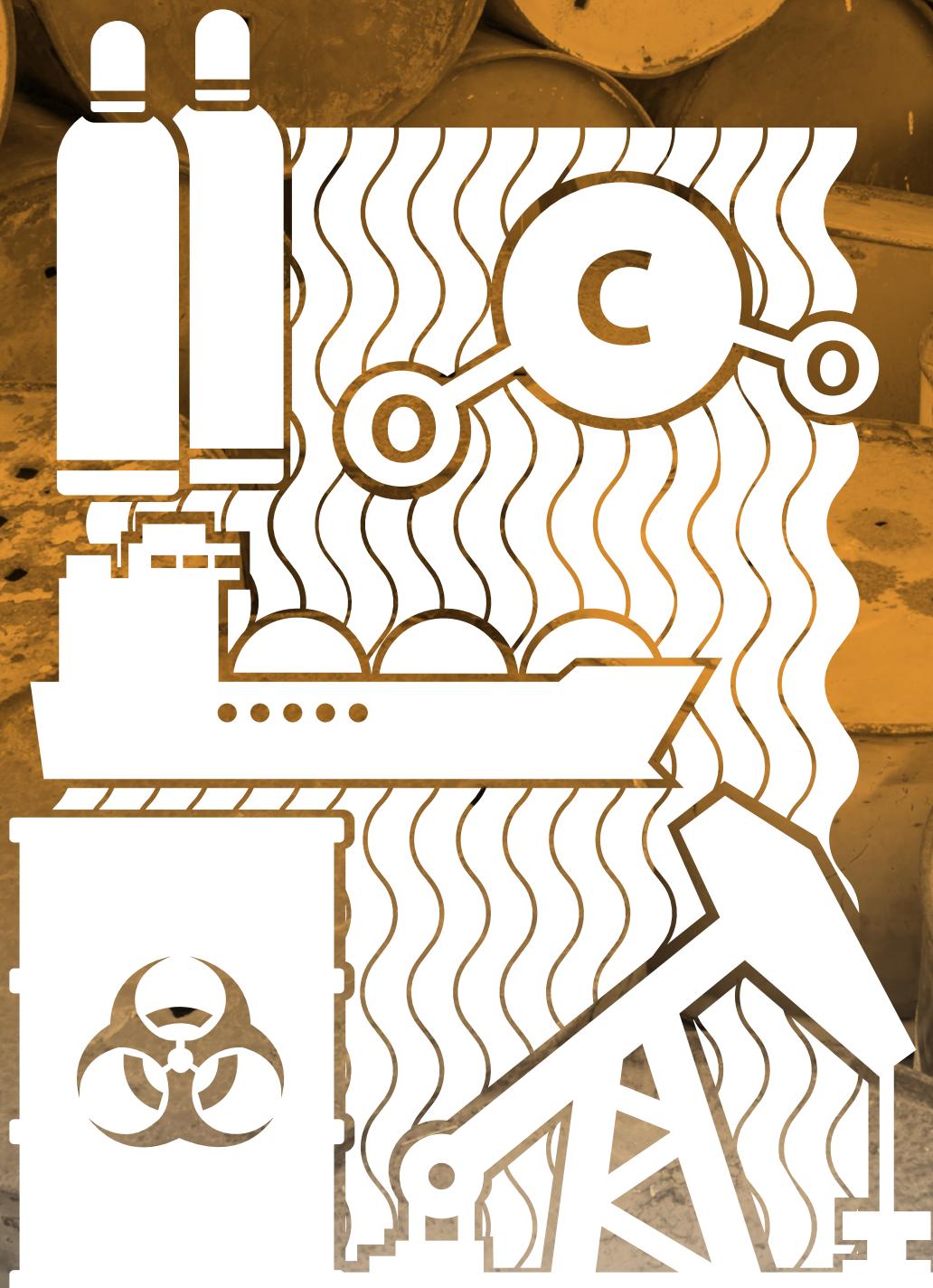


WASTE AND ENVIRONMENT ANNUAL REPORT

ABU DHABI 2019





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2- Waste Impact on Environment

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INTRODUCTION

The Organisation for Economic Cooperation and Development defined waste as follows: Waste refers to materials that are not prime products (that is, products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose⁽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 comprises three main parts that highlight the relationships between society and the environment.



THE MAIN OBJECTIVE OF THIS REPORT

Inform Abu Dhabi Government and its stakeholders on the status and trends of waste in the Emirate of Abu Dhabi. The data used in this report represents the period between 2013 - 2018.



PROTECTING THE ENVIRONMENT

Since its establishment, the United Arab Emirates embraced sustainable efforts to achieve balance between the economic and social growth and preserving its cultural, social and environmental heritage to ensure sustainable development for present and future generations.

**H.H. Sheikh Khalifa bin Zayed Al Nahyan,
President of the United Arab Emirates**

⁽¹⁾The Organisation for Economic Cooperation and Development 2013, Glossary of Statistic terms", (<http://stats.oecd.org/glossary/detail.asp?ID=2896>)

Using the DPSIR framework (Drivers, Pressures, State, Impacts and Responses) helps identifying and evaluating the complex and multidimensional relation between the cause and impacts, as well as with society and the environment. Drivers such as population growth and the economic development, consumption and production patterns create pressures upon the environment that can result in impacts the environment. These drivers generate environmental pressures including an increase in pollutant emissions, waste and destructive operations to extract resources. Such pressures cause

changes in the environment with impacts on both humans and the ecosystems and DPSIR helps analyse these processes. It also documents governmental and community responses to reduce the impact of risks arising from these operations. In addition, the future outlook can take many forms in many degrees of the government and societal measures, not only for the main driving forces but also to the environmental ones and their impacts on the ecosystems and human health.



Environment Agency – Abu Dhabi (EAD) and Abu Dhabi Waste Management Center (Tadweer) are two main entities that carry out the task of waste management in the Emirate of Abu Dhabi, and provide the required services to establish an integrated waste management system that is consistent with Abu Dhabi Plan 2030.



DRIVERS, PRESSURES AND IMPACTS OF WASTE ON THE ENVIRONMENT

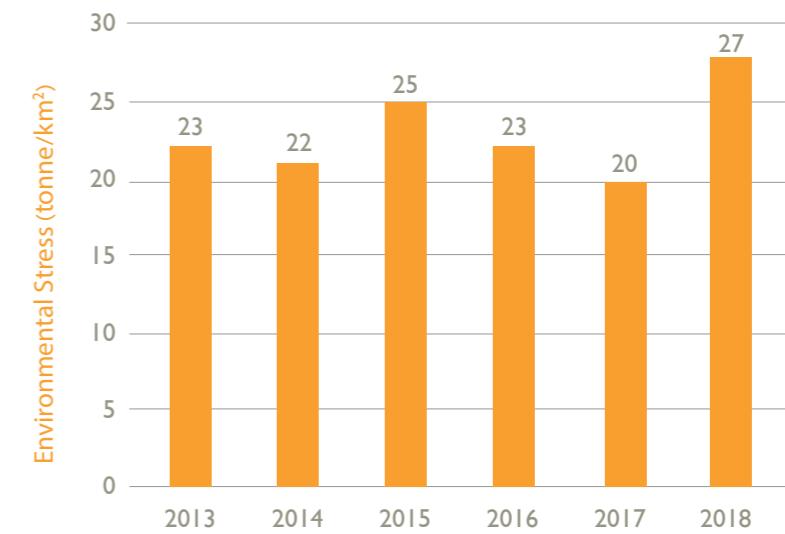
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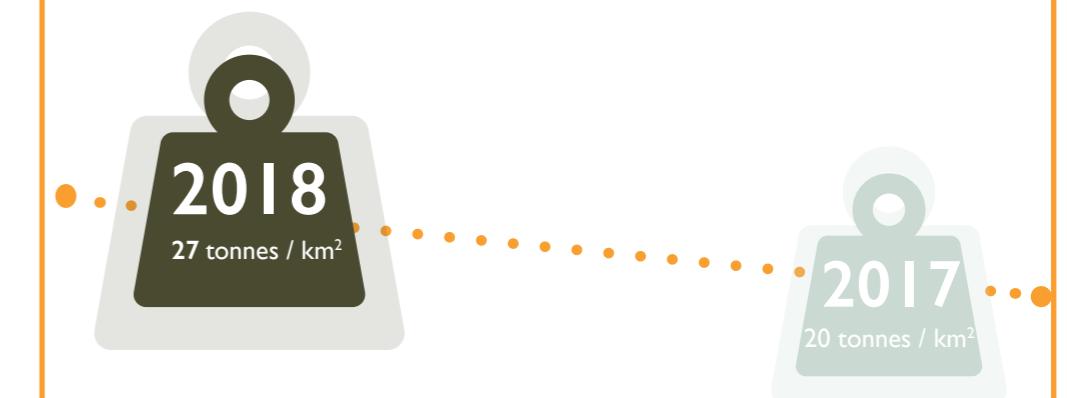
Population growth and economic development are two of the main forces of waste generation in the emirate. The environmental stress index⁽²⁾ is the amount of municipal solid waste generated in the emirate divided by the area of the emirate (tonne / km²), Figure (I).

The amount of municipal solid waste
Environmental Stress
Area of emirate

Figure (I) : Environmental Stress index



THE GREATEST ENVIRONMENTAL STRESS FROM THE WASTE GENERATION



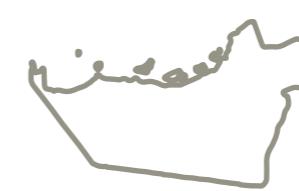
The greatest environmental stress from the waste generation was in 2018 with 27 tonnes/km², while the least was in 2017 with 20 tonnes/km².



Waste is any substance that is disposed of after use or to be disposed of where it becomes worthless, defective and not usable. Adequate waste management includes these activities and procedures needed from production to final disposal for the preservation of the environment and protect human health. Without a proper management for waste,

solid waste may attract insects, rodents and animals that dig waste, which in turn may lead to outbreaks of diseases transmitted through air or water. The absence of proper waste management may pollute surface and groundwater, as well as soil and air. It also can cause more problems for humans and other species and ecosystems.

A) WASTE AND CLIMATE CHANGE



9.8 million
tonne of non-hazardous solid waste in the emirate of Abu Dhabi

Abu Dhabi's waste sector contributes with 3.61% of greenhouse gases 4,892 Gigagrams of CO₂ equivalent according to the latest greenhouse gas inventory of Abu Dhabi Emirate in 2016. It includes gas emissions of Methane, Carbon Dioxide, Nitrous Oxide, while Methane represent 98% emissions compared to other gases.

Between 2010 and 2012 the total emissions of greenhouse gases emissions from the waste sector increased by 23%, while it decreased

in 2016 by 28%, Figure (2). The main reason for this decrease in the last years is the low amount of solid waste dumped as a result to low waste generation per capita, in addition to the change in composition of waste material (lower degradable organic compound- DOC) and the improved wastewater treatment technology (lower biological oxygen demand and methane conversion factors) also contributed in the emission decrease to a small extent.

Figure 2: Greenhouse gases trend in Abu Dhabi



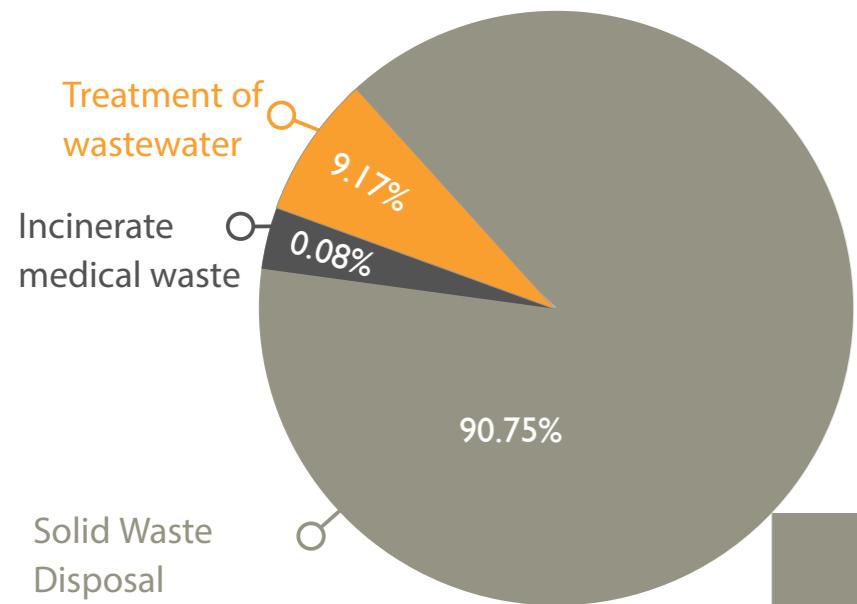
B) WASTE AND GREENHOUSE GAS EMISSION

The GHG emissions arising from the waste sector include CH₄ from MSW disposal sites, methane emissions from treatment of domestic wastewater and sludge, and N₂O from human sewage through wastewater treatment.

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 4,892 Gg CO₂ eq, of which about 90.75 % of emissions were due to solid waste disposal in the dumpsites and the landfill, about 9.17 % were due to wastewater treatment and about 0.08 % were due to medical incinerator waste, Figure (3).

Figure (3) : GHG Emissions from Waste



Greenhouse Gas Source & Sink Categories	Total GHG Emissions (Gg CO ₂ eq)
Waste Total	4,892
Solid Waste Disposal	4,439.4
Treatment of wastewater	448.6
Incinerate medical waste	3.73

C) PUBLIC HEALTH

Public health concerns are usually the basis of solid waste management programmes. Thus, inappropriate waste management can attract rodents and insects, it can also harbour intestinal

parasites and other diseases for humans, and can result from exposure to dangerous waste, especially when exposed to combustion, it may cause various other diseases, including cancer.

D) ENVIRONMENTAL PROTECTION

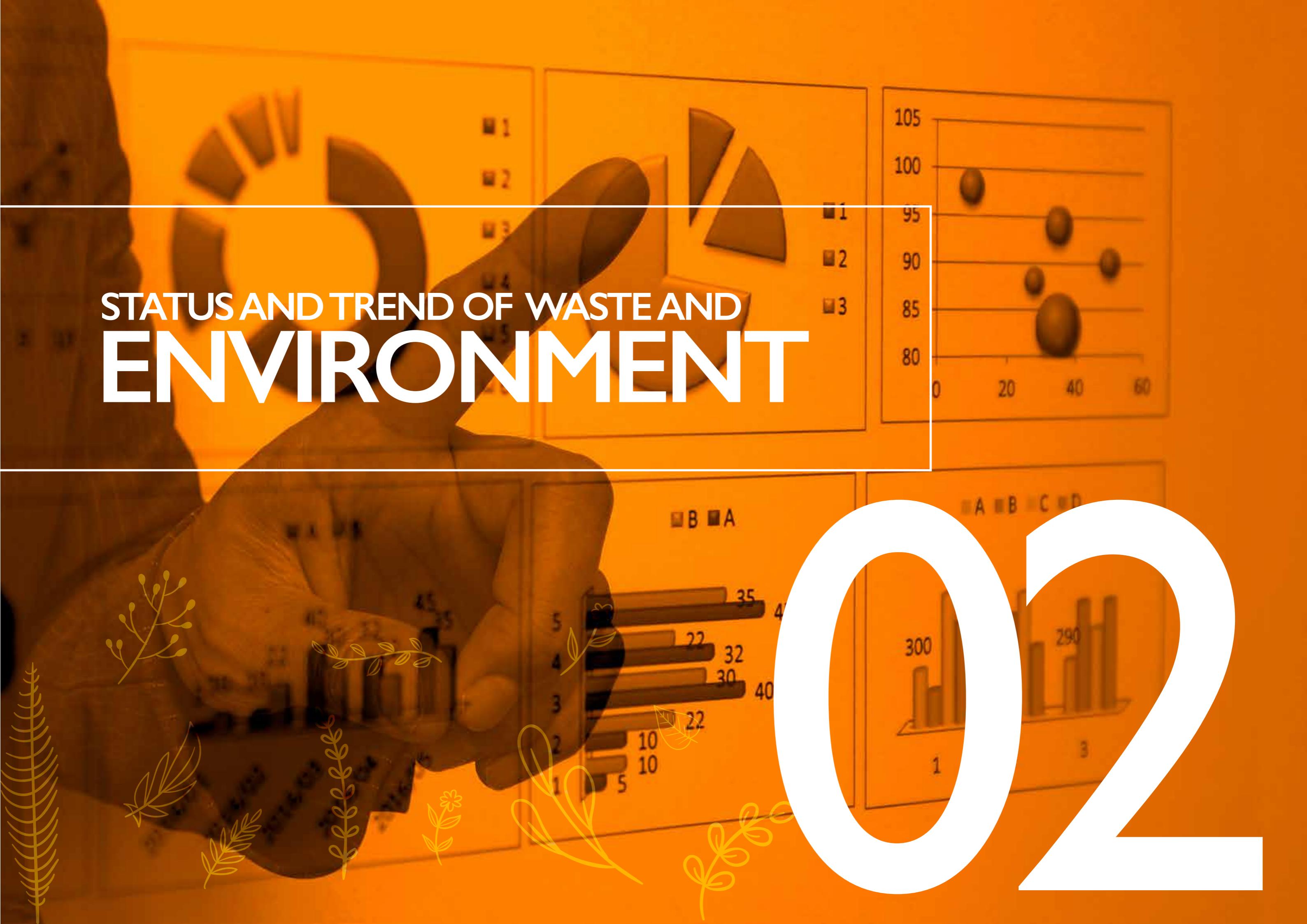
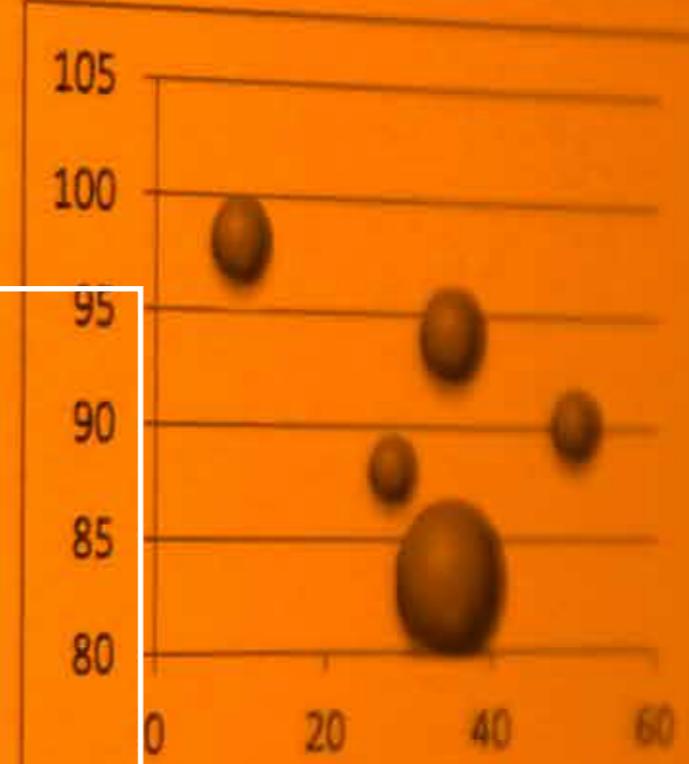
Poorly collected or improperly disposed of waste can have a detrimental impact on the environment. Lack of enforced regulations increases the potential of illegal dump sites, which is harmful to population and the environment.

Inadequate protection also increases the threats to groundwater from contamination, surface waters from leachate, and air from the burning of waste that is not properly collected and treated.



STATUS AND TREND OF WASTE AND ENVIRONMENT

02





THE TREND OF WASTE GENERATION AND CHANGE IN **ABU DHABI**

In 2018, the total solid waste generated in the Emirate of Abu Dhabi was approximately 9,985,369 tonnes, and the hazardous waste represented 181,937 tonnes in addition to 9,803,432 tonnes of non-hazardous solid waste, Figure (4). According to the data available

Figure (4) : Waste Generation in Abu Dhabi 2018

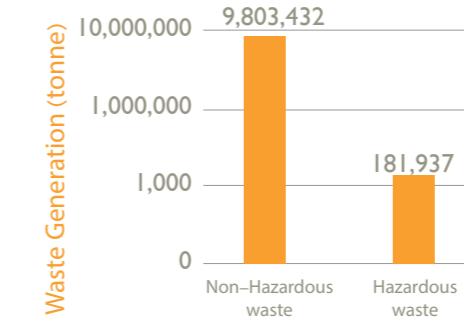
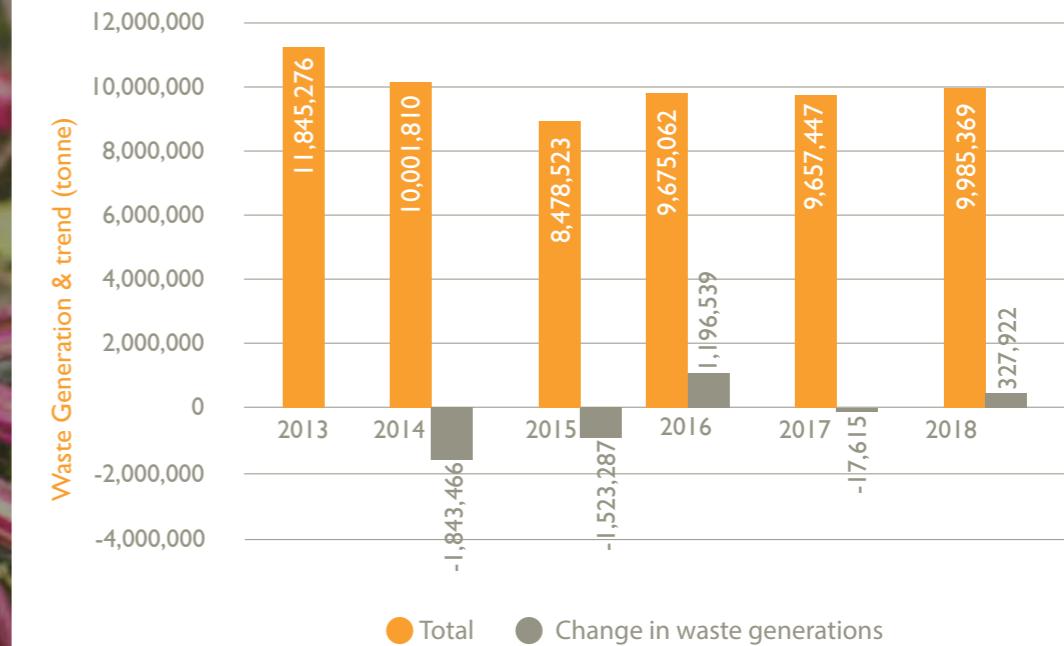


Figure (5) : Trend of Waste Generation in Abu Dhabi



from the Statistics Centre - Abu Dhabi, Figure (5) shows total waste generation in Abu Dhabi Emirate over time. Waste generation decreased from 2013 to 2015 but then has slowly increase over time to a point where the amount generated in 2018 is almost the same as in 2014.

A) GENERATION AND TREND OF NON-HAZARDOUS SOLID WASTE

Non-hazardous solid waste is classified according to the waste source to construction and demolition waste, industrial and commercial waste, municipal waste, and agricultural waste. According to 2018 data, the industrial and commercial sectors generated approximately 36% of non-hazardous solid waste, 32 % of this waste comes from the construction and

demolition sector, followed by the municipal sector, then the agricultural sector, Figure (6). Meanwhile, Figure (7) shows the trend of generation of non-hazardous solid waste during the period from 2013 to 2018. It was slightly decreased since 2013 to 2015, later it gradually increased since 2015, albeit with a slight drop in 2017, the overall trend appears to be increasing since 2015.

Figure (6): Quantities of Non-Hazardous Solid Waste Categories

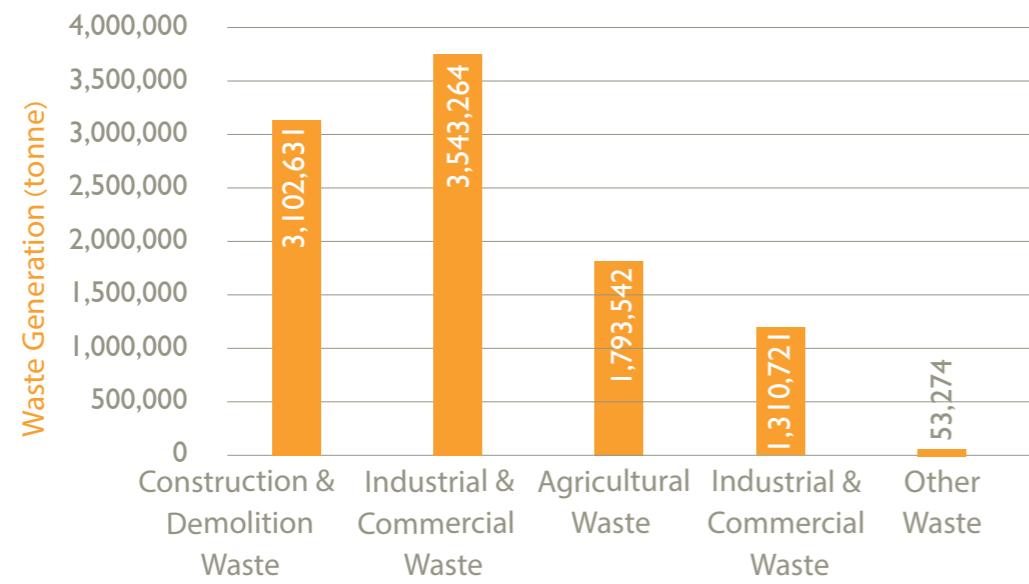
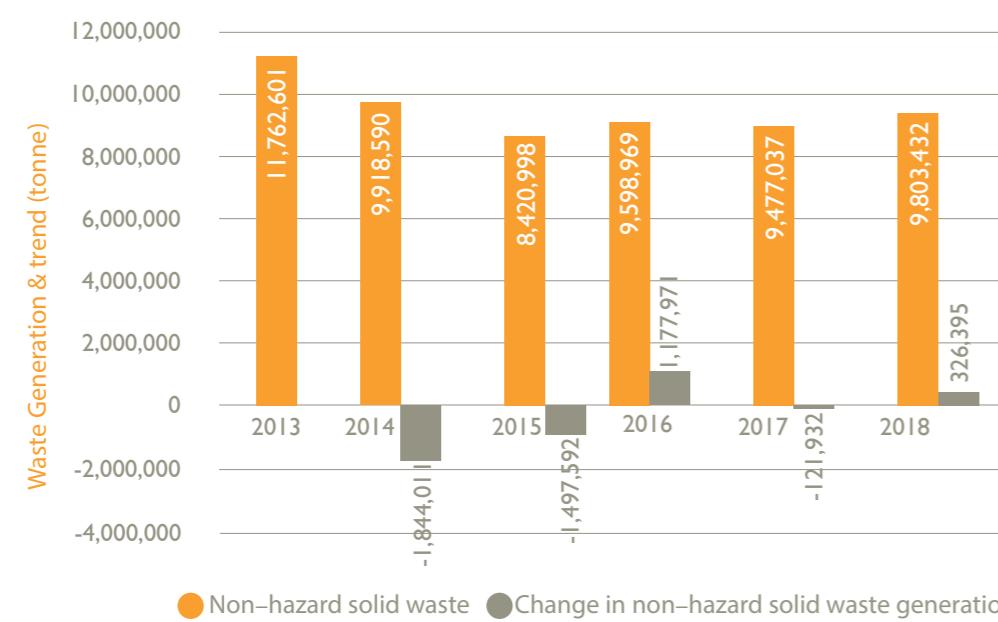


Figure (7): Trend of Non-Hazardous Solid Waste Generations



I) THE CHANGE IN THE GENERATION OF CONSTRUCTION AND DEMOLITION WASTE

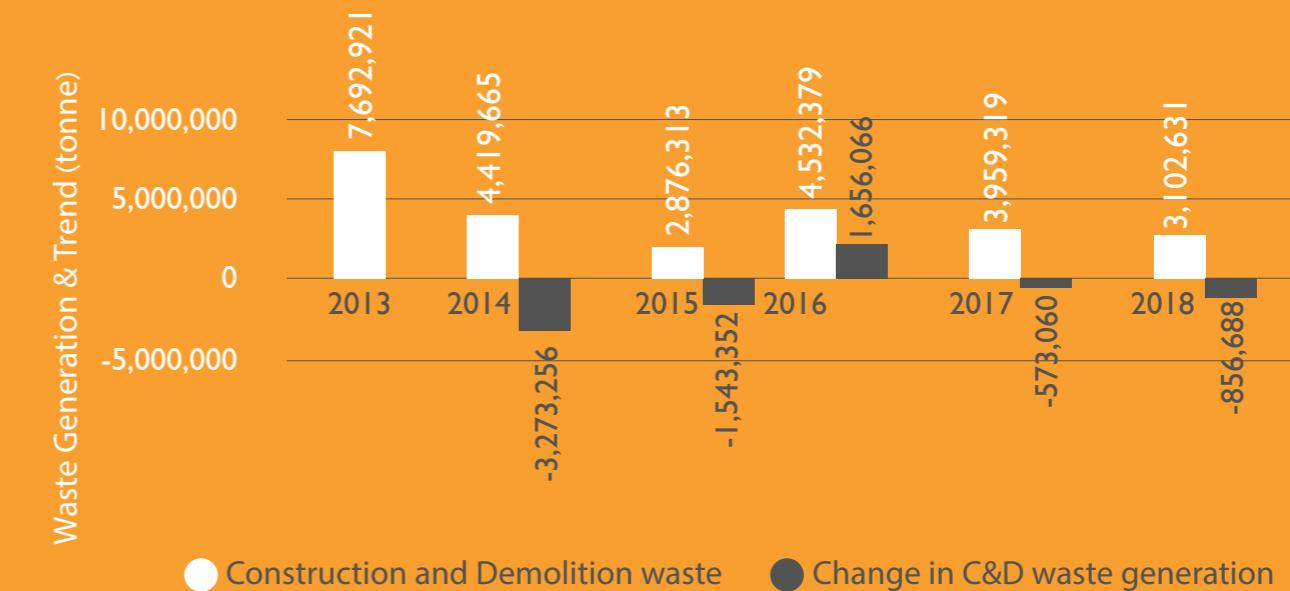


CONSTRUCTION WASTE COMPRISSES UNWANTED MATERIAL PRODUCED DIRECTLY OR INCIDENTALLY DURING CONSTRUCTION ACTIVITIES.

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. Figure (8) shows the trend of C&D waste generation in Abu Dhabi Emirate.

Figure (8): Trend of C&D Waste Generation



2) THE CHANGE IN THE GENERATION OF MUNICIPAL SOLID WASTE

MSW is a waste type consisting of everyday items that are discarded by the public such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances,

and others. Figure (9) shows the trend of MSW generation in Abu Dhabi Emirate varied over time, leading to the highest increase in 2018.

Figure (9) : Trend of MSW Generation

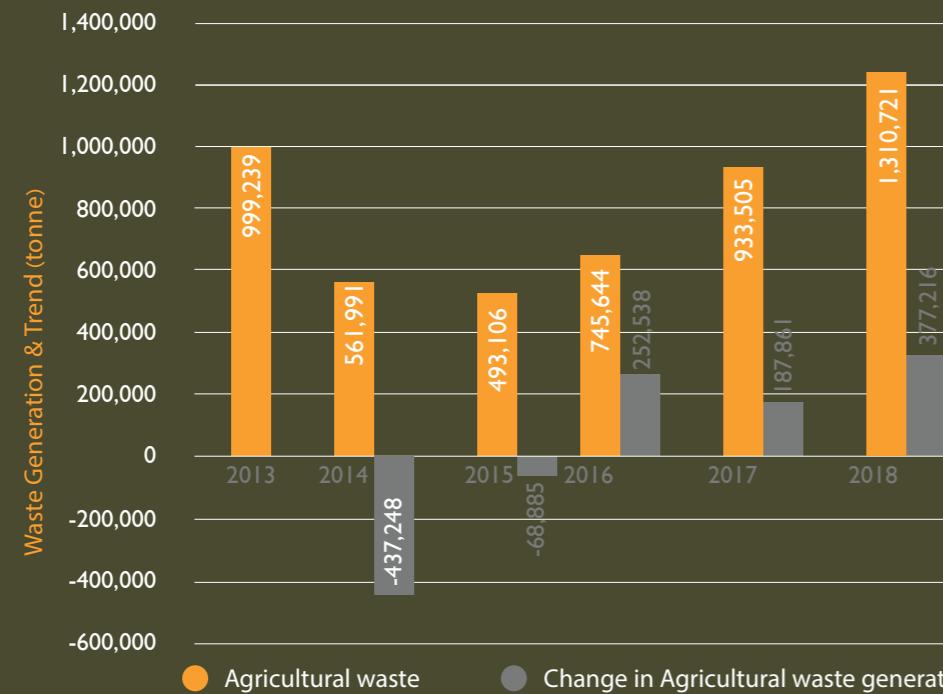


3) THE CHANGE IN THE GENERATION OF AGRICULTURAL WASTE

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. Figure (10) shows the

trend of agriculture waste generation in Abu Dhabi Emirate varied over time, it was decrease since 2013 to 2015 and leading to the highest increase in 2018.

Figure (10) : Trend of Agricultural Waste Generation

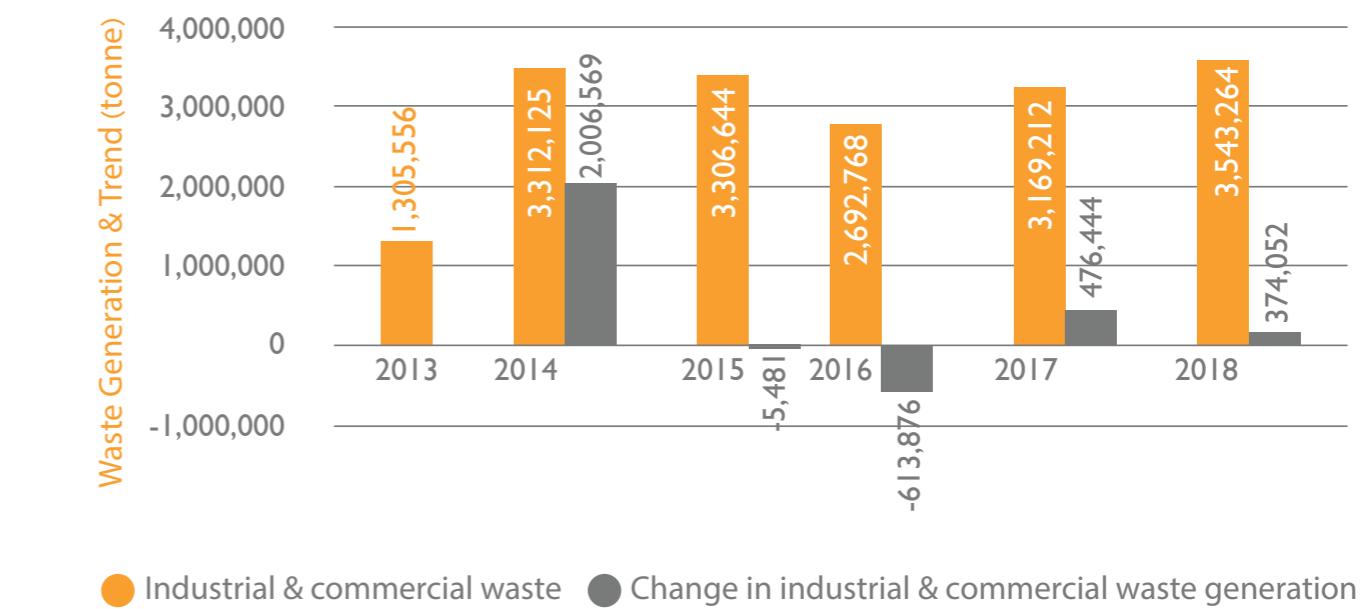


4) THE CHANGE IN THE GENERATION OF INDUSTRIAL AND COMMERCIAL WASTE

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.

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. Figure (11) shows a trend of industrial and commercial waste generation in Abu Dhabi Emirate.

Figure (11) : Trend of industrial and Commercial Waste Generation



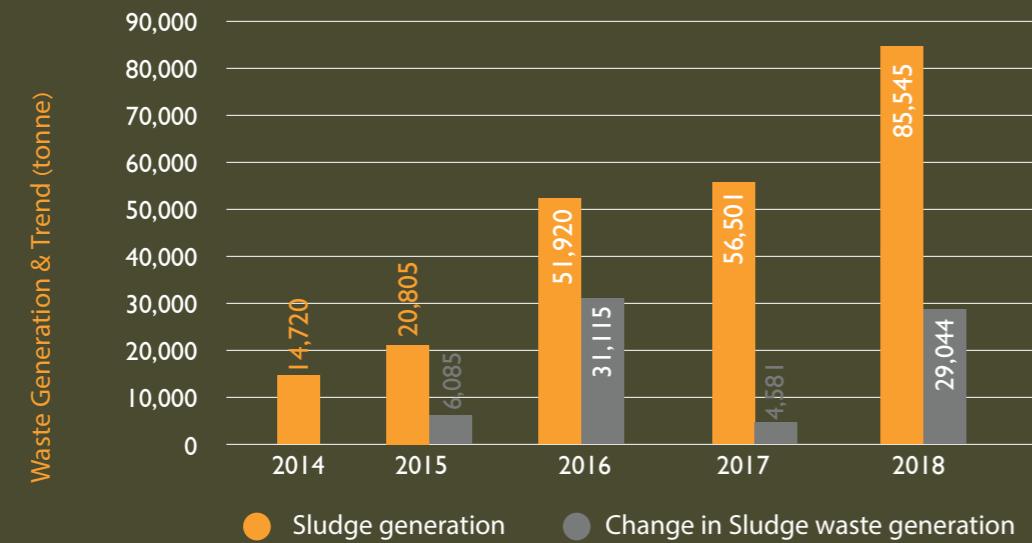
5) THE CHANGE IN SLUDGE GENERATION

Sludge is semi-solid slurry produced as sewage sludge from wastewater treatment processes.

Figure (12) shows the trend of sludge generation

in Abu Dhabi Emirate is slightly increased from 2014 to 2018.

Figure (12) : Trend of Sludge Generation Waste



6) THE 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. Figure (13) shows the trend of the domestic wastewater generation in Abu Dhabi Emirate in million cubic metres (mcm).

Figure (13) : Trend of Wastewater Generation



B) THE GENERATION AND TREND OF HAZARDOUS WASTE

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). Figure (15) shows the trend of hazardous waste generation.

Figure (14) : Quantities of Hazardous Waste by Category

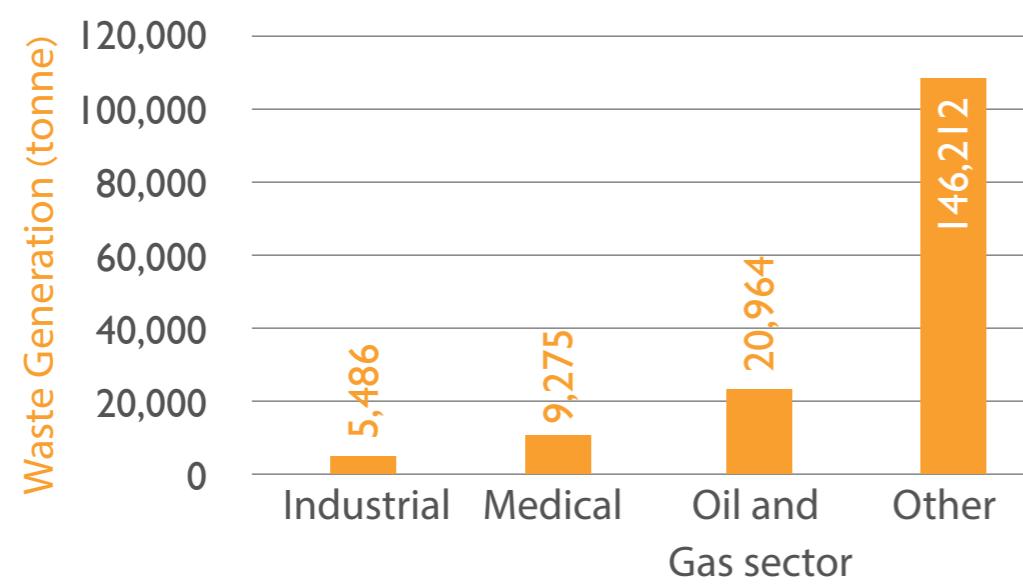
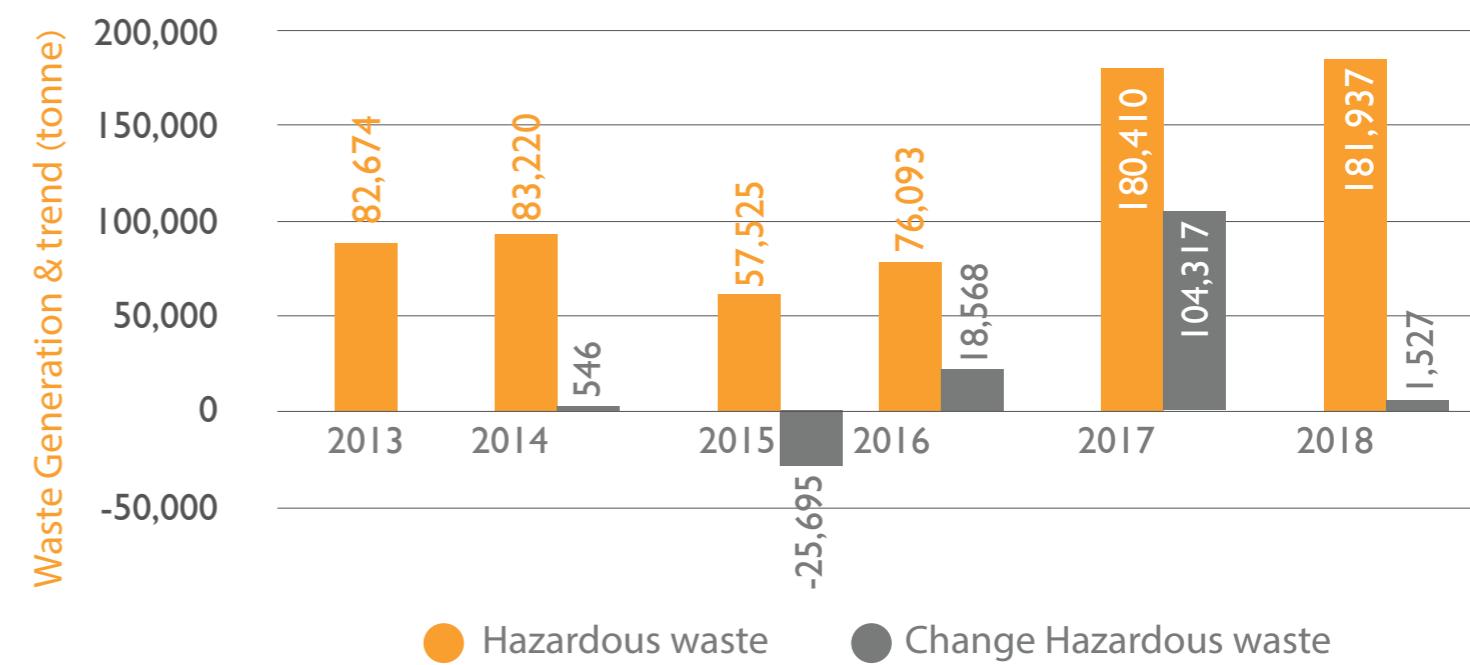
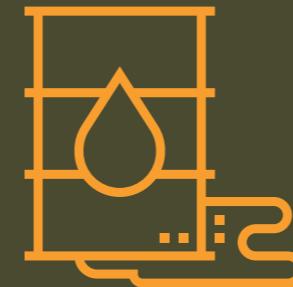


Figure (15) : Trend of Hazardous Waste Generation



I) THE CHANGE IN THE GENERATION OF HAZARDOUS INDUSTRIAL WASTE

A) INDUSTRIAL HAZARDOUS WASTE FROM OIL AND GAS

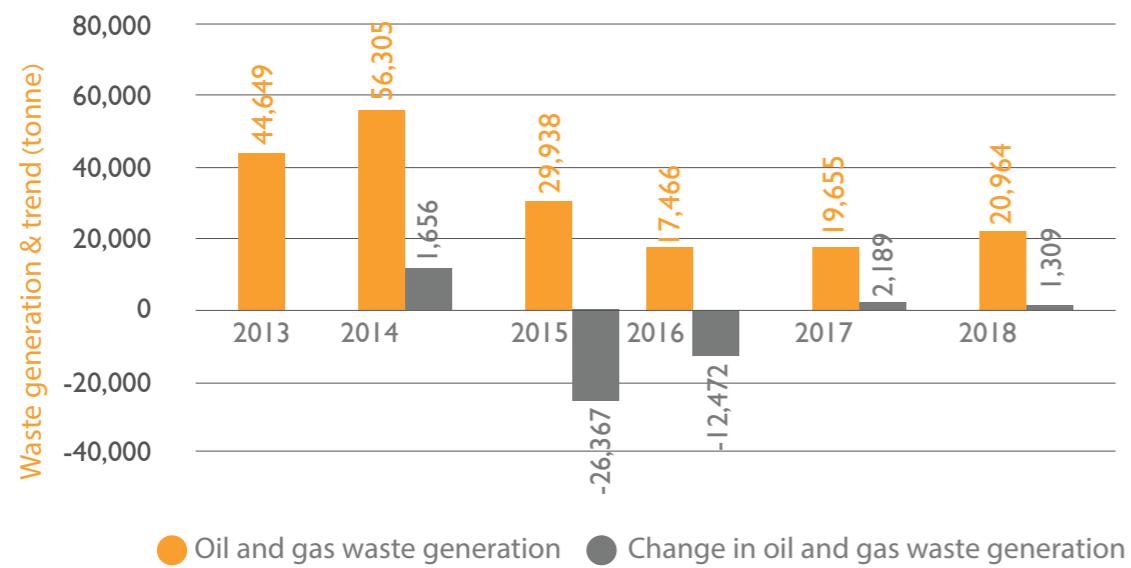


OIL AND GAS WASTE IS PART OF THE INDUSTRIAL HAZARDOUS WASTE

It 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. Figure

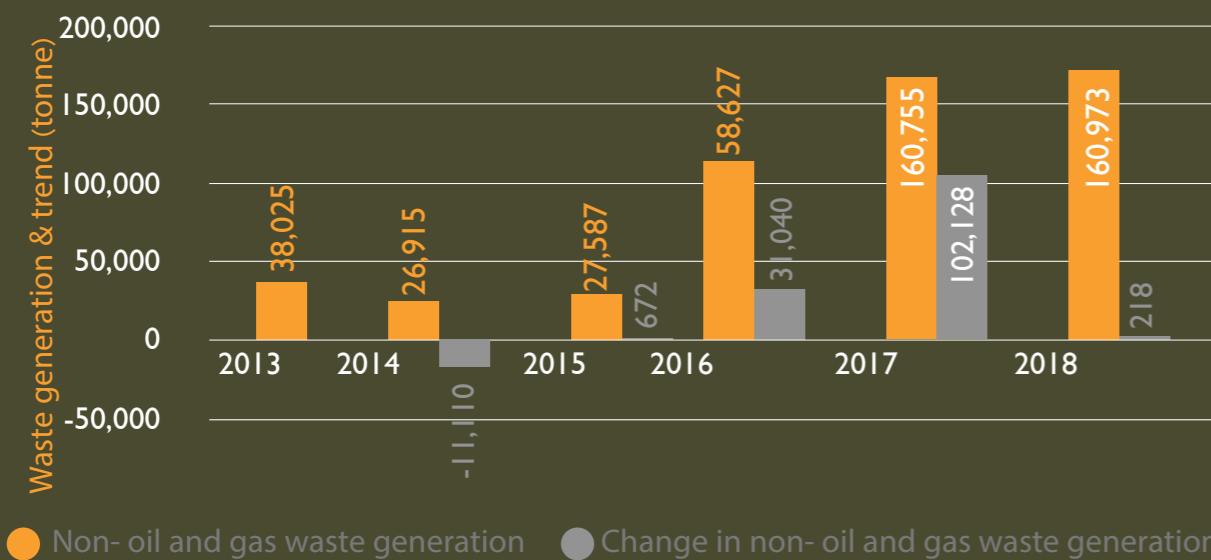
(16) shows the trend of Oil and Gas Hazardous waste generation, and Figure (17) shows the trend of Non- Oil and Gas Hazardous waste generation throughout this period.

Figure (16): Trend of Oil & Gas Hazardous Waste Generation

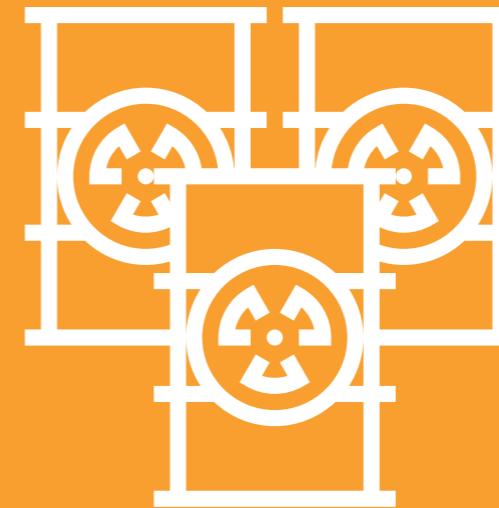


B) INDUSTRIAL HAZARDOUS WASTE OTHER THAN OIL AND GAS

Figure (17): Trend of Non-oil & Gas Hazardous Waste

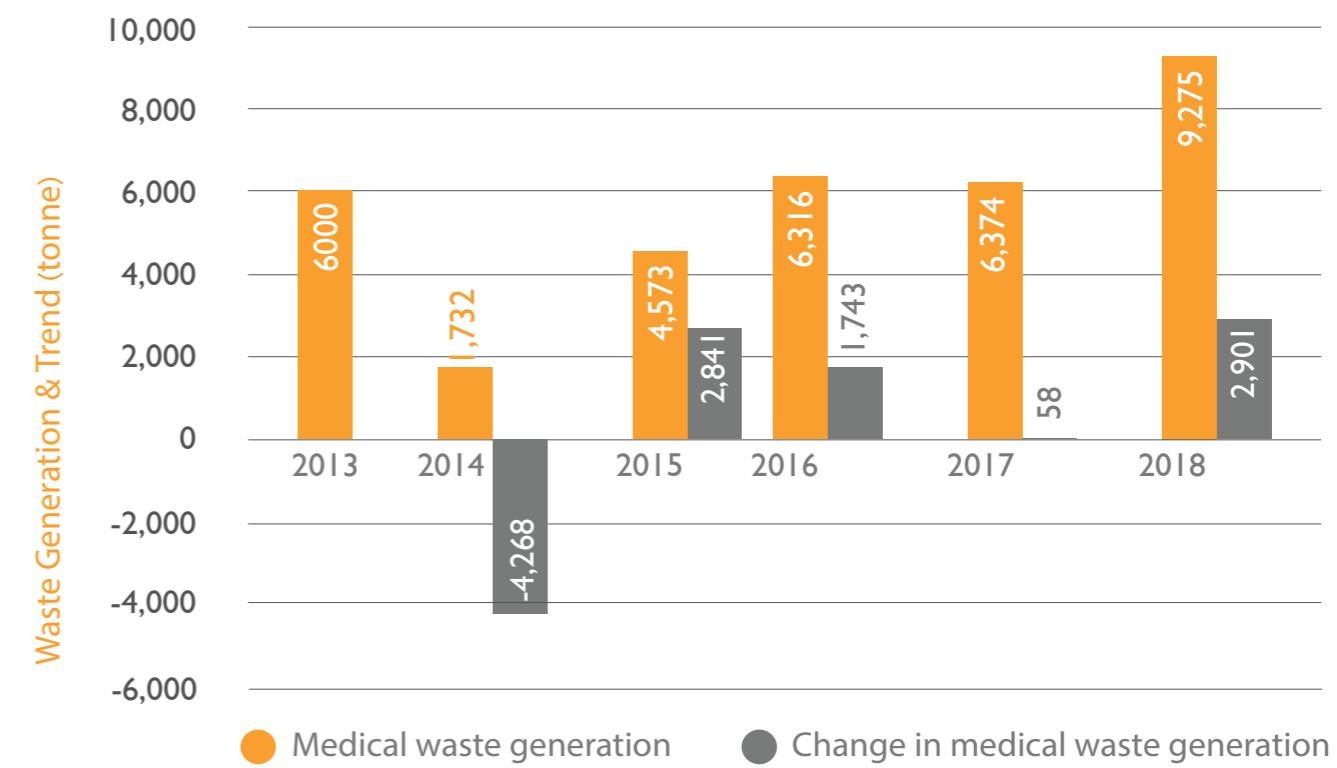


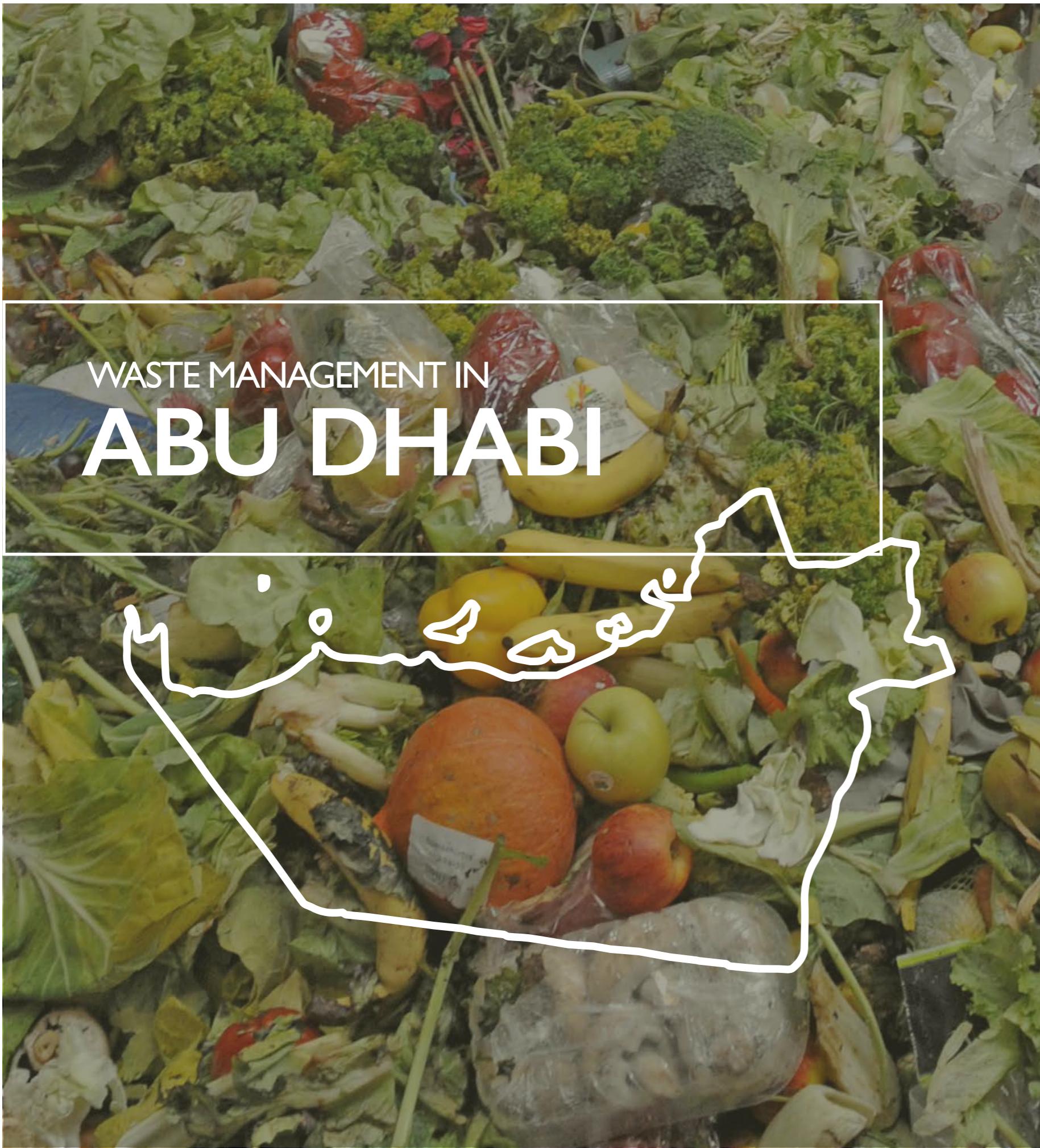
2) THE CHANGE IN THE GENERATION OF MEDICAL WASTE



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. FIGURE (18) SHOWS THE TREND OF MEDICAL WASTE GENERATION.

Figuer (18): Trend of Medical Waste Generation

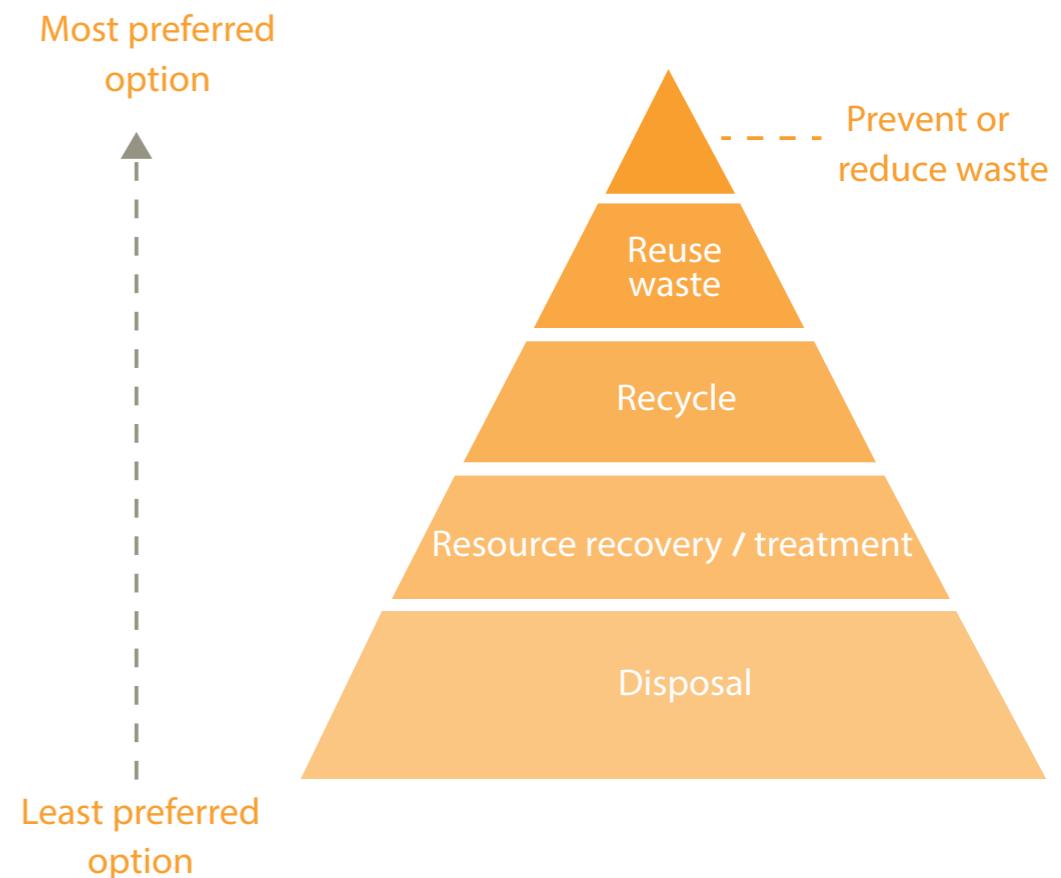




Integrated waste management highlights the need to deal with waste in a comprehensive way with a careful selection and sustainable application, appropriate technology, working conditions, and create a “social link” between the community and waste management authorities. The integrated waste management of a high degree of professionalism, and the society plays a pivotal role to enhance effectiveness of waste management. Integrated waste management should focus on clear goals and hierarchical management of waste, ie: preventing or reducing waste, reuse, recycle, and often adding to these three elements

a fourth element “Restoration / recovery” and life-cycle approach⁽³⁾. A life cycle approach and waste hierarchy are considered integrated waste management and an environmentally efficient method with a reasonable economic cost. This approach will consider mixing less waste produced, reused or recycled including resource recovery and waste processing using the best available technology and disposed of in a healthy landfill only when it cannot be managed.

Figure(19): Abu Dhabi Integrated Solid Waste Management



⁽³⁾ Hoornweg, D. and Bhada-Tata, P., 2012, WHAT A WASTE A Global Review of Solid Waste Management, Urban Development Series, March 2012, No. 15. WorldBank, Washington, DC 20433 USA.

A WASTE FACILITIES IN THE EMIRATE OF ABU DHABI

Figure (20) shows the waste facilities in Abu Dhabi Emirate.

- LANDFILL:

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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.

- SANITARY LANDFILL:

One landfill site in Al Ain

- TRANSFER STATION:

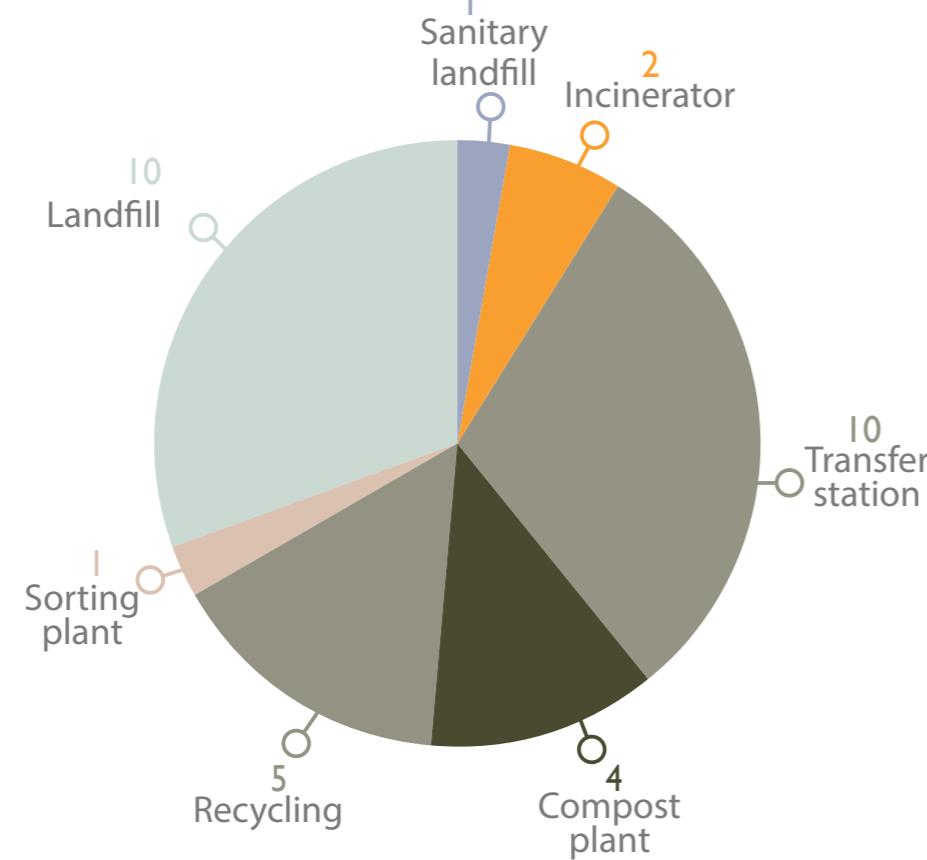
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stations are distributed among the three regions of the Emirate of Abu Dhabi in different locations e.g. Al Mafraq , Remah, Al Wagan, Al Hiyar, Sweihan.

- SORTING PLANT:

One sorting stations in Al Ain

Figure (20): Waste Facilities in Abu Dhabi Emirate

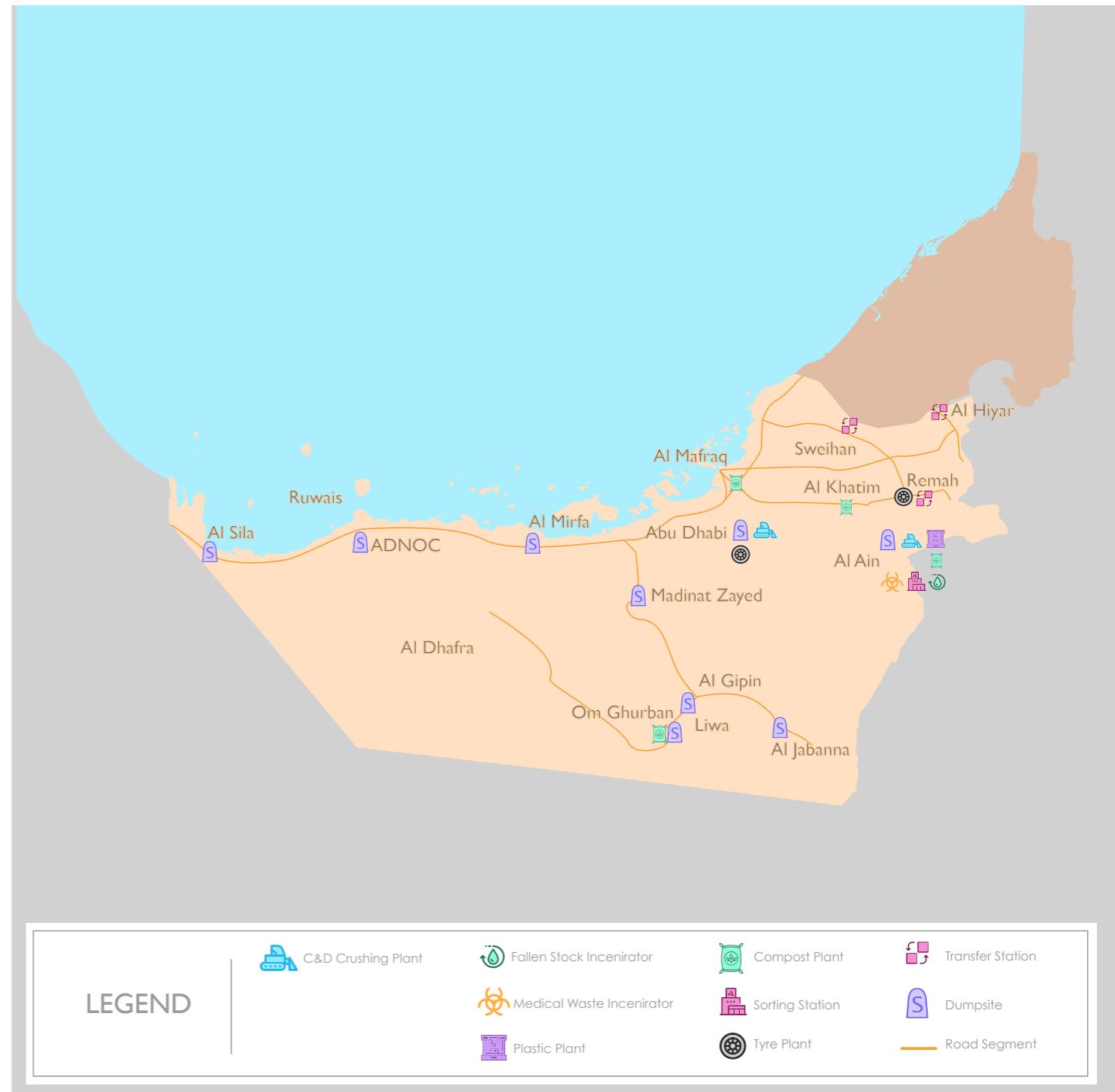


- Compost Plant: four plants are distributed in different location of Abu Dhabi Emirate i.e. Al Ain, Al Mafraq, Liwa, and Al Khatim.

- Recycling: two Construction and Demolition crushing plants were built in Al Ain and Al Dhafra. Factories for treating waste such as, waste Tyre plant the Abu Dhabi and Al Ain region and plastics treating plant in Al Ain region.

- Incinerator: two medical and animal waste incinerators are operating in Al Ain.

Figure (21) Shows the geographical distribution of the waste facilities along Abu Dhabi





Abu Dhabi aims to reduce waste generation to address the increasing trend of annual waste generation, as this potentially has negative impacts on public health and the environment.

Based on the goal of the government, municipal solid waste generated will be reduced to 1.5 kg /capita / day by 2021, and will treat 75 % of municipal solid waste by 2021.

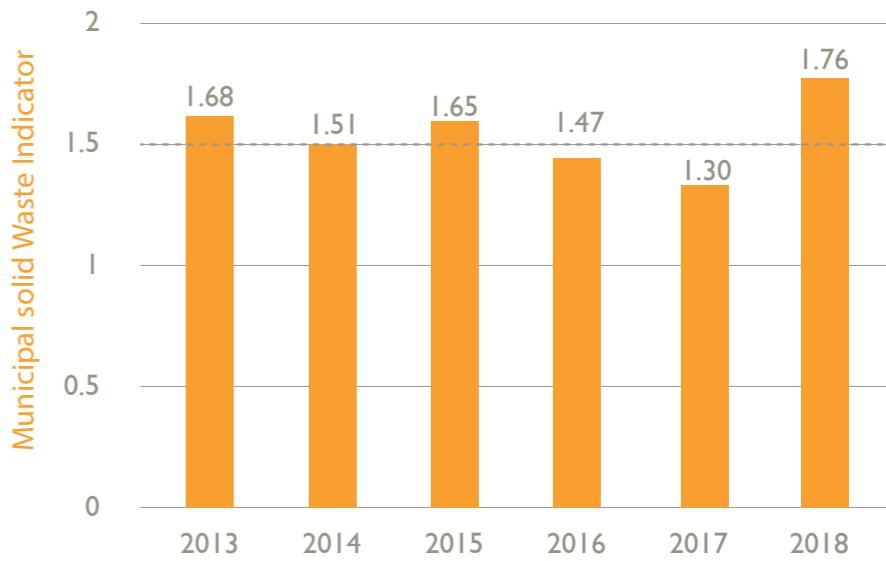
A) MUNICIPAL SOLID WASTE INDICATOR

Municipal solid waste per capita indicator is total average amount of municipal solid waste generated annually divided by population, and the

result will be divided by the number of days per year (kg/capita/day).

HOWEVER, THE GOVERNMENT'S GOAL IS TO
REACH 1.5 (KG /CAPITA /DAY) IN 2021, FIGURE
(22).

Figure (22): Municipal solid Waste Indicator



The chart shows that the maximum MSW per capita is 1.76 kg/capita/day at 2018, while the minimum MSW per capita is 1.30 kg/capita/day at 2017.

B) AN INDICATOR OF THE AMOUNT OF TREATED WASTE TO THE TOTAL WASTE GENERATED

(MUNICIPAL SOLID WASTE)

WASTE TRANSFER ACCORDING TO THE PROCESS

The government's goal is to treat 75 % of municipal solid waste by the year 2021.



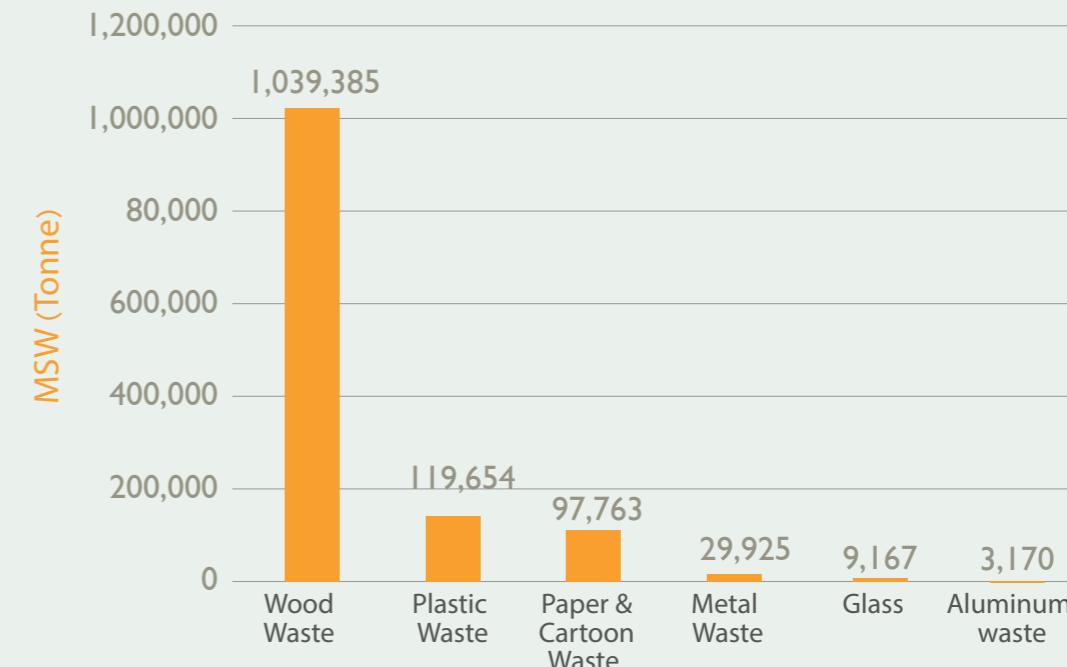
RECYCLING

“REDUCE, REUSE AND RECYCLE”

Recycling is the process of converting waste into reusable materials to avoid losing materials that could be useful, reducing consumption of new raw materials, reducing energy use, reducing air pollution (due to burning) and water pollution (because of the landfills) by reducing the need for “conventional” waste disposal and greenhouse gas

emissions. Recycling is a major process to reduce waste, which is the third stage in the hierarchy for waste after the waste prevention, reduction or reuse. Figure (23) shows recycled municipal solid waste and that wood waste forms the largest recycled category.

Figure (23): Municipal solid Waste recycled Indicator



LANDFILL

It is a location to dispose waste through burying and it is the oldest method used for waste treatment. Historically, dumpsites were the most common way to get rid of waste, and it is still being used all over the world.

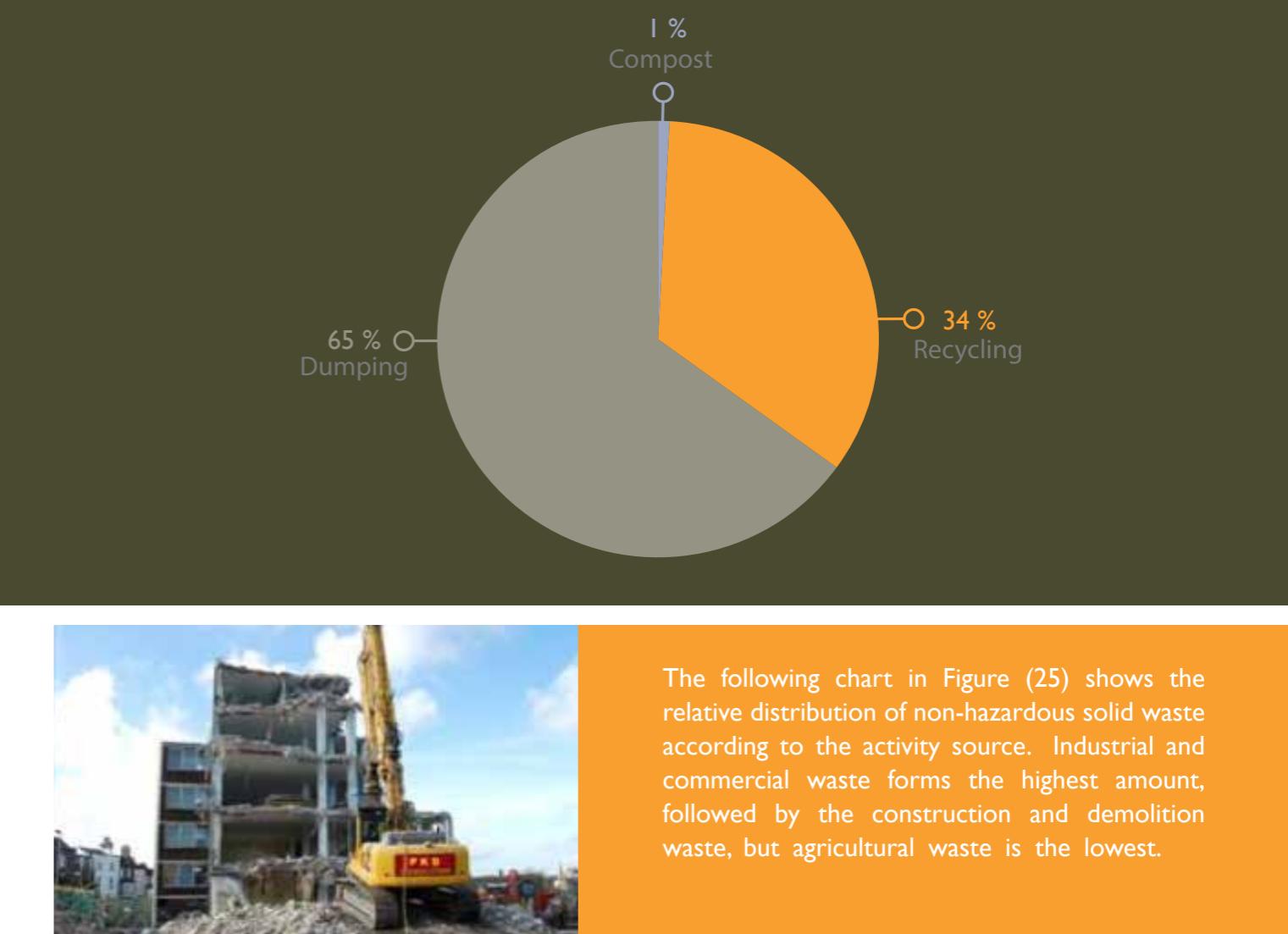


COMPOST

Compost is an organic material that are degraded and recycled as a fertiliser and soil conditioner. Compost is an essential component in organic farming. At the most basic level, composting requires a pile of organic matter known as green waste (foliage, food waste), and after few weeks or months the material decompose into humus. Dividing the vegetable material into small parts will help the decomposition process in addition to adding water and ensuring proper ventilation by stirring the mixture regularly. Worms and fungi increase decomposition of substances. Bacteria that require oxygen starts functioning (aerobic bacteria) and fungi control the chemical process by converting the inputs into heat, carbon dioxide, and ammonium.

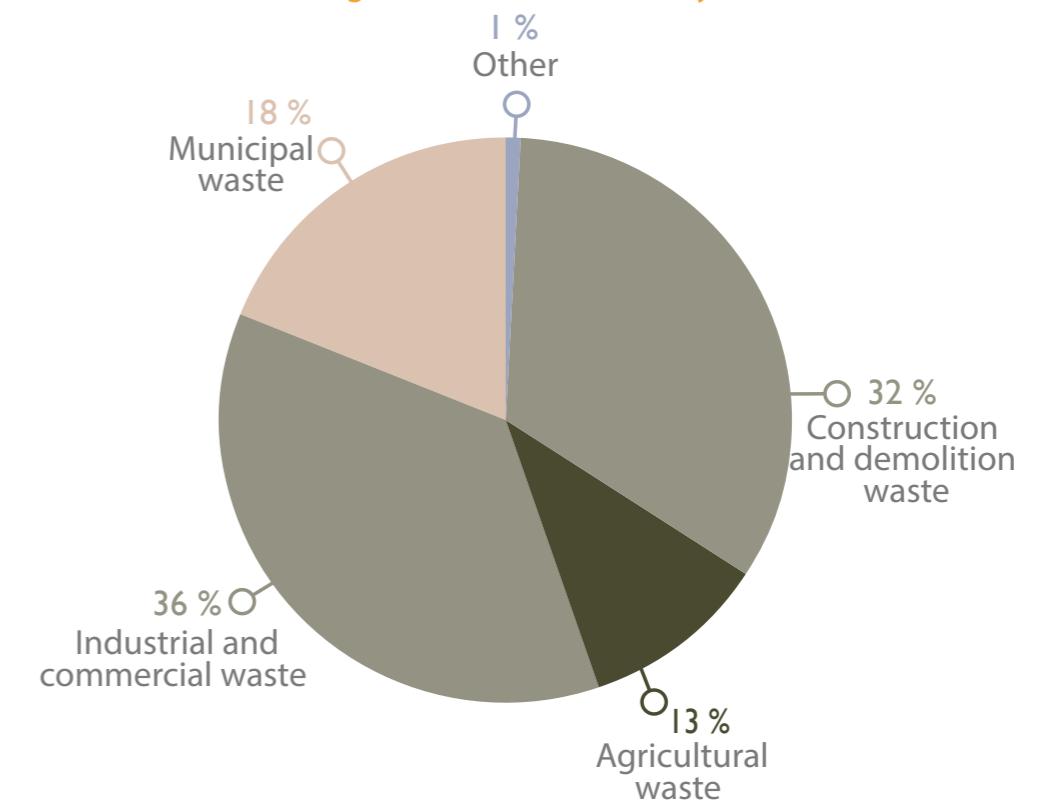
The statistical data on waste for the year 2018 indicates that 34 % of the total non-hazardous solid waste is recycled. In addition, 65 % were buried in landfills as shown in Figure (24). This number is very far from the government's goal by 2021, which requires great efforts to achieve.

Figure(24): Distribution of non-hazardous solid waste by disposal method.



The following chart in Figure (25) shows the relative distribution of non-hazardous solid waste according to the activity source. Industrial and commercial waste forms the highest amount, followed by the construction and demolition waste, but agricultural waste is the lowest.

Figure(25): Waste divert by sector

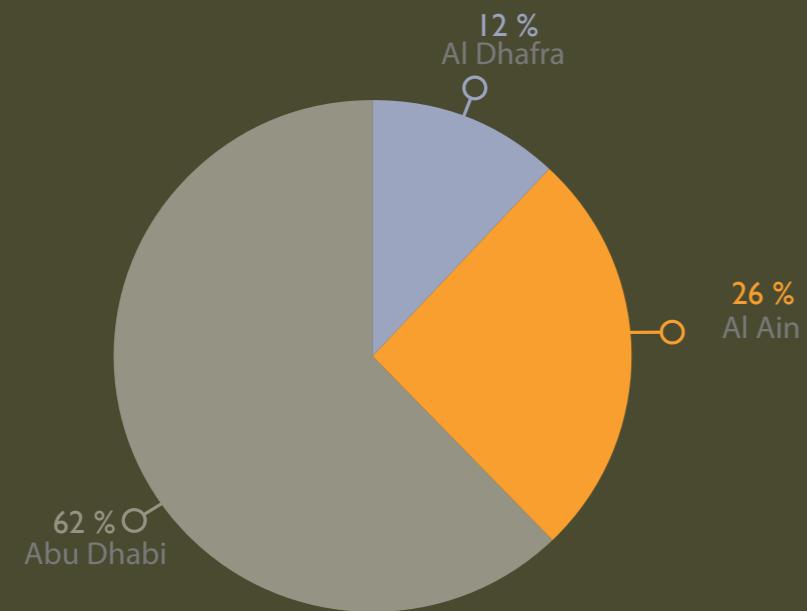


C) WASTE GENERATION FROM REGIONS

Official statistics for the year 2018 estimate that 9,803,432 tonnes of non-hazardous solid waste were generated in the Emirate of Abu Dhabi during 2018, equivalent to about 26,859

tonnes everyday. Approximately 62 % of the total amount was generated from the Abu Dhabi region, 26 % from Al Ain and 12 % from the Al Dhafra region, see Figure (26).

Figure (26): Non-hazardous Solid Waste Generated by Region



RESPONSE AND OUTLOOK OF WASTE AND ENVIRONMENT

OP3





THE ENVIRONMENT AGENCY – ABU DHABI'S INITIATIVES TO REDUCE WASTE

The Environment Agency - Abu Dhabi prepared an initiative, in cooperation with its partners, to reduce waste. This initiative focuses on alternative solutions to use single-use plastic materials and their impacts on the environment. The agency has developed a plan to



DURING 2018, EAD CONDUCTED SEVERAL WORKSHOPS:

- EAD launched a campaign “ Together We Make a Difference“ to raise awareness and encourage the public to adapt sustainable behaviors to protect natural habitats and highlight the impact of random waste on the environment. We organized 15 clean up campaigns, and we were able to collect 8,000 kg of waste.
- EAD conducted a workshop on “Sustainable Management of Businesses Waste” to reduce waste, and to enable all organisations to adapt to waste reduction practices, by identifying the challenges that organisations face to manage waste and presenting proposals and solutions to help them implement easy and effective waste management.
- EAD launched a campaign to “Reduce Plastic Pollution” in cooperation with Emirates Nature - WWF and Yas Mall of Al Dar Properties. The campaign aims to encourage visitors to replace their plastic bags with environmentally friendly bags and pledge their commitment to reduce the use of plastic by signing on the pledge wall. The campaign also highlighted the devastating effect of plastic materials on the environment and encouraged all visitors to contribute and take measures to reduce plastic waste. The results of the campaign were that we collected more than 20,000 bags and were all sent to the recycling center.
- EAD conducted a workshop to reduce waste generation in restaurants. The workshop aimed to guide stakeholders on the best practices for reducing waste in restaurants to enable overcoming challenges of waste management by focusing on reducing packaging or wrapping, single-use plastics and other types of waste. The workshop was attended by representatives from approximately 40 restaurants.
- EAD also conducted this year the “Do You Need a Bag” initiative in cooperation with ADNOC and the Ministry of Climate Change and the Environment, to enhance the importance of the environmental protection and reduce single-use plastic bags in ADNOC stores.

minimise waste targeting various stakeholders such as the public sector, private sector, industries, the commercial sector and the general public. It encourages all targeted stakeholders to reduce single use plastics and other types of waste.



A) ABU DHABI POLICY ON SINGLE USE PLASTICS

Waste policy in Abu Dhabi aims to reduce generating single-use plastics that may leak into the environment and cause environmental damage, and develop solutions to change society's behaviour to be more sustainable. The aim is to move to

a closed circular economic system based on reducing plastic leakage and stopping the use of avoidable plastic materials, separating and recycling the rest of them, in addition to encouraging society to use more sustainable alternatives.

B) ABU DHABI MASTER PLAN FOR WASTE MANAGEMENT

Waste Management master plan 2040 for the Emirate of Abu Dhabi was developed by the Center for Waste Management - Abu Dhabi (Tadweer). The plan aims to achieve an integrated, sustainable and economic system, and is based on the best global leading practices that include four main goals:

1. Provide a summary of the current infrastructure capabilities and recommendations for future requirements to develop and plan waste management until 2040.
2. Align with the key performance

indicators that include the Abu Dhabi Plan 2030 and the Abu Dhabi Environment Vision 2030, which indicates diverting more than 85% of waste from landfills.

3. Develop a plan for implementing waste and infrastructure initiatives in the emirate that embody policies and directives.
4. Develop laws, policies, and regulations regarding organizational and institutional changes required to comply with the 2040 Plan.

C) MEDICAL AND HAZARDOUS WASTE TREATMENT

In line with implementing the integrated management of waste project and promote the safe and sustainable collection of waste, and within the general waste management strategy in the emirate, Tadweer has announced the establishment of three stations to treat medical and hazardous waste; two of them in Abu Dhabi city and one in Al Ain city. The environmental license was issued for the first station, which will

be located near Al Dhafra waste dump site, south west of Abu Dhabi city, while the second station of Abu Dhabi city is still under environmental study and will be located near the first station. The two stations will be able to treat about 15,000 tonnes of medical and hazardous waste annually. An environmental license has also been issued for Al Ain City station, which will be able to treat about 500 kg of medical and hazardous

D) BIOGAS EXTRACTION FROM LANDFILLS

Abu Dhabi Waste Management Center (Tadweer) signed a contract in cooperation with a global company to implement the first investment project of its kind in the Middle East region to extract gas from the Al Dhafra landfill, which is the largest landfill in Abu Dhabi. The project contributes in converting waste gas into energy reducing greenhouse gas emissions from landfill to the atmosphere.

The project is expected to produce about 5 megawatts of energy, and it will also be registered as one of the projects that operates according to the clean development mechanism, stipulated in the preliminary United Nations agreement, on climate change to monitor the project's carbon emissions performance.

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