BUR

EGYPT'S FIRST BIENNIAL UPDATE REPORT

to the UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

UNDP

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EEAA

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to the UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

2018

Published by Ministry of Environment, Egyptian Environmental Affairs Agency
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Acknowledgement

I am proud to share this first Biennial Update Report for Egypt with the UNFCCC. It was prepared under the auspices of the Former Minister of Environment, Dr. Khaled Fahmy.

I would like to thank the Project Manager and her team for all her efforts and dedication ensuring that a high-quality report was prepared in a transparent manner and this report was prepared by trained national experts.

Egypt's first Biennial Update Report would not have been possible without the hard work and dedication of all stakeholders including project team, national experts and line ministries. I am particularly thankful for the Global Environmental Facility and the United National Development Programme for providing Egypt with this opportunity and support to make this possible.

Dr. Yasmine Fouad

Minister of Environment

Former Minister's Foreword

Climate change is one of the most pivotal challenges facing the world today. Climate change poses a fundamental threat to livelihoods, ecosystems, water resources, infrastructure, and the global economy. Governments, companies, and societies need to collaborate to control global greenhouse gas emissions, substantially reduce the extent of the future climate change, and avoid its anticipated severe impacts that would undermine development gains.

The Paris Agreement builds upon the United Nations Framework Convention on Climate Change (UNFCCC), and – for the first time – brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries. The Paris Agreement charts a new course in the global climate change action and a base to build an equitable agreement between all countries.

With Egypt's endorsement of the UNFCCC's Paris Agreement in April 2016 and then ratification by the Egyptian Parliament in June 2017, Egypt is committed to submit this first Biennial Update Report (BUR). The BUR project will enable Egypt to prepare and submit its Biennial Update Reports (BURs) to the Conference of the Parties (CoP) of the United Nations Framework Convention on Climate Change (UNFCCC) for the fulfillment of Egypt's obligation to the Convention. H.E. Abdelfattah Al Sisi, President of Egypt and Coordinator of the Committee of the African Heads of State and Government on Climate Change (CAHOSCC), gave an official speech during COP 21 in Paris in 2015. His excellency stressed on the seriousness of the current situation stating that: "the African continent is the lowest contributor to climate change in the world, though it is the most affected by its negative impacts" and invited the international community to provide the needed support to shift this course. Egypt met its commitments on submitting the intended nationally determined contributions (INDC), and in parallel launched Egypt's Sustainable Development Strategy for 2030 as a pledge towards sustainability and preserving the environment for future generations.

The BUR project has provided capacity building programs to build the national expertise in Egypt and registered 40 Arabic-speaking professionals in the UNFCCC rooster of experts. The future BURs preparation would support the Government of Egypt to periodically collect key development indicators under the newly proposed Monitoring, Reporting, and Validation (MRV) system. These data are crucial not only for climate change reporting, but also could influence policies and mechanisms economy aligned with Egypt's Sustainable Development Vision 2030.

I would like to seize this opportunity to express my sincere gratitude to the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) for the support provided during the process of the first BUR preparation. I would like as well to thank the officials of the Ministry of Environment and other ministries, governmental organizations, the BUR Project Team and the consulting team for their dedication and commitment in the preparation of the document through a participatory process, which included a series of workshops, seminars and meetings involving all key stakeholders.

Thank you.

Dr. Khaled Fahmy

Former Minister of Environment

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FISCAL YEAR (FY)
1st July- 30th June

Currency Equivalents
22nd of May 2018
(Central Bank of Egypt)

1 US Dollar (USD) = 17.9566 Egyptian Pound (EGP)
1 Euro (EUR) = 21.1169 Egyptian Pound (EGP)

UNITS AND MEASURES	
bcf	Billion Cubic Feet
BCM	Billion Cubic Meter
bbl/d	Barrels Per Day
CO_2e	Carbon Dioxide Equivalent
EGP	Egyptian Pound
Gg	Giga Gram
GWh	Gigawatt-Hours
Km	Kilometer
kWh	Kilo Watt Hour
MJ	Mega Joules
Mtoe	Millions Tons of Oil Equivalent
MW	Mega Watt
USD	United States Dollars

Acronyms and Abbreviations

AFD	Agence Française De Développement
AFOLU	Agriculture, Forestry and Other Land Use
ARC	Agricultural Research Center
BMZ	The German Federal Ministry for Economic Cooperation and Development
BUR	Biennial Update Report
CAPMAS	Central Agency for Public Mobilization and Statistics
CCCD	Climate Change Central Department
CDM	Clean Development Mechanism
CDM-DNA	CDM Designated National Authority
CEDARE	The Centre for Environment and Development for The Arab Region and Europe
CEO	Chief Executive Officer
CERs	Certified Emission Reductions
CH_4	Methane
CME	Coordinating Managing Entity
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CORC	Cairo Oil Refining Company
CORI	Coastal Research Institute
CSP	Concentrated Solar Power
CTF	Clean Technology Fund
CUF	Capacity Utilization Factors
DDT	Dichloro-Diphenyl-Trichloroethane
DNA	Designated National Authority
EAS	Agricultural Economic Affairs Sector
EBRD	European Bank for Reconstruction and Development
ECHEM	Egyptian Petrochemicals Holding Company
ECO	Environmental Compliance and Sustainable Development Office
ECRI	Environment and Climate Changes Research Institute
EE	Energy Efficiency
EEAA	Egyptian Environmental Affairs Agency
EEHC	Egyptian Electricity Holding Company
EETC	Egyptian Electricity Transmission Company
EEU	Energy Efficiency Units
EGAS	Egyptian Natural Gas Holding Company
EGPC	Egyptian General Petroleum Corporation
EHA	Egyptian Hotel Association
ENCPC	Egypt National Cleaner Production Center
EnMS	Energy Management System
EOS	Egyptian Organization for Standardization
EPAP	Egyptian Pollution Abatement Programme

EPR	Extended Producer Responsibility
EU	European Union
FAO	Food and Agriculture Organization
FEI	Federation of Egyptian Industries
FIT	Feed-in Tariff
Ganope	Ganoub El Wadi Petroleum Holding Company
GDP	Gross Domestic Product
GEF	Global Environment Facility
GERD	Grand Ethiopian Renaissance Dam
GGF	Green Growth Fund
GHGI	Greenhouse Gas Inventory
GHGs	Greenhouse Gases
GIZ	Deutsche Gesellschaft Für Internationale Zusammenarbeit
GNI	Gross National Income
GoE	Government of Egypt
GOPP	General Organization of Physical Planning
GPG	Good Practice Guidance
GSH	Green Star Hotel
GWP	Global Warming Potential
HBRC	Housing and Building Research Center
HCWW	Holding Company for Waste Water
HFCs	Hydrofluorocarbons
ICZM	Integrated Coastal Zone Management
IDA	Industrial Development Authority
IDSC	Information and Decision Support Center
IEE	Industrial Energy Efficiency
IER	Incineration with Energy Recovery
IFC	International Finance Corporation
IGCC	Integrated Gasification Combined Cycle
IMC	Industrial Modernization Centre
IMF	International Monetary Fund
INC	Initial National Communication
INDC	Intended Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Process and Product Use
ISWMS	Integrated Solid Waste Management Sector
JBIC	Japan Bank for International Cooperation
KFW	Kreditanstalt Fuer Wiederaufbau
LECB	Low-Emission Capacity Building
LED	Light-Emitting Diode
LPG	Liquefied Petroleum Gas
MED-ENEC	Energy Efficiency in the Construction Sector in the Mediterranean
MIIC	Ministry of Investment & International Cooperation

MALR	Ministry of Agriculture & Land Reclamation
MoCA	Ministry of Civil Aviation
MoD	Ministry of Defense
MoE	Ministry of Environment
MoERE	Ministry of Electricity and Renewable Energy
MoH	Ministry of Housing
MoHP	Ministry of Health and Population
MoLD	Ministry of Local Development
MoP	Ministry of Petroleum and Mineral Resources
MoTI	Ministry of Trade and Industry
MRV	Measurement, Reporting, And Verification
MSW	Municipal Solid Waste
MWRI	Ministry of Water Resources and Irrigation
N_2O	Nitrous Oxide
NAMA	Nationally Appropriate Mitigation Actions
NCCC	National Council for Climate Change
NEEAP	National Energy Efficiency Action Plan
NG	Natural Gas
NMVOCs	Non-Methane Volatile Organic Compounds
NOU	National Ozone Unit
NOx	Oxides of Nitrogen
NRC	National Research Center
NREA	New & Renewable Energy Authority
NSWMP	National Solid Waste Management Programme
NWRC	National Water Resources Centre
ODA	Official Development Assistance
ODS	Ozone Depleting Substances
PDP	Participatory Development Programme
PFCs	Per-Fluorocarbons
PMU	Project Management Unit
POAs	Program of Activities
PPSI	Private Public-Sector Industry Project
PV	Photovoltaic
QA	Quality Assurance
QA-WG	Quality Assurance Working Group
QC	Quality Control
RDF	Refuse Derived Fuel
RE	Renewable Energy
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
REM	Renewable Energy in the Mediterranean Region
SADS	Sustainable Agricultural Development Strategy Towards 2030
SAP	Structural Adjustment Program

SAR	Second Assessment Report
SCCF	Special Climate Change Fund
SDS	Sustainable Development Strategy
SEC	Supreme Energy Council
SECO	Swiss State Secretariat for Economic Affairs
SF_6	Sulphur Hexafluoride
SIDPEC	Sidi Kreer Petrochemcal Company
SLR	Sea Level Rise
SMEs	Small and Medium Enterprises
SNC	Second National Communication
SO_2	Sulphur Dioxide
STP	Egypt Sustainable Transport Program
SWH	Solar Water Heaters
SWM	Solid Waste Management
TA	Technical Assistance
TDM	Transport Demand Management
TIMES	The Integrated Markal-Efom System
TNC	Third National Communication
TS-WG	Technical Support Working Group
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
WB	World Bank
WMRA	Waste Management Regulatory Authority

TABLE OF CONTENTS

List of Tables

List of Figures

Executive Summary

As a Party to the United Nations Framework Convention on Climate Change (UNFCCC), the Government of Egypt (GoE) recognizes the importance of meeting collectively the ultimate objective of the Convention, which is mainly to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Egypt has submitted the Initial National Communication in 1999, the Second National Communication in 2010, and the Third National Communication in 2016. The Government of Egypt has prepared this first Biennial Update Report (BUR) for submission to the UNFCCC in 2018.

A National Steering Committee, chaired by the CEO of the Egyptian Environmental Affairs Agency (EEAA) and including representatives of relevant ministries and agencies, was constituted to facilitate and oversee the preparation of the BUR. Preparation of the BUR included on-going technical consultations with multiple stakeholders. In addition, a collaboration has been established with the National Statistics Agency - Central Agency for Public Mobilization and Statistics (CAPMAS) - to ensure the sustainability of the Greenhouse Gas Inventory (GHGI) data collection. Following several rounds of reviews, the BUR was adopted by the National Council on Climate Change (NCCC).

National Circumstances

The Arab Republic of Egypt spans over the northeast corner of Africa and the west corner of Asia through a land bridge formed by the Sinai Peninsula. Egypt has a total land area of 1,000,000 square kilometers. The terrain consists of a vast desert plateau that is interrupted by the Nile Valley and Delta. Administratively, Egypt is divided into 27 governorates.

Egypt has a dry and hot desert **climate** with a mild winter from November to April and a hot summer from May to October. Egypt receives between 20 mm to 200 mm of annual average precipitation along the Mediterranean coastline. Over the past 25 years, a rise in temperature rise have been observed. In addition, a significant rise in extreme weather events over the last ten years has caused casualties and economic losses.

Egypt is a developing country, with a fast-growing **population** of about 90 million as of 2015 (CAPMAS, 2016). About 95% of the population lives on only 4% of the total land area in the Nile Valley and Delta. Demographics in Egypt are dominated by youth with a median age of 24 and 50% of the population under 25 years old (CAPMAS, 2015). With an ambitious economic growth outlook, these demographics place considerable stresses on natural resources, employment, infrastructure, education, and health care.

Table A summarizes key socio-economic indicators for Egypt in 2015.

Table A: Summary of key socio-economic indicators for Egypt, 2015 (CAPMAS, 2016)

Indicator	Value
Population (million)	90.08
Urban population as percentage of total population (percentage)	42.7%
Population below poverty line (percentage, 2012/2013)	26.3%
Unemployment rate (percentage)	12.8%
Life expectancy at birth (years) Male Female	 70.1 72.9
Literacy rate (percentage)	76%
GDP (2014/2015) Billion EGP Billion USD (1 USD = 7.32 EGP, Central Bank of Egypt in 2014/2015)	 2,459 336
GDP per capita ($)	3,730

Supplying a share agreed by international treaties at 55.5 billion cubic meters (BCM) per year, the Nile river is the main source of fresh water for Egypt. The remaining fresh water resources available provide an additional 20 BCM and include groundwater aquifers, reuse of agricultural drainage and treated wastewater, rain and floods, and desalination. With population and economic growth, there has been a sharp decline in the annual freshwater resources available per capita, pushing the country closer to the severe water scarcity threshold (500 cubic meters per capita per year). Climate change impacts, water pollution, and geopolitical factors (such as the Grand Ethiopian Renaissance Dam) are expected to exacerbate water stress in Egypt. The GoE is implementing a substantial investment program towards efficient, reuse, and generation of new water sources as a national priority.

Climate change is expected to be a source of pressure on the coastal zones, particularly the Nile Delta, due to impact of the sea level rise (SLR) and the recurrence of severe storms and extreme events (IDSC, 2011). This would negatively impact ecosystems, human health, the reliability and operating costs of water and sanitation infrastructure, and the country's economic activities in general.

Egypt's economy has begun to recover in FY 2014/2015 after the period of political instability between 2011 - 2014 as a consequence of two revolutions. In FY 2014/2015, the total Gross Domestic Product (GDP) was estimated at $336 billion and a Gross National Income (GNI) per capita of $3,730. The economic situation deteriorated during this 3.5 years period due to frequent electricity outages and decrease in foreign direct investment caused by the substantial gap between production and consumption of natural gas resulting in a severe energy crisis starting 2012.

Until recently, Egypt was a self-sufficient energy consumer, meeting its energy needs through local production. However, this has been reversed due to growth in energy demand by 32% from 1990 to 2014 encouraged by heavy energy subsidies constituting 7% of the country's GDP (CAPMAS, 2015). In 2012, due to the prolonged electricity blackouts, the government rerouted the natural gas from energy-intensive industries, specifically the cement sector, to power plants used to generate electricity for the residential sector.

In 2014, as part of comprehensive energy sector reform to address the domestic demand for energy, the GoE permitted the use of coal in cement production and selected energy-intensive sectors. To control emissions, granting coal licenses to cement plants by the Ministry of Environment is conditional on a implementation of GHG reduction action plans. The GoE has also taken concrete measures towards improved energy efficiency and transition to clean and renewable energy in the framework of the Strategy for Integrated Sustainable Energy 2035. The Strategy targets include increasing the contribution of renewable energy to 37% of the electricity mix by 2035 and encouraging private sector investments through net metering, feed-in-tariff, and other schemes.

During FY 2012/2013, energy consumption by the transport sector reached approximately 16.6 million tons oil equivalent (mtoe), representing 48% of total petroleum energy consumption. The industrial sector in Egypt remains an important pillar of the economy, contributing to ca. 34% of GDP in 2015, but is also responsible for about 37% of total energy consumption. The agriculture sector constituted 11.8% of the economy in 2015 and employs 27.5% of the labor force. To address growing challenges and reform the waste sector, the Waste Management Regulatory Authority (WMRA) was established in 2015.

Institutional Arrangements

Egypt ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1994 as a member of non-Annex I Parties. Egypt signed the Paris Agreement in April 2015 and the Parliament ratified the agreement in June 2017.

The Ministry of Environment (MoE) was established in 1997 to be responsible for the country's environmental affairs. The policies of the Ministry are executed by the Egyptian Environmental Affairs Agency (EEAA). The Climate Change Unit was established at EEAA in 1996 and was upgraded to a Central Department (CCCD) in 2009 to strengthen the climate change institutional structure on the national level. A national climate change committee was formed in 1997 and restructured over the years. In 2015, it was designated the National Climate Change Council (NCCC) to include mandates to meet the rapidly evolving on climate change scene at the national, regional and international levels. Moreover, the GoE adopted the United Nations Sustainable Development Goals and in 2016 thus launched the national Sustainable Development Strategy 2030.

National GHG Inventory

The GHG inventory (GHGI) has been prepared according to 2006 Intergovernmental Panel on Climate Change (IPCC) GHGI Guidelines for the time series between 2005 (last year covered by the TNC GHG Inventory) and 2015. As per IPCC guidelines, the GHGI covers four sectors: i) Energy, ii) Industrial Process and Product Use (IPPU), iii) Agriculture, Forestry, and Other Land Use (AFOLU), and

iv) Waste. It includes a breakdown of Egypt's anthropogenic GHG emissions by source of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydro fluorocarbons (HFCs), per-fluorocarbons (PFCs) and sulphur hexafluoride (SF_6) as well as precursors (NOx, CO, NMVOCs, SO_2).

Egypt's GHG emissions for 2015 totaled 325,614 Gg CO_2e. The breakdown by gas is 237,871 Gg CO_2e from CO_2 emissions, 41,483 Gg CO_2e. from CH_4 emissions, and 38,574 Gg CO_2e. from N_2O emissions. Total GHG emissions have increased by 31% from 2005 to 2015 with an average annual growth rate of 2.35%. GHG emissions from the Energy, IPPU and Waste sectors have increased by 40%, 49%, and 34% respectively; while the emisions from the AFOLU sector have decreased by 7% over the same period.

Energy Sector:

As shown in Figure A, Energy is the highest GHG-emitting sector accounting for 64.5% of the total emissions for 2015 (210,171 Gg CO_2e).

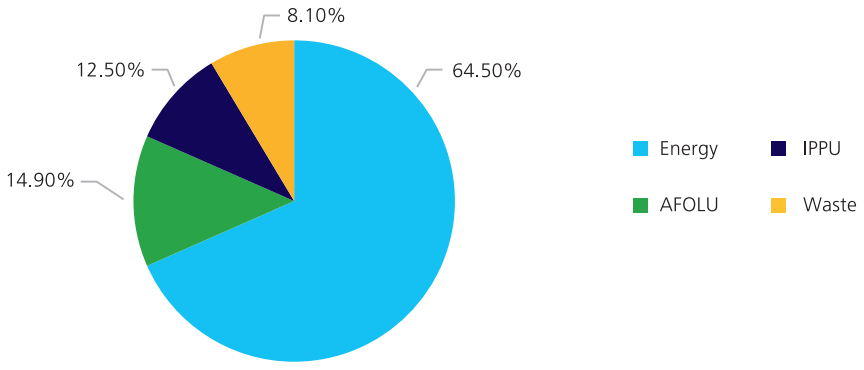


Figure A: GHG contribution of each sector to the total emissions, 2015

Energy sector contributed 87% of national CO_2 emissions, 3% of CH_4 emissions, and 2% of N_2O emissions in 2015. Energy sector emissions resulted from 1) fuel combustion activities (97%) and 2) fugitive emissions from oil and natural gas (3%), as illustrated in Figure B. Analysis performed using the IPCC software yielded a total of 3% Uncertainty for the energy sector inventory and 4% trend uncertainty between 2005 till 2015.

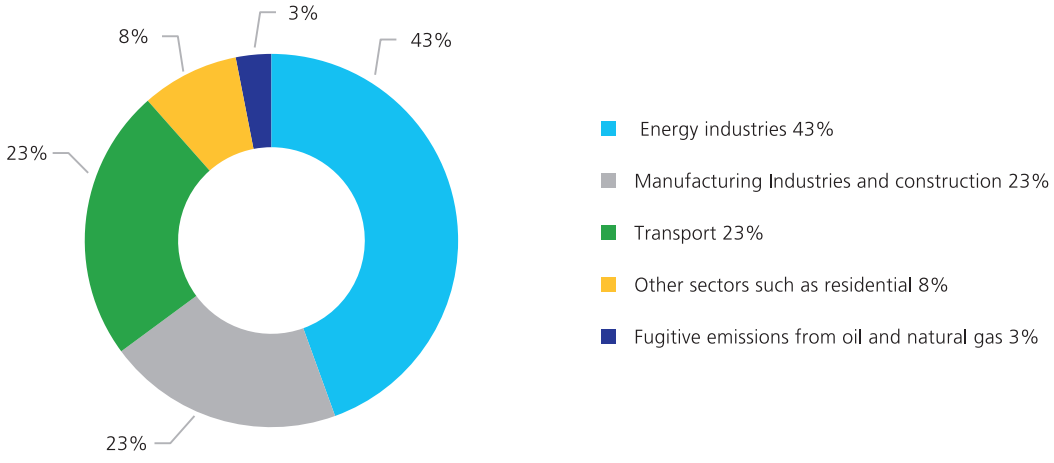


Figure B: Emissions per category for the energy sector, 2015

IPPU Sector:

The IPPU sector contributed 12.5% of national GHG emissions (40,664 Gg CO_2e) in 2015. Sector emissions constituted 12% of national CO_2 emissions and 12% of N_2O emissions. Sector emissions resulted from 1) mineral industry (54%), 2) chemical industry (18%), 3) metal industry (17%), and 4) product uses as substitutes for Ozone depleting substances (11%), as illustrated in Figure C. Analysis performed using the IPCC software yielded 14 % uncertainty for the IPPU sector inventory and 27 % trend uncertainty over the period between 2005 and 2015.

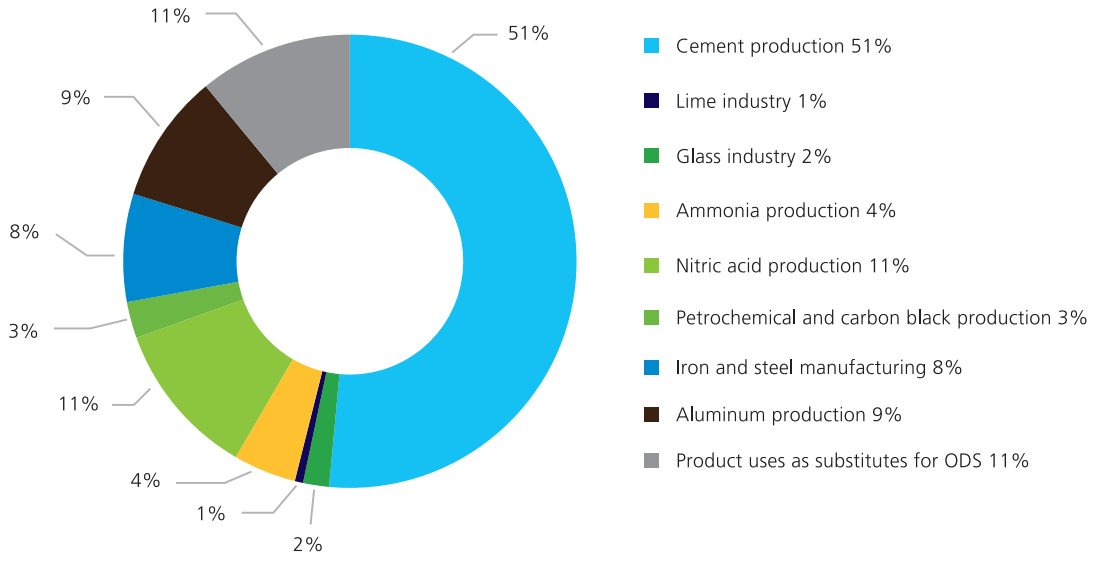


Figure C: Emissions per category for the IPPU sector, 2015

AFOLU Sector:

The AFOLU sector contributed 14.9% of national GHG emissions (48,390 Gg CO_2e) in 2015. Sector emissions resulted from 1) enteric fermentation, 2) manure management, 3) field residuals burning, 4) agriculture soil, and 5) rice cultivation. The largest contributor to the total GHG emissions is aggregate sources and non-CO_2 emissions sources on land (66%) followed by livestock (34%), as illustrated in Figure D. Uncertainty analysis for activity data was conducted based on expert judgment and is ranged between± 15%, while uncertainty of the emission factors is ± 50%.

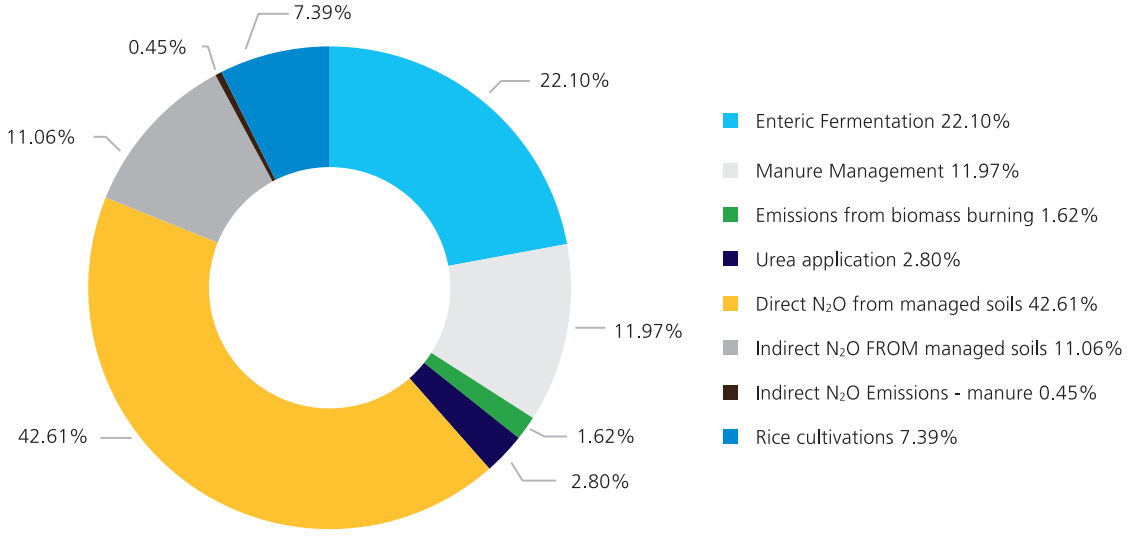


Figure D: Emissions per category for the AFOLU sector, 2015

Waste Sector:

The waste sector contributed 8.1% of national GHG emissions (26,389 Gg CO_2e) in 2015. Sector emissions resulted from 1) solid waste disposal and 2) domestic and industrial wastewater treatment and discharge; with minor contributions from biological treatment of solid waste as well as incineration & open burning of solid waste, as illustrated in Figure E. Analysis performed using the IPCC software yielded 83% inventory trend uncertainty between 2005 till 2015. This is likely due to the high uncertainty of emission factors in general and activity data for industrial wastewater specifically.

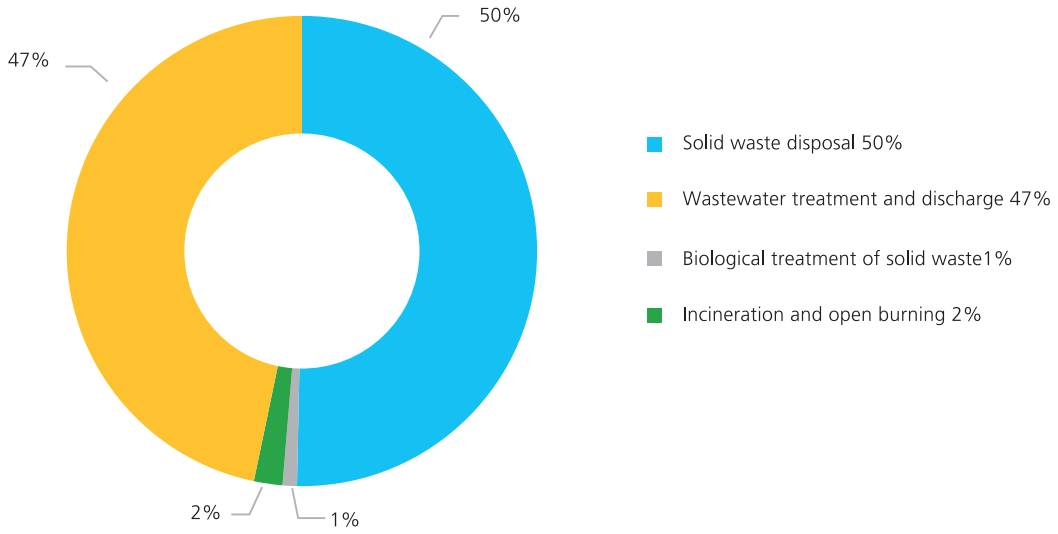


Figure E: Emissions per category for the waste sector, 2015

Key Category:

Key category analysis for the combined GHG databases of the four sectors results indicate that the largest contributor to GHG emissions is CO_2 from Gaseous Fuels combustion in Energy Industries (20.16%), followed by CO_2 from Road Transportation (15.0%), and N_2O from direct N_2O emissions from managed soils (6.87%).

Mitigation Policies and Actions

GHG mitigation policies and actions achieved between 2005 and 2015 include energy, industry, waste, and agriculture and other land use sectors as summarized in Table B.

Table B: Summary of achieved mitigation policies and actions, 2005 - 2015

Sector	Title	Brief Description	GHGs reductions
Energy	Electricity sector subsidy reform program (2014 - 2015)	Removed partially the electricity subsidies through the gradual increase of the tariff. The measures were led by MoERE in close collaboration with the Cabinet of Ministers and were essential for promoting and enabling renewable energy and energy efficiency measures.	Not estimated
Energy	Increase of renewable energy contribution to the national electricity generation (2013 -2015)	Increased the contribution of renewable energy to the electricity generated to achieve the national target of 20% by 2022 and 37% by 2035. The renewable energy share in 2015 was: 452 GWh from hydropower, 1444 GWh from wind energy, and 167 GWh from solar energy.	0.48 million tCO_2e in 2015 (excluding CDM projects)
Energy	Energy efficiency for the electricity generation and endusers (2005 - 2015)	Improved fuel consumption efficiency per unit electricity produced and reduced grid peak loads. Examples of implemented measures include nationwide media and grassroots awareness campaigns, national programs for home appliance energy efficiency labeling, and energy efficient lighting.	Not fully estimated.
Energy	Sustainable transport program and expansion of metro network (2009 - 2015)	Expanded the Greater Cairo underground metro network and created an enabling policy and institutional environment and to leverage financial resources for the sustainable transport sector development, including public-private partnerships.	1.05 million tCO_2e in 2015 from lines 2 & 3 of the Cairo Metro and estimated 1.4 million tCO_2e over 20 years from STP

Sector	Title	Brief Description	GHGs reductions
IPPU	Industrial Energy Efficiency Project (IEE) (2013 - 2015)	Addressed some of the key barriers to industrial energy efficiency through an integrated approach that combines capacity building and technical assistance interventions at the policy, institutional, and enterprise level.	2.44 million tCO_2e between 2013- 2015
IPPU	Egyptian Pollution Abatement Project (EPAP) - Phase II (2007 - 2015)	Aimed to improve Egyptian industry compliance with environmental standards and regulations for eligible industries in Greater Cairo and Alexandria.	656,336 tCO_2 per year
IPPU	Private Public Sector Industry Project (PPSI) (2008 - 2012)	Reduced industrial pollution and improved living and workplace environment by reaching compliance in at least one environmental media for eligible industries in Upper and Lower Egypt.	Not estimated.
Waste	Egyptian National Solid Waste Management Programme (2012 - 2015)	NSWMP conducted capacity building for government and non-governmental actors to establish and operate an efficient and cost effective waste management system at national, governorate, and local level.	Not estimated.
AFOLU	Bioenergy for Sustainable Rural Development (2010 - 2015)	Advanced the use of renewable biomass as an energy resource, for the purpose of promoting sustainable rural development in Egypt and reducing greenhouse gas emissions resulting from conventional energy sources.	192,240 tCO_2e over 20 years lifetime

Planned measures beyond 2015 are presented in this report, and are all conditional on support from developed countries. Moreover, an update to Egypt's CDM projects registered till end of December 2015 is also presented in this report. The current CDM portfolio has an estimated emission reduction of about 4.2 million tCO_2e per year.

Information on mitigation actions and their effects has been documented, to the extent possible, according to UNFCCC guidelines on BUR preparation. Wherever possible, information on methodologies & assumptions as well as steps taken or envisaged to achieve mitigation measures is reported. However, there are capacity building needs that should be met in the future to adequately measure report and verify climate actions.

Finance, Technology, and Capacity Building Needs, and Support Received

Towards continuous improvement in national climate reporting, adequate institutional, technical, and financial arrangements are needed. In this context, a number of gaps need to be addressed:

- **Data Availability, Access, and Quality:** This includes data gaps and constraints in GHG inventory estimation, tracking of mitigation and adaptation measures and progress, identification of specific needs, information regarding climate support received, and distinguishing climate finance from the overall funding received.
- **Limited Resources for Coordinating Entity:** The national entity coordinating climate action and reporting (Climate Change Central Department - CCCD - of the Egyptian Environmental Affairs Agency- EEAA) should be supported with necessary resources to successfully achieve its mandate and cooperate effectively with national partners.
- **MRV Institutional Barriers:** The absence of an inventory for achieved development projects and programs is a main barrier to scaling up implementation of mitigation and adaptation measures across Egypt. The MRV system should be put in place to track the progress of achievements and associated development impact of each project.
- **Competent Personnel to Prepare Funding Proposals:** Substantial resources are required to implement capacity building programs and establish robust information systems to address the challenges of climate change. This requires financial support from international organizations. Competent personnel capable of preparing bankable funding proposals acceptable to donors and aligned with their development objectives are needed.

Financial, technical, and capacity building needs for each adaptation and mitigation program is outlined in the BUR. Planned adaptation projects and their co-benefits are indicated as well. In addition, financial resources , technology transfer, capacity-building and technical support received from the Global Environment Facility, developed country Parties, Climate Funds and multilateral institutions for activities relating to climate change, including for the preparation of this BUR are presented.

Domestic Monitoring, Reporting, and Verification Arrangements

A national Climate MRV system, not yet formally adopted by the NCCC, was proposed based on engagement of representatives from all concerned ministries and national entities. The proposed MRV structure consists of a supervisory body. The CCCD is the national coordinating entity with relevant ministries and the national Statistics Agency (CAPMAS). The CCCD, represented by the NCCC, has two arms: the quality assurance working group (QA-WG) and the technical support working group (TS-WG). CAPMAS would act as the central data coordinating entity. MRV pathways for data flow consists of four tracks: i) GHG Inventory MRV, ii) Mitigation Policies and Actions MRV, iii) Support Received MRV, and iv) Adaptation Policies and Actions MRV. The proposed MRV structure is summarized in Figure F.

The kick-off for the domestic MRV is pending funding and other resources, which once available would support the national institutions to mobilize for implementation.

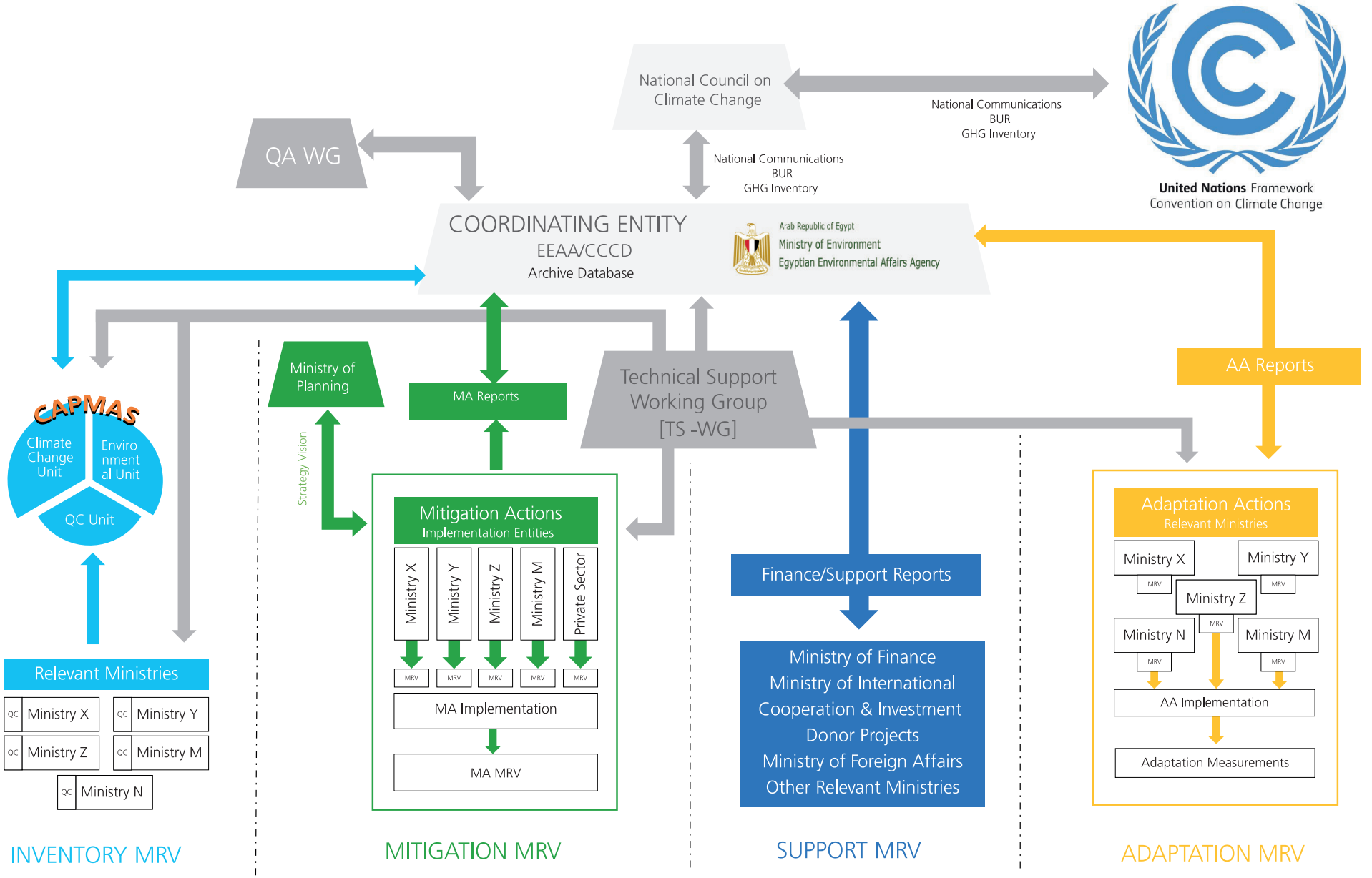
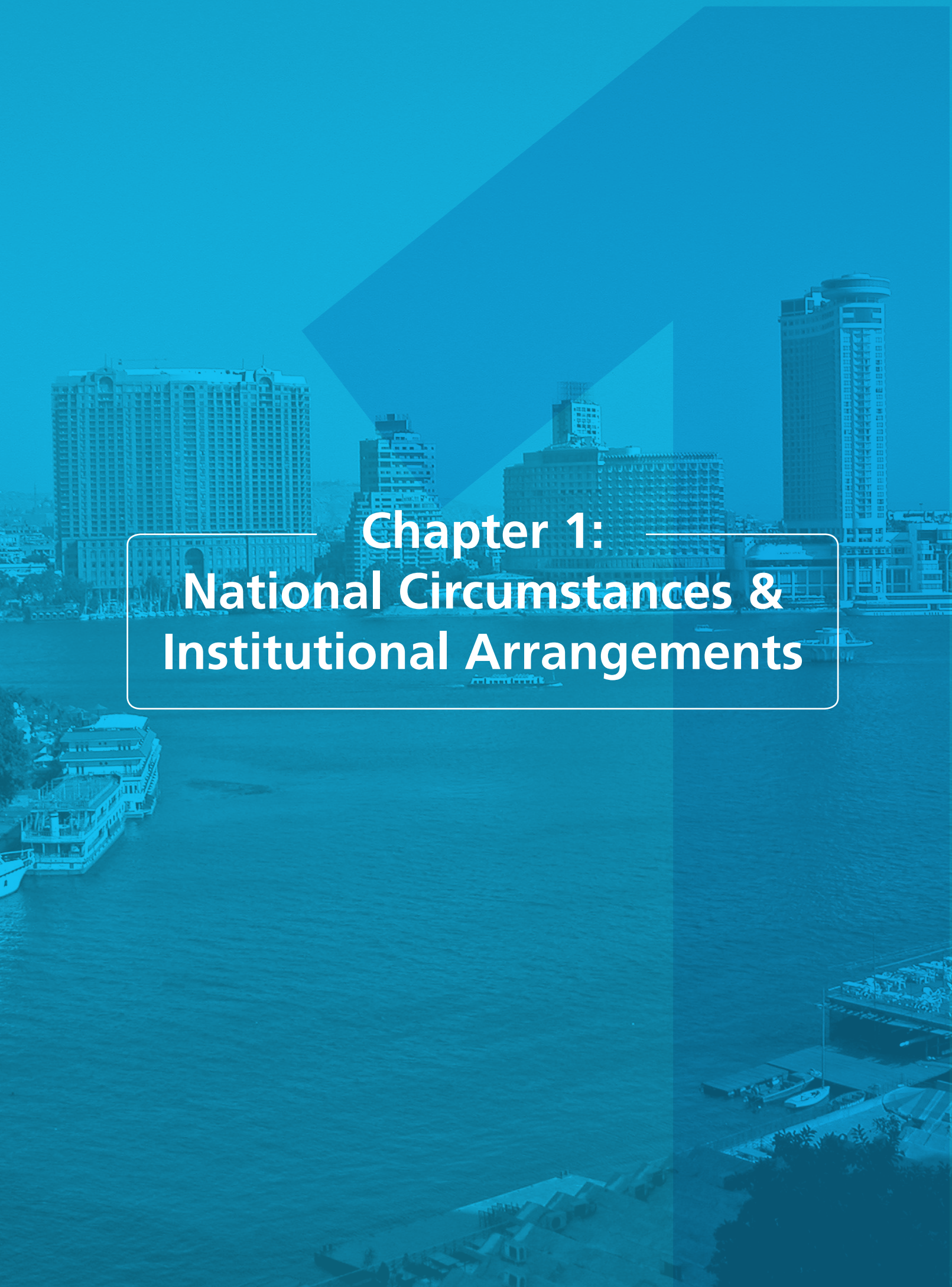


Figure F: Schematic diagram for the proposed MRV structure



Chapter 1: National Circumstances & Institutional Arrangements

1.1 Country Profile

The Arab Republic of Egypt is a transcontinental country spanning over the northeast corner of Africa and the west corner of Asia through a land bridge formed by the Sinai Peninsula. Most of Egypt's territory lies within the Nile Valley of North Africa, but it is also considered a Mediterranean country as it is bordered by the Mediterranean Sea to the north. To the east, it is bordered by the Red Sea. Its neighboring countries include Palestine and Israel to the northeast, Sudan to the south and Libya to the west. Egypt has a total land area of 1,000,000 square kilometers. Topography ranges from 133 meters below sea level in the Western Desert to 2,642 meters above sea level in the Sinai Peninsula. The Egyptian terrain consists of a vast desert plateau interrupted by the Nile Valley and Delta. Administratively, Egypt is divided into 27 governorates (refer to Figure 1.1).

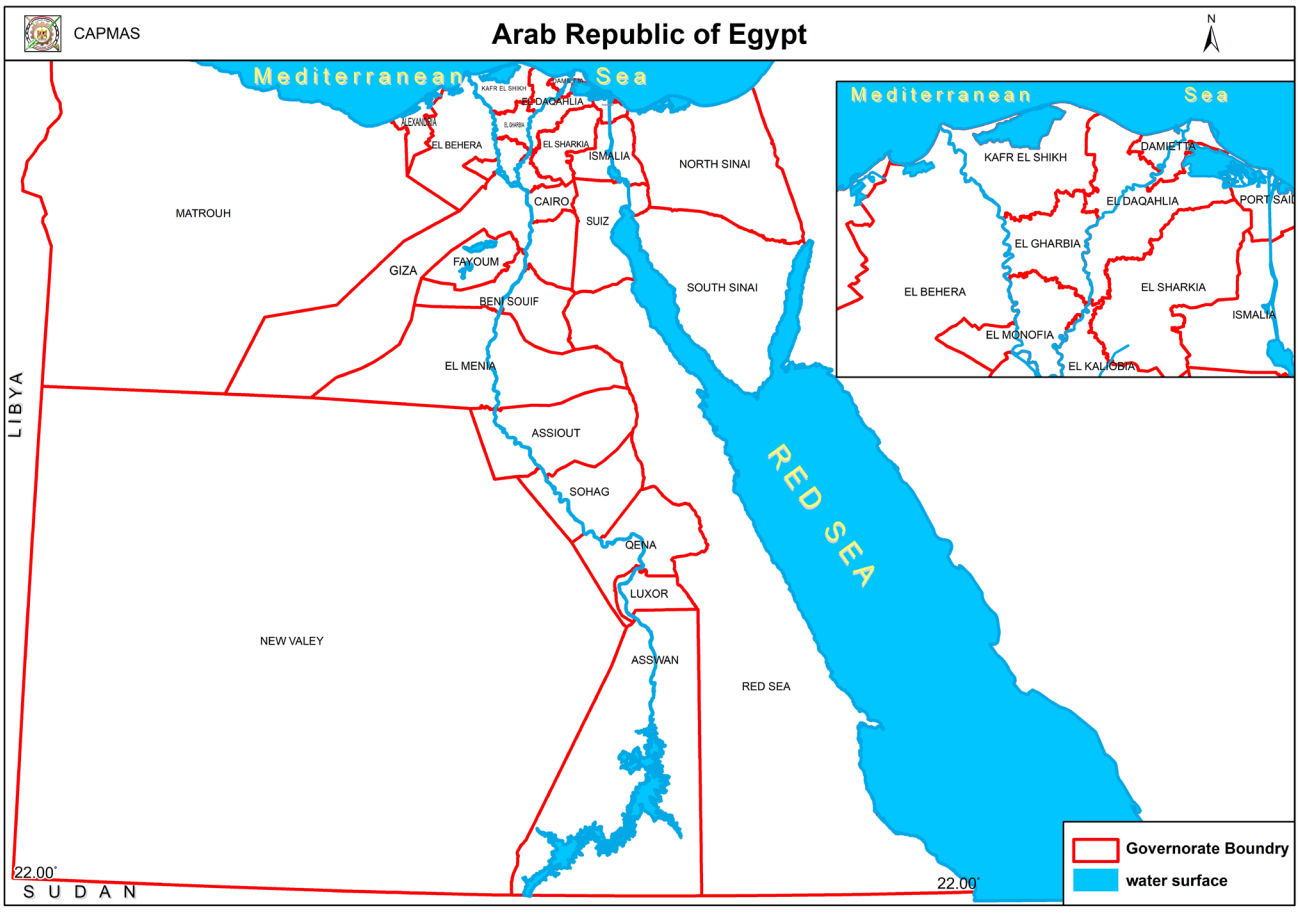


Figure 1.1: Official Map of the Arab Republic of Egypt with Governorate Boundaries (CAPMAS, 2018)

Egypt is a developing country, with a fast-growing population facing numerous development challenges and ambitious aspirations for economic growth. Table 1.1 summarizes the key socio-economic indicators for Egypt in 2015.

Table 1.1: Summary of key socio-economic indicators for Egypt in 2015 (CAPMAS, 2016)

Indicator	Value
Population (million)	90.08
Urban population as percentage of total population (percentage)	42.7%
Population below poverty line (percentage, 2012/2013) (Egyptian poverty line)	26.3%
Unemployment rate (percentage)	12.8%
Life expectancy at birth (years) Male Female	 70.1 72.9
Literacy rate (percentage)	76%
GDP (2014/2015) Billion EGP Billion USD (1 USD = 7.32 EGP, Central Bank of Egypt in 2014/2015)	 2,459 336
GDP per capita ($)	3,730

1.2 Climate and Extreme Weather Events

Egypt has a dry and hot desert climate and two main seasons: a mild winter from November to April and a hot summer from May to October. The differences between seasons are the variations in daytime temperatures and in prevailing winds.

Temperature:

In the coastal regions, temperatures range between an average minimum of 14°C in winter and an average maximum of 30°C in summer. Temperatures vary widely in the inland desert areas, especially in summer, ranging from 7°C at night to 43°C during the day. During the winter, temperatures in the desert fluctuate less dramatically, but they can be as low as 0°C at night and as high as 18°C during the day. Over the past 25 years, increasing trends in temperature rise have been observed. Figure 1.2 and Figure 1.3 show annual trends of temperature in two major cities (Cairo and Alexandria) in Egypt between 1990 and 2015.

Precipitation:

Egypt receives between 20 mm to 200 mm annual average precipitation along the Mediterranean coastline. Rainfall is more concentrated over Alexandria and Rafah. The rest of the country rarely receives rain and is dominated by arid desert climate. Figure 1.2 and Figure 1.3 illustrate the annual rainfall trend for two major cities (Cairo and Alexandria) in Egypt between 1990 to 2015.

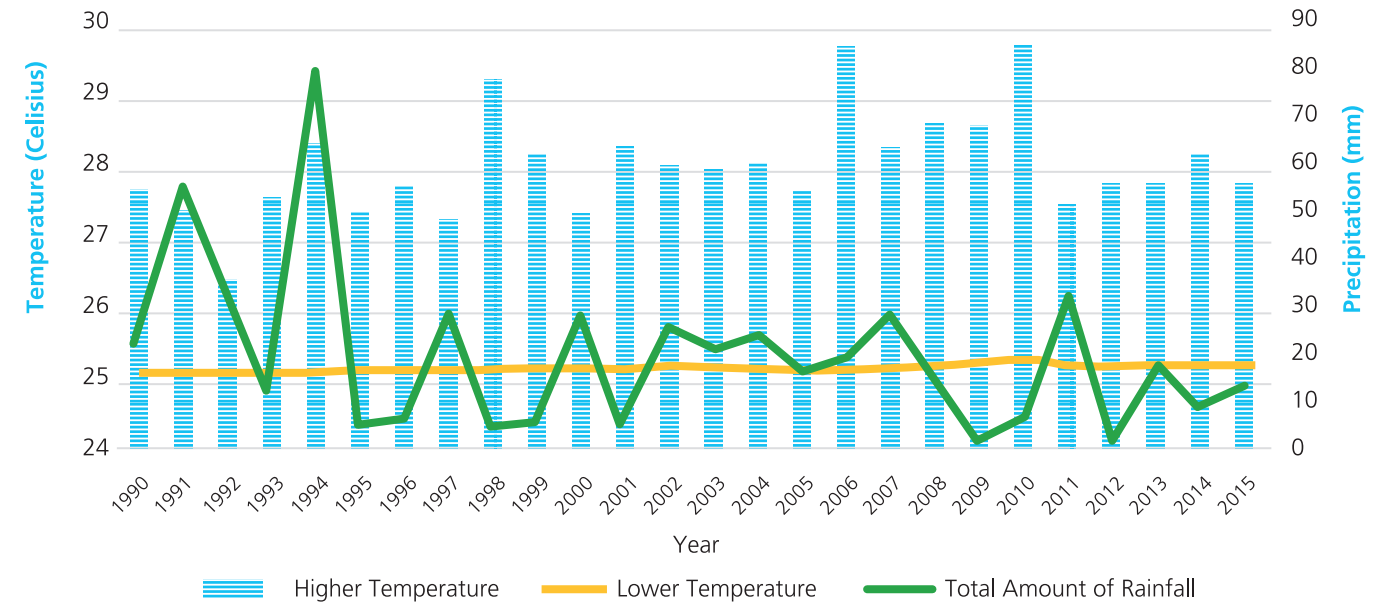


Figure 1.2: Average annual temperature and precipitation trends in Cairo, 1990-2015 (EMA, 2018)

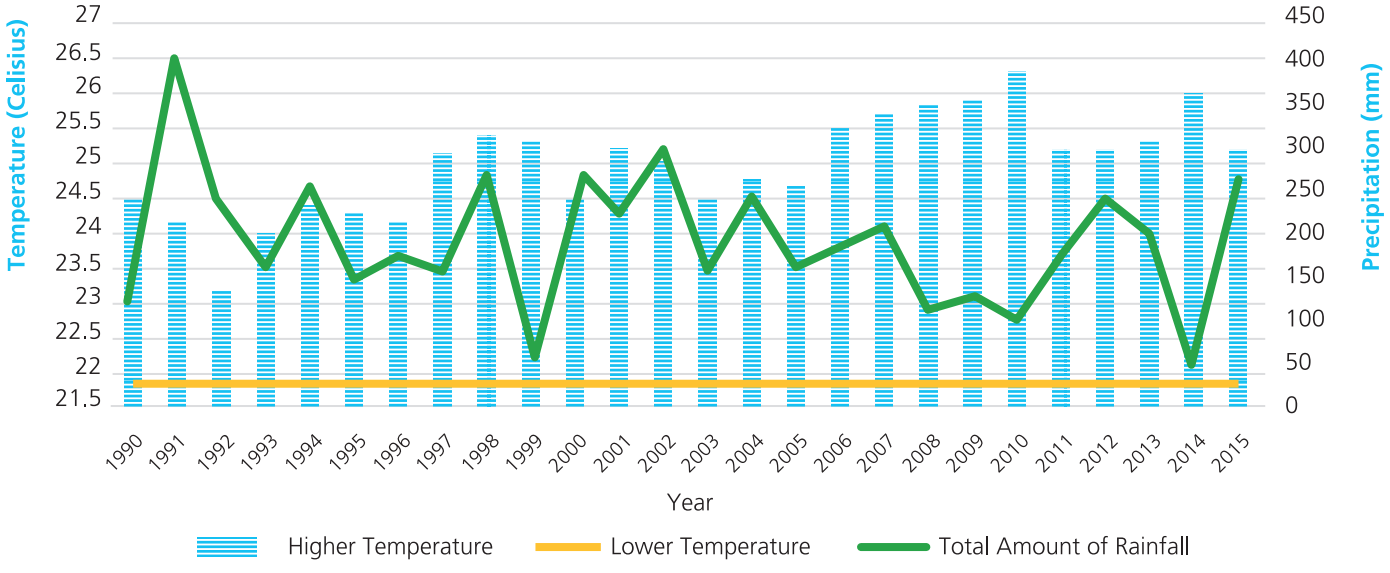


Figure 1.3: Average annual temperature and precipitation trends in Alexandria, 1990-2015 (EMA, 2018)

Extreme Weather Events:

The number of extreme weather events have increased significantly in Egypt over the last ten years inducing casualties and economic losses. The following are examples of incidents that have been observed:

- Extreme heat temperature. Based on historical daily temperature data from 1990 - 2015 collected by the Central Laboratory for Agricultural Climate in 11 Governorates representing the different agro-ecological zones in Egypt, two extreme heat temperatures have occurred: the first in 1998 and the second during 2010 with significant negative impact on strategic crops production according to the statistics of the Agricultural Economic Affairs Sector under MALR. Results indicated that increase in minimum, maximum and mean temperatures in the winter of 2010 at different stations in Egypt were above normal by an average 2.2 °C. This extreme temperature increase caused decrease in wheat yield in Egypt during crop season 2010 as compared with crop season 2009. The Upper Egypt Governorates had the highest decrease in wheat yield by -21.2% and the Nile Delta Governorates had the lowest decrease by -8.2% (Khalil and Hassanein, 2016).
- Extreme cold temperature. A cold wave occurred in January 2008 where the maximum and minimum temperatures during this month were below normal. Damage caused to agricultural crops was 50% for citrus, 40% for beans, 40% for bananas, 30% for mangos, 20% for tomatoes, and 2% for potatoes (Khalil and Hassanein, 2016).
- Extreme wind. During November 2004, a locust attack on different agricultural regions in Egypt took place over a 60 km front along the Mediterranean coast, unprecedented in the previous 50 years. This has been linked to changes in wind direction (Khalil and Hassanein, 2016). The extent of related damage has not been quantified.
- Flash floods. In January 2010, heavy rain exceeding 80 mm/day, led to the worst flash-floods in Egypt since 1994 leading to 15 deaths, evacuation of 3500 people and estimated material losses of 25.3 million US dollars. The floods affected the Sinai Peninsula, Red Sea coast, and Aswan Governorate in Upper Egypt (Attaher and Medany, 2011).
- Snow and rain storms. In December 2010, snow and rain storms caused temperatures to plunge to below freezing in some places with wind speeds up to 60 km per hour, ending weeks of unseasonably warm and dry dust storms. Eighteen people were killed and 59 injured in traffic accidents associated with bad weather, closed several ports and airports, and disrupted traffic in the Suez Canal (Attaher and Medany, 2011).

1.3 Population Demographics

Egypt has population of around 90 million as of 2015 (CAPMAS, 2016). About 95% of the population lives in the Nile Valley and Delta on 4% of Egypt's total land area. This yields an average population density of 1,136 persons per square kilometer and strains on the ecosystem of the Nile river. Over 20% of Egypt's total population is located in the Greater Cairo area, with an estimated population of approximately 18.7 million as of 2015. The second most populated city in Egypt is Alexandria, with 4.8 million inhabitants (CAPMAS, 2016). Around 57% of the population live in rural settings. Internal migration- primarily by young men- takes place to megacities in search of employment and a higher standard of living, despite government efforts to encourage youth relocation to newly reclaimed desert areas. Figure 1.4 shows the population distribution across Egyptian governorates.

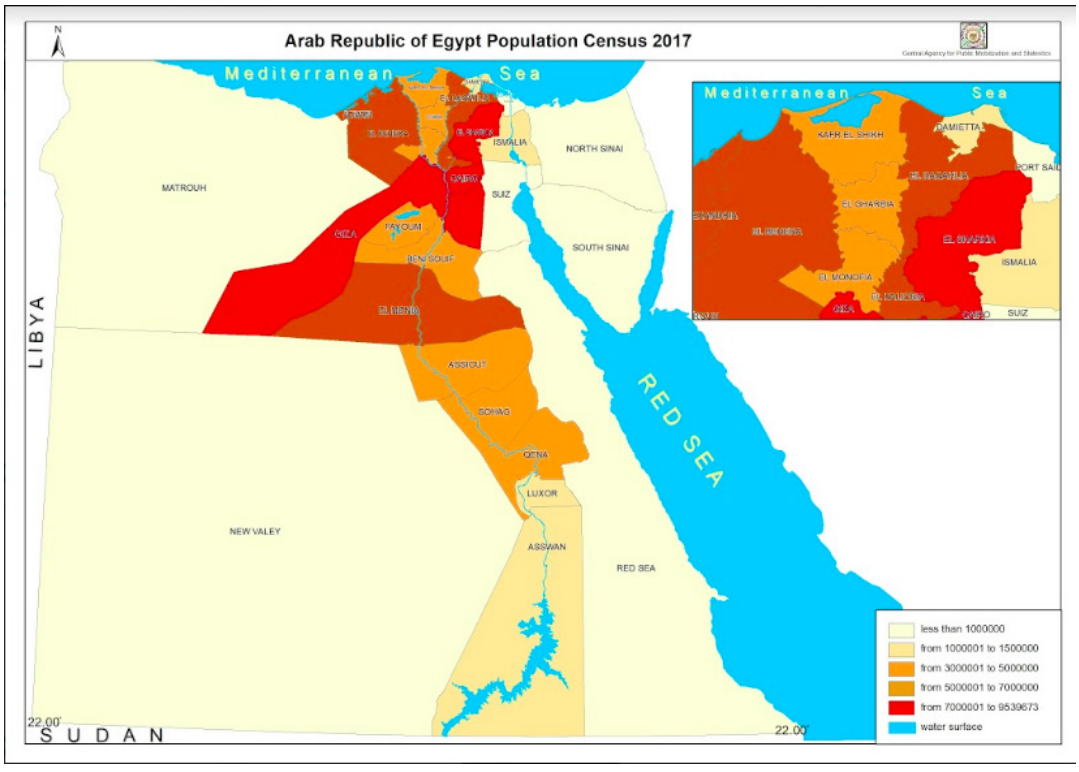


Figure 1.4: Population of Egyptian governorates based on census of year 2017 (CAPMAS, 2018)

According to CAPMAS, total population increase from 1990 to 2015 was 35.1 million (39%). Egypt demographics are dominated by youth, with a median age of 24 and 50% of the population under 25 years old (CAPMAS, 2015). With an ambitious economic growth outlook, these demographics place considerable strain on natural resources, employment, infrastructure, education, and health care. Substantial encroachment on the limited agricultural land has taken place due to population growth & density pressuring the natural and built environment (EEAA, 2016a). Demographics are also a factor in increased difficulty ensuring basic food supply, health services, and implementation of poverty alleviation and social support programs. Other effects of demographics include reduction of annual per capita share of fresh due to reliance on a fixed quota from the Nile river water and limited fresh water resources.

1.4 Stress on Water Resources

The Nile river is the main source of fresh water for Egypt with an annual allocated share of 55.5 billion cubic meters (BCM) per year under the Nile Waters Agreement of 1959. Other fresh water resources available are underground aquifers, reuse of agricultural drainage & treated wastewater, rain & floods, and desalination. These contribute an additional ca. 20 BCM per year to the 55.5 BCM from the Nile, as summarized in Table 1.2. This has increased by 2.6 BCM from FY 2010/2011 due to the increase in the reuse of agricultural drainage and desalination.

Table 1.2: Water availability and sources in Egypt, FY 2014/2015 (CAPMAS, 2016)

Water input	Million m^3 per year
Share from Nile river	55,500
Underground water in Nile valley and Delta	6,900
Reuse of agricultural drainage water	11,700
Reuse of treated wastewater	1,300
Rain and floods	900
Seawater Desalination	100
Total	76,400

Quality of Nile water has been severely impacted by pollution and increasing stresses by the growing population. Pollution sources such as agricultural drainage, industrial wastewater, and sewage discharge into the Nile river or irrigation canals and agriculture drains have led to increased levels of heavy metals, nitrogen, sulphur and other harmful chemicals (Dakkak, 2017). In light of the current situation of water scarcity in Egypt, the government of Egypt is considering the efficient use of water, reuse of treated wastewater, and generation of new water sources (such as desalination) as a national priority.

One of the most recent developments posing a risk on fresh water availability in Egypt is the construction of the Grand Ethiopian Renaissance Dam (GERD) expected to be commissioned in 2018. Concerns have risen over the implications the GERD would have on the downstream countries of the Nile basin. It is expected that during the filling of the GERD reservoir and during GERD operation in years of low flows, the Nile water flows to Egypt would be reduced by 25%. Egypt is currently highly dependent on the river Nile as the main source of freshwater for economic activity and livelihoods. As Egypt has already been experiencing a sharp decline of renewable freshwater per capita (from 900 cubic meters in 2000 to 600 cubic meters in 2017), it is expected that the effect of the GERD - in addition to climate change impacts - would only exacerbate the water issue in Egypt, edging the country closer to severe water scarcity of 500 cubic meters per capita in the future (Gad, 2017).

To address the gap in freshwater supply, substantial investments in seawater desalination, irrigation efficiency, and wastewater reuse would be needed. These would also require additional energy for operation. Hydropower generated by the Aswan High Dam would be reduced and substitute electrical energy will most likely be generated from combustion of fossil-fuel.

1.5 Coastal Zones and Delta Submergence

Egyptian coasts stretch over 3,500 km: 1,200 km on the Mediterranean Sea and 2,300 km on the Red Sea (EEAA, 2016a). About 15% of the total population of Egypt lives in coastal zones. Egypt coastal zones are characterized by diverse resources and abundant development potential. They are a source of biodiversity and mineral resources and are vital for maritime transport and trade.

Climate change is expected to be a source of pressure on coastal zones, particularly with the impact of the sea level rise on low land and the recurrence of severe storms and extreme weather events (IDSC, 2011). The coastal area of the Nile Delta is highly prone to flooding as a result of sea level rise. This may be accompanied by soil subsidence at varying rates, depending on topographical and geological characteristics. Delta coastal zones can be divided into three sub-zones, based on the degree of vulnerability of the location to sea level rise and erosion.

1. Sub-zone 1: These low-lying locations are usually vulnerable to sea level rise and erosion, and are therefore considered high risk. Sub-zone 1 locations include Manzala Lake shore, the Tarh area, east and west of Rosetta City, the area between Gamasa and the port of Damietta, Al Gamiel, and the Al Tina Sahl on the Sinai coast.
2. Sub-zone 2: Shores in this zone are characterized as relatively safe. Due to the presence of natural barriers such as sand dunes, the risk of inundation is minimized. In addition, sedimentation rates in this zone range from 3-10 meters annually, which act as a natural defense to flooding and erosion.
3. Sub-zone 3: Locations in this zone are either naturally or artificially protected areas. It is important to note that around 17% of the delta coastal areas are protected by concrete or hard structures such as seawalls that rise between 6 and 8 meters above sea level.

1.6 Economy and Political Situation

The total GDP in FY 2014/2015 was estimated at $336 billion compared to $89.7 billion in 2005 (CAPMAS, 2016). Overall exports were estimated to be $22 billion, while overall imports were $74 billion in 2014/2015. Gross National Income (GNI) per capita is estimated to be around $3,730 in FY 2014/2015 compared to $2,150 in FY 2005/2006. Official data indicate that 26.3% of the population lived below the poverty line in FY 2013/2014, while poverty rates were as high as 49.4% in rural Upper Egypt (CAPMAS, 2016). Figure 1.5 below illustrates the GDP trend from FY 2004/2005 to FY 2014/2015 in billion Egyptian Pounds.

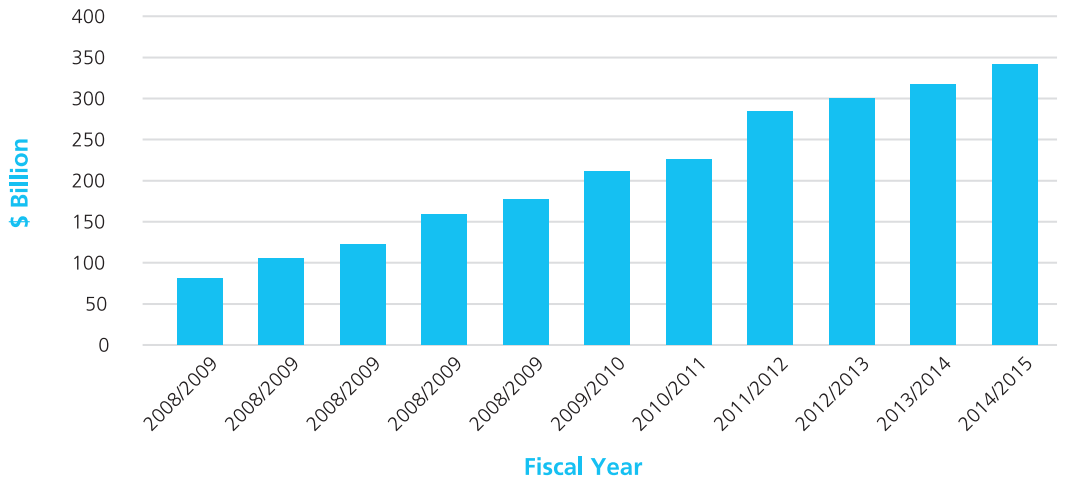


Figure 1.5: GDP trends from FY 2004/2005 to FY 2014/2015 (based on variable annual average US exchange rate)

Political turmoil since 2011 with two revolutions, 25 January 2011 and 30 June 2013, caused significant delays and freezing of the vast majority of planned programs which severely affected the economy. The political instability during this 3.5 years period, coupled with frequent electricity outages due to natural gas shortages and decrease in foreign direct investments had its heavy toll on the struggling economy. Consequently, in the period from FY 2010/2011 to FY 2013/2014, the real growth rate of the Gross Domestic Product (GDP) ranged between a modest 2.1-2.2%. The economy began to recover in FY 2014/2015 at a GDP real growth rate doubling to 4.2% as social unrest stabilized and the new President was sworn into office in June 2014. The services sector is the highest contributor to GDP with about 56%, followed by industry 34%, and agriculture 11% in 2014/2015, as summarized in Table 1.3. On the other hand, the agriculture sector is a significant contributor to the total labor force at 27.5% followed by industry at ca. 22% (CAPMAS, 2016).

Table 1.3: GDP contribution by selected economic sectors, FY 2014/2015 (CAPMAS, 2016)

Sector	GDP Value (Million EGP)	Contribution to Total GDP (%)
Agriculture	274,959	11.18%
Mining (Oil ,Gas & Other)	313,738	12.75%
Manufacturing industries	407,868	16.58%
Construction	118,035	4.8%
Tourism	45,144	1.83%
Other services	1,299,281	54.69%
Total	2,459,025	100%

1.7 Energy Sector

Egypt relies mainly on natural gas and petroleum products to satisfy 98% of the total primary energy consumption in FY 2014/2015 compared to 1.5% from hydropower, 0.4% from coal, and 0.1% from wind and solar power (IEA, 2018). The highest electricity consumer is the residential sector (44%) followed by the industry sector (26%) (MoERE, 2016). The industry sector is among the top consumers for natural gas, especially energy intensive industries such as cement and fertilizers.

Until recently, Egypt was a self-sufficient energy consumer, meeting its energy needs through local production. However, this has been reversed by the growing energy demand, encouraged by heavy energy subsidies, which has put increasing pressure on available fuel supplies and inflating the budget deficit along with it. In FY 2013/2014, the energy subsidies bill amounted to EGP 120 billion, representing a 19% compound annual growth rate since 2010. This is an acute increase from only EGP 1 billion 20 years ago. Energy subsidy constitutes 7% GDP (CAPMAS, 2015).

During the political turmoil that followed the year 2011, there has been a drop in the production rates of natural gas and petroleum products, with no concession agreements signed between 2010 and 2012. After Egypt's oil production peak of more than 900,000 bbl/d in the mid-1990s, output began to decline as oil fields have matured. In addition, Egypt's per capita primary energy consumption grew by 32% from 1990 to 2014 which led to a huge gap between the production and the consumption of energy resulting in shortages of electricity and a severe crisis starting 2012.

1.7.1 Energy Crisis of 2012

In the summer of 2012, the growing demand for energy, a slowdown of natural gas production and the halt of oil and gas explorations, collectively led to a national energy crisis in Egypt. Residential areas across the country were experiencing frequent electricity blackouts, and the volume of natural gas provided to heavy industries had been significantly reduced. Natural gas production, which had once peaked at 6.06 bcf per day in 2009, had been steadily decreasing by around 3% annually since 2009. This eventually led the government in 2012 to reroute the natural gas from heavy industries, specifically the cement sector, to power plants used to generate electricity for the major residential areas in order to avoid prolonged electricity blackouts and public discontent. Natural gas shortages and electricity blackouts continued throughout 2013 and 2014, and reached a critical stage during the summer of 2014, where the power generation deficit reached a maximum 5,300 megawatts, corresponding to around one eighth of Egypt's installed energy capacity (IFC, 2016). This setback not only affected the local economy, but also reduced export, which had a direct effect on foreign currency shortages. Egypt, once a net exporter, had become an importer of natural gas. In 2014, as part of comprehensive energy sector reform to address the domestic demand for energy, the GoE permitted the use of coal in cement production and selected energy-intensive sectors.

Due to the ongoing natural gas shortages post-2012, the government continued to cut natural gas supplies to energy-intensive industries. The cement industry which initially consumed 7.4% of the total natural gas supply and 16.3% of the produced electricity was greatly affected by natural gas shortages. According to the head of the Egyptian Cement Association at the Federation of Egyptian Industries, in January 2014 the Egyptian Natural Gas Holding Company reduced natural gas supply to cement companies by 50 percent, which resulted in an equal percentage of decline in cement production. It is estimated that cement industry energy demand in 2025 would require about 9.7 million tons of coal per year to produce 72 million tons of clinker (IFC, 2016).

By 2014, natural gas shortages had decreased yet the GoE initiated fuel subsidy reform for the industrial sector. The price of natural gas increased by as much as 33% for the cement industry. Being highly energy-intensive, cement plants were in dire need of an affordable alternative to natural gas. Coal was considered a viable option due to its international availability, affordability, consistent quality, and high calorific value. The usage of coal for the cement industry was approved by the GoE in 2014. To control emissions, granting coal licenses to cement plants by the Ministry of Environment is conditional on a implementation of GHG reduction action plans. On the other hand, there are government plans in cooperation with the private sector to encourage the increase of use of alternative fuels by the cement sector in Egypt (only 6.4% of the fuel mix in 2014).

1.7.2 Comprehensive Energy Reform

The GoE has taken substantive steps to reform the energy sector in recent years. Energy subsidies, in combination with economic stagnation, have contributed to an increasing deficit on the national budget which reached nearly 12% GDP in 2013. In 2014, the Ministry of Electricity announced a five-year program (FY 2014/2015 - FY 2018/2019) to eliminate energy subsidies entirely and encourage rationalization. This is not limited to price reform, but includes actions to improve energy efficiency, enable alternative energy sources, and promoting the transition to clean and renewable energy. The '20/20' initiative, originally established in 2008, had set a target of 20% of all electricity to be generated from renewables by 2022, which was upscaled to 37% renewable energy share by 2035.

Coupled with increasing oil & gas production, GoE is also looking to diversify its energy mix. According to Strategy for Integrated Sustainable Energy 2035, the GoE supports - considering cost effectiveness and energy security - energy diversification through renewables, energy efficiency, nuclear energy and clean coal technology. The fuel mix target for electricity generation in FY 2034/2035 (approved scenario 4B) is 34% coal, 19.9% fuel oil and natural gas, 8.8% nuclear, 14.6% wind, 11.8% solar photovoltaic (PV), 7.6% concentrated solar power (CSP), and 3.2% hydropower.

The GoE is reforming the sector to attract private investment through net metering and feed-in-tariff schemes for renewable energy launched in 2013 and 2014 respectively. Furthermore, a new Electricity Law (No. 87 of 2015) was issued on 7 July, 2015 as a milestone to liberalize the energy market.

1.8 Transportation Sector

During FY 2012/2013, transport sector total energy consumption accounted for nearly 16.6 million tons oil equivalent (mtoe), representing 48% of total petroleum energy consumption. The transport activity in Egypt is characterized by relying predominantly on roads for both passenger and freight transport. During FY 2011/2012, total passengers activity was estimated at 1,021 million passenger-km, of which road transport accounted for 93% compared to 7% for railways and almost 0% for river transport. During the same year, total freight transport activity was estimated at 211 million tons-km of which road represented 96.5% compared to 1.9% for railways and 1.7% for river transport (Ministry of Transport, 2012).

The escalating energy demand of the transport sector was obvious in the increase of both gasoline and diesel imports which accounted for about 6.9 million tons during the same fiscal year 2012/2013 respectively, in addition to the drastic increase of total subsidy that reached more than $17 billion.

1.9 Industry Sector

The industrial sector in Egypt remains an important pillar of the economy, contributing roughly to 34% GDP in 2015, but also responsible for about 37% of the total energy consumption. The government has rolled out a broad strategy focused on small and medium-sized enterprise (SME) development, value-added industries and improved financing channels. According to the Egypt Industrial Development Strategy report (2012), the formal industrial sector employed around 2.4 million workers, with an estimated 1.5 million in informal establishments (about 20% of the labor force). Production cost reduction- through lower consumption of energy and other resources combined with improved productivity through industry modernization- is undertaken to increase exports and improve competitiveness.

1.10 Waste Sector

An estimated 95 million tons of solid waste was generated in Egypt in 2010 according to the Egyptian Environmental Affairs Agency (EEAA). The two biggest sectors contributing solid waste generation were municipal and agricultural waste, generating 21 and 31 million tons, respectively (EEAA, 2016b).

Integrated Solid Waste Management remains a major challenge facing Egypt. Although there has incremental regulatory, planning, technological, and financial improvements in the solid waste sector over the past two decades, open dumping and burning of waste are still common practice due to low collection rates and treatment & disposal capacity. This has led to negative occupational & public health impacts as well environmental degradation and loss of resources.

Unclear responsibilities, inadequate legal frameworks, outdated practices, lack of funding, and the absence of a national regulatory entity are among many reasons which have made it difficult to manage the solid waste sector in an integrated and circular approach.

In 2015, the Waste Management Regulatory Authority (WMRA) was established in an effort to mitigate the impacts of the growing waste challenges faced by Egypt. WMRA's main mission is to:

- Politicize, strategize, regulate, plan, and monitor the overall waste management processes at both central and local level, to improve their management in an environmentally safe manner;
- Strengthen cooperation between Egypt, other States, and development partners, relevant international and regional organizations in arena of waste, and financial institutions;
- Recommend the legal actions necessary to be taken for accession of the international and regional conventions on wastes and communicate their environmental and socio-economic benefits; and
- Create the enabling environment to attract and promote investments in environmentally sound waste management.

In relation to wastewater, about 357 municipal treatment plants are operational with total installed capacity of 13,266,159 m^3/day as of 2013. The operations of the plants is under the supervision of the Egyptian National Holding Company of Water and Wastewater (HCWW) throughout Egypt's 25 governorates. The estimated total annual national sewage sludge generation in Egypt was approximately 1 million tons in 2014 and it is mainly used for agricultural land application.

1.11 Agriculture Sector

Despite sector share of the GDP falling from 19.3% in 1990 to 11.18% in 2015, Agriculture remains a vital pillar of the Egyptian Economy. The economy relies heavily on the agricultural sector for food, fiber, and other products. It provides livelihoods for about 55% of the population and employs 27.5% of the labor force. Agriculture, forestry and fishing sector grew 3.0% in 2015. In this context, the sector contribution to GDP at current prices stood at $3.46 billion in 2015 (MALR, 2009).

Sector development is hindered by several factors. Currently, only a small share of Egypt's land, mostly surrounding the Nile delta, qualifies as agricultural land. This leads to considerable pressure on output growth potential. The GoE aims to continue investing in land reclamation projects to increase the area available for agricultural production. The GoE announced new plans in 2014 to reclaim four million acres of desert land to meet the long-term needs as part of the Sustainable Development Strategy: Egypt's Vision 2030 (SDS, 2016).

Additionally, national investment in the agriculture and irrigation sectors grew by 11% - from $1.6 billion in 2014 to $1.8 billion in 2015. Improvement in water availability and efficiency could be achieved by water management through more effective on-farm practices, changes in cropping patterns towards less water-consuming crops, introduction of improved irrigation systems as well as reuse of drainage water and treated sewage water (MALR, 2009).

1.12 Institutional Arrangements

1.12.1 Government Structure

Egypt is a democratic republic. The executive branch is composed of the President as Head of the State and the Prime Minister heading the Cabinet of Ministers. In 2010, the legislative branch was a bicameral parliament consisting of the Shura Council (the Consultative Council) of at least 150 seats, and the House of Representatives of at least 350 seats. Under the new constitution set in 2014, the legislative branch was changed to the Unicameral House of Representatives. The Judicial branch consists of:

- Court of Cassation: consists of the court president and numbers of judges organized in circuits with cases heard by panels of 5 judges
- Supreme Administrative Court: the highest court of the State Council which consists of the court president and organized in circuits with cases heard by panels of 5 judges.

1.12.2 Environmental Governance

Policies of The Ministry of Environment (MoE) - established in 1997- are executed by the Egyptian Environmental Affairs Agency (EEAA). In June 1997, the responsibility of first full-time Minister of Environment was instated by Presidential Decree no. 275/1997. Thereon, the ministry has focused, in close collaboration with the national and international development partners, on environmental policies, setting priorities, and implementing initiatives within a context of sustainable development. According to the Law 4/1994 for the protection of the Environment, the EEAA was restructured with the new mandate to substitute the institution initially established in 1982. At the central level, EEAA represents the executive arm of the Ministry.

1.12.3 Commitment to Climate Change and Sustainable Development

Egypt ratified in 1994 the United Nations Framework Convention on Climate Change (UNFCCC) as a member of the non-Annex I Parties. In 1996, the Climate Change Unit was established at EEAA and was upgraded to a Central Department (CCCD) in 2009, in order to strengthen the climate change institutional structure on the national level. A Climate Change Committee was formed in 1997, which was restructured in 2007 through decree No.272. The national committee for CDM was established in 2005 and reformed in 2010, it acts as the CDM Designated National Authority (CDM-DNA), that review and issue the letters of no objections and approvals to the CDM projects in Egypt.

The new Climate Change Committee has been chaired by the Minister of State for Environmental Affairs and includes members representing a wide range of governmental and non-governmental representatives. The climate change committee was later reformed as the National Climate Change Council (NCCC) in 2015 through the Prime Minister Decree No.1912, with additional mandates and tasks that come to match the rapid transformations on climate change at the national, regional and international levels. Lately, Egypt signed the Paris Agreement in April 2015, which was ratified by the Egyptian Parliament in June 2017.

Moreover, in line with the United Nations 2030 Agenda for Sustainable Development, the GoE has launched Egypt Vision 2030, also known as Sustainable Development Strategy 2030 (SDS). The SDS 2030 encompasses the economic, social and environmental dimensions of development and is an umbrella under which development plans in Egypt are guided by the Sustainable Development Goals.

1.12.4 Preparation of this BUR

To date, Egypt has prepared three National Communications, the Initial National Communication (INC) in 1999, the Second National Communication (SNC) in 2010 and the Third National Communication (TNC) in 2016.

For this first Biennial Update Report (BUR), data was collected from relevant Ministries and national entities based on the Presidential Decree 566 of 2016 that obliges all the relevant ministries and governmental entities to be subject to terms of the Paris Agreement.

Since January 2017, meetings were held with key stakeholders, senior government officials across several ministries, and donor-funded programmes relevant to Monitoring, Reporting, and Verification (MRV) of greenhouse gas emissions, adaptation and mitigation policies and programs, as well as support received and further needs required by Egypt for climate change action. The objective of the meetings was to discuss establishing comprehensive institutional setup to ensure the sustainability of reporting in the future and discuss the opportunities, challenges, and capacity building needs for fulfilling the reporting requirements under the UNFCCC. The discussions revealed that climate change is increasingly being considered in important policies and strategies in Egypt. A host of measures are being put in place to ensure the appropriate level of monitoring, reporting and verification of GHGs, as well as monitoring of mitigation actions that Egypt is implementing or considering.

The GHG inventory was prepared by five National Experts led by a Team Leader who was supported by the UNDP-GEF BUR Project Team under the direct supervision of the EEAA CEO and the Director of the CCCD in EEAA and Climate Change National Focal Point. The BUR project has been implemented following UNDP's national implementation modality, according to the Standard Basic Assistance Agreement between UNDP and the Government of Egypt, and the Country Programme. The BUR Project Board/Steering Committee has comprised of the representatives from:

- Ministry of Environment /Egyptian Environmental Affairs Agency (MoE/EEAA)
- Ministry of Agriculture & Land Reclamation (MALR)
- Ministry of Trade and Industry (MoTI)
- Ministry of Electricity and Renewable Energy (MoERE)
- Ministry of Transportation (MoT)
- Ministry of Health and population (MoHP)
- Ministry of Petroleum & Mineral Resources (MoP)
- Ministry of Investment & International Cooperation (MIIC)
- Ministry of Foreign Affairs
- Ministry of Civil Aviation (MoCA)
- Central Agency for Public Mobilization and Statistics (CAPMAS)
- Waste Management Regulatory Agency, Ministry of Environment (WMRA)

For the first time, collaboration has been established with the Central Agency for Public Mobilization and Statistics (CAPMAS) to ensure the sustainability of the Greenhouse Gas Inventory (GHGI) data collection. CAPMAS is the official statistical agency of Egypt that collects, processes, analyzes, and disseminates national statistical data and conducts the census.

Chapter 2: Greenhouse Gas Inventory

This chapter presents a summary of Egypt's national GHG inventory for the time series between 2005 and 2015. The inventory has been prepared following 2006 IPCC Guidelines, and covers the following sectors:

- Energy
- Industrial Process and Product Use (IPPU)
- Agriculture, Forestry, and other Land Use (AFOLU)
- Waste

GHG emission trend analysis is presented by sector, subcategory, and gas type. Data uncertainty is analyzed sector by sector while key category analysis is performed on the combined sectors and their subcategories. Addressing gaps and reducing uncertainty encountered in previous GHGI reporting for the INC, SNC and TNC were sought. Technical and statistical elements were incorporated to improve the GHG Inventory preparation for the BUR. Therefore, the current BUR inventory has invested in identifying reliable data sources as well as improving data collection methodologies for future BURs.

2.1 GHG Inventory Methodology

In the latest UNFCCC submission, 2005 was the last year covered in the TNC GHG Inventory. Therefore, the BUR GHG inventory covers the period from 2005 to 2015. It includes a breakdown of national anthropogenic GHG emissions by source of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydro fluorocarbons (HFCs), per-fluorocarbons (PFCs) and sulphur hexafluoride (SF6) as well as precursors (NOx, CO, NMVOCs, SO_2).

Egypt's GHG inventory has been compiled using the Intergovernmental Panel on Climate Change (IPCC) GHG Inventory software, in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the IPCC Good Practice Guidance (GPG) 2000.

It is worth noting that the BUR is Egypt's first attempt to use the IPCC GHG Inventory software. The software's summary and sectoral tables have been reported in the current inventory, in accordance with the "Guidelines for the preparation of national communications from parties not included in Annex I to the convention", as contained in the Annex to decision 17/CP.8.

Results of the inventory are reported in Giga-grams (Thousand tons) of carbon dioxide equivalent (Gg CO_2e). The default Global Warming Potential (GWP) values from the IPCC Second Assessment Report (SAR), provided in Annex A (100-year time horizon), has been selected for calculating the CO_2 equivalent values. Mainly Tier 1 has been used together with the default emission factors for the GHGI estimations. Uncertainty analysis has been conducted for activity data as well as emission factors and an uncertainty reporting table has been generated, as defined in the 2006 IPCC Guidelines. Moreover, data gaps have been identified in the current inventory and improvement plans have been developed to address them and potentially upgrade to higher tiers in the future BURs. Sectoral specialists have developed a Manual of Procedures for future inventory compilers, which includes specific instructions on how to effectively use the IPCC software to suit data availability and country's circumstances.

2.2 Methodology for Data Collection and Data Sources

In order to collect consistent and reliable data for the current inventory, data have been collected from a variety of primary and secondary sources. Stakeholder mapping was conducted for each sector and questionnaires have been designed to collect data. This was followed by meetings and semi-structured interviews with ministries representatives, affiliated organizations, as well as national experts. National publications and statistics issued by the relevant governmental entities were prioritized as the official data source when available.

A new framework for the data collection system for GHG Inventory preparation is proposed for future GHG inventories. Steps were taken to position the national statistics entity (CAPMAS) as the focal point for collecting the data required from the ministries and other agencies to prepare the national GHG inventories. This included suggestions for new data or modifications to the existing data collection forms. The collected data would be sent to the Climate Change Central Department (CCCD) at Egyptian Environmental Affairs Agency (EEAA), who would be in charge for compiling the GHG inventories. Capacity building for CAPMAS personnel was provided as part of these preparatory activities as well.

2.3 GHG Emissions and Removals

Egypt's GHG emissions for 2015 totaled 325,614 Gg CO_2e. Trends in GHG emissions for the four sectors over the period from 2005 to 2015 are presented in Figure 2.1, and further analysis is presented in section 2.7. The breakdown of the total GHG emissions for the period 2005 to 2015 by sector is presented in Annex B.

Total GHG emissions have increased by 31% from 2005 to 2015. Emissions from the energy, IPPU and waste sectors increased by 40%, 49%, and 34% respectively; while the emisions from the AFOLU sector have decreased by 7% over the same period. The change in total and per sector emissions is shown in Figure 2.2. This is further explained in the trend analysis by sector, presented in section 2.4.

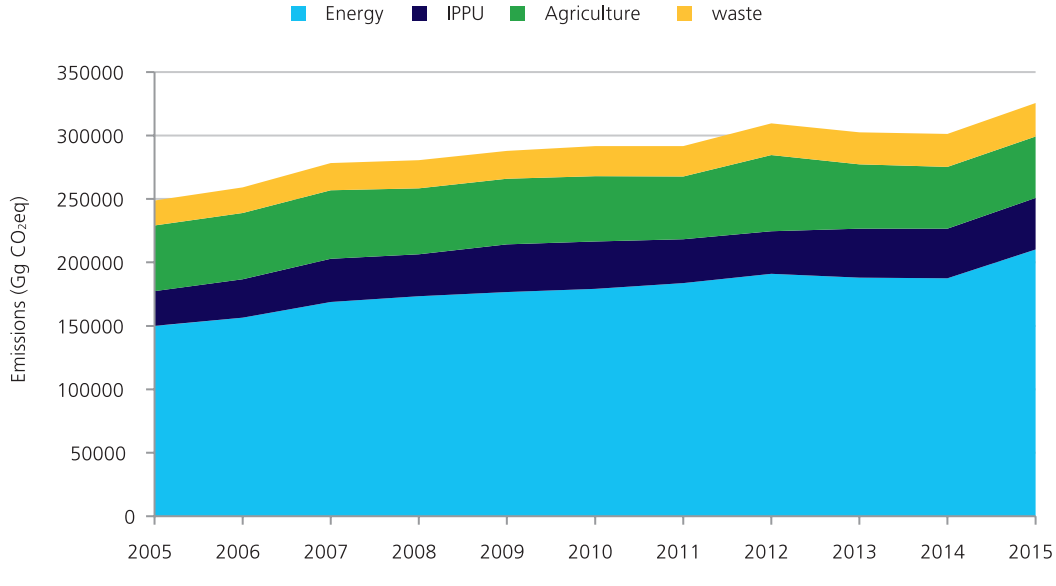


Figure 2.1: GHG emission trend in the period from 2005 to 2015 per sector

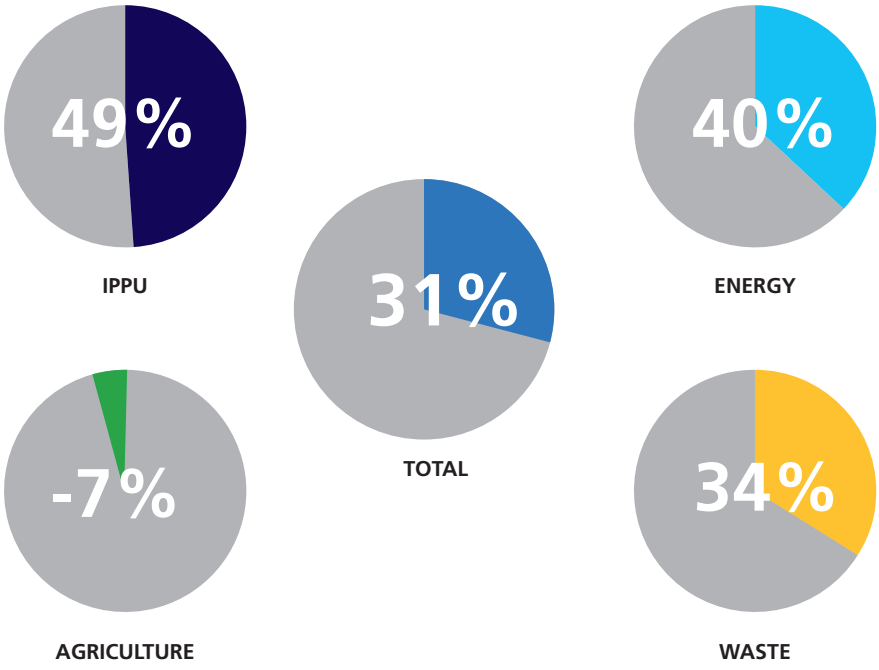


Figure 2.2: Percentage increase in GHG emissions in 2015 as compared to 2005

The contribution of each sector to total emissions is presented in percentage of CO_2e as indicated below in Figure 2.3 for years 2005, 2010 and 2015. The energy sector accounts for the largest share at above 60% of the total emissions for all years from 2005 to 2015.

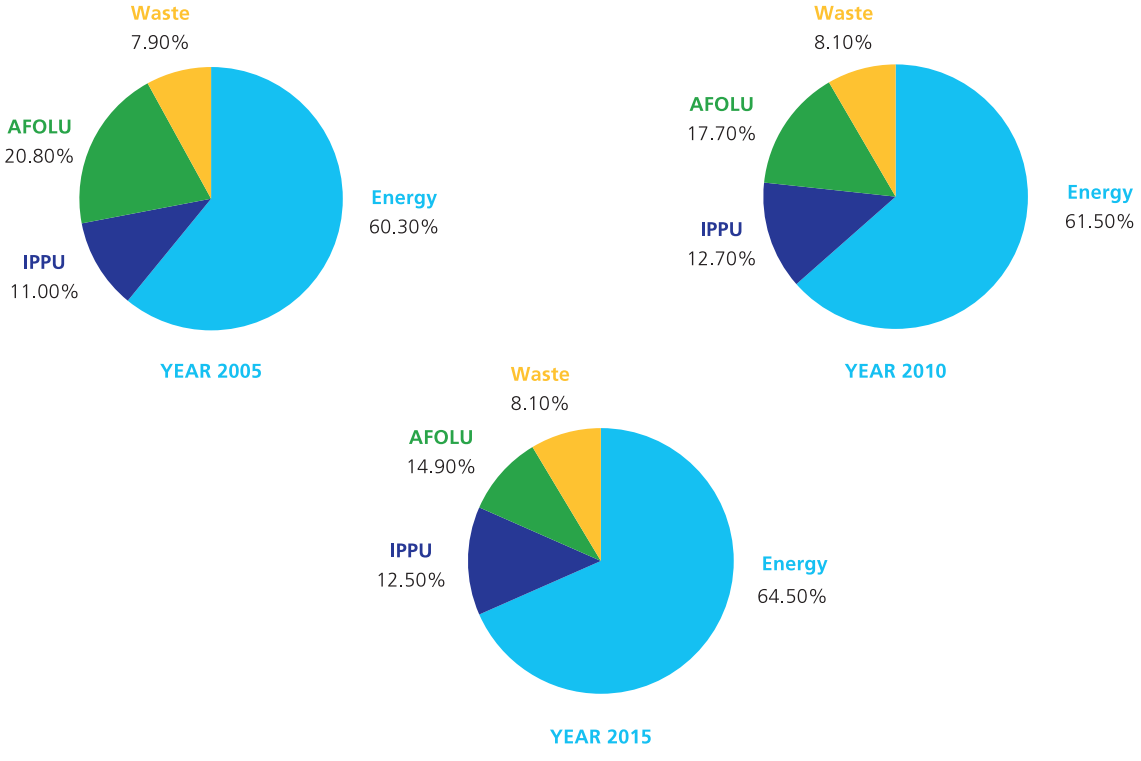


Figure 2.3: GHG contribution of each sector to the total emission in 2005, 2010, and 2015

The trend from 2005 to 2015 by gas type is illustrated in Figure 2.4. CO_2, CH_4, N_2O, HFCs, and PFCs emissions accounted for 69%, 14%, 15%, 0% and 2% respectively in 2005. While in comparison to year 2015, the CO_2, CH_4, N_2O, HFCs, and PFCs emissions accounted for 73%, 13%, 12%, 1% and 1% of the total GHG emissions as shown in Figure 2.5.

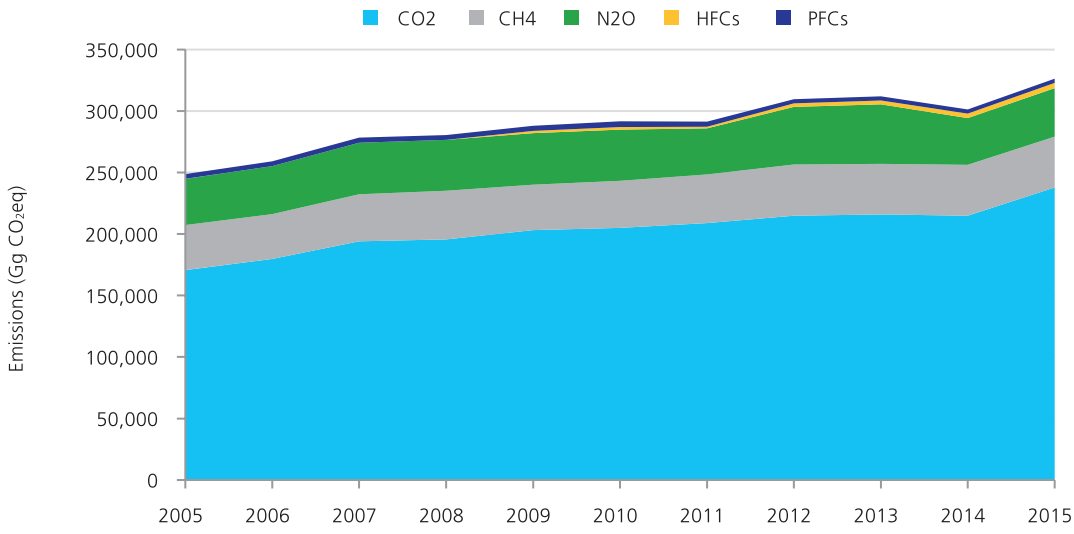


Figure 2.4: Emission trend per gas type (Gg CO_2e)

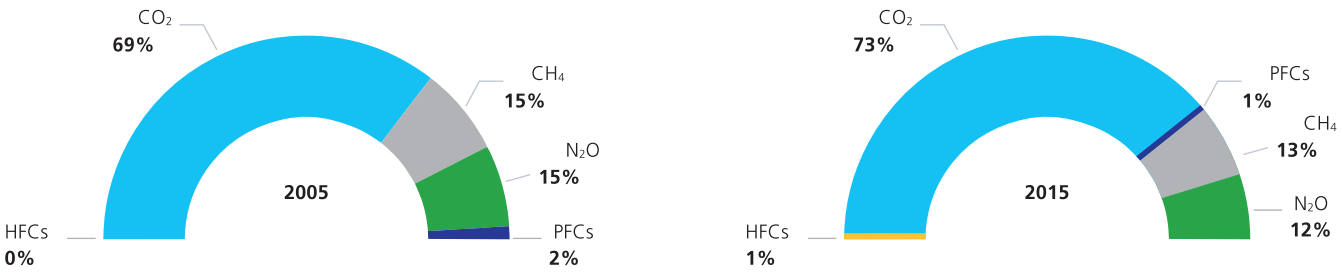


Figure 2.5: Contribution of each gas in emissions for 2005 and 2015

Breakdown by gas of total GHG emissions in 2015 (325,614 Gg CO_2e) is as follows:

- CO_2: 237,871 Gg CO_2e
- CH_4: 41,483 Gg CO_2e
- N_2O: 38,574 Gg CO_2e
- HFCs: 4,308 Gg CO_2e
- PFCs: 3,379 Gg CO_2e

Detailed GHG emissions for year 2015 are listed in Annex C.

The largest contributor to CO_2 emissions is the energy sector, to N_2O emissions is the AFOLU sector, and to CH_4 emissions is the waste sector. The contribution of each sector in the total CO_2, CH_4, and N_2O emissions are illustrated in the Figure 2.6 below.

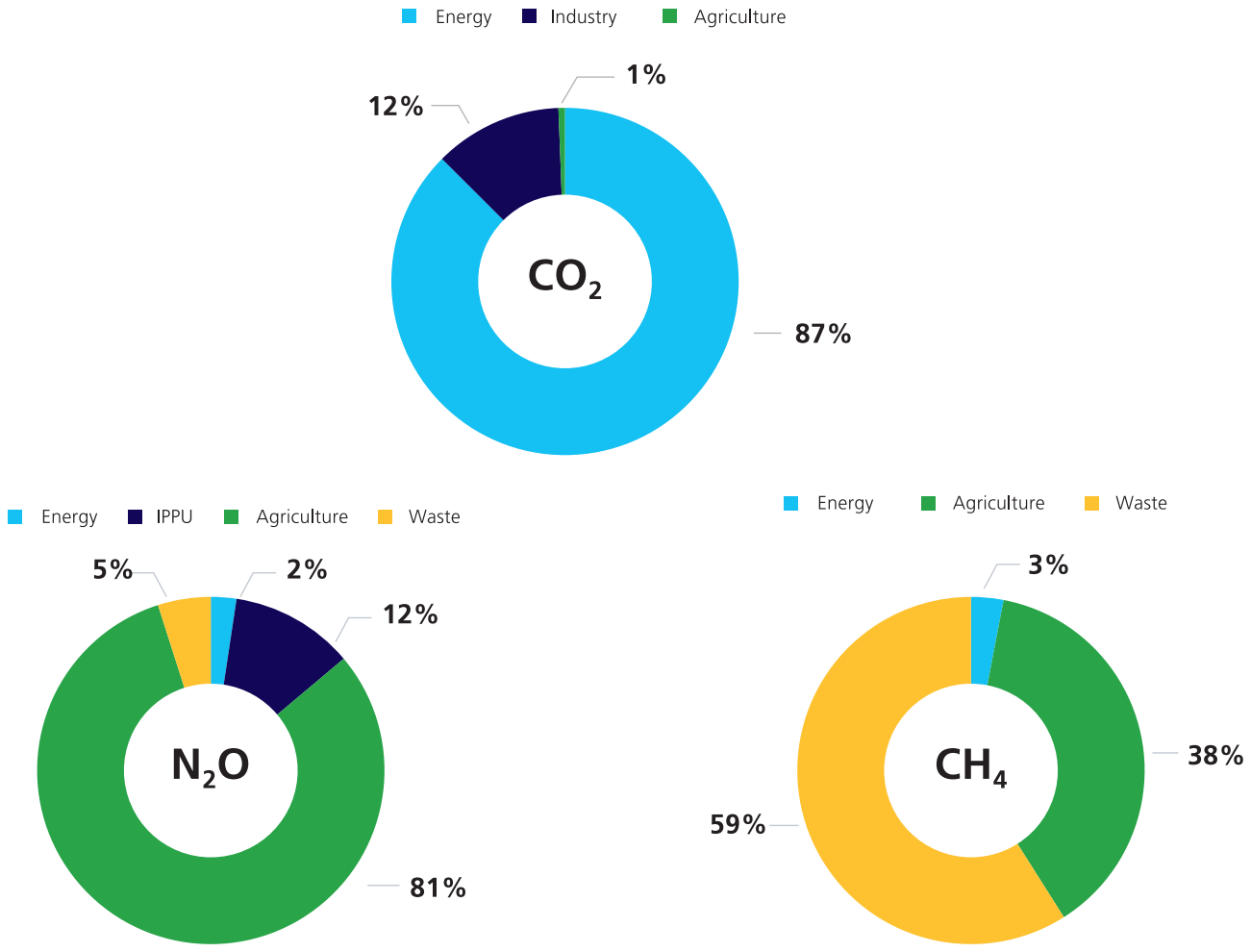


Figure 2.6: GHG emissions share per sector by gas, 2015

2.4 Breakdown of Emissions by Sector

2.4.1 Energy Sector

Overview

The energy sector contributes to approximately 64.5% of total GHG emissions in 2015 (210,171 Gg CO_2e). Energy sector emissions represent 87% of total CO_2, 3% of total CH_4, and 2% of total N_2O emissions. Energy sector GHG emissions in Egypt are mainly generated from 1) fossil fuel combustion activities (97%), and 2) fugitive emissions from oil and natural gas (3%).

Uncertainty analysis performed using the IPCC software yielded 3% for the total energy sector inventory and 4% for the trend uncertainty over the period between 2005 and 2015. The uncertainty is based on expert judgment.

Methodology and Data Sources

The methodology used for developing the GHG inventory and collecting the data was as follows:

- Energy sector inventory of GHGs emissions and sinks for Egypt has been compiled for the fiscal years 2005/2006 through 2015/2016. The base fiscal year was 2005/2006.
- Reliable activity data for the energy sector were used from national sectoral reports issued by relevant governmental institutions, such as the Egyptian General Petroleum Corporation (EGPC), the Egyptian Gas Holding Company (EGAS) and the Egyptian Electricity Holding Company (EEHC). In addition to aggregated energy statistics for Egypt from the website of the International Energy Agency (IEA).
- Default emission factors in IPCC good practice guidance issued in the years 1996 and 2006 have been utilized.
- Emissions released from bunker fuels were not estimated.
- Estimates have been made for the base fiscal year 2005/2006.
- Aggregated fuel data for the transport sector have been utilized due to unavailability of consistent data and information on the subsectors (i.e. railway, civil aviation, waterborne navigation) during the period between 2005 till 2015. GHG emissions for the transport sector considered only road transport since it represents the highest energy consumer.
- Emissions resulting from the use of coal as a fuel in the cement industry have been considered in 2015.

Trend Analysis

Figure 2.7 illustrates the energy sector GHG emissions trend from 2005 to 2015. Total emissions in 2015 have increased by 40% as compared with 2005. This is due to annual growth of energy consumption during this period to meet the increasing demand. As shown in Figure 2.7, total emissions have slightly increased during 2007 - 2010 and 2012 – 2014. Year 2015 recorded a significant increase after actualizing the successful actions undertaken by the GoE to quickly overcome the energy crisis that the country encountered between 2012 to 2014.

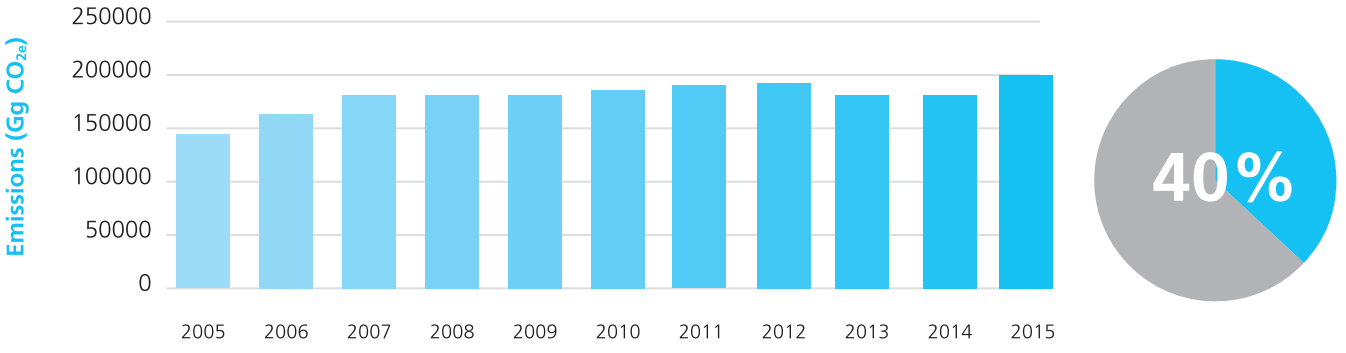


Figure 2.7: GHG emissions from energy sector over the period 2005-2015 (Gg CO_2e)

Total GHGs emissions from the energy sector have increased from around 150,027 Gg CO_2e in 2005 to 210,171 Gg CO_2e in 2015 at 3% average annual growth rate. Fuel combustion activities represents the largest share of the total GHG emissions. It increased from about 145,000 Gg CO_2e in 2005 to about 203,000 Gg CO_2e in 2015. This constituted 95% and 97% of the energy sector's total GHG emissions in 2005 and 2015 respectively.

Emissions per Gas and Category

CO_2 emissions account for 99% of total GHG emissions of the energy sector as shown in Figure 2.8. In 2015, fuel combustion activities include the following categories: energy industries (43%), manufacturing industries and construction (23%), transport (23%), other sectors such as residential (8%), and fugitive emissions from oil and natural gas (3%). Figure 2.9 shows the contribution of the subsectors to the total energy emissions, represented as a percentage of total CO_2e.

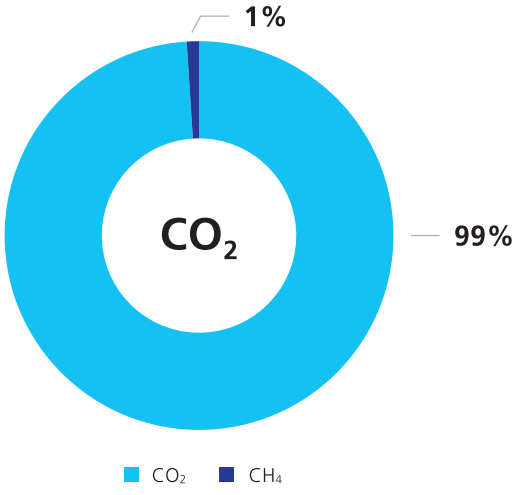


Figure 2.8: Energy emissions per gas, 2015

The distribution of subcategory shares to total energy sector GHG emissions in 2005 comprises of 42% from energy industries (electricity generation and oil refining), 22% from manufacturing industries and construction, 19% from transport, 12% from other sectors (mainly residential and agriculture), and 5% from oil and natural gas fugitive emissions.

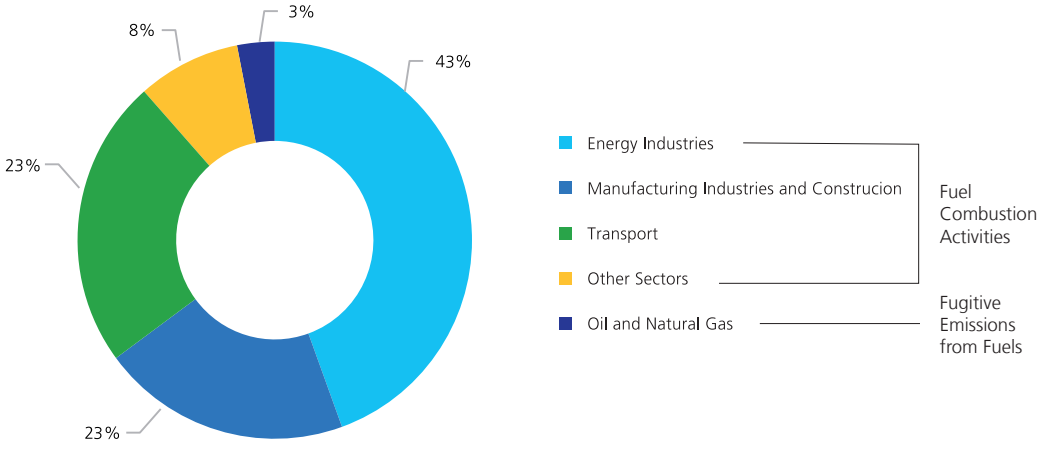


Figure 2.9: Emissions per category in energy sector, 2015

Contribution of each Category to the Emissions

Figure 2.10 presents the contribution of the main categories to the total CO_2, CH_4 and N_2O emissions. Fuel combustion activities account for 97% of total emissions while fugitive emissions from fuel accounts for the remaining 3%; with CO_2 is the main contributor.

Figure 2.11 presents the contribution of fuel combustion activities subcategories to total CO_2, CH_4 and N_2O emissions, while Figure 2.12 presents the contribution of fugitive emissions subcategories to total CO_2, CH_4 and N_2O emissions.

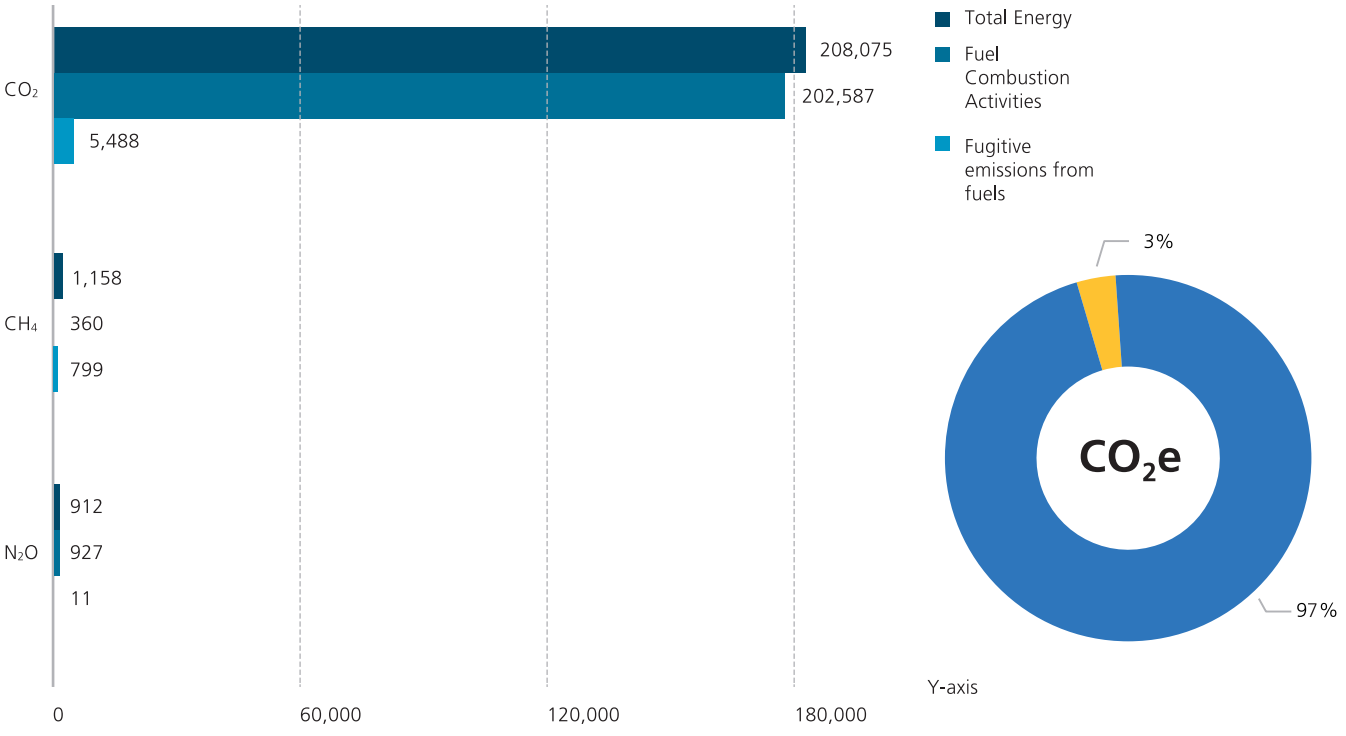


Figure 2.10: Main energy categories contributing to total energy emissions, 2015 (Gg CO_2e)

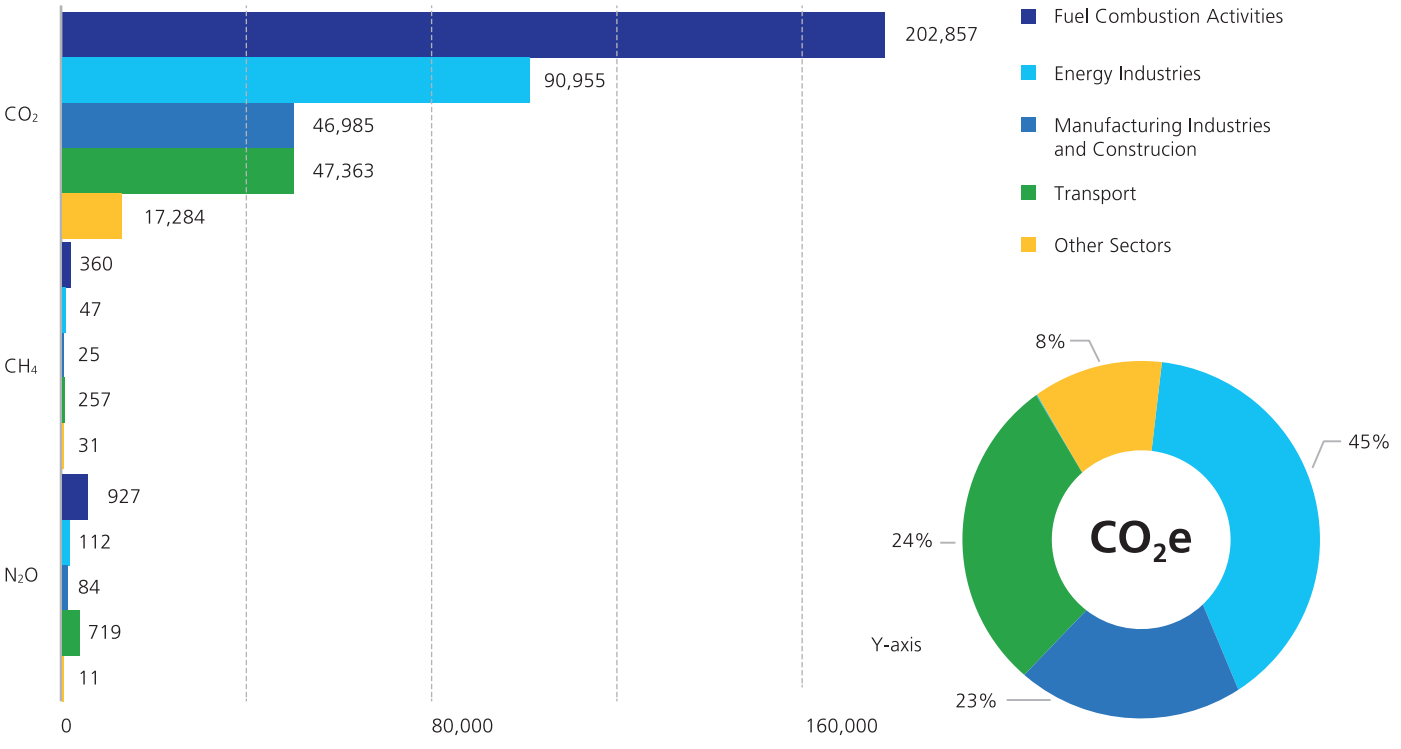


Figure 2.11: Fuel combustion activities categories contribution, 2015 (Gg CO_2e)

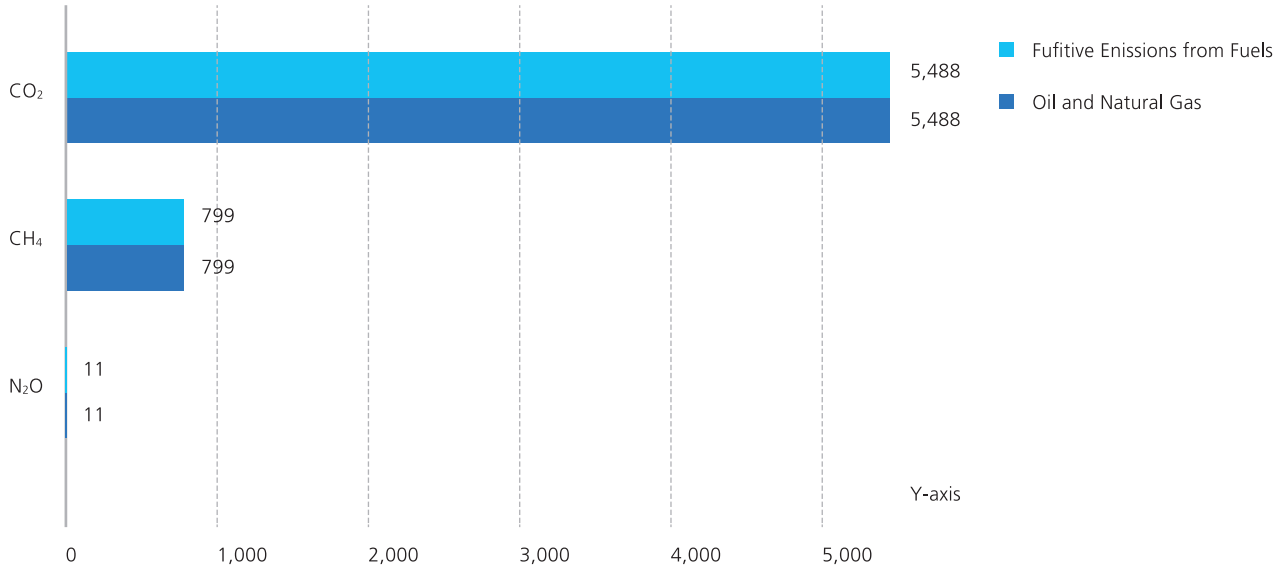


Figure 2.12: Fugitive emissions from fuel categories contribution, 2015 (Gg CO_2e)

2.4.2 Industrial Process and Product Use (IPPU) Sector

Overview

The IPPU sector is responsible for 12.5% of total GHG emissions (about 40,664 Gg CO_2e). The total IPPU emissions in 2015 are 49% higher than in 2005. IPPU emissions represent 12% of the total CO_2 emissions & 12% of total N_2O emissions and are mainly generated from 1) mineral industry (54%), 2) chemical industry (18%), 3) metal industry (17%), and 4) product uses as substitutes for Ozone depleting substances (11%).

Uncertainty analysis for activity data was conducted based on expert judgment. Uncertainty analysis performed using the IPCC software yielded a total of 14% for the total IPPU sector inventory and 27% for the trend uncertainty over the period between 2005 and 2015.

Methodology and Data Sources

The methodology used for developing the GHG inventory and collecting the data was as follows:

- The main data source for the industrial production was CAPMAS. The data obtained through CAPMAS from the private sector was reported by calendar year while the public sector was reported by fiscal year in accordance with their respective financial year.
- The Industrial Development Authority (IDA) under MoTI was the second main data source. The data availed included the production capacity, raw materials types and amounts, and the date of license issuance for the relevant industries.
- The Federation of Egyptian Industries was also approached as another data source through its Building Materials, Metallurgical and Chemical Industrial Chambers. The chambers are in direct contact with the industrial establishments but they do not collect data from these industries on regular basis.
- The National Ozone Unit (NOU) of EEAA is the main information source for the concerned Ozone Depleting Substances (ODS) substitutes in Egypt. The data in relation to imports reported to and registered by the NOU was provided.

- Supplementary data was also found in the international statistical publications such as the "Steel Statistical Yearbook 2016" which has details on the iron and steel production related to manufacturing technology in Egypt between 2006 till 2015.
- The Egyptian Petrochemical Company (ECHEM) had published as well annual reports containing details on production from its affiliated petrochemical companies between 2004 until 2014.

Trend Analysis

Figure 2.13 shows that total GHGs emissions from the IPPU sector have increased from 27.2 million tons of CO_2e in year 2005 to 40.67 million tons of CO_2e in year 2015, with an annual growth rate of 4.1% and an overall increase of 49%.

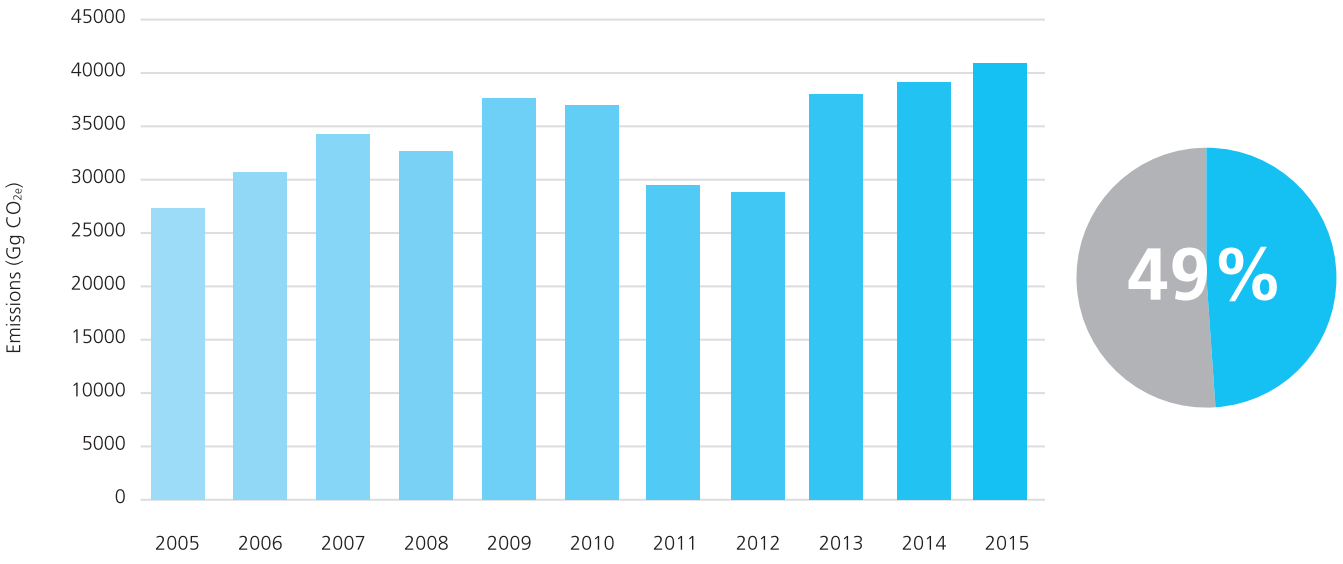


Figure 2.13: GHG emissions from IPPU sector over the period 2005 -2015 (Gg CO_2e)

Subsectors of the IPPU which follow the same trend of the total emissions, are the mineral and chemical industry with a growth rate of 4.6% and 5.1 % respectively. On the other hand, the metal industry had shown a decline of 2.3% while the ODS substitutes had a very sharp growth of 58.3%. These figures can be explained by the following facts:

- The mineral industry has been growing in Egypt at a steady rate, especially the cement industry.
- The chemical industry has also been growing, specifically the fertilizers industry and the petrochemical industries (including ethylene and methanol production which started in 2011).
- The metal industry has been facing some difficulties especially the iron and steel industry owned by the public sector, while the steel industries operated by the private sector were flourishing. The aluminum industry seemed to slightly decline after the year 2011.
- The ODS were phasing out from Egypt in the early 2000s, which explains the high growth rate of ODS substitutes emissions between 2005 till 2015.

It is apparent that there is a smooth growth of GHG emissions until 2011, reflecting the growth in the industrial sector, followed by a slight decline post the year 2011, and finally an increase in emissions reflecting the improving national economic conditions.

Emissions per Gas and Category

CO_2 emissions account for 70% of IPPU total GHG emissions, while N_2O, HFCs, and PFCs account for 11%, 11%, and 8% respectively, as illustrated in Figure 2.14.

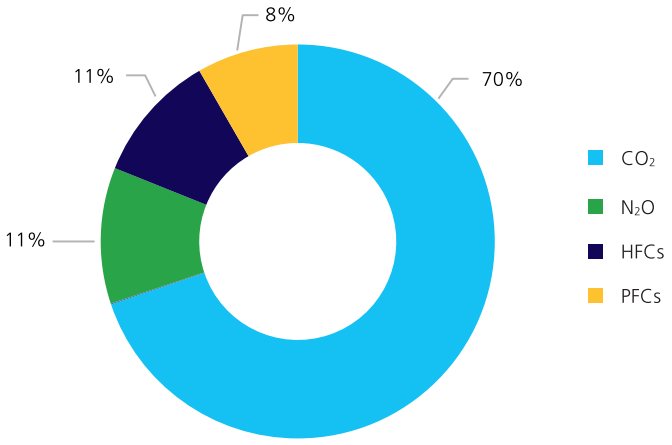


Figure 2.14: Emissions per gas for the IPPU sector, 2015

Contribution of each subcategory to the total IPPU GHG emissions is presented in Figure 2.15:

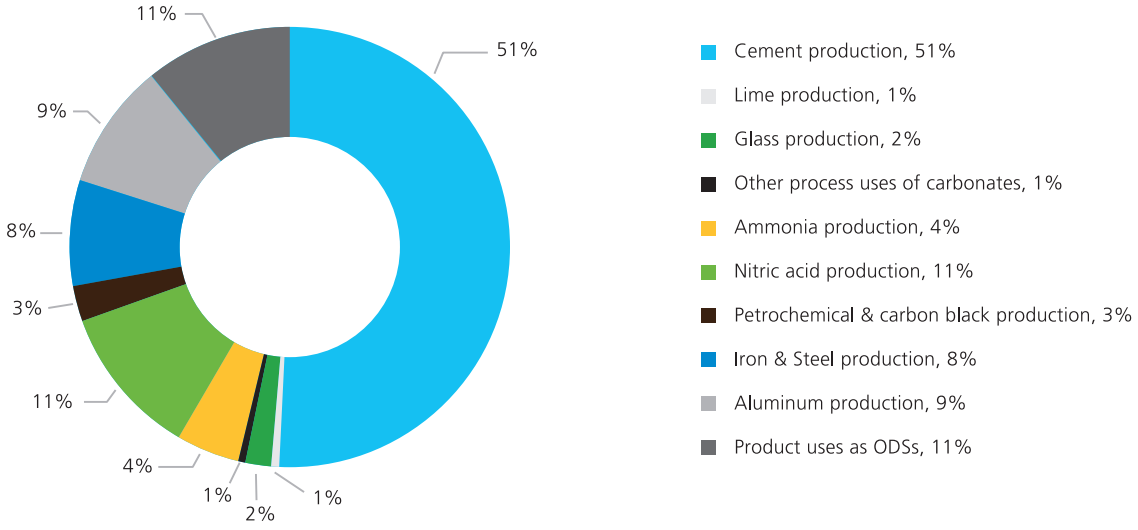


Figure 2.15: Emissions per category for the IPPU sector, 2015

Contribution of each Category to the Emissions

Figure 2.16 presents the contribution of the main IPPU subcategories to total CO_2, CH_4 and N_2O emissions.

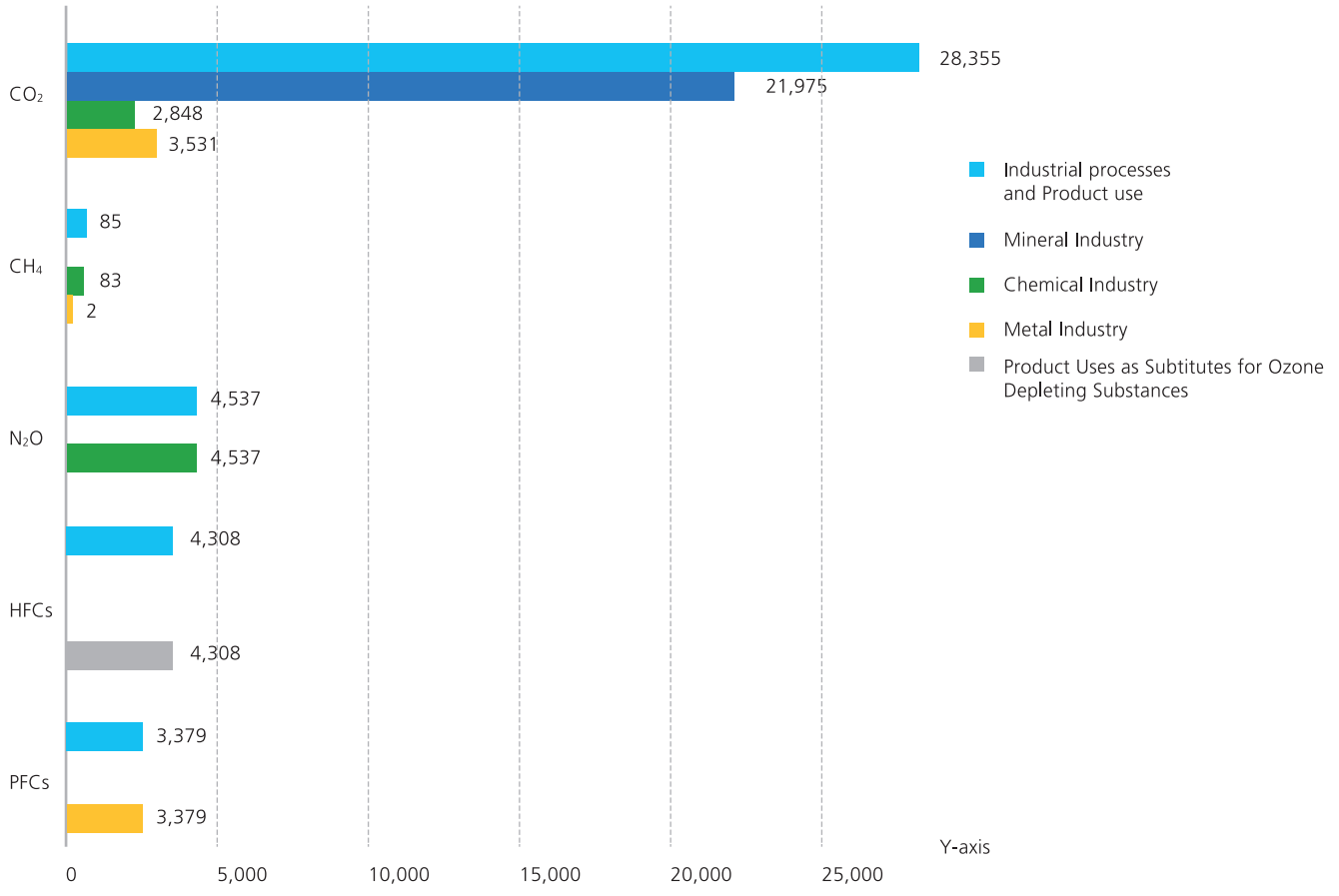


Figure 2.16: Main IPPU categories contribution to the total IPPU emissions, 2015 (Gg CO_2e)

The emissions from mineral industries are mainly CO_2. Figure 2.17 shows the contribution of the subcategories of the mineral industries to its total CO_2 emissions.

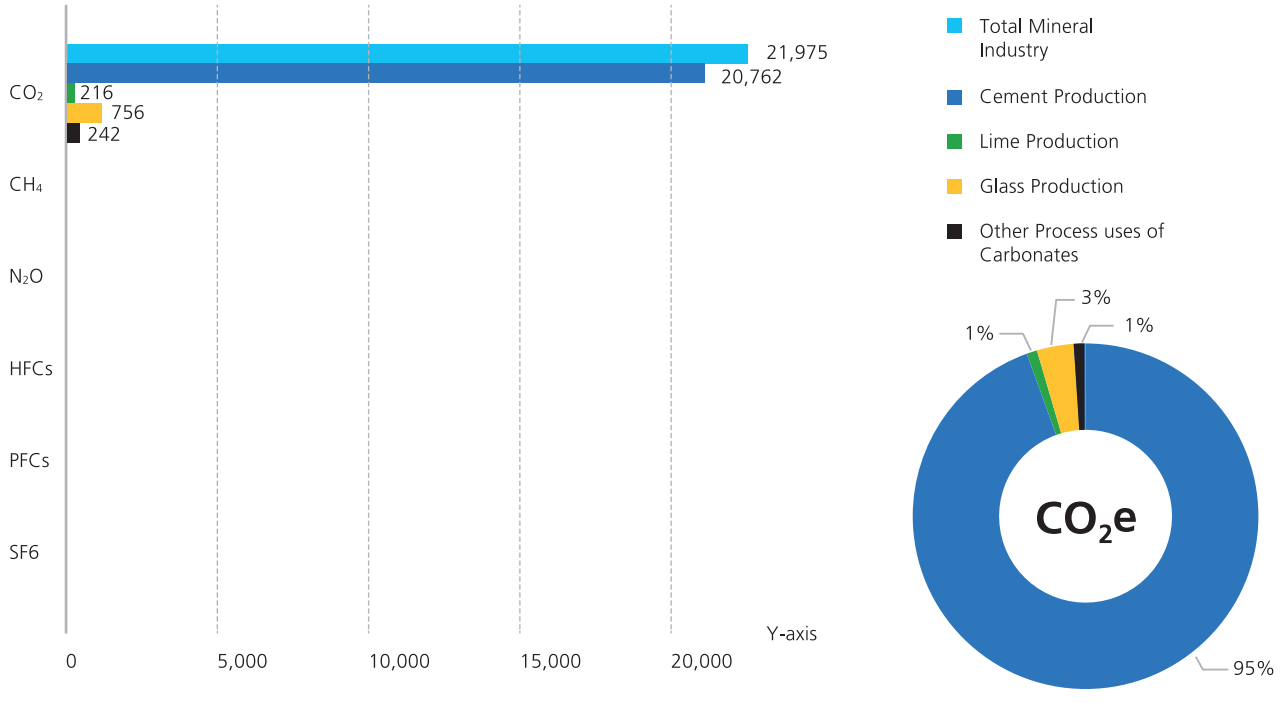


Figure 2.17: Mineral industries categories contribution, 2015 (Gg CO_2e)

The emissions from chemical industries are mainly N_2O. Figure 2.18 shows the contribution of the subcategories of the chemical industries to its total emissions.

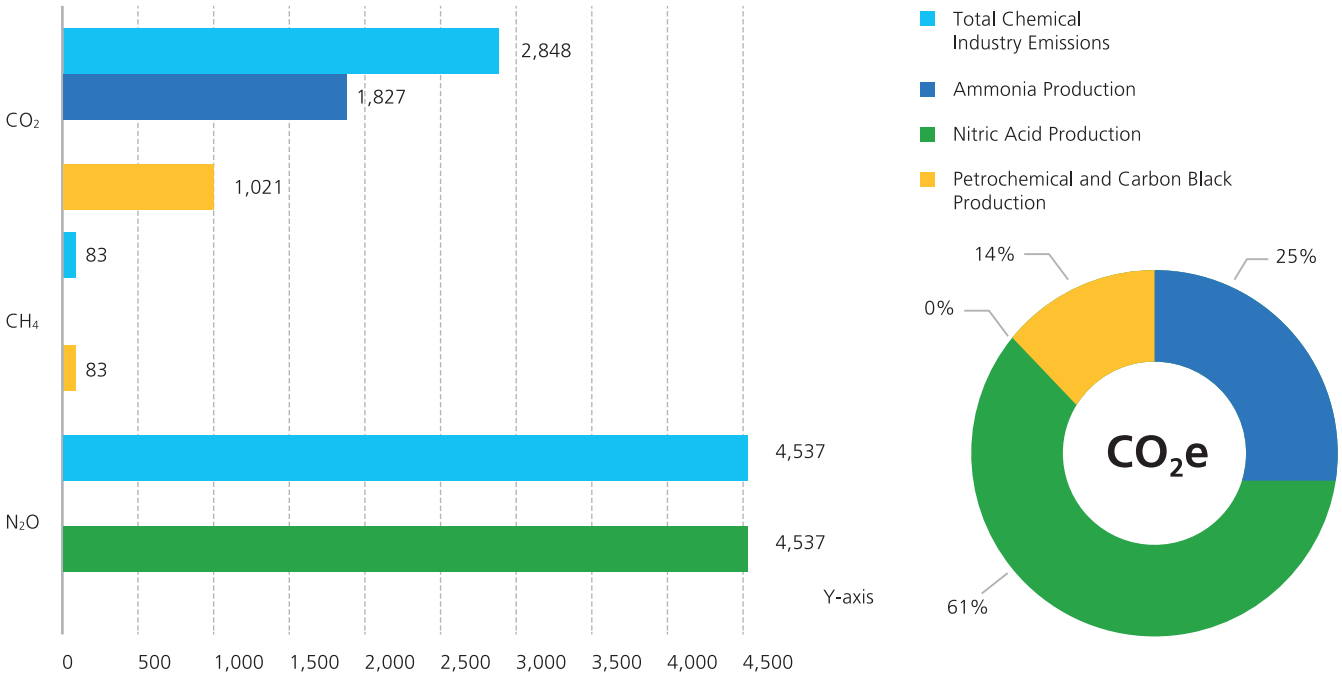


Figure 2.18: Chemical Industries Categories Contribution in 2015

The emissions from Ozone Depleting substances are HFCs as shown in Figure 2.19.

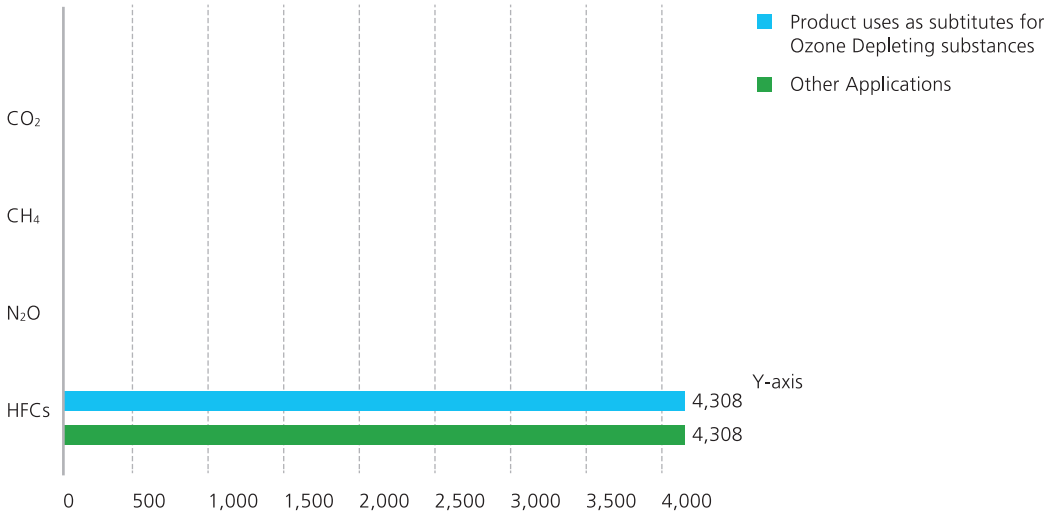


Figure 2.19: Ozone Depleting Substances Categories Contribution in 2015

The emissions from metal industries are mainly CO_2 and PFCs. Figure 2.20 shows the contribution of the subcategories of the metal industries to its total emissions.

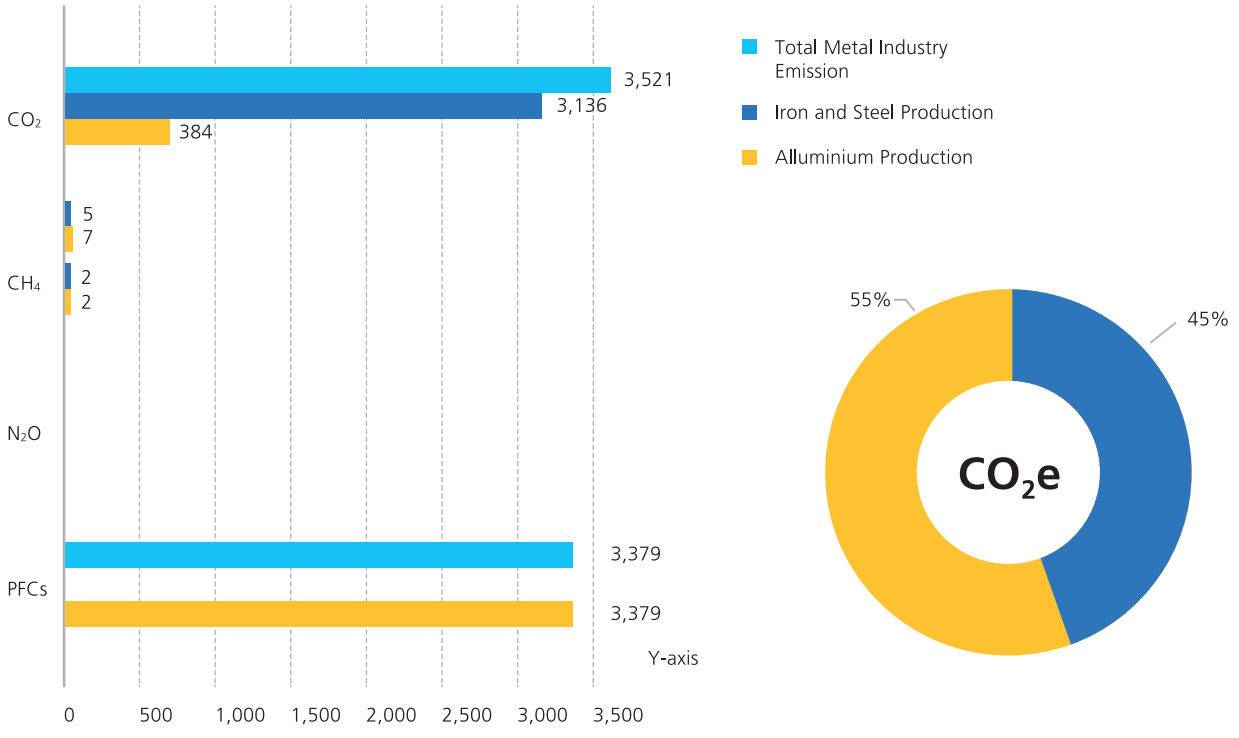


Figure 2.20: Metal Industries Categories Contribution in 2015

2.4.3 Agriculture, Forestry, and Other Land Use (AFOLU) Sector

Overview

The AFOLU sector contributed 14.9% (48,390 Gg CO_2e) of national GHG emissions in 2015. AFOLU sector GHG emissions are mainly generated from 1) enteric fermentation, 2) manure management, 3) rice cultivation, 4) agriculture soil, and 5) field residuals burning. The largest contributor to the total GHG emissions is aggregate sources and non-CO_2 emissions sources on land (66%) followed by livestock (34%).

Uncertainty analysis for activity data was conducted based on expert judgment and ranged between ± 15%, while uncertainty of the emission factors is ± 50%. The emission factors are selected from the default values in the IPCC 2006 Guidelines for Africa. Consequently, this led to the increase of the uncertainty due to the differences between the Egyptian environment compared to the majority of the African countries, especially in relation to cropland, livestock and poultry.

Methodology and Data Sources

The methodology used for developing the GHG inventory and collecting the data was as follows:

- The main activity data sources were the Agricultural Economic Affairs Sector (EAS), under the Ministry of Agriculture and Land Reclamation (MALR), and CAPMAS.
- There are no ecosystems in Egypt that could be considered as natural savannahs. As a result, the GHG emissions for this subcategory were not estimated.
- With regards to land, the only data available were related to land reclamation and crop land converted to settlement. Therefore, the net change of croplands has been estimated.

Trend Analysis

Figure 2.21 shows the AFOLU GHG emissions trend between 2005 and 2015. Total AFOLU emissions in 2015 are 7% lower than in 2005. A main reason for the decrease is the reduction in fertilizer use.

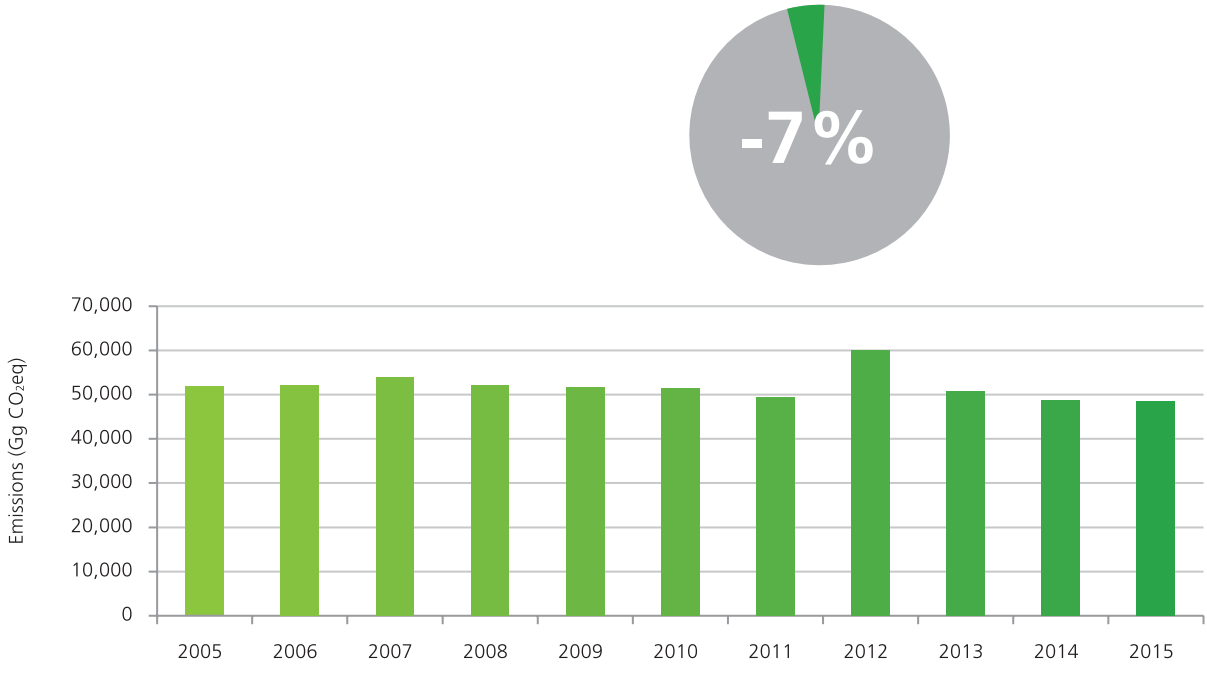


Figure 2.21: GHG Emissions from AFOLU Sector 2005-2015

In 2005, aggregate sources and non-CO_2 emissions from land accounted for about 70% of the total AFOLU GHGs emissions. Regression analysis between the total AFOLU GHGs emissions and the amounts of synthetic fertilizers and urea showed strong correlation for the period between 2005 till 2015. This explains the general decrease in the total AFOLU GHGs emissions, which was associated with a decrease in the use of synthetic fertilizers and urea for the period between 2005 till 2015. It also explains the fluctuations in the total AFOLU GHG emissions resulting from the variations in the amounts of synthetic fertilizers and urea used.

One of the key elements affecting the use of fertilizers is the change in the policies of MALR concerning fertilizers allocations for farmers as per available financial resources/plan. Companies have adjusted manufacturing or importing of fertilizers in response to such MALR plans. In addition, the use of synesthetic fertilizers has been reduced as a result of the economic situation. The farmers preferred using compost than using synesthetic fertilizer due to its greater benefit in terms of nitrogen and lower purchase price.

Emissions per Gas and Category

AFOLU sector emissions consist of 65% N_2O, 32% CH_4, and 3% CO_2 as shown in Figure 2.22.

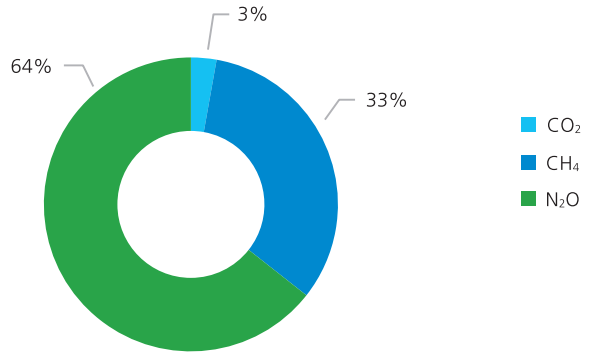


Figure 2.22: Emissions per gas for the AFOLU sector, 2015

Emissions per category of the AFOLU GHG emissions are illustrated in Figure 2.23.

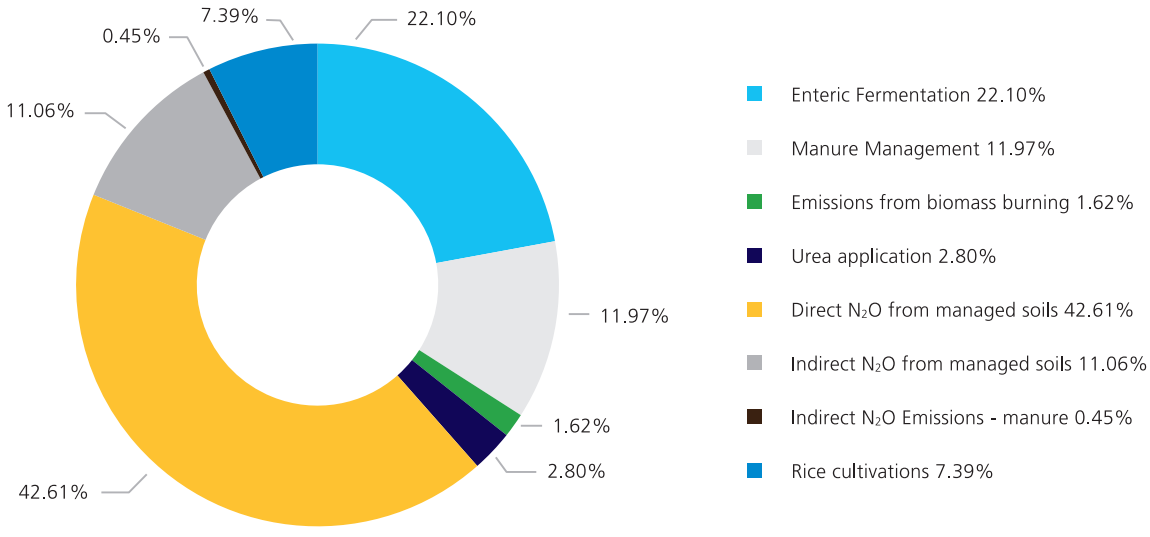


Figure 2.23: Emissions per category for the agriculture sector, 2015

Contribution of each Category to the Emissions

Figure 2.24 presents the contribution of the main AFOLU subcategories to CO_2, CH_4, and N_2O emissions. The emissions from livestock are mainly CH_4 and N_2O. Figure 2.25 shows the contribution of livestock sub categories to its total GHG emissions. The emissions from aggregate sources and non-CO_2 emissions sources on land are mainly CH_4 and N_2O. Figure 2.26 shows the contribution of aggregate sources and non-CO_2 emissions sources on land sub categories to its total GHG emissions.

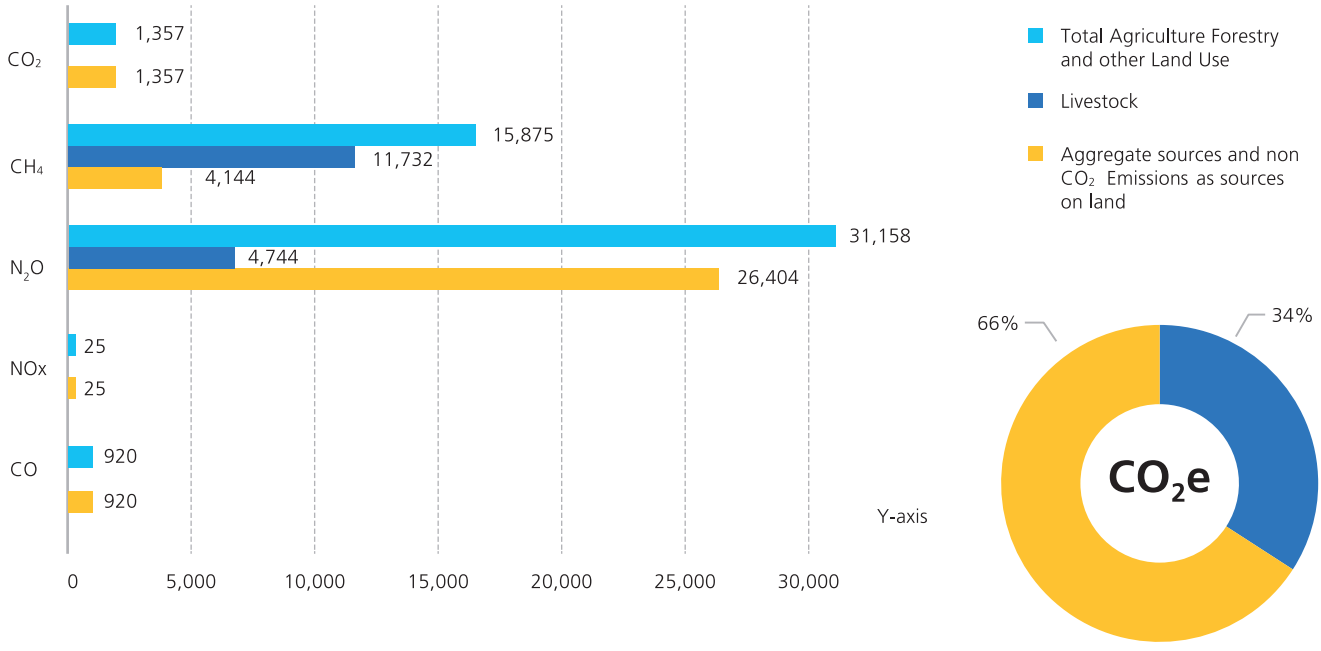


Figure 2.24: Main categories contributing to total AFOLU emissions, 2015 (Gg CO_2e)

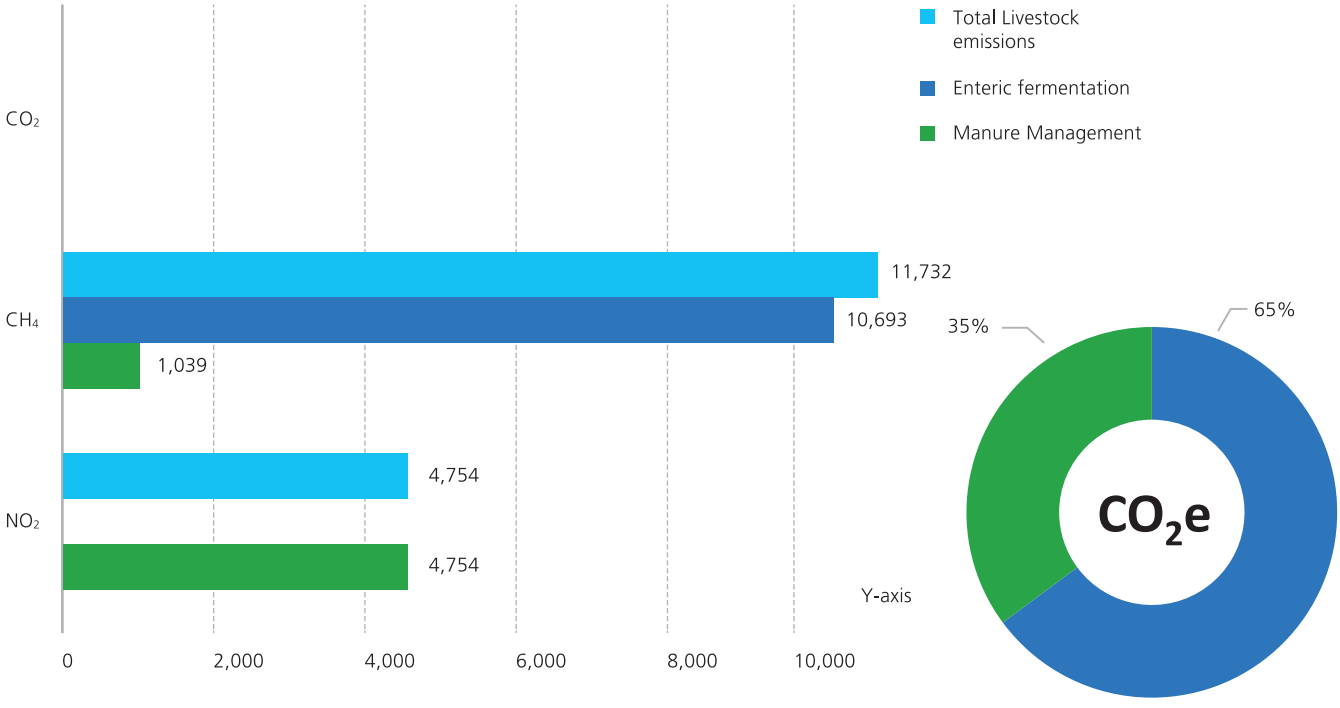


Figure 2.25: Categories contributing to total livestock emissions, 2015 (Gg CO_2e)

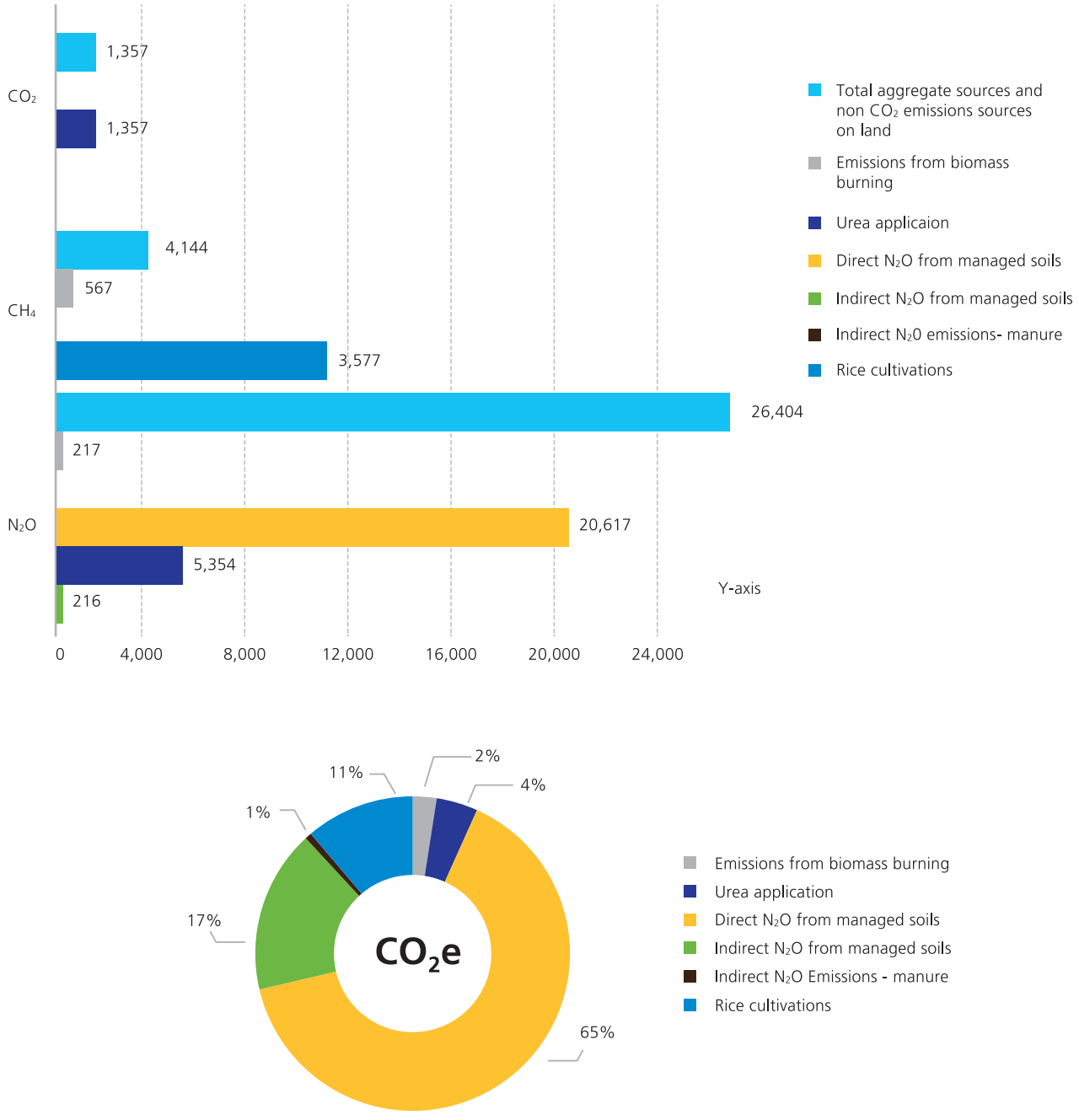


Figure 2.26: Categories contributing to total aggregate sources and non-CO_2 emission sources on land, 2015 (Gg CO_2e)

2.4.4 Waste Sector

Overview

The waste sector is responsible for about 8.1% of the GHG emissions estimated in 2015 at 26,389 Gg CO_2e, an increase of 34% in comparison to 2005. Waste sector GHG emissions are mainly generated from 1) solid waste disposal and 2) domestic & industrial wastewater treatment & discharge; with minor contributions from biological treatment of solid waste and incineration and open burning of solid waste.

In general, activity data and emission factor uncertainties were obtained directly or calculated from 2006 IPCC GHGI Guidelines. Uncertainties were selected from 2006 IPCC GHGI guidelines based on expert judgment. Expert judgment was also used to place higher uncertainty on open-burning and industrial wastewater activity data. Uncertainty analysis performed using the IPCC software yielded a total 83% for the trend uncertainty over the period between 2005 till 2015. This is likely due to the high activity data uncertainty for industrial wastewater and the high emission factor uncertainties.

Methodology and Data Sources

The methodology used for developing the GHG inventory and collecting the data was as follows:

- A list of data needed for the waste sector inventory in the 2006 IPCC GHGI software was developed.
- Software data needs were filtered according to applicability to the Egyptian national circumstances.
- Needed data applicable to the national circumstances was mainly activity data, in addition to selected parameters. In general, IPCC default parameters and emission factors were used for waste sector inventory calculations, while national data was used for the activity data and selected parameters.
- Data needed was requested from the relevant governmental institution(s).
- In case data from governmental institutions was not available, priority was given to obtaining data from published national sources and reports. In some cases, official regional/international reports, which included data on Egypt, were used.
- In cases where governmental entities provided data that was also published in national, regional, or international reports, these were used to cross-check the data provided.
- A significant portion of the needed data was obtained from CAPMAS either from published thematic reports or from CAPMAS databases. Data obtained from CAPMAS included:
  - Solid waste amounts, composition, disposal methods;
  - Domestic wastewater treatment and discharge in urban and rural areas;
  - Loading on centralized wastewater treatment plants; and
  - Annual production from selected industries.
- Other data was obtained either directly from governmental entities (such as disposal site properties and estimates of open burning from Waste Management Regulatory Authority; clinical waste amounts and treatment methods from the Ministry of Health; domestic wastewater collection and treatment from the Holding Company for Water and Wastewater under the Ministry of Housing) and cross-validated with data from CAPMAS and other sources.
- Other sources included expert interviews and reports issued by EEAA (State of the Environment Report), thematic programs (such as the National Solid Waste Program - NSWMP & SWEEP-NET), as well as other documents related to solid and liquid waste management facilities.

Trend Analysis

Figure 2.27 shows the waste sector GHG emissions trend between 2005 till 2015. Total waste sector emissions in 2015 are 34% higher than in 2005. This yields an average growth rate of ~3% per year.

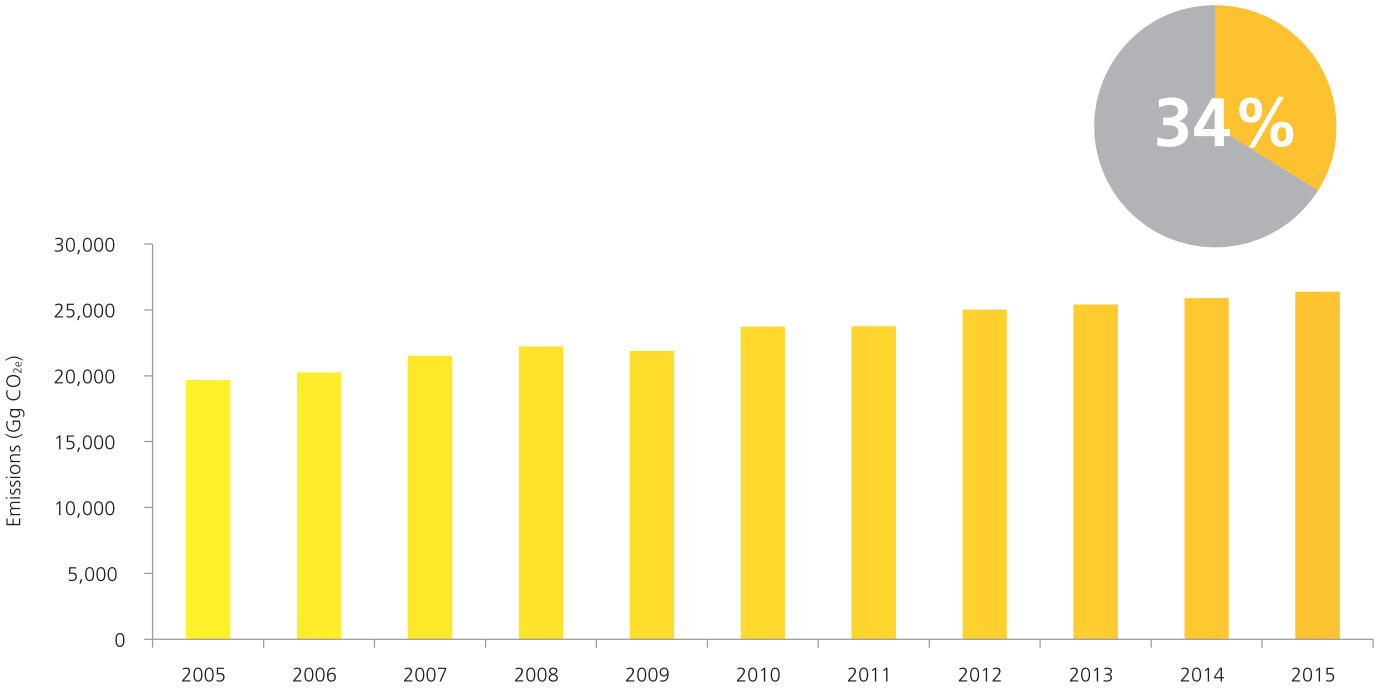


Figure 2.27: GHG Emissions from Waste Sector between 2005-2015

GHG emissions increased by 24% for solid waste disposal sites, 37% for domestic and industrial wastewater treatment and discharge, 26% for biological treatment of solid waste (composting), and 23% for open-burning of waste between 2005 and 2015. Emissions from medical waste incineration grew by more than 600% between 2005 and 2015 due to systematic improvements in the collection systems as well as the increased number and performance of incineration units.

Annual relative contributions of the four waste subcategories have remained generally constant over the 10-year period with (1) Solid Waste Disposal Sites (SWDS) and (2) Domestic & Industrial Wastewater Treatment and Discharge (DIWTD) contributing 97% of waste sector GHG emissions. Throughout the time-series, SWDS contributed between 50% and 53% of waste sector GHG emissions while DIWTD contributed between 44% and 47%.

Almost all inventory years in the period between 2005 and 2015 follow a similar trend, where Methane (CH_4) emissions account for more than 92% of overall Waste Sector GHG emissions. Nitrous Oxide (N_2O) follows with around 7.7%, while Carbon Dioxide (CO_2) emissions account for less than 0.2% of waste sector GHG emissions.

Emissions per Gas and Category

CH_4 emissions account for 92 % of total waste GHG emissions, followed by N_2O at 8% as shown in Figure 2.28.

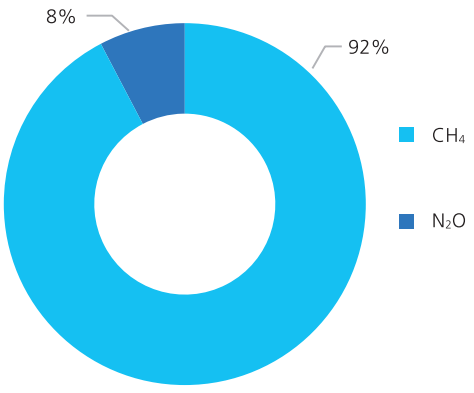


Figure 2.28: Emissions per gas for the waste sector, 2015

The distribution of contributions by category to the total waste GHG emissions are 50% from solid waste disposal, 47% from wastewater treatment and discharge, 2% from incineration and open burning, and 1% from biological treatment of solid waste, as illustrated in Figure 2.29.

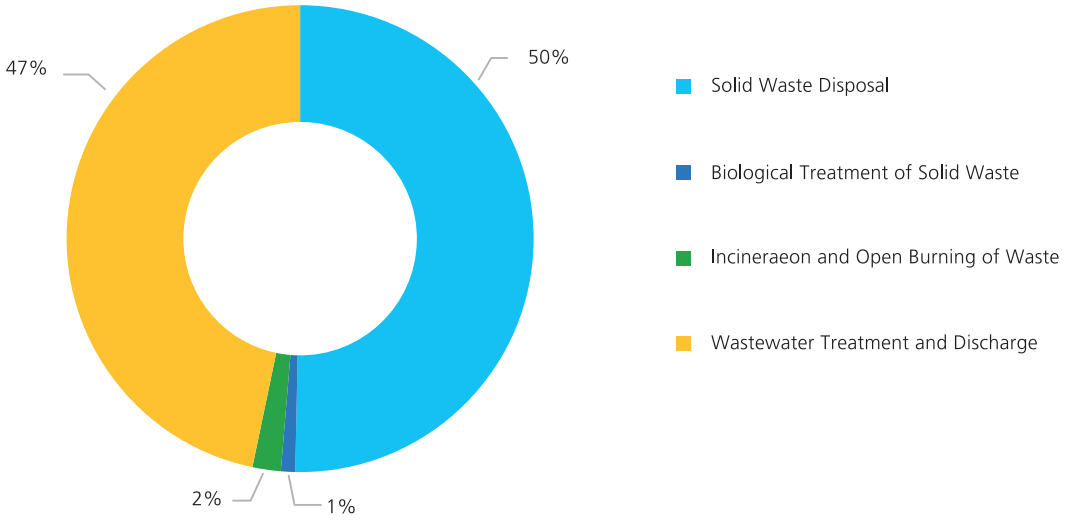


Figure 2.29: Emissions per category for the waste sector, 2015

Contribution of each Category to the Emissions

Figure 2.30 presents the contribution of each subcategory to the total CO_2, CH_4, and N_2O emissions. The emissions from waste categories are mainly CH_4 and N_2O as shown in the donut charts.

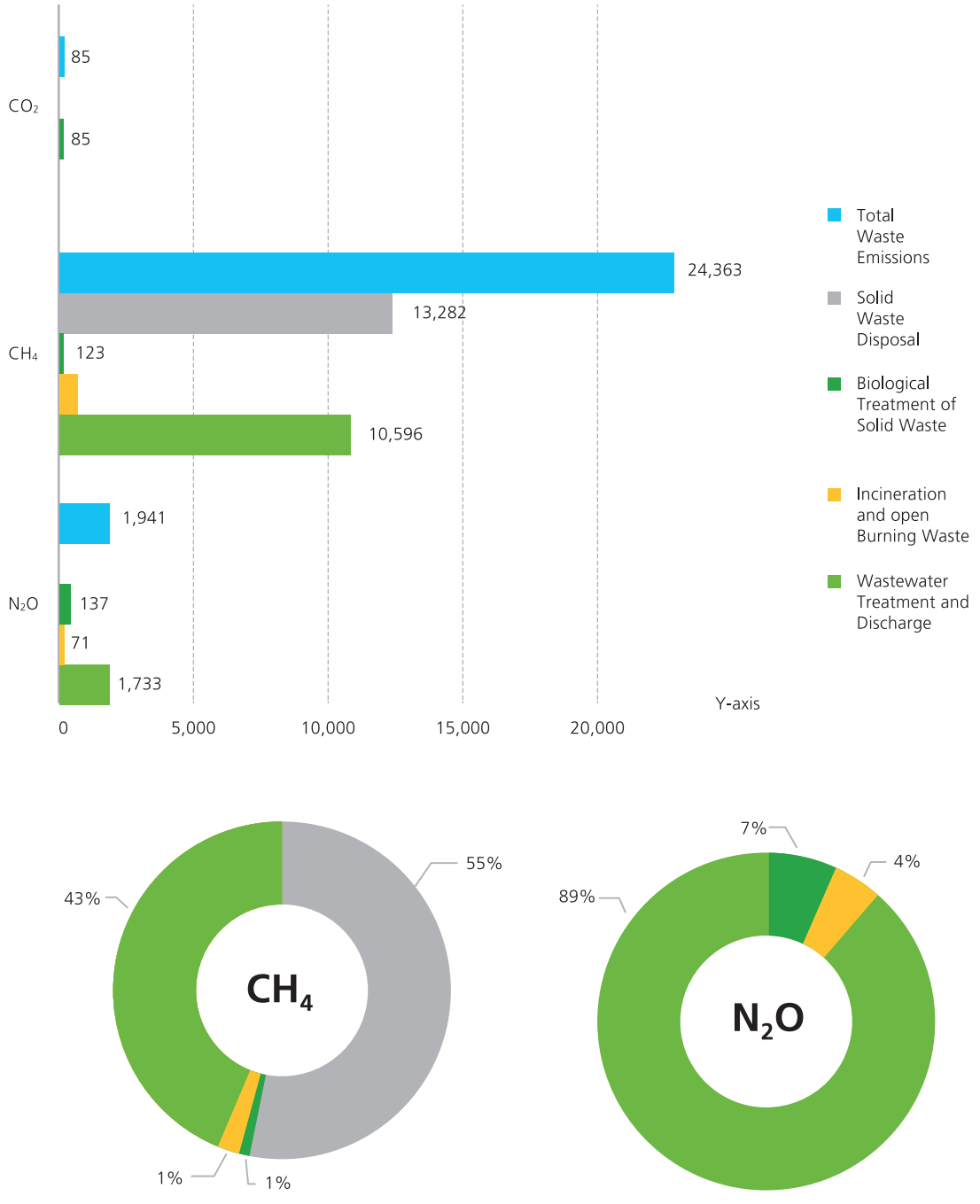


Figure 2.30: Main waste sector categories contribution to the total waste sector emissions, 2015 (Gg CO_2e)

2.5 Comparison of GHGI of TNC and BUR

Since 2005 is overlapping between the Third National Communication and the BUR, a comparison is provided below for each sector and its associated categories. In case significant differences occur, an explanation is outlined.

2.5.1 Energy Sector

Table 2.1: Energy sector GHGs emission comparison between TNC and BUR for 2005

Category	TNC	BUR	% Difference
	Gg CO_2e	Gg CO_2e	
1 – Total Energy	159,688	150,027	-6.05
Fuel Combustion Activities	147,324	145,287	-1.4
Industry	34,522	32,562	-6.01
Transport	33,093	29,104	-13.7
Agriculture	2,586	6,294	58.91
Residential & Commercial	13,329	12,236	-8.93
Electricity	54,845	56,416	2.78
Petroleum	8,946	9,674	7.52
Fugitive Emissions	12,364	7,130	-73.4

There are no significant differences between the TNC and BUR for 2005 since the variability lies within 5% to 7%. The difference between the total fuel combustion is -1.4% and the difference between the total energy is -6.05%. This is also apparent for other subcategories of industry, electricity, and petroleum. The slight differences in these subcategories are mainly due to the methods of calculation. The major differences between categories like agriculture and fugitive emissions and even moderate differences such as transport are mainly due to discrepancy in data, which was more available during the preparation of the BUR.

2.5.2 IPPU Sector

Table 2.2: IPPU Sector GHGs emission comparison between TNC and BUR for 2005

Category	TNC	BUR	% Difference
	Gg CO_2e	Gg CO_2e	
2 - Industrial Processes and Product Use	42,010	27,280	35%
Mineral Industry	16,920	13,956	18%
Chemical Industry	6,970	4,554	35 %
Metal Industry	2,650	8,727	229%
Product Uses as Substitutes for Ozone Depleting Substances	15,470	43	100%

The main difference between 2005 in the TNC and 2005 in the BUR is the contribution of the Product Uses as Substitutes for Ozone Depleting Substances. Since in the TNC, the Ozone Depleting Substances including halons, CFCs and HCFCs were added to the ozone depleting substitutes. According to the requirements of the IPCC 1996 Guidelines, which was used for the calculation of the inventory of the TNC, as well as the IPPC 2006 Guidelines, which are used in BUR calculations, only "Emissions Related to Production of Halocarbons and Sulphur Hexafluoride (HFCs, PFCs and SF6)" (IPCC Guidelines 1996) and "Emissions of Fluorinated Substitutes for Ozone Depleting Substances" (IPCC Guidelines, 2006) should be included in the GHGs inventory. In the TNC Report, the CFCs and HCFCs were not supposed to be included in the calculations.

As for the differences in the mineral sector, this is due to the usage of production capacity in the GHG calculations rather than actual production in the TNC. For the chemical sector, the difference was due to the usage of higher emission factors than those recommended by the IPCC guidelines in the calculations of GHG emissions in the TNC. In relation to the disparity in estimates of GHG emissions in the metal sector, this was mainly due to the underestimation of the national production of iron and steel in the TNC and the assumption that aluminum was produced using Søderberg technology while it actually utilizes the prebake technology.

2.5.3 AFOLU Sector

Table 2.3: AFOLU sector GHGs emissions comparison between TNC and BUR for 2005

Category	TNC	BUR	% Difference
	Gg CO_2e	Gg CO_2e	
3- Agriculture, Forestry, and Other Land Use	39,446	51,787	24%
Enteric Fermentation	9,063	10,099	10%
Manure Management	3,974	4,532	12%
Rice Cultivation	4,637	4,425	-5%
Agricultural Soils	20,022	30,200	34%
Field Burning of Agricultural Residues	1,751	650	-169%

The main difference between 2005 in the TNC and the BUR is resulting from the increase in livestock populations in 2005 for the BUR GHG emissions, in addition to the increased use of fertilizer in agriculture (natural and synthetic fertilizers). It should be noted that the data used for the recalculation of the 2005 emissions in the BUR are taken from official sources (the Economic Affairs Sector under MALR and CAPMAS) using the published statistics, while the data sources of the TNC are unknown.

2.5.4 Waste Sector

Table 2.4: Waste sector GHGs emission comparison between TNC and BUR for 2005

Category	TNC	BUR	% Difference
	Gg CO_2e	Gg CO_2e	
4- Waste	19,198	19,676	-2%
Solid Waste Disposal	11,526	10,431	10%
Wastewater Treatment & Discharge	7,665	8,658	-13%
Incineration	6.54	5.1	22%
Composting	Not Calculated	200	-
Open Burning of Waste	Not Calculated	380	-

In terms of total waste sector GHG emissions, BUR re-calculation for 2005 is about 2% higher than that reported in the TNC for 2005.

TNC calculation of GHG emissions from the solid waste disposal sites subcategory is around 10% higher than calculated for the BUR. This difference is significant but may be partly attributed to the selection of parameters such as the percentage of municipal waste routed to the different disposal site types and to assumed waste composition at disposal. However, a more significant source of difference could be the 20% of municipal waste generated that is calculated as being diverted to biological treatment "composting" (7%) and open burning of waste (13%). These two categories had not been calculated for the TNC. Therefore, the total amount deposited in solid waste disposal sites is 20% lower in the BUR than calculated for the TNC. This is reflected in the higher emissions from this subcategory in the TNC compared to the BUR.

TNC calculation of GHG emissions from wastewater treatment and discharge is around 13% lower than the calculated for the BUR. This significant difference could most likely be attributed to the contribution of industrial wastewater treatment and discharge. Inclusion of wastewater generated from some industries which were not considered in the TNC may have led to higher GHG emissions in the BUR.

The 22% difference in incineration emissions is most likely due to difference in data sources but is, nevertheless, quite small in terms of absolute value and does not contribute significantly to the overall inventory.

2.6 Key Category Analysis

Key category analysis has been performed using the 2006 IPCC software on the combined GHG databases for the different sectors (Energy, IPPU, AFOLU and Waste). The results are shown in Figure 2.31. The largest contributor to national GHG emissions is CO_2 from gaseous fuels under the energy industries (20.2%), followed by CO_2 from road transportation (15.0%) and N_2O from direct N_2O emissions from managed soils (6.9%). The complete key category analysis is available in Annex E.

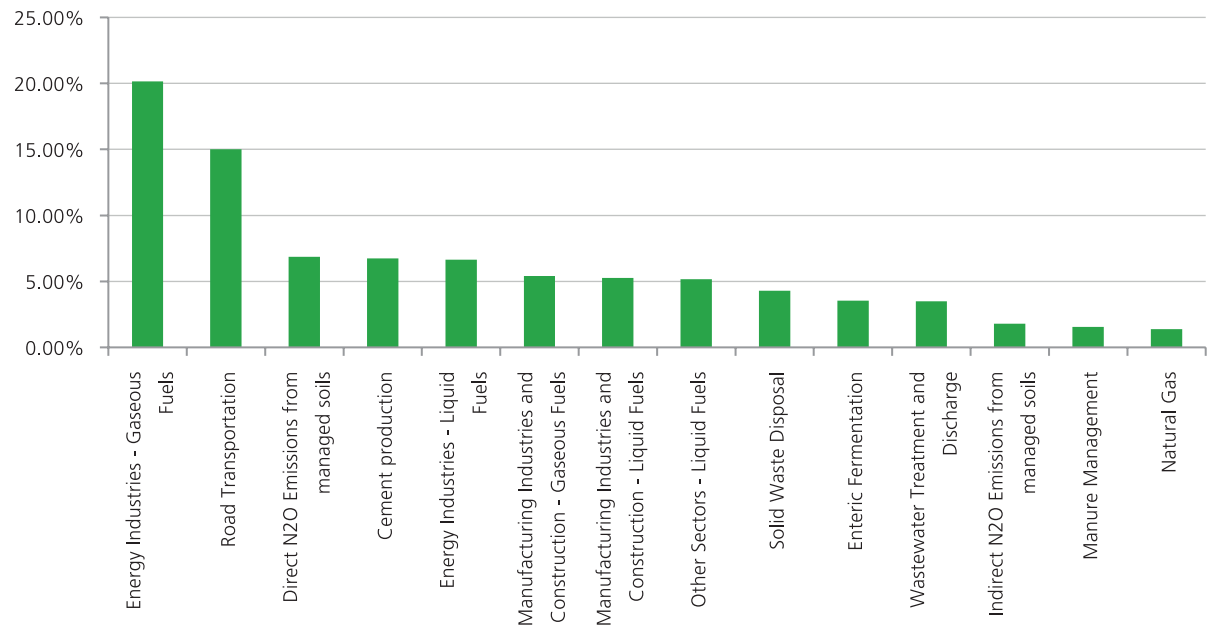


Figure 2.31: Key category analysis representation for top 16 contributors to GHG emissions

2.7 QA/QC and Verification

2.7.1 QA/QC for Data Collection

Quality Control

Activity data were collected from the different relevant ministries, other affiliated entities, and CAPMAS. The collected data were compared against publications and other sources, when relevant, and cross-checked with the data collected for the TNC. An activity data report pertaining to each sector has been developed by each of the Sector Specialists and reviewed by the BUR team leader, which has also included emission factors and parameters.

Following the entry of activity data in the IPCC Software, activity data tables were generated and reviewed against the original set of data. In general, the quality control process consisted of the following:

- Check that units are correctly used;
- Undertake database completeness checks;
- Compare estimates and emission factors against previous inventories (i.e. TNC); and
- Internal documentation of all activities.

Quality Assurance

Third party experts and the BUR Steering Committee were involved in reviewing the GHG inventory results. Activity data reports were reviewed by BUR management team, who were not involved in the data collection and compilation process.

2.7.2 QA/QC for the Calculation of Emissions

Quality Control

GHG emissions were calculated using the 2006 IPCC software. The main database has been distributed to the four Sector Specialists (Energy & Transport, Industry, Waste and Agriculture) after adjusting the settings for the Administrative Section of the database. Quality control of the completed databases has been conducted by the GHG Team Leader, who has not been involved in the emission computation. Quality control included the following:

- Check that units are correctly recorded
- Check for errors in data inputs
- Check for consistency in data between source categories
- Conduct completeness checks
- Internal documentation of the quality control process and comments communicated with the Sector Specialists

Quality Assurance

Completed databases and GHG inventory report were reviewed by BUR management team, steering committee and third-party experts who were not involved in the software use.

2.8 Improvement Plan

General notes applicable to all sectors:

The process of assessing and developing the GHGI for the energy sector in Egypt (including transport) should be improved by minimizing the uncertainty and increasing the calculations accuracy as per the methodology of the 2006 IPCC Guidelines. Therefore, it is essential to recommend a road map for the improvement of that process that includes and not limited to the following activities:

- Defining the data gaps and consequently the type and sources of additional data and categories needed for utilizing Tiers 2 and 3 of the 2006 IPCC Guidelines in the future if feasible.
- Preparing user-friendly data collection forms using national and sectoral terminology and definitions.
- Introducing and explaining data collection forms through coordination meetings with CAPMAS and, ideally, representatives from the relevant institutions.
- Upon agreement with CAPMAS, integrating the required data into the existing CAPMAS data collection systems (i.e. forms and surveys).
- Studying the feasibility of establishing a concerned unit within EEAA to be responsible for collecting the GHGI data, this unit could be affiliated to the CCCD.
- Establishing the necessary databases and systems within EEAA for GHGI development, analysis, reporting, verification and updating in cooperation and collaboration with the concerned ministries and authorities.
- Strengthening the existing institutional set up for the development of GHGI, including capacity building and training of responsible staff within the concerned entities on effective approaches and methodologies for the data collection and preparation of GHGI.
- Conducting surveys and studies for estimating country-specific emission factors for the various sectors, and involving the governmental, academic institutes and scientific research centers in the measurement and documentation processes.
- Establishing the appropriate legal framework and issuing the necessary legislation to oblige the various concerned entities and organizations to collect GHGI data for the energy sector.

Additional notes applicable to the IPPU sector:

The sources of data for the industrial production are: CAPMAS, IDA, international statistical publications, the Egyptian Petrochemical Company (ECHEM), and the National Ozone Unit (NOU) under the EEAA. It is proposed to specifically raise the capacity of the above entities in terms of understanding the data requirements for GHG calculation through training workshops and regular capacity building sessions.

It is recommended to collect data from CAMPAS on an annual basis (end of December) and add to the questionnaire directed to industries additional data requirements, such as:

- Raw material types and annual consumption of each materials; and
- Production technology

Data from the IDA can be used to verify the data obtained from CAPMAS, after amending the questionnaire, which they send to industries during the process of updating their license, with the following inserts:

- Actual annual production in the past years since their last license renewal;
- Raw material types and annual consumption of each material during each year; and
- Production technology used.

A protocol should also be signed between EEAA and IDA requesting IDA to provide EEAA with all needed information including those previously not supplied such as fertilizers and petrochemicals.

Data on the production of petrochemical industries including methanol, ethylene and some fertilizers that are under the supervision of ECHEM, were extracted from the annual published reports of ECHEM. It is recommended that ECHEM reports on its actual annual production of all types of chemicals under the IPCC guidelines and also state its production technology and feedstock type used.

With respect to the Ozone Depleting Substances Substitutes, the data provided by the NOU was provided in the form of lump sum quantities for each type of chemical that is being imported. It was reported that the ODS substitutes were not manufactured in Egypt and the only information available was that reported to the NOU on imports as recorded by the Egyptian Customs Authority. There is no record of the distribution of each chemical among the different uses (such as refrigeration, air conditioning). It is therefore recommended that a decree is issued obliging the Egyptian Customs Authority to report on any material or product imported containing any of the list chemicals listed in the IPCC guidelines as ODS substitutes.

Additional notes applicable to the AFOLU sector:

Improve the methodologies adopted to create the GHGI for the sector with the following:

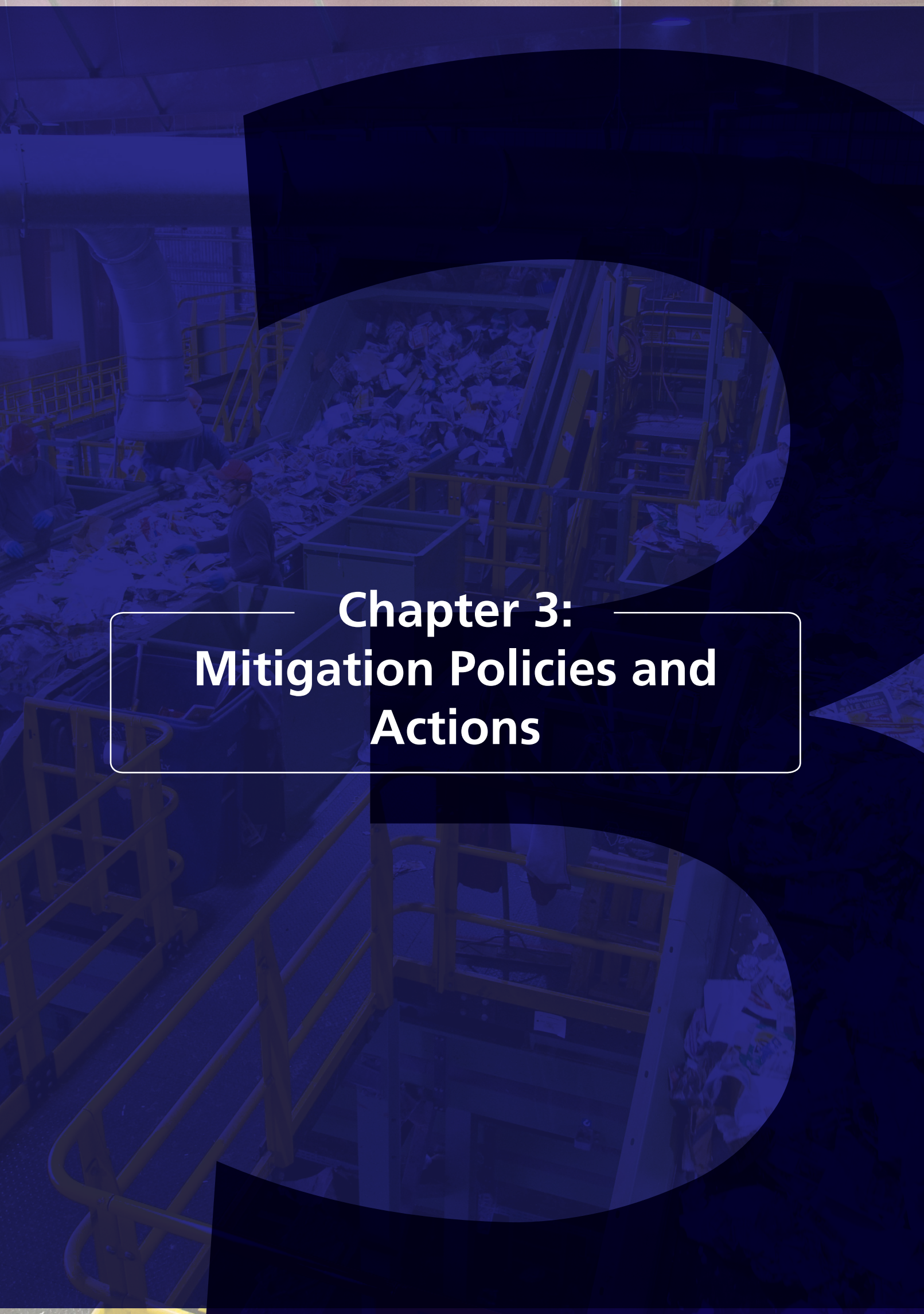
- Improvement of estimation of crop area, yield and production, especially in the presence of mixed and/or repeated cropping, yield of root crops, small area estimation, etc.
- Integrate remote sensing in data collection for agricultural statistics.
- Use of GPS in data collection for agricultural statistics.
- Matching of census data with current survey data.
- Use of integrated agricultural survey methodology (master sampling frames and database).
- Integration of administrative data for improving the agricultural statistics.
- Use of integrated sample surveys for the estimation of livestock production.
- Establish linkages between the statistical methods for national statistics and those for agricultural research.
- Apply automatic data processing.
- Conduct agriculture census with complete enumeration using remote sensing.
- Management of samples in the case of annual agricultural surveys in the framework of a permanent system for agricultural statistics.
- Develop methods for estimating agriculture productivity including (livestock by number and type), livestock by production (i.e. meat, milk, etc.), horticulture production (fruits and vegetables) and crop forecasting methods.

Additional notes applicable to the waste sector:

In addition to the general notes applicable to all sectors, significant emphasis should be placed on the measurement and reporting of industrial wastewater data. This includes the generated volumes of wastewater, chemical oxygen demand, and treatment methods in the industries identified by the 2006 IPCC GHGI guidelines.

Actions are currently underway to integrate the inventory data in the CAPMAS data collection forms from entities related to the waste sector, which includes:

- Ministry of Local Development for solid waste amounts, composition, treatment, and disposal; In addition to properties/classification of disposal sites as per IPCC guidelines.
- Ministry of Housing (Holding Company for Water and Wastewater) for the data on sludge generation amounts and management as well domestic and industrial wastewater data.
- Industrial facilities for data on solid waste and wastewater.
- Ministry of Health for medical waste.



Chapter 3: Mitigation Policies and Actions

This chapter provides information on the actions to mitigate anthropogenic emissions in Egypt by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol. It provides an update to the key mitigation actions reported under the Third National Communication and those listed in document FCCC/SBI/2013/INF.12/Rev.2 (UNFCCC, 2013). It includes, in accordance with Article 12, paragraph 1(b) of the UNFCCC, the steps taken or envisaged by Egypt to implement the Convention, taking into account the specific national development priorities, objectives, and circumstances.

The information on the mitigation actions and their effects have been documented, to the extent possible, following the UNFCCC guidelines on BUR, including the associated methodologies and assumptions. Wherever possible, information on the steps taken or envisaged to achieve the mitigation measures were reported. However, there are capacity building needs in reporting the mitigation actions. These are highlighted in Chapter 4 of this report. Furthermore, the description of domestic measurement, reporting and verification arrangements are summarized in Chapter 5.

3.1 Overview

The reported mitigation policies and actions cover energy, industry, waste, agriculture and other land use, and cross cutting sectors. For each mitigation action or groups of mitigation actions, the following information is provided in a tabular format:

a. Name of the mitigation action and basic information including the nature of the action, coverage (i.e. sectors and gases), and the implementation timeframe;
b. Objectives with quantitative goals and description of the action;
c. Information on the progress of implementation of the mitigation actions andthe underlying steps undertaken or envisaged, and the results achieved, such as estimated outcomes and emission reductions;
d. Information on methodologies and assumptions; and
e. Key progress indicators

The mitigation policies and actions are categorized as i) achieved measures between 2005 - 2015 in section 3.2, and ii) planned measures beyond 2015 in section 3.3. The actions supported by international mechanisms are provided in section 3.4 as an update to CDM projects in Egypt registered till the end of December 2015.

3.2 Achieved Mitigation Policies and Actions (2005 - 2015)

The mitigation policies and actions achieved between 2005 and 2015 for each sector are listed in this section. International funding and other support received for these measures are reported in Chapter 4.

3.2.1 Energy Sector

During the last years, the energy sector faced multiple challenges heightened by the periodic electricity blackouts in 2012 and onwards. To sustainably address the significant increase in energy demand, the Government of Egypt undertook a number of concrete measures that led to the resolvement of the energy crisis.

Energy subsidies has been a fiscal burden on the country's budget constituting 7% of GDP equivalent to the expenditure of EGP 120 billion in 2013/2014 (CAPMAS, 2015). In July 2014, the Prime Minister issued the decree 1257 for year 2014 that introduced a five-year plan to phase out the electricity subsidies by fiscal year 2018/2019. This has positively encouraged the roll-out of renewable energy and energy efficiency programs.

To ensure greater security of energy supply and diversify its energy sources, the Government of Egypt had an ambitious goal to expand the share of renewable energy in the electricity mix. In February 2008, the government adopted a National Renewable Energy Strategy to achieve a generation of 20% of the country's electricity from renewable resources by 2022. Wind energy is expected to provide 12% (7,200 MW) of the target, 2% from solar energy, and 6% from hydropower (NREA, 2010; MoERE, 2016). One third of the planned renewable energy capacity would be state-owned projects financed through public investments by the New and Renewable Energy Agency (NREA) in cooperation with international financing institutions. While the remaining two thirds would be private sector projects.

In early 2013, the net metering scheme was issued by EgyptERA to allow small-scale renewable energy projects in the residential and industrial/commercial sector to feed electricity into the low voltage grid (EgyptERA, 2013). In September 2014, the government approved the issuance of Feed-in Tariffs (FITs) for solar PV and wind projects under the Prime Ministerial Decree 1947/2014 with fixed tariffs over 25 years for PV and over 20 years for wind. In October 2014, the Presidential Decree No. 135 of 2014 was issued in amendment to the law of the establishment of the New and Renewable Energy Authority (NREA) to allow it to sell generated electricity by its projects to one of the subsidiaries of the Holding Company or investors from the private sector. In addition to the establishment of companies whether solely or in partnership with other parties to establish, operate and maintain renewable energy projects. The FITs scheme was complemented by Law 203/2014 issued in December 2014 to incentivize electricity generation from renewable energy sources through four mechanisms: i) governmental projects through NREA, ii) projects tendered by the Egyptian Electricity Transmission Company (EETC) under Build, Own, and Operate (BOO) system, iii) FITs, and iv) mutual agreements (NREA, 2016).

Finally, a new Strategy for Integrated Sustainable Energy 2035 has been completed in November 2015 based on four strategic goals to ensure the technical and financial sustainability of the energy sector, while targeting energy diversification through renewable energy and a gradual subsidy phase-out plan. The selected scenario 4B was approved by the Supreme Energy Council (SEC) in October 2016, with a target to reach the share of renewable energy 37% by 2035 (GoE, 2015). The Supreme Council of Energy, whose members consist of key government ministries and which directly comes under the Prime Minister Cabinet, is mandated to provide overall guidance on the energy sector strategy and policy.

Energy efficiency is an important component of Egypt's Strategy for Integrated Sustainable Energy 2035 since it supports the country to achieve three policy objectives: i) reduce the reliance on limited energy sources and thus contribute to the security of energy supply; ii) introduce less expensive alternative energy solutions that create a competitive market; and iii) decrease local pollutants and GHGs emissions and depletion of natural resources that has negative impacts on the environment. The Supreme Council of Energy had set up its own Energy Efficiency Unit (EEU) in May 2009. This entity was created with the aim of streamlining energy efficiency activities nationally and fulfilling the national energy efficiency target of 8.3% reduction in energy use by 2022. In addition, Energy Efficiency Units have been established in several ministries (i.e. MoERE, MoP, MoTI). In 2012, Egypt adopted a National Energy Efficiency Action Plan 2012-2015 (NEEAP) for the Electricity Sector with cumulative energy efficiency target of 5% (NEEAP, 2012). However, after the gradual removal of the energy subsidies that commenced in 2014, Egypt has enormous opportunities to reduce its energy intensity across all segments of the economy that previously were slowed down by the low financial feasibility of the energy efficiency projects.

The progress of four energy mitigation actions are reported, which are:

- Energy Mitigation Action #1: Electricity sector subsidy reform program (2014 - 2015);
- Energy Mitigation Action #2: Increase of renewable energy contribution to the national electricity generation (2013 -2015);
- Energy Mitigation Action #3: Energy efficiency for the electricity generation and end users (2005 - 2015); and
- Energy Mitigation Action #4: Sustainable transport program and expansion of metro network (2009 - 2015).

Energy Mitigation Action #1	Electricity Sector Subsidy Reform Program				
Subsector	**Nature of Action**	**Implementing entity(ies)**	**GHGs Scope**	**Estimated GHGs Reductions**	**Duration**
Electricity	Policy, Economic	MoERE	CO_2	Not Estimated	2014 - 2015

Main Objective(s)

Remove electricity subsidies by FY 2018/2019.

Description of the Mitigation Action

Energy subsidy had exceeded 20% of the national budget and 7% GDP in 2013/2014. To support the resource efficiency & environmental protection and reduce burdens on the national budget, Egypt has started undertaking a set of measures to progressively remove electricity subsidies since July 2014. The subsidy reform measures in the electricity sector were led by MoERE in close collaboration with the Cabinet of Ministers. Multiple and/or single-tier energy tariff reform was also applied on industrial, commercial, touristic, and agricultural users as part of the subsidy reform program.

Under the umbrella of Egypt's Strategy for Integrated Sustainable Energy 2035, subsidy reform was accompanied by substantial renewable energy and energy efficiency programs as outlined under Energy Mitigation Action 2 and 3 in this chapter.

Methodologies and Assumptions

Despite its unquestionable impact on improving the competitiveness and economic viability of renewable energy and energy efficiency interventions on all sectors and scales, isolating quantitative electricity savings (and therefore, GHG emission reductions) due to the energy subsidy reform program is a complex undertaking that had not been available until the publication of this BUR.

Progress Achieved (2005-2015)

The table below outlines the electricity tariff increases in Fiscal Years (FY) 2014/2015 and 2015/2016 for the residential sector, as an example:

Sliced consumption (kWh/month)	FY 2014/2015		FY 2015/2016	
	Piasters/kWh	Customer Service Charge (EGP/customer/month)	Piasters/kWh	Customer Service Charge (EGP/customer/month)
0 – 50	7.5	0	7.5	1
51 – 100	14.5	0	14.5	1.5
0 - 200* 101 – 200	16	0	16	3
201 -350	24	0	30.5	6
351 -650	34	0	40.5	8
651 – 1000	60	0	71	20
More than 1000	74	0	84	20
Zero read	-	-	-	6

*This sliced consumption was in 2014/2015 for consumptions exceeding 100 kWh/month to be fully priced according to this segment.

Key Indicator(s)

Subsidy level (%) on for the various fuel types for each reporting year.
Subsidy level (%) on for the electricity sector by user sub-sector for each reporting year.

Source:

- Ministry of Electricity and Renewable Energy Annual Report 2014/2015
- Ministry of Electricity and Renewable Energy Annual Report 2015/2016
- Egypt's Strategy for Integrated Sustainable Energy 2035

Energy Mitigation Action #2	Increase of Renewable Energy Contribution to National Electricity Generation				
Subsector	**Nature of Action**	**Implementing entity(ies)**	**GHGs Scope**	**Estimated GHGs Reductions**	**Duration**
Renewable energy	Policy, Economic, and Projects	MoERE	CO2	0.48 million tCO_2e in 2015 (excluding CDM projects)	2013 - 2015

Main Objective(s)

Increase the contribution of renewable energy to the electricity generated to 20% by 2022 and 37% by 2035.

Description of the Mitigation Action

As part of a national plan to increase energy security while reducing GHGs emissions and local pollution, Egypt is undertaking a set of measures to significantly increase the contribution of Renewable Energy (RE) sources to the electricity sector. These measures are led by MoERE and are focused on enabling public and private investment in solar energy, wind energy, and hydropower.

In 2013, a net metering scheme allowed small-scale renewable energy projects in the residential and industrial/commercial sector to feed electricity into the low voltage grid. On September the 17th, 2014 the Cabinet of Ministers approved a Feed-in Tariff (FIT) scheme for electricity generation from renewable sources (PV solar and wind). Phase 1 of the FiT (2015 - 2017) scheme included limited-term land concessions to investors for installation of 4300 MW broken down as follows:

- 2000 MW Utility-scale Wind Energy
- 2000 MW Utility-scale Photovoltaic Solar Energy (up to 50 MW)
- 300 MW Distributed Photovoltaic Solar Energy (under 500 kW)

Achieving the 37% renewables target requires undertaking a set of measures, some which had been initiated prior to updating the target in 2016. Key enabling measures areoutlined in the progress achieved field below.

Methodologies and Assumptions

The Integrated MARKAL-EFOM System (TIMES) model was used to conduct energy and environmental scenario analysis as part of comprehensive multi-dimensional and multi-stakeholder planning of the whole Egyptian energy sector. Based on the TIMES model outcome, among other considerations, the renewables-in-electricity-production target was updated to 37% by 2035.

Quantitative GHGs emission reductions in 2014/2015 have been calculated as follows:

- The electricity grid fuel mix is 6.9% generated from renewable energy (12,063 GWh) and 93.1% from fossil fuels (162,812 GWh).
- Total amounts of fossil fuels (assumed 72% natural gas and 28% fuel oil) consumed by power plants for electricity production in the calculation year were converted to total carbon dioxide emissions using IPCC emission factors.
- Total CO_2 was then divided by total gigawatt-hours produced from fossil fuel units in the calculation year to get an estimate of the Grid Emission Factor (623 tCO_2/GWh).
- Grid emission factor was multiplied by GWh produced from renewable sources (refer to below) in the calculation year to estimate CO_2 emission reductions.
    - Hydropower 452 GWh
    - Wind 1444 GWh
    - Solar 167 GWh

Progress Achieved (2005-2015)
Renewable Energy Law (Decree No 203/2014) to enable national and foreign investment in multi-scale renewables.
Feed-in Tariff (FIT) mechanisms for large-scale (>500 kW) and small-scale (<500 kW) solar and wind energy.
Mechanisms for small-scale photovoltaic solar with net metering systems (issued in 2013).
Implementation (2007) & expansion (2008, 2009, 2010) of Zafarana Wind Farm in the Red Sea up to: 547 MW installed, 1444 GWh production in 2015, and 0.9 $MtCO_2e$ reduction in 2015.
Note: 400 MW of the 547 MW installed capacity (74%) is registered under 4 CDM projects (please see relevant section below). To avoid double-counting, only 26% of the 1444 GWh produced in 2015 is converted to GHG emission reduction (0.1 $MtCO_2e$) in this mitigation action, while the rest are reported in the CDM section of this chapter.
Implementation (2008) of Nagaa Hammadi Hydropower Station: 64 MW installed, 452 GWh production in 2015, and 0.28 $MtCO_2e$ reduction in 2015.
Implementation (1/7/2011) of Kureimat Hybrid Concentrated Solar Power (CSP) plant: 20 MW CSP installed, 167 GWh production in 2015, and 0.1 $MtCO_2e$ reduction in 2015.
Key Indicator(s)
To calculate RE Contribution to Total Electricity Installed Capacity in reporting year (%): • RE Installed Capacity in reporting year (GW) for each type of RE • Total Installed Capacity in reporting year (GW) from all sources To calculate RE Contribution to Total Electricity production in reporting year (%): • RE electricity production in reporting year (GWh) for each type of RE • Total electricity production in reporting year (GWh) from all sources

Source:
- Egypt's Strategy for Integrated Sustainable Energy 2035
- Ministry of Electricity and Renewable Energy Annual Report 2014/2015
- Ministry of Electricity and Renewable Energy Annual Report 2015/2016
- New and Renewable Energy Authority (http://www.nrea.gov.eg/Technology/WindStations)

Energy Mitigation Action #3	Energy Efficiency for Electricity Generation and End Users				
Subsector	**Nature of Action**	**Implementing entity(ies)**	**GHGs Scope**	**Estimated GHGs Reductions**	**Duration**
Electricity	Policy and Programs	MoERE	CO_2	Not fully estimated	2005 - 2015
Main Objective(s)					
Improving fuel consumption efficiency per unit electricity produced and reducing grid peak loads.					
Description of the Mitigation Action					
As part of a national plan to improve energy efficiency in the electricity sector and reduce GHGs emissions, a set of measures has been planned and implemented on both the production (supply) and the consumption (demand) sides. On the demand side, two consecutive GEF-funded flagship programs included a variety of EE measures and projects: 'Energy Efficiency Improvement and Greenhouse Gas Reduction Project' (1998-2010) and 'Improving the Energy Efficiency of Lighting and Building Appliances' (2010-2017). Examples of implemented and planned measures include nationwide media and grassroots awareness campaigns, national programs for home appliance energy efficiency labelling, market accessibility to energy-efficient lighting, prepaid residential metering. Supply side EE measures include extensive power station maintenance and upgrade programs.					

Methodologies and Assumptions
To calculate the GHGs emission reduction for this mitigation action, the various programs either provided their own estimates of the emission reductions or provided a quantitative estimate of fuel or energy savings. For emission reductions estimated by the programs, these are reported in this mitigation action as received (with a brief note of methodology and assumptions, wherever possible). For fuel or energy savings reported by the programs, the approximation methodology used in Energy Mitigation Action #2 (above) is used to calculate GHGs emission reductions.
Progress Achieved (2005-2015)
Nationwide awareness campaign "bel maoul" launched in 2011 to reduce electricity consumption.
Energy Efficiency Improvement and Greenhouse Gas Reduction Project (EEIGGR) • Energy efficiency improvement on the supply side (energy generation and transmission) that led to loss reduction up to 3.68% in the year 2011/2012. The accumulating energy savings is equal to 4.73 million TOE and 13.8 million tCO_2e. • Dissemination of efficient lighting system (CFL) that resulted in total energy saving in 2010 of 4.96 TOE and 14.8 million tCO_2e. • Energy efficiency improvement in governmental building and street lighting. • Demonstration projects in the head quarter of MoERE. • Pilot project in the headquarter of MWRI (efficient lighting). • Energy efficiency projects in public lightings.
Implemented Standards and Labeling programme on home appliances for electricity rating (2011-2015): • Implemented more than 15 energy efficiency lighting pilot projects in various types of buildings and street lighting through providing technical assistance and co-financing. This led to savings between 25 and 40 percent of total electricity consumption. • Ministry's energy performance standards have been developed for fans and dishwashers and enforced by ministerial decree. • Organized training sessions on energy efficiency street lighting code in cooperation with Housing and Building Research Center (HBRC). • Training courses on auditing and energy efficiency lighting in buildings in cooperation with MED-ENEC have been conducted. • A study on monitoring and evaluation of standards and labels program has been implemented. • In cooperation with EOS, the project has developed LED lamps specifications. • Assisted the Ministry of Housing and Urban Communities to prepare the tender documents for implementing a LED/PV street lighting project.
The installation 6 million LED lamps in 2015 (from total target of 13 million lamps) resulted in electricity savings of 519 GWh (equivalent to 323,337 tCO_2).
The installation 600,000 energy efficient street lamps in 2015 (from total target of 3.9 million lamps).
Maintenance program (2012-2015) for power plants saving annually 1.144 million MWh. It is calculated as follows: 880 MW (2015 total) x 4 hours/day (operation time) x 325 day/year. This is equivalent to 712,712 tCO_2e.
Issued Electricity Law 87/2015 (with specific articles 45-51 for Electricity Efficiency and Energy Management).
Key Indicator(s)
• Fuel consumption profile • Electricity peak load profile • Fuel consumption efficiency per unit of electricity produced (for example: ton fuel per kWh)

Source:

- Egypt's Strategy for Integrated Sustainable Energy 2035
- Ministry of Electricity and Renewable Energy Annual Report 2014/2015
- Ministry of Electricity and Renewable Energy Annual Report 2015/2016 http://www.eeiggr.com/e_achievements.html
- http://www.eg.undp.org/content/egypt/en/home/operations/projects/climate-and-disaster-resilience/energy-efficiency.html
- http://www.eg.undp.org/content/dam/egypt/docs/Environment%20and%20Energy/00060162_Final%20Draft%20-%20Project%20Document.pdf

Energy Mitigation Action #4	Sustainable Transport Program and Expansion of Metro Network				
Subsector	**Nature of Action**	**Implementing entity(ies)**	**GHGs Scope**	**Estimated GHGs Reductions**	**Duration**
Transportation	Programs	Ministry of Transport and EEAA	CO_2	1,050,000 tCO_2e in 2015 from lines 2 & 3 of the Cairo Metro and estimated 1.4 M tCO_2e over 20 years from STP	2009 - 2015

Main Objective(s)

Cairo Metro: Expanding the greater Cairo underground metro network

Egypt Sustainable Transport Program (STP): Creating an enabling policy and institutional environment and to leverage financial resources for the sustainable transport sector development, including public-private partnerships.

Description of the Mitigation Action

With the overall goal of "reducing the growth of the energy consumption and the related greenhouse gas emissions of the transport sector in Egypt, while simultaneously mitigating the local environmental and other problems of increasing traffic such as deteriorated urban air quality and congestion", as elaborated by the Egypt Sustainable Transport Program (STP). With a focus on Cairo, a megacity of more than 21 million inhabitants, this mitigation action includes two key undertakings: expansion of the greater Cairo underground metro network and the GEF co-funded STP program.

Seeking "increasing or sustaining the modal share of greenhouse gas emission reducing public and non-motorized transportation options, discouraging the use of private cars and facilitating freight transportation by more energy efficient truck operations and increasing the share of cargo transported on rail and inland waterways", the STP is structured as follows:

- Component 1: Demonstrating a concept for new, integrated high-quality public transport services (to exert a shift from private cars) for Cairo and its satellite cities that is successfully introduced and replicated on the basis of concession to private operator(s) under city authority supervision.
- Component 2: Increasing and sustaining the modal share of non-motorized transport (NMT) in middle-size provincial cities.
- Component 3: Successfully introducing Transport Demand Management (TDM) concepts with an objective to expand TDM towards more aggressive measures over time to effectively discourage the use of private cars, when less carbon-intensive modes of transport such as good quality public transport services are available.
- Component 4: Improving the energy efficiency of freight transport.
- Component 5: Strengthening the institutional capacity to promote sustainable transport sector development during and after the project.

The reporting period of mitigation actions in this BUR (2005-2015) includes the final stage (stage 5: 2.6 km) of the second metro line and stages 1 and 2 of the third metro line (4.3 and 7.7 km, respectively); with stages 3 (17.7 km) and 4 (18.17 km) planned to follow. The third line will be the first to link east and west Cairo and is expected to save 2 million surface passenger trips per day.

Methodologies and Assumptions

Construction of stages 3 and 4 the Cairo third metro line is still ongoing until the publication of this BUR.

Therefore, despite the considerable GHG emission reduction that would result from operation of the complete third line, emission reductions can only be reported for Cairo second and third metro lines in the timeframe of this mitigation action.

The STP reported the following GHGs emission reduction achieved for each component and the potential reduction from replication projects:

Project Component	Estimated Fuel Savings (Ton/ 20 Years)		Estimated Emission Reduction (Tons of CO_2e/20 Years)	
	Pilot Project	Potential Replication	Pilot Project	Potential Replication
1	93,000	193,000	290,000	600,000
2	84,000	1.451 M	262,000	4-5 M
3	26,000	5.806 M	81,000	>18 M
4	307,000	1.612 M	850,000	>5 M
Total	0.51 M	9.62 M	1.483 M	>28 M

Progress Achieved (2005-2015)

Operation of Stage 5 of Cairo Metro Second Line (2005).
Operation of Stage 1 (2012) & Stage 2 (2014) of Cairo Metro Third Line.

Two pilot networks with cycling lanes and pedestrian-friendly sidewalks along 6 main corridors with a total length of about 14 km in each of Fayoum and Shebin El-Kom Cities are under implementation.

Variable sign message system has been installed around city center in Cairo to direct car drivers to vacant places in multi-level parking areas.

Full designs for high-quality bus services to outlying suburbs of Cairo and feeder bus services to Cairo Metro stations have been completed.

Determination of emission factors for certain car and taxi models in an urban setting has been complete. These emission factors are essential inputs into a national sustainable transport policy.

Key Indicator(s)

Cairo Metro: Number of daily surface passenger trips substituted by first and second stages of the Cairo Metro third line.

Egypt Sustainable Transport Program:
- Completion of pilot project
- Replication of pilot projects

Source:
- Ministry of Environment
- http://www.eg.undp.org/content/egypt/en/home/operations/projects/climate-and-disaster-resilience/SustainableTransport.html
- http://www.stp-egypt.org/en

3.2.2 Industry Sector

The structure of Egypt's economy moved toward further industrialization during the last decade, where the share of industry in the total GDP increased from EGP 89 billion to EGP 408 billion between 2004/2005 and 2014/2015 (CAPMAS, 2018). This expansion has increased the energy consumption of the industrial sector as well and the GHGs emissions. A segment of the existing industries is old and still use inefficient outdated technologies. Based on previous studies and surveys carried out by national and international organizations, it was estimated that the total energy savings potential in Egypt is about 23% out of which the industrial sector holds about 40% of the total energy savings potential (World Bank, 2010). Most industries could save between 10-40% of their energy consumption by relying on commercially available advanced technologies in Egypt and improving operational practices.

Initially, the beginning of the energy initiatives in the late 1980s was signaled by the Government of Egypt's commitment to address the growing problem of air pollution. Since energy efficiency is directly linked to environmental improvements, the Ministry of Environment (MoE) and its main executing agency, the Egyptian Environmental Affairs Agency (EEAA), are one of the most important players in this field. The ministry was involved in a number of environmental programmes financed by international donors and organizations (e.g. EPAP II and PPSI). Other key national players in the industrial sector are:

- Egypt National Cleaner Production Center (ENCPC) that was established as a service provider to industry supported by the Ministry of Trade and Industry (MoTI) in close cooperation with the United Nations Industrial Development Organization (UNIDO).
- Industrial Modernization Centre (IMC) that was set up by the Energy Efficiency and Environment Protection Program end of 2007. IMC works under the auspices of the MoTI and operates with funds provided by the EU, GoE and the private sector.
- Environmental Compliance and Sustainable Development Office (ECO) was established within the Federation of Egyptian Industries to provide environmental consultancy services and raise awareness of the national industry with these issues.

The progress of three industry mitigation actions are reported, which are:

- Industry Mitigation Action #1: Industrial Energy Efficiency Project (IEE) (2013 - 2015);
- Industry Mitigation Action #2: Egyptian Pollution Abatement Project - Phase II (2007 - 2015); and
- Industry Mitigation Action #3: Private Public Sector Industry Project (PPSI) (2008 - 2012).

Industry Mitigation Action #1	Industrial Energy Efficiency Project (IEE)				
Subsector	**Type of Instrument**	**Implementing entity(ies)**	**GHGs Scope**	**Estimated GHGs Reductions**	**Duration**
Energy efficiency	Policy, TA, Projects	EEAA, IDA, EOS, IMC, FEI	CO_2	2.44 million tCO_2e between 2013- 2015	2012-2015

Main Objective(s)

The Project addressed some of the key barriers to industrial energy efficiency through an integrated approach that combines capacity building and technical assistance interventions at the policy, institutional and enterprise level.

Description of the Mitigation Action

IEE project started in January 2013 with EEAA as the lead executing partner and in full cooperation with the Industrial Development Authority (IDA), the Egyptian organization for Standardization (EOS), the Industrial Modernization Center (IMC), the Federation of Egyptian Industries (FEI), and implemented by the United Nations Industrial Development organization (UNIDO). The primary target groups of the project are industrial decision-makers (managers), engineers, vendors and other professionals and IEE policy-making and/or implementing institutions.

Methodologies and Assumptions

The data collection process was carried out in cooperation with the IDA, which provided UNIDO experts with national statistics. Moreover, surveys, sessions and meetings were carried out with 26 participating plants, who worked with UNIDO experts on collecting three years data. The plants were closely involved in the verification of the data to ensure the homogeneity and accuracy of the results. UNIDO experts and consultants analyzed the results and calculated potential savings for the participating plants.

Progress Achieved (2005-2015)

Component 1 - National program to define energy benchmarks and energy efficiency policy: Supportive policy instruments (EnMS) for delivering EE in industry and contribute to international competitiveness.

Component 2 - Awareness raising on industrial energy efficiency and management in industry: Widespread awareness on EE and Energy Management.

Component 3 - Capacity Building for Energy Efficiency Services: A cadre is available of specialized/certified energy management and system optimization experts.

Component 4 - Access to finance for energy efficiency improvement projects: Increased access to financial assistance for implementing EE projects.

Component 5 - Implementation of energy management systems and system optimization: State of the art energy management practices and EE measures are demonstrated.

Key Indicator(s)

The indicator would be the reduction in energy consumption compared to baseline year. The estimated total potential energy savings for three energy intensive sectors in Egypt are:

Sector	No. of analyzed plants	Total sector energy saving potential (PJ/year)
Cement	11	52
Fertilizer	5	36.5
Iron and steel	8	11

Source:

- http://ieeegypt.org/iee-2/what-is-iee/
- Dr. Gihan Bayoumi, IEE Egypt Project Manager - UNIDO

Industry Mitigation Action #2	Egyptian Pollution Abatement Project (EPAP II)				
Subsector	**Type of Instrument**	**Implementing entity(ies)**	**GHGs Scope**	**Estimated GHGs Reductions**	**Duration**
Multiple sectors	Policy, TA, Projects	EEAA	CO_2	656,336 tCO_2/ year	2007 - 2015
Main Objective(s)					
This is a major project under the Ministry of Environment that aimed to improve the compliance of the Egyptian industry with environmental standards and regulations.					
Description of the Mitigation Action					
Eligible industries in Greater Cairo and Alexandria took advantage of funds available through the Egyptian Pollution Abatement Project (EPAP II). The primary focus was on the cement, brickworks, petroleum, chemical, and steel industry. This last phase of the project started in 2007and ended in 2015. Funding was available for industrial activities in Greater Cairo and Alexandria. Companies applying must be creditworthy and projects should: a) comply with Egyptian environmental law. b) decrease pollution loads by 50%; c) are technically and economically feasible; and d) fall under the following areas: • End of pipe treatment for air emissions and waste water. • In-process modifications and cleaner technologies. • Work environment. • Energy conservation and conversion to cleaner fuels. • Hazardous waste management. • Environmental services.					
Methodologies and Assumptions					
The impact on GHG emission reduction was calculated for six sub-projects that focused on conversion from heavy fuel-oil to natural gas. This reduction was estimated at 656,336 tCO_2/year. The investment cost was 37.48 million US dollars.					
Progress Achieved (2005-2015)					
The details on the progress achieved was not provided at the time of this BUR preparation.					
Key Indicator(s)					
• Energy savings (kWh) compared to baseline year. • GHGs emission reductions (tCO_2e/year) due to fuel switching to lower carbon fuel. • Percentage (%) decrease in pollution loads.					

Source:

- http://industry.eeaa.gov.eg

Industry Mitigation Action #3	Private Public-Sector Industry Project (PPSI)				
Subsector	**Type of Instrument**	**Implementing entity(ies)**	**GHGs Scope**	**Estimated GHGs Reductions**	**Duration**
Multiple sectors	Policy, TA, Projects	EEAA	CO_2	Not estimated	2008 - 2012
Main Objective(s)					
The overall objective of PPSI is to reduce industrial pollution and improve the workplace and surrounding environment by reaching compliance in at least one environmental media (air emissions, wastewater, solid and hazardous waste, and workplace environment).					
Description of the Mitigation Action					
PPSI was available to eligible private and public companies (excluding multinationals) in Upper and Lower Egypt (excluding Greater Cairo and Alexandria) seeking to implement pollution abatement projects. PPSI is supported by KfW with a grant facility of 6.7 million Euros for project implementation and 0.6 million Euros for institutional and advisory support. Preferential financing is available to SMEs with an annual turnover of less than EGP 20 million. Eligible sub-projects should: a) result in the industrial establishment being fully compliant with the environmental law in at least one of the following areas: air, water, solid waste and workplace environment; c) be technically and economically feasible; and d) fall under the following areas: • End-of-pipe treatment for air emissions and wastewater treatment • Resource conservation • Integrated measures such as cleaner production, energy efficiency, cleaner fuels • Prevention and/or treatment of hazardous and solid waste • Workplace environment					
Methodologies and Assumptions					
Not estimated.					
Progress Achieved (2005-2015)					
Conducted marketing workshops and meetings with business associations that generated 85 applications.					
Undertook 40 rapid assessments and 20 detailed assessments of potential projects.					
Submitted 10 project applications for investment.					
Key Indicator(s)					
• Energy savings (kWh) compared to baseline year. • GHGs emission reductions (tCO_2e/year) due to fuel switching to lower carbon fuel. • Percentage (%) compliance with environmental law limits for pollutants.					

Source:

- http://industry.eeaa.gov.eg
- https://www.h2020.net/component/jdownloads/send/161-lectures/1489-4askar?option=com_jdownloads

3.2.3 Waste Sector

Egypt is a densely populated country with an average annual population growth of about 2.59% between 2005 and 2015 (CAPMAS, 2016). The changing patterns of consumption is higher than the pace of the expansion of waste services and infrastructure to serve the growing population. In 2009, the Government of Egypt established an Inter-Ministerial Committee for Solid Waste Management to address the situation. The Committee includes representatives from all relevant ministries and one of its mandates included proposing the future institutional arrangements to govern the waste management sector across Egypt (GIZ, 2014). On September 2013, a decision was made to establish a new "Integrated Solid Waste Management Sector (ISWMS)", under the Ministry of State for Environmental Affairs (MoE), to implement the National Solid Waste Management Program (NSWMP). In November 2015, a national Waste Management Regulatory Authority (WMRA) was established with the issuance of Prime Minister Decree No. 3005/2015 and housed under MoE. The authority intends to become a singular coordination agency responsible to regulate, follow and oversee all waste management processes at both central and local levels, strengthen relationships between Egypt and other states and international organizations in the arena of waste, and attract and promote investments in the collection transport, treatment and safe disposal of wastes (WMRA, 2018).

In relation to wastewater, the Government of Egypt had invested more than US$24 billion in development of water and wastewater services over the last 20 years (MoH, 2005). However due to limited national financial resources it is estimated that still, on average, 44% of the generated wastewater is not treated, equivalent to 2.85 BCM, representing 5% of Egypt's annual share of the Nile river (CEDARE, 2014). The government aims that 100% of the Egyptian population will have access to safe sewerage services by 2030 (SDS, 2016). The generated sludge from wastewater treatment is not sufficiently utilized. There have been some pilot projects, such as biogas generation in Gabal El Asfar wastewater treatment plant and co-firing in cement kilns as an alternative fuel.

Improving waste management infrastructure combats environmental degradation and, accordingly, is central to the government's plans. On the other hand, it requires significant investments. In order to leverage the private sector's know-how and efficiency in public utility services, the Public Private Partnership Law (No.67/2010) was passed on May 2010 as part of the Government's strategy to develop the country's infrastructure.

The progress of one waste sector mitigation action is reported:

- Waste Mitigation Action #1: Egyptian National Solid Waste Management Programme (NSWMP) (2012 - 2015).

Waste Mitigation Action #1	Egyptian National Solid Waste Management Programme (NSWMP)				
Subsector	**Type of Instrument**	**Implementing entity(ies)**	**GHGs Scope**	**Estimated GHGs Reductions**	**Duration**
Solid waste	Policy, TA, capacity building, and projects	EEAA	CO_2	Not estimated	2012 - 2015
Main Objective(s)					
The purpose of the NSWMP is to build the capacity of government and non-governmental actors to set up and sustainably operate an effective and cost-covering waste management system at national, governorate and local level.					
Description of the Mitigation Action					
NSWMP was setup to support the establishment of new and effective policies, legislation and institutional arrangements for waste management at the national and governorate level in Egypt, coupled with enhanced professional capacity, and an investment pipeline for implementation of sectoral projects at the regional and local level. The NSWMP shall provide a contribution to reform the solid waste sector of Egypt and the step by step implementation of the related infrastructure. It is intended to make a significant contribution to climate change mitigation.					
Methodologies and Assumptions					
Not estimated.					
Progress Achieved (2005-2015)					
With support from the programme, a national dialogue on the development of the strategic and political framework has been established. A national waste policy has been developed in consultation with all relevant stakeholders and submitted to the ministry.					
An annual forum was organized to promote networking between all actors in the waste sector. An internet platform is under development.					
Operator models for collecting and recycling of waste are currently being piloted in the governorates.					
Alternative financing models for waste management are being examined, for example Extended Producer Responsibility (EPR).					
Key Indicator(s)					
• Not available.					

Source:

- https://www.giz.de/en/worldwide/22230.html
- http://nswmp.net/nswmp/goals-of-the-nswmp/

3.2.4 Agriculture and Other Land Use Sector

The development of the agricultural sector in Egypt was guided by three main sequential strategies with different directions at each period: i) the 1980s Agricultural Development Strategy which dealt with the liberalization of the agricultural sector, pricing policies and increasing the annual growth rate of agricultural production to 3.4%; ii) the 1990s Agricultural Development Strategy which focused on completing the economic reform program in the agricultural sector, increasing the value of agricultural exports to EGP 5 billion, and achieving an annual agricultural growth rate of 3%; and iii) the Agricultural Development Strategy towards 2017 which concentrated on achieving self- sufficiency in cereals, targeting an annual agricultural growth rate of 4.1%, and continuing the land reclamation program of 150,000 feddans annually. In 2009, the Government of Egypt adopted the fourth and most recent Sustainable Agricultural Development Strategy towards 2030 (SADS 2030) to respond to the recent global and national challenges facing the agriculture sector (MALR, 2009).

The main strategic objectives of the SADS 2030 are as follows:

- Sustainable use of natural agricultural resources through enhancing water-use efficiency in irrigated agriculture, expansion of reclaimed areas, crop and water productivity, maximizing returns of rainfed agriculture, and protecting agricultural land from encroachment and degradation of soil fertility;
- Increasing agricultural productivity through productivity improvement of field and horticultural crops and resistance to drought, salinity and pests, increase meat and milk yield to meet the rise in per capita animal protein consumption by developing cattle, buffalo, poultry and fisheries production;
- Increasing the competitiveness of agricultural products in local and international markets;
- Raising the degree of food security of the strategic food commodities by promoting self-sufficiency, improving nutritional standards and dietary patterns, reduce pre- and post-harvest losses, enhancing food quality and safety, and improve social safety nets for food support;
- Improving the climate for agricultural investment; and
- Improving the living standards of the rural inhabitants, and reducing poverty rates in the rural areas.

The progress of one agriculture and other land use sector mitigation action is reported:

- Agriculture Mitigation Action #1: Bioenergy for Sustainable Rural Development (2010 - 2015).

Agriculture Mitigation Action #1	Bioenergy for Sustainable Rural Development				
Subsector	**Type of Instrument**	**Implementing entity(ies)**	**GHGs Scope**	**Estimated GHGs Reductions**	**Duration**
Agricultural waste and manure	Projects and capacity building	EEAA	CH_4 CO_2	192,240 tCO_2e over 20 years lifetime	2010 - 2015

Main Objective(s)

The primary objective of the project was to advance the use of renewable biomass as an energy resource, for the purpose of promoting sustainable rural development in Egypt and reducing greenhouse gas (GHG) emissions resulting from the use of conventional energy sources.

Description of the Mitigation Action

The biomass options that have been advanced under this project include: anaerobic biomass digesters for dung, household sewage, and related high-moisture feedstocks; anaerobic biomass digesters for leafy feedstocks including agricultural residues, biomass densification (briquetting, pelletization) for rural enterprise and household applications; efficient biomass stoves, furnaces and dryers for rural enterprise, and household applications; and biomass gasification for production of fuel gas for process heat, shaft power, pumping and electricity. These are technologies that have been widely demonstrated in several countries, have clear links with rural energy needs, and provide a beneficial alternative use for biomass resources that currently cause waste management problems.

Methodologies and Assumptions

The table below shows the GHGs reductions related to the installations included in this project. Total reductions over a period of 20 years is 192,240 tons of CO_2.

Application	tCO_2/year per installation/MW	Number/ capacity of installations	Emission reductions (tCO_2/year)
Biogas - family	1.6 / unit	1,000 units	1600
Biogas - community	13.5 / unit	10 units	135
Biogas - farm	58.6 / unit	2 units	117
Combustion/gasification	1940/MW	4 MW	7760
Total (tCO_2/year)			9,612
Total (tCO_2/20 year)			192,240

Source of above assumptions and estimates is "Pre-feasibility Studies and Draft Business Plans of Selected Bioenergy Applications in Egypt."

Progress Achieved (2005-2015)

950 family size biogas units have been functioning well for more than eighteen months and beneficiaries are satisfied. 100 units are 100% grants and others are 50% cost sharing by beneficiary.

7 large biogas units that each serve three houses. These units have also been functioning well for almost twelve months.

9 biogas specialized companies registered and are now working to install biogas units and take after the sale services in the market.

Private and public factories domestically manufacture required stoves and pipes that were imported from India during last year.

Two new batches of 8 engineers and 8 masons joined the on-job training program.

The Project Management Unit (PMU) and its counterparts have developed, organized and facilitated 18 seminars, workshops and awareness meetings in 13 governorates to present the project and distribute application forms.

Key Indicator(s)

- Renewable energy generated (kWh).
- GHGs reduction from replacement of fossil fuels with renewable energy (tCO_2).
- GHGs reduction from avoidance of biomass burning and dumping (tCO_2).

Source:

- https://www.thegef.org/project/bioenergy-sustainable-rural-development
- http://www.eg.undp.org/content/egypt/en/home/operations/projects/sustainable-development/BioEnergyforSustainableRuralDevelopment.html
- http://www.eg.undp.org/content/dam/egypt/docs/Environment%20and%20Energy/00045899_Final%20Approved%20Project%20Doc%20Egypt%20Biomass.pdf

3.3 Mitigation Policies and Actions

This section summarizes the planned mitigation actions beyond 2015 (refer to Table 3.1) which are all conditional on the provision of support from developed countries. The programs identified from NAMA mapping or in process to be submitted as a NAMA project are indicated.

Table 3.1: List of Planned Mitigation Policies and Actions Beyond 2015

No.	Mitigation Action	Sector / Subsector	Implementing Entity	Description and Potential Impact	Duration
1.	Removal of energy subsidies	Electricity, oil & gas	MoERE and MoP	Continuation of the subsidy phase-out and reforms for the electricity sector led by MoERE. Similarly, oil products and natural gas pricing reforms*, to be led by MoP. This would include partial subsidy removal from the various fossil fuel types as well as plans to introduce a smart card fuel rationing system for the transportation sector.	2016 -2019
2.	Install additional renewable energy generation to reach 37% target by 2035	Energy, Renewable energy	MoERE	A target of 20% renewables in electricity production by 2022 had been set previously by GoE. Based on a comprehensive analysis carried out by key stakeholders in the Egyptian energy sector, the SEC approved in 2016 an updated target of 37% electricity production from renewable sources by 2035 (scenario 4B). These are broken down as follows: • 14.6% Wind Energy (61,027 GWh) • 11.8% Photovoltaic solar (49,407 GWh) • 7.6% Solar concentrators (31,843 GWh) • 3.2% Hydropower (13,589 GWh) Examples of planned projects: • Continuation of the renewable energy expansion program: Gabal El Zeit Wind Farm; • Continuation of the renewable energy expansion program: Benban Solar Park; and • Utility-scale CSP, PV, wind, biomass, waste-to-energy power generation.	2016 - 2035

No.	Mitigation Action	Sector / Subsector	Implementing Entity	Description and Potential Impact	Duration
3.	Renewable energy and solar water heaters in the housing sector*	Energy and Housing	MoH	Install solar water heaters in residential buildings.	-
4.	Energy Efficiency as per the Energy Strategy 2035 (all sectors) and National Energy Efficiency Action Plan 2018/2019 - 2020/2021 (NEEAP 2) for Electricity sector	Energy, Energy efficiency	All ministries	Electricity sector would implement measures under NEAP 2, examples are: Prepaid meters project (5 million meters) Smart meters pilot project aims to install 250,000 smart meters. Oil and gas sector would implement measures to reach energy efficiency target under Energy Strategy 2035, examples are: Energy conservation for heaters and steam boilers (6 oil refineries); Improving combustion efficiency (boilers) in power plants; and Waste heat recovery of 200 turbines. Aviation sector led by MoCA: fuel efficiency program (2016 - 2021)	2016 - 2035
5.	Sustainable transport programs and national rail system expansion	Energy, Transport	National Authority Tunnel (Nat) and Egyptian National-Railway (ENR)	Passenger: 1- Expansion of greater Cairo metro lines and Alexandria (Alex) lines: • Line 3 – Phase 3&4 • Line 4 - Phase 1 • Line 5 • Line 6 • Abuqir, Alex • Alex Tram 2- Expansion of national electrical railway network • 10th of Ramadan – administrative Capital • Ain sokhna - Alamin (passenger - fright) 3- Expansion of public transport services Freight • Freight Modal shift from road to rail.	2016 – onwards - 6 years - 6 years - 6 years - 8 years - 6 years

No.	Mitigation Action	Sector / Subsector	Implementing Entity	Description and Potential Impact	Duration
6.	Low carbon roadmap for the Egyptian cement industry including alternative fuels utilization**	IPPU, Cement	MoTI and EEAA	The potential for GHGs emission reductions through four main levers: 1. Lowering the clinker content in cement (from the current 89% to 80%); 2. Increasing the use of Alternative Fuels or Recyclables (Increase to 8%, of which 50% will come from biomass and 50% from fossil fuels); 3. Energy Efficiency Improvements (>= 3620 MJ/tonne clinker); and 4. Increasing the capacity utilization factors (CUF) of the clinker production installations (85%).	2016 - onwards
7.	National Solid Waste Management Programme (NSWMP)	Waste	EEAA	Integrated waste management technologies for all waste types (municipal solid waste, agricultural wastes, sewage sludge, industrial waste, animal manure, medical waste and hazardous waste). Advanced technologies for improved sanitary landfilling, incineration with Energy Recovery (IER), gasification, anaerobic digestion, composting and co-firing in cement kilns.*	2016 - onwards
8.	Feed-in tariff for electricity generation from waste	Energy, Waste, AFOLU	EEAA	Feed in tariff for electricity generation from MSW, agricultural residues, and biogas.	-
9.	Reduction of the cultivated areas of rice	AFOLU	MALR	Design policy and economic incentives for farmers to reduce the cultivated area of the rice crop.	2017-2030

No.	Mitigation Action	Sector / Subsector	Implementing Entity	Description and Potential Impact	Duration
10.	Reduce GHGs emissions from livestock	AFOLU	MALR	Reduce GHGs emissions from livestock by changing feeding patterns (strategic supplementation), increasing milk productivity, and improving breeding (mainly for dairy cattle and buffalo).	2017-2030
11.	Recycling agricultural waste and manure	AFOLU and Energy	MALR	Produce compost and bioenergy from agricultural waste and manure. Previous national efforts resulted in the recycling of 2,583,338 tons of rice straw. The estimated rice straw produced is 3,289,558 tons, out of which 112,500 tons is burned.	2016 - onwards
12.	Green Growth Fund (GGF)	Cross-cutting	Financial institutions	GGF aims to contribute, in the form of a public private partnership with a layered risk/return structure, to enhancing energy efficiency and fostering renewable energies to reduce CO_2 emissions through the provision of dedicated financing to businesses and households via partnering with financial institutions and direct financing.	2016- onwards
13.	Implementation of a national MRV system	Cross-cutting	all sectors	Establish National Monitoring, Reporting, and Verification (MRV) system.	-

This mitigation action has been identified under the NAMA Mapping conducted under Low Emission Capacity Building Programme (LECB) supported by EEAA and UNDP.

** Under this mitigation measure, the "Alternative Fuels" component is under preparation to be submitted as a NAMA by EBRD. A separate study on alternative fuels utilization for cement sector in Egypt has been launched by IFC in 2016.

3.4 Clean Development Mechanism

The current portfolio of CDM project activities in Egypt is extensive in comparison to the other MENA countries. Egypt's existing portfolio comprises of 20 CDM projects and 6 PoAs. The portfolio is well balanced given the number of different project types and categories (refer to Table 3.2). It comprises of six renewable energy, two waste management, one transport, seven fuel switching, six energy efficiency and four industry projects. The first Egyptian PoA, Egypt Vehicle Scrapping and Recycling Programme, registered in June 30, 2011, is as well the first ever transport Program of Activities to be registered under the CDM.

The current portfolio has an estimated emission reduction of about 4.2 million tCO_2e per year.

Table 3.2: Egypt's Portfolio of CDM projects and PoAs

No.	Project Name	Estimated emission reductions (tCO_2e per year)	Registration Date
Renewable Energy			
1.	Zafarana Wind Power Plant Project 120 MW (NREA– Japan)	248,609	22-Jun-07
2.	Zafarana 8 - Wind Power Plant Project, Arab Republic of Egypt 120 MW (NREA-Denmark)	209,714	23- Sept-10
3.	Zafarana 85 MW Wind Power Plant Project in the Arab Republic of Egypt (NREA)	170,364	08-Aug-11
4.	Zafarana KfW IV Wind Farm Project 80 MW (NREA)	171,500	02-Mar-10
5.	Renewable Energy Programme of Activities in Middle East and North Africa, proposed by CES, (1st CPA in Saudi Arabia), CME: CES Carbon Services Ltd, Ireland	Didn't start yet in Egypt	28-Dec-12
6.	Programme for Grid Connected Renewable Energy in the Mediterranean Region (REM) (1st CPA in Morocco)	Didn't start yet in Egypt	29-Oct-12
Waste Management			
7.	Onyx Alexandria Landfill Gas Capture and Flaring Project	370,903	15-Dec-06
8.	Land Filling and Processing Services for Southern Zone in Cairo	25,053	29-Oct-12
Transport			
9.	Egypt Vehicle Scrapping and Recycling (POA)	20 (1st CPA)	30-Jun-11

No.	Project Name	Estimated emission reductions (tCO_2e per year)	Registration Date
Fuel Switching			
10.	Emissions reduction through partial substitution of fossil fuels with renewable plantation biomass and biomass residues in CEMEX Assuit Cement Plant	416,528	17-Jan-11
11.	Egyptian Brick Factory GHG Reduction Project	430,350	14-Jul-10
12.	Fuel Switching from Mazout to Natural Gas in Misr Fine Spinning & Weaving and Misr Beida	45,051	19-Jan-11
13.	Partial Fuel Switching to Agricultural Wastes & Refuse Derived Fuel (RDF) at Helwan Cement	42,615	26-Dec-12
14.	Partial Fuel Switching to Agricultural Wastes & Refuse Derived Fuel at Kattameya Cement Plant	32,320	24-Dec-12
15.	PoA for Fuel Switching at SMEs (small and medium-sized enterprises) in Egypt	155	31-Dec-12
16.	Partial Fuel Switching at Arabian Cement	70,862	28-Dec-12
Energy Efficiency			
17.	Al-Sindian 13 MW Natural Gas based Cogeneration Package Project, Egypt	25,384	10-Feb-12
18.	Waste Gas-based Cogeneration Project at Alexandria Carbon Black Co., Egypt	109,514	26-Jul-08
19.	International Water Purification Programme (1st CPA in Uganda)	Didn't start yet in Egypt	16-Nov-12
20.	Gas Flare Recovery in Suez Oil Processing Company	186,230	31-Jan-13
21.	Advanced Energy Solutions for Buildings. Programme of Activities (PoA) with Saudi Arabia, Oman and Ireland (1st CPA in Saudi Arabia)	Didn't start yet in Egypt	28-Mar-14
22.	Network Energy Optimization	9,794	23-Nov-15
Industry			
23.	Catalytic N_2O destruction project in the tail gas of the Nitric Acid Plant of Abu Qir Fertilizer Co.	1,065,881	07-Oct-06
24.	Reduction of N_2O emissions from the new nitric acid plant of Egypt Hydrocarbon Corporation at Ain Sokhna	251,595	18-Oct-12
25.	N_2O and NOX Abatement Project at Delta-ASMEDA Fertilizer	190,000	24-Dec-12
26.	N_2O abatement at KIMA	120,553	20-Dec-12

Chapter 4: Finance, Technology, and Capacity Building Needs and Support Received

This chapter presents information on Egypt's need for continued reporting of the GHG inventory under the Convention; financial, technological and capacity-building needs; and financing received for both mitigation and adaptation programs. The content of this Chapter should be read in conjunction with the information provided in Chapter 3 on the achieved and planned mitigation actions. Section 4.1 elaborates on the definition followed for climate finance and methodology utilized in this report. Section 4.2 details the generic constraints, gaps, and needs with sub-sections specific to adaptation and mitigation. Section 4.3 reports on the financial resources, technology transfer, capacity-building and technical support received from the Global Environment Facility, developed country Parties, Climate Funds and multilateral institutions for activities relating to climate change, including for the preparation of this Biennial Update Report

4.1 Climate Finance Definition and Methodology

For the purpose of this report, Climate Finance is defined as international funding provided as grants and/or concessional loans for climate change projects. The commercial loans and Official Development Aid (ODA), for projects implemented before 2015, are excluded. Only projects that focus mainly on climate change were accounted for in this chapter. Projects with co-benefits are reported separately. It was challenging this cycle to indicate the climate finance portion, therefore the total funds received were outlined.

The amounts have been reported by the national partners receiving the financial support and the Ministry of International Cooperation (refer to Table 4.9). In Table 4.9, only the amounts tied to agreements signed between 2005 and 2015 have been indicated as commitments already received, despite that several projects have not reached yet completion and operation. Similarly, if the adaptation or mitigation projects has been initiated between 2005 and 2015 but still continuing beyond 2015, the total amount of funding is reported (Table 4.7, Table 4.8, Table 4.10 and Table 4.11). This will not be provided in the subsequent reporting cycles to avoid double counting.

4.2 Constraints, Gaps, and Related Needs

The climate change actions from non-Annex I countries are voluntary and conditional with the availability of financial, technical and capacity building support from developed countries. This should be considering the right of developing countries to achieve sustainable development and poverty eradication according to their national priorities and strategies. This section details the needs to seek further support to achieve Egypt's planned climate change actions and is divided into general constraints (section 4.2.1), specific adaptation gaps and needs (section 4.2.2), and specific mitigation gaps and needs (section 4.2.3).

4.2.1 General Constraints

The Government of Egypt is continuously striving to improve the national climate change reporting to the UNFCCC from the first national communication submitted in July 1999 until this first BUR. The requirement of BUR submission entails data needs on a regular basis. To achieve continuous improvement in national reporting, there is a need to put in place adequate institutional, technical, and financial arrangements.

i) Data Availability, Access, and Quality:
There has been data gaps and constraints in this first BUR reporting. This includes GHGs inventory estimation, tracking of mitigation and adaptation measures and progress in each sector, information about the support received, specific identification of needs, and classifying climate financing from the overall funding received for the projects implemented.

In relation to the GHGs inventory estimation, as indicated in Chapter 2, the non-availability of relevant and reliable data sets, and poor accessibility are a result of inefficient institutional coordination. Consistent data reporting formats should be designed for GHGs inventory reporting, improvement in data collection and aggregation, enhancing data depths to move to higher methodology tiers, and conducting measurements for Egypt's emission coefficients. The uncertainty involved in the activity data and emission factors will be reduced with improved data gathering and archiving arrangements. In addition to knowledge transfer for GHGs estimation methodology for non-traditional climate change actions, such as the electricity subsidy reform that was rolled out in Egypt starting from 2014.

As to the tracking of mitigation and adaptation programs, there is absence of a centralized entity that coordinates with each ministry and monitors the progress of the measures implemented and GHGs reductions achieved. Similarly, for the type of support received and needed, this information is not evaluated periodically. Intensive communication with the stakeholders was conducted to collect the information presented in this report and several of the required data wasn't available or not estimated as indicated in Chapter 3 and Chapter 4.

For the funding received, there is no classification by the Ministry of Investment and International Cooperation and the relevant ministries receiving the support for Climate Finance. Therefore, it wasn't possible to segregate the 'Climate Finance' portion from the total amount of funding received in this chapter.

ii) Limited Resources for Coordinating Entity:

Institutional networking and coordination is a critical success factor for establishing these improved data frameworks and reporting formats tailored to the various sectors. All national partners should cooperate in this effort under a Coordinating Entity through efficient information systems and channels. This entity should be allocated with suitable resources to successfully achieve its mandate. A National Inventory Management System, an information technology based platform, could be a long term institutional structure for automating and systemizing reporting along with QA and QC arrangements and database for national emission factors.

iii) MRV Institutional Barriers:

There is specific urgency for the improvement Measuring, Reporting, and Verifying (MRV) systems. As pointed out in the Third National Communication, the decision-making process is not based on solid information and data, integrated sectoral analysis and research-based policy advice and recommendations, which still stands. The absence of an institutional memory and a hands-on inventory of successful development projects and programs remains one of the main barriers to scale up mitigation and adaptation measures across Egypt and transparently disseminate their achievements. A structure for the MRV system is proposed in Chapter 5 and additional specific MRV capacity building needs for each sector is summarized in Table 4.1.

iv) Competent Personnel to Prepare Funding Proposals:

Moreover, financing is a continuous challenge requiring consistent support from the international community. Egypt's efforts towards meeting the Intended Nationally Determined Contributions (INDC), NAMAs, and other climate change actions would require proper training and upgrading of skills across sectors. Furthermore, adaptive capacity is influenced largely by the ability to communicate potential risks to vulnerable communities and the ability to react to these perceived risks. Substantial resources would be required to implement capacity building programmes nationally and establish robust information systems to address climate change challenges. This would require financial support from international resources and competent personnel capable to prepare funding proposals acceptable to donors in terms of quality and alignment to development objectives.

Table 4.1: Specific MRV capacity building needs by sector

Sector	MRV Capacity Building Needs
Energy	The most promising sector to establish an ideal MRV system. Nearly all the GHG-relevant data of this sector originates from the fuel consumption documented by the Ministry of Petroleum and MoERE. Accordingly, the capacity building requirements of this sector will be mainly related to the estimation and reporting of GHG emissions resulting from fuel combustion.
Agriculture	The data required for GHG estimation for the agriculture sector is mainly related to livestock population data in addition to the amount of nitrogen based fertilizers. The capacity building requirements of the agriculture sector is mainly related to GHG estimation and data collection. However, there are limited trained staff to estimate GHG emissions which need to be expanded. As a result, a programme for capacity-building has been drafted. This program targets the entire CCIC (around 30 people) and 2-4 people from each of the 29 other institutes affiliated to the MALR. Currently, GHG emissions from agriculture are based on rough estimates with a significant uncertainty (up to %40). To improve the data, country-specific emission factors are required but funding is not available to conduct this exercise. Activity data are collected by the statistics office within Agricultural Economic Affairs Sector (EAS) which is affiliated to the Ministry (2 persons for each village). Since 2011, new remote sensing data has become available for the whole country.
Industry	Generally, the IDA is the main entity which has the data required for GHG estimation in the industrial sector However, more effort is required to make data reporting smoother and more systematic, especially for medium-scale industries. In addition, trainings are required for the methodological estimation of GHG emissions. In terms of capacity-building needs, there is a need for raising capacity on how to assess and prioritize mitigation opportunities, as well as how to identify cross-sectoral interventions and the related technologies.
Waste	The Ministry of Local Development is one of the key actors in the waste sector in Egypt. However, the quality of data provided by the Ministry is not sufficient. In order to implement an ideal MRV system for the waste sector, there are several gaps that need to be addressed in advance. Trainings on data collection and GHG estimation are required for both the solid waste and wastewater sub-sectors.

4.2.2 Adaptation Gaps and Needs

In 2011, Egypt released its National Strategy for Adaptation to Climate Change and Disaster Risk Reduction (IDSC, 2011) identifying the sectors affected by climate change and measures to adapt to its severity. Further elaboration has been provided in the Third National Communication that Egypt submitted to the UNFCCC in November 2016 (published March 2016). This subsection mainly represents an update to these two key documents, supported by further studies (EEAA, 2010; MALR, 2013; MWRI, 2013). This report has focused on the top three sectors vulnerable to climate change in Egypt: i) water resources and irrigation, ii) agriculture, and iii) coastal zone protection.

i) Water Resources and Irrigation:
Egypt is largely dependent on the Nile river that supplies more than 95% of the country's water needs while the remaining is pumped from underground water. Climate change would increase the frequency and intensity of extreme precipitation events leading to increase in flood risks and droughts from increased temperatures. The natural flow of the Nile river will be decrease due to the decline of rainfall on the upper Nile basins as well as the reduction of rainfall on the east Mediterranean coastal zone. Furthermore, the sea level rise (SLR) would impact the quality of groundwater in the coastal aquifers, where if abstraction is excessive pumping of saline water may take place.

In addition to climate change, there are other factors that would deepen the vulnerability of Egypt's water resources. At present, Egypt is a water scarce country at 678 m3 per capita in 2010 (EEAA, 2016a). The fast growing population is expected to double the water demand in the coming 30–40 years. The recent tensions between Egypt and Nile Basin countries, the political unrest and division of Sudan, and the construction of the Renaissance Dam in Ethiopia could affect the water quota and the actual supply that reaches the country. Moreover, the Nile river pollution whether within the borders of Egypt or from upper basin countries due to the use of chemical fertilizers and disposal of DDT loads used for Malaria treatment will magnify the issue of fresh water availability.

All the above factors would negatively impact ecosystems, human health, and the reliability and operating costs of water and sanitation infrastructure. The current water management practices are very likely to be inadequate to reduce these adverse consequences of climate change. Table 4.2 summarizes the adaptation measures in the water resources and irrigation sector planned by the Government of Egypt till 2030 and the required financial, technical, and capacity building needs for each program. The total estimated budget for the planned adaptation measures is 7,974 million US dollars. The planned adaptation projects with other co-benefits are presented in Table 4.3.

Table 4.2: The needs of future adaptation programs in water resources and irrigation sector (beyond 2015)

Program	Stakeholders	Estimated Budget	Support required			Timeframe (years)
			Technology	Capacity building	Technical support	
Enhance Toshka spillway	MWRI, MALR	31	√			5
Monitor climate change and extreme events	MWRI, NWRC, ECRI	7	√	√	√	2
Monitor water quality of Nile river, canals, and drains	MWRI, NWRC, EEAA	35	√			2
Freshwater injection barriers near the shoreline	MWRI, NWRC	175	√		√	20
Enhance early warning and prediction tools at Upper Nile	MWRI, NWRC	4	√	√	√	3
Monitor groundwater aquifers	MWRI, NWRC	9	√		√	2
Develop a special laboratory for monitoring water distribution all over Egypt (surface and groundwater)	MWRI, NWRC, EEAA	3	√	√	√	2
Improve agriculture drainage water reuse	MWRI, MALR	2,479	√		√	15
Construction protection for Oasis: • Develop monitoring network for drought, land degradation and natural resources depletion • Rehabilitation of existing and construction of new pump stations • Rehabilitate groundwater wells for development and protection • Agriculture drains and lakes	MWRI, MALR, EEAA, ECRI, MoERE	783	√	√	√	10
Study for protecting all Oasis in Egypt from climate change impacts and the adaptation plans	MWRI, MALR, EEAA, ECRI	5	√	√	√	2
Building capacity to deal with flood risk from Upper Nile	MWRI	3		√		5
Develop an efficient laboratory for protecting water quality in the Nile, canals, drains and groundwater	MWRI, EEAA	16	√	√	√	3
Develop a system for incentives	MWRI	2	√	√	√	2
Drilling new wells from the fossil groundwater	MWRI	1,454	√		√	10

Program	Stakeholders	Estimated Budget	Support required			Timeframe (years)
			Technology	Capacity building	Technical support	
Improve rainfall harvesting	MWRI, NWRC, Universities	799	√	√	√	10
Rehabilitation of agriculture drains	MWRI	602	√	√	√	15
Rehabilitation of hydraulic structures	MWRI	53	√	√	√	15
Reduce evaporation from Lake Nasser	MWRI, NWRC	1	√	√	√	5
Rehabilitation of irrigation main and secondary canals	MWRI	1,505	√		√	15
Public awareness program	MWRI	8		√		10
Total = $7,974,000 USD						

Source: Source: EEAA (2010) and MWRI (2013).

Table 4.3: Adaptation programs with co-benefits in water resources and irrigation sector and their needs

Program	Stakeholders	Estimated Budget	Support required			Timeframe (years)
			Technology	Capacity building	Technical support	
Improve current sewage treatment plants to adapt to the expected decrease in water resources	MoH, HCWW, MWRI, NRC	4,792	√	√	√	10
Construction of sewage treatment plants	MoH, HCWW MWRI, NRC	29,042	√	√	√	15
Treatment of MWRI drains	MWRI, MALR, EEAA, ECRI, Universities	50,824	√	√	√	15
Construction of desalination plants	MoH, HCWW, MWRI, NRC	32,463	√	√	√	20
Rehabilitation of irrigation main and secondary canals	MWRI	1,505	√		√	15

Source: Source: EEAA (2010) and MWRI (2013).

ii) Agriculture:

The agriculture sector in Egypt provides employment to 55% of the labor force, contributes 14% to the Gross Domestic Product (GDP), but also consumes about 80% of the country's total water resources. The consequences of climate change on the sector is the decrease in the national food production by 11% to a maximum 51% due to lower productivity of crops and livestock from increased frequency of droughts and floods. The change in the temperature patterns, humidity regimes, and increase in the extreme weather events would affect the frequency of the occurrence of pests' infestations and plant diseases. Moreover, higher temperatures would increase water evaporation and water consumption putting additional pressure on water resources to meet irrigation needs. The sea-level rise, reduced recharge rates, and higher evaporation rates will extend areas of salinization of groundwater and estuaries, resulting in a decrease in freshwater availability. This will have a negative impact on the Delta's agricultural land, particularly the northern areas bordering the Mediterranean coast. The socio-economic effects, such as labor migration from marginal and coastal areas, would further aggravate the situation.

Table 4.4 summarizes the adaptation measures in the agricultural sector planned by the Government of Egypt till 2035 and the required financial, technical, and capacity building needs for each program. The total estimated budget for the planned adaptation measures is 3.455 million US dollars.

Table 4.4: The needs of future adaptation programs in agriculture sector (beyond 2015)

Program	Specific measures needed	Stakeholders	Estimated Budget ($USD)	Support required			Timeframe (years)
				Technology	Capacity building	Technical support	
Agricultural inputs	• Replacing the current fertilizers by soil conditioners. • Study the vulnerability and the adaptation of the cropping pattern and systems at farm, regional and national levels. • Conduct wide scale assessment of field crops stress-tolerant varieties development, in terms of heat, water shortage and salinity stresses. • Develop adaptation measures for soil maintenance, under different agricultural systems, with special attention to the hotspot agricultural locations in Egypt	• MoALR • ARC	$750,000	√	√	√	3 years
Observation and control of climate change in agriculture	• Construction of research and information centers that may strengthen climate networks in Egypt using satellites and radars. • Construction of database and information system on climate change related to adaptation and mitigation.	• MoALR • ARC and affiliated laboratories	$1.5 million	√		√	5 years
Complete resource management of land and agricultural production	• Preparation of climate maps of an agriculture regions that may help in the agricultural policy.	• MoALR	$100,000	√		√	2 years
	• Preparation of cropping patterns that may help to nationalize the use of irrigation water and agricultural rotations.		$50,000	√	√	√	1 year
	• Project the new communities that may be established to absorb population that may have to leave their homes as result to the adverse effects of climate change.		$20,000			√	1 year
	• Conduct a study on pests, insect diseases that may result from the effect of climate change.		$25,000	√		√	2 years
	• Raising farmer's awareness about the important of proper use of water resources and good agricultural practices.		$10,000	√		√	2 years

Program	Specific measures needed	Stakeholders	Estimated Budget ($USD)	Support required			Timeframe (years)
				Technology	Capacity building	Technical support	
Complete resource management of land and agricultural production	• Improve cattle breeds through an artificial insemination program developed for smallholders.	• MoALR	$500,000	√	√	√	2 years
	• Close feed gap, introduce new techniques for producing non-traditional animal feeds of higher nutritional value through recycling the agricultural residues.		$150,000	√	√	√	2 years
	• Conducting national project to select the best livestock types adapted with climate change challenges and limited contribution in GHG emission.		$200,000	√	√	√	2 years
Agriculture policy	• Design a new policy program to improve efficient water use in irrigation and support organic agriculture.	• MoALR	$150,000	√		√	3 years
Total = $3,455,000 USD							

Source: EEAA (2010) and MALR (2013).

iii) Coastal Zone Protection:

The Nile Delta is considered the top coastal area in Egypt at risk from the sea level rise and extreme weather events caused by the climate change. The estimation of this sea level rise is about 100 cm by year 2100, taking into account land subsidence phenomenon in the Nile Delta. This will have severe socio-economic impacts from the destruction of homes and infrastructure on land, loss of lives and migration of affected populations, increase in unemployment, rise in the occurrence of health hazards and spread of diseases, and food shortages. In addition to salt water intrusion into coastal groundwater causing soil salinization, deterioration of crop quality, loss of productivity, and freshwater fisheries. As to the Red sea coast, one of Egypt's top tourist destination, due to the impact of increasing water temperature and acidity it would lead to the bleaching of coral reef and decrease fish catch in the coastal waters.

Table 4.5 summarizes the future adaptation measures in the coastal zone protection sector planned by the Government of Egypt and the required financial, technical, and capacity building needs for each program. The total estimated budget for the planned adaptation measures is 9,328 million US dollars.

Table 4.5: The needs of future adaptation programs in coastal zone protection sector (beyond 2015)

Program	Stakeholders	Estimated Budget	Support required			Timeframe (years)
			Technology	Capacity building	Technical support	
Development of Decision Support Tools for impact of SLR and extreme weather events	MWRI, NWRC, CoRI, ECRI	7	√	√	√	Not estimated
Construct works needed for protection from SLR and extreme weather events in urban areas in East, Mid, and West Delta	MWRI, MoH, MLD	247	√	√	√	Not estimated
Construct works needed for protection from SLR and extreme weather events for infrastructures in urban areas (sewage line, pump stations, roads)	MWRI, MoH, MLD, MoE, HCWW, MoT	4,133	√	√	√	Not estimated
Rehabilitation of irrigation and drainage pump stations to accommodate the SLR and extreme weather events	MWRI, MoERE, NWRC	1,372	√	√	√	Not estimated
Construct works needed for protection from SLR and extreme weather events for Lake Manzala, Lake Burullus, Lake Edku, Lake Maryout, El-Bardaweel Lake, and other Northern Lakes	MWRI, MALR, EEAA, NWRC, CoRI, ECRI	177	√	√	√	Not estimated
Construct break walls in front of major cities	MWRI, MLD, EEAA	964	√	√	√	Not estimated
Protect and rehabilitate existing shore protection works and periodic beach nourishment	MWRI, CoRI	1,972	√	√	√	Not estimated
Protecting natural sand dunes along Northern Coast	MWRI, MLD, EEAA, NWRC, CoRI, ECRI	376	√	√	√	Not estimated
Construct groins along the Northern coast	MWRI	80	√	√	√	Not estimated
Total = $9,328,000 USD						

Source: EEAA (2010) and MWRI (2013).

4.2.3 Mitigation Gaps and Needs

Table 4.6 summarizes the mitigation measures in all sectors planned by the Government of Egypt from 2016 and onwards (described in Chapter 3, section 3.3). The required financial, technical, and capacity building needs for each program are indicated, when available.

Table 4.6: The needs of future mitigation programs (beyond 2015)

Program	Specific measures needed	Stakeholders	Estimated Budget ($USD)	Support required			Timeframe (years)
				Technology	Capacity building	Technical support	
Removal of energy subsidies	• Support on estimation of GHG emission reduction due to subsidy reform actions.	• MoERE and MoP	Not estimated		√	√	2015-2022
Install additional renewable energy generation to reach 37% target by 2035	• Support on planning, finance, implementation, regulation of RE policies & programs. • Support on developing bankable NAMAs. • Support on establishing MRV systems.	• MoERE	Not estimated	√	√	√	2015-2035
Renewable energy and solar water heaters (SWH) in the housing sector	• Support on planning, finance, implementation, regulation of residential/commercial RE/SWH policies & programs. • Support on developing bankable NAMAs. • Support on establishing MRV systems.	• MoH	Not estimated	√	√	√	2015-Onwards
Energy Efficiency as per the Energy Strategy 2035 (all sectors) and National Energy Efficiency Action Plan 2018/2019 - 2020/2021 (NEEAP 2) for Electricity sector	• Support on planning, finance, implementation, regulation of national EE policies & programs. • Support on developing bankable NAMAs & establishing MRV systems for programs.	• Multiple	$7.125 million for EE in 6 refineries	√	√	√	2018-2020 & Onwards

Program	Specific measures needed	Stakeholders	Estimated Budget ($USD)	Support required			Timeframe (years)
				Technology	Capacity building	Technical support	
Sustainable transport programs and national rail system expansion	• Support on planning, finance, implementation, regulation of sustainable transport and rail network expansion programs. • Support on developing bankable NAMAs and establishing MRV systems for programs.	• Ministry of Transport	$18.26 billion for metro lines and national railway network	√	√	√	2015-Onwards
Low carbon roadmap for the Egyptian cement industry including alternative fuels utilization	• Support on planning, finance, implementation, regulation of a low carbon cement industry roadmap. Support on developing bankable NAMAs and establishing MRV systems for programs.	• MoTI and EEAA	Not estimated	√	√	√	2015 - Onwards
National Solid Waste Management Programme (NSWMP)	• Support on planning, finance, implementation, regulation of the national solid waste management sector. • Support on developing bankable NAMAs and establishing MRV systems for programs.	• EEAA, MoTI, MoLD	Not estimated	√	√	√	2015-Onwards
Feed-in tariff for electricity generation from waste	• Support on planning, finance, implementation, regulation of a feed-in tariff scheme for electricity generation from waste-to-energy processes. • Support on developing bankable NAMAs and establishing MRV systems. • Technology, technical, and capacity building support in techno-economic assessment, tendering, implementation, and regulation of waste-to-energy systems.	• MoERE	Not estimated	√	√	√	2015-Onwards

Program	Specific measures needed	Stakeholders	Estimated Budget ($USD)	Support required			Timeframe (years)
				Technology	Capacity building	Technical support	
Reduction of cultivated rice areas	• Support on planning, finance, implementation, regulation of reduction of rice cultivation. • Support on developing bankable NAMAs and establishing MRV systems for programs.	• MALR	Not estimated	√	√	√	2017-2030
Reduce GHGs emissions from livestock	• Support on planning, finance, implementation, regulation of reduction of GHG emissions from livestock. • Support on developing bankable NAMAs and establishing MRV systems for programs.	• MALR	Not estimated	√	√	√	2017-2030
Recycling agricultural waste and manure	• Support on planning, finance, implementation, regulation of compost and bioenergy production from agricultural waste. • Support on developing bankable NAMAs and establishing MRV systems for programs.	• MALR	Not estimated	√	√	√	2015-Onwards
Implementation of national and sectoral MRV systems	• Support on planning, finance, implementation, regulation of national, sectoral, and facility-specific MRV systems for GHGs inventories & mitigation actions.	• Multiple	Not estimated		√	√	2015-Onwards

4.3 Information on Support Received

This section details the support received by the Government of Egypt to achieve the climate change actions implemented between 2005 - 2015. Itis divided into support received for adaptation (section 4.3.1), support received for mitigation (section 4.3.2), support received for cross-cutting programs (section 4.3.3), and support received for this BUR report (section 4.3.4).

4.3.1 Support Received for Adaptation

Table 4.7 summarizes the international support received for adaptation programs implemented by the Government of Egypt from 2005 onwards. The total amount of funding received for the adaptation programs is 19.54 million US dollars.

Table 4.7: International support received for adaptation programs from 2005 and onwards

Program	Sector	Measures achieved	Donor	Total funding amount and type	Other support received			Timeframe (years)
					Technology	Capacity building	Technical support	
Mainstreaming global environment in national plans and policies by strengthening the monitoring and reporting systems for Multilateral Environmental Agreements in Egypt	Waste resource sector	• Capacity building for public participations in the area of climate change.	GEF	$475,000		√		2008 - 2011
Adaptation to climate change in the Nile Delta through Integrated Coastal Zone Management (ICZM)	Coastal protection	• Beach reinforcement and nourishment. • Construction of seawalls and breakwaters. • Vegetative buffers, sand placement and dune stabilization.	GEF/SCCF	$4,000,000		√	√	2009-2014
Building resilient food security systems to benefit the southern Egypt region	Agriculture	• Capacity development for farmers. • Integrate on-farm water conservation solutions through small-scale low-cost technological solutions. • Using drought tolerant crop varieties. • Innovative irrigation tools. • Early warning system for weather extreme events.	UNFCCC Adaptation Fund	$6,904,318	√	√		2013 – 2016
Integrated management and innovation in rural settlements	Agriculture	• Improve rain-harvesting techniques. • Water recycling. • Improving irrigation techniques. • Improved long-term forecasting to enhance Egypt's ability to cope with prolonged drought.	GEF	$7,812,000	√	√	√	2015 – Present
Fifth operational phase of the GEF small grants program in Egypt	Cross-cutting		GEF	$825,600		√	√	2011-2015

Source: Global Environment Facility (GEF), UNFCCC Adaptation Fund Egypt, GIZ, and EU.

4.3.2 Support Received for Mitigation

Table 4.8 summarizes the international support received for mitigation programs implemented by the Government of Egypt from 2005 and onwards (described in Chapter 3, section 3.2).

Table 4.8: International support received for mitigation programs between from 2005 and onwards

Program	Sector	Measures achieved	Donor and total funding amount and type	Other support received			Timeframe (years)
				Technology	Capacity building	Technical support	
Electricity Sector Subsidy Reform Program	Electricity Generation	• Gradual removal of subsidies on electricity starting 2014 • Re-pricing of electricity in a tier-based system • Establishment of social safety nets in the context of energy sector reform • Modeling National Energy Sector based on 4 comprehensive long-term strategic scenarios • Development of Egypt's Strategy for Integrated Sustainable Energy 2035	Energy reform Policy Support Program European union (EU): 60 M Euro Technical Assistance to Support Reform of the Energy Sector: Social Safety Nets World Bank (WB): 6 M USD		√	√	2014 - 2015
Increase of energy contribution to national electricity generation	Energy, Renewable Energy	• Setting two targets for contribution of RE in national power generation (electricity): 20% by 2022 & 37% by 2035 • Implementation of utility-scale wind, solar, and hydropower projects: Nagaa Hammadi hydropower station; Kureimat Hybrid Concentrated Solar Power (CSP) plant; & Small-scale photovoltaic solar with net metering system • Issuance of feed-in tariff and net-metering schemes	Kureimat Hybrid Concentrated Solar Power (CSP) plant GEF/WB: 49.8 M USD	√	√	√	2013 - 2015

Program	Sector	Measures achieved	Donor and total funding amount and type	Other support received			Timeframe (years)
				Technology	Capacity building	Technical support	
Energy Efficiency for Electricity Generation and End Users	Energy, Energy Efficiency	• Implementation of a package of energy efficiency measures accompanying subsidy reform and RE investments. • Standards and Labeling programme on home appliances for electricity rating. • Promotion of LED lighting technology. • Nationwide awareness campaign to reduce electricity consumption. • Promulgation of Electricity Law 87/2015 (with specific articles 45-51 for Electricity Efficiency and Energy Management). • Implementation of a program for conversion of simple cycle power plants to Integrated Gasification Combined Cycle (IGCC).	Energy Efficiency Improvement and Greenhouse Gas Reduction Project (1998 - 2010) GEF: 4.110 M USD Improving the Energy Efficiency of Lighting and Building Appliances (2010 - 2015) GEF: 4.450 M USD Conversion of Shabab and West Damietta Power Plants from simple cycle to IGCC European Bank for Reconstruction and Development (EBRD): 190 M USD	√	√	√	2005 - 2015
Sustainable Transport Program and Expansion of Cairo Metro Network	Energy, Transportation	• Egypt Sustainable Transport (STP) Program activities and pilot projects. • Stage 5 of Cairo Metro Second Line. • Stage 1 & Stage 2 of Cairo Metro Third Line.	STP: GEF/UNDP: 7 M USD National: 37 M USD	√	√	√	2009 - 2015
Industrial Energy Efficiency Project (IEE)	Energy, Industry	• National program to define energy benchmarks and energy efficiency policy. • Awareness raising on industrial energy efficiency and management in industry. • Capacity Building for Energy Efficiency Services. • Access to finance for energy efficiency improvement projects. • Implementation of energy management systems and system optimization.	GEF: 3.95 M USD National: 24.1 M USD		√	√	2012-2015

Program	Sector	Measures achieved	Donor and total funding amount and type	Other support received			Timeframe (years)
				Technology	Capacity building	Technical support	
Egyptian Pollution Abatement Project (EPAP II)*	Energy, Environment, Industry	• Pollution abatement measures financed for cement, brickworks, petroleum, chemical, and steel industrial facilities in Greater Cairo and Alexandria. • 6 Projects involving switching from heavy fuel oil to natural gas.	Finance: EIB: 40 M Euro AFD: 40 M Euro JBIC: 4.7 B Yen WB: 20 M USD Technical Assistance: EIB: 3 M Euro Government of Finland: 0.9 M Euro National: 17.5 M LE	√	√	√	2007 - 2015
Private Public Sector Industry Project (PPSI)*	Energy, Environment, Industry	• Pollution abatement measures financed for industrial facilities in Upper and lower Egypt (excluding Greater Cairo and Alexandria)	KfW: 7.26 M Euro (grant)	√	√	√	2008 - 2012
Egyptian National Solid Waste Management Programme (NSWMP)	Waste, Environment	• Established National Waste Management Regulatory Authority (WMRA) • Issued Strategic Directives on Integrated Solid Waste Management • Holds an annual national forum on waste management for knowledge transfer and networking • Established an internet platform for solid waste related issues • Drafting a solid waste management law which addressed planning, finance, standards for implementing integrated solid waste management systems in the context of social inclusion, cost recovery, the Polluter Pays, Extended Producer Responsibility (EPR) principles • Pilotted operator models for primary collection and recycling of municipal solid in 4 governorates • Supporting the implementation of holistic solid waste management systems in 4 governorates	KFW GIZ EU SECO	√	√	√	2012 - 2015
Bioenergy for Sustainable Rural Development	Energy, AFOLU, Waste		GEF: 3 M USD Co-financing: 12.4 M USD	√	√	√	2010 - 2015

* The climate change component was minor in this project.

Table 4.9: International support received for Renewable Energy programs (agreements signed between 2005 - 2015)

Program/Project	Donor	Agreement Date	National Recipient	Currency	Amount (Millions)
Loans					
Zafarana wind farm- phase 3	Germany	2003	New and Renewable Energy Authority (NREA)	Euro	15
West Gulf of Suez wind farm	Spain	2008	MoERE	Euro	119
Gabal El-Zeit 220 MW wind farm	Japan	2010	NREA	Yen	388
Wind farm	World Bank (WB)	2010	EETC	USD	70
Wind Farm	Clean Technology Fund (CTF) - World Bank (WB)	2010	EETC	USD	150
Aswan 20 MW Photovoltaic Power Plant	Agence Française de Développement (AFD)	2015	NREA	Euro	40
Grants					
Wind farm	CTF-WB	2010	EETC	USD	0.25
Wind energy potential	Arab Fund for Economic and Social Development	2011	NREA	Kuwaiti Dinars	0.3
Feasibility study for a 20 MW PV power plant	AFD	2012	NREA	Euro	0.8

Source: Ministry of Investment and International Cooperation.

4.3.3 Support Received for Cross-Cutting Programs

A total funding of 5 million US dollars has been received for both the Climate Change Risk Management Programme and the Low Emission Capacity Building Project as summarized in Table 4.10.

Table 4.10: International support received for cross-cutting programs

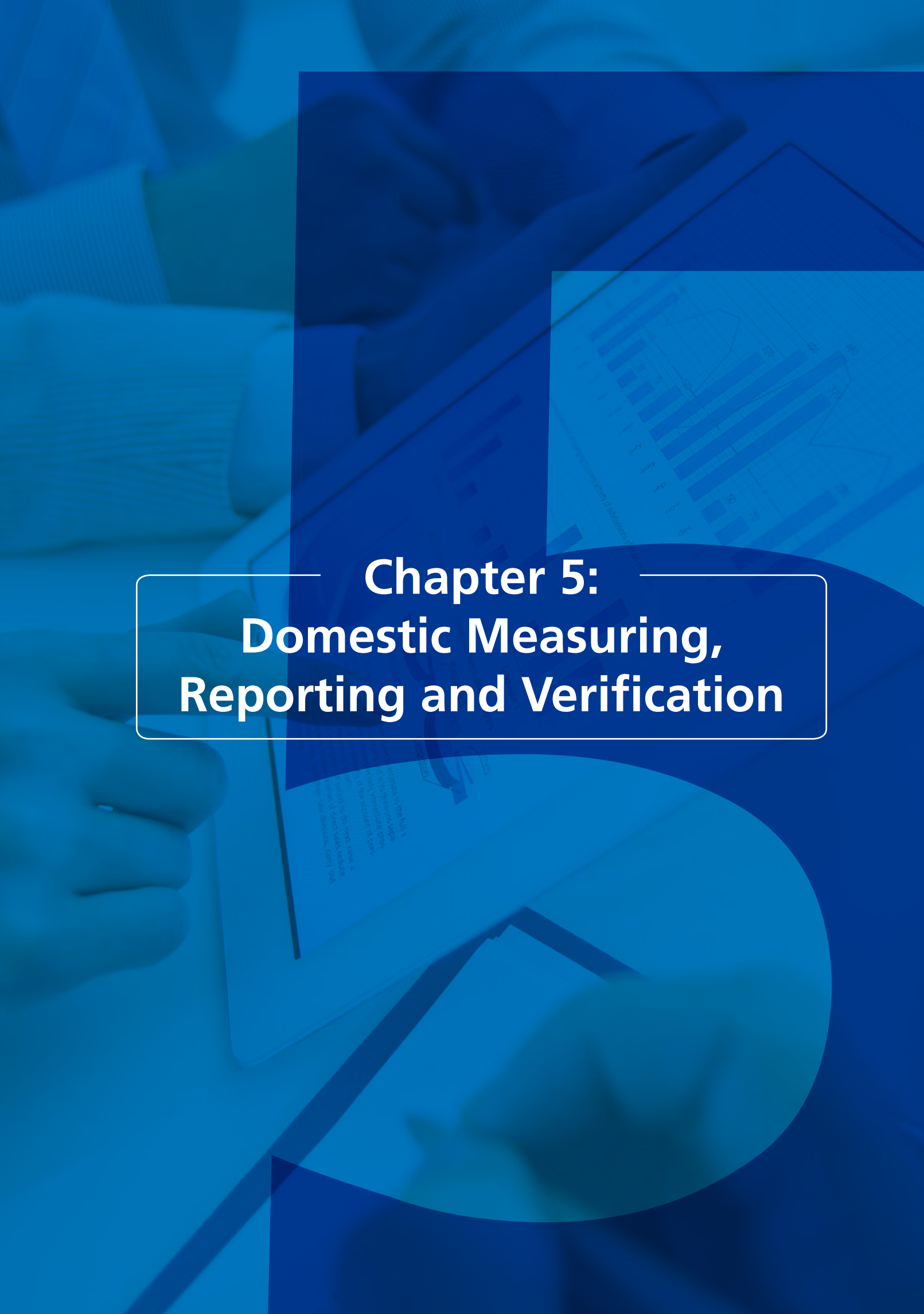
Program	Sector	Measures achieved	Donor and total funding amount and type	Other support received			Timeframe (years)
				Technology	Capacity building	Technical support	
Climate Change Risk Management Programme	Multiple	• Established Clean Development Awareness and Promotion Unit • Contributed to establishment of the Energy Efficiency Unit (EEU) to advise the Cabinet of Ministers on Energy Efficiency • Supported development of a national Energy Efficiency roadmap • Supported the modeling of various climate change scenarios in the water sector • Provided resources to develop the forecasting capacity & long-term forecast analysis of climate change impact on water • Supported the Ministry of Agriculture and Land Reclamation and its affiliated research centers to develop methodological approaches and planning tools, with particular emphasis on zoning and mapping tools • Supported research activities (mainly concentrating on deficit irrigation) and simulation exercises on the impacts of climate change on key crops • Supported the production and screening of a documentary film titled "The Future of Climate Change in Egypt" in the framework of public awareness and advocacy on climate change.	FAO, IFAD, UNDP, UNEP, UNESCO, UNIDO: 4 M USD		√	√	2008 -2013
Low Emission Capacity Building Project (LECB)	Multiple	• The project aimed to strengthen national capacities to mainstream climate change policies into national development plans.	EU and co-finance: 1 M USD		√	√	2013 - 2018

4.3.4 Support Received for BUR Report

Egypt received financial support from the Global Environment Facility (GEF) to prepare this report, which was crucial to ensure the provision of updated information and without which transparency and data collection would be impaired. GEF's financial support amounted to USD 352,000 as shown in Table 4.11 below. The support included capacity building and technical support for both adaptation and mitigation.

Table 4.11: International support received for this BUR Report

Program	Sector	Measures achieved	Donor and total funding amount and type	Other support received			Timeframe (years)
				Technology	Capacity building	Technical support	
Egypt's First Biennial Update Report (enabling Activity)	Adaptation	• Capacity development for the ministries and raise awareness on the recent adaptation actions and climate change.	GEF/UNDP $352,000		√	√	2016-2018
	Mitigation	• Raise awareness regarding mitigation actions • Support Ministries in developing MRV system to monitor mitigation and adaptation actions.					



Chapter 5: Domestic Measuring, Reporting and Verification

Measurement, reporting and verification (MRV) systems are the foundation for enhanced national and international action on climate change. MRV occurs at the international level, but can also be voluntary at the national level. Developing countries are encouraged to utilize the existing domestic processes, arrangements or systems, including nationally available information, methodologies, experts and other aspects for domestic MRV.

This chapter presents Egypt's proposed national MRV system. It was developed by engaging representatives from all concerned ministries and national entities for input and review. This proposed domestic MRV has not yet been formally adopted by the National Council on Climate Change (NCCC). Moreover, mobilization of the domestic MRV is pending funding and other resources, as elaborated in Chapter 4. Once available, this would support national institutions to mobilize for MRV implementation.

5.1 Proposed National MRV System

At present, the 2006 IPCC Software is used as the national archiving system essential for preserving the institutional memory of the GHGI data. In addition to existing partial MRV activities for each sector as outlined in section 5.2, on the short to medium term, this data archiving system and partial activities should evolve into a comprehensive national MRV system. Egypt proposes the following key components for the national MRV system:

MEASUREMENT of:

1. Activity data and national emission factors to calculate the GHGs for the emissions and removals in all sectors (energy, IPPU, AFOLU, and waste);
2. Support received financially, technologically, technically, and capacity building for implementing these mitigation and adaptation policies and actions.

REPORTING on:

3. GHG inventory;
4. Adaptation and mitigation policies and actions and associated data on cost-benefit;

VERIFICATION of:

5. Reported GHG inventory; and
6. GHGs emission reductions through implementing mitigation actions;

The next steps for the proposed national MRV system are:

1. Establish a National MRV Climate Change System;
2. Implement Data Improvement Plan for GHG Inventory Data; and
3. Develop an Improvement Plan for MRV system for Mitigation, Adaptation and Support Data Collected.

In parallel, the national MRV system requires a reformulation of the roles of the ministerial entities in order to be aligned with the Paris Agreement. This will be presented in section 5.3. Furthermore, section 5.4 elaborates on the proposed four tracks to structure the national MRV system and section 5.5 will elaborate on the potential data providers.

5.2 Current MRV Activities

The following are the current MRV activities in each sector to leverage upon the new proposed system.

5.2.1 Energy Sector

- Ministry of Petroleum. High Energy Efficiency Committee, under the Ministry of Petroleum, was established in 2015 as a centralized setup to collect data from the holding companies: Egyptian General Petroleum Corporation (EGPC), Egyptian Natural Gas Holding Company (EGAS), Egyptian Petrochemicals Holding Company (ECHEM) and Egyptian Petroleum Holding Company (Ganope). In conjunction, 100 energy efficiency units were established in 2017 in each holding company to report to the central EE unit. These EE units collect data for energy production, energy consumption, and monitor energy savings achieved in each company. EGAS has already developed templates for data collection utilized by subsidiary companies. The Ministry is also undergoing the establishment of an Energy Efficiency and Climate Unit (EECU).
- Ministry of Electricity and Renewable Energy. There is an automated National Energy Control Center, which collects real-time data from all stages of the electricity system (generation, transmission, and distribution). The data is reported on a monthly basis, however, the information can be extracted at any time if needed. In addition, each power plant has a dedicated person responsible for MRV and an environmental manager.
- Ministry of Tourism. A green tourism program was established, whereby the Ministry of Tourism launched an initiative to co-invest with hotels in energy efficiency and renewable energy projects. Another initiative is the Green Star Hotel (GSH) which is a national green certification and capacity-building program managed by the Egyptian Hotel Association (EHA) under the patronage of the Egyptian Ministry of Tourism.

5.2.2 Industry Sector

- Ministry of Trade and Industry (MoTI) – Egypt National Cleaner Production Centre (ENCPC). The ENCPC aims to develop and maintain a database of all industrial facilities in Egypt. It collects data from multiple sources such as chambers of commerce, Federation of Egyptian Industries, investor associations and other sectoral associations. It has recently completed a review of all industrial activity over the past 10 years in order to benchmark the industrial sectors and sub-sectors and to identify opportunities for improvement.
- MoTI - Industrial Development Agency (IDA) – Although the Agency has a statutory role of collecting data from all industrial facilities, the quality of data needs to be improved. Capacity building for IDA staff could be rather beneficial since the Agency is responsible for renewal of operation licenses and updating the database for industrial activity (production), fuel consumption and other parameters which are relevant for calculating GHG emissions from this sector.

5.2.3 Agriculture Sector

- Ministry of Agriculture and Land Reclamation (MALR) - Agricultural Economic Affairs Sector (EAS). The EAS is the sole source of data for the GHGI calculations of the AFLOU sector. One of the main publications of the EAS is the "Annual Bulletin of Agricultural Economics", the main source of official agricultural statistics in Egypt. To generate the statistics the agricultural sector collects data via the agricultural census, annual crop cutting surveys, regional reports, estimates obtained from persons with professional experience. The EAS also tabulates and publishes data produced by other departments of MALR and by other ministries and organizations (i.e. CAPMAS).
- MALR - Climate Change Information Center and Renewable Energy (CCICRE). CCICRE is the compiler of AFLOU's GHGI of Egypt from the data published by EAS. CCICRE utilizes the IPCCC software for the GHGI calculations. The main objective of CCICRE is enhancing the GHG inventory data sources & capacity building to build sustainable inventory systems and mitigation actions for agriculture. CCICRE has important opportunity to strengthen and promoting reforms in policies and investments that indirectly reduce vulnerability to climate change (e.g. improved water demand management, agriculture diversification supply chain development), or that promote reduction of GHG emissions.

5.2.4 Waste Sector

Ministry of Housing, Ministry of Local Development, Ministry of Trade and Industry, and Ministry of Environment. The responsibility of the solid waste sub-sector in Egypt is divided between many entities including Ministry of Housing (wastewater), Ministry of Local Development (municipal solid waste), Ministry of Trade and Industry (industrial waste), and the newly established Waste Management Regulatory Authority (WMRA) in 2015 under the Ministry of Environment. On the other hand, the data collection and reporting is challenging in particular for the solid waste sector.

Ministry of Housing. For the wastewater sub-sector, much effort is required since there is insufficient data and monitoring for the treatment & discharge methods and quality of domestic and, especially, industrial wastewater and sludge. In addition, the roles and responsibilities of the different relevant entities and coordination among them needs to be improved.

5.2.5 Water Resources and Coastal Zones Protection

National Water Research Center – Environment and Climate Change Research Institute. The mandate of the institute is to evaluate the impacts of climate change and to prepare strategies for climate change adaptation in the water resource sector and shore protection. The institutes also directly record weather data, in addition to the data issued by the Meteorology institute. There are 10 stations already installed and a further 14 stations will be installed in the near future.

5.3 Re-formulation of Institutional Setup

The reformulation of the institutional setup consists of three main structures: i) ministerial climate change focal point, ii) quality assurance working group (QA-WG), and iii) technical support working group (TS-WG).

5.3.1 Ministerial Climate Change Focal Points

The Climate Change Central Department (CCCD) is the technical secretariat of the National Climate Change Council (NCCC) and the focal point for the UNFCCC. The CCCD have an important role in supervising the preparation of climate change reports and promoting new policies. The CCCD is proposed as the coordinating entity for the new MRV system. Currently, the Central Agency for Public Mobilization and Statistics (CAPMAS) is the only organization that has the legal authority to collect data from the relevant ministries. CAPMAS has a dedicated environmental unit, however it is recommended to expand it to include a Climate Change GHG sub-unit to collect GHG inventory data from the various sectors. It is strongly recommended to establish permanent Climate Change and MRV focal points in all relevant ministries to report the GHG inventory relevant data to CAPMAS and to report to CCCD-EEAA the mitigation and adaptation actions and needs and support received. Some of the ministries already have climate change units, while other ministries may add such tasks to the responsibilities of other existing units. This step may prove to be lengthy and requires additional resources.

5.3.2 Quality Assurance Working Group [QA-WG]

Quality assurance on drafted national reports is a crucial step in any well-established MRV system. It is important to review the developed reports by external experts or entities who were not involved in the preparation of such reports to provide independent and professional views. It is proposed to create a separate working group for the quality assurance (QA-WG). The proposed role for this working group is to review and verify all reports (i.e. BUR, national communication) produced by the coordinating entity prior to submission to the UNFCCC. The QA-WG will then provide the coordinating entity with feedback on the reviewed reports for further improvement.

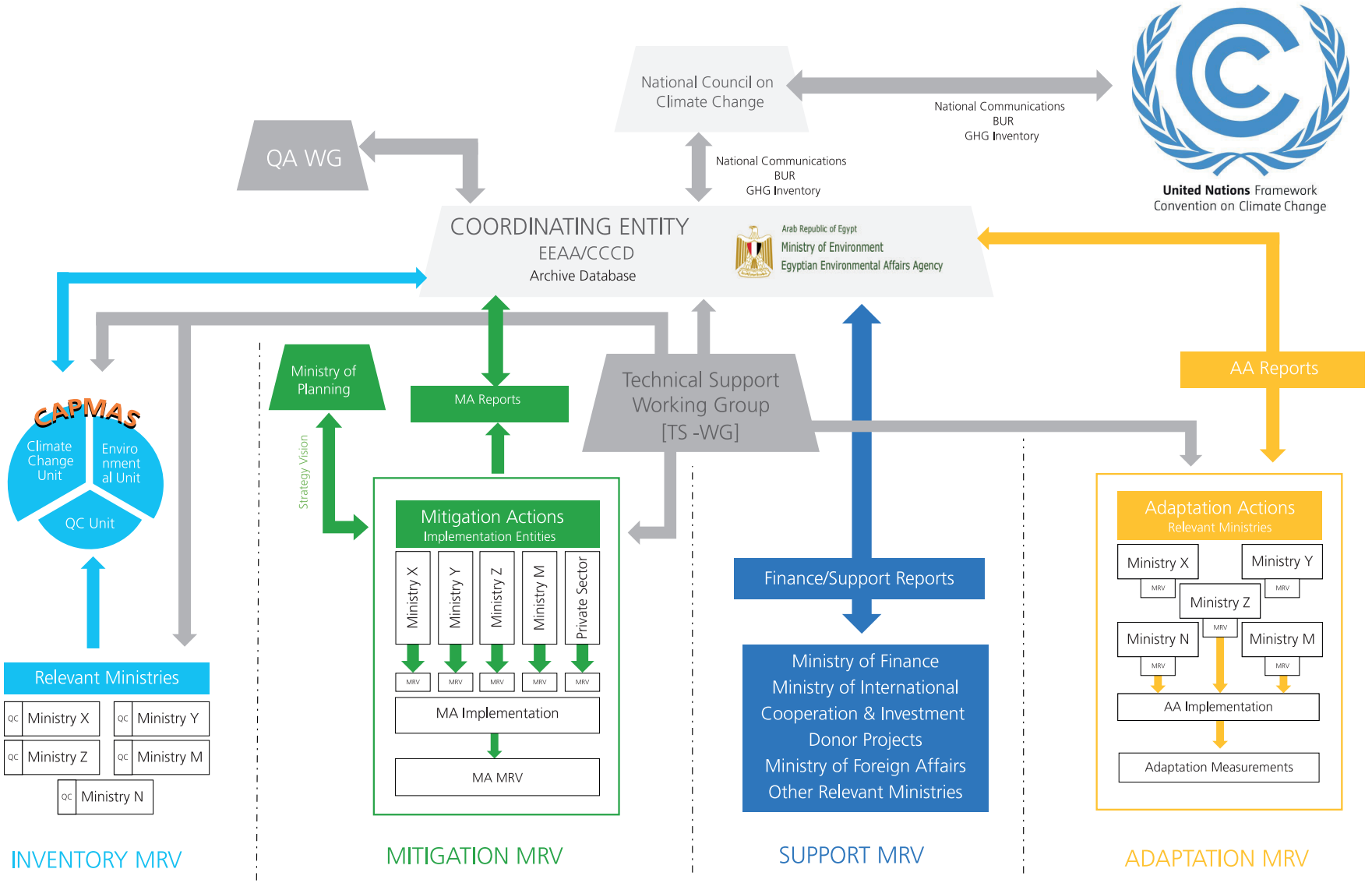
5.3.3 Technical Support Working Group [TS-WG]

The Technical Support Working Group for MRV (TS-WG) is to be established from a group of national experts to provide technical assistance and guidance to the coordinating entity, CAPMAS, and the relevant ministries. The main role of the TS-WG is to provide support to the coordinating entity regarding the design of data collection templates for GHG inventory, mitigation actions, and support and review the prepared reports prior to submission to the QA-WG and UNFCCC.

5.4 MRV Structure

The proposed MRV structure would consist of a supervisory body, represented by NCCC, that acts as the national focal point to UNFCCC. The CCCD is the national coordinating entity with relevant ministries and CAPMAS. The CCCD has two arms, the quality assurance working group (QA-WG) and the technical support working group (TS-WG). CAPMAS would act as the central data coordinating entity. The MRV pathways for data flow consist of four tracks: i) GHG Inventory MRV, ii) Mitigation Policies and Actions MRV, iii) Support Received MRV, and iv) Adaptation Policies and Actions MRV. The proposed MRV structure is summarized in Figure 5.1.

Figure 5.1: Schematic diagram for the proposed MRV structure



5.4.1 GHG Inventory MRV

The first track is concerned with GHG inventory, which could be based on aggregate national level data as outlined in Figure 5.2 below. This track is primarily concerned with gathering GHG data through CAPMAS from the respective MRV units under each relevant ministry. CAPMAS will then collect the data and send it to the coordinating entity for GHG inventory estimation and reporting purposes. As mentioned above, the TS-WG will also provide support, when needed, for CAPMAS and the relevant ministries. This support would include capacity building for personnel responsible for GHGI data collection from the relevant sectors, setting up baseline(s), and data cross-checks and verification.

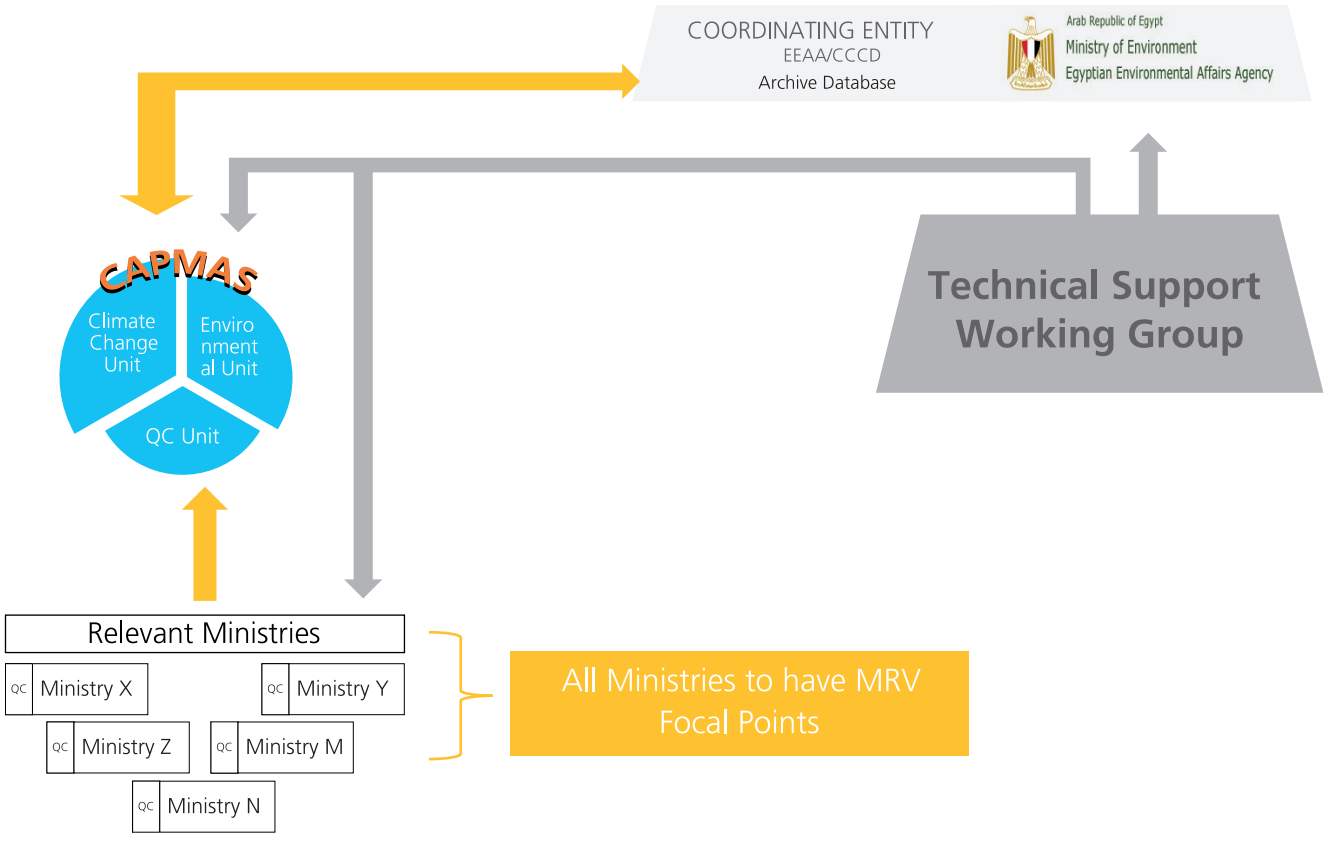


Figure 5.2: Schematic diagram for GHG inventory MRV (track 1)

5.4.2 Mitigation Policies and Actions MRV

The second track is the Mitigation Policies and Actions MRV as illustrated in Figure 5.3. This track would involve the Ministry of Planning to provide the country's vision and strategies as a basis. The purpose is to align all the ministries and ensure consistent collaboration across all entities. The Ministry of Planning would cascade the national strategies, such as Sustainable Development Strategy 2030, to the relevant ministries to plan their mitigation policies and actions accordingly. Each ministry would have an MRV unit responsible for quantifying the actual GHG reductions resulting from the implementation of the mitigation policies and actions. Each ministry will submit an Annual Report directly to the Coordinating Entity providing information about the status of implementation. As mentioned above, the TS-WG will provide technical support to the implementing entities regarding defining the key progress indicators, MRV plan, and GHG estimation methodologies.

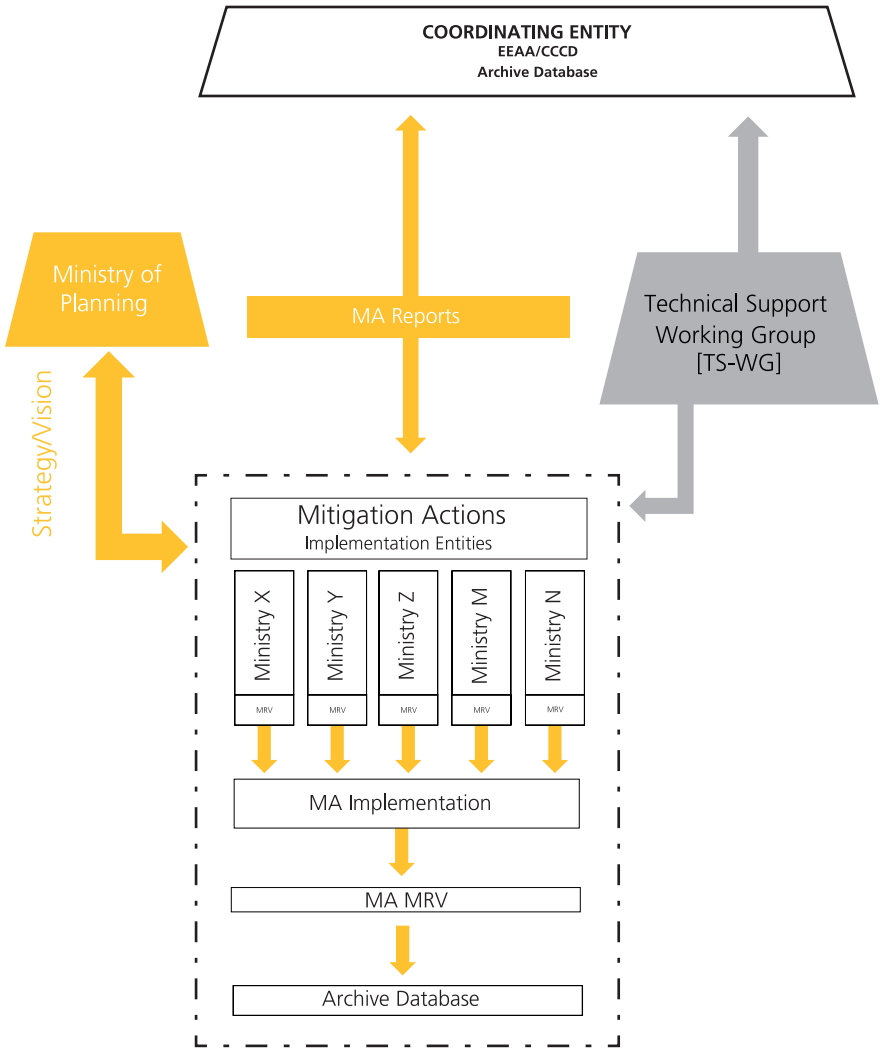


Figure 5.3: Schematic diagram for mitigation policies and actions MRV (track 2)

5.4.3 Support Received MRV

The third track is the Support Received MRV outlined in Figure 5.4. The Ministry of Investment and International Cooperation and the Ministry of Finance are to determine the sources of finance of the different climate change related activities. This would include both domestic and international financial resources. The international support will be through donor-funded projects, multilateral financial institutions and bilateral cooperation with development agencies. Other ministries that receive climate support should also determine the sources of finance for their climate related activities and report them to the CCCD as the National Coordinating Entity, which would be subsequently included in the issued national official reports (e.g. NC, BUR).

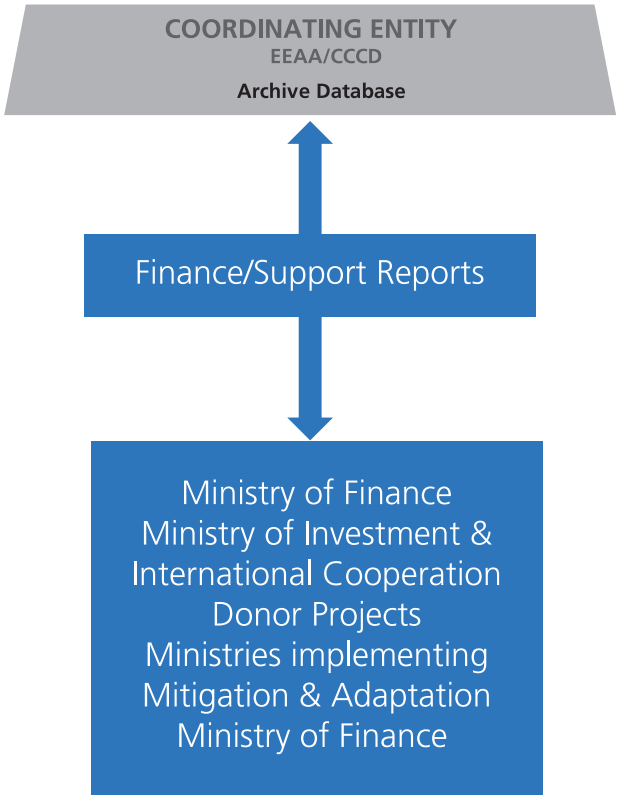


Figure 5.4: Schematic diagram for support received MRV (track 3)

5.4.4 Adaptation Policies and Actions MRV

The fourth and final track is the Adaptation Policies and Actions MRV, which would be implemented across all relevant ministries. As shown in Figure 5.5, the ministries would report to the National Coordinating Entity on the progress of the adaptation policies and actions and the main results achieved. Similar to the previous tracks, the TS-WG will provide support as needed

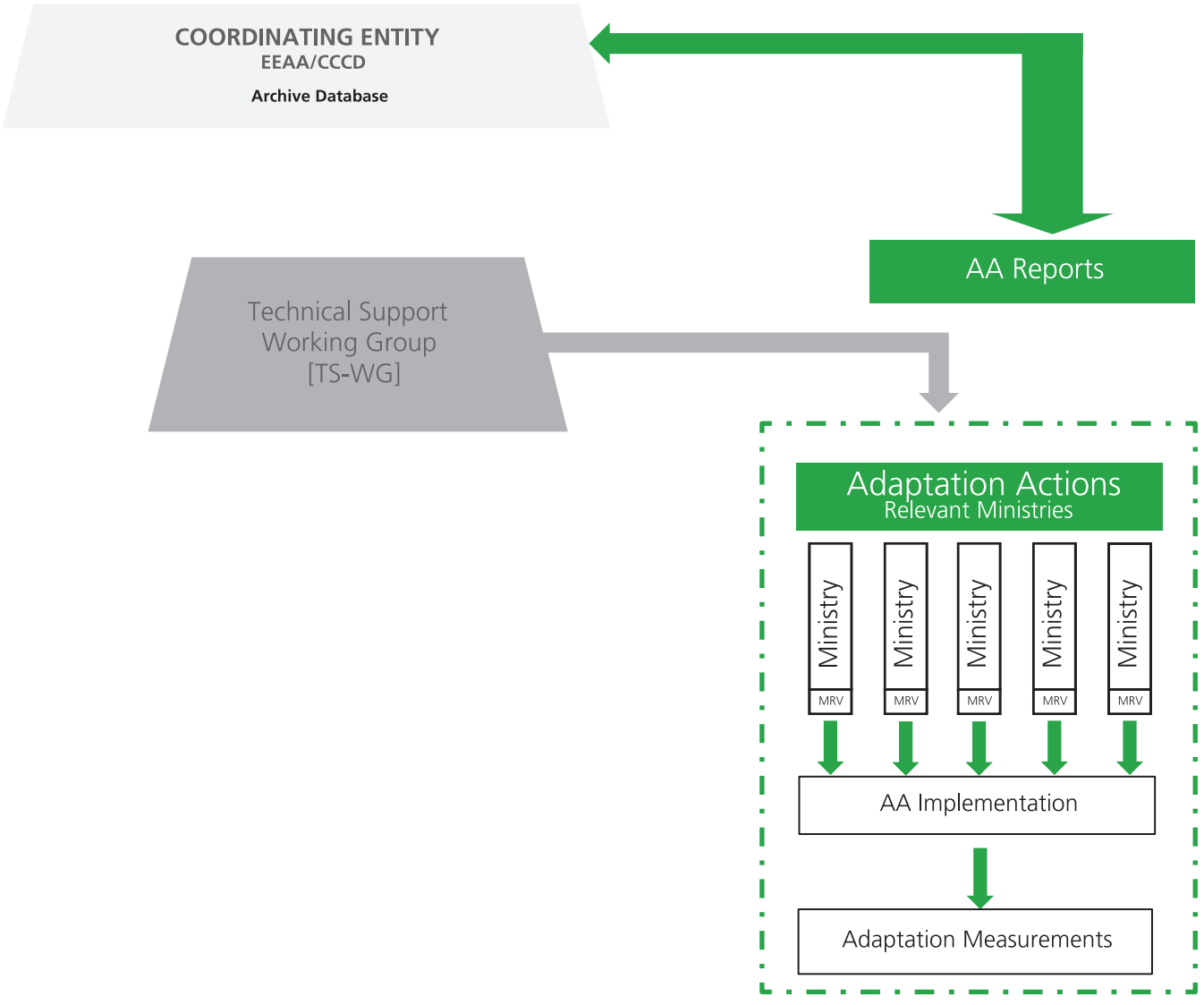


Figure 5.5: Schematic diagram for adaptation policies and actions MRV (track 4)

5.5 Data Providers

Under each track, the data providers are proposed as follows:

Track 1: GHGs Inventory

CAPMAS is proposed to act as the data hub to which the GHG inventory information flows from the relevant ministries. By law, all ministries are obliged to submit annual data to CAPMAS, which positions it as the best candidate for the GHG inventory data collection. Currently CAPMAS has a dedicated environmental unit, however, this unit should be expanded to include a Climate Change GHG Unit to capture GHG inventory data. The issuance of a Prime Ministerial Decree to enforce the data flow between CAPMAS and the National Coordinating Entity may be necessary to ensure it receives the required GHG data on a periodic basis. A quality control plan should be developed and obligated upon all departments. All data that are used for GHG inventory purposes should be validated.

Track 2: Mitigation Policies and Actions MRV

The relevant ministries and other entities implementing the mitigation programs are proposed to be the data providers and responsible to monitor the progress of such actions. This is a dynamic process since new entities are always added whenever a national or sectoral level mitigation program is implemented. The templates and methodologies to be used by these entities involved are proposed to be prepared by the TS-WG. Each ministerial MRV unit will generate reports on their respective mitigation programs in line with the national strategies issued by the Ministry of Planning and communicate them directly to the Coordinating Entity.

Track 3: Support Received MRV

The Ministry of Finance and the Ministry of Investment and International Cooperation are proposed as the data provider to the Coordinating Entity on the support received. This entails categorizing climate change projects receiving climate finance and indicating the type of funding received in the system by the concerned ministry.

Track 4: Adaptation Policies and Actions MRV

Similar to track 2, the relevant ministries and other entities implementing the adaptation programs are proposed to be the data providers and responsible to monitor the progress of such actions. Moreover, universities and research centers can play an important role in supporting the ministries for relevant data collection and for monitoring the performance of the adaptation actions (e.g. there are 22 agricultural universities in Egypt rich in field experts and researchers). Each ministerial MRV unit will generate reports on their respective adaptation actions that would be sent directly to the Coordinating Entity.

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Chapter 5

Institutional setup MRV project, 2017

Annexes

Annex A – (GWP) Global Warming Potential

Gas	GWP
CO_2, CH_4 & N_2O	
CO_2	1
CH_4	21
N_2O	310
HFCs	
HFC-23 (CHF_3)	11,700
HFC-32 (CH_2F_2)	650
HFC-41 (CH_3F)	150
HFC-43 - 10mee ($CF_3CHFCHFCF_2CF_3$)	1,300
HFC-125 (CHF_2CF_3)	2,800
HFC-134 (CHF_2CHF_2)	1,000
HFC-134a (CHF_2CHF_3)	1,300
HFC-152a (CHF_3CHF_2)	140
HFC-143 (CHF_2CH_2F)	300
HFC-143a (CHF_3CH_3)	3,800
HFC-227ea (CF_3CHFCF_3)	2,900
HFC-236fa ($CF_3CH_2CF_3$)	6,300
HFC-245ca ($CH_2FCF_2CHF_2$)	560
PFCs	
PFC-14 (CF_4)	6,500
PFC-116 (C_2F_6)	9,200
PFC-218 (C_3F_8)	7,000
PFC-31-10 (C_4F_{10})	7,000
PFC-318 (c-C_4F_8)	8,700
PFC-4-1-12 (C_5F_{12})	7,500
PFC-5-1-1-4 (C_6F_{14})	7,400
SF6	
SF_6	23,900

Annex B – GHG Emissions Trend

Year	Energy (Gg CO_2eq)	IPPU (Gg CO_2eq)	AFOLU (Gg CO_2Ceq)	Waste (Gg CO_2eq)	Total (Gg CO_2eq)
2005	150,027	27,280	51,787	19,676	248,770
2006	156,583	30,257	52,099	20,259	259,198
2007	168,760	34,075	54,014	21,519	278,367
2008	173,376	32,931	52,017	22,221	280,545
2009	176,670	37,630	51,752	21,889	287,941
2010	179,240	37,171	51,511	23,739	291,662
2011	183,665	34,629	49,503	23,754	291,551
2012	190,919	33,624	60,047	25,019	309,609
2013	188,079	38,434	50,681	25,404	302,598
2014	187,575	39,017	48,727	25,905	301,223
2015	210,171	40,664	48,390	26,389	325,614

Annex C – GHG Emissions (CO_2 Equivalent) in 2015

Categories	Emissions CO_2 Equivalents (Gg)			Emissions CO_2 Equivalents (Gg)				Total Equivalent CO_2
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors	
Total National Emissions and Removals	**237,871**	**41,483**	**38,574**	**4,308**	**3,379**			**325,614**
1 - Energy	**208,075**	**1,159**	**938**	**NE**	**NE**	**NE**	**NE**	**210,171**
1.A - Fuel Combustion Activities	202,587	360	927	NE	NE	NE	NE	203,874
1.A.1 - Energy Industries	90,955	47	112	NE	NE	NE	NE	91,115
1.A.2 - Manufacturing Industries and Construction	46,985	25	84	NE	NE	NE	NE	47,094
1.A.3 – Transport	47,363	257	719	NE	NE	NE	NE	48,339
1.A.4 - Other Sectors	17,284	31	11	NE	NE	NE	NE	17,326
1.A.5 - Non-Specified	NA	NA	NA	NA	NA	NA	NA	NA
1.B - Fugitive emissions from fuels	5,488	799	11	NE	NE	NE	NE	6,297
1.B.1 - Solid Fuels	NE	NE	NE	NE	NE	NE	NE	0
1.B.2 - Oil and Natural Gas	5,488	799	11	NE	NE	NE	NE	6,297
1.B.3 - Other emissions from Energy Production	NE	NE	NE	NE	NE	NE	NE	0
1.C - Carbon dioxide Transport and Storage	NA	NA	NA	NA	NA	NA	NA	NA
2 - Industrial Processes and Product Use	**28,355**	**85**	**4,537**	**4,308**	**3,379**	**0**	**0**	**40,664**
2.A - Mineral Industry	21,975	NA	NA	NA	NA	NA	NA	21,975
2.A.1 - Cement production	20,762	NA	NA	NA	NA	NA	NA	20,762
2.A.2 - Lime production	216	NA	NA	NA	NA	NA	NA	216
2.A.3 - Glass Production	756	NA	NA	NA	NA	NA	NA	756
2.A.4 - Other Process Uses of Carbonates	242	NA	NA	NA	NA	NA	NA	242
2.A.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	0

Categories	Emissions CO_2 Equivalents (Gg)			Emissions CO_2 Equivalents (Gg)				Total Equivalent CO_2
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors	
2.B - Chemical Industry	2,848	83	4,537	NA	NA	NA	NA	7,468
2.B.1 - Ammonia Production	1,827	NA	NA	NA	NA	NA	NA	1827
2.B.2 - Nitric Acid Production	NA	NA	4,537	NA	NA	NA	NA	4537
2.B.3 - Adipic Acid Production	NO	NO	NO	NO	NO	NO	NO	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production.	NO	NO	NO	NO	NO	NO	NO	0
2.B.5 - Carbide Production	NO	NO	NO	NO	NO	NO	NO	0
2.B.6 - Titanium Dioxide Production	NO	NO	NO	NO	NO	NO	NO	0
2.B.7 - Soda Ash Production	NE	NA	NA	NA	NA	NA	NA	0
2.B.8 - Petrochemical and Carbon Black Production	1,021	83	NA	NA	NA	NA	NA	1,105
2.B.9 - Fluorochemical Production	NO	NO	NO	NO	NO	NO	NO	0
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	0
2.C - Metal Industry	3,531	2	NA	NA	3,379	NA	NA	6,913
2.C.1 - Iron and Steel Production	3,136	2	NA	NA	NA	NA	NA	3,138
2.C.2 - Ferroalloys Production	NO	NO	NO	NO	NO	NO	NO	0
2.C.3 - Aluminum production	384	NA	NA	NA	3,379	NA	NA	3,763
2.C.4 - Magnesium production	NO	NO	NO	NO	NO	NO	NO	0
2.C.5 - Lead Production	5	NA	NA	NA	NA	NA	NA	5
2.C.6 - Zinc Production	7	NA	NA	NA	NA	NA	NA	7
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	0

Categories	Emissions CO_2 Equivalents (Gg)			Emissions CO_2 Equivalents (Gg)				Total Equivalent CO_2
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors	
2.D - Non-Energy Products from Fuels and Solvent Use	NO	NO	NO	NO	NO	NO	NO	0
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	4,308	0	0	0	4,308
2.F.1 - Refrigeration and Air Conditioning	NE	NE	NE	NE	NE	NE	NE	0
2.F.2 - Foam Blowing Agents	NE	NE	NE	NE	NE	NE	NE	0
2.F.3 - Fire Protection	NE	NE	NE	NE	NE	NE	NE	0
2.F.4 – Aerosols	NE	NE	NE	NE	NE	NE	NE	0
2.F.5 – Solvents	NE	NE	NE	NE	NE	NE	NE	0
2.F.6 - Other Applications (please specify)	NA	NA	NA	4,308	NA	NA	NA	4,308
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO	NO	0
2.H - Other	NO	NO	NO	NO	NO	NO	NO	0
3 - Agriculture, Forestry, and Other Land Use	**1,357**	**15,876**	**31,158**	**0**	**0**	**0**	**0**	**48,390**
3.A - Livestock	NO	11,732	4,754	NA	NA	NA	NA	16,486
3.A.1 - Enteric Fermentation	NO	10,693	NA	NA	NA	NA	NA	10,693
3.A.2 - Manure Management	NO	1,039	4,754	NA	NA	NA	NA	5,793
3.B - Land	NE	0	0	0	0	0	0	NE
3.B.1 - Forest land	NO	NO	NO	NO	NO	NO	NO	NO
3.B.2 - Cropland	NE	0	0	0	0	0	0	NE
3.B.3 - Grassland	NO	NO	NO	NO	NO	NO	NO	NO
3.B.4 - Wetlands	NE	NE	NE	NE	NE	NE	NE	NE
3.B.5 - Settlements	0	0	0	0	0	0	0	0
3.B.6 - Other Land	0	0	0	0	0	0	0	0

Categories	Emissions CO_2 Equivalents (Gg)			Emissions CO_2 Equivalents (Gg)				Total Equivalent CO_2
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors	
3.C - Aggregate sources and non-CO2 emissions sources on land	1,357	4,143	26,404	NA	NA	NA	NA	31,905
3.C.1 - Emissions from biomass burning	NA	567	217	NA	NA	NA	NA	784
3.C.2 - Liming	NA	NA	NA	NA	NA	NA	NA	NA
3.C.3 - Urea application	274	NA	NA	NA	NA	NA	NA	274
3.C.4 - Direct N2O Emissions from managed soils	NA	NA	20,617	NA	NA	NA	NA	20,617
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	5,354	NA	NA	NA	NA	5,354
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	216	NA	NA	NA	NA	216
3.C.7 - Rice cultivations	NA	3,576	NA	NA	NA	NA	NA	3,576
3.C.8 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO
3.D - Other	NO	NO	NO	NO	NO	NO	NO	NO
4 - Waste	**85**	**24,363**	**1,941**	**NO**	**NO**	**NO**	**NO**	**26,389**
4.A - Solid Waste Disposal	0	13,282	0	NO	NO	NO	NO	13,282
4.B - Biological Treatment of Solid Waste	0	123	137	NO	NO	NO	NO	260
4.C - Incineration and Open Burning of Waste	85	362	71	NO	NO	NO	NO	517
4.D - Wastewater Treatment and Discharge	0	10,596	1,733	NO	NO	NO	NO	12,329
4.E - Other (please specify)	NA	NA	NA	NA	NA	NA	NA	0
5 - Other								**0**
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3								0
5.B - Other (please specify)								0

Annex D – Common Reporting Format Tables

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
Total National Emissions and Removals	237,871	1,975.40	124.43	4,308	3,379				25	920		
1 - Energy	208,075	55	3.02	NE	NE	NE	NE					
1.A - Fuel Combustion Activities	202,587	17	2.99	NE	NE	NE	NE					
1.A.1 - Energy Industries	90,955	2	0.36	NE	NE	NE	NE					
1.A.1.a - Main Activity Electricity and Heat Production	87,553	2	0.32	NE	NE	NE	NE					
1.A.1.a.i - Electricity Generation	87,553	2	0.32	NE	NE	NE	NE					
1.A.1.b - Petroleum Refining	2244	0.09	0.02	NE	NE	NE	NE					
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	1,158	0.01	0.02	NE	NE	NE	NE					
1.A.1.c.i - Manufacture of Solid Fuels	1,158	0.01	0.02	NE	NE	NE	NE					

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
	Net CO_2 (1) (2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
1.A.2 - Manufacturing Industries and Construction	46,985	1	0.27	NE	NE	NE	NE					
1.A.3 - Transport	47,363	12	2	NE	NE	NE	NE					
1.A.3.b - Road Transportation	47,363	12	2	NE	NE	NE	NE					
1.A.4 - Other Sectors	17,284	1	0.04	NE	NE	NE	NE					
1.A.4.b - Residential	16,019	1.31	0.03	NE	NE	NE	NE					
1.A.4.c - Agriculture/Forestry/ Fishing/Fish Farms	1,265	0.17	0.01	NE	NE	NE	NE					
1.A.4.c.i - Stationary	1,265	0.17	0.01	NE	NE	NE	NE					
1.A.5 - Non-Specified	NA	NA	NA	NA	NA	NA	NA					
1.B - Fugitive emissions from fuels	5,488	38	0.04	NE	NE	NE	NE					
1.B.1 - Solid Fuels	NE	NE	NE	NE	NE	NE	NE					
1.B.2 - Oil and Natural Gas	5,488	38	0.04	NE	NE	NE	NE					
1.B.2.a - Oil	2,088	38.00	0.03	NE	NE	NE	NE					

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
	Net CO_2 (1) (2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
1.B.2.a.i - Venting	5	36.73	0	NE	NE	NE	NE					
1.B.2.a.ii - Flaring	2,084	1.27	0.03	NE	NE	NE	NE					
1.B.2.b - Natural Gas	3,399	0.04	0.001	NE	NE	NE	NE					
1.B.2.b.i - Venting	3,330	0.00	0	NE	NE	NE	NE					
1.B.2.b.ii - Flaring	69	0.04	0.001	NE	NE	NE	NE					
1.B.3 - Other emissions from Energy Production	NE	NE	NE	NE	NE	NE	NE					
1.C - Carbon dioxide Transport and Storage	NA	NA	NA	NA	NA	NA	NA					
1.C.1 - Transport of CO2	NA	NA	NA	NA	NA	NA	NA					
1.C.2 - Injection and Storage	NA	NA	NA	NA	NA	NA	NA					
1.C.3 - Other	NA	NA	NA	NA	NA	NA	NA					
2 - Industrial Processes and Product Use	28,355	4.07	14.64	4,308	3,379							
2.A - Mineral Industry	21,975	NA	NA	NA	NA	NA	NA					

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
2.A.1 - Cement production	20,762	NA	NA	NA	NA	NA	NA					
2.A.2 - Lime production	216	NA	NA	NA	NA	NA	NA					
2.A.3 - Glass Production	756	NA	NA	NA	NA	NA	NA					
2.A.4 - Other Process Uses of Carbonates	242	NA	NA	NA	NA	NA	NA					
2.A.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO					
2.B - Chemical Industry	2,848	3.98	14.64	NA	NA	NA	NA					
2.B.1 - Ammonia Production	1,827	NA	NA	NA	NA	NA	NA					
2.B.2 - Nitric Acid Production	NA	NA	14.64	NA	NA	NA	NA					
2.B.3 - Adipic Acid Production	NO	NO	NO	NO	NO	NO	NO					
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	NO	NO	NO	NO	NO	NO	NO					
2.B.5 - Carbide Production	NO	NO	NO	NO	NO	NO	NO					

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
2.B.6 - Titanium Dioxide Production	NO	NO	NO	NO	NO	NO	NO					
2.B.7 - Soda Ash Production	NE	NA	NA	NA	NA	NA	NA					
2.B.8 - Petrochemical and Carbon Black Production	1,021	3.98	NA	NA	NA	NA	NA					
2.B.9 - Fluorochemical Production	NO	NO	NO	NO	NO	NO	NO					
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO					
2.C - Metal Industry	3,531	0.09	NA	NA	3,379	NA	NA					
2.C.1 - Iron and Steel Production	3,136	0.09	NA	NA	NA	NA	NA					
2.C.2 - Ferroalloys Production	NO	NO	NO	NO	NO	NO	NO					
2.C.3 - Aluminium production	384	NA	NA	NA	3,379	NA	NA					
2.C.4 - Magnesium production	NO	NO	NO	NO	NO	NO	NO					
2.C.5 - Lead Production	5	NA	NA	NA	NA	NA	NA					

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
	Net CO_2 (1) (2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
2.C.6 - Zinc Production	7	NA	NA	NA	NA	NA	NA					
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO					
2.D - Non-Energy Products from Fuels and Solvent Use	NO	NO	NO	NO	NO	NO	NO					
2.D.1 - Lubricant Use	NO	NO	NO	NO	NO	NO	NO					
2.D.2 - Paraffin Wax Use	NO	NO	NO	NO	NO	NO	NO					
2.D.3 - Solvent Use	NO	NO	NO	NO	NO	NO	NO					
2.D.4 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO					
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO					
2.E.1 - Integrated Circuit or Semiconductor	NO	NO	NO	NO	NO	NO	NO					
2.E.2 - TFT Flat Panel Display	NO	NO	NO	NO	NO	NO	NO					
2.E.3 - Photovoltaics	NO	NO	NO	NO	NO	NO	NO					
2.E.4 - Heat Transfer Fluid	NO	NO	NO	NO	NO	NO	NO					

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
	Net CO_2 (1) (2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO					
2.F - Product Uses as Substitutes for Ozone Depleting Substances				4,308								
2.F.1 - Refrigeration and Air Conditioning	NE	NE	NE	NE	NE	NE	NE					
2.F.2 - Foam Blowing Agents	NE	NE	NE	NE	NE	NE	NE					
2.F.3 - Fire Protection	NE	NE	NE	NE	NE	NE	NE					
2.F.4 - Aerosols	NE	NE	NE	NE	NE	NE	NE					
2.F.5 - Solvents	NE	NE	NE	NE	NE	NE	NE					
2.F.6 - Other Applications (please specify)	NA	NA	NA	4,308	NA	NA	NA					
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO	NO					
2.G.1 - Electrical Equipment	NO	NO	NO	NO	NO	NO	NO					
2.G.2 - SF6 and PFCs from Other Product Uses	NO	NO	NO	NO	NO	NO	NO					

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
	Net CO_2 (1) (2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
2.G.3 - N2O from Product Uses	NO	NO	NO	NO	NO	NO	NO					
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO					
2.H - Other	NO	NO	NO	NO	NO	NO	NO					
2.H.1 - Pulp and Paper Industry	NO	NO	NO	NO	NO	NO	NO					
2.H.2 - Food and Beverages Industry	NO	NO	NO	NO	NO	NO	NO					
2.H.3 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO					
3 - Agriculture, Forestry, and Other Land Use	1,357	756	101	0	0	0	0		25	920		
3.A - Livestock	NO	559	15	NA	NA	NA	NA					
3.A.1 - Enteric Fermentation	NO	509	NA	NA	NA	NA	NA					
3.A.2 - Manure Management	NO	50	15	NA	NA	NA	NA					
3.B - Land	NE	0	0	0	0	0	0					
3.B.1 - Forest land	NO	NO	NO	NO	NO	NO	NO					
3.B.2 - Cropland	NE	0	0	0	0	0	0					

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
	Net CO_2 (1) (2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
3.B.3 - Grassland	NO	NO	NO	NO	NO	NO	NO					
3.B.4 - Wetlands	NE	NE	NE	NE	NE	NE	NE					
3.B.5 - Settlements	0	0	0	0	0	0	0					
3.B.6 - Other Land	0	0	0	0	0	0	0					
3.C - Aggregate sources and non-CO2 emissions sources on land	1,357	197	85	NA	NA	NA	NA		25	920		
3.C.1 - Emissions from biomass burning	NA	27	1	NA	NA	NA	NA		25	920		
3.C.2 - Liming	NA	NA	NA	NA	NA	NA	NA					
3.C.3 - Urea application	1,357	NA	NA	NA	NA	NA	NA					
3.C.4 - Direct N2O Emissions from managed soils	NA	NA	67	NA	NA	NA	NA					
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	17	NA	NA	NA	NA					

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
	Net CO_2 (1)(2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	1	NA	NA	NA	NA					
3.C.7 - Rice cultivations	NA	170	NA	NA	NA	NA	NA					
3.C.8 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO					
3.D - Other	NO	NO	NO	NO	NO	NO	NO					
3.D.1 - Harvested Wood Products	NO	NO	NO	NO	NO	NO	NO					
3.D.2 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO					
4 - Waste	85	1160	6.26	NO	NO	NO	NO					
4.A - Solid Waste Disposal	0	632	0	NO	NO	NO	NO					
4.B - Biological Treatment of Solid Waste	0	6	0.44	NO	NO	NO	NO					

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)				Emissions (Gg)				
	Net CO_2 (1) (2)	CH_4	N_2O	HFCs	PFCs	SF_6	Other halogenated gases with CO_2 equivalent conversion factors (3)	Other halogenated gases without CO_2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO_2
4.C - Incineration and Open Burning of Waste	85	17	0.23	NO	NO	NO	NO					
4.D - Wastewater Treatment and Discharge	0	505	5.59	NO	NO	NO	NO					
4.E - Other (please specify)	NA	NA	NA	NA	NA	NA	NA					
5 - Other												
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3												
5.B - Other (please specify)												

Annex E - Key Category Analysis Table

IPCC Category	Greenhouse gas	2015 (Gg CO_2 Eq)	Absolute (Gg CO_2 Eq)	Fraction	Cumulative Total (%)
Energy Industries - Gaseous Fuels	CARBON DIOXIDE (CO_2)	60728.811	60728.811	20.16%	20.16%
Road Transportation	CARBON DIOXIDE (CO_2)	45186.00873	45186.00873	15.00%	35.16%
Direct N_2O Emissions from managed soils	NITROUS OXIDE (N_2O)	20692.29894	20692.29894	6.87%	42.03%
Cement production	CARBON DIOXIDE (CO_2)	20322.76008	20322.76008	6.75%	48.77%
Energy Industries - Liquid Fuels	CARBON DIOXIDE (CO_2)	20013.43152	20013.43152	6.64%	55.41%
Manufacturing Industries and Construction - Gaseous Fuels	CARBON DIOXIDE (CO_2)	16297.7793	16297.7793	5.41%	60.82%
Manufacturing Industries and Construction - Liquid Fuels	CARBON DIOXIDE (CO_2)	15881.85127	15881.85127	5.27%	66.10%
Other Sectors - Liquid Fuels	CARBON DIOXIDE (CO_2)	15591.15343	15591.15343	5.18%	71.27%
Solid Waste Disposal	METHANE (CH_4)	12947.37835	12947.37835	4.30%	75.57%
Enteric Fermentation	METHANE (CH_4)	10634.28908	10634.28908	3.53%	79.10%
Wastewater Treatment and Discharge	METHANE (CH_4)	10494.85378	10494.85378	3.48%	82.58%
Indirect N2O Emissions from managed soils	NITROUS OXIDE (N_2O)	5379.756093	5379.756093	1.79%	84.37%
Manure Management	NITROUS OXIDE (N_2O)	4641.686266	4641.686266	1.54%	85.91%
Natural Gas	CARBON DIOXIDE (CO_2)	4126.9033	4126.9033	1.37%	87.28%
Nitric Acid Production	NITROUS OXIDE (N_2O)	4105.49895	4105.49895	1.36%	88.64%
Rice cultivations	METHANE (CH_4)	4011.909825	4011.909825	1.33%	89.97%
Other Applications (please specify)	HFCs, PFCs	3689.8302	3689.8302	1.22%	91.20%
Iron and Steel Production	CARBON DIOXIDE (CO_2)	3450.3	3450.3	1.15%	92.34%
Aluminium production	PFCs (PFCs)	3166.43712	3166.43712	1.05%	93.39%

IPCC Category	Greenhouse gas	2015 (Gg CO_2 Eq)	Absolute (Gg CO_2 Eq)	Fraction	Cumulative Tota (%)
Other Sectors - Gaseous Fuels	CARBON DIOXIDE (CO_2)	3116.2989	3116.2989	1.03%	94.43%
Oil	CARBON DIOXIDE (CO_2)	2065.545125	2065.545125	0.69%	95.11%
Wastewater Treatment and Discharge	NITROUS OXIDE (N_2O)	1697.976423	1697.976423	0.56%	95.68%
Ammonia Production	CARBON DIOXIDE (CO_2)	1652.881429	1652.881429	0.55%	96.23%
Manufacturing Industries and Construction - Solid Fuels	CARBON DIOXIDE (CO_2)	1416.29504	1416.29504	0.47%	96.70%
Urea application	CARBON DIOXIDE (CO_2)	1350.970867	1350.970867	0.45%	97.15%
Energy Industries - Solid Fuels	CARBON DIOXIDE (CO_2)	1157.79048	1157.79048	0.38%	97.53%
Petrochemical and Carbon Black Production	CARBON DIOXIDE (CO_2)	1023.55	1023.55	0.34%	97.87%
Manure Management	METHANE (CH_4)	1019.520347	1019.520347	0.34%	98.21%
Oil	METHANE (CH_4)	789.230505	789.230505	0.26%	98.47%
Glass Production	CARBON DIOXIDE (CO_2)	726.450795	726.450795	0.24%	98.71%
Road Transportation	NITROUS OXIDE (N_2O)	690.8958902	690.8958902	0.23%	98.94%
Emissions from biomass burning	METHANE (CH_4)	564.8878636	564.8878636	0.19%	99.13%
Aluminum production	CARBON DIOXIDE (CO_2)	359.8224	359.8224	0.12%	99.25%

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