	**21,800**
Abu Dhabi						
Working Wells	4,240	3,990	3,880	3,780	2,980	8,500
Non-Working Wells	2,130	1,980	1,540	1,160	1,100	1,500
Al Ain						
Working Wells	41,650	40,870	40,870	39,820	35,460	32,000
Non-Working Wells	22,250	20,360	19,600	18,760	16,350	11,000
Western Region						
Working Wells	28,980	27,180	26,540	25,650	26,850	27,700
Non-Working Wells	16,670	15,800	15,130	14,920	13,880	9,300

Source: Environment Agency - Abu Dhabi

*Estimates

Figure: 4.2 Percentage Distribution of Number of Working Wells by Region, 2010*



*Estimates

4.4.2 Average Withdrawal of Groundwater in Abu Dhabi Emirate

High averages of groundwater withdrawal occur in the city of Al Ain, constituting more than half of the average annual withdrawal in the Emirate of Abu Dhabi, given the concentration of agriculture, followed by the Western Region. In 2010, average withdrawals of groundwater reached 56% and 41% in the city of Al Ain and Western Region respectively, whereas Abu Dhabi city's share was 3% of the annual average withdrawal. The average annual withdrawal has been continuously decreasing since 2005 where it decreased by 21.4%.

4.7. Average Withdrawal of Groundwater by Region

(Million Cubic Metres)

Region	2005	2006	2007	2008	2009	2010
Total*	**2,862.1**	**2,736.8**	**2,668.8**	**2,585.6**	**2,400.0**	**2,250.9**
Abu Dhabi	158.2	148.3	134.6	122.7	101.3	78.0
Al Ain	1,570.0	1,520.9	1,499.1	1,455.1	1,286.9	1,260.8
Western Region	1,133.9	1,067.6	1,035.1	1,007.7	1,011.7	912.0

Source: Environment Agency - Abu Dhabi

* Figures may not sum up to totals due to rounding

4.4.3 Groundwater Reserves in Abu Dhabi Emirate

Groundwater reserves in the Emirate of Abu Dhabi stood at 636,620 MCM in 2010 out of which 79% is saline, 18% is brackish, and only 3% is fresh groundwater. This implies that about 97% of this water contains dissolved salts which may alter the quality of soil. Therefore, educational and awareness programs on wise water-use should be implemented in the Emirate. It is also recommended to make use of excess desalinated water and treated effluent to the maximum.

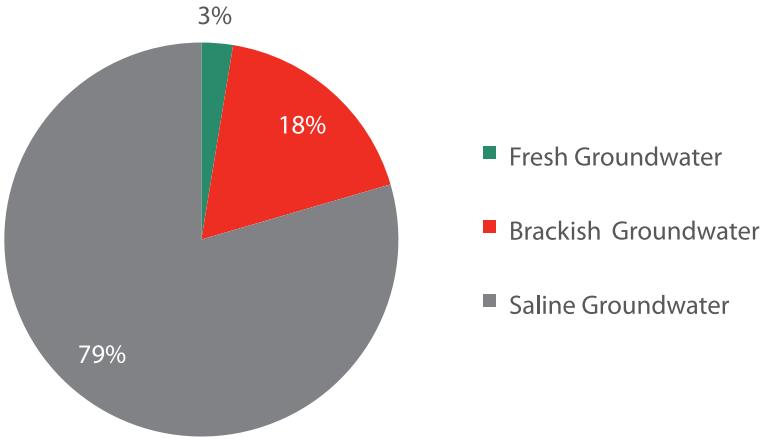
4.8. Amount of Groundwater Reserves by Type

(Million Cubic Metres)

Type	2005	2006	2007	2008	2009	2010
Total	**646,750**	**644,490**	**642,350**	**640,280**	**638,410**	**636,620**
Fresh Groundwater	16,250	16,290	16,350	16,380	16,410	16,420
Brackish Groundwater	119,000	117,500	116,600	115,300	114,800	114,000
Saline Groundwater	511,500	510,700	509,400	508,600	507,200	506,200

Source: Environment Agency - Abu Dhabi

Figure: 4.3 Percentage Distribution of Groundwater Reserves by Type, 2010



4.9. Total Non-Conventional Water Resources by Type

(Million Cubic Metres)

Type	2005	2006	2007	2008	2009	2010
Total	**770.0**	**828.6**	**874.0**	**897.9**	**909.6**	**999.3**
Desalinated Water Consumption	667.0	722.1	756.7	773.8	790.0	873.0
Quantity of Treated Wastewater Reuse	103.0	106.5	117.3	124.1	119.6	126.3

Source: Statistics Centre - Abu Dhabi

4.5 Water Consumption in the Irrigation of Agricultural Areas in Abu Dhabi Emirate

Despite the increase of Agricultural areas in the Abu Dhabi Emirate, there is a continuous reduction in the average water consumption per agricultural hectare since 2007. Average water consumption per agricultural hectare in 2010 decreased by 6.61% compared to that of 2009 which also decreased by 7.74% from the average consumption in 2007.

4.10. Total Consumption of Water in the Irrigation of Agricultural Areas - Abu Dhabi Emirate

(Million Cubic Metres)

Item	2007	2008	2009	2010
Groundwater Consumption	2,668.8	2,585.6	2,400.0	2,250.9
Desalinated Water Consumption	25.9	26.5	27.0	32.4
Treated Wastewater Reuse	117.3	124.1	119.6	126.3
Total Consumption	**2,812.0**	**2,736.2**	**2,546.6**	**2,409.6**
Agricultural area (Hectare)	70,374.8	73,151.2	73,795.7	74,767.9
Average Water Consumption per Agricultural Hectare (Cubic Meters)	39,957.5	37,404.7	34,508.8	32,227.7
% Reduction of Water Consumption per Agricultural Hectare	na	6.39	7.74	6.61

Source: Statistics Centre - Abu Dhabi, Environment Agency, Abu Dhabi Food Control Authority, Abu Dhabi Sewerage Services Company, Abu Dhabi Distribution Company, Al Ain Distribution Company

4.6 Sewage in Abu Dhabi Emirate

Wastewater treatment is one way of utilizing water and diversifying its sources, especially when conventional water resources are scarce in the presence of increasing water demand. In 2010, quantity of wastewater inflow in the Abu Dhabi Emirate reached 255.5 MCM where 97% of the quantity was treated. In general, the quantity of treated wastewater increased by 66% during the period between 2005 - 2009, while the quantity of treated wastewater reuse increased by 23% during the same period.

With the increasing demand on wastewater treatment and reuse in the Emirate of Abu Dhabi, the environmental monitoring level and health standards of wastewater treatment, reuse or disposal also increased. There are several parameters that are examined in the process of wastewater treatment, such as the daily amount of dry sludge and the concentrations of biochemical oxygen demand and suspended solids. In 2010, the daily production of dry sludge decreased by 17.7% compared to 2009, whereas the concentration of suspended solids increased by 8.3 % to reach about 97 kg per day.

4.11. Quantity of Wastewater Inflow by Region

(Million Cubic Metres)

Region	2005	2006	2007	2008	2009	2010
Total*	**153.1**	**173.7**	**192.0**	**218.5**	**233.8**	**255.5**
Abu Dhabi	119.4	131.4	142.87	160.4	173.1	188.8
Al Ain	33.7	37.4	42.08	50.5	52.1	57.3
Western Region	na	4.9	7.09	7.6	8.7	9.4

Source: Abu Dhabi Sewerage Services Company

* Figures may not sum up to totals due to rounding

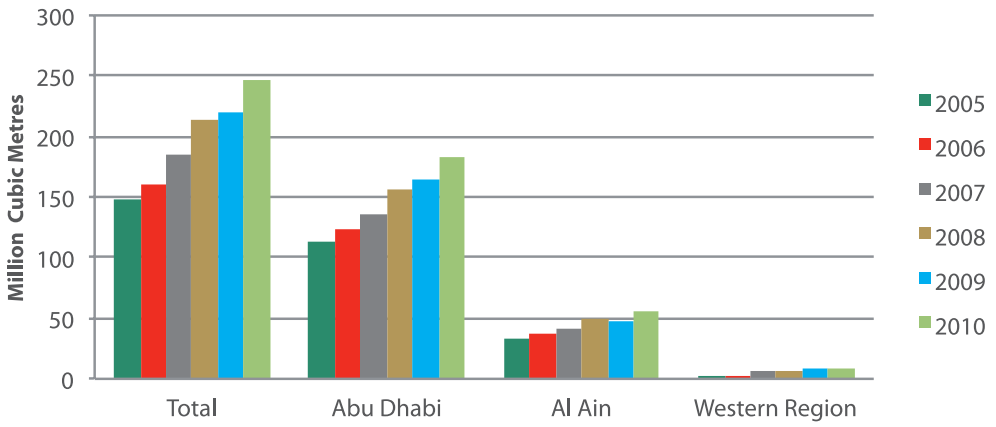
4.12. Quantity of Treated Wastewater by Region

(Million Cubic Metres)

Region	2005	2006	2007	2008	2009	2010
Total	**148.3**	**161.2**	**184.3**	**213.8**	**220.9**	**246.6**
Abu Dhabi	113.9	123.0	136.5	156.3	165.2	183.0
Al Ain	33.0	36.7	41.4	50.0	48.1	54.8
Western Region	1.4	1.5	6.4	7.5	7.6	8.8

Source: Abu Dhabi Sewerage Services Company

Figure: 4.4 Quantity of Treated Wastewater by Region



4.13. Quantity of Treated Wastewater Reuse by Region

(Million Cubic Metres)

Region	2005	2006	2007	2008	2009	2010
Total	**103.0**	**106.5**	**117.3**	**124.1**	**119.6**	**126.3**
Abu Dhabi	69.7	70.1	74.2	73.3	71.7	65.5
Al Ain	31.9	34.8	37.8	45.3	40.6	52.0
Western Region	1.4	1.6	5.3	5.5	7.3	8.8

Source: Abu Dhabi Sewerage Services Company

4.14. Total Wastewater Treatment Plants Capacity by Region

(Million Cubic Metres)

Region	2005	2006	2007	2008	2009	2010
Total	**135.774**	**135.774**	**135.774**	**135.774**	**183.198**	**511.363**
Abu Dhabi	95.872	95.872	95.872	95.872	130.320	360.260
Al Ain	29.426	29.426	29.426	29.426	41.585	139.760
Western Region	10.476	10.476	10.476	10.476	11.293	11.343

Source: Abu Dhabi Sewerage Services Company

4.15. Total Conventional Wastewater Treatment Plants Capacity by Region

(Million Cubic Metres)

Region	2005	2006	2007	2008	2009	2010
Total	**134.391**	**134.391**	**134.391**	**134.391**	**171.605**	**488.780**
Abu Dhabi	95.872	95.872	95.872	95.872	124.845	343.830
Al Ain	29.211	29.211	29.211	29.211	35.690	133.870
Western Region	9.308	9.308	9.308	9.308	11.070	11.080

Source: Abu Dhabi Sewerage Services Company

4.16. Total Non-Conventional Wastewater Treatment Plants Capacity by Region

(Million Cubic Metres)

Region	2005	2006	2007	2008	2009	2010
Total	**1.383**	**1.383**	**1.383**	**1.383**	**11.593**	**22.583**
Abu Dhabi	na	na	na	na	5.475	16.430
Al Ain	0.215	0.215	0.215	0.215	5.895	5.890
Western Region	1.168	1.168	1.168	1.168	0.223	0.263

Source: Abu Dhabi Sewerage Services Company

4.17. Average Daily Amount of Dry Sludge by Region

(Tons/day)

Region	2006	2007	2008	2009	2010
Total	**97.73**	**112.24**	**128.66**	**164.83**	**135.63**
Abu Dhabi	73.23	82.22	95.88	122.09	100.49
Al Ain	24.20	28.96	28.02	40.67	29.95
Western Region	0.30	1.05	4.75	2.08	5.18

Source: Abu Dhabi Sewerage Services Company

4.18. Average Daily concentration of BOD by Region

(Tons/day)

Region	2006	2007	2008	2009	2010
Total	**82,071.12**	**88,757.22**	**104,495.08**	**115,726.45**	**119,011.71**
Abu Dhabi	54,944.22	59,758.01	73,790.92	75,900.60	87,930.76
Al Ain	23,957.90	24,193.40	25,597.46	33,104.24	26,683.20
Western Region	3,169.00	4,805.81	5,106.70	6,721.62	4,397.75

Source: Abu Dhabi Sewerage Services Company

4.19. Average Daily Concentration of Suspended Solids by Region

(Tons/day)

Region	2006	2007	2008	2009	2010
Total	**69.47**	**81.28**	**91.32**	**89.94**	**97.38**
Abu Dhabi	47.08	54.08	69.73	70.04	73.06
Al Ain	22.09	26.16	18.14	19.90	20.74
Western Region	0.29	1.04	3.45	na	3.59

Source: Abu Dhabi Sewerage Services Company

4.7 Marine Waters Quality in Abu Dhabi City

The table below presents readings of Abu Dhabi city marine waters quality in terms of temperature, salinity, dissolved oxygen, in addition to nutrients, such as phosphate, nitrates, and others. The readings have been taken at monitoring stations at certain depths in eleven regions identified in the attached map.

The waters off the Emirate of Abu Dhabi are fairly nutrient-rich. Nutrient inputs into the sea from dust to sand storms, sewage discharges and land runoff near-shore areas. Examples of important nutrients in the sea water essential for the life and growth of plants and phytoplankton include nitrites, nitrates, ammonia, phosphates, and silicates. Generally, nutrients level rises in closed areas where it is difficult for water renewal to occur or in industrial zones which have intensive human activities. Such areas are reflected on the map and they are 2, 3, and 4. Area number 4 has a high level of nutrients since it is an industrial zone (Mussafah).

The salinity in the Arabian Gulf is relatively high because of combined influence of restricted exchange of Gulf waters with the open ocean, the high evaporation rates result from high temperatures, and the desalination industry. The salinity in marine waters in the city of Abu Dhabi in 2010 ranges between 42-48 Practical Salinity Unit (psu).

Regarding dissolved oxygen, most of the readings taken exceed are between 4-5 mg/liter and these are ideal levels for supporting the life of marine living organisms.

The following table contains the physical and chemical measurements along with nutrients concentration off the marine waters of Abu Dhabi city according to the locations of the samples taken as identified on the map.

4.20. Marine Waters Quality in the City Abu Dhabi, 2010

Region number	Max. Depth	Secchi Depth	(pH)	Salinity	Temperature	Dissolved Oxygen	Biochemical Oxygen Demand (BOD)	Chlorophyll	Phosphate PO_4	Silicate Sio_3	Nitrate NO_3	Nitrite NO_2	Ammonium NH_4
	(m)			(psu)	(^oC)	(mg/L)		(mcg/L)					
1	7.0	4.5	8.28	48.24	27.5	5.21	12.3	5.4	345.0	673.3	2963.5	25.0	76.7
2	5.0	2.5	8.22	42.28	28.67	4.67	14.3	10.6	2947.5	1445.8	18136.7	1578.3	738.3
3	6.5	4.5	8.27	47.15	27.68	4.87	9.1	3.9	205.8	515.0	5290.0	27.5	40.0
4	5.0	4.6	8.26	47.13	27.96	4.76	10.5	3.5	267.5	552.0	1934.6	13.33	37.5
5	5.0	6.1	8.27	46.80	27.89	4.95	8.8	1.9	207.5	1046.7	1920.8	32.5	52.5
6	4.5	6.0	8.32	44.10	22.07	5.57	7.0	1.0	250.0	110.0	400.0	10.0	20.0
7	5.0	6.3	8.19	48.34	28.06	4.70	9.1	0.8	162.5	853.3	533.3	9.16	46.7
8	6.0	8.1	8.20	45.92	27.44	4.68	8.3	0.6	113.3	390.8	1357.5	2.5	52.5
9	8.0	9.2	8.24	44.08	28.01	4.61	8.6	0.7	98.3	238.3	958.3	0.0	48.3
10	6.0	8.1	8.24	43.94	28.14	4.61	13.0	0.8	93.3	368.3	1044.6	2.5	48.3
11	5.5	7.0	8.20	43.76	28.27	4.52	10.5	1.0	96.7	855.0	1516.7	2.5	97.7

Source: Environment Agency – Abu Dhabi

Figure: 4.5 Location of Marine Water Quality Monitoring Stations Abu Dhabi City, 2010

Chapter Five

5. Health and Safety Statistics

Food safety and occupational health and safety are increasingly important health issues that receive great deal and intensified efforts by governments. Food safety is a science which deals with procedures related to the handling, preparation, and storage of food to prevent the occurrence of food poisoning and foodborne illnesses. The presence of occupational health and safety management systems aims at providing secure working environments though identifying and controlling risks and minimizing the possibility of accidents occurrence.

In 2010, there were 75 cases of fatal occupational incidents and 26 fatal occupational road accidents recorded in the Emirate of Abu Dhabi. There were 1,259 cases of foodborne illnesses and food poisoning caused by consuming foods or drinks contaminated with bacteria and viruses. Typhoid accounted for the largest share of poisoning cases, claiming 335 victims or 26.6% of the total cases of poisoning during the year 2010.

5.1 Food Poisoning and Foodborne Illnesses in Abu Dhabi Emirate

Food Safety is considered as an essential health issue and that is because foodborne illnesses which are caused by biotoxins, pathogens, and chemical contaminants impose serious public health threat around the world.

Food poisoning is defined as an illness caused by consuming foods or drinks contaminated with bacteria, viruses, or poisons, with different severity levels that may sometimes cause death. Symptoms of food poisoning usually include nausea, vomiting, and abdominal cramps, diarrhea, fever, shivering, and others. Such symptoms may affect one person or a group of people who have had the same contaminated foods or drinks. As a result of the increasing number of problems related to food safety and consumer worries, governments exert huge efforts to improve food safety and human health.

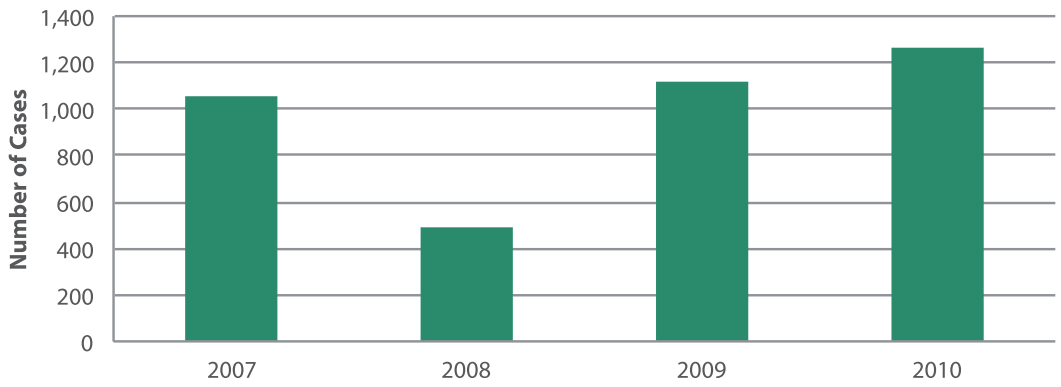
In 2010 there were 1,259 cases of food poisoning and foodborne illnesses in the Emirate of Abu Dhabi.Typhoid accounted for the largest share of poisoning cases, claiming 335 victims or 26.6% of the total cases of poisoning.

5.1. Number of Food Poisoning and Foodborne illnesses by Type

Type	2007	2008	2009	2010
Total	**1,051**	**489**	**1,114**	**1,259**
Salmonella	128	47	205	90
Other Food Poisoning	215	85	309	471
Typhoid Fever	77	117	133	335
Viral Hepatitis A	211	212	181	193
Giardia Lambia	170	na	36	55
Bacillary Dysentery	71	na	52	51
Bacterial Dysentery	na	na	123	na
Paratyphoid Fever	5	12	30	12
Brucellosis	69	na	45	52
Other	105	16	na	na

Source: Health Authority - Abu Dhabi

Figure: 5.1 Number of Food Poisoning and Foodborne illnesses - Abu Dhabi Emirate



5.2 Occupational Health and Safety

Occupational health and safety is a multidisciplinary field that aims at promoting healthy and safe work and working environments, enhances the social, mental, and physical well being of workers, support their working capacity, and therefore increase productivity in work place. It is essential for all employers to implement occupational health and safety management system to constantly identify and control health and safety risks and reduce accidents potentiality.

5.2.1 Road and Occupational Injuries in Abu Dhabi Emirate

The number of death toll caused by occupational injuries in the Emirate of Abu Dhabi reached 75 deaths in 2010, whereas the number of deaths caused by occupational road traffic injuries reached 26 accounting for 7.4% of total road traffic injury deaths. During the same year, three deaths were reported in the water and electricity production sector, four deaths in the oil and gas sector, and two in the sewerage services activity.

5.2. Number of Injury Deaths by Injury Category

Injury Category	2007	2008	2009	2010
Total	**527**	**498**	**538**	**451**
Road Traffic Injury (RTI)	427	422	430	350
Occupational Injury	66	68	82	75
Occupational RTI	34	8	26	26

Source: Health Authority - Abu Dhabi

Figure: 5.2 Number of Injury Deaths by Injury Category - Abu Dhabi Emirate

5.2.2 Occupational Health and Safety Statistics – Water and Electricity Production Sector

ADWEA's Lost Time Injury Incidents of 22 per million man-hours worked increased by 16% in 2010 whereas Road Traffic Incidents is 63% less than the previous year. There were three more fatality incidents in 2010 compared to 2009. One disability incident has been recorded in 2010.

5.3. Number of Occupational Health and Safety Incidents - Water and Electricity Production Sector

Item	2005	2006	2007	2008	2009	2010
Fatality Incidents	1	2	0	3	3	6
Fatality Non Recordable	0	0	0	0	0	0
Disability Incident	0	0	0	0	0	1
Lost Time Injury Incidents	9	15	18	27	19	22
Medical Treatment Case	5	18	43	290	531	472
Restricted Workday Case	0	2	2	3	4	1
Serious Near Miss	4	18	75	66	72	51
Journey Incident	0	0	0	0	3	0
Reporting Dangerous Occurrence	0	5	6	6	9	4
Occurrence of Occupational Disease	0	0	0	0	0	0
Road Traffic Incidents	44	14	15	15	8	3
Other (near miss)	43	78	206	948	1,423	545

Source: Abu Dhabi Water and Electricity Authority - ADWEA

5.4. Rate of Injuries and Incidents Registered Per Million Man-Hours Worked - Water and Electricity Production Sector

Item	2005	2006	2007	2008	2009	2010
Number of Working Hours (Million Hours)	9.85	20.99	25.08	36.85	50.57	42.13
Lost Time Injury Frequency Rate (LTIFR)	0.91	0.71	0.72	0.73	0.38	0.52
Lost Time Injury Severity Rate (LTISR)	2.10	4.20	14.40	6.10	4.70	17.10
Total Reportable Case Frequency (TRCF)*	**0.10**	**1.00**	**1.70**	**8.00**	**10.60**	**11.30**

Source: Abu Dhabi Water and Electricity Authority - ADWEA

*Includes Fatal Accident Rate (FAR)

5.2.3 Occupational Health and Safety Statistics – Oil and Gas Sector

ADNOC's Lost Time Injury Incidents of 66 per million man-hours worked decreased by 12% in 2010 whereas Road Traffic Incidents is 31% more than the previous year. The Lost Time Injury Frequency Rate (LTIFR) and the Fatal Accident Rate (FAR) for 2010 were the lowest in the last six years.

5.5. Number of Occupational Health and Safety Incidents - Oil and Gas Sector

Item	2005	2006	2007	2008	2009	2010
Fatality Incidents	6	5	4	4	7	4
Fatality Non Recordable	na	8	5	9	7	11
Disability Incident	0	0	2	2	1	0
Lost Time Injury Incidents	53	57	58	68	75	66
Medical Treatment Case	123	107	141	114	93	144
Restricted Workday Case	41	42	53	48	44	58
Serious Near Miss	na	na	na	na	164	131
Journey Incident	na	na	na	na	na	na
Reporting Dangerous Occurrence	na	na	na	na	na	na
Occurrence of Occupational Disease	na	na	na	na	na	na
Road Traffic Incidents	171	93	116	169	135	177
Other (near miss)	na	na	na	na	24,255	30,055

Source: Abu Dhabi National Oil Company - ADNOC

5.6. Rate of Injuries and Incidents Registered Per Million Man-Hours Worked - Oil and Gas Sector

Item	2005	2006	2007	2008	2009	2010
Number of Working Hours (Million Hours)	171.00	191.00	230.00	298.00	313.00	355.00
Lost Time Injury Frequency Rate (LTIFR)	0.31	0.30	0.25	0.23	0.24	0.19
Lost Time Injury Severity Rate (LTISR)	na	na	na	na	na	na
Total Reportable Case Frequency (TRCF)	**1.27**	**1.08**	**1.09**	**0.79**	**0.68**	**0.76**
Fatal Accident Rate (FAR)	3.50	2.62	1.74	1.34	2.23	1.13

Source: Abu Dhabi National Oil Company - ADNOC

5.2.4 Occupational Health and Safety Statistics – Sewerage Services

Abu Dhabi Sewerage Services activity recorded two fatal incidents and one road traffic incident in 2010. The Total Reportable Case Frequency (TRCF) and Fatal Accident Rate (FAR) for 2010 were the lowest in the past four years.

5.7. Number of Occupational Health and Safety Incidents - Sewerage Services

Item	2007	2008	2009	2010
Fatality Incidents	1	1	1	2
Fatality Non Recordable	0	0	0	0
Disability Incident	0	0	0	0
Lost Time Injury Incidents	2	2	6	0
Medical Treatment Case	0	0	0	0
Restricted Workday Case	0	0	0	0
Serious Near Miss	0	0	182	244
Journey Incident	0	0	0	0
Reporting Dangerous Occurrence	0	0	1	2
Occurrence of Occupational Disease	0	0	0	0
Road Traffic Incidents	0	0	0	1
Other (near miss)	0	0	0	0

Source: Abu Dhabi Sewerage Services Company

5.8 Rate of Injuries and Incidents Registered Per Million Man-Hours Worked - Sewerage Services

Item	2007	2008	2009	2010
Number of Working Hours (Million Hours)	2.44	5.33	12.34	15.77
Lost Time Injury Frequency Rate (LTIFR)	0.16	0.91	0.73	0.00
Lost Time Injury Severity Rate (LTISR)	0.41	1.82	7.31	0.00
Total Reportable Case Frequency (TRCF)	**0.00**	**1.82**	**0.92**	**0.12**
Fatal Accident Rate (FAR)	0.08	0.91	0.46	0.05

Source: Abu Dhabi Sewerage Services Company

Chapter Six

6. Waste Statistics

Waste, with its different compositions and disposal methods, is regarded as one of the important environmental issues due to the health and environmental harms associated with it. Improper disposal of waste may result in contamination of groundwater when it is land filled, polluting the atmosphere with harmful gases when it is burned, or contaminating the seas when waste is thrown into them. Also, even if waste is disposed through the proper means of imbedding, it requires large areas of land which may not be available for many countries. Consequently, an increasing need for safe and effective waste management system emerges along with waste recycling that conserves the environment and contributes economic benefits to society and its economic sectors. The total amount of waste In 2010 reached about 9.97 million tons of which 27% was transferred to landfills and 24% was recycled.

6.1 Solid Waste in Abu Dhabi Emirate

Total amount of waste generated in 2010 reached about 9.97 million tons with a daily average of 27.3 thousand tons. The demolition and construction activity accounts for 74% of total waste generated, whereas the amount of solid municipal waste reached about 834 thousand tons of which 63% was in the Abu Dhabi region.

6.1. Waste Generation by Source Activity and Region, 2010

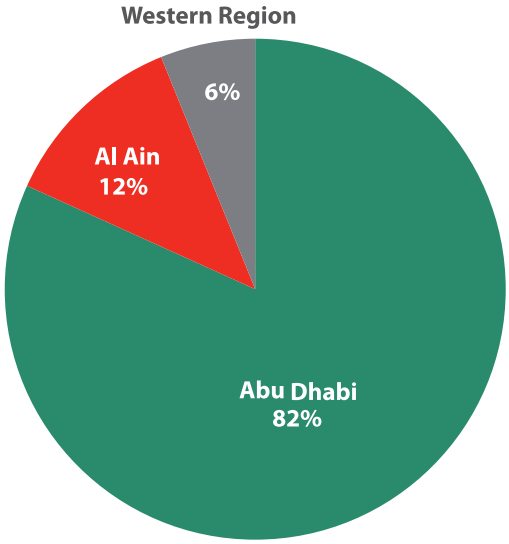
(Tons)

Source	Total	Abu Dhabi	Al Ain	Western Region
Grand Total	**9,974,190**	**8,155,950**	**1,206,780**	**611,460**
Daily average	**27,326.55**	**22,345.07**	**3,306.25**	**1,675.23**
Municipal Solid Waste	834,300	525,000	234,300	75,000
Commercial and Industrial Waste	875,400	761,400	82,500	31,500
Agricultural Waste	828,600	250,200	184,800	393,600
Construction and Demolition	7,402,500	6,587,700	703,800	111,000
Hazardous Medical waste*	4,890	3,150	1,380	360
Industrial Hazardous Waste	28,500	28,500	0	0

Source: The Centre of Waste Management - Abu Dhabi

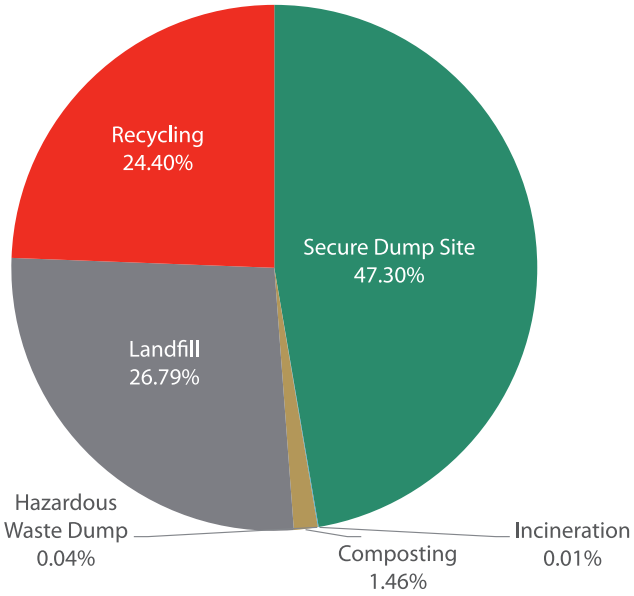
* Estimates

Figure: 6.1 Percentage Distribution of Waste Amount by Region, 2010



In the light of waste management development in the emirate of Abu Dhabi, the percentage of waste recycled in 2010 was about 24%, and the amount of waste transported to secured dump sites to be managed and treated was 47%, whereas the amount of landfilled waste was 27% of total amount of waste generated. Secure dump site is a place where waste is landfilled in secured cells to be treated and it differs from landfills in that it does not have a sewage system to deal with the wastewater produced.

Figure: 6.2 Percentage Distribution of Waste Amount by Type of Disposal - Abu Dhabi Emirate, 2010



Chapter Seven

7. Appendix - Definitions

7.1 Environment

Environment:

The whole external conditions which affect the life, growth, and the existence of a living organism on earth including climate, air, water, soil, metals, and the living organisms.

Environmental Statistics:

Statistics that describe the state and trends of the environment covering the natural environment (air/cliamte, water, land/soil)and living organisms in their ecosystems and human settlements. Environmental statistics are integrative in nature, measuring human activities and naturalevents that affect the environment, the impact of these activities and events, and the social responses to environmental impacts. Broad definitions include environmental indicators, indices and accounting (2).

7.2 Climate

Atmospheric Pressure:

The weight of the air column that extends from the surface of the ground until the end of the atmosphere of the Earth. Air pressure is one of the most important weather elements. The difference in atmospheric pressure leads to the emergence of descendant force which is the main cause of air movement from one place to another and that is wind. Thus transferring energy from one place to another and causing fluctuations in weather and climate.

Atmospheric pressure at sea level is equivalent to the a mercury column of height 76 cm. and the atmospheric Atmospheric pressure is inversely proportional to the degree of air temperature. When temperature rises, air expands and density decreases, then decreasing the weight and pressure, and vice versa. If temperature decreases, air shrinks and gains weight, the pressure rises. Also air pressure rises or decreases with increasing or decreasing the altitude from sea level.

Average Rainfall:

The average of the amounts of falling rain in millimeter within one month or year.

Climate:

The condition of weather at a particular location or region over a long period of time that can be a month, a year, a season, or several years. It is the long-term result in the atmosphere including elements, such as temperature, solar radiation humidity, rainfall, atmospheric pressure, wind speed and direction, and the variations of these elements.

Heaviest fall:

The highest amount of rainfall in millimeter on a certain location within one month or year (a period of time)

Precipitation:

It is the total volume of precipitation from the atmosphere, including rain, snow, hail and dew falling within the country in one year (1).

Relative Humidity:

It is a percentage of water vapor mass per unit volume of air relative to the mass of water vapor necessary to satisfy the same volume unit, at the same temperature and atmospheric pressure.

Relative humidity % = (Actual water vapor pressure / Saturation water vapor pressure) * 100 OR
Relative humidity % = (Specific humidity / Saturation specific humidity) * 100
The relative humidity changes during the day depending on temperature because the saturation vapor pressure is controlled by temperature. Relative humidity is low during the day and rises gradually to reach its highest levels in the last hours of the night at the minimum temperatures. Sometimes the saturation may lead to formation of dew, if temperature is higher than zero degree centigrade or frost if the temperature is below zero centigrade.

Solar Radiation:

A set of ethereal radiation from the sun such as light and radiant heat, and others.

Sunshine:

It is the number of hours of sunshine during the day time. It is measured in the period where sun light is not veiled as a result of clouds, fog or particles stuck (e.g., smog).

Winds:

It is the horizontal movement of air, and air either moves up or down causing what is known as updrafts and downdrafts. The sun is the primary source of climatic changes on earth as the sun rays heat and stretch the air and consequently its pressure decreases and winds move from areas with high atmospheric pressure to areas of low atmospheric pressure. Because the earth rotates around itself, the wind does not blow go directly from high pressure areas to low pressure, but deviates to the right direction in the northern hemisphere and to the left direction in the southern hemisphere because of the "Coriolis effect" resulting from the earth's rotation on its axis.

7.3 Air

Air Pollution:

The presence of contaminant or pollutant substances a pollutant in air that do not disperse properly and interfere with human health or welfare, or produce other harmful environmental effects (2).

Annual mean concentration:

Arithmetic mean over all valid measurements for the respective year (1).

Carbon Dioxide (CO_2):

Colorless, odorless and non-poisonous gas that results from fossil fuel combustion and is normally a part of ambient air. It is also produced in the respiration of living organisms (plants and animals), and considered to be the main greenhouse gas, contributing to climate change (2).

Carbon Dioxide Emissions (per Capita):

Carbon dioxide emissions per capita is the total amount of carbon dioxide emitted by a country as a consequence of human (production and consumption) activities, divided by the population of the country. This include emissions of carbon dioxide include emissions from consumption of solid, liquid and gas fuels; cement production; and gas flaring. National reporting to the United Nations Framework Convention on Climate Change, which follows the Intergovernmental Panel on Climate Change guidelines, is based on national emission inventories and covers all sources of anthropogenic carbon dioxide emissions as well as carbon sinks (such as forests). Carbon dioxide emissions per capita are calculated by dividing carbon dioxide emissions by the number of people in the national population (1).

Carbon Monoxide (CO):

Colorless, odorless and poisonous gas produced by incomplete fossil fuel combustion. Carbon monoxide combines with the hemoglobin of human beings, reducing its oxygen carrying capacity, with effects harmful to human beings (2).

Decibel:

The unit of sound measurement on a logarithmic scale, with sound approximately doubling in loudness for every increase of 10 decibels (2).

Ground Level Ozone (O_3):

Ozone presents as a secondary pollutant in the lower atmosphere, where its formation can be enhanced by other pollutants. It is highly toxic at levels above 0.1 parts per million (p.p.m.) (2).

Methane:

Colorless, odor-less and flammable gaseous hydrocarbon created by anaerobic decomposition of organic compounds. Methane is a potent greenhouse gas (2).

Nitrogen Dioxide (NO_2):

A reddish - brown very toxic gas with a strong irritating smell. When present in high concentrations, it causes serious damage to the lungs. Nitrogen dioxide is an oxidant which reacts in air forming nitric acid causing corrosion in addition to the formation of toxic organic nitrates that contribute to the production of ground-level ozone and smog.

Nitrogen Oxides (NOx):

product of combustion from transportation and stationary sources. It is a major contributor to acid despositions and the formation of ground level ozone in the troposphere (2).

Noise:

Audible sound from traffic, construction and so on that may generate unpleasant and harmful effects (hearing loss). It is measured in decibels (2).

Ozone (O_3):

Pungent, colorless, toxic gas that contains three atoms of oxygen in each molecule. It occurs naturally at a concentration of about 0.01 parts per million (p.p.m.) of air. Levels of 0.1 p.p.m. ppm are considered to be toxic. In the stratosphere, ozone provides a protective layer shielding the earth from the harmful effects of ultraviolet radiation on human beings and other biota. In the troposphere, it is a major component of photochemical smog, which seriously affects the human respiratory system (2).

Particulates
Fine liquid or solid particles, such as dust, smoke, mist, fumes or smog found in air or emissions (2).
Remote Regions/ Background site:
Monitoring stations far from any industrial or densely populated area (1).

Sulphur Dioxide (SO_2):

heavy, pungent colourless gas formed by the combustion of fossil fuels. It is harmful to human beings and vegetation, and contributes to the acidity in precipiation (2).

Suspended Particulate Matter (SPM10):

Finely divided solids or liquids, less than 10 µm (micrometers), that may be dispersed through the air from combustion processes, industrial activities or natural sources (1).

Volatile Organic Compounds:

Organic compounds that evaporate readily and contribute to air pollution mainly through the production of photochemcial oxidants (2).

Volatile Organic Compounds Except for Methane (NMVOCs):

They are These are emissions produced mainly in fuel combustion and in processes that use solvents or solvent-based products such as painting, metal degreasing etc. Several of these chemicals are harmful to human health if inhaled, ingested, drunk or get in contact with skin. NM-VOCs are significant precursors to ground level ozone formation. NM-VOCs are the sum of all hydrocarbon air pollutants except methane (1).

7.4 Energy

The System Average Interruption Index (SAIFI):

The average number of interruptions experienced by each customer in the electricity supply service.

The System Average Duration Index (SAIDI):

The average number interruptions duration in minutes experienced by each customer in the electricity supply service.

Power Transmission System Availability:

Transmission System Availability is calculated in terms of the summation of the availabilities of individual circuits of the main interconnected transmission system expressed as a percentage of the total number of circuits. A circuit is defined as an overhead line, cable, transformer, or any combination of these plant items controlled by one or more circuit breakers.

7.5 Water

Advanced Treatment:

Process capable of reducing specific constituents in wastewater not normally achieved by other treatment options. It covers all unit operations that are not considered to be mechanical or biological (1).

Biochemical Oxygen Demands (BOD)

Amount of dissolved oxygen required by organisms for the aerobic decomposition of organic matter present in water. This is measured at 20 degrees Celsius for a period of five days. The parameter yields information on the degree of water pollution with organic matter (3).

Biological Treatment:

Wastewater treatment employing aerobic and anaerobic micro-organisms that results in decanted effluents and separate sludge containing microbial mass together with pollutants. Biological treatment processes are also used in combination or in conjunction with mechanical treatment (1).

Brackish water

Water containing salt at a concentration significantly lower than that of sea water. The concentration of total dissolved salts is usually in the range of 1,000 -10,000 milligrams per litre (mg/l) (3).

Desalinated Water:

Total volume of water obtained from desalination of (i.e., removal of salt from) seawater and brackish water (3).

Fresh groundwater:

Water which is being held in, and can usually be recovered from, or via, an underground formation. All permanent and temporary deposits of water, both artificially charged and naturally occurring in the subsoil, of at least sufficient quality for use (3).

Freshwater:

Freshwater is water that contains only minimal quantities of dissolved salts, especially sodium chloride, thus distinguishing it from sea water or brackish water (1).

Mechanical Treatment:

Treatment of a physical and mechanical nature that results in decanted effluents and separate sludge. Mechanical processes are also used in combination and/or in conjunction with biological and advanced unit operations. Mechanical treatment includes processes as sedimentation, flotation, etc (1).

Sea Water:

Sea water is water from a sea or ocean. On average, sea water in the world's oceans has a salinity of ~3.5%. This means that for every 1 litre (1000 ml) of sea water there are 35 grams of salts (mostly, but not entirely, sodium chloride) dissolved in it (3).

Sewage Sludge Productio (Dry Matter)

The accumulated settled solids, either moist or mixed, with a liquid component as a result of natural or artificial processes, that have been separated from various types of waste water during treatment (3).

Total Public Water Supply:

Water supplied by economic units engaged in collection, purification and distribution of water (including desalting of sea water to produce water as the principal product of interest, and excluding system operation for agricultural purposes and treatment of waste water solely in order to prevent pollution.) It corresponds to ISIC division 41. Deliveries of water from one pubic supply undertaking to another are excluded (1).

Total Reuse of Freshwater:

Freshwater that has undergone wastewater treatment and is deliverable to a user as reclaimed wastewater. This means the direct supply of treated effluent to the use. Excluded is wastewater discharged into watercourse and used again downstream (1).

Total Wastewater Generated:

The quantity of water in cubic meters (m3) that is discharged due to being of no further immediate value to the purpose for which it was used or in the pursuit of which it was produced because of its quality, quantity or time of occurrence (1).

Total Wastewater Treatment:

Process to render waste water fit to meet applicable environmental standards or other quality norms for recycling or reuse (1).

Treated in Other Treatment Plants:

Treatment of wastewater in any non-public treatment plants, i.e. industrial wastewater plants. Excluded from 'Other wastewater treatment' is treatment in under independent treatment facilities such as septic tanks (1).

Treatment in Independent Treatment Facilities:

Individual private treatment facilities to treat domestic and other wastewater in cases where a public waste water network is not available or not justified either because it would produce no environmental benefits . Examples of such systems are treatment in wastewater tanks (1).

Wastewater Treated in Public Treatment Plants:

All treatment of wastewater in municipal treatment plants by official authorities, or by private companies for local authorities, whose main purpose is wastewater treatment (1).

Water Transmission System Availability:

Water Transmission System Availability is calculated in percentage in terms of the summation of the availabilities of transmission system components, such as pumps, water transmission lines, storage tanks, and surge vessels.

7.6 Health and Safety

Food Poisoning:

Any illness caused by infection or poisoning resulting from food or water consumption. Food poisoning may affect individuals or group of people who have consumed the same contaminated food or drinks that contained harmful substance (toxin) or pathogens (bacteria, virus, and parasite) or chemical or allergic substances. Food poisoning has various factors and symptoms.

Occupational Health and Safety:

A discipline concerned with protecting the health and safety of people engaged with work by fostering a safe illness and accident-free environment. In other words, it is a set of procedure and rules within legislative framework aiming at protecting man from injures and possessions from being damaged or lost.

Occupational Accident:

The harm that happens to a worker because of an accident is defined as "injury" as a direct result of an accident to that labor. Occupational accident is defined as work-related injury that occurs to the worker at the workplace or because of it, is also one of the injuries occurring to workers on their way to work or returning from work, provided that the labor used the regular route without interruption or deviation. The occupational diseases are also considered as work injuries.

7.7 Waste

Agriculture (Forest) wastes:

All waste from agricultural and forestry activities (1).

Composting:

A biological process that submits biodegradable waste to anaerobic or aerobic decomposition, and that results in a product that is recovered (1).

Construction Waste:

All waste from construction activities. This category refers to waste generated in ISIC division 45 (1).

Hazardous Waste:

Wastes that, owing to their toxic, infectious, radioactive or flammable properties pose a substantial actual or potential hazard to the health of humans and other living organisms and the environment (1).

Incineration:

Controlled burning of waste materials with or without energy restoration (1).

Incineration Plants:

Facilities for burning waste under controlled conditions, with or without energy recovery (1).

Industrial Waste:

Include wastes from mine, quarries, manufacturing industries, energy production, and construction (1).

Landfilled Waste:

This includes all amounts of waste transferred to landfill, either directly, or after sorting and/or treatment, as well as residues from recovery and disposal operations for dispatch to landfill. Landfill is the final placement of waste into or onto the land in a controlled or uncontrolled way. The definition covers both in-house landfills, where a generator of waste is carries out its own waste disposal on site) as well as in external landfills (1).

Landfills:

Sites that manage the final placement of waste in or on the land in a controlled or uncontrolled way (1).

Liquid Waste:

Liquid products or outputs resulting from the use of water produced by manufacturing processes and leftover industrial materials, such as oils that are disposed of by on-site treatment, sewage network, dumping into the sea or via other disposal routes.

Municipal Waste:

Municipal waste includes household waste and similar waste. The definition also includes bulky waste (e.g. white goods, old furniture, mattresses) and yard waste, leaves, grass clippings, street sweepings, the content of litter containers, and market cleansing waste, if managed as waste. It includes waste originating from: households, commerce and trade, small businesses, office buildings and institutions (schools, hospitals, government buildings). It also includes waste from selected municipal services, i.e. waste from park and garden maintenance, waste from street cleaning services (street sweepings, the content of litter containers, market cleansing waste), if managed as waste. The definition excludes waste from municipal sewage network and treatment, municipal construction and demolition waste (1).

Municipal Waste Collected:

Municipal waste collected by or on behalf of municipalities, as well as municipal waste collected by the private sector. It includes mixed household waste, and fractions collected separately for recovery operations (through door-to-door collection and/or through voluntary deposits) (1).

Municipal Waste Generated:

This amount is the sum of the amount of municipal waste collected plus the estimated amount of municipal waste from areas not served by a municipal waste collection service (1).

Municipal Waste Managed in a Country:

The amount of municipal waste collected in the country -amount exported before treatment or disposal + amount imported for treatment or disposal (1).

Oil Spill:

Oil, discharged accidentally or intentionally, that floats on the surface of water bodies as a discrete mass and is carried by the wind, currents and tides. Oil spills can be partially controlled by chemical dispersion, combustion, mechanical containment and adsorption. They have destructive effects on coastal ecosystems (2).

Other (Waste Treatment/Disposal):

Any other final treatment or disposal different from recycling (composting), incineration and landfill. Permanent storage of waste is included here (1).

Recycling:

Reusing of waste materials in production process by restoring them from wastes, except reusing as fuel (1).

Treatment Plants:

Facilities for the physical, thermal, chemical, or biological processing of waste that change the characteristics of the waste in order to reduce its volume or hazardous nature, facilitate its handling, or enhance recycling. Composting plants are included in this type of treatment (1).

Wastes:

Materials that are not prime products (that is, products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose, with the exception of wastes recycled or reused in place of production (i.e. establishments) and wastes discharged directly to waster or ambient air (1).

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Note: