هيئة البيئة - أبوظبي
Environment Agency - ABU DHABI

MERCURY EMISSIONS INVENTORY FOR ABU DHABI EMIRATE

Executive Summary

June 2016

TABLE OF CONTENTS

Foreword..... 5-6
Chapter 1 – The Mercury Problem..... 7-8
Chapter 2 – Methodology..... 11-12
2.1 Mercury Emissions Inventory for the Year 2010 and 2012..... 13-15
2.2 Mercury Emissions Projections until the Year 2030..... 16
Chapter 3 – Total Mercury Emissions..... 17-18
3.1 Baseline Total Mercury Emissions..... 19-22
3.2 Mercury Emission Indicators and Comparisons with Other Countries..... 23-24
3.3 Mercury Emissions Projections for Abu Dhabi Emirate..... 25-26
Chapter 4 – Industry Sector Emissions..... 27-28
4.1 Baseline Mercury Emissions for the Industry Sector..... 29-30
4.2 Mercury Emission Projections for the Industry Sector..... 31-32
Chapter 5 – Waste Sector Emissions..... 33-34
5.1 Baseline Mercury Emissions for the Waste Sector..... 35-36
5.2 Mercury Emission Projections for the Waste Sector..... 37-38
Chapter 6 – Energy Sector Emissions..... 39-40
6.1 Baseline Mercury Emissions for the Energy Sector..... 41-42
6.2 Mercury Emissions Projections for the Energy Sector..... 43-44
Chapter 7 – Mercury Releases to Water..... 45-46
Chapter 8 – Lessons Learned and Recommendations..... 49-50
8.1 Lessons learned..... 51
8.2 Recommendations..... 52
Stakeholder Acknowledgements:..... 53-54

“Mercury is one of the top ten chemicals of major public health concern and is a substance which disperses into and remains in ecosystems for generations, causing severe ill health and intellectual impairment to exposed populations.”

WHO Director-General Dr Margaret Chan

“The Minamata Convention will protect people and improve standards of living for millions around the world, especially the most vulnerable. Let us strive to achieve universal adherence to this valuable new instrument, and advance together toward a safer, more sustainable and healthier planet for all.”

United Nations Secretary General Ban Ki-moon

FOREWORD

This report presents the main findings of the Mercury Emissions Inventory for Abu Dhabi Emirate including baseline emissions for the year 2010 and 2012, and emission projections until 2030 according to business-as-usual scenario in the year 2010 (2010-BAU) and extended emission control (BAU-EXEC) scenario. The work was carried out by the Environment Agency - Abu Dhabi (EAD) between December 2014 and June 2016, with the purpose of identifying the anthropogenic sources and quantifying mercury emissions to the atmosphere, as well as to indicate possible sources and quantities of mercury discharged to the aquatic environment in Abu Dhabi Emirate.

The initiative "Mercury emissions inventory for Abu Dhabi Emirate" was developed under the auspices of the Abu Dhabi government and the Emirate›s plan for sustainable environment and optimal use of resources, and in line with the EAD's strategic priority to protect the air quality, water and soil through building a strong and comprehensive understanding and knowledge. The project is considered a key component in the EAD's comprehensive monitoring for atmospheric emissions in Abu Dhabi Emirate. Atmospheric monitoring activities are being carried out through a number of projects and operations implemented at the emirate level, including greenhouse gas (GHG) inventory, air emissions inventory, the continuous monitoring of air pollutants through a network of air quality monitoring stations deployed in various parts of the emirate. The linkage between climate change, air quality and the environmental risk of mercury (Hg) contamination is seen as important in this regard, and various tasks have thus been conducted to ensure access to a greater understanding of the atmospheric emissions and to reduce health and environmental risks in the Emirate of Abu Dhabi.

The mercury emission inventory supports the federal government towards fulfilling its commitments to the Minamata Convention on Mercury by enhancing the robustness of the United Arab Emirates (UAE) national mercury emissions inventory and the national communications to the United Nations Environmental Program (UNEP).

The mercury emissions inventory also strengthens the capacity of entities to efficiently track their sectors' emissions, provides the Abu Dhabi Emirate with a solid foundation for identifying the necessary environmental improvement measures and provides advice and support to policy developers at an Emirate and Federal level to ensure that the environment is considered and planned for, in balance with social and economic needs.

It is further recognized that integration of the mercury inventory work with other international convention-work that aims to reduce emissions (such as the UNFCCC), will allow for consideration of potential synergies and lead to maximise overall benefits.
Details of the emission inventory and projection are available in the technical documents of the project (Sundseth, K., Thorne, R.J., Pacyna, J.M., Pacyna, E.G., Hamed, H.I. (2016) Mercury emission inventory and emission scenarios for the Emirate Abu Dhabi.

CHAPTER 1
THE MERCURY PROBLEM

Mercury is a naturally occurring, toxic, heavy metal. Human activity has, however significantly increased mercury levels in the environment over the past few centuries. Once emitted to the air, mercury falls to the earth and builds up in our waters and soils, which lasts for many years and travels across continents[Global mercury assessment, UNEP, 2002]. Some key messages from the international community include the following:

- Mercury and its compounds are naturally occurring in air, water and soil, and are highly toxic.
- Exposure to even small amounts of mercury may cause serious health problems, and may have toxic effects on the nervous, digestive and immune systems, and lungs, kidneys, skin and eyes.
- Mercury emissions result from various human activities, either as a side effect from industrial processes (where mercury exists as impurities in the raw material such as in fossil fuels and in various ores), or from being intentionally used in industry or in consumer products.
- Mercury emitted to the environment may be transported over long distances by air, and to some degree, by water currents. A small portion of this mercury ends up in the environment and undergoes methylation, converting mercury to methylmercury (MeHg), which is toxic and bio-accumulates to dangerous levels in the food-chain.
- The most common exposure to methylated mercury is through ingestion of fish and other marine species.
- The effects of mercury pollution can be observed at local scale, but are regarded as a global problem. A need for cooperative action to reduce emissions and exposure has therefore been internationally recognized.
- Global biogeochemical cycling of mercury is likely to be affected by rapid global climate change.
- There is a considerable time lag before emissions reductions have a demonstrable effect on mercury levels in human food chains.
- International actions that support and encourage global action on mercury reduction are mainly linked to the Minamata Convention.

The Minamata Convention on Mercury is a global treaty to protect human health and the environment from the adverse effects of mercury.

The United Arab Emirates (UAE) was amongst the first countries in the world that signed the Convention on October 10th, 2013, and ratified it on April 27th, 2015.

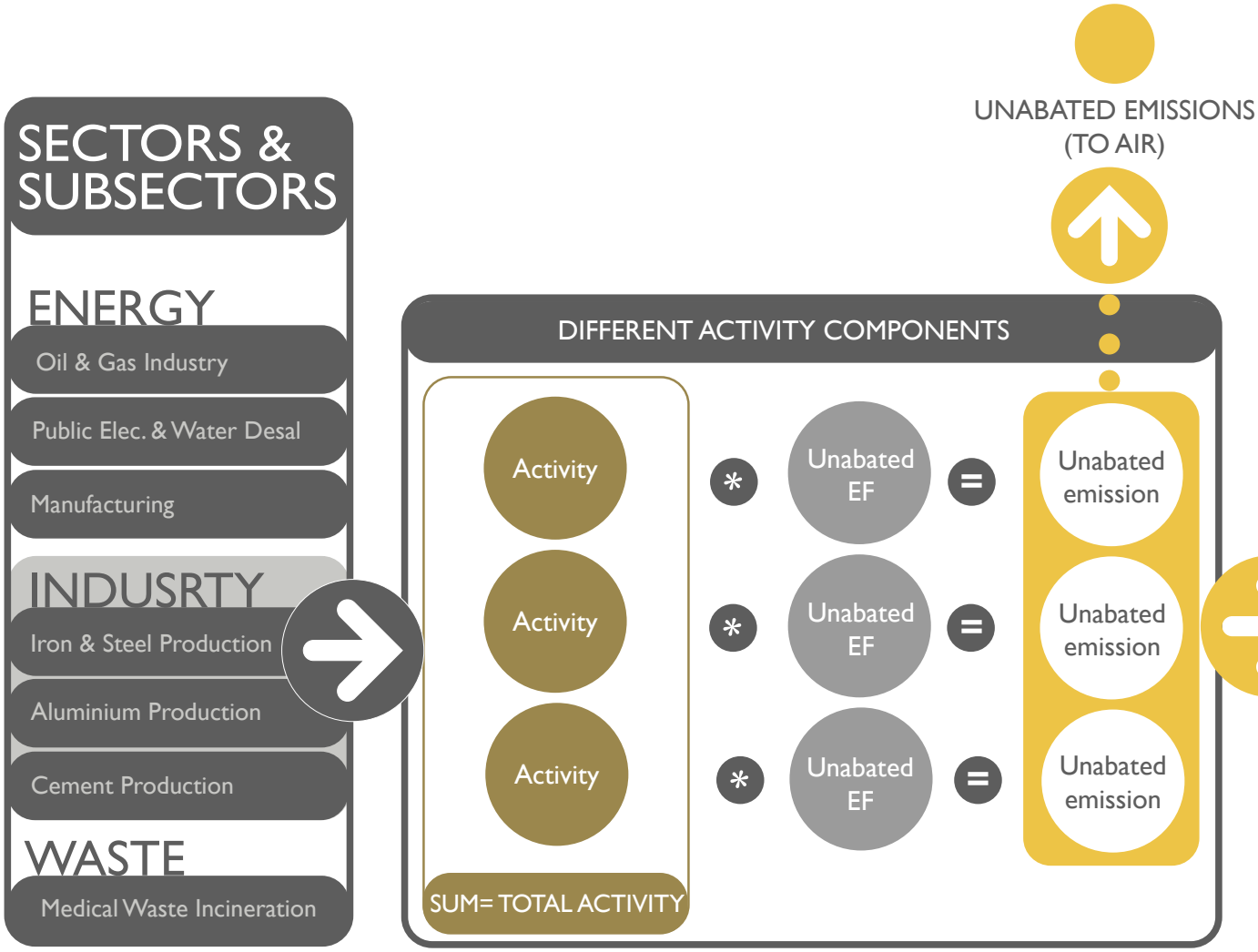
CHAPTER 2
METHODOLOGY

2.1 Mercury Emissions Inventory for the Years 2012 & 2010

The mercury emissions inventory for the years 2010 and 2012 was produced based on international (UNEP, EMEP/EEA) guideline methodology. Data on activities, unabated emission factors, emission reduction technology applied and their mercury removal efficiencies was collected, verified and compiled during the project duration. Generic default data was used in cases where no local data was available.

The method used to calculate emission estimates for the inventory is shown in Figure 1.

The emission sources identified in this project were classified in three main sectors, namely, the industry sector, the waste sector, and the energy sector. It was identified during the project that the Abu Dhabi Emirate chemical industry did not apply the types of process technology that require the use of mercury, so it was concluded that no mercury emissions derive from this sector and thus, the chemical industry was not included in the analysis.



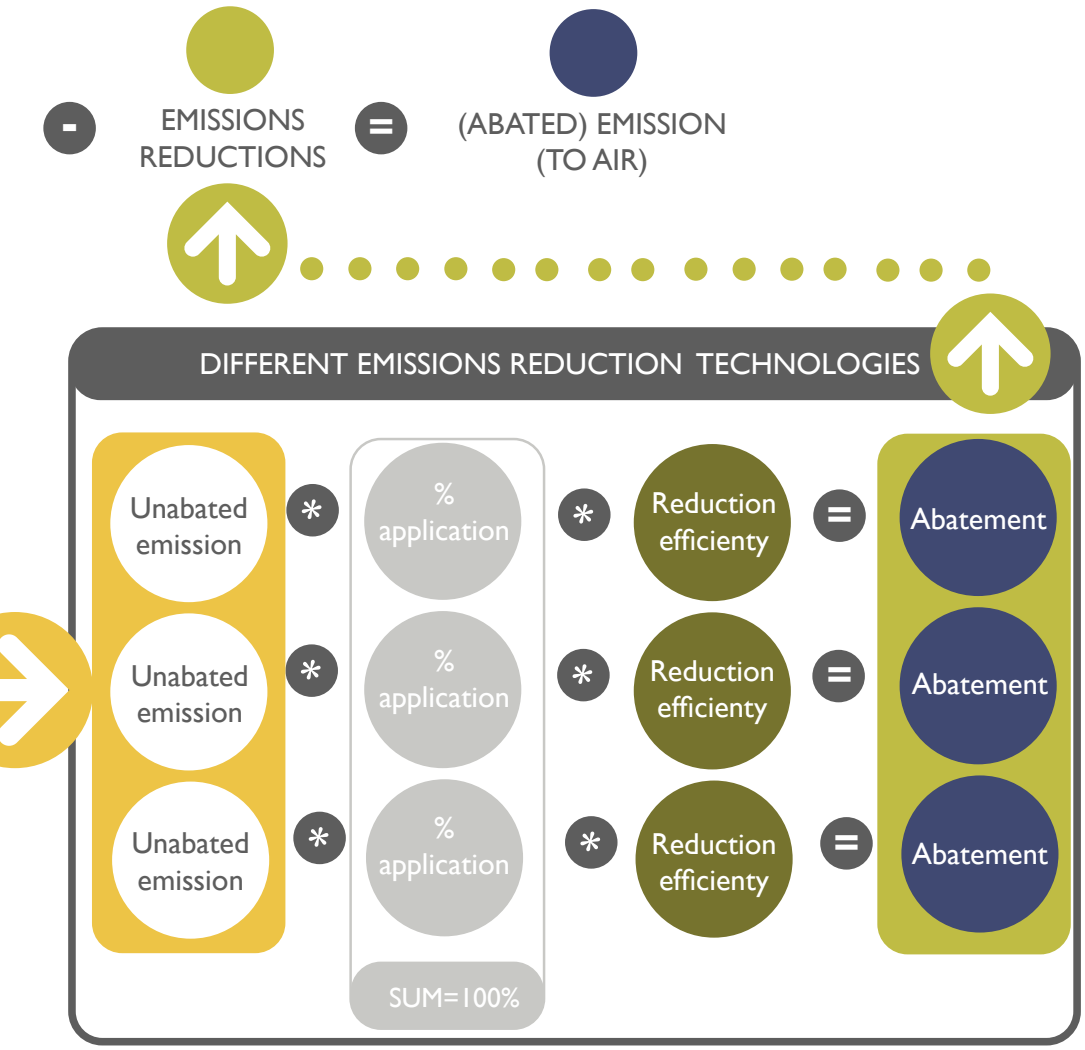


Figure 1: The method used to calculate mercury emission estimates in the inventory (Modified from UNEP).

Mercury emissions resulting from use of products containing mercury were estimated using a slightly different methodology than for mercury emissions from primary activities. For products, the mercury emissions were estimated on the basis of consumption (net import) data on mercury containing product groups combined with literature data on mercury contents in such products. The mercury consumed in products was then distributed among default distribution factors (DF) and multiplied with default emission factors (EF) as seen in Figure 2.

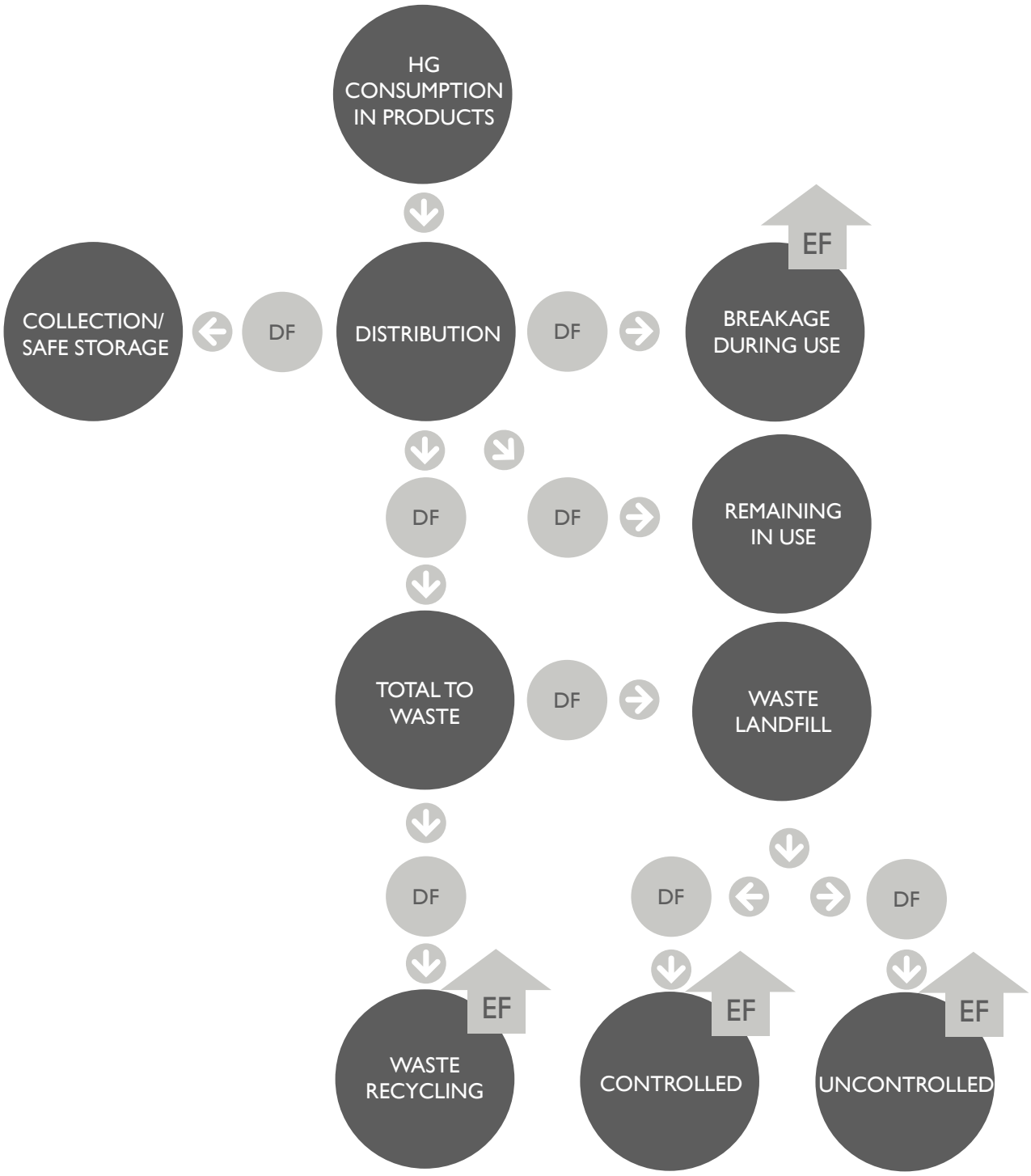


Figure 2: Procedure to estimate mercury emissions resulting from use and disposal of products containing mercury.

2.2 Mercury Emissions Projections until the Year 2030

Two initial projections of mercury emissions until 2030 were created according to Business-As-Usual scenario in the year 2010(2010-BAU) and Business-As-Usual with Extended Emission Control (BAU-EXEC) projections. A model was developed for each sector, based on inventoried 2010 and 2012 emissions and estimated sectoral changes for the year 2013 and beyond. Sectoral changes were based on the strategies and plans in place in the base year 2010.

2010-BAU mercury emissions were projected to 2030 taking into account development policies and plans in place in the base year of 2010, and taking into account expected population, gross domestic product (GDP) and sectoral growth.

BAU-EXEC mercury emissions were projected to 2030 taking into account policies and plans in place in the base year of 2010, and taking into account expected population, GDP and sectoral growth, but modified with the inclusion of any emission reduction plans that have been either drafted or accepted since 2010.

The mercury emissions projections were compared to show how emissions change with the future development plans, technology change, and emissions control measures including Greenhouse Gas (GHG) mitigation measures affecting mercury emissions as a co-benefit.

CHAPTER 3
TOTAL MERCURY EMISSIONS

1
2
3
4
5
6
1
2
3
105
100
95
90
85
80
0
20
40
60
B A
35
45
22
32
30
40
22
10
10
5
5
4
3
2
1
A B C D
300
280
290
1
2
3

3.1 Baseline Total Mercury Emissions

The inventory results give an estimate of 485 kg of mercury emitted to air from man-made sources in 2010, while the estimate in 2012 was 535 kg. The majority of the mercury emissions to air (57.4% in 2010 and 51.8% in 2012) occurred from the waste sector, resulting mainly from releases associated with the use of mercury- containing products and to a small degree from incineration of medical waste. The industry sector, comprising process emissions from primary production of iron and steel, aluminium, and cement, represents the second largest emitter of mercury to air (31.4% in 2010 and 40% in 2012). The energy sector is responsible for 11.2% of the anthropogenic mercury emissions to air in 2010 and 8.2% in 2012.

Figure 3 and Figure 4 illustrate the distribution of estimates of the Abu Dhabi Emirate mercury emissions to air from anthropogenic sources in 2010 and 2012 according to the single source contribution (subsectors). Figure 5 summarizes the mercury emissions to air by main sector for the year 2010 and 2012.

MERCURY EMISSIONS TO AIR BY SUBSECTOR IN 2010

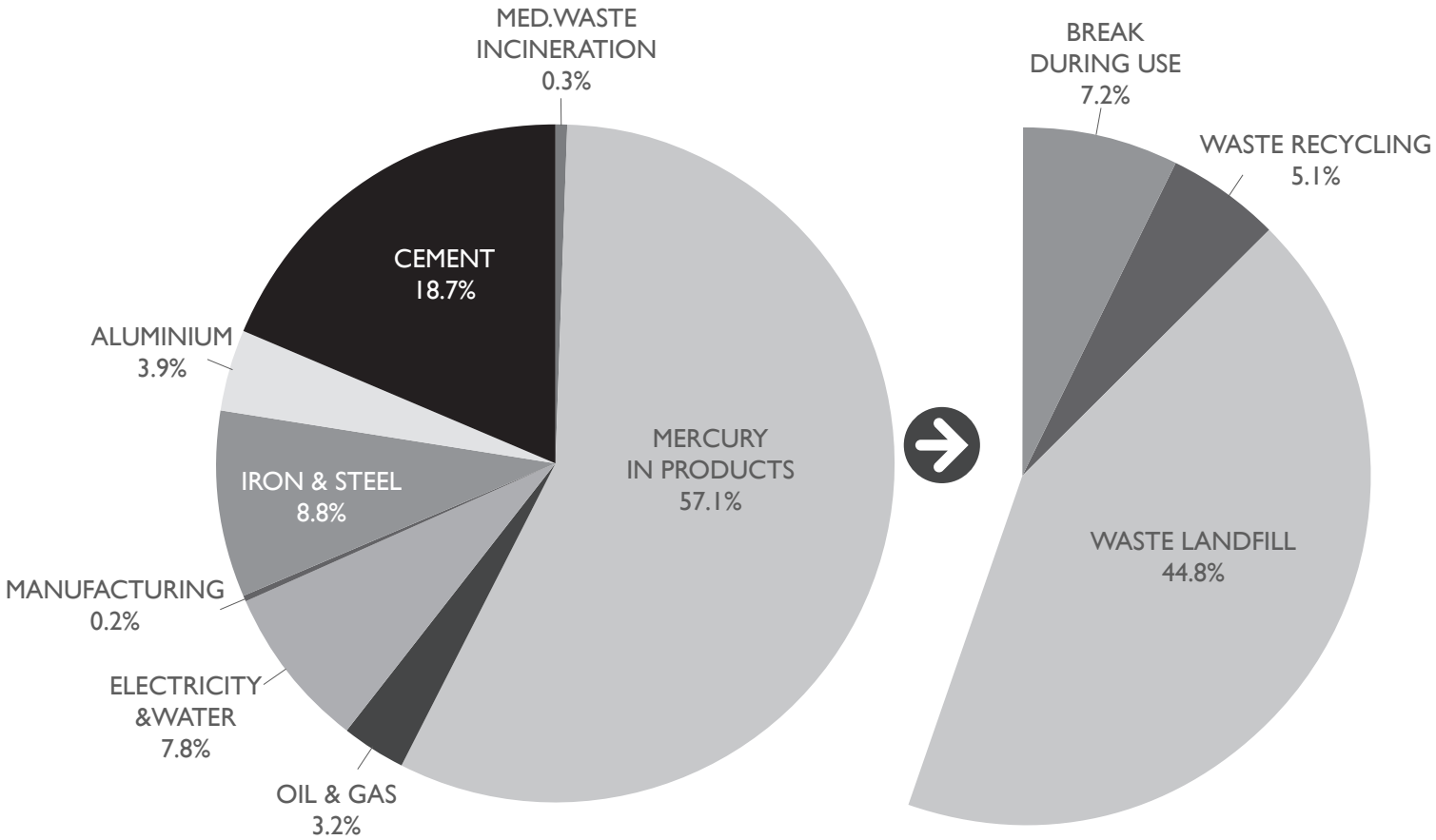


Figure 3: Abu Dhabi mercury emissions to air by subsector in 2010.

MERCURY EMISSIONS TO AIR BY SUBSECTOR IN 2012

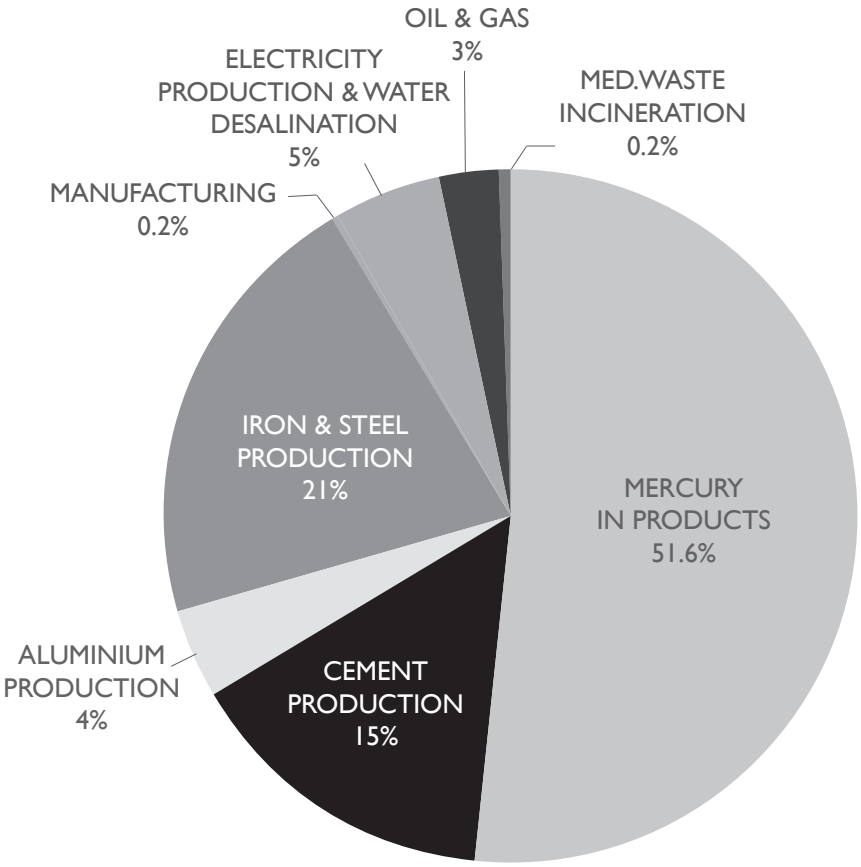


Figure 4: Abu Dhabi mercury emissions to air by subsector in 2012.

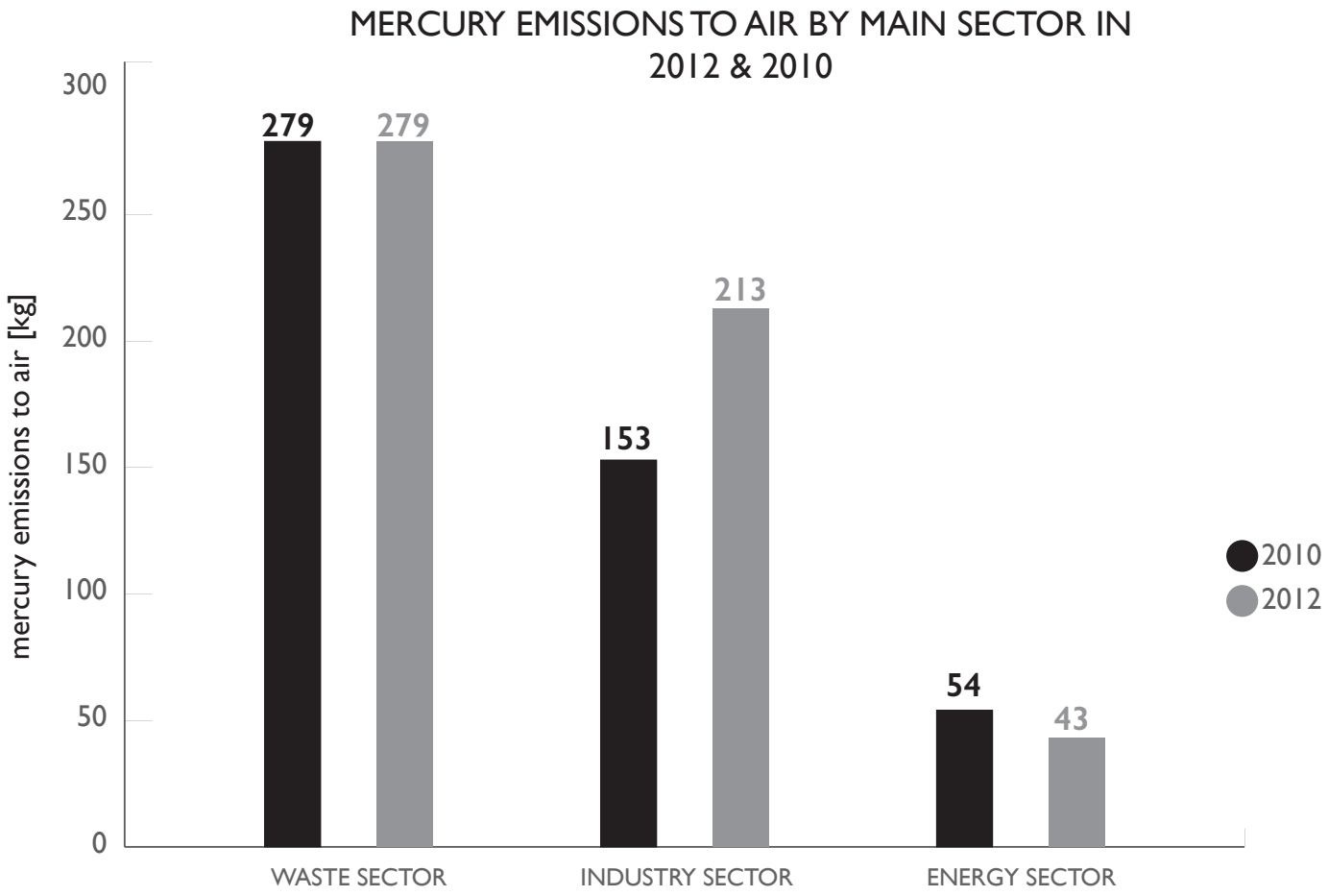


Figure 5: Abu Dhabi mercury emissions to air by main sector in 2010 and 2012.

An increase of 10% in mercury emissions to air was calculated from the year 2010 to 2012. No mercury emissions increase or decrease was estimated for waste, as similar assumptions on mercury used in products were used for both years. A small decrease (8%) of mercury emissions was estimated in medical waste incineration as a result of a decreased reported amount of incinerated medical waste.

A relatively large increase was expected to occur from industry (40% increase), mainly as a result of production capacity expansions in the period, and also from increased needs of energy. A 20% decrease of mercury emissions was estimated in the energy sector in the same period, mainly caused by fuel substitution from raw gas and oil to consumer quality gas in the public electricity and water desalination subsector.

3.2 Mercury Emission Indicators and Comparisons with Other Countries

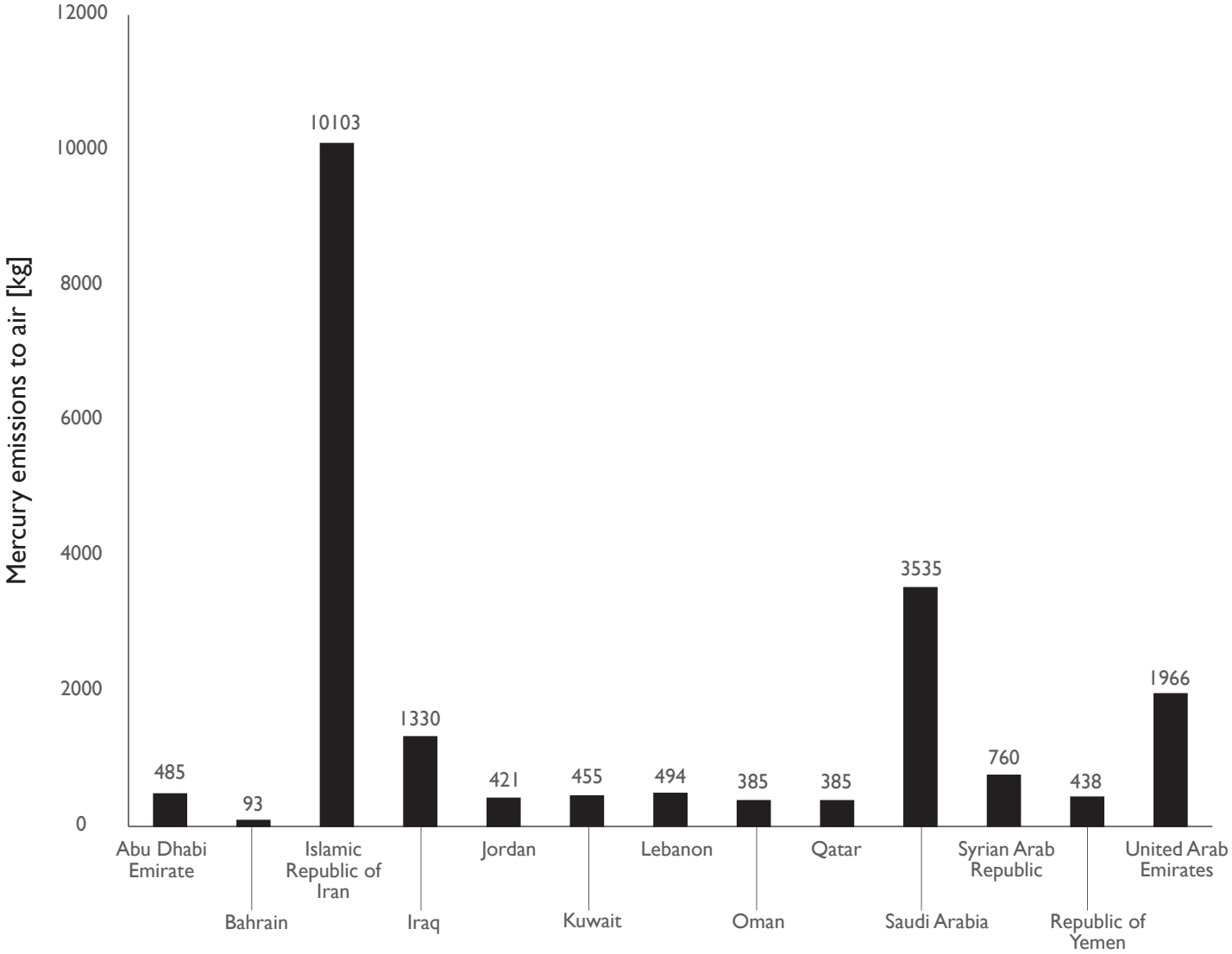


Figure -6a: Total mercury emissions for Abu Dhabi and some selected Middle-East countries, 2010

The calculated baseline atmospheric mercury emissions in this study for Abu Dhabi Emirate correspond to about 25% of the UAE's mercury emissions reported by UNEP in its study of the global mercury emissions for the year 2010. Significant inventory differences were identified between the two studies with regard to sources of emissions, production quantities of cement and iron and steel, and with regard to assumptions on the quality of fossil fuel combusted for power generation. Furthermore, a different assumption was made between the two studies on the technology used for aluminium production.

However, UNEP assessment for the UAE's mercury emissions was based on the statistical data sources of IEA, UNEP 2012, USGS 2012 (input data 2009-2010).

By looking at the total mercury emissions (Figure 6-a) and the mercury emission indicator per GDP (Figure 6-b) in the year 2010, Abu Dhabi Emirate shows lower mercury emission and emission intensity (2.9 kg mercury to air/ billion USD current 2010 prices) compared to other communities in the region.

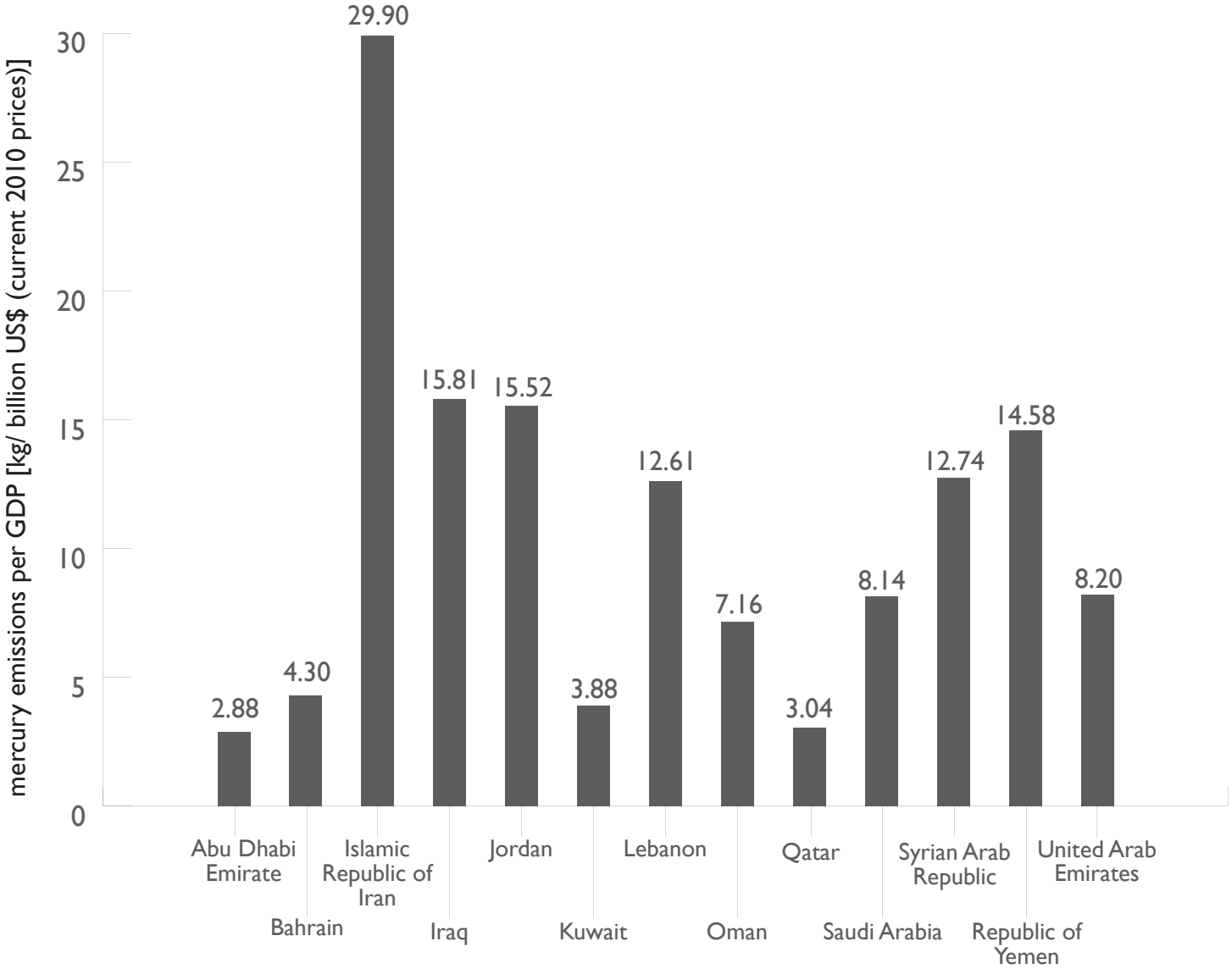


Figure -6b: Mercury emissions per GDP for Abu Dhabi and some selected Middle-Eastern countries, 2010

[1] UNEP 2013, Global mercury assessment.
[2] Based on UNEP assessment study of global mercury emissions for the year 2010.

3.3 Mercury Emissions Projections for Abu Dhabi Emirate

Future emissions of mercury to air are expected to increase by 115% from 485 kg in 2010 to 1,045 kg in the year 2030 (Figure 7-a) if the development plans continue according to the business-as-usual (BAU) scenario; with policies as in the base year 2010 and taking into account the expected changes in population, GDP and sectoral growth.

If the development plans consider additional emission mitigation measures and policies, in what so called extended emission control projection (BAU-EXEC), mercury emissions are expected to increase by only 34 % from 485 kg in 2010 to 649 kg in the year 2030 (Figure 7-b). Thus, the Emirate has the potential to reduce about 38% of its 2010-BAU emissions by the year 2030 (Figure 8). The largest potential for emission reductions is in implementation of Minamata Convention on mercury-containing products (29%), followed by technology upgrades in iron and steel production (5%), and clean energy supply with energy demand side management (4%).

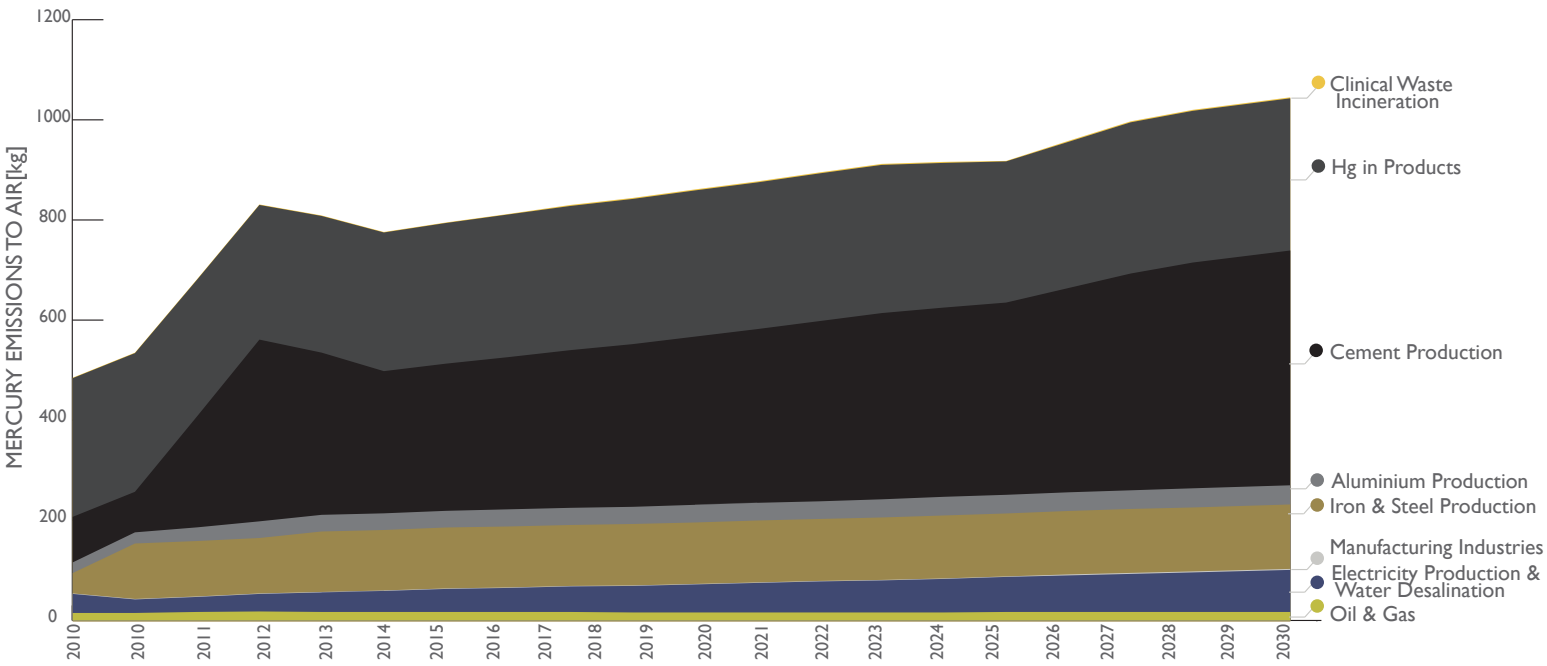


Figure 7-a: Estimated cumulative mercury emissions to air until 2030, according to 2010 business-as-usual (2010-BAU) scenario.

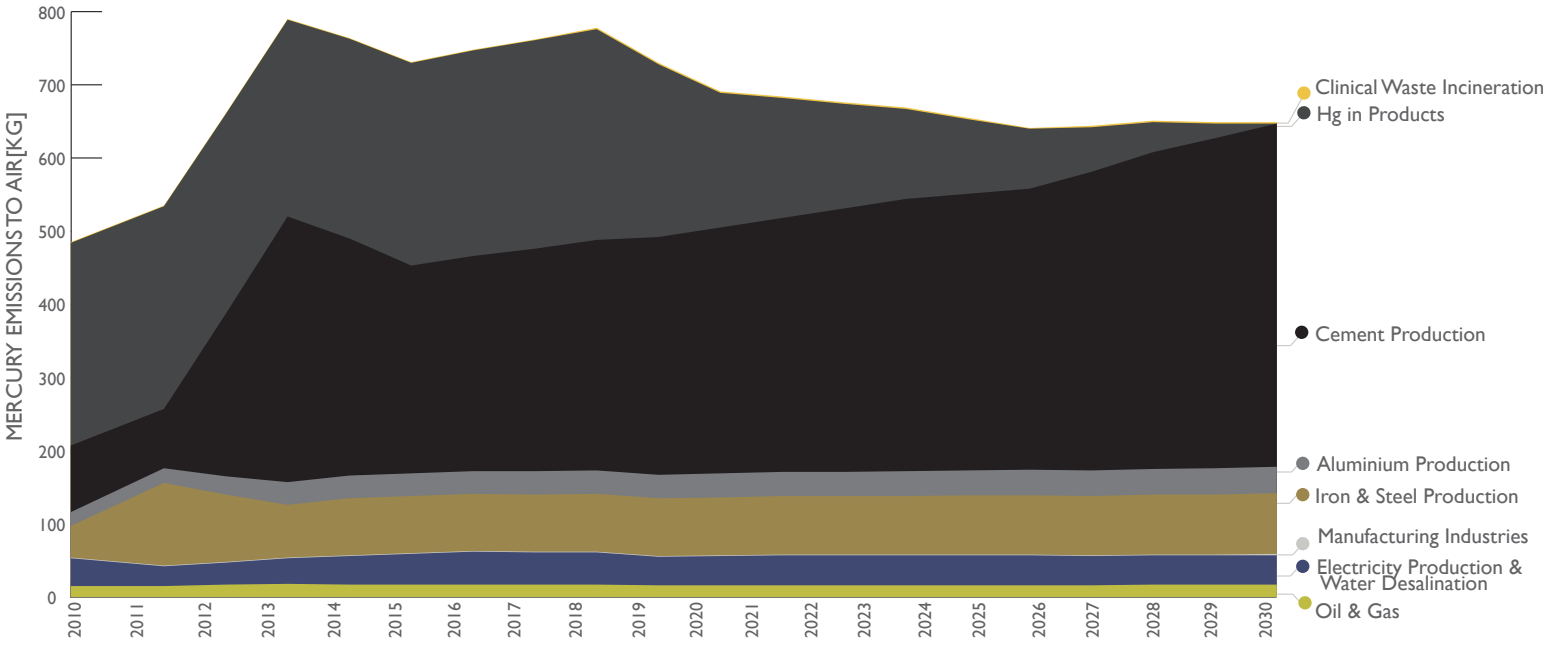


Figure 7-b: Estimated cumulative mercury emissions to air until 2030, according to business-as-usual with extended emission control (BAU-EXEC) scenario.

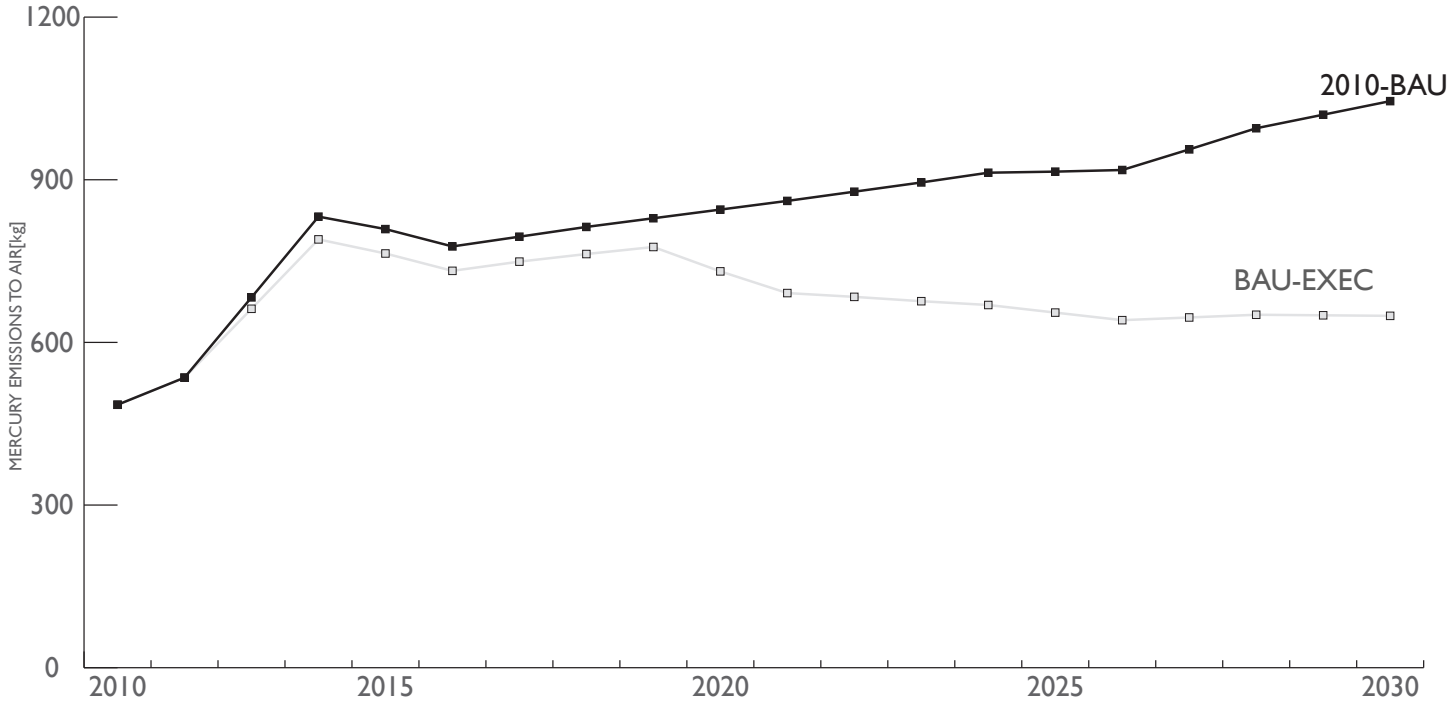


Figure 8: Comparison of total estimated mercury emissions to air until 2030, according to business-as-usual 2010-BAU and business-as-usual with extended emission control (BAU-EXEC) scenarios.

CHAPTER 4
INDUSTRY SECTOR EMISSIONS

The industry sector covers mercury emissions occurring from industrial processes for primary production of ferrous metals (i.e., iron and steel), non-ferrous metals (i.e., aluminium) and cement.

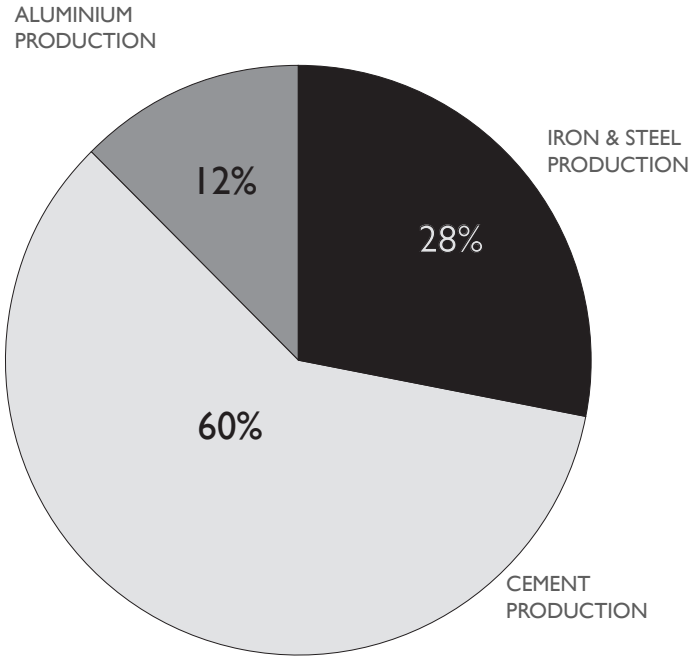
The mercury enters the production processes as impurities in raw materials or in fossil fuels, and is mainly released through high-temperature processes.

Mercury emissions deriving from the combustion of fossil fuels for energy purposes are accounted for separately in the manufacturing industries subsector.

4.1 Baseline Mercury Emissions for the Industry Sector

The Industry sector was the source of 153 kg mercury emissions to air (31.4% of the Abu Dhabi Emirate total) in the year 2010 and 213 kg mercury emissions to air (40% of the Abu Dhabi Emirate total) in the year 2012. Cement production was the single largest source in the industry sector in the year 2010 while metal production was the single largest source in the year 2012 (Figure 9).

MERCURY EMISSIONS TO AIR FOR THE INDUSTRY SECTOR IN 2010



MERCURY EMISSIONS TO AIR FOR THE INDUSTRY SECTOR IN 2012

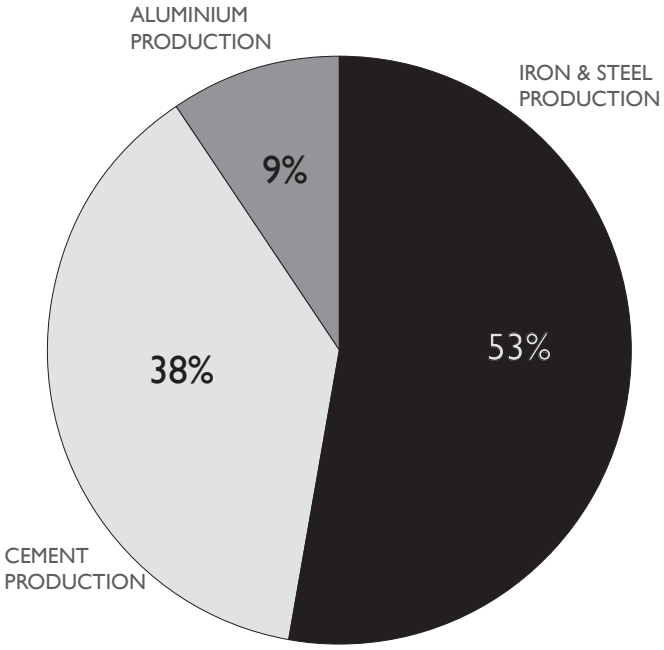


Figure 9: Contribution of the industrial subsectors in the total industry mercury emissions to air in Abu Dhabi Emirate for the years 2010 and 2012.

Between the years 2010 and 2012, mercury emissions to air increased by almost 40%, mostly from iron production (Figure 10).

MERCURY EMISSIONS TO AIR FOR THE INDUSTRY SUBSECTORS IN 2012 & 2010

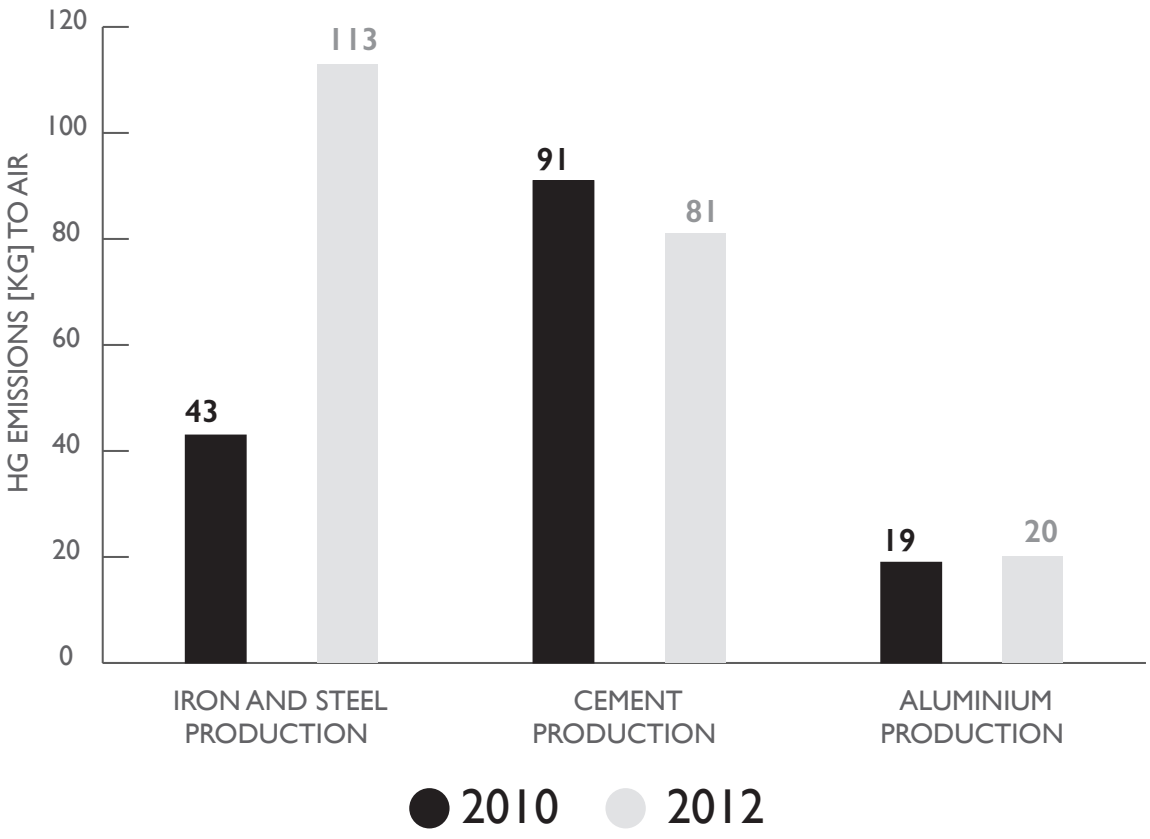


Figure 10: Mercury emissions to air from the industry subsectors in Abu Dhabi Emirate for the years 2010 and 2012.

4.2 Mercury Emissions Projections for the Industry Sector

Industry sector mercury emissions to air were extrapolated until 2030 based on:

2010 Business-As-Usual (2010-BAU)
The relationship between GDP per capita and cement production per capita, GDP and aluminium production, and quantities of aluminium, iron and steel, combined with known capacity increases.

Business-As-Usual with EXtended Emission Control (BAU-EXEC):
Information regarding technology upgrades for iron and steel production (Emirates Steel, communication to EAD).

In the BAU scenario (Figure 11), mercury emissions to air will increase by a factor of 3.16 by 2030 (from 153 kg in 2010 to 637 kg in 2030). The largest increase will occur from cement production, accounting for more than 78% of the total mercury industry emissions increase. Iron and steel production accounts for 18% of the increase. Technology upgrades for iron and steel production, accounted for in the BAU-EXEC scenario, may reduce mercury emissions from industry to air by 7.6% (to 588 kg) in relation to the BAU in the year 2030. This equals about 4.6% reduction of the Emirate's total BAU emissions in the year 2030.

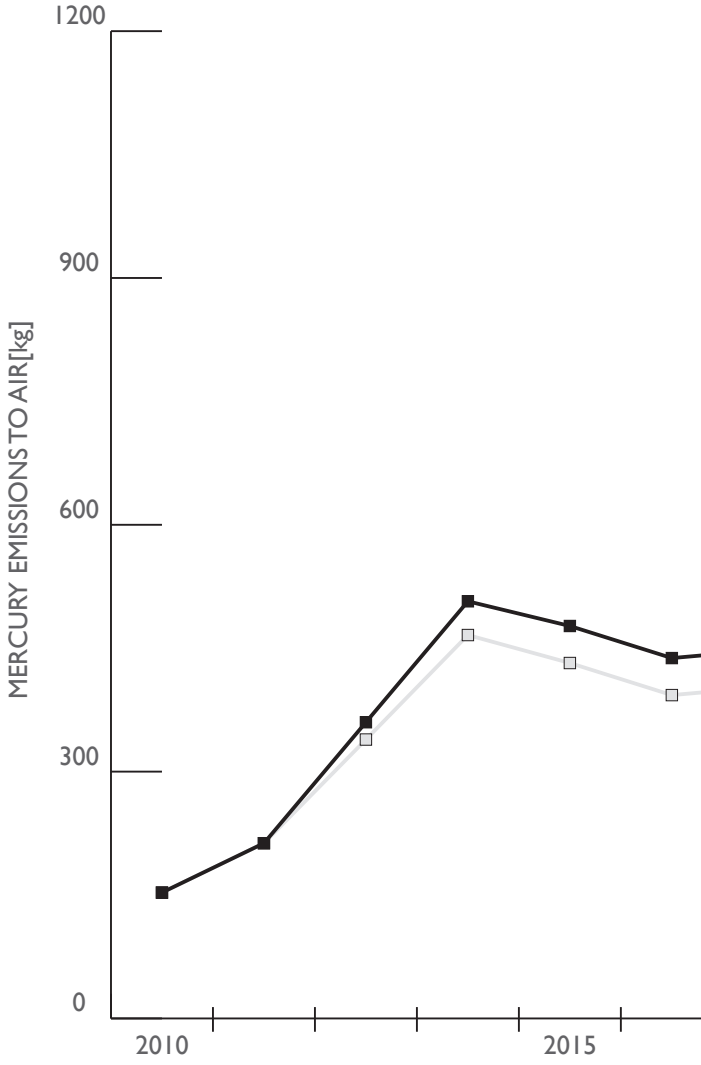
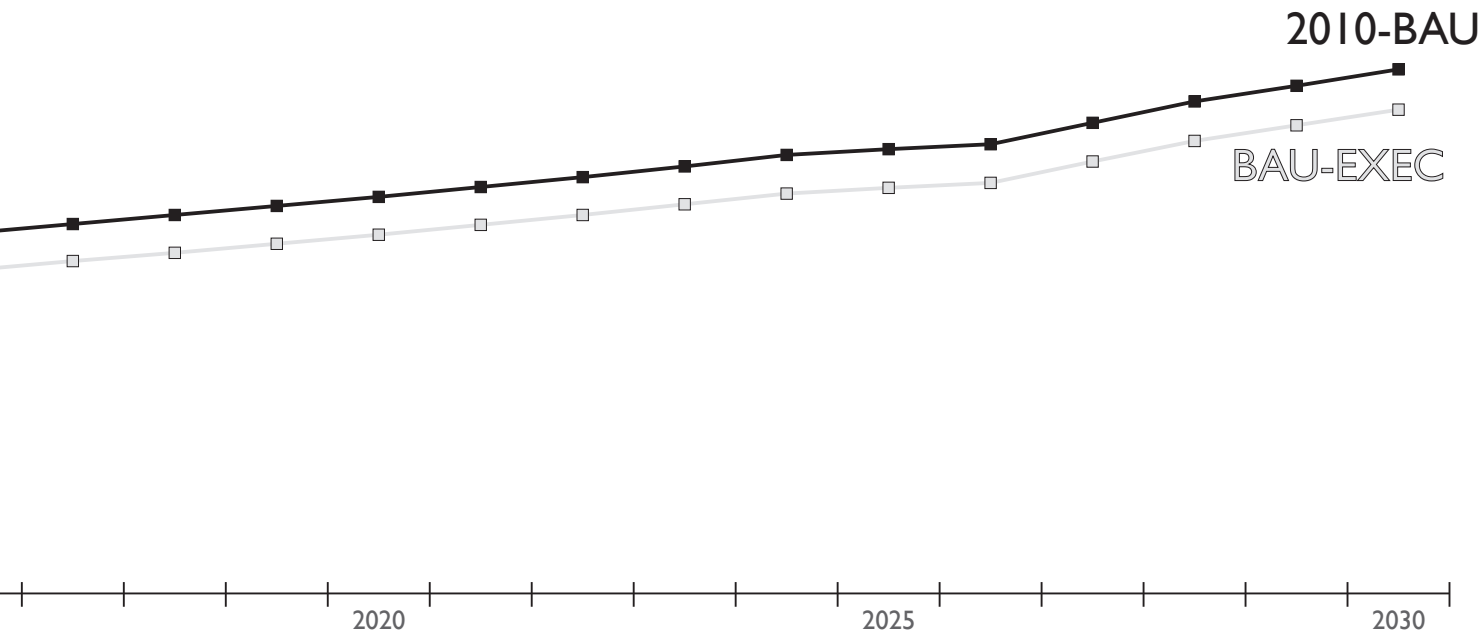


Figure 11: Projected mercury emissions from
emission control (BAU-EXEC) scenarios.



the Industry sector, according to 2010 business-as-usual (2010-BAU) and business-as-usual with extended

CHAPTER 5
WASTE SECTOR EMISSIONS

The waste sector includes emissions from landfilling, breakage, and waste handling of products containing mercury, such as lamps, batteries, electrical switches and relays, barometers, and thermometers. The sector also covers the incineration of medical waste.

5.1 Baseline Mercury Emissions for the Waste Sector

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 landfilling, waste recycling, and from breakage during use. Minor emissions were expected from incineration of medical waste (Figure 12).

MERCURY EMISSIONS TO AIR FOR THE WASTE SECTOR IN 2010 AND 2012

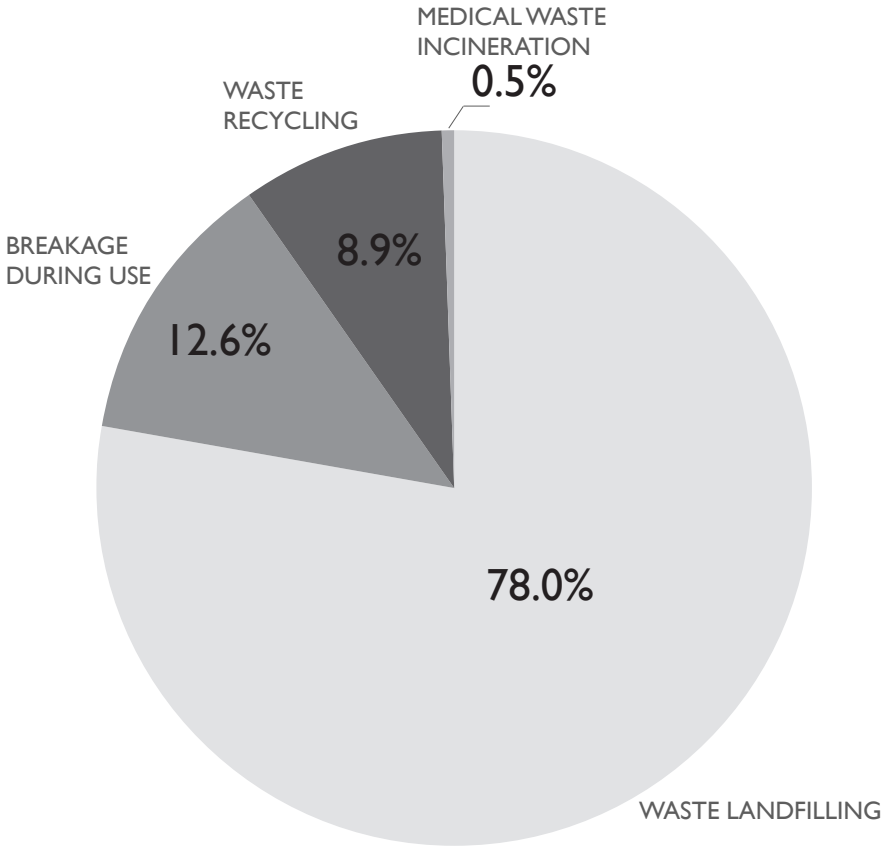


Figure 12: Contribution of the waste activities in the total waste mercury emissions to air, in Abu Dhabi Emirate for the years 2010 and 2012.

No significant changes in mercury emissions to air were reported for the waste sector between the years 2010 and 2012, as similar activity data on mercury used in products was adopted for both years. A small decrease in emissions (8%) was observed for medical waste incineration as a result of the decreased activity in 2012 (Figure 13).

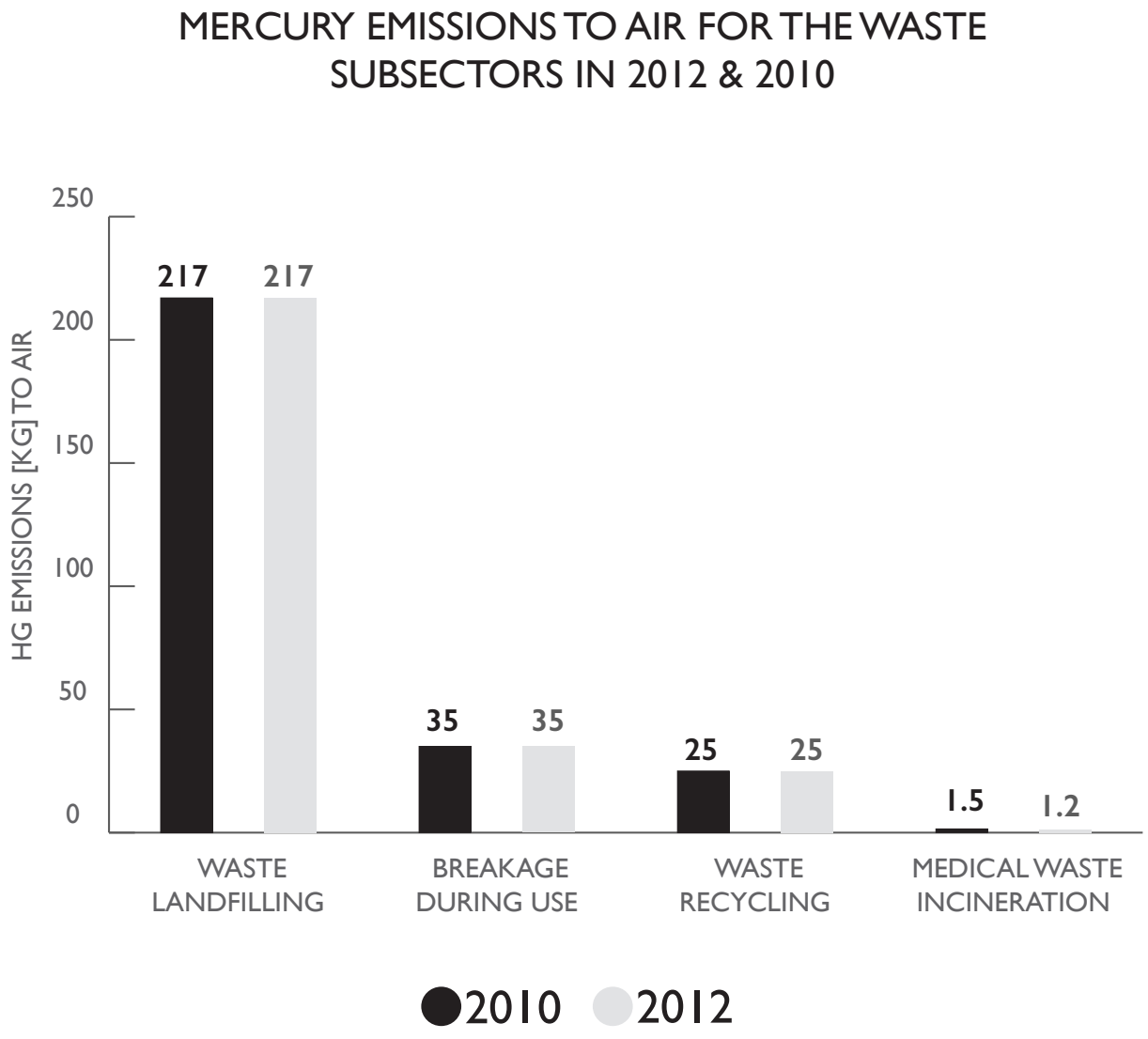


Figure 13: Mercury emissions to air from the waste sector in Abu Dhabi Emirate for the years 2010 and 2012.

5.2 Mercury Emissions Projections for the Waste Sector

Waste sector mercury emissions were extrapolated until 2030 based on:

2010 Business-As-Usual (2010-BAU)

The relationship between the consumed quantities of mercury-containing products and incinerated medical waste in 2012 to the total GDP per capita projected to 2030.

Business-As-Usual with EXtended Emission Control (BAU-EXEC):

The relationship between the consumed quantities of mercury-containing products in 2012 to the total GDP per capita projected to 2030, but with the inclusion of phase out of products in the year 2020 according to requirements of the Minamata Convention on Mercury. Emissions from breakage of products during use and from waste recycling were assumed to continue at a successive decreasing pace over two additional years (i.e. during their in-use lifetime) after the year 2020, while emissions from landfilling of such products were assumed to continue in a successive decreasing pace over 10 additional years after the year 2020. No additional assumption was made for incineration of medical waste.

In the BAU scenario (Figure 14), mercury emissions to air will increase by 10% in 2030 (from 279 kg in 2010 to 306 kg in 2030). Phasing-out of mercury-containing products by implementation of the Minamata Convention on Mercury (BAU-EXEC scenario) will reduce the mercury emissions from waste to air by 99% (to 2 kg) in relation to the BAU in the year 2030. This equals 29% reduction of the Emirate's total BAU emissions in the year 2030.

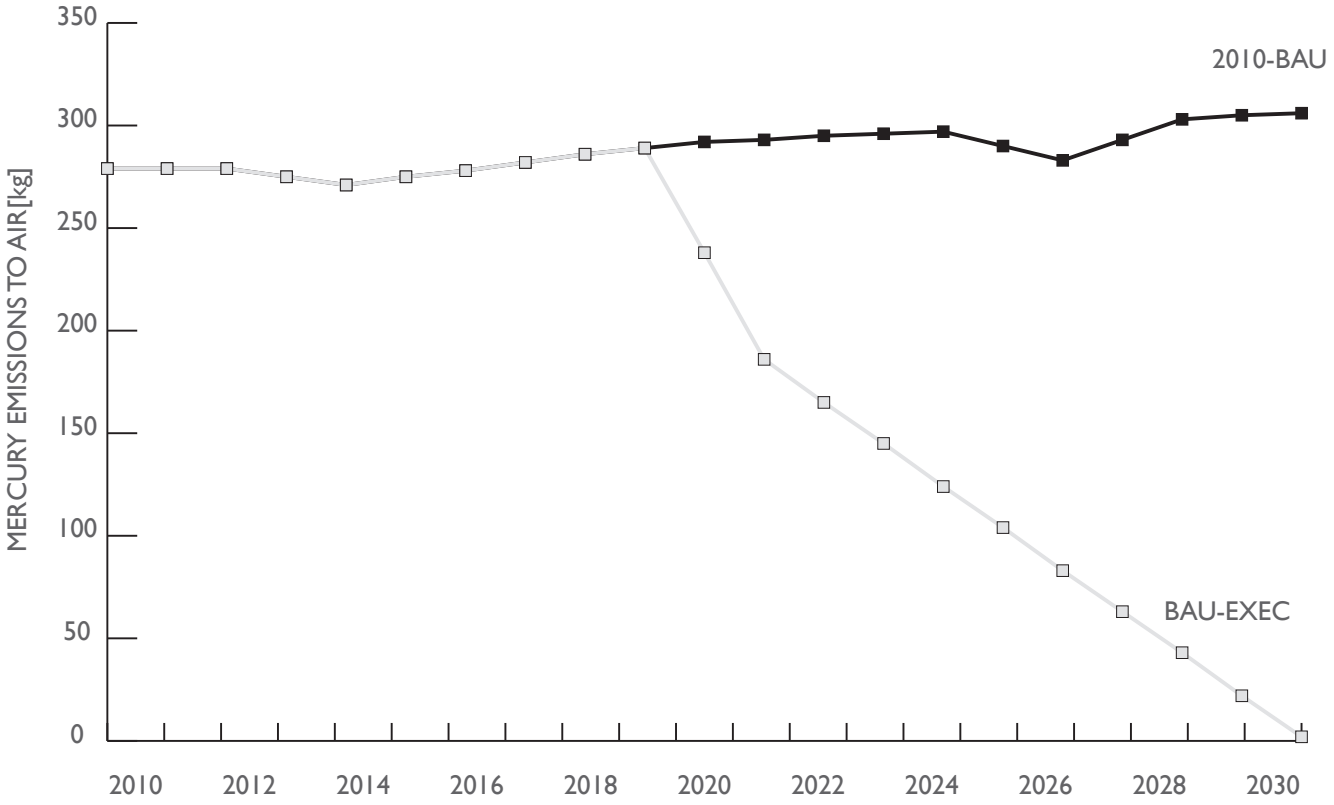


Figure 14: Projected mercury emissions to air from the Waste sector, according to 2010 business-as-usual (2010-BAU) and business-as-usual with extended emission control (BAU-EXEC) scenarios.

CHAPTER 6
ENERGY SECTOR EMISSIONS

Potential sources of mercury emissions from the energy sector in the Abu Dhabi Emirate include the exploration and exploitation of oil and gas, the conversion of these primary energy sources into more usable energy forms in refineries and power plants, and the combustion of fuels in stationary applications.
The energy sector includes the following subsectors:

- Oil and gas activities
- Public electricity and water desalination
- Manufacturing

6.1 Baseline Mercury Emissions for the Energy Sector

The energy sector was the source of 54 kg of mercury emitted to the atmosphere in the year 2010 and 43 kg of mercury emitted to the atmosphere in 2012. The public electricity production and water desalination subsector emits the majority of the emissions in the energy sector, accounting for 70% of the energy sector emissions in 2010 and 63% in 2012 (Figure 15). The main source of these emissions is the combustion of natural gas for power production and water desalination. The oil and gas activities emit 28% and 34% of the energy sector emissions in year 2010 and 2012 respectively. Those emissions originate from crude oil refining and from combustion of fossil fuels for oil and gas extraction and refining. Fossil fuel combustion in the manufacturing is emitting relatively small amounts of mercury to the atmosphere.

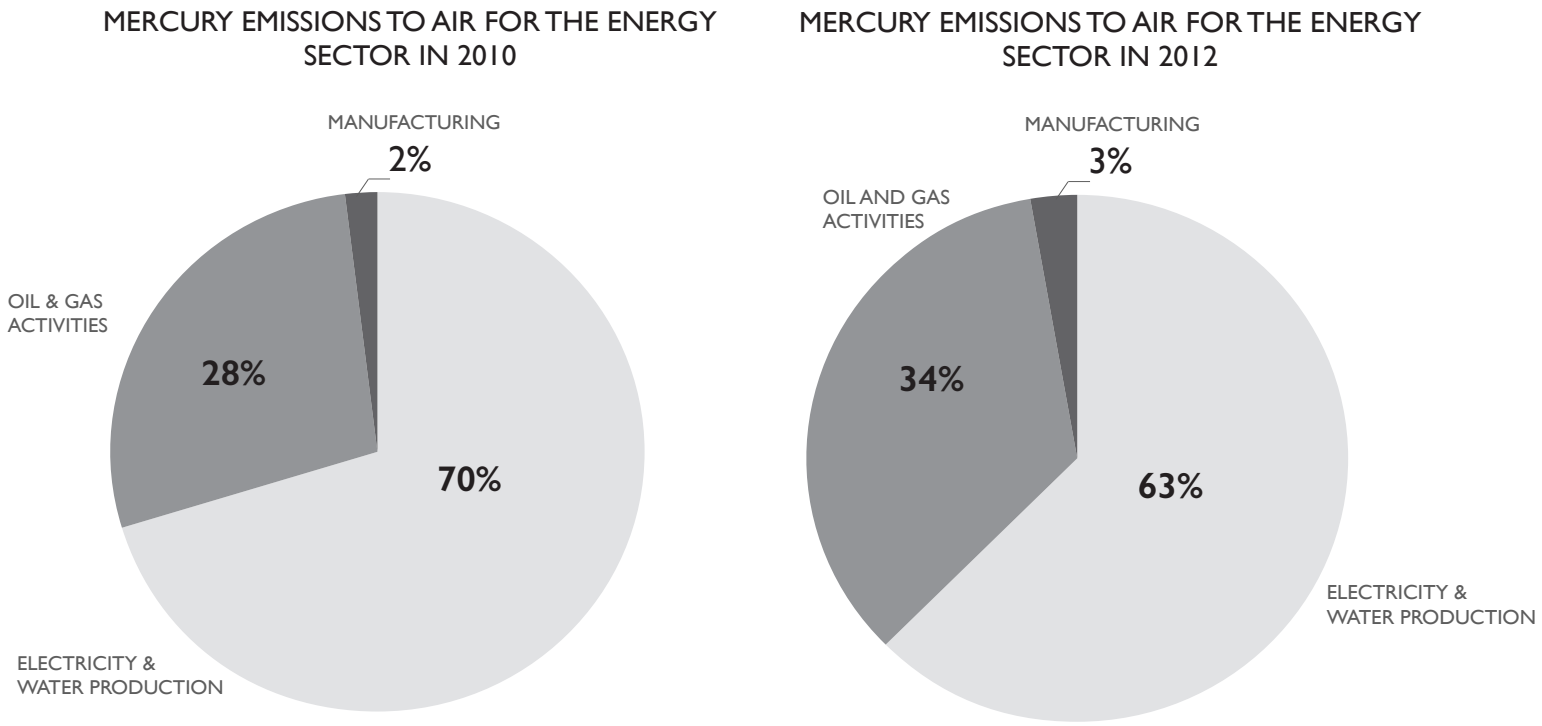


Figure 15: Contribution of the energy subsectors in the total energy mercury emissions to air, in Abu Dhabi Emirate for the years 2010 and 2012.

Between the years 2010 and 2012, mercury emissions to air in the energy sector decreased by 20% in 2012, mainly due to fuel substitution from raw gas and oils to consumer quality gas in the public electricity and water desalination subsector. In 2012, mercury emissions to air in electricity and water desalination decreased by 29%, and in manufacturing industries increased by 35%. The mercury emissions to air calculated for the year 2010 and 2012 are illustrated in Figure 16.

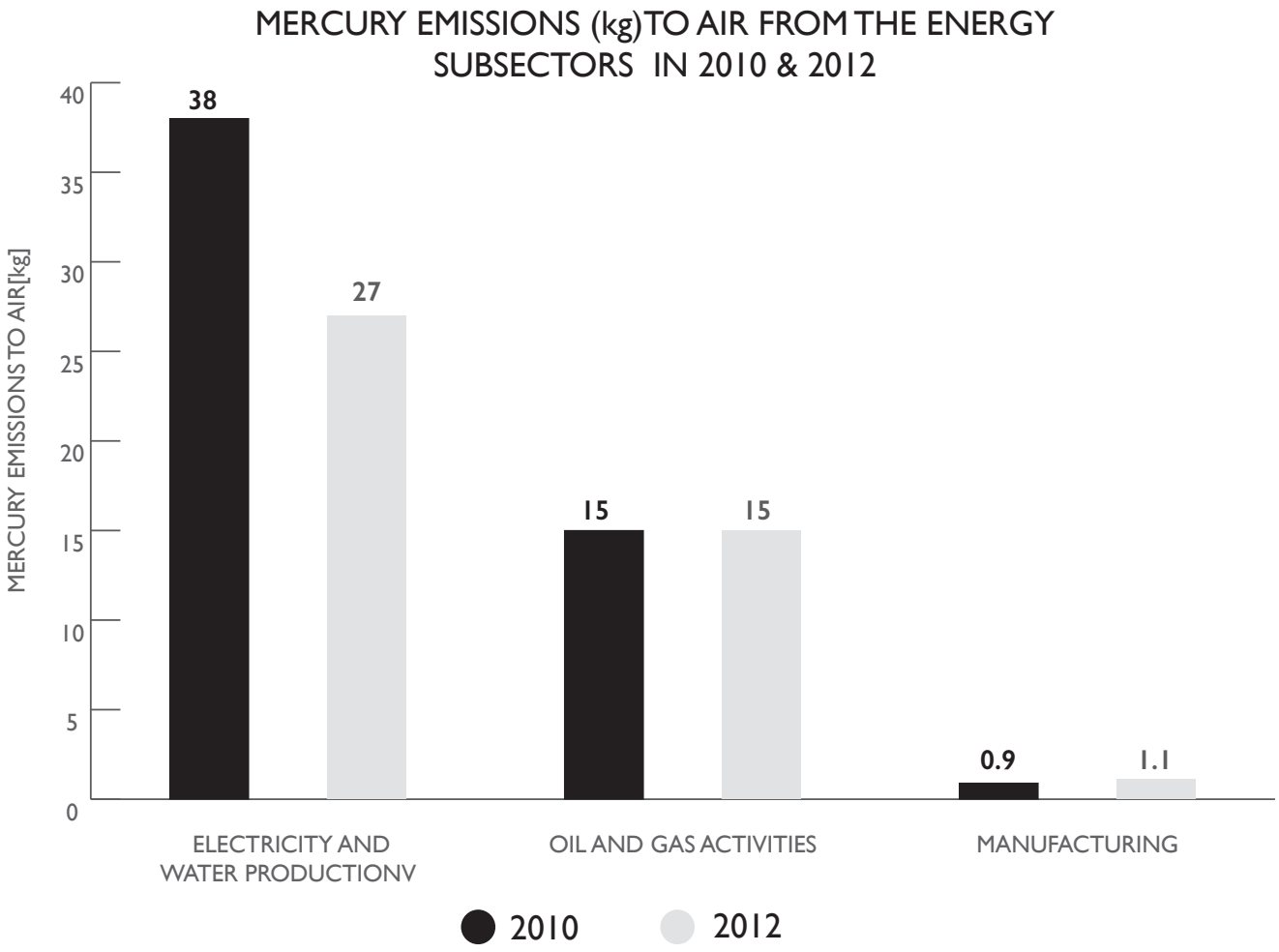


Figure 16: Mercury emissions to air from the energy sector, in Abu Dhabi Emirate for the years 2010 and 2012.

6.2 Mercury Emissions Projections for the Energy Sector

Energy sector mercury emissions to air were extrapolated until 2030, based on:
2010 Business-As-Usual (2010-BAU) IEA projections for UAE oil and gas production,ADWEA electricity demand projections, production quantities of commodities and domestic and agriculture electricity demand forecasts in the AGEDI Public Health Co-Benefits document.

Business-As-Usual with EXtended Emission Control (BAU-EXEC): A reduction in flaring growth rates, an improvement in heat rate of selected facilities, a change in the fuel mix for electricity production, and a reduction in electricity demand. The effect on mercury emission control as a result of carbon capture and storage plans is unknown, and was therefore not included in the analysis.

In the BAU scenario (Figure 17), Energy sector mercury emissions will increase by 90% in 2030 (from 54 kg in 2010 to 102.5 kg in 2030. Additional mitigation measures, accounted for in the BAU-EXEC scenario, may reduce Energy sector mercury emissions to air by 43% in the year 2030, compared to the BAU. This equals a 4% reduction of the Emirate's total BAU emissions in the year 2030.

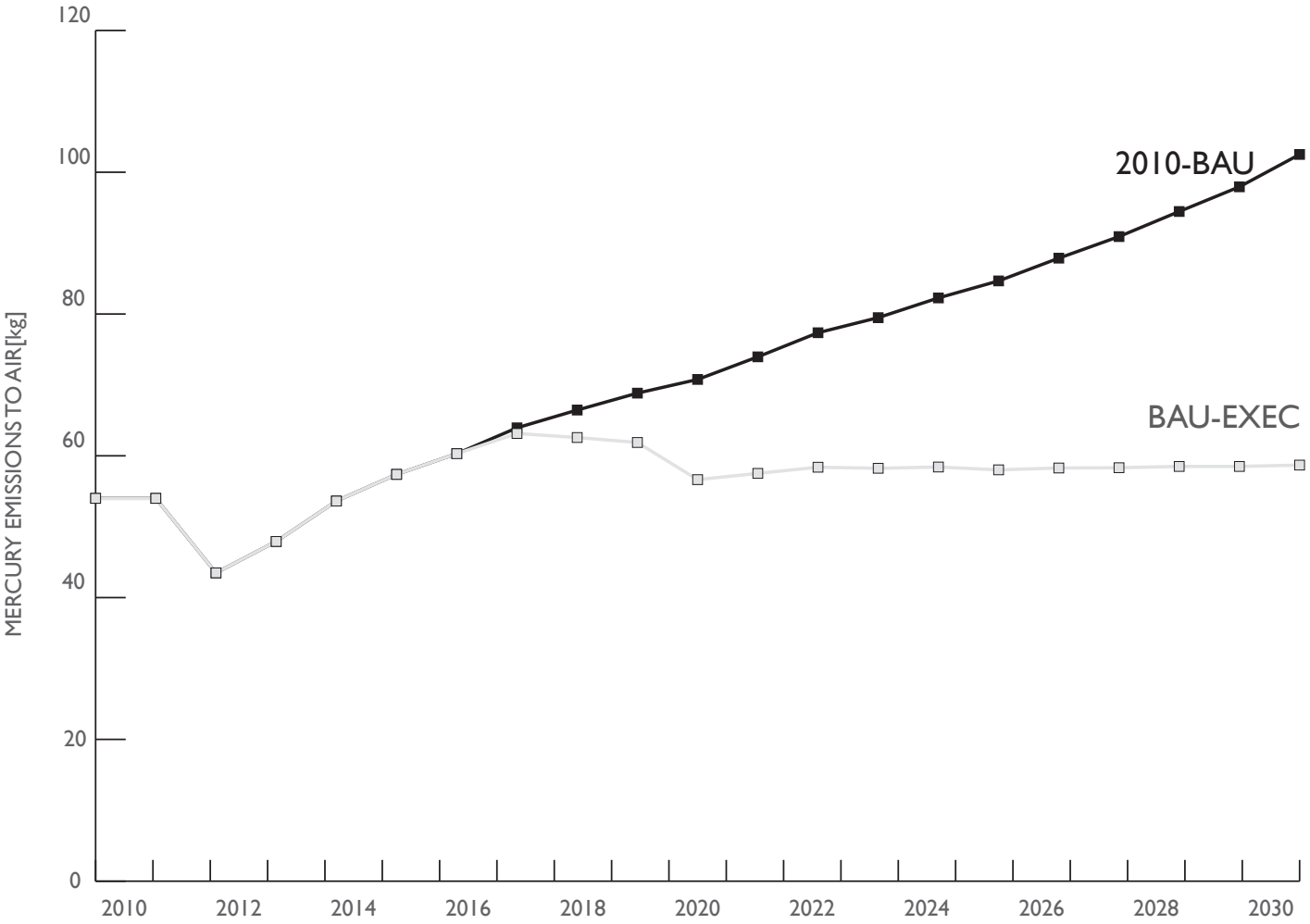


Figure 17: Projected mercury emissions to air from the Energy sector, according to 2010 business-as-usual (2010-BAU)and business-as-usual with extended emission control (BAU-EXEC) scenarios.

CHAPTER 7
MERCURY RELEASES TO WATER

One of the most important pathways for introducing mercury to aquatic systems is atmospheric deposition. Alternatively, mercury deposited to land can be transported to aquatic environments through surface run-off, with a major proportion retained in soil and vegetation. Soil thus acts as a terrestrial mercury pool, which may act as a source of mercury for aquatic systems, through soil erosion and leaching. In countries with a dry climate such as in the UAE (<100 mm surface runoff per year), it is normally assumed that aquatic inputs from surface runoff are limited.

The quantities of mercury emissions to the aquatic environment in the Abu Dhabi Emirate were estimated as 28-29 kg in the years 2010 and 2012. This includes an estimate of 0.5 kg mercury from oil refining, 25 – 26 kg mercury from aluminium production, and about 3 kg of mercury releases from waste landfills (UNEP assumes that 1/100 of the emissions to air are transported to water).

Considering the BAU projection results of oil refining, aluminium production and landfilled waste, releases to the aquatic environment were predicted to reach 52 kg by 2030. This corresponds to an increase of about 80-85% of the base year releases to the aquatic environment. For the BAU-EXEC projection results, no mercury is released from waste landfills in 2030 as a result of the phasing-out of products containing mercury. In such case, the releases to water in 2030 can be projected at 49 kg.

However, it is clear that information regarding releases of mercury to aquatic systems is incomplete. Guidance and emission factors data are not available for some categories that might be important contributors such as waste handling, cement production, iron and and steel production, power production and manufacturing. Additionally, the mobility and subsequent transport of mercury from its source to aquatic environments greatly depend on the chemical form of mercury in combination with site-specific conditions including climate. It is likely that the dry and warm climate in the Abu Dhabi Emirate would affect the mobility of mercury and for this reason, the recommended UNEP distribution factors to water is not representative. Thus, a large degree of uncertainty is associated with any estimation of mercury entering the aquatic environment in Abu Dhabi Emirate.

CHAPTER 8
LESSONS LEARNED AND RECOMMENDATIONS

AP 4966
هيئة البيئة - أبوظبي
Environment Agency - ABU DHABI

8.1 Lessons learned

The EAD`s initiative for development of mercury emissions inventory with emission projections gives a first overview of mercury emissions to the atmosphere in the Abu Dhabi Emirate for the years 2010 and 2012, and the first emission projections until 2030. In addition, an indication of potential releases of mercury to aquatic environment in Abu Dhabi Emirate was attempted for the first time. During the project performance, the following lessons were learned that can be addressed for improvement of the future inventory cycles:

- Mercury emission inventories require complex data, making technical-level stakeholder involvement and stakeholder capacity building necessary.

- Information about mercury contents in various raw materials and fuels as well as mercury contents in products ending up in wastes and their distribution factors into various pathways were unavailable. For this reason, UNEP default values were often used.

- Information on mercury mitigation measures and efficiencies of air pollution control devices installed at a facility level was very limited.

- The Abu Dhabi Emirate mercury inventory results are particularly sensitive to assumptions made on the mercury contents in fuels and the quality of fuel combusted, especially for the combustion of gas. The large variations in mercury concentrations reported in the international literature indicate that there are large regional differences and that the use of generic data would potentially affect the inventory accuracy. To limit uncertainties, research that provides locally specific values is needed.

- Information regarding releases of mercury to aquatic systems is incomplete and data is not available for some key industries, including iron and steel, cement, and electricity production. It is not clear how site-specific conditions and climate do impact on the mobility and transport of mercury from its source to aquatic environments.

- As new data becomes available, it is essential to refine and update the emission inventory and the emission projections. This process requires involvement of the technical experts and decision makers from all relevant stakeholders.

8.2 Recommendations

The followings are recommendations for the mercury work forward in Abu Dhabi Emirate:

- The mercury emission inventory and projections should consistently and regularly be updated to obtain continuity and to be representative for the increased development and new industries in the Emirate. Regulations for monitoring, reporting and verification (MRV) of mercury emissions data and mitigation measures can support the national MRV to Minamata Convention and also contribute in controlling the local emissions.

- In-depth sector inventories including inventory of mercury emissions, mitigation measures and technologies are necessary to be performed for the major sources, particularly for energy industries, primary industries of metals and cement, and waste disposal of products containing mercury. All relevant authorities, industries and academia should be actively involved in data compilation and measurement programmes (measurements of mercury concentration levels).

- Mercury monitoring and research programs should be coordinated with other monitoring programs in order to strengthen the knowledge and improve understanding of the interlinks between the different atmospheric emissions, and also to identify the possible environmental co-benefits and responses to mitigate the emissions.

- Abu Dhabi is encouraged to propose to the Minamata Convention Secretariat, the organization of a Regional Center (RC-Hg) for capacity building and transfer of technology to reduce mercury emissions to the countries of West Asia. The main role of the RC-Hg could be to promote activities in the region in order to facilitate the evaluation of the effectiveness of the Convention in the region through development of appropriate monitoring network dealing with emissions assessment and concentration and deposition measurements. The West Asia region could include the same countries as the ones cooperating within the Regional Center of Stockholm Convention on POPs, coordinated by the Kuwait Institute for Scientific Research (KISR).

- Efforts should be made to identify cost effective and sustainable solutions for mercury emission reductions in the future. Cost-benefit analysis of potential measures, practises and strategies should be developed to allow for a proper and sustainable selection of mercury emission reductions. In this regard, models and a decision support tool should be developed to assess scenarios and their economic costs and benefits.

- Impact assessment of products containing mercury that exist in the local market (practice of use and disposal) and mercury emissions chemical speciation on the human health is encouraged. Mercury platform for public awareness and share of knowledge is an important instrument for reducing the risk of mercury pollution.

- Establishing of an Emirate level- mercury consortium (steering committee and technical expert group) is encouraged to guide and strengthen the necessary mercury actions in the Emirate.

STAKEHOLDER ACKNOWLEDGEMENTS

- Ministry of Climate Change and Environment (MOCCE)
- Ministry of Energy (MOE)
- Emirates Authority For Standardization and Metrology (ESMA)
- Abu Dhabi National Oil Company (ADNOC)
- Abu Dhabi Water and Electricity Authority (ADWEA)
- Statistics Centre-Abu Dhabi (SCAD)
- Abu Dhabi Quality and Conformity Council (QCC)
- Centre of Waste Management – Abu Dhabi (TADWEER)
- Regulation and Supervision Bureau (RSB)
- Abu Dhabi Department of Economic Development (DED)
- Higher Corporation for Specialized Economic Zones (ZonesCorp)
- Industrial Development Bureau (IDB)
- Abu Dhabi Ports
- Health Authority Abu Dhabi (HAAD)
- Department of Municipal Affairs and Transport (DMAT)
- Abu Dhabi Municipality (ADM)
- Al Ain Municipality
- Western Region Municipality (WRM)
- Urban Planning Council (UPC)
- Abu Dhabi Sewerage Services Company (ADSSC)
- Abu Dhabi Food Control Authority (ADFCA)
- Masdar Institute
- Zayed University
- Emirates Aluminium (EMAL)
- Emirates Steel
- Al Jaber Iron and Steel
- Arkan Building Material Company PJSC (cement industry)
- Al Ghaith Industries (Chemical manufacturing industry)
- Union Chlorine LCC (Chemical manufacturing industry)
- Safe Water Chemicals LCC (Chemical manufacturing industry)

COPYRIGHT Environment Agency - Abu Dhabi

© All rights reserved. No part of this report may be reproduced in any material from (including photocopying or storing in any medium by electronic means) without the written permission of the copyright holder. Application for the copyright holders' written permission to reproduce any part of this publication should be addressed to the publisher, in accordance with the international copyright Act 1956 and the UAE Federal Law No. (7) Of 2002, concerning copyrights and neighbouring rights, and person acting in contravention of this will be liable to criminal prosecution and civil claims.

Photo credits: **Environment Agency - Abu Dhabi**

CONTACT US

Environment Agency - Abu Dhabi
Call us: **(+971) 2 4454777**

E-mail us: **customerservice@ead.ae**
Know more about us: **www.ead.ae**

@EADTweets
Environment Agency -Abu Dhabi
Environment Abu Dhabi
Environment Agency -Abu Dhabi