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<tr>
<th>Abbr</th>
<th>Description</th>
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<tbody>
<tr>
<td>AFR</td>
<td>Sub-Saharan Africa Region</td>
</tr>
<tr>
<td>BOD</td>
<td>Biochemical Oxygen Demand</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulation</td>
</tr>
<tr>
<td>CH₄</td>
<td>Methane</td>
</tr>
<tr>
<td>C&amp;D</td>
<td>Construction and Demolition</td>
</tr>
<tr>
<td>EAP</td>
<td>East Asia and the Pacific Region</td>
</tr>
<tr>
<td>ECA</td>
<td>Eastern and Central Asia Region</td>
</tr>
<tr>
<td>EPA</td>
<td>Environment Protection Agency - USA</td>
</tr>
<tr>
<td>FANR</td>
<td>Federal Authority for Nuclear Regulation</td>
</tr>
<tr>
<td>GCC</td>
<td>Gulf Cooperation Council</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>Gg CO₂ eq</td>
<td>Gigagrams Carbon Dioxide Equivalent</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse Gas</td>
</tr>
<tr>
<td>Hg</td>
<td>Mercury</td>
</tr>
<tr>
<td>Gt CO₂ eq</td>
<td>Gigaton Carbon Dioxide Equivalent</td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel of Climate Change</td>
</tr>
<tr>
<td>ISWA</td>
<td>International Solid Waste Association</td>
</tr>
<tr>
<td>ISWM</td>
<td>Integrated Solid Waste Management</td>
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<tr>
<td>kg</td>
<td>Kilogramme</td>
</tr>
<tr>
<td>LAC</td>
<td>Latin America and the Caribbean Region</td>
</tr>
<tr>
<td>MCM</td>
<td>Million Cubic Metres</td>
</tr>
<tr>
<td>MENA</td>
<td>Middle East and North Africa Region</td>
</tr>
<tr>
<td>MSW</td>
<td>Municipal Solid Waste</td>
</tr>
<tr>
<td>mt CO₂ eq</td>
<td>metric tons Carbon Dioxide Equivalent</td>
</tr>
<tr>
<td>N₂O</td>
<td>Nitrous Oxide</td>
</tr>
<tr>
<td>NH₄</td>
<td>Ammonium</td>
</tr>
<tr>
<td>NO₃</td>
<td>Nitrate</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-Operation and Development Region</td>
</tr>
<tr>
<td>RCRA</td>
<td>Resource Conservation and Recovery Act</td>
</tr>
<tr>
<td>SAR</td>
<td>South Asia Region</td>
</tr>
<tr>
<td>SCAD</td>
<td>Statistical Centre - Abu Dhabi</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>WtE</td>
<td>Waste-to-Energy</td>
</tr>
</tbody>
</table>
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INTRODUCTION

The OECD defines wastes as: “Wastes are materials that are not prime products (that is products produced for the market) for which the initial user has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose” 1

Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded.

This report is made up of nine sections organised into three main parts displaying the relationships between society and the environment.

THE MAIN GOAL
to keep governments and stakeholders informed as to the status and trends of waste in Abu Dhabi Emirate. The data that used in this report represent the period of 2009 to 2014.

ENVIRONMENTAL CONSERVATION:
Since its establishment, the United Arab Emirates has put forth sustained efforts toward striking a balance between economic and social growth and the preservation of its cultural, social and environmental heritage, to ensure sustainable development for the present and future generation.

H.H. Sheikh Khalifa Bin Zayed Al Nahyan,
President of United Arab Emirates.

Using the drivers, pressures, state, impacts and responses (DPSIR) analytical framework helps to identify and evaluate the complex and multidimensional cause-and-effect relationships between society and the environment. Drivers such as population dynamics, economic demand and unsustainable consumption and production patterns are processes that lead to impacts on the environment. These drivers often directly or indirectly result in environmental pressures including increased emissions of pollutants and wastes and destructive resource extraction. Such pressures cause changes to the environment with concomitant impacts on both humans and ecosystems. The DPSIR analytical framework helps to identify these processes. Also the government and community responses to mitigate the impact of the derived risks out of these processes are documented. Moreover, the future outlook that can take many forms at many scales from government and community actions not only to the underlying drivers, but also to the environmental pressures and their impacts on ecosystems and human health.

Environment Agency – Abu Dhabi (EAD) and Tadweer are the key entities with a mandate for waste management within Abu Dhabi Emirate. These entities are responsible for drafting and implementing the Waste Management Strategy and all aspects of service delivery required to establish a full cycle integrated waste management system in line with the Abu Dhabi 2030 plan.
DRIVERS, PRESSURES AND IMPACTS OF WASTE ON THE ENVIRONMENT
Population growth together with economic development, are the main drivers for waste generation in Abu Dhabi Emirate. Where, accordingly, the annual per capita GDP amounted to AED 358.6 thousand in 2014 and AED 388.6 thousand in 2013.

The resident population of Abu Dhabi Emirate was 2,656,448 people in 2014 with an annual population growth rate of 7.6%. However, the population density of Abu Dhabi Emirate in 2014 was 44.7 persons per square kilometre and in 2013 were 41 persons per square kilometre. Figure (1) displays the trend of population increase in the period of 2010 to 2014 together with the GDP growth per year.
FIG (2) : Population Density Growth
The population density of Abu Dhabi Emirate in 2014 was 44.7 persons per square kilometre. The population density in Abu Dhabi Region, Al Ain Region and Al Gharbia were 148.9, 52.6, and 8.9 persons per square kilometre respectively.

Figure (2) displays the changes in population density within the three regions and in Abu Dhabi Emirate as a whole, from the period started from 2005 to 2014. This chart shows about 93.5% population growth in Abu Dhabi Emirate during this period, which is one of the mean drivers for increased generation of waste. Also Abu Dhabi region is the highest population density; meanwhile Al Gharbia is the most sparsely populated region in the Abu Dhabi Emirate but with a fast population growth.
The environmental stress indicator is the amount of the municipal solid waste generated in a country divided by country’s area, expressed in (ton/km²), where Abu Dhabi Emirate’s area is 59,434.7km². Fig (3)
The greatest environmental stress from the waste generation was in 2012 with 214 ton/km², while the least was in 2009 with 162 ton/km², followed by 167 ton/km² in 2014.
WASTE IMPACT ON
ENVIRONMENT
Waste is any substance discarded after primary use that is worthless, defective and of no use. Proper waste management comprises those activities and actions necessary to manage waste from creation to final disposal to conserve the environment and protect human health. Without proper waste management, solid waste can attract insects, vermin, and scavenging animals. This can in turn lead to the spread of air or water-borne diseases. Lack of proper waste management can also lead to contamination of surface and groundwater, as well as soil and air. This can cause more problems for humans, other species, and ecosystems.

A. WASTE AND CLIMATE CHANGE

Every year, more than 11 billion tons of solid waste is collected worldwide and decay of the organic proportion of solid waste contributes to about 5% (1,460 mt CO₂ eq) of global Greenhouse Gas (GHG) emissions. Encouraging waste minimisation through MSW programmes can therefore have significant up-stream GHG minimisation benefits.

Methane from landfills represents 12% of total global methane emissions (EPA 2006b). Landfills are responsible for almost half of the methane emissions attributed to the municipal waste sector in 2010 (IPCC, 2007). The level of methane from landfills varies by country, depending on waste composition, climatic conditions (ambient temperature, precipitation) and waste disposal practices.
In 2010 and 2012, the waste sector was the source of 279 kg mercury emissions (58% and 52% of Abu Dhabi Emirate total emissions in the year 2010 and 2012 respectively). The largest atmospheric mercury emission source from the waste sector is associated with releases from mercury used intentionally in products, leading to emissions from waste landfills, waste recycling, and from breakage during use. Minor emissions were expected from incineration of medical waste Fig (5).

### C. WASTE AND MERCURY EMISSION

In Abu Dhabi Emirate, based on the collected information and assumptions described below, waste sector comprises: MSW disposal, domestic/commercial wastewater treatment as well as sludge treatment. The GHG emissions from the waste sector were estimated at 6,857 Gg CO$_2$ eq, of which about 92% of emissions were due to solid waste disposal in the dumpsites and landfills and about 8% were due to wastewater treatment Fig (4). The dominant emission was followed by N$_2$O. In the overall inventory, the contribution of waste sector was about 6.9% of the total GHG emissions.

### FIG (4) : GHG Emissions from Waste

![Bar chart showing GHG emissions from waste](image)

<table>
<thead>
<tr>
<th>Greenhouse Gas Source &amp; Sink Categories</th>
<th>Total GHG Emissions (Gg CO$_2$ eq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Total</td>
<td>6,856.90</td>
</tr>
<tr>
<td>Solid Waste Disposal</td>
<td>6,318.57</td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>538.34</td>
</tr>
</tbody>
</table>

### PAGE 17
Usually public health concerns are the basis for solid waste management programmes. Inappropriately managed waste can attract rodents and insects, which can harbour gastrointestinal parasites and other conditions for humans, and exposure to hazardous wastes, particularly when they are burned, can cause various other diseases including cancers.

Poorly collected or improperly disposed of waste can have a detrimental impact on the environment. Lack of enforced regulations increases the potential of illegal dump sites, which is harmful to population and the environment. Also, increases the environmental threats include contamination of groundwater and surface water by leachate, as well as air pollution from burning of waste that is not properly collected and disposed.
STATE AND TREND OF WASTE AND ENVIRONMENT
ENVIRONMENT
STATE AND TREND OF WASTE AND

02
WHERE ARE WE?
The daily average Municipal Solid Waste (MSW) generation per capita in 2012 of the world regions were calculated by the World Bank and represented in Fig (6) together with Abu Dhabi Emirate daily average per capita at 2014 to show the position of Abu Dhabi comparing to the world regions. The average of Abu Dhabi was calculated using the 2014 data available from Statistical Centre of Abu Dhabi (SCAD). The minimum average of MSW generation with 0.45 Kg/capita/day for the SAR region and the maximum average were 2.2 kg/capita/day of the OECD region. Meanwhile Abu Dhabi average is 1.56 kg/capita/day considered as the second highest region in generating MSW.
B. ABU DHABI AND GULF COOPERATION COUNCIL

The Gulf Cooperation Council (GCC) comprises Saudi Arabia, Kuwait, Bahrain, Qatar, United Arab Emirates (UAE), and the Sultanate of Oman. The daily average MSW generation per capita of GCC countries (see Figure 7) were calculated using data from World Bank (2012), Kuwait Statistical Year Book (2013), and Abu Dhabi Emirate’s SCAD (2014) to show the position of Abu Dhabi in comparison to GCC countries. UAE is considered the highest amongst GCC countries in generating MSW while Oman is the lowest.

FIG (7) : Average Municipal Waste Generation form Abu Dhabi and the GCC (2012 - 2014)
FIG (8) : Municipal Waste Generation from Abu Dhabi Emirate and other Emirates

Legend
- Abu Dhabi
- Ajman
- Dubai
- Fujairah
- Ras Al Khaimah
- Sharjah
- Umm Al Quwain
Total waste generated in 2014 of Abu Dhabi Emirate was 10,001,810 tonnes, and 83,220 tonnes out of the total categorised as hazardous waste generated from hospitals, factories and oil and gas sector. Meanwhile, 9,918,590 tons of the total waste was categorised as non-hazardous waste generated from municipal sector and Construction and demolition, industrial sector, commercial sector and agricultural sectors and others Fig. (9).
According to the available data from SCAD, the following chart Fig (10) displays the trend of total waste generations in Abu Dhabi. The diagram displays waste generation data from 2009 to 2014. Waste generation increases gradually over time, with an average rate of 24% up to a maximum in 2012 and starts to gradually decline until 2014 with average rate of 21.8%.
Non-Hazardous waste is classified according to the source of waste into construction and demolition waste, industrial and commercial waste, municipal waste, agriculture waste and sludge. Construction and demolition sector generate more than 44.6% of the non-hazardous waste, 33.4% of this waste is from industrial and commercial sector followed by municipal and agriculture sectors Fig (11). Meanwhile, Fig (12) displays the trend of Non-Hazardous waste generations along the Period of 2009 to 2014, which is increased until 2012 and starts decreased toward 2014.

**FIG (11) : Quantities of Non-Hazardous Waste Categories**

**FIG (12) : Trend of Non-Hazardous Waste Generations**

- Non-hazardous waste
- Change in non-hazard waste generation
This includes building materials such as insulation, nails, electrical wiring, and rebar, as well as waste originating from site preparation such as dredging materials, tree stumps, and rubble. Construction waste may contain lead, asbestos, or other hazardous substances while demolition waste is waste debris from destruction of a building. The debris varies from insulation, electrical wiring, rebar, wood, concrete, and bricks. It also may contain lead, asbestos or different hazardous materials. Fig (13) shows the trend of C&D waste generation in Abu Dhabi Emirate is increased until 2012 and starts decreased toward 2014.

**FIG (13) : Trend of C&D Waste Generation**

<table>
<thead>
<tr>
<th>Year</th>
<th>Waste Generation (ton)</th>
<th>Change in C&amp;D waste generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>7,050,000</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>7,403,000</td>
<td>353,000</td>
</tr>
<tr>
<td>2011</td>
<td>7,624,575</td>
<td>221,575</td>
</tr>
<tr>
<td>2012</td>
<td>9,628,309</td>
<td>2,003,734</td>
</tr>
<tr>
<td>2013</td>
<td>7,692,921</td>
<td>-1,935,388</td>
</tr>
<tr>
<td>2014</td>
<td>4,419,665</td>
<td>-3,273,256</td>
</tr>
</tbody>
</table>

● Construction and Demolition waste  ● Change in C&D waste generation
2. CHANGE IN MUNICIPAL SOLID WASTE GENERATION

MSW is a waste type consisting of everyday items that are discarded by the public Fig (14) such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, and others. Fig (15) shows the trend of MSW generation in Abu Dhabi Emirate is increased until 2013 and starts decreased toward 2014.

**FIG (14) : Municipal Solid Waste Components**

- 7% Others
- 25% Paper and Paper Board
- 39% Organic Materials
- 3% Textile
- 19% Plastic
- 3% Metals
- 4% Glass

**FIG (15) : Trend of MSW Generation**

Waste Generation & Trend (ton)

- 2009: 1,072,186
- 2010: 1,073,000
- 2011: 1,105,602
- 2012: 1,277,648
- 2013: 1,528,093
- 2014: 1,466,590

Legend:
- Municipal Solid Waste
- Change in MSW generation
Agricultural waste is biodegradable waste that may comprise farm, forest, garden or park waste, such as grass or flower cuttings and hedge trimmings, as well as domestic and commercial food waste. Fig (16) shows the trend of agriculture waste generation in Abu Dhabi Emirate is increased until 2013 and starts decreased toward 2014.

**FIG (16) : Trend of Agricultural Waste Generation**

- 2009: 754,571
- 2010: 792,300
- 2011: 816,069
- 2012: 898,258
- 2013: 999,239
- 2014: 561,991

Agricultural waste

Change in Agricultural waste generation
Commercial waste is the waste from premises used wholly or mainly for the purposes of a trade or business or for the purpose of sport, recreation, education or entertainment but not including household, agricultural or industrial waste.

Industrial waste is the waste produced by industrial activity which includes any materials rendered useless during a manufacturing process such as that of factories, mills, and mining operations. Fig (17) shows a trend of increasing industrial and commercial waste generation in Abu Dhabi Emirate.

**FIG (17) : Trend of industrial and Commercial Waste Generation**

<table>
<thead>
<tr>
<th>Year</th>
<th>Waste Generation &amp; Trend (ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>594,857</td>
</tr>
<tr>
<td>2010</td>
<td>625,000</td>
</tr>
<tr>
<td>2011</td>
<td>641,338</td>
</tr>
<tr>
<td>2012</td>
<td>801,747</td>
</tr>
<tr>
<td>2013</td>
<td>1,065,586</td>
</tr>
<tr>
<td>2014</td>
<td>3,312,125</td>
</tr>
</tbody>
</table>

- **Industrial and commercial waste**
- **Change in industrial & commercial waste generation**
5. CHANGE IN SLUDGE GENERATION

Sludge is semi-solid slurry produced as sewage sludge from wastewater treatment processes. Fig (18) shows the trend of sludge generation in Abu Dhabi Emirate is slightly increased until 2011 and strongly decreased at 2012 then increased at 2013 and deceased again at 2014.

![FIG (18) : Trend of Sludge Generation](image)

6. CHANGE IN WASTEWATER GENERATION

Wastewater is any water that has been adversely affected in quality by anthropogenic influence. Wastewater can originate from a combination of domestic, industrial, commercial or agricultural activities, surface runoff or storm water, and from sewer inflow or infiltration.

Fig (19) shows the trend of the domestic wastewater generation in Abu Dhabi Emirate in million cubic metres (mcm).

![FIG (19) : Trend of Wastewater Generation](image)
Hazardous waste is waste with properties that make it dangerous or potentially harmful to human health or the environment. Hazardous wastes can be liquids, solids, contained gases, or sludge. They can be the by-products of manufacturing processes or simply discarded commercial products, like cleaning fluids or pesticides. Hazardous wastes are divided into two major categories: characteristic wastes and listed wastes. Characteristic hazardous wastes are materials that are known or tested to exhibit one or more hazardous traits such as: ignitability, reactivity, corrosivity, toxicity. Listed hazardous wastes are materials specifically listed by regulatory authorities as hazardous waste that are from non-specific sources, specific sources, or discarded chemical products. Hazardous waste is generated from different sources like the industry sector (non-oil and gas, oil and gas industries) which is responsible for approximate 67% of the hazardous waste generations followed by 18% of the slaughterhouses waste, 2% medical waste and 13% of other sources Fig (20). Fig (21) shows the trend of hazardous waste generation along this period.
I. CHANGE IN INDUSTRIAL HAZARDOUS WASTE GENERATION

I. OIL & GAS INDUSTRIAL HAZARDOUS WASTE

Oil and gas waste is part of the industrial hazardous waste and defined as any petroleum-based or synthetic oil that through contamination has become unsuitable for its original purpose due to the presence of impurities or loss of original properties. Fig (22) shows the trend of Oil and Gas Hazardous waste generation, and Fig (23) shows the trend of Non-Oil and Gas Hazardous waste generation throughout this period.
II. NON-OIL & GAS INDUSTRIAL HAZARDOUS WASTE

FIG (22) : Trend of Oil & Gas Hazardous Waste Generation

FIG (23) : Trend of Non-oil & Gas Hazardous Waste
2. CHANGE IN MEDICAL WASTE GENERATION

Medical wastes are the results of medical, nursing, dental, pharmaceutical including expired medicines or other related clinical activity, being waste that has the potential to cause injury, infection, or offence. **FIG (24) shows the trend of medical waste generation.**

**FIG (24) : Trend of Medical Waste Generation**
WASTE MANAGEMENT IN

ABU DHABI
Integrated solid waste management (ISWM) reflects the need to approach solid waste in a comprehensive manner with careful selection and sustained application of appropriate technology, working conditions, and establishment of a ‘social link’ between the community and designated waste management authorities (most commonly local government). ISWM is based on both a high degree of professionalism on behalf of solid waste managers; and on the appreciation of the critical role that the community, employees, and local (and increasingly global) ecosystems have in effective SWM. ISWM should be driven by clear objectives and is based on the hierarchy of waste management: reduce, reuse, recycle — often adding a fourth ‘R’ for recovery and life cycle approach (LCA).²

LCA and the waste hierarchy consider ISWM is environmentally effective and economically affordable. This approach will take into consideration a combination of reduction in the amount of waste generated, reuse or recycling of waste, including resource recovery, treating the waste using the best available technology and disposal in sanitary landfill, only when waste cannot be managed.

FIG (25) : Abu Dhabi Integrated Solid Waste Management

Fig (26) shows the waste facilities in Abu Dhabi Emirate.

**A. WASTE FACILITIES IN ABU DHABI EMIRATE**

- **DUMPSITE:**
  10 controlled dumpsites distributed across the emirate of Abu Dhabi in the three regions i.e. Al Dhafra, Al Ain, Ruwais, Madinat Zayed, Al Mirfa, Al Jabanna, Al Sila’a, Al Gurban, ADNOC.

- **TRANSFER STATION:**
  10 stations are distributed among the three regions of the emirate of Abu Dhabi in different locations e.g. Al Mafraq, Remah, Al Wagan, Al Hiyar, Sweihan, Al Mafraq.

- **SANITARY LANDFILL:**
  one landfill site in Al Ain

- **SORTING PLANT:**
  1 sorting stations are located in Al Ain and Al Dhafra

**FIG (26) : Waste Facilities 2014**
• Compost Plant: 4 plants are distributed in different location of Abu Dhabi Emirate e.g. Al Ain, Al Mafraq, Liwa, and Al Khatim.

• Recycling: 2 Construction and demolition Crushing plants were built in Al Ain and Al Dhafra. Waste Engine Oil plant in Al Musaffah is recycling the engine oils. Waste Tyre Plant in western region is recycling the tyres.

• Incinerator: 2 medical and animal waste incinerators are operating in Al Ain.

Fig (27) Shows the geographical distribution of the waste facilities along Abu Dhabi Emirate.
Abu Dhabi aims to reduce solid waste generation to deal with the increasing amount year by year, which causes a negative impact on the environment and on the public health. Based on the government target municipal solid waste will be reduced to 1.5 kg/capita/day by 2021, also to divert 75% of the solid waste from the landfill sites by 2021.

According to the data analysis of waste generated the amount of waste generation increased until 2012 but then started to decrease with significant changes. However, there are no effective initiatives or activities on the ground to reduce the waste generations behind this change in the trend.
A MUNICIPAL SOLID WASTE PER CAPITA INDICATOR

Municipal solid waste per capita indicator is total average amount of municipal solid waste generated annually divided by population, and then the result will be divided by the number of days per year (kg/capita/day).

FIG (28) : Municipal solid Waste Indicator

The chart shows that the maximum MSW per capita is 1.71 kg/capita/day at 2013, while the minimum MSW per capita is 1.43 kg/capita/day at 2011.

HOWEVER, THE GOVERNMENT TARGET IS 1.5 KG/CAPITA/DAY IN 2021 FIG (28).
Recycling is a process to convert waste materials into reusable material to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution (from incineration) and water pollution (from landfilling) by reducing the need for “conventional” waste disposal and lower greenhouse gas emissions. Recycling is a key component of modern waste reduction and is the third component of the waste hierarchy “Reduce, Reuse and Recycle”.

The government target is to divert 75% of the Municipal Solid waste from the landfill sites by 2021.
Landfill site is a site for the disposal of waste materials by burial and is the oldest form of waste treatment. Historically, landfills have been the most common method of organised waste disposal and remain so in many places around the world.
and more than 75% was dumped in the landfill sites as shown in Fig (29). This figure is very far from the government target by 2021, which will need a great deal of effort to meet this target in the coming years.

Waste statistical 2014 data (SCAD, 2014) shows that 23% of the total collected solid waste was recycled.

At the simplest level, the process of composting simply requires making a heap of wetted organic matter known as green waste (leaves, food waste) and waiting for the materials to break down into humus after a period of weeks or months. The decomposition process is aided by shredding the plant matter, adding water and ensuring proper aeration by regularly turning the mixture. Worms and fungi further break up the material. Bacteria requiring oxygen to function (aerobic bacteria) and fungi manage the chemical process by converting the inputs into heat, carbon dioxide and ammonium.

Compost is organic matter that has been decomposed and recycled as a fertiliser and soil amendment. Compost is a key ingredient in organic farming.
Meanwhile the following chart Fig (30) displays the ratio of total waste diversion by source from disposing to landfills. Agriculture wastes represent the highest percentage of waste diversion followed by Construction and Demolition, industrial and commercial waste and MSW is the least percentage of waste diversion.

FIG (30) : Waste Diversion by Sector
The official figures on waste generation in Abu Dhabi do not begin to tell the whole story. They do not include large quantities of waste dumped at thousands of illegal sites scattered along the emirate, some of which have been in use for many years and are steadily growing in size, polluting the environment and threatening the public health. Meanwhile, there is significant increase of the illegal waste dump sites in the entire emirate of Abu Dhabi.

The recent study was completed at 2015 to determine the distribution of illegal dumpsites along Abu Dhabi Emirate. This study was prepared by using high resolution Aerial photography analysis to map the illegal dumpsites. 53% out of illegal dumpsites was located in Al Ain region mainly around farms and Ezab areas, 30% in western region, and 17% in Abu Dhabi region. There is increase with more than 35% in illegal dumpsites comparing to the 2007 survey Fig (32).

FIG (31) : Non-Hazardous Solid Waste Generation by Region

C. WASTE GENERATION FROM REGIONS

The official statistics as of 2014 estimated that 9,918,591 tonnes of solid wastes were produced in the emirate of Abu Dhabi during 2014, which is equal to more than 27,174 tonnes every day with approximately 68% of the total waste was generated from Abu Dhabi region, compared with 18% in the Western region and 14% in Al Ain region Fig (31).

D. ILLEGAL DUMPSITES IN THE EMIRATE OF ABU DHABI
In many countries, informal waste pickers contribute significantly to waste management and resource efficiency by collecting, sorting, trading and sometimes even processing waste materials. With the focus of the Millennium Development Goals on poverty reduction, and of waste strategies on improving recycling rates, one of the major challenges in solid waste management in developing countries is how best to work with this informal sector to improve their livelihoods, working conditions and efficiency in recycling.

In Abu Dhabi, the informal sector is affecting the official figures on waste generation and it is lead to increasing the number of illegal dumpsites. This sector begins to grow starting from 2013 and 2014 with the absence of effective policy to control this sector, which is affected the official figure of waste generation in this period. This is in addition to the internal and external export activities of the waste materials, where UAE was ranked the 9th in the world on exporting the used metals especially copper in the world.

One of the challenges in solid waste management in Abu Dhabi is how best to work with this informal sector to improve the control of waste life cycle, which will reflect positively on the economy and increase the opportunity to new business development and mitigating the environment impact of the waste. In addition to get the right figures of waste generation in Abu Dhabi Emirate.
RESPONSE AND OUTLOOK
OF WASTE AND
ENVIRONMENT
KEY INITIATIVES IN WASTE MANAGEMENT
The high-level strategy for Abu Dhabi waste management was developed jointly by the Environment Agency - Abu Dhabi (EAD), Tadweer (Center of Waste Management - Abu Dhabi CWM), Federal Authority for Nuclear Regulation (FANR), and the Abu Dhabi Sewerage Services Company (ADSSC). It is also addresses oil and gas waste to be inclusive of all types.

The strategy aims to upgrade the Emirate’s waste management infrastructure, operations, monitoring, and funding mechanisms in the course of the next 5-10 years in the Abu Dhabi environment vision 2030.

The Environment Agency - Abu Dhabi (EAD), in collaboration with Tadweer (Center of Waste Management - Abu Dhabi), has issued in 2015 a set of policies and guidelines with the aim of reinforcing sustainable waste management in the Emirate of Abu Dhabi.

The new policies include waste planning policy, waste classification policy, licensing and enforcement policy, waste collection, segregation, transfer and tracking policy, waste reuse, recycling, and resource recovery, treatment and disposal policy in addition to a technical guideline for waste classification.
Working alongside with its stakeholders, EAD recently led efforts on developing an overall strategy for waste management in Abu Dhabi. The strategy outlines roles and responsibilities, in addition to detailing mechanisms for the development and adoption of policies, regulations, guidelines and executive decrees. These policies will serve as a guiding framework for the waste sector, and will aid in EAD mission to creating a completely integrated system that encourages recycling and reusing, and reducing the waste sent to landfills. This step marks a major milestone in EAD contribution towards the Government’s strategy to further transform Abu Dhabi into a city that continues to meet global standards.

Imposing tariffs on waste is one of the many means universally adopted for the purpose of reducing the volume of production, a measure to promote waste reduction at its source. Tadweer (Center of Waste Management - Abu Dhabi) has adopted the tariff system in order to preserve the emirate’s environment from the negative impact of waste production to create a sustainable Abu Dhabi for future generations.

The Tariff system is applied on commercial and industrial sectors. Tadweer (Center of Waste Management - Abu Dhabi) has also developed technical procedures, manuals and guidelines outlining the services provided by all companies operating in the field of waste management in the emirate, which includes both waste producers and environmental services providers.

C. LICENSES, TARIFFS AND CUSTOMER SERVICE

SERVICE

TADWEER MANUALS INCLUDE INFORMATION ABOUT ALL TYPES OF SERVICES PROVIDED TO CUSTOMERS, WITH THE REQUIRED DOCUMENTS, FEES AND TIME FRAME OF EACH SERVICE.
Many participants have already seen the benefits of reducing wasteful paper use; it saves money, it saves time, it encourages a more resource savvy approach to life and doing business and it reduces waste. It also reduces our impact on the environment and our contribution to climate change by saving trees (forest habitats and species), reducing water use, water & air pollution and carbon emissions, plus it decreases the amount of waste that goes to landfill. Reducing wasteful paper use makes sense for individuals, for business, for our environment, for our future. In 2013 and beyond, Paperless Day will continue to be held on the 3rd Wednesday of November.

The number of participants for Paperless Day, an initiative organised by the Environment Agency - Abu Dhabi, increased from 270,000 people in 2011 to 294,075 people in 2012 including individuals, government organisations, universities and NGOs from UAE. Paperless Day 2012 was supported by a number of organisations from government; semi-government, private and education sectors, and the 2012 Paperless Day results in a reduction of nearly 14 ton of CO₂ emitted.
The Abu Dhabi Urban Planning Council (UPC) is recognised internationally for large-scale sustainable urban planning and for rapid growth.

**PLAN ABU DHABI 2030**

Urban master plan addresses sustainability as a core principle.

Estidama, which is the Arabic word for sustainability, is an initiative developed and promoted by the UPC. Estidama is the intellectual legacy of the late Sheikh Zayed bin Sultan Al Nahyan and a manifestation of visionary governance promoting thoughtful and responsible development. The leadership of Abu Dhabi are progressing the principles and imperatives for sustainable development through Estidama, while recognising that the unique cultural, climatic and economic development needs of the region require a more localised definition of sustainability.

Estidama is not just a rating method or something people do, it is a vision and a desire to achieve a new sustainable way of life in the Arab world.

**THE ULTIMATE GOAL**

of Estidama

is to preserve and enrich Abu Dhabi's physical and cultural identity, while creating an always improving quality of life for its residents on four equal pillars of sustainability: environmental, economic, social, and cultural. This touches all aspects of life in Abu Dhabi - the way we build, the way we resource, the way we live, the choices we make - all in an effort to attain a sustainable state of living.

Estidama arose from the need to properly

**PLAN, DESIGN, CONSTRUCT OPERATE SUSTAINABLE DEVELOPMENTS**

with respect to the traditions embedded within the rich local culture on one hand and the harsh climatic nature of the region on the other. To this end, project owners, developers, design teams and even residents need to think differently about how they approach the design and planning process.
The ‘Saving Grace’ Project, known locally as Hefth Al Ne’ma, is a humanitarian initiative overseen by the Red Crescent Authority in order to overcome the extravagance and waste of surplus of food, and redistribute it to the poor and needy with the support of the Abu Dhabi Food Control Authority and the Department of Municipal Affairs - Abu Dhabi Municipality.

Since its establishment in 2005, the project contributed to alleviate the suffering of thousands of needy families, orphans and workers as well as increased public awareness about the importance of empathy with the suffering of the disadvantaged in society.

The project is divided into several sections aimed at:

- **Reducing Waste of Food**
- **Furniture**
- **Clothing**
- **Medicine**

The contributors such as hotels, restaurants, palaces and wedding halls inform the Red Crescent authority on schedule of events and ceremonies. Then, the project team prepares tools necessary to maintain the quality and temperature of the food and deliver it to the needy in the same day.
WASTE AND ENVIRONMENTAL OUTLOOK
A. Nuclear Waste

NUCLEAR WASTE HAS BEEN SAFELY STORED AROUND THE WORLD FOR DECADES.

ENECC is currently reviewing options for long-term storage, but disposal of solid waste will be done in strict accordance with the guidelines outlined by FANR and IAEA. For low level waste – storage options include near surface or geological repositories. For high level waste such as spent fuel, these can be safely stored and closely monitored either at the plant site or at a centralised location.
ICBA conducted number of applied studies to improve the soil quality in UAE by producing the biochar from the organic wastes that generated in farm areas. These studies aim to reuse the organic farm wastes to produce biochar with low cost technology that can be adopted by farmers in them farms.

Biochar (BC) is a carbon rich martial produced via pyrolysis of organic waste that comes from plants and animals (biomass) with limited oxygen that can be used as a soil conditioner and as a means to sequester carbon. It is by the pyrolysis of biomass by heating it in an oxygen free or low oxygen environment.

The low-cost biochar production technology has been tested at the ICBA station to transform date palm feedstock into valuable biochar at 300-350°C. The entire process took 2 hours to transform 30 kg of date palm feedstock into 10 kg biochar. Testing biochar produced from date palm feedstock to improve health of UAE soils to enhance crop production.

A growing population, a reliance on landfill sites and lack of sustainability led to a new master plan for disposal of the emirate’s waste. The Centre of Waste Management – Tadweer – revealed how it will tackle this challenge under its Abu Dhabi Waste Master Plan 2040.

"The emirate is facing many challenges pertaining to waste and among them is the exponential growth in population, which is expected to double over the next 25 years. We have to take action today, not tomorrow, nor next month.

Eisa Saif Al Qubaisi
General Manager of Tadweer"
The most recent figures, from 2013, show that 12 MILLION TONNES of waste was produced.

The plan to curtail levels of waste over the next 25 YEARS include stepping up recycling, especially for motor oil, construction waste, used tires, plastics and food.

This will lead to building a database about the volume and sources of waste, methods of disposal that support strategic decisions and develop future plans for waste management in line with the Abu Dhabi Plan 2030.

Mr Al Qubaisi

Society needs to be meticulously practicing segregation of recyclables from general waste. To achieve waste reduction objectives Tadweer is collaborating with the Environment Agency - Abu Dhabi.

Environment Agency – Abu Dhabi has taken the initiative to prepare a series of guidelines for sustainable waste management, illustrating key environmental sustainability challenges facing the emirate of Abu Dhabi and how to address them. The guideline will explain the steps that should be taken by organisations in the concerned sector to reduce the waste generation. It also addresses how they can take responsibility and play vital role in the collection, segregation, transfer and disposal of their waste.

Environment Agency – Abu Dhabi for the stakeholders, as one of this series of waste guidelines. The guideline explains the steps that should be taken by organisations in the construction sector to reduce the amount of waste generated on site and their role in the collection, segregation, transfer and disposal of their waste. Lessons-Learnt and Best-Practices are illustrated clearly by giving case studies to support findings and recommendations made. The guideline also highlights the benefits of an integrated professional and efficient waste management system, encouraging organisations to adopt it for a better and sustainable environment.
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