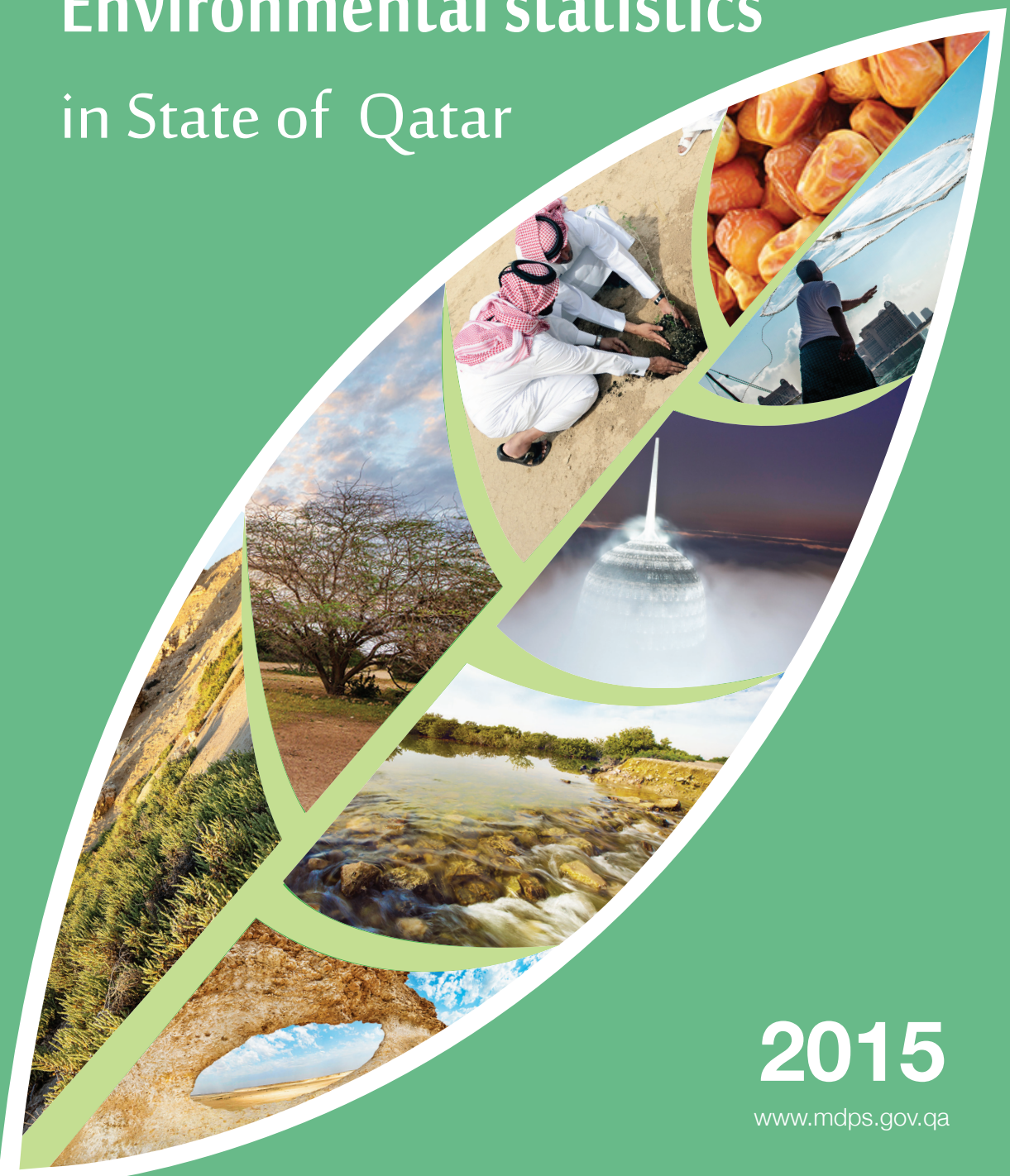
وزارة التخطيط التنموي والإحصاء
Ministry of Development Planning and Statistics

# Environmental statistics

## in State of Qatar



2015

www.mdps.gov.qa

وزارة التخطيط التنموي والإحصاء

Ministry of Development Planning and Statistics

# Environment Statistics

## In the State of Qatar

April, 2017

**H.H. Sheikh Tamim Bin Hamad Al-Thani**

**Emir of the State of Qatar**

**In case of quotation, please refer to this publication as follows:**

Ministry of Development Planning and Statistics, 2017, Environment Statistics Report 2017

Doha - Qatar

**Correspondence to be forwarded to:**

Ministry of Development Planning and Statistics

P.O. Box: 1855, Doha - Qatar

Tel: +974 4495 8888

Fax: +974 4495 9999

For statistical data, please send your request to: MDR@mdps.gov.qa

**Follow us on:**

www.mdps.gov.qa

www.qalm.gov.qa

MDPSQatar

@MDPSQatar

mdps_qr

MDPSQatar

# Preface

The Ministry of Development Planning and Statistics (MDPS) is pleased to present its third annual Report on Environment Statistics 2015. Environment statistics considered a database which required for the development of environment indicators and for compiling of environment accounts to measure the economic impact on the environment and to measure the goods and services that the environment provides freely to the economy and communities. The ecosystem services include the provision of natural resources (such as fish, water and soil) and recreational services for the purpose of sports, tourism and leisure.

The environmental development, which is the fourth pillar of the National Development Strategy (NDS) 2017-2022, emphasizes the importance of integrated programs that are based on modern and comprehensive environment statistics to inform about reduction of resources over-exploitation and impacts of damage to the environment as a result of rapid population and economic growth, which in turn leads to air and water resources pollution, groundwater depletion, ecosystem disturbance (imbalance) and the subsequent loss of biological species and biodiversity and an increase of the problems caused by improper land use, in addition to the problems of energy use and climate change.

In order to provide these basic environmental data and indices in conformity with international standards to serve planners, workers, researchers and those interested in environment, there must be a coordination between relevant ministries and institutions. Such coordination has become very important to resolve environmental issues in this regard, and to create an updated environmental database to act as a national reference based on the latest international standards, and a reliable source for environmental information, in order to take knowledge-based decisions, and to provide the public with a comprehensive report on the state of the environment. This report also serves multiple purposes, such as the National Environment Strategy Goals and Sustainable Development Goals (SDGs) 2030, where various environmental statistics contribute to meeting more than 50% of the required sustainable development indicators, competitiveness indicators and other regional and international requirements.

Accordingly, MDPS has paid special attention to the issue of the environment. Thus, MDPS has established two sections: the Environmental Development Planning Section and the Environment Statistics Section. MDPS receives environmental data from several sources, such as the ministries, agencies and relevant institutions.

The report is prepared based on Qatar environment statistics national framework emanating from the UN environment statistics framework,

and the DPSIR framework, the system of driving forces affecting the environment and the pressures generated by the needs of this forces (population and economy) on the environment, the state of the environment in light of these resulting pressures and impacts on the environment to meet these needs, and the role of the government and various sectors in responding to the protection and management of the environment.

This report shows the significant progress made by the State of Qatar in response to the environment challenges reflected in the change in the state of the environment both in the state of natural assets and in the quality of environmental conditions and services, resulting from the pressures caused by the population and economic growth. The response came in different aspects, such as the provision of financial and human resources, environmental education and legislative structures needed to protect and manage the environment.

Moreover, the report highlights the need to improve the quality of comprehensive data and to fill out data gaps (such as the data related to solid waste, biodiversity, emission of greenhouse gases, expenditures on environment protection and environment labor force) in close collaboration with all key stakeholders, both government and non-government. Furthermore, all the statistics included in this report will be available on MDPS website and Qatar Information Exchange (QALAM) website.

The Ministry of Development Planning and Statistics avails this opportunity to extend its sincere thanks and appreciation to all ministries, government departments and public and private institutions that have contributed to the statistical information in this report. MDPS anticipates that those interested in this field will provide it with their objective and constructive observations that can contribute to the development and improvement of future issues of this report, and improve the quality of environment statistics in Qatar.

**Dr. Saleh M. Al-Nabit**
**Minister of Development Planning and Statistics**

# Contents

# List of Tables

# List of Figures

# List of Maps

## Introduction

Qatar National Vision QNV 2030 has paid a special attention to the environment theme, which is unparalleled in many Middle Eastern countries, and has dealt with the environment development pillar on an equal footing with the rest of QNV four pillars; human development, social development and economic development.

The Environment Statistics Report reflects MDPS effectiveness in publishing updated comprehensive environment statistics that serve as a national reference and an index of performance of the environment sector's national strategy, which is the executive tool of QNV 2030. The report also helps in the establishment of a national environment database that serves as a beacon for researchers, planners, academics and entrepreneurs.

This 3rd issue of Environment Statistics Report 2015 is produced in a way different from previous years in accordance with the Environment Statistics Section's mandates, where environment statistics tables are compiled by environment field to fall under the sector they represent in terms of a framework based on causal analysis which describes interactions between the community (the three pillars of QNV) and the environment through the production of information and indicators that are related to environment policy. This interaction describes the pressures of human activities on the environment, the state of the environment as a result of these pressures, the impacts of the changing state of the environment on the ecosystem itself and on human health, and finally the societal response to the change in the state of the environment.

## Objectives of the Environment Statistics Report:

- Provide statistical data on various environment elements and their distribution in Qatar, and monitor environment indicators in terms of the state of the environment and impact on the environment ...etc.
- Combine planning tools with environment statistical indicators.
- Monitor the value of the State's contributions and assistance to preserve the global environment.
- Measure goods and services provided by the environment to economy, and measure the impact of the economy on the environment.
- Increase community awareness of the importance of preserving the environment, and support efforts to protect the environment.
- Provide data on available and stocked natural resources and the safe extraction of those resources.
- Provide data on environment pollutants by types, sources and extent of impact on the environment.
- Provide information about the responses and actions taken to protect the environment in Qatar.

## Environment Data Sources

The environment statistics data is based on several sources: the administrative registrations of data producing entities, the general census and the specialized environmental surveys.

1. **Administrative registrations data from authorities concerned with the environment protection**

   The environment statistics are collected from various ministries and government and public institutions and administrations based on their envoironment competence and from private organisations and associations working in the field of environment. Statistics are also collected from various statistical departments within MDPS, such as the Economic Statistics and National Accounts Dept. and IMS Dept. Communications are established with these public and private institutions followed by visits in order to provide updates on environmental data and information and to clarify emerging new requirements by these institutions.

2. **General Census**

   The environment data on completed buildings and residential units connected to public utilities (water, electricity and sewerage network) are collected through the general census questionnaire, which is conducted every 10 years.

3. **Specialized Environmental Surveys**

   The environment data and information are collected through pre-prepared questionnaires that target several public and private agencies concerned with the environment. In 2015, a survey at the level of the State of Qatar (questionnaire on municipal waste statistics) was conducted targeting household waste collection from the general line, while private companies were not targeted in this field, so as to provide data on collected household solid waste. Moreover, an environment surveys was accompined to the energy survey which was conducted by department of economics statistics.

This report is targeting decision-makers and planners working in environment-related government agencies and institutions, universities and scientific research centers, various media, activists for environment protection and conservation, and regional and international environment-related organizations.

# UN Framework for the Development of Environment Statistics (FDES) [1]

The Environment Statistics Report in Qatar 2016 is based on the UN Framework for the Development of Environment Statistics (FDES)[2] which aimed at organizing environment statistics at the national and international levels.

The Framework for the Development of Environment Statistics (FDES) 2013، including the Core Set of Environment Statistics, as well as an Action Plan for putting the FDES to work, were endorsed by the 44th session of the UN Statistical Commission[3] (New York, 26 February–1 March 2013)

**FDES History:**

FDES is used to link the components of the environment to the collected statistical data sets. In which the components of the environment are the scope of environment statistics, the FDES sets are catogarized based on the recognition that environmental problems are the result of human activities and natural events, as a reflecting to these activities a sequence of action, impact, and reaction. Due to relevant information of social, economic activities, and natural events, therefore, refers to their impacts on the environment, the responses to these impacts by the society, individuals and organizations in order to bring about an environmental balance.

**FDES Structure:**

The contents of FDES are statistical topics, through which the components of the environment can be converted to describable and analytical statistical topics. The components of the environment in the FDES are natural resources, such as soil, climate, human settlements, flora and fauna.

**What is the FDES?**

The FDES is a multi-purpose conceptual and statistical framework that is comprehensive and integrative in nature, and marks out the scope of environment statistics. It provides an organizing structure to guide the collection and compilation of environment statistics at the national level. It brings together data from various relevant subject areas and sources. It is broad and holistic in nature، covering the issues and aspects of the environment that are relevant to policy analysis and decision making by applying it to cross-cutting issues, such as climate change.

**The FDES consists of six components as follows (see Figure 1):**

- Environment conditions and quality - environment resources and their uses – residuals - extreme events and disasters - human settlements and environmental health - environment protection, management and engagement.

(1) A Framework for the Development of Environment Statistics

(2) Corresponding International Standard Classification link: http://unstats.un.org/unsd/environment/fdes.htm

(3) The United Nations Statistical Commission is the apex entity of the global statistical system bringing together Chief Statisticians from member states from around the world. It is the highest decision making body for international statistical activities, especially the setting of statistical standards, the development of concepts and methods and their implementation at the national and international level.

**Figure 1: FDES Components**


### Uses of FDES

There is a need to develop a framework that can help in the development, coordination and organization of environment statistics, and there is a perception of the use of this framework for the following specific purposes:

- Reviewing environmental problems and concerns and identifying their measurable aspects.
- Identifying the variables of the statistical aspects of measurable environmental concerns.
- Assessing the needs for data and its sources and availability.
- Structuring databases, information systems and statistical publications.

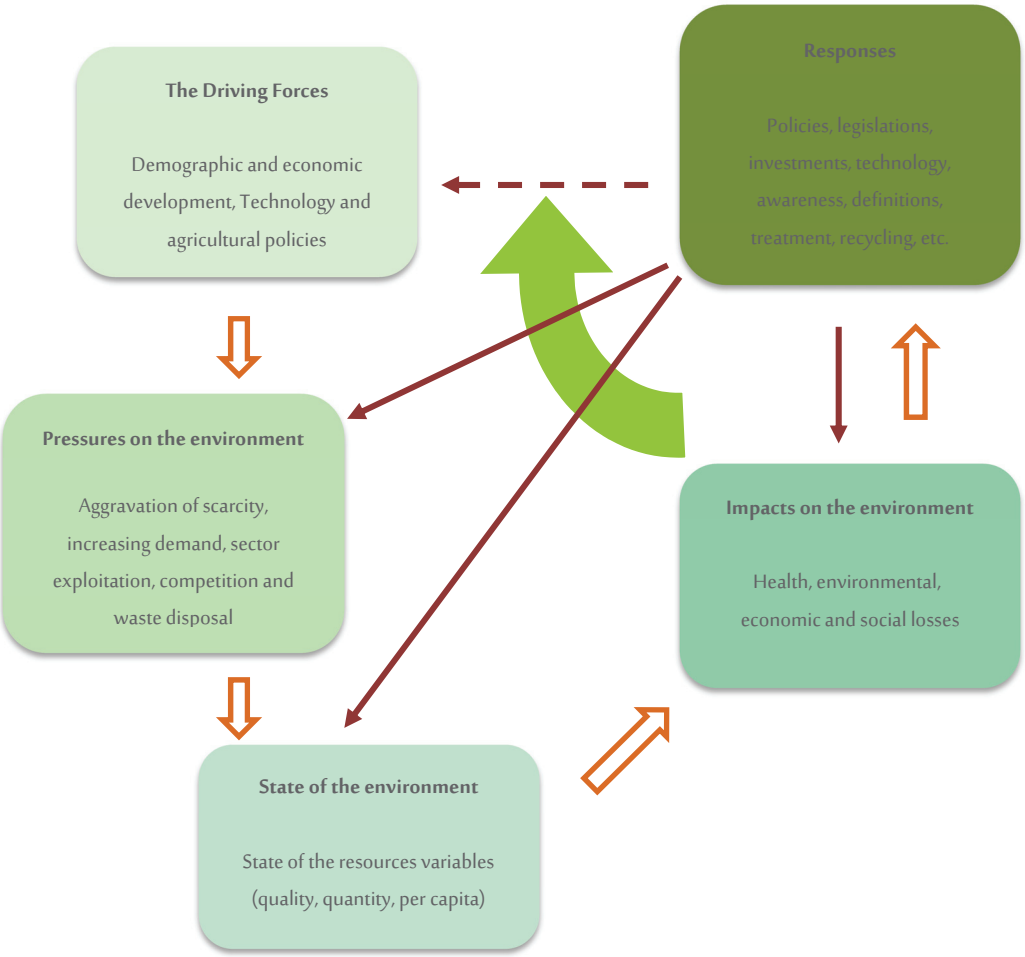
### Importance of Environment Statistics for Policy-making

The environment statistics create key information about the state of the environment and its most relevant changes through space and time. It's strengthen assessments through quantitative techniques, making analyses more robust, timely and progressively harmonized at the international level. The environment statistics is necessary for producing environmental assessments, state of the environment reports, environmental compendia, environmental indicators, sustainable development indicators، as well as facilitating the integrated environmental-economic accounting.

### Relation to Other Existing Frameworks

The FDES is structured in a way that allows links to economic and social domains. It is compatible with and supports other state of the art frameworks and systems، both statistical and analytical, such as the System of Environmental-Economic Accounting (SEEA), the Driving forces—Pressure—State—Impact—Response (DPSIR) framework, as shown in Figure 2 below:

**Figure 2: Environmental frameworks' relation to economic and social domains**



**The driving forces:** are the forces associated with the economic, demographic and social developments, which affect various aspects of environmental resources as a result of the requirements of these developments.

**Pressures on the environment:** are those emerging pressures on the environment as a result of the requirements and needs of the driving forces. Those pressures are represented in the increase of demand for environmental goods, services and resources required to provide the needs of the driving forces.

**State of the environment:** is the current state of the environment after being exposed to pressures, the vulnerability and the magnitude and direction of change in the state of environmental services, goods and resources.

**Impacts on the environment:** are the consequences linked to the magnitude of change in environmental conditions, services, goods and resources. These consequences are often associated with the diseases afflicting human beings, as well as the loss of environmental resources and/or the extent of change in the effectiveness of environmental goods and services.

**Responses to the environment:** are the actions and measures taken to protect and manage the environment in ways that address the impact on the environment and ensure the sustainability of environmental assets and the flow of environmental goods and services for both current and future generations.

**Uses of FDES:**

- Is a flexible multi-purpose tool that adapts to the needs and priorities of the countries and different users.
- Helps to identify a set of statistics related to decision-making.
- Facilitates presentation of data synthesis.
- Simplifies the complex environmental issues adequately.
- Consistent with other statiscal frameworks and classifications.
- Enhances sound concepts.

**Challenge Facing the Production of Environment Statistics**

The environment statistics include a wide range of information, which is multidisciplinary by nature. The resources of the environment statistics are distributed across a variety of data producers, and are compiled in many ways. In order to effectively produce environment statistics, it is necessary to have a specific statistical and environmental expertise, scientific knowledge, institutional development capabilities and sufficient resources. Many countries still receive substantial technical assistance and capacity building in this regard. Consequently, environment statistics requires an appropriate framework to guide its development, coordination and organization at all levels, in addition to the lack of database from institutional sources.

## Summary of Environmental Indicators and the Indicators of the Aspects Affecting Them

**Table 1: Summary of environmental indicators and the indicators of the aspects affecting them**

| Indicator | Value | Unit |
|---|---|---|
| **Chapter 1: Indicators of the driving forces** | | |
| The rate of population growth 2011-2015 | 7 | % |
| The highest distribution of population in the state by municipalities was in Doha Municipality, Census 2015 | 39.8 | % |
| Population density of Doha, Census 2015 | 4,353 | Person/km$^2$ |
| GDP 2015 | 607,544 | Million Q.R. |
| The average growth rate of GDP 2011-2015 | 6.1 | % |
| The average growth rate of the construction sector 2011-2015 | 14.9 | % |
| **Chapter 2: Indicators of the pressures on the environment** | | |
| Road lengths 2015 | 9,726 | Km |
| Annual growth rate of the main road lengths 2010 and 2015 | 0 | % |
| Total area of arable land 2015 | 65,000 | Hectare |
| Actual cultivated land area 2015 | 11,571 | Hectare |
| Uncultivated arable land area 2015 | 53,429 | Hectare |
| Number of registered farms 2015 | 1,290 | Number |
| Self-sufficiency percentage 2015 | 12.2 | Percentage |
| Amount of fertilizers used 2015 | 22 | Ton |
| Amount of chemical pesticide imports 2015 | 130,000 | Kg |
| Value-added in agriculture, forestry and fishing sector 2014 | 761 | Million Qatari Riyals |
| Percentage of workers in agriculture, forestry and fishing to total labor force 2015 | 1.23 | % |
| Green space area (excluding public parks) 2015 | 1284.2 | Thousand m2 |
| Number of public parks 2015 | 86 | Number |
| Public parks area 2015 | 1,288 | Thousand m2 |
| Amount of demand for water 2015 | 498.8 | Million m3 per year |
| Amount of electricity consumption 2015 | 41,499 | Giga watt/hour |
| Total cars and motorcycles 2015 | 1,092,806 | Number |
| Total new registered cars and motorcycles 2015 | 114,651 | Number |
| Percentage of population connected to sewage services 2015 | 100 | % |

| Indicator | Value | Unit |
|---|---|---|
| Percentage of completed buildings connected to sewage network, Census 2015 | 87.7 | % |
| Percentage of housing units connected to sewage network, Census 2015 | 91.4 | % |
| Percentage of completed buildings connected to electricity grid, Census 2015 | 99.7 | % |
| Percentage of completed buildings connected to water network, Census 2015 | 99.7 | % |
| **Chapter 3: Indicators of environmental status and impact** | | |
| Number of air monitoring stations 2015 | 30 | Number |
| Number of marine buoys 2015 | 2 | Number |
| Number of earthquake monitoring stations 2015 | 6 | Number |
| Annual rainfall rates, Doha International Airport Station 2015 | 114.5 | Mm |
| Average maximum relative humidity, Doha International Airport station 2015 | 72 | % |
| Average minimum relative humidity, Doha International Airport station 2015 | 32 | % |
| Average maximum atmospheric pressure, Doha International Airport station 2015 | 1016.1 | HB |
| Average minimum atmospheric pressure, Doha International Airport station 2015 | 1003.5 | HB |
| Average wind speed, Doha International Airport station 2015 | 7.1 | Knot |
| Average daily hours of sunshine 2015 | 9.3 | Hour |
| Number of terrestrial and marine reserves 2015 | 14 | Number |
| Terrestrial and marine reserves area 2015 | 3,464.74 | $km^2$ |
| Percentage of terrestrial reserves area to total area of Qatar and its islands 2015 | 30.6 | % |
| Number of Arabian Oryx in nature reserves 2015 | 1,550 | Number |
| Number of registered terrestrial flora and fauna 2013 | 1,101 | Number |
| Number of registered marine flora and fauna 2013 | 947 | Number |
| Number of extinct terrestrial flora and fauna 2013 | 2 | Number |
| Number of endangered terrestrial flora and fauna 2013 | 6 | Number |
| Number of endangered marine flora and fauna 2013 | 5 | Number |
| Average amount of fish catch per fishing vessel 2015 | 32 | Metric ton per vessel |
| Average amount of fish catch per fisherman 2015 | 5 | Metric ton/fisherman |
| Average number of fishermen per fishing vessel 2015 | 6 | Metric ton per |

| Indicator | Value | Unit |
|---|---|---|
| | | vessel |
| Percentage of fish stocks within safe biological limits 2015 | 68 | % |
| Rate of over-exploitation of fishing 2015 | 2,379 | Ton |
| Rate of sustainable exploitation of fishing 2015 | 2,536 | Ton |
| Amount of fish farming 2015 | 10 | Ton |
| Annual average water balance 2014 | 47.5 | Million m3 per year |
| Desalinated water production (not including loss) 2015 | 507.5 | Million m3 per year |
| Amount of abstracted groundwater 2014 | 250.03 | Million m3 per year |
| Amount of reused wastewater 2015 | 193 | Million m3 per year |
| Amount of actual water losses 2015 | 25.5 | Million m3 per year |
| Rate of actual water losses 2015 | 4.27 | % |
| Percentage of Non-Conforming Samples of Microbial Analysis of Drinking Water from Public sources 2015 | 0.0 | % |
| Percentage of Non-Conforming Samples of Microbial Analysis of Drinking Water from Private sources 2015 | 2.4 | % |
| Percentage of Non-Conforming Samples of Microbial Analysis of Drinking Water from Other sources 2015 | 19.5 | % |
| Percentage of Non-Conforming samples of Chemical Analysis of Desalinated and bottled Water 2015 | 2.0 | % |
| Percentage of Non-Conforming samples of Pseudomonas Analysis of Desalinated and bottled Water 2015 | 3.4 | % |
| Percentage of Non-Conforming samples of Regular Analysis of Desalinated and bottled Water, 2015 | 3.8 | % |
| Percentage of Non-Conforming samples of Other Analysis of Desalinated and bottled Water, 2015 | 1.8 | % |
| Percentage of Non-Conforming Samples of Analysis of Desalinated Water 2015 | 0.0 | % |
| Percentage of Non-Conforming Samples of Analysis of bottled Water 2015 | 4.5 | % |
| Number of sewage plants 2015 | 23 | Number |
| Design capacity of sewage plants 2015 | 809 | 1,000 m3 per day |
| Percentage of treated wastewater to total wastewater 2015 | 98.2 | % |
| Amount of treated wastewater used for agriculture irrigation 2015 | 66,289 | 1,000 m3 per year |

| Indicator | Value | Unit |
|---|---|---|
| Amount of treated wastewater used for green space irrigation 2015 | 31,088 | 1,000 m3 per year |
| Amount of treated wastewater used to inject groundwater 2015 | 57,291 | 1,000 m3 per year |
| Treated water discharged in lakes 2015 | 38,845 | 1,000 m3 per year |
| Treated water discharged in the sea 2015 | 350 | 1,000 m3 per year |
| Total discharge of surface groundwater to the sea 2015 | 75,686,500 | m3 per year |
| Rate of BOD removal 2015 | 98.7 | % |
| Rate of COD removal 2015 | 95.9 | % |
| Number of solid waste deportation stations 2015 | 4 | Number |
| Number of solid waste landfills 2015 | 2 | Number |
| Number of solid waste dumps 2015 | 2 | Number |
| Number of solid waste treatment plants 2015 | 1 | Number |
| Total amount of treated waste 2015 | 7,683,635 | Ton |
| Per capita household waste production 2015 | 1.23 | Kg per day |
| Number of tons of recycled materials 2015 | 53,171 | Ton |
| Compost waste production (including pre-screening compost) 2015 | 35,135 | Ton |
| Waste to energy | 238,670 | Megawatts/hour |
| Biological gases | 20,920 | 1,000 m3 |
| Generation of hazardous waste in tons per million US dollars of GDP at fixed price (100 = 2013) 2015 | 0.37 | Ton/US $ 1,000,000 |
| Per capita of total generated hazardous waste 2015 | 32.5 | Metric ton per capita |
| Mass consumption of substances that deplete the ozone layer 2014 | 1,558.01 | Metric ton |
| Amount of substances that deplete the ozone layer, according to Montreal Protocol 2014 | 84.91 | Metric ton |
| Number of cases of infectious and communicable diseases reported to the Department of Preventive Health 2015 | 9,183 | Number |
| Number of recorded cases of tuberculosis 2015 | 529 | Number |
| **Chapter 4: Indicators of responses for the protection and management of the environment** | | |
| Public expenditures on the protection and management of the environment sector 2015 | 2,580.3 | Million Qatari Riyals |

| Indicator | Value | Unit |
|---|---|---|
| Capital expenditures on the protection and management of the environment sector 2015 | 1,869.4 | Million Qatari Riyals |
| Current expenditures on the protection and management of the environment sector 2015 | 224 | Million Qatari Riyals |
| Expenditures on environment-related scientific research 2015 | 306,129,063 | QR |
| Expenditures on environmental activities 2015 | 127,98 | 1,000 QR |
| Number of legislations for the protection and management of the environment 2015 | 13 | Number |
| Number of international conventions and treaties for the protection and management of the environment 2015 | 6 | Number |
| Number of projects that are subject to environmental impact assessment in response to environmental requirements 2015 | 5,231 | Number |
| Number of students enrolled in universities and colleges in environmental disciplines 2014/2015 | 274 | Number |
| Number of students graduated from universities and colleges in environmental disciplines 2014/2015 | 60 | Number |

## Chapter One

# The Driving Forces

# The Driving Forces

This chapter includes key economic, demographic and social developments in Qatar. It also includes changes in lifestyle accompanying these developments, especially in recent years, and the subsequent construction boom, and unprecedented increase in the number of population in the state. This chapter highlights some demographic and economic indicators. The population development is the main driver that affects the rapid evolution and change in land use and urban, industrial and agricultural expansion.

## 1. General Information about the State of Qatar

### *1.1 Geographic Location*

The State of Qatar lies between latitudes `27 24° and `10 26° north of the equator and longitudes `45 50° and `40 51° east Greenwich line. Qatar is a peninsula situated in the middle of the west coast of the Arabian Gulf and extends northward into the Arabian Gulf.

### *1.2 Area*

Qatar is about 160 km in length from the south to the far north and about 89 km in width from east to west. Its total area is about 11,627 square kilometers.

**Table 1.1: Area of the State of Qatar ($km^2$) by General Census Years 1986-2015**

| Year | Area ($km^2$) |
|---|---|
| 1986 | 11,475 |
| 1997 | 11,532 |
| 2004 | 11,508 |
| 2010 | 11,607 |
| 2015 | 11,627 |

Source: MDPS, General Census of Population, Housing and Establishments

### *1.3 Qatari Islands*

Scientifically speaking, an island is a piece of land surrounded by water from all sides, whether these waters are seas, lakes, rivers or oceans. Islands are formed in several ways that are either tectonic, volcanic or they appear as a result of coastal erosion, ice, coral accumulation or sedimentation. Islands are usually classified into continental islands and oceanic islands. Qatar has a number of islands, including Halul, Shraouh, Ashat, Al Bashiriyah, Al Safliyah, Al Aaliyah and Rukn.

**Table 1.2: Qatari islands by area and distance from coast line (km)**

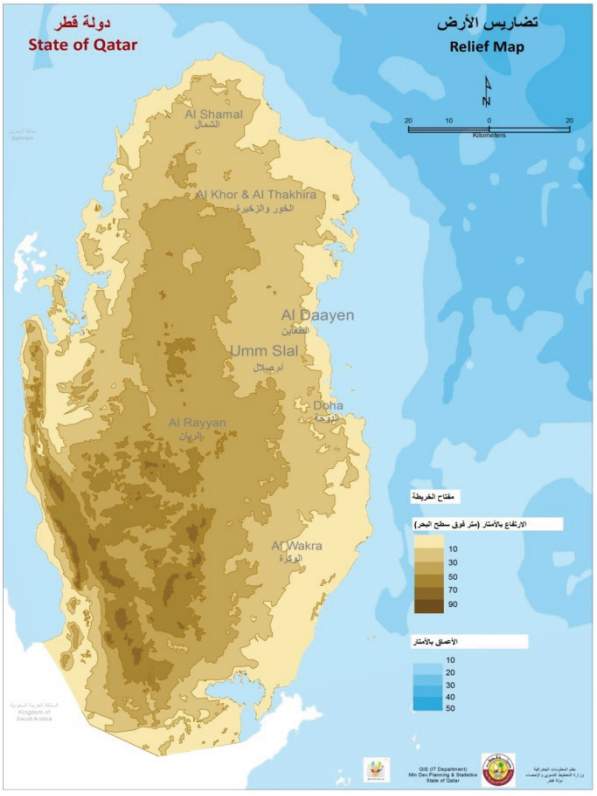
| Island | Area (km) | Distance from Coast Line (km) |
|---|---|---|
| Halul | 1.5 | 90.0 |
| Al Aalyah | 1.8 | 7.0 |
| Al Safliyah | 1.0 | 5.0 |
| Shraouh | 1.0 | 63.0 |
| Ashat | 6.0 | 10.0 |
| Al Bashiryah | 5.0 | 1.5 |
| Rukn | 1.4 | 2.0 |
| **Total** | **17.68** | **178.5** |

Source: Ministry of Interior, Directorate of Coasts Security

## *1.4 Qatar's Surface and Topography*

Qatar Peninsula is made up of a rocky flat surface peppered with some hills that reaches a height of 100 meters above sea level. The bulk of the country is a desert sand clothed with short shrubs that are covered with sand and unstable pebbles. One can notice the moving sand dunes, which are around 40 meters high, in the southern part of the state, and in the north-eastern coast near Ras Laffan. The northern part of the state is relatively low, and gradually increases to rise toward the west and southwest.

**Map 1.1: Topography of Qatar according to height above the Earth's surface and depth of the sea (meters)**




Source: GIS Network - Qatar

## *1.5 Climate in Qatar*

The climate of Qatar is of a desert nature with high temperatures especially in the summer. The mean high temperatures in the summer are characterized with a relatively high humidity, especially in coastal areas. Winter in Qatar is warm in general with a drop in temperatures to low levels from time to time. Qatar suffers from scarcity of rainfall throughout the year.

## *1.6 Administrative Divisions of Municipal Boundaries in Qatar*

The administrative boundaries of municipalities are divided into eight municipalities, namely; Doha, Al Rayyan, Al Wakra, Umm Salal, Al Khor, Al Shamal, Al Thaayin and Al Shihaniyah. Al Wakra Municipality is the largest municipality area wise (22.2% of national territory), whereas Doha Municipality is the smallest (1.2% of national territory).

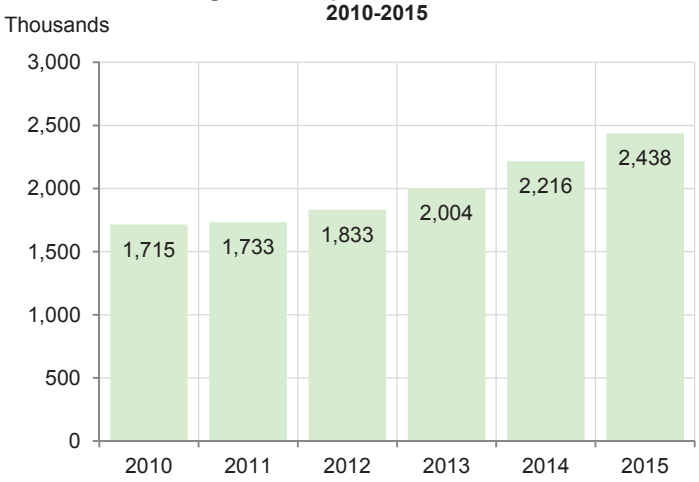
.

# 2. Population Indicators

## 2.1 *Population of Qatar*

The population of the State of Qatar amounted to two million four hundred and thirty eight thousand people in the mid-year population 2015. The figure below shows an increase in population during previous years, with an annual growth rate of 9% between 2014 and 2015.

**Figure 1.1: Population in Thousands 2010-2015**




## 2.2 *Annual Population Growth Rate*

The annual population growth rate in Qatar reached its highest peak in 2014, amounting to 11%. Then the rate retreated to 10% in 2015. Monitoring population growth rates is very crucial as the increase or decreases affects the demand for natural resources, electricity, water and economy. This is in addition to the expected amounts of consumption of food commodities and waste resulting from the daily consumption.

**Table 1.3: Population and Annual Population Growth Rate 2010-2015**

| Description | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| Mid-year population | 1,715,098 | 1,732,717 | 1,832,903 | 2,003,700 | 2,216,180 | 2,437,790 |
| Annual Population Growth Rate | 5% | 1% | 6% | 9% | 11% | 10% |

Source: MDPS, Mid-Year Population Estimates
Source: MDPS, Annual Statistics Abstract, Chapter of Population Statistics

## 2.3 Population Density

In the administrative division of municipal boundaries, Al-Wakra Municipality comes first in terms of area by 22.2% of the national territory, whereas Doha Municipality comes last with 1.2% of total area of Qatar. With regard to the distribution of population by municipalities, Doha Municipality comes first (39.8% of total population). It also has the highest rate of population density (4,353 persons per $km^2$). The lowest number of population rate by municipalities is in Al-Shamal Municipality by 0.4% of total population, with a population density of 10 persons per $km^2$.

**Table 1.4: Population by Municipality and Density (person/km2) Census 2015**

| Municipality | Area ($km^2$) | Population | Population Density (person/$km^2$) |
|---|---|---|---|
| Doha | 219.7 | 957,457 | 4353.5 |
| Al Rayan | 2450.1 | 605,712 | 247.2 |
| Al Wakra | 2577.6 | 299,037 | 116.0 |
| Umm Salal | 318.4 | 90,835 | 285.3 |
| Al Khor | 1602.2 | 202,031 | 126.1 |
| Al Shamal | 859.9 | 8,794 | 10.2 |
| Al Thaayin | 290.2 | 54,339 | 187.2 |
| Al Shyhaniya | 3308.9 | 187,571 | 56.7 |
| **Total** | **11627.0** | **2,404,776** | **206.8** |

Source: MDPS, Simplified Population Census 2015

The statistics in Table (1.5) indicate a six-fold increase of population density rate between the censuses in 1986 and 2015, increasing from 32 persons per $km^2$ in Census 1986 up to 207 persons per $km^2$ in Census 2015. We also find that population density rate doubled during the last two censuses in 2010 and 2015, from 146 to 207 persons per $km^2$.

**Table 1.5: Population and Population Density (person/$km^2$) by Census Years 1986-2015**

| Year | Population | Area of Qatar ($km^2$) | Population Density (person/$km^2$) |
|---|---|---|---|
| 1986 | 369,079 | 11,475 | 32 |
| 1997 | 522,023 | 11,532 | 45 |
| 2004 | 744,029 | 11,508 | 65 |
| 2010 | 1,699,435 | 11,607 | 146 |
| 2015 | 2,404,776 | 11,627 | 207 |

Source: MDPS, Population, Housing and Establishments Census

# 3. Economic Indicators

GDP growth is linked to the growth of goods and services, the demand for which has increased in Qatar, especially in recent times, by 24% during the period 2011-2014. Despite the decrease in the growth rate by 0.7% in 2015 compared to 2014, the average growth rate during the period 2011-2015 was 6.1%. This in itself is a high growth rate compared to many countries.

**Table 1.6: GDP (current prices), average annual per capita GDP growth rate, Consumer Price Index, inflation rate in Qatar, and growth of GDP by economic activity (constant prices 2013=100) 2011-2015**

| Indicator | 2011 | 2012 | 2013 | 2014 | 2015* |
|---|---|---|---|---|---|
| GDP at current prices (million QR) | 618,088 | 692,655 | 734,863 | 764,797 | 607,544 |
| Average annual per capita GDP growth rate (percent) | | 5.9 | -2.9 | -5.9 | -27.7 |
| Consumer Price Index (2013=100) | 95 | 97 | 100 | 103 | 105 |
| Per capita GDP rate (QR) | 356,716 | 377,901 | 366,753 | 345,097 | 249,608 |
| Inflation rate in Qatar 2010-2015 at current prices (percent) | | 2.3 | 3.2 | 3.4 | 1.7 |
| GDP growth by economic activity (percent) | 13.4 | 4.9 | 4.6 | 4.0 | 3.7 |

* Preliminary data 2015
Source: MDPS, Economic Statistics Bulletin

The population growth is a major player behind this GDP growth, in addition to the mega projects launched by Qatar during this period. It is noted that the average population growth rate for the same period amounted to 7%, indicating a correlation between population growth and economic growth.

The statistics in Table (1.7) show a huge growth in the construction sector, where the average growth reached 18.3% during the years 2013 to 2015, whereas the average growth rate reached 14.9% over the period 2011-2015.

The results also show a growth in import demand, evidenced by 10.0% growth in import duties in 2015 and 13.4%, in the last four years, while the average growth in this sector amounted to 6.5% over the period 2011-2015. In the same context, the growth rate increased on domestic services in the last three years by 9.4%, while the average growth rate in this sector amounted to 7.0% over the period 2011-2015.

The above-mentioned growth rates reflect the extent of homogeneity of growth associated with meeting the needs of population growth and mega projects on one hand. On the other hand, these growth rates demonstrate how closely this growth is linked to the increased demand for environment resources, and the increased pressure on the ability of different ecosystems to absorb the pressures arising from these hops, such as increased emissions, waste, demand for water resources and others.

**Table 1.7: Percentage distribution of GDP growth by economic activity at constant prices (2013=100) 2011-2015**

| Economic Activity | | 2011 | 2012 | 2013 | 2014 | 2015* | Mid-Period 2011 - 2015 |
|---|---|---|---|---|---|---|---|
| 1 | Agriculture and Fishery | 5.4 | 4.6 | 5.9 | 8.2 | 8.0 | 6.4 |
| 2 | Mining and quarrying (including oil and gas) | 15.0 | 1.2 | 0.1 | -1.5 | -0.2 | 2.9 |
| 3 | Manufacturing | 10.0 | 11.1 | 5.6 | 4.1 | 3.2 | 6.8 |
| 4 | Electricity and water | 7.9 | 10.5 | 6.4 | 10.6 | 7.0 | 8.5 |
| 5 | Construction | 10.6 | 9.0 | 19.0 | 18.1 | 17.8 | 14.9 |
| 6 | Trade, hotels, restaurants | 12.8 | 6.3 | 13.2 | 14.3 | 8.0 | 10.9 |
| 7 | Transport, storage and communications | 14.7 | 6.2 | -0.5 | 11.9 | 4.2 | 7.3 |
| 8 | Finance, insurance, real estate and business services | 11.0 | 11.4 | 13.3 | 12.3 | 8.7 | 11.3 |
| 9 | Government services | 13.5 | 12.3 | 15.1 | 7.3 | 6.1 | 10.9 |
| 10 | Social services | 2.9 | 7.7 | 9.4 | 8.1 | 9.1 | 7.4 |
| 11 | Domestic services | 0.8 | 6.0 | 10.3 | 9.2 | 8.8 | 7.0 |
| 12 | Financial brokerage services measured indirectly | 14.9 | 8.1 | 22.0 | 5.1 | 8.6 | 11.7 |
| 13 | Import duties | -1.2 | 19.9 | 0.0 | 3.7 | 10.0 | 6.5 |
| | **Total** | **13.4** | **13.4** | **4.9** | **4.6** | **4.0** | **80.6** |

* Preliminary data 2015
Source: MDPS, Economic Statistics Bulletin

Chapter Two

# Pressure on the Environment

# Pressure on the Environment

This chapter covers aspects of pressure on the environment resulting from meeting the different needs of population and economic developments and the subsequent developments in lifestyles, which in turn add pressure on the environment through increased emissions, waste and environment resources, such as water. It also covers the pressures on land use in various types and the associated requirements for some of these demands, such as the use of pesticides and fertilizers in agriculture. The chapter also includes the proportion of houses connected to sewage networks, in addition to the amount of resulting pressure on the environmental service and assimilation of the pollutants of wastewater.

## 1. Land Use

The land use indicators meet the important basic information required by governments, policy-makers, researchers, analysts and civil society organizations. Land use is a unique environmental source that defines the space in which economic activities and environmental processes occur.

Land cover and land use are closely correlated, where land cover refers to the vital aspect of land cover, while land use refers to the function represented by the land use.

### Box (2.1): Land Use In Relation to National Policies

The following programs/projects have emanated from the national strategy to enhance economic and technical efficiency.

Program/Project:
1. Land use efficiency.
Targets:
- Approve and implement a National Master Plan for integrated land use and transport planning.
- Establish well serviced and efficiently managed and regulated special economic zones for industrial lands.
- Achieve sustainable improvements in agricultural productivity.
Outcomes:
- Improved efficiency in allocation and uses of land.

**Program/Project:**
2. Environmental information database/ land use.

Targets:

Create a searchable electronic information source.
Outcomes:
Improved governance and regional and international cooperation.

Land use relation to international frameworks, such as the Sustainable Development Goals (SDGs) 2030
Goal (2), Indicator (1.4): Percentage of agricultural area under sustainable agricultural practices.
Goal (15), Indicator (1.1): Forest area as a percentage of total land area.
Goal (11), Indicator (1.3): Percentage of land consumption rate to population growth rate.
Indicator (11.7.1): Average share of the built-up area of cities that is open space for public use for all

Land use in relation to international frameworks, such as international competitiveness indicators
Road network density per $km^2$.

**Table 2.1: Land use area according to UN Category classification (km2) 2010-2015**

| Serial No. | Category | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|
| 1 | Agricultural land (1) = (2)+(3)+(4)+(5) | 650 | 650 | 650 | 650 | 650 | 650 |
| 2 | Arable land (2) | 29.1 | 24.1 | 23.0 | 23.7 | 30.6 | 24.1 |
| 3 | Land under permanent crops (3) | 27.7 | 27.2 | 30.5 | 31.5 | 25.0 | 25.0 |
| 4 | Land under permanent meadows and pastures (4) | 48.3 | 39 | 51.8 | 70.9 | 61.2 | 66.7 |
| 5 | Fallow and other agricultural land (5) | 544.9 | 559.8 | 544.7 | 523.9 | 533.4 | 534.3 |
| 6 | Forest and other wooded land (6) = (7)+(8) | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | Land under forest (7) | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | Other wooded land (8) | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | Built-up and related land (9) | … | … | … | … | … | … |
| 10 | Wet open land include mangroves area (10) | 7.31 | | | | | 9.1 |
| 11 | Dry open land with special vegetation cover (11) | … | … | … | … | … | … |
| 12 | Open land without, or with insignificant, vegetation cover (12) | … | … | … | … | … | … |

| Serial No. | Category | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|
| 13 | Total land area (13) = (1)+(6)+(9)+(10)+(11)+ (12) | … | … | … | … | … | … |
| 14 | Waters (14) (inland water bodies area) | … | … | … | … | … | … |
| 15 | Total area of the State of Qatar (15) = (13)+(14) | 1607.8 | … | … | … | … | 11627.0 |

…: Not available.
(2) Including area cultivated with grains and vegetables.
(3) Including area cultivated with fruits and palms.
(4) Including area cultivated with green fodder.
(5) Including uncultivated arable land.
Source: MDPS, General Census of Population, Housing and Establishments.
Source: MDPS, Annual Statistical Abstract, Chapter of Agriculture statistics.
Source: GIS Network, Qatar.

## *1.1 Land Used for Roads*

The population and economic growth relies on transport of all kinds. Transport, in turn, requires passages and routes that take out areas from the state land so as to meet the growing needs of population and economy. Meeting these needs leads to an increased demand for transport. Many studies have linked the economic growth to increased demand for transport and the accompanying consequences on the environment, including the construction of roads and increased land use for this purpose.

The statistics in Table (2.2) show the lengths of roads in Qatar during the period 2010-2015, indicating no change in road length growth rate. But when comparing between the years 2010 and 2014, the annual road length growth rate fell to -7%. In terms of road lengths by road type, the statistics of 2015 indicate a rise in main road lengths to 1,060 km, with an average annual growth of 3%, and a rise in 3rd grade road lengths to 2,783 km at an annual growth rate of 26% in 2010. Secondary road lengths also increased to 1,337 km at an annual growth rate of 21% from 2010, while local road lengths declined to 4,546 km in 2015 at an annual growth rate of -10%.

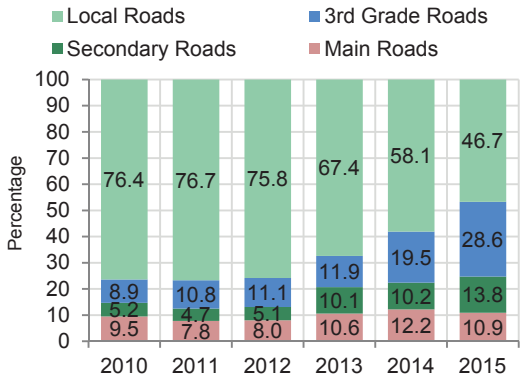
**Table 2.2: Road lengths by road type (km) 2010-2015**

| Road Type | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual Growth Rate 2010 and 2015 |
|---|---|---|---|---|---|---|---|
| Main Roads | 931 | 711 | 715 | 1,018 | 905 | 1,060 | %3 |
| Secondary Roads | 508 | 426 | 456 | 967 | 759 | 1,337 | %21 |
| 3rd Grade Roads | 879 | 986 | 1,000 | 1,138 | 1,441 | 2,783 | %26 |
| Local Roads | 7,510 | 7,002 | 6,809 | 6,469 | 4,302 | 4,546 | %-10 |
| **Total** | **9,828** | **9,125** | **8,980** | **9,592** | **7,407** | **9,726** | **%0** |

Source: MDPS, Annual Statistical Abstract, Chapter of Transport Statistics.

In terms of the relative importance of road lengths, Figure (2.1) on road lengths in Qatar during the period 2010-2015 illustrates that local roads had the lion's share of road lengths in 2010, amounting to 76.4% of total road lengths of all types, compared to 46.7% in 2015. Also in 2015, 3rd grade roads ranked in second place of relative importance with 28.6%, followed by secondary roads with 13.8%, and then main roads with 10.9%. It is noted that 3rd grade road lengths increased during the same period with a gradual decline in local road length rates.

**Figure 2.1: Percentage Distribution of Road Lengths by Road Type 2010-2015**




## *1.2 Annual and Permanent Crops Area*

The increase in cultivated area is directly linked to the increase in population and economic prosperity, which in turn puts pressure on environmental resources through the consequences on the environment to provide agricultural requirements of water resources, which are already scarce in Qatar. Also this creates pressure on groundwater reserves as a result of over abstraction, and pressure on the environment as a result of pesticide use in agricultural production. The following Box shows the agricultural use in relation to national policies and various international frameworks.

### Box (2.2): Agricultural Use In Relation to National Policies

The following programs/projects have emanated from the national strategy to enhance economic and technical efficiency.

**Program/Project:**
1. Water use efficiency.
Targets:
- Develop a program for water conservation measures within the agricultural development plans.
- Expand the sewage treatment networks to increase recycled water use.
- Achieve sustainable improvements in agricultural productivity.
Outcomes:
- Improve water use efficiency.

**Program/Project:**
2. Environmental information database /agricultural use.

Targets:
- Create a searchable electronic information source.
Outcomes:
Improved governance and regional and international cooperation.

Agricultural use in relation to international frameworks, such as the Sustainable Development Goals (SDGs) 2030

- Goal (2), Indicator (9): Percentage of change in the tariff on the imports and exports of agricultural products.

Agricultural use in relation to international frameworks, such as international competitiveness indicators.

- Agricultural land area (thousand hectares)

**Map 2.1: Farms (including estates - Izaab), 2010 and 2015**

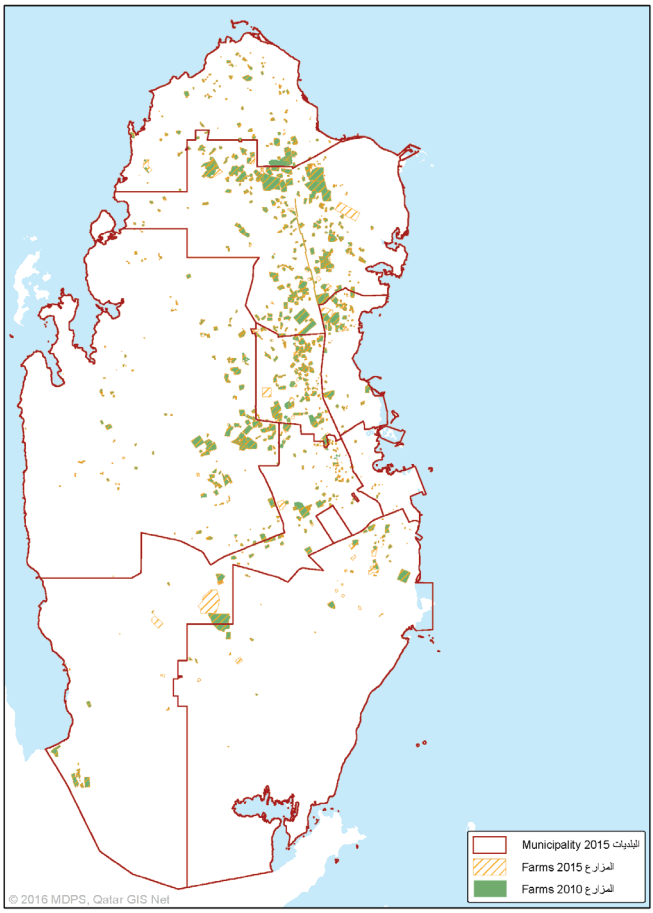


Figure (2.2) below indicates that the total arable land area in Qatar amounted to 65,000 hectares in 2015. This area has been constant over the past few years. The actual cultivated land was 11,571 hectares and the arable land was 53,429 hectares in 2015.

**Figure 2.2: Total arable land area (2010-2015)**

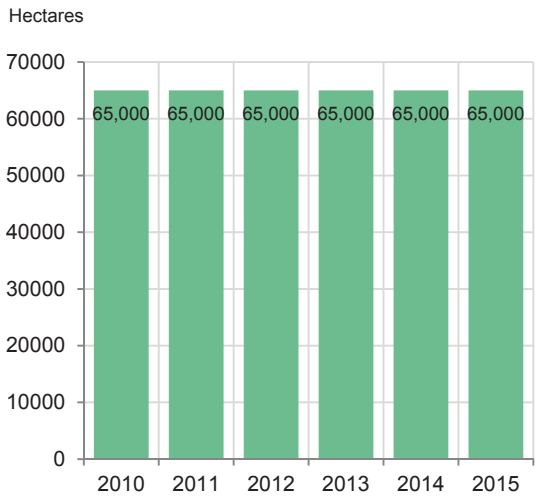
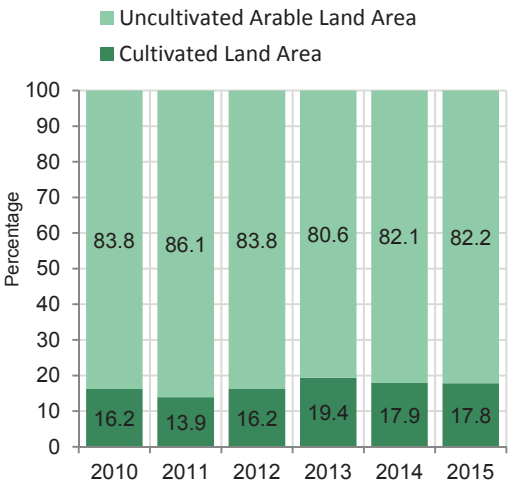



**Figure 2.3: Percentage Distribution of Agricultural Use Area 2010-2015**




In 2015, the percentage of uncultivated arable land area was 82.2% of total arable land, while the percentage of cultivated land area was 17.8% of total arable land. It is noted that the percentages are almost constant over the past few years.

In terms of crop area in agricultural land, Table (2.3) below shows that the green fodder cultivated land area is the largest of total cultivated land in 2015, with an area of 6,666 hectares, at a relative importance of 57.6% of total cultivated area, followed by palm tree area by 2,300 hectares at a relative importance of 19.9%, followed by vegetables area by 2,105 hectares at a relative importance of 18.2%, followed by field crops area by 308 hectares at a relative importance of 2.7%, and finally the fruit tree area by 192 hectares at a relative importance of

**Table 2.3: Arable land area by type (hectare) 2010-2015**

| Year | Cultivated Land Area | | | | | | Un-Cultivated Land Area | Total Arable Land |
|---|---|---|---|---|---|---|---|---|
| | Cereal | Vegetables | Fruits | Palm | Green Fodder | Total | | |
| 2010 | 410 | 2,498 | 304 | 2,469 | 4,825 | 10,506 | 54,494 | 65,000 |
| 2011 | 281 | 2,126 | 349 | 2,366 | 3,898 | 9,020 | 55,980 | 65,000 |
| 2012 | 314 | 1,988 | 570 | 2,477 | 5,183 | 10,532 | 54,468 | 65,000 |
| 2013 | 395 | 1,973 | 550 | 2,599 | 7,093 | 12,610 | 52,390 | 65,000 |
| 2014 | 379 | 2,681 | 205 | 2,290 | 6,108 | 11,663 | 53,337 | 65,000 |
| 2015 | 308 | 2,105 | 192 | 2,300 | 6,666 | 11,571 | 53,429 | 65,000 |
| Annual Growth Rate 2010 and 2015 | -6% | -3% | -9% | -1% | 7% | 2% | 0% | 0% |

Source: MDPS, Annual Statistical Abstract, Chapter of Agricultural Statistics.

Table (2.4) indicates that registered farms in Qatar amounted to 1,290 farms in 2015, with an area of 47,470 hectares. As for active farms, they reached 910 farms, with an area of 36,631 hectares.

**Table 2.4: Agricultural Land Uses (Hectare, Number, Percentage) 2010-2015**

| Type | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual Growth Rate 2010 and 2015 |
|---|---|---|---|---|---|---|---|
| Total arable area (hectare) | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | 65,000 | **0%** |
| Number of registered farms | 1,275 | 1,281 | 1,318 | 1,340 | 1,282 | 1,290 | **0%** |
| Total registered farms area | 44,422 | 43,047 | 44,591 | 47,478 | 47,116 | 47,470 | **1%** |
| Total arable area of registered farms | 26,653 | 25,828 | 26,755 | 28,487 | 28,270 | 28,482 | **1%** |
| Number of active farms | 822 | 831 | 833 | 839 | 872 | 910 | **2%** |
| Total active farms area | 35,958 | 34,598 | 33,168 | 36,123 | 35,862 | 36,631 | **0%** |
| Total arable area of active farms | 21,575 | 20,759 | 19,901 | 21,674 | 21,517 | 21,979 | **0%** |

| Type | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual Growth Rate 2010 and 2015 |
|---|---|---|---|---|---|---|---|
| Crop area of exposed crops in active farms | 9,962 | 8,556 | 10,259 | 12,473 | 11,030 | 11,571 | **3%** |
| Total crop area of active farms | 10,506 | 9,021 | 10,388 | 12,609 | 11,217 | 11,804 | **2%** |
| Degree of farming intensity % | 48.7 | 43.5 | 52.2 | 58.2 | 52.1 | 53.7 | **2%** |

Source: Ministry of Municipality and Environment, Annual Bulletin of Crops Area and Production.

In 2015, the per capita arable land area was 2.2 hectares per year, and per capita cultivated land area was 0.5 hectares per year. A decline in per capita arable land area is observed due to the increase in population, while the per capita cultivated land area is constant over the years.

.

**Figure 2.4: Percentage of active farms of total registered farms 2010-2015**

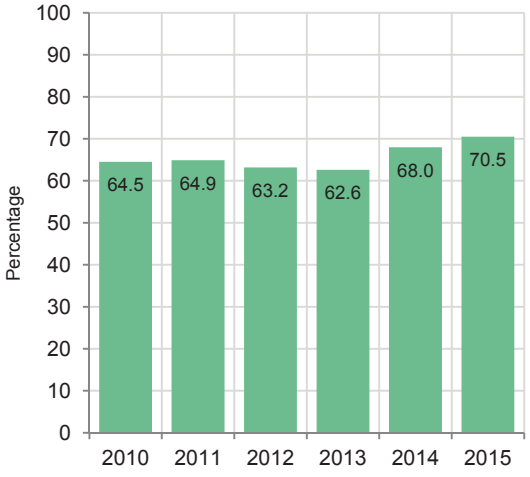
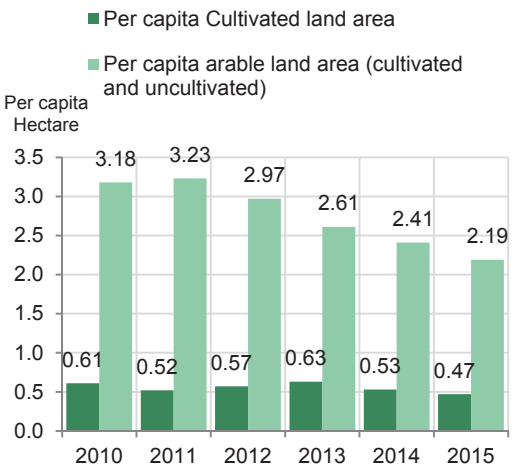



**Figure 2.5: Per capita Cultivated land area and per capita arable land area 2010-2015**



In terms of distribution of farms by municipality and farm type, Table (2.5) below shows that Al Khor Municipality took the lead in farm area, occupying 35% of total farm area in the state in 2015, followed by Umm Salal Municipality by 11%. The least farm area was in Doha Municipality with 0.7% only. This percentage is expected in Doha Municipality as a result of the pressure of urban sprawl accompanied by roads, constructions and facilities at the expense of the sustainable land distribution. Statistics indicate that in 2015 there were 590 crop farms, 19 livestock farms, 673 mixed crop-livestock farms and 8 other farms.

**Table 2.5: Number and area of farms (Hectare) by type and municipality 2015**

| Municipality | Crops | | Livestock | | Mixed | | Others* | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. of Farms | Area (Hectare) | No. of Farms | Area (Hectare) | No. of Farms | Area (Hectare) | No. of Farms | Area (Hectare) | No. of Farms | Area (Hectare) |
| Doha | 22 | 348.4 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | **22** | **348.4** |
| Al-Rayan | 256 | 10621.1 | 8 | 518.8 | 234 | 5990.3 | 1 | 6.2 | **499** | **17136.4** |
| Al Wakra | 38 | 1013.3 | 3 | 259.7 | 30 | 915.5 | 0 | 0.0 | **71** | **2188.5** |
| Umm Salal | 80 | 1912.0 | 2 | 85.8 | 78 | 2970.9 | 1 | 75.6 | **161** | **5044.2** |
| Al Khor | 119 | 5313.5 | 3 | 105.6 | 220 | 11501.4 | 2 | 23.3 | **344** | **16943.7** |
| Al Shamal | 48 | 919.2 | 2 | 12.0 | 87 | 3077.2 | 4 | 94.1 | **141** | **4102.4** |
| Al Dhaayin | 27 | 384.7 | 1 | 14.7 | 24 | 1306.9 | 0 | 0.0 | **52** | **1706.3** |
| **Total** | **590** | **20512.2** | **19** | **996.5** | **673** | **25762.1** | **8** | **199.2** | **1290** | **47470.0** |

* Others (recreational, fishery, bees, neglected)

Source: Ministry of Municipality and Environment, Annual Bulletin of Crops Area and Production.

## *1.3 Annual and Permanent Crops*

With 541,957 tons, the green fodder production dominated the agricultural production in 2015 by 72.6%, followed by milk and dairy products with 79,804 tons at a relative importance of 10.7%, followed by vegetables with 58,077 tons at a relative importance of 7.8%, followed by fruits and dates with 28,339 tons at a relative importance of 3.8%, followed by meat production with 16,541 tons at a relative importance of 2.2%, followed by fish with 15,202 tons at a relative importance of 2.0%, followed by egg production with 4,522 tons at a relative importance of 0.6%, and finally comes cereal production with 1,613 tons at a relative importance of 0.2% (see Table 2.6).

**Table 2.6: Agricultural production by food groups (tons) 2010-2015**

| Food Group | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual Growth Rate 2010 and 2015 |
|---|---|---|---|---|---|---|---|
| Cereal | 2,665 | 1,700 | 1,904 | 2,260 | 2,455 | 1,613 | **-10%** |
| Green Fodder | 392,423 | 318,266 | 421,256 | 574,207 | 496,136 | 541,957 | **7%** |
| Fruits and Dates | 22,258 | 21,554 | 22,546 | 32,989 | 28,244 | 28,339 | **5%** |
| Vegetables | 51,658 | 45,357 | 43,565 | 43,446 | 50,648 | 58,077 | **2%** |
| Meat | 11,119 | 12,225 | 10,792 | 13,550 | 15,401 | 16,541 | **8%** |
| Milk and Dairy Products | 35,609 | 37,835 | 39,551 | 58,743 | 90,803 | 79,804 | **18%** |
| Eggs | 4,532 | 4,969 | 4,309 | 4,365 | 4,338 | 4,522 | **0%** |
| Fish | 13,760 | 12,995 | 11,273 | 12,005 | 16,213 | 15,202 | **2%** |
| Total | 534,024 | 454,901 | 555,196 | 741,565 | 704,238 | 746,055 | **7%** |

Source: Ministry of Municipality and Environment, Annual Bulletin of Crops Area and Production.

## *1.4 Food Self-Sufficiency*

The population food security statistics indicate that food self-sufficiency stood at 12.2% in 2015, at an annual growth rate of 3% from 2010. A fluctuation in the index of food self-sufficiency ratios in Qatar was observed over the period (2010-2015).

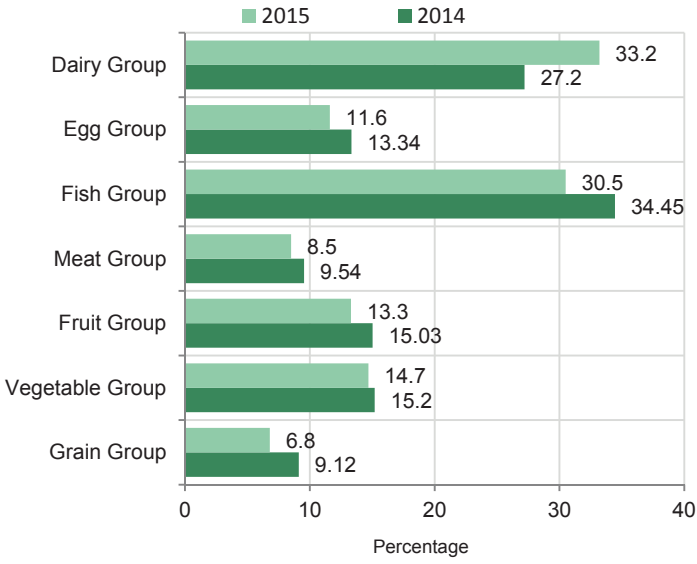
With regard to self-sufficiency by food groups, the percentage of self-sufficiency in milk and dairy products stood at 33.2% in 2015, which is higher than the rest of food groups, followed by self-sufficiency in fish at 30.5%, vegetable group at 14.7%, fruits at 13.3%, eggs at 11.6%, meat at 8.5%, and finally the cereal group at 6.8%. However, a lack of self-sufficiency has been noticed over the years in the following food groups: legume and oilseed group, sugar group and oil and fat group.

**Table 2.7: Total food commodities available for consumption and Self-sufficiency percentage (ton, %) 2010-2015**

| Year | Local Production (Ton) | Available for Consumption (Ton) | Percentage of Food Self-Sufficiency |
|---|---|---|---|
| 2010 | 170,507 | 1,592,979 | 10.7 |
| 2011 | 168,699 | 1,636,459 | 10.3 |
| 2012 | 176,256 | 1,606,810 | 11.0 |
| 2013 | 212,495 | 1,569,335 | 15.3 |
| 2014 | 242,161 | 1,788,492 | 13.5 |
| 2015 | 269,639 | 213,754 | 12.2 |
| Annual Growth Rate 2010 and 2015 | 10% | -33% | 3% |

Source: Ministry of Municipality and Environment, Annual Bulletin of Agricultural Commodity Consumption

**Figure 2.6: Percentage of self-sufficiency by food groups 2014-2015**




Note: For the rest of food groups, the percentage of self-sufficiency equals zero percent.

Source: Ministry of Municipality and Environment, Annual Bulletin of Agricultural Commodity Consumption.

## *1.5 Amounts of Fertilizers and Pesticides Used*

### 1.5.1 Amounts of Fertilizers Used

The organic substance in compost plays an important role in the physical and chemical changes, and in the activity of soil bacteria which is beneficial to plant. The good soil is defined as the soil that has water-holding capacity and is air-permeated, resulting in a noticeable activity of roots which in turn would help healthy and normal growth with lots of natural ingredients needed for the plant to yield a good harvest and increase the crop. Nitrogen and natural potassium both provide the plant with nutrition when needed, and they do not dissolve in soil water. Compost is the fertilizers that contain, wholly or partially, nutrients of the soil in the shape of animal or vegetable organic compounds. The organic matter is the main component that needs to be in the soil to ensure a sustainable yield. The sandy soil in arid and semi-arid environments contains very little or no organic matter.

In terms of soil relation to the environment, the compost undoubtedly improves the properties of the soil, retains water, activates the beneficial bacteria and is free of weeds and harmful bacteria. The statistics indicate that the volume of fertilizers used in 2015 amounted to 225 tons of heat-treated compost.

**Table 2.8: Amount of fertilizers used by type of fertilizer (ton) 2010-2015**

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| Soft Compost | 12,814 | 1,024 | 9,012 | 1,743 | 0 | 0 |
| Rough Compost | 0 | 3,528 | 0 | 0 | 0 | 0 |
| Poultry Manure | 1,326 | 0 | 0 | 0 | 0 | 0 |
| Heat-Treated Compost | 0 | 0 | 0 | 0 | 0 | 225 |
| **Total** | **14,140** | **4,552** | **9,012** | **1,743** | **0** | **225** |

Source: Ministry of Municipality and Environment

### 1.5.2 Amount of Imported Pesticides by Type

In order to meet the population growth which is pressing on the environment in terms of increased demand for agricultural products to provide necessary food, the agricultural policies have adopted the intensive agriculture pattern which requires a number of measures, including the use of pesticides. Pesticides are used in Qatar for agricultural purposes (such as insecticides, fungicides and herbicides) to protect the palm trees and gardens from insects and combat insects in government buildings and private housing. The massive use of pesticides has serious impacts on the environment itself and on the ecosystems, such as biodiversity, pollution of groundwater and impacts on public health.

Table (2.9) below shows that the amount of chemical pesticide imports increased from 73,746 kg to 130,000 kg (an annual growth rate of 12%) during the period 2010-2015 due to higher imports of the following chemical pesticides: insecticides, fungicides and herbicides at an annual growth of 13%, 61% and 30% respectively. On the other hand, no chemical pesticides were imported for public health and growth regulators purposes. Lower imports of chemical pesticides for public health purposes were noted post 2012. In terms of relative importance, the fungicides occupied the largest share of imported pesticides by 65.5% of total chemical pesticides imported in 2015.

**Table 2.9: Qatar imports of chemical pesticides by type (kg) 2010-2015**

| Type of Imported Pesticide | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual Growth Rate 2010 and 2015 |
|---|---|---|---|---|---|---|---|
| Pesticides used for public health purposes | 15,240 | 50,900 | 141,889 | 33,120 | 9,435 | 0 | -100% |
| Insecticides | 8,300 | 10,900 | 25,424 | 12788 | 30,055 | 15,477 | 13% |
| Fungicides | 7,791 | 3,400 | 3,150 | 4,920 | 11,680 | 85,141 | 61% |
| Herbicides | 1,264 | 0 | 4,000 | 0 | 500 | 4,682 | 30% |
| Unspecified pesticides | 41,149 | 39,400 | 0 | 34,173 | 500 | 24,700 | -10% |
| Growth regulators | 3 | 0 | 0 | 0 | 0 | 0 | -100% |
| **Total** | **73,746** | **104,600** | **174,463** | **85,001** | **52,170** | **130,000** | **12%** |

Source: Ministry of Municipality and Environment

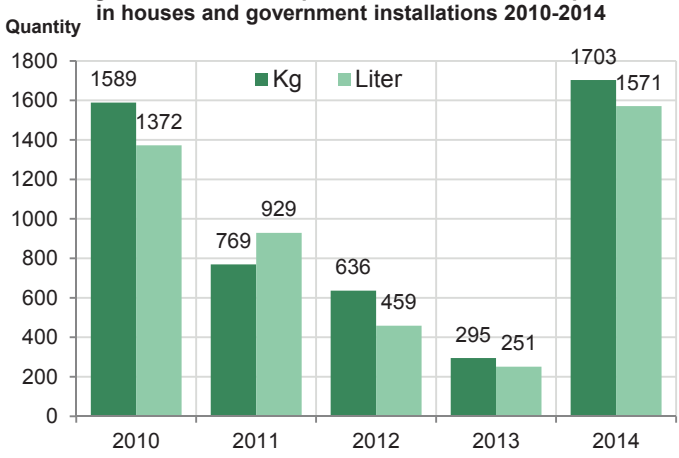
### 1.5.3 Amount of pesticides used to control pests at homes and government installations

Scientifically, the pest control methods are generally divided into: natural control and applied control. The natural control includes factors that destroy or limit the spread of the pest naturally without human intervention, as natural conditions reduce pests. These factors are mainly:

- Nutritional factors: such as lack of food due to drought or lack of breadwinner.
- Aerial factors: such as high or low temperature, humidity, wind and precipitation.
- Vital factors: one of the examples is natural enemies, such as predators, parasites or fungal, bacterial and viral insect diseases.
- Topographical factors: such as the presence of deserts and others.

The applied control is the human interference to apply such control when natural control fails to perform its role. The community needs to control insects and rodents, such as fleas, cockroaches, rats and other pests. Figure (2.7) shows that the pesticides used to control pests at houses and government installations amounted to 1,703 kg and 1,571 liters in 2014.

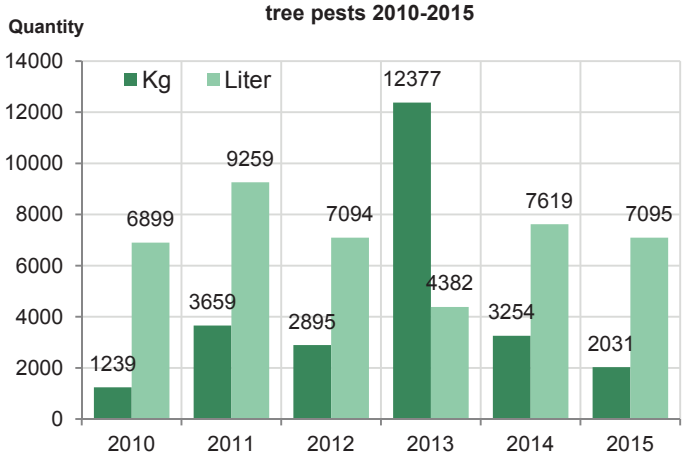
**Figure 2.7: Amount of pesticides used to control pests in houses and government installations 2010-2014**




## 1.5.4 Amount of pesticides used to combat palm tree pests

Palm trees are exposed to various pests, such as animals, insects, fungus, bacteria, weed, etc. Pesticides are used to reduce losses caused by such pests. Statistics from Figure (2.8) show that the pesticides used to control palm pests amounted to 2,031 kg and 7,095 liters in 2015. It is also noted that the indicator of amount of pesticides used to control palm pests is declining post 2013.

**Figure 2.8: Amount of pesticides used to control palm tree pests 2010-2015**



## 1.6 *Importance of agriculture, forestry and fishing sector for Qatar's economy*

Despite the importance of the agricultural sector in Qatar, as it supplies some needed food commodities, and thus achieves part of food security, it consumed about 35% of total water sources used in the economic sectors in Qatar, i.e. about (296.3) million cubic meters in 2015 and about 92% of the groundwater uses, in addition to agricultural subsidies provided by the state for this sector. Thus, the adopted policies during the last few years have contributed to raise the rate of national food self-sufficiency rather than the agricultural policies aimed at ensuring food security through trade and regional integration, leading to huge increases in water demand by the agricultural sector.

The weight of this sector for Qatari economy is still limited, both in terms of its contribution to GDP, or in terms of the availability of employment opportunities (employment). The value added in the agriculture and fishing sector amounted to QR 761 million in 2014 compared to QR 537 million, an annual growth rate of 9% from 2010.

As for employment in the agriculture and fishing sector, the agriculture sector contributes to create jobs through agricultural labor force, as labor force rate in the agriculture activity reached 1.2% of total labor force in 2015. This figure is low compared to previous years, where it was constant by almost an average of 1.4% during the period 2010-2014. However, we noticed an increase in the number of labor force in this sector from 17,116 workers in 2010 to 24,006 workers in 2015, most of them were expats. The annual growth rate during this period amounted to 6%.

**Table 2.10: Importance of agriculture, forestry and fishing sector for Qatari economy 2010-2015**

| Year | Economic Agricultural Sector | | | Agricultural Labor Force | | |
|---|---|---|---|---|---|---|
| | Value added in agriculture, forestry and fishing sector (million QR) | GDP at current prices (million QR) | *Percentage of value added in agriculture, forestry and fishing sector of GDP%* | Number of workers in agriculture, forestry and fishing sector | Total number of labor force | Percentage of workers in agriculture, forestry and fishing sector of total labor force% |
| 2010 | 537 | 455,445 | 0.12 | 17,116 | 1,269,403 | 1.35 |
| 2011 | 590 | 618,089 | 0.1 | 17,287 | 1,271,074 | 1.36 |
| 2012 | 641 | 692,655 | 0.09 | 18,162 | 1,341,193 | 1.35 |
| 2013 | 695 | 734,863 | 0.09 | 21,207 | 1,543,265 | 1.37 |
| 2014 | 761 | 764,797 | 0.1 | 23,123 | 1,689,933 | 1.37 |
| 2015 | … | ... | … | 24,006 | 1,956,627 | 1.23 |
| Annual Growth Rate 2010 & 2015 | 9% | 14% | -4% | 6% | 6% | 0% |

… : Not available.
Source: MDPS, Labor Force Sample Survey.
Source: MDPS, Census 2010& 2015.
Source: MDPS, National Accounts Statistics.

## 1.7 *Amount and value of exports and imports of agricultural products*

The value of exports of Qatari agricultural products amounted to 64,606 Thousand QR decreasing from the exports of 2010 by an annual growth rate of -56%. As for imports of agricultural products, their value increased steadily at an annual growth rate of 12% during the same period, amounting to 10,033,971 Thousand QR in 2015, compared to 5,717,142 Thousand QR in 2010.

**Table 2.11: Amounts and value of agricultural product exports and imports in Qatar (tons, thousand QR) 2010-2015**

| Year | Agricultural Products Exports | | Agricultural Products Imports | |
|---|---|---|---|---|
| | Amount (ton) | Value (thousand QR) | Amount (ton) | Value (thousand QR) |
| 2010 | 3,424,774 | 4,010,997 | 1,592,747 | 5,717,142 |
| 2011 | 2,934,033 | 4,639,969 | 1,589,686 | 7,311,082 |
| 2012 | … | 90,385 | … | 748,985 |
| 2013 | … | 80,493 | … | 8,226,946 |
| 2014 | … | 115,545 | … | 10,393,482 |
| 2015 | … | 64,606 | … | 10,033,971 |
| **Annual Growth Rate 2010 & 2015** | ... | -56% | ... | 12% |

… : Not available.

Source: Ministry of Municipality and Environment, Annual Bulletin of Agricultural Commodity Consumption

## 1.8 *Livestock breeding on farms by type and municipality*

The total number of livestock on farms amounted to 382 thousand in 2015, an annual growth rate of 37% from 2014. Table (2.12) shows that the annual growth rates of horse breeding on farms was high, amounting to 61% compared to the rest of the annual growth rates of livestock breeding on farms, followed by sheep breeding 56%, and then cow breeding 20% from year 2014.

**Table 2.12: Number of livestock on farms by type and municipality, 2014 and 2015**

| Type | Total Livestock in 2014 | Total Livestock in 2015 | Annual Growth Rate 2014 & 2015 | Number of Livestock by Municipality 2015 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Doha | Al Rayyan | Al Wakra | Umm Salal | Al Khor | Al Shamal | Al Dhaayin |
| Cow | 18,533 | 22,331 | 20% | 0 | 10,038 | 65 | 2,621 | 4,764 | 4,418 | 425 |
| Sheep (Lamb) | 148,838 | 231,820 | 56% | 0 | 52,582 | 8,375 | 23,607 | 109,377 | 33,109 | 4,770 |
| Goat | 74,023 | 86,226 | 16% | 0 | 27,380 | 6,093 | 9,974 | 33,202 | 5,933 | 3,644 |
| Camel | 11,385 | 13,288 | 17% | 0 | 8,342 | 308 | 1,002 | 2,167 | 1,160 | 309 |
| Horse | 1,941 | 3,122 | 61% | 0 | 702 | 12 | 1,089 | 728 | 198 | 393 |
| Other | 23,915 | 25,667 | 7% | 0 | 9,464 | 93 | 3,577 | 10,437 | 1,746 | 350 |
| **Total** | **278,635** | **382,454** | **37%** | **0** | **108,508** | **14,946** | **41,870** | **160,675** | **46,564** | **9,891** |

Source: Ministry of Municipal and Environment, Annual Bulletin of Crop Areas and Production

In terms of the number of livestock on farms by municipality, the above table shows that the number of livestock in Al Khor Municipality occupied the biggest share in terms of livestock breeding on farms, amounting to 161 thousand, followed by Al Rayyan Municipality with 109 thousands, followed by Al Shamal Municipality with around 47 thousands, followed by Umm Salal Municipality with nearly 42 thousands, and finally Al Dhaayin Municipality with about 10 thousands. It is worth mentioning that in Doha Municipality there is no livestock breeding on farms, as they are allocated for permanent crop cultivation.

## *1.9 Green Space Area by Municipality*

According to available data, the total green space area in Qatar amounted to 1.284 million square meters in 2015, at an annual growth rate of -4% from 2010. In terms of relative importance of green space area by municipality in 2015, we find that the vast share of green space area was in Al Rayyan Municipality with 9% of total green space area by municipality. In terms of annual growth rates in 2010 and 2015, we find that the highest rates of green space area by municipality were in Al Khor and Al Thakhira Municipalities at 23%, followed by Al Dhaayin at 14%, followed by Umm Salal at 13%.

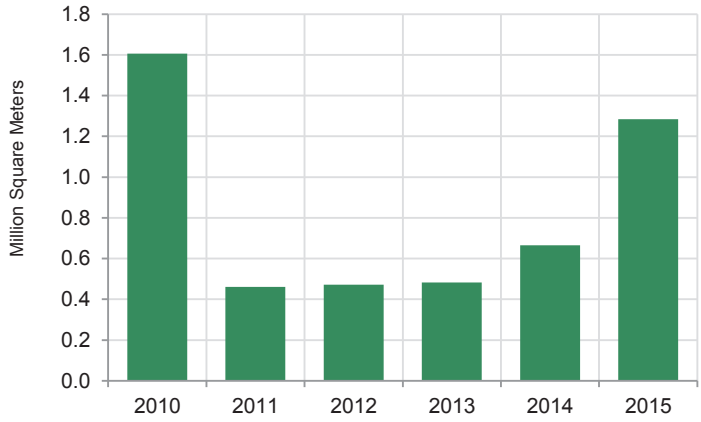
**Table 2.13: Green space area ($m^2$) in Qatar, excluding public parks 2010-2015**

| Municipality | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual Growth Rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|
| Al Khor & Al Thakhira | 25,920 | 25,920 | 25,920 | 25,920 | 72,876 | 72,876 | 23% |
| Doha | 1,164,588 | ... | ... | ... | ... | 592,229 | -13% |
| Al Rayyan | 329,331 | 344,269 | 344,269 | 344,269 | 484,873 | 502,206 | 9% |
| Al Shamal | 8,523 | 8,523 | 8,523 | 8,523 | 8,523 | 14,241 | 11% |
| Al Dhaayin | 18,830 | 23,300 | 25,000 | 35,000 | 35,000 | 36,550 | 14% |
| Al Wakra | 48,776 | 48,776 | 52,858 | 52,858 | 47,000 | 47,000 | -1% |
| Umm salal | 10,400 | 10,400 | 14,600 | 15,200 | 16,700 | 19,000 | 13% |
| Total | 1,606,368 | 461,188 | 471,170 | 481,770 | 664,972 | 1,284,102 | -4% |

... : Not available

Source: Ministry of Municipality and Environment

**Figure 2.9: Green space area (Million $m^2$) in Qatar excluding public parks 2010-2015**




* The data of a Doha Municipality is not available which caused to reduce the trend during the period 2011-2014

The number of planted trees, shrubs and palm trees amounted to 171,450 in 2015, of which 10,717 were palm trees, 45,956 were assorted trees, 13726 were shrubs and 101,051 were other types. It is noted that there was an increase in the annual growth rates of the number of trees, shrubs and palms, as well as their area from the year 2010.

## Table 2.14: Green spaces area in Qatar, excluding public parks (Number, thousand square meters, km) 2010-2015

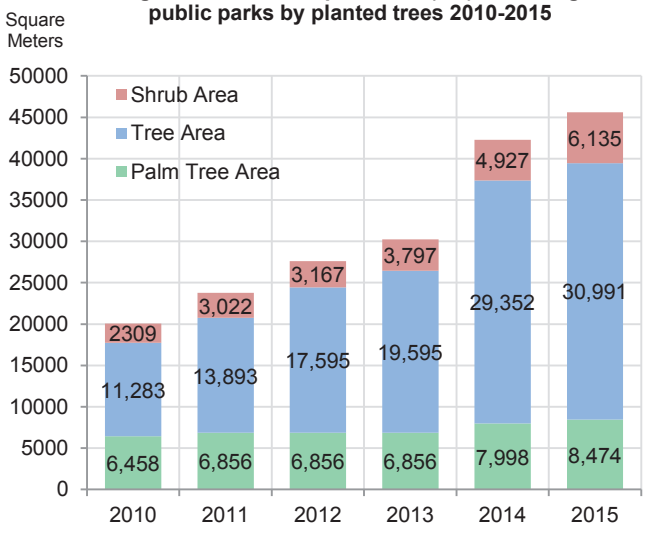
| Municipality | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual Growth Rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|
| Cultivated area (green spaces) (thousand m2) | 1,606,368 | 461,188 | 471,170 | 481,770 | 664,972 | 1,284,102 | -4% |
| Re-cultivated area (maintenance) m2 | 1 | 1 | 1 | 1 | 1 | 1 | 100% |
| Number of palm trees | 13,779 | 5,340 | 5,146 | 5,067 | 5,595 | 10,717 | -5% |
| Palm tree area m2 | 6,458 | 6,856 | 6,856 | 6,856 | 7,998 | 8,474 | 6% |
| Number of trees | 28,354 | 19,985 | 23,356 | 22,577 | 29,336 | 45,956 | 10% |
| Tree area m2 | 11,283 | 13,893 | 17,595 | 19,595 | 29,352 | 30,991 | 22% |
| Number of shrubs | 83,156 | 4,846 | 4,986 | 5,808 | 7,807 | 13,726 | -30% |
| Shrub area m2 | 2309 | 3,022 | 3,167 | 3,797 | 4,927 | 6,135 | 22% |
| Number of others | 14,000 | 16,150 | 44,900 | 61,661 | 86,016 | 101,051 | 48% |
| Total trees | 139,289 | 46,321 | 78,388 | 95,113 | 128,754 | 171,450 | 4% |
| Total tree area | 20,050 | 23,771 | 27,618 | 30,248 | 42,277 | 45,600 | 18% |
| Central islands and roadside planting (km) | … | 700 | 1,502 | 4,002 | 1,202 | 42,141 | … |

…..: not available

- Doha Municipality data, not available (2011-2014).
- Re-cultivated area includes Al Rayyan Municipality only.
- Number of palm trees, shrubs, trees and other types does not include Al Shyhaniya Municipality.
- Area of palm trees, shrubs and trees include Al Shamal and Umm Salal Municipalities only.
- Roadside planting includes Umm Salal Municipality only.

Source: Ministry of Municipality and Environment

**Figure 2.10: Green space area (m2) excluding public parks by planted trees 2010-2015**



## *1.10 Public Park Area by Municipality*

According to available data, the number of public parks in the State of Qatar was 86 parks in 2015, an annual growth rate of 9% from the year 2010, with a total area of 1,288,584 square meters. In 2015, the number of trees planted in public parks amounted to 1,270 palm trees, 8,673 trees, 3,194 shrubs and 84,989 other types.

In terms of annual growth rates of trees planted in public parks, there was an increase in the annual growth rate of bushes by 10% from the year 2010, and so was the case for the number of various other trees, where the annual growth rates increased by 6%, whereas the green space area in public parks stood at an annual growth rate of 5% from the year 2010.

**Table 2.15: Public parks by number and area 2010-2015**

| | Number of Public Parks | Public Park Area $m^2$ | Cultivated Area (Green Spaces) $m^2$ | Re-cultivated Area (Maintenance) m2 | Number of Palm Trees | Palm Tree Area m2 | Number of Trees | Tree Area $m^2$ | Number of Shrubs | Shrub Area $m^2$ | Number of Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2010 | 56 | 1,073,461 | 410,505 | 0 | 1,253 | 1,962 | 6,526 | 4,901 | 1,485 | 744 | 71,035 |
| 2011 | 57 | 1,078,613 | 412,212 | 0 | 1,284 | 1,972 | 6,598 | 4,945 | 1569 | 741 | 71,035 |
| 2012 | 59 | 1,095,953 | 418,867 | 147,089 | 1,188 | 2,022 | 6,619 | 4,965 | 1,627 | 774 | 76,115 |
| 2013 | 69 | 1,145,035 | 434,904 | 147,089 | 1,244 | 2,158 | 6,883 | 5,200 | 1,731 | 852 | 82,050 |
| 2014 | 82 | 1,247,152 | 506,253 | 147,089 | 1,248 | 2,205 | 8,281 | 6,829 | 1,871 | 992 | 82,050 |
| 2015 | 86 | 1,288,584 | 526,603 | 7,750 | 1,270 | 2,267 | 8,637 | 7,468 | 3,194 | 1,223 | 84,989 |
| Annual Growth Rate 2010 & 2015 | 9% | 4% | 5% | … | 0% | 3% | 6% | 9% | 17% | 10% | 4% |

… : Not available
Cultivated area includes Al Shihaniya Municipality only.
Re-cultivated area includes Al Khor and Al Thakhira Municipalities only.
Source: Ministry of Municipality and Environment

## 2. Water Demand for total sectors

Water demand is part of the pressures resulting from meeting the needs of population and economy on natural resources, including water resources. Currently, water demand exceeds all previous demands, due to population growth and mobility, rising living standards, changes in food consumption habits and the pressures resulting from the growing need for energy, water and energy nexus.

Water demand in the State of Qatar reached 499 million cubic meters in 2015. Accordingly, Qatar Electricity and Water Co (Kahrama). has launched a national program for rationalization and energy efficiency to reduce water and electricity consumption. The State of Qatar seeks to enact a law for water to reduce water consumption and sustain water resources for the coming generations.

**Table 2.16: Water demand (million cubic meters per year) 2010-2015**

| Year | Water Demand |
|---|---|
| 2010 | 352.6 |
| 2011 | 370.3 |
| 2012 | 408.3 |
| 2013 | 436.8 |
| 2014 | 463.4 |
| 2015 | 498.8 |
| Annual Growth Rate 2010 & 2015 | %7 |

Source: Qatar Electricity and Water Co.

# 3. Energy Generation

Energy generation comes to meet the consumption linked to emerging needs resulting from the increase in population and economic growth, and pressures in the production of electricity and energy used for water desalination as well as fuel for vehicles and other population and economic growth requirements. The environment is being pressured by the increasing energy use, which in turn leads to more emissions released into the air and consequently cause a change in the ambient air quality and concentrations of greenhouse gases.

## Box (3): Energy Generation in Relation to National Policies

The following programs/projects have emanated from the national strategy to enhance economic and technical efficiency.

**Program/Project:**
1. energy and gas.
Targets:
- Study the opportunities to lower gas consumption per unit and water cogeneration unit through the modernization of the delivery system.
- Improve thermal efficiency in power production.
- advance the adoption of energy-saving technologies.
- keep Qatar's green buildings code implementation on track.
- Establish a national level committee on renewable energy.
Outcomes:
- improve energy efficiency, environmental quality and value creation.

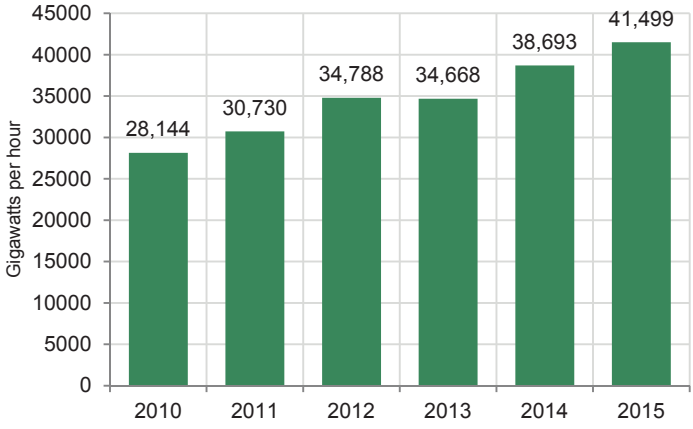
**Program/Project:**
2. Reduction of natural gas combustion and emissions.
Targets:
- Reduce gas combustion rate in half to 0.0115 billion cubic meters per million tons of generated energy, compared to 0.0230 billion cubic meters per million tons of produced power in 2008.
outcomes:
- Fresh air and effective responses to climate change.

**Program/Project:**
3. Environmental information database /energy generation.
Targets:
- Create a searchable electronic information source.
Outcomes:
Improved governance and regional and international cooperation.
Power generation's relation to international frameworks, such as the Sustainable Development Goals 2030 (SDGs)
Goal (7), Indicator (1.3): Power density measured by the primary power and GDP.
Power generation's relation to international frameworks, such as international competitiveness

indicators
energy use Intensity.

The total amount of electricity generated reached 41 thousand gigawatts per hour in 2015, an annual growth rate of 8% compared to the year 2010. The following figure shows a rise in the trend of the amount of electricity generated.

**Figure 2.11: Energy Generation per year (gigawatts per hour) 2010-2015**



## 4. Transport by Type of License

Car use is linked to the needs of the population, urbanization, economic prosperity and modern massive construction. All of these aspects resulting from the driving forces of population and economic development add pressure on environmental resources. The pressure resulting from the increased number of cars in Qatar is embodied in many aspects, such as increased emissions from the combustion of the fuel used in different transport vehicles, as well as the change in land use as a result of expansion of existing roads and construction of new roads, in addition to the water consumed in cleaning these vehicles and the resulting residuals, such as oils, batteries, tires, car bodies and discarded cars. Box (4) below shows the transport use relation to national policies and international frameworks.

### Box (4): Transport Use in Relation to National Policies

The following programs/projects have emanated from the national strategy to enhance economic and technical efficiency.

**Program/Project:**
1- Improvement of air quality management and emission reduction.
Targets:
To eliminate increased ozone levels in Qatar through the improvement of air quality management.
Outcomes:
Fresh air and effective responses to climate change.

**Program/Project:**
2- Prevention of communicable diseases.
Targets:
Reduce the rate of pulmonary tuberculosis outbreak from 6.1 cases to 1.1 cases per 10,000 people.
The application of early warning system to monitor and track cases.
Outcomes:
Reduce the threat of communicable diseases.

**Program/Project:**
3- Land use efficiency.
Targets:
Adoption and implementation of a comprehensive national plan for urban development and integrated transport.
Outcomes:
Improvement of land use efficiency.

**Program/Project:**
4. Database on environmental information/transport.
Targets:
Establish an electronic database that offers the possibility to search.
Outcomes:
Improvement of environment management and cooperation at regional and international levels.

**Transport use relation to international frameworks, such as the Sustainable Development Goals 2030 (SDGs)**

- Goal (3), Indicator (6): Tuberculosis infections per 1,000 people per year.

**Transport use relation to international frameworks, such as international competitiveness indicators**

- Density of road network per km2.

The statistics in Table (2.17) below show that the total number of cars and motorcycles reached more than million in 2015, of which 999 thousand cars were government-license cars, private cars, private transport cars and taxis.

The table also shows the cumulative numbers of various means of transport during the period 2010-2015, where government vehicle licenses top the list at an annual growth rate of 12% from the year 2010, followed by other types of licenses amounting to 10%, and then private licenses and private transport licenses at an annual growth rate of 8% for each.

**Table 2.17: Total cars and motorcycles by type of license 2010-2015**

| Type of License | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual Growth Rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|
| Government | 678 | 668 | 684 | 755 | 2,559 | 1,176 | 12% |
| Private | 484,891 | 515,559 | 562,266 | 606,257 | 647,923 | 697,032 | 8% |
| Private Transport | 186,775 | 197,469 | 211,443 | 227,530 | 246,340 | 271,719 | 8% |
| heavy-duty vehicles | 25,095 | 26,419 | 25,024 | 25,024 | 25,753 | 32,060 | 5% |
| Taxi | 26,502 | 26,616 | 27,320 | 27,887 | 28,419 | 28,997 | 2% |
| Motorcycle | 11,490 | 12,555 | 12,542 | 13,235 | 14,584 | 15,965 | 7% |
| Trailer | 32,618 | 33,016 | 33,055 | 33,031 | 35,781 | 40,126 | 4% |
| Public Transport | 2,826 | 2,794 | 2,773 | 3,867 | 2,705 | 3,022 | 1% |
| Other | 1,664 | 1,787 | 2,020 | 2,328 | 644 | 2,709 | 10% |
| Total | 772,539 | 816,883 | 877,127 | 939,914 | 1,004,708 | 1,092,806 | 7% |

Source: MDPS, Annual Statistical Abstract – Chapter of Transport and Communication Statistics.

The statistics in Table (2.18) indicate that the total number of registered new cars and motorcycles stood at 114,651 in 2015, an annual growth rate of 12% from year 2010. It is worth mentioning that the growth rate for public transport reached 185%, followed by government cars 33%, trailers 24%, and then heavy-duty vehicles 20%. The growth rate of motorcycles reached 18%, as a considerable number of them are used for home delivery, such as restaurant products, mail and other services. However, the increase in the number of private cars during the same period reached about 10%, in line with the population increase in the same period at an annual growth rate of 7% in 2010 and 2015. This figure also goes in line with the economic growth of 6.2% for the same period, which includes an increase on demand for all types of transport. Even the heavy-duty vehicles used in building and road construction increased by 16%, and even trailers used in transport of goods increased by 16%.

**Table 2.18: Registered new cars and motorcycles by type of license 2010-2015**

| Type of License | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual Growth Rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|
| Government | 108 | 30 | 168 | 100 | 520 | 448 | 33% |
| Private | 41,074 | 45,316 | 58,923 | 65,025 | 69,479 | 67,447 | 10% |
| Private Transport | 17,140 | 18,484 | 21,712 | 24,311 | 29,129 | 31,274 | 13% |
| heavy-duty vehicles | 2,666 | 2,948 | 37 | 3,242 | 4,899 | 6,767 | 20% |
| Taxi | 522 | 582 | 1,164 | 881 | 1,328 | 1,024 | 14% |
| Motorcycle | 895 | 1,285 | 1,328 | 1,477 | 1,903 | 2,006 | 18% |
| Trailer | 1,607 | 1,403 | 1,146 | 1,358 | 2,910 | 4,725 | 24% |
| Public Transport | 2 | 5 | 7 | 13 | 31 | 379 | 185% |
| Other | 293 | 252 | 534 | 674 | 122 | 581 | 15% |
| Total | 64,307 | 70,305 | 85,019 | 97,081 | 110,321 | 114,651 | 12% |

Source: MDPS, Annual Statistical Abstract – Chapter of Transport and Communications Statistics.

# 5. Completed Buildings Connected to Public Utilities

## Box (5): Urban Wastewater in Relation to National Policies

The following programs/projects have emanated from the national strategy to enhance economic and technical efficiency.

**Program/Project:**
1- Efficiency use projects.
Targets:
Expansion of the sewage treatment networks to increase recycled wastewater use.
Study the feasibility of establishing systems for the collection and treatment of industrial wastewater.
Outcomes:
Improvement of use efficiency.

**Program/Project:**
2. Database on environmental Information/wastewater.
Targets:
Establish an electronic database that offers the possibility to search.
Outcomes:
Improvement of environment management and cooperation at regional and international levels.

**Wastewater use relation to international frameworks, such as the Sustainable Development Goals 2030 (SDGs)**

- Goal (6), Indicator (1): Proportion of population using safely managed drinking water services.
- Goal (6), Indicator (2): Proportion of population using safely managed wastewater services.
- Goal (6), Indicator (3): Proportion of safely treated wastewater by economic activity.
- Goal (7), Indicator (1): Percentage of population with access to electricity.

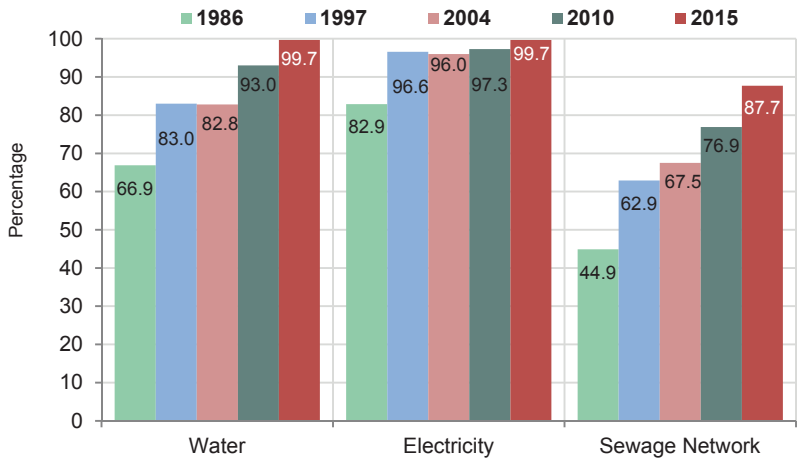
**Wastewater use relation to international frameworks, such as international competitiveness indicators**

- Proportion of population whose domestic wastewater is treated at wastewater treatment plants.
- Intensity of consumption/abstracted amount in million cubic meters.

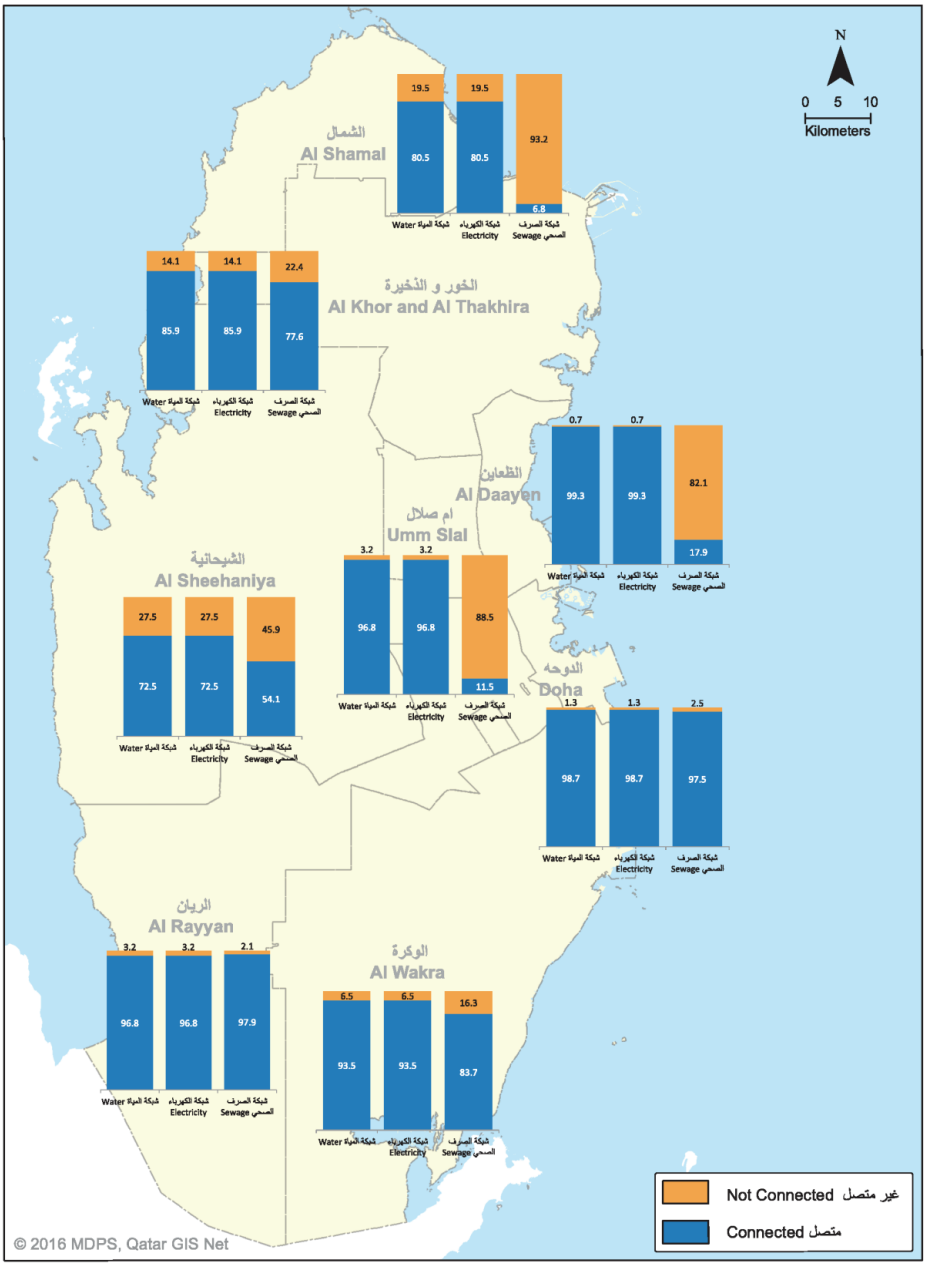
The statistics in Figure (2.12) below indicate a general rise in completed buildings connected to public utility networks during the years of Census 1986-2015. The index of completed buildings connected to electricity grid increased from 82.9% in 1986 to 99.7% in 2015. So is the case with the index of completed buildings connected to water network, which increased from 66.9% in 1986 to 99.7% in 2015, and the index of completed buildings connected to sewage network from 44.9 in 1986 to 87.7% in 2015. A rapid development of the curve is observed in completed buildings connected to sewage network over the years of the census.

The geographical map shows the distribution of completed buildings by connection to sewage and municipal network. As for the wastewater of completed buildings not connected to sewage network, it is collected by tanks which discharge the wastewater at the domestic wastewater treatment plants.

**Figure 2.12: Percentage of completed buildings connected to public utlity network by type of utility and public census years 1986-2015**



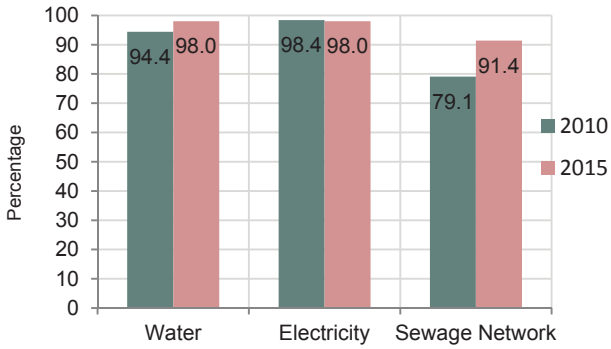
## Map 2.2: Completed buildings by connection to public utilities Census 2015



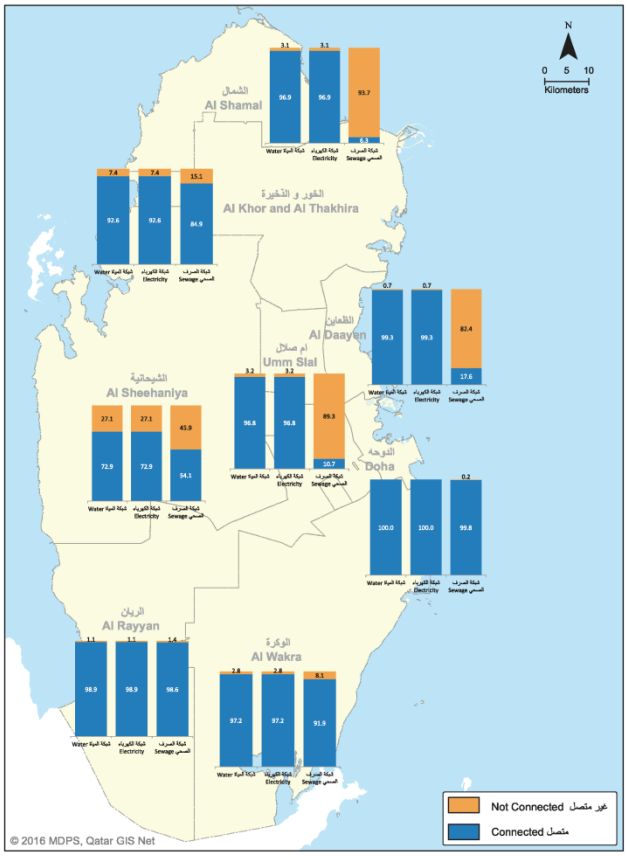
# 6. Housing Units Connected to Public Utilities

According to statistics from Censuses 2010 and 2015, there was a significant increase in housing units connected to sewerage network from 79.1% to 91.4%. Also, the indices of housing units connected to electricity grid and water network indicators were high in both censuses.

**Figure 2.13: Percentage of Housing Units Connected to Public Utilities Network by Type of Utility, Censuses 2010 and 2015**




Map 2.3: Housing Units Connected to Public Utilities Census 2015



# 7. Urban Wastewater

This indicator is linked to the pressure caused by the use of water to meet the needs of the population, urbanization and economic prosperity. All these aspects resulting from the driving force of population and economic development add pressure on environmental resources. The pressure resulting from the increased number of those connected to sewage network in Qatar is embodied in many aspects, such as the increasing pollution caused by wastewater discharged in the environmental resources and the potential pollution of groundwater resources, soil, coastal environment and biodiversity.

In Census 2015, the percentage of completed buildings connected to sewage network amounted to 87.7%. During the years of censuses an improvement was observed in index performance and the rapid rise of completed buildings connected to the network. As for the residents who live in buildings not connected to sewage network, they are generally served by tankers to transport wastewater to treatment plants, and thus the percentage of population connected to wastewater services is 100%.

With regards to housing units connected to sewage network, the results of Censuses (1986-2010) indicate that the number of these housing units increased from 204,831 (accounting for 79.1% of total housing units) in 2010 to 286,903 (accounting for 91.4 % of total housing units) in 2015.

As for housing units connected by municipality in Census 2015, the highest percentage was in Doha Municipality (99.8%), while the percentage was lower in Al Shamal, Umm Salal and Al Dhaayin Municipalities by 6.3% 10.7% and 17.6% respectively.

**Figure 2.14: Percentage of completed buildings connected to public sewage network by Census years 1986-2015**

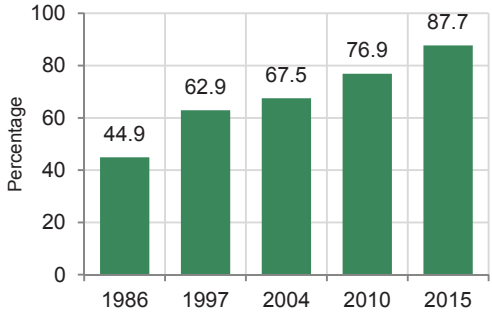



**Figure 2.15: Percentage of housing units connected to public sewage network, 2010 & 2015**

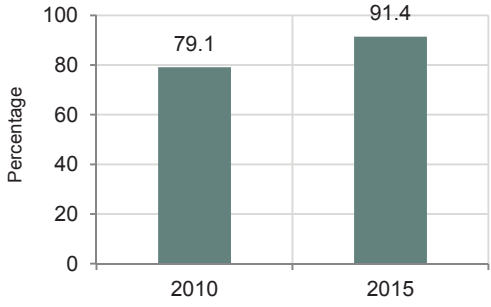
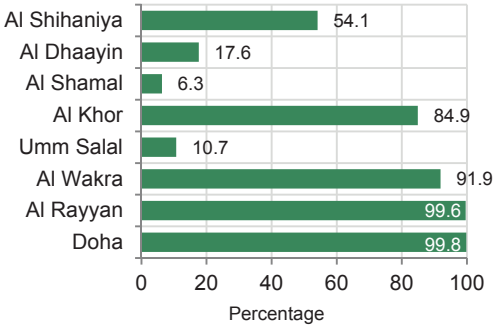



**Figure 2.16: Percentage of housing units connected to public sewage network by municipality, Census 2015**




Source: MDPS, General Census of Population (1986, 1997, 2004, 2010, 2015).

Chapter Three

# The State of the Environmental and the Impacts

# The State of the Environmental and the Impacts

The State of the environmental is linked to many aspects, whether they are natural aspects related to geographical location, nature of land, and climate and weather factors, or they are related to other factors that are mainly related to human activities and their consequences. This chapter measures the change in the state of the environmental caused by pressure on various aspects of the environment. Most of these changes are of negative trend that impacts the state of the environmental itself and the health of ecosystems, as well as the environmental health needed for the human health. Changes increase in the state of the environmental when the existing local ecosystems are fragile, limited and prone to change rapidly.

As a result of the negative change in the state of the environmental, this chapter also addresses the impacts of this change on human health as well as the health of ecosystems, and the extent of environmental degradation caused by the change in the state of the environment, and the concomitant diseases, air, water and food borne diseases. The chapter also addresses the loss of environmental resources, such as biodiversity; and depletion of environmental resources, such as water resources. This chapter further reviews each of the following topics: the climate of the State of Qatar, biodiversity, water resources and their uses and quality, waste, energy consumption, air quality, consumption of ozone-depleting substances and the environmental pollution borne diseases.

## 1. Climate

Qatar is characterized by a desert climate with high temperatures, especially in the summer times. The average high temperatures are linked to high relative humidity, especially in coastal areas. Qatar's winter is generally warm, and temperatures in winter fall to low levels from time to time.

The weather in Qatar is monitored by 30 stations, 2 monitoring buoys and 6 seismic stations. Table (3.1) and Map (3.1) below indicate the number and distribution of weather monitoring stations both onshore and offshore. In this report the climate statistics of five selected weather monitoring stations will be analzyed, namely; Ruwais, Dukhan, Mesaieed, Al Karanah and Doha International Airport.

**Table 3.1: Number of weather monitoring stations (onshore and offshore) during period 2010-2015**

| Stations | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| No. of air monitoring stations | 15 | 20 | 20 | 20 | 30 | 30 |
| No. of Buoys | ... | ... | ... | ... | 2 | 2 |
| No. of seismic stations | ... | ... | ... | ... | 6 | 6 |

...: Not available
Source: General Authority for Civil Aviation, Department of Meteorology.

The Doha International Airport station is one of the oldest weather monitoring stations, where one can find values of climate elements since 1962. The following results on some of the values of climate elements that were monitored during the period 2010-2015 indicate that the average minimum temperature at Doha International Airport station reached 25.2˚ C in 2015, while the average maximum temperature reached 33.7˚ C.

With regards to climate indicators, statistics indicate an increase in the average annual rainfall at Doha Airport from 33.1 mm in 2010 to 114.5 mm in 2015. The average minimum relative humidity amounted to 32%, while the average maximum in the same year was 72%. In 2015, the lowest mean annual atmospheric pressure stood at 1003.5 hPa, while the highest reached 1016.1 hPa. The highest average daily sunshine hours in 2015 were 12.2 hours in June, and the lowest were 6.9 hours in December.

## 1.1 *Temperature*

Temperatures are measured in the shade and are monitored around the clock like the rest of the weather elements. The analysis includes the average annual and monthly temperatures and long-term temperatures.

### 1.1.1 Average Annual Temperature

In 2015, the annual temperatures recorded at selected monitoring stations alternated between 27◦ C and 30◦ C. The annual temperature at Al Karanah station reached 29.9◦ C, which was the highest temperature among the five stations, and Doha International Airport 29.9◦ C. The least annual temperature was recorded at Ruwais station reaching 27.4◦ C. When comparing annual temperatures in 2010 to 2015 by stations, we find that the average temperature at Al Karanah station increased from 28.1º C to 29.9º C.

**Table 3.2: Average annual temperatures (Celsius) recorded by selected monitoring stations, 2010-2015**

| Stations | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| Ruwais | 27.4 | 26.5 | 26.8 | 26.8 | 27.3 | 27.4 |
| Dukhan | 27.6 | 26.6 | 26.8 | 26.6 | 27.1 | 27.5 |
| Mesaieed | 28.2 | 27.6 | 27.8 | 27.5 | 27.9 | 28.4 |
| Al Karanah | 28.1 | 27.3 | 27.6 | 27.1 | 27.5 | 29.9 |
| Doha Intl. Airport | 29.0 | 28.4 | 28.7 | 28.4 | 28.8 | 29.0 |

Source: General Authority for Civil Aviation, Department of Meteorology.

### 1.1.2 Average maximum and minimum monthly temperatures

The maximum temperature is defined as the highest temperature recorded during the day, and is usually recorded in the middle of the day. The minimum temperature is the lowest temperature recorded during the day, and is usually recorded between dawn and sunrise.

**Table 3.3: Average maximum and minmum temperatures at selected monitoring stations in Qatar in 2015, and average long-term temperatures (Celsius) in 31 years (1962-1992) at Doha International Airport**

| Station | Temp. | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Doha Intl. Airport (average 1962-1992) | Min | 12.8 | 13.7 | 16.7 | 20.6 | 25.0 | 27.7 | 29.1 | 28.9 | 26.5 | 23.4 | 19.5 | 15.0 |
| | Max | 21.7 | 23.0 | 26.8 | 31.9 | 38.2 | 41.2 | 41.5 | 40.7 | 38.6 | 35.2 | 29.5 | 24.1 |
| Doha Intl. Airport | Min | 15.1 | 17.0 | 19.6 | 23.9 | 29.6 | 32.0 | 32.7 | 32.7 | 31.0 | 28.7 | 23.0 | 16.8 |
| | Max | 24.0 | 25.2 | 26.8 | 34.6 | 39.7 | 41.3 | 42.3 | 41.7 | 39.5 | 36.5 | 29.4 | 23.6 |
| Al Karanah | Min | 11.0 | 13.0 | 16.7 | 20.5 | 26.1 | 27.6 | 29.9 | 29.8 | 27.5 | 24.4 | ... | ... |
| | Max | 23.1 | 26.0 | 28.9 | 35.1 | 41.8 | 42.8 | 44.6 | 45.4 | 41.1 | 37.8 | ... | ... |
| Dukhan | Min | 13.0 | 15.4 | 18.0 | 22.0 | 26.5 | 28.8 | 30.6 | 30.2 | 28.2 | 26.2 | 21.9 | 15.6 |
| | Max | 20.8 | 22.6 | 26.9 | 31.3 | 38.4 | 38.1 | 40.4 | 41.2 | 38.8 | 35.3 | 27.7 | 21.1 |
| Ruwais | Min | 15.3 | 17.6 | 19.4 | 23.2 | 27.8 | 31.7 | 31.2 | 31.2 | 29.8 | 28.2 | 23.4 | 17.6 |
| | Max | 21.5 | 23.0 | 24.6 | 29.0 | 34.8 | 35.1 | 37.0 | 38.0 | 36.7 | 33.9 | 27.5 | 22.0 |
| Mesaieed | Min | 12.5 | 14.9 | 18.4 | 20.9 | 27.3 | 26.9 | 30.0 | 31.3 | 28.2 | 26.2 | 20.6 | 14.9 |
| | Max | 22.4 | 25.5 | 27.2 | 37.2 | 39.3 | 42.4 | 42.2 | 41.0 | 38.7 | 36.4 | 29.6 | 23.6 |

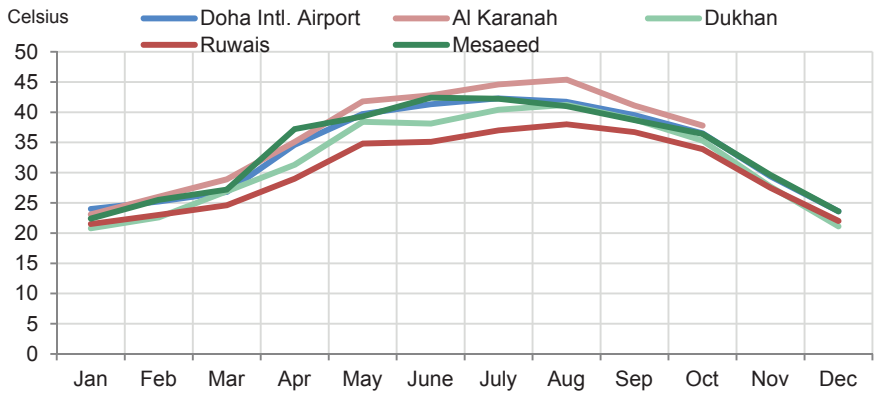
...: not available
Source: General Authority for Civil Aviation, Department of Meteorology.
World Meteorological Organization http://www.worldweather.org/116/c00221.htm.

The average maximum temperature statistics in five selected monitoring stations show that the highest maximum temperature was recorded at Al Karanah station as of May until August, where the temperature was too high compared to other stations during 2015. However, Doha international Airport station recorded the lowest average minimum temperatures compared to other stations over the months of 2015.

Comparing the average temperatures recorded at Doha International Airport at a long-term rate, we note that during the period (January-March) and the period (October-December) 2015, the average minimum temperature rose by 2.3° C from the average long-term minimum temperature during the period 1962-2015 for the same months. The same applies to the monthly average maximum temperature recorded in 2015

during the period (April-September), rising up 0.75° C from the average long-term maximum temperature during the period 1962-2015.

**Figure 3.1: Monthly average maximum temperatures by month and selected monitoring stations 2015**




From the results of the average maximum and minimum temperatures by monitoring stations in 2015, we find that the lowest average minimum temperature by stations was recorded at Al Karanah station in January, reaching 11° C, and the highest average maximum temperature by stations was recorded at Al Karanah station in 2015, reaching 44.6° C.

.

Map 3.1: Temperatures by month and selected monitoring stations 2015

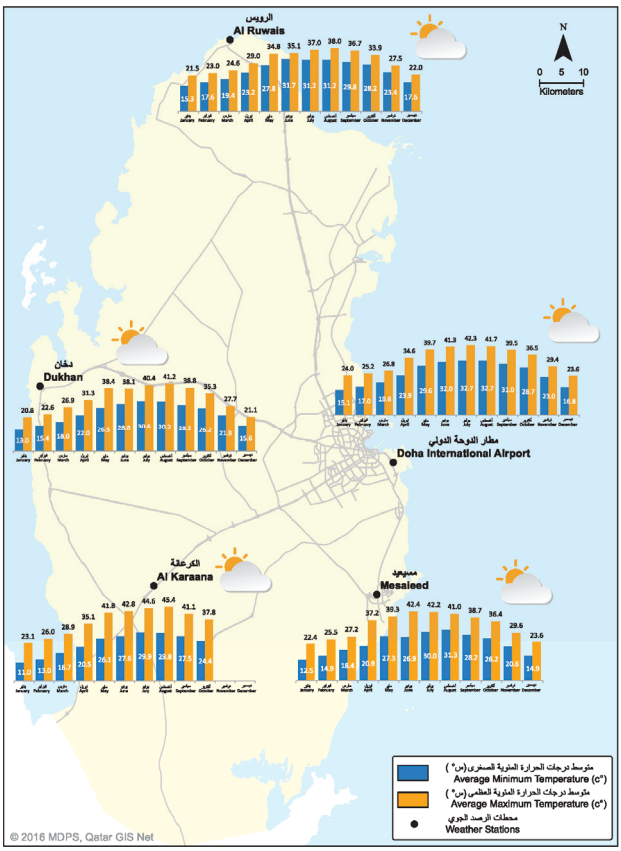
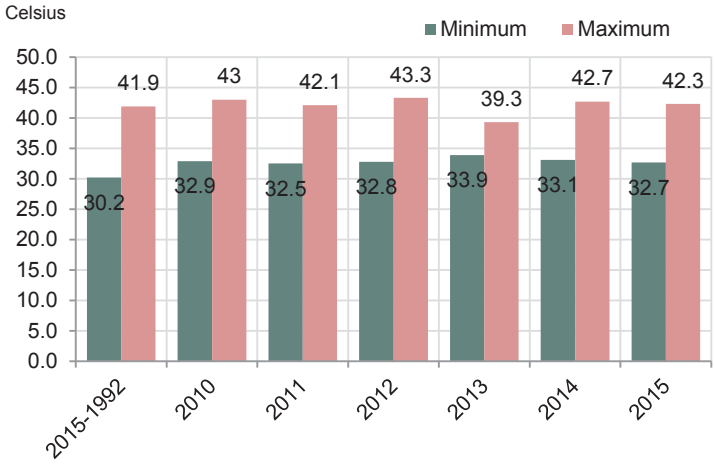


Figure 3.2 below indicates the average minimum and maximum temperatures in July at Doha International Airport during the period 2010-2015 and the average long-term temperatures during the period (1962-2015). The data indicates that the highest average maximum temperature was in 2012, reaching 43.3˚ C, while the highest average minimum temperature was in 2013 reaching 33.9 ˚ C. It is noted also that all average maximum and minimum temperatures for the years 2010-2015 were above the average long-term temperatures (1962-2015).

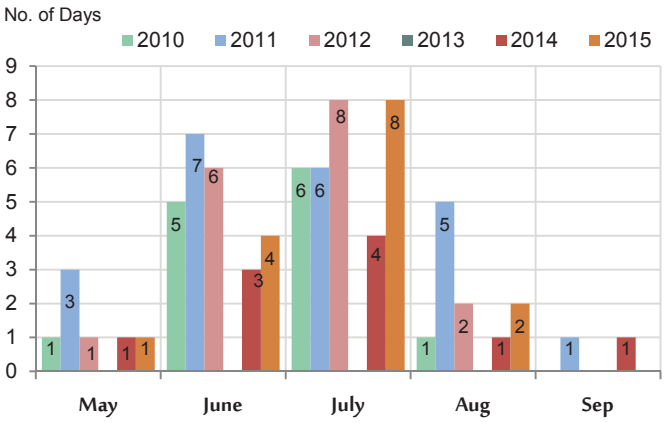
**Figure 3.2: Average minimum and maximum temperatures in July at Doha Intl. Airport (2010-2015) and average long-term temperatures (1962-1992)**




From statistics of absolute maximum and minimum temperatures recorded at Doha International Airport in 2015. We find that 30 July was the hottest day in 2015, where the maximum temperature reached 48.1˚ C, while 26 December was the coldest day in 2015, reaching 10.7˚ C. In the same year, the number of days in which temperatures rose above 40˚ C amounted to 117 days, out of which 15 days were scattered between the months of May and August where temperatures reached 45˚ C and above. Statistics also indicate that the number of days in which temperatures rose above 45˚ C and above was 15 days, including eight days in July alone.

Comparing the temperatures at Doha International Airport during the period (2010-2015), the recorded maximum temperatures that were equal or above 45˚ C were distributed between the months of May and August. However, the month of July in 2012 and 2015 was the hottest in both years, with the temperature soaring above 45˚ C during eight days in July of both years (see Figure 3.3 below).

**Figure 3.3: Number of days in which temperatures recorded were equal or above 45˚ C by month and year at Doha Intl. Airport 2010-2015**




Note: During the remaining months of the year the temperature did not exceed 45˚ C.

## *1.2 Rainfall*

Rainfall includes all types of rain, such as drizzle (where the rainfall accumulating during 24 hours is less than 1 mm) and light, medium and heavy rain that may lead to floods and flash floods.

### 1.2.1 Annual Rainfall Rates

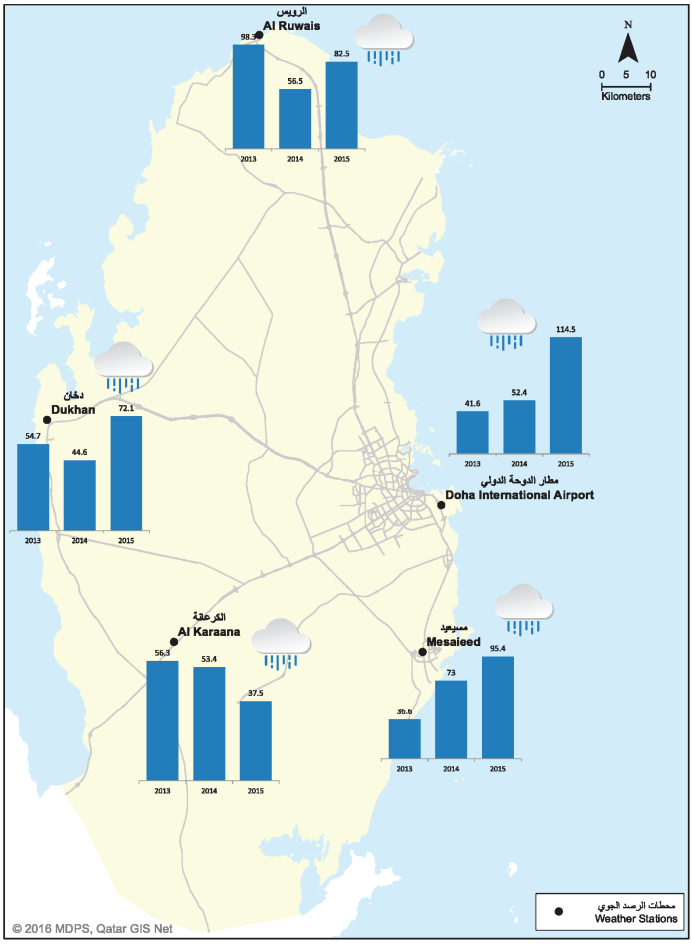
Rain in Qatar is slight and irregular, and it falls for a few days in the winter. Heavy rain may fall for short periods during the day, as is the case in all the desert areas. The annual average total rainfall at Doha International Airport station rose from 33.1 mm in 2010 to 114.5 mm in 2015. In comparison between the selected monitoring stations, the meteorological statistics indicate an increase in rainfall rates from previous years, where the highest annual rainfall rates stood at 114.5 mm at Doha International Airport, while it was very little at Al Karanah station, with an average of 37.5 mm in 2015. It should be noted that the rise in rainfall rate at Doha International Airport was very high compared to the average total amounts of rainfall recorded at this station during the period (2010-2014), where the annual growth rate reached 28% from 2010.

**Table 3.4: Annual rainfall rates by selected monitoring stations (mm) 2010-2015**

| Station | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| Mesaeed | 24.8 | 30.3 | 17.6 | 36.6 | 73.0 | 95.4 |
| Ruwais | 33.8 | 93.8 | 40.0 | 98.3 | 56.5 | 82.5 |
| Dukhan | 10.0 | 33.8 | 35.8 | 54.7 | 44.6 | 72.1 |
| Doha Intl. Airport | 33.1 | 70.5 | 23.9 | 41.6 | 52.4 | 114.5 |
| Al Karanah | 27.1 | 22.0 | 32.9 | 56.3 | 53.4 | 37.5 |

Source: General Authority for Civil Aviation, Department of Meteorology.

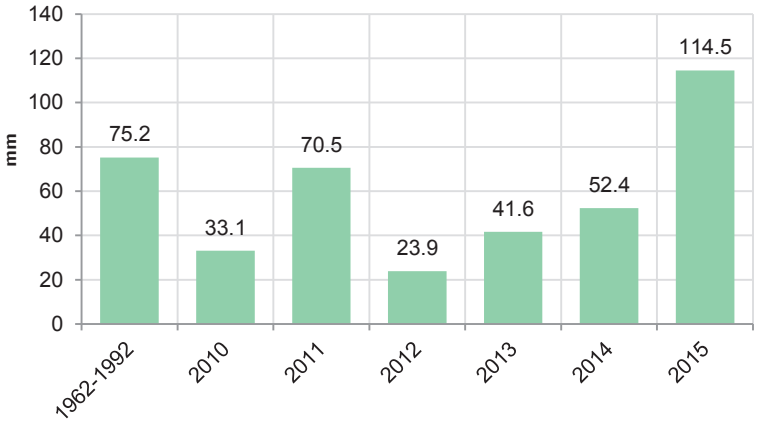
Map 3.2: Rainfall rate by years and selected monitoring stations (mm) 2013-2015



### 1.2.2 Annual Long-Term Rainfall Rates

Figure (3.4) below shows the total amount of annual rainfall recorded at Doha International Airport during the period 2010-2015 and the average amount of long-term rainfall during the period (1962-1992). One can notice that the amount of rainfall rose dramatically in 2015, reaching 114.5 mm, while the average long-term rainfall reached 75.2 mm (1962-1992).

**Figure 3.4: Annual rainfall recorded at Doha Intl. Airport (2010-2015), and average long-term rainfall (1962-1992)**




### 1.2.3 Monthly Rainfall Rates

The year 2015 was characterized by spring rainfall in March and April at all selected stations. The statistics indicate that the highest amounts of rainfall by months was at Ruwais station in December 2015, at a rate of 58.3 mm, followed by Doha International Airport station in December also at a rate of 51.3 mm.

## *1.3 Relative Humidity (RH)*

Relative humidity is the ratio of the partial pressure of water vapor to the equilibrium vapor pressure of water at a given temperature

### 1.3.1 Annual Average Relative Humidity

The relative humidity increases in coastal areas than in internal and desert areas. In 2015, the annual average minimum relative humidity amounted to 32%, while the annual average maximum relative humidity amounted to 72% at Doha International Airport station. The averages minimum relative humidity ranged between 18% and 53% and the averages maximum relative humidity ranged between 72% and 80% at the five selected monitoring stations in 2015.

**Table 3.5: Annual average minimum and maximum relative humidity by selected monitoring stations 2010-2015**

| Station | RH | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|
| **Mesaeed** | Min | 35 | 31 | 30 | 32 | 31 | 32 |
| | Max | 75 | 77 | 77 | 76 | 77 | 76 |
| **Ruwais** | Min | 52 | 54 | 53 | 53 | 49 | 53 |
| | Max | 86 | 83 | 83 | 84 | 82 | 83 |
| **Dukhan** | Min | 38 | 41 | 35 | 43 | 39 | 38 |
| | Max | 82 | 82 | 81 | 79 | 80 | 80 |
| **Doha Intl. Airport** | Min | 49 | 48 | 46 | 31 | 31 | 32 |
| | Max | 83 | 79 | 79 | 74 | 71 | 72 |
| **Al Karanah** | Min | 19 | 21 | 18 | 31 | 22 | 18 |
| | Max | 74 | 78 | 76 | 70 | 81 | 75 |

Source: General Authority for Civil Aviation, Department of Meteorology.

### 1.3.2 Averages Monthly Maximum and Minimum Relative Humidity

In 2015, Doha International Airport station recorded a clear change in the average maximum relative humidity between different months of the year, reaching 83% in the winter months and dropping to 79% in the summer months. Similarly, at the same station, the average minimum relative humidity showed a marked disparity between the different months of the year, amounting to 39% in the winter and decreasing to 32% in the summer. The average maximum relative humidity during 2015 by weather monitoring stations, ranged between 53% at Doha International Airport and 90% at Al Karanah station as the table below indicates.

## *1.4 Atmospheric Pressure*

### 1.4.1 Monthly Maximum and Minimum Atmospheric Pressure Values (Highest and Lowest)

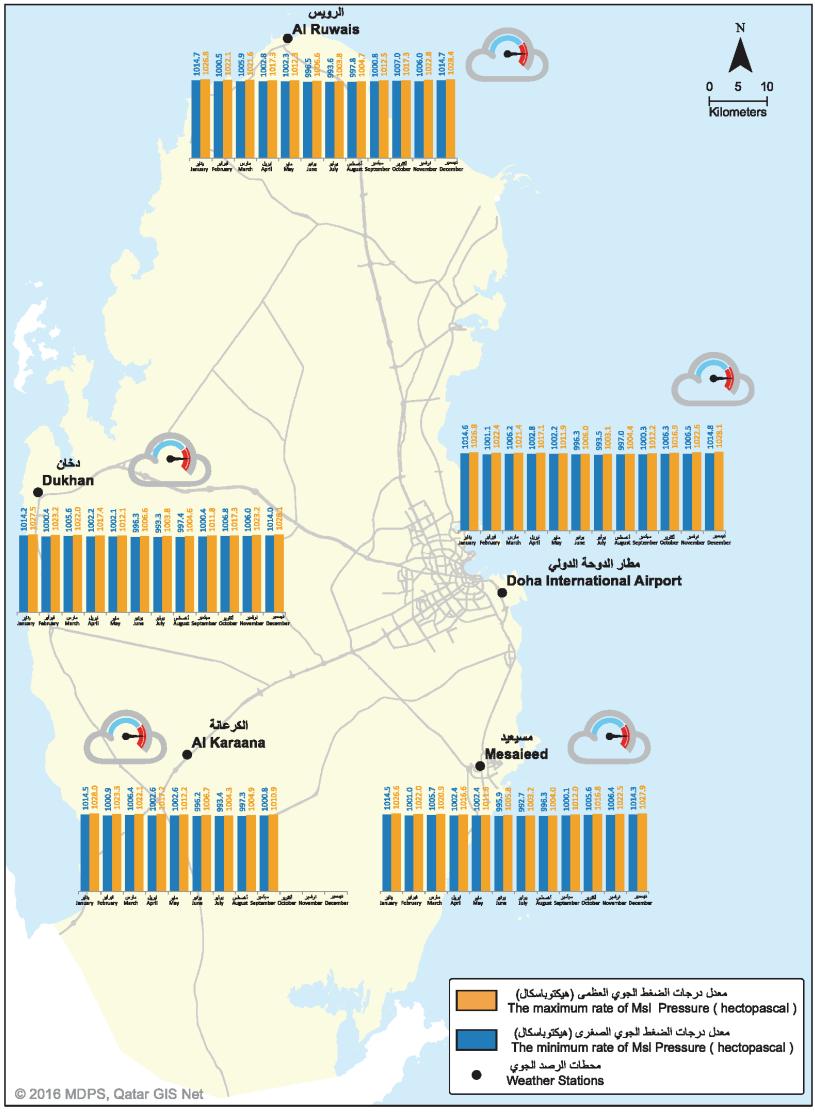
Qatar's winter witnesses averages of high atmospheric pressure unlike the summer due to high temperature. According to Doha International Airport station statistics, the maximum value of atmospheric pressure reached 1027 HB in January 2015, then it gradually declined, recording the lowest values in the summer, especially in July, reaching the lowest recorded atmospheric pressure value of 994 HB, then it began to gradually rise again.

## Table 3.6: Highest and lowest values of maximum and minimum atmospheric pressure (HB) by months and selected monitoring stations 2015

| Month | Doha Intl. Airport | | Al Karanah | | Dukhan | | Ruwais | | Mesaeed | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| **Jan** | 1014.6 | 1026.8 | 1014.5 | 1028 | 1014.2 | 1027.5 | 1014.7 | 1026.8 | 1014.5 | 1026.6 |
| **Feb** | 1001.1 | 1022.4 | 1000.9 | 1023.3 | 1000.4 | 1023.2 | 1000.5 | 1022.1 | 1001.0 | 1022.0 |
| **Mar** | 1006.2 | 1021.4 | 1006.4 | 1022.1 | 1005.6 | 1022.0 | 1005.9 | 1021.6 | 1005.7 | 1020.9 |
| **Apr** | 1002.8 | 1002.8 | 1002.6 | 1017.2 | 1002.2 | 1017.4 | 1002.8 | 1017.3 | 1002.4 | 1016.6 |
| **May** | 1002.2 | 1011.9 | 1002.6 | 1012.2 | 1002.1 | 1012.1 | 1002.3 | 1012.3 | 1002.4 | 1011.6 |
| **June** | 996.3 | 1006.0 | 996.2 | 1006.7 | 996.3 | 1006.6 | 996.5 | 1006.6 | 995.9 | 1005.8 |
| **July** | 993.5 | 1003.1 | 993.4 | 1004.3 | 993.3 | 1003.8 | 993.6 | 1003.8 | 992.7 | 1003.2 |
| **Aug** | 997.0 | 1004.4 | 997.3 | 1004.9 | 997.4 | 1004.6 | 997.8 | 1004.7 | 996.3 | 1004.0 |
| **Sep** | 1000.3 | 1012.2 | 1000.8 | 1010.9 | 1000.4 | 1011.8 | 1000.8 | 1012.5 | 1000.1 | 1012.0 |
| **Oct** | 1006.3 | 1016.9 | ... | ... | 1006.8 | 1017.3 | 1007.0 | 1017.3 | 1005.6 | 1016.8 |
| **Nov** | 1006.5 | 1022.6 | ... | ... | 1006.0 | 1023.2 | 1006.0 | 1022.8 | 1006.4 | 1022.5 |
| **Dec** | 1014.8 | 1028.1 | ... | ... | 1014.0 | 1028.1 | 1014.7 | 1028.4 | 1014.3 | 1027.9 |
| **Total** | 1003.5 | 1016.1 | 1001.6 | 1014.4 | 1003.2 | 1016.5 | 1003.6 | 1016.4 | 1003.1 | 1015.8 |

…..: Not available.
Source: General Authority for Civil Aviation, Department of Meteorology.

## Map 3.3: Atmospheric Pressure by months and selected monitoring stations (HB) 2015



## *1.5 Wind Speed*

There are two types of wind in Qatar:

- Al Shamal wind: a northern to northwesterly wind that comes loaded with dirt and dust sometimes. It is a semi-permanent wind that blows throughout the year and helps to soften the atmosphere.
- Al Kous wind: a south-western wind that causes a significant rise in temperatures (hot waves).

### 1.5.1 Annual Average Wind Speed

The statistics in Table (3.7) indicate that the annual average wind speed recorded at weather monitoring stations were not much different from each other, except for Ruwais station, where the annual average wind speed was 9.1 knots in 2010, and reached 6.8 knots in 2015. When comparing between weather monitoring stations for maximum wind speed in 2015.

**Table 3.7: Annual average wind speed by selected weather monitoring stations 2010-2015**

| Station | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| **Mesaeed** | 7.4 | 8.4 | 7.8 | 7.9 | 7.3 | 7.5 |
| **Ruwais** | 9.1 | 9.6 | 8.2 | 6.9 | 6.2 | 6.8 |
| **Dukhan** | 8.3 | 9.5 | 8.5 | 8.6 | 8.1 | 8.4 |
| **Doha Airport** | 7.0 | 7.8 | 7.3 | 7.5 | 7.2 | 7.1 |
| **Al Karanah** | 7.5 | 8.1 | 7.2 | 6.9 | 6.4 | 6.8 |

Source: General Authority for Civil Aviation, Department of Meteorology.

### 1.5.2 Monthly Average Wind Speed

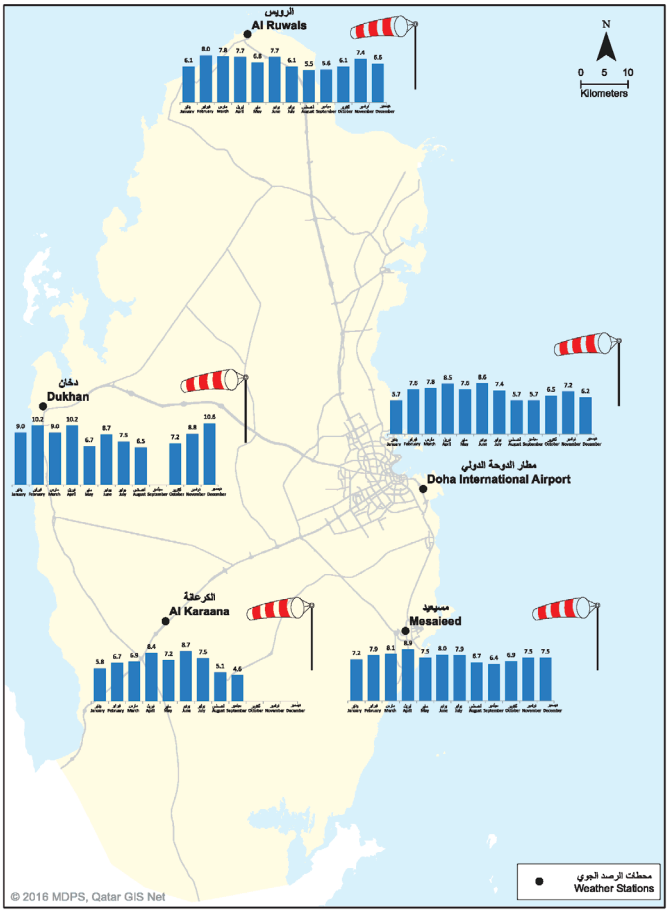
Table (3.8) shows that the highest value of monthly average wind speed was recorded at Dukhan station in December, 2015, reaching 10.6 knots, while the lowest value was at Al Karanah station in September 2015, reaching 4.6 knots.

**Table 3.8: Wind speed (knots) by months and selected weather monitoring stations 2015**

| Station | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Doha Airport | 5.7 | 7.6 | 7.8 | 8.5 | 7.8 | 8.6 | 7.4 | 5.7 | 5.7 | 6.5 | 7.2 | 6.2 | 7.1 |
| Al Karanah | 5.8 | 6.7 | 6.9 | 8.4 | 7.2 | 8.7 | 7.5 | 5.1 | 4.6 | ... | ... | ... | 6.8 |
| Dukhan | 9.0 | 10.2 | 9.0 | 10.2 | 6.7 | 8.7 | 7.5 | 6.5 | 6.3 | 7.2 | 8.8 | 10.6 | 8.4 |
| Ruwais | 6.1 | 8.0 | 7.8 | 7.7 | 6.8 | 7.7 | 6.1 | 5.5 | 5.6 | 6.1 | 7.4 | 6.6 | 6.8 |
| Mesaeed | 7.2 | 7.9 | 8.1 | 8.9 | 7.5 | 8.0 | 7.9 | 6.7 | 6.4 | 6.9 | 7.5 | 7.5 | 7.5 |

…..: Not available.
Source: General Authority for Civil Aviation, Department of Meteorology.

Map 3.4: Monthly average wind speed by months and selected weather monitoring stations (knot) 2015



## *1.6 Solar Radiation*

### 1.6.1 Average Total Monthly Solar Radiation Per Year

Qatar sky is cloud free on most days of the year, leading to long sunshine hours and large amounts of solar radiation falling on the surface, thus causing a significant rise in temperature and evaporation rates.

The data on the number of sunshine hours provide information about the number of hours of sunshine per year. We note that in 2015 the number of sunshine hours recorded at weather stations does not very much, except for Dukhan station, where sunshine hours were lower than that at its counterparts, reaching 237.7 hours per year, while the highest number of sunshine hours was recorded at Ruwais station, reaching 289.2 hours per year.

From the table and the map above on comparing the average total number of sunshine hours by stations during the years 2010 and 2015, we notice a decrease in the number of sunshine hours at both Dukhan and Doha International Airport stations, where the average total number of monthly sunshine hours at Dukhan station was 270.3 hours in 2010, while the average total number of monthly sunshine hours reached 237.3 hours in 2015. So is the case at Doha international Airport, where the average total number of monthly sunshine hours declined from 288.8 hours in 2010 to 281.5 hours in 2015, while it increased at Ruwais station between 2010 and 2015. However, the total number of monthly sunshine hours was constant at Mesaieed station in 2010 and 2015 (281 hour).

### 1.6.2 Daily Solar Radiation

The data on the average daily number of sunshine hours provide information about the length of the day and periods of clouds when sunshine intensity declines below a certain level. During summer months in 2015, the average length of daylight hours amounted to 10.9 hours and 10.8 at both Doha International Airport and Ruwais stations, while the lowest average length of daylight in the winter months in the same year was 7.7 , 7.6 hours at the Doha International Airport and Dukhan.

**Table 3.9: Average daily sunshine hours by months and selected weather monitoring stations in 2015**

| Station | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Doha Airport** | 8.1 | 8.0 | 7.2 | 10.2 | 10.4 | 12.2 | 11.3 | 11.2 | 9.8 | 8.9 | 7.9 | 6.9 | 9.3 |
| **Al Karanah** | 8.2 | 9.4 | 7.9 | 10.4 | 11.0 | 12.5 | 11.3 | 10.9 | 9.8 | 9.2 | ... | ... | 10.1 |
| **Dukhan** | 8.0 | 8.8 | 7.2 | 8.3 | 8.3 | 9.9 | 8.7 | 9.9 | 9.3 | 9.0 | 7.8 | 6.0 | 8.4 |
| **Ruwais** | 9.0 | 8.4 | 7.4 | 10.2 | 11.0 | 11.0 | 11.3 | 11.3 | 9.4 | 9.8 | 8.0 | 7.3 | 9.5 |
| **Mesaeed** | 8.2 | 9.2 | 7.4 | 9.7 | 9.6 | 11.4 | 10.5 | 10.3 | 9.5 | 9.7 | 8.1 | 7.5 | 9.3 |

…..: Not available.
Source: General Authority for Civil Aviation, Department of Meteorology.

### 1.6.3 Monthly Solar Radiation

The result of total monthly sunshine hours by months and selected weather stations in 2015, show the same order as compared to the table of average daily number of sunshine hours, where total daylight hours in the summer months (average summer months from May to September) reached 329.2 hours at Doha Airport and 330.3 hour at Ruwais stations in 2015, while the lowest average total daylight hours in the winter months of the same year was recorded at Dukhan and Doha Airport stations, reaching 247.0 hours and 237.8 hours respectively. In 2015, the average number of daylight hours in the summer months (May to September) was around 10.3 hours, while the average number of sunshine hours in the winter months (December to February) amounted to about 8 hours.

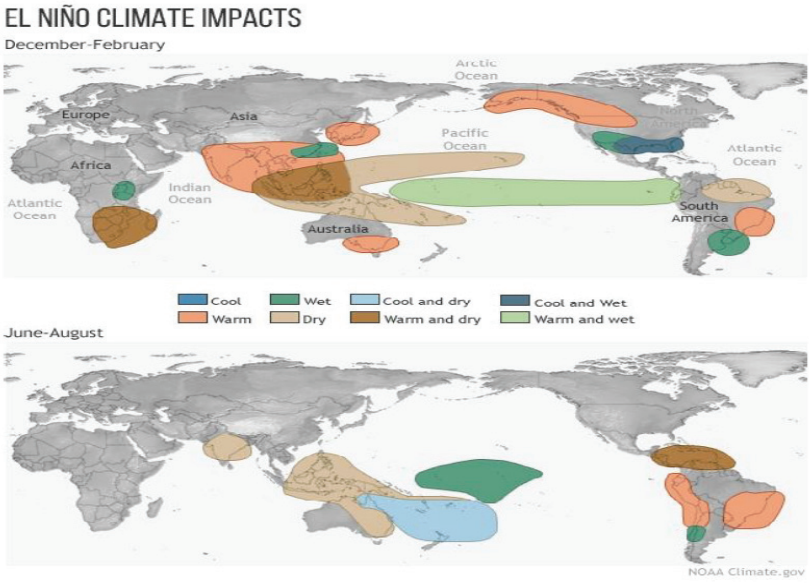
## *1.7 El Niño*

El Niño is a natural climatic phenomenon that significantly increases the surface water temperature, especially in the period between the end of the summer and autumn. This rising water temperature causes warm streams of water in the tropics situated in the equator between the west coast of South America, the east coast of Asia and the north-east of Australia which is surrounded by the Pacific Ocean. The water moves towards the east until it reaches the coasts of Peru and Ecuador in South America, causing severe climate and environmental changes around the world. It is worth noting that this phenomenon affects the ocean every 4 to 12 years .

### 1.7.1 El Niño Impact on Qatar and GCC Countries

El Niño is one of the key environmental indicators of climate sector. Map (3.5) "El Niño Climate Impacts on the World" shows that the State of Qatar and the GCC countries do not fall into the main area prone to impact during El Niño, but one cannot rule out some impacts on seasonal temperatures during the occurrence of El Niño. Nevertheless, there has been no proof of El Niño impact on the State of Qatar.

Map 3.5: El Niño climate impacts worldwide



## *1.8 Weather Phenomena*

There is a close link between human health and the weather phenomena, such as the temperature increase or decrease, dust, sand storm, haze, etc. These weather phenomena cause diseases of the respiratory tract, inflammation of the eyes, conjunctivitis, fever, cold ... etc.

- Haze: the phenomenon of low horizontal visibility caused by fine suspended particles in the air surface layer so that the horizontal visibility is 5 km or less.
- Sand and dust storms: the phenomenon of low visibility when active and strong winds blow sand and dust, leading to low horizontal visibility of 1 km or less.
- Fog: the phenomenon of water vapor condensation in the air layer in contact with the surface of the Earth, leading to low horizontal visibility of less than 1 km.

The number of haze days (horizontal visibility 5 km or less) that haze days go through seasonal periods drawing a wavy curve across months of the year, where most of haze days in 2015 occurred in July, reaching 18 days, then gradually declined to 4 days in November, and resumed rising again.

## 2. Biodiversity

The biodiversity indicator is linked to the accuracy of biological systems in the state. This indicator shows the level of environmental sustainability as well as to what extent the environmental policies are included within national plans. The box below shows the relationship between this indicator, the national policies and other regional and international commitments.

### Box (6): Biodiversity Relation to National Policies

The following programs/projects have emanated from the national strategy to enhance economic and technical efficiency.

**Program/Project:**
1. Create a national database on biodiversity.
Targets:
- Create a comprehensive electronic database on biodiversity.
- Expand protected areas that are actively managed.

Outcomes:
- Conservation, protection and management of nature and natural heritage in a sustainable manner.

**Program/Project:**
2. Sustainable fish resources.
Targets:
- Increase fish stock levels, enforce effective laws and provide possibilities for local aquaculture breeding farms.

Outcomes:
- Conservation of fish stock.

**Program/Project:**
3. Land use efficiency.
Targets:
- Achieve sustainable improvements in agricultural productivity.

Outcomes:
- Improve land use efficiency.

**Biodiversity relation to international frameworks, such as the Sustainable Development Goals 2030 (SDGs)**
- Goal (14), Indicator (2): Proportion of fish stocks within biologically sustainable levels.
- Goal (14), Indicator (7.1): Sustainable fisheries as a percentage of GDP in small island developing States, least developed countries and all countries
- Goal (14), Indicator (5.1): Coverage of protected areas in relation to marine areas
- Goal (15), Indicator (5.1): Red List Index.
- Goal (15), Indicator (7.1): Proportion of traded wildlife that was poached or illicitly trafficked.

## 2.1 Natural Reserves

The number of terrestrial and marine natural reserves stood at 14 in 2015, covering an area of 3,464.74 $km^2$ at an annual growth rate of 0.01% from 2010, due to the expansion in Wadi Sultana reserve, amounting to an area of 1.33 $km^2$. Thus, the number of reserves increased from 11 during the period (2011-2013) to 12 reserves in 2014. In terms of area of natural reserves, the results for 2015 show that the largest area was Khor Al Adaid, where the terrestrial area of this reserve reached 1,293.16 $km^2$, accounting for 11.1 % of total area of Qatar, while the marine area of this reserve reached 540.1 $km^2$.

**Table 3.10: Area of natural reserves in Qatar (terrestrial and marine) (km2) 2015**

| Natural Reserve | Terrestrial | | Marine | Total |
|---|---|---|---|---|
| | $Km^2$ | % | $Km^2$ | $Km^2$ |
| **Total area of Qatar with islands** | 11,627.04 | ... | ... | ... |
| **Al Eraiq** | 54.76 | 0.00 | 0.00 | 54.76 |
| **Al Thakhira** | 113.10 | 0.01 | 180.52 | 293.62 |
| **Khor Al Adaid** | 1293.16 | 0.11 | 539.81 | 1832.97 |
| **Al rafa** | 53.33 | 0.00 | 0.00 | 53.33 |
| **Um Al Amad** | 5.72 | 0.00 | 0.00 | 5.72 |
| **Um Qarn** | 24.71 | 0.00 | 0.00 | 24.71 |
| **Sunai** | 3.92 | 0.00 | 0.00 | 3.92 |
| **Al reem** | 1154.10 | 0.10 | 0.00 | 1154.10 |
| **Al Sheehaniya** | 0.79 | 0.00 | 0.00 | 0.79 |
| **Al Mashabiya** | 4.76 | 0.00 | 0.00 | 4.76 |
| **Al Wusail** | 34.73 | 0.00 | 0.00 | 34.73 |
| **Wadi Sultana** | 1.33 | 0.00 | 0.00 | 1.33 |
| **Total Reserves** | 2744.41 | 0.24 | 720.33 | 3464.74 |

Source: Private Engineering Office

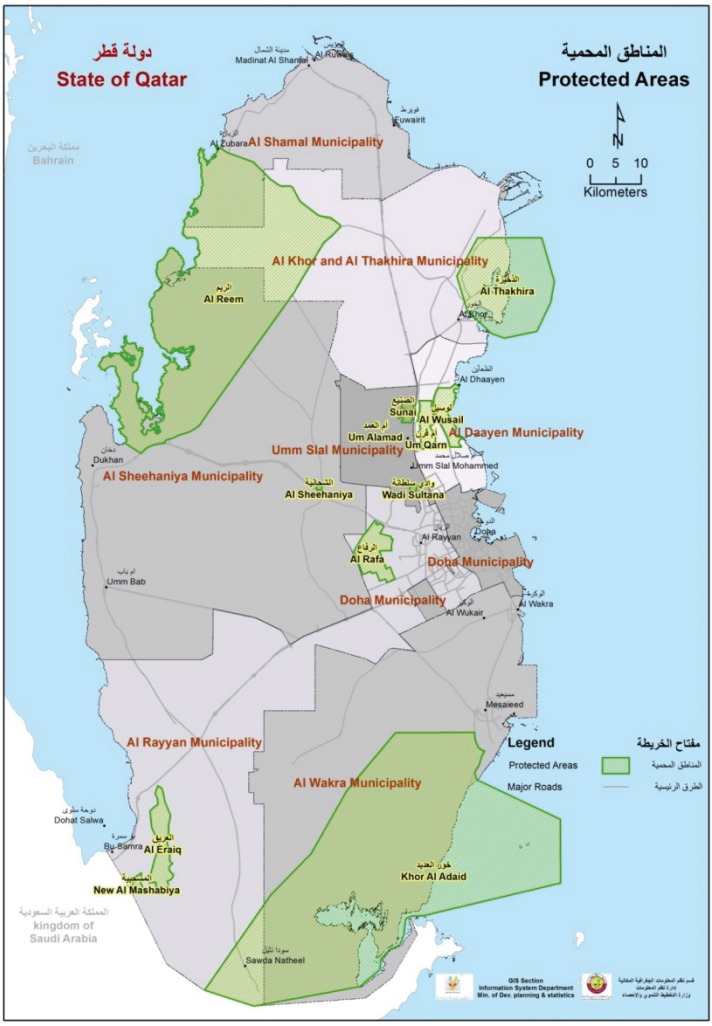
The statistics in the table below indicate a stability in the proportion of terrestrial reserves during the period (2011-2015) at 23.60% of total area of Qatar with islands, which is an achievement in itself, despite rapid population growth and urbanization experienced by the State recently.

## Table 3.11: Number and area of natural reserves (terrestrial and marine) in Qatar ($km^2$) 2010-2015

| Year | Number of Terrestrial Natural Reserves | Number of Marine Natural Reserves | Total Number of Terrestrial and Marine Natural Reserves | Area of Terrestrial Natural Reserves (km2) | Area of Marine Natural Reserves (km2) | Area of Terrestrial and Marine Natural Reserves (km2) | Percentage of Terrestrial Natural Reserves to Total Area |
|---|---|---|---|---|---|---|---|
| **2010** | 10 | 2 | 12 | 2,738.43 | 720.51 | 3,458.94 | %23.50 |
| **2011** | 11 | 2 | 13 | 2,770.90 | 720.51 | 3,491.41 | %23.78 |
| **2012** | 11 | 2 | 13 | 2,743.19 | 720.51 | 3,463.70 | %23.54 |
| **2013** | 11 | 2 | 13 | 2,742.97 | 720.51 | 3,463.48 | %23.54 |
| **2014** | 12 | 2 | 14 | 2,744.41 | 720.33 | 3,464.74 | %23.60 |
| **2015** | 12 | 2 | 14 | 2,744.41 | 720.33 | 3,464.74 | %23.60 |
| **Annual Growth Rate 2010 & 2015** | 4% | 0% | 3% | 0% | 0% | 0% | 0% |

Source: Private Engineering Office

Map 3.6: Distribution of Natural Reserves in Qatar 2015



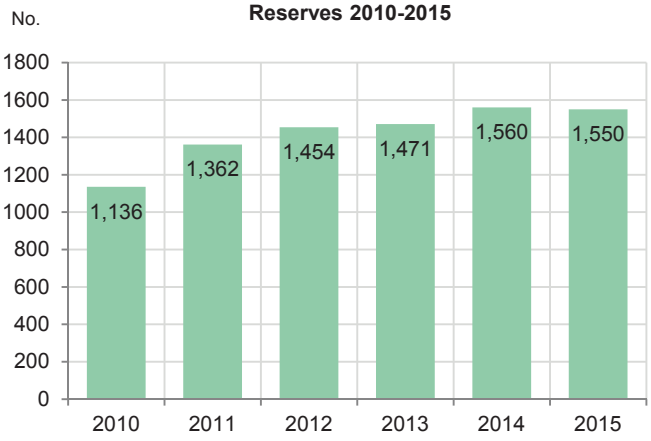

## 2.2 *Arabian Oryx in Natural Reserves*

The Arabian Oryx is classified as endangered species and is listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). It was extinct in the wild by the early 1970s when the last one of its kind was killed in the Empty Quarter desert at Oman Saudi border, but was saved in zoos and private reserves, and was reintroduced into the wild starting in 1980. However, the success of this process has been uneven([4]).

(4) Wikipedia the Free Encyclopedia: https://en.wikipedia.org/wiki/Arabian_oryx

Qatar has been giving special attention to protect and breed these animals in large fenced reserves where they can live and move around comfortably. Statistics indicate that the number of Arabian Oryx in terrestrial nature reserves has increased from 1,136 in 2010 to 1,550 in 2015, at an annual growth rate of 6%.

**Figure 3.5: Number of Arabian Oryx in Natural Reserves 2010-2015**




The Arabian Oryx is distributed in 11 terrestrial natural reserves, and the maximum number is in Al Mashabiya reserve which accommodates more than half the number of Arabian Oryx in Qatar in 2015 (i.e. 52.8% of total Arabian oryx in nature reserves).

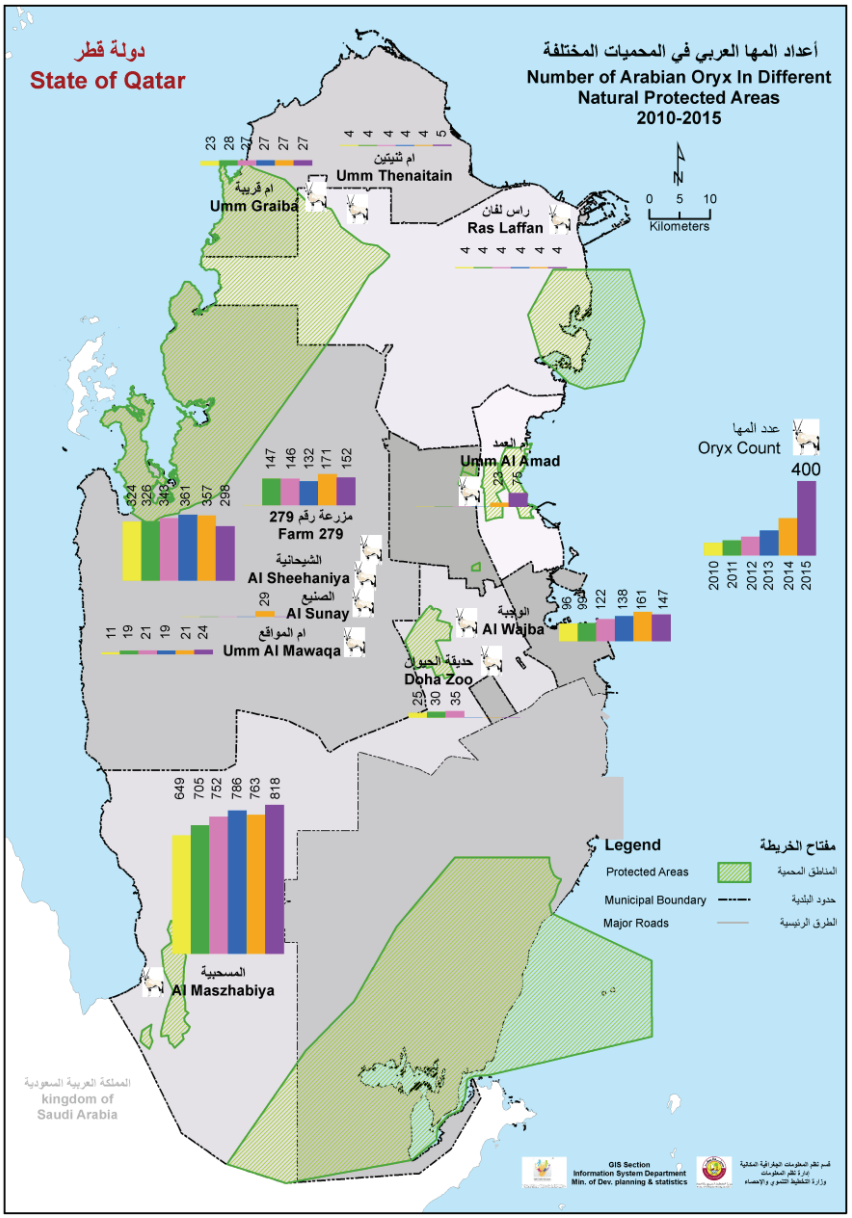
**Table 3.12: Total number of Arabian Oryx by terrestrial nature reserves (2010-2015)**

| Natural Reserve | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual Growth Rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|
| **Al Shihaniya** | 324 | 326 | 343 | 361 | 357 | 298 | -2% |
| **Al Mashabiya** | 649 | 705 | 752 | 786 | 763 | 818 | 5% |
| **Doha Zoo1** | 25 | 30 | 35 | 0 | 0 | 0 | -100% |
| **Al Wajba** | 96 | 99 | 122 | 138 | 161 | 147 | 9% |
| **Um Thanyatain** | 4 | 4 | 4 | 4 | 4 | 5 | 5% |
| **Um Qariba** | 23 | 28 | 27 | 27 | 27 | 27 | 3% |
| **Um Al Mawaqi** | 11 | 19 | 21 | 19 | 21 | 24 | 17% |
| **Ras Lafan** | 4 | 4 | 4 | 4 | 4 | 4 | 0% |
| **Al Sinai2** | 0 | 0 | 0 | 0 | 29 | 0 | 0% |
| **Farm No. (279)3** | ... | 147 | 146 | 132 | 171 | 152 | 0% |
| **Um Al Amad** | .. . | … | … | … | 23 | 75 | 0% |
| **Total** | 1,136 | 1,362 | 1,454 | 1,471 | 1,560 | 1,550 | 6% |

Closed for maintenance since 2012. (2)Added on 2014 (3) Added on 2011.
… : Not available
Source Private Engineering Office

In terms of the distribution of the Arabian Oryx by natural reserves, despite the small area of Al Mashabyiah reserve, it accommodates more than half the number of Arabian Oryx. On the contrary, the number of Arabian Oryx is less in Um Qariba, Um Thanyatain and Ras Laffan reserves, despite their vast area. Whereas, there is no Arabian Oryx in Khor Al Adaid or Al Thakhira reserves.

Map 3.7: Number of Arabian Oryx in different natural reserves 2010-2015



## 2.3 Number of Endangered Species by Type

In 2013, the number of terrestrial flora and fauna amounted to 1,101 species, while the number of marine flora and fauna amounted to 967 marine species. The statistics in the table below indicate the following:

- There are two species of extinct terrestrial flora and fauna (2 species of terrestrial birds), 6 endangered species (5 species of terrestrial birds and one species of terrestrial mammals), as well as 171 rare and threatened species (170 terrestrial invertebrates and one terrestrial mammal).
- With regards to marine flora and fauna, 5 endangered species have been recorded (4 marine mammals and one marine bird) and 20 rare and threatened species (11 marine mammals and 9 marine birds).

**Table 3.13: Number of registered species by type (terrestrial and marine) and risk of extinction 2010 and 2013**

| Type of Species | Years | Extinct | Endangered | Rare/Threatened | Total Number of Registered Species |
|---|---|---|---|---|---|
| Terrestrial flora and fauna | 2010 | 2 | 6 | 171 | 1,101 |
| | 2013 | 2 | 6 | 171 | 1,101 |
| Marine flora and fauna | 2010 | 0 | 5 | 20 | 947 |
| | 2013 | 0 | 5 | 20 | 967 |

Source: Ministry of Municipality and Environment

The statistics in Table (3.14) below indicate that there are 2 species of extinct terrestrial birds and 5 species of endangered birds out of 322 species of terrestrial birds registered in Qatar.

There is one endangered species of terrestrial mammal and one rare/threatened species of terrestrial mammal out of 8 species of terrestrial mammals in 2013.

**Table 3.14: Number of terrestrial flora and fauna by species and risk of extinction 2010 and 2013**

| Terrestrial Species | T. Flora | Fungus | T. Mammals | Amphibians | T. Reptiles | T. Birds | T. Invertebrates | Terrestrial Species | T. Flora |
|---|---|---|---|---|---|---|---|---|---|
| 2010 | Extinct | 0 | 0 | 0 | 0 | 0 | 2 | 0 | **2** |
| | Endangered | 0 | 0 | 1 | 0 | 0 | 5 | 0 | **6** |
| | Threatened/Rare | 0 | 0 | 1 | 0 | 0 | 0 | 170 | **171** |
| | Total | **371** | **142** | **8** | **1** | **29** | **322** | **228** | **1101** |
| 2013 | Extinct | 0 | 0 | 0 | 0 | 0 | 2 | 0 | **2** |
| | Endangered | 0 | 0 | 1 | 0 | 0 | 5 | 0 | **6** |
| | Threatened/Rare | 0 | 0 | 1 | 0 | 0 | 0 | 170 | **171** |
| | Total | **422** | **142** | **8** | **1** | **29** | **322** | **228** | **1152** |

Source: Ministry of Municipality and Environment

The statistics in Table (3.15) below indicate that there were 4 species of endangered marine mammals and 11 species of rare and threatened mammals out of 15 species of marine mammals in 2015. However, there was only one species of endangered marine birds, and 9 species of rare and threatened birds out of 15 species of marine birds. It should be noted that the statistics of 2010 and 2013 indicate that in 2010 the number of reptiles which were endangered, rare and threatened with extinction reached 10 reptiles, whereas in 2013, thanks to the State's efforts in protecting the environment and preserving biodiversity, there was no longer a threat of extinction.

**Table 3.15: Number of marine flora and fauna by species and threat of extinction 2010 and 2013**

| Marine Species | Marine Flora | Fish | Marine Mammals | Marine Invertebrates | Marine Birds | Marine Reptiles | Marine Species | Marine Flora |
|---|---|---|---|---|---|---|---|---|
| 2010 | Extinct | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| | Endangered | 0 | 0 | 4 | 0 | 0 | 1 | **5** |
| | Threatened/Rare | 0 | 0 | 11 | 0 | 0 | 9 | **20** |
| | Total | **402** | **136** | **15** | **379** | **15** | **20** | **967** |
| 2013 | Extinct | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| | Endangered | 0 | 0 | 4 | 0 | 1 | 0 | **5** |
| | Threatened/Rare | 0 | 0 | 11 | 0 | 9 | 0 | **20** |
| | Total | **402** | **57** | **15** | **379** | **15** | **20** | **888** |

Source: Ministry of Municipality and Environment

## 2.4 Fish Stocks

The Environment statistics aim to provide statistical data on aquatic resources, including fish stocks in view of its importance for the development of sustainable fisheries industry procedures. The National Development Strategy of the State of Qatar 2011-2016 stressed on the need to have sustainable fish resources and to monitor poaching which represents an environmental and food supply threat, in order to preserve and increase fish stocks, enforce effective laws and provide support for local aquaculture breeding farms.

The proportion of fish stocks within a biologically sustainable level is also linked to Goal 14 / Target 14 / Section 4 (14.4.1) of SDGs 2030 on the protection and exploitation of marine resources in a sustainable way to achieve sustainable development. The proportion of fish stocks within safe biological limits is defined as the proportion of fish stocks or species that are being exploited within the maximum sustainable biological productivity.

It is worth mentioning that the United Nations Convention on the Law of the Sea (UNCLOS III) entered into force in 1994, and was ratified by the State of Qatar on the ninth of December 2002[5]. The convention also includes sustainability indicators relating to fishing (see UN Statistics Division 2013):

- Yield-related indicators: catches.
- Fishing capacity-related indicators: Fishing effort and intensity.

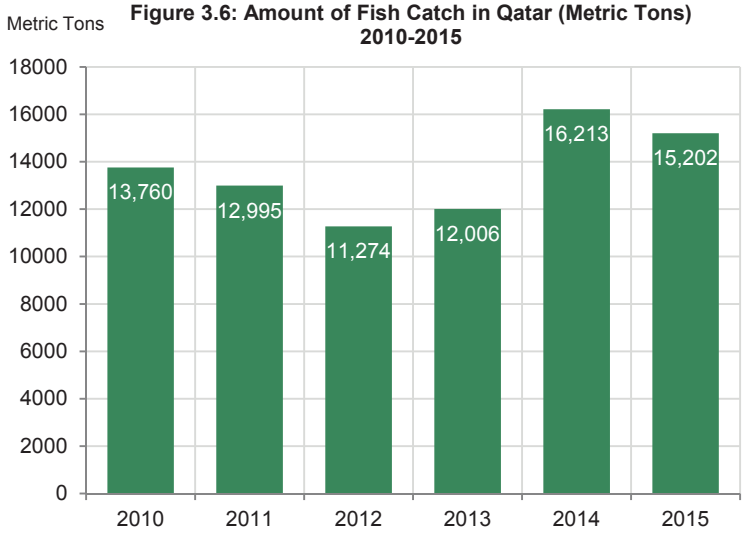
The statistics indicate that the total amount of fish catch increased from 13,760 metric tons in 2010 to 15,202 metric tons in 2015 and fishing reached its peak rate in 2014 at an amount of 16,213 metric tons.

(5) UNCLOS
http://treaties.un.org/pages/ViewDetailsIII.aspx?&src=TREATY&mtdsg_no=XXI~6&chapter=21&Temp=mtdsg3&lang=en

**Table 3.16: Amount of fish catch and number of fishing vessels and fishermen 2010-2015**

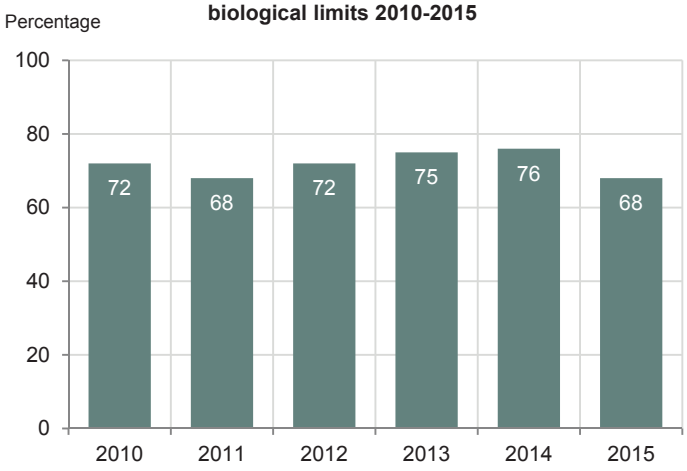
| Year | Fish Catch (metric tons) | No. of Fishing Vessels | No. of Fishermen | Average amount of fish catch per fishing vessels (metric tons per vessel) | Average amount of fish catch per fisherman (metric tons per vessel) | Average number of fishermen per fishing vessels (fisherman per fishing vessel) |
|---|---|---|---|---|---|---|
| 2010 | 13,760.40 | 495 | 3,300 | 28 | 4 | 7 |
| 2011 | 12,995.00 | 497 | 3,641 | 26 | 4 | 7 |
| 2012 | 11,273.50 | 499 | 3,573 | 23 | 3 | 7 |
| 2013 | 12,005.90 | 499 | 2,264 | 24 | 5 | 5 |
| 2014 | 16,213.00 | 464 | 2,900 | 35 | 6 | 6 |
| 2015 | 15,202.00 | 475 | 3,011 | 32 | 5 | 6 |
| Annual Growth Rate 2010 & 2015 | 2% | -1% | -2% | 3% | 5% | -3% |

**Figure 3.6: Amount of Fish Catch in Qatar (Metric Tons) 2010-2015**




As for the percentage of fish stocks within safe biological limits, it is defined as the percentage of fish stocks or fish species exploited within their level of maximum biological productivity. The graph indicates that the percentage of fish stocks within safe biological limits has declined from 72% in 2010 to 68% in 2015

**Figure 3.7: Percentage of fish stocks within safe biological limits 2010-2015**



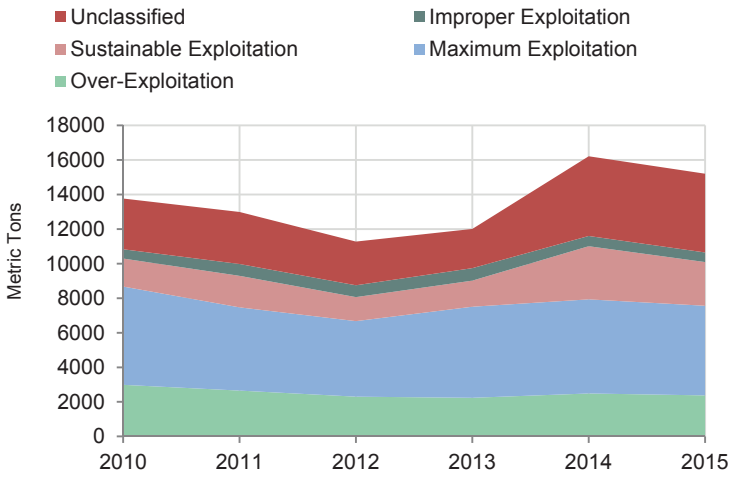

The results in Table (3.17) “fishing by exploitation rate” indicate that the current rate of over-exploitation of stocks of "kingfish, greyish grunt and painted sweetlip fish" exceeds the maximum exploitation rate, indicating that their stocks are exposed to overfishing pressure, reaching 2,379 tons of fish. On the other hand, the rate of fish catch in maximum fishing exploitation category increased to 5,181 tons. This includes toothless trevally, grouper and emperor fish. As for the longnose cavalla, jish, red snapper, blackspot snapper, gold lined seabream and rabbit fish, they are within sustainable exploitation rate, amounting to 2,536 metric tons in 2015.

**Table 3.17: Fishing by exploitation rate (tons) 2010-2015**

| Exploitation Type | Over-Exploitation | Maximum Exploitation | Sustainable Exploitation | Improper Exploitation | Unclassified | Total |
|---|---|---|---|---|---|---|
| 2010 | 2,982 | 5,697 | 1,617 | 535 | 2,937 | 13,769 |
| 2011 | 2,650 | 4,819 | 1,827 | 688 | 3,010 | 12,995 |
| 2012 | 2,299 | 4,370 | 1,395 | 685 | 2,526 | 11,274 |
| 2013 | 2,235 | 5,270 | 1,513 | 721 | 2,267 | 12,006 |
| 2014 | 2,488 | 5,449 | 3,071 | 593 | 4,612 | 16,213 |
| 2015 | 2,379 | 5,181 | 2,536 | 556 | 4,550 | 15,202 |
| Annual Growth Rate 2010 & 2015 | -4% | -2% | 9% | 1% | 9% | 2% |

Overexploitation: kingfish, greyish grunt and painted sweetlip fish.
Maximum exploitation: toothless trevally, grouper and emperor fish.
Sustainable exploitation: longnose cavalla, jish, red snapper, blackspot snapper, goldlined seabream and rabbit fish.
Improper exploitation: humped fish.
Unclassified: including fish and crustaceans such as: tuna fish, dhalaa, jidd, barracuda, sakan, flat needlefish, Karari, greater omberjack, mullet, goldsilk seabream, twobar seabream, badhah, fin bream, threadfin bream, qeen, lobster, crab, khathaq and others.
Source: Ministry of Municipality and Environment

**Figure 3.8: Fish catch by exploitation rate (metric tons) 2010-2015**

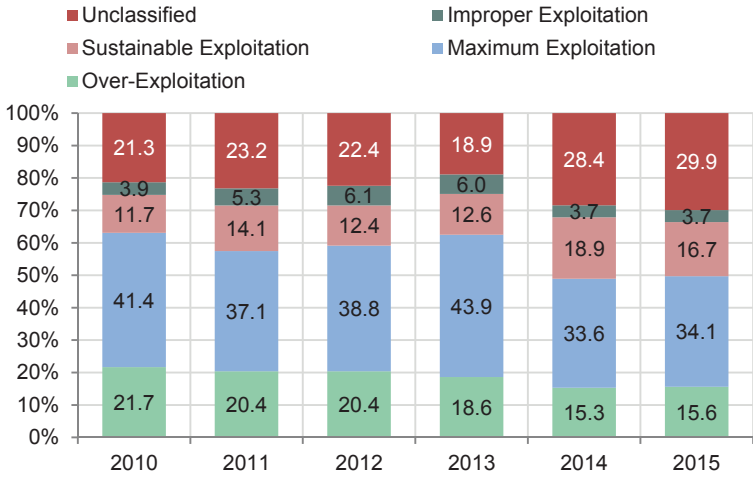



The results of Table (3.18) "distribution of fish catch by exploitation rate 2010-2015" show that the highest percentage of over-exploitation during the period (2010-2015) was in 2010, reaching 21.7%, while the lowest was in 2014 and 2015, reaching 15.3% and 15.6% respectively. Logically, it is obvious that these years have the highest rate of sustainable exploitation, reaching 18.9% and 16.7% respectively, while the lowest rate of sustainable exploitation was in 2010, scoring 11.7% of fish with maximum exploitation.

**Table 3.18: Percentage distribution of fishing by exploitation rate 2010-2015**

| Year | Over-Exploitation | Maximum Exploitation | Sustainable Exploitation | Improper Exploitation | Unclassified | Total |
|---|---|---|---|---|---|---|
| **2010** | 21.7 | 41.4 | 11.7 | 3.9 | 21.3 | 100.0 |
| **2011** | 20.4 | 37.1 | 14.1 | 5.3 | 23.2 | 100.0 |
| **2012** | 20.4 | 38.8 | 12.4 | 6.1 | 22.4 | 100.0 |
| **2013** | 18.6 | 43.9 | 12.6 | 6.0 | 18.9 | 100.0 |
| **2014** | 15.3 | 33.6 | 18.9 | 3.7 | 28.4 | 100.0 |
| **2015** | 15.6 | 34.1 | 16.7 | 3.7 | 29.9 | 100.0 |

**Figure 3.9: Percentage distribution of fishing by exploitation rate 2010-2015**




The previous table (3.16) shows an increase in fishing quota per vessel during the period 2010-2015 from 28 tons per vessel in 2010 to 32 tons per vessel in 2015. This increase reflects the evolution of fishing equipment and methods. The statistics indicate a decline in the number of fishing vessels during the same period from 495 in 2010 to 475 in 2015.

Following the same pattern, the statistics in Figure (3.10) below indicate a decline in the number of fishermen from 3,300 to 3,011 fishermen during the period 2010-2015, while fish catch increased from 4 tons per fisherman in 2010 to 5 tons per fisherman in 2015.

**Figure 3.10: Fishing Effort 2010-2015**

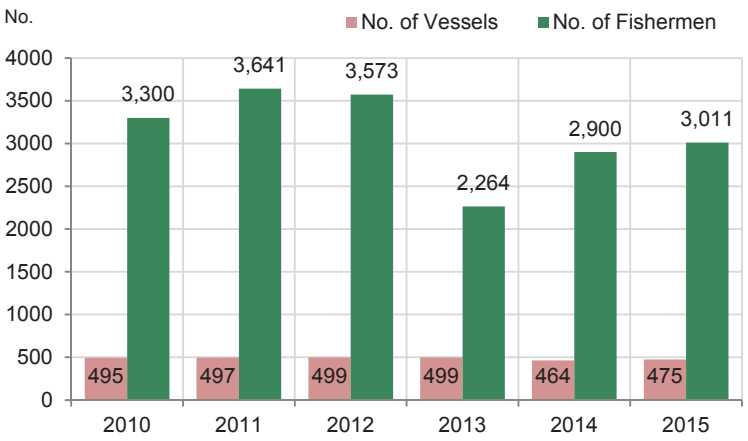
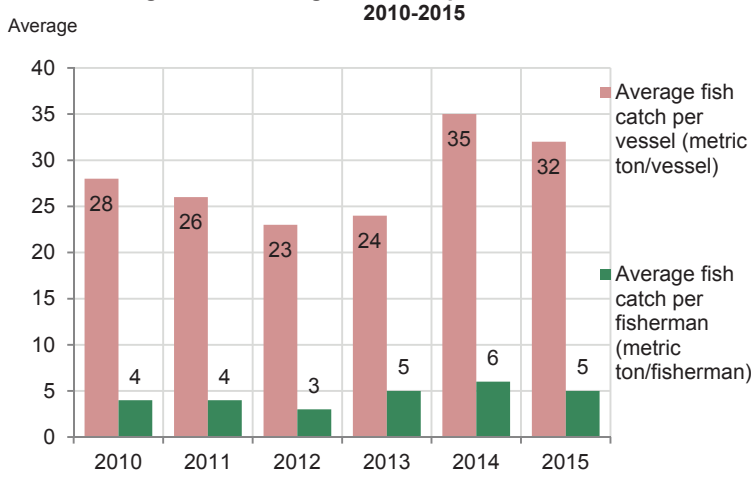


Figure (3.11) clearly shows that fishing rate reached its peak in 2014 at an average of 35 metric tons per vessel and 6 metric tons per fisherman.

**Figure 3.11: Average fish catch per vessel and fisherman 2010-2015**




The statistics on artisanal fishing vessels in Qatar indicate that they reached 475 vessels in 2015, at an annual growth rate of -1% from 2010. It should be noted that Al Khor City scored the highest share of the number of artisanal fishing vessels, amounting to 234 vessels (i.e. 49.3% of total artisanal fishing vessels) at an annual growth rate of 6% from 2010, while the annual growth rate of the number of artisanal fishing vessels declined in Doha, Al Shamal and Al Wakra to -7% , -6% and -5% respectively.

**Table 3.19: Number of artisanal fishing vessels by coastal areas 2010-2015**

| Year | Doha | Al Khor | Al Wakra | Al Shamal | Total |
|---|---|---|---|---|---|
| **2010** | 24 | 174 | 237 | 60 | 495 |
| **2011** | 25 | 175 | 239 | 58 | 497 |
| **2012** | 22 | 196 | 227 | 54 | 499 |
| **2013** | 22 | 196 | 226 | 55 | 499 |
| **2014** | 19 | 214 | 191 | 40 | 464 |
| **2015** | 17 | 234 | 179 | 45 | 475 |
| **Annual Growth Rate 2010 & 2015** | -7% | 6% | -5% | -6% | -1% |

According to statistics in Table (3.20), the number of sailors in artisanal fishing amounted to 3,011 sailors in 2015, at an annual growth rate of -2% from 2010. The statistics indicate an increase in the number of sailors in Al Khor City, amounting to 1,408 sailors, at an annual growth rate of 4% from 2010, while the number of sailors dropped in both Doha and Al Wakra at a rate of -11% and -6% respectively from 2010.

**Table 3.20: Number of sailors in artisanal fishing by coastal areas 2010-2015**

| Year | Doha | Al Khor | Al Wakra | Al Shamal | Total |
|---|---|---|---|---|---|
| **2010** | 187 | 1,164 | 1,630 | 319 | 3,300 |
| **2011** | 163 | 1,285 | 1,774 | 419 | 3,641 |
| **2012** | 137 | 1,390 | 1,628 | 418 | 3,573 |
| **2013** | 81 | 868 | 1,022 | 293 | 2,264 |
| **2014** | 95 | 1,367 | 1,148 | 290 | 2,900 |
| **2015** | 104 | 1,408 | 1,186 | 313 | 3,011 |
| **Annual Growth Rate 2010 & 2015** | -11% | 4% | -6% | 0% | -2% |

## *2.5 Fish Farming*

At present, there are development projects to increase fish stocks, and achieve self-sufficiency in fish. These projects fall under the National Development Strategy 2011-2016 for natural resources, which includes two core programs; first program aims to improve fisheries production technique, which is based primarily on setting up a comprehensive national plan for the development of fish farming in Qatar to meet the growing market needs of fish, which cannot be met by fish production from fisheries, as it already reached its maximum limit of exploitation. The second program reviews and strengthens legislations relating to the exploitation of fishery resources, and is based primarily on the actions and measures that will protect and develop aquatic resources and exploit them in proper ways in order to increase fish stocks, especially in terms of preventing overfishing and reducing practices that threaten the marine environment and thus fisheries in the state. According to statistics in Table (3.21), the amount of the Nile tilapia fish farming reached 10 metric tons in 2015, at an annual growth rate of -23% from 2010. It is of importance to encourage private sector investment in the field of fish farming and aquaculture, which provides strategic stocks to meet Qatar population needs of food in the wake of the shrinking surplus of fish production in recent years and the significant increase in the population as a result of the major economic and urban boom witnessed in Qatar.

**Table 3.21: Fish farming (tons) 2010-2015**

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual Growth Rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|
| Fish Farming* | 36 | 36 | 56 | 56 | 56 | 10 | -23% |

* Nile tilapia fish

Source: Ministry of Municipality and Environment

## 2.6 *Volume and Value of Exports and Imports of Fish, Crustaceans, Molluscs and Others*

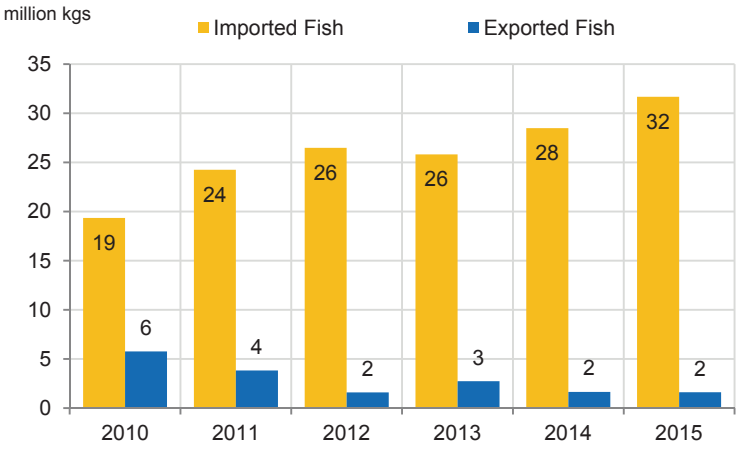
The statistics in Table (3.22) and Figure (3.12) indicate an increase in the amount of fish and crustaceans imported to Qatar, reaching nearly 32 million kg worth of QR 280 million, while the amount of exported fish reached approximately 2 million kg worth of QR 6 million. The annual growth rate for the amount of exported fish decreased -22% from the year 2010.

**Table 3.22: Volume and value of Qatar exports and imports of fish, crustaceans, molluscs and other aquatic invertebrates (kg, QR) 2010-2015**

| Year | Imports | | Exports | |
|---|---|---|---|---|
| | Volume of Imported Fish (kg) | Value of Imported Fish (QR) | | Volume of Imported Fish (kg) |
| **2010** | 19,346,293 | 171,089,962 | 5,761,203 | 19,222,905 |
| **2011** | 24,254,398 | 199,325,100 | 3,828,809 | 10,794,022 |
| **2012** | 26,476,624 | 209,423,493 | 1,596,238 | 4,708,762 |
| **2013** | 25,819,252 | 197,168,366 | 2,742,425 | 9,177,574 |
| **2014** | 28,484,450 | 235,587,753 | 1,641,466 | 5,444,664 |
| **2015** | 31,678,827 | 279,612,419 | 1,613,719 | 6,233,648 |
| **Annual Growth Rate 2010 & 2015** | 10% | 10% | -22% | -20% |

Source: MDPS, Statistical Abstract, Chapter of Foreign Trade Statistics

**Figure 3.12: Volume of exports and imports of fish, crustaceans, molluscs and other aquatic invertebrates (million kgs) 2010-2015**



## 3. Uses and types of Water resources

Water is at the core of the national and international priorities, mainly in the countries suffering from natural water resources shortage, e.g. the State of Qatar. This attention is manifested in the relationship of water to Qatar's National Development Strategy as shown in the box below. As the subject of water is significant, it is not limited to the below-stated programs and goals, but it intersects with other multiple projects, goals and outputs of this strategy.

### Box (7): Water Relationship to National Policies

The following programs/projects resulted from Qatar's NDS within the promotion plans of economic and technical efficiency, and environment protection for the coming generations:

**Programs/projects:**
1- Water use efficiency
Targets:
- Reduce desalinated water leakage from distribution networks to 10% in proportion to the current ratio estimated at (30%-35%).
- Make sure that water meters gauge the entire consumed water.
- Support installation of modern devices used at homes, and other techniques to conserve water.
- Develop a procedures plan to conserve water within the agricultural development plans.
- Expand wastewater treatment networks to increase recycled water use
- Prepare a feasibility study to establish systems to collect and treat industrial wastewater.
Outcomes:
Promote water use efficiency and conservation

**Program/project:**
2- National Law of Water
Targets:
Enact a holistic national law of water to establish an integrated system of quality requirements, discharge regulations, conservation incentives of water, to replace the current list of regulations and provisions.
Outcomes:
- Pure water and sustainable use.

**Program/project:**
3- Groundwater table management plan in urban areas
Targets:
- Monitor groundwater, preserve aquifers, and remove excess water at the groundwater table in Doha.

Program/project:
4- Environment/water data base
Targets:
- Establishment of electronic data base that offers search possibility.
Outcomes:
- Improved environmental management and cooperation at regional and international level.

Water relationship to international frameworks, e.g. SDGs 2030.

- Goal 6, indicator 3.1: percentage of safely treated wastewater
- Goal 6, indicator 4.1: change in water use efficiency over a period of time
- Goal 6, indicator 4.2: Pressure ratio over water consumption: pure water abstraction vis-à-vis the available pure water sources.
- Goal 6, indicator 5.1: degree of implementation of water resources integrated management.

Water relationship to international frameworks, e.g. international competitiveness indicators

- water resources- total per capita internal renewable water in cubic meters
- waste water treatment plants % of population served
- water consumption intensity - water withdrawal in million cubic meters

Qatar is among the world's least countries with natural fresh water resources, i.e. annual production rate, out of groundwater resources, does not exceed 65.5 million m3, out of rainfall (long-term annual average 1990-2011), amounted to 63.3 million m3, and out of annual inflows of groundwater from Saudi Arabia, reached 2.2 million m3. In the Table (3.23) below, it is clear that the annual water abstraction safe level should not surpass 47.5 million $m^3$, after calculation of the outflow of water from aquifers into the sea, and deep saline reservoirs which amounts to 18 million m3 annually. Therefore, the annual renewable safe abstraction of water (water balance) represents 47.5 million $m^3$.

**Table 3.23: Natural Water Balance of Aquifers in Qatar (Average Annual Values During 1990-2014)**

| Balance item | Million $m^3$ /year | Source |
|---|---|---|
| **Recharge of aquifers from rainfall** | 63.3 | Ministry of Environment (long-term annual average 1990-2011) |
| **Inflows from Saudi Arabia** | 2.2 | Agriculture and Water Research Management (2006) (long-term annual average) |

| Balance item | Million $m^3$ /year | Source |
|---|---|---|
| **Total water renewable resources (groundwater abstraction safe level) = (1) + (2)** | 65.5 | |
| **Flowing out groundwater reservoirs into the sea and deep saline reservoirs** | 18.0 | Ministry of Environment (long-term annual average 1990-2011) |
| **Annual average of water balance (net and safe renewed yield on an annual basis)[1] = (3) – (4)** | 47.5 | |

[1]: Does not include return flow from irrigation.
Source: Ministry of Municipality and Environment

In reality, however, groundwater abstraction ratio is higher five times than the safe yield (250 million m3/year) which leads to groundwater depletion, and leakage of seawater and deep saline groundwater into aquifers, and therefore leading to salinity increase and concentration of dissolved solids. In addition, high salinity and dissolved solids concentrations could turn water unsafe for drinking and inappropriate for agricultural purposes.

Shortage of water resources, harsh climate conditions, polluted groundwater, inappropriate agricultural patterns, improper agricultural practices, over grazing, and lack of socio-economic development lead altogether to water deterioration and desertification. In turn, the problem of desertification will aggravate due to the accumulation of salinity year after year, causing soil deterioration and making it infertile which is the main reason for abandoned farms. Such deteriorated soil exist in farms in vicinity of coasts owing to the impact of high saline irrigation water, or on inland farms where solid soil is exposed to salinity.

## *3.1 Groundwater Quality and Quantity*

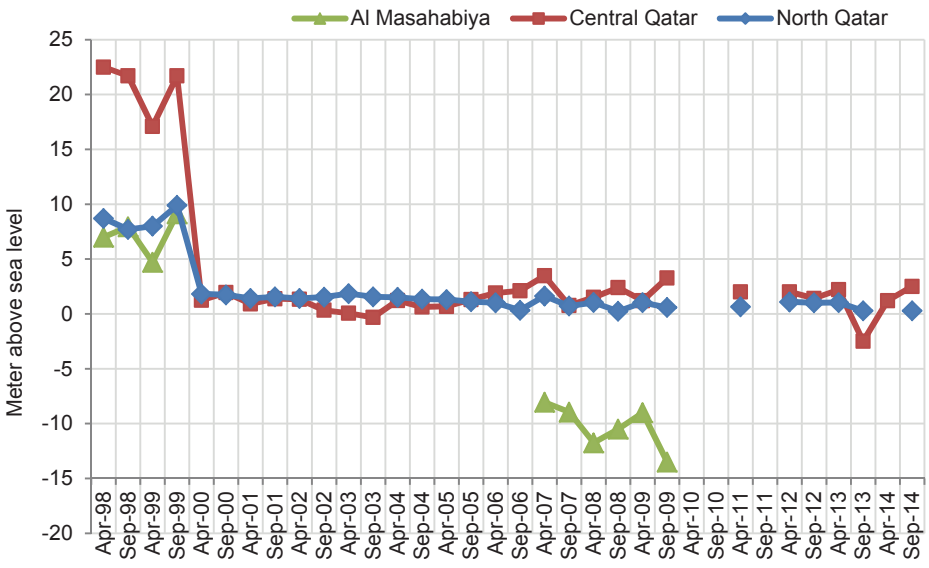
Groundwater depletion can be monitored through the changes at groundwater levels and quality of water. Overexploitation of groundwater may lead to leakage of seawater and deep saline groundwater into aquifers, and therefore leading to salinity increase and concentration of dissolved solids. In addition, high salinity and dissolved solids concentrations could turn water unsafe for drinking and inappropriate for agricultural purposes. To clarify the groundwater deterioration level, we will tackle groundwater levels and salinity (electrical resistivity), and total dissolved solids in the main aquifers in Qatar.

Groundwater quality is based on the Ministry of Municipality and Environment's groundwater network control program which has featured 3,585 samples taken from 295 wells since April 1998. It is noteworthy that some monitored groundwater wells includes saline groundwater owing to its proximity to the sea or to its depth. To evaluate the trend of aquifers, the arithmetic mean (50%) was used instead of the

mean value, taking into account that the impact of the single extreme values might be ignored (as the very highly monitoring results in a single well among several aquifers).

There is a reliable time series for some aquifers levels from April 1998 up to September 2014. Figure 3.13 below shows the average aquifers levels in the north and center of Qatar, and Al-Mashabiya. Thus, we find that aquifers levels in north Qatar showed a declining trend (0.3 meter above sea level in 2014). As for the aquifers levels located in Central Qatar, they change over time, and no important trend manifests in the long run (mean value). During the short period of observation over Al-Mashabiya, it is clear that the trend is descending. The monitored mean level reached 14 meters below sea level in Al-Mashabiya area.

**Figure 3.13: Aquifers Levels in North Qatar , Central Qatar and Al-Mashabiya (average of entire available observations) 1998-2014**




Source: Kahramaa, and computations of the Ministry of Development Planning and Statistics

It is worth mentioning that most groundwater abstractions ( 230 million $m^3$ in 2014) are directed for agricultural purposes; i.e. 85% of total abstracted groundwater), whereas the remaining proportion is allocated for domestic use by 9.7 million $m^3$, and municipal uses by 10.4 million $m^3$, and industrial uses by 0.2 million $m^3$.

**Table 3.24: Quantity of Abstracted Groundwater by Sector of Use (million $m^3$/year) 2010-2014**

| Year | Total abstracted groundwater | Uses of groundwater | | | |
|---|---|---|---|---|---|
| | | farms | municipal | domestic | industrial |
| **2010** | 248.2 | 228.9 | 9.3 | 9.8 | 0.2 |
| **2011** | 249.6 | 229.5 | 10.2 | 9.7 | 0.2 |
| **2012** | 250.3 | 230.1 | 10.4 | 9.6 | 0.2 |
| **2013** | 250.1 | 230 | 10.2 | 9.7 | 0.2 |
| **2014** | 250.3 | 230 | 10.4 | 9.7 | 0.2 |

Source: Ministry of Municipality and Environment

Table (3.25), and Figures (3.14), and (3.15) present average salinity measured by electrical conductivity (dS/m), and dissolved solids (PPM) for four aquifers in Al-Mashabiya, South Qatar, Central Qatar, and North Qatar.

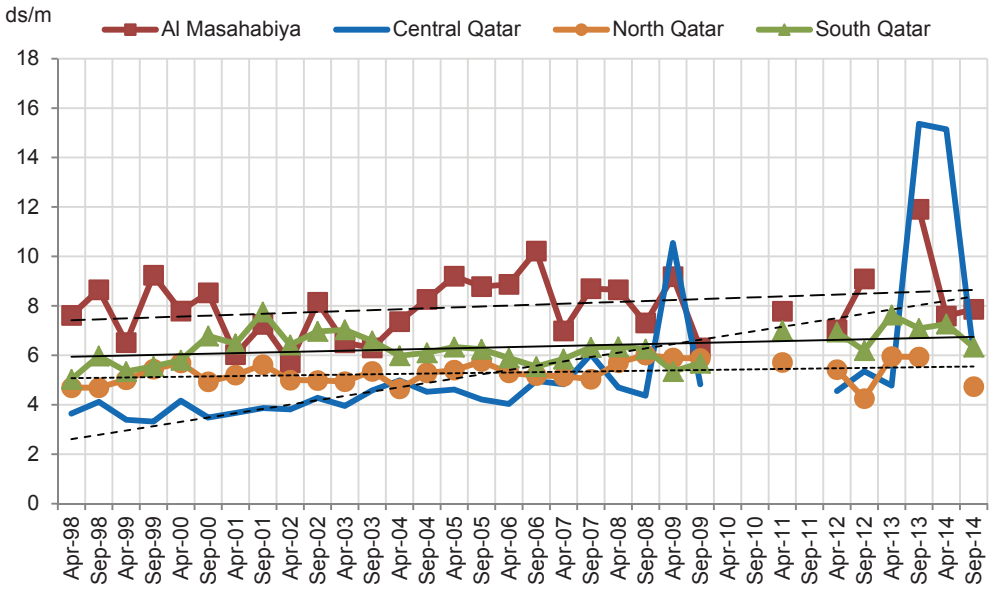
It is clear that during the period 1998-2014, the four aquifers have been categorized as water of medium salinity that is increasing in salinity. According to the available data, the dissolved solids are slightly decreasing in Al-Mashabiya, North Qatar, and South Qatar.

**Table 3.25: Salinity in Aquifers Monitored from 1998 to 2014: Maximum and Minimum Mean Values (Average of All Aquifers and Monitoring Period), and Their Trends**

| Aquifer | Electrical Conductivity (dS/m) | | Total Dissolved solids (Part per million) | | FOA classification | Salinity tendency (1998 –2014 ) |
|---|---|---|---|---|---|---|
| | Minimum | Maximum | Minimum | Maximum | | |
| **Al-Mashabiya** | 5.70 | 11.91 | 3,780 | 7,368 | Highly saline | Increasing |
| **North Qatar** | 4.25 | 6.01 | 2,550 | 3610 | Highly saline | Not found |
| **Central Qatar** | 3.32 | 15.36 | 2420 | 9210 | Moderately saline | Increasing |
| **South Qatar** | 5.03 | 7.75 | 3,205 | 4580 | Moderately saline | Not found |

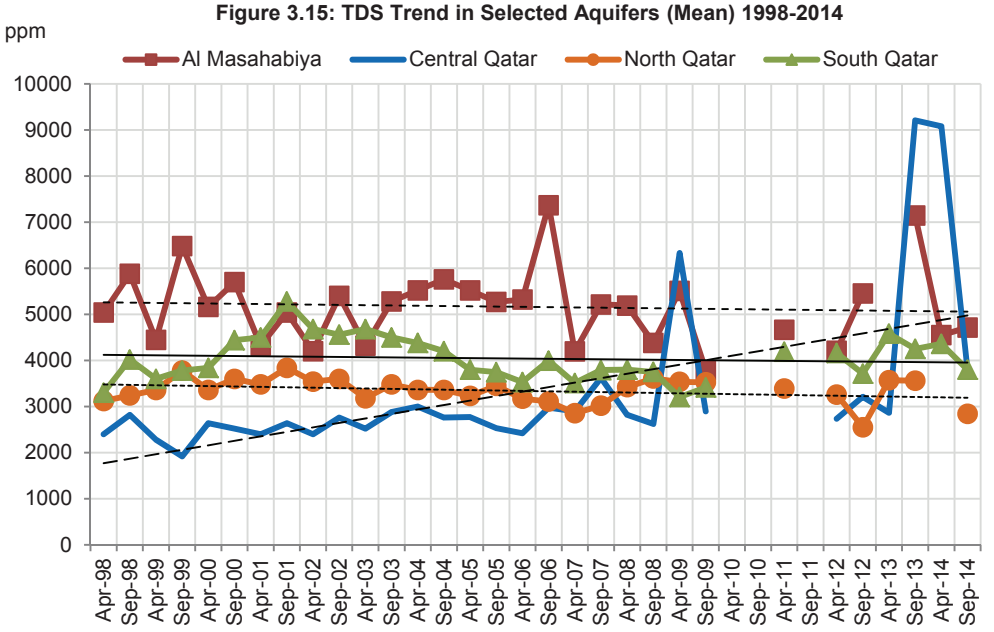
Source: Kahramaa, and computations of the Ministry of Development Planning and Statistics

**Figure 3.14: Trend of Electrical Conductivity in Selected Aquifers (Mean) 1998-2014**




Source: Kahramaa, and computations of the Ministry of Development Planning and Statistics

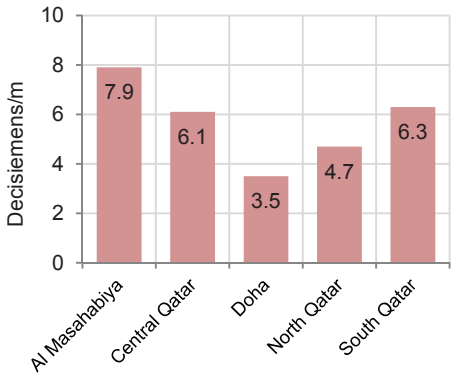
**Figure 3.15: TDS Trend in Selected Aquifers (Mean) 1998-2014**




Source: Kahramaa, and computations of the Ministry of Development Planning and Statistics

As for the aquifers with highest salinity (average of electrical resistivity and dissolved solids) in 2014, they are Wadi Al-Ariq, Al-Mashabiya, and South Qatar.

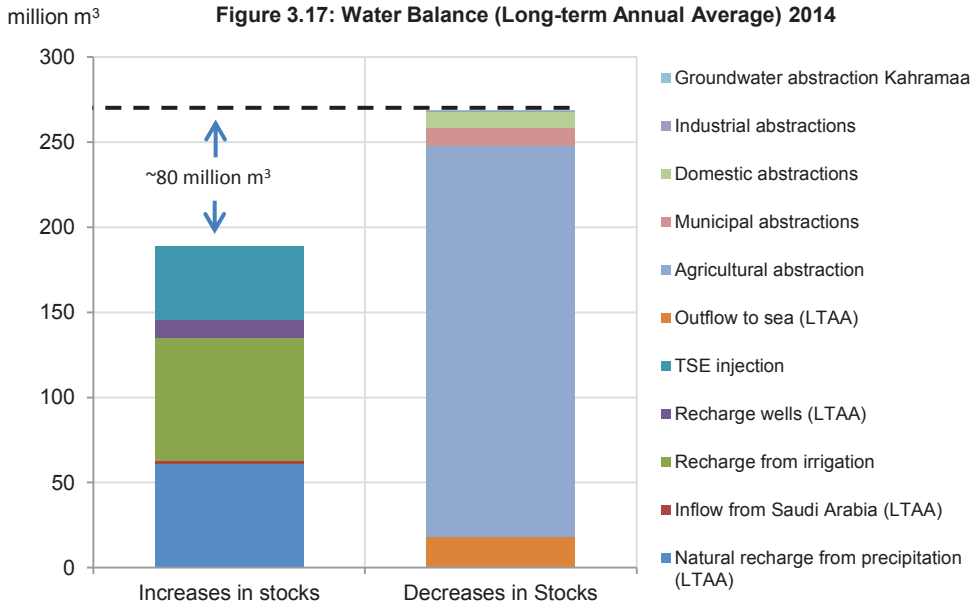
**Figure 3.16: Electrical Conductivity in September 2014 (Average of Entire Wells per Each Aquifer)**




Source: Kahramaa, and MDPS computations

Figure (3.17) shows the latest annual average of groundwater balance (long-term annual average of natural water balance and figures of the artificial balance items of 2014). The long-term renewable natural water resources are estimated at around 63 million m3 per year (60.8 million m3 of recharge due to rainfall, and 2.2 million m3 flow into Qatar from Saudi Arabia on an annual basis). The mentioned natural recharge sources account for 33% of annual additions to aquifers. As for the remaining proportion of annual additions to aquifers, it accounts for 67% due to artificial recharge processes (recharge of wells), and injection of treated wastewater and irrigation return flow.

**Figure 3.17: Water Balance (Long-term Annual Average) 2014**



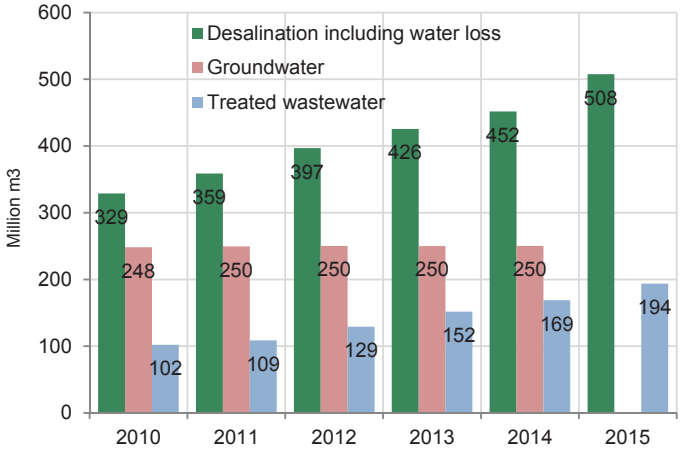

Source: Ministry of Environment, Kahramaa, and Ashghal – Data compiled by the Ministry of Development Planning and Statistics

## *3.2 Water Abstraction and Uses*

Figure (3.18) shows the water available for use, and highlights the increasing demand for water owing to the population and economic growth in Qatar. To meet this growing demand, desalination and groundwater abstraction are overused beyond their safe yield. Thus, total water available for use (including desalinated water, groundwater, and reused wastewater) amounted to 855 Mm3. Desalinated water production (after loss) constituted 59.3% (508 Mm3/year), groundwater 29.3% (250 Mm3), and treated wastewater 11.4% (97 Mm3) of total water available for use in 2015.

The current groundwater abstraction ratios are five times equal to natural renewable water, and over 90% of it is used in agriculture.

**Figure 3.18: Water Available for Use (Excluding Water Loss) by Type of Water (Mm3) 2010-2015**




*: Ground water for the year 2015 is not available from data source

Comparing the desalinated water production during the period 2010-2015, the findings showed a 9% rise in the annual growth rate of desalinated water production in 2015 vis-à-vis 2010. Water services subscribers increased by 32% during the same period, while real water loss slumped form 9.2% in 2010 to 4.3% in 2015, which is aligned with Qatar's NDS goals aiming to reduce water loss by -23% compared to 2010.

**Table 3.26: Water Production and Real Loss (Mm3 – %) 2010-2015**

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Growth rate of 2010 and 2015 | Annual growth rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|---|
| **Desalinated water ($Mm^3$) including loss** | 362.1 | 391.7 | 426.1 | 453.2 | 482.2 | 533 | 47% | 8% |
| **Desalinated water ($Mm^3$) not including loss** | 328.8 | 359.6 | 397.0 | 425.6 | 451.8 | 507.5 | 54% | 9% |
| **Real loss ($Mm^3$)** | 33.3 | 32.1 | 29.1 | 27.6 | 30.4 | 25.5 | -23% | -5% |
| **Real loss (%)** | 9.20% | 8.20% | 6.80% | 6.10% | 6.30% | 4.27% | -54% | 14% |
| **Number of desalinated water consumers (water service subscribers)** | 210,475 | 225,027 | 241,204 | 242,552 | 262,018 | 277,433 | 32% | 6% |

Source: Kahramaa

The water available for use is composed of desalinated sea water, treated wastewater, and abstracted groundwater. In 2014, total water available for use amounted to 937.68 Mm3; it consists of desalinated sea water (54.09%), abstracted groundwater (26.69%), and treated wastewater (18.02%).

In 2014, over 10% of available water was not used because it was lost during transport (3.25%), or discharged into lagoons (3.32%), or discharged into the sea (0.04%), or injected into deep aquifers (4.64%).

Since 2008, total water withdrawn from aquifers remained unchanged at 250 Mm3 annually, i.e. over five times higher than theoretical maximum of sustainable abstraction. 92% of abstracted groundwater is used for agriculture purposes, whereas 8% is allocated for domestic, municipal, and industrial uses.

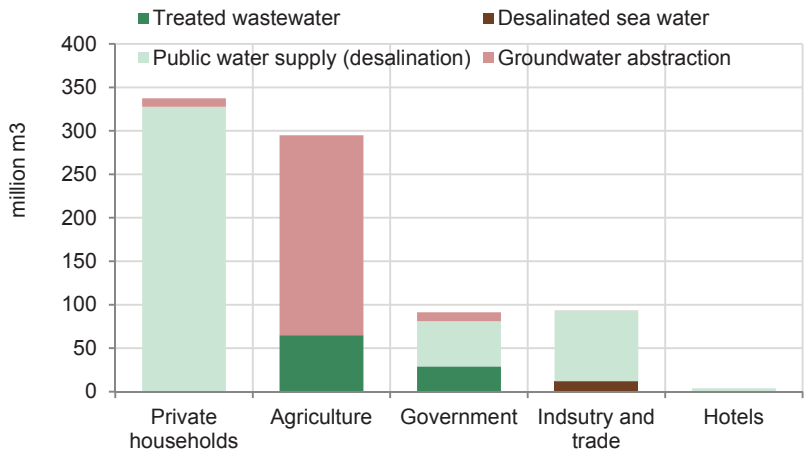
In 2014, around 50% of treated wastewater was directly reused for agriculture and green spaces, while about 20.03% was discharged into lagoons and sea. Thus, it becomes unavailable for use again. In addition, 29.54% was injected into deep aquifers.

Assumptions and Clarifications on Statistics:

a) Industrial uses of water: data are provided by QP HSE Sustainable Development Industry Reporting initiative (published by the Ministry of Energy and Industry in 2013), in which 30 companies were listed (91% of companies). The report is assumed to feature the uses mentioned by Kahramaa, and provided for industries, whereas the production of the desalinated water took place in the industrial cities, and the value of 2011 was used as imputation for 2012 and 2014.
b) Commercial uses include supplies from Kahramaa to the large industrial complexes.
c) No data are available for cost-free water uses. However, they were computed by the Ministry of Development Planning and Statistics as follows: water production minus water loss, and minus cost-free water uses. Therefore, a benefit from the cost-free water uses in private homes was considered.

In 2014, total water used in Qatar (after deducting water loss quantities from the public network estimated at 32.9 $Mm^3$) amounted to 851.5 $Mm^3$. The largest share is directed for private domestic uses at 337.4 $Mm^3$, followed by government uses 91.3 $Mm^3$, and commercial activities 71.16 $Mm^3$, then came industries at last at 10.3 $Mm^3$. As for the key sources of water used in agriculture, they are as follows: groundwater (229.5 $Mm^3$ (92%)), and treated wastewater (64.29 $Mm^3$ (15%)). Please refer to Figure (3.19) below.

**Figure 3.19: Water Use by Sector and Water Source Excluding Water Loss during Transport (Mm3) 2014**




Source: Ministry of Municipality and Environment, and compilation was conducted by the MDPS

Table (3.27) presents full balance of water uses in Qatar in 2014. The Table indicates that a large proportion of water appropriate for use is still not exploited, e.g. treated wastewater which is discharged into lagoons and sea (31.47%), or quantities of drinking water loss during transport (3.25%).

**Table 3.27: Water Use Balance 2014**

| Water use balance 2014 (mm3) | Water available for use | Water uses and lost quantities | Remarks |
|---|---|---|---|
| **Total desalinated water (public and industrial)** | 493.20 | | Public and industrial water desalination |
| **Abstracted groundwater** | 252.10 | | Include ground water abstraction from, agricultural, Domestics, Municipal and Industries wells |
| **Treated wastewater** | 168.93 | | Effluent of treated wastewater from UWWTPs |
| **Total water available for use** | 11.30 | | Amount of Total water before water loss |
| **Water loss during transport** | 925.53 | | Amount of Total Water loss |
| **Treated wastewater discharged into lagoons** | | 11.30 | |
| **Treated wastewater discharged into sea** | | 30.48 | Total losses |
| **Treated wastewater injected into aquifers** | | 31.11 | |
| **Water used in agriculture** | | 0.36 | Wells and treated |

| Water use balance 2014 (mm3) | Water available for use | Water uses and lost quantities | Remarks |
|---|---|---|---|
| | | | wastewater |
| **Water used in industry** | | 43.47 | It includes industrial cities (data taken from Sustainable Development Industry Report) |
| **Water used in commercial activities** | | 294.92 | It includes general water supplies for large industrial complexes and hotels |
| **Water used in private homes** | | 85.45 | |
| **Government use** | | 347.59 | General water supplies, sewage water for irrigation purposes and green spaces |
| **Total water use and water loss** | | 80.85 | |
| **Total desalinated water (public and industrial)** | | 925.53 | Public and industrial water desalination |

Source: Ministry of Municipality and Environment, Kahramaa and Ashghal. Data compilation conducted by the MDPS

**Figure 3.20: Water Available for Use (%) 2014**

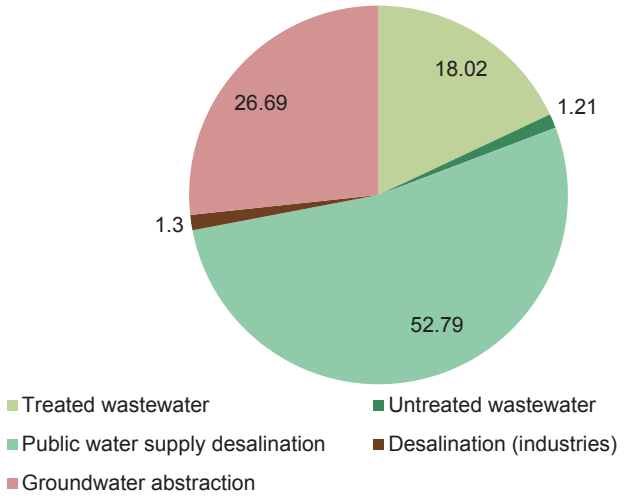


**Figure 3.21: Water Uses and Lost Quantities (%) 2014**

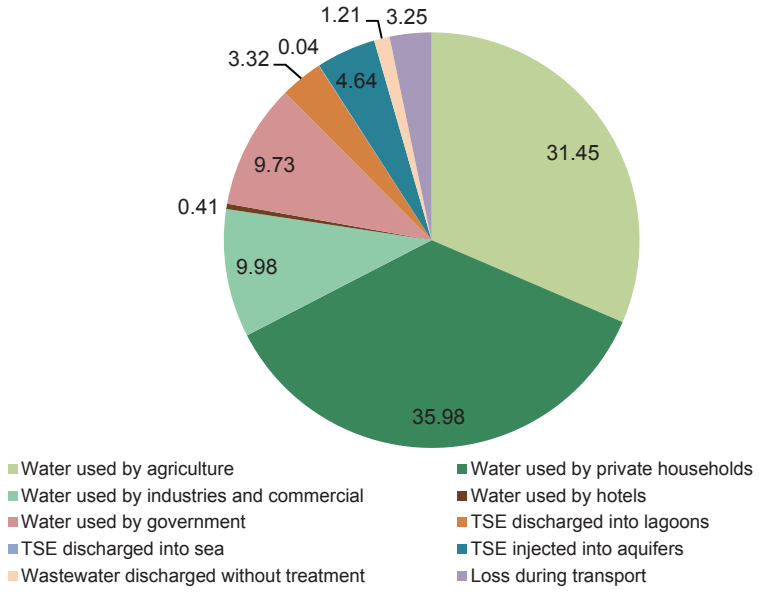
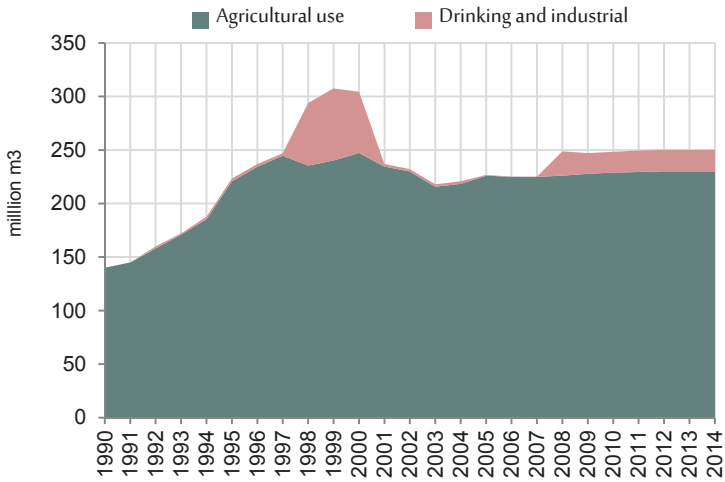



Figure (3.22) shows the abstracted groundwater from 1990 to 2014. Abstraction reached its peak in 1999 when 307 $Mm^3$ were withdrawn, which equaled six times the water balance (long-term annual average)[6]. Since 2008, groundwater abstraction ratio recorded 250 $Mm^3$, i.e. equaling five times the water balance (long-term annual average). Along those years, agriculture took the largest share of abstracted water (92% in 2014).

(6) Natural recharge of aquifers, inflows from Saudi Arabia minus water flowing out into sea and deep aquifers (47.5 Mm3 per year) (long-term annual average).

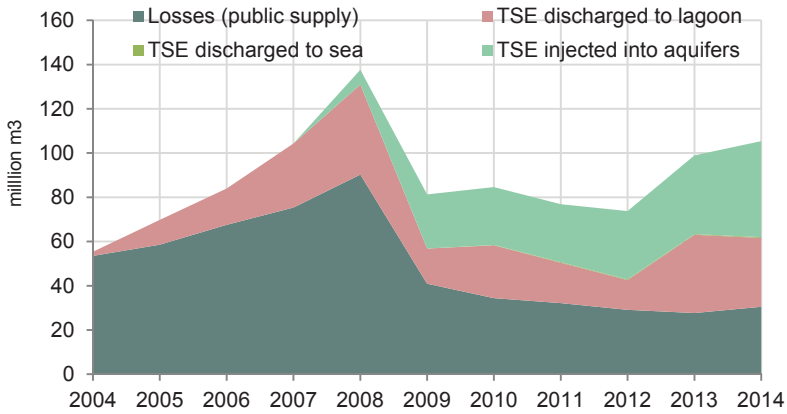
**Figure 3.22: Groundwater Abstraction 1990-2014**




Source: Ministry of Environment and Kahramaa

Figure (3.23) indicates the quantities of water los and unused treated wastewater during the period (2004-2014). The Figure shows that water loss caused by public water supplies network, and treated wastewater discharged into lagoons, reached their peak in 2008, and decreased remarkably again since 2009. Treated wastewater which is discharged into the sea is considered unimportant.

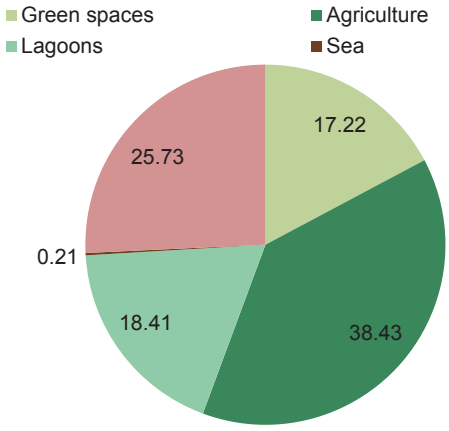
**Figure 3.23: Unused Water and Injection of Treated Wastewater 2004-2014**




Source: Kahramaa and Ashghal. Compilation conducted by the MDPS

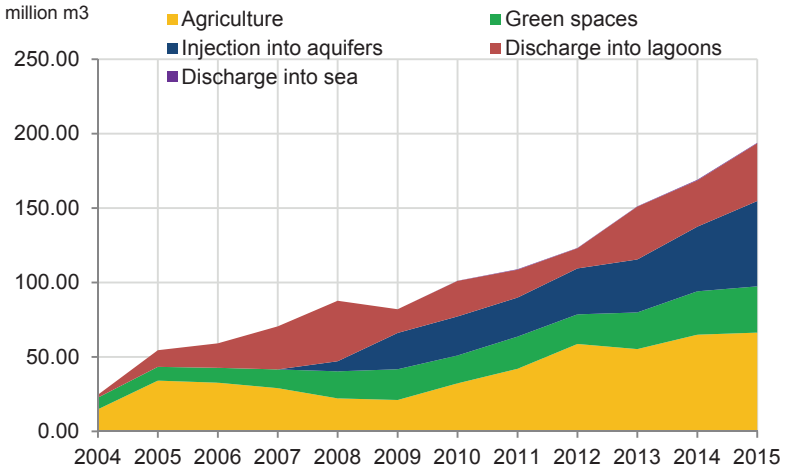
Given the increasing design capacity of wastewater treatment since 2004, treated wastewater production quadrupled from 24.54 Mm3 in 2004 to 260.32 Mm3 in 2014. Agriculture had the largest share of treated wastewater use (38.43% in 2014), followed by government use to irrigate green spaces (17.22%). In 2014, around 18.41% of treated wastewater was discharged into lagoons, and therefore became unavailable for use. In addition, 25.73% of treated wastewater was injected into deep aquifers, and less than 1% was discharged into the sea. Figures (3.24) and (3.25).

**Figure 3.24: Use and Discharge of Treated Wastewater 2014**




Source: Public Works Authority (Ashghal)

**Figure 3.25: Use and Discharge of Treated Wastewater 2004-2014**



## 3.3 *Fresh water quality*

Water quality is monitored by the Ministry of Public Health which is considered as a regulatory body providing Qatar's population with its needs within the national and international health standards. Table (3.28) shows quality of drinking water according to bacteriological tests of drinking water samples by municipality and source in 2015.

**Table 3.28: Results of Bacteriological Tests of Drinking Water Samples by Municipality and Source 2015**

| Municipality | Drinking Water Source | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Public Sources | | | Private Sources | | | Other Sources (farms) | | |
| | Total number of samples | Number of Non conformable samples | Percentage of Non conformable samples | Total number of samples | Number of Non conformable samples | Percentage of Non conformable samples | Total number of samples | Number of Non conformable samples | Percentage Non conformable samples |
| Doha and Al-Rayyan | 169 | 0 | 0.0 | 2,919 | 79 | 2.7 | 0.0 | 0 | 0.0 |
| Al-Wakra | 121 | 0 | 0.0 | 232 | 6 | 2.6 | 0.0 | 0 | 0.0 |
| Umm Salal | 34 | 0 | 0.0 | 47 | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Al-Khor | 24 | 0 | 0.0 | 42 | 1 | 2.4 | 0.0 | 0 | 0.0 |
| Al-Shamal | 45 | 0 | 0.0 | 24 | 0 | 0.0 | 22.0 | 8 | 36.4 |
| Al-Daayen | 0 | 0 | 0.0 | 6 | 0 | 0.0 | 0.0 | 0 | 0.0 |
| Al-Shihaniya | 60 | 0 | 0.0 | 41 | 1 | 2.4 | 0.0 | 0 | 0.0 |
| Total | 408 | 0 | 0.0 | 3,311 | 87 | 2.6 | 22.0 | 8 | 3.64 |

Public sources: public government agencies

Private sources: Kahramaa services in private sources

Source: Ministry of Public Health

*These data are samples from farm well water, which is untreated water and is highly saline, and thus it does not meet standards.

**Table 3.29: Results of Bacteriological Tests of Drinking Water Samples by Month and Source 2015**

| Month | Drinking Water Source | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Public Sources | | | Public Sources | | | Public Sources | | |
| | Total number of samples | Number of Non conformable samples | Percentage of Non conformable samples | Total number of samples | Number of Non conformable samples | Percentage of Non conformable samples | Total number of samples | Number of Non conformable samples | Percentage Non conformable samples |
| January | 32 | 0 | 0.0 | 161 | 2 | 1.2 | 0 | 0 | 0.0 |
| February | 29 | 0 | 0.0 | 381 | 3 | 0.8 | 5 | 0 | 0.0 |
| March | 50 | 0 | 0.0 | 337 | 8 | 2.4 | 1 | 0 | 0.0 |
| April | 44 | 0 | 0.0 | 275 | 6 | 2.2 | 10 | 1 | 10.0 |
| May | 47 | 0 | 0.0 | 268 | 4 | 1.5 | 5 | 0 | 0.0 |
| June | 39 | 0 | 0.0 | 240 | 3 | 1.3 | 1 | 0 | 0.0 |
| July | 25 | 0 | 0.0 | 105 | 4 | 3.8 | 9 | 3 | 33.0 |
| August | 31 | 0 | 0.0 | 195 | 11 | 5.6 | 7 | 4 | 57.0 |

| Month | Drinking Water Source | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Public Sources | | | Public Sources | | | Public Sources | | |
| | Total number of samples | Number of Non conformable samples | Percentage of Non conformable samples | Total number of samples | Number of Non conformable samples | Percentage of Non conformable samples | Total number of samples | Number of Non conformable samples | Percentage Non conformable samples |
| **September** | 37 | 0 | 0.0 | 383 | 8 | 2.0 | 0 | 0 | 0.0 |
| **October** | 39 | 0 | 0.0 | 239 | 8 | 3.3 | 0 | 0 | 0.0 |
| **November** | 46 | 0 | 0.0 | 199 | 8 | 4.0 | 2 | 0 | 0.0 |
| **December** | 34 | 0 | 0.0 | 122 | 6 | 4.9 | 1 | 0 | 0.0 |
| **Total** | 453 | 0 | 0.0 | 2,905 | 71 | 2.4 | 41 | 8 | 19.5 |

Public sources: public government agencies
Private sources: Kahramaa services in private sources
Source: Ministry of Public Health
*These data are samples from farm well water, which is untreated water and is highly saline, and thus it does not meet standards.

The Figure (3.26) on the results of bacteriological tests of drinking water samples by source during the period (2010-2015) indicates that no Non conformable samples were recorded in public sources that were taken from government agencies, and if found during some years, they did not exceed 0.7%. In most years, Non conformable samples equaled 0.00 as in 2015. Non conformable samples, taken from private sources which were taken from the end of Kahramaa network (service provider), attained 2.6% in 2015, while the average of this percentage during the period (2010-2015) accounted for 1.9%. In addition, the results of drinking water tests during the same period indicate the majority of Non conformable samples were from other sources which mainly include farms. In general, the proportion of incompatible drinking water samples from all sources decreased from 2.8% in 2010 to 2.5% in 2015.

**Figure 3.26: Percentage of Incompatible Samples in Bacteriological Tests of Drinking Water Samples by Source 2010-2015**

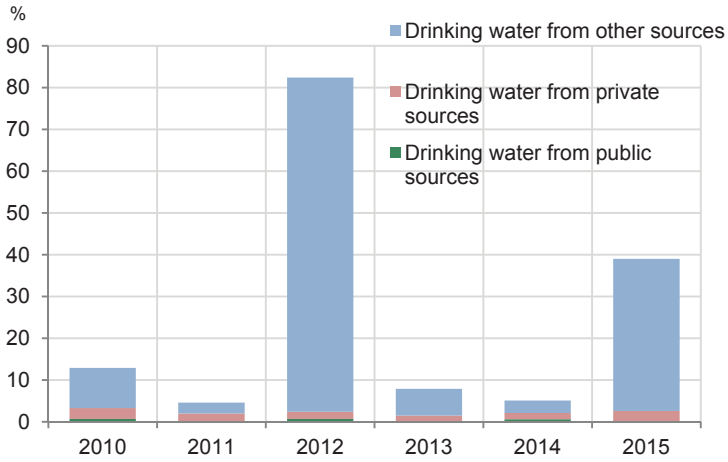
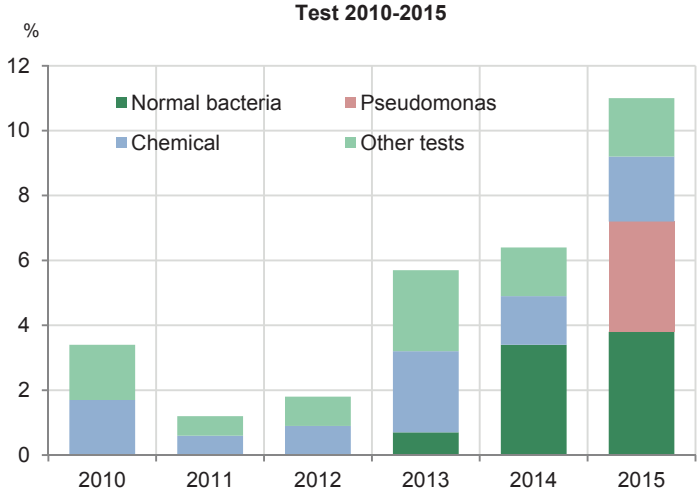


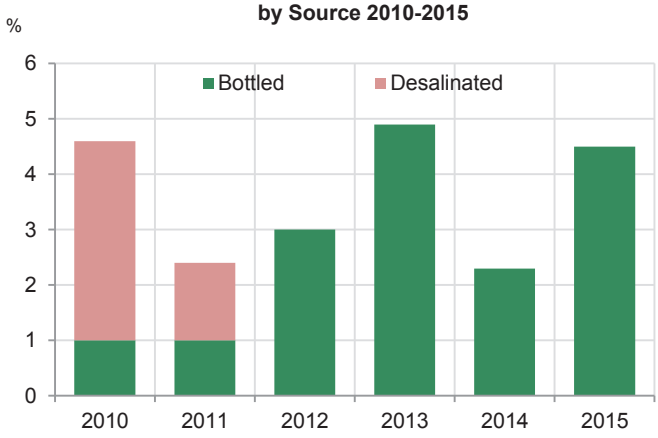
Figure (3.27) indicates that the percentage of incompatible samples, taken from desalination water plants, mineral water, and bottled water in 2015, were distributed over four tests during the period (2010-2015). In the rest of other years, incompatible samples were confined to “other tests” and “chemical tests”. The incompatible samples were nearly proven in “other tests” in 2010 and 2015 by reaching about 1.75% , while the incompatible samples in “chemical tests” increased from 1.7% in 2010 to 2% in 2015; a rise of 0.3%.

**Figure 3.27: Percentage of Incompatible Samples of Tests of Desalination Water Plants and Bottled Water by Type of Test 2010-2015**




It is remarked in Figure (3.28) that no desalinated drinking water samples were found incompatible in “chemical and bacteriological tests” during the period 2012-2015. In 2011, however, the percentage of desalinated drinking water samples that were incompatible with standards in “chemical and bacteriological tests” did not not exceed 1%. The percentage of drinking bottled water which was incompatible with the standards reached 4.5% in 2015.

**Figure 3.28: Percentage of Incompatible Samples of Tests of Desalination Water Plants and Bottled Water by Source 2010-2015**




Source: Ministry of Public Health

## 3.4 *Quality of wastewater generated from urban areas*

### 3.4.1 Collection of wastewater from urban areas and infrastructure for its treatment

Wastewater collection, and infrastructure available for its treatment has several environmental benefits such as the reduction of transfer of contaminants into groundwater, preservation of biodiversity which might be affected by wastewater contaminants, and decrease of nutrients discharged into coastal waters, and therefore reduction of coastal water pollution. Most importantly, treated wastewater is considered as an alternative source of water that reduces pressure on water resources, and contributes to their sustainability, especially in the countries that suffer from water shortage such as the State of Qatar. Such an orientation allows further reliance on water reuse in agriculture and green spaces irrigation, or any other type of uses.

Number of wastewater treatment plants reached 23; an annual growth rate of 10% , and with a design capacity of 809 thousand m3 per day in 2015. Compared to previous years, wastewater treatment plants design capacity rose by 25% during the period 2010-2015. The plants received 197 Mm3 of wastewater per year, of which 193 Mm3 were treated, i.e. 98.2% of total wastewater in 2015.

## Table 3.30: Wastewater in Sewage Treatment Plants 2010-2015

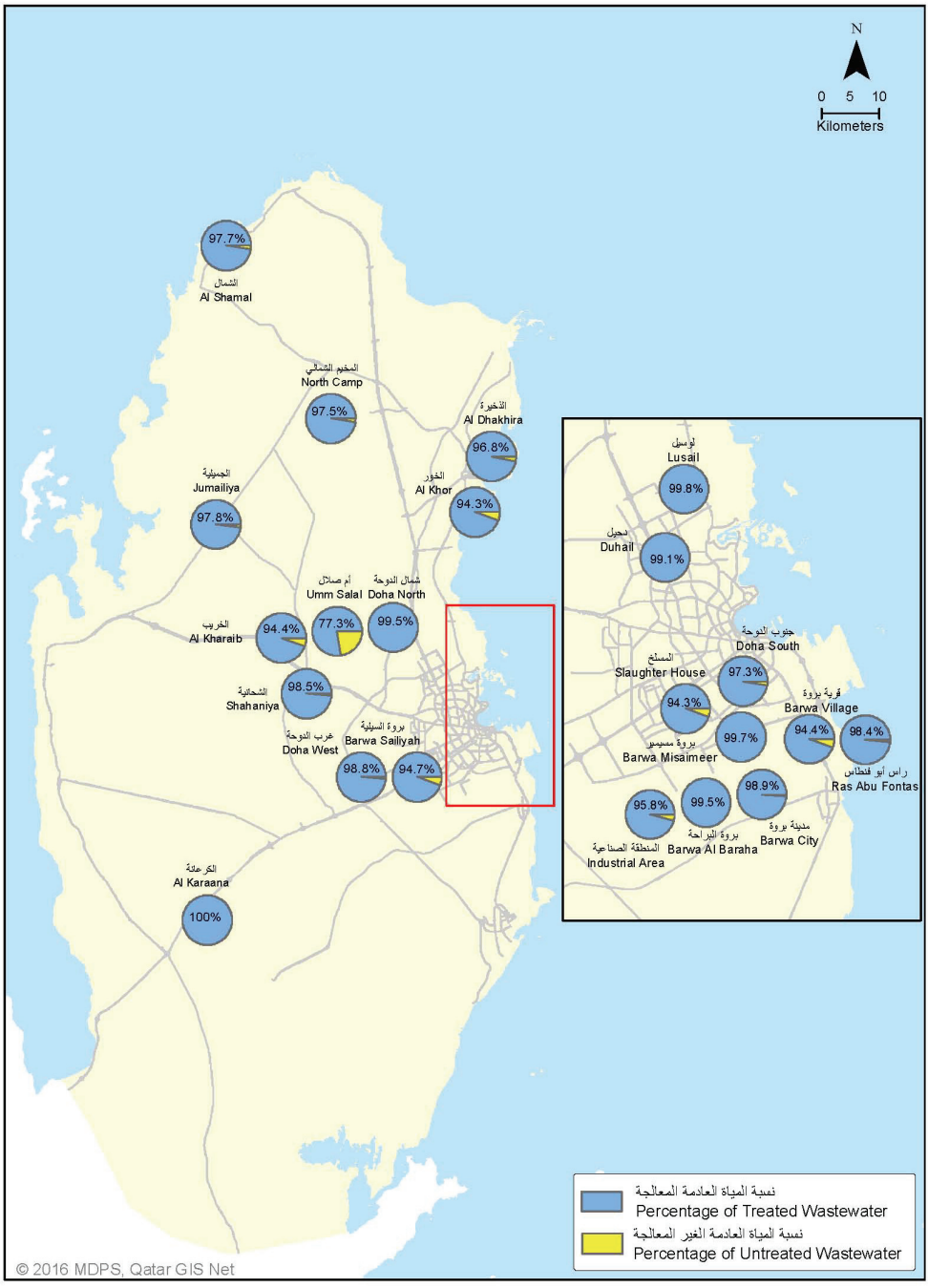
| Item | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual growth rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|
| Number of Sewage Plants | 14 | 18 | 20 | 22 | 23 | 23 | 10% |
| Total design capacity of sewage treatment plants (1000 m3/day) | 260 | 323 | 379 | 695 | 705 | 809 | 25% |
| Quantity of assembled wastewater (1000 m3/year) | 101,653 | 123,887 | 142,339 | 158,792 | 173,933 | 197,492 | 14% |
| Quantity of treated wastewater (1000 m3/year) | 101,135 | 108,759 | 129,212 | 151,883 | 168,949 | 193,854 | 14% |
| Percentage of treated wastewater of total wastewater | %99.5 | %87.8 | %90.8 | %95.6 | %97.1 | %98.2 | -0.3% |
| Treated wastewater used for agriculture (1000 m3/year) | 32,275 | 41,979 | 58,707 | 55,233 | 64,920 | 66,289 | 15% |
| Treated wastewater used for green spaces irrigation (1000 m3/year) | 18,630 | 21,657 | 19,915 | 24,670 | 29,096 | 31,088 | 11% |
| Treated wastewater used for injection into aquifers (1000 m3/year) | 26,240 | 26,212 | 30,854 | 35,599 | 43,465 | 57,291 | 17% |
| Treated wastewater discharged into lagoons (1000 m3/year) | 23,878 | 18,760 | 13,474 | 35,391 | 31,109 | 38,845 | 10% |
| Treated wastewater discharged into sea (1000 m3/year) | 141 | 268 | 293 | 234 | 358 | 350 | 20% |

| Item | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual growth rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|
| Dry sludge from wastewater (ton per year) | 11,087 | 20,443 | 21,573 | 27,575 | 32,352 | 40,099 | 29% |
| Sludge from wastewater (1000 $m^3$ per year) | 104 | 263 | 372 | 303 | 550 | 224 | 17% |
| Quantity of wastewater not assembled in wastewater treatment plants, and discharged untreated into lagoons ($mm^3$) | 20,075 | 16,425,000 | 21,900,000 | 18,037,935 | 11,303,180 | 1,699,666 | 143% |
| Total discharge of groundwater into the sea ($mm^3$ per year) | … | 76,337,156 | 68,685,456 | 64,367,443 | 63,016,341 | 75,686,500 | … |

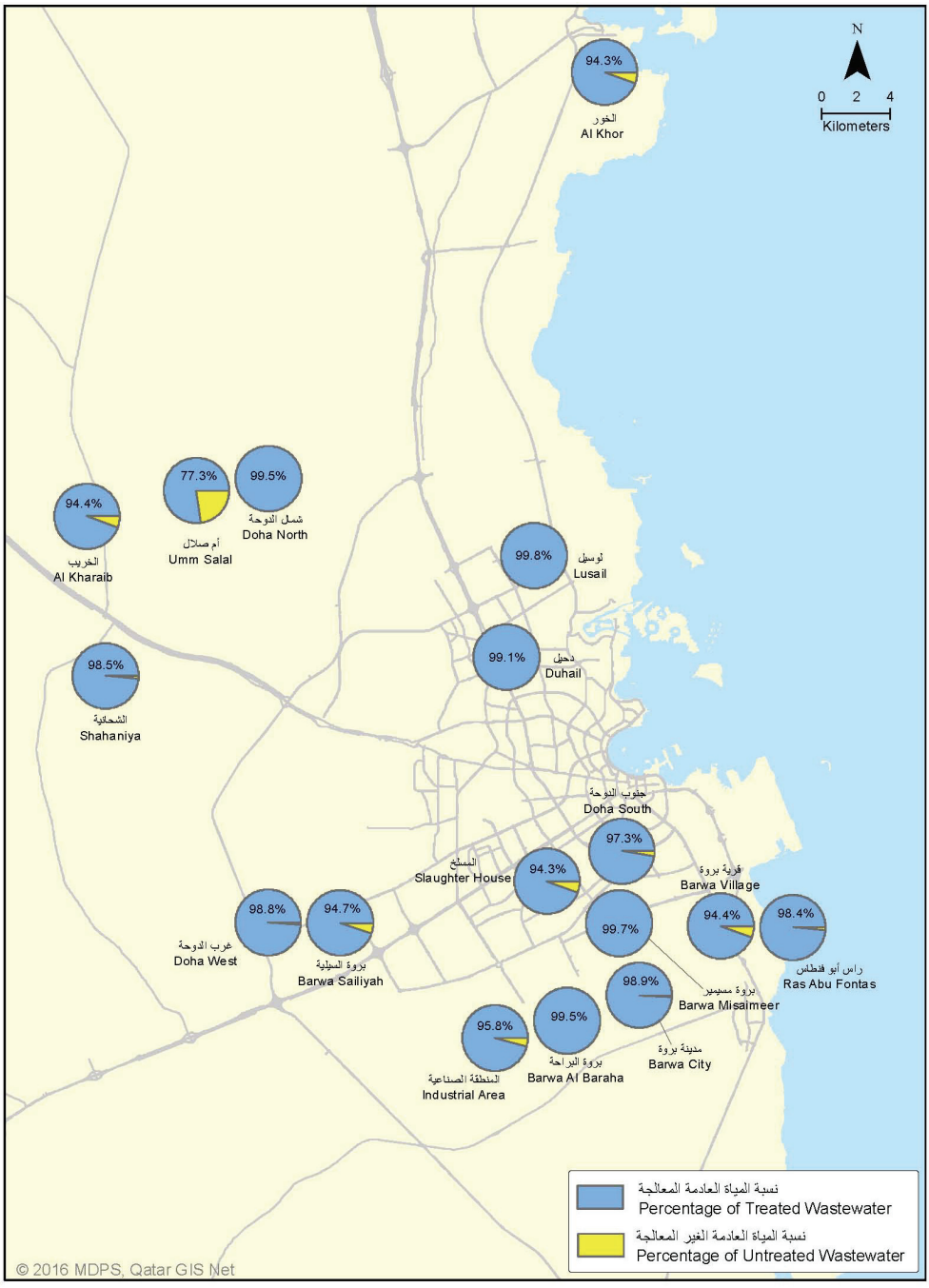
…: Not available

Source: Public Works Authority (Ashghal)

## Map 3.8: Treated Wastewater Ratio of Total Wastewater by Plants 2015



## Map 3.9: Treated Wastewater Ratio of Total Wastewater by Plants of Doha Municipality 2015



### 3.4.2 Wastewater Treatment in Wastewater Plants by Type

Wastewater is treated in wastewater plants in Qatar through three types of treatment: secondary and tertiary (disinfection), and tertiary (removal of nitrogen and phosphorous). Secondary treatment is defined as the removal of biodegradable organic compounds (dissolved and suspended) and removal of suspended solids. Typical disinfection is featured in the conventional secondary treatment. Tertiary treatment is the removal of solids that remained in the secondary treatment, and sand filtration and refineries are usually used. Further, tertiary treatment includes removal of nitrogen, phosphorous, as well as disinfection.

According to the type of wastewater treatment in plants, five plants use secondary treatment, which are Jamiliyah, Al-Kharaib, Shamal, Slaughter House, and Ras Abu Fontas. Besides, 15 plants use tertiary treatment: Al-Thakhira, Al-Khor, Barwa Al-Baraha, Barwa village, Doha West, Duhail, Industrial Area, Doha South, Shahaniya, Al-Karana, Umm Salal, and North Camp. Three plants use tertiary treatment by nitrogen and phosphorus removal, which are Doha North, Doha West, and Lusail.

**Table 3.31: Wastewater Treatment Plants from Urban Areas, Hydraulic Design Capacity, and Wastewater Quantity Pumped into Each Plant 2015**

| Name of wastewater treatment plant | Type of treatment | Hydraulic Design Capacity | | Wastewater amount pumped into each plant (1,000 m3/year) |
|---|---|---|---|---|
| | | 1,000 m3/day | 1,000 m3/year | |
| Jamiliyah PTP | Secondary treatment | 0.54 | 197.10 | 139.03 |
| AL-Kharaib PTP | | 0.06 | 21.90 | 18.00 |
| Shamal PTP | | 0.15 | 54.75 | 34.96 |
| Slaughter House PTP | | 0.81 | 296.00 | 88.00 |
| Ras Abu Fontas PTP | | 0.54 | 197.10 | 127.89 |
| Al Thakhira PTP | Tertiary (disinfection) | 1.62 | 591.30 | 932.53 |
| Al Khor PTP | | 9.72 | 3547.80 | 2920.00 |
| Barwa Albaraha PTP | | 12.00 | 4380.00 | 3980.00 |
| Barwa village PTP | | 15.00 | 5475.00 | 1337.00 |
| Barwa Musaimeer PTP | | 15.00 | 5475.00 | 347.00 |
| Barwa sailiayh PTP | | 1.50 | 547.50 | 302.00 |
| Barwa village PTP | | 1.00 | 365.00 | 215.00 |
| Doha West STW OLD | | 54.00 | 19710.00 | 21408.49 |
| Duhail PTP | | 0.81 | 295.65 | 90.02 |
| Industrial Area STW | | 24.00 | 8760.00 | 8469.00 |
| Doha South STW | | 180.00 | 65700.00 | 66262.00 |
| Shahaniyah PTP | | 1.35 | 490.93 | 531.29 |
| Umm Salal PTP | | 1.50 | 547.50 | 392.32 |

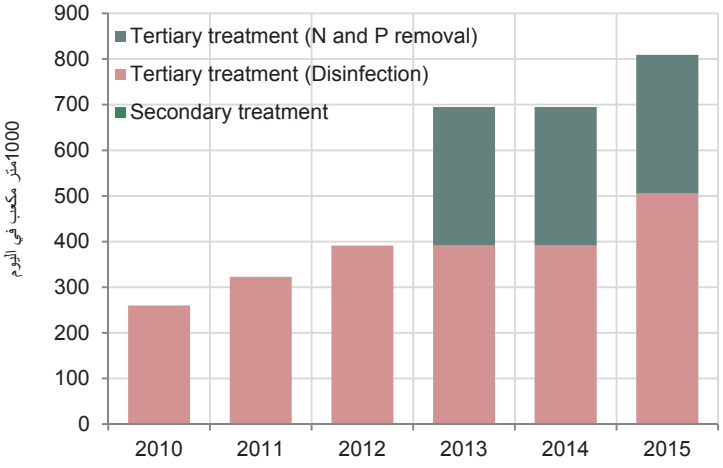
| Name of wastewater treatment plant | Type of treatment | Hydraulic Design Capacity | | Wastewater amount pumped into each plant (1,000 m3/year) |
|---|---|---|---|---|
| | | 1,000 m3/day | 1,000 m3/year | |
| Al Karana PTP(1) | Tertiary treatment (N and P removal) | 10.00 | 3650.00 | 2271.52 |
| North Camp PTP | | 0.25 | 89.43 | 81.00 |
| Doha North STW | | 244.00 | 89060.00 | 12173.00 |
| Doha West STW | | 175.50 | 64057.50 | 65647.65 |
| Lusail STW (2) | | 60.00 | 21900.00 | 9812.00 |
| **Total (3)** | | **809.34** | **295409.45** | **197491.70** |

(1) Al-Karaana: under test and operation on tanks .
(2) Lusail Plant: Uses tanker
(3)The total does not include Slaughter House Plant

Source: Public Works Authority (Ashghal)

The design capacity of wastewater treatment plants which implement secondary treatment amounted to 2.1 thousand m3/day, and tertiary treatment (disinfection) to 503.2 thousand $m^3$/day, and tertiary treatment (nitrogen and phosphorous removal) to 304.0 thousand m3/day in 2015.

**Figure 3.29: Hydraulic Design Capacity by Type of Treatment at Wastewater Treatment Plants 2010-2015**




Statistics indicate that Doha West Wastewater Treatment Plan started implementing advanced tertiary treatment (N and P removal) in 2012. Doha West Plant treated over 33% of wastewater generated by urban areas in Qatar. In addition, Lusail Plant wastewater transported by tanks started removal of nitrogen and phosphorous in 2013. It is noteworthy that since 2004, all urban wastewater treatment plants have been equipped with, at least, secondary treatment means leading to the discard of organic pollution to a large extent.

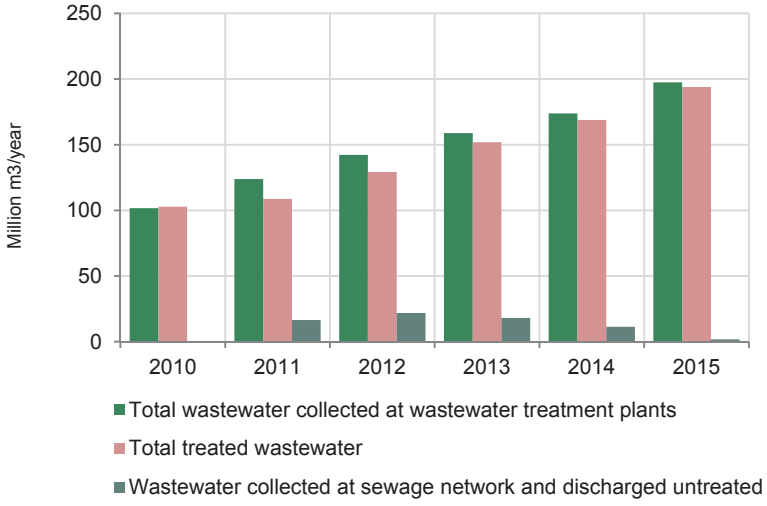
### 3.4.3 Urban wastewater treatment, discharge and quality.

In 2015, total urban wastewater (excluding Industrial area) attained 199.2 million m3, of which 99.1% was treated in wastewater treatment plants. Since 2004, organic pollution (BOD and COD) has been removed by over 95% most of the time. 98.7% of BOD and 95.9% of COD were removed in treatment plants (23 plants) of urban wastewater in 2015.

Doha West Plant is Qatar's largest treatment plant of urban wastewater. It achieves high removal ratios of BOD, COD, nitrogen, and phosphorous. In 2015, over 65 Mm3 of wastewater were treated (33% of total urban wastewater in Qatar). In Doha West Plant, 99.1% of BOD, 96% of COD, 81.8% of overall nitrogen, and 87.3% of overall phosphorous were removed.

Since 2013, over 89% of urban wastewater has been treated in treatment plants. In 2015, treatment rose to 99% of wastewater, and around 1.70 Mm3,collected via tankers, were discharged in Al-Karaana lagoon (this water is not often produced by residential units). See Figure (3.30).

**Figure 3.30: Collected wastewater, treated wastewater and discharged untreated wastewater (million m3/year) 2010-2015**




Source: Public Works Authority (Ashghal)

Statistics of Figure (3.31) show that organic pollution was removed in terms of BOD at over 95% until 2015. During the period 2010-2015, BOD collected amount increased from 19,632 metric tons in 2010 to 39,419 metric tons in 2015 (a 15% annual growth). In addition, removal ratio remained unchanged at 98.7% during the same period.

**Figure 3.31: Treatment Efficiency at Urban Wastewater Treatment Plants by BOD (Ton, %) 2010-2015**

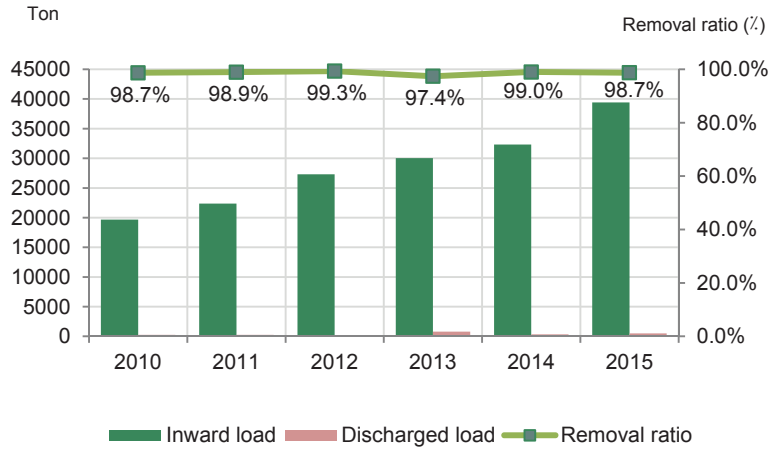
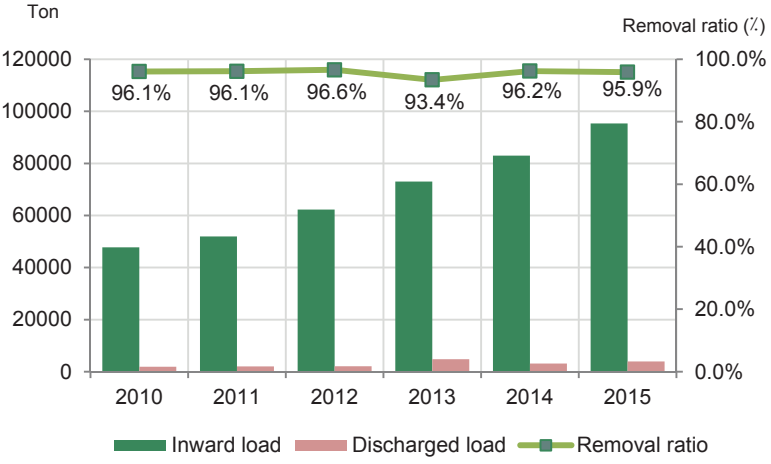



**Figure 3.32: Treatment Efficiency at Urban Wastewater Treatment Plants by COD (Ton, %) 2010-2015**



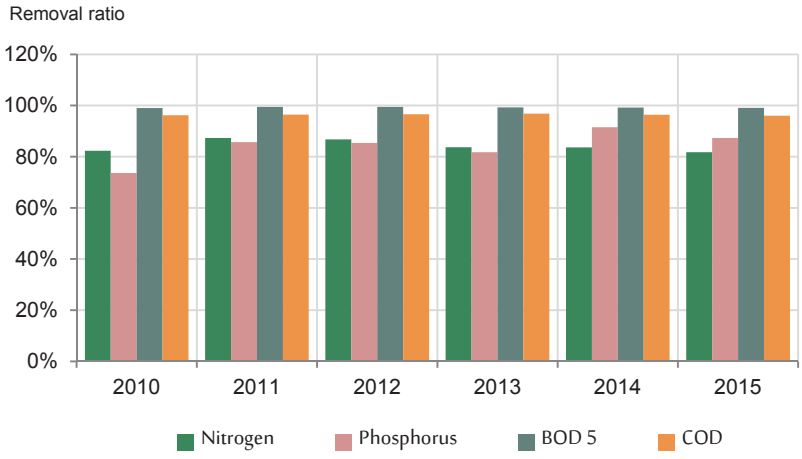

Source: Public Works Authority (Ashghal)

Source: MDPS computations

During the period 2010-2015, COD was highly removed and exceeded 90%. COD quantities, collected in 2010, increased from 47,671 metric tons to 95,355 metric tons in 2015 (an annual growth of 15%). Removal ratio decreased slightly in the same period from 96.1% to 95.9%.

Figure (3.33) on removal of BOD, COD, and overall nitrogen and phosphorous in Doha West Plant during the period 2010-2015, indicates that this latter is Qatar's largest treatment plant of urban wastewater at a design capacity of 175.5 thousand m3/day. Doha West Plant is equipped with the ability to remove nitrogen and phosphorous since 2009. Phosphorous removal rose from 73.6% in 2010 to 87.3% in 2015, while nitrogen removal decreased from 82.3% to 81.8% for the same period.

**Figure 3.33: BOD Removal Ratio 5, COD, Total N and P Removal at Wastewater Treatment Plant of Doha West 2010-2015**




Source: Public Works Authority (Ashghal)

Source: MDPS computations

### 3.4.4 Quality of wastewater

The Public Works Authority took samples of treated wastewater in sewage treatment plants to conduct detailed tests on Escherishia Coli. Table (3.32) indicates the presence of incompatible samples taken from Barwa Plant (17.3%), Barwa Al-Sailaih Plant (8.2%), Barwa Village Plant (26.9%), Barwa Al-Baraha Plant (15.4%), and Duhail Plant (8.2%). Meanwhile, no incompatible samples were found in the other sewage treatment plants in 2015. As for the samples results of parasite tests (worms), no incompatible samples were found in those plants.

**Table 3.32: Detailed and Specialized Results of Bacteriological and Parasitic Tests for Treated Water by Sewage Treatment Plant 2015**

| Sewage Treatment Plant | Detailed Tests by Escherishia Coli/ 100 Mi | | | | | Parasites tests (Protozoa) | | |
|---|---|---|---|---|---|---|---|---|
| | Total samples | Compatible samples | | Incompatible samples | | No. of samples | Incompatible samples | |
| | | No. | % | No. | % | | No. | % |
| **Doha South** | 360 | 360 | 0 | 0 | 0.0 | | | |
| **Doha West** | 52 | 52 | 100 | 0 | 0.0 | 52 | 0 | 0.0 |
| **Doha West (Old)** | 52 | 52 | 100 | 0 | 0.0 | | 0 | |
| **Industrial Area** | 360 | 360 | 100 | 0 | 0.0 | | 0 | |
| **Doha North** | 344 | 344 | 100 | 0 | 0.0 | 290 | 0 | 0.0 |
| **Lusail** | 45 | 45 | 100 | 0 | 0.0 | 114 | 0 | 0.0 |
| **Barwa** | 52 | 43 | 83 | 9 | 17.3 | | 0 | |
| **Barwa Mesaimer** | 51 | 51 | 100 | 0 | 0.0 | | 0 | |
| **Barwa Al-Sailaih** | 49 | 45 | 92 | 4 | 8.2 | | 0 | |
| **Barwa Village** | 52 | 38 | 73 | 14 | 26.9 | | 0 | |
| **Barwa Al-Baraha** | 52 | 44 | 85 | 8 | 15.4 | | 0 | |
| **Al-Khor** | 96 | 96 | 100 | 0 | 0.0 | | 0 | |
| **Ras Abu Fontas** | 51 | 51 | 100 | 0 | 0.0 | | 0 | |
| **Al-Shahaniyah** | 48 | 48 | 100 | 0 | 0.0 | | 0 | |
| **Al-Thakhira** | 51 | 51 | 100 | 0 | 0.0 | | 0 | |
| **Jamiliyah** | 52 | 52 | 100 | 0 | 0.0 | | 0 | |
| **North Camp** | 52 | 52 | 100 | 0 | 0.0 | | 0 | |
| **Al-Shamal** | 52 | 52 | 100 | 0 | 0.0 | | 0 | |
| **Duhail** | 49 | 45 | 92 | 4 | 8.2 | | 0 | |
| **Umm Salal** | 51 | 51 | 100 | 0 | 0.0 | | 0 | |
| **Al-Kharaib** | 52 | 52 | 100 | 0 | 0.0 | | 0 | |

Source: Public Works Authority (Ashghal)

Referring to the tests conducted by Ashghal on the concentration of the inward and outward pollutants from sewage treatment plants, it was made clear that no incompatible samples taken in 2015 were found according to the treatment plant and non-conforming characteristics.

The Ministry of Public Health, while controlling the quality of treated wastewater according to the source used for irrigation at the Cornische area during the period 2010-2015, relied on WHO's standards related to microorganisms, and FOA's standards related to heavy metals.

Table (3.33) statistics indicate the results of detailed and specialized bacteriological and parasitic tests of treated wastewater by sewage treatment plant during the period 2010-2013. The results show that no incompatible samples, taken from these plants, are observed in the monitored plants. The Ministry of Public Health, as a regulatory body, conducts these tests to monitor the quality of treated wastewater.

**Table 3.33: Results of Detailed and Specialized Bacteriological and Parasitic Tests of Treated Wastewater by Sewage Treatment Plant 2010-2013***

| Year | Sewage Treatment Plant | Detailed Tests by Escherishia Coli/ 100 Mi | | | Parasites tests (Protozoa) | | |
|---|---|---|---|---|---|---|---|
| | | No. of samples | Incompatible samples | | No. of samples | Incompatible samples | |
| | | | No. | % | | | No. |
| 2010 | Doha South | 12 | 0 | 0.0 | 12 | 0 | 0.0 |
| | Doha West | 12 | 0 | 0.0 | 12 | 0 | 0.0 |
| | Doha North | 12 | 0 | 0.0 | 12 | 0 | 0.0 |
| | Total | 36 | 0 | 0.0 | 36 | 0 | 0.0 |
| 2011 | Doha South | 12 | 0 | 0.0 | 12 | 0 | 0.0 |
| | Doha West | 12 | 0 | 0.0 | 12 | 0 | 0.0 |
| | Doha North | 12 | 0 | 0.0 | 12 | 0 | 0.0 |
| | Total | 36 | 0 | 0.0 | 36 | 0 | 0.0 |
| 2012 | Doha South | 12 | 0 | 0.0 | 12 | 0 | 0.0 |
| | Doha West | 12 | 0 | 0.0 | 12 | 0 | 0.0 |
| | Doha North | 12 | 0 | 0.0 | 12 | 0 | 0.0 |
| | Total | 36 | 0 | 0.0 | 36 | 0 | 0.0 |
| 2013 | Doha South | 12 | 0 | 0.0 | 12 | 0 | 0.0 |
| | Doha West | 12 | 0 | 0.0 | 12 | 0 | 0.0 |
| | Doha North | 12 | 0 | 0.0 | 12 | 0 | 0.0 |
| | Total | 36 | 0 | 0.0 | 36 | 0 | 0.0 |

*:Sampling stopped during 2014-2015 and resumed in 2016

Source: Ministry of Public Health

Table (3.34) shows that the samples of treated wastewater used for irrigation, monitored in the Cornische area, conformed to the international standards of the Escherishia Coli detailed tests. Samples that are incompatible with (protozoa) standards plummeted down from 4.0% in 2010 to 0.0% in the recent years (2012 and 2013). The monitoring program was temporarily in pause in 2014 and 2015, and resumed in 2016.

## Table 3.34: Quality of Treated Wastewater by Test Source, Use, and Type of Tests (Corniche) 2010-2013*

| Year | Corniche (irrigation of green spaces and trees) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Detailed tests of Escherishia Coli | | | Parasite tests (Protozoa) | | | Other tests | | |
| | Compatible samples | Incompatible samples | Percentage of incompatible samples | Compatible samples | Incompatible samples | Percentage of incompatible samples | Compatible samples | Incompatible samples | Percentage of incompatible samples |
| 2010 | 104 | 0 | %0.0 | 100 | 4 | %4.0 | 36 | 0 | %0.0 |
| 2011 | 147 | 0 | %0.0 | 143 | 4 | %2.8 | 36 | 0 | %0.0 |
| 2012 | 154 | 0 | %0.0 | 154 | 0 | %0.0 | 36 | 0 | %0.0 |
| 2013 | 97 | 0 | %0.0 | 97 | 0 | %0.0 | 36 | 0 | %0.0 |

*: Temporary pause in sampling in 2014 and 2015, and resumed in 2016

Source: Ministry of Public Health

# 4. Treated Solid Waste and Waste Management

Waste is defined as unwanted materials generated by daily human activity. They are generated either due to domestic, municipal, or different industrial activities. Waste represent a burden on environment and considered harmful to public health. Municipal waste is not considered dangerous and does not cause hazardous environment problems, and is easy to dispose of safely. The Government gives special attention to waste management and treatment, due to its keenness to reduce waste effects on health, maintain civic view of the country, and promote waste reduction practices, in light of Qatar's increasing economic growth in diverse sectors such as construction and demolition, industry, trade, and agriculture.

## Box (8): National Policy Relationship to Waste Management

The following programs/projects result from the National Development Strategy within its environment protection plan for the coming generations:

**Program/project:**

1- Establish a solid waste management plan including the contribution of the then Ministry of Municipality and Urban Planning (currently Ministry of Municipality and Environment).

Goals:

- Establish a solid waste management plan that emphasizes recycling.
- Attain 38% of recycling of solid waste, (currently it is 8%).
- Fix domestic waste generation at 1.6 Kg daily per capita.

Outputs:

Reduction of waste and increase recycling and use efficiency

**Programs/projects:**

2- Database of environment/waste management

Goals:

- Establish an electronic database that offers the search possibility

Outputs:

- Improve environment management and cooperation at regional and international level

**Waste management relationship to international frameworks such as SDGs 2030**

- Goal (11), indicator (4): percentage of solid urban waste regularly collected and appropriately discharged vis-à-vis the entire waste generated in the cities.
- Goal (12), indicator (4): national recycling ratio, and tons of recycled materials.
- Goal (12), indicator (4.2): Total hazardous waste generated per capita, and ratio of hazardous waste which is treated by type of treatment.
- Goal (11), indicator (6.1): percentage of solid urban waste which is regularly collected and

appropriatly discharged of total waste generated in the city.

Waste management relationship to international frameworks such as the indicators of international competitiveness.
- Recycling ratio of paper/cardboard

The 2015 statistics indicate that the number of waste transfer stations amounted to four: transfer stations of Al-Khor, Dukhan, Doha South, and Doha West. There are two waste landfills: Umm Al-Afai, and Mesaieeed. There are two waste dumps which are Umm Thintayn, and Rawdat Rashed. There is one solid waste treatment station in Mesaeid.

**Table 3.35: Number of Waste Management Facilities 2011-2016**

| Station | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Annual growth rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|
| **Transfer stations** | 4 | 4 | 4 | 4 | 4 | 4 | 0% |
| **No. of landfills** | 2 | 2 | 2 | 2 | 2 | 2 | 0% |
| **No. of dumps** | 1 | 1 | 1 | 1 | 1 | 2 | 15% |
| **No. of waste treatment centers 1** | 1 | 1 | 1 | 1 | 1 | 1 | 0% |

1: Domestic Solid Waste Management Center in Mesaieed

Total solid waste in Qatar amounted to 7.7 million tons in 2015. According to the results in the Table (3.36), treated solid waste decreased after it was 12 million tons in 2010. Around 56% of domestic waste was discharged into DSWMC in Mesaieed in 2015.

**Table 3.36: Treated Waste by Type and Waste Management Facility (ton) 2010-2015**

| Waste by type | Waste management facility | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|
| **Domestic** | Umm Al-Afai (1) | 846,630 | 628,235 | 44,151 | 0 | 0 | 0 |
| | Mesaieed | 0 | 0 | 258,991 | 326,960 | 408,526 | 482,640 |
| | DSWMC | 0 | 187,067 | 568,466 | 603,703 | 639,522 | 613,226 |
| | Total domestic waste | 846,630 | 815,302 | 871,608 | 930,663 | 1,048,048 | 1,095,866 |
| **Construction Bulky (2)** | Rawdat Rashid Dump | 8,864,475 | 9,099,486 | 9,228,296 | 8,893,750 | 6,433,372 | 3,806,745 |
| | Umm Al Afai landfill | 0 | 0 | 0 | 0 | 0 | 459,857 |
| | Mesaieed landfill | 338,987 | 470,298 | 59,086 | 0 | 0 | 0 |
| | Total construction waste | 0 | 0 | 419,503 | 460,737 | 622,978 | 469,669 |
| | Umm Al-Afai landfill | 9,203,462 | 9,569,784 | 9,706,885 | 9,354,487 | 7,056,350 | 4,276,414 |

| Waste by type | Waste management facility | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|
| | Mesaieed landfill | 0 | 0 | 0 | 0 | 0 | 459,857 |
| Tires | Total bulky waste | 1,748,989 | 1,751,101 | 304,259 | 0 | 0 | 0 |
| | Rawdat Rashid Dump\import (3) | 0 | 0 | 1,340,776 | 1,796,396 | 1,747,678 | 2,048,954 |
| | Rawdat Rashid Dump\treated | 1,748,989 | 1,751,101 | 1,645,035 | 1,796,396 | 1,747,678 | 2,048,954 |
| Other | Umm Al-Afai landfill\ treated | 0 | 657,211 | 799,822 | 816,759 | 972,501 | 1,117,163 |
| | DSWMC | 0 | 0 | 0 | 0 | 0 | 398,057 |
| | Total tires\import | 18,519 | 0 | 0 | 0 | 0 | 285,272 |
| | Total tires\ treated | 18,519 | 21,353 | 24,611 | 25,391 | 31,605 | 45,566 |
| | Umm Al-Afai landfill | 0 | 0 | 0 | 0 | 0 | 683,328 |
| Domestic | Mesaieed landfill | 5,030 | 5,931 | 558 | 0 | 0 | 0 |
| | DSWMC | 0 | 0 | 4,797 | 10,064 | 12,540 | 207,367 |
| | Total other types | 0 | 0 | 0 | 0 | 0 | 9,468 |
| | Umm Al-Afai (1) | 5,030 | 5,931 | 5,355 | 10,064 | 12,540 | 216,835 |
| **Total \ import** | | **11,822,630** | **12,163,471** | **12,253,494** | **12,117,001** | **9,896,221** | **7,683,635** |
| **Total \Treated** | | **0** | **0** | **0** | **0** | **0** | **1,143,186** |

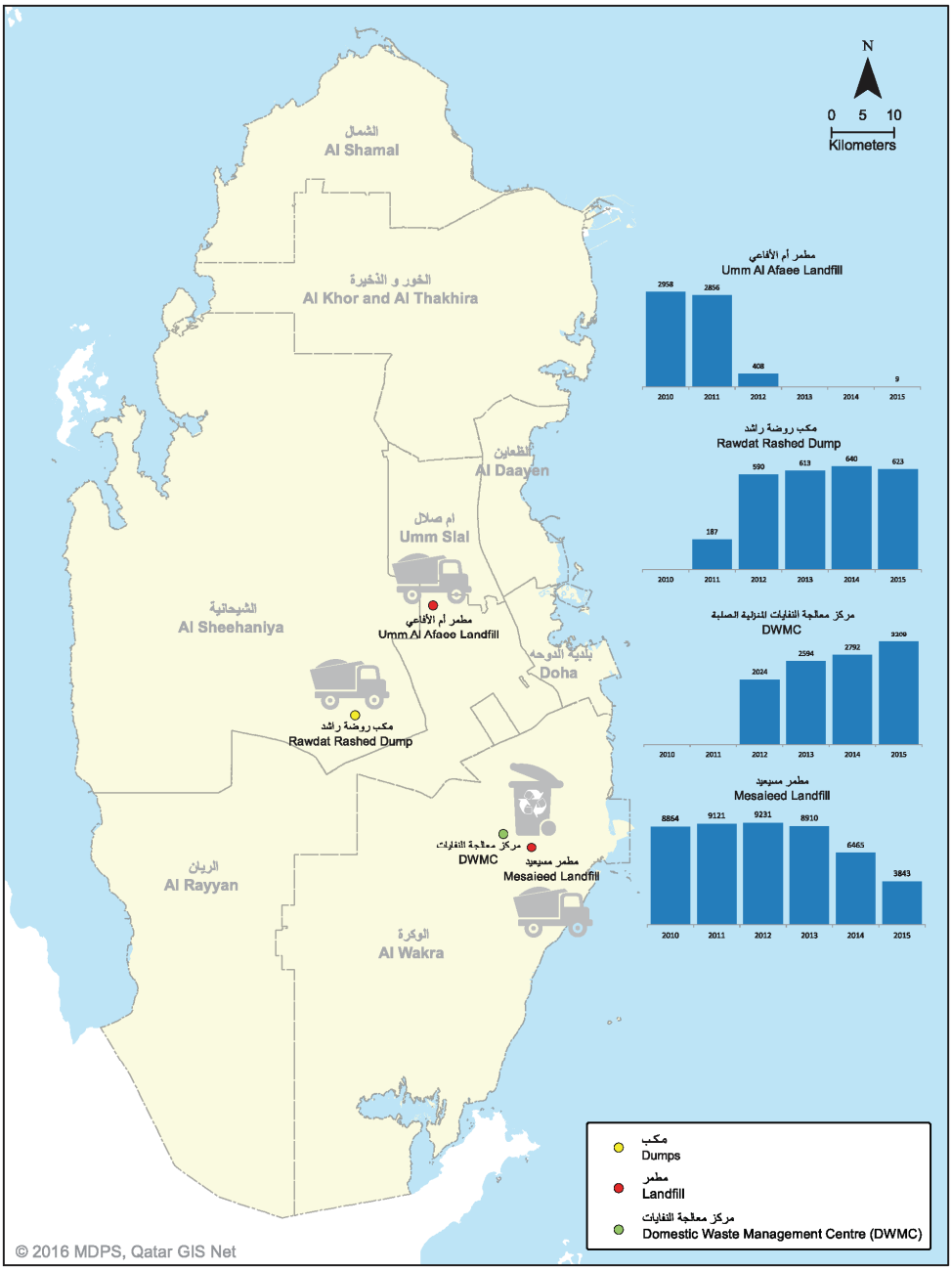
(1) Since 2013 Umm Al-Afai has been Closed.

(2) Bulky waste disposed of only in Umm Al-Afai and Rawdat Rashid.

(3) Rawdat Rashid Dump was closed for tires waste during 2008-2010 .

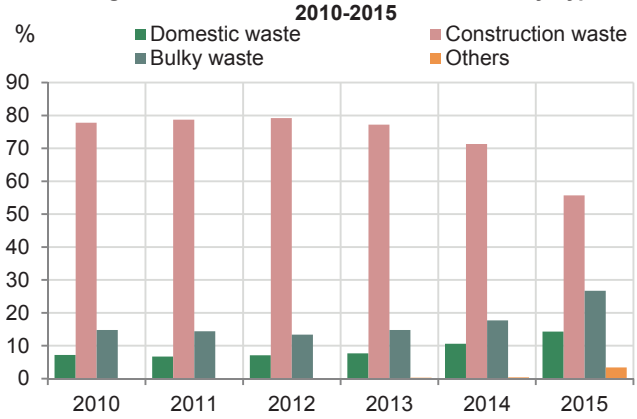
Source: Ministry of Municipality and Environment

## Map (3.10): Waste Generated by Waste Management Facilities (1000 metric tons) 2010-2015



According to relative importance, Qatar's construction sector comes first in terms of the amount of treated waste, with 55.7% of total waste in 2015.

**Figure 3.34: Relative Distribution of Waste by Type 2010-2015**




Around 3,002 tons of domestic waste were generated on a daily basis in 2015. This means that the average is 1.23 kg per capita on a daily basis.

**Table: 3.37: Daily Generation of Solid Waste by Type (metric ton/day) 2010-2015**

| Year | Domestic waste | Construction waste | Bulky waste | Tires | Others | Total |
|---|---|---|---|---|---|---|
| **2010** | 2,320 | 25,215 | 4,792 | 51 | 14 | 32,391 |
| **2011** | 2,234 | 26,219 | 4,798 | 59 | 16 | 33,325 |
| **2012** | 2,388 | 26,594 | 4,507 | 67 | 15 | 33,571 |
| **2013** | 2,550 | 25,629 | 4,922 | 70 | 28 | 33,197 |
| **2014** | 2,871 | 19,332 | 4,788 | 87 | 34 | 27,113 |
| **2015** | 3,002 | 11,716 | 5,614 | 125 | 594 | 21,051 |

Source: MDPS account

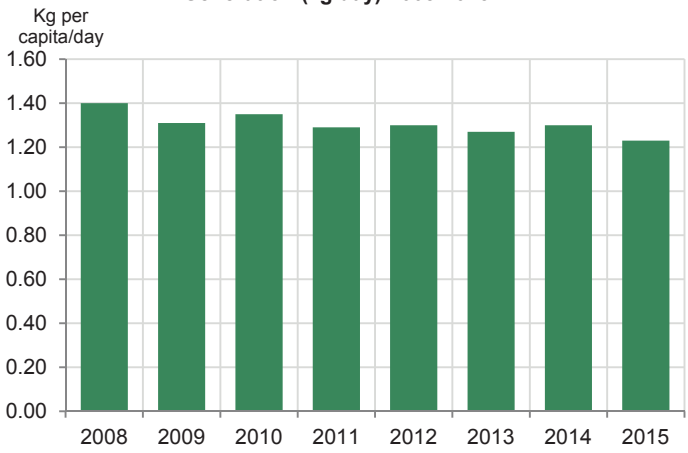
**Table 3.38: Daily Treated Waste by Type (kg/day) 2010-2015**

| Year | Domestic waste | Construction waste | Bulky waste | Tires | Others | Total |
|---|---|---|---|---|---|---|
| **2010** | 2,319,534 | 25,214,964 | 4,791,751 | 50,737 | 13,781 | 32,390,767 |
| **2011** | 2,233,704 | 26,218,586 | 4,797,537 | 58,501 | 16,249 | 33,324,579 |
| **2012** | 2,387,967 | 26,594,205 | 4,506,945 | 67,427 | 14,671 | 33,571,217 |
| **2013** | 2,549,761 | 25,628,732 | 4,921,633 | 69,564 | 27,573 | 33,197,263 |
| **2014** | 2,871,364 | 19,332,466 | 4,788,159 | 86,589 | 34,356 | 27,112,933 |
| **2015** | 3,002,374 | 11,716,203 | 5,613,573 | 124,838 | 594,069 | 21,051,056 |

Source: MDPS account

Figure (3.35): Daily per capita domestic waste generation reduced from 1.40 kg to 1.23 kg, which is less than the target identified by the National Development Strategy (1.6 kg).

**Figure 3.35: Daily Per Capita Domestic Waste Generation (kg/day) 2008-2015**




## *4.1 Recycled Waste*

Waste degradation over the years leads to the absorption of contaminants by water sources (underground or surface), and soil pollution, which affect food and contaminate drinking water, and therefore jeopardize public safety. In addition, waste pollutes the atmosphere by sending pollutant gases that put the health of people, plants, and living organisms at risk by affecting the respiratory system, along with the emission of unpleasant odors. Further, waste distorts the natural views and beauty of nature. From this perspective, communities have come to realize the environmental problems, and taken action accordingly to recycle waste, which has several benefits including the protection and preservation of natural resources, reduction of waste, and provides new job opportunities.

Statistics indicate that treated waste amounted to nearly 7.7 million tons in 2015. DSWMC received 613 thousand tons, and 53 thousand tons were recycled. This quantity is considered very tiny compared to the generated, collected and treated waste. Here comes to play the role of the civil society's awareness regarding the importance of recycling and environment protection, encouragement of private and public sector to prepare projects that recycle all types of waste, and the importance of inculcation of recycling in the Qatari values and on the school curricula.

**Table 3.39: Recycled Waste (Ton) 2011-2015**

| Item | 2011 | 2012 | 2013 | 2014 | 2015 | Annual growth rate 2010 &2015 |
|---|---|---|---|---|---|---|
| **Total waste treated** | 12,163,471 | 12,253,494 | 12,117,001 | 9,896,221 | 7,683,635 | -11% |
| **Waste treated in DSWMC in Mesaieed** | 187,067 | 568,466 | 603,703 | 639,522 | 613,226 | 35% |
| **No. of materials recycled** | 2,404 | 104 | 5,183 | 4,380 | 53,171 | 117% |

## *4.2 Converting waste into products*

DSWMC in Mesaieed started operating in 2011. It is one of the largest waste recycling specialized centers in the Middle East. The center's area is 3 km2 near Mesaieed city, and its capacity, whose design meets all environment safety requirements in terms of recycling and production, amounts to 2300 tons per day . The recycling process passes through five stages in DSWMC, the first one starts with weighting, and the second is about separation and recycling, while the third is waste-to-energy, and the fourth is recycling to obtain high quality liquid or solid compost. This latter is one of the center's characteristics to increase green spaces, whereas the fifth is represented in the landfill which receives 5% of waste.

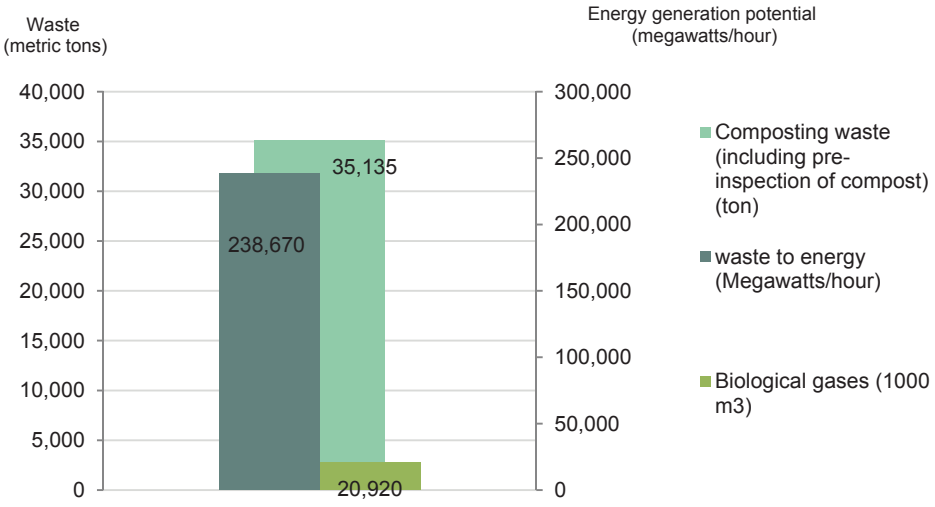
It is noteworthy that the center converts waste into energy. Most waste that enters the center is recycled according to the applicable regulations. A low percentage goes to landfills in the form of ashes after drying and removal of impurities so that the subsoil and groundwater will not be affected.

**Table 3.40: DSWMC's Productive Capacity by Type 2012-2015**

| Item | 2012 | 2013 | 2014 | 2015 | Annual growth rate 2012 & 2015 |
|---|---|---|---|---|---|
| **Quantity of waste treated in DSWMC (ton)** | 622,695 | 639,522 | 612,646 | 590,351 | -2% |
| **Composting waste (including compost pre-inspection) ton** | 31,781 | 35,135 | 63,880 | 38,861 | 7% |
| **waste to energy (Megawatts/hour)** | 212,446 | 238,670 | 203,628 | 152,961 | -10% |
| **Biological gases (1000 $m^3$)** | 25,206 | 20,920 | 14,038 | 14,045 | -18% |

The DSWMC has achieved a quantum leap in converting solid waste into energy and recyclable materials, and in producing organic compost to support agricultural sector. The DSWMC generates about 153 thousand megawatts of electrical energy, used to operate this center, and part of this energy goes to government sector.

**Figure 3.36: DSWMC's Productive Capacity by Type 2012-2015**



# 5. Hazardous Waste

Hazardous waste is waste that exhibits dangerous traits such as toxicity, corrosivity, reactivity, and ignitability which make it harmful to environment and human health. Hazardous waste is composed of biomedical waste, in addition to the waste of industry, and oil and gas. This kind of waste includes also chemicals, acids, alkalis and contaminated soil etc.

Hazardous waste generation index during (2010-2015) fluctuated from 0.23 metric ton per each unit of GDP in 2010 to 0.74 metric ton per each unit of GPD in 2014. Afterwards, it was decreased to 0.37 metric ton per each unit of GDP in 2015.

**Figure 3.37: Hazardous Waste Generation in Tons per Each Million US Dollars from GDP (Constant Prices 2013=100) for the Years 2010-2015**

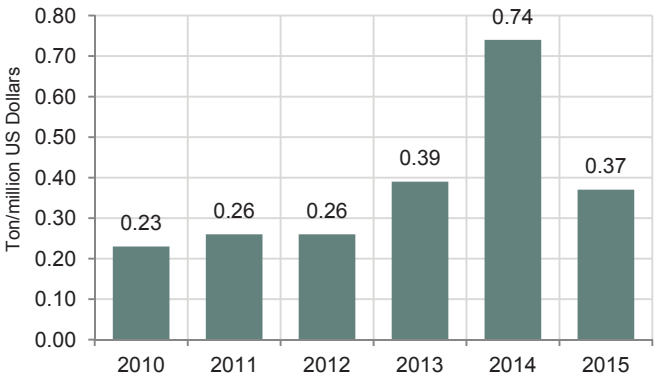
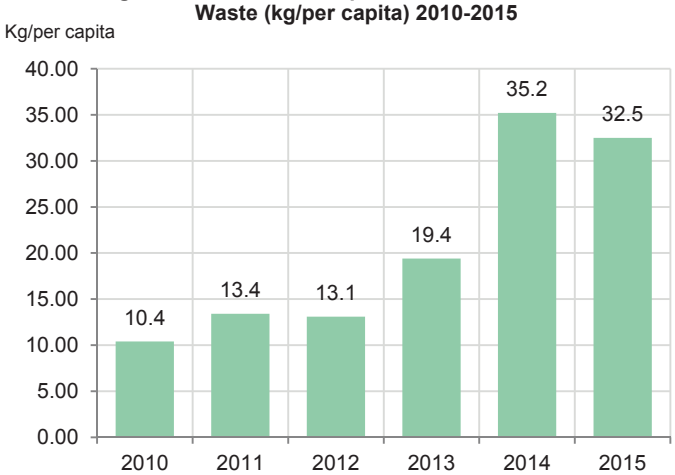


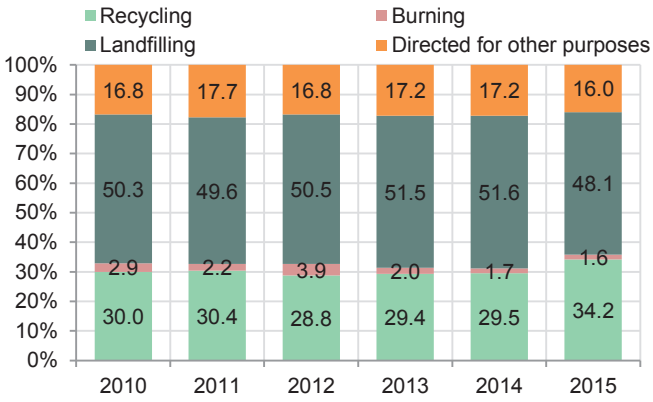

Figure (3.38) indicates that the total per capita generated hazardous waste amounted to 32.5 kg in 2015, and it reached its peak in 2014, and decreased again in 2015.

**Figure 3.38: Total Per Capita Generated Hazardous Waste (kg/per capita) 2010-2015**



The recycling process of hazardous waste enables to change the characteristics and traits of hazardous waste to turn it not dangerous or less dangerous. Afterwards, it can be dealt with safely. Thus, it can be collected, stored, and disposed of without causing harm to individuals and environment. According to the Figure (3.39), it was remarked that 48.1% of hazardous waste was disposed of in landfills, followed by 34.2% recycled, and 16% used for other purposes, and finally 1.6% was burnt in 2015.

**Figure 3.39: Relative Distribution of Hazardous Waste by Type of Disposal 2010-2015**

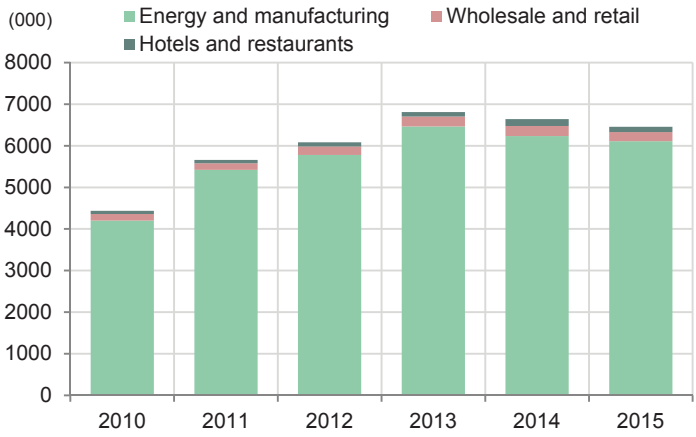


# 6. Energy Consumption

## *6.1 Energy consumption in the different economic sectors*

Figure (3.40) highlights the results of spending on electricity and its consumption within the intermediate consumption items in the different sectors during (2010-2015). Spending on electricity has two forms, the first is included in expenditure on electricity, whereas the second is done separately. Results indicate that energy and manufacturing received separately QR 6.1 million (95%) of total separate expenditure on electricity. In the second place came wholesale and retail trade whose expenditure on electricity amounted to QR 221.1 thousand (3%) of total separate expenditure on electricity. Expenditure on electricity in the activities of hotels and restaurants attained QR 125.7 thousand (1%).

**Figure 3.40: Expenditure on Electricity by Economic Activity 2010-2015**




Results indicate that the highest annual growth rate of the expenditure on electricity during the period (2010-2015) was in hotels and education (10%), followed by energy and manufacturing (8%), and then wholesale and retail activities (7%).

As for the annual growth rate during the period (2010-2015), the highest growth rate in expenditure on electricity was in the sector of hotels and restaurants (64%) in 2015 of total expenditure in intermediate consumption on electricity, compared to 2010. The activity of energy and manufacturing came second (48%) in 2015 of total expenditure in intermediate consumption on electricity, compared to 2010. The activity of wholesale and retail trade came third (40%) in 2015 compared to 2010.

**Table 3.41: Expenditure on Electricity, Fuel and Oil by Economic Activity (QR) 2010-2015**

| Economic activity | | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual growth rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|---|
| Banks | Electricity and water | 21,424 | 21,298 | 22,490 | 23,307 | 26,992 | 26,818 | 5% |
| | Fuel and oil | 1,564 | 1,366 | 12,285 | 1,246 | 1,405 | 1,442 | -2% |
| Insurance | Electricity and water | 1,759 | 3,927 | 5,587 | 2,010 | 2,404 | 3,256 | 13% |
| | Fuel and oil | 703 | 216 | 1,075 | 395 | 376 | 465 | -8% |
| Energy and manufacturing | Electricity | 4,203,332 | 5,422,501 | 5,778,810 | 6,466,466 | 6,233,543 | 6,108,948 | 8% |
| | Water | 2,081,764 | 3,209,196 | 2,659,274 | 2,945,915 | 3,047,582 | 3,161,390 | 9% |
| Wholesale and retail trade | Electricity | 157,592 | 157,186 | 205,404 | 235,466 | 241,670 | 221,168 | 7% |
| | Water | 45,304 | 38,282 | 53,897 | 54,498 | 63,389 | 59,955 | 6% |
| | Fuel and oil | … | 127,753 | 153,572 | 189,936 | 258,063 | 202,336 | … |
| Transport and communication | Electricity and water | 48,772 | 102,643 | 72,660 | 77,832 | 80,438 | 114,488 | 19% |
| | Fuel and oil | … | 10,855,332 | 11,580,239 | 12,058,708 | 13,124,577 | 9,693,410 | … |
| Construction | Electricity and water | 303,878 | 251,418 | 310,304 | 324,307 | 344,776 | 466,682 | 9% |
| | Fuel and oil | 888,228 | 1,061,415 | 1,012,269 | 1,300,043 | 1,718,582 | 1,937,433 | 17% |
| Business services | Electricity and water | 888,228 | 133,765 | 108,409 | 179,791 | 158,737 | 204,605 | -25% |
| | Fuel and oil | 78,721 | 85,884 | 162,583 | 100,684 | 123,374 | 244,206 | 25% |
| Personal social services | Electricity and water | 56,219 | 65,137 | 63,386 | 70,528 | 71,655 | 195,803 | 28% |
| | Fuel and oil | … | 45,491 | 45,074 | 84,958 | 71,739 | 123,279 | … |
| Hotels and restaurants | Electricity | 76,746 | 79,805 | 99,850 | 108,650 | 168,586 | 125,708 | 10% |
| | Water | 36,382 | 24,885 | 29,697 | 33,357 | 35,844 | 83,080 | 18% |
| | Fuel and oil | 28,776 | 37,150 | 40,587 | 46,902 | 62,696 | 90,577 | 26% |

…..: Not available

Source: Ministry of Development Planning and Statistics – Economic Statistics Bulletin

According to the relative importance of expenditure in terms of intermediate consumption of both electricity and water, the highest share was registered for the sector of construction (50.3%), while the lowest was for insurance (1%) of total expenditure on intermediate consumption of both electricity and water in 2014.

## 6.2 *Electrical energy consumption*

This consumption responds to the needs of the increasing population number and economic growth, which in turn causes pressure on environment regarding the production of electricity. Therefore, environment is negatively affected often due to this use which relies on fossil fuels to generate energy. Consequently, it is necessary to alleviate the impacts on environment through multiple methods, such as the increasing reliance on renewable energy sources and electricity use efficiency. Uses of energy lead to further air emissions, and therefore change in the status of the surrounding air quality, and concentrations of greenhouse gases which cause negative impacts on human health and biological systems.

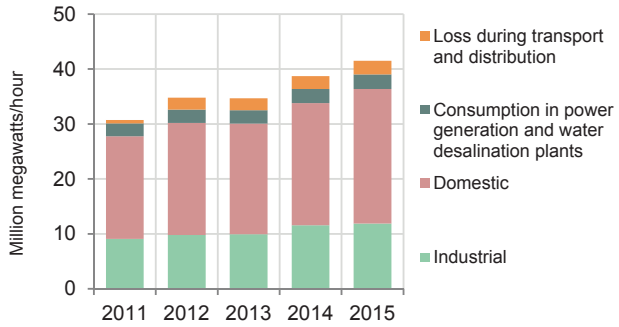
Total electricity consumption amounted to 41 million megawatts/hour in 2015 (8% increase compared to 2011). Electricity consumption in the domestic sector had the highest share of total consumed electricity in 2015. It amounted to 24 million megawatts/hour, and had relative importance of 59%, followed by industrial sector which consumed 12 million megawatts/ hour, and had a relative importance of 28.6%, followed by the consumption in power generation and water desalination plants at around 3 million megawatts/hour, and had relative importance of 6.4%. The loss during transport and distribution of electricity reached about 2 million megawatts/hour, and relative importance of 6% in 2015.

**Table 3.42: Electricity Consumption by Sector (megawatts/hour) 2011-2015**

| Sector | 2011 | 2012 | 2013 | 2014 | 2015 | Annual growth rate 2011 & 2015 |
|---|---|---|---|---|---|---|
| Industrial | 9,088,525 | 9,798,062 | 9,944,423 | 11,568,215 | 11,886,696 | 7% |
| Domestic | 18,670,383 | 20,386,671 | 20,121,050 | 22,215,842 | 24,490,670 | 7% |
| Consumption in power generation and water desalination plants | 2347138 | 2,435,593 | 2,443,814 | 2,567,926 | 2,647,006 | 3% |
| Loss during transport and distribution | 624,434 | 2,167,607 | 2,159,043 | 2,340,897 | 2,474,889 | 41% |
| Total | 30,730,480 | 34,787,933 | 34,668,330 | 38,692,880 | 41,499,261 | 8% |

Source: Kahramaa – Annual Statistical Report

**Figure 3.41: Electricity Consumption by Sector (megawatts/hour) 2011-2015**



# 7. Air Quality

All organisms including human beings, animals, plants, and even inanimate objects interact within the atmosphere. Air and respiration are of course the main elements of life without which this latter becomes impossible even for minutes. Therefore, keeping air pure and unpolluted is necessary for the life and health of all organisms.

The effects of human activities, which lead to the increase in pollutants in environment, manifest in the emission of pollutants into the air, water, and soil. Air quality pollutants mean that any substance that enters the air environment in quantities surpassing the minimum limit as per the approved national, regional and international standards. This substance features sulfur dioxide, hydrogen sulfide, measured nitrogen oxides, chemo-light oxidizers (Ozone), carbon monoxide, non-methane hydrocarbons, lead components, sulphates, fluorides, ammonia, and suspended molecules that can be inhaled.

Air pollution is one of the most environmental dangers to health. By reducing air pollution, countries can alleviate the burden of diseases caused by respiratory infections, heart diseases, and lung cancer. The more air pollution is reduced, the more respiratory and cardiovascular health is improved for both the long and short terms.

## Box (10): air quality relationship to national policies

The following programs/projects result from the National Development Strategy within its environment protection plan for the coming generations

**Program/project**

1- Energy and gas efficiency

Goals:

- Study choices to reduce gas consumption per each joint electricity and water production unit through the update of connection systems.
- Improve thermal efficiency in the production of energy.
- Expedite the adoption of energy conservation techniques.
- Make sure of green spaces system implementation follow up in Qatar.
- Establish a national committee for renewable energy.

Outputs:

- Enhance use efficiency of energy and gas, and improve air quality.

**Program/ project:**

2- Improve air quality management.

Goals:

- Eradicate cases of increasing ozone levels in Qatar via the improvement of air quality

management.
Outputs:
- Improve environment management and cooperation at regional and international level
Pure air and effective responses for climate change.

**Program/ project:**
3- Prevention from communicable diseases
Goals:
- Reduction of TB widespread from 6.1 to 1.1 cases per 10,000 people.
- Application of an early warning system for monitoring and tracking cases.

Outputs:
- Reduction of threat of communicable diseases
Program/project:
4-Database of environment/air quality
Goals:
- Establish an online database providing the search possibility
Outputs:
- Improve environment management and cooperation at regional and international level

Air quality relationship to the international frameworks, such as the SDGs 2030
- Goal 11: indicator 5: average levels of fine particles (PM10 and PM2.5) in the cities (weighted in terms of population).

The Ministry of Municipality and Environment adopted a new approach to provide the air quality-related data in 2014 in order to respond to Qatar's National Development Strategy. It also took the entire procedures which would improve the air quality. The Ministry of Municipality and Environment monitors the air quality from three air monitoring stations. Movenpick Station (Cornische), Qatar University Station, and Aspire Zone Station:

**Table 3.43: Pollutants by Method of Reaction, Source and Effects**

| Name of pollutant | Method of reaction | Source | Effects |
|---|---|---|---|
| **Ground level ozone (O3) or the bad ozone O3** | It is not emitted directly into the air, but it is created by chemical reactions between (NOx) and (VOCs) in the presence of sunlight. | Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NOx and VOC. | Lung diseases, sensitivity in the eye and respiratory system |
| **Fine suspended particles (PM10)** | It is a complex mixture of extremely small particles and liquid droplets that get into the air. It is composed of a variety of substances and chemicals. | Air pollutants are composed due to natural processes, such as forest fires and erosion caused by wind and human activities, such as agriculture, flues, motor vehicle exhaust, and construction. Examples include dust, dirt, soot, contaminated soil, and smoke. | These particles are small enough to get deep into the lungs and cause hazardous health effects. In this regard, attention should be paid to the fine suspended particles with sizes of 2.5 microns or less ($PM_{2.5}$) which get deep into the lungs. |
| **Sulfur dioxide (SO2)** | It is one of a group of highly reactive gases called sulfur oxides | It is a result of fossil fuel burning in other energy plants and industrial establishments. As for the secondary sources of $SO_2$ emissions, they include industrial processes such as mineral extraction, fuel burning in trucks, large vessels and machinery, which contain high levels of sulfur | It is linked to a variety of negative effects on the respiratory system. |
| **Nitrogen dioxide/nitrogen oxides (NO2)** | It is one of a group of highly reactive gases called nitrogen oxides. Other nitrogen oxides include nitrous acid and nitric acid. $NO_2$ is used as the indicator for the larger group of nitrogen oxides. | $NO_2$ forms from emissions from cars, trucks and buses, power plants, and off-road equipment. It has a role in the contribution of forming the ozone at ground level and pollution of fine particles. | $NO_2$ is linked to a number of harmful effects on the respiratory system. |
| **Carbon monoxide (CO)** | It is a colorless and odorless gas | CO is released when something is burned. The greatest sources of CO are cars, trucks and other vehicles or machinery that burn fossil fuels. | Breathing CO reduces the amount of oxygen that can be transported in the blood stream to critical organs like the heart and brain, and tissues. Breathing a high concentration of CO can lead to death. |

The following standards are used to describe the air quality index: clean (0-50), normal (51-100), less than normal (101-150), limited pollution (151-200), polluted (201-300), very polluted (301-500). The normal standard was used as a national limit which the pollution level should not surpass.

The following table (3.44) shows that during 2014 and 2015, the index values did not exceed the normal limit of the entire monitored pollutants. All values were included in the clean standard except the fine suspended particles with a diameter of 10 micrometers or less (PM10). Those particles were registered within the normal standard in 2014 in all monitoring stations. However, they surpassed the national standard in Qatar University station in 2015, where it was registered under the "less normal standard".

**Table 3.44: Air Quality Annual Average in Doha by Site 2014 & 2015**

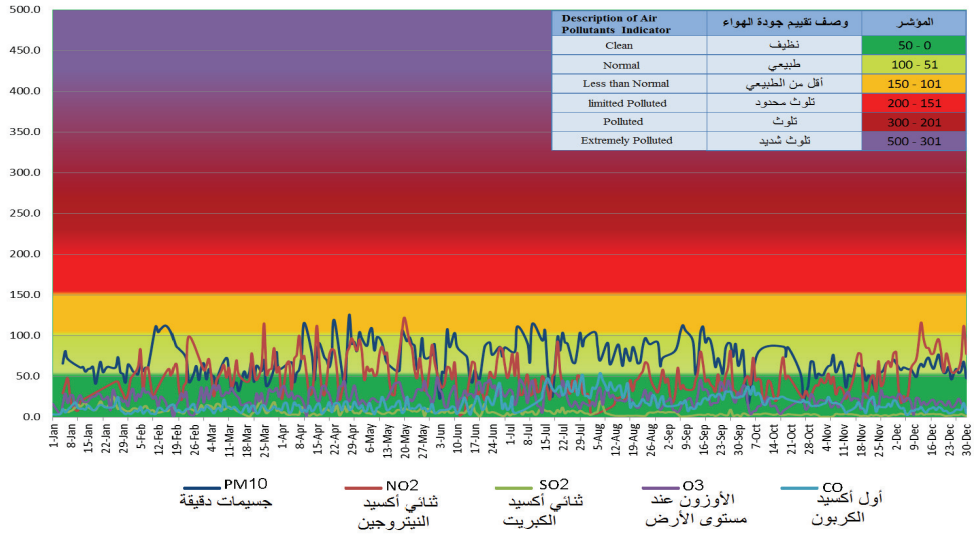
| Pollutants and station site | 2014 | | | 2015 | | | Annual limit* |
|---|---|---|---|---|---|---|---|
| | Aspire Zone | Qatar University | Corniche | Aspire Zone | Qatar University | Corniche | |
| **Sulfur dioxide ($SO_2$)** | Clean | Clean | Clean | Clean | Clean | Clean | Normal |
| **Nitrogen dioxide ($NO_2$)** | Clean | Clean | Clean | Clean | Clean | Clean | Normal |
| **Ground Level Ozone ($O_3$)** | Clean | Clean | Clean | Clean | Clean | Clean | Normal |
| **Carbon Monoxide (CO)** | Clean | Clean | Clean | Clean | Clean | Clean | Normal |
| **Particulate Matter (PM10)** | Normal | Normal | Normal | Normal | Less than Normal | Normal | Normal |

Source: Ministry of Municipality and Environment

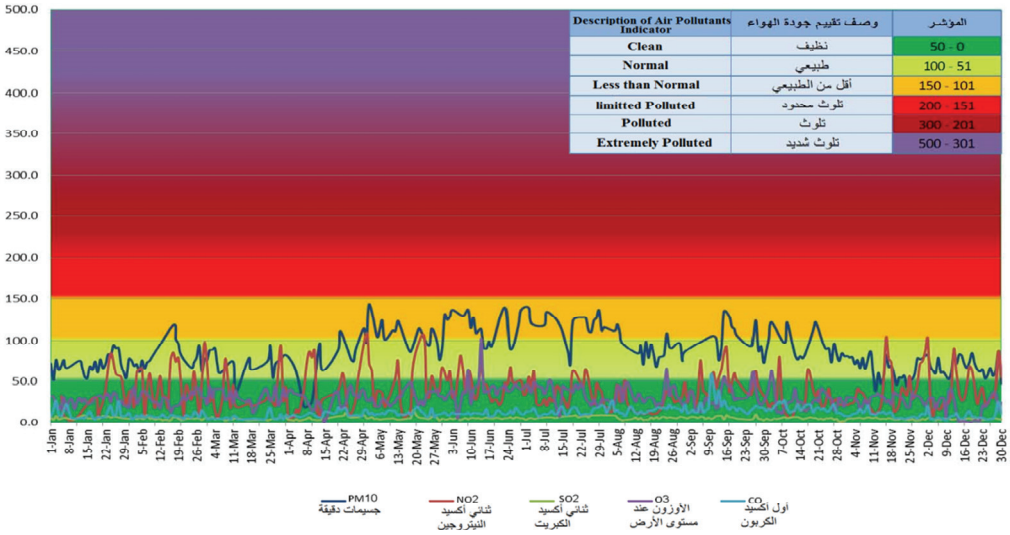
* Annual limit is seen as the description of the "normal" standard

| Air Quality Index | |
|---|---|
| Clean | 0-50 |
| Normal | 51-100 |
| Less than normal | 101-150 |
| Limited pollution | 151-200 |
| Polluted | 201-300 |
| Very polluted | 301-500 |

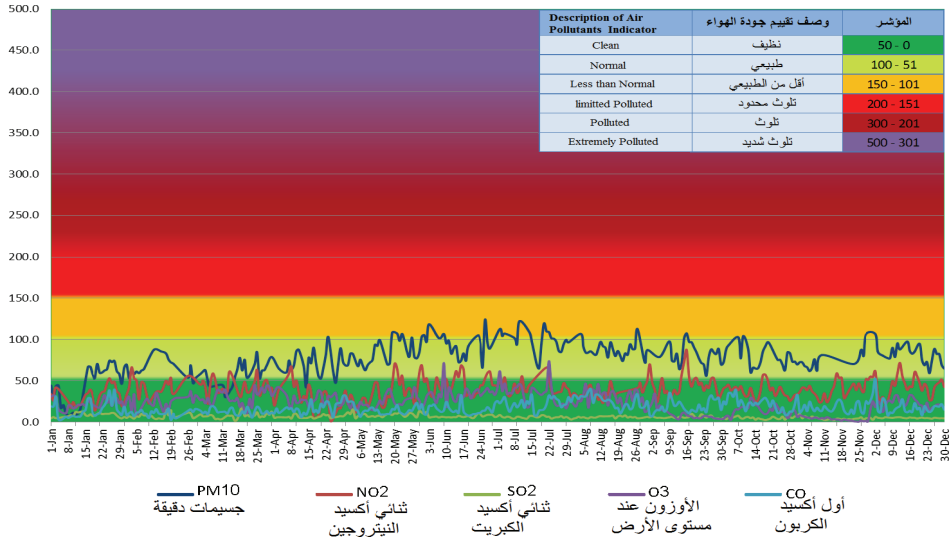
## Figure 3.42: Air Quality for all items 2015, AL-Corniche




## Figure 3.43: Air Quality for all items 2015, Qatar University



## Figure 3.44: Air Quality for all items 2015, Aspire Zone



# 8. Greenhouse gases

## Box (11): air emissions relationship to national policies

The following programs and projects resulted from the National Development Strategy to promote the economic and technical efficiency.

**Program/project**

1- Energy and gas efficiency

Goals:

- Study choices to reduce gas consumption per each joint electricity and water production unit through the update of connection systems.
- Improve thermal efficiency in the production of energy.
- Expedite the adoption of energy conservation techniques.
- Make sure of green spaces system implementation follow up in Qatar.
- Establish a national committee for renewable energy.

Outputs:

Enhance energy and gas use efficiency, and improve air quality.

**Program/project:**

2- Reduction of natural gas flaring and emissions

Goals:

- Cut gas flaring by half to reach 0.0115 billion m3 per each million tons of generated energy compared to 0.0230 billion m3 in 2008.

Outputs:

- Pure air and effective responses for climate change.

**Program/project:**

3- Database of environment and air emissions

Goals:

- Establish an online database providing search possibility

Outputs:

- Improve environment management and cooperation at regional and international level

Air quality relationship to the international frameworks, such as the SDGs 2030.

- Goal (9) – indicator (4.1): CO2 emissions per each unit of added value.

Air quality relationship to the international frameworks such as the indicators of international competitiveness.

-Energy use intensity

Greenhouse emissions are linked to the phenomenon of global warming, and therefore climate change. These phenomena are international and trans-boundary. Thus, countries have joint responsibility to find solutions and means to reduce climate change risks. The UN Climate Change Conference held in Paris in 2015 asserted that practical solutions should be found to reduce the climate change risks within the cost limit which countries could afford without affecting the permanent energy supplies required by human development. These practical solutions consist in the management of environmental effects on energy supplies, the diversification of access to the types of renewable fuel, low carbon fuels, and clean energy. Not only do such solutions contribute to environment protection, but to the creation of job opportunities and new investments as well, and consequently achieve big gains in living standards.

The main six global warming gases sources:

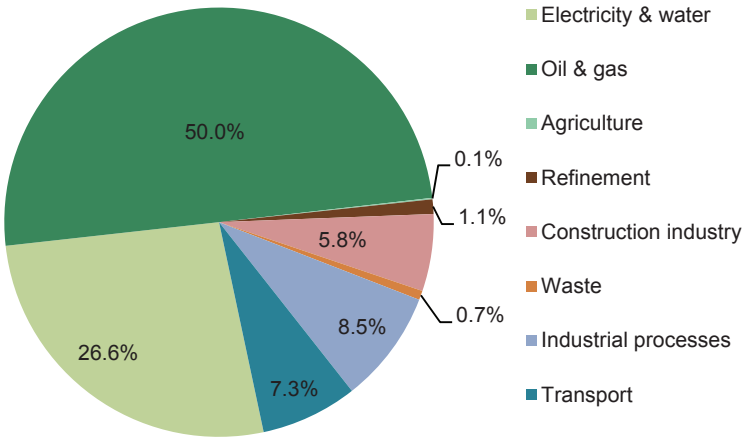
1. CO2.
2. CH4.
3. N2O.
4. PFCs.
5. HFCs.
6. SF.

The above mentioned greenhouse gases trap heat in the atmosphere to make the earth warm and keep climate moderate. Those gases are rather influential to global warming than being pollutants. Carbon dioxide, one of the main gases, enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), in addition to its non-absorption due to the vast deforestation. There is also the Methane (CH4)which results from livestock and other agricultural practices and from the decay of organic waste in municipal solid waste landfills. It is produced due to woks od mines and gas pipelines, etc. Further, Nitrous oxide (N2O), another greenhouse gas, is emitted during agricultural and industrial activities.

To reduce gas emissions, and to alleviate and adapt with the climate change effects, the State of Qatar submitted its executive plan to the Paris Conference held in 2015. The plan entitled “Intended Nationally Determined Contributions Report” submitted to the Secretariat of the UN Framework Convention on Climate Change under the two resolutions (1/11) and (1/02), and in accordance with the resolution (2/11), and the principles and decisions of the Clime Change Framework Convention.

The Ministry of Municipality and Environment is currently working on releasing the second national communications report which it started preparing in 2015. The following figure shows the largest contributions of greenhouse gases emissions in Qatar as mentioned in its first national communications report in 2007. This relative distribution shows the environment status due to the emissions caused by the different human activities, and energy consumption either to respond to the population needs or to the economic growth.

**Figure 3.45: Relative Distribution of Contributions of Greenhouse Emissions in Qatar According to National Communication Reports in 2007**



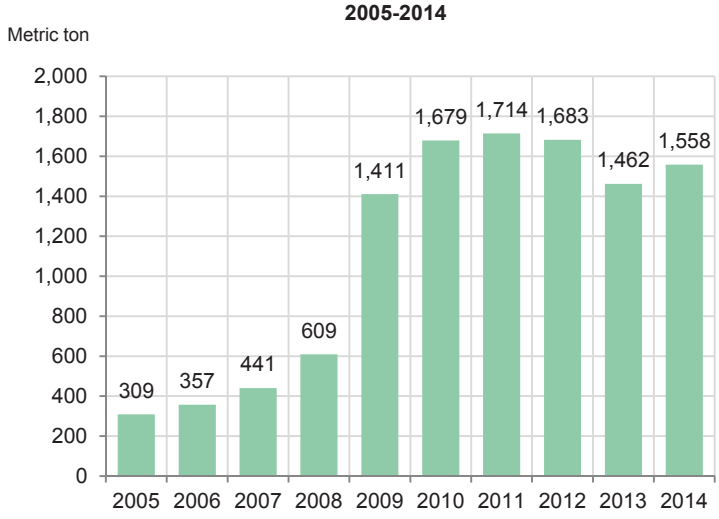

Source: Ministry of Municipality and Environment – First National Communication Report 2007

From the Figure above, it is clear that the largest contributing sectors in greenhouse emissions represented in oil and gas, though an unofficial report released in 2015 indicating a considerable decrease in emissions. The Figure also shows that water and electricity generation came second in the production of these emissions. Such contribution remains normal in a country that heavily depends on desalination and energy. Therefore, not only does water use conservation preserve water resources, but it contributes to the decrease in emissions as well. In third and fourth places came industry sector and transport sector at 8.5% and 7.3% respectively. Such percentages might be cut by maximizing dependence on renewable energy, increasing use of public transport, and providing environment-friendly transport means.

# 9. Ozone-depleting Substances Consumption

The consumption of ozone-depleting substances is the total consumption of ozone-depleting potential, weighted by metric tons of each ozone-depleting substance equivalent, and controlled under the Montreal Protocol on Substances that Deplete the Ozone Layer. Ozone-depleting substances are defined in the Montreal Protocol as substances containing chlorine or bromine that destroy the stratospheric ozone layer which absorbs most of the biologically damaging ultraviolet radiation. The phasing out of ozone depleting substances, and their substitution by less harmful substances or new processes, are aimed at the recovery of the ozone layer. The substances controlled by the Montreal Protocol include CFCs, halons, and methyl bromide, etc.

**Figure 3.46: Mass of Consumption of ODS (metric ton) 2005-2014**




The below table (3.45) indicates that only (HCFCs-22) and (HFC-134a) were consumed after 2009. These substances have low ozone depletion potential.

### Table 3.45: Mass of Consumption of ODS (metric ton) 2005-2014

| Substance | CFC 11 | CFC 12 | CFC 22 | HCFCs - 123 | HCFCs - 141b | HCFCs – 142b | Total |
|---|---|---|---|---|---|---|---|
| **2005** | 6.1 | 30.9 | 272.2 | 0 | 0 | 0 | 309.2 |
| **2006** | 4.4 | 27.1 | 325.9 | 0 | 0 | 0 | 357.4 |
| **2007** | 3.0 | 10.0 | 427.8 | 0 | 0 | 0 | 440.8 |
| **2008** | 1.8 | 3.3 | 604.0 | 0 | 0 | 0 | 609.1 |
| **2009** | 0.0 | 0.0 | 1,225.0 | 0 | 6.8 | 178.8 | 1410.6 |
| **2010** | 0.0 | 0.0 | 1,446.0 | 16.36 | 3.68 | 212.9 | 1678.94 |
| **2011** | 0.0 | 0.0 | 1,483.1 | 12.4 | 12.45 | 206.4 | 1714.35 |
| **2012** | 0.0 | 0.0 | 1,497.4 | 35.7 | 17.41 | 132 | 1682.51 |
| **2013** | 0.0 | 0.0 | 1368 | 30.5 | 15.71 | 47.63 | 1461.84 |
| **2014** | 0.0 | 0.0 | 1495 | 40.98 | 10.05 | 11.98 | 1558.01 |
| **Annual growth rate 2005 and 2014** | -100% | -100% | 16% | | | 0% | 18% |

Source: Ministry of Municipality and Environment

Consumption of ozone-depleting substances decreased in 2014 compared to 2012. It increased six-fold in terms of the mass consumed in comparison with 2005, whereas it only doubled in 2014 compared to 2005.

### Table 3.46: ODS (metric ton) According to Montreal Protocol 2005-2014

| Substance | CFC 11 | CFC 12 | CFC 22 | HCFCs - 123 | HCFCs - 141b | HCFCs – 142b | Total |
|---|---|---|---|---|---|---|---|
| **2005** | 6.1 | 30.9 | 15.0 | 0 | 0 | 0 | 52.00 |
| **2006** | 4.4 | 27.1 | 17.9 | 0 | 0 | 0 | 49.40 |
| **2007** | 3.0 | 10.0 | 23.5 | 0 | 0 | 0 | 36.50 |
| **2008** | 1.8 | 3.3 | 33.2 | 0 | 0 | 0 | 38.30 |
| **2009** | 0.0 | 0.0 | 67.4 | 0 | 0.75 | 11.6 | 79.75 |
| **2010** | 0.0 | 0.0 | 79.5 | 0.33 | 0.40 | 13.84 | 94.07 |
| **2011** | 0.0 | 0.0 | 81.6 | 0.25 | 1.37 | 13.42 | 96.64 |
| **2012** | 0.0 | 0.0 | 82.4 | 0.71 | 1.92 | 8.58 | 93.61 |

| Substance | CFC 11 | CFC 12 | CFC 22 | HCFCs - 123 | HCFCs - 141b | HCFCs – 142b | Total |
|---|---|---|---|---|---|---|---|
| **2013** | 0.0 | 0.0 | 75.2 | 0.61 | 1.73 | 3.10 | 80.64 |
| **2014** | 0.0 | 0.0 | 82.2 | 0.82 | 1.11 | 0.78 | 84.91 |

Data on per capita consumption of ozone-depleting substances indicate that the annual per capita consumption of ozone-depleting substances decreased during 2005 and 2014 to 0.06 kg per capita per year, reaching 0.03 kg per capita per year. This is due to the ban on the import of CFCs -11 and CFCs -12 as of 2010 under the Montreal Protocol.

**Figure 3.47: Per Capita ODS Consumption (kg/per capita) 2005-2014**

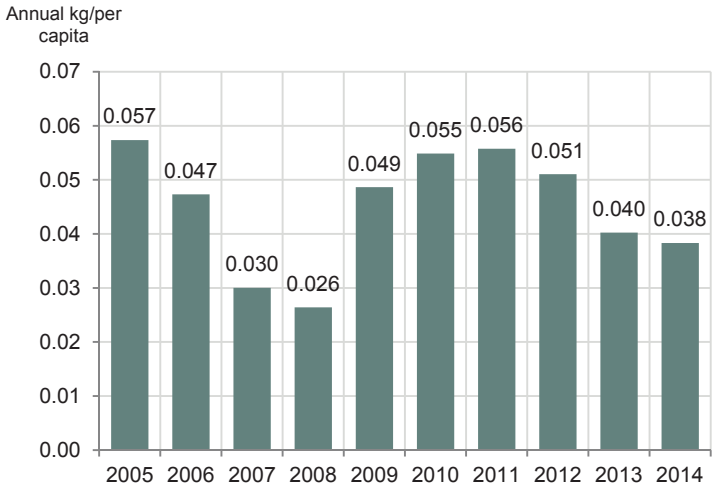
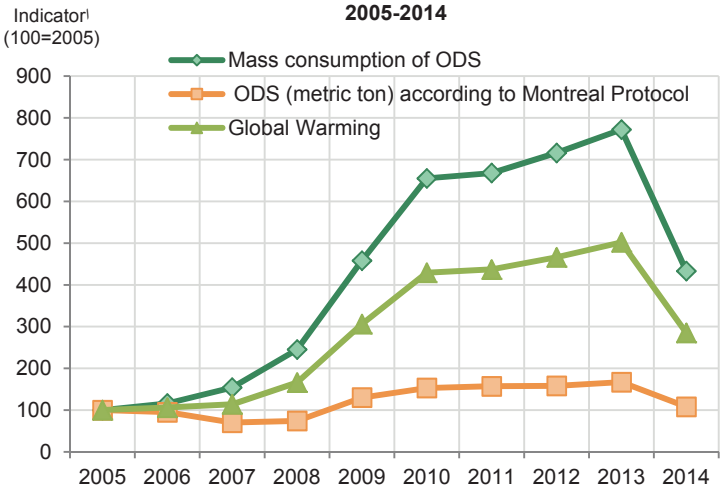



Figure (3.48) indicates the ODS consumption in Qatar during the period (2005-2014) calculated based on the mass and global warming potential and ozone depletion potential. The figure shows a general slump in the mass consumption of ODS at 433%, and ODP at 108%, as well as global worming potential at 285%.

**Figure 3.48: Comparing the Mass Consumption of ODS, Global Warming Potential, and Ozone Depletion Potential 2005-2014**




Source: Ministry of Municipality and Environment

Source: MDPS computations

# 10. Environment pollution borne diseases

Not only does environment pollution affect the health of biological systems and the ecosystem in general, but it affects the human health which depends and interacts with the biological systems related to the population, food, and water environment. The national environment strategy has become aware of this interdependence through the following framework.

## Box (12): relationship of the environment pollution borne diseases with national policies

The following programs and projects resulted from the national strategy to promote economic and technical efficiency:

**Program/project:**

1- Prevention of communicable diseases

Goal:

- Cut the percentage of TB from 6.1 cases to 1.1 per each 10000 people.
- Application of an early warning system for monitoring and tracking cases.

Outputs:

- Cut the percentage of communicable diseases threat

**Program/project:**

2-Reduce natural gas flaring and emissions

Goal:

- Decrease gas flaring by half to reach 0.0115 billion meters per each million ton of generated energy compared to 0.0230 billion m3 per each million tons of generated energy.

Outputs:

Pure air and effective responses to clime change.

**Program/project:**

3- Environment database/relation of diseases with environment pollution

Goals:

- Establish an online database providing the search possibility.

Outputs:

- Improve environment management and cooperation at regional and international level.

Energy uses relationship to the international framework such as the SDGs 2030

Goal (3), indicator No. (1.9): mortality rate in proportion to air quality

From the below table, the infectious and communicable diseases reported to the Preventive Health Department at the Ministry of Public Health during the period (2010-2015). It is obvious that the highest annual growth rates of diseases were typhoid and paratyphoid. The rates increased to around 37% in 2015 compared to 2010. The increase in meningitis incidence, including its brain and non-brain types amounted to 24% in 2014 compared to 2010.

In general, the total cases of infectious and communicable diseases reported to the Preventive Health Department during 2010-2015 slumped to 24%. The total reported cases decreased from 36,551 in 2010 to 9,183 in 2015. The cases of mumps/parotitis decreased to -33% in 2015 compared to 2010. During the same period, the percentage of TB in 2015 (-1%).

**Table 3.47: Number of Infectious and Communicable Diseases Cases Reported to the Preventive Health Department 2010-2015**

| Diseases | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual growth rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|
| Typhoid/ paratyphoid | 78 | 124 | 468 | 67 | 411 | 383 | 37% |
| bacterial food poisoning | 489 | 398 | 528 | 795 | 402 | 353 | -6% |
| TB | 324 | 313 | 252 | 256 | 143 | 305 | -1% |
| Non-pulmonary TB | 256 | 240 | 259 | 215 | 322 | 224 | -3% |
| Leprosy | 34 | 28 | 44 | 39 | 44 | 30 | -2% |
| Measles | 198 | 101 | 160 | 73 | 46 | 18 | -38% |
| Rubella | 23 | 16 | 20 | 58 | 20 | 7 | -21% |
| Hepatitis | 1,550 | 1,544 | 1,769 | 2,027 | 1,317 | 619 | -17% |
| Mumps/parotitis | 152 | 368 | 382 | 289 | 13 | 21 | -33% |
| Infectious diarrhea diseases | 1,038 | 816 | 235 | 810 | 400 | 0 | -100% |
| Scabies | 285 | 289 | 328 | 380 | 538 | 688 | 19% |
| Meningitis and types | 88 | 146 | 191 | 271 | 215 | 263 | 24% |
| Other | 32,036 | 2,682 | 4,194 | 5,546 | 5,546 | 6272 | -28% |
| Total | 36,551 | 7,065 | 8,830 | 10,826 | 9,417 | 9183 | -24% |

Source: Ministry of Public Health

Source: MDPS – Annual Statistical Group – Health Chapter

The following table shows the TB cases registered by country of origin of patients during 2010-2015. TB cases amounted to 529 cases, most of them are of Asian origin, including 143 from Nepal, 120 from India, 53 from Bangladesh, 18 from Qatar, and 176 from other countries. Further, the total TB cases declined by 2% compared to 2010.

**Table 3.48: Number of TB Cases Registered by Country of Nationality 2010-2015**

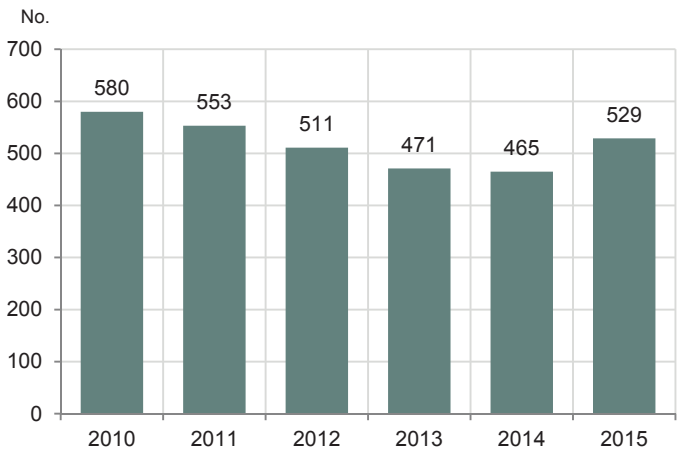
| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Annual growth rate 2010 & 2015 |
|---|---|---|---|---|---|---|---|
| Qatar | 18 | 26 | 14 | 10 | 16 | 18 | 0% |
| KSA | 1 | 2 | 0 | 2 | 0 | 0 | -100% |
| Somalia | 2 | 0 | 1 | 2 | 3 | 0 | -100% |
| Egypt | 4 | 5 | 4 | 5 | 4 | 2 | -13% |
| India | 119 | 129 | 108 | 99 | 100 | 120 | 0% |
| Pakistan | 19 | 20 | 21 | 18 | 22 | 17 | -2% |
| Iran | 2 | 3 | 1 | 0 | 1 | 0 | -100% |
| Bangladesh | 26 | 19 | 29 | 20 | 34 | 53 | 15% |
| Nepal | 236 | 193 | 177 | 157 | 127 | 143 | -10% |
| Other countries | 153 | 156 | 156 | 158 | 158 | 176 | 3% |
| Total | 580 | 553 | 511 | 471 | 465 | 529 | -2% |

Source: Ministry of Public Health

Source: MDPS – Annual Statistical Group – Health Chapter

The following Figure shows the highest decrease is remarked in 2014 compared to 2010. Total cases registered for the different nationalities amounted to 465 cases. However, in 2015, the total cases increased to reach 529.

**Figure 3.52: Number of TB Cases 2010-2015**



The Table 3.49 shows the number of deaths registered by selected causes of death during the period 2012-2015. According to statistics, the annual growth rates of deaths increased by 15% compared to 2012. According to the relative importance, the respiratory system-related deaths (including pneumonia, acute LRTI, chronic lower respiratory diseases, rest of respiratory system diseases) were the highest in terms of causes of death. They made up in average 40% of total death causes during the period (2012-2015). They are as follows: Pneumonia-related deaths (16%), the rest of the respiratory system diseases related deaths (20%), chronic lower respiratory diseases (3%), causes of death related to the malignant tumors in the bronchus and lung (11%).

**Table 3.49: Number of Deaths Registered by Cause of Death 2012-2015**

| Cause of death | 2012 | 2013 | 2014 | 2015 | Annual growth rate 2012 & 2015 |
|---|---|---|---|---|---|
| Infectious diarrhea and gastroenteritis | 0 | 0 | 1 | 0 | |
| Other gastroenteritis | 0 | 0 | 1 | 0 | |
| Other TB diseases | 0 | 0 | 0 | 4 | |
| Blood poisoning | 6 | 13 | 17 | 24 | 59% |
| Hepatitis | 6 | 9 | 12 | 10 | 19% |
| Malaria | 1 | 0 | 1 | 0 | -100% |
| Rest of infectious and parasitic diseases | 6 | 7 | 5 | 6 | 0% |
| Malignant tumor in the bronchus and lung | 23 | 30 | 31 | 35 | 15% |
| Leukemia | 15 | 14 | 13 | 13 | -5% |
| Rest of blood diseases, blood-forming organs diseases, and other particular perturbations including immune mechanism | 9 | 12 | 12 | 3 | -31% |
| Rest of endocrine, nutritional, and metabolic diseases | 22 | 11 | 19 | 17 | -8% |
| Arteriosclerosis | 0 | 1 | 3 | 0 | |
| Rest of circulatory system diseases | 10 | 7 | 9 | 6 | -16% |
| Influenza | 0 | 3 | 4 | 4 | |
| Pneumonia | 16 | 41 | 70 | 50 | 46% |
| Other acute LRTI | 1 | 2 | 2 | 4 | 59% |
| chronic lower respiratory diseases | 9 | 7 | 5 | 7 | -8% |
| Rest of respiratory system diseases | 48 | 40 | 34 | 97 | 26% |
| Liver diseases | 31 | 25 | 35 | 27 | -5% |
| Poisoning incidence and exposure to poisonous substances | 4 | 9 | 53 | 11 | 40% |
| Total | 207 | 231 | 327 | 318 | 15% |

Source MDPS, Births and Deaths Bulletin.

Chapter Four

# Response Activities for Environment Protection and Management

# Response Activities for Environment Protection and Management

This chapter focuses on the State's willingness and commitment to the environment protection and management, and introduction of necessary relevant legislation. It also intends to provide qualified human cadres able to implement the related activities. In addition, this chapter seeks to raise environment awareness culture either through awareness campaigns, or via provision of curricula aiming to inculcate environment protection and management into the children's mind, the leaders of future.

This chapter includes expenditure on environment protection, headcount, volunteers, trainers, and participants featured in the different environment programs, relevant legislation, enviroment laws, international conventions, new projects subject to their impact assessment on environment, environment education, natural disasters preparedeness, and environment investment – green economy.

Response comes last in the analytical conceptual framework series of the model of driving forces – pressures – states – impacts – responses DPSIR. It reflects the response of the community, including all public and private agencies and civil society, regarding the improvement of environment and alleviation of impacts, maintenance of natural resources, and sustainability of natural assets. Response represents a new cycle of the analytical conceptual framework series of the driving forces through adjusting the driving forces pressures and impacts on environment.

Qatar National Vision 2030 comes as a declaration of the response of the State's different bodies to the protection and management of environment which is the fourth pillar of QNV2030. Besides other goals, QNV 2030 aims to establish an equilibrium between development needs and environment resources protection. To ensure the sustainability of economic growth and social wellbeing, there should be a holistic environment vision with the priority to protect environment resources for us and for the coming generations.

The State of Qatar is committed to providing necessary funds for the protection of environment, human resources, and legislative and educational tools related to the environment protection. Meanwhile, it ensures the achievement of sustainable development, and balance among the four pillars of QNV 2030 in terms of distribution of financial and human resources that are necessary for the achievement of this vision and its sectorial strategies related to the environment protection.

This chapter demonstrates Qatar's multiple response aspects to protect environment at national and international level. The State of Qatar has engaged in several relevant international treaties and conventions, and perhaps, the goals of SDG 2030 reflect the relation of sustainability goals with many environment protection and management

response, which the country conducts as part of its commitment to the environment protection as part of the international community. Such interdependence between response and SDG 2030 is shown below:

## Box (13): relationship of response indicators with the SDG 2030

- Goal 3, indicator No. 19: net and gross official development aid for medical research and basic health sectors.

- Goal 6, indicator 6: official development aid for the activities and programs related to water and sanitation.

Goal 6, indicator 7: proportion of local administrative units which have institutional and procedural policies and measures for the participation of local communities in the environment management and sanitation.

Goal 7, indicator 5: Effective from 2020, Developed countries undertakes to donate $ 100 million per year.

- Goal 11, indicator 7: the percentage of cities which implement flexible strategies to reduce risks in line with the approved international frameworks (such as the Hyogo Framework to Reduce Disaster Risks)whose designs, implementation and follow-up include the marginalized groups.

Goal 12, indicator No. 3: number of parties in the international multi-party environment conventions on the other hazardous and chemical substances and waste which fulfill their commitments and engagements to submit information requested by each relevant document.

- Goal 12, indicator No. 5: No. of enterprises which publish reports on sustainability7.

- Goal 13, indicator No. 1: Effective from 2020, Developed countries undertakes to donate $ 100 million per year.

- Goal 13, indicator No. 1.3: number of countries which included in their primary, secondary, and tertiary education, the subject of climate change mitigation and adaptation and reduction of its impacts and early warning.

- Goal 14, indicator No. 5: number of countries which implement legislatively and programmatically the conditions mentioned in the regional sea protocols, and ratification and implementation of ILO's marine and fisheries treaties.

- Goal 14, indicator No. (1.B): The achieved progress of countries regarding the application of legal/regulatory/policy/ institutional framework that recognizes the right to protect small fisheries and have access to them.

- Goal 15, indicator No. 8: official development aids and general expenditure on the sustainable preservation and use of biodiversity and ecosystem.

- Goal 15, indicator No. 1.6: number of countries which adopt the legislative, administrative, and

(7) The number of enterprises which submit reports on sustainability amounted to 16 large-sized enterprises in 2015, and accordingly receive the relevant permits from the Ministry of Municipality and Environment.

political frameworks to ensure equal and fair sharing of benefits.

- Goal 15, indicator No. 1.8: The percentage of countries which adopt national legislation related to the prevention and control of invasion of alien species, and provide the necessary resources thereof.

- Goal 17, indicator No. 12: number of countries which ratified and implemented the relevant international instruments within the International Maritime Organization (safety, security, environment protection, civil accountability, compensation and insurance), and the ILO's Maritime Convention, and adopted carbon pricing mechanisms.

## 1. Expenditure on environment protection

Among the important and vital response activities, provided by the country and its expenditures sectors, for the environment protection and management, there are the expenses on the environment protection and management. These are financial expenses spent by the public and private sector and households to minimize or reduce environment pollution, rehabilitate facilities and manage environment resources, and ensure the continuity and sustainability of environment services and goods. The national environment strategy includes programs and targets on the expenditures spent on environment protection as shown in the box below:

### Box (14): Relationship of the Expenditure on Environment Protection with National Policies

The following programs/projects resulted from the NDS within the economic stability promotion and environment protection for the coming generations:

**The following programs/projects:**

1-Link public finance with the National Development Strategy/ re-budgeting

Targets:

Establish a forward coordinated budget, linked to the NDS 2011-2016, NDS 2017-2022, and to the operational plans of the spending authorities.

Outcomes:

- Review of public finance framework.

**The following programs/projects:**

2- Public Investment Management

Targets:

- Establish programs of public investment in which the entire biggest decisions related to public

investment are taken, based on a systematic assessment of their benefits and costs in proportion to the national development priorities in general.

- Enable the private sector to engage in public investment projects within a coherent framework that provides development benefits for the country, including knowledge and skills sharing.

Outcomes:

- Public Investment Management Framework

- Close links between the expenditure on environment protection and many environment strategy programs

Relationship of the expenditure on environment protection with the international frameworks such as the SDGs.

A variety of SDGs/ see the box 13 above.

Relationship of the expenditure on environment protection with the international frameworks such as the Indicators of International Competitiveness.

- Spending on health/reducing pollutants in the air, soil, marine environment, and improving environment conditions for the population.

The economic diversification, which is the target of several countries owing to its importance in diversifying the income sources, and reducing dependence on limited resources, is related to and results from the expenditures on environment. In addition, a sustainable economy, able to ensure economic growth without causing harm to the environment sources, stems from the expenditures on environment. This economy which is environment friendly is called the green economy. It is capable of attracting several investments, especially in the quasi-absence of competition when talking about local environment systems. At the same time, this kind of economy usually creates more new job opportunities than the conventional economy does.

## *1.1 Public environment expenditure*

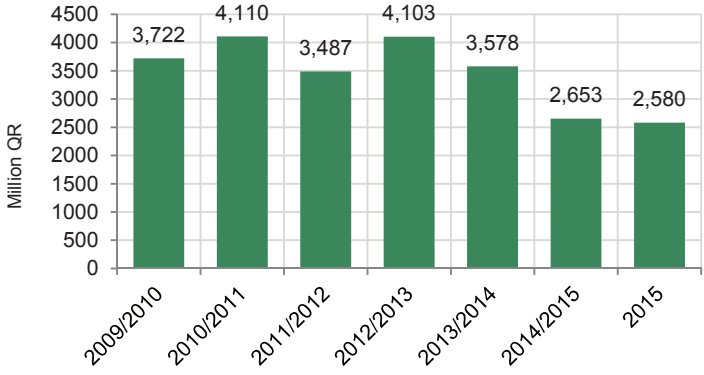
This section features the public expenditure on environment during the period (2004-2015). It covered the majority of items included in the budget of the Ministry of Environment and its other government counterparts in the Classification of the Functions of Government (COFOG). The following is the summary of the main conclusions:

The environment related public expenditure covered many projects and activities concerned with general cleanness, sanitation, waste treatment, construction and maintenance of public parks, planting trees and beautifying streets, in addition to the operational (current) expenditure of a number of public institutions in this sector.

- Statistics indicate that total expenditure on environment during 2004-2015 amounted to around QR30.5 billion. Expenditure is focused in sanitation and waste (69.2%), and in parks project (47%) of total spending on this sector.
- The public budget expenditures on environment increased significantly during the previous twelve year. They rose from less than QR 400 million in the 2004/2005 budget to about QR 4.1 billion in the budget 2010/2011. Afterwards, the expenditure declined gradually to approximately QR 2.6 billion in 2015.
- Doha and Al-Rayyan sewage network projects received the highest share of expenditure on the environment projects. The expenditure increased considerably in budget of the fiscal year 2007/2008 to reach QR 1.1 billion. Total expenditure up to 2015 amounted to about QR16.7 billion.

Figure (4.1) shows the public expenditure on the environment protection and management sector during the fiscal years 2009/2010 – 2015 (million QR). It is noteworthy that these expenses are classified according to the (COFOG). They only included current expenses, salaries and wages of the Ministry of Environment (prior to merger with the Ministry of Municipality and Urban Planning), noting that the environment affairs are distributed in the different ministries and public institutions. In general, the UN Classification of Resource Use and Management Activities and Expenditure (CRUMA) should be adopted to cover the different expenditure on the environment protection and management.

**Figure 4.1: Public Expenditure on Environment Protection and Management (million QR) 2009/2010 - 2015**




The Table (1.4) and Figure (2.4) show the value of public expenditure on the sector of environment protection and management by the type of expenditure and environmental domain (million QR) during the fiscal year 2009/2010 – 2015. From the results, it is clear that expenses on environment amounted to about QR 24.2 billion

during this period, QR 16.6 billion of which focused in the capital expenditure and main projects in the field of sanitation, waste, and parks at an average percentage amounted to 68.6% of total expenditure on the sector of environment during this period. Almost QR 7.6 billion were spent on the current expenditure, salaries and wages at an average of 31.4% of total expenditure on environment during the fiscal years (2009/2010 – 2015).

**Table 4.1: Public Expenditure on Environment Protection and Management by Type of Expenditure and Environmental Domain (million QR) 2009/2010-2015**

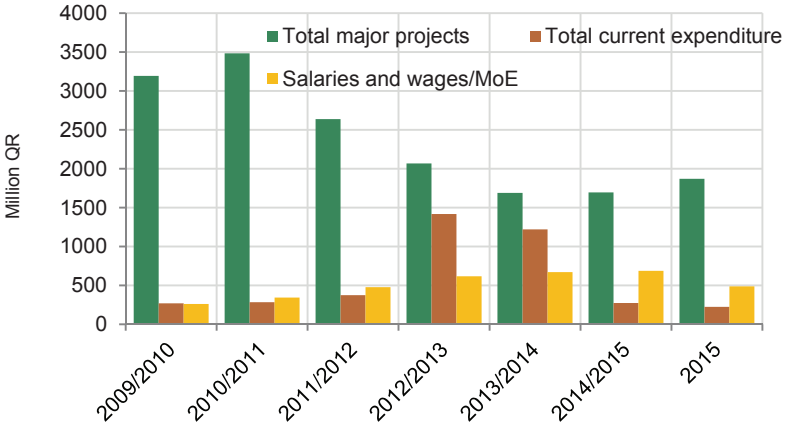
| Type of expenditure | 2009/ 2010 | 2010/ 2011 | 2011/ 2012 | 2012/ 2013 | 2013/ 2014 | 2014/ 2015 | 2015 | Annual growth rate 2009/2010 & 2015 |
|---|---|---|---|---|---|---|---|---|
| **Capital expenditure** | | | | | | | | |
| Waste management | 481.7 | 222.1 | 111.5 | 11.8 | 24.1 | 76.5 | 63.8 | -33% |
| Measurement, control and alike | 0.0 | 0.0 | 5.6 | 6.4 | 13.8 | 2.9 | 1.1 | … |
| Protection of natural views and parks | 31.3 | 111.5 | 226.4 | 165.1 | 89.5 | 110.0 | 18.4 | -10% |
| Wastewater management | 2680.3 | 3149.8 | 2293.6 | 1885.1 | 1562.1 | 1504.8 | 1786.1 | -8% |
| Total key projects | 3193.3 | 3483.5 | 2637.0 | 2068.4 | 1689.5 | 1694.2 | 1869.4 | -10% |
| **Current expenditure** | | | | | | | | |
| Current expenditure/ Ministry of Environment | 192.6 | 218.0 | 254.3 | 785.8 | 684.8 | 124.2 | 87.2 | -15% |
| Waste management | 33.9 | 26.1 | 76.7 | 119.8 | 151.7 | 93.6 | 65.6 | 14% |
| Protection of landscapes and parks | 42.0 | 39.5 | 41.7 | 37.9 | 38.4 | 55.1 | 71.6 | 11% |
| Environment activities not classified elsewhere | 0.0 | 0.0 | 0.0 | 474.5 | 344.1 | 0.0 | 0.0 | 0% |
| Total current expenditure | 268.5 | 283.5 | 372.7 | 1418.0 | 1219.0 | 272.9 | 224.3 | -4% |
| Salaries and wages/ Ministry of Environment | 259.9 | 343.3 | 477.4 | 616.8 | 669.5 | 685.8 | 486.6 | 13% |
| Total expenditure on environment protection | 3721.7 | 4110.3 | 3487.1 | 4103.2 | 3577.9 | 2652.9 | 2580.3 | -7% |

Source: Ministry of Economy and Finance – Financial Policies Management.

The below-cited Table shows that the share of salaries and wages at the Ministry of Environment made up an average of about 15% during the period 2009/2010-2015, whereas the current expenditure constituted 9% of total expenditure on environment protection (capital expenditure, current expenditure, salaries and wages).

According to the results, Most capital expenditures were on sanitation projects where expenditure ratio amounted to 90% of total capital expenditure on environment protection and management during the fiscal years (2009/2010-2015). The average capital expenditure on sewage projects reached 71% of total spending on environment protection (capital expenditure, current expenditure, salaries, and wages) during the same period.

**Figure 4.2: Public Expenditure on Environment Protection and Management by Type of Expenditure and Environmental Domain (million QR) 2009/2010 - 2015**




## *1.2 Government expenditure on environment by the spending agency*

The Table (4.2) shows that the environment concerned public agencies' total financial expenditure on environment increased from QR 24.4 billion in 20019/2010 to QR 30.2 billion in 2013/2014; a 24% growth between the two fiscal years.

Concerning the agency with the highest spending on environment, there is the Supreme Council for Environment whose expenditure rose from QR 949 million in 2009/2010 to QR 1.4 billion in 2013/2014. In other words, its expenditure increased twofold and a half. During the same period, the Supreme Council for Environment's expenditure proportion was only 2% of total expenditure of the public agencies concerned with environment in 2009/2010, and increased to 5% in 2013/2014.

Regarding the type of expenditure, the Supreme Council for Environment's capital expenditure on secondary and primary projects attained 5% of total expenditure (current and capital expenditure) during the fiscal year 2013/2014. In general, the capital expenditure growth rate increased by 14% in 2013/2014 compared to 2009/2010. The capital expenditure rose from QR 20.8 billion in 2009/2010 to QR 23.8 billion in 2013/2014. Ashghal's capital expenditure on the environment doubled in

2013/2014 compared to 2009/2010. It increased from QR 5.1billion in 2009/2010 to QR 10.3 billion in 2013/2014.

**Table 4.2: Government Environment Agencies' Expenditure on Environment by Year and Spending Agency for the Fiscal Years* (Thousand QR) 2009/2010–2013/2014**

| Spending agency | Salaries/wages | Current expenditure | Capital expenditure on secondary projects | Capital expenditure on major projects | Total |
|---|---|---|---|---|---|
| **2009/2010** | | | | | |
| Supreme Council for Environment | 259,868 | 192,596 | 15,258 | 8,002 | 475,724 |
| General Authority of Civil Aviation | 156,691 | 221,080 | 17,000 | 8,476,187 | 8,870,958 |
| Public Works Authority (Ashghal) | 250,117 | 208,333 | 25,000 | 5,085,145 | 5,568,596 |
| Ministry of Energy and Industry | 627,600 | 1,706,666 | 35,611 | 7,136,737 | 9,506,614 |
| **2010/2011** | | | | | |
| Supreme Council for Environment | 343,300 | 218,018 | 21,665 | 79,974 | 662,957 |
| General Authority of Civil Aviation | 140,729 | 269,131 | 16,283 | 9,958,286 | 10,384,430 |
| Public Works Authority (Ashghal) | 275,135 | 226,239 | 18,033 | 5,777,587 | 6,296,994 |
| Ministry of Energy and Industry | 654,796 | 1,838,208 | 38,398 | 10,514,589 | 13,045,991 |
| **2011/2012** | | | | | |
| Supreme Council for Environment | 477,392 | 254,268 | 19,575 | 107,189 | 858,424 |
| General Authority of Civil Aviation | 189,110 | 327,397 | 13,750 | 10,819,223 | 11,349,480 |
| Public Works Authority (Ashghal) | 368,026 | 231,604 | 50,000 | 6,392,539 | 7,042,169 |
| Ministry of Energy and Industry | 756,996 | 2,993,720 | 35,457 | 7,705,928 | 11,492,101 |
| **2013/2014** | | | | | |
| Supreme Council for Environment | 669,445 | 684,357 | 9,073 | 61,851 | 1,424,727 |
| General Authority of Civil Aviation | 265,443 | 299,668 | 45,000 | 7,823,638 | 8,433,749 |
| Public Works Authority (Ashghal) | 491,540 | 355,000 | 86,667 | 10,298,367 | 11,231,573 |
| Ministry of Energy and Industry | 732,737 | 2,917,127 | 66,836 | 5,400,872 | 9,117,571 |

*: Data of 2012/2013 are not available
Source: Ministry of Finance

## *1.3 Expenditure on environment by environmental domain*

Expenditure is generally divided into two types: current expenditure which includes operating expenses, maintenance, salaries and wages, and the capital expenditure which features expenditure on projects, and assets increasing.

The environment protection and management activities are divided into several classes according to the environmental domain on which spending takes place to protect and manage it. These environmental domains consist of different environment

aspects such as waste and wastewater management, biodiversity, air pollutants reduction, environment researches and development, environment assets management, etc. Based on data availability, the following Table shows the expenditure on environment by environmental domain and type of expenditure in 2015. Not all the targeted agencies in this study provided the required data, and some of them provided data without giving segregated of the type of expenditure or identified environmental domain.

Table (4.3) indicates that the highest expenditure on the environment protection and management was on wastewater management at 68% of total expenditures on the environmental fields, followed by reduction of natural and technological disasters (15%), whereas the expenditure on environmental domain not elsewhere classified reached 9% of total expenditure on the different environmental fields.

Results about the type of expenditure indicate that the percentage of capital expenditure of total expenditure (current and capital) on the different environmental domains, where both capital and current expenditures are found, registered only 14%. In light of limited data availability, it was difficult to generalize this percentage. Regarding the highest capital expenditure, it was on the reduction of pollution (air and climate protection) at around 52% of total expenditure on this field (current and capital expenditures).

**Table 4.3: Environmental Expenditure by Type of Expenditure and Environmental Domain (Thousand QR) 2015**

| Code | Environmental Domain | Current expenditure | Capital expenditure | Total | Percentage distribution |
|---|---|---|---|---|---|
| | **Waste management** | | | | |
| **1.4** | Thermal treatment* | 20.0 | 0.0 | 20.0 | **%0.01** |
| | **Wastewater treatment** | | | | |
| **2.2** | Sewage systems | 68,874.4 | 0.0 | 68,874.4 | |
| **2.3** | Wastewater treatment units | 78,416.5 | 0.0 | 78,416.5 | |
| **2.4** | Cooling water treatment * | 3,000.0 | 0.0 | 3,000.0 | |
| **2.5** | Measurement, control and alike. | 5,470.8 | 0.0 | 5,470.8 | |
| **2.7** | Other activities | 3,519.0 | 0.0 | 3,519.0 | |
| | Total | 159,280.7 | 0.0 | 159,280.7 | **68.0%** |
| | **Expenditure on abatement of pollution (air and climate protection)** | | | | |
| **3.2** | Ambient air protection | 214.9 | 124.2 | 339.0 | |
| **3.5** | Other activities | 164.6 | 290.6 | 455.2 | |
| | Total | 379.5 | 414.8 | 794.3 | **0.34%** |
| | **Protection against radiation (excluding external safety)** | | | | |
| **7.1** | Ambient air protection | 280.1 | 0.0 | 280.1 | |
| | **Research & Development (R&D)** | | | | |
| **9.7** | Studies to protect species and habitats | 2,022.5 | 55.0 | 2,077.5 | |

| Code | Environmental Domain | Current expenditure | Capital expenditure | Total | Percentage distribution |
|---|---|---|---|---|---|
| **9.8** | Environment impact assessment | 461.9 | 0.0 | 461.9 | |
| | Total | 2,484.4 | 55.0 | 2,539.4 | **1.08%** |
| | **Environment protection activities not elsewhere classified (n.e.c)** | | | | |
| **10.1** | General management and environment-related laws and instructions, and likewise. | 299.2 | 0.0 | 299.2 | |
| **10.3** | Awareness, training, and environment media and information | 2،677.0 | 150.4 | 2،827.4 | |
| **10.5** | Environment activities, n.e.c | 100.0 | 50.0 | 150.0 | |
| **10.6** | Tools and equipment | 17،900.4 | 79.2 | 17،979.6 | |
| **10.7** | Any other activities (scientific expeditions) | 17.0 | 0.0 | 17.0 | |
| | Total | 20،993.7 | 279.6 | 21،273.3 | **9.08%** |
| | **Reduction of the impacts of natural and technological disasters** | | | | |
| **12.1** | Prevention of natural and technical disasters, preparedness, wreckage removal, and rehabilitation | 25,440.9 | 0.0 | 25,440.9 | |
| **12.2** | Early warning systems | 10,558.0 | 0.0 | 10,558.0 | |
| | Total | 35,998.9 | 0.0 | 35,998.9 | **15.36%** |
| | **Monitoring stations, labs, and other environment observatories** | | | | |
| **13.1** | Monitoring stations protection and rehabilitation | 450.7 | 0.0 | 450.7 | |
| **13.4** | Monitoring stations maintenance cost | 532.0 | 0.0 | 532.0 | |
| **13.5** | Procedures, measures, labs, and likewise. | 5,344.3 | 0.0 | 5,344.3 | |
| **13.6** | Other activities | 7,866.5 | 0.0 | 7,866.5 | |
| | Total | 14,193.4 | 0.0 | 14,193.4 | **6.06%** |
| **Overall total** | | **233,630.7** | **749.3** | **234,380.1** | **100%** |

Source: Via the process of data collection from public agencies targeted in the study

*: Heat treatment and cooling water treatment include data from non-government agencies

## *1.4 Environment expenditure in scientific research*

Qatar's Research & Development Survey 2012 identify a scientific research as a creative work conducted on the basis of a systematic approach. The survey intends to increase the knowledge on human, cultural, and community aspects, and uses them for the invention of new impactions. It is noted that the invention includes a wide set of activities which lead to the introduction of a new or remarkably improved product.

According to the type of research and development, and scientific field, the Research & Development Survey 2012 indicates that expenditure on research by sector in the field of environment for business sector, amounted to 30% of total expenditure on research and development, and to 53.1% in the government sector, and 0% in the higher education sector. It is noteworthy that the classification of research and development is made according to the binary number, leading sometimes to the incorporation of some environment sciences with other sciences and fields, or the incorporation of some other sciences with the environment fields. The second Research and Development Survey 2015 is already well underway.

## Table 4.4: Expenditure on R&D by Sector and Classification of Social and Economic Goals (QR) 2012

| Item | Business sector | | Government sector | | Higher education sector | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Value Q.R. | % | Value Q.R. | % | Value Q.R. | % | Value Q.R. | % |
| **Land discovery and exploitation** | 99,414,707 | %12 | 30,901,525 | %2.9 | 136,298,297 | %10 | 266,614,528 | %8.2 |
| **Environment** | 252,360,409 | %30 | 53,768,654 | %5.1 | 0 | %0 | 306,129,063 | %9.4 |
| **Transportation, communication, and other infrastructure-related areas** | 30,589,141 | %3.6 | 15,450,763 | %1.5 | 0 | %0 | 46,039,903 | %1.4 |
| **Energy** | 122,356,562 | %15 | 32,755,617 | %3.1 | 0 | %0 | 155,112,179 | %4.8 |
| **Industrial and technological production** | 59,648,824 | %7.1 | 15,450,763 | %1.5 | 74,964,063 | %5.5 | 150,063,650 | %4.6 |
| **Health** | 107,061,992 | %13 | 403,573,918 | %38 | 284,863,440 | %21 | 795,499,349 | %24 |
| **Agriculture** | 0 | %0 | 80,343,965 | %7.6 | 0 | %0 | 80,343,965 | %2.5 |
| **Education** | 91,767,422 | %11 | 203,950,066 | %19 | 185,365,683 | %14 | 481,083,171 | %15 |
| **Culture, entertainment, religion, and media means** | 0 | %0 | 9,270,458 | %0.9 | 408,894,890 | %30 | 418,165,347 | %13 |
| **Political, social systems and structures, and processes** | 39,765,883 | %4.7 | 63,039,111 | %6 | 81,778,978 | %6 | 184,583,972 | %5.7 |
| **General knowledge delivery** | 38,236,426 | %4.5 | 142,147,015 | %14 | 190,817,615 | %14 | 371,201,056 | %11 |
| **Total** | 841,201,364 | %100 | 1,050,651,854 | %100 | 1,362,982,966 | %100 | 3,254,836,183 | %100 |

Source: MDPS – R&D Survey 2012

# 2. Employees, Volunteers, trainers, and participants in the different environment programs

## *2.1 Environment protection employees*

Environment is often accused of slowing down the economy due to the environment protection requirements such as the environmental conditions and standards, which some may consider as a hindrance to the economy. However, the reality shows the opposite. When we protect environment, this protection requires the presence of several activities and programs, and therefore the attraction of further investments which push forward the economy, and in turn create job opportunities that accomplish the economic cycle.

The employees working in the different environment protection activities are not limited to only specialists. Any employee is working in the environment protection activity is considered environmental worker, even if his/her specialization or job is not directly related to the environment protection. Being an employee in an environmental field means s/he is an environmental worker. The below Tables (4.5) and (4.6) show some employees working in the environment protection activities in 2015, and in the different government, semi-government, and private sectors targeted in the data collection process.

The results of table (4.5) indicate the headcount in the environment protection-related industry by nationality, sex, compensation, and main economic activity in 2015. The results show that the highest share by economic activities was in waste collection, treatment and disposal, and materials recovery at 41%, followed by the percentage of employees in the other treatment and service activities of waste management (33%). Employees in sanitation accounted for 26% of total employees in the total activities of supplies, sanitation, and waste management and treatment.

The results indicate the total headcount in total activities of supplies, sanitation, and waste management and treatment amounted to 1.5 thousand (1%) of total headcount in the industry sector which amount to167.1 thousand employees, of which the Qatari employees make up 1% of total headcount in activities of supplies, sanitation, and waste management and treatment. The compensation of total employees in activities of supplies, sanitation, and waste management and treatment amounted to QR 114.6 million (0.5%) of total compensation of the employees in the industry sector which account for QR 22.5 billion.

## Table 4.5: Headcount in Environment Protection-related Industries by Nationality, Sex, Compensation and Main Economic Activity (Number, Thousand QR) 2015

| Code | Main economic activity | No. of Qataris | | | No. of non-Qataris | | | Total | | | Compensation (000 QR) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Males | Females | Total | Males | Females | Total | Males | Females | Total | Qataris | Non-Qataris | Total |
| **37** | **Sanitation** | 0 | 0 | 0 | 376 | 5 | 381 | 376 | 5 | 381 | 0 | 17,332 | 17,332 |
| **3700** | **Sanitation** | 0 | 0 | 0 | 376 | 5 | 381 | 376 | 5 | 381 | 0 | 17,332 | 17,332 |
| **38** | **Waste collection, treatment and disposal, and materials recovery** | 8 | 0 | 8 | 545 | 40 | 585 | 553 | 40 | 593 | 193 | 59,433 | 59,626 |
| **3821** | **Treatment and disposal of non-hazardous waste** | 0 | 0 | 0 | 351 | 36 | 387 | 351 | 36 | 387 | 0 | 52,212 | 52,212 |
| **3830** | **Materials recovery** | 8 | 0 | 8 | 194 | 4 | 198 | 202 | 4 | 206 | 193 | 7,221 | 7,414 |
| **39** | **Treatment activities, and other waste management services** | 8 | 0 | 8 | 467 | 0 | 467 | 475 | 0 | 475 | 0 | 37,625 | 37,625 |
| **3900** | **Treatment activities, and other waste management services** | 8 | 0 | 8 | 467 | 0 | 467 | 475 | 0 | 475 | 0 | 37,625 | 37,625 |
| **E** | **Total activities of supplies, sanitation and waste management and treatment** | 16 | 0 | 16 | 1,388 | 45 | 1,433 | 1,404 | 45 | 1,449 | 193 | 114,390 | 114,583 |
| **3821** | **Treatment and disposal of hazardous waste** | 0 | 0 | 0 | 351 | 36 | 387 | 351 | 36 | 387 | 0 | 52,212 | 52,212 |

Source: MDPS – Annual Bulletin of Economic Statistics/ energy and industry

According to the Table (6.4) below, there are some remarks on data such as the lack of commitment of some data providers. For example, the headcount in the annual allocations of environment protection activity (total annual salaries for these employees), we sometimes find compatible data on the headcount and the annual allocations according to the environment protection activities, and sometimes we find that data on the headcount without mentioning their annual allocations. However, we sometimes find the opposite because data were provided on the annual allocations without mentioning the headcount.

According to the available data, the results in the table indicate that the number of employees working in environment related activities and programs that target, in general, environment protection were the highest in terms of the annual allocations (71%) of total annual allocations for the employees working in the different environment activities, followed by the employees in the activities of groundwater quality control and air quality (18%) of total annual allocations in the different environment activities.

## Table 4.6: Headcount in Different Environment Activities by Type of Activity, Sex, Nationality and Annual Salaries (Number, QR) 2015

| Different environment activities | Headcount in environment | | | | | | | | | Total annual salaries (QR) | Percentage distribution | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Qataris | | | Non-Qataris | | | Overall total | | | | Labor | Total salaries |
| | Males | Females | Total | Males | Females | Total | Males | Females | Total | | | |
| **Employees in environment protection** | 29 | 21 | 50 | 17 | 5 | 22 | 46 | 26 | 72 | 30,075,920 | %6.9 | %71.1 |
| **Employees in environment security and safety** | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 516,000 | %0.1 | %1.2 |
| **Employees in wastewater treatment** | 4 | 0 | 4 | 0 | 730 | 730 | 4 | 730 | 734 | 1,800,000 | %70.1 | %4.3 |
| **Employees in groundwater quality control and air quality** | 3 | 6 | 9 | 23 | 5 | 28 | 26 | 11 | 37 | 7,789,590 | %3.5 | %18.4 |
| **Employees in waste management** | 0 | 0 | 0 | 7 | 0 | 7 | 7 | 0 | 7 | 250,000 | %0.7 | %0.6 |
| **Employees in environment management and information** | 0 | 4 | 4 | 1 | 0 | 1 | 1 | 4 | 5 | 1,880,331 | %0.5 | %4.4 |
| **Employees in other environment activities (meteorology forecasting, environmental modeling)** | 79 | 38 | 117 | 70 | 4 | 74 | 149 | 42 | 191 | ... | %18.2 | ... |
| **Total** | 116 | 69 | 185 | 118 | 744 | 862 | 234 | 813 | 1,047 | 42,311,841 | %100.0 | %100.0 |

Source: data collected from the agencies targeted in the data collection process

The Table above shows that the percentage of employees in wastewater treatment activities is the highest (70%) of total employees in the different environment activities, followed by the employees working in the other environment activities which include meteorology, climate modeling, forecasts, and other similar fields at 18% of total employees in the different environment activities. The percentage of employees in the environment management and information, employees in environment security and safety, and employees in waste management reached 1.2% of total employees in the different environment activities.

According to the nationality of employees, the Table (4.6) shows that male and female Qatari employees amounted to 185 (18%) of total employees in the activities of environment management and protection (1047 employees).

Table (4.7) shows the headcount in the different environment protection activities by educational status, nationality, and sex in 2015 according to the available data. Holders of intermediate diploma who have university level and above reached 69.6% of total employees in the environment protection activities, whereas the holders of secondary diploma or less than secondary diploma amounted to 28.9% of total employees in the different environment protection activities. Around 1.5% of employees in environment protection activities are stated without giving their educational level.

**Table 4.7: Headcount* in Different Environment Protection Activities by Education, Nationality and Sex 2015**

| Item | Qataris | | | Non-Qataris | | | Overall total | | | Total headcount percentage distribution |
|---|---|---|---|---|---|---|---|---|---|---|
| | Males | Females | Total | Males | Females | Total | Males | Females | Total | |
| **Less than secondary** | 10 | 2 | 12 | 19 | 0 | 19 | 29 | 2 | 31 | %9.1 |
| **Secondary** | 36 | 15 | 51 | 16 | 0 | 16 | 52 | 15 | 67 | %19.8 |
| **Intermediate diploma** | 8 | 1 | 9 | 25 | 0 | 25 | 33 | 1 | 34 | %10.0 |
| **University and above** | 56 | 51 | 107 | 83 | 12 | 95 | 139 | 63 | 202 | %59.6 |
| **Not specified** | 3 | 0 | 3 | 1 | 1 | 2 | 4 | 1 | 5 | %1.5 |
| **Total** | 113 | 69 | 182 | 144 | 13 | 157 | 257 | 82 | 339 | %100.0 |

Source: data collected from the agencies targeted in the data collection process

*: Headcount in this Table is incompatible with the headcount in the above Table (4.4) due to the fact that some agencies have only provided data on the headcount without their education levels.

## 2.2 *Volunteers, trainers and participants in the different environment programs*

The Table (4.8) shows the number of volunteers, trainers, and participants in some different environment programs, according to data availability, education, nationality, and sex in 2015. The results indicate that Qataris (58.2%) are the highest in terms of volunteers, trainers, and participants in the environment programs, whereas non-Qataris represented 41.8%. Regarding gender, the male Qatari volunteers accounted for 55.7% as against 44.3% of non-Qatari males. The female Qatari volunteers amounted to 62.1% compared to female non-Qatari volunteers which registered 37.9%.

As for the education level of the volunteers, trainers, and participants in the different environment programs, the percentage of 85.9% is registered for the volunteers with secondary and less than secondary diploma, and 14.1% for the volunteers with an intermediate diploma and above.

**Table 4.8: Number of Volunteers, trainers and participants in different environment programs by education, nationality and sex 2015**

| Item | Qataris | | | Non-Qataris | | | Overall total | | | Percent |
|---|---|---|---|---|---|---|---|---|---|---|
| | Males | Females | Total | Males | Females | Total | Males | Females | Total | |
| **Number of volunteers in environment** | | | | | | | | | | |
| **Volunteers in environment protection** | 395 | 300 | 695 | 315 | 183 | 498 | 710 | 483 | 1,193 | %95.6 |
| **Trainers who provided environment training courses and workshops** | 1 | 0 | 1 | 2 | 0 | 2 | 3 | 0 | 3 | %0.2 |
| **Participants in the different environment programs** | 30 | 0 | 30 | 22 | 0 | 22 | 52 | 0 | 52 | %4.2 |
| **Total*** | 426 | 300 | 726 | 339 | 183 | 522 | 765 | 483 | 1,248 | %100.0 |
| **Education level** | | | | | | | | | | |
| **Less than secondary** | 210 | 170 | 380 | 165 | 95 | 260 | 375 | 265 | 640 | %59.5 |
| **Secondary** | 13 | 95 | 108 | 110 | 66 | 176 | 123 | 161 | 284 | %26.4 |
| **Intermediate diploma** | 35 | 20 | 55 | 25 | 15 | 40 | 60 | 35 | 95 | %8.8 |
| **University and above** | 20 | 15 | 35 | 15 | 7 | 22 | 35 | 22 | 57 | %5.3 |
| **Total *** | 278 | 300 | 578 | 315 | 183 | 498 | 593 | 483 | 1,076 | %100.0 |

Source: data collected from the agencies targeted in the data collection process

*: There is a difference in the number of volunteers and their education level due to the fact that some agencies have not mentioned the education level of volunteers in their different environment programs.

## 3. Environmental Commitment activities

The scientific and specialized aspects of environment management and protection are not less important than the ones that are embodied in the obtaining of environment-related prizes by national agencies, awarded either from international organizations, or other national institutions. Besides, These aspects can be manifested in environment-focused gatherings, meetings, and conferences at national, regional and international level. In addition, they can be represented in awareness campaigns which are perhaps the most well-known and widespread activities. Those awareness campaigns can be separate or an accompanying activity to a particular environmental project. There are also environment advocacy programs which represent activities reflecting the willingness of communities and organizations to protect environment. They can be manifested in a community development aspect that targets local neighboring communities in a particular environment project, and therefore, an integrated plan would be established to realize material and moral benefits. However, they do not change a lot in their living patterns.

Table (4.9) displays one aspect of these activities which express the environmental compliance on different levels in 2015 according to data availability. Data were not provided from all the agencies targeted in the study. The results indicate that expenditure on the environment awareness activities was the highest among the other relevant environment compliance activities at 47.6% (QR 6 million). In the second place came the expenditure on the environment development campaigns targeting local community at 31.3% (QR 4 million), followed by the expenditure on the courses, conferences, and training workshops related the environment at 17.6% of total cost of these activities.

According to the number of these environmental activities, the environment-related courses, conferences, and workshops came first at 21.1% of total relevant activities, followed by the environmental prizes which were obtained by national agencies at 18.4%, followed by awareness campaigns at 17.1% of total relevant activities.

**Table 4.9: Environment Commitment Activities by Type of Activity and Cost (QR) 2015**

| Environmental commitment activity | No. of activities | Cost (QR) | Activities (%) | Cost (%) |
|---|---|---|---|---|
| Environment-related courses, conferences, and workshops | 16 | 2,250,000 | %21.1 | %17.6 |
| Environmental development campaigns for local community | 12 | 4,000,000 | %15.8 | %31.3 |
| Environment advocacy programs | 4 | 450,000 | %5.3 | %3.5 |
| Environment awareness campaigns | 13 | 6,098,000 | %17.1 | %47.6 |
| No. of environment contests | 6 | ... | %7.9 | ... |
| Obtained environment related prizes | 14 | | %18.4 | |
| Awarded environment-related prizes | 11 | ... | %14.5 | ... |
| Total | 76 | 12,798,000 | %100.0 | %100.0 |

…: Not available
Source: data collection from the agencies included in the study/questionnaire

The Table (4.10) shows the distribution of prizes during the period 2010-2015 according to the number of prize-awarded national agencies, type of prizes, and awarding agency (international or national) according to data availability. In general, the results show that these prizes are awarded in 2015, and the majority of them were awarded from international agencies totaling 71.4 of total prizes awarded.

**Table 4.10: Number and Type of Prizes Obtained by National Agencies 2010-2015**

| Year | No. of national agencies which obtained prizes | No. of prizes | Type of prizes | |
|---|---|---|---|---|
| | | | National | International |
| **2010** | 1 | 2 | 0 | 2 |
| **2011** | 1 | 2 | 0 | 2 |
| **2012** | 1 | 3 | 0 | 3 |
| **2013** | 1 | 3 | 0 | 3 |
| **2014** | 1 | 6 | 1 | 5 |
| **2015** | 3 | 14 | 4 | 10 |

Source: data collection from the agencies included in the study/questionnaire

- All the targeted agencies have not provided the required data, and some of them have not provided data in a chronological order, while others have not committed to the required details.

# 4. Environment related legislation and regulations and international conventions

The Permanent Constitution of the State of Qatar presents several environment-centered issues, and asserts their alignment with the Islamic standards and Sharia from which the Constitution is derived, and in accordance with the international standards. The Article (6) of the Permanent Constitution says: the State shall respect international charters and conventions and shall strive to implement all international agreements, charters and conventions to which it is a party. In addition, the Articles (23) and (33) on public health, natural resources, and environment protection and its natural balance, the Constitution seeks to realize the comprehensive and sustainable development for all generations. As a result, environment-focused regulations and legislation have been derived from these laws.

## *4.1 Environment related regulations and legislations*

The legislation and regulations which organize and impose the environment management and protection go hand in hand with the rest of the State's response acts to the management of environment. For example, there is the financing aspect (expenditure), availability of human resources, and other aspects of the State's preparedness for environment protection. Table (4.11) shows the number of laws and legislative regulations issued by the State's different agencies to protect and manage the environment, as well as the international and regional conventions and agreement during the period 2011-2015. According to the relative importance of legislation, the "ministerial decision" and "law" constitute 38.5% each, the "Emiri decisions" 15.4%, and the "decree" and "law" 7.7% in 2015.

The relative importance of international and regional conventions and treaties in 2015, the decree concerned with these conventions and Agreements reached 66.7% of total ministerial decrees, decisions, and laws.

**Table 4.11: Number of Legislations Issued for the Environment Protection and Management by Convention and Type of Legislation 2011-2015**

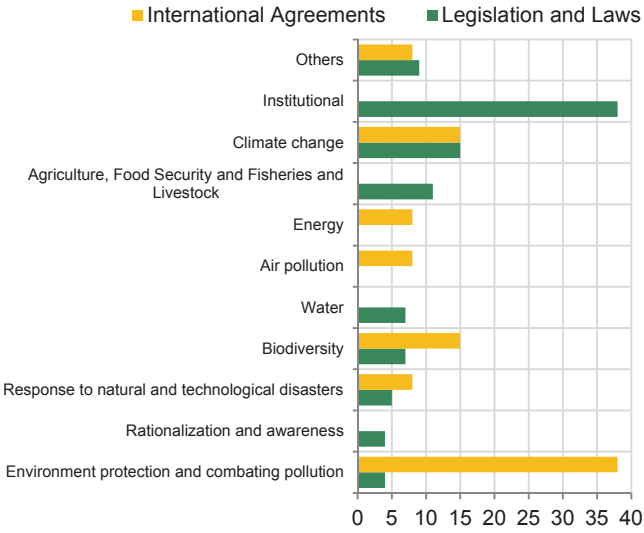
| Year | Type of Legislation | | | | | International and Regional Conventions and Agreements | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Emiri | Ministerial | Decree and Law | Law | Total | Decree | Ministerial Decision | Law | Total |
| **2011** | 4 | 7 | 0 | 0 | 11 | 0 | 0 | 0 | 0 |
| **2012** | 2 | 4 | 2 | 0 | 8 | 0 | 0 | 1 | 1 |
| **2013** | 0 | 5 | 2 | 0 | 7 | 4 | 0 | 1 | 5 |
| **2014** | 6 | 7 | 0 | 0 | 13 | 1 | 0 | 0 | 1 |
| **2015** | 2 | 5 | 1 | 5 | 13 | 4 | 1 | 1 | 6 |

In respect of international and regional legislation, laws, conventions, and agreements, during the period 2010-2015, and issued according to the environmental field, the Figure (4.3) below indicates that the Emiri and ministerial decisions related to the organization and restructuring of the institutions concerned with the environment protection and management reaped the highest percentage, followed by the percentage of ministerial

decisions related to the climate change amounting to 15%. In third place, came the ministerial decisions on agriculture, food security, and fisheries and livestock at 11%.

The results of the international conventions indicate that the environment protection and anti-pollution attained 38%, followed by the agreements on climate change and biodiversity which registered 15% each. In third place, there were the agreements on air pollution, energy, and natural disaster response at 8%.

**Figure 4.3: Relative Distribution of Legislation, International Agreements on Environment Protection by Type of Environmental Domain and Type of Legislation 2011-2015**




## 4.2 *International conventions*

Since the joining of the State of Qatar to the United Nations in 1971, it has been an active member in multiple international, Islamic, Arabic, and Gulf affairs. It has also been a member-state in different UN's specialized agencies since 1971, and a member of the Muslim World League since 1972, and the Arab League since 1971. It was also a founding member of GCC in 1981.

The State of Qatar lives within a global organism governed by multiple international and regional frameworks, conventions, and laws from which the different types of agreements and their specializations are derived. It is well-known that the environment issues are entirely transboundary, which require concerted efforts of all countries to protect the environment of our planet.

The State of Qatar, within its response framework for the environment protection and management, has been an effective party in several environment protection and management – centered conventions, either international, bilateral, or multilateral, as well as at regional and Arab level. It is noteworthy that many legislative, institutional, human, and financial aspects were resulted accordingly to keep up with the requirements of these agreements. The appendix delineates a list of these environment-relevant conventions which the State of Qatar has signed.

## 5. The new projects whose effects on environment are subject impact assessment

The projects in the State of Qatar are subject to impact assessment on the environment, which is a process whose scope and type of analysis rely on the nature and volume of potential environment impacts of the proposed project. The environment assessment tackles the risks and potential environmental impacts on a particular region, and searches for the project available alternatives. In addition, it also identifies the means which lead to the improvement of the choice of the project impact, site, planning, design, and implementation to prevent, reduce, mitigate, or compensate its negative environment impacts. The environmental assessment features the alleviation and management of negative environment impacts all over the project implementation period. The environmental evaluation takes into account the natural environment (air, water, and land), human health and safety, and social aspects. The project owner shall be responsible for the conduct of the environmental impact assessment.

### Box (15): the relation of the new projects impact assessment with their effects on environment and public health

The following programs and projects resulted from the NDS to promote the economic and technical efficiency:

The program/project:

- Additional public health services

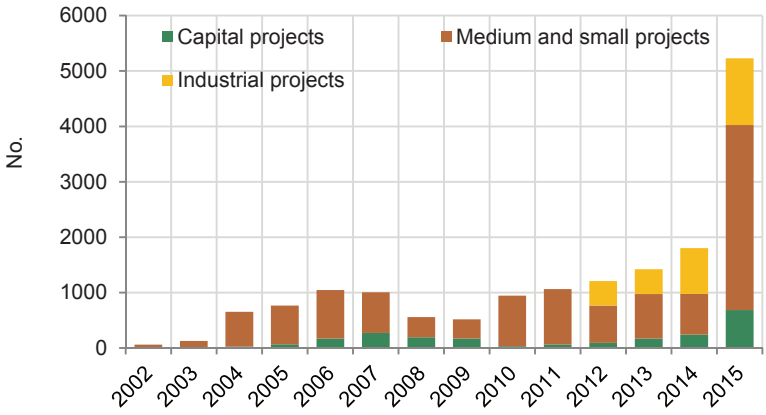
Targets: - Evaluate the environmental effects on health in the entire projects which affect public health.

Outcomes: - Provide public health with additional needs.

The findings of the Figure below show a rise in the number of projects which are subject to the environmental impacts assessment evaluation as a response to the environment conditions in 2015 compared to the number of projects in 2010. The number of projects increased approximately fourfold to reach 5,231 in 2015 compared to 943 in 2010.

The highest rise ratio was in the capital projects where it was over twenty times higher in 2015 than 2010, followed by the small and medium projects which increased threefold in 2015 compared to 2010. In third place came the industrial projects which doubled vis-à-vis 2012.

**Figure 4.4: Number of New Projects Whose Effects on Environment Are Subject to Impact Assessment by Type of Project 2002-2015**




Source: Ministry of Municipality and Environment

# 6. Environment-related education

Not only does environment protection tackle reduction of pollutants and emissions, but it has gone beyond that to become typical for human beings, especially in their educational phases, when they comprehend the relations between the biotic and abiotic components within which we live. Further, the environment-related education provide us with specialists capable of managing change in the human activities to align them with the laws of the universe, and not to ruin, with our own hands, the living organisms within which we are living. In addition, the environment-related education addresses the negative effects caused by the population and economic growth on the environment resources and ecosystem.

The national strategies-related knowledge and skill building programs assert the importance of education role and scientific research in the achievement of the different types of human development. The box below delineates the relation of education with environment and National Development Strategy.

### Box (16): the relation of environment-related education with the National Development Strategy

The following programs and projects resulted from the National Development Strategy within the environment protection program for the coming generations:

Program/project:

Effective and productive scientific research

Targets:

- Establish a national strategy that pinpoints priority areas for the scientific research and development.

Outcomes:

- Achieve a higher level of scientific innovation

The relation of education-related education with SDGs 2030

- Inclusion of climate change issues on the national curricula

## *6.1 Environment-specialized students and graduates at different universities and faculties.*

The environment-related education has a role in the environment awareness increase. The environmental science areas, which are characterized by extreme diversification to include approximately the most well-known life sciences, are distributed, and overlap in the economic and social aspects to work together within an integrated organism to achieve sustainability. In this regard, the below Table demonstrates the

number of students at universities and faculties in the State of Qatar according to gender, university, college, and environmental specialization during the academic years 2010/2011–2014/2015. In addition, the findings show that the number of students rose recently during the period 2010-2015. The number of male and female students reached 98 and 176 respectively in 2015, with an annual increase rate of 27% for males and 28% for females compared to 2010/2011. In terms of the number of students by university and faculty, the highest number was at Qatar University's different educational levels compared to their counterparts in the other educational institutions. The number of both male and female students amounted to 233, i.e. 85% of total students in environment-specialized educational institutions.

**Table 4.12: Number of Students at Universities and Faculties by Gender, University, Faculty and Environment Specialization during Academic Years 2010/2011–2014/2015**

| Universities and faculties | Environment-related education major | 2010/2011 | | 2011/2012 | | 2012/2013 | | 2013/2014 | | 2014/2015 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | M | F | M | F | M | F | M | F | M | F |
| **Qatar Aeronautical College** | Meteorology | 17 | 9 | 18 | 12 | 1 | 9 | 2 | 7 | 9 | 3 |
| **North Atlantic College – Qatar** | HSE | 4 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | Health and Safety – Public Health | 4 | 13 | 0 | 0 | 0 | 0 | 7 | 17 | 0 | 0 |
| | Health and Safety: Food Security and Inspection | 6 | 7 | 0 | 0 | 0 | 0 | 4 | 2 | 0 | 0 |
| **UCL – Qatar** | Archeology | | | | | | | 5 | 8 | 5 | 8 |
| | Conservation | | | | | | | 5 | 9 | 3 | 12 |
| **Qatar University** | Environment Sciences | 7 | 35 | 16 | 43 | 34 | 51 | 45 | 73 | 58 | 105 |
| | Master in Environment Sciences | 0 | 0 | 0 | 8 | 1 | 16 | 2 | 15 | 4 | 11 |
| | Master in Environmental Engineering | 0 | 0 | 4 | 5 | 7 | 7 | 6 | 10 | 14 | 13 |
| | Master in Urban Planning and Design | 0 | 0 | 1 | 10 | 0 | 8 | 1 | 15 | 3 | 21 |
| | PhD in Urban Planning and Design | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 3 |
| **Total** | | 38 | 65 | 39 | 78 | 44 | 91 | 78 | 158 | 98 | 176 |

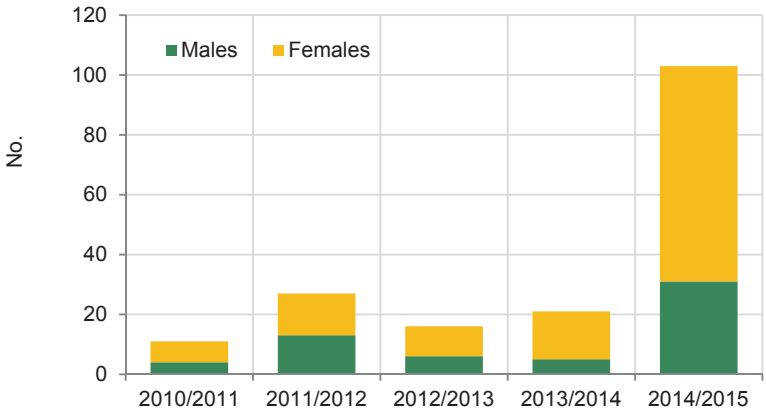
Source: Public and private universities

Similarly, Figure (4.5) shows the number of graduates majoring in environmental areas of study increased during the period 2010/2011– 20114/2015. The male and female graduates amounted to 23 and 37 respectively in 2014/2015.

The number of graduates according to the educational institution was the highest at Qatar University with its different educational levels compared to the number of graduates from the other educational institutions. The number of male and females

graduates amounted to 25, i.e. 42% of total graduates in the environment majors in the educational institutions.

**Figure 4.5: Number of Graduates in Environment-Specialized Majors from Universities and Faculties by Gender 2010/2011 - 2014/2015**




## 6.2 *Environment on the curriculum*

The inclusion of environment subjects on the curriculum of the different educational levels is considered a quantum leap in the consolidation of the environment concepts and issues. The environment subjects are also linked to the evaluation of human behavior towards the environment and natural resources protection related issues, e.g. waste generation reduction, culture of recycling, and maintenance of biodiversity related to the food chains and many other environmental topics which were tackled by these curricula.

This inclusion leads to increase the awareness of the children of today, who will be the leaders of tomorrow, about the different environmental issues, and arm them with education which will enable them to sustainably manage the future development.

Table (4.13) shows that these environment lessons and modules are featured in the preliminary educational levels. It is remarked that the percentage of modules, which addresses the environmental topics in the first and second grades, amounted to 25% of total modules for the subject of sciences. Further, in the fifth and sixth grades, the Table below indicates that a clear attention is given to the subjects of environment. The environment-centered modules attain around 50% compared to the entire modules of science in both grades. The focus on the environmental issues continues until advanced levels (ninth grade) to become later a specialized areas of study such as chemistry, physics, and biology from the tenth to the twelfth grades.

**Table 4.13: Number of Environment Modules in the Subject of Sciences in Primary and Preparatory Levels 2015**

| Grade | Environment modules | Overall modules | Percentage of environment modules of total modules | Biotic components* | Abiotic components** |
|---|---|---|---|---|---|
| **First semester** | | | | | |
| First | 2 | 8 | 25% | 2 | 0 |
| Fifth | 4 | 7 | 57% | 3 | 1 |
| Sixth | 3 | 7 | 43% | 2 | 1 |
| Seventh | 1 | 8 | 13% | 1 | 0 |
| Eighth | 3 | 7 | 43% | 1 | 2 |
| Ninth | 4 | 8 | 50% | 2 | 2 |
| **Second semester** | | | | | |
| First | 2 | 8 | 25% | 2 | 0 |
| Third | 1 | 3 | 33% | 1 | 0 |
| Fourth | 3 | 4 | 75% | 1 | 2 |
| Fifth | 2 | 6 | 33% | 1 | 1 |
| Sixth | 3 | 5 | 60% | 2 | 1 |
| Seventh | 5 | 8 | 63% | 2 | 3 |
| Eighth | 3 | 7 | 43% | 1 | 2 |
| Ninth | 2 | 9 | 22% | 0 | 2 |

*: Biotic environment components feature all living organisms in the environment – humans, flora, fauna, fungi, bacteria, and the rest of the unicellular organisms.

**: Abiotic environment components include the physical parts of the environment: soil and land, water and air, energy (temperature and light), wind – wind-propelled force, sea waves, water flow in the valley or on the earth's surface , water-propelled force.

Source: data collection from different grades curricula

Table (4.14) displays the number of environment-centered modules which were included in the subjects of biology, physics, and chemistry in the secondary level in 2015. The results point out that the percentage of the environment-centered modules in the subject of biology in the basic twelfth grade was the highest during the first and second semesters. It constituted an average in both semesters of 83% of the number of total modules of the subject of biology.

The percentage of environment-focused modules in the subject of biology in the advanced eleventh grade came second at 75% during both the first and second semesters of total number of modules for the subject of biology.

As for the environment modules percentage in the subject of physics, the findings show that the advanced eleventh grade was the highest during the second semester. It attained 75% of total modules number for the physics subject in the second semester. Both the basic and advanced twelfth grades came second in the second semester, accounting for 50% of the number of total modules of the subject of physics.

Concerning the environment modules percentage in the subject of chemistry, the results show that the basic twelfth grade was the highest during the first and second semesters, at an average of 50% in both semesters of total modules for the subject of chemistry. The basic and advanced eleventh grades came second at 67% of total modules of the subject of chemistry in the first semester. Similarly, the tenth grade achieved the same percentage (67%) in the second semester of total modules for the chemistry subject in the second semester.

**Table 4.14: Number of Environment Modules in Secondary Level in the Subjects of Biology, Physics and Chemistry 2015**

| Grade | Environment modules | Total modules | Percentage of environment modules of total modules | Biotic components* | Abiotic components** |
|---|---|---|---|---|---|
| **Biology (First semester)** | | | | | |
| Twelfth (basic) | 3 | 3 | 100% | 1 | 2 |
| Eleventh (advanced) | 3 | 4 | 75% | 0 | 3 |
| twelfth (advanced) | 2 | 3 | 67% | 0 | 2 |
| **Biology (Second semester)** | | | | | |
| Tenth (basic) | 2 | 4 | 50% | 1 | 1 |
| Eleventh (basic) | 2 | 3 | 67% | | 2 |
| Twelfth (basic) | 2 | 3 | 67% | 1 | 1 |
| Eleventh (advanced) | 3 | 4 | 75% | 1 | 2 |
| Twelfth (advanced) | 1 | 4 | 25% | 0 | 1 |
| **Physics (First semester)** | | | | | |
| Eleventh (basic) | 1 | 3 | 33% | 0 | 3 |
| **Physics (Second semester)** | | | | | |
| Twelfth (basic) | 1 | 2 | 50% | 0 | 2 |
| Eleventh (advanced) | 3 | 4 | 75% | 0 | 4 |
| Twelfth (advanced) | 1 | 2 | 50% | 0 | 2 |
| **Chemistry (Second semester)** | | | | | |
| Tenth | 2 | 3 | 67% | 0 | 3 |
| Eleventh (basic) | 2 | 3 | 67% | 0 | 3 |
| Twelfth (basic) | 1 | 3 | 33% | 0 | 3 |
| Eleventh (advanced) | 2 | 3 | 67% | 0 | 3 |
| Twelfth (advanced) | 1 | 4 | 25% | 0 | 4 |
| Twelfth (basic) | 2 | 3 | 67% | 0 | 3 |

*: Biotic environment components feature all living organisms in the environment – humans, flora, fauna, fungi, bacteria, and the rest of the unicellular organisms.

**: Abiotic environment components include the physical parts of the environment: soil and land, water and air, energy (temperature and light), wind – wind-propelled force, sea waves, water flow in the valley or on the earth's surface , water-propelled force.

Source: data collection from different grades curricula

Due to their ramification and interrelation with many aspects and sciences, some environmental and scientific issues have been included in the culture and social subjects.

Table (4.15) shows the number of environment-focused modules in the subjects of social sciences and general knowledge in the primary, preparatory, and secondary levels in 2015. Results indicate that the percentage of environment-focused modules in social sciences was the highest in the preparatory level at an average of 56%, in the secondary level at 53%, and in the primary level at 38% of total modules of the subject of the social sciences during the second semester.

Results show that the percentage of environment modules in the subject of general knowledge in the advanced and basic twelfth grades was the highest at 50%, followed by the ninth and tenth grades at 33% of total modules in the subject of general knowledge in the first semester.

**Table 4.15: Number of Environment Modules in Primary, Preparatory and Secondary Levels in the Subjects of Social Sciences and General Knowledge 2015**

| Grade | Environment modules | Overall modules | Percentage of environment modules | Biotic components * | Abiotic components** |
|---|---|---|---|---|---|
| **Social sciences (Second semester)** | | | | | |
| Third | 2 | 4 | 50% | 0 | 2 |
| Fourth | 2 | 6 | 33% | 0 | 2 |
| Fifth | 1 | 6 | 17% | 1 | 0 |
| Sixth | 3 | 6 | 50% | 1 | 2 |
| Seventh | 4 | 6 | 67% | 2 | 2 |
| Eighth | 2 | 6 | 33% | 1 | 1 |
| Ninth | 4 | 6 | 67% | 3 | 1 |
| Tenth | 4 | 6 | 67% | 1 | 3 |
| Eleventh (basic) | 2 | 4 | 50% | 1 | 1 |
| Twelfth (basic) | 1 | 2 | 50% | 1 | 0 |
| Eleventh (advanced) | 2 | 4 | 50% | 1 | 1 |
| Twelfth (advanced) | 1 | 2 | 50% | 0 | 1 |
| **General knowledge (First semester)** | | | | | |
| Eighth | 2 | 6 | 33% | 2 | 0 |
| Ninth | 1 | 6 | 17% | 1 | 0 |
| Tenth | 2 | 6 | 33% | 0 | 2 |
| Eleventh (basic) | 2 | 6 | 33% | 0 | 2 |
| Twelfth (basic) | 1 | 4 | 25% | 0 | 1 |
| Eleventh (advanced) | 2 | 4 | 50% | 0 | 2 |
| Twelfth (advanced) | 1 | 4 | 25% | 0 | 1 |

*: Biotic environment components feature all living organisms in the environment – humans, flora, fauna, fungi, bacteria, and the rest of the unicellular organisms.

**: Abiotic environment components include the physical parts of the environment: soil and land, water and air, energy (temperature and light), wind – wind-propelled force, sea waves, water flow in the valley or on the earth's surface , water-propelled force.

Source: data collection from different grades curricula

# 7. Environmental Investment – green economy

The environmental investment concept refers to the investment that is beneficial to the environment protection and management, leading to the demonstration of one aspect of the State's response management for the environment protection and management.

The environmental investments in the State of Qatar are diverse in multiple environmental fields, such as the processes of waste collection, treatment, and recycling; the service providers of the works of gardening, parks, and landscape views; the enterprises which provide cooling methods, and environmental consulting; the enterprises which provide wastewater management, and renewable energy investments; and other investments whose services are concerned with the environment protection and management. However, no data on environmental investments were available during the preparation of this report.

The environmental investments are not only beneficial to the environment, but to the society and economy as well, and therefore achieve a balance among the three sustainable development pillars. These investments are accompanied by the creation of job opportunities for different positions such as ordinary labor, skilled labor, specialists and experts. Moreover, such kind of investments leads to the creation of diverse economic opportunities which push forward the economic growth in different sectors.

## *7.1 Environment services-related industries*

The Table (4.16) delineates the economic activities associated with the environment services which are classified according to the ISIC (Rev. 4) on the industry of supplies and activities of wastewater, and waste management and treatment. Based on the results, a financial deficit is remarked in this activity. The net added value is negative, and it represents the total added value of depreciation. According to the data in the Table below, the total added value is negative representing production minus the supplies of goods services.

## Table 4.16: Environment Protection-Related Industries by Economic Activity and Added Value 2015

| Activity code (ISIC) | Main economic activity | Net added value | Depreciation | Total added value | Supplies of goods and services | | | Production value | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Total | Services | Goods | Total | Other revenues | Products |
| **E** | **Water supplies, Sanitation, and waste management and treatment** | -32,458 | 11,635 | -20,823 | 538,608 | 473,362 | 65,246 | 517,785 | 135,253 | 382,532 |
| **37** | **Sanitation** | 22,147 | 5,200 | 27,347 | 53,954 | 48,995 | 4,959 | 81,301 | 0 | 81,301 |
| **3,700** | **Sanitation** | 22,147 | 5,200 | 27,347 | 53,954 | 48,995 | 4,959 | 81,301 | 0 | 81,301 |
| **38** | **Waste collection, treatment and discharge, and material recovery** | -177,755 | 6,435 | -171,320 | 421,629 | 394,640 | 26,989 | 250,309 | 0 | 250,309 |
| **3821** | **Treatment and Discharge of hazardous waste** | -191,073 | 4,197 | -186,876 | 396,566 | 381,516 | 15,050 | 209,690 | 0 | 209,690 |
| **3,830** | **Material recovery** | 13,318 | 2,238 | 15,556 | 25,063 | 13,124 | 11,939 | 40,619 | 0 | 40,619 |
| **39** | **Other treatment and management of Waste** | 123,150 | 0 | 123,150 | 63,025 | 29,727 | 33,298 | 186,175 | 135,253 | 50,922 |
| **3,900** | **Other treatment and management of Waste** | 123,150 | 0 | 123,150 | 63,025 | 29,727 | 33,298 | 186,175 | 135,253 | 50,922 |
| | **Total** | -32,458 | 11,635 | -20,823 | 538,608 | 473,362 | 65,246 | 517,785 | 135,253 | 382,532 |

Source: MDPS – Annual Economic Statistics Bulletin/Energy and Industry

## 7.2 *Alternatives to provide cooling*

Among the response activities, there are environment-friendly alternatives compared to the conventional means. These activities are featured in the green economy which is aimed at reducing the conventional economy negative impacts on the environment via the exploitation of non-conventional sources as alternatives in water resources uses, energy consumption reduction, and therefore reduction of emissions.

For example, multiple enterprises have recently adopted the district cooling method through air cooling service which is provided by cooling units that use treated wastewater in the cooling process. According to Kahramaa, the energy used in such type of cooling is less by 40% - 50% than its counterpart methods of conventional cooling.

The production of this type of cooling in the State of Qatar is made by enterprises specialized in this field, and some other establishments which provide that kind of cooling for own use. There are some establishments which treat sewage water produced by the establishment itself, and then used it in cooling within an integrated process aiming to treat wastewater and reduce energy uses.

Table (4.17) regarding some of these enterprises shows the saved electrical energy that is used in the process of cooling compared to the conventional method, and the reduction of CO2 emissions. This contributes to improving the quality of environment, preserving the natural resources, and creating a large number of job opportunities compared to the conventional cooling methods (approximately without staff). The cooling stations offered around 35 technical jobs, apart from the other accompanying jobs such as clerks, accountants, salespersons, and service and support staff.

**Table 4.17: Some Indicators of the Cooling Process during 2010-2015**

| Year | Cooling stations capacity (million tons of cooling/hour | Used water (m3) | Used energy (GWh) | Electrical energy saving vis-à-vis conventional cooling (GWh) | Reduction of generated emissions vis-à-vis conventional cooling method (million tons of carbon dioxide-equivalent) |
|---|---|---|---|---|---|
| **2010** | 169,995,710 | 1,390,419 | 187 | 102 | 66,024 |
| **2011** | 124,837,668 | 1,514,603 | 222 | 125 | 80,497 |
| **2012** | 267,276,750 | 1,953,508 | 264 | 190 | 122,714 |
| **2013** | 291,185,327 | 2,078,022 | 286 | 209 | 134,960 |
| **2014** | 324,620,702 | 2,388,304 | 327 | 225 | 145,329 |
| **2015** | 364,783,976 | 2,713,526 | 367 | 253 | 163,104 |

Source: Data collection from the targeted agencies

# 8. Preparedness for natural disasters

The preparedness for natural disasters and emergencies features measures and procedures that reduce the effects of natural and technical disasters and emergencies. At the same time, it monitors and demonstrates the response plans for the State, private sector, and community organizations to confront natural disasters and calamities. It also monitors the amount of foreign aid provided for the natural disaster-stricken countries. The State of Qatar provides aid for many affected countries in the different places worldwide. However, during the preparation stage of the report, we were not able to obtain the required data on Qatar's aid given to other countries, nor the data representing Qatar's preparedness for disasters and calamities. Despite availability of some data in the expenditure section in this report regarding early warning programs and preparedness for disasters and emergencies in a government agency, these data do not reflect high preparedness of the State of Qatar in this regard.

# References and data sources


1. The Permanent Constitution of the State of Qatar
2. NDS 2011-2016
3. UNEP
4. Qatar Civil Aviation Authority – Meteorology Department
5. Ministry of Municipality and Environment
6. Ministry of Public Health
7. Ministry of Finance
8. Ministry of Interior
9. Public Works Authority (Ashghal)
10. Qatar General Electricity and Water Coporation (Kahramaa)
11. CGIS – Qatar
12. Ministry of Municipality and Environment – Annual Agricultural Comsuption Bulletin
13. Ministry of Municipality and Environment – Annual Bulletin of Crop Production Tracts
14. Ministry of Municipality and Environment – Annual Bulletin of Fish Statistics
15. MDPS – Environment Statistics Reprot 2013
16. MDPS – Water Statistics Report 2016
17. MDPS – Annual Statistical Abstract – Environment Statistics Chapter
18. MDPS - Annual Statistical Abstract – Agriculture Statistics Chapter
19. MDPS - Annual Statistical Abstract – Population Statistics Chapter
20. MDPS - Annual Statistical Abstract – Education Statistics Chapter
21. MDPS - Annual Statistical Abstract – Foreign Trade Statistics Chapter
22. MDPS – Annual Statistical Abstract – Transport Statistics Chapter
23. MDPS - Annual Statistical Abstract – National Accounts Statistics Chapter
24. MDPS - Annual Statistical Abstract – Foreign Trade Statistics Chapter
25. MDPS – Window on Economic Statistics of the State of Qatar
26. MDPS – Census of Population, Housing and Establishments 1986, 1997, 2004, 2010 and 2015.
27. MDPS – Annual Economic Statistics Bulletin
28. MDPS – Labor Force Sample Survey
29. Population Permanent Committee – Population and Waster Report
30. Book: Climate in the State of Qatar – Omar Soleiman Madwi – Civil Aviation and Meteorology Department 1997

31. https://www.moi.gov.qa/site/arabic/departments/coastBorder/sections/sec357/357.html
32. http://www.cpc.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml
33. http://www.hail.org.sa/page.aspx?id=71fb6854-729b-42c3-899a-02aa1114db2
34. http://www.almrsal.com/post/267121
35. http://shamela.ws/browse.php/book-2021/page-40#page-40
36. http://bougria-tif.blogspot.qa/2011/09/blog-post_3740.html
37. http://www.raya.com/Mob/GetPage/f6451603-4dff-4ca1-9c10-122741d17432/d91cdf97-9f94-4aa8-8aae-bdcc08fb30c4
38. http://www.raya.com/home/print/f6451603-4dff-4ca1-9c10-122741d17432/4538c0fe-64f2-458a-9aec-1ce86540b6b5
39. http://kenanaonline.com/users/lobnamohamed/posts/379381
40. http://www.mme.gov.qa/cui/view.dox?id=455&contentID=3539&siteID=1
41. http://www.qna.org.qa/News/

# Appendices

## Environment-Related International Conventions 1978-2016

| Year | Type of Convention |
|---|---|
| **International Convention** | |
| **1987** | Vienna Convention (1985) for the Protection of the Ozone Layer, and Montreal Executive Protocol of 1987 on ODS and its amendments of 1990 and 1992. |
| **Decree 15 of 1996** | The Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal 1989 |
| **Decree 29 of 1999** | Convention to Combat Desertification in the Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa |
| **Decree-law 22 of 2001** | Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction |
| **2004** | The Rotterdam Convention on Prior Informed Consent (PIC) Procedure of Certain Pesticides and Chemicals in International Trade |
| **1993** | Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction |
| **1995** | The Basel Convention on the Control of Transboundary Movements of Hazardous Waste and Their Disposal 1989 |
| **1996** | The Comprehensive Nuclear-Test-Ban Treaty |
| **1997** | The Convention on the Law of Non-Navigational Uses of International Watercourses |
| **2001** | Stockholm Convention on Persistent Organic Pollutants |
| **2004** | The International Treaty on Plant Genetic Resources for Food and Agriculture |
| **2005** | Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation of 2005 (Complete Text of Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation of 2005( |
| **2005** | The Protocol for the Suppression of Unlawful Acts against the Safety of Fixed Platforms Located on the Continental Shelf |
| **2009** | Qatar's Agreement with the International Atomic Energy Agency to apply guarantees within the framework of Nuclear Weapons Non-Proliferation Convention |
| **2010** | The cultural cooperation convention between the Government of Qatar and the Islamic Educational, Scientific and Cultural Organization |

| Year | Type of Convention |
|---|---|
| **Multilateral Agreement** | |
| **1971** | The Ramsar Convention on Wetlands |
| **1973** | Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| **1979** | The Convention on the Conservation of Migratory Species of Wild Animals |
| **1982** | United Nations Convention on the Law of the Sea, Third Conference of the Law of the Sea |
| **Decree 36 of 1989** | Protocol concerning Marine Pollution resulting from Exploration and Exploitation of the Continental Shelf 1988 |
| **1992** | UN Framework Convention on Climate Change |
| **Decree-law 90 of 1996** | The Biodiversity Convention 1992 |
| **2016** | Paris Agreement on Climate Change 2016 |
| **Regional Conventions** | |
| **1979** | Convention on the Establishment of the Arab Fisheries Company |
| **1990** | Protocol of Protection of the Marine Environment against Pollution from Land-based Sources on 21 February 1990 - Regional Marine Environment Protection Organization in Kuwait (regional) |
| **1992** | GCC Unified Patent System |
| **2001** | Convention on Conservation of Wildlife and its Natural Habitats in GCC countries |
| **2011** | Statute of the GCC Emergency Management Center |
| **International Protocol** | |
| **2007** | Cartagena Protocol on Biosafety |
| **Bilateral Agreements** | |
| **1993** | Agreement between the Government of the State of Qatar and the United Nations Educational, Scientific and Cultural Organization of the work on the UNESCO Regional Bureau for Arab countries in the Gulf |
| **2008** | MoU on bilateral recognition of precious metals stamping and cooperation in the measurement and monitoring of precious metals and valuable stones between the Government of Qatar and the Government of Sultanate of Oman |
| **2012** | MoU on agriculture, livestock, and fishing between the Government of Qatar and Government of Bulgaria |
| **2012** | MoU on cooperation in education and scientific research between the Government of Qatar and Ukraine's Cabinet |
| **2016** | MoU between the State of Qatar and Government of Turkish Republic on the cooperation in environment |

QNL Deposit Number:

ISBN:

www.mdps.gov.qa