



UNITED ARAB EMIRATES  
MINISTRY OF ENERGY & INDUSTRY



# United Arab Emirates 4rth National Communication Report



# Welcome

## to the United Arab Emirates' Fourth National Communica- tion Report

This report has been prepared following substantial collective efforts from a series of stakeholders and Government entities within the UAE, working under the United Nation Framework of Climate Change, to illustrate the systematic process and the substantial progress that the UAE has made to mitigate climate change related issues.

In February 2016, the UAE Government announced a strategic restructuring process that instructed the creation of new Ministries. One of these was the Ministry of Climate Change and Environment created to manage all aspects related to climate change and environment.

One of the strategic goals of the Ministry of Climate Change and Environment is to work with local and federal stakeholders across the UAE to achieve the goals and objectives related to climate change and environment under the UAE Vision 2021, a strategic and visionary document that sets the requirements for sustainable growth in the Nation.

The delivery of a Sustainable Environment and Infrastructure is one of the six national priorities identified in the National Agenda of the Vision 2021 for appropriate government action. This priority focuses on the goals to improve the quality of air, preserving water resources and increasing the contribution of clean energy.

The goal of the UAE Government is to ensure sustainable development while preserving the environment and balancing economic and social development in cooperation with relevant UAE entities and across sectors.

The UAE has proven through numerous initiatives, both local and international, that it is laying out comprehensive actions to achieve these goals. It is significantly reducing its carbon emissions through a wide array of initiatives, such as the monitoring and tracking of Global Greenhouse Gas emissions to assess its impact and create policies, strategies, and measures for continued reduction of GHG emissions.

Earlier this year, the government has announced the UAE Energy Plan 2050 which will aim to reduce carbon dioxide emissions by 70 percent from the power sector. This achievement is enabled by increasing the share of clean energy in the generation mix to 50 percent and improving energy efficiency by 40 percent by the middle of the century, resulting in savings worth up to AED 700 billion.

The action contributes to the UAE's drive to attain green growth and sustainable development to expand the role of low carbon technologies in the economy by investing in renewable energy and peaceful nuclear energy.

Furthermore, green growth plans are being implemented under the UAE's Green Agenda 2015-2030. Other notable national-level environmental strategies and action plans include the Biodiversity Strategy and Action Plan, Marine and Coastal Sustainability Strategy and the Water Conservation Strategy and Strategy to Combat Desertification.

In 2017, the UAE launched the National Climate Change Plan to 2050, which is a comprehensive framework to transition into a climate resilient, green economy, while managing greenhouse gas emissions, minimizing climate risks and increasing climate adaptation capabilities, and engaging the private sector and other stakeholders in developing innovative solutions. At the heart of the Plan are the national clean energy targets of 27% by 2021, and 50% by 2050, to be achieved through the deployment of large-scale nuclear and renewable energy projects. The UAE Council of Climate Change and Environment established in 2016 will oversee the implementation of the Plan.

The UAE continues to be an active participant and contributor to numerous regional and international dialogues and environmental conventions, including the UN Framework Convention on Climate Change, Convention on Biological Diversity, UN Convention to Combat Desertification and the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

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**United Arab Emirates**



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# Chapter



# National Circumstance



# Governance

The government of the UAE is a constitutionally based federal system. As is common to federal governance structures, each of the individual emirates retains certain powers. At the federal level, the governance structure comprises several interconnected governing bodies that include the Supreme Council, the Council of Ministers (Cabinet), the Federal National Council (parliamentary body) and the Federal Supreme Court, an independent judiciary.

The Supreme Council, comprising the rulers of each constituent emirate, holds both legislative and executive powers, directs policy and elects a president from amongst the Supreme Council to serve for a five-year term. In 2009, the Supreme Council reelected President Sheikh Khalifa for another five-year term.

The Council of Ministers or Cabinet is the executive authority for the federation and is headed by the Prime Minister (also the Vice President) following approval by the Supreme Council and President.

The Prime Minister/Vice President then proposes the Cabinet, which requires the president's ratification. Legislative power is shared with the Federal National Council, which debates, reviews and makes recommendations to federal draft laws, constitutional amendments, annual budgets, and international treaties. Consisting of 40 members from all seven emirates half of whom are directly elected by the citizenry and the other half appointed, the Federal National Council wields considerable influence over the drafting of new legislation as the majority of their recommendations and amendments have been implemented.

The Federal Judiciary, whose independence is guaranteed by the Constitution, includes the Supreme Court and the Courts of First Instance. The Federal Supreme Court consists of five judges who are appointed by the Supreme Council and who arbitrate on the constitutionality of laws, inter-emirate disagreements, and the disputes between individual emirates and the federal government.

UAE Vision 2021 was launched by H.H. Sheikh Mohammed bin Rashid Al Maktoum, Vice-President and Prime Minister of the UAE and Ruler of Dubai, at the closing of a Cabinet meeting in 2010. The Vision aims to make the UAE among the best countries in the world by the Golden Jubilee of the Union. In order to translate the Vision into reality, its pillars have been mapped into six national priorities, which represent the key focus sectors of government action in the coming years. These sectors are national identity- justice- education- health- economy- environment.

In 2016 a new ministerial structure have been published by the UAE government forming the list of ministries to support UAE 2021 vision agenda.

In 2016 a new ministerial structure have been published by the UAE government forming the the list of ministries to support UAE 2021 vision agenda:

**Ministry of Defence**

**Ministry of Presidential Affairs**

**Ministry of Foreign Affairs and International Cooperation**

**Ministry of Cabinet Affairs & The Future**

**Ministry of Community Development**

**Ministry of Health and Prevention**

**Ministry of State for Federal National Council Affairs**

**Ministry of Climate Change and Environment**

**Ministry of Interior**

**Ministry of Finance**

**Ministry of Culture and Knowledge Development**

**Ministry of Economy**

**Ministry of Education**

**Ministry of Human Resources and Emiratisation**

**Ministry of Justice**

**Ministry of Energy**

**Ministry of Infrastructure Development**

# Oil and Gas

The UAE is a leading global producer of oil and natural gas, ranking seventh in proven reserves for oil and seventh in the world regarding natural gas (OPEC, 2014).

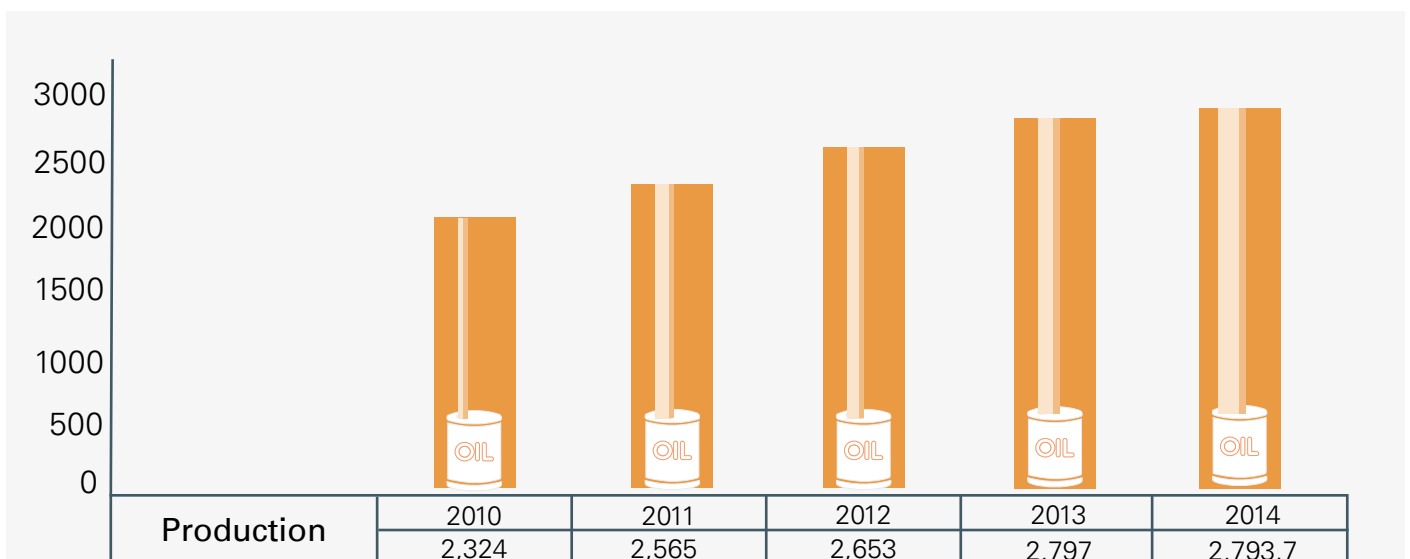
The UAE has proven oil reserves of 97.8 billion barrels as of 2014, accounting for about 6.6% of global oil reserves. Although recent explorations have not yielded new oil reserves, the UAE has been able to maintain its proven reserves through enhanced oil recovery (EOR) technologies that increases extraction rates of mature oil projects. The majority of UAE oil has been exported to Asian markets, particularly Japan. In 2014, the UAE produced about 2.8 million barrels per day, roughly 9% of OPEC production.

*The attached figure below that shows the UAE oil production (2010-2014).*

The UAE has developed a system of domestic pipelines to link production fields with processing plants and ports. The largest of these is the 48" diameter onshore pipeline, and 400 km long Abu Dhabi Crude Oil Pipeline (ADCOP), which transports 1.5 million barrel per day (bbl/d) from ADCO's Habshan oil fields in the Emirate of Abu Dhabi, through the deserts, and mountains of the Emirates of Sharjah and Ras Al Khaima, to the Emirate of Fujairah on the east coast of UAE. The ADCOP was completed in March 2011 and was created in order to increase security of supply while also reducing oil transportation through the heavily trafficked Strait of Hormuz.

The country has proven natural gas reserves of 6.1 trillion cubic meters as of 2014, which represent about 3.0% of global natural gas reserves. The majority of reserves are located in Abu Dhabi, though Sharjah, Dubai and Ras al-Khaima also have marginal amounts.

## UAE Crude Oil Production



Natural gas exports are had managed by an ADNOC subsidiary, Abu Dhabi Gas Liquefaction Co. (ADGAS). The National Gas Shipping Company (NGSCO) handles shipments from (ADNATCO/NGSCO) the LNG plant, and operates the LNG carriers.

In contrast with oil, the UAE is a net importer of natural gas. With electricity and desalinated water generation dependent on natural gas, a rapidly increasing population has placed added pressure on the UAE's natural gas production reserves such that in 2008, domestic consumption of natural gas exceeded production for the first time.

In 2014, the first transboundary natural gas line in the Gulf Arab region started transporting (via subsea pipeline by Dolphin Energy Ltd) approximately 23.197 billion cubic meters (BCM) of natural gas from Qatar's North Field to Abu Dhabi, and 185.5 million cubic meters (MCM) of liquefied natural gas (LNG) to Dubai through tankers by DUSUP at Jabal Ali.

## Climate

The United Arab Emirates has an arid desert climate with only two main seasons, winter and summer separated by two transitional periods respectively.

### ***Winter Season (December to March):***

The winter season comprises the months from December to March. During this season the country could be affected by the ridge of the Siberian high pressure extending towards the Arabian Gulf, associated with fresh northwesterly or northeasterly surface winds at times. The region may also be affected by two different low pressure systems such as the Red Sea trough and the passage of the Mediterranean trough, in addition to the Easterly trough which they could cause different intensities of rainfall over scattered parts of the country.

### ***In this season the temperatures over the country are as follows:***

Mean temperatures	16.4°C to 24°C
Mean maximum Temperatures	21.3°C to 31°C
Mean minimum Temperatures	11.6°C to 19°C

During this period the cold air masses affecting the country causing drop on temperatures passing through the country may cause drops in the temperature. The air temperatures may drop to less than 1°C over the mountains and over some internal regions.

### ***First Transitional Period (April to May):***

The climate is distinguished by with variability and rapid change in weather during this period. The air temperatures are start to increase gradually over most regions of the country in this period:

Mean temperatures	26°C to 33.5°C
Mean maximum Temperatures	32°C to 40.7°C
Mean minimum Temperatures	20°C to 26.6°C

Rain may occur with the passage of depression, may be associated with thunder activities at times. The tropical cyclone, coming from the Indian Ocean and the Arabian Sea may come into sight over the region at the end of this season



### **Summer Season (June to September):**

The Indian monsoon low pressure system and the thermal low over the Empty Quarter are dominant over the region, which play an important role in rising the temperature over the country. The maximum temperature can be expected to climb may be raise up to 50°, especially over the southern parts. Hot and humid air masses are affecting the country.

Mean temperatures	32°C to 37.2°C
Mean maximum Temperatures	38.7°C to 40°C
Mean minimum Temperatures	26.6°C to 31.4°C

Summer rainfall tends to be lower, particularly along the coastal areas, away from the mountains. The mountain ranges play an important role for the clouds to develop and eventually rain in the cloud development process for rainfall to eventually occur, such rainfall is orographic in nature.

### **Second Transitional Period (October to November):**

This period is distinguished by rapid variability in weather. The Siberian high pressure starts to extend towards our region, at which the temperatures drop gradually.

Mean temperatures	24°C to 30°C
Mean maximum Temperatures	29°C to 37°C
Mean minimum Temperatures	19°C to 25.2°C

The relative humidity gradually increases, causing frequent fog formation over different regions of the country. Some low pressure system passes over the lower layer of the atmosphere associated with upper trough, which may lead to rainfall with different intensities.



# Environment

The UAE boasts a diverse range of marine and terrestrial ecosystems such as coral reefs, mangrove forests, sand dunes and mountains, with a wide range of flora and fauna, although it has less virtually no freshwater resources as it is located in a hyper arid desert region. The protection of plants, species and their habitats are therefore important, and 35 protected areas have been established to date, occupying a total area of 15,855 km<sup>2</sup>. The presences of “Blue Carbon” coastal and marine ecosystems (e.g., mangroves, salt marshes and seagrass beds) that store and sequester carbon are particularly noteworthy for their contribution to climate change mitigation and adaptation.

“

On land and in the sea, our fore-fathers lived and survived in this environment. They were able to do so because they recognized the need to conserve it, to take from it only what they needed to live, and to preserve it for succeeding generations.

”

*Sheikh Zayed bin Sultan Al Nahyan, The first President of the United Arab Emirates.*

During the past few decades, the UAE has taken steps to preserving its unique environment through environmental protection policies, measures and activities, in which the establishment of strong institutions have played an important role:

The Supreme Committee of Environment was formed with the task of drafting laws, legislations and regulations in order to ensure a healthy environment.

**1975**

The Federal Environmental Agency was established to replace the Supreme Committee of Environment, and was mandated to look after all the environmental issue at the federal level.

**1993**

The Ministry of Environment and Water was established reflecting the importance of conserving the environment and water.

*February*

**2006**

Following the government reshuffle, the Ministry of Climate Change and Environment was tasked assigned to manage all aspects related to climate change and environment.

*February*

**2016**

The UAE Government aims to ensure sustainable development while preserving the environment and balancing economic and social development in cooperation with relevant UAE entities across sectors. The UAE Vision 2021, the UAE's national development agenda which aims to make the UAE among the best countries in the world by the Golden Jubilee of the Union in 2021, guides the way. Sustainable environment and infrastructure is one of the six national priorities that have been identified for appropriate government action with focus on improving the quality of air, preserving water resources, increasing the contribution of clean energy. Furthermore, green growth plans are being implemented under the UAE Green Agenda 2015-2030. Other notable national-level environmental strategies and action plans include the Biodiversity Strategy and Action Plan, Marine and Coastal Sustainability Strategy and the Water Conservation Strategy and Strategy to Combat Desertification.

The UAE is an active participant and contributor to numerous regional and international dialogues and environmental conventions, including the UN Framework Convention on Climate Change, Convention on Biological Diversity, UN Convention to Combat Desertification and the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

# Education

In 2014, the United Arab Emirates (UAE) ranked 41 out of 188 countries at the “very high human development category” according to the Human Development Index (HDI). Education is considered as one of the most important tools that target the development of the Emirati society. As mandated by the UAE constitution, secondary education is free, while primary education is not only free but also compulsory for all UAE citizens. Lately, gross and net enrollment rates in both primary and secondary education increased significantly.

In its keen pursuit to provide the highest international educational standards and eliminate illiteracy, the UAE -since 1971- has provided formal education through schools, vocational institutes, colleges, and universities. On-formal education programs are also provided. Therefore, the government has allocated 21.2% of the 2016 federal budget to the educational sector. Today, educational institutions are available all over the UAE, providing equal opportunity of education to all students.

## Making a difference

In 2015 the Ministry of Education (MOE) initiated major structural reforms as part of its Strategic Plan 2015-2020 in order to achieve the UAE Vision 2021. The reform processes started by setting an open line of communication between all stakeholders in the educational field and the MOE leadership. The development of education in the UAE has encompassed both male students (50.7%) and female students (49.3%), meeting the needs of all the individuals who join free public schools. Private education sector also plays a complementary role in providing high quality education for all students in UAE.

The education development process started with Developing the National Learning Standards Framework that is aligned with international standards. The framework’s main aim is to equip students with 21st Century skills in addition to fostering UAE graduates with competencies and characteristics acquired by graduates in other developed countries. As part of its steady efforts to boost innovation, the MOE has established the Entrepreneurship and Innovation Directorate (EID). EID is in charge of overseeing outlining the framework and standards for the implementation of entrepreneurship and innovation in education. EID also provides professional development programs for both teachers and students, starting effective connections with national institutions of concern.

The Ministry of Education has always strived to develop a balanced educational environment, by involving both Emirati and expatriate students in a cohesive and harmonious atmosphere, one that provides ample opportunities for promoting the culture of tolerance and peaceful coexistence in the country.

It is also worth mentioning that UAE has achieved gender parity in education. Emirati women have greatly benefited from the educational opportunities offered by the UAE government, which has led many to achieve leadership positions at different levels in the country.

## Curriculum Development

In the Academic Year 2014-2015, the Ministry of Education has initiated a major reform in the national curriculum for all subjects in its attempt to reach the target set by the UAE National Agenda. Grades 1, 4, 7, and 10 curricula for all subjects were first developed based on the National Learning Standards Framework and are to be implemented in 2015-2016. All other grades curricula are being similarly developed, and will be ready for the start of the Academic Year 2016-2017.

The newly developed curricula are designed and structured to help students acquire 21st Century skills and integrating these skills into all subjects throughout all levels and cycles. It also aims at reinforcing UAE's traditions and culture with a special focus on Islam, and the Arabic language as integral parts of the national culture. Special attention is given to ICT, innovation, creativity, critical thinking, problem solving, brainstorming and discussion. More attention is also given to various methods and tools and tools that enhance education process such as project-based learning (PBL), robotic laboratories, and STEAM (the integration of Science, Technology, Engineering, Mathematics and Arts).

As part of MOE's reformation efforts, further changes in the educational system were carried at the secondary level. Science and Art streams were replaced by another tracking system; Regular and Advanced. The new tracking system aims to equip students with strong academic foundation as well as the required skills to ensure direct entry to tertiary education without the need for a foundation year. The new system provides equal opportunities for regular track students to apply for admission to colleges of medicine and natural sciences if they attend special courses at the university during the first year.

The newly developed curricula are also designed to help Emirati students perform better on international assessments. MOE has participated in various international tests such as TIMSS (The Trends in International Mathematics and Science Study), PISA (The Program for International Student Assessment) and PIRLS (Progress in International Reading Literacy Study) to track the quality of education in national schools.

Test results shall provide decision-makers with information needed to plan for future development. They also scale and measure specific skills and competencies among the Emirati students compared to students from all over the world. It is worth mentioning that in the year 2011, UAE students participated in the (TIMSS) and (PIRLS) assessments. UAE students managed to achieve advanced results in the Arab Region in Sciences, Mathematics, and Reading. The UAE government has ambitious plans to exceed the international standards, which are set by the International Association for the Evaluation of Educational Achievement (IEA) through continuous curricula, instruction, and assessment criteria development.

MOE is working to introduce a new track for academically distinguished students, known as Advanced Science Program (ASP). The ASP program mandates that students study mathematics and sciences in English starting from grade 7 through grade 12 in addition to preparing them to take the internationally renowned Advanced Placement (AP) tests. This gives students preference for university admission and possible exemption from some first year university courses.

## Higher Education

Secondary school graduates, who are eligible for tertiary education admission, are given the chance to join government-owned higher education institutes at a zero cost. The UAE government also provides Emirati students with the option of pursuing their university education abroad, as part of the government scholarship programs. The below table shows the number and gender of secondary graduates who joined the government owned higher education institutes in the academic year 2009-2010.

### Academic year 2016/2017 Enrollment data

Institution Type	National		Non-National		Unknown	
	Male	Female	Male	Female	Male	Female
Public	14,327	35,527	1,904	2,782	5	4
Private	15,647	15,270	24,183	27,568	6	32

### Education Sector Environment, Health & Safety Management System Framework

MOE took a proactive approach and actions towards the establishment and development of a modern and integrated Environment, Health & Safety Management System (EHSMS) Framework for the Education Sector. In brief the Education Sector EHSMS Framework establishes the minimum requirements to meet and comply with all the Education Sector Entities. It covers the following criteria starting from leadership, planning, support, operations, monitoring and Performance Management and Evaluation.

It is currently under final revisions for approval and endorsement. It is planned for official launching in September 2016, and shall be monitored by the recently established EHS (Environment, Health & Safety) Directorate at MOE.

Since the establishment of the EHS Directorate 6 months ago and in line with the development process of the EHSMS Framework, the Directorate started its recruitment process for Directorate Staff and Schools EHS Officers. EHS Directorate also planned and conducted the following activities:

- Three sessions for communication and consultation with Schools Leadership Team.
- Three Occupational Health & Safety Qualification Courses for Schools Assessments & Inspections Teams.
- Twenty one Twenty-one Occupational Health & Safety Awareness Qualification Courses for Government Schools Principals.

# Economy

The UAE's economy has proven to be largely resistant to the tumultuous global economy over the last few years. Despite the oil price slump, the UAE was able to maintain its economic growth thanks mainly to its diversification policy implemented to strengthen its non-oil sector.

The country's Gross Domestic Product (GDP) registered a 4.6 per cent growth in 2014 and was increased by approximately 3.5 per cent in 2015 at Constant Prices. The non-oil sector contributed up to 69 per cent to the total revenue, while the oil industry accounted for only 31 per cent.

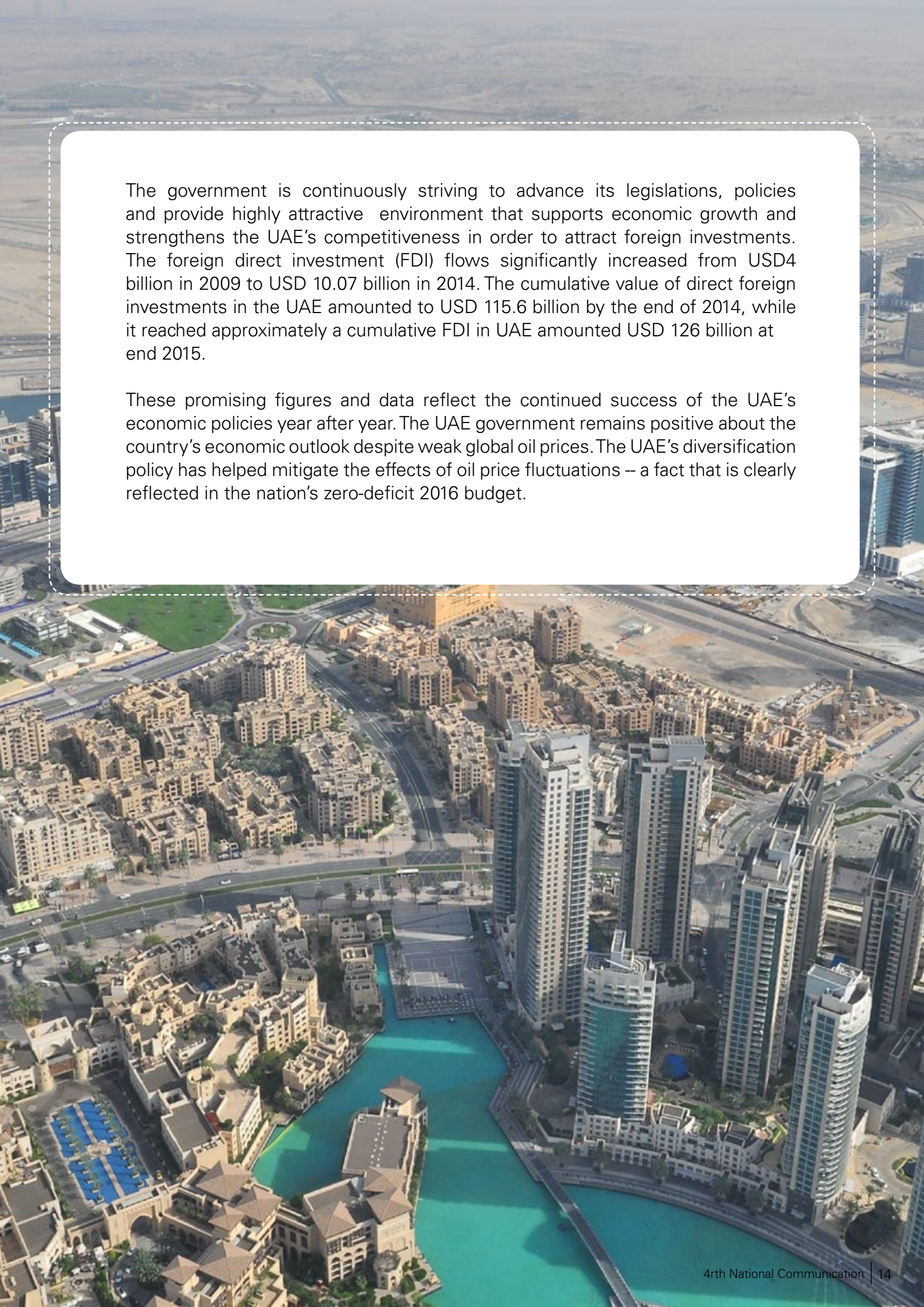
Our well-planned and balanced economic policies enacted under the guidance of our visionary leaders have successfully laid the foundation for our current resilient national economy, enabling us to overcome even the most difficult challenges. Furthermore, the country's sustainable economy reflects our milestones in implementing needed reforms in various economic sectors.

In 2015, the UAE's non-oil foreign trade rose to USD 424 billion from USD 352.6 billion in 2011. The UAE trade data is split into two categories: First, the direct trade data, representing 68% of the UAE total trade volume with the value of USD 288.3 Billion. Second, The Free Zone Trade data, representing 32% of the UAE total trade volume with the value of USD 135.3 billion. The statistical data for the non-oil trade of UAE revealed a significant increase in terms of exports to the outside world. Reaching an increase of 17% over the past year which reflects the quality of the industry and its local products.

The sturdiness of the UAE economy is widely reflected across recent international reports and global indicators. In fact, the country is currently ranked 16th place in the 'Enabling Trade' index and has also placed 17th in the 'Global Competitiveness' report for 2015 - 2016.

The country also secured the 31st place on the Ease of Doing Business Index, maintained its top rank on the world trade map at the region's level, ranked 20th globally in commodity exports, and 19th globally in commodity imports in 2015. These rankings were all based on the Trade Statistics and outlook 2016 report released by the World Trade Organization (WTO) on 7 April 2016 of the same year.

The country also placed first in the Middle East and 30th globally on the list of the most competitive manufacturing nations in the Middle East, according to Deloitte report 2013 released in cooperation with the Global Competitiveness Council Also ranked first among Arab states and 22nd globally on the Global Investment Indicator from June 1, 2013 to June 30, 2014.

An aerial photograph of a modern city, likely Dubai, featuring a large artificial canal with turquoise water. The canal is surrounded by high-rise buildings and residential areas. The sky is clear and blue. The image is framed by a white dashed border.

The government is continuously striving to advance its legislations, policies and provide highly attractive environment that supports economic growth and strengthens the UAE's competitiveness in order to attract foreign investments. The foreign direct investment (FDI) flows significantly increased from USD4 billion in 2009 to USD 10.07 billion in 2014. The cumulative value of direct foreign investments in the UAE amounted to USD 115.6 billion by the end of 2014, while it reached approximately a cumulative FDI in UAE amounted USD 126 billion at end 2015.

These promising figures and data reflect the continued success of the UAE's economic policies year after year. The UAE government remains positive about the country's economic outlook despite weak global oil prices. The UAE's diversification policy has helped mitigate the effects of oil price fluctuations – a fact that is clearly reflected in the nation's zero-deficit 2016 budget.

# Energy

Electricity in the UAE:

Since the start of the 21st century, the UAE Government is delivering one of the most ambitious energy transitions in the region, and the world. To achieve this, the UAE has used its vast expertise in the energy sector and in the creation and delivery of key initiatives, such as innovative Public and Private Partnerships to modernize its electricity sector.

This energy transformation is the result of the collective efforts of energy stakeholders working in close collaboration with policymakers across the UAE, and a continuous support of the leadership of the Nation.

The energy transformation of the UAE targets the diversification of its energy portfolio, with an increasing role of clean energy, greater energy security, and the protection of the environment and conservation of natural resources.

Clean energy has become a strategic resource for the growth of the UAE, and in 2009, the government UAE announced to raise the contribution of the clean energy from 24 per cent to 27 per cent by 2021 as part of its commitment to global efforts to fight climate.

In 2017, the Ministry of Energy announced the Energy Plan 2050, which targets an even greater provision of clean energy by 2050 to a total of 50% of the energy portfolio.

UAE ranked the 1st internationally in electricity access according to the World Bank's Doing Business 2018 . The UAE has for the third consecutive year been ranked first in the Middle East and North Africa, (MENA) and first globally in access to electricity, according to the World Bank's Doing Business 2018 report, which measures the ease of doing business in 189 countries around the world. This achievement reflects the continued efforts exerted by water and electricity authorities across the UAE to provide reliable and commercially viable electricity for various sectors in accordance with international standards and regulations. The Water and Electricity Authorities in the UAE seek to achieve the UAE's target to sustain a highlyperforming and modern electricity sector that powers the growth of the Nation, in adherence to the

- **Efficiency in electricity service by providing production units.**
- **Establishment of high quality electric power transmission & distribution grids to respond to the increasing demand for electricity.**
- **Upgrading equipment operation efficiency in generation, transmission and distribution and rationalization of consumption through public awareness campaigns along with inclusion of other sources of electricity generation such as solar power, nuclear power and wind power.**



The following four authorities are responsible for supply of water and electricity in the UAE:

**Abu Dhabi Water & Electricity Authority – Responsible for Water & Electricity services in Abu Dhabi.**

- **Dubai Electricity & Water Authority – Responsible for Water & Electricity services in Dubai.**
- **Sharjah Electricity & Water Authority – Responsible for Water & Electricity services in Sharjah.**
- **Federal Electricity & Water Authority – Responsible for Water & Electricity services in Northern Emirates (Ajman- Umm al-Quwain – Ras Al Khaimah- Fujairah)**

In parallel, the Ministry of Energy and Industry, and the Abu Dhabi Regulation & Supervision Bureau undertake Regulation & Supervision of the electricity sector in the UAE. The Abu Dhabi Energy Authority and the Dubai Supreme Council of Energy are responsible for ensuring a stable and reliable supply of energy to final users across these respective emirates, as well as the drafting of policies and strategies related to energy sector in general.

The Abu Dhabi electricity market is structured on the Sole Purchaser method, meaning that the Abu Dhabi Water & Electricity Company (ADWEC) purchases all generated and produced water and electricity from licensed producers. Then, ADWEC sells the commodities to the Abu Dhabi Water & Electricity Authority (ADWEA) which, in turn, resells water and electricity produced in the emirate to Abu Dhabi Distribution Co. and Al Ain Distribution Company. Moreover, Abu Dhabi Water & Electricity Authority pays charges to Abu Dhabi Transmission & Despatch Company “TRANSCO” against use of electricity transmission system. This process is regulated by Abu Dhabi Regulation & Supervision Bureau.

The Ministry of Energy and Industry represents the United Arab Emirates and its energy sector across international and regional forums, undertaking the coordination between local authorities on energy, water and industry affairs. Moreover, the Ministry of Energy and Industry supervises the integrity of national interconnection grid which interconnects all electrical grids in the UAE.

To increase electrical capacity and enable a modern, competitive and highly-performing energy sector, Abu Dhabi offers shares to private energy companies and consortiums through Public and Private Partnership systems to deliver and operate independent water & electricity projects. Ownership of electricity generation, production and transmission is divided between local sector and foreign private sector at a percentage that averages 60% to 40. This model of growth and operations has witnessed some of the biggest energy projects in the region thanks to innovative partnerships that enable long-term collaboration in construction, ownership and operations of energy projects in the UAE. Renewable energy in the UAE was delivered in March 2013, with the inauguration of the Shams Power company (a branch of Masdar).

Moreover, the state launched “Mohammed Bin Rashid Al Maktoum Solar Park Project” being delivered by a consortium of companies for the Dubai Electricity & Water Authority. This renewable project is one of the largest new strategic projects in the world based developed on “Independent Power Producer” model in renewable energy market. It is estimated that the delivery of the project production capacity will reach 1000 megawatts by 2020 and 5000 megawatts by 2030.

The park will include a research & development center, an innovation center, academic centers and training centers. Dubai Electricity & Water Authority (DEWA) also announced Construction of first unit of 1322 MW (2\*666 MW) Phase 1 Hassyan clean coal power plant based on “ Independent Power Producer” model which is expected to start operation by 2020 in addition addition to launching “Smart Grids” project

Providing a reliable electrical power resource is the key to achieve future development in the UAE since demand for energy in the UAE increases by 9 % every year, tripling international average.

The provision of baseload clean electricity will become of strategic importance to power the growth of the UAE. To achieve this, the Emirates Nuclear Energy Corporation was launched in 2009 to provide the UAE with safe, clean, reliable and sustainable peaceful nuclear energy. The first 1400 megawatt nuclear reactors is being commissioned, with the goal to complete four APR-1400 reactors in Barakah operated in adherence to the highest standards of nuclear safety, quality and security. Once operational, the 5600 megawatts of electricity produced by the four nuclear reactors will produce 25 % of the total electricity generated in the UAE and save an estimated 24 million tons of CO2 emissions per year.

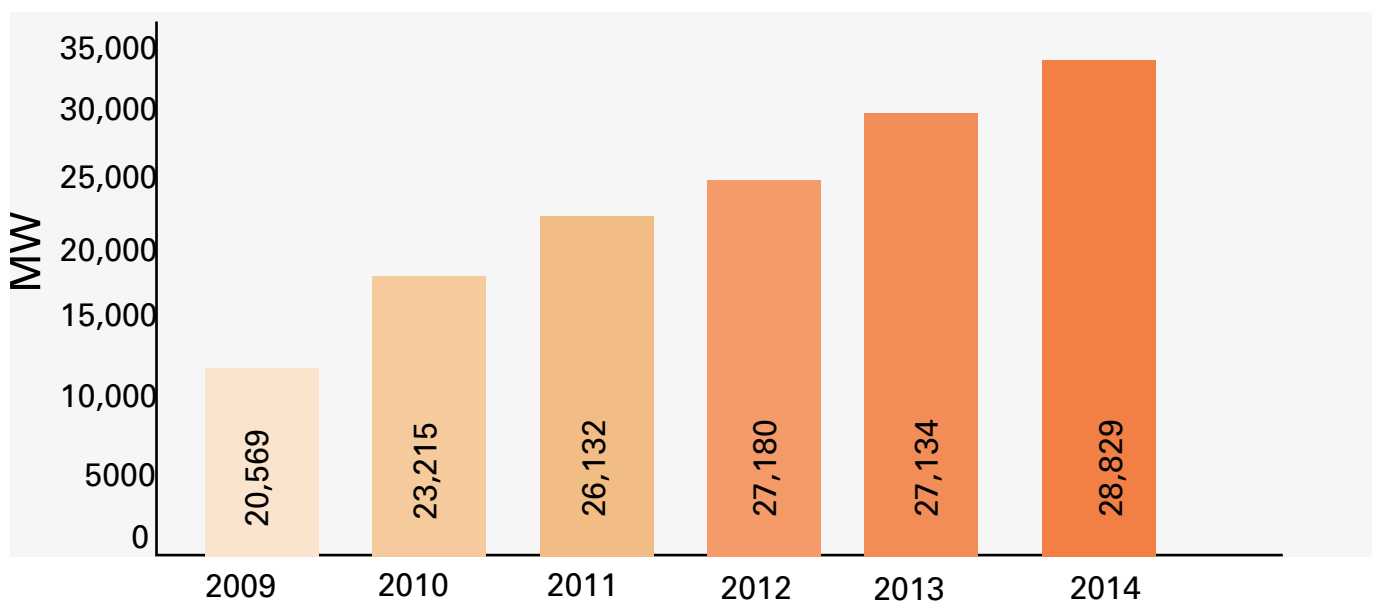
### Electricity generation in the UAE

Total installed power generation capacity of power station in the UAE was about 28,829 megawatts in 2014 reaching a growth rate of 31 % by 2021.

Abu Dhabi Water & Electricity Authority leads electricity generation in the UAE, with an installed power generation capacity of 15,546 megawatt. Installed capacity in DEWA for years 2015,2016 & 2017 are 9656 MW, 10000 MW abd 10200 MW respectively,the Sharjah Electricity & Water Authority with installed power generation capacity of 2,895 megawatt, and Federal Electricity & Water Authority (responsible for electricity of Ajman- Umm al-Quwain – Ras Al Khaimah- Fujairah) came forth with installed power generation capacity of 733 megawatt.

Total installed power generation capacity increased from 15865 MW in 2006 to 28,829 MW in 2014

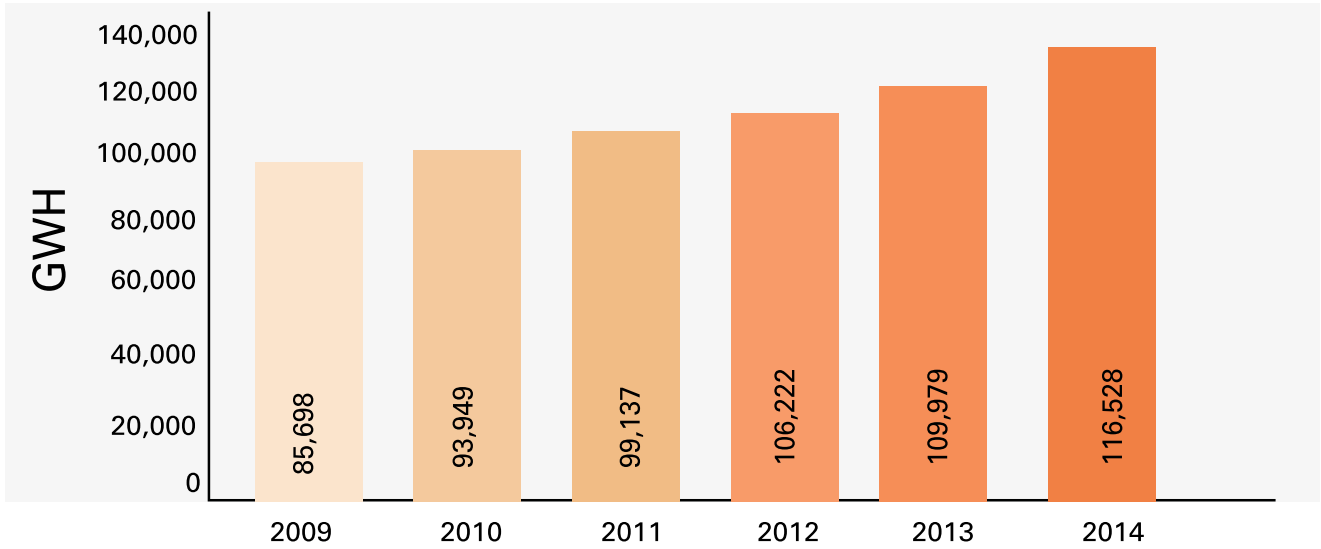
### Installed Capacity 2009- 2014



The generated electric power in 2014 was 116,528 GWH with 24,280GWH more than 2009 (about 22%), which reflects the regular growth in electric power production to meet the increasing demand in all fields in the UAE.

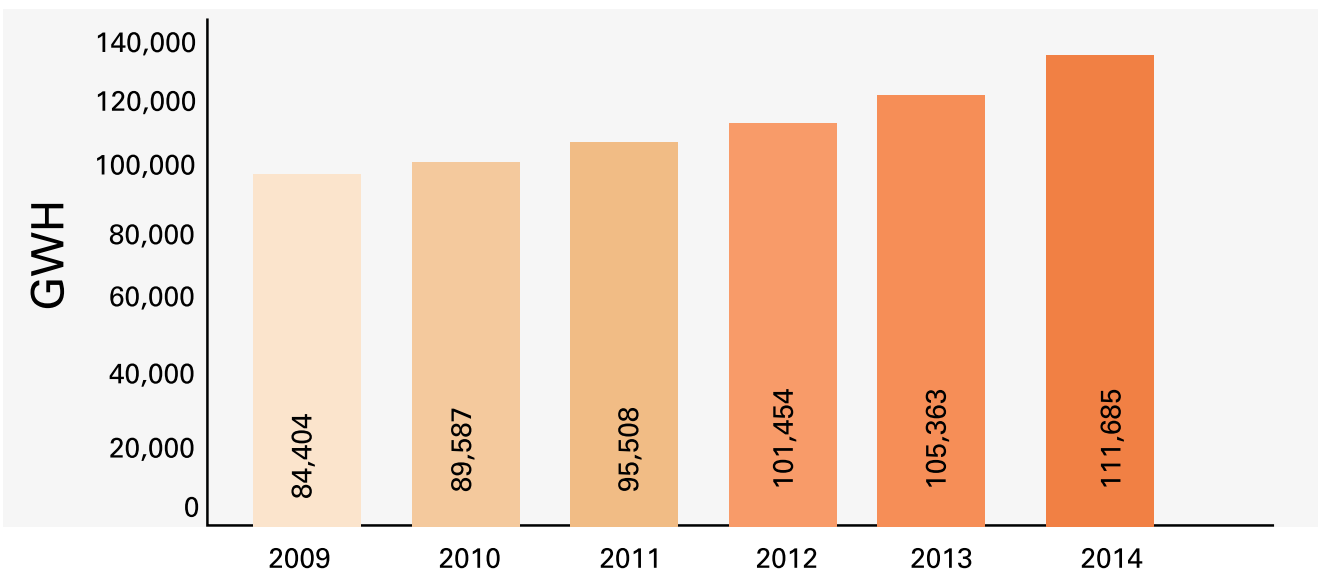
The Abu Dhabi Water & Electricity Authority alone contributed with about 60 % to the total production in 2014. Abu Dhabi Water & Electricity Authority and Dubai Electricity & Water Authority together contributed about 94% of total production in 2014.

### Electricity Generation

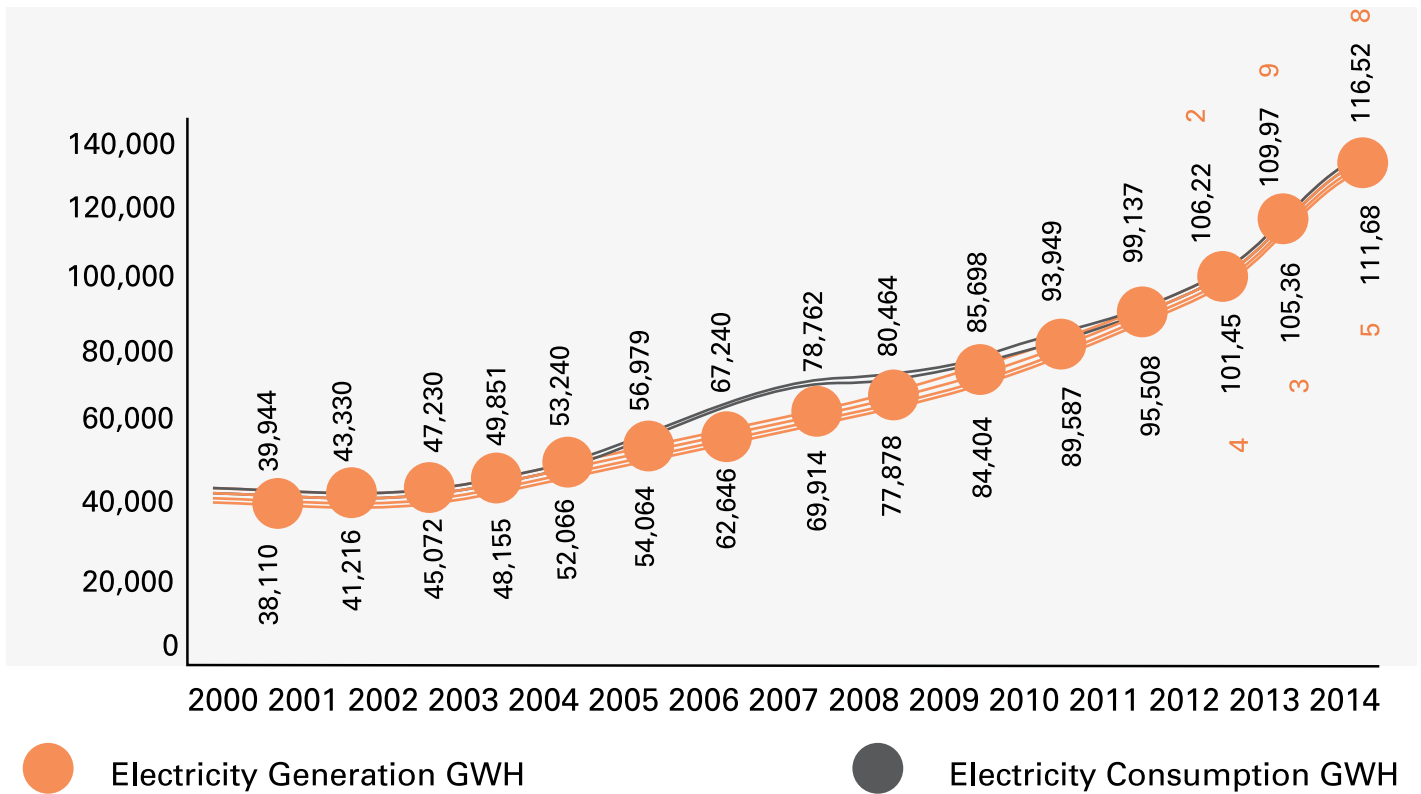


The consumed electric power in 2014 was about 111,685 gigawatt-hour. Presently, electricity in the United Arab Emirates is predominantly produced through conventional thermal energy production technologies. like (natural gas and diesel) followed by renewable energy (solar power).

### Electricity Consumption



## UAE Electricity Generation & Consumption (GWH)



The number of electricity subscribers in the UAE in 2014 reached 1,819,382 subscribers with 4.24 % more than the 1,745,456 subscribers in 2013, which reflects the regular increase in the demand for electricity in all sectors.

Electricity rates in the local market are shown in the following table. Rates of water and electricity charges are determined at each authority level in coordination the Ministry of Energy and industry (including used formula and standard) taking into account financial support provided by the UAE governments.

Consumption Slabs tariffs are differ from one authority to another (Abu Dhabi Water & Electricity Authority- Dubai Electricity & Water Authority- Sharjah Electricity & Water Authority- Federal Electricity & Water Authority) and consumption is calculated according to different consumption methodologies.

# Sector

Sector		ADWEA		Slabs System	DEWA	SEWA	FEWA
		Daily consumption slab rate	Tariff (Fils/kWh)		Tariff (Fils/kWh)		
Residential buildings for Locals	Apartment	Less or equal to 30	5	1 → 2000	7.5		
		More than 30	5.5	2001 → 4000	9	7.5	7.5
	Villa	Less or equal to 400	5	4001 → 6000	10.5		
		More than 400	5.5	6001 → AND ABOVE	12.5		
Residential buildings for non- Locals	Apartment	Less or equal to 20	21	1 → 2000	23	30	28
		More than 20	31.8	2001 → 4000	28	33	33
	Villa	Less or equal to 200	21	4001 → 6000	32	37	37
		More than 200	31.8	6001 → AND ABOVE	38	43	43
Commercial buildings	Fixed		16	1 → 2000	23	28	28
				2001 → 4000	28	33	33
				4001 → 6000	32	37	37
				6001 → AND ABOVE	38	43	43
Industrial facilities	Fixed	The load is less than 1 megawatts	16	1 → 10000	23	44	44
		The load is more than 1 megawatts	Off-peak time 16 Peak time 16	10001 → AND ABOVE	38		
Agricultural facilities	Fixed		3	— — —	Residential tariff	7.5	7.5
Governmental	Fixed		31.8	1 → 10000	23		28
				10001 → AND ABOVE	38	40	43

## Potential of clean energy technology

Over the past decade, securing a stable and affordable energy supply has become a significant global issue. Volatility and the high prices of hydrocarbon fuels have prompted many governments to reconsider their energy options.

Concerns over the environmental impact of certain types of energy generation has led decision makers to choose new energy technologies and driven policy changes in the sector.

This is also true for the UAE. Although the country is well-endowed with hydrocarbon resources, it is also diversifying its supply options and placing increasing importance on how energy use is managed, guided by new legislation and innovative initiatives and projects.

The UAE investments in clean energy respond to a strategy to diversify the power supply mix and reduce reliance on natural gas which has been fueling almost entirely water and power generation in the country. Among the renewable energy resources, the UAE has significant solar energy resources. It receives over 10 hours of daily sunlight on average and almost 350 sunny days per year. The average total solar irradiation is high roughly at 6.5 kWh/m<sup>2</sup>/day .

In contrast to solar resource, wind resource is much less abundant. However, many areas of UAE exhibit wind speed of 5-6 m/s which are currently categorized as low potential but with advancements in wind technology (larger and more efficient wind turbines), such resources are becoming more technically and economy viable.

Waste to energy is another promising source of clean energy, and the UAE has conducted studies to explore the potential and commercial viability of this resource, with some studies estimating 900 MW of waste to energy in the UAE.

Clean energy can be employed in the four key sectors of the economy which include industry, buildings (commercial, residential, public and agriculture), transport and power sectors. Solar thermal presents an option for employing low and high temperature heat for various industrial processes such as cement, ceramics manufacturing and food processing. However, the use of solar thermal energy is still limited in UAE industries.

## Clean Coal and Hassayan

Other primary clean energy sources include Hydroelectric Power and Clean Coal. In regards to Clean Coal, DEWA has launched the Hassayan Clean Coal Power Plant to produce electricity based on the Independent Power Producer (IPP) model, and which will begin operation in 2020, and will reach a coal-fired capacity of 3,996 MW by 2026. The plant will adopt the use of ultra-supercritical technology in its operations, in full compliance with international standards, and will also meet flue gas emission limits more stringently than both the Industrial Emissions Directive of the European Union and the International Finance Corporation Guidelines. In regards, to hydroelectric power, the Dubai Electricity and Water Authority will build a hydroelectric power station in Hatta that will make use of the water stored in the mountains next to Al Hattawi Dam. This project is the first of its kind and will produce 250 MW with a lifespan of 60-80 years.

## Electrification of the transport sector

The UAE is targeting an ambitious expansion of the electrification of the transport sector, both in private and public transport. For UAE energy policymakers this is a key pathway for shifting transport energy requirements from petroleum products to electric resources. In this regard, various technologies are being explored including modal shift of passengers from road to electric trams or rail, electric vehicles, as well as plug-in hybrid and fully electric vehicles.

The power sector is estimated to produce most of the clean energy in UAE, primarily as solar PV. With current projects, the UAE will be deploying about 1700 MW of solar PV by 2021. This shall result in a 1.76% contribution of solar power in the overall power generation mix. Over the last years and following the expertise in developing Public and Private Partnerships in the energy sector, the UAE energy authorities have set the world's most commercially competitive unsubsidized solar PV projects. In 2016, a 800 MW plant in Dubai achieved a new record price of 2.99 US Cents/Kwh. In March 2017, Abu Dhabi announced the lowest cost, through the partnership of Abu Dhabi Water and Electricity Authority with Japan's Marubeni and China's Jinko Solar to build a 1.17 gigawatt solar power plant in Sweihan at a weighted 2.42 US cents per kilowatt hour (kWh). These solar projects are being developed through an independent power producer (IPP) framework which has brought significant investment to the country in solar power generation.

## Innovation and Research and Development

The UAE has also established clean energy innovation and scientific research centers, while adopting new technologies and supporting the development of applied research in innovation across the renewables industry. This is a part of UAE's overall strategy of developing into a knowledge based economy which exports knowledge. The deployment of large scale solar projects in the desert is challenged by specific issues such as dust, humidity and high temperatures. The UAE has pioneered solar development in the region and has developed knowledge and solutions which can be deployed in other desert countries. It is also leading the development of water production through renewable energy systems and technology.

In line with Dubai Electricity and Water Authority vision to be a sustainable, innovative, world-class utility and strengthen the efficiency and reliability of electricity generation, distribution and transmission, DEWA is developing world-class Research and Development facilities, initiatives and capabilities.

The R&D centre aims to support DEWA's vision to promote sustainability in energy supply, diversify energy sources, and create a business environment that encourages innovation. It also aims to support Dubai's strategy to build a knowledge-based economy by improving efficiency standards and supporting renewable energy initiatives. The Centre will contribute to strengthening Dubai's position as a global hub for Research and Development in renewable energy, clean technologies and sustainability related initiatives. DEWA R&D will also enhance capacity building in these areas to enable Dubai to meet the requirements of sustainable development in the Emirate.



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Currently, we are completing the R&D facilities at the Mohammed bin Rashid Al Maktoum Solar Park, with a total investment of AED500 million up to 2020. Infrastructure includes a state-of-the-art 4,000 square metre R&D centre that will host most of the R&D activities (operational by end of Q1 2018); an Outdoor Testing Facility for studying solutions and equipment under the harsh and hot environmental conditions of the UAE (operational since 2015), and the first-ever 3D-printed lab for R&D on Drones, Robotics and Artificial Intelligence (commissioned in Q3 2017 and currently operational).

Additionally, we are developing the Smart Grid Integration lab, which will be equipped with a grid simulator capable of testing up to six energy storage systems in parallel, each with a power rating up to 250 kW. At present, in our Outdoor Testing Facilities we are testing and benchmarking the performance of different commercial PV (30 panels of different technologies at different tilt-angles, produced by different manufacturers)

and Building-Integrated Photovoltaics (BIPV) technologies, suitable procedures and solutions for O&M efficiency in PV plants, Reverse Osmosis for water desalination (100 kW system) and Atmospheric Water Generation solutions.

The R&D department can count on a strong and diverse team (international and national scientists and engineers), with a great balance of experienced hires and university graduates from global and regional institutions. DEWA R&D's comprehensive projects portfolio is organised across 5 areas, namely (a) solar, (b) water, (c) energy efficiency, (d) smart grid integration & energy storage, (e) robotics & AI. These R&D areas and related programmes have been developed in alignment with the DEWA strategy, as well as national strategies including Dubai Clean Energy Strategy 2050, UAE National Agenda 2021, UAE Energy Strategy 2050 etc.

Examples of ongoing projects include soiling mitigation for solar panels, Virtual Power Plant (VPP) pilot development, testing of components and development of interfaces and intelligence for smart grid applications, development of drones and AI / advanced-analytics solutions for different utility applications, and 3D printing of components and facilities for our core operations. Additionally, we are exploring opportunities for engagement in R&D activities and providing internal consultancy and due diligence services on topics spanning from solar-to-chemicals hydrogen electrolysis and fuel cells, to wind, autonomous vehicle etc. also , DEWA R&D is organising two editions of the Solar Decathlon Middle East, one in 2018 and one in 2020. Projects will be focused on solving the issues and needs for sustainable living in this region.



# Transport

The UAE Government has set that the growth of the Nation to be focused on sustainable development while preserving the environment. To achieve this, the transportation sector must seek a balance between responsible growth and economic and social development.

The UAE Vision 2021 National Agenda focuses on the objective to improve the quality of air, the preservation of water resources, and an increase in the contribution of clean energy, as well as the implementation of green growth plans. Over the last years, the country has taken great strides towards building a sustainable transportation sector and infrastructure systems, while limiting its impact on the environment.

The National Agenda also highlights the importance of infrastructure, as an enabler for economic, industrial and social growth. The Agenda sets the target for UAE infrastructure to be among the best in the world in the quality of road networks, ports, railways, airports infrastructure, and shipping lanes. This will allow the UAE to become a forerunner in the provision of Smart services. Today, the UAE is considered a major transportation hub in the Middle East, due to its strategic geographic position, as well as its modern airports and ports, which experience high traffic throughout the year.

## Land Transport

In December 2015, the 264 km-long “First Stage” of the UAE’s federal railway network commenced commercial operations. The railway transported granulated sulfur from the gas fields in Shah and Habshan to the port of Ruwais.

This became the inception of UAE railroads which, once completed, will deliver over 1,200 km of Federal railway network linking all seven Emirates and fully integrated into the Gulf Cooperation Council Rail Network. This access will provide the opportunity to link the six GCC member states along the eastern coast of the Arabian Gulf through rail.

In addition, the UAE is striving to reduce its dependence on automobiles by building a comprehensive public transit system.

For example, Dubai aims to increase public transport use from the current 14.7% to 30% in 2030. To facilitate this goal, the Roads and Transport Authority in Dubai has created a Strategic Plan to focus on the following priorities:

- Foster connectivity and integration
- Develop smart transportation & traffic solutions
- Enhance integration between transportation planning and urban planning
- Encourage public transport
- Manage travel demand and congestion
- Enhance transport & traffic safety

## Ensure environmental, social and financial sustainability

### Maritime Transport

The UAE is continuously expanding and modernizing its maritime infrastructure and resources. To achieve this, the Federal Transport Authority-Land and Maritime is responsible for regulating and overseeing UAE Maritime affairs in adherence to the implementation of International Maritime Conventions. Over the years, the UAE has ratified 27 out of the 54 International Maritime Organization (IMO) Conventions in force and is progressing on adopting the remaining conventions in the near future.

Today, UAE hub ports are handling over 13 million TEUs annually, while catering to a total population of 2 billion within a close radius. It achieves this through its advanced infrastructure, trans-shipment facilities, as well as a modern and efficient management.

From a policymaking perspective, the UAE is updating its Maritime Commercial Law no.26 of 1981. In addition, the established and internationally-reputed Dubai International Finance Center (DIFC) has consolidated itself in dealing with maritime arbitrations, marine insurance, and disputes through its Maritime Court.

The UAE has adopted a strategy to increase the tonnages under its flag, recognizing 12 Ship Classification Societies members of the International Association of Classification Societies (IACS) in addition to the UAE Class Society (TASNEEF), the only ship Classification Society in the whole region.

The UAE is continuously upgrading ports infrastructure and has the ambition to become the leading maritime hub internationally by achieving the following objectives:

- Continuously maintaining and upgrading its Aids to Navigation
- Increasing its Global Maritime Distress and Safety System (GMDSS)
- Establishing the UAE Search and Rescue Center (SAR)
- Monitoring UAE flag Vessels global positions through UAE Long Range Identification and Tracking system (LRIT)
- Establishing the National Casualties Investigation Committee to decrease shipping casualties
- Complying with International Ship and Port Facilities Security Code (ISPS) through issuing Statements of Compliance to complying UAE ports.

As a member of IMO since 1981, the UAE is aiming for the IMO Council membership in its next elections 2017, thus increasing UAE involvement in establishing International Conventions through its Council Committees meetings deliberations.

## Air Transport

The UAE main airports are Dubai International Airport, which was the third busiest airport in the world in 2015, and Abu Dhabi International Airport. In 2015, Dubai received 14.2 million visitors and Abu Dhabi 4.1 million visitors. Dubai also has a second Airport, Al Maktoum International Airport, and there are international airports in Sharjah, Ras Al Khaimah, Fujairah and Al Ain.”

## Public Health

The UAE enjoys a comprehensive, government-funded health service and a developing private health sector. This has allowed the country to achieve health statistics on par with those in the most developed nations. Life expectancy at birth 2013 = total 77 Years , Male 76 while female 78 and Mortality rate per 1000 live births, UN-IGME2013 estimates , Under 5=7.9 per 1000, Infant =6.5 per 1000, Neonatal =4.3 per 1000. Endemic diseases have been eradicated leaving cardiovascular disease as the principal cause of death.

In 2009, the Ministry of Health, in partnership with the Ibn Sina Pharmacy group, conducted a comprehensive health survey of 28,000 UAE residents. The results showed that 18% were diabetic, 12% were borderline diabetic, 68% were overweight or obese and 47% had normal cholesterol levels. Moreover, the of outside survey are Adults (18+years): overweight=74%, and obesity=37.2%

Youths(13-18 years): overweight =38.4%, and obesity=14.4%

Raised blood Glucose(18+years)=18.5%

These results demonstrate how critical preventative medicine will be to future health policy in the UAE. While health expenditures as a General government Expenditure on health as% of General government expenditure is 9.4%. And , out-of-pocket expenditure as %of total health expenditure is 18.8%. also, per capita total expenditure on health USS exchange rate is 1569

Portion of government expenditure has remained fairly constant since 1995, health expenditures per capita in real terms has increased 70%, from US\$920 in 1995 to US\$1,544 in 2010 (see Table 1-1). As a result, substantial health care infrastructure exists throughout the country, though Dubai and Abu Dhabi typically have the most modern facilities.

Indicator	1995	2000	2005	2010
Health expenditure, public (% of government expenditure)	8.1%	7.6%	8.6%	8.8%
Health expenditure per capita (current US\$)	713\$	699\$	896\$	1,450\$
Health expenditure per capita, (2005 international US\$)	920\$	805\$	811\$	1,544\$

The UAE has both public and private institutions are investing in either expanding or improving existing facilities. For example, SEHA, the health services company that operates government hospitals and clinics in Abu Dhabi, has plans to replace both the Al Mafraq Hospital and Al Ain Hospital by 2013. The Ajman Health Zone is also investing US\$140 million to create a set of primary health centers, a diabetes and obesity center and a medical fitness center. Umm al-Qaiwain Hospital is also undergoing a revamp costing about US\$110 million and the new 400-bed Jebel Ali Trauma and Emergency Centre in

Dubai is now open. The 200-bed Al Jalila Children's Specialty Hospital in Dubai was also recently completed. Moreover, the total Public Hospitals are 38 hospitals and total beds are 6564 bed. While, total Private Hospitals are 78 and total beds is 4051bed. In 2013 the total No of Hospitals are 116 and the total number Of Beds are 10615.

The government is also working to expand health insurance. In 2008, the Abu Dhabi emirate made medical insurance mandatory, an add-on to previous mandate that all expatriates and their dependent have health insurance. As of 2009, the number of insured people in Abu Dhabi was 1.9 million, up from around 150,000 in 2006. Moving forward, the UAE government plans to expand health care coverage to every Emirati and expatriate.

In order to develop an integrated healthcare policy throughout all Emirates, the UAE established a Health Council in July 2008. This national council coordinates federal and local healthcare efforts in both the public and private healthcare sectors.

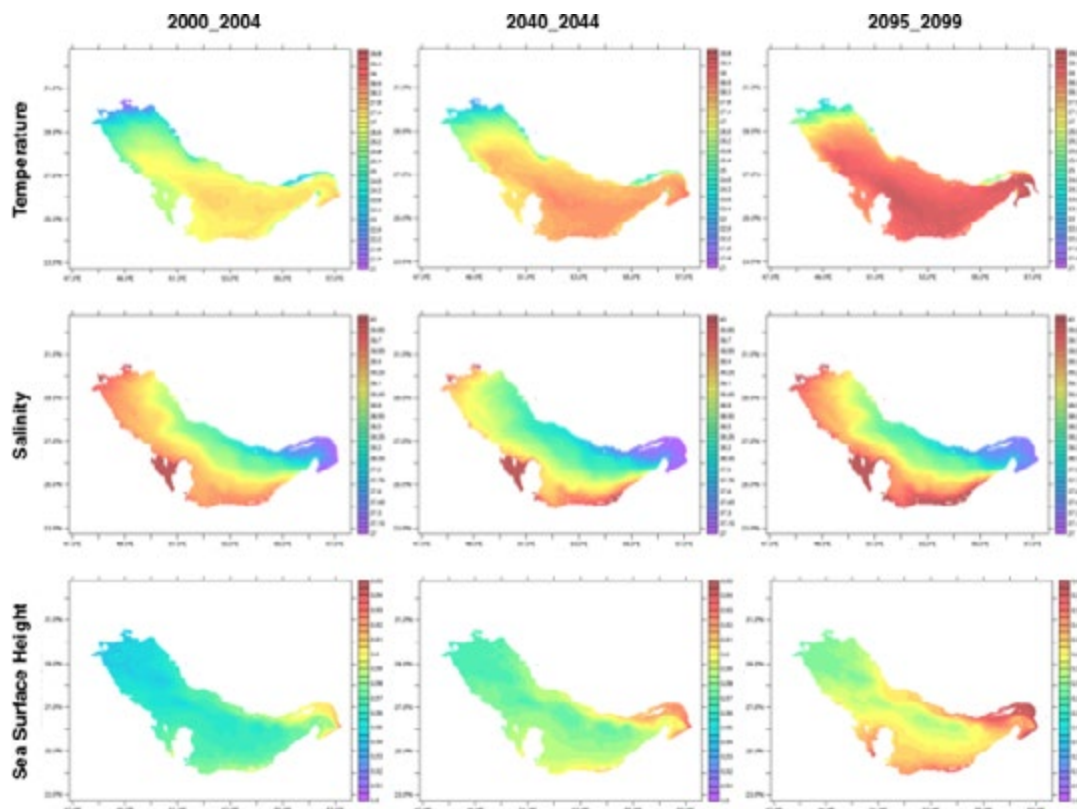
Regional and local bodies also exist, such as the Health Authority-Abu Dhabi and the Dubai Health Authority. Since 2009, the Ministry of Health has concentrated on bringing health care in northern emirates up to levels offered in Abu Dhabi and Dubai. The Government finances 81% of the cost of health care, but several initiatives towards privatization have been launched recently (Alrawi and Hussain, 2011).

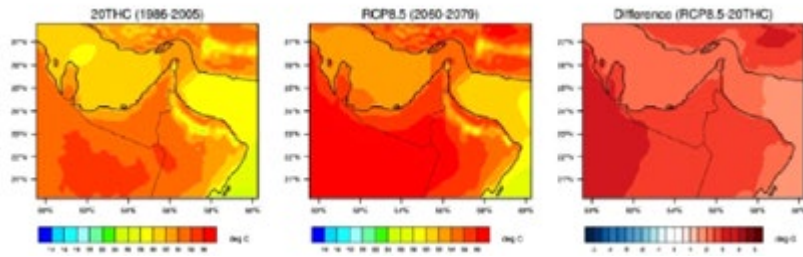


## Regional Ocean Modeling

Regional Ocean Modeling applied the Regional Ocean Modeling System (ROMS) to downscale the outputs of the Mixed Resolution GCM developed by the Max Planck Institute for Meteorology (MPI). Only one RCP was considered, RCP8.5. The regional ocean model was validated against historical data for the 2002-2006 period for the Arabian Gulf domain, using 1.1 km average horizontal resolution and a vertical resolution varying from 0.1 cm to 4 meters. The results indicate changes in the Arabian Gulf compared to historical trends, namely in temperature, salinity and circulation patterns although they are mostly uneven across the Arabian Gulf. For example, by late century (2095-2099), sea surface temperature of about 1.7 °C increase is expected in the central Gulf area and about 2.8 °C increase in some parts of the Gulf, such as around the Strait of Hormuz. Sea surface salinity is projected to both decrease and increase, depending on location, where modest increases of about 0.5 practical salinity units (psu) is expected along the UAE coast south of the Northern Emirates by late century. Sea level rise is projected to be in the range of about 2.7 cm (in the central Gulf area) to 5 cm (around the Strait of Hormuz) increase, depending on location, by late century. Not all major contributing factors of sea level rise, however, were accounted for in the modeling, due to limitations in current suites of GCMs, including the MPI- Mixed Resolution GCM.

### Temperature, Salinity and Sea Surface Height Changes

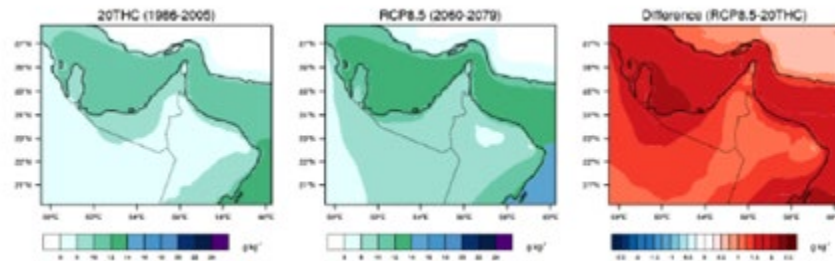




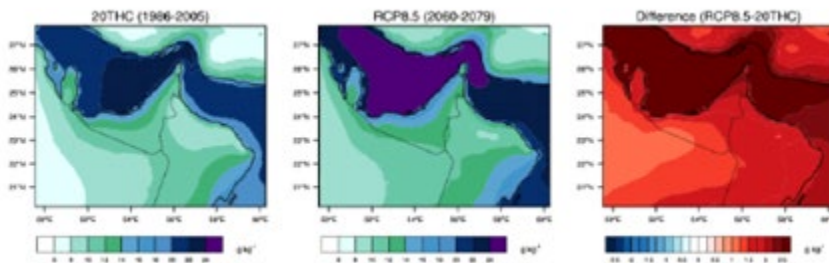
Future temperature around the UAE using the validated WRF model for the historical period (left), 2060-2079 under RCP 8.5 (center), and the percent difference (right), averaged over winter months (top) and over summer months (bottom).

Source: "FINAL Executive Briefing - Regional atmospheric modeling", AGEDI, 2015  
Average DJF Specific Humidity

### Average DJF Specific Humidity



### Average JJA Specific Humidity



Future humidity around the UAE using the validated WRF model for the historical period (left), 2060-2079 under RCP 8.5 (center), and the percent difference (right), averaged over winter months (top) and over summer months (bottom).

Source: "FINAL Executive Briefing - Regional atmospheric modeling", AGEDI, 2015

*Future humidity around the UAE using the validated WRF model for the historical period (left), 2060-2079 under RCP 8.5 (center), and the percent difference (right), averaged over winter months (top) and over summer months (bottom).*

Source: "FINAL Executive Briefing - Regional atmospheric modeling", AGEDI, 2015



*Early (2000-2004), mid 21st century (2040-2044) and late 21st century (2095-2099) time-averaged sea surface temperature (degrees Celsius), sea surface salinity (practical salinity units), and sea level height (cm) in the Arabian Gulf*

*Source: "FINAL Executive Briefing – Regional Ocean Modeling" AGEDI, 2015*

These findings are generally consistent with the trends observed in GCMs at the global level, but the regional models provide more detailed and precise projections which could assist not only in relevant policy development to increase climate resilience and mitigate climate risks, but could also provide insights into business development opportunities (e.g., building renewable energy plants factoring future climatic conditions such as wind direction).

Furthermore, the increase of salinity of the Arabian Gulf due to climate change will be further exacerbated by desalination processes to produce potable water. The Arabian Peninsula relies heavily on desalinated seawater. Since 2000, desalinated water production have increased about 9% per year in the region, and roughly 10% per year in the UAE, and is expected to increase further, in order to meet growing water demand due to population and socio-economic developments. AGEDI's recent study investigated the combined impacts of climate change and desalination on the Arabian Gulf. The study was based on the Regional Ocean Model and projected changes against four potential scenarios of plant discharge levels to mid-century (2040-2050). The study found that hot and highly saline brine discharges from desalination plants will significantly impact surface and bottom temperatures as well salinity throughout the Gulf, depending on the location and depth. These changes are likely to affect sea grasses and other ecosystems that support a wide range of aquatic species and calls for attention when developing climate adaptive measures for the Arabian Gulf.

## **Agriculture, Fisheries & Food Security**

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Climate change is expected to affect various aspects of the agriculture sector in the UAE. For example, increased temperatures and resulting increased salinity due to higher evaporation rate could reduce types of crops that could tolerate in the already arid desert environment and increase susceptibility to the emergence of plant pests. The Ministry of Climate Change and Environment is working on making agriculture more sustainable and encouraging effective use of natural resources in a manner that is economically, environmentally and socially sustainable, while enhancing its contribution to the UAE's food security.

With limited water resources and arable land, a number of initiatives have been implemented to ensure sustainability of the sector while increasing productivity and relevant health benefits, especially in view of climate change. One such example is the adoption of the climate-smart agriculture (CSA) approach to adapt agricultural systems, mitigate emissions and ensure food security in a changing climate. Under this approach, farmers are encouraged to adopt a number of farming systems, namely: 1) organic farming since it emits less greenhouse gases and sequesters higher levels of atmospheric carbon dioxide compared to conventional farming; and 2) hydroponic farming as a promising alternative to water-intensive conventional farming. Moreover, the Integrated Pest Management (IPM) approach is implemented to control the palm pests through "NAKILNA" ("Our Palm") initiative to ensure sustainable palm cultivation which hold an important economic value in the UAE's agriculture sector.

Furthermore, the UAE is developing and implementing a number of initiatives which aim to increase the resilience of the UAE's agro-food system through climate change adaptation and mitigation actions, such as, the promotion of climate change adaptive crop varieties, adoption of modified protected agriculture technologies (e.g., efficient greenhouses with cooling and recycled water systems), creation of strategic water reserves, use of renewable energy and adoption of low-carbon footprint agro-systems (e.g., enhanced logistic platforms). Regulations also play an important role in ensuring sustainable agricultural practices.

Research and development is an important factor in the sustainable development of the agricultural sector. A number of leading research institutions based in the UAE, including the International Center for Biosaline Agriculture and the International Center for Agricultural Research in the Dry Areas, work on improving agricultural productivity and sustainability in hyper arid and saline environment through innovative measures. For example, the world's first research facility to grow both food (fish and shrimp) and fuel (salt-tolerant halophyte plants) using desert land irrigated by sea water was opened in March 2016. The 2-hectare site in Abu Dhabi is managed by the Masdar Institute of Science and Technology and funded by the Sustainable Bioenergy Research Consortium formed by leading companies in the aviation sector such as Etihad Airways, Boeing and Honeywell. The project has both climate change adaptation and mitigation co-benefits, and may be scaled up to a 200-hectare site, if proven successful. Such innovative research and development is expected to further develop under the Emirates Committee for Sustainable Environment Research established in 2016 focused on addressing environmental sustainability and climate change.

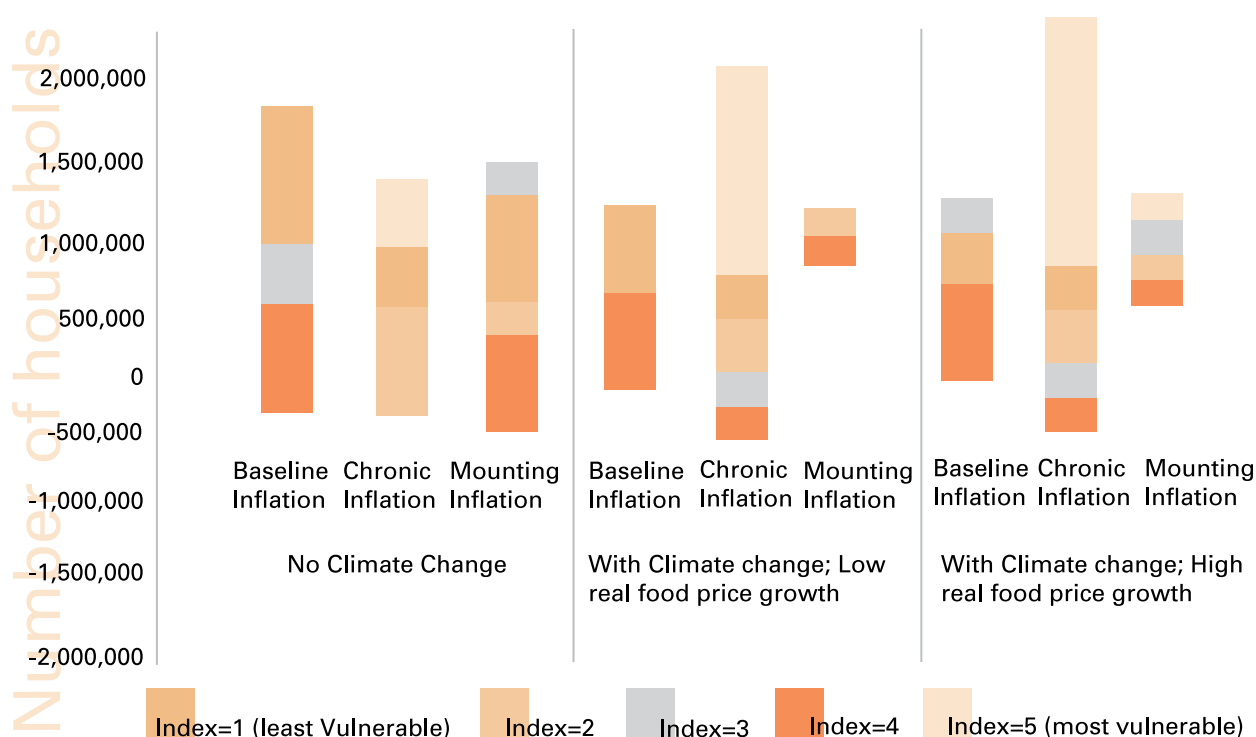




Work is also underway in the UAE to promote sustainable fisheries. This is conducted as a combination of initiatives, such as regulations to prohibit fishing and selling of endangered species during breeding seasons, installing artificial coves (reefs) in order to sustain and allow marine species to breed and grow, introduction of aquaculture, the establishment of the state of the art sheikh Khalifa bin Zayed Marine Research Center which includes hatcheries for local species. Healthy oceans and seas that support sustainable fisheries transcend borders and is a major concern for the global community. The UAE in cooperation with the Government of the Republic of Seychelles has hosted two Blue Economy Summits (2014 and 2016) to support sustainable management of the marine environment and resources, and to meet relevant Sustainable Development Goals.

At the same time, the UAE is highly dependent on food imports due to limited arable land and water availability. The UAE is currently classified as “food secure” according to international food security indexes such as the Global Food Security Index of The Economist. Climate change, however, in combination with other factors could affect the UAE’s food security in the long-run. Therefore, AGEDI’s recent food security project looked at how future climatic conditions may affect agricultural productivity of major food exporting countries to the UAE, and hence, the long-term food security of the UAE with attention to how UAE households may be affected. The study was mainly based on trade statistics from the Food and Agriculture Organization and utilized the outputs from the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) model developed by the International Food Policy Research Institute (IFPRI). IMPACT provides country and region-specific projections of agricultural commodity supply, demand, trade, and food prices within the context of climate change. The results from the study indicated that supply of certain products may be particularly constrained under climate change, such as wheat and rice, and could negatively affect lower-to middle income households with price increases, resulting in a greater share of household budgets spent on food. The IMPACT model is however a global model comprised of 115 countries/regions. The UAE is currently included as part of the Gulf region and breaking out this region further reflecting specific characteristics of the UAE may increase the accuracy of projecting future food security and associated impacts.

### Change in the total number of UAE households classified by the Micro Index, all scenarios



## Biodiversity

The UAE is home to a wide range of fauna and flora .Many of them are under threat due to pollution, rapid urbanization and climate change ,among others .Some of the species are classified as “ vulnerable” or “ endangered ” according to the IUCN Red List of the International Union for Conservation of Nature (IUCN) ,(such as the Arabian tahr ,Arabian leopard ,Arabian Oryx ,green turtle ,fin whale and dugongs.

The UAE has issued a National Biodiversity Strategy and Action Plan (NBSAP) (to guide national efforts in conserving biodiversity during the coming decade ,as well as a National Strategy to Combat Desertification .Under these frameworks ,the UAE has adopted many projects to sustain its biodiversity and to benefit from numerous ecosystem services that are crucial to human well-being.

## Blue Carbon

One of the key pillars of the UAE’s ecosystem in the context of climate change is “ Blue Carbon ” which is coastal and marine ecosystems such as mangrove forests ,salt marshes and seagrass beds .They protect the shorelines ,provide nursery grounds and habitats for a wide range of species and support coastal tourism .Moreover ,their preservation and enhancement provide climate change mitigation benefits as they sequester and store significantly more carbon – around 4 times faster and more permanently - than terrestrial ecosystems .The UAE has also significant amounts of sabkha) salt flat (which does not sequester ,but store carbon .To this end ,studies have been conducted to provide a baseline carbon assessment of Blue Carbon ecosystems across the UAE in different settings) e.g , lagoons ,natural and planted mangroves .(Key entities leading this work were the Ministry of Climate Change and Environment ,AGEDI and the Environment Agency – Abu Dhabi with support from relevant local authorities and international Blue Carbon experts.

While carbon stocks of hyper-arid and saline mangroves of the UAE generally sit at the lower end of carbon stocks on a global scale) at 293.15 Mg C/ha of the mean carbon stock of all the studied sites compared to the global average of about 1000 Mg C/ha (and considerably vary at different locations within the UAE ,the study has revealed that high carbon stocks are found in some parts of the UAE such as in the south of the City of Kalba 824) Mg/ha (in older ,mature mangrove forests.

The study has helped to identify carbon stocks that are particularly valuable and reinforced the importance of appropriate conservation measures to protect the Blue Carbon ecosystems ,especially as if destroyed ,they will release carbon into the atmosphere and contribute to global warming ,and furthermore, it takes decades for mangroves to be able to sequester and store equivalent amount of carbon to mature mangrove forests.

On a regional level, the UAE is taking part in AGEDI’s two regional projects which aim to assess the vulnerability of marine and terrestrial biodiversity to long-term changes due to climate change.

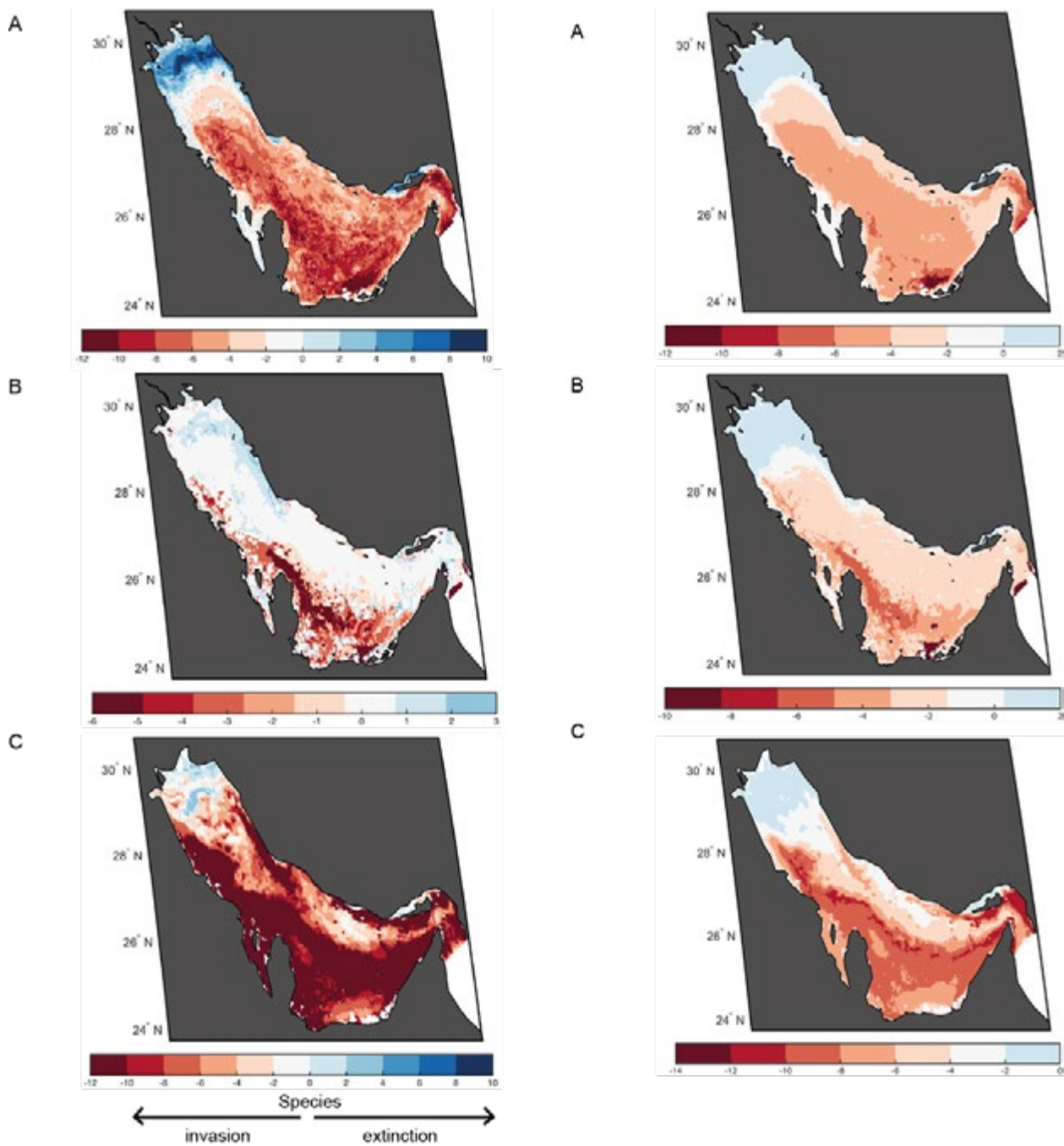


# Marine Biodiversity

The Marine Biodiversity project consisted of four main elements: 1) development of a marine species database development for the Arabian Gulf, subsequently incorporated into publicly available online databases - "FishBase" for fish and "SeaLifeBase" for non-fish species; 2) fish catch reconstructions by country, for seven countries bordering the Arabian Gulf, for the period 1950-2010; 3) environmental niche modeling of 56 priority species (48 fish species, three seagrass species and five vulnerable or endangered charismatic species such as dugong and dolphin) using the outputs of the Regional Ocean Modeling for RCP 8.5 and three different models (Non-Parametric Probabilistic Ecological Niche Model, Ecological Niche Factor Analysis, Bioclimate Analysis and Prediction Model; multiple models were utilized in order to increase the level of certainty) to project climate change impacts on species invasion, species local extinction, and habitat suitability; and 4) assessment of the vulnerability of commercial fishing industry, by country, under climate change (RCP 8.5 scenario).

While there are considerable variations among the results from the three models, they generally indicated possible local extinction in the Arabian Gulf, in some cases, reduction of up to 35% of species and possible invasion of species up to 5 % by 2090 relative to 2010. The UAE is one of the regions that is likely to be affected from marine biodiversity loss as well as decline in commercial fish catch with socio-economic consequences. Some of the migratory species such as sea turtles may be able to adapt to the changing climate by adjusting their migratory patterns compared to other non-migratory species endemic to the Gulf that may be more significantly affected. Nevertheless, climate change is expected to affect a wide range of species and the study has identified the need to increase the robustness of conservation measures, such as effective and enforced fisheries policies as well as Marine Protected Areas (MPA) to mitigate potential habitat destruction and increase species resilience to climate change. Projected changes by 2090 relative to 2010 from (A) NPPEN and (B) ENFA and (C) BIOCLIM.

*Rate of local extinction and specie- Index of habitat biodiversity suitability  
Invasion (sum of predicted habitat suitability)*



(left panel), species invasion is represented by positive values while species local extinction is represented by negative values.

(right panel), increasing habitat biodiversity suitability is represented by values to the right of the scale while decreasing habitat biodiversity suitability is represented by values to the left of the scale

Source: "Marine Biodiversity and Climate Change: Final Technical Report" AGEDI, 2016

# Terrestrial Biodiversity

The Terrestrial Biodiversity project, to be completed by the end of 2016, is comprised of three main elements: 1) development of a terrestrial species database for the Arabian Peninsula; 2) individual species distribution modeling using MaxEnt to project impacts of climate change on future habitat suitability for 18 priority terrestrial species (birds, mammals and plants); and 3) generalized dissimilarity modeling at the community level (i.e., plants, mammals, breeding birds, non-breeding birds) to project changes in species composition under current and future climate. Both of the modeling used outputs from the Regional Atmospheric Modeling for RCP 4.5 and RCP 8.5. Results of the assessment are expected to increase understanding of what climate change could mean for the region's biodiversity and in developing suitable adaptation plans to minimize climate change impacts to the ecosystem.

Also at the regional level, the UAE is engaged in the development of the Ecosystem Based Management Strategy for ROPME Sea Area (2016-2017). In partnership with UNEP and in consultation with major national, regional and international stakeholders, Regional Organization for the Protection of the Marine Environment (ROPME) is developing a Strategy for the Arabian Gulf that focuses on the interlinkage between ecosystem service delivery and human needs, including implementation mechanisms such as capacity development at the national and regional levels in line with best practices world-wide.



## Coastal Zone Management

Coastal zones are directly affected by impacts of climate change, such as coastal inundation and erosion due to sea level rise that affect habitats and infrastructure, and destruction of marine and coastal ecosystems due to ocean acidification and temperature increases that provide valuable ecosystem services. The UAE has developed a National Strategy for Marine and Coastal Environment Sustainability, which aims to conserve and ensure sustainability of the marine and coastal ecosystems through integrated coastal zone management, capacity building and public awareness raising, as well as regional and international cooperation. Integrated coastal zone management plays an important role in addressing current and long-term climate change related coastal challenges by establishing ecosystem based approaches and applying adaptive management and spatial planning approaches in order to encourage socio-economic activities that do not compromise environmental integrity. The Strategy is implemented through the National Marine and Coastal Environment Monitoring Programme (2016-2021) by the Ministry of Climate Change and Environment in cooperation with the National Center of Meteorology and Seismology as well as relevant local entities. The program focuses on marine water quality, biodiversity and the dynamics of coastal areas, and provides relevant data for decision-making based on regular monitoring and reporting along with evaluation of the effectiveness of supporting legislation.

Similarly, AGEDI's coastal vulnerability assessment project (to be completed by the end of 2016) aims to respond to a need for a quantitative assessment of near-term (10-15 years) coastal zone vulnerability associated with climate change, through the development of a "coastal vulnerability index" (CVI). An ecosystem services-based model called the "Integrated Valuation of Ecosystem Service and Tradeoffs" (InVEST), developed by the Natural Capital Project, is used to identify exposed shoreline and vulnerable coastal communities by assessing each segment (250 m<sup>2</sup>) of the UAE coastline to climate change risks (e.g., increased storms and sea level rise), and ranks their vulnerability from lowest to highest. The study will also highlight the extent to which natural systems (e.g., mangroves, coral reefs and sand dunes) provide climate change adaptation benefits by reducing climate risks to coastal communities and assets, and how changes to those ecosystems affect adaptation benefits. Of particular focus is on the acquisition of spatial information which is critical for adequate planning, especially in view of multiple - sometimes competing - usage of coastal land and ecosystems. Once completed, the results will assist policy makers in adopting appropriate adaptation measures to protect vulnerable coastal zones and infrastructure.

## Education Awareness

Raising awareness for all those concerned are critical in adapting to climate change. The UAE's National Strategy for Awareness and Education 2015-2021, based on international standard, guidelines and best practices, serves as the unified roadmap by focusing on six key objectives:

- Educate the youth through the integration of environmental education in schools, universities and vocational institutions;
- Improve the community's involvement and commitment to sustainability and environmental protection;
- Encourage the active involvement of businesses and industries in tackling environmental priorities and moving towards sustainable behaviors and practices;
- Ensure integration of environmental considerations into government policies and complement the Strategy with policy and regulatory instruments;
- Ensure alignment and effectiveness of environmental education and awareness efforts by periodically tracking the progress, effectiveness and efficiency of the Strategy; and build adequate capabilities in the UAE to enable delivery of the Strategy.

The Ministry of Climate Change and Environment conducts an annual national environmental awareness and behavior survey in order to track changes and assess the effectiveness of the Strategy implementation.

The engagement of the youth is of particular importance given that approximately 30% of the UAE population is under the age of 24. The Ministry of Climate Change and Environment and the Ministry of Education is therefore jointly working on an initiative called “Our Generation” to develop school curricula that focuses on climate change amongst other environmental priorities. In addition, a nation-wide “Sustainable School Initiative” (SSI) has been launched, following the successful program in the emirate of Abu Dhabi since 2009. SSI is a whole of school initiative, addressing students, teachers, parents, administrators, non-teaching staff and links with the community with expected outcomes to reduce environmental footprint and promote sustainability. The Initiative is comprised of four main components: Green Audit System, a tool designed to help school communities to audit their use of resources such as water and electricity; Teachers’ Capacity Building, which encourage teachers to pursue on-going environmental training; Empowering Students to lead environmental activities in their communities through Eco Clubs established and run by students; and Hands on Field Experience aimed at fostering better understanding of why students need to care for the environment.

Likewise, “Sustainable Campus Initiative” led by Environment Agency – Abu Dhabi engages around a dozen of leading universities from around the UAE in strengthening and building leadership capacities of youth to address environmental sustainability including climate change and take a major role in developing sustainable communities as “Agents for Change”. For example, its Sustainable Campus Audit framework provides a structure to help translate academic learning into practice at the campus level, and the initiative functions as a platform for youth to build networks domestically and internationally, such as through the monthly “Green Youth Majlis” gatherings.

The engagement of businesses and industries are another priority area, where the Ministry of Climate Change and Environment has launched “Sustainable A Lifestyle” initiative which supports the industries’ responsibility and active involvement in delivering and achieving environmental awareness across different segments of the society.

# Regional and International Cooperation

The UAE hosted a workshop co-organized with the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Environment Programme (UNEP) on the Lima Adaptation Knowledge Initiative (LAKI) for the GCC-region in June 2015. The workshop was co-hosted by AGEDI, the LAKI sub-regional coordination entity for the GCC sub-region. While governments around the world at various levels are taking measures to “adapt” to potential impacts of climate change, gaps in knowledge – be it insufficient rainfall data, accurate mapping of fauna and flora, robust projection of sea level rise, or economic analysis of costs of inaction – are often cited as barriers for successful adaptation actions. The LAKI workshop was aimed at enhancing successful adaptation actions by identifying and prioritizing knowledge gaps and ways to addressing them in the Gulf region, such as fostering governance mechanisms at the national level for evidence-based decision making and effective implementation, as well as strengthening regional cooperation for unified data gathering, monitoring and capacity building.

The outcome of the workshop was reported to the 43rd session of the UNFCCC’s Subsidiary Body for Scientific and Technological Advice in December 2015. Furthermore at the regional level, the UAE is supporting ROPME’s Climate Change Impact Assessment work, which is conducted in partnership with UNEP and intended to perform a wide assessment of climate change impacts and propose adaptation strategies for sea level rise, cyclones and dust fall with emphasis on early warning capacity and acidification. The UAE is also engaged in the planning of ROPME’s Four Season Oceanographic Cruise of the Arabian Gulf, which is expected to take place in 2016-2017 with the objective to carry out cruises in four consecutive seasons for comprehensive study of the state of the marine environment all year round to highlight critical seasonal variations, which could also shed light to impacts of climate change on the marine environment.



# Chapter

# 2

# National Greenhouse Gas Inventory

# Introduction

## Climate Change and Greenhouse Gases

Climate change is a long-term change in the earth's climate due to anthropogenic activities and partly due to the nature reacting to these external changes by these activities. The link between greenhouse gases and their impact on the temperature of the Earth was first mentioned as far back as 1824.

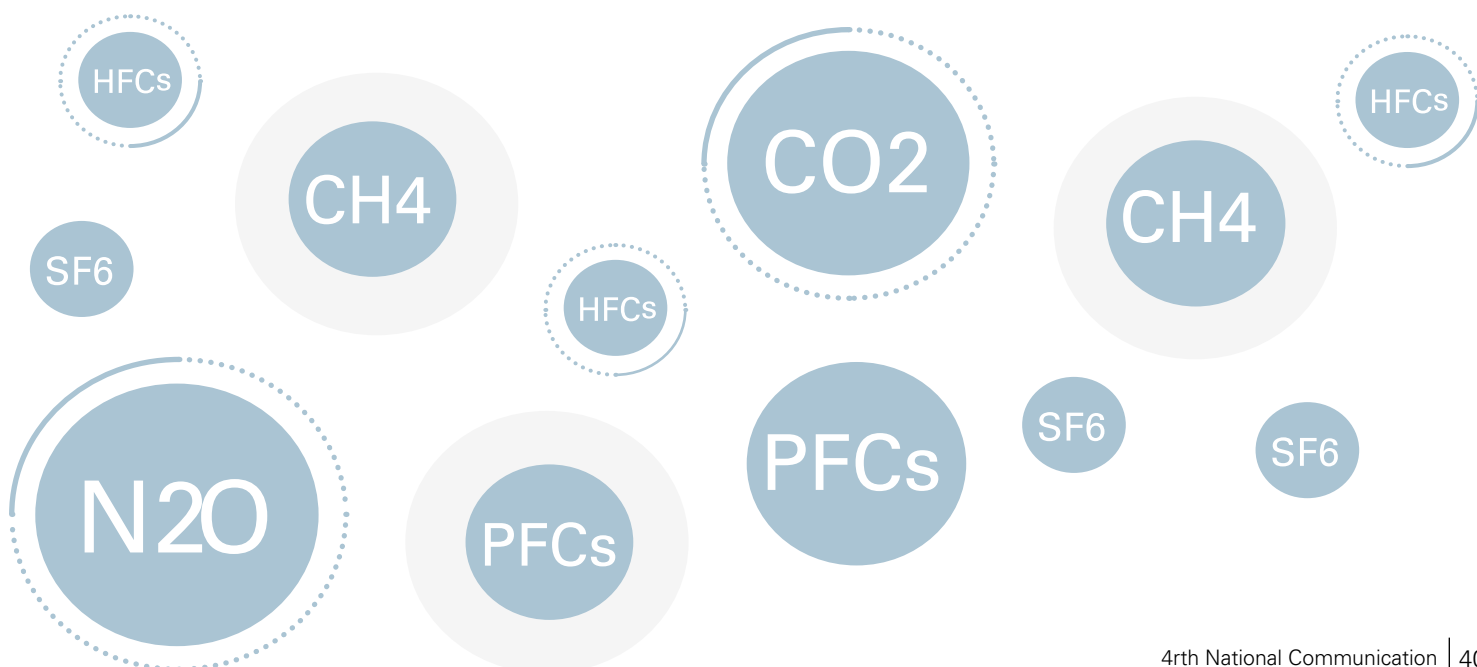
In the last century, the UN formed the Intergovernmental Panel on Climate Change (IPCC), a scientific body to investigate the issue. The first assessment report of the IPCC was released in 1990. Since then scientific knowledge has evolved to a point that few dispute that the large amounts of greenhouse gases in the atmosphere are having profound impact on climate.

The latest report on the status of climate change and the impacts on the ecosystems is elaborated in the Fifth Assessment Report by IPCC.

The United Nations Framework Convention on Climate Change (UNFCCC) is an international treaty, which was created in 1992 to address the issues raised by IPCC. Each following year decisions were taken in the Conference of Parties (COP) to the convention to limit average global temperature increases and the resulting climate change, and to adapt to the inevitable changes to the ecosystems.

An outcome to the UNFCCC negotiations was the creation of the Kyoto Protocol in the third COP, which came into force in 2005 and provided an international binding to reducing emissions. The Kyoto Protocol distinguished the roles of the developed and developing countries and the UAE was classified as a Non Annex I country given our national circumstances. Beside Carbon Dioxide (CO<sub>2</sub>), Nitrous Oxide (N<sub>2</sub>O) and Methane (CH<sub>4</sub>), the Kyoto Protocol deals with the greenhouse gases Sulphur hexafluoride (SF<sub>6</sub>), Hydro-Fluorocarbons (HFCs) and Per Fluorocarbons (PFCs).

The 21st COP was held in Paris in December 2015, this resulted in the historical "Paris Agreement" which includes both the developed and developing nations in the efforts to curb global warming. The legal agreement aims to maintain the global average temperature rise to well below 2 degrees and aspiring to 1.5 degree Celsius. The Paris Agreement is the result of the long and hard negotiations, which were ongoing under the Ad Hoc Durban Platform since 2012.



# UAE's Role

The United Arab Emirates has been the forerunner for initiating efforts to tackle climate change. The UNFCCC came into force in 1994, and the UAE ratified the Convention in 1995. The Kyoto Protocol was endorsed by the UAE in 2005 where it was classified as a Non-Annex 1 party. As a party to the UNFCCC, the UAE has issued the National Communications in the years 2007, 2010 and 2013.

As a follow up to the COP21 in Paris the UAE has submitted their Intended Nationally Determined Contributions (INDCs) to the UNFCCC highlighting the 24% clean energy target set by National Agenda as part of the UAE Vision 2021.

The leadership of the UAE has always included the impact on the environment and climate change as part of the long-term vision for the nation. The UAE Vision 2021 ensures sustainable development while preserving the environment, and achievement of a perfect balance between economic and social growth.

Monitoring the CO<sub>2</sub> emissions of the UAE is under the mandate of the Ministry of Energy and Industry as the majority of the emissions arise from the Energy sector activities. The UAE Greenhouse Gas (GHG) Inventory has been commissioned to estimate the impact of the activities in the Nation on the global issue of climate change. The annual update of the UAE GHG Inventory will provide the collection of data and closing of data gaps which is necessary to create the baseline and further evaluate the mitigation efforts to reduce carbon emissions and support the future UAE INDC submissions which are the mandate of the Paris Agreement.

## Sector Overview

The emissions' source/sink categories are grouped into the major sectors below which are: energy, industrial processes, agriculture, land-use change and forestry (LULUCF), and waste. These categories listed cover most of the UAE's activities emitting or removing greenhouse gases, based on the data obtained from 2014.

- Energy
- Industrial Processes
- Agriculture
- Land-Use Change and Forestry (LULUCF)
- Waste

# 1 Energy

Energy emissions refer to the total emission of all greenhouse gases from stationary and mobile energy activities (fuel combustion as well as fugitive fuel emissions).

## Fuel Combustion Activities

### Energy Industries

- Public Electricity, Cooling, and Heat Production
- Petroleum Refining

### Manufacturing Industries and Construction

- Transport
- Other Sectors
- Residential
- Fugitive Emissions from Fuels
- Oil and Natural Gas
- Venting and Flaring

# 3 Agriculture

Includes all anthropogenic emissions from agriculture sector, except for fuel combustion emissions and sewage emissions, which are covered in Energy and Waste sectors.

- Enteric Fermentation
- Manure Management
- Agricultural Soils

# 5 Waste

All the emissions associated with waste management are included in this sector.

- Solid Waste Disposal on Land
- Waste Water Handling
- Others- Human Sewage
- Incineration emissions are negligible

# 2 Industrial Processes

Emissions within this sector comprise by-product or fugitive emissions of greenhouse gases from industrial processes. Emissions from fuel combustion in industry are reported under Energy's manufacturing industries and construction sub-sector.

## Mineral Products

- Cement Production

## Chemical Industry

- Ammonia Production

## Metal Production

- Iron and Steel Production
- Aluminum Production

# 4 Land-Use Change and Forestry (LULUCF)

Total emissions and removals from forest and land use change activities are included in this sector. This sector has only one sub-sector relevant for the UAE.

- Changes in Forest
- Wetlands- Mangroves

# Inventory Preparation Process

## Methodology:

The Intergovernmental Panel on Climate Change (IPCC) is the leading international and scientific body for the assessment of climate change, under the auspices of the United Nations (UN). The IPCC Guidelines for National Greenhouse Gas Inventories are approved internationally and developed through an international process. They were first accepted in 1994 and published in 1995. UNFCCC Conference of the Parties 3 (COP3) held in 1997 in Kyoto reaffirmed that the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories should be used as "methodologies for estimating anthropogenic emissions by sources and removals by sinks of greenhouse gases". The GHG inventory is being conducted and biennial updated at the emirate geographical level such as the Abu Dhabi GHG inventory using the Revised 1996 IPCC Guidelines. The 2006 IPCC Guidelines are also practiced as complementary to cover the new gases and sources/ sinks and also to verify the Emirate inventory results.

## Assessment of the Sources and Sinks of Greenhouse Gas Emissions Not Included:

The six greenhouse gases encompassed by the Kyoto Protocol include the following: Carbon dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), Nitrous oxide (N<sub>2</sub>O), Hydrofluorocarbons (HFC), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF<sub>6</sub>).

The direct emissions include CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O and hence are given the highest priority for reporting by the IPCC guidelines followed by HFCs, PFCs and SF<sub>6</sub>. The second criteria used for selecting the gases that are accounted for and reported include the relative importance of the source and sink activities within the country and the availability of relevant information. Based on the above-mentioned criteria, out of the six gases/ gas groups, HFC emissions are not accounted in this cycle, due to the lack of relevant data. SF<sub>6</sub> data is available but not complete and hence they have been left out as per the criteria of selection set by the IPCC 1996 guidelines. However, the PFC emissions are accounted for as per the applicability and availability of the activity data. The table outlines reasons for exclusion of certain gases as well as the areas under which CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O and PFC gases are covered.

CO<sub>2</sub>

Covered under all sectors except for waste

CH<sub>4</sub>

Covered under waste, energy and agriculture sectors

N<sub>2</sub>O

Covered under waste, energy and agriculture

sectors

PFC

Not covered due to unavailability of data

Covered under IPPU

HFC

Not covered as it is not a requirement of Non-Annex I countries

NM VOC

Not covered as it is not a requirement of Non-Annex I countries

SF<sub>6</sub>

# Input Data Collection

## Stakeholder Communication:

### Exclusive Stakeholder Workshop

The GHG inventory cycle was initiated with an exclusive stakeholder workshop, informing the stakeholders about past efforts, the stages of UAE GHG Inventory and their role in the data gathering process. Expected future steps were provided to them and a general overview of the project plan was presented for their necessary action. This workshop not only increased awareness and understanding among more than 50 stakeholders that attended, but also resulted in more effective communication channels by identifying relevant focal points and accurate data collection by clarifying data requirements.

## Data Sources:

### Increased Involvement of Centralized Stakeholders

Centralized stakeholders refer to stakeholders who own significant data repositories pertaining to GHG emissions, such as Federal Competitiveness and Statistics Authority (FCSA), Statistics Center of Abu Dhabi (SCAD), and the Ministry of Energy and Industry (MoENI) national energy statistics. The FCSA is instrumental in providing data from all over the UAE, while SCAD holds exclusive data for the Emirate of Abu Dhabi for different sectors. In the current cycle, these stakeholders have been involved to a larger and more detailed extent with the amount of data shared with MoENI resulting in better quality of data received and reduced double counting during calculation phase.

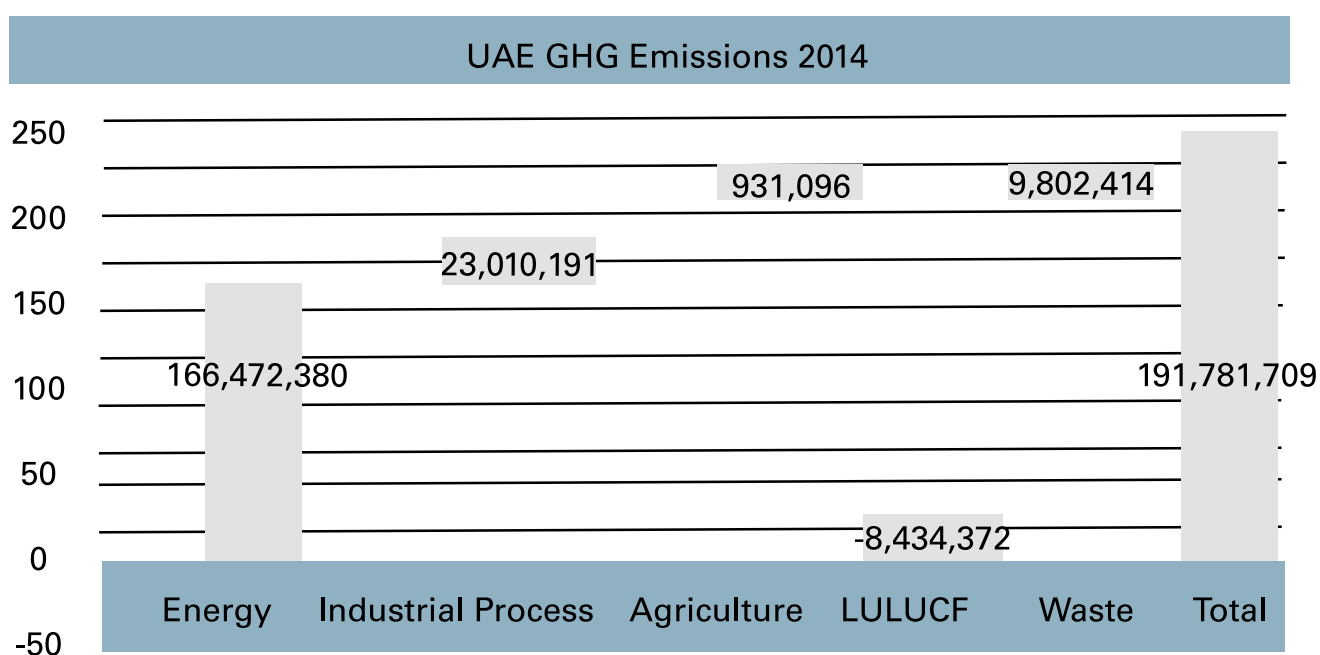
## Uncertainties

Uncertainties are a factor in any estimate of national emissions. Some important causes of uncertainty are:

- Differing interpretations of source and sink category or other definitions, assumptions, units etc.
- Use of simplified representations with “averaged” values, especially emission factors and related assumptions to represent characteristics of a given population
- Uncertainty in the basic socio-economic activity data which drives the calculations
- Inherent uncertainty in the scientific understanding of the basic processes leading to emissions and removals

The uncertainty of activity data and emission factor are estimated based on expert judgment in line with the IPCC 2006 suggestions. Based on this cycle's assessment, the uncertainty stands at an estimated +/-13%.

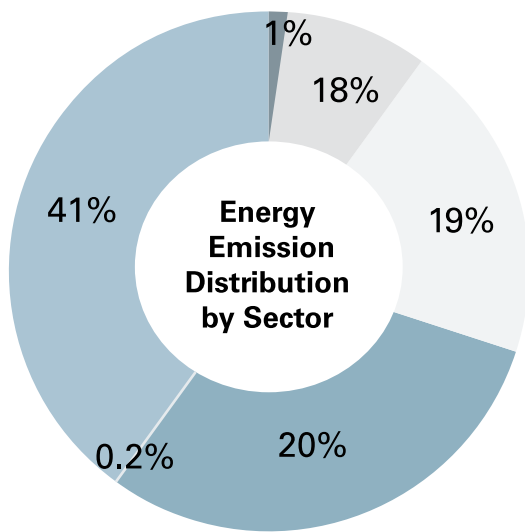
The UAE has total GHG emissions of 191,781,709 tCO<sub>2</sub>e from the emission activities within the country. The largest emissions are from the energy sector; whereas the agriculture sector contributes the least. The following sections provide detailed breakdown of the emissions per sector and the contribution of the key greenhouse gases to the total emissions.



**UAE Emissions by Sector and GHG Type 2014**

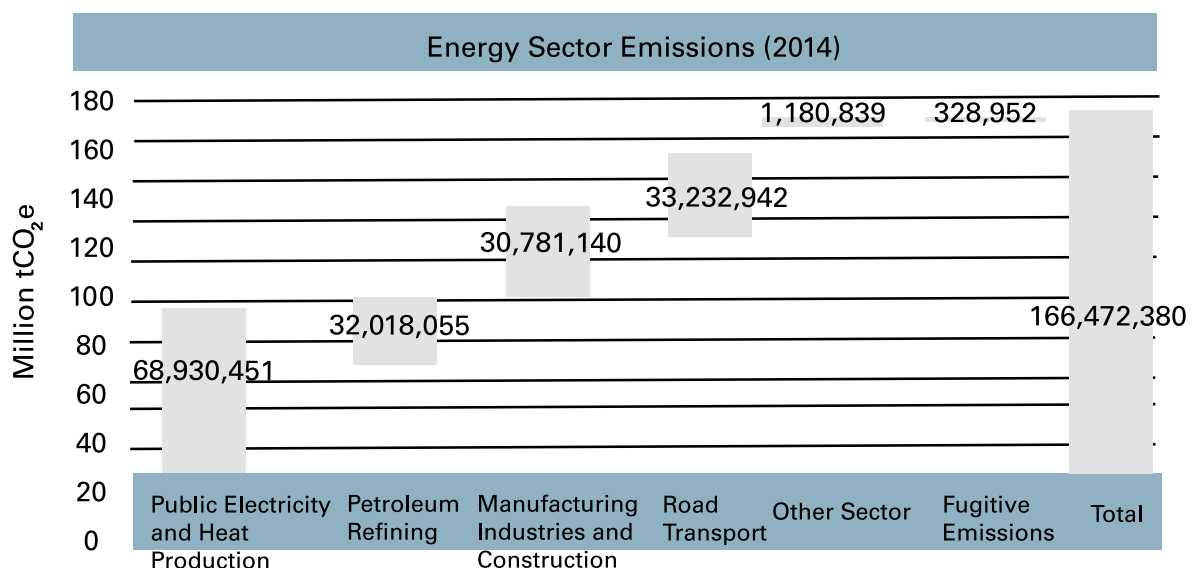
Greenhouse gas source and sink categories 2014 -	CO <sub>2</sub> emissio Gg	CO <sub>2</sub> removals Gg	CH <sub>4</sub> Gg	N <sub>2</sub> O Gg	PFCs Gg	CH <sub>4</sub> Gg CO <sub>2</sub> e	N <sub>2</sub> O Gg CO <sub>2</sub> e	PFC Gg CO <sub>2</sub> e	Total GHG tCO <sub>2</sub> e
.1 Energy	166,208.99	0	7.71	0.33		161.93	101.46	0	166,472,380
.2 Industrial Process	22,676	0	0	0	0.047524451	0	0	334	23,010,191
.3 Agriculture	0	0	39.49	0.33	0	829.22	101.88	0	931,096
.4 LUCF	0	8,434-	0	0.00	0	0	0	0	8,434,372-
.5 Waste	0	0	454.90	0.80	0	9,552.94	249.47	0	9,802,414
<b>TOTAL</b>	<b>188,885</b>	<b>8,434-</b>	<b>502</b>	<b>1</b>	<b>0</b>	<b>10,544</b>	<b>453</b>	<b>334</b>	<b>191,781,709</b>

## Energy in the same format as industrial Processes



- Electricity and Water Generation 41%
- Transport 20%
- Oil and Gas Refining 19%
- Manufacturing Industries 18%
- Residential 1%
- Venting and Flaring 0.2%

The total emissions from the Energy sector within the UAE amount to an estimated 166,472,380 tCO<sub>2</sub>e. The breakdown of the emission distribution is as shown in the above figure. The largest source of GHG emissions within the energy sector is the public electricity production, which amounts to 68,930,451 tCO<sub>2</sub>e. This sub-sector includes the data that comes from the four major utilities. The majority of the power generation plants employ co-generation and utilize natural gas as fuel. Given the climatic and geographical conditions of the UAE and water scarcity, there is high dependence on electricity for the generation of water for the population. The emissions from water desalination are included within the public electricity production sub-sector due to the energy intensive nature of the water generation process in the country. It is important to note that the large-scale developments in clean energy conducted presently by the UAE will reduce the emissions of the energy sector. For example, the UAE peaceful nuclear energy project is estimated to save more than 24 million tons of CO<sub>2</sub> emissions every year, once the four nuclear energy plants are operational.





The second largest contributors to the energy sector emissions include the road transportation and it amounts to 33,232,942 tCO<sub>2</sub>e. This sub sector covers private and public vehicles and corresponding to the data that comes from the Ministry of Energy and Industry's Annual Statistical Report that cover fuel suppliers in the country, namely.

Emissions for Sub Sectors within Energy Sector						
SECTORAL REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Gg			Gg CO <sub>2</sub> e		tCO <sub>2</sub> e
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CH <sub>4</sub>	N <sub>2</sub> O	Total GHG
Total Energy	166,209	7.71	0.33	162	101	166,472,380
A Fuel Combustion Activities) Sectoral Approach(	0	0	0	0	0	0
1 Energy Industries	100,943.35	0.09	0.12	1.84	37.20	100,982,395
a Public Electricity and Heat Production	68,925.30	0.09	0.01	1.84	3.31	68,930,451
b Petroleum Refining	32,018.06	0	0	0	0	32,018,055
2 Manufacturing Industries and Construction	30,767.85	0.29	0.02	6.15	7.13	30,781,140
3 Transport	32,995.43	7.14	0.28	149.99	87.52	33,232,942
b Road Transportation	32,995.43	7.14	0.28	149.99	87.52	33,232,942
4 Other Sectors	1,173.40	0.19	0.01	3.95	3.50	1,180,839
b Residential	1,173.40	0.19	0.01	3.95	3.50	1,180,839
B Fugitive Emissions from Fuels	0	0	0	0	0	0
2 Oil and Natural Gas	328.95	0	0	0	0	328,952
c Venting and Flaring	328.95	0	0	0	0	328,952

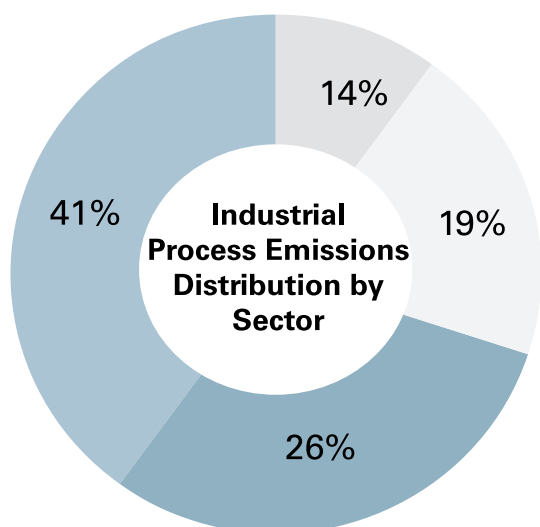
Petroleum refinery is a major contributor to the GDP of the UAE and the subsequent GHG emissions from this subsector are 32,018,055 tCO<sub>2</sub>e.

The GHG emissions from the manufacturing industries and construction sector amounts to 30,781,140 tCO<sub>2</sub>e. The key source of emissions is the Aluminum subsector that relies on natural gas based power plants, and amounts to nearly 54% of the emissions from the manufacturing industry and construction sector. Emissions from the cement sector, which utilizes coal, natural gas and diesel for furnaces and generators, amount to 22% of the emissions from the manufacturing industry and construction sector. The remaining 24% of emissions are from the other industries such as steel, ceramics, etc. with manufacturing activities in the country.

The residential subsector within the energy sector accounts for 1,180,839 tCO<sub>2</sub>e. Data for LPG, obtained from the primary fuel suppliers in UAE, was used to determine the contribution of the residential sector's fuel consumption in the energy sector emissions.

The fugitive emissions, in the energy sector, account for the venting and flaring activities of oil and natural gas in petroleum refineries. The amount of emissions from this subsector is only 328,952 tCO<sub>2</sub>e, which is the smallest subsector contribution to the total energy sector.

## Industrial Processes:



Cement Production 41%   Ammonia Production 26%   Iron and Steel 19%   Aluminum 14%

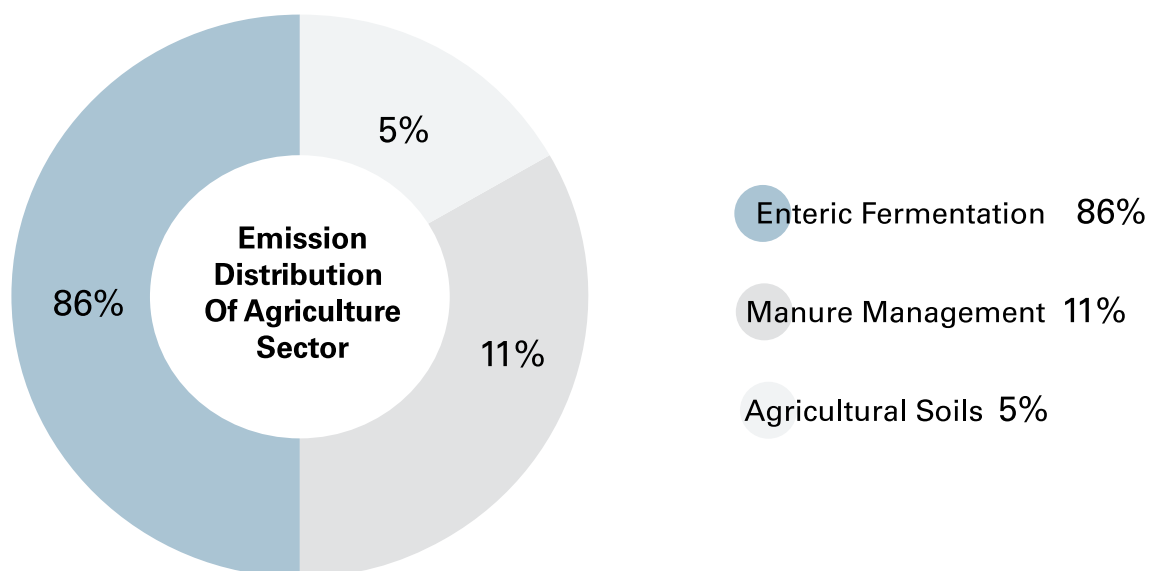
The total emissions from the Industrial Process Sector amount to an estimated 23,010,191 tCO<sub>2</sub>e. The breakdown of the emission distribution is as shown in the above figure. The largest contribution to the industrial processes emissions comes from the mineral products sub-sector that produces cement manufacturing. The emissions from cement manufacturing have the largest share with a total value of 11,830,145 tCO<sub>2</sub>e. The source of emissions in the cement manufacturing process is the production of clinker whose total production, from the ten identified cement manufacturers in UAE, amounts to 22.5 million tons of clinker. The chemical industry has the second largest share of emissions in the industrial process sector. This sub-sector covers the production of ammonia in the Emirate of Abu Dhabi and its total emissions are 1,707,027 tCO<sub>2</sub>e.

Emissions for Sub sectors within Industrial Processes								
SECTORAL REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES								
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Gg				Gg CO <sub>2</sub> e			tCO <sub>2</sub> e
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	PFC	CH <sub>4</sub>	N <sub>2</sub> O	PFC	Total GHG
Total Industrial Processes	22,675.91	0	0	0	0	0	334.28	23,010,191
A Mineral Products	11,830.14	0	0	0	0	0	0	11,830,145
1 Cement Production	11,830.14	0	0	0.00	0	0	0	11,830,145
B Chemical Industry	1,707.03	0	0	0	0	0	0	1,707,027
1 Ammonia Production	1,707.03	0	0	0.00	0	0	0	1,707,027
C Metal Production	9,138.74	0	0	0.05	0	0	334.28	9,473,020
1 Iron and Steel Production	5,527.40	0	0	0.00	0	0		5,527,400
3 Aluminium Production	3,611.34	0	0	0.05	0	0	334.28	3,945,620

The metal production subsector altogether contributes to a total of 9,473,020 tCO<sub>2</sub>e, which is from the emissions of the iron, steel and aluminium production. The iron and steel production activities in UAE have a higher share in the metal production with emissions of 5,527,400 tCO<sub>2</sub>e, whereas the emissions of the aluminium producer amount to a total of 3,945,620 tCO<sub>2</sub>e.

## Agriculture:

The total emissions from the Agricultural sector in the UAE amount to 931,096 tCO<sub>2</sub>e. The breakdown of the emission distribution is as show in the below figure. The enteric fermentation in the digestive tracts of the livestock in the country is the major contributor to the agricultural sector emissions with a total of 780,005 tCO<sub>2</sub>e. The other two subsectors, agricultural soils and manure management, have emissions of 101,656 tCO<sub>2</sub>e and 49,435 tCO<sub>2</sub>e respectively.

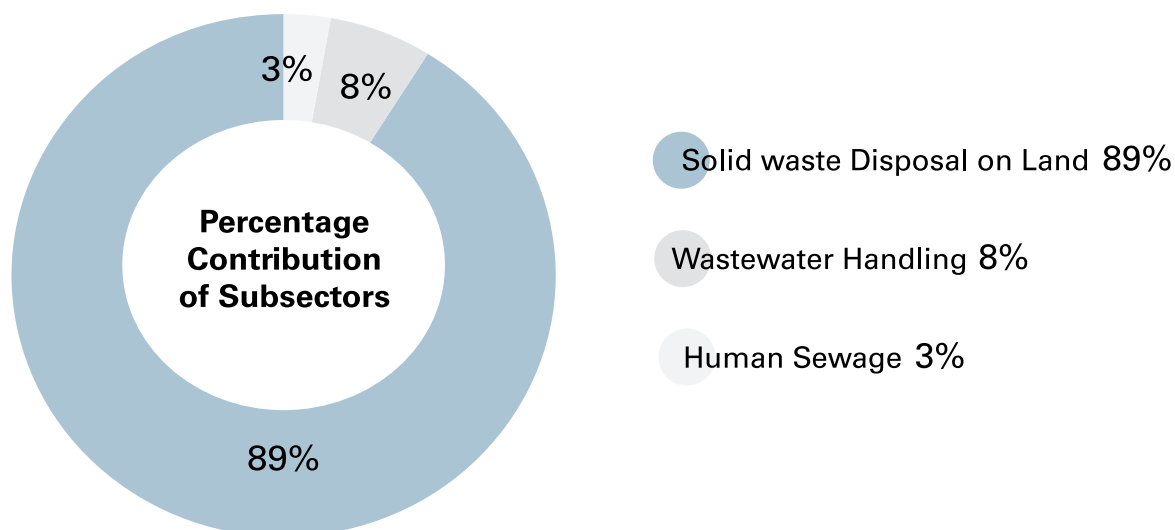


Emissions for Sub Sectors within Agriculture Sector					
SECTORAL REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES					
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Gg		Gg CO <sub>2</sub> e		tCO <sub>2</sub> e
	CH <sub>4</sub>	N <sub>2</sub> O	CH <sub>4</sub>	N <sub>2</sub> O	Total GHG
Total Agriculture	39.49	0.33	829.22	101.88	931,096
<b>A Enteric Fermentation</b>	<b>37.14</b>	<b>0</b>	<b>780.01</b>	<b>0</b>	<b>780,005.30</b>
1 Cattle	3.85	0	80.81	0	80,811
3 Sheep	7.01	0	147.24	0	147,239
4 Goats	9.54	0	200.36	0	200,359
5 Camels and Llamas	16.74	0	351.44	0	351,438
6 Horses	0.01	0	0	0	158.76
<b>B Manure Management</b>	<b>2.34</b>	<b>0.001</b>	<b>49</b>	<b>0.22</b>	<b>49,435</b>
1 Cattle	0.21	0	4.49	0	4,489
3 Sheep	0.29	0	6.18	0	6,184
4 Goats	0.42	0	8.82	0	8,816
5 Camels and Llamas	0.93	0	19.56	0	19,558
6 Horses	0.00	0	0.02	0	19.2276
9 Poultry	0.48	0	10.14	0	10,143
11 Liquid Systems	0	0.00002	0	0.01	6.138
13 Other) Poultry Manure Management(	0	0.001	0	0.22	218.701714
<b>D Agricultural Soils*</b>	<b>0</b>	<b>0.33</b>	<b>0</b>	<b>101.66</b>	<b>101,656</b>

Table:4

## Waste:

The total emission from the Waste Sector is and estimated 9,802,414 tCO<sub>2</sub>e. The breakdown of the emission distribution is as shown above. The vast majority of the emissions arise from the Municipal Solid Waste (MSW) that is disposed of and allowed to degrade in the landfills. The emissions are in terms of methane gas being released during the degradation process, which amounts to 8,774,019 tCO<sub>2</sub>e.



The emissions from the sludge handling systems are included to ensure that emissions are not underestimated. The records obtained from the FCSA national waste statistics show that sludge from wastewater, for both domestic and commercial consumption, is dumped in the landfill and this is accounted for in the wastewater handling subsection that amounts to 778,921 tCO<sub>2</sub>e.

The human sewage is another subsector that, although, has a less significant impact on emissions, is accounted for in the waste sector. As with the other two subsectors within the waste sector, CO<sub>2</sub> is not the emitted gas. For human sewage, nitrous oxide is the emitted gas and the total value of emissions for this subsector is 249,474 tCO<sub>2</sub>e.

Emissions per Sub Sector within Waste						
SECTORAL REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES						
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Gg			Gg CO <sub>2</sub> e		tCO <sub>2</sub> e
	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CH <sub>4</sub>	N <sub>2</sub> O	Total GHG Emissions
Total Waste	0	454.90	0.80	9,552.94	249.47	9,802,414
A Solid Waste Disposal on Land	0	417.81	0	8,774.02	0	8,774,019
1 Managed Waste Disposal on Land	0	417.81	0	8,774.02	0	8,774,019
B Wastewater Handling	0	37.09	0	778.92	0	778,921
2 Domestic and Commercial Wastewater	0	37.09	0	778.92	0	778,921
D Others - HUMAN SEWAGE	0	0	0.80	0	249.47	249,474

Table:5

# Chapter

# 3

# Adaptation to Climate Change

# Introduction

Climate change adaptation is an equally important issue as mitigation, as the UAE is likely to be affected by impacts of climate change similar to other countries in the region. Some of the potential effects include changes in weather patterns, increased air and seawater temperatures, sea level rise, and increased extreme weather events.

The UAE is located in a highly arid (an average rainfall of under 100 mm) and water scarce coastal environment with high temperature and humidity in the summer months (hottest days reaching over 49°C. Humidity reaches close to 100% on humid days).

Therefore, the changes produced by climate change will have direct and indirect economic, environmental and social impacts on the UAE. The foreseen adverse effects will impact marine and terrestrial biodiversity, agricultural productivity and water availability.

Rising sea levels could affect the UAE's critical infrastructures, such as desalination and power stations, as well as habitats located on coastal zones facing the Arabian Gulf or the Gulf of Oman.

Given the prospect of climate change challenges, the UAE is implementing a range of policies and programs both at the national and local levels to adapt to and reduce its vulnerability to climate change, some of which have mitigation co-benefits. Decision-making is informed through a wide range of stakeholder consultation processes, including the private sector, as well as best available scientific studies as highlighted in this section, to address the science-policy interface. Detailed adaptation programs will be developed for a number of key sectors moving forward under the National Climate Change Plan to minimize risks and improve the adaptive capabilities of the UAE.

## Regional Climate Change Modeling

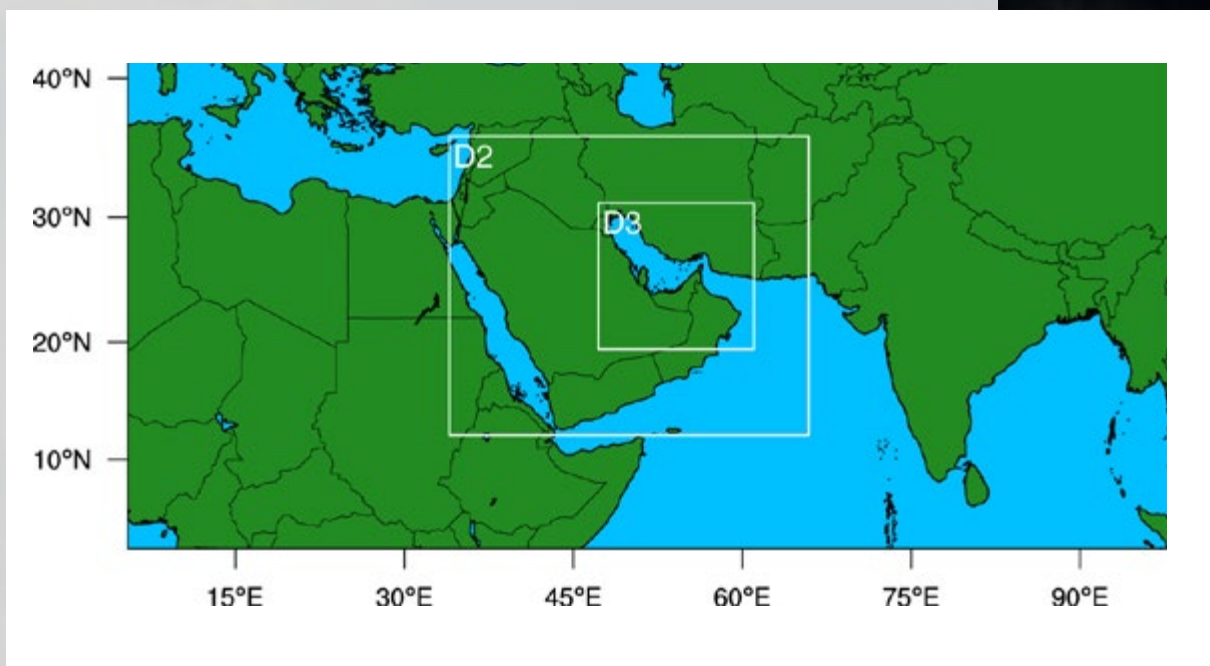
Future climate modeling and forecasting studies are helpful in devising appropriate adaptation measures. In order to increase the reliability of future climate projections and the effectiveness of corresponding policy responses, the Abu Dhabi Global Environmental Data Initiative (AGEDI) conducted a multi-year project (2013-2016) to study impacts of climate change at the local, national and regional levels, including on terrestrial and marine ecosystems, coastal zones, food security and water resources. Key findings from the study reinforced the importance of climate change adaptation as a policy priority for the UAE and also informed the development of the National Climate Change Plan.

The basis of AGEDI's work was the regional climate modeling. Globally, scientific projections of future impacts of climate change are based on General Circulation Models (GCMs) which are global-level climate models that represent physical processes in the atmosphere, ocean, cryosphere (portions of the Earth's surface where water is in solid form) and land surface to simulate the response of the global climate system to increasing greenhouse gas (GHG) concentrations. The outputs of GCMs are however rather coarse and do not sufficiently reflect local-to-regional topography and meteorological dynamics in the Arabian Gulf region. The terrain in the region can be complex and meteorological conditions – particularly extreme wind events – can be volatile, hence the importance of regional modeling.

# Regional Atmospheric Modeling

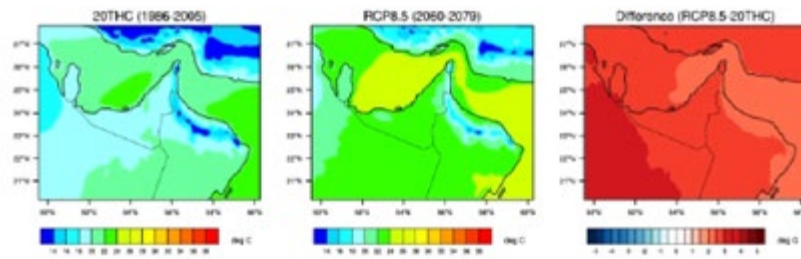
Regional Atmospheric Modeling applied the Weather Research Forecasting (WRF) Model developed by the National Center for Atmospheric Research (NCAR) to dynamically downscale the outputs of the Community Climate System Model Version 4 (CCSM4) GCM. Two Representative Concentration Pathways (RCPs) in the Intergovernmental Panel on Climate Change (IPCC)'s Fifth Assessment Report (AR5) were considered, RCP8.5 (high emissions trajectory) and RCP4.5 (low-to-moderate emissions scenario). The model was validated against historical data for the 1986-2005 period for nested domains of increasing resolution, 36 km, 12 km, and 4 km, which are considerably higher compared to the CCSM4's 100 km resolution.

Some of the key findings indicate that the entire Arabian Peninsula is expected to become hotter and more humid in the future due to climate change. For example, for already hot and humid summer months, an increase in temperature between 2°C (RCP 4.5) to 3°C (RCP 8.5) is projected by the 2060-2079 period relative to the historical period. Humidity is expected to increase by around 10% across the UAE, and in particular, in the northeast of the country. It is also possible that average annual precipitation may increase in the UAE, especially during summer months, although projected reductions in some days with rainfall indicate a possible increase in heavier rainfall events.

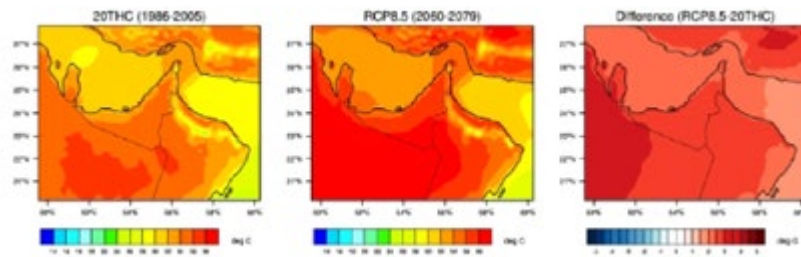


Source: "FINAL Executive Briefing - Regional atmospheric modeling," AGEDI, 2015

## Average December, January and February (DJF) Temperature



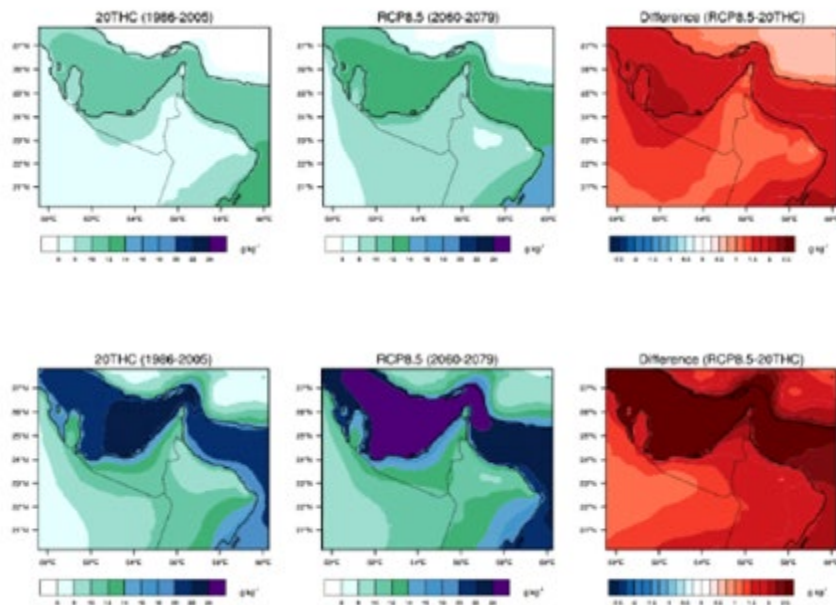
## Average June, July and August (JJA) Temperature



Future temperature around the UAE using the validated WRF model for the historical period (left), 2060-2079 under RCP 8.5 (center), and the percent difference (right), averaged over winter months (top) and over summer months (bottom).

Source: "FINAL Executive Briefing - Regional atmospheric modeling," AGEDI, 2015

## Average DJF Specific Humidity





Future humidity around the UAE using the validated WRF model for the historical period (left), 2060-2079 under RCP 8.5 (center), and the percent difference (right), averaged over winter months (top) and over summer months (bottom).

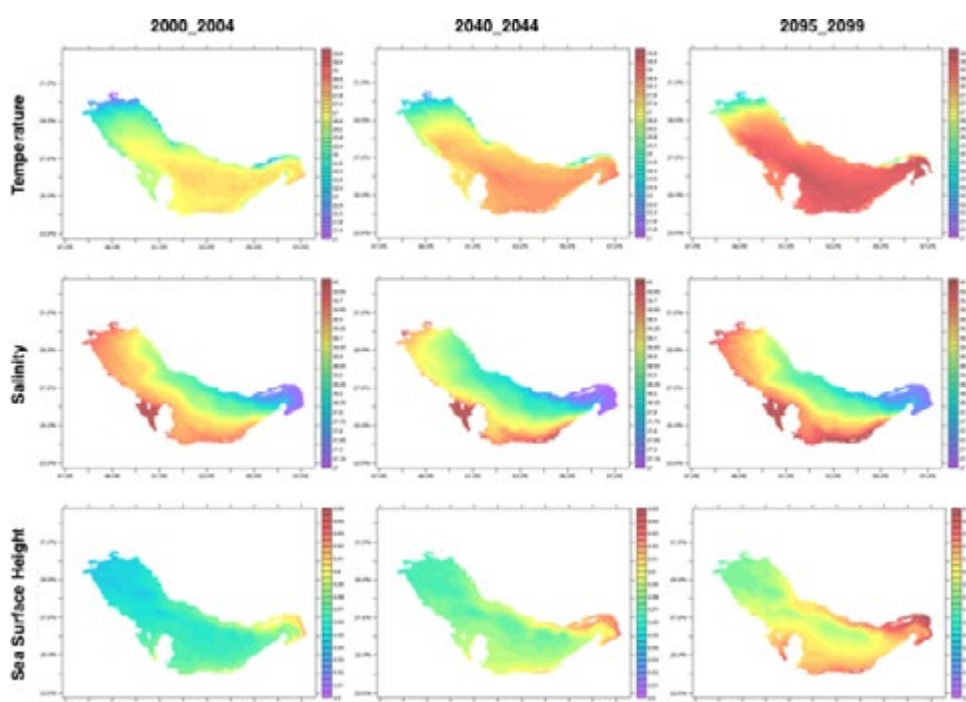
Source: "FINAL Executive Briefing - Regional atmospheric modeling"; AGEDI, 2015

## Regional Ocean Modeling

Regional Ocean Modeling applied the Regional Ocean Modeling System (ROMS) to downscale the outputs of the Mixed Resolution GCM developed by the Max Planck Institute for Meteorology (MPI). Only one RCP was considered, RCP8.5. The regional ocean model was validated against historical data for the 2002-2006 period for the Arabian Gulf domain, using 1.1 km average horizontal resolution and a vertical resolution varying from 0.1 cm to 4 meters.

The results indicate changes in the Arabian Gulf compared to historical trends, namely in temperature, salinity and circulation patterns although they are mostly uneven across the Arabian Gulf. For example, by late century (2095-2099), sea surface temperature of about 1.7 °C increase is expected in the central Gulf area and about 2.8 °C increase in some parts of the Gulf, such as around the Strait of Hormuz. Sea surface salinity is projected to both decrease and increase, depending on location, where modest increases of about 0.5 practical salinity units (psu) is expected along the UAE coast south of the Northern Emirates by late century. Sea level rise is projected to be in the range of about 2.7 cm (in the central Gulf area) to 5 cm (around the Strait of Hormuz) increase, depending on location, by late century. Not all major contributing factors of sea level rise, however, were accounted for in the modeling, due to limitations in current suites of GCMs, including the MPI- Mixed Resolution GCM. More accurate projection of regional sea level rise would therefore first require integration of the major drivers of sea level rise (i.e., thermal expansion and deglaciation) into the GCMs, which is underway in the ocean modeling scientific community.

### Temperature, Salinity and Sea Surface Height Changes



Early (2000-2004), mid 21st century (2040-2044) and late 21st century (2095-2099) time-averaged sea surface temperature (degrees Celsius), sea surface salinity (practical salinity units), and sea level height (cm) in the Arabian Gulf


Source: "FINAL Executive Briefing – Regional Ocean Modeling" AGEDI, 2015

These findings are generally consistent with the trends observed in GCMs at the global level, but the regional models provide more detailed and precise projections which could assist not only in relevant policy development to increase climate resilience and mitigate climate risks, but could also provide insights into business development opportunities (e.g., building renewable energy plants factoring future climatic conditions such as wind direction).

Furthermore, the increase of salinity of the Arabian Gulf due to climate change will be further exacerbated by desalination processes to produce potable water. The Arabian Peninsula relies heavily on desalinated seawater. Since 2000, desalinated water production has increased about 9% per year in the region, and roughly 10% per year in the UAE, and is expected to increase further, to meet growing water demand due to population and socio-economic developments. AGEDI's recent study investigated the combined impacts of climate change and desalination on the Arabian Gulf. The study was based on the Regional Ocean Model and projected changes against four potential scenarios of plant discharge levels to mid-century (2040-2050). The study found that hot and highly saline brine discharges from desalination plants will significantly impact surface and bottom temperatures as well salinity throughout the Gulf, depending on the location and depth. These changes are likely to affect sea grasses and other ecosystems that support a wide range of aquatic species and calls for attention when developing climate adaptive measures for the Arabian Gulf.

## Agriculture, Fisheries & Food Security

Climate change is expected to affect various aspects of the agriculture sector in the UAE. For example, increased temperatures and resulting increased salinity due to higher evaporation rate could reduce types of crops that could tolerate in the already arid desert environment and increase susceptibility to the emergence of plant pests. The Ministry of Climate Change and Environment is working on making agriculture more sustainable and encouraging efficient use of natural resources in a manner that is economical, environmental and socially sustainable while enhancing its contribution to the UAE's food security. With limited water resources and arable land, a number of initiatives have been implemented to ensure sustainability of the sector while increasing productivity and relevant health benefits, especially in view of climate change. One such example is the adoption of the climate-smart agriculture (CSA) approach to adapt agricultural systems, mitigate emissions and ensure food security in a changing climate. Under this approach, farmers are encouraged to adopt a number of farming systems, namely: 1) organic farming since it emits less greenhouse gases and sequesters higher levels of atmospheric carbon dioxide compared to conventional farming; and 2) hydroponic farming as a promising alternative to water-intensive conventional farming. Moreover, the Integrated Pest Management (IPM) approach is implemented to control the palm pests through "NAKILNA" ("Our Palm") initiative to ensure sustainable palm cultivation which hold an important economic value in the UAE's agriculture sector.



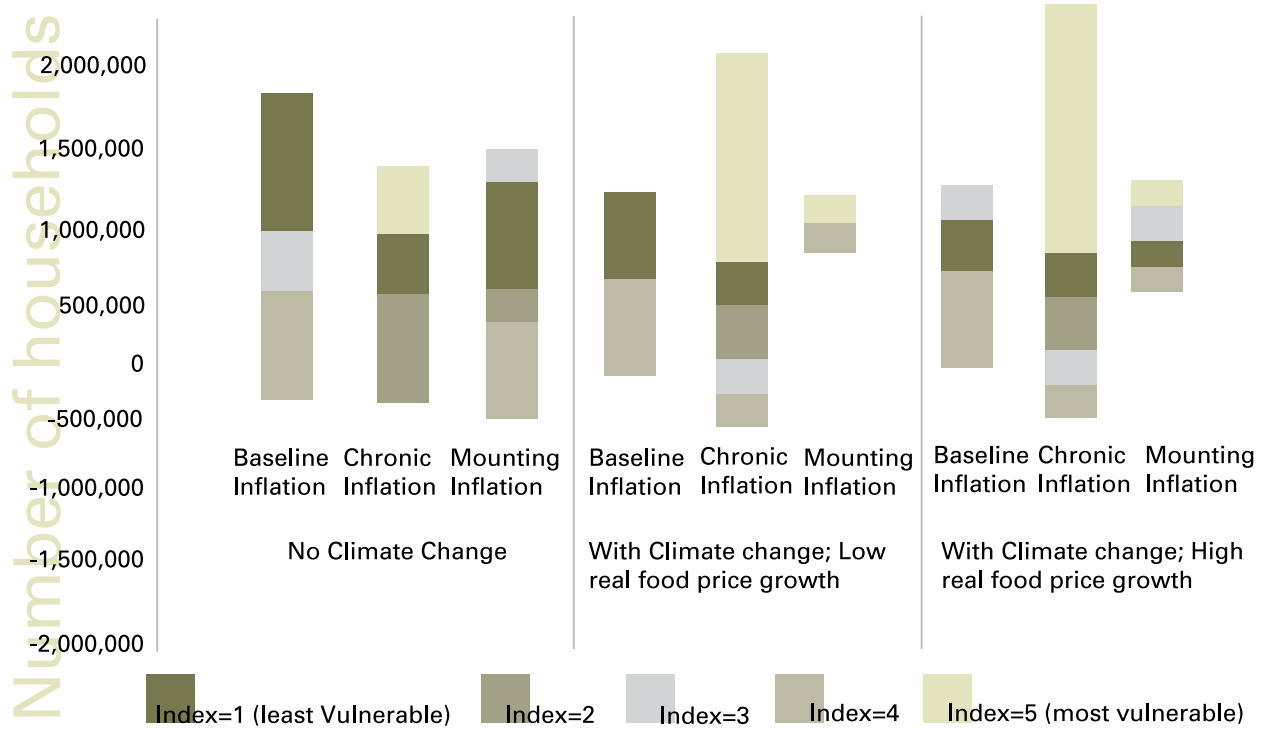
Furthermore, the UAE is developing and implementing a number of initiatives which aim to increase the resilience of the UAE's agro-food system through climate change adaptation and mitigation actions, such as, the promotion of climate change adaptive crop varieties, adoption of modified protected agriculture technologies (e.g., efficient greenhouses with cooling and recycled water systems), creation of strategic water reserves, use of clean energy and adoption of low-carbon footprint agro-systems (e.g., enhanced logistic platforms). Regulations also play an important role in ensuring sustainable agricultural practices. Research and development is an important factor in the sustainable development of the agricultural sector. A number of leading research institutions based in the UAE, including the International Center for Biosaline Agriculture and the International Center for Agricultural Research in the Dry Areas, work on improving agricultural productivity and sustainability in hyper arid and saline environment through innovative measures. For example, the world's first research facility to grow both food (fish and shrimp) and fuel (salt-tolerant halophyte plants) using desert land irrigated by sea water was opened in March 2016. The 2-hectare site in Abu Dhabi is managed by the Masdar Institute of Science and Technology and funded by the Sustainable Bioenergy Research Consortium formed by leading companies in the aviation sector such as Etihad Airways, Boeing and Honeywell. The project has both climate change adaptation and mitigation co-benefits, and may be scaled up to a 200-hectare site, if proven successful. Such innovative research and development is expected to further develop under the Emirates Committee for Sustainable Environment Research established in 2016 focused on addressing environmental sustainability and climate change.

Work is also underway in the UAE to promote sustainable fisheries, especially as oceans are increasingly affected by impacts of climate change, such as increased temperatures and acidification. This is conducted as a combination of initiatives, such as regulations to prohibit fishing and selling of endangered species during breeding seasons, installing artificial coves (reefs) in order to sustain and allow marine species to breed and grow, introduction of aquaculture, the establishment of the state of the art sheikh Khalifa bin Zayed Marine

Research Center which includes hatcheries for local species. Healthy oceans and seas that support sustainable fisheries transcend borders and is a major concern for the global community. The UAE in cooperation with the Government of the Republic of Seychelles has hosted two Blue Economy Summits (2014 and 2016) to support sustainable management of the marine environment and resources, and to meet relevant Sustainable Development Goals. Mental sustainability and climate change. At the same time, the UAE is highly dependent on food imports due to limited arable land and water availability. The UAE is currently classified as “food secure” according to international food security indexes such as the Global Food Security Index of The Economist. Climate change, however, in combination with other factors could affect the UAE’s food security in the long-run. Therefore, AGEDI’s recent food security project looked at how future climatic conditions may affect agricultural productivity of major food exporting countries to the UAE, and hence, the long-term food security of the UAE with attention to how UAE households may be affected. The study was mainly based on trade statistics from the Food and Agriculture Organization and utilized the outputs from the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) model developed by the International Food Policy Research Institute (IFPRI). IMPACT provides country and region-specific projections of agricultural commodity supply, demand, trade, and food prices within the context of climate change. The study looked at a number of scenarios (e.g., levels of future inflation, food price and impacts of climate change). The results from the study indicated that supply of certain products may be particularly constrained under climate change, such as wheat and rice, and could negatively affect lower-to middle income households with price increases, resulting in a greater share of household budgets spent on food. The below figure indicates that adding climate change to an already highly stressed situation (i.e., chronic inflation) can increase the number of the most vulnerable households by 100%, under the “high real food price” scenario. The IMPACT model is however a global model comprised of 115 countries/regions. The UAE is currently included as part of the Gulf region and breaking out this region further reflecting specific characteristics of the UAE may increase the accuracy of projecting future food security and associated impacts.



## Change in the total number of UAE households classified by the Micro Index, all scenarios



Source: "Food Security and Climate Change: Executive Summary" AGEDI (2015)

## Biodiversity

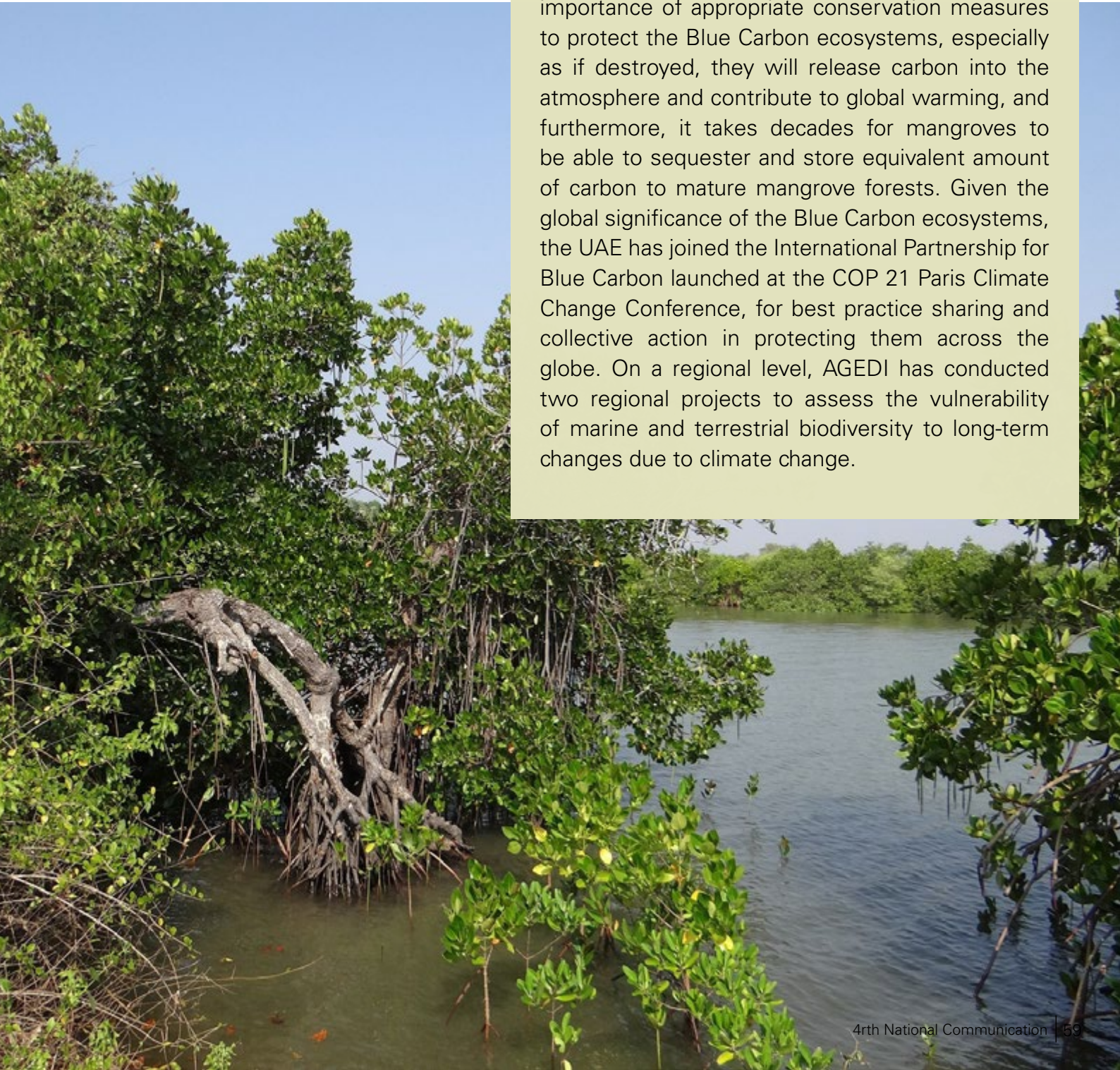
The UAE is home to a wide range of fauna and flora. Many of them are under threat due to pollution, rapid urbanization and climate change, among others. Some of the species are classified as "vulnerable" or "endangered" according to the IUCN Red List of the International Union for Conservation of Nature (IUCN), such as the Arabian tahr, Arabian leopard, Arabian Oryx, green turtle, fin whale and dugongs. The UAE has issued a National Biodiversity Strategy and Action Plan (NBSAP) to guide national efforts in conserving biodiversity during the coming decade, as well as a National Strategy to Combat Desertification. Under these frameworks, the UAE has adopted many projects to sustain its biodiversity and to benefit from numerous ecosystem services that are crucial to human well-being.

### Blue Carbon

One of the key pillars of the UAE's ecosystem in the context of climate change is "Blue Carbon" which is coastal and marine ecosystems such as mangrove forests, salt marshes and seagrass beds. They protect the shorelines, provide nursery grounds and habitats for a wide range of species and support coastal tourism. Moreover, their preservation and enhancement provide climate change mitigation benefits as they sequester and store significantly more carbon – around 4 times faster and more permanently - than terrestrial ecosystems. The UAE has also significant amounts of sabkha (salt flat) which does not sequester, but store carbon. UAE is one of the first countries to test and release the application of the 2013 Supplement to the 2006 IPCC Guidelines for its GHG inventory at the Abu Dhabi level." [reference: L. Schile, J. Kauffman, S. Crooks, J. Fourqurean, J. Glavan, and J. Megonigal. Limits on carbon sequestration in arid blue carbon ecosystems. Ecological Society of America: Ecological Applications, 27(3), 2017, pp. 859–874].

To this end, studies have been conducted to provide a baseline carbon assessment of Blue Carbon ecosystems across the UAE in different settings (e.g., lagoons, natural and planted mangroves). Key entities leading this work were the Ministry of Climate Change and Environment, AGEDI and the Environment Agency – Abu Dhabi with support from relevant local authorities and international Blue Carbon experts. While carbon stocks of hyper-arid and saline mangroves of the UAE generally sit at the lower end of carbon stocks on a global scale (at 293.15 Mg C/ha of the mean carbon stock of all the studied sites compared to the global average of about 1000 Mg C/ha) and considerably vary at different locations within the UAE, the study has revealed that high carbon stocks are found in some parts of the UAE such as in the south of the City of Kalba (824 Mg/ha) in older, mature mangrove forests.

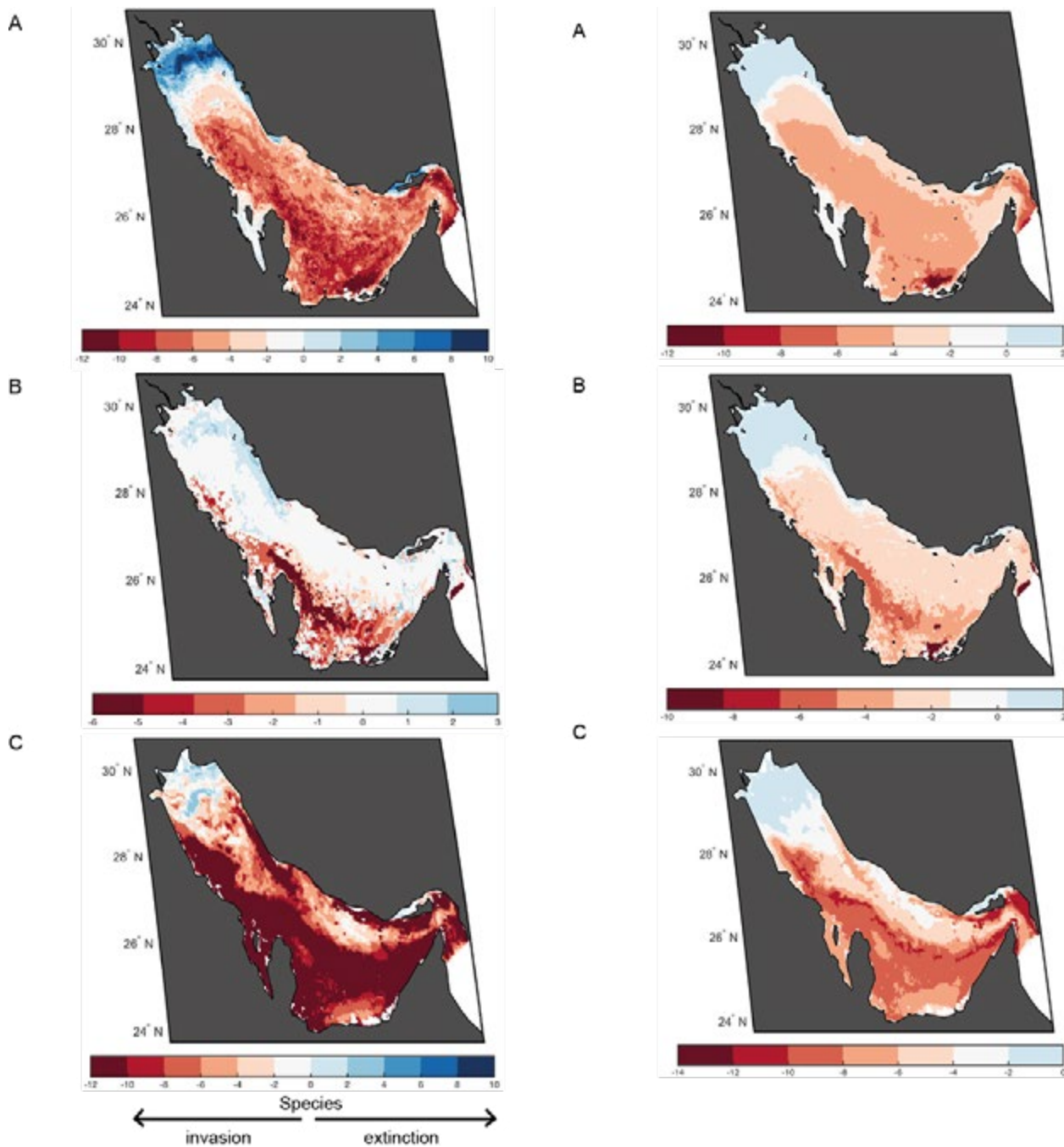
The study has helped to identify carbon stocks that are particularly valuable and reinforced the importance of appropriate conservation measures to protect the Blue Carbon ecosystems, especially as if destroyed, they will release carbon into the atmosphere and contribute to global warming, and furthermore, it takes decades for mangroves to be able to sequester and store equivalent amount of carbon to mature mangrove forests. Given the global significance of the Blue Carbon ecosystems, the UAE has joined the International Partnership for Blue Carbon launched at the COP 21 Paris Climate Change Conference, for best practice sharing and collective action in protecting them across the globe. On a regional level, AGEDI has conducted two regional projects to assess the vulnerability of marine and terrestrial biodiversity to long-term changes due to climate change.



# Marine & Terrestrial Biodiversity

The Marine Biodiversity project consisted of four main elements: 1) development of a marine species database development for the Arabian Gulf, subsequently incorporated into publicly available online databases - "FishBase" for fish and "SeaLife-Base" for non-fish species; 2) fish catch reconstructions by country, for seven countries bordering the Arabian Gulf, for the period 1950-2010; 3) environmental niche modeling of 56 priority species (48 fish species, three seagrass species and five vulnerable or endangered charismatic species such as dugong and dolphin) using the outputs of the Regional Ocean Modeling for RCP 8.5 and three different models (Non-Parametric Probabilistic Ecological Niche Model, Ecological Niche Factor Analysis, Bioclimate Analysis and Prediction Model; multiple models were utilized in order to increase the level of certainty) to project climate change impacts on species invasion, species local extinction, and habitat suitability; and 4) assessment of the vulnerability of commercial fishing industry, by country, under climate change (RCP 8.5 scenario). While there are considerable variations among the results from the three models, they generally indicated possible local extinction in the Arabian Gulf, in some cases, reduction of up to 35% of species and possible invasion of species up to 5 % by 2090 relative to 2010. The UAE is one of the regions that is likely to be affected from marine biodiversity loss as well as decline in commercial fish catch with socio-economic consequences. Some of the migratory species such as sea turtles may be able to adapt to the changing climate by adjusting their migratory patterns compared to other non-migratory species endemic to the Gulf that may be more significantly affected. Nevertheless, climate change is expected to affect a wide range of species and the study has identified the need to increase the robustness of conservation measures, such as effective and enforced fisheries policies as well as Marine Protected Areas (MPA) to mitigate potential habitat destruction and increase species resilience to climate change.

Projected changes by 2090 relative to 2010 from (A) NPPEN and (B) ENFA and (C) BIOCLIM.  
 Rate of local extinction and species Invasion Index of habitat biodiversity suitability  
 (sum of predicted habitat suitability)



(left panel), species invasion is represented by positive values while species local extinction is represented by negative values. (right panel), increasing habitat biodiversity suitability is represented by values to the right of the scale while decreasing habitat biodiversity suitability is represented by values to the left of the scale.

Source: "Marine Biodiversity and Climate Change: Final Technical Report" AGEDI, 2016



The Terrestrial Biodiversity project comprised of three main elements: 1) development of a terrestrial species database for the Arabian Peninsula; 2) individual species distribution modeling using MaxEnt to project impacts of climate change on future habitat suitability for 18 priority terrestrial species (birds, mammals and plants); and 3) generalized dissimilarity modeling at the community level (i.e., plants, mammals, breeding birds, non-breeding birds) to project changes in species composition under current and future climate. Both of the modeling used outputs from the Regional Atmospheric Modeling for RCP 4.5 and RCP 8.5. The project concluded that for the identified priority species, loss of suitable habitat is expected to be most obvious in the southern half of the Arabian Peninsula region, including the UAE. However, these losses may be offset to some extent by gains in suitable habitat. Moreover, the project suggested that climate change will result in widespread alteration of existing biodiversity composition, including local extinction of species. Thus conservation and management actions should emphasize the preservation of ecological processes, while allowing or facilitating changes in biodiversity states.

Also at the regional level, the UAE is engaged in the development of the Ecosystem Based Management Strategy for ROPME Sea Area. In partnership with UNEP and in consultation with major national, regional and international stakeholders, Regional Organization for the Protection of the Marine Environment (ROPME) is developing a strategy for the Arabian Gulf that focuses on the interlinkage between ecosystem service delivery and human needs, including implementation mechanisms such as capacity development at the national and regional levels in line with best practices world-wide.

## Coastal Zone Management

Coastal zones are directly affected by impacts of climate change, such coastal inundation and erosion due to sea level rise that affect habitats and infrastructure, and destruction of marine and coastal ecosystems due to ocean acidification and temperature increases that provide valuable ecosystem services. The UAE has developed a National Strategy for Marine and Coastal Environment Sustainability, which aims to conserve and ensure sustainability of the marine and coastal ecosystems through integrated coastal zone management, capacity building and public awareness raising, as well as regional and international cooperation. Integrated coastal zone management plays an important role in addressing current and long-term climate change related coastal challenges by establishing ecosystem based approaches and applying adaptive management and spatial planning approaches in order to encourage socio-economic activities that do not compromise environmental integrity. The Strategy is implemented through the National Marine and Coastal Environment Monitoring Programme (2016-2021) by the Ministry of Climate Change and Environment in cooperation with the National Center of Meteorology and Seismology as well as relevant local entities. The program focuses on marine water quality, biodiversity and the dynamics of coastal areas, and provides relevant data for decision-making based on regular monitoring and reporting along with evaluation of the effectiveness of supporting legislation.

Similarly, AGEDI's coastal vulnerability assessment project responded to a need for a quantitative assessment of near-term (10-15 years) coastal zone vulnerability associated with climate change, through the development of a "coastal vulnerability index" (CVI). An ecosystem services-based model called the "Integrated Valuation of Ecosystem Service and Tradeoffs" (InVEST), developed by the Natural Capital Project, was used to identify exposed shoreline and vulnerable coastal communities by assessing each segment (250 m<sup>2</sup>) of the UAE coastline to climate change risks (e.g., increased storms and sea level rise), and ranked their vulnerability from lowest to highest. The study also highlighted the extent to which natural systems (e.g., mangroves, coral reefs and sand dunes) provide climate change adaptation benefits by reducing climate risks to coastal communities and assets, and how changes to those ecosystems affect adaptation benefits. The acquisition of spatial information is particularly critical for adequate planning, especially in view of multiple - sometimes competing - usage of coastal land and ecosystems. The results will assist policy makers in adopting appropriate adaptation measures to protect vulnerable coastal zones and infrastructure.

## Education & Awareness

Raising awareness for all those concerned are critical in adapting to climate change. The UAE's National Strategy for Awareness and Education 2015-2021, based on international standard, guidelines and best practices, serves as the unified roadmap by focusing on six key objectives:

- 1** Educate the youth through the integration of environmental education in schools, universities and vocational institutions;
- 2** Improve the community's involvement and commitment to sustainability and environmental protection;
- 3** Encourage the active involvement of businesses and industries in tackling environmental priorities and moving towards sustainable behaviors and practices;
- 4** Ensure integration of environmental considerations into government policies and complement the Strategy with policy and regulatory instruments;
- 5** Ensure alignment and effectiveness of environmental education and awareness efforts by periodically tracking the progress, effectiveness and efficiency of the Strategy
- 6** Build adequate capabilities in the UAE to enable delivery of the Strategy

The Ministry of Climate Change and Environment conducts an annual national environmental awareness and behavior survey in order to track changes and assess the effectiveness of the Strategy implementation.



# The engagement of the youth

is of particular importance given that approximately 30% of the UAE population is under the age of 24. The Ministry of Climate Change and Environment and the Ministry of Education is therefore jointly working on an initiative called “Our Generation” to develop school curricula that focuses on climate change amongst other environmental priorities. In addition, a nation-wide “Sustainable School Initiative” (SSI) has been launched, following the successful program in the emirate of Abu Dhabi since 2009. SSI is a whole of school initiative, addressing students, teachers, parents, administrators, non-teaching staff and links with the community with expected outcomes to reduce environmental footprint and promote sustainability. The Initiative is comprised of four main components: Green Audit System, a tool designed to help school communities to audit their use of resources such as water and electricity; Teachers’ Capacity Building, which encourage teachers to pursue on-going environmental training; Empowering Students to lead environmental activities in their communities through Eco Clubs established and run by students;

and Hands on Field Experience aimed at fostering better understanding of why students need to care for the environment. Likewise, “Sustainable Campus Initiative” led by Environment Agency – Abu Dhabi engages around a dozen of leading universities from around the UAE in strengthening and building leadership capacities of youth to address environmental sustainability including climate change and take a major role in developing sustainable communities as “Agents for Change”. For example, its Sustainable Campus Audit framework provides a structure to help translate academic learning into practice at the campus level, and the initiative functions as a platform for youth to build networks domestically and internationally, such as through the monthly “Green Youth Majlis” gatherings. The engagement of businesses and industries are another priority area, where the Ministry of Climate Change and Environment has launched “Sustainable A Lifestyle” initiative which supports the industries’ responsibility and active involvement in delivering and achieving environmental awareness across different segments of the society.

# Regional and International Cooperation

The UAE is an active participant in regional and international cooperation on climate change, including on climate adaptation in various platforms, such as the annual Abu Dhabi Sustainability Week and the Conference of Parties to the United Nations Framework Convention on Climate Change (UNFCCC), where best practice and knowledge sharing are encouraged.

The UAE hosted a workshop co-organized with the UNFCCC and the United Nations Environment Programme (UNEP) on the Lima Adaptation Knowledge Initiative (LAKI) for the GCC-region in June 2015. The workshop was co-hosted by AGEDI, the LAKI sub-regional coordination entity for the GCC sub-region. While governments around the world at various levels are taking measures to “adapt” to potential impacts of climate change, gaps in knowledge – be it insufficient rainfall data, accurate mapping of fauna and flora, robust projection of sea level rise, or economic analysis of costs of inaction – are often cited as barriers for successful adaptation actions. The LAKI workshop was aimed at enhancing successful adaptation actions by identifying and prioritizing knowledge gaps and ways to addressing them in the Gulf region, such as fostering governance mechanisms at the national level for evidence-based decision making and effective implementation, as well as strengthening regional cooperation for unified data gathering, monitoring and capacity building. The outcome of the workshop was reported to the 43rd session of the UNFCCC’s Subsidiary Body for Scientific and Technological Advice in December 2015.



# Chapter

# 4

# Mitigate GHG Emission

# Energy Demand

The United Arab Emirates had always realized the concern of the high levels of greenhouse gas emissions and so had initiated continuous initiatives to cut down the GHG emissions. The energy demand management represents one of the most economical ways of cutting down greenhouse gas emissions. In 2017, The United Arab Emirates had launched the first National Energy strategy 2050, setting an ambitious target of 40% reduction in Energy consumption. The target was set to moderate the energy consumption across the three main sectors consuming Energy, which are Building's, Transport and Industry. The strategy ultimately aims to reduce the consumption while maintaining the UAE growth coupled with sustainability and security of supply; which had driven leaders to make efficiency and sustainability a top priority. Additionally, the UAE Government support had been identified by the Government official mandate to commence on the second phase of the national Energy strategy which is " the national Program for Demand Side management" aiming to realize the 40% target across the three sectors. The program has been leveraged by Research, economic feasibility and Innovation, in the sort medium and long run.

The Program shall identify the Policies and regulations to steer demand side management in the Emirate in three sectors Buildings, transport and industry. These efforts include implementing demand abatement and energy efficiency measures, evaluating energy consumption, developing intensity mapping for the United Arab Emirates through consolidation of the existing practices and scaling it up to a national level national Demand side management plan. The National Master plan is expected by the third quarter of the year 2018.

Until recently, there have been focused efforts to achieve the demand side management across UAE. The following are the most recent ones addressing building regulations, building retrofits, standards and labels for appliances and equipment's, outdoor lighting, change of tariff rates, distributed solar power generation, awareness programs and leading examples in industry and transport energy efficiency.

# Buildings Regula- tions



In 2017, UAE Government had officially set an official mandate to commence the National Green building codes project. The National code project is expected to complete by end of 2018. The project aims to consolidate the current building codes and provide a national policy frame work for the United Arab Emirates. Below are some of the current active practices:

## **Abu Dhabi's Estidama Pearl Rating System**

Abu Dhabi Urban Planning Council (UPC) developed the Estidama framework in 2008 to address the sustainable development of the Emirate. The framework was followed by the launch of Abu Dhabi's green building rating system, Estidama Pearl Rating System (PRS). Since September 2010, the PRS has been integrated into the building permit process where all new buildings must meet the 1 Pearl requirements, whilst all government funded buildings must achieve minimum of 2 Pearls.

According to statistics provided by the UPC, as of October 2015, over 1,000 buildings and 12,500 villas have been awarded the PRS Design Rating. However, the PRS doesn't only address the design of buildings; it also awards projects at the construction and operation phases to ensure proper implementation and efficient operation.



## Green Code building at Dubai Municipality

Dubai Municipality commenced the application of green building regulations across new build projects to minimize the negative impacts of climate change and reduce the carbon footprint. Energy and water efficiency measures have also been applied to improve the consumption and to maintain projects and buildings sustainability.

Aligned with Dubai government's strategic plans, Dubai Municipality launched its Green Building Regulations and Specifications (GBR&S) in 2011 to be applied as mandatory requirements for new construction in the Emirate. These regulations have been mandated on government owned buildings since 2011 and on all new buildings in Dubai starting 2014. Based on the GBR&S, Dubai Municipality introduced Al Sa'fat rating system in 2016 to strengthen the sustainable built environment in the city, and support the goal of Dubai's Plan 2021 to create a smart and sustainable city.

## DEWA's Sustainable Building Al Quoz, Dubai

DEWA's Sustainable Building in Al Quoz in Dubai, is the first sustainable government building in the UAE and the largest government building in the world to receive a Platinum Rating for green buildings from Leadership in Energy and Environmental Design (LEED). It achieved 98 out of 110 points as per the rating criteria for the design set by the US Green Building Council. Recycled materials comprise 36% of the construction material used. The building uses 66% less energy thanks to the additional insulation in its walls and roof and special glass to reduce heat transfer into the building, which helps reduce carbon emissions and protect the environment. Highly efficient water-cooled chillers cut down energy use. The building uses low powered LED lights and automatic lighting control systems with occupancy sensors. In addition, renewable energy is available through an on-site 660 kilowatt (kW) solar power plant. Advanced systems used in the Sustainable Building help reduce water consumption by as much as 48%. All sewage water is treated by a grey water treatment and sewage treatment plant.

## Al-Sheraa Building

DEWA's new headquarters, named Al-Sheraa (Arabic for sail) will be the tallest, largest, and smartest net Zero Energy Building in the world. The total built-up area will be over 2 million square feet, over 200,000 square feet of land. It is being built in the heart of the Cultural Village in Al Jadaf. The building will have over 16,500 square metres of photovoltaic solar panels to produce over 3,500 kilowatts. There will be more than 2,000 square metres of Building Integrated Photovoltaics (BIPV). Total renewable energy generated by the building will be over 5,800 megawatt hours (MW/h) annually.





### **Green Building:**

The planning, design, construction and operations of a green building strategy comprises several considerations that focus on the aspects of sustainability, such as energy usage, water usage, indoor environment quality, material selection and the building's effects on the environment.

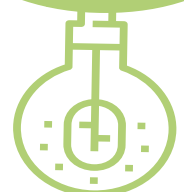
The UAE Vice President, Prime Minister and Ruler of Dubai His Highness Sheikh Mohammed bin Rashid Al Maktoum in line with the Dubai Strategic Plan 2015, decided upon implementing green building specifications on all buildings in Dubai as per the highest environment-friendly international standards. These standards have been modified to adapt to local conditions to keep the UAE a green and sustainable Nation.

In Dubai, the standards have been created to support Dubai's Strategic Plan to create a modern green city as well as leverage Dubai's infrastructure to meet the requirements of future green developments.

This year, Dubai Municipality will ensure that every building in the Emirates of Dubai has to follow the new and approved specification for systems thermal insulation. These systems are designed to reduce energy consumption in refrigerated buildings. The building owners will be asked to abide by the minimum caloric requirements designed to reduce power loads which require minimum heat transfer. These requirements take into consideration specifications for ceilings, wallpapers, windows and glass.

Among such proud green projects is Al Khazzan Park. This newly renovated park is now entirely powered by solar energy systems and uses artistic elements that echo Dubai's approach to preserving nature. By converting to LED lighting, the park has reduced its annual energy consumption by 50% and the implementation of an off-grid solar PV system has resulted in annual savings of 43,100 kilograms of carbon dioxide, the equivalent of 1,100 trees.

At the same time, Al Fahidi Souk in Bur Dubai has achieved full compliance with Green Building Regulations in preparation for its grand opening. Its energy saving systems, natural lighting arrangements, eco-friendly building materials and insulation methods make it an exemplary green development. Techniques such as solar water-heating system and skylights, which allow natural daylight to penetrate the structure and light colors on the structure's exterior decrease heat absorption, thereby reducing cooling demands. These are projected to result in 45% energy savings and 20% water savings compared to conventional systems.



Dubai Municipality implemented a series of sustainable projects which were recognized regionally and internationally. In 2011, Dubai Municipality applied the off-grid PV systems in various projects (Al Fahaidi Market, Al Manara Center & Quran Park Green Building) as a part of Green Building Regulations.

The Al Fahaidi Market was the first sustainable market in Dubai that achieved compliance with Dubai Green Building Regulations. Also, in 2015, Dubai Municipality implemented the first zero energy park in the UAE and the Middle East.

Recognition has also been an efficient channel to recognize excellence in Energy Demand reduction projects. The following awards has been granted to DM for their efforts in applying sustainability measures in Dubai's projects:

Green Apple Silver Award  
2015 (Al Fahaidi Market)

Middle East Electricity Award  
2016 (Lighting Project of The Year)

Green Word Silver Award 2015 (Al  
Khazzan Park)

Numerous systems, technologies and applications have been applied in the constructed sustainable projects such as:

- Solar power systems (on grid and off grid systems)
- Solar lighting systems (standalone and central lighting systems)
- Solar thermal systems (solar water heaters)
- LED lighting solutions (indoor and outdoor lighting)
- Induction lighting solutions (outdoor and sport areas lighting)
- High efficient HVAC system (inverter type air-conditioning and others)
- Demand controlled ventilation
- Exhaust air energy recovery systems
- High efficient pumps with VFD control
- Closed parking ventilation and CO sensors
- Smart building management systems
- Electronic water taps (high efficient fittings, tap aerators and others)
- Toilets dual flushes
- Gray water systems (condensate water recovery from air-conditioning, treated irrigation water and others)
- Electrical cars chargers and designated parking spots.
- Waste management systems.

Due to the energy efficiency measures and applied technologies, especially PV systems, Dubai Municipality is saving an estimated 4,590 MWH annually, which is equivalent to 2 Ton of CO<sub>2</sub>, or the equivalent of approximately 51,000 trees.

## Building Retrofits

Retrofitting buildings across the UAE has become a key drive to energy efficiency initiatives across the Emirates, project owners will begin to lead retrofitting initiatives in commercial and residential buildings. Planners, designers and technology experts will share innovation in efficient cooling systems, lighting and water management. In 2017, UAE Government had officially set an official mandate to commence the Government buildings retrofit Program, including about 5000 Buildings. This mandate resonates with the national Demand Side management program and consolidates the existing retrofits programs across UAE including commercial and residential buildings through targeting the main consumption drivers (cooling, lighting, industrial processes and buildings' envelope).



## Institutionalization of Emirates Green Building Council in Dubai

As per Dubai's Integrated Energy Strategy (DIES 2030) launched in 2011, Dubai aims to decrease 30% of the energy and water use in the emirate by 2030. Noticing the building sector's contribution to the total consumption, the Dubai government addresses the inefficient operation of existing buildings and aims to retrofit 25% of the building stock by 2030. To achieve this, Etihad ESCO was established to boost the performance contracting market and provide financial schemes for energy-efficient projects and building retrofits. Etihad ESCO aims to generate 1.7 TWh energy savings, 5.6 BIG water savings, and 1 M tons CO2 emissions' reduction by 2030. The Emirates GBC EEP also supports Dubai's retrofitting initiative by strengthening the capacity of the industry and creating links between government bodies, the construction industry, and financial facilities. In 2016, Dubai announced the completion of JAFZA retrofit project, which was the largest guaranteed energy savings project in the Middle East by then, with an investment value of AED 64 million; replacing ACs, lights and water fixtures. Over 6 years, guaranteed savings will reach 158 GWh (28% savings) of Electricity, 1.2 billion IG (36% savings) of Water equivalent to AED 132m (31% savings). In March 2017, the Tarsheed Programme under the Abu Dhabi Water & Electricity Authority (ADWEA) and the Abu Dhabi Distribution Company (ADDC), was launched successfully. The registration of Energy Services Company's (ESCOs) has seen the announcement of a few approved ESCOs showing that market is set to grow steadily. Tarsheed programme will also form a work plan for replacing all electric devices, such as ACs, ventilation systems, lighting systems, elevators, and water pumps with energy efficient ones that comply with the standards and specifications put by the competent authorities like Emirates Authority For Standardization and Metrology (ESMA), Estidama program of Abu Dhabi UPC, Abu Dhabi Quality and Conformity Council (QCC) as well as the Department of Municipal Affairs and Transport.



# The Dubai Clean Energy Strategy 2050

The Dubai Clean Energy Strategy 2050 was launched by HH Sheikh Mohammed bin Rashid Al Maktoum, to provide 7% of Dubai's total power output from clean energy by 2020. This target will increase to 25% by 2030 and 75% by 2050. The strategy consists of five main pillars: infrastructure, legislation, funding, building capacities and skills, and having an environmentally friendly energy mix.

The Mohammed bin Rashid Al Maktoum Solar Park In January 2012, HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, launched the Mohammed bin Rashid Al Maktoum Solar Park. It is the largest single-site solar park in the world. It will generate 1,000MW by 2020 and 5,000MW by 2030, with total investments worth up to AED 50 billion. Upon completion, the solar park will reduce over 6.5 million tonnes of carbon dioxide emissions annually. DEWA has adopted the Independent Power Producer (IPP) model for the solar park's projects. At the time of the bids, DEWA achieved world records in electricity prices, contributing to the decline of its global cost. Renewable energy is growing cheaper to produce, with bid prices for solar and wind power projects in Europe and the Middle East dropping to levels comparable with coal-fired thermal power, according to a Japanese study published by the Nikkei Asian Review.

## First Phase

The 13MW first phase became operational on 22 October 2013, and the project contributed to a major reduction of carbon emissions in adherence with the Clean Development Mechanism. The first phase contributes to an annual reduction of about 15,000 tonnes of carbon emissions. The surface area of the project covers 280,000 square metres.

## Second Phase

On 20 March 2017, HH Sheikh Mohammed bin Rashid Al Maktoum inaugurated the 200MW second phase of the solar park. It is the largest and first project of its kind in the region's solar energy sector, based on the Independent Power Producer (IPP) model. The project provides clean energy to 50,000 residences in the Emirate, reducing 214,000 tonnes of carbon emissions annually. This phase installed 2.3 million photovoltaic solar panels over an area of 4.5 square kilometres.

## Third Phase

In June 2016, DEWA announced that the consortium led by Masdar was selected to build the 800MW third phase of the solar park. DEWA recorded a world record of USD 2.99 cents per kW/h for the IPP bid. The 200MW first stage of the third phase became operational on 1 May 2018. The second and third stages will become operational in 2019 and 2020 respectively.

## Fourth Phase

On 19 March 2018, HH Sheikh Mohammed bin Rashid Al Maktoum broke ground for the largest investment Concentrated Solar Power (CSP) project in the world. The AED14.2 billion project will produce 700MW with a lowest Levelised Cost of Electricity (LCOE) of USD 7.3 cents per kW/h. The project will feature the world's tallest solar tower, at 260 metres and will be commissioned in stages, starting from Q4 of 2020.

# Standards and labels for appliances and equipment

## Energy Efficiency Standardization at ESMA

The Emirates Authority for Standardization and Metrology (ESMA) has initiated the Energy Efficiency Standardization and Labeling (EESL) Program in 2012. The EESL program aims at enhancing the performance of Electric Appliances using multiple methods deemed effective in raising the performance of those appliances. The Program includes (3) key stages of when defined for any appliance, those are:



Banning Low performing products (obsolete) by setting a minimum efficiency target.



Setting Performance Rating for eligible products (those who passed stage 1) by comparing input and output performance measurement of the appliance. The result of this stage is defining which performance category they fall under from a range of (1 to 5) star rating.



Provision of financial Incentive for higher performing appliances in term of fee reduction alongside by a display of information using EESL unique National Label.

EESL program classifies the significant introduction of the scheme by prioritizing products/appliances according their energy consumption, magnitude of products in the market and product efficiency potential. As a result, the program is covering the following product categories:

- 1- 2014 – Non-ducted Room Air-conditioners
- 2- 2013 – Clothes washing machines and dryers
- 3- 2014 – Household refrigerators and freezers
- 4- 2016 – Dishwashers

In 2017, new programs were implemented. These are:

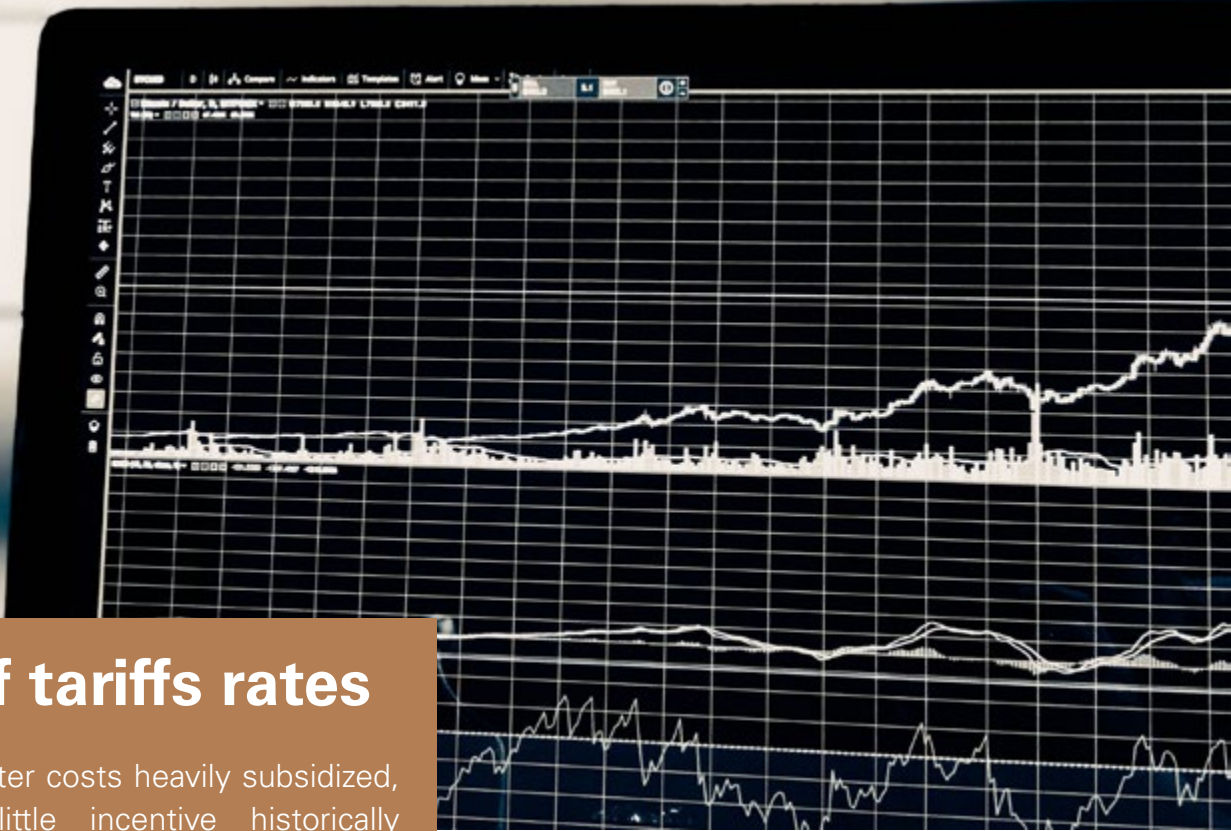
- 1- 2017 – Television sets/panels.
- 2- 2017 – electric ovens.
- 3- 2017 – elevators.
- 4- 2017 – Vacuum cleaner

# Outdoor Lights

Major projects had been Completed of successfully as pilot projects in the fields of outdoor lighting (e.g., residential LED implementations in Al Barsha South 1&2, delivering over 50% energy savings) and water reuse (with implementation of switchoff measures and new quantity standards for public irrigation), paving the way for larger scale implementation in the coming years. Since 2012, about 10,000 LED lights have been installed across Dubai parks as 4000 through new projects and 6000 through retrofit of conventional lights. Additionally, operating hours have been about 8 hours per night with switch off after 10pm.

The Abu Dhabi City Municipality (ADM) will begin on the Abu Dhabi Lighting project in the first quarter of next year 2018. Starting Q1 2018, the agency will replace existing conventional lights with LED units across the emirate. Project completion is expected within an 18-month period, and its operational duration is 10 years. The project will be rolled out as public-private partnership (PPP) development. The partners would be involved with the supply, installation, operation, maintenance, and financing aspects of the project, which includes up to 43,000 units. Similar services would also be provided by the partners for a smart central control system related to the lighting units, which will be delivered to ADM following the completion of the installation and operation period. The project is expected to boost energy efficiency in the Abudhabi contributing to the national energy consumption reduction targets. Participation in the tender has a prerequisite of compliance to the Abudhabi Quality and Conformity Council (QCC) certificate for street lighting.





## Change of tariffs rates

With energy and water costs heavily subsidized, there has been little incentive historically for households or businesses to limit their consumption. However, it has also been proved that price signals are a very important tool to induce energy efficient behaviors and promote their collaboration with utilities on load optimization and ultimately lead to lower consumption of fossil fuels.

For this reason, utilities across UAE began to introduce price changes as a Demand side management strategy in an attempt to curve demand trends. Another factor affecting system cost is the load profile, since the peak consumption defines generation capacity requirements, smoothing down the load profile has been another DSM strategy like increase share of solar generation supporting day – time peak, while outdoor lighting program and ESMA standards reduce the evening- time peak.

Tariff reviews have been accompanied by prolonged communication efforts so that the changes are sustained overtime. Utilities invest significant resources in awareness measures across a variety of channels. In 2017, UAE government had launched the National Campaign awareness as part of the National Demand Side management Program with specific performance measures.



# Distributed Solar Power

## DEWA's rooftop solar energy initiative

In 2014, DEWA launched Shams Dubai, which allows customers to install solar PV panels on their rooftops to generate electricity from solar power. The generated electricity is used on-site and the surplus is exported to DEWA's grid. An offset between exported and imported electricity units is conducted and the customer account is settled based on this offset.

The initiative implements Executive Council resolution number 46 of 2014, issued by HH Sheikh Hamdan bin Mohammed bin Rashid Al Maktoum, Crown Prince of Dubai and Chairman of the Dubai Executive Council, to regulate electricity produced from PV panels to the power distribution system in Dubai. By end of August 2018, DEWA connected over 1,145 buildings to Dubai's power grid with a capacity of nearly 50MW.

## Dubai Electricity Water Authority CDMs and i-RECs:

DEWA is fully committed to achieving overall sustainable development, having registered several of its projects as Clean Development Mechanisms (CDMs) projects under the United Nations Framework Convention on Climate Change for Climate Change (UNFCCC). Registration of these projects signifies the use of innovative renewable energy and energy efficiency solutions, and allows DEWA to monetise Certified Emission Reduction (CER) credits, also known as carbon credits, as an additional form of revenue over the next years.

The CDM Executive Board of the United Nations Framework Convention on Climate Change has awarded DEWA with 10,635 and 95,197 carbon credits for the first phase of the Mohammed bin Rashid Al Maktoum Solar Park and Thermal Energy Storage Turbine Inlet Air Cooling (TESTIAC) project, respectively.

Under the Clean Development Mechanisms Framework, DEWA also initiated the UAE Small Scale Solar Programme of Activities (PoA) to facilitate financing of projects and environmental programmes through certifying emission reductions by owners and developers of solar projects in the UAE. The PoA will also officially support Shams Dubai, which is one of the eight programmes to drive sustainability that is part of the Demand Side Management Strategy launched by the Dubai Supreme Council of Energy.

In 2017, DEWA became the first entity in the MENA region to acquire International Renewable Energy Credits, or i-RECs. The i-REC is a voluntary system for international trade in renewable-energy certificates. The system was created to encourage utilities around the world to increase the amount of renewable or clean energy in their supply mix relative to fossil fuels. This move supports DEWA's commitment to the environment and its adherence to increase the share of clean energy in the energy mix. It also underlines DEWA's efforts to encourage the use of clean energy and promote environmental sustainability and a green economy. DEWA has acquired i-RECs equivalent to 25,000 megawatt hours of annual net electricity supplied to the grid from the 13MW Mohammed bin Rashid Al Maktoum Solar Park power plant for the year 2017.



# Awareness Program

The launch of a common efforts in the field of DSM awareness, marked by the activation of an Integrated Outreach and Awareness Committee (IOAC) comprising nominated champions from DSM Program Owner entities. The newly established committee is expected to assess awareness priorities and lead participating entities to define more synergistic outreach plans in support to the DSM Programs.

## Some leading examples

### ADNOC plans to improve energy efficiency by 10% by 2020

The energy efficiency strategy will reduce ADNOC's gas consumption by 156 million cu. ft a day, thus saving a total of US\$1 billion by that time. The initiatives to enhance energy efficiency have already cut CO2 emissions by 3.1 million tonnes, the equivalent of 658,800 car rides a year, compared to 2014. ADNOC will optimise energy usage, consumption and performance across a range of industry-related activities, and upgrade systems to measure and record data for better energy planning.

### Al Dhaffa Energy Efficiency Project

ADNATCO & NGSCO, an ADNOC Group Company that transports ADNOC's products worldwide, initiated a three-phase energy efficiency program across their shipping fleet with the aim of identifying gaps, setting a baseline and implementing recommendations and industry best practices.

PHASE 1	PHASE 2
Fuel consumption saving of 3,788 metric tons (equivalent to US\$ 2.5m) CO2 emission reduction of 11,797 metric tons	Fuel consumption saving of 7,306 metric tons (equivalent to US\$ 4.6m) CO2 emission reduction of 21,915 metric tons

### Replacing on-site power generation with imports from the grid

In 2009, ADCO initiated a phasing-out project whereby onsite power generation was gradually replaced by imported electricity from Abu Dhabi Water and Electricity Authority (ADWEA). The electricity generated by ADWEA was produced at a higher energy efficiency of 40% compared to the on-site generation capability. The implementation of this initiative across ADCO's assets resulted in indirect energy saving of 2,916,958 GJ.

### DEWA's Conservation Programmes

DEWA's conservation programmes and initiatives achieved significant savings in electricity and water across all sectors. Between 2009 and 2017, customers saved over 1.677 TW/h of electricity and 6.66 billion gallons of water, worth over AED 1.038 billion. The savings resulted in offsetting around 900,000 tonnes of carbon emissions. DEWA's programmes and initiatives managed to reduce electricity use by 19% and water by 27% in the residential sector.

The commercial sector reduced electricity use by 9% and water by 29%. The industrial sector reduced electricity use by 14% and water by 28%. Educational institutions succeeded in reducing electricity use by 10% and water by 24%. Government and semi-governmental organisations reduced electricity use by 12% and water by 21%. Accumulated savings from electricity and water consumption, equate to over one million trees, more than 104 million LED light bulbs, and over 12,000 Olympic-sized swimming pools.

### Strategies adopted to reduce waste to landfill

The objective to reduce waste has transformed Dubai Municipality's waste management strategy and practice, evolving from a simple street cleaning operation to a modern, sophisticated, integrated and sustainable waste management system. Through an integrated approach and putting emphasis on sustainability, Dubai Municipality continues to meet and exceed the demands of the society for a high quality, efficient and effective waste management services.

### Big Belly Waste Containers

Big belly is a waste container (bin) that uses solar power for 100% of its energy needs. It can hold six to eight times more waste than the average street bin, because of its compaction capability. The volume sensors installed in the bin triggers compaction when the waste reaches a certain level. Each of the big belly stations geotagged in CLEAN (Management Software). Fill levels, the route it is located for the expected next collection program, alerts or notification, and more can be monitored. With the significant increase in collection efficiency, fuel consumption, manpower and equipment utilization are minimized.

### Vehicle Tracking System (Rasid)

Rasid is a GPS-based technology that provides real time management and tracking system for fleet. The system is also integrated with efficiency and security applications to enhance the productivity of the vehicle and manpower. The system will be characterized by its flexibility and strength, stability and continuous uninterrupted performance. Incorporated in the design are wide range of functionalities such as vehicle maintenance, vehicle tracking and diagnostics, driver management, speed management, fuel management and health and safety management. The Waste Management Department in Dubai municipality has the system installed and operational in its fleet.

### My City My Environment

Dubai Municipality is keen on applying international best practices to provide top class services to its residents and in turn pro-actively promote individual environmental responsibility and sustainability. Door-to-door waste collection is an "at source" waste segregation program aimed to increase the collection rate of recyclables at the residential sector while at the same time providing also disposal option for unrecyclable waste. The system provides (2) bins, one for recyclables and the other one for general waste. Various areas in the Emirate will be covered by the initiative.

## Underground Waste Compactors

Underground waste collection system is an innovative solution to address the waste disposal needs in busy and heavily populated public areas.

With only a large bin underground, the system eliminates the space that is supposed to be occupied by communal bins. Having a compacting mechanism, the system has more storage capacity which in turn reduces collection frequency to empty the container. The system also eliminates odors, protects the machinery from vandalism, and provides a better aesthetic look in the area. The underground waste compactors were installed in various strategic locations all around Dubai.

## Sustainability Bins – Dubai Municipality

The best way to start recycling is to segregate the waste at the source. This keeps the materials clean and free from contamination ensuring high quality materials for recovery. Dubai Municipality has initiated a program to install recycling containers at various locations. The bins provides individuals an opportunity to care for the environment by depositing recyclable items such as Paper, Plastics, Aluminum/Steel cans and Glass bottles.

## ADNOC Natural Gas for Vehicles

ADNOC distribution commenced their mission in 2010 to introduce a new fuel, Natural Gas for Vehicles (NGV), into the local market.

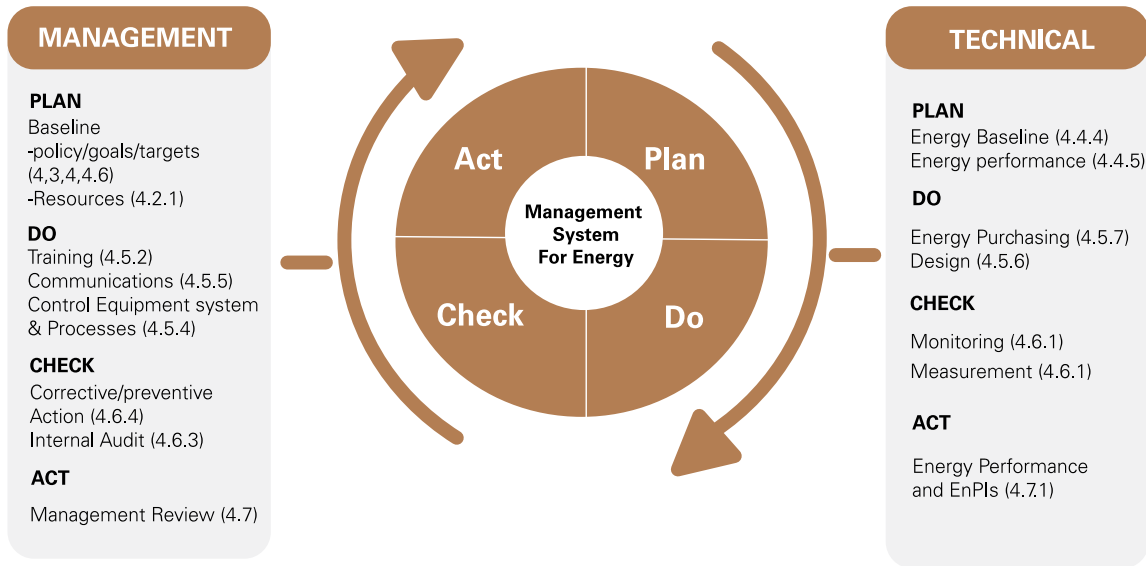
NGV is widely considered to be an inherently safe fuel, due to its narrower flammability range, and one which delivers significant reductions in emissions when compared to petrol-fueled vehicle.

Emission	Emission Reduction %
Carbon Dioxide	20-30 %
Carbon monoxide	50-800 %
Nitrogen oxides	25-60 %
Non-methane hydrocarbon	50-75 %

## ADNOC Group-wide ISO 50001 Energy Management System

In 2015, ADNOC made significant progress towards realizing its energy efficiency goals by obtaining the group-wide ISO 50001 certification in energy management. The energy management system (EnMS) ensures that energy efficiency is built into the core of ADNOC's business and operations, from resource-efficient production, all the way to the transportation and use of products. It will also help ADNOC make a significant contribution towards resource and climate protection.

## ISO/DIS 50001 ENERGY MANAGEMENT SYSTEMS



## Transport Sector

In fuel efficiency, ESMA promoted a series of initiatives. In February 2016, the authority established regulations mandating provisions for fuel efficiency ratings for motor vehicles effective from 2017 models onwards. Following this initiative was the implementation of the fuel efficiency and wet grip ratings for tires manufactured and/or sold in the country, also implemented in the beginning of 2017. In addition to this, the authority has laid down a new draft for the standard relating to vehicle fuel economy. In addition, on July 2016, ESMA set the minimum specifications for electric vehicles, defining requirements particularly, in relation to the adaptability of these vehicles to local weather conditions. The authority has also partnered with Mercedes-Benz and the Road Transportation Authority (RTA) of the UAE in November 2016, to oversee the first-ever automated drive from Dubai to Abu Dhabi. The following month, the authority has successfully hosted the 2nd Future Mobility Conference which was held in Dubai, UAE.

## Road and Transportation Authority - Dubai

The Road and Transportation Authority of Dubai (RTA) has undertaken and accomplished several large projects and developed a high-quality mass transit system, comprising the automated driverless metro system (two lines totaling about 75 km and 47 air-conditioned stations includes two transfer stations between lines), the tram (11 km track length, all with catenary free power supply, and 11 air-conditioned stations), a fleet of over 1,500 buses, and close to 10,000 taxis. All these projects have contributed to the development of the Emirate. In terms of numbers, the following table will give you a glimpse of the achievements.

# Projects

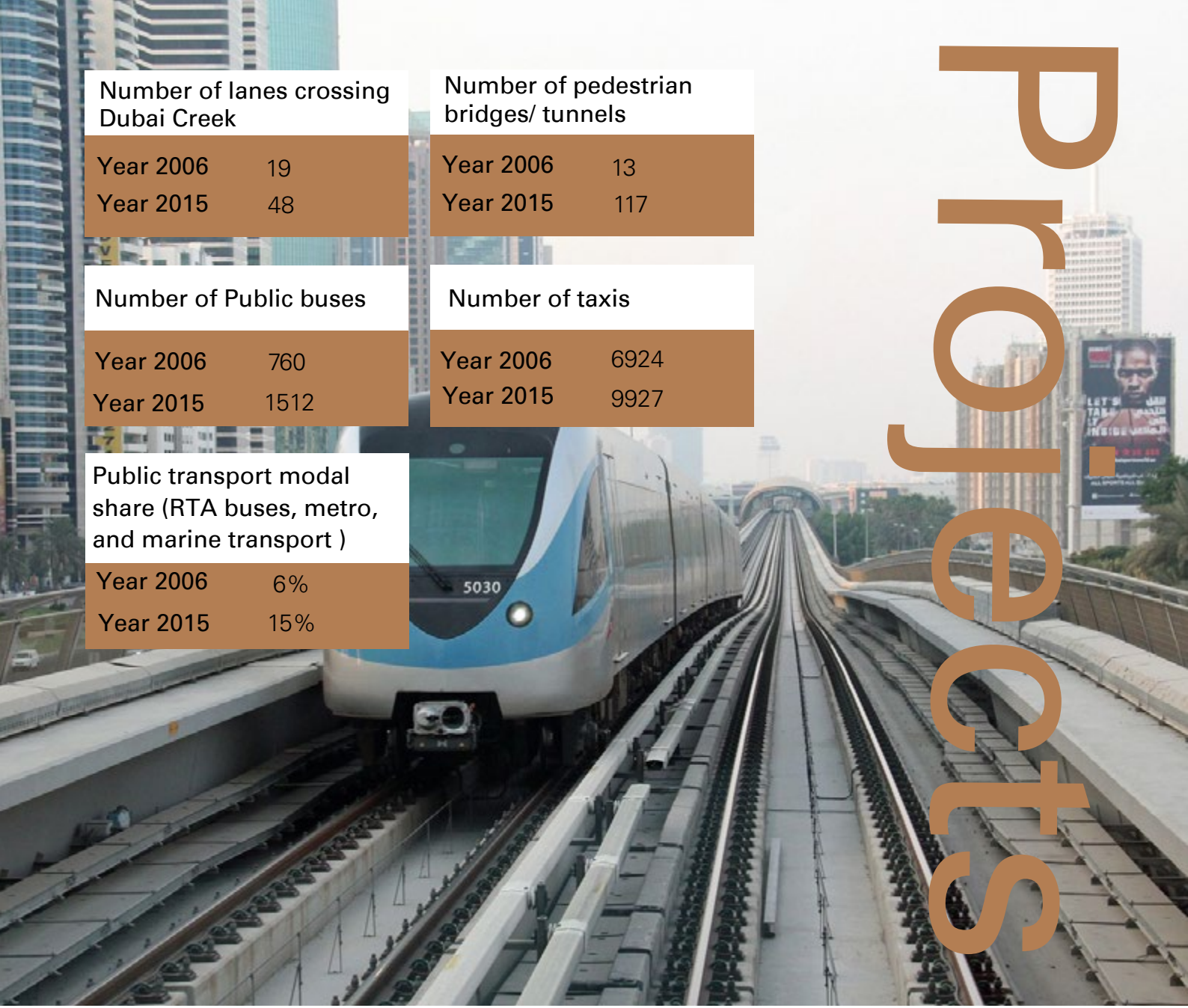
Number of lanes crossing Dubai Creek	
Year 2006	19
Year 2015	48

Number of pedestrian bridges/ tunnels	
Year 2006	13
Year 2015	117

Number of Public buses	
Year 2006	760
Year 2015	1512

Number of taxis	
Year 2006	6924
Year 2015	9927

Public transport modal share (RTA buses, metro, and marine transport )	
Year 2006	6%
Year 2015	15%



## RTA's contribution towards UAE's vision of sustainability

RTA has rolled out several innovative projects & initiatives aimed at conserving the environment such as the clean energy and green buildings. RTA boasts of several pioneering projects such as the Dubai Metro, Dubai Tram projects, and Electric Abras initiative, all projects are powered by electric power and at the same time contribute to reducing the use of private vehicles. Thus, they contribute to reducing carbon emission in Dubai city. The RTA has managed to support ranking Dubai amongst the leading modern metropolises in the fields of mass transport and associated infrastructure. The Dubai Metro, which was inaugurated in September 2009, has changed the way both residents and tourists move around the city. The Dubai Metro reduces CO2 emissions by over 837 tons per day (as per 2015 calculations) by the reduction of vehicles from road and the resulting reduced congestion. The Dubai Tram, launched in November 2014, has innovated mass transportation in many areas. It is the first turnkey tramway or light rail system in the Middle East. Its ground-based power supply system employs leading-edge technology which energizes the current rail beneath the tram as it passes. This is considered safer than conventional overhead catenary-type systems, and again shifting the public from using private vehicles to public transportation and hence reducing CO2 emissions. Electric Abras initiative, this initiative target to use electric motors instead of the traditional diesel motors, and the project was broadened to include 17 Abras.

RTA has recently announced its plan to convert 50% of Dubai Taxi fleet to hybrid cabs by 2021 following a successful trial operation of hybrid taxis conducted by Dubai Taxi Corporation since 2008. This fleet is estimated to reduce carbon emissions by 33% compared with non-hybrid taxis and slashing fuel consumption by 33%.

In addition, measures have been taken to curb air pollutants such as sulfur and nitrogen oxides, hydrocarbons and carbon monoxide resulting from operation of public buses and using low sulfur diesel (10 ppm), whereas the fuel used in the local markets has sulfur content ten times of the fuel used in RTA public buses; which in turn is released in a form of environment-polluting emissions. Recently, RTA started a trial for an Electric Bus powered by battery system and a trial for a CNG operated Buses. RTA's smart apps are creative and user-friendly, as proven by over 4 million downloads, RTA, which is also in charge of road vehicle and driver licensing, provides premium services to its customers. 173 administrative and information services are available via 9 specialized smart apps. These apps contributed to the achievement of environmental sustainability, conservation of energy sources for future generations and realization of the strategic goals of the Dubai Government.

RTA estimated the savings due to using the smart applications by customers without the need to attend in person to the RTA customer care centers in 2015 as follows; 3 million paper sheets, 370 trees, 29 million km driving distance, 4 million liters of fuel, and 8 million kg of CO<sub>2</sub> emission. These figures are expected to increase yearly as more smart applications are being introduced by RTA. RTA embarked on replacing gradually the existing traffic lights in Dubai by halogen bulbs using LED power-saving technology enabling the saving of about one million kilowatt per annum, and reducing carbon dioxide emissions by 430 tons per annum following the full completion of the project expected 2018. RTA also started a Pilot Project for LED street lights at Al Barsha South, the expected power saving will be about 380,000 kilowatt-hours per annum, reducing carbon dioxide emissions by 163 tons per annum.

RTA's endeavours for Energy & Green Economy derives from the National & Local Government Strategies such as, the UAE's Vision 2021, Dubai Plan 2021, UAE Green Growth Strategy, Dubai Carbon Abatement Strategy 2021, the Dubai Integrated Energy Strategy 2030, the Dubai Clean Energy Strategy 2050, and the other related Strategies and Plans.

# Chapter

# 5

# Other Information

In terms of applying technology and policy solutions today across the country, the UAE is investing in innovation for the climate and energy solutions of the future. This comes with the continued progress in the UAE to strengthen the work on climate change via capacity building and society awareness for individual, institutional and commercial aspects.

An integrated assessment is done at all levels to offer basis for more comprehensive accounting of the broader scope of benefits. Current measures can help to support policymaker continued investments, while also promoting public awareness of the benefits of sustainable development practices.

## Technology transfer:

The UAE is seeking to play an active role in developing new technologies for meeting future energy solutions. These efforts are made to promote sustainable energy development by stimulating economic growth, nurturing social development, and promoting environmental protection.

### 1 Carbon Capture, Usage and Storage (CCUS):

ADNOC's established a joint venture company with Abu Dhabi Future Energy Company (Masdar) named 'Al Reyadah', which means 'leadership' in Arabic, to undertake a network of carbon capture, usage and storage (CCUS) projects in the Emirate of Abu Dhabi.

The first of these projects is currently underway, and aims to capture 800,000 tons of CO<sub>2</sub> annually upon its completion in 2016.

The captured CO<sub>2</sub> will be compressed and transported to oil fields operated by ADCO, one of ADNOC's Group Companies, where it will be used to enhance oil recovery and ultimately be stored underground.

**ADNOC CCUS Project - Quick Facts**

The ESI CCUS is the Middle East's first commercial scale CCUS facility and the only CCS project outside of North America

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Completion is set for Q2 of 2016

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Project is the first time injected CO<sub>2</sub> will be used for EOR in the region

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Project will sequester 800,000 tonnes of CO<sub>2</sub> annually and liberate natural gas for power generation

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Project will include a compression facility and a 45 km pipeline

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Construction contract for the facility is worth AED 450 million





## 2 Sustainable Zero Flaring through Spiking Gas Compressor at ADCO Shah Field:

Gas flaring from the oil industry represents 1.5% of global greenhouse gas (GHG) emissions. In an effort to improve environmental performance, ADCO commissioned spiking gas compressors at the Shah Field, located 230 km South of Abu Dhabi.

The project resulted in the recovery of 5.1 million standard cubic feet per day (MMSCFD) of flared gas (the equivalent of approximately 2.5 million household gas cylinders), which corresponds to a reduction of 110,000 metric tons of CO<sub>2</sub> per year as well as a significant improvement in ambient air quality. The project is registered with the UNFCCC Clean Development Mechanism (CDM) project database.

## 3 Abu Dhabi Water and Electricity Authority:

In compliance with ADWEA commitment to limit carbon emissions, an initiative in 2012 measured the intensity of CO<sub>2</sub> emissions associated with water and electricity production. The initiative has enabled better insight into operation efficiency through measuring the gas emissions per each unit, (kg CO<sub>2</sub>/MIG) for water and (Kg CO<sub>2</sub>/ kwh) Electricity.

ADWEC uses significant efforts to ensure the highest performance of energy efficiency, minimal fuel waste, while continuing to explore cutting-edge technology for to enhance performance.

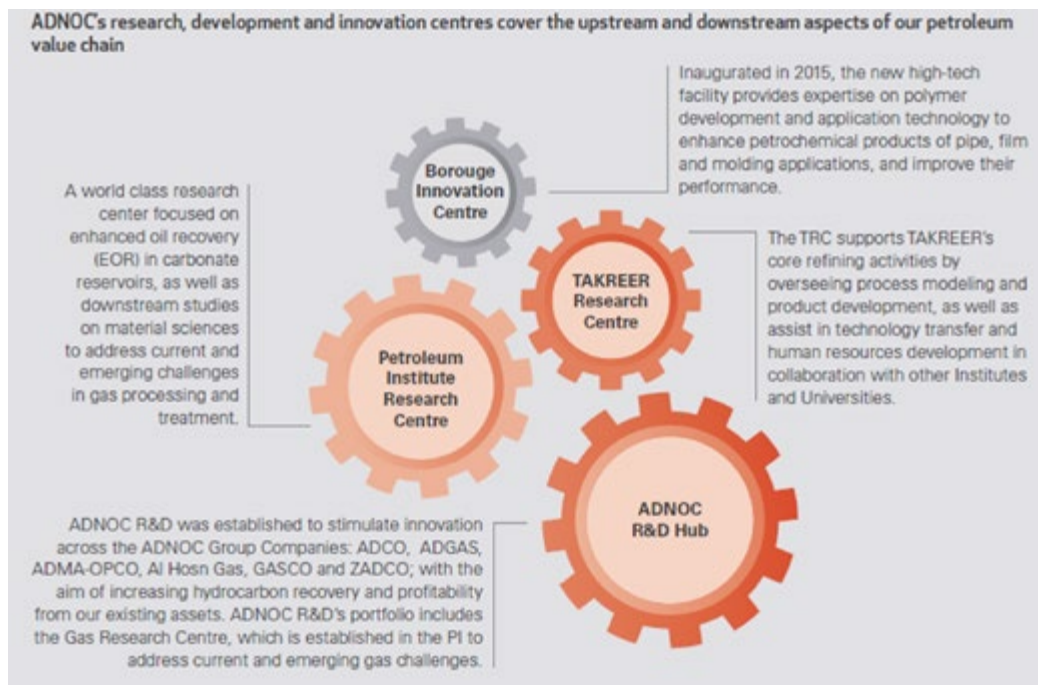
The entity is working in a sophisticated forecasting program, i.e. fuel demand estimator that enables the company to estimate the future needs for fuel, based on expected demand. This translates into key initiatives, such as, if an independent producer of water and electricity consumed fuel more than the expected amount, the producing company will be fined; and, if a producing company consumed less fuel, it will be rewarded financially.

## Studies and researches:

Investing resources to enhance research is one of the most promising approaches for managing for climate change impacts in various areas.

Many entities in the UAE are working on research and development sector to contribute in transforming the UAE into a future hub of knowledge, research, investment, and examples of clean energy production and consumption.

**ADNOC's research, development and innovation centers covers the upstream and downstream aspects of petroleum value chain:**



### DEWA efforts in researches:

In 2015, DEWA allocated AED 15.7 million to be spent on research and development with the aim to further improve the reliability of electricity and water supply. In 2016, the authority started the construction of its own R&D Center, which seeks to provide research infrastructure and build capabilities to support our strategic projects.

The Center focuses on four research areas (renewable energy generation, smart grid, energy efficiency, and water). During 2015, the outdoor testing facility was also commissioned. It includes both monitoring and instrumentation rooms for the evaluation of 31 different photovoltaic technologies under the operating conditions in the Mohammed bin Rashid al Maktoum Solar Park. Other projects initiated include novel approaches for load analysis and forecasting, electric vehicle chargers, and drone development. A full research lab for drones is currently being planned to accommodate both indoor and outdoor testing, 3D prototyping and drone intelligence development for purposes such as the monitoring of our assets and protection of our infrastructure.

### The Emirates Centre for Strategic Studies and Research efforts:

Since its inception in 1994, the Emirates Center for Strategic Studies and Research (ECSSR) has attached great importance to the issues of climate change because they are closely associated with energy, water, food, health, environment, sustainable development, and other issues that lie at the core of the UAE's national security. This interest is reflected in the ECSSR's publications, studies, conferences, symposia, and lectures. Over the past years, the ECSSR has published several books and research papers on the issues of energy, climate change, and environment, and organized numerous conferences and symposia on this topic. Additionally, the ECSSR has established a new administration within its administrative structure devoted to the issues of water, food, and health with the aim of offering new modern visions on how to deal with these issues in the light of the various changes. The most important of these are climate and technological changes, in addition to the geo-strategic considerations and factors and their implications on the food, water, and environmental security of the UAE, in particular, and the world, in general.

## Technical Guidelines for Retrofitting Existing Buildings in the UAE

To support the retrofitting market in the UAE, in 2015 EmiratesGBC compiled a set of technical instructions to develop guidelines for retrofitting existing buildings in the UAE. These guidelines formed the content of the EmiratesGBC Technical Guidelines for Existing Buildings and provide the UAE industry professionals, building owners, operators, and end-users with economically viable and environment friendly methods to retrofit buildings. All over, the Technical Guidelines features 31 key retrofit methods with concerted focus on energy, water management, air quality, materials, wastes, innovation and management.

## State of Play of Sustainable Buildings and Cities in the UAE

In support of the comprehensive UNEP-driven study on the "State of Play of Sustainable Buildings and Cities in MENA," EmiratesGBC compiled research in 2015-2016 to demonstrate the state of green buildings and cities in the UAE. The study is the result of cooperation between the Centre for Environment and Development for the Arab Region and Europe (CEDARE) and the United Nations Environment program (UNEP) to support the Global Initiative for Resource Efficient Cities (GI-REC) that was launched by UNEP in 2012 which provides a regional review and baseline for policy makers in the region.

## Abu Dhabi and Dubai Green Building City Market Briefs

EmiratesGBC prepares annually the Green Building City Market Briefs for Abu Dhabi and Dubai in partnership with the U.S. Green Building Council (USGBC), C40 Cities Climate Leadership Group and the World Green Building Council (WorldGBC). These briefs highlight the green building policies in Abu Dhabi and Dubai with emphasis on the planned and implemented initiatives that promote sustainable development.

## Nearly Zero Energy Buildings in the UAE

EmiratesGBC is currently developing a technical paper on the concept of Nearly Zero Energy Buildings (nZEB) in the UAE. The paper aims to find an accurate definition of nZEBs and to identify an action plan on how best to achieve nZEBs. As per the study, the definition of nZEBs must be flexible against several factors including balancing boundaries, time-frames, metrics of balance and renewable energy supply options.

### Zayed University:

Various related activities are taking place at UAE Universities. For example, Zayed University has a climate forum that focus on public awareness. The goal of Zayed University's Forum is to evaluate the outcome from Paris COP21 meeting with special focus on the impact in the GCC region. The Forum will serve as a platform for decision makers, scientists, young researchers, and private sector representatives to interact and discuss the research agenda for the future.

Toward this end, the meeting will have emphasis on the future shape of fundamental science and engineering research programs. Societal factors influence natural resources priorities, and several dimension of sustainable development and the conference consider this dimension to subsequently define research topics in this area. The conference will have a focused session to explain, translate, and disseminate key results from COP21 and define its major impacts on United Arab Emirates and GCC in terms of adaptation, climate finance, mitigation and technology.



## Community awareness:

The UAE plans to enhance the individual and institutional awareness to address the challenges of climate change. This will enhance public awareness, develop institutions undertaking social needed analyses, and contribute to better decision-making. Many campaigns have been done on the UAE on the national and local level to fulfil the community needs in understanding climate change.

## Ecological Footprint Initiative (EFI) (ongoing):

In 2007, the UAE launched the Ecological Footprint Initiative (EFI) through a partnership between the Ministry of Environment and Water (now called Ministry of Climate Change and Environment), Environment Agency – Abu Dhabi, Emirates Wildlife Society in association with WWF, and the Global Footprint Network, transforming the UAE from a country with one of the highest per capita Ecological Footprint per capita in the world, to one with some of the most advanced Ecological Footprint science. In 2012, the partnership welcomed the Emirates Authority for Standardization and Metrology.

EFI's mission is to develop science-based policies that will cause a measurable reduction in the UAE's carbon footprint, and address climate change. Carbon forms the largest component of the country's footprint. Key principles followed in EFI engagements include: science-based policy analysis, capacity building, multi-sector collaboration across public, private and civil society actors, and open and transparent consultation.

Since 2007, The EFI has conducted ground-breaking research to guide the development of effective policies that will lead to carbon footprint reductions, three of which are the following:

- 1 In 2009-2010, the EFI developed a scientific tool to track how the power and water sector's development might affect Abu Dhabi's CO<sub>2</sub> emissions and the UAE's per capita Ecological Footprint up to 2030. Led by researchers from EWS-WWF and the Masdar Institute, the tool assesses the impacts of policies such as renewable energy, more energy and water-efficient equipment, and green building codes to decarbonize the power and water sector.

The technical work, supported by Global Footprint Network (GFN), was extensively informed by a comprehensive stakeholder consultation process for which key technical experts and policy makers from energy and water utility companies, as well as regulators, urban planners, academics, economists, businesses and government agencies, provided input, data and expertise.

The tool indicated that if the most ambitious measures were implemented in Abu Dhabi alone, by 2030 that emirate's CO<sub>2</sub> emissions could be reduced by up to 40% and the UAE's overall per capita Footprint could be reduced by 1 gha/person. Developing a more comprehensive strategy to reduce the UAE's CO<sub>2</sub> emissions and per capita Footprint will require a combined effort by all emirates. However, any strategy to reduce the carbon Footprint will fundamentally depend on the assessment of data and policy measures for other sectors, such as transport, manufacturing, oil/gas and land-use, along with a full economic and social assessment of the policies being implemented.

- 2 In 2012-2014, the EFI undertook a technical study to develop a policy demonstration cycle for an energy-efficiency standard and labelling system for indoor lighting in the UAE. EWS-WWF conducted research to understand the technical, economic and sustainability impacts of the proposed lighting regulation, which was used to support the Emirates Authority for Standardization and Metrology with the development of the standard.

The results showed that implementing energy efficiency standards for indoor lighting can save an estimated 2,046GWh of electricity in the UAE a year, over 90% of which will be from replacing inefficient incandescent lights (based on the 2011 UAE population). These energy savings are the equivalent of avoiding investment in approximately 340-500MW of power generation capacity, or avoiding capital costs of AED 100-146.3 million annually for 20 years, which is a typical period over which power station investments are financed. The results furthermore showed that implementing energy efficiency standards for indoor lighting can save the UAE an estimated 668 million dirhams per year after full adoption of Energy Efficient Lights (EELs), which is comprised of 459 million dirhams of savings to households from reduced electricity bills and 216 million dirhams for the government in terms of reduced subsidies. Lastly, the results showed that implementing energy efficiency standards for indoor lighting can allow the UAE to reduce almost one million tons of CO2 emissions per year, equivalent to removing over 165,000 cars off the road.

The UAE Indoor Lighting Standard was developed by the Emirates Authority for Standardization and Metrology, and has been under implementation since 2014. The standard prevents low quality indoor bulbs from entering the UAE market. It considers energy efficiency, electrical safety, hazardous chemical limits, functionality and safe disposal. As a result of this Standard, the UAE is now being supplied with the following high efficiency light bulbs: Compact Fluorescent Lamps (CFLs), which are much more efficient than incandescent light bulbs; Light Emitting Diodes (LEDs), which offer high efficiency and much longer lifetimes than most lamps; and Halogens, which are more efficient than traditional incandescent light bulbs.

- 3 In 2015 – 2016, the EFI undertook a technical study to support the development of a UAE Vehicle Fuel Economy standard. The study consisted of three components: development of a UAE vehicles baseline to understand the current fleet's fuel efficiency; development of regulatory scenarios, and assessment of related technical, economic and environmental implications; and assessment of the required policy framework (including compliance procedures and consumer incentives).



The policy proposal based on the study has been approved by the EFI Steering Committee, and the standard is currently being developed by ESMA. The standard is being modelled on Corporate Average Fuel Economy (CAFE) standards, which are the main tool governments (e.g. the United States of America and Saudi Arabia) use to reduce fuel consumption and CO2 emissions from new light-duty vehicles. The technical study further concluded that the adoption of this type of Standard would result in annual fuel savings benefits of 2.3 billion litres in 2025 and 6.1 billion litres in 2035, which correspond to CO2 emission reductions of 5.4 MtCO2 and 14.5 MtCO2 respectively. Annual savings in 2035 are equivalent to the removal of 4.5 million cars operating at current fuel economy from UAE roads.

**Heroes of the UAE Campaign** – Heroes of the UAE was a sustainable lifestyle campaign, which was developed by EWS-WWF and the Environment Agency – Abu Dhabi in February 2009. The campaign provided simple tips on how to reduce energy and water consumption in a bid to help tackle the UAE’s Ecological Footprint and global climate change. EFI science has allowed the campaign to target the sectors of UAE society that most significantly contribute to the country’s large per capita Ecological Footprint: households, schools and the government and private sectors. This science-based communication has provided valuable credibility to the campaign. It has also helped on specific areas to build momentum and achieve positive reductions in the UAE’s footprint.

## From 2009 to 2011, the campaign has achieved several milestones including:

A business toolkit to promote energy and water conservation measures in office spaces

Initiation of 14 green makeovers with schools, businesses, government and households

Thirty-five pledges from companies to become Corporate Heroes and reduce their energy and water consumption by 10% in 12 months

9,792 online pledges to reduce energy and water consumption across the UAE

In May 2010, the Heroes of the UAE Private Sector program (completed) was launched to motivate and inspire private sector organizations to reduce their energy and water consumption, the main contributors to carbon emissions. This was the first and only voluntary program in the UAE to have set reduction targets verified by a third party. Eight organizations set out on a journey to become more sustainable as part of this program. The organizations implemented technical and behavioral changes across air conditioning, lighting, office equipment and water. Seven out of eight organizations invested between 4, 875 dirhams and 160,000 dirhams, and the payback time for these retrofits was less than 16 months. This allowed organizations to achieve 12% energy savings and 35% water savings, the total of which equals to 16% CO2 savings, which is equivalent to removing 2,695 passenger cars of the road. This proved that simple, cost effective changes can reduce energy and water use and provide financial benefits to any organization.

In 2015, ADNOC and its Group Companies undertook the first group-wide stakeholder engagement campaign in Madinat Zayed. The campaign set a precedent for ADNOC's engagement practices in the region, by collaborating and engaging with a spectrum of parties and regional representatives individually and collectively in a traditional setting that enabled the effective sharing of knowledge and viewpoints. These include members of government and public bodies, members of the general public, and the student community across schools, colleges and universities.

The goal of the campaign was to raise awareness on ADNOC's current and future operations in Al Gharbia; as well as the HSE and crisis management and emergency response procedures; and ADNOC's group-wide socioeconomic development plans and opportunities in the region.

Under the principal theme of 'we care for our community', ADNOC drew on the group-wide expertise to develop tailored activities that helped support its corporate goals. The three-month campaign concluded with an exhibition that brought all parties together in a central location in Madinat Zayed, to showcase the winning projects and the results achieved by the campaign, and to engage in open dialogue on issues of potential concern to the community, particularly those related to ADNOC's operations in Al Gharbia.

# Al Gharbia Stakeholder Engagement Campaign

## Drawing Competition

Primary school students were engaged on the basic principles of sustainability and participated in a drawing competition to encourage the visualisation and application of sustainability in their daily endeavours

## Exhibition

Information booths across medical, crisis management, HSE and HR functions were organised to educate visitors on ADNOC's efforts across these areas. A tour of ADNOC's newly installed air quality monitoring station was provided, in addition to training on first aid and firefighting to encourage HSE practices at home.

## Barzah

A traditional tent-style setting was arranged to engage in open dialogue with members of the general public, which commenced with a traditional poetry reading and concluded with a communal donor.

## Environment Essay Competition

The winner, Ms. Aisha Al Hosani from the Higher College of Technology, shared her essay writing talents on climate change in the opening ceremony on the first day of the exhibition

## Innovation Competition

A series of innovative model designs were constructed by students from universities in colleges on environmental issues water desalination, hazardous waste handling and sustainable cultivation

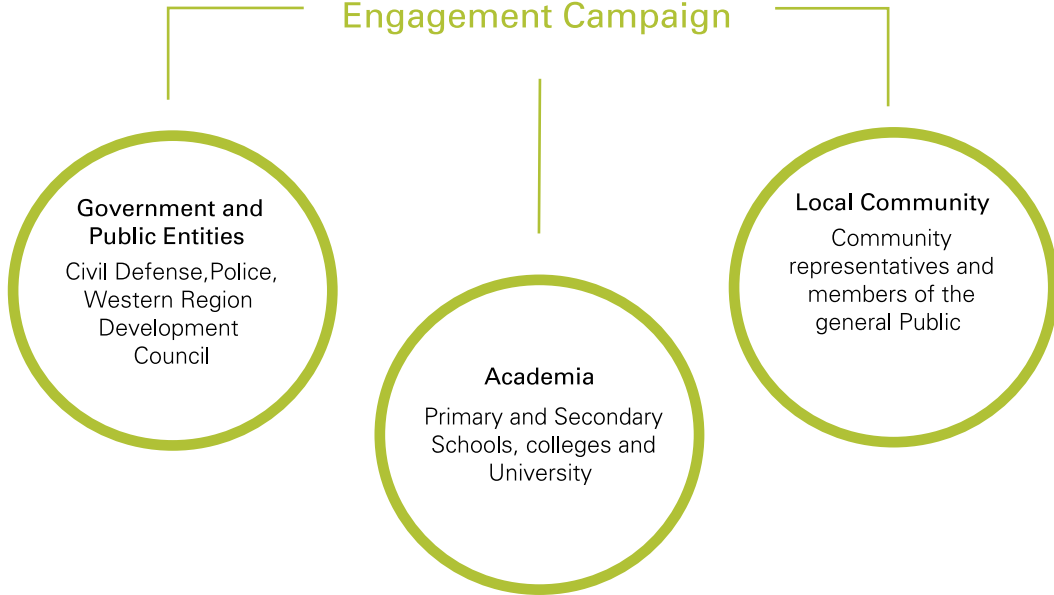
## Art from Recycled Waste Competition

ADNOC partnered with 'Abu Dhabi Art Hub', a local artist community that specialises in visual art projects, to conduct a series of workshops in secondary schools on recycling waste to art

The dialogue sessions were conducted in a traditional 'Barzah' setting (with one day designated for men and the other exclusively for women), and covered topics such as HSE and emergency response procedures, local hiring plans and processes, potential plans to expand fuelling facilities to better meet the community's energy needs, and opportunities for collaboration with local product and service providers. Senior representatives from ADNOC as well as CEOs from across the Group Companies participated in discussing the issues raised during these sessions. An impact and recommendations report was prepared to help better understand and address the community's requirements. The process will also help inform the development of a centralised and group-wide stakeholder engagement procedure which will be undertaken by ADNOC in co-ordination with its major stakeholder groups.



## AL Gharbia Stakeholder Engagement Campaign



## Sustainability Reporting



ADNOC issued its first Sustainability Report in ,2009 in accordance with the de facto sustainability reporting guidelines – the Global Reporting Initiative) GRI.(

In 2014, ADNOC underwent external assurance (by EY) for 10 of its material sustainability performance indicators (non-financial).

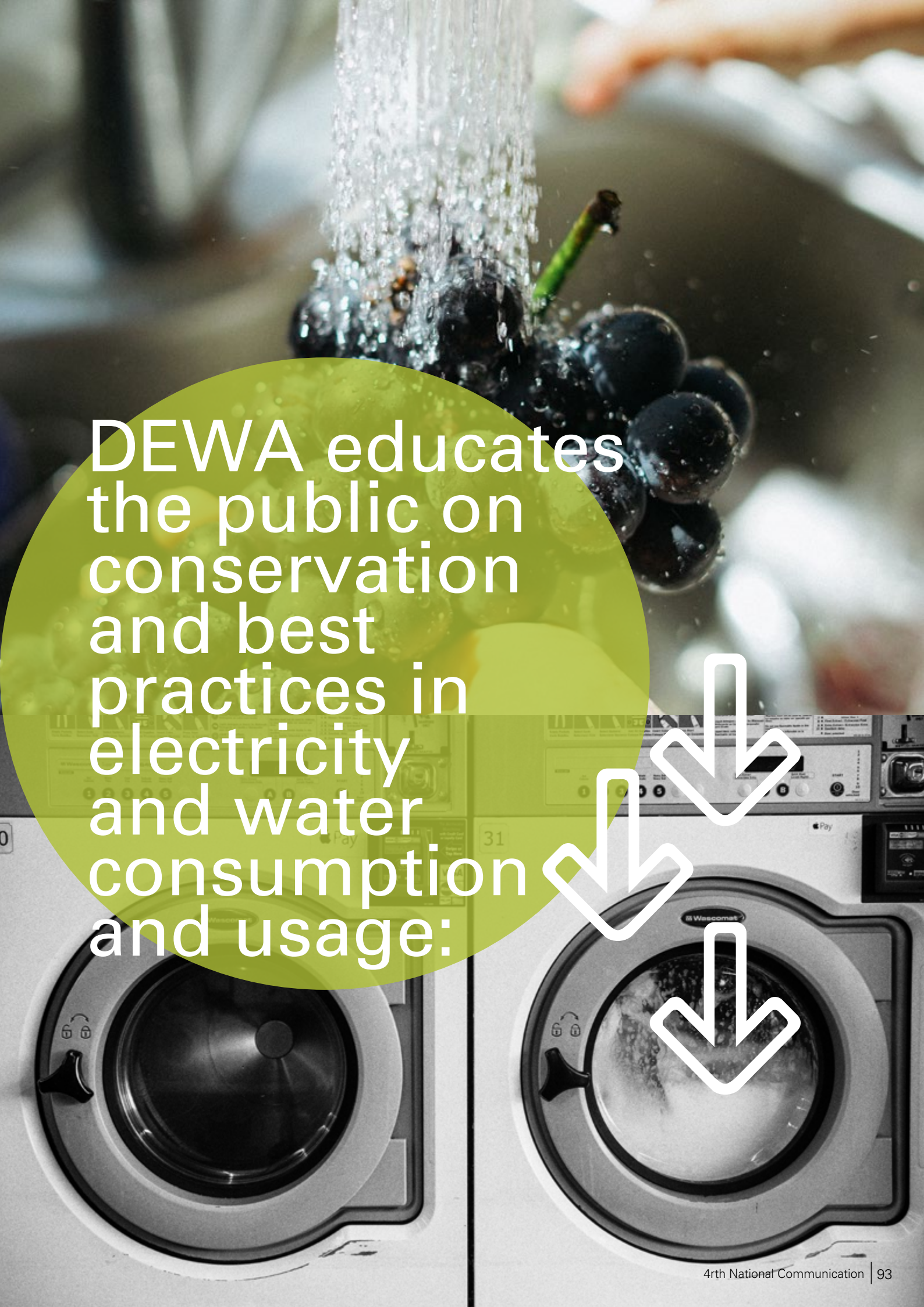


### DEWA's sustainability reports:

DEWA issued its 5th annual Sustainability Report 2017. It highlights its efforts to promote sustainability in all its environmental, social and economic aspects, providing a sustainable model for energy and water conservation, and supporting economic growth without harming the environment and its natural resources. The report also highlights DEWA's achievements to support the 17 UN Sustainable Development Goals 2030 to address the pressing environmental, political and economic challenges the world is facing.

ADNOC GROUP SUSTAINABILITY REPORT 2015  
TAKING INNOVATION TO NEW HEIGHTS





DEWA educates the public on conservation and best practices in electricity and water consumption and usage:

Over the last years, DEWA has engaged in proactive awareness campaigns with a variety of stakeholders to promote community awareness of energy use and energy preservation. These include:

Programs for educational institutions, Government departments, commercial establishments, residents, neighborhoods etc.	Awareness campaigns Changing behavior.	Assist our residential customers to understand their consumption Electricity and water Audits.
Identify ways for our customers to conserve water and power Energy saving Equipment Provide energy water-saving devices.	Integrated media campaigns, road shows, workshops etc.	DEWA website (conservation tips), social media
Broadcast email and SMS messages	Leaflets, brochures	Recognition schemes Best Consumer Award,
Conservation Award - For a Better Tomorrow		

Dubai achieved significant results in reducing electricity use and carbon emissions during Earth Hour 2018. DEWA recorded savings of 323 megawatts (MW) in electricity consumption in Dubai, a 32% further reduction compared to last year. This is equivalent to a reduction in CO<sub>2</sub> emissions of 140 tonnes. As the National Strategic Partner of Earth Hour UAE, DEWA organised activities to celebrate Earth Hour, under the umbrella of the Dubai Supreme Council of Energy; and in partnership with the Emirates Wildlife Society (EWS), in association with the World Wide Fund for Nature (WWF), and with the support of Dubai Properties Group.

#### Awareness in Dubai municipality:

The Dubai Municipality plays an important role to increase the awareness level of society through a comprehensive environmental awareness outreach program that includes:

- Preparing and organizing environmental education courses such as lectures workshops and presentations.
- Organizing and participating in local and international environmental events, exhibitions and campaigns such as the DM Car free Day, Earth Hour and Clean up the World.
- Preparation of environmental awareness publications and materials such as booklets and Brochures.

The Dubai Municipality, while addressing the Environmental awareness level for the public, is targeting all grades of schools and universities students, whether governmental or private in Dubai or abroad by preparing and providing a free lectures and workshops related to various environmental issues and workshops.

## Dubai Car Free Day

This annual initiative launched by Dubai Municipality from 2010, where all the governmental and private sectors are encouraged to participate to use the public transportation instead of using private cars, where in 2015, more than 30,000 cars were not used by the employees which has resulted in reduction of 100 tons of CO2 emissions.



## Emirates Wildlife Society-World Wide Fund:

To fully understand the barriers to energy and water efficiency in the private sector and identify solutions, EWS-WWF commissioned a survey covering 363 companies across three Emirates, namely Abu Dhabi, Dubai and Sharjah. The survey was conducted in both Arabic and English, through a series of face-to-face interviews, across a two-month period and was completed in January 2015. The types of companies interviewed were split into categories of SMEs (small medium establishments), medium corporates and large enterprises. The survey was the first statistically representative survey of the private sector on energy and water efficiency barriers in the UAE.

The survey found that the private sector primarily faced issues related to: high costs of energy and water efficient technologies (identified as barrier by 37% of survey participants); low availability of products (identified as barrier by 34% of survey participants); lack of market accessibility (identified as barrier by 27% of survey participants); and limited understanding of electricity and water subsidies (identified as barrier by 25% of survey participants).

The EWS-WWF report, "What is holding back the private sector?," documents all key barriers to energy and water efficiency in the private sector, and acts as a springboard for the private sector to do more.

Top three key barriers to energy and water efficiency in the private sector project (completed) – The Harnessing the Invisible Fuel: How to unlock the energy and water efficiency potential of the UAE private sector report delves deep into the three key barriers hampering the uptake of energy and water efficiency in the UAE private sector. This builds further on the report, What is Holding Back the Private Sector?. The three major barriers hampering the uptake of energy and water efficiency in the UAE private sector, as outlined in the report, are: high cost of energy and water efficient technologies; low availability of products and lack of market accessibility; and limited understanding of electricity and water subsidies.



In addition, the report outlines seven recommendations for policymakers on how to unleash the potential for energy and water efficiency in the UAE.

These include, among others: development of a national climate change and energy policy, including clear greenhouse-gas reduction targets and detailed plans for implementation and monitoring; implementation of stronger and more impactful standards for energy and water efficient technologies; and calculation of true costs of electricity and water, including environmental externalities, to pave the way for nationwide tariff reform.

**Heroes Business Toolkit (2010)** – Developed under the Heroes of the UAE Private Sector program, the Heroes Business Toolkit is a comprehensive set of tools to assist organizations in getting started on their journey to sustainability, ranging from guides on how to measure a baseline and craft a strategy to reduce energy and water consumption, to engagement tools for staff. The toolkit is a benefit under the EWS-WWF Corporate Membership program (CMP), which operates by bringing together a network of like-minded companies that want to safeguard UAE’s natural resources for generations to come. Under the Ecological Footprint Initiative (mentioned above), in 2009, the EFI partnership worked to enhance understanding of consumption patterns by breaking down the UAE footprint by sector. The results showed that the three main Ecological Footprint-driving sectors contributing to the UAE’s Footprint were the following: household 57%; business and industry 30%; and government 12%. Due to the high contribution of households to the Ecological Footprint, it was decided that immediate action should be taken to inform UAE households on how to reduce it. This led to the development of the Heroes of the UAE Campaign, aimed at raising awareness about the Footprint, climate change, and how these issues can be tackled via water and energy conservation. For more information on the Heroes of the UAE Campaign.

**Be’ati Watani program** - Launched in 2011 for 3 years, Be’ati Watani was a comprehensive bilingual online environmental resource for 6-14 year olds, and was the first environmental education program devoted specifically to the UAE environment.

Comprising of eight levels, students were encouraged to follow main characters, Hamad and Ayesha, as they learned about the different local and global environmental concepts and issues. The modules covered the country’s fauna, flora and natural habitats, provide tips on simple ‘to do’ conservation actions in schools and homes that should form a part of children’s daily lives, and introduce vital global issues such as climate change and what we can do about it. Students could then test their environmental knowledge to see how much they have learned. Designed to stimulate more in-depth thought on the growing environmental issues we face on a daily basis and to engage a wider range of students in meaningful environmental discussions, Be’ati Watani also included a blog on the student portal. In addition, this online experience enabled students of participating schools to access quizzes, grades, certificates and prizes.

**Overall, Be’ati Watani strived to:**

- Boost environmental knowledge among children aged 6-14 years old
- Foster a sense of ownership and pride in the on-going protection of the UAE’s distinctive biodiversity
- Stimulate thinking about connections between human consumption patterns and the environment
- Provide teachers resources to help facilitate classroom discussions on environmental subjects
- Initiate the study of the environment in school curricula across the UAE



**Eco-Schools Program** – Eco-Schools is an international Educational for Sustainable Development (ESD) certification and award program of the Foundation for Environmental Education (FEE) that guides schools to embed sustainability principles into the heart of school life. As the National Operator for FEE programmes in the UAE, EWS-WWF was selected to implement the Eco-Schools program in the UAE from 2010 – 2012 through the HSBC Eco-Schools Climate Initiative, and from 2012-2015 through Eco-Schools UAE with the endorsement of the Ministry of Education.

Adopting a holistic approach to education, the Eco-Schools program combined classroom study with student-led environmental action in the school and within the wider community. Since the introduction of the program in the UAE, 45 private and public schools actively participated in the program. The Eco-schools that were rewarded with the prestigious Green Flag Certification had to implement the program for at least two years, and went through a rigorous assessment process where they demonstrated excellence and success in improving their environmental performance. 18 schools have since been awarded the Green Flag in the UAE.



While working on the themes of Energy, Water, Waste (including Litter), and Biodiversity, participating schools collectively lowered their electricity consumption by 30.3% and water consumption by 30.8% over the last three-years of the program period. Another improvement observed among almost all Eco-Schools was the reduction in litter within the school campuses. Waste sorting and recycling practices were also taken up more actively by students and teachers, especially with regards to use of paper and plastic.





Local environmental organization and civic authorities have recognized the efforts by these schools and rewarded them with sustainability awards, both at the emirate level as well as internationally. UNESCO selected EWS-WWF Education projects, which included Eco-Schools UAE, as one of the five best practices in ESD in the region; invited to showcase the project at the World ESD Conference in Japan in November 2014.

Water Research and Learning program (WRLP) (ongoing) – developed by EWS-WWF under a 5-year (2013-2017) sponsorship agreement with HSBC in Wadi Wurayah National Park, the WRLP is a citizen-science program aimed at raising awareness about water conservation issues in the Middle-East, which are narrowly linked to climate change issues. New awareness curriculum focusing more specifically on the theme of climate change are being developed and will be implemented in 2016-2017. Current research program developed in WRLP with the assistance of volunteers focuses on monitoring freshwater species populations (Toads and Dragonflies) and assessing the effects of temperature rise on their development and survival.

Earth Hour (ongoing, annual campaign) – From its beginnings in just one city in 2007, Earth Hour has become a global phenomenon reaching out to 1.8 billion people worldwide today.

Earth Hour is an opportunity for every single person around the world to unite in taking a stand against climate change and supporting the will of the public behind tackling it. Switching off one light in one room in one house may seem insignificant, but Earth Hour shows that when many people switch off many lights, in many rooms in many houses, the impact is considerably more noticeable.

If re-enacted, this action and the commitment to go beyond the hour, for example by recycling or re-using, the impact can be just as impressive. With the invitation to 'switch off and go beyond the hour' extended to everyone, Earth Hour quickly grew into an annual global event. Earth Hour is scheduled on the last Saturday of every March – closely coinciding with the equinox to ensure most cities are in darkness as it is rolled out around the world.

In 2016, locally, all seven emirates participated in Earth Hour, with key landmarks switching off such as Burj Khalifa, Burj Al Arab, Sheikh Zayed Grand Mosque, Etihad Towers, Al Qasba (Eye of the Emirates) and many more.

Every year, EWS-WWF organises various activities and fundraising initiatives around Earth Hour – most often in partnership with relevant entities. For example, in 2016, EWS-WWF partnered with Dubai Electricity and Water Authority (DEWA) to raise awareness on the campaign through a public event and various other channels.

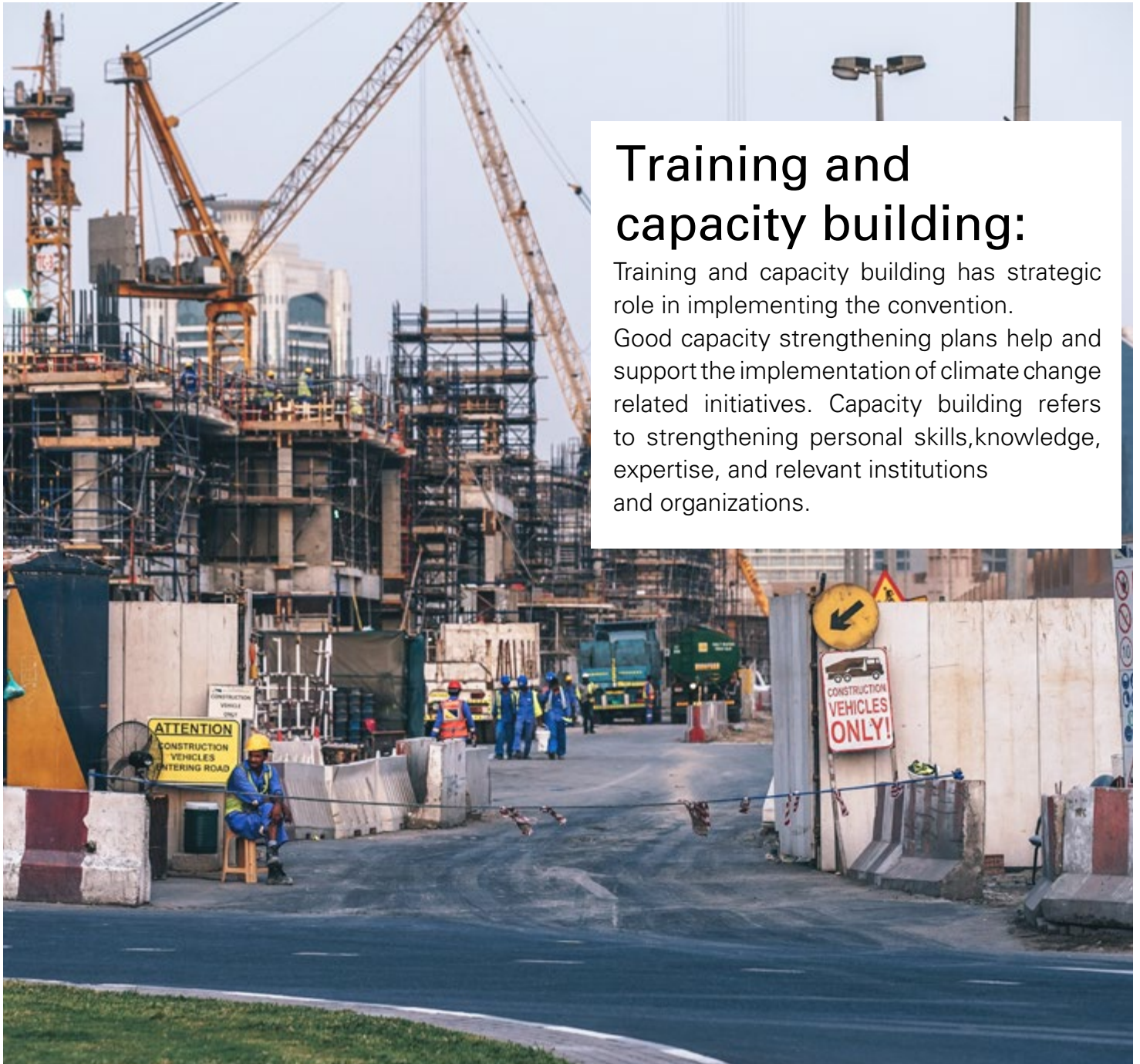


### Abu Dhabi Water and Electricity Authority:

ADWEA and its group of companies work on activating rationalization of water and energy consumption programs, therefore, they launched an awareness program under the slogan of

«Rationalization of consumption is a faith value and national duty “Let’s rationalize”. This program included a media campaign that featured awareness television ads and the organization of an awareness stand at all ADWEA’s exhibitions and other exhibitions in which it participated. Furthermore, the Customer Service departments in the distribution companies conducted additional awareness campaigns to rationalize the consumption of water and energy and received many university and school visits in this regard.

ADWEA and its companies launched a campaign for the rationalization of water and electricity consumption on buses, in collaboration with the Department of Transport in Abu Dhabi. The campaign lasted for one month within ADWEA ongoing plan to rationalize water consumption. The campaign featured awareness slogans on five buses of the Department of Transport in Abu Dhabi, driving around in the major regions of the capital.



## Training and capacity building:

Training and capacity building has strategic role in implementing the convention. Good capacity strengthening plans help and support the implementation of climate change related initiatives. Capacity building refers to strengthening personal skills, knowledge, expertise, and relevant institutions and organizations.

## DEWA:

To further develop and retain world-class workforce, DEWA provides all possible support to its employees to further improve their talents and skills, and strengthen social cohesion. One of the key ways in which we support our employees at all levels of our organization is by providing training to continually enhance their skills. Since 2010, we have witnessed a steady increase in average leadership training hours, manager training hours and non-supervisory employee training hours. We also run a career development and succession planning program at DEWA.

In 2015, we developed our technical competency frameworks and updated our behavioral competency frameworks. A portion of our employees attended our development centres, with individual development plans produced for each delegate. Succession management is equally critical in order for us to ensure continuity, retain and develop knowledge and intellectual capital for the future and encourage individual employee growth and development. As a result succession planning for up to 81 critical positions in our organization has been carried out, with the majority of the positions to be held by UAE nationals.

## Scholarships Offered by ADWEA ADWEA

Provides its employees and those in the group of companies with educational programs to continue their higher studies (M.A. and Ph.D.levels) through signing agreements with foreign prestigious external and internal educational institutions, (e.g. Khalifa University and Masdar Institute), to improve the education process of the national employees. Positive returns for these programs shows clearly in the return of these competencies to work in ADWEA and support our human resources with more qualifications to develop our business and raise the level of provision of services in this important sector. In 2014 Emirati Scholars supported on ADWEA scholarship program reach 132 beneficiary.

## Emirates green building council efforts in capacity building:

With the aim of advancing green building principles in the UAE, EmiratesGBC hosts monthly technical workshops, focus days and several events to share knowledge, challenges, best practices and lessons learned. Due to the growing demand for qualified professionals, EmiratesGBC has partnered with British University in Dubai to provide sustainability courses including the LEED preparatory exam courses (Green Associate and Accredited Professional), Certified Energy Manager, and Certified Energy Auditor trainings. Based on the EmiratesGBC Technical Guidelines for retrofitting existing buildings in the UAE, EmiratesGBC is currently developing a Building Retrofit Training which introduces a range of retrofit methods to improve the efficiency of existing buildings in the UAE. The technical content has been formatted for readers with varying levels of experience where two levels of training are offered.

Under its Hospitality Program, EmiratesGBC has developed training modules specific to hospitality stakeholders that cover key areas of hotels' operations. These training modules can be tailored to assist any level of hotel staff, addressing general facts on green hospitality for those less informed, while also covering more technical aspects that can support the engineering departments. In addition to sustainable water, energy and waste management, modules also address sustainable food, housekeeping, communications and CSR.

# Exhibitions and events:

The UAE also hosts a number of high profile international gatherings focusing on sustainable development issues.

## DEWA- WETEX:

Under the directives of HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, and the patronage of HH Sheikh Hamdan bin Rashid Al Maktoum, Deputy Ruler of Dubai, Minister of Finance, and President of Dubai Electricity and Water Authority, DEWA has been organising the Water, Energy, Technology, and Environment Exhibition (WETEX) for 19 years. WETEX has established its position as one of the largest and most important specialised exhibitions in the region and a leading global event that brings together exhibitors, visitors, experts, specialists, decision makers, and investors interested in the water, energy, technology and environment. The 19th WETEX in 2017 attracted over 2,000 exhibitors and 31,000 visitors from over 50 countries, in addition to 75 sponsors. Because of the increasing demand for participation in the exhibition, space has been expanded to cover 70,000 square metres. WETEX 2017 coincided with the 4th World Green Economy Summit, and the 2nd Dubai Solar Show, which covered 14,000 square metres. WETEX is organised under the umbrella of Green Week, which features a series of community-oriented environmental activities, making it unique event as it reaches all of society. AED 841 million.

## EmiratesGBC:

Besides the monthly and quarterly events organized by EmiratesGBC, the Council holds an Annual Congress, a flagship event which serves as an important platform for the green building industry to critically explore the research, development, technology, and regulations required to build sustainable urban living environments in the UAE and the region.

## SOLAR DECATHLON MIDDLE EAST:

Solar Decathlon Middle East (SDME) is an international competition created through an agreement between the Dubai Supreme Council of Energy, DEWA, and the US Department of Energy. Through this competition, universities from all over the world compete to design, build, and operate sustainable, cost-and-energy efficient models of solar-powered houses, which will contribute toward protecting the environment and be capable of adapting to the climate problems in the region. DEWA is working to provide all means of support to students in order to achieve the Solar Decathlon's success, which is in line with our vision, and our strategic directions. A total of 18 teams from 13 countries have been shortlisted for the final stage of the Solar Decathlon 2018. The winning teams will be awarded cash prizes of over AED 10 million. Dubai will host the first two cycles of the Solar Decathlon, which is to be held for the first time in the Middle East, in 2018 at the Mohammed bin Rashid Al Maktoum Solar Park and again in 2020 to coincide with World EXPO in Dubai.

## Rewards

The UAE government has allocated some investment to encourage innovation in initiatives, researches and inventions on climate change. These engagements comes as awards on best practices regarding climate change and other related issues like green building, transportation, clean energy and others.

## Dubai Award for Sustainable Transport

The daily rising demand for both people and goods' mobility has resulted in increasing levels of congestion on the road system of the UAE, unacceptable loss of human lives resulting from transport-related incidents and posing serious threats to the fragile natural environment.

Unless effectively managed, all of those consequences will continue to negatively affect the quality of life, undermine economic prosperity and weaken UAE's position as a leading country in the world.

The Award is an Annual Award aims to encourage and raise awareness among the community and its various organizations to play a proactive and constructive role in supporting the RTA to carry out its objectives by initiating and pursuing sustainable transport practices.

The Award also highlights the leading role of the RTA in fostering partnership & relations with all strategic bodies & partners in the fields of mobility, safety and conservation of environment.

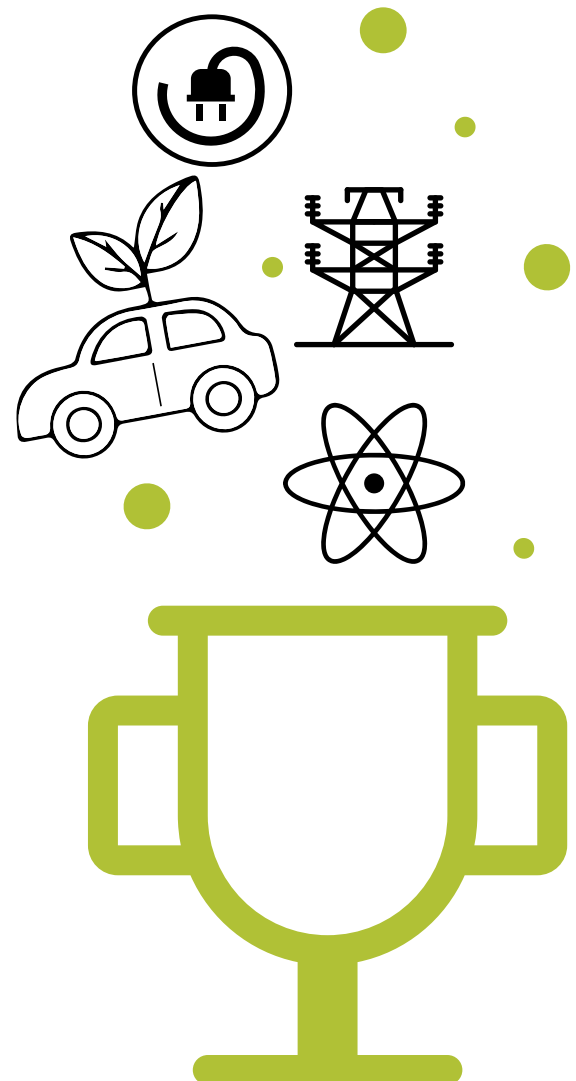
The Award contributes to realizing the strategic objectives of the RTA in integrating transport systems, achieving highest levels of safety & security, highlighting the significance of sustained development, and caring for the environment.

Interested parties can apply and compete in four major Award categories and four Special Awards which include (Mobility Management, Transport Safety, Environmental Protection, Transport for the Disabled, and Special Awards: The Best Academic Research, Best Student Project, Best Journalist, The Best Media Team).

## RTA's Energy & Green Economy Award:

In 2013, RTA launched the Annual RTA's Energy & Green Economy Award as part of its policy aimed at motivating employees, sectors & agencies, strategic partners, and customers (including suppliers, contractors and consultants) to propose the best ideas and practices for revamping the concept of green economy and power saving.

The Award targeting Six Categories (Green Fronds), Agency / Sector Category, Projects Category, Strategic Partner Category, Stakeholders category, RTA individual category, and Students Category. Also, the Award evaluation criteria established based on the UAE Six Green Economy Tracks; namely; Green Energy, Green Policies, Green City, Climate Changes, Green Life, and Green technology.



## Public Transport Day

RTA launched this initiative in 2009. The initiative has succeeded in realizing its objectives of showcasing the role of Dubai in supporting efforts made to improve the environment, achieve sustainable development, encourage people to use public transport means, and raise public transport ridership levels by educating users about the benefits of public transport.

The Day is also intended to promote RTA's modern mass transit means comprising the Dubai metro and tram as well as buses and marine transit modes, besides achieving the integration of multi-modal transit systems, and showcasing the leading role of Dubai in general and RTA in particular in uplifting the profile of public transport.

After obtaining ISO 14001:2004, ISO OHSAS 18001:2007 in 2010, RTA obtained ISO 50001:2011 certification in Energy Management System in 2013 in recognition to RTA's efforts to ensure the highest international standards of corporate sustainability in manifestation of its vision of providing safe and smooth transport for all.

Implementing the Energy Management System in conformity with the International Standards Organization (ISO) has also contributed to improving management practices by fulfilling more operation requirements of energy-efficient management system. RTA has now been capable of monitoring and managing the use of energy efficiently, and ensuring transport sustainability.

RTA's environmental endeavours were richly rewarded by clinching the coveted BGREEN Award as The Most Sustainable Government Entity in the region in 2014 and the Sustainable Company of The Year in 2015.

## EmiratesGBC Awards Program:

For the past four consecutive years (2013-2016), the EmiratesGBC Awards Program has awarded companies that demonstrated implementation of sustainable design, construction and/or operation of buildings. Similar to previous years, the 2016 Awards were presented in five main categories, including Green Facility Management Organization of the Year, Green Building Material/Product Award, Green Building Research Award, Training Initiative of the Year and Green Building of the Year with its sub-categories including Green Hotel, Green School, Green Residential and Green Commercial Building.

In 2017, the Annual EmiratesGBC Awards will be rebranded as the Annual MENA Green Building Awards to celebrate the accomplishments of MENA-wide projects. The MENA Green Building Awards is supported by the World Green Building Council as well as other regional GBCs including LebanonGBC and JordanGBC.

The ultimate goal of these awards is to help establish a replicable model for sustainable buildings and support environmental stewardships across the region.

# Chapter

# 9

# Constraints and Gaps

# Data Collection

The process to develop the National GHG Inventory involves a wide array of energy stakeholders across the UAE. Over the years, this process has been instrumental in raising the awareness across energy stakeholders on issues related to Climate Change and GHG mitigation strategies.

The data collection includes both the industry data, as well as the emission factors and parameters. The activity data for the Energy sector is readily available through the regular reporting procedures of the UAE to OPEC, which includes the generation of the Annual Energy Statistics by the Ministry of Energy.

The Industrial sector includes the cement, aluminum, chemical and iron and steel industries. The aluminum sector has developed its data reporting framework to provide data for Tier 3 calculation approaches. The remaining industries continue to work towards developing plant-specific emission factors.

The Waste, Agriculture, and Land-Use Change and Forestry (LUCF) sectors require improvements on the capacity to collect all the specific parameters and develop country-specific emission factors.

In the waste sector, the activity data for Solid Waste Management is reported from the source to the National Statistics entity- Federal Competitiveness and Statistics Authority. Whereas the wastewater sector data collection practices are yet to mature, the parameters selected for this section remain the default values provided by IPCC due to the lack of resources and research to report/develop country-specific data.

Additionally, an innovation for this year's report of the LUCF sector is that the UAE has included the Mangrove cover where there is substantial work performed for research as well as data collection processes. A similar level of work for the forest and plantation areas, as well as for identifying country-specific sequestration rates for these sub-sectors, will be developed for future editions.

The data collection and validation process is crucial to the robustness of the National GHG Inventory. The automation of this phase will be able to relieve the capacity to address and substantially improve the areas of research and development of the emission factors and parameter selection.

With this in mind, the UAE launched the Data Management and Automation Platform called "Atmata". The inventory's maturity is expected to increase in the coming years, improving key factors such as data centralization, reduced uncertainty, or stakeholders engagement. The implementation of the Automation Platform will offer several advantages such as reduced process time, minimal calculation errors, improved quality control, detailed data and emission analysis.

# Mitigation Evaluation

The UAE has submitted various CDM projects in the past as well as the latest Clean Energy Target for 2021 in the Nationally Determined Contributions. Due to the nature of the energy sector, the national level collection of the multiple emission reduction projects and evaluation of the reduction potential is an area that requires improvement.

The primary constraint is the absence of a uniform process for reporting reductions. The estimation of the emission reductions are performed by the individual entities who own the projects, and they apply different methodologies to determine the total emission reductions.

Additionally, there are local government efforts for setting emission reduction targets within the Emirates, which also follow separate methodologies, and hence consolidation at the national level is challenging. The bottom-up buildup of the Mitigation efforts from the various projects in the UAE is required to identify progressive targets for emission reduction. Currently, the lack of capacity building and unavailability of standardized national processes for the evaluation of the projects restricts the assessment only to the Clean Energy Projects.

# Public Awareness and Capacity Building

The overall awareness of the public in the UAE towards climate change has improved since the COP21. The UAE was among the first countries to ratify the Paris Agreement and the following year the federal restructuring resulted in the creation of the Ministry of Climate Change and Environment. This dedicated allocation of resources has resulted in various public awareness programs such as blue carbon project, Indicator reporting information system (IRIS) and EcoCity World Summit 2015.

An area for continuous improvement is that, despite the efforts of the government towards raising awareness on the issues of climate change, the details of climate change science are still confusing to many.

The technical capacity required to accumulate and disseminate the knowledge around climate change is still lacking. This lack of capacity as mentioned in the previous sections hinders the GHG inventory development and the mitigation analysis. Additionally, to produce transparent and consistent reporting, there is a need to develop the capacity of the entities who are reviewing the indicators related to Climate Change.

The Research and Development in the UAE are motivated by the issue of climate change but are focusing on developing technology for abatement compared to projects, which focuses on the improvements in data, and information, which are necessary to understand the impact of climate change on the UAE.



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