Fourth National Communication on Climate Change

NATIONAL INVENTORY REPORT

Republic of North Macedonia

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UNFCCC National Focal Point

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Abbreviations and acronyms

AFOLU	Agriculture, Forestry and Other Land Use
BUR	Biennial Update Report
BUR1	First Biennial Update Report
BUR2	Second Biennial Update Report
BUR3	Third Biennial Update Report
CC	Climate Change
CHPs	Combined Heat and Power Plants
CLC	CORINE Land Cover
CMC	Center for Management of Crises
CRF	Common Reporting Format
CS	Country Specific
CTA	Chief Technical Advisor
DF	Default Factor
DOC	Degradable Organic Carbon
EC	European Commission
EEA	European Environment Agency
EFDB	Emission Factor Database
EMEP	European Monitoring and Evaluation Programme
EO	Earth Observation
Eurostat	Statistical Office of the European Union
FAOStat	Food and Agriculture Organization of the United Nations Statistical Databases
FFU	Firefighting Union
F-gas	Fluorinated gas
FOD	First Order Decay
FOLU	Forest and Other Land Use
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GSP	Global Support Programme
GWP	Global Warming Potential
IDT	Inventory Development Team
IE	Included elsewhere
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
IST	Imperial Smelt Technology
LPG	Liquefied Petroleum Gas
LU	Land Use
LUCF	Land-Use Change and Forestry
LULUCF	Land Use, Land-Use Change and Forestry
MAFWE	Ministry of Agriculture, Forestry and Water Economy
MAKSTAT	Database of the State Statistical Office of the Republic of North Macedonia
MANU	Macedonian Academy of Sciences and Arts
MCC	Macedonian Chambers of Commerce
MKD	Macedonian Denar

MMR	Monitoring Mechanism Regulation
MMU	Minimum Mapping Unit
MNAV	Macedonian Navigation Agency
MOEPP	Ministry of Environment and Physical Planning
MRV	Measurement, Reporting and Verification
NA	Not Applicable
NACE	Nomenclature of Economic Activities
NC	National Communication
NC1	First National Communication
NC2	Second National Communication
NC3	Third National Communication
NC4	Fourth National Communication
NCCC	National Communication on Climate Change
NCV	Net calorific value
NE	Not estimated
NIR	National Inventory Report
NO	Not Occurring
ODS	Ozone-Depleting Substances
OECD	Organization for Economic Cooperation and Development
PV	Photovoltaic
QA	Quality Assurance
QAT	Quality Assurance Team
QC	Quality Control
RCESD	Research Center for Energy and Sustainable Development
RS	Remote Sensing
SAR	Second Assessment Report
SSO	State Statistical Office
SWDS	Solid Waste Disposal Sites
T1	Tier 1
T2	Tier 2
TWG	Technical Working Group
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USA	United States of America
USD	United States Dollar
MOE	Ministry of Economy

Chemical symbols

$CaCO_3$	Limestone
$CaMgCO_3$	Dolomite
CH_4	Methane
$CO(NH_2)_2$	Urea
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2-eq	Carbon Dioxide equivalents
$HCO3^-$	Bicarbonate
HFCs	Hydro Fluorocarbons
N	Nitrogen
N_2O	Nitrous Oxide
Na_2CO_3	Sodium carbonate
NH_3	Ammonia
NH_4^{+2}	Ammonium
NMVOC	Non-Methane Volatile Organic Compound,
NO_3^-	Nitrate
NOx	Nitrogen Oxides
OH^-	Hydroxyl ion
PFCs	Per Fluorocarbons
SF_6	Sulphur hexafluoride
SO_2	Sulphur Dioxide
SO_x	Sulphur Oxides

Units and Metric Symbols

UNIT	Name	Unit for
g	gram	mass
W	watt	power
J	joule	energy
m	meter	length
Wh	watt hour	energy
toe	ton of oil equivalent	energy
Mass Unit Conversion		
1g		
1kg	= 1 000 g	
1t	= 1 000 kg	= 1 Mg
1kt	= 1 000 t	= 1 Gg
1Mt	= 1 000 000 t	= 1 Tg

Metric Symbol	Prefix	Factor
P	peta	10^{15}
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
h	hecto	10^{2}
da	deca	10^{1}
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
µ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}

Executive summary

As a Party to the United Nations Framework Convention on Climate Change (UNFCCC), the Republic of North Macedonia (Macedonia) committed to developing an Inventory of the anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHGs), as a part of its National Communications (NCs) on Climate Change and Biennial Update Reports(BURs). So far, the country has submitted to the UNFCCC three National Communications and three Biennial Update Reports. This National Inventory Report (NIR) edition will be part of the Fourth National Communication (NC4).

The first national GHG inventory was developed under the First National Communication (NC1) for the period 1990 – 1998. Under the Second National Communication (NC2), the emissions reported in NC1 were revised (using better activity data) and extended to cover the period 1999 – 2002 (Figure 5). In the Third National Communication (NC3), the GHG inventory considered emissions from 2003 – 2009. The GHG emissions in these reports were estimated following the 1996 Revised IPCC Guidelines for National Greenhouse Gas Inventories and the 2000 IPCC Good Practice Guidance. In the First Biennial Update Report (BUR1), the inventory was produced using the IPCC Inventory Software, in compliance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Due to the improvement of the method used for emissions estimation (from 1996 to 2006 IPCC Guidelines), the time series reported in the previous inventories (for period 1990 - 2009) were recalculated and extended to consider the period 2010 – 2012. The same approach was used in the subsequent Biennial Update Reports (BURs), expanding the GHG inventory to include the years 2013 and 2014 under the Second BUR (BUR2) and the years 2015 and 2016 under the Third BUR (BUR3). In BUR2, the emissions for 2012 were recalculated using the most recent available data. In BUR3, the data sources were revised due to some gaps identified in the previous BUR, and the whole time series were recalculated to maintain consistency.

The inventory activities under the Fourth National Communication (NC4) continue the work done in the previous BURs and include developing the GHG inventory for 2017, 2018, and 2019. The inventory was prepared following the 2006 IPCC Guidelines and using the IPCC Inventory Software (version 2.691 – from January 23, 2020). Due to the change of the methodology for land use and land-use changes, and newly available sources of information, another recalculation was made of the whole time series reported in the BUR3.

The inventory covers sources of greenhouse gas emissions and removals by sinks grouped under four main sectors: Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU), and Waste, disaggregated by categories and subcategories. It includes a database for the major GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs). The inventory also covers the indirect greenhouse gases: carbon monoxide (CO), oxides of nitrogen (NO_X), and non-methane volatile organic compounds (NMVOCs), sulphur dioxide (SO_2), and ammonia (NH_3). The emissions of sulphur hexafluoride (SF6) are not estimated for Macedonia due to the lack of activity data.

The national inventory process includes the following key players:

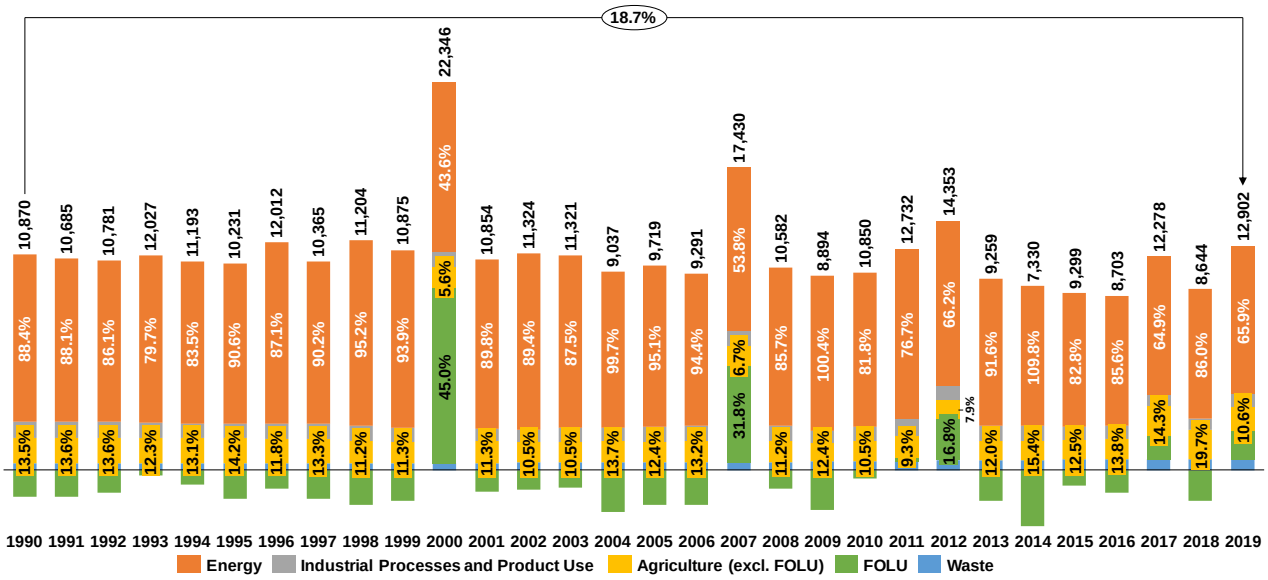
- **Ministry of Environment and Physical Planning**, responsible for supervising the national inventory process and reporting the emissions to UNFCCC and also for other international reporting;
- **GHG Inventory Development Team**, composed of the team from the Macedonian Academy of Sciences and Arts (MANU team) and AFOLU team from the University of Ss. Cyril and Methodius (UKIM) - Institute of Agriculture, Hans Em Faculty of Forest Sciences, Landscape Architecture and Environmental Engineering, Faculty of Agricultural Sciences and Food;
- **Data Suppliers**, with State Statistical Office being the most important data source;
- **Verification Team,** which includes experts working on Quality Control, as well as experts working on Quality Assurance. The last is also ensured by multilayer structure involving CTA, NCCC and GSP.

The preparation of the national GHG inventory is project based, supported by Global Environment Facility (GEF) and United Nations Development Program (UNDP). The estimated emissions in the inventory are transparent and publicly available within the national climate change platform www.klimatskipromeni.mk, open data portal (data.gov.mk) and UNFCCC web site. This also contributes to transparency in reporting of climate data required under Article 13 of the Paris Agreement.

The aggregate GHG emissions and removals (net emissions) in 2019 are estimated to be 12902 Gg CO_2-eq (including the FOLU sector) (Figure 1). Figure 1 shows the time series of emissions and removals (given in CO_2-eq) from 1990 to 2019. There are significant fluctuations in the net emissions in 2000, 2007, 2012, 2017,

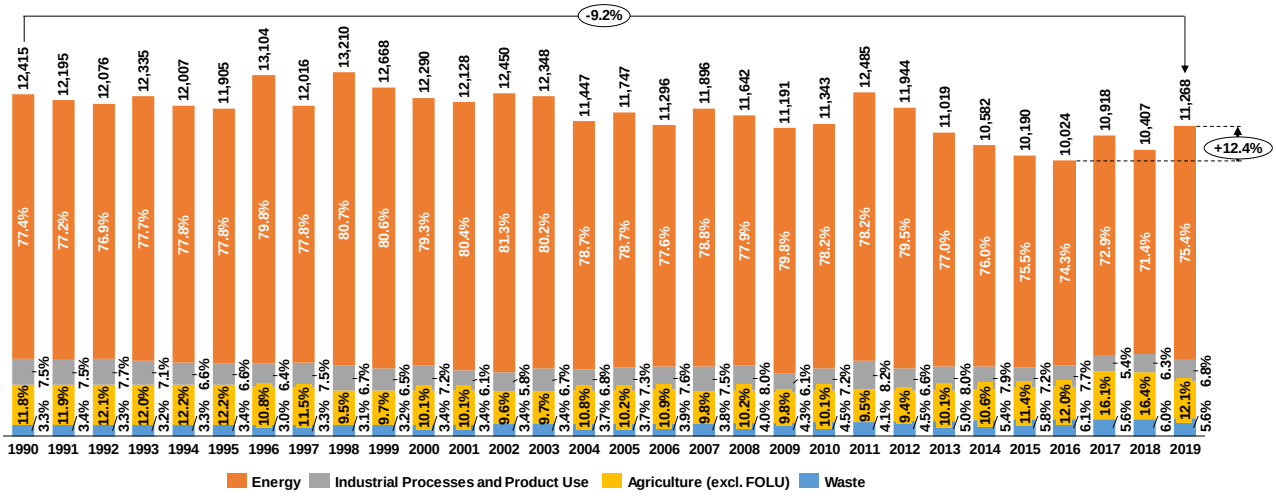
and 2019, where one can notice increased emissions in the FOLU sector (instead of removals) due to the intensified forest fires/wildfires. The net GHG emissions in 2019 increased by 18.7% compared to 1990, or 48.2% compared to 2016, mainly because instead of sinks, emissions occur from the forestry sector.

Figure 1. GHG emissions and removals by sector (in Gg CO2-eq)



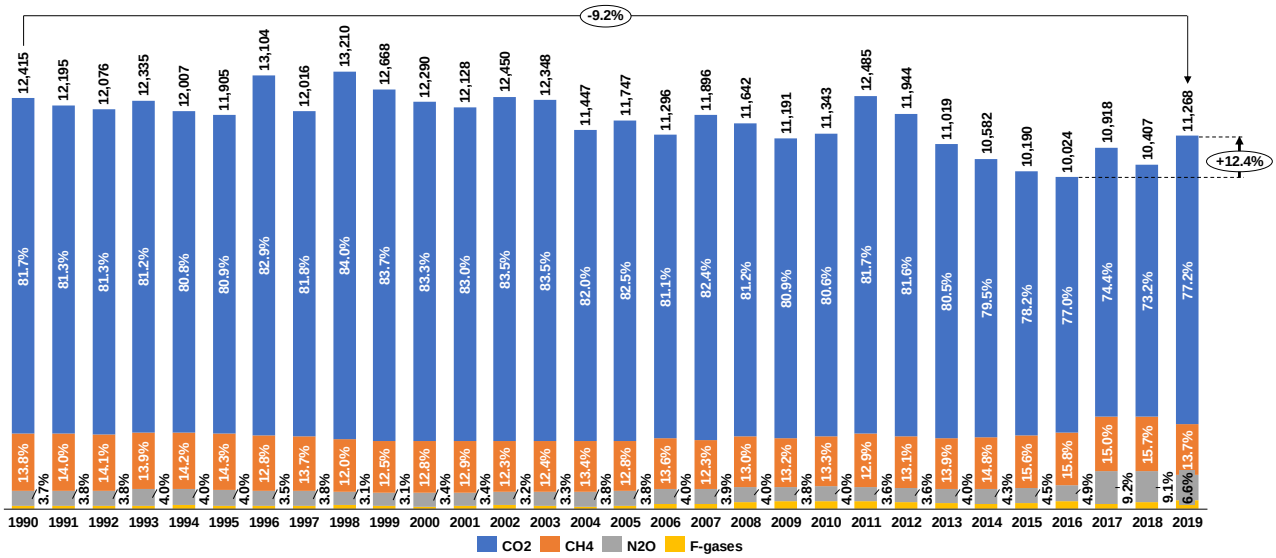
If the removals (or emissions, in years with forest fires) from the FOLU sector are not accounted for, the total GHG emissions in 2019 are 11268 Gg CO_2-eq (Figure 2). The most significant share of emissions is from the Energy sector, accounting for 75.4% in 2019, followed by the Agriculture (excluding FOLU) with 12.1%, IPPU sector with 6.8% and the Waste sector with 5.6% share. The dominant share of emissions for the Energy sector is evident throughout the whole time series. When excluding FOLU, the emissions in 2019 are reduced by 9.2% competed to 1990. In general, since 2012, a decreasing trend of emissions is evident, reaching the lowest level of 10024 Gg CO_2-eq in 2016, despite minor variations in 2017 and 2019, due to increased domestic electricity production instead of import.

Figure 2. Total GHG emissions by sector, excluding FOLU sector (in Gg CO_2-eq)



Analyzing the GHG emissions by gas (excluding the FOLU sector), it is evident that the most dominant are the CO_2 emissions (Figure 3). Their share accounts for 77.2% in 2019, followed by the CH_4 emissions with 13.7%, then N_2O emissions with 6.6%, and all F-gasses with 2.5%.

Figure 3. Total GHG emissions by gas, excluding FOLU (in Gg CO_2-eq)



The GHG inventory in the Energy sector accounts for the emissions released as a result of fuel combustion activities and the fugitive emissions from extraction of solid and transmission and distribution of liquid and gaseous fuels. In this report, the emissions have been calculated by two methods: Reference approach (top-down) - using the apparent fuel consumption to account for the carbon flows into and out of the country and Sectoral approach - accounting for the fuel consumption by sectors. The estimated CO_2 emissions with the Reference approach are 7,163 Gg CO_2 in 2018 and 8,202 Gg CO_2 in 2019.

The Sectoral approach emissions are divided into the following categories: Energy Industries, Manufacturing Industries and Construction, Transport, Other sectors (Commercial/Institutional, Residential and Agriculture/Forestry/Fishing) and Non-Specified. In addition, the Fugitive emissions from extraction of lignite, oil refining, and transmission of natural gas have been calculated. Therefore, the overall GHG emissions in the Energy sector are 7,429 Gg CO_2-eq in 2018 and 8,501 Gg CO_2-eq in 2019. Most of the GHG emissions in 2019 occur in the category Energy Industries (54%), followed by Transport (27.7%) and Manufacturing Industries and Construction (12.6%). The other two categories together accounted for nearly 4% of the total emissions in 2019, and the remaining less than 2% are Fugitive emissions. Almost all of the GHG emissions in 2019 are CO_2 emissions (96.5%), and CH_4 and N_2O emissions amount to only 2.8% and 0.7%, respectively.

The GHG emissions in the IPPU sector in Macedonia come either from the manufacturing industries or the usage of ozone-depleting substances (ODS) substitutes for refrigeration and air-conditioning. Until 2000, the metal industry was a dominant source of emissions, mainly from ferroalloy production. After 2000, the ODS substitutes usage in the country started to increase, so the share of the Metal industry emissions in total IPPU sector emissions decreased considerably (from 64% in 1990 to 21% in 2016 and nearly 12% in 2019). At the same time, the Mineral industry emissions have been fluctuating over the inventory period, showing a slightly increasing trend in the last years. In the last three reporting years, the product uses as ODS substitutes had grown by around 20% (relative to 2016), resulting in a share of about 36% of the IPPU sector emissions in 2019. However, the dominant share had the Mineral industry with 48% in 2016, 64% in 2017, 58% in 2018, and around 52% in 2019. Emissions from the other categories, like the Chemical industry, Non-Energy Products from Fuels and Solvent Use, Electronics Industry and Other Product Manufacture and Use do not occur in the country.

The level of the overall greenhouse emissions from this sector is consistent throughout the entire reporting period, 1990 – 2019. The overall emissions from the IPPU sector achieved 763 Gg CO_2-eq, representing a decrease of 18.2% relative to 1990, or a minor reduction of 0.7% compared to 2016.

The GHG emissions from the AFOLU sector include emissions associated with Livestock, Forestry, and Land Use. Activities related to Livestock production emit CH_4 and N_2O. Additionally, N_2O is emitted due to manure storage and processing (management). Total AFOLU emissions vary from 11300.4 Gg CO_2-eq in 2000 to the lowest -2125.1.3 Gg CO_2-eq in 2014, followed by significant variations for the period 2015 to 2019, which is mainly the result of the year to year changes of emissions in forestland. The main source of AFOLU emissions is the livestock sector. Cattle are the primary source of GHG among the ruminants. The majority of

methane emission arouses from enteric fermentation (approx. 80%), while manure management contributes only 15-18% of the total CH_4.emissions.

The forestry sector is the major contributor of GHG sinks in the country within the Land subsector of AFOLU, except for several years when due to forest fires (burned areas), emissions from this category of land use were significantly above the annual average. The forestland area, the species composition (conifers, broadleaved, mixed), and the annual increment and removals from the forests are relatively stable. Land as part of AFOLU, and more specifically Forestland, are significant sinks of GHG in most cases. In some years of the reporting period, like in 2005 (-2230.5 Gg CO_2-eq), 2014 (-3382.2 Gg CO_2-eq), and 2018 (-2255.4 Gg CO_2-eq), removals are notable. At the same time, years with significant numbers of forest fires and large burned areas of forest contribute to an increase in GHG emissions (2000 with 9842.7 Gg CO_2-eq, 2017 with 1133.2 Gg CO_2-eq, and 2019 with 1059.59 Gg CO_2-eq).

The other land use, like Cropland, Grassland, Settlements, and Other land, participate in the emission of CO_2. In some periods, like 2016-2019, it can be considered a significant GHG emissions source. These emissions mainly result from the conversion from one land use category to another, when significant amounts of above and below-ground biomass are rapidly removed and is considered a direct loss. For the other areas, which remain under the same land use category, gains and losses are in balance (Tier 1) and are considered carbon neutral.

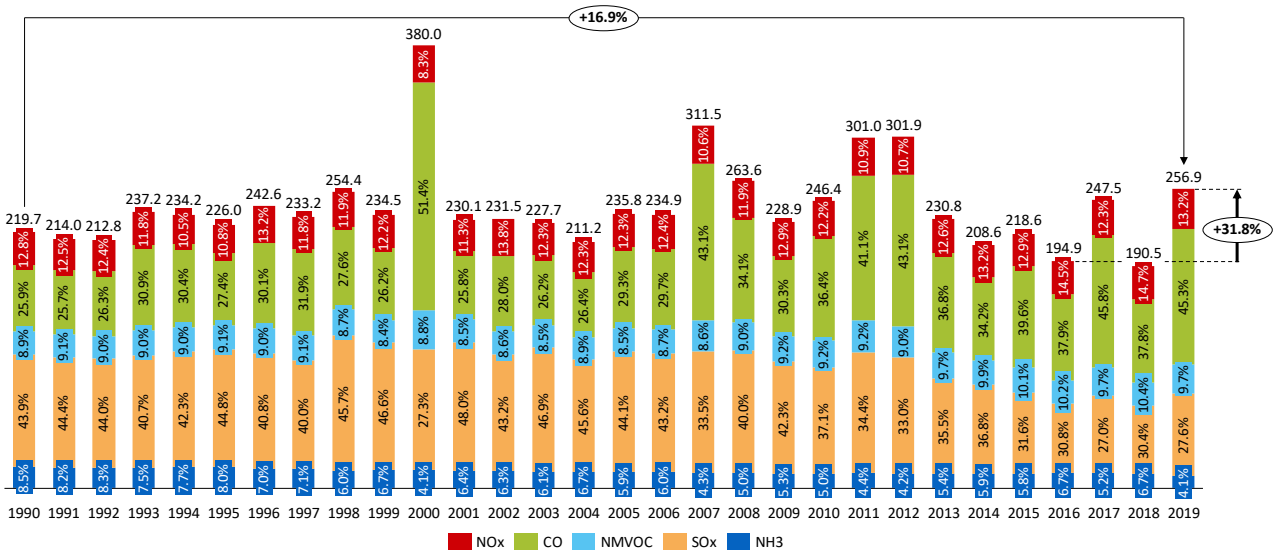
For the non-CO_2 sources of GHG, it can be concluded that numerous management practices and inputs result in a significant amount of GHG emissions, which, when summed up, differ in a wide range for specific periods. In the period 1990-2016, the total emissions of GHG vary from 307.8. Gg CO_2-eq in the year 2000 up to 369.1 Gg CO_2-eq in 2016. In the last three years of the analyzed period (2017-2019), there has been a severe increase in emissions from non-CO_2 sources, especially in the categories: direct and indirect emissions from managed soils and manure management. There are no extreme changes in the overall emissions trend for the other two categories of non-CO_2 emissions, urea application, and rice cultivation. Managed soils are a significant source of non-CO_2 gases, which contribute to the total AFOLU CO_2-eq emissions (excluding sinks from Forestry) starting from 17.11% in 2000 up to 29.37 % in 2017.

The categories reported under the Waste sector are Solid Waste Disposal, Biological Treatment of Solid Waste, Incineration and Open Burning of Waste, and Waste Water Treatment and Discharge. The data categorization format is consistent with previous years in order to preserve the existing time series, except in sectors where data was introduced for the first time.

The calculations show that the Waste sector is one of the sectors with an increasing GHG emissions trend, achieving 635 Gg CO_2-eq in 2019, which is 56% more than the 1990-level or nearly 5% more than the 2016-level. Out of all the sectors, the Solid Waste Disposal category's emissions are most significant, with almost 80% of the total GHG emission in 2019. The second category with considerable GHG emissions is Wastewater Treatment and Discharge, which participates for around 17% in 2019. Incineration and open burning of waste contributed to 3.6% of the total Waste sector emissions in the last five reported years. The CH_4 and N_2O emissions from the Biological Treatment of Solid Waste category do not contribute essentially to the overall emissions due to the small amount of reported composted waste. Around 92% of the GHG emissions are CH_4 in the last three reporting years, while N_2O and CO_2 participate with 7% and 1%, respectively.

The Precursors and indirect emissions have been estimated in line with the EMEP/EEA Emission Inventory Guidebook, in a consistent, complete and comparable manner for the entire inventory period 1990 – 2019. The results for precursors and indirect emissions show that in 2019 they increased by 16.9% and 31.8% compared to 1990 and 2016, respectively (Figure 4). On average, the emissions are around 200 Gg/year, but there are peaks in 2000, 2007, 2008, 2011, and 2012 mainly due to forest fires. The highest numbers are estimated for 2000, 380 Gg. SO_2 participates with around 50% over the entire reporting period. Still, its shares have been below 40% in the last five years, resulting from the reduction in electricity production from lignite and fuel change (oil for heat production is replaced with natural gas). CO is the second contributor, participating with around 30%, peaking in the years with more forest fires and increasing in the last years due to the increased road transportation. Starting from BUR3, the emissions of NH_3 are reported in the inventory, which participate with around 6% during the reporting period.

Figure 4. Emissions of NOx, CO, NMVOC, SO_2 and NH_3 (in Gg)



The assessment of the sectoral precursors and indirect emissions shows that during the entire reporting period, the Energy sector is the most significant contributor in all of them except in NH_3. In 2019, this sector was a source of almost all SO_2 and NO_x emissions, 99.1 and 91.7%, respectively. At the same time, the energy sector participates with 54.6% in CO and 60.6% in NMVOC. AFOLU is the second contributor with around 94% share in NH_3, 33.4% in NMVOC, and 40.4% in CO. Waste participates with 3.7% in CO primarily due to open burning of waste.

The analysis of key categories that contribute the most to the absolute level of national emissions and removals (level assessment) and to the trend of emissions and removals (trend assessment) is conducted using Approach 1. According to this approach, key categories are identified using a pre-determined cumulative emissions threshold. Key categories are considered those that add up to 95% of the total level/trend when summed together in descending order of magnitude.

The level assessment is performed for 1990 as a base year and 2019 as the latest year. The categories with the highest (absolute) values of Gg CO_2-eq (both emissions and removals) include Energy Industries – Solid Fuels (31%) (Energy sector), Road Transportation (17.5%) (Energy sector), Forest Land Remaining Forest Land (8.7%) (AFOLU sector), Enteric Fermentation (4.8%) (AFOLU sector), Solid Waste Disposal (3.9%) (Waste sector) and Manufacturing Industries and Construction – Solid Fuels (3.9%) (Energy sector). Usually, the Forest land category is relevant for sinks, but the estimates for 2019 show emissions from this category due to forest fires/wildfires.

The trend assessment of source categories is executed, taking 1990 as the base year and 2019 as the latest inventory year. The purpose of this trend assessment is to emphasize the categories whose trend is significantly different from the trend of the overall inventory, regardless of whether the category trend is increasing or decreasing or is a sink or source. The results show that the Energy Industries-solid fuels participate with 25.7%, followed by Forest Land Remaining Forest Land with 19.4%, Road Transportation with 11%, Manufacturing Industries and Construction – Liquid Fuels with 8.5%, and Other Sectors –Liquid Fuels with 5.1%.

The uncertainty analysis is again conducted using **both methods**, Approach 1 (Error Propagation method) and Approach 2 (which is actually an implementation of the Monte Carlo method), for **each sector** of the inventory for 2017, 2018 and 2019. IPCC software was used for the first approach, while for the second one, the MATLAB model developed in BUR2 was applied.

The Macedonian approach towards **QA/QC activities** in the national GHG inventory process is based on the in-depth analyses of the current practices of the inventory compilation in the country and the relevant international best practices. The resulting **QA/QC plan** developed within the BUR1, with the extension of QA activities within the energy sector from the BUR2, was applied in the inventory process of the BUR3 and in the preparation of this inventory. This QA/QC plan has proved effective in achieving QA/QC objectives, and as such, is planned to be implemented for the inventory processes in the future National Communications on Climate Change and Biennial Update Reports.

This report also outlines by sector the **good practices, improvements and recommendations for future inventories**, regarding activity data collection, level of disaggregation, consistency and quality of the activity data, as well as application of more sophisticated methods for emissions estimates.

1 Introduction

As a Party to the United Nations Framework Convention on Climate Change (UNFCCC), the Republic of North Macedonia (Macedonia) committed to developing an Inventory of the anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHGs), as a part of its National Communications on Climate Change and Biennial Update Reports. So far, the country has submitted to the UNFCCC three National Communications and three Biennial Update Reports. This National Inventory Report (NIR) edition will be part of the Fourth National Communication (NC4).

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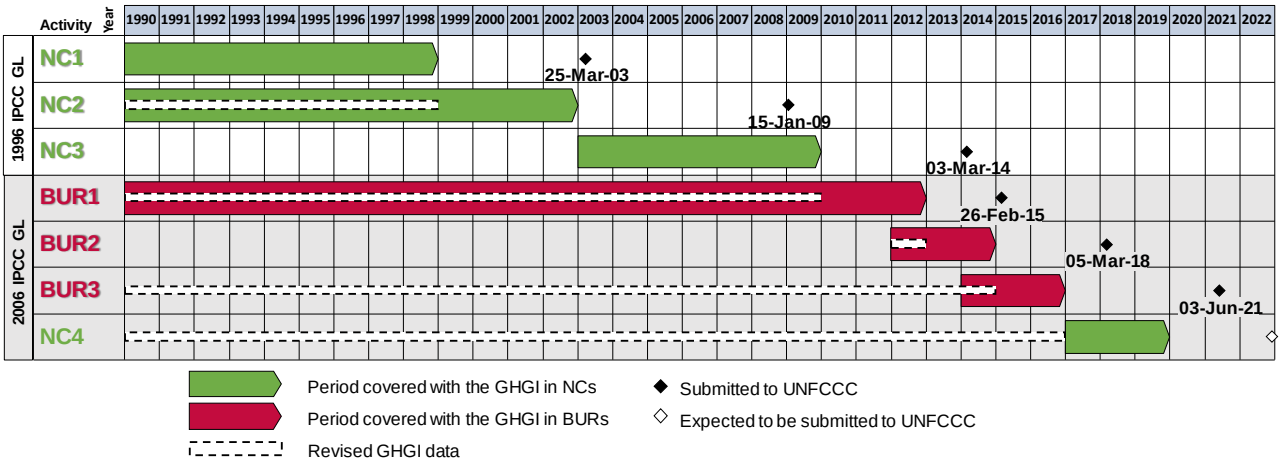
The inventory activities under the Fourth National Communication (NC4) continue the work done in the previous BURs and include developing the GHG inventory for 2017, 2018, and 2019. The inventory was prepared following the 2006 IPCC Guidelines and using the IPCC Inventory Software (version 2.691 – from January 23, 2020). Due to the change of the methodology for land use and land-use changes, and newly available sources of information, another recalculation was made of the whole time series reported in the BUR3.

Figure 5. Development of the GHG Inventories of as part of the reporting documents to UNFCCC



Note: NC = National Communication, BUR = Biennial Update Report; GHGI = Greenhouse Gases Inventory

The inventory covers sources of greenhouse gas emissions and removals by sinks grouped under four main sectors: Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU), and Waste, disaggregated by categories and subcategories. It includes a database for the major GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs). The inventory also covers the indirect greenhouse gases: carbon monoxide (CO), oxides of nitrogen (NO_X), and non-methane volatile organic compounds (NMVOCs), sulphur dioxide (SO_2),

and ammonia (NH_3). The emissions of sulphur hexafluoride (SF_6) are not estimated for Macedonia due to the lack of activity data.

The data used for the preparation of national inventory are primarily taken from official national documents such as statistical yearbooks, energy balances, sectoral reports and MAKSTAT database from the State Statistical Office (SSO), various strategies and annual reports from relevant institutions, like the Ministry of Environment and Physical Planning (MOEPP), Ministry of Agriculture, Forestry and Water Economy (MAFWE), etc., and various international databases such as UN projections for population and FAOStat.

This National Inventory Report consists of 12 chapters. The first (introductory) chapter provides background information on the inventory process, and the second chapter presents the methodologies used for the GHG emission estimates. An overview of the trends of overall GHG emissions and removals by sinks in Macedonia is given in Chapter 3, while detailed elaboration by sector is presented from Chapter 4 to Chapter 7. The information on precursors and indirect emissions are provided in Chapter 8. The analysis of key categories of emissions and removals (level and trend assessment) was also conducted, and presented in Chapter 9. The uncertainty analysis, conducted for 2017, 2018, and 2019 using both methods (the Error Propagation and the Monte Carlo) for each inventory sector is presented in Chapter 10. IPCC software was used for the first approach, while for the second one, the MATLAB model developed in BUR2 was applied

The Macedonian approach towards QA/QC activities in the national GHG inventory process is based on the in-depth analyses of the practices of the inventory compilation in the country and the relevant international best practices. The current QA/QC plan was initially developed in the BUR1 and extended with QA activities for the energy sector in BUR2. This QA/QC plan was applied to the BUR3 inventory process and to prepare this inventory. Detailed information on the QA/QC procedures is provided in Chapter 11.

Chapter 12 outlines the good practices and improvements made in the inventory process by sector. The recommendations regarding the data collection, level of disaggregation, consistency, and quality of the activity data, and the application of more sophisticated methods for emissions estimates that should be considered in subsequent inventories are summarized in an Improvement plan.

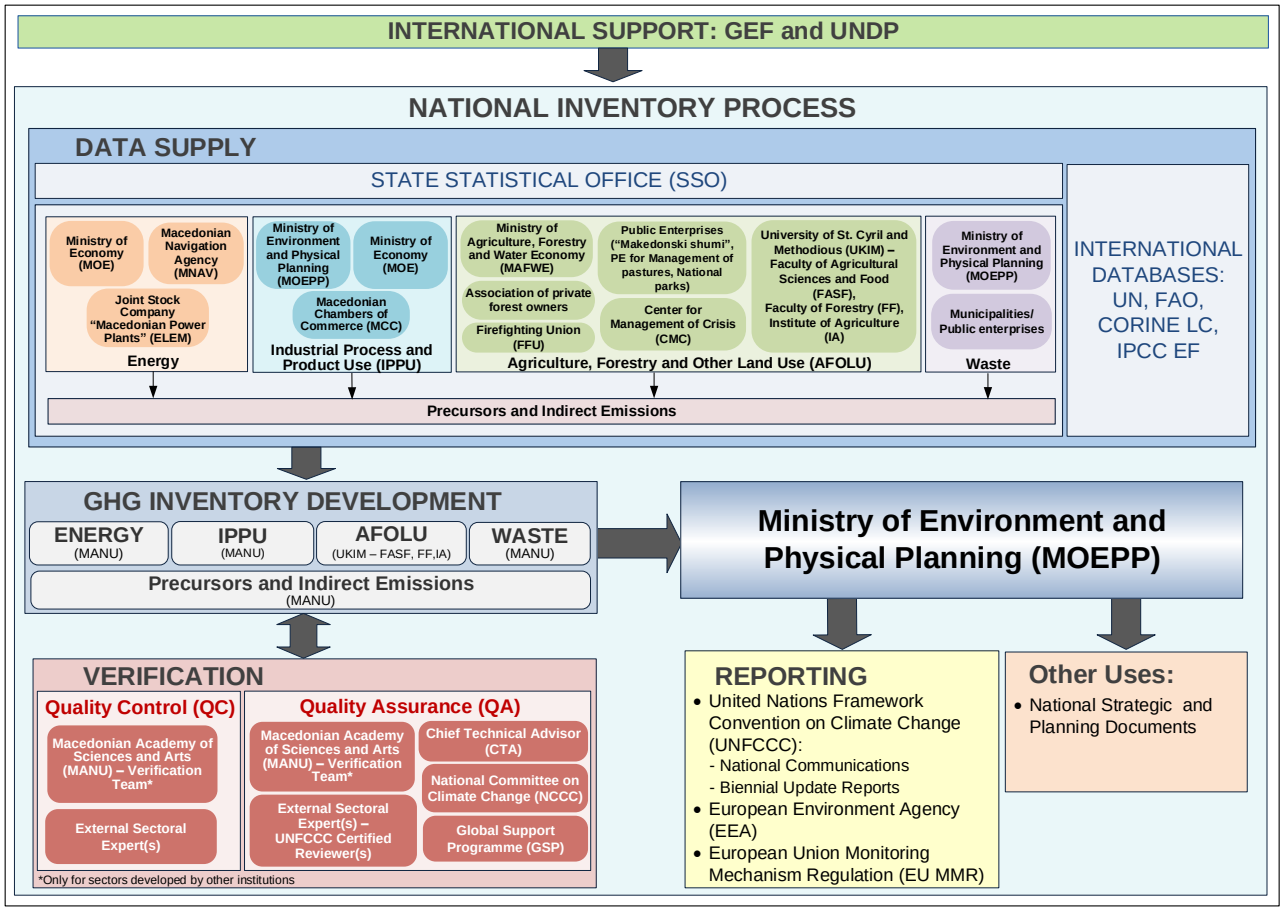
The national inventory process (Figure 6) includes the following key players:

- **Ministry of Environment and Physical Planning**, responsible for supervising the national inventory process and reporting the emissions to UNFCCC and also for other international reporting;
- **GHG Inventory Development Team**, composed of the team from the Macedonian Academy of Sciences and Arts (MANU) and AFOLU team from the University of Ss. Cyril and Methodius (UKIM) - Institute of Agriculture, Hans Em Faculty of Forest Sciences, Landscape Architecture and Environmental Engineering, Faculty of Agricultural Sciences and Food;
- **Verification Team,** which includes experts working on Quality Control, as well as experts working on Quality Assurance. The last is also ensured by multilayer structure involving CTA, NCCC and GSP.

During the development of this NIR, the Ministry of Environment and Physical Planning has been developing new legislation (i.e., The Law on Climate Action and its secondary legislation – the Decree on GHG Inventory System and the Rulebook on GHG reporting), that should establish a legally binding inter-institutional coordination mechanism for reporting of GHG emissions. The draft versions of legal acts had been prepared but not officially adopted when this NIR was finalized.

So far, the preparation of the national GHG inventory is project-based, supported by Global Environment Facility (GEF) and United Nations Development Programme (UNDP). The estimated emissions in the inventory are publicly available within the national climate change platform www.klimatskipromeni.mk, open data portal (data.gov.mk) and UNFCCC website. This also contributes to transparency in reporting of climate data required under Article 13 of the Paris Agreement.

Figure 6. National inventory process



2 Methodology

The Greenhouse gas Inventory was prepared following the 2006 IPCC National GHG Inventory Guidelines, using the IPCC Inventory Software version 2.691 (from on 23 January 2020, as the latest version available at the time of the preparing the Inventory). In line with the guidelines, the GHG emissions and removals estimates are divided into following main sectors:

- Energy
- Industrial Processes and Product Use (IPPU)
- Agriculture, Forestry and Other Land Use (AFOLU)
- Waste
- Other (e.g., indirect emissions from nitrogen deposition from non-agriculture sources)

Each sector comprises individual categories and subcategories, so the national inventory was developed at subcategory level.

The inventory covers the GHGs CO_2, CH_4, N_2O, PFCs and HFCs and precursors and indirect emissions of: CO, NO_x, NMVOC, SO_2 and NH_3. The emission of SF_6 is not estimated for Macedonia due to the unavailability of activity data.

In the IPCC Guidelines, the GHG estimation methods are divided into three tiers: Tier 1 is for the "default method", which is the simplest and is usually applied when no country-specific emission factors are available; Tier 2 method uses the same procedure as Tier 1 methods, but incorporate emission factors and/or parametric activity data that are specific to the country or at least one of its regions and Tier 3 is reserved for country-specific methods (models, censuses, and others). In the preparation of Macedonia's National Inventory, the Tier 2 method was applied for CO_2 emission factors for lignite, residual fuel oil and natural gas for Fuel combustion activities in Energy sector. Tier 2 was also used in IPPU sector for emission factors in Mineral industry, for cement production and in Metal industry, for Iron and steel production and Ferroalloys production. The Waste sector is another sector with Tier 2 application, through IPCC FOD method and taking into account the country-specific activity data on waste disposal at solid waste disposal sites (SWDS) and the historical data on GDP and population. For the other sectors the default method, Tier 1, was used. The methods applied in the preparation of this national GHG inventory under NC4, are summarized in Appendix I (section A I.2, Table 95).

To facilitate aggregate reporting of GHG values, expressed as carbon dioxide equivalents (CO_2-eq) the global warming potentials (GWPs) values provided in the IPCC AR4 (temporal horizon 100 years) were used (see Table 1). According to the Decision 17/CP.8, all non-Annex-I countries should estimate their GHG emissions using GWPs from the IPCC Second Assessment Report, since Macedonia is EU-candidate country*, during the preparation of the GHG inventory under the BUR3, it was decided to use GWPs from IPCC AR4. The same GWPs are used for the preparation of this inventory.

Table 1. Global warming potential values used in the preparation of the GHG Inventory (100 years time horizon)

Gas	CO_2 equivalent
CO_2	1
CH_4	25
N_2O	298

Gas	CO_2 equivalent
CF_4	7390
C_2F_6	12200
HFC-23	14800
HFC-32	675
HFC-125	3500
HFC-134a	1430
HFC-152a	124
HFC-143a	4470
HFC-227ea	3220
HFC-236fa	9810

Source: IPCC Fourth Assessment Report (AR4), 2007

*Note from UNFCC Common Metrics *"In 2013, under the framework of the UNFCCC reporting guidelines on annual inventories for Annex I Parties, the COP, by decision 24/CP.19, decided that, from 2015, the GWPs used to calculate the CO_2 equivalence of emissions and removals of GHGs shall be, also those listed in the column entitled "Global warming potential for given time horizon" in table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the IPCC, based on the effects of GHGs over a 100-year time horizon."*

The estimates of precursors and indirect emissions (including indirect NH_3 emissions) are based on the EMEP/EEA Emission Inventory Guidebook, 2019. The calculation is performed using the same activity data as for GHG estimations. The tables used for the emission factors are referenced in the subchapters by sectors in Chapter 8. The estimations for all sectors is done using the Tier 1 approach, except for the category Biological treatment of waste – composting in the Waste sector for which Tier 2 emission factors are applied. The higher Tier methodologies require detailed characteristics of the fuels used in combination with onsite measurements or other detailed parameters, which were not available at the time of preparation of this inventory

3 Emission trends

This section gives an overview of the trends of GHG emissions and removals by sinks in North Macedonia. The GHG Inventory covers the period 1990 – 2019. The last reported year in the previous National Inventory report under the BUR3 was 2016. In this report, the emissions estimates were made for the years 2017, 2018 and 2019. Additionally, the emissions for 1990, 2000, 2005, 2014, 2015 and 2016 are given, as years reported in the previous submissions (NCs and BURs) to UNFCCC. More detailed information on the GHG emissions and removals for each sector are provided in the subsequent sections (Chapter 4 to Chapter 7). The precursors and indirect emissions are separately presented and elaborated by sectors in Chapter 8.

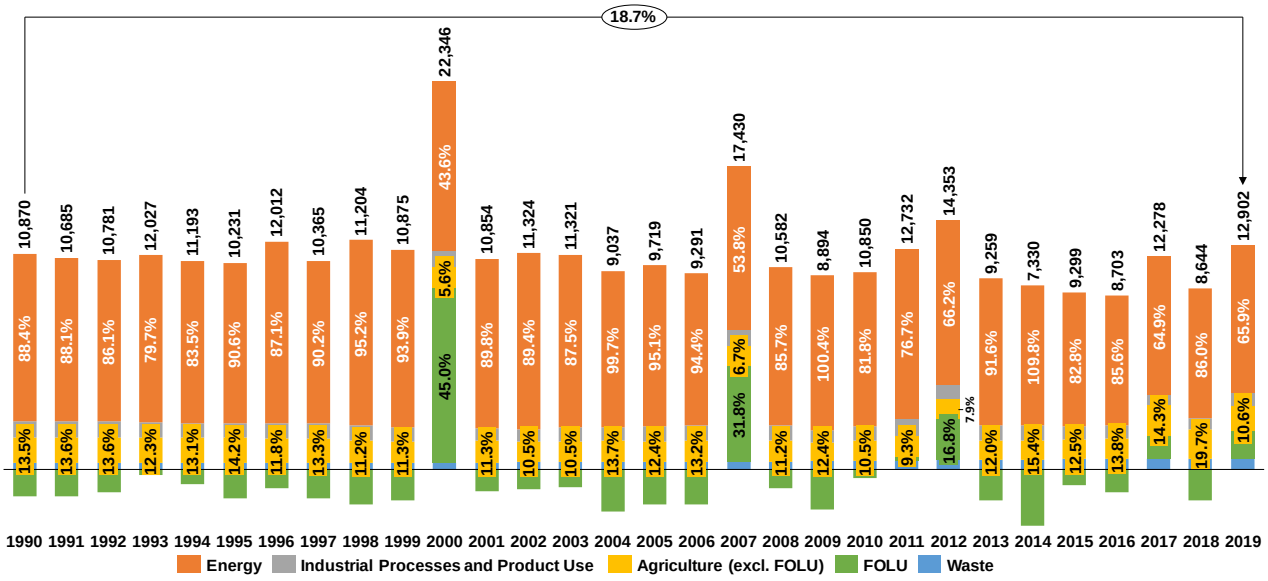
3.1 Aggregate GHG emissions

The aggregate GHG emissions and removals (net emissions) in 2019 are estimated to be 12902 Gg CO_2-eq (including the FOLU sector) (Table 2). Figure 7 shows the time series of emissions and removals (given in CO_2-eq) from 1990 to 2019. There are significant fluctuations in the net emissions in 2000, 2007, 2012, 2017, and 2019, where one can notice increased emissions in the FOLU sector (instead of removals) due to the intensified forest fires/wildfires. The net GHG emissions in 2019 increased by 18.7% compared to 1990, or 48.2% compared to 2016, mainly because instead of sinks, emissions occur from the forestry sector. However, in recent years, minor variations in the emissions are noticeable for the other sectors, explained more in the subsequent chapters for each sector.

Table 2. GHG emissions and removals by sector (in Gg CO_2-eq)

Sector	1990	2000	2005	2014	2015	2016	2017	2018	2019
Energy	9608.0	9744.4	9247.3	8045.1	7697.0	7446.5	7964.1	7429.5	8501.1
Industrial Processes and Product Use	932.2	888.4	861.7	835.9	734.2	768.3	587.7	651.2	763.0
Agriculture (without FOLU)	1468.2	1244.3	1203.1	1126.9	1163.9	1202.6	1755.1	1704.4	1368.3
FOLU	-1545.5	10056.1	-2027.9	-3252.0	-890.2	-1320.6	1359.7	-1762.9	1634.4
Waste	406.7	412.7	435.2	573.8	594.6	606.7	611.0	621.5	635.2
Total (incl. FOLU) – Net emissions	**10869.6**	**22345.9**	**9719.4**	**7329.7**	**9299.4**	**8703.5**	**12277.7**	**8643.7**	**12901.9**
Total (excl. FOLU)	**12415.1**	**12289.8**	**11747.3**	**10581.6**	**10189.6**	**10024.1**	**10918.0**	**10406.6**	**11267.6**

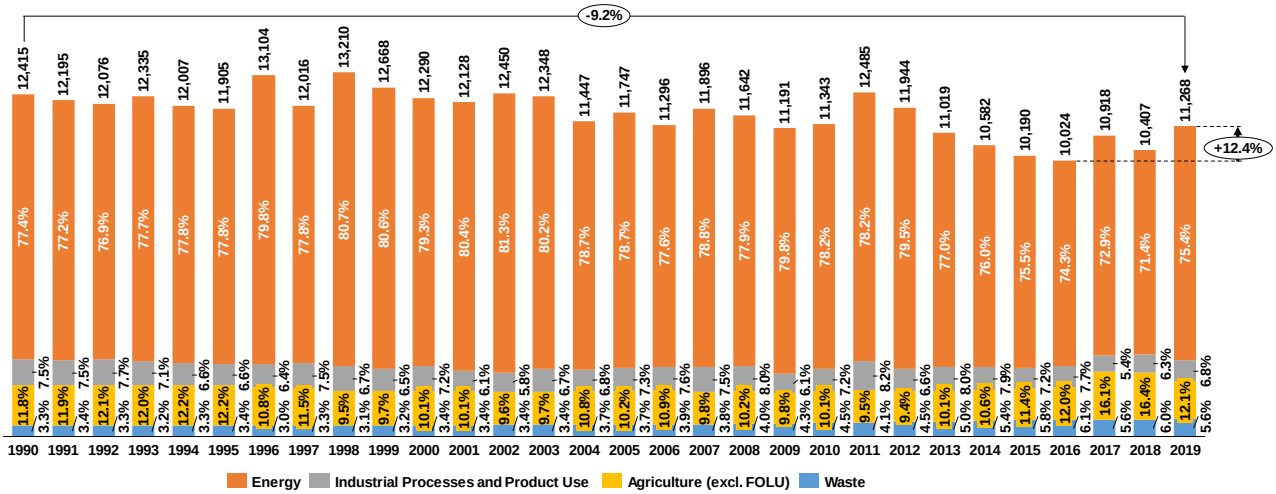
Figure 7. GHG emissions and removals by sector (in Gg CO2-eq)



If the removals (or emissions, in years with forest fires) from the FOLU sector are not accounted for, the total GHG emissions in 2019 are 11268 Gg CO_2-eq (Figure 8). The most significant share of emissions is from the Energy sector, accounting for 75.4% in 2019, followed by the Agriculture (excluding FOLU) with 12.1%, IPPU sector with 6.8% and the Waste sector with 5.6% share. The dominant share of emissions for the Energy sector is evident throughout the whole time series. When excluding FOLU, the emissions in 2019 are reduced

by 9.2% competed to 1990. In general, since 2012, a decreasing trend of emissions is evident, reaching the lowest level of 10024 Gg CO_2-eq in 2016, despite minor variations in 2017 and 2019, due to increased domestic electricity production instead of import.

Figure 8. Total GHG emissions by sector, excluding FOLU sector (in Gg CO_2-eq)



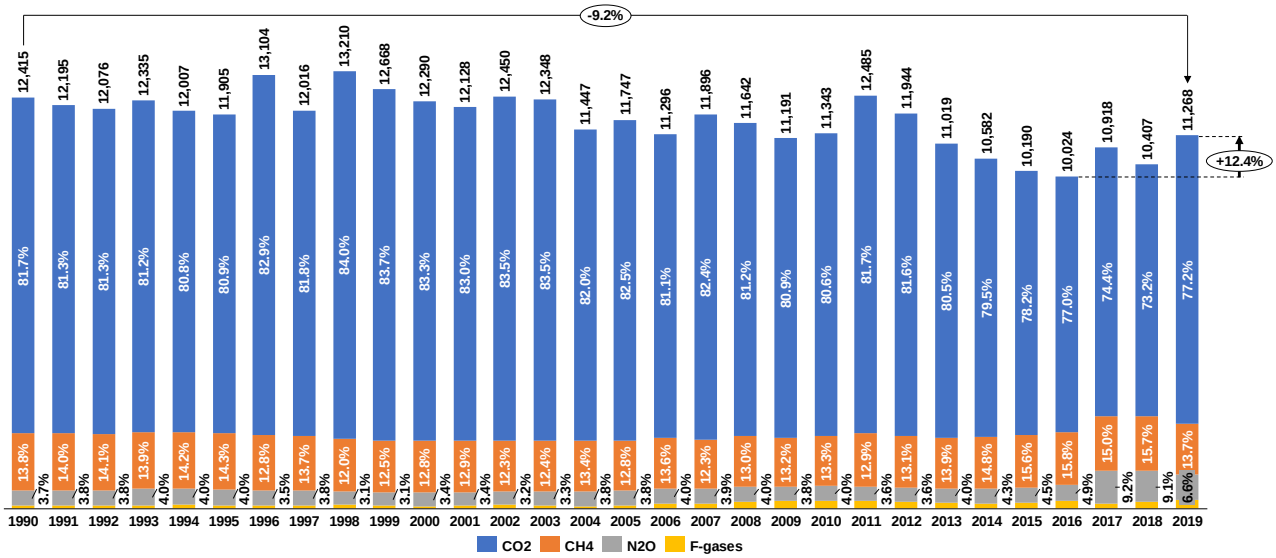
3.2 GHG emissions by gas

Analyzing the GHG emissions by gas (excluding the FOLU sector), it is evident that the most dominant are the CO_2 emissions (Table 3 and Figure 9). Their share accounts for 77.2% in 2019, followed by the CH_4 emissions with 13.7%, then N_2O emissions with 6.6%, and all F-gasses with 2.5%.

Table 3. GHG emissions by gas (in CO_2-eq)

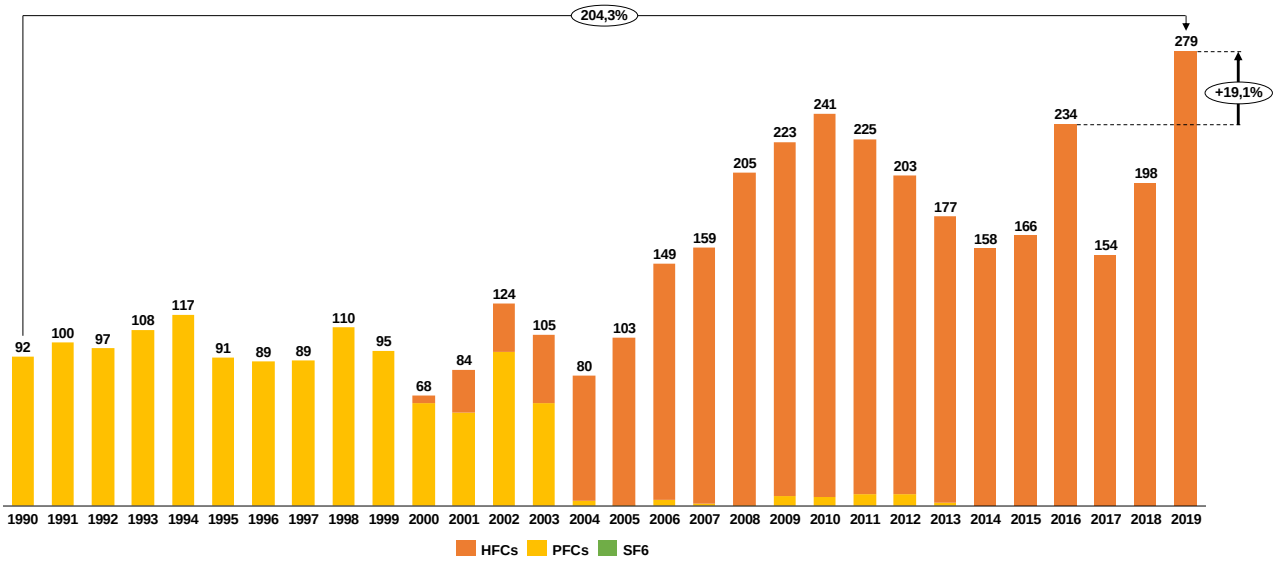
Gas	1990	2000	2005	2014	2015	2016	2017	2018	2019
CO_2 (incl. FOLU)	10147.4	10236.7	9688.8	8411.4	7970.6	7717.0	8123.4	7620.7	8698.2
CO_2 (excl. FOLU)	1713.2	1571.7	1509.4	1562.0	1594.3	1585.8	1640.4	1635.6	1546.1
CH_4	462.8	413.8	445.9	450.5	458.8	487.0	1000.3	951.9	744.4
N_2O	0.0	4.8	102.8	157.8	165.9	234.2	153.9	198.4	278.9
HFCs	91.7	62.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0
PFCs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SF_6	10147.4	10236.7	9688.8	8411.4	7970.6	7717.0	8123.4	7620.7	8698.2
Total (incl. FOLU) - Net emissions	**10869.6**	**22345.9**	**9719.4**	**7329.7**	**9299.4**	**8703.5**	**12277.7**	**8643.7**	**12901.9**
Total (excl. FOLU)	**12415.1**	**12289.8**	**11747.3**	**10581.6**	**10189.6**	**10024.1**	**10918.0**	**10406.6**	**11267.6**

Figure 9. Total GHG emissions by gas, excluding FOLU (in Gg CO_2-eq)



Despite the small share of the F-gases in the total emissions, only HFCs and PFCs are reported in the inventory (Table 3). The SF_6 emissions are not estimated for Macedonia due to the unavailability of activity data. As shown in Figure 10, the emissions of HFCs start in the year 2000, achieving 279 Gg CO_2-eq in 2019, fluctuating over time, depending on the activities in the IPPU sector, while the PFCs emissions are considerably decreasing after 2003. The significant growth in the import of gases (blends) used for refrigeration and air-conditioning has increased HFCs emissions in recent years.

Figure 10. Emissions of F-gasses (in Gg CO_2-eq)



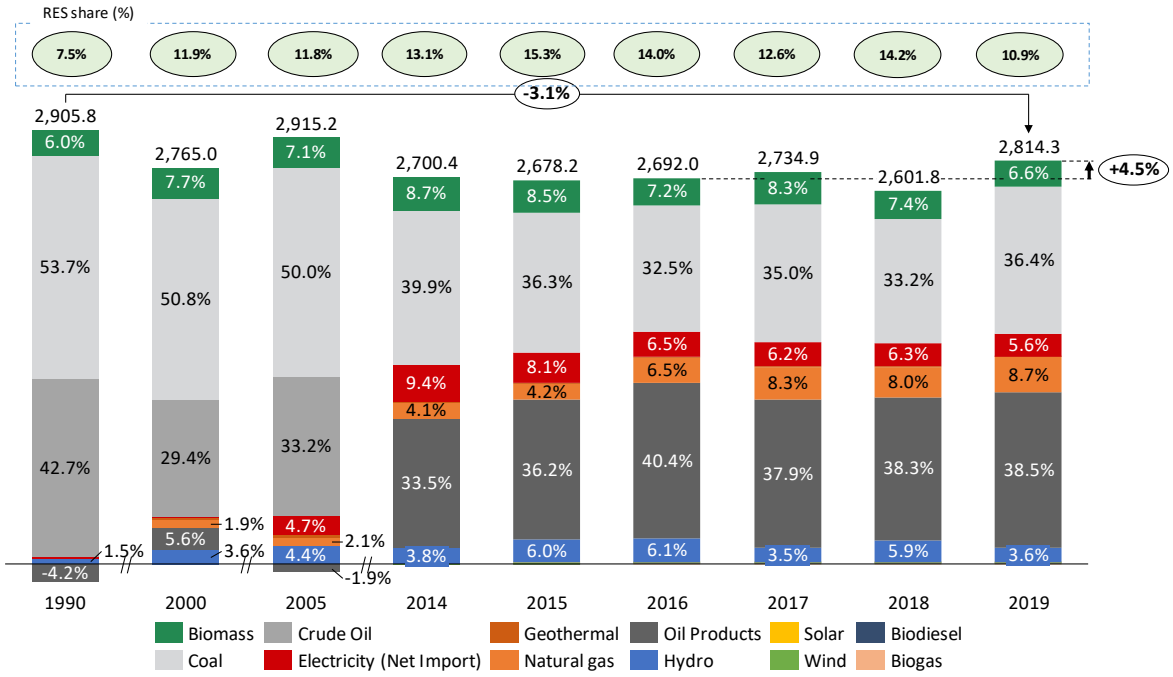
4 Energy

The gross inland consumption in Macedonia is still dominated by fossil fuels, although their share is decreasing over the reported period, from 92% in 1990 to 84% in 2019 (Figure 11). At the same time, the share of renewable energy sources has doubled (7.5% in 1990 to around 14% in 2016 and 2018). The rest of the gross inland consumption is covered by the electricity import, which increased from insignificant 0.2% in 1990 to 6.5% in 2016, or 5.6% in 2019. The gross inland consumption in total in 2019 is 7% lower compared to the consumption in 1990.

Historically, the most dominant fuel in Macedonia is coal (predominantly lignite) which has accounted for average 40% of the gross inland consumption. The situation is changed by 2019 because the oil products participated with 38.5% and natural gas with 8.7%, while share of coal is reduced to 36.4% (Figure 11).

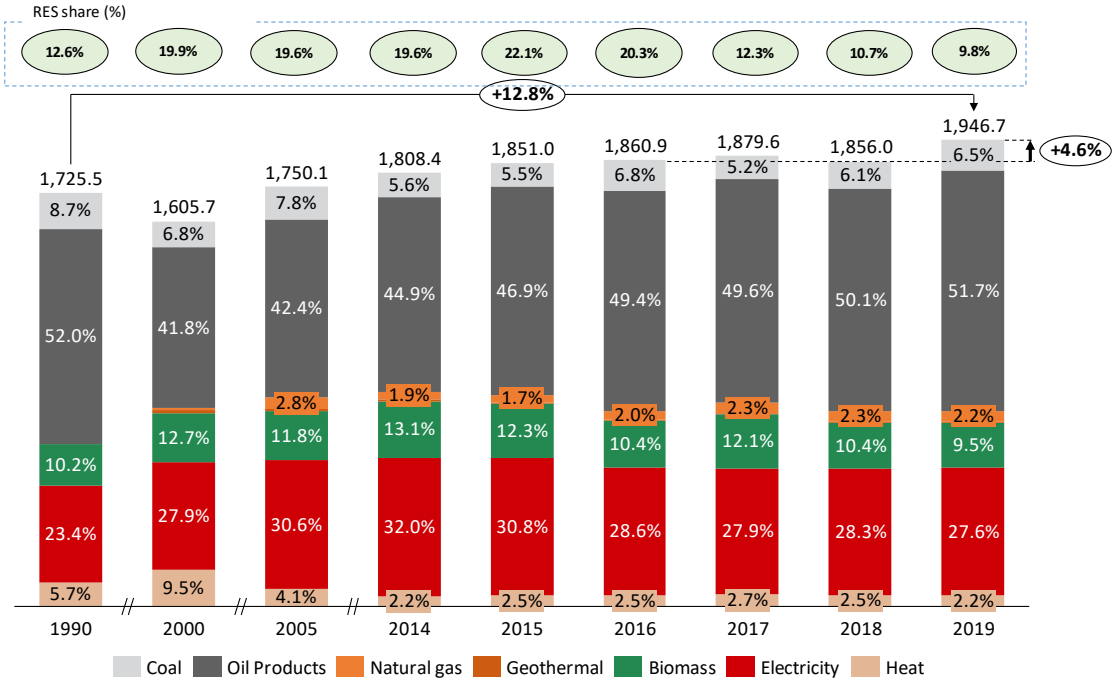
The final energy consumption does not follow the same trend line as the gross inland consumption (Figure 12). The highest consumption of 1880 ktoe, in the reported period, is recorded in 2017 which is almost 9% higher compared to the consumption in 1990. In 2019, oil products account for the largest share of final energy consumption (52%), while electricity is next (28%), followed by biomass with 9.5%, coal with 6.5% and heat and natural gas with nearly 2% each. The efficiency of the energy system, represented with the ratio of final energy consumption per gross inland consumption, has increased to nearly 70% in 2019 which is 10 percentage points more compared to 1990.

Figure 11. Gross inland consumption (in ktoe)



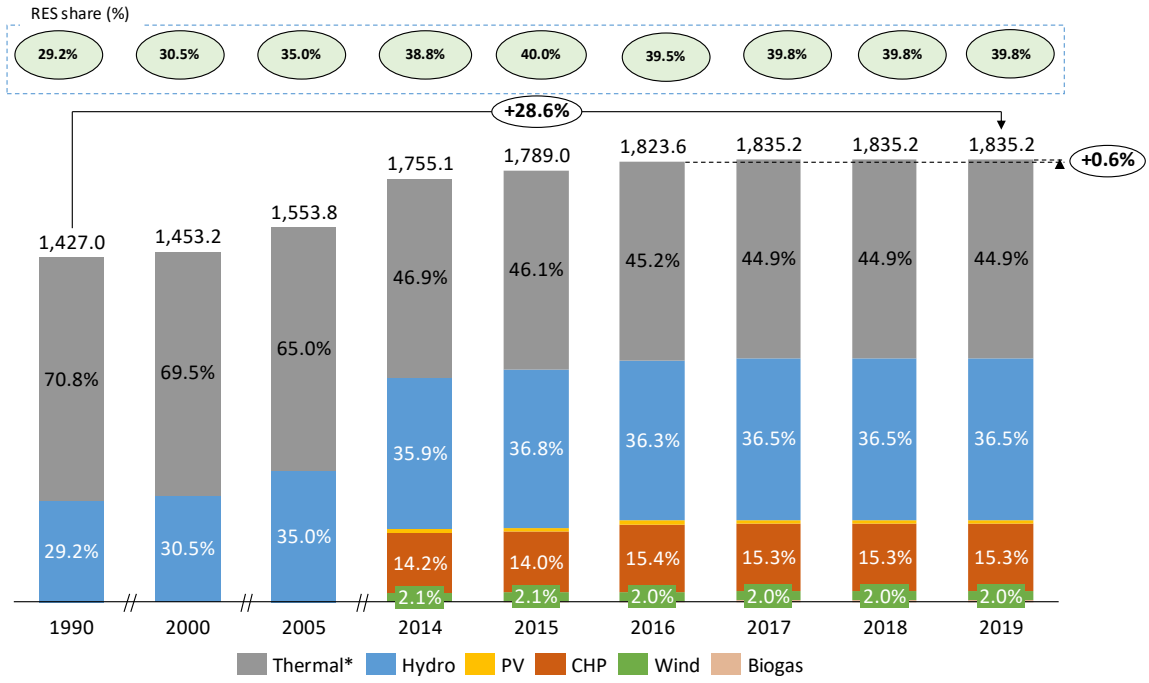
Electricity together with biomass are very important commodities for Macedonia, as domestic resources. In 2019, the electricity available for final energy consumption accounted for 6241 GWh (536 ktoe). Although, in the reported years, the share of electricity in final energy consumption has increased from 23.4% in 1990 up to 32% in 2014, but in the last few years has decreased, reaching 27.6% in 2019, most probably as a result of energy efficiency measures as well as weather conditions.

Figure 12. Final energy consumption (in ktoe)



The installed capacity for electricity production is mainly composed of thermal power plants, 71% in 1990 and 45% in 2019 (Figure 13). They are followed by hydropower plants with 29% in 1990 and 36.5% in 2019. Technologies such as PV, wind and combined heat and power plants have also been deployed during the reported years and their shares in 2019 were 1%, 2% and 15% of the total installed capacity, respectively. The RES installed capacity in total participate with almost 40% in 2019 which is 10 percentage points more compare to 1990.

Figure 13. Installed capacity of power plants (only PP that produced electricity in the certain year) (in MW)

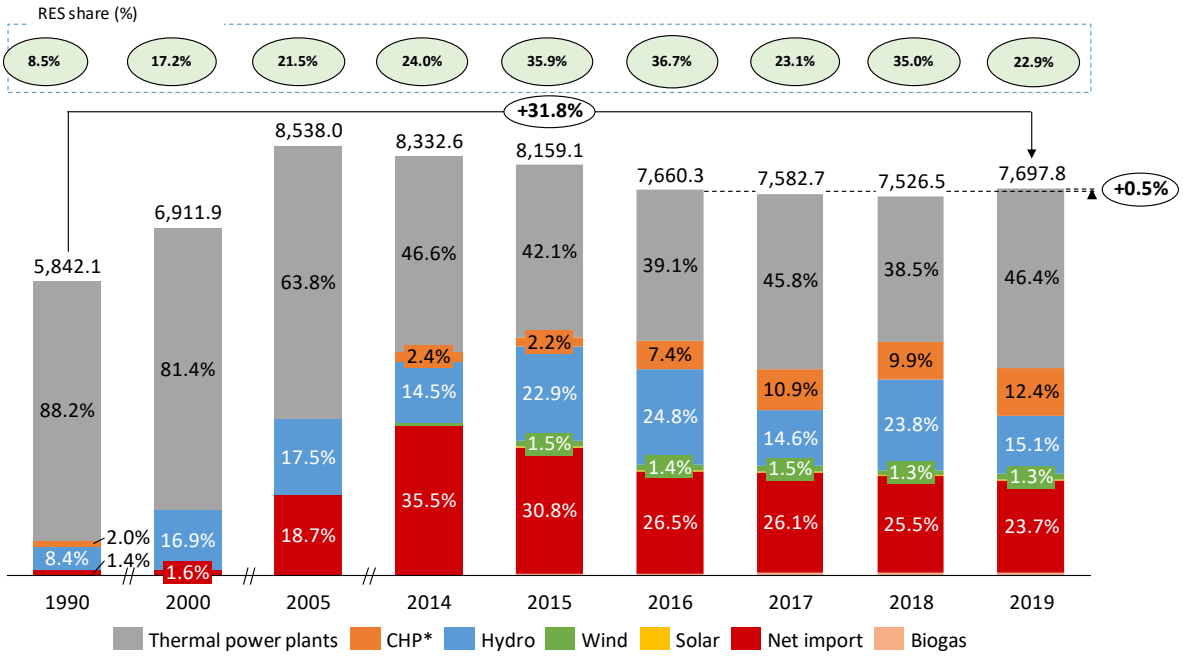


**Note: From 2010 onward, the installed capacity of thermal PP does not include the capacity of TPP Negotino (used as a cold reserve)*

Considering these installed capacities, the electricity is mainly produced in the thermal power plants, i.e. 88% in 1990 and 46% in 2019 (Figure 14), followed by the production from hydropower plants, which is 8% in 1990 and 15% in 2019. Although, 15% of the installed capacity in Macedonia is from CHPs, their

production in 2016 accounts for 7.4%, but it 2019 increased to 12.4%. Electricity net import had a significant share of 35.5% and 31% in 2014 and 2015 respectively, which by 2019 has reduced to 23.7%.

Figure 14. Electricity production and net import (in GWh)



Note: In 1990 the value is for Autoproducers' CHP

4.1 Emission trends – Reference approach

In this chapter, the emissions have been calculated using the Reference approach, which is a top-down and straightforward approach applied on the basis of relatively easily available energy supply statistics. It has been applied using the apparent fuel consumption figures to account for the fuel flows into and out of the country. The estimated CO_2 emissions and the apparent fuel consumption for the reporting years, are presented in Table 4. Compared to 2016 the numbers in 2017, 2018 and 2019 show that:

- the gaseous fuel consumption has increased by 28.5% and 18.9%, respectively,
- the liquid fuel consumption has decreased by 12.7% and 14%, respectively,
- the solid fuels consumption has increased by 9.3% and decreased by 1.4%, respectively,

The fuels changes resulted in increase of the total CO_2 emissions by 7% in 2017 and decrease by 1.4% in 2018, relative to 2016.

Table 4. Apparent fuel consumption (in TJ) and CO_2 emissions (in Gg) – Reference approach

	1990		2000		2005		2014		2015		2016		2017		2018		2019	
	AC* (TJ)	CO_2 Emiss. (Gg)	AC* (TJ)	CO_2 Emiss. (Gg)	AC* (TJ)	CO_2 Emiss. (Gg)	AC* (TJ)	CO_2 Emiss. (Gg)	AC* (TJ)	CO_2 Emiss. (Gg)	AC* (TJ)	CO_2 Emiss. (Gg)	AC* (TJ)	CO_2 Emiss. (Gg)	AC* (TJ)	CO_2 Emiss. (Gg)	AC* (TJ)	CO_2 Emiss. (Gg)
Liquid Fuels	42328	3086	37103	2703	36462	2731	35271	2646	37401	2794	39037	2876	39180	2879	38598	2836	41724	3082
Solid Fuels	55282	6101	58862	6519	61092	6165	45112	4827	40676	4346	36685	3898	400098	4282	36185	3850	42881	4565
Gaseous Fuels	0	0	2277	125	2638	145	4638	255	4658	257	7298	402	9376	516	8678	478	10104	556
Total	**97610**	**9187**	**98242**	**9348**	**100192**	**9042**	**85021**	**7728**	**82735**	**7396**	**83019**	**7176**	**88654**	**7677**	**83460**	**7163**	**94709**	**8202**

*Note: *AC = Apparent consumption;*

4.2 Emission trends – Sectoral approach

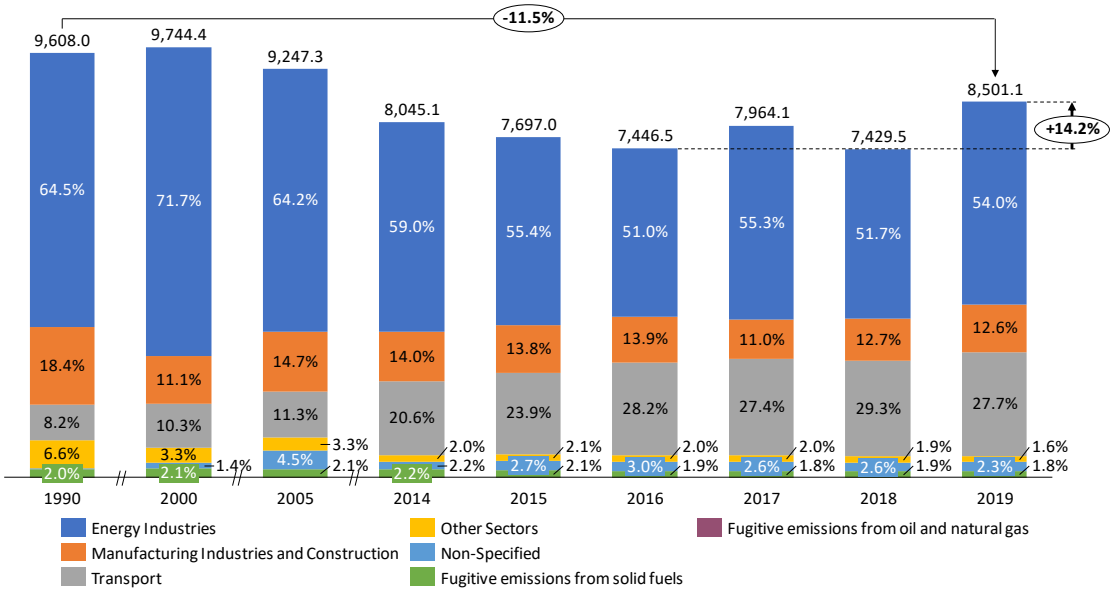
The Sectoral approach of the inventory for the Energy sector accounts for the GHG emissions released as a result of Fuel combustion activities, as well as the fugitive emissions from extraction of solid fuels and transmission and distribution of liquid and gaseous fuels. The emissions from Fuel combustion activities are derived from several categories:

- Energy Industries
- Manufacturing Industries and Construction,
- Transport,
- Other Sectors (Commercial/Institutional, Residential and Agriculture/Forestry/Fishing),
- Non-Specified

The total Energy sector emissions by category can be observed in Figure 15. One can notice a decreasing emission trend due to reduced electricity production from the Energy Industries, replaced mainly with electricity import. Although the emissions in 2018 have nearly the same values as in 2016 (as the lowest level), in 2019, the emissions increased by 14% relative to the 2016 level due to increased domestic production and reduced import. But, compared to 1990-level, in 2019, the emissions are lower by 11.5%.

Most of the GHG emissions in 2019 occur in the category Energy Industries (54%), followed by Transport (27.7%) and Manufacturing Industries and Construction (12.6%). The other two categories together account for nearly 4% of the total emissions in 2019 and the remaining less than 2% are Fugitive emissions.

Figure 15. GHG emissions in Energy sector, by category (in Gg CO_2-eq)



The overall GHG emissions in Energy sector by gas (in Gg of CO_2-eq) for the reporting years, are given in Figure 16. Notably, almost all of the GHG emissions in 2019 are actually CO_2 emissions (96.5%), and CH_4 and N_2O emissions amount to only 2.8% and 0.7%, respectively.

Figure 16. GHG emissions in Energy sector, by gas (in Gg of CO_2-eq)

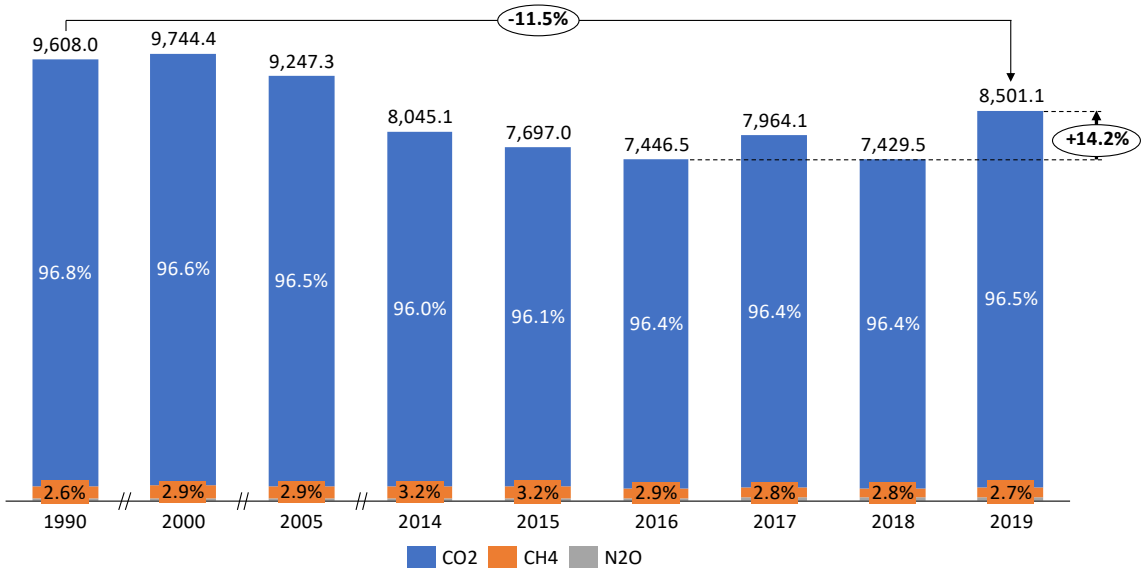


Table 5 presents the actual values of the GHG emissions in Energy sector, by category (in Gg CO_2-eq).

Table 5. GHG emissions in Energy sector, by category (in Gg CO_2-eq)

Categories	1990	2000	2005	2014	2015	2016	2017	2018	2019
Energy	**9608.0**	**9744.4**	**9247.3**	**8045.1**	**7697.0**	**7446.5**	**7964.1**	**7429.5**	**8501.1**
Fuel Combustion Activities	**9414.7**	**9536.5**	**9056.8**	**7866.1**	**7533.1**	**7304.3**	**7823.5**	**7291.6**	**8349.9**
Energy Industries	6197.0	6987.3	5940.5	4746.9	4260.6	3801.2	4400.6	3839.2	4587.9
Manufacturing Industries and Construction	1771.1	1080.4	1356.2	1127.5	1063.2	1035.4	875.5	940.5	1071.3
Transport	788.4	1007.5	1043.8	1656.9	1838.3	2096.5	2178.2	2174.6	2356.6
Other Sectors	635.1	325.8	302.7	157.9	161.6	149.4	158.5	142.4	138.3
Non-Specified	23.0	135.5	413.6	177.0	209.4	221.7	210.7	194.9	195.7
Fugitive emissions from fuels	**193.3**	**208.0**	**190.5**	**178.9**	**163.9**	**142.2**	**140.6**	**137.9**	**151.2**
Solid Fuels	192.6	207.5	189.9	178.9	163.9	142.2	140.6	137.9	151.2
Oil and Natural Gas	0.7	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.0

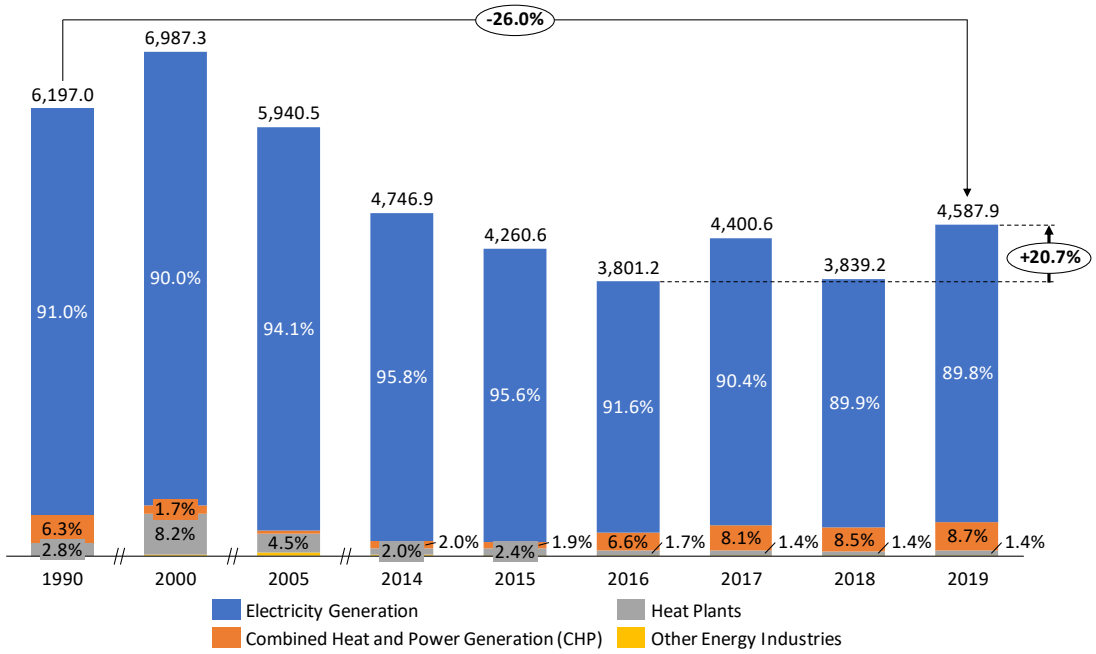
4.2.1 Energy industries

The Energy Industries cover the following subcategories:

- Electricity Generation
- Combined Heat and Power Generation (CHP)
- Heat Plants
- Other Energy Industries

Electricity Generation contributes the most to the category's emissions, i.e. almost 90% in 2019 (Figure 17) or 48.5% to the total Energy sector emissions in 2019. Lignite (as a domestic source) and natural gas are the primary energy sources for electricity production in the country. In the previous years, residual fuel oil was one of the main energy sources used in the Energy Industries. Still, it was gradually replaced by natural gas, especially for electricity and heat production. Due to fuel switch and reduced electricity production from lignite, the emissions from this category in 2016 are lower by 19.9% compared to 2014. But, the emissions grow again in 2019 (by 21% relative to 2016) due to the increased domestic production and reduced import (see Figure 14). However, compared to 1990-levels, the emissions in 2019 decreased by 26%.

Figure 17. GHG emissions in Energy Industries (in Gg CO_2-eq)



In Table 6, the GHG emissions in Energy Industries by gas can be found. The CO_2 emissions dominate in Energy Industries, while CH_4 and N_2O are less than 0.5% of the total emissions in this category.

4.2.2 Manufacturing industries and construction

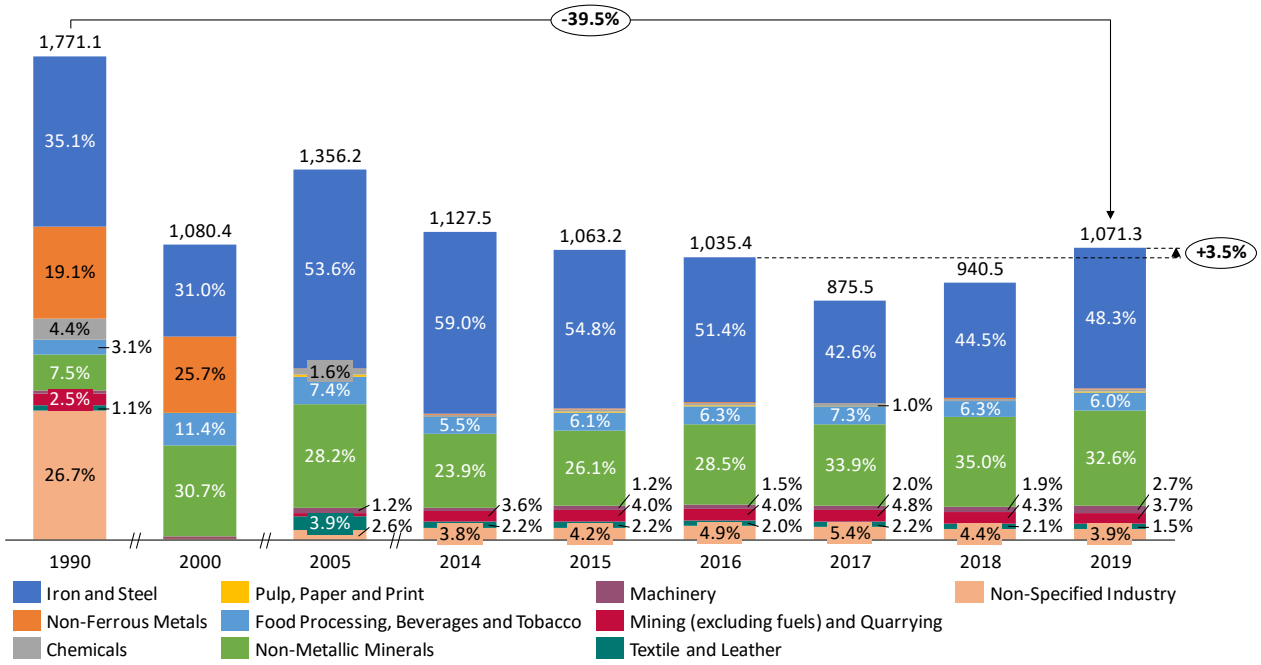
Manufacturing Industries and Construction as an Energy category had a portion of 12.6% in the overall Energy sector emissions in 2019.The fuels used in this category consist of: coking coal, other bituminous coal, lignite, liquefied petroleum gases, residual fuel oil, natural gas, wood/wood waste (biomass and wood wastes, wood briquettes and pellets), sub-bituminous coal, petroleum coke, and gas/diesel oil (road diesel, and heating and other gasoil).

The category itself includes the following subcategories:

- Iron and Steel
- Non-Ferrous Metals
- Chemicals
- Pulp, Paper and Print
- Food Processing, Beverages and Tobacco
- Non-Metallic Minerals
- Machinery
- Mining (excluding fuels) and Quarrying
- Textile and Leather
- Non-specified Industry

The total emissions by subcategories are illustrated in Figure 18. The top three most intensive subcategories in 2019 are Iron and Steel (48.3% of the category emissions), Non-Metallic Minerals (32.6%) and Food Processing, Beverages and Tobacco (6%). The declining trend over the reported period resulted in lower emissions in 2019 by nearly 40%. However, due to the intensified activities in the Iron and steel industry in recent years, the emissions are slightly higher (3.5%) when compared to the 2016-level. The GHG emissions by gas in this category are presented in Table 7.

Figure 18. GHG emissions in Manufacturing Industries and Construction (in Gg CO_2-eq)



Note: In 1990 the categories Non-Specified Industry include more industry branches compare to the other years.

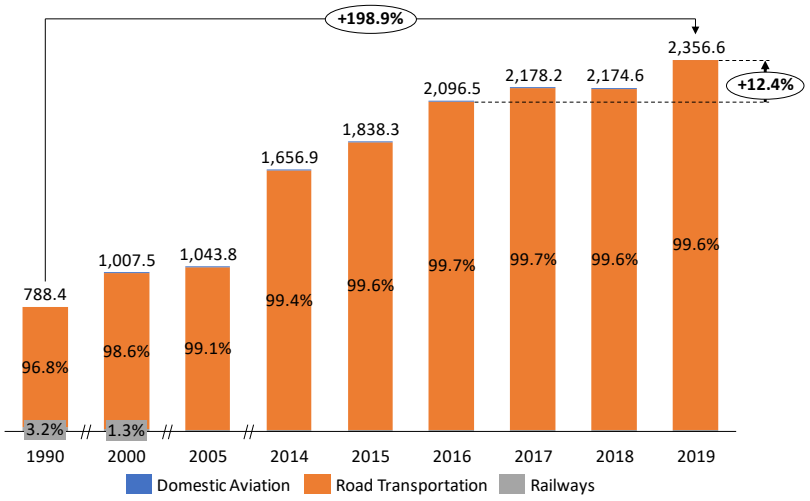
In the previous inventory submissions (NIRs under BUR1 and BUR2), the total emissions from Manufacturing industries and construction for 1990 - 2004 were reported only under the subcategory Non-specified Industries. This was corrected in the NIR under the BUR3, using the IEA data and SSO energy balances to disaggregate the activity data from the subcategory Non-Specified Industry to other subcategories, thus maintaining consistency with the emissions reported from 2005 to 2016. The same approach was used in this report.

4.2.3 Transport

Participating with 27.7% in 2019, the transport category is the second biggest contributor in the overall Energy sector emissions. Regarding the fuels, gas/diesel oil (road diesel), motor gasoline, liquefied petroleum gases (LPG), aviation gasoline and natural gas are used.

Three subcategories actively contributing to the emissions: Road Transportation, Railways and Domestic Aviation. Road Transportation releases almost all of the emissions 99.6% in 2019, while emissions from Railways are nearly 0.4% and from the Domestic Aviation are close to zero (Figure 19). Unlike the other categories and Energy sector as a whole, the emissions from the Transport show an increasing trend, or 26.5% more emissions in 2019 compared to 2014, and 12.4% more in 2019 compared to 2016. Over the period 1990 - 2016 the emission increased by almost 200% (Figure 19). An insight in Transport GHG emissions by categories and by gasses are given in Table 8.

Figure 19. GHG emissions in Transport (in Gg CO_2-eq)



Improvements in the GHG emission calculations for the category Road Transportation

In the previous inventory submissions, the emissions from Road Transportation were calculated at an aggregated level based on the fuel consumption in road transport reported in the annual energy balances due to the lack of data on fuel consumption by vehicle type. In this inventory, the GHG emissions from the Road Transportation were calculated at a more disaggregated level, by subcategories available in the IPCC Inventory software, which include: passenger cars (with and without 3- way catalysts), light-duty trucks (with and without 3-way catalysts), heavy-duty trucks and busses and motorcycles, evaporative emissions from vehicles, and emissions associated with catalytic converter use in road vehicles, i.e. urea-based catalysts[2].

The emissions are estimated based on the fuel consumption by type of vehicle. As a source of information for vehicle type activity data, the National Road Transport Emission Inventory was used. The road transport emission inventory was developed for the period 2014 – 2018 as a separate activity under previous BURs (BUR2 – period 2014 – 2016, BUR3 for period 2017-2018). Based on the data from the COPERT database, the distribution of fuel consumption by the subcategories (as in the IPCC Inventory Software) was provided as input for this GHG inventory. From this input data, the shares of fuels by subcategory were calculated for each year of period 2014 – 2018. For the years not covered with the COPERT database (i.e. period 1990 – 2013 and 2019), the activity data was derived from the total road transport fuel consumption used in previous inventories, using the overlap splicing technique and the average values of calculated shares of fuels by subcategory from COPERT data.

The estimated emissions disaggregated by subcategories are presented in Table 8.

[2]*Note from IPCC 2006 GL:* Urea consumption for catalytic converters in vehicles is directly related to the vehicle fuel consumption and technology

4.2.4 Other sectors

In this category fuels such as: lignite, liquefied petroleum gases, motor gasoline, residual fuel oil, wood/wood waste (biomass and wood wastes, wood briquettes and pellets), gas/diesel oil (road diesel, heating and other gasoil) and natural gas are utilized. Two subcategories, Residential and Agriculture/Forestry/Fishing/Fish Farms contribute in the emissions in the category Other sector, which emitted only 1.6% in the overall Energy sector emissions in 2019. For the second subcategory, only emissions from stationary combustion of fuels are estimated. In 2019, 69% of the emissions in this category came from the Residential subcategory and the rest 31% from the Agriculture/Forestry/Fishing/Fish Farms. The GHG emissions in 2019 were 78.2% and 7.4% lower than the emissions reported in 1990 and 2016, respectively. The GHG emissions from Other Sectors in absolute terms are listed in Table 9.

In the previous reports (BUR1 and BUR2), for the period 1990 – 2005 the category Other Sector also included the emissions under the subcategory Commercial/Institutional, while after 2005 these emissions were reported under the Non-specified subcategory (in accordance with the SSO energy balances). In the BUR3, based on the IEA and SSO energy balances, the activity data for the period 1990 to 2005 are included within the Non-Specified instead of Commercial/Institutional subcategory. This was done in order to be compatible with the subcategories reported in the Energy Balances from the SSO, thus reporting a consistent time series of emissions for the period 1990 – 2019 under this category.

Figure 20. GHG emissions in Other Sectors (in Gg CO_2-eq)

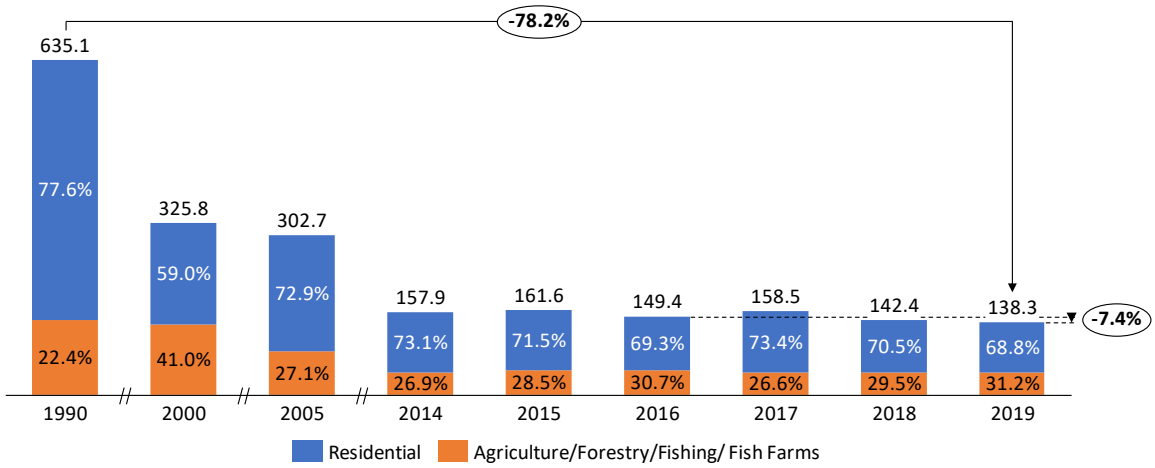


Table 6. GHG emissions in Energy Industries, by category and by gas (in Gg CO_2-eq)

Categories	1990			2000			2005			2014			2015			2016			2017			2018			2019		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Energy Industries	**6171.3**	**1.7**	**24.0**	**6958.2**	**2.5**	**26.6**	**5913.4**	**1.7**	**25.4**	**4726.9**	**1.2**	**18.7**	**4242.8**	**1.1**	**16.7**	**3785.8**	**1.0**	**14.4**	**4382.9**	**1.2**	**16.5**	**3823.8**	**1.0**	**14.4**	**4569.5**	**1.2**	**17.2**
Main Activity Electricity and Heat Production	**6171.3**	**1.7**	**24.0**	**6945.5**	**2.4**	**26.6**	**5875.3**	**1.6**	**25.3**	**4713.0**	**1.2**	**18.7**	**4237.7**	**1.1**	**16.7**	**3780.2**	**1.0**	**14.4**	**4377.8**	**1.2**	**16.5**	**3817.4**	**1.0**	**14.4**	**4565.0**	**1.2**	**17.2**
Electricity Generation	5613.2	1.3	22.5	6259.8	1.6	24.5	5566.9	1.4	24.6	4527.5	1.1	18.5	4054.6	1.0	16.6	3466.3	0.9	14.2	3959.3	1.0	16.3	3436.4	0.8	14.2	4103.9	1.0	16.9
Combined Heat and Power Generation (CHP)	386.2	0.3	1.1	118.3	0.1	0.3	39.5	0.0	0.2	92.9	0.0	0.1	81.0	0.0	0.0	250.9	0.1	0.1	357.1	0.2	0.2	325.7	0.1	0.2	398.7	0.2	0.2
Heat Plants	172.0	0.2	0.4	567.4	0.7	1.7	268.9	0.2	0.6	92.6	0.0	0.1	102.1	0.0	0.1	63.1	0.0	0.0	61.3	0.0	0.0	55.3	0.0	0.0	62.4	0.0	0.0
Manufacture of Solid Fuels and Other Energy Industries	**NA**	**NA**	**NA**	**12.7**	**0.0**	**0.0**	**38.1**	**0.0**	**0.1**	**13.9**	**0.0**	**0.0**	**5.1**	**0.0**	**0.0**	**5.5**	**0.0**	**0.0**	**5.1**	**0.0**	**0.0**	**6.4**	**0.0**	**0.0**	**4.5**	**0.0**	**0.0**
Other Energy Industries	NA	NA	NA	12.7	0.0	0.0	38.1	0.0	0.1	13.9	0.0	0.0	5.1	0.0	0.0	5.5	0.0	0.0	5.1	0.0	0.0	6.4	0.0	0.0	4.5	0.0	0.0

Note: *NA – Not Applicable*

Table 7. GHG emissions in Manufacturing Industries and Construction, by category and by gas (in Gg CO2-eq)

Categories	1990			2000			2005			2014			2015			2016			2017			2018			2019		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Manufacturing Industries and Construction	**1763.4**	**2.6**	**5.2**	**1075.4**	**1.7**	**3.3**	**1349.7**	**2.2**	**4.2**	**1122.0**	**1.8**	**3.6**	**1058.0**	**1.8**	**3.4**	**1029.9**	**1.9**	**3.6**	**871.0**	**1.6**	**3.0**	**935.4**	**1.8**	**3.3**	**1065.6**	**2.0**	**3.7**
Iron and Steel	618.9	1.0	1.9	333.0	0.6	1.2	723.1	1.5	2.7	662.1	1.2	2.3	579.7	1.0	2.0	529.8	0.9	1.7	371.2	0.6	1.1	416.7	0.8	1.4	514.4	1.0	1.8
Non-Ferrous Metals	336.4	0.8	1.4	276.0	0.6	1.0	1.7	0.0	0.0	2.3	0.0	0.0	2.8	0.0	0.0	3.4	0.0	0.0	3.5	0.0	0.0	3.5	0.0	0.0	3.1	0.0	0.0
Chemicals	77.5	0.1	0.2	0.0	0.0	0.0	21.4	0.0	0.0	7.1	0.0	0.0	8.8	0.0	0.0	7.9	0.0	0.0	8.8	0.0	0.0	8.1	0.0	0.0	8.7	0.0	0.0
Pulp, Paper and Print	0.0	0.0	0.0	0.0	0.0	0.0	8.4	0.0	0.0	2.3	0.0	0.0	2.9	0.0	0.0	2.2	0.0	0.0	2.7	0.0	0.0	2.3	0.0	0.0	2.6	0.0	0.0
Food Processing, Beverages and Tobacco	53.8	0.1	0.1	122.6	0.1	0.3	99.5	0.1	0.2	61.5	0.2	0.3	64.8	0.2	0.3	65.0	0.2	0.3	63.8	0.2	0.3	58.4	0.2	0.3	63.8	0.2	0.3
Non-Metallic Minerals	133.0	0.1	0.2	330.9	0.3	0.7	380.8	0.3	0.7	269.0	0.2	0.5	276.2	0.3	0.7	293.1	0.6	1.1	295.3	0.6	1.2	327.1	0.7	1.3	347.3	0.7	1.3
Machinery	9.3	0.0	0.0	2.9	0.0	0.0	16.4	0.0	0.0	10.6	0.0	0.0	12.5	0.0	0.0	15.9	0.0	0.0	17.6	0.0	0.0	18.3	0.0	0.0	28.9	0.0	0.1
Mining (excluding fuels) and Quarrying	43.8	0.0	0.1	5.3	0.0	0.0	11.3	0.0	0.0	40.6	0.0	0.1	42.5	0.0	0.1	40.9	0.0	0.1	42.1	0.0	0.1	40.7	0.0	0.1	39.1	0.0	0.1
Textile and Leather	19.6	0.0	0.1	0.6	0.0	0.0	52.8	0.1	0.3	24.4	0.1	0.1	23.0	0.0	0.1	21.0	0.0	0.1	19.4	0.0	0.1	19.5	0.0	0.1	16.3	0.0	0.1
Non-Specified Industry	471.1	0.5	1.1	3.9	0.0	0.1	34.3	0.1	0.2	42.2	0.1	0.1	44.9	0.1	0.1	50.6	0.1	0.2	46.6	0.1	0.2	40.8	0.1	0.1	41.2	0.1	0.1

Table 8. GHG emissions in Transport, by category and by gas (in Gg CO_2-eq)

Categories	1990			2000			2005			2014			2015			2016			2017			2018			2019		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Transport	**772.0**	**1.8**	**14.6**	**986.4**	**6.7**	**14.3**	**1021.9**	**7.0**	**15.0**	**1623.4**	**9.3**	**24.2**	**1801.8**	**10.0**	**26.5**	**2055.6**	**10.7**	**30.3**	**2135.5**	**11.0**	**31.7**	**2127.8**	**14.1**	**32.7**	**2297.9**	**21.0**	**37.8**
Civil Aviation (Domestic)	**NA**	**NA**	**NA**	**1.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.2**	**0.0**	**0.0**	**0.2**	**0.0**	**0.0**	**0.2**	**0.0**	**0.0**	**0.3**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.2**	**0.0**	**0.0**
Road Transportation	**749.7**	**1.8**	**12.1**	**972.1**	**6.7**	**14.3**	**1013.5**	**6.9**	**14.0**	**1615.0**	**9.3**	**23.2**	**1795.7**	**10.0**	**25.8**	**2049.0**	**10.7**	**29.6**	**2128.9**	**11.0**	**31.0**	**2120.9**	**14.1**	**31.9**	**2289.5**	**21.0**	**36.8**
Cars	**584.1**	**1.1**	**9.6**	**682.5**	**5.3**	**9.8**	**706.8**	**6.2**	**9.3**	**993.3**	**7.2**	**13.2**	**1102.5**	**7.8**	**14.6**	**1280.0**	**8.4**	**17.2**	**1332.6**	**8.3**	**18.1**	**1353.1**	**8.4**	**18.4**	**1401.3**	**8.7**	**19.0**
Passenger cars with 3-way catalysts	555.4	0.8	9.2	652.7	5.0	9.4	671.6	5.7	8.9	923.9	6.3	12.5	1052.6	7.1	14.1	1231.0	7.7	16.8	1284.2	7.7	17.6	1313.5	7.9	18.0	1343.0	7.9	18.4
Passenger cars without 3-way catalysts	28.6	0.3	0.4	29.8	0.3	0.4	35.2	0.5	0.4	69.4	0.9	0.7	49.8	0.7	0.5	49.0	0.7	0.4	48.5	0.6	0.5	39.6	0.5	0.4	58.3	0.7	0.6
Light-duty trucks	**61.0**	**0.4**	**0.9**	**85.4**	**1.0**	**1.3**	**84.9**	**0.4**	**1.3**	**149.7**	**0.5**	**2.3**	**166.2**	**0.5**	**2.6**	**181.9**	**0.5**	**2.8**	**191.8**	**0.5**	**3.0**	**186.5**	**0.4**	**2.9**	**204.3**	**0.5**	**3.2**
Light-duty trucks with 3-way catalysts	56.6	0.4	0.8	78.9	1.0	1.2	78.4	0.3	1.2	133.8	0.4	2.1	151.4	0.4	2.3	168.0	0.4	2.6	179.2	0.4	2.8	176.4	0.4	2.7	193.5	0.5	3.0
Light-duty trucks without 3-way catalysts	4.4	0.0	0.1	6.5	0.0	0.1	6.5	0.0	0.1	15.9	0.0	0.2	14.8	0.0	0.2	14.0	0.0	0.2	12.6	0.0	0.2	10.1	0.0	0.2	10.8	0.0	0.2
Heavy-duty trucks and buses	**96.6**	**0.1**	**1.5**	**197.2**	**0.3**	**3.1**	**216.1**	**0.3**	**3.4**	**467.1**	**1.5**	**7.7**	**521.5**	**1.7**	**8.5**	**580.8**	**1.8**	**9.5**	**597.8**	**2.1**	**9.9**	**575.0**	**5.2**	**10.6**	**677.4**	**11.8**	**14.6**
Motorcycles	**3.0**	**0.0**	**0.0**	**2.6**	**0.0**	**0.0**	**2.1**	**0.0**	**0.0**	**1.5**	**0.0**	**0.0**	**1.6**	**0.0**	**0.0**	**2.0**	**0.0**	**0.0**	**2.3**	**0.0**	**0.0**	**2.0**	**0.0**	**0.0**	**1.9**	**0.0**	**0.0**
Evaporative emissions from vehicles	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Urea-based catalysts	**0.5**	**0.0**	**0.0**	**0.3**	**0.0**	**0.0**	**0.4**	**0.0**	**0.0**	**0.8**	**0.0**	**0.0**	**1.0**	**0.0**	**0.0**	**1.3**	**0.0**	**0.0**	**1.5**	**0.0**	**0.0**	**1.5**	**0.0**	**0.0**	**1.8**	**0.0**	**0.0**
Railways	**22.3**	**0.0**	**2.6**	**13.3**	**0.0**	**0.0**	**8.3**	**0.0**	**1.0**	**8.3**	**0.0**	**1.0**	**6.0**	**0.0**	**0.7**	**6.4**	**0.0**	**0.7**	**6.3**	**0.0**	**0.7**	**6.8**	**0.0**	**0.8**	**8.2**	**0.0**	**0.9**

Note: NA – Not Applicable

Table 9. GHG emissions in Other Sectors, by category and by gas (in Gg CO_2-eq)

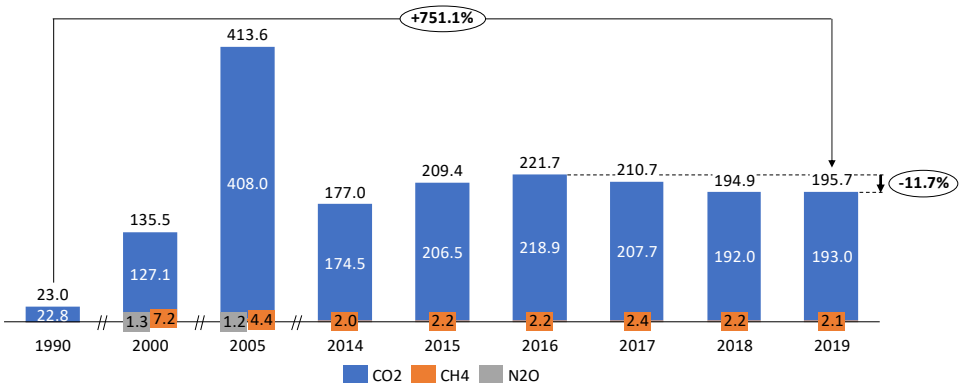
Categories	1990			2000			2005			2014			2015			2016			2017			2018			2019		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Other Sectors	**566.4**	**58.5**	**10.2**	**256.4**	**59.7**	**9.7**	**228.2**	**64.2**	**10.3**	**74.8**	**71.7**	**11.4**	**81.0**	**69.5**	**11.1**	**81.2**	**58.8**	**9.4**	**78.9**	**68.6**	**11.0**	**75.7**	**57.6**	**9.2**	**74.3**	**55.2**	**8.8**
Residential	425.1	58.1	9.8	123.8	59.2	9.4	147.0	63.6	10.1	33.3	70.8	11.3	36.0	68.6	10.9	36.3	58.0	9.2	37.7	67.8	10.8	34.5	56.8	9.0	32.2	54.4	8.7
Agriculture/Forestry /Fishing/ Fish Farms	141.3	0.5	0.3	132.6	0.5	0.3	81.2	0.6	0.2	41.5	0.8	0.2	45.0	0.9	0.2	45.0	0.8	0.2	41.2	0.8	0.2	41.1	0.8	0.2	42.2	0.7	0.2
Stationary	141.3	0.5	0.3	132.7	0.5	0.3	81.2	0.6	0.2	41.7	0.8	0.2	45.3	0.9	0.2	45.2	0.8	0.2	41.4	0.8	0.2	41.3	0.8	0.2	42.2	0.7	0.2

4.2.5 Non-specified

The last category from the Fuel Combustion Activities is Non-Specified, having a share of 2.3% of the Energy sector GHG emissions in 2019. The following fuels are being combusted: Lignite, Liquefied Petroleum Gases, Residual Fuel Oil, Natural Gas, Wood/Wood Waste (Biomass), Gas/Diesel Oil (Road Diesel and Heating and Other Gasoil). The GHG emissions are depicted in Figure 21.

The category contributes to the overall Energy sector emissions generally with an increasing trend. In 2016 there is an increasing of 25.3% compared to 2014, while in 2019 the emissions decreased by 11.7% compared to 2016. The pick year is 2005 achieving 413.6 Gg CO_2-eq (more than two times higher compared to 2018. The reason for such huge difference is higher consumption of Lignite, Residual Fuel Oil and Gas/Diesel Oil in 2005, while in 2019 there is more Electricity consumption.

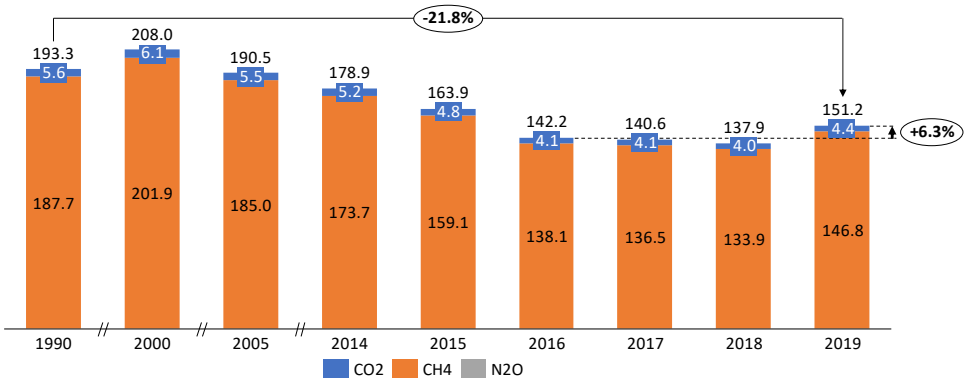
Figure 21. GHG emissions in Non-Specified category (in Gg CO_2-eq)



4.2.6 Fugitive emissions from fuels

In Macedonia, fugitive emissions originate from coal mining and handling within surface mines (mining and post-mining seam gas emissions), oil refining and natural gas venting. Direct GHG emissions arising from fugitive emissions from fuels are dominantly CH_4 emissions, with lower share of CO_2 emissions that were included in the BUR3. The fugitive emissions contributed with 1.8% in the overall Energy sector emissions in 2019. Almost all of them came from solid fuels (coal mining) or 151.2 Gg CO_2-eq in 2019, i.e. the fugitive emissions from oil and natural gas are below 0.1 Gg CO_2-eq (Figure 22). Over the reported period, the fugitive emissions have decreased by 21.8%.

Figure 22. Fugitive emissions from fuels by gasses (in Gg CO_2-eq)



4.2.7 Memo and Information Items: International aviation and Biomass combustion for energy production

The contributions from the International Aviation are almost insignificant. Jet kerosine is used as fuel. The emissions have increased throughout the period 2016-2019 (by 76.2%) (Figure 23). According to the IPCC Guidelines, the CO_2 emissions that occur as a result of biomass combustion for energy production are reported as information items. These emissions have increased over the period 1990 – 2016 for 10.2% (Figure 24).

Figure 23. GHG emissions from International aviation (in Gg CO_2-eq) – Memo Items

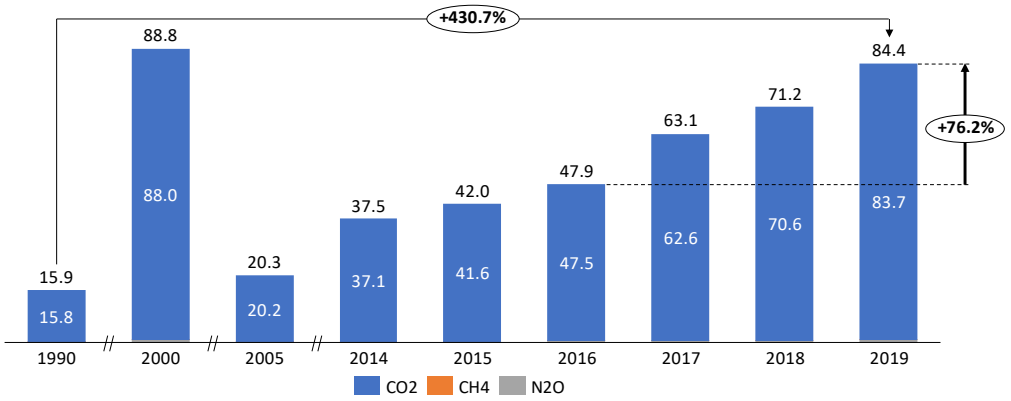
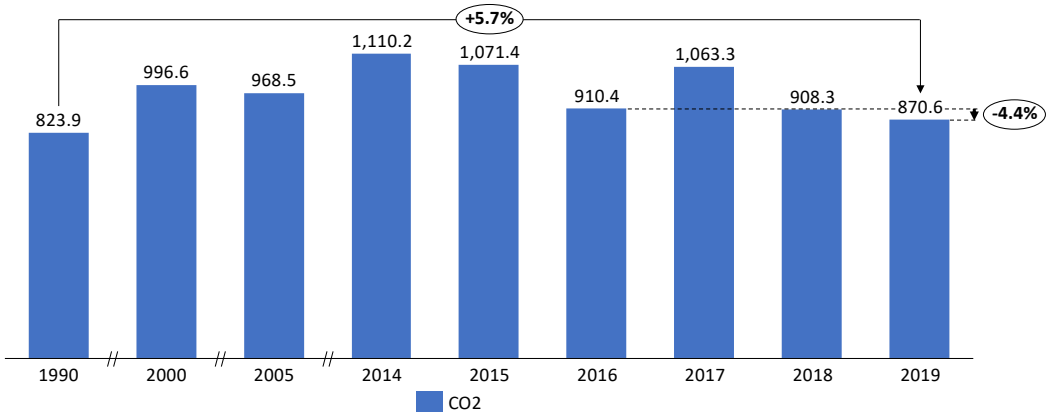


Figure 24. CO_2 emissions from biomass burning for energy production (Gg) – Information Item



4.3 Comparison of Reference and Sectoral approach

It is considered a good practice to compare the results of the two approaches in order to assess possible flaws in the evaluation. Therefore, Table 10 summarizes the total apparent consumption and CO_2 emissions estimated using the Reference Approach, the energy consumption and CO_2 emissions obtained from the Sectoral Approach, as well as the calculated differences.

The total differences in energy consumption and CO_2 emissions are smaller than 2% for all reported years. Furthermore, the differences from 2014 up to 2018 are smaller than 0.02%.

Table 10. Comparison of Sectoral and Reference Approach – total consumption and CO2 emissions for all reported years

	Reference Approach		Sectoral Approach		Differences	
Year	**Apparent consumption (TJ)**	**CO_2 Emissions (Gg)**	**Energy Consumption (TJ)**	**CO_2 Emissions (Gg)**	**Energy Consumption (%)**	**CO_2 Emissions (%)**
1990	97609.8	9187.0	97641.2	9295.4	-0.032	-1.166
2000	98242.2	9347.6	98065.5	9403.1	0.18	-0.59
2005	100191.8	9041.8	98218.3	8920.7	2.009	1.356
2014	85021.4	7728.3	85002.3	7720.8	0.022	0.097
2015	82734.6	7396.2	82697.9	7389.2	0.044	0.095
2016	83019.2	7175.6	82971.5	7170.0	0.057	0.078
2017	88654.2	7677.1	88595.8	7674.4	0.068	0.034
2018	83460.4	7163.3	83298.8	7153.1	0.193	0.141
2019	94708.6	8202.4	94582.4	8198.5	0.133	0.047

4.4 Recalculations

For the Energy sector, the emissions were recalculated only for the category Road Transportation using the activity data derived based on the inventory of road transport emissions developed in the COPERT model, as was explained in section 4.2.3 Transport.

Table 11 presents the emissions reported in the inventory under BUR3, the recalculated emissions in this inventory, and the difference between them. Even though the default emission factors were used, and the total fuel consumption in road transport was the same as in previous inventories, there are still slight differences in the estimated emissions. The reason might be that the IPCC Inventory Software calculates the emissions more precisely at the subcategory level than at an aggregated level.

Table 11. Recalculations of emissions from the category Road Transportation (in Gg CO_2-eq)

Category		1990	2000	2005	2014	2015	2016	2017	2018
Road Transportation	BUR3	766.2	992.1	1034.1	1647.0	1831.0	2089.3	2171.1	2170.0
	NC4	763.5	993.0	1034.5	1647.5	1831.4	2089.2	2170.9	2166.9
	Difference (BUR3-NC4)	**2.7**	**-0.9**	**-0.4**	**-0.5**	**-0.5**	**0.1**	**0.2**	**3.1**

4.5 Methodology and emission factors

The choice of Tier for each calculation of the GHG emissions from the Energy sector was determined by the accessibility of the corresponding national data. In this inventory report the following Tiers have been used:

- Tier 1: data on the amount of fuel combusted in the source category; default emissions factor
- Tier 2: data on the amount of fuel combusted in the source category; a country-specific emissions factor for the source category and fuel for CO_2 emissions

The CO_2 emissions from the combustion of lignite, residual fuel oil and natural gas have been calculated using the Tier 2 methodology. Due to the lack of data on the carbon content of lignite since 2013, the country-specific emission factor of lignite calculated for 2012, was used to estimate the CO_2 emissions in this BUR as well for the years 2014 - 2018. The country-specific emission factor has also been calculated for residual fuel oil, using the same data on carbon content and the NCV as in the previous BURs. For the years 2017, 2018 and 2019, the national emission factor for natural gas was updated using data for the natural gas composition specification provided by MOEPP (based on the reports from the measuring station at the entry point of the natural gas pipeline in the country).

The State Statistical Office issues annual Energy balances with information on fuel consumption both in natural units and kilotons of oil equivalent (ktoe). These data were used to calculate the NCV of each fuel in a certain year. It should be noted that the variations of fuels' NCV from one sector to another were taken into account in this inventory.

When compared to the BUR1, the Energy balances used for the BUR2 and BUR3 have provided a more disaggregated data set. Namely, similar fuels, which in the older issues of the Energy balances had been grouped together, are given separately. This indicates a higher resolution approach of the State Statistical Office, but it also indicates that certain fuels have become significant enough to be reported independently.

The concept of disaggregated data set applies also to the biomass and in the Energy balances issued since 2005, it has been reported in the following three categories:

- Biomass
- Wood wastes, Wood briquettes and Pellets
- Wood of fruit trees and other plant residues

In order to take advantage of the disaggregation, in the Macedonian GHG inventory, in the IPCC Inventory Software, there are three entries for Wood/Wood Wastes, one for *Biomass* (or fuelwood) reported in 1000 m^3, other for *Wood wastes, Wood briquettes and Pellets* reported in Gg and the third for *Wood of fruit trees and other plant residues* also reported in 1000 m^3 but with different conversion factor (NCV) from the biomass.

Regarding the fugitive emissions from fuels, specifically surface mines, the average CO_2 emission factor ($0.44m^3$ $tonne^{-1}$) from the 2019 Refinements to the 2006 IPCC Guidelines was taken in account, while for the CH_4 the factor remains the same as in the previous BURs.

The emission factors used to estimate the GHG emissions are given in Table 12.

Table 12. Emission factors used for Energy sector

Emission factor	NC4	Comment
Energy Industries	CS,	CS EF for lignite and residual fuel oil same as NIR-BUR1, NIR-BUR2, and NIR-BUR3 CS EF for natural gas updated for 2017, 2018 and 2019
Manufacturing Industries and Construction **Other Sectors** **Non-Specified**	CS, DF	CS EF for lignite and residual fuel oil same as NIR-BUR1, NIR-BUR2, and NIR-BUR3 CS EF for natural gas updated for 2017, 2018 and 2019 DF from 2006 IPCC Guidelines
Transport	DF	DF from 2006 IPCC Guidelines
Fugitive emissions from fuels	DF	DF from 2019 Refinements to the 2006 IPCC Guidelines

Note: DF=Default Factor, CS= Country Specific

4.6 Data sources

The main data sources for the Energy sector are the Energy balances from the State Statistical Office as the most relevant institution for gathering accurate information and the Energy Balances and Statistics from the International Energy Agency (IEA) as a secondary data source. For a source of information for vehicle type activity data, the National Road Transport Emission Inventory was used based on the data from the COPERT database (Table 13).

Table 13. Data sources for Energy sector

	Documents	Data provider
Energy sector	• National Road Transport Emission Inventory - COPERT Database 2014 - 2018	MOEPP
	• MAKSTAT database 2005-2019* • Energy balances, Revised data 2005-2016 • Energy Balances, Final data 1998 • Energy Balances, Final data 1999 • Energy Balances, Final data 2000 • Energy Balances, Final data 2001 • Energy Balances, Final data 2002	SSO
	• IEA Energy Balances and Statistics (1990-1997;2003,2004)	IEA

**For 2019 preliminary data were used*

5 Industrial processes and product use

The industrial production in Macedonia has slowed down after the economic transition period in the '90s. Many industrial plants in the country have either lowered the volume of manufacturing or entirely shut down. However, several industries that continued their production have become the largest contributors of GHG emissions in the Industrial processes and product use (IPPU) sector. Most of the GHG emissions come from the metal industry (from steel and ferroalloys production) and the mineral industry (from production of cement production).

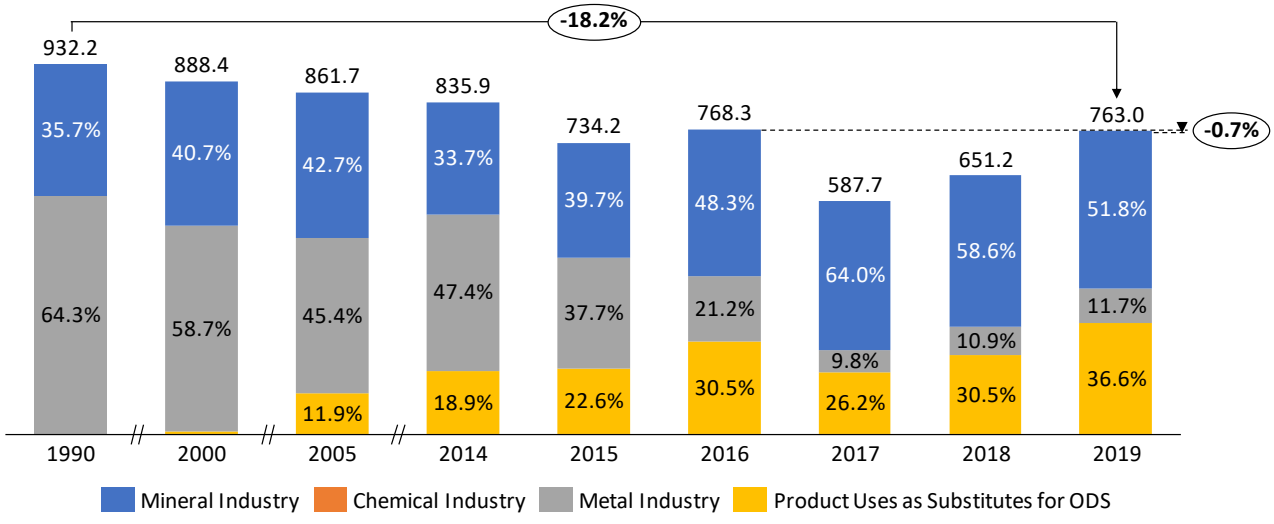
The rest of the greenhouse emissions in the country come from usage of substitutes for ozone-depleting substances (ODS) for refrigeration and air-conditioning. All of the ODS alternatives are imported in the country, either pure or as a blend.

5.1 Emission trends

Over the reported period, the emissions from this sector had slightly changed, however the participation of different categories had significantly changed. In the 2019, the overall emissions from IPPU sector achieved 763 Gg CO2-eq, which represent a decrease of 18.2% relative to 1990, or a minor decrease of 0.7% compared to 2016 (Figure 25).

Until 2000, the metal industry was prevailing source of the emissions, mostly from the ferroalloy production. After 2000, when ODS substitutes usage in the country have started to increase, the share of the GHG emissions from the Metal industry have decreased considerably (from 64% in 1990 to 21% in 2016, and nearly 12% in 2019). At same time, the emissions from the Mineral industry have been fluctuating over the inventory period, showing slightly increasing trend, in the last years. In the last three reporting years the product uses as substitutes for ODS had grown for around 20% (relative to 2016), resulting with share of around 36% of the IPPU sector emissions in 2019. However, the dominant share had the Mineral industry with 48%, in 2016, 64% in 2017, 58% in 2018 and around 52% in 2019. Emissions from the other categories, like Chemical industry, Non-Energy Products from Fuels and Solvent Use, Electronics Industry and Other Product Manufacture and Use do not occur in the country (Table 14).

Figure 25. GHG emissions from the IPPU sector, by category (in Gg CO2-eq)



In 2019, the CO_2 emissions accounted for 63.4% of the overall greenhouse emissions from IPPU. The HFCs were second highest contributor and accounted for 36.6% of the total emissions. CH_4 emissions were negligible (accounting for less than 0.001% of the greenhouse emissions from this sector. The emission of SF_6 were not estimated due to unavailability of activity data. The emissions segregated by gas are presented in Table 15 and Table 16.

Table 14. GHG emissions from the IPPU sector, by category (in Gg CO2-eq)

Categories	1990	2000	2005	2014	2015	2016	2017	2018	2019
Industrial Processes and Product Use	**932.2**	**888.4**	**861.7**	**835.9**	**734.2**	**768.3**	**587.7**	**651.2**	**763.0**
Mineral Industry	**333.1**	**361.8**	**368.1**	**281.7**	**291.2**	**371.1**	**376.3**	**381.8**	**395.2**
Cement production	293.8	348.8	355.3	274.2	285.4	364.6	374.4	376.8	376.9
Lime production	33.7	11.2	11.1	6.4	4.7	5.4	0.8	4.0	17.2
Glass Production	0.33	0.05	0.01	0.01	0.01	0.05	0.05	0.05	0.07
Other Process Uses of Carbonates	5.3	1.9	1.6	1.1	1.1	1.0	1.0	1.0	1.0
Ceramics	2.6	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Other Uses of Soda Ash	2.7	1.4	1.3	1.1	1.0	1.0	1.0	1.0	1.0
Other	NO, NA								
Chemical Industry	**NO,NA**								
Metal Industry	**599.1**	**521.8**	**390.8**	**396.4**	**277.0**	**162.9**	**57.6**	**71.0**	89.0
Iron and Steel Production	24.7	15.2	58.2	17.0	11.0	15.3	24.8	24.1	21.7
Ferroalloys Production	265.6	196.4	332.2	379.4	264.6	145.3	28.9	41.3	61.5
Aluminium production	100.4	68.9	0.4	NO	NO	NO	NO	NO	NO
Lead Production	22.1	23.0	NO	NO	1.4	2.3	3.9	5.5	5.7
Zinc Production	186.2	218.4	NO	NO	NO	NO	NO	NO	NO
Non-Energy Products from Fuels and Solvent Use	**NA, NO**								
Electronics Industry	**NA, NO**								
Product Uses as Substitutes for ODS	**0.0**	**4.8**	**102.8**	**157.8**	**165.9**	**234.2**	**153.9**	**198.4**	**278.9**
Refrigeration and Air Conditioning	0.0	4.8	102.8	157.8	165.9	234.2	153.9	198.4	**278.9**
Refrigeration and Stationary Air Conditioning	0.0	4.8	102.8	157.8	165.9	234.2	153.9	198.4	**278.9**
Mobile Air Conditioning*	IE								
Foam Blowing Agents	**NA, NE**								
Fire Protection									
Aerosols									
Solvents									
Other Applications									
Other Product Manufacture and Use									
Other									

Note: *Emissions from Refrigeration and Air Conditioning are calculated based on imported substitute of ODS and all are reported under Stationary Air Conditioning

NO - Not occurring, NA – Not Applicable, NE – Not Estimated, IE – Included Elsewhere

Figure 26. GHG emissions from the IPPU sector, by gas (in Gg CO_2-eq)

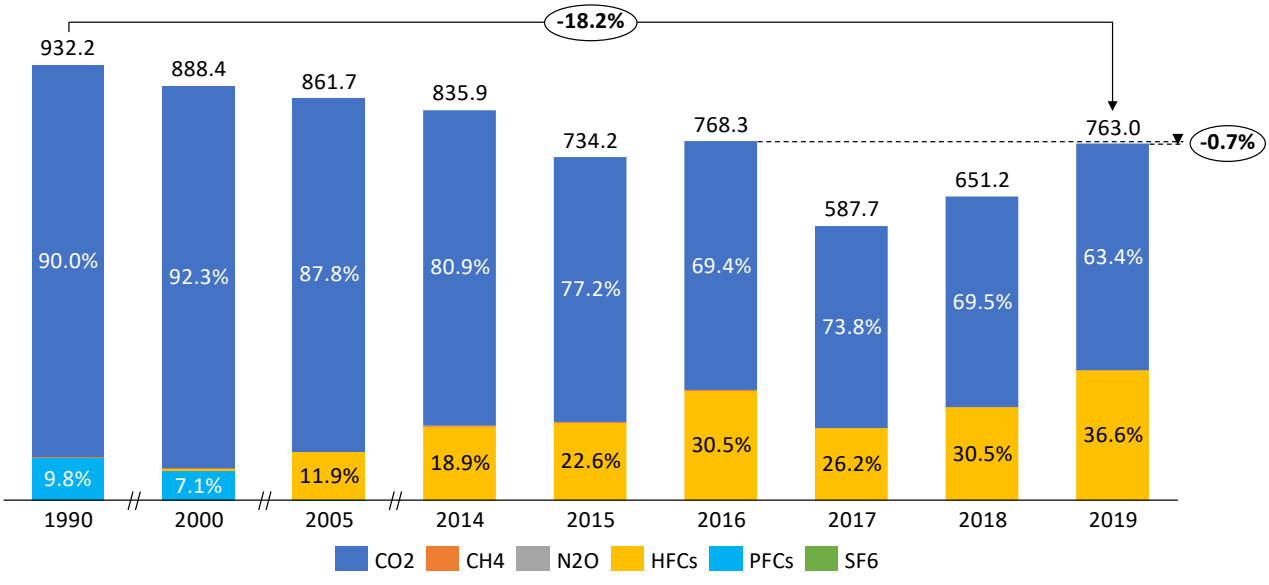


Table 15. CO_2, CH_4 and NO_x emissions from the IPPU sector, by category (in Gg CO_2-eq)

Categories	1990			2000			2005			2014			2015			2016			2017			2018			2019		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Industrial Processes and Product Use	**839.3**	**1.3**	**0.0**	**819.8**	**1.0**	**0.0**	**756.7**	**1.8**	**0.0**	**677.8**	**1.8**	**0.0**	**570.3**	**1.2**	**0.0**	**541.7**	**0.6**	**0.0**	**433.9**	**0.0**	**0.0**	**452.5**	**0.0**	**0.0**	484.1	0.0	
Mineral Industry	333.1	NA	NA	361.8	NA	NA	368.1	NA	NA	283.2	NA	NA	294.4	NA	NA	379.4	NA	NA	**376.3**	NA	NA	**381.5**	NA	NA	395.2	NA	NA
Chemical Industry	NO, NA																										
Metal Industry	506.2	1.3	NA	457.9	1.0	NA	388.7	1.8	NA	394.6	1.8	NA	275.9	1.2	NA	162.3	0.6	NA	57.6	0.0	NA	70.9	0.0	NA	89.0	0.0	NA
Non-Energy Products from Fuels and Solvent Use	NO, NA	NA		NO, NA	NA		NO, NA	NA		NO, NA	NA		NO, NA	NA		NO, NA	NA		NO, NA	NA		NO, NA	NA		NO, NA	NA	
Electronics Industry	NA																										
Product Uses as Substitutes for ODS	NA																										
Other Product Manufacture and Use	NA																										
Other	NA																										

NO - Not occurring, NA – Not Applicable, NE – Not Estimated

Table 16. HFCs, PFCs and SF_6 emissions from the IPPU sector, by category (in Gg CO_2-eq)

Categories	1990			2000			2005			2014			2015			2016			2017			2018			2019		
	HFCs	PFCs	SF_6	HFCs	PFCs	SF_6	HFCs	PFCs	SF_6	HFCs	PFCs	SF_6	HFCs	PFCs	SF_6	HFCs	PFCs	SF_6	HFCs	PFCs	SF_6	HFCs	PFCs	SF_6	HFCs	PFCs	SF_6
Industrial Processes and Product Use	**NO**	**91.7**	**NO**	**4.8**	**62.9**	**NO**	**102.8**	**0.3**	**NO**	**157.8**	**NO**	**NO**	**165.9**	**NO**	**NO**	**234.2**	**NO**	**NO**	**153.9**	**NO**	**NO**	**198.4**	**NO**	**NO**	**278.9**	**NO**	**NO**
Mineral Industry	NA																										
Chemical Industry																											
Metal Industry	NO	91.7	NO	NO	62.9	NO	NO	0.3	NO	NO																	
Non-Energy Products from Fuels and Solvent Use	NA																										
Electronics Industry	NA, NO		NE, NA	NA, NO		NE, NA	NA, NO		NE, NA	NA, NO		NE, NA	NA, NO		NE, NA	NA, NO		NE, NA	NA, NO		NE, NA	NA, NO		NE, NA	NA, NO		NE, NA
Product Uses as Substitutes for ODS	NO	NO	NO	4.8	NO	NO	**102.8**	NO	NO	157.8	NO	NO	165.91	NO	NO	234.2	NO	NO	153.9	NO	NO	198.4	NO	NO	278.9	NO	NO
Other Product Manufacture and Use	NA	NO, NA		NA	NO, NA		NA	NO, NA		NA	NO, NA		NA	NO, NA		NA	NO, NA		NA	NO, NA		NA	NO, NA				
Other	NA																										

NO - Not occurring, NA – Not Applicable, NE – Not Estimated

5.2 Mineral industry

5.2.1 Cement production

There is only one cement production factory in the country. Marlstone is used as basic mineral raw material and is obtained from the open-cast mine, located within the factory. Marlstone, as a non-metallic mineral raw material, is a basic component in the production of clinker, i.e., cement. The emissions from the cement production were influenced by the volume of industrial activity and their fluctuation were observed over the inventory period. However, an increasing trend can be seen in the last three years, resulting with 28% higher emissions in 2019 relative to 1990, or 3.4% higher relative to 2016.

In the BUR3, some improvements have been made of the activity data for the cement production. Specifically, by taking into account the clinker production and the specific emission of CO_2 (per ton clinker) reported in annual reports from the factory "Titan-Usje", the clinker fraction in cement was calculated for each year in the period 2007 – 2016, and for the previous years (1990 – 2006) the average value of these fractions was used. Also, the annual report for Industry from the SSO were used as a data source for the cement production.

5.2.2 Lime production

According to the SSO's reports for Industry sector, the lime production in the country include production of quicklime, hydraulic lime and slacked lime, with variation in their production between the years (not all of them are produced in all years). In 2010, 2011 and 2012, there is no evident lime production in the country, and from 2012 until 2019 only production of hydraulic lime is reported.

The emissions from lime production are influenced by the volume of industrial activity and follow a generally decreasing trend over the inventory period, except in 2019, where one can notice an increase. Thus, in 2018 the emission is 88% lower than in 1990, but in 2019 is nearly 50% of the 1990 level.

5.2.3 Glass production

The glass production in the country is noticeable before 2000, but after that there is no substantial production, although in 2019 a negligible increase can be seen. As a result, the overall emissions from this category from 0.33 Gg CO_2-eq in 1990 were reduced to around 0.07 CO_2-eq in 2019.

5.2.4 Other process uses of carbonates

The other process uses of carbonates in the mineral industry in the country include ceramics production and soda ash use in the chemical industry. The data for different types of clay used in the industry for processing of other non-metallic minerals from the SSO reports, available only until 1998, is used as activity data for ceramic production. To calculate the mass of carbon consumed, a default carbonate content of 10% was used. Since there was evident production of ceramic products (such as bricks and roof tiles, refractory products, expanded clay products, wall and floor tiles, table and ornamental ware, sanitary ware etc.) in the country after 1998, the data for ceramic products were multiplied by a factor of 1.2 in order to continue the trend line for the clay. The factor was calculated as an average of the ratio between the data for clay used in processing industries and the ceramics products produced in the period 1990 – 1998. According to the SSO reports, soda ash is used in the industry for production of basic chemical products and in the industry for processing of chemical products, but data are only available until 1998. The trend of these data was used to extrapolate the series until 2018.

Therefore, the estimated emissions from other process uses of carbonates followed the decreasing trend of both, ceramic product and soda ash uses.

5.3 Metal industry

5.3.1 Iron and steel production

Steel production in Macedonia mainly relies on electricity. The economic activity in this area covers steel and hot rolled plate production. The basic raw material in the technological process of steel production is scrap iron. Iron ore is not used. The production process takes place in two plants: the production of steel in slabs

takes place at the Steel Mill while the production of hot rolled plates takes place at the Rolling Mill for thick plates. The production process of the Steel Mill involves the preparation and processing of scrap iron which is melted in an electric arc furnace, thus producing liquid steel. This liquid steel is then further processed in a ladle furnace (which is an electric furnace) and afterwards continuously cast into slabs. The process in the Rolling Mill for thick plates includes the heating of slabs in pre-heating furnace and the hot rolling of slabs in rolling mills. In the process of the production of slabs, apart from scrap iron as the main input raw material, other materials are used which act as reducing agents, melting agents and electrodes for the electric furnaces (anthracite, coke, lime, dolomite, electrode mass). To calculate the emissions from this category, the data for production of steel middling, steel fragments and slabs were taken into consideration from the SSO reports for Industry, which represent only the steel making process. The MOEPP has started to use Tier 2 approach for calculation of air pollutants from Iron and Steel Industry (for the separate processes) and during the preparation of this report only the data for the last few years were available. Once MOEPP will have a consistent series of calculation for each of the Iron and steel processes from 1990 onward, the same activity data should be taken into consideration in the development of the future GHG inventories.

The trend of the CO_2 emissions from steel production had significant variations. The fluctuations can be partially described as consequences of financial crises that have occurred in the country and in the region, and for some years even globally. In 2012, the industrial installations in the country were obliged to buy electricity at the open market, therefore their production become highly dependent on the market price of the electricity, which had also reflection on the emissions from this industry. As a result, the emissions in 2016 from this industry were 38% lower compared to 1990, and 10% lower relative to 2014. However, in the last two year the steel production have increased. Therefore, the emissions from this category in 2019 reached almost 22 Gg CO_2-eq, or 12% lower than in 1990, and 42% higher compared to 2016–level.

5.3.2 Ferroalloys production

In Macedonia, electricity is mainly used for the production of ferro-alloy. In the electric furnaces, heating is realized by passing current through graphite electrodes suspended in a cup-shaped, refractory-lined steel shell. Carbon reduction of the metallic oxides occurs as both coke and graphite electrodes are consumed. This process results in both CO_2 and CH_4 emissions.

The trend of the GHG emissions from ferroalloy production is fluctuating over the observed period, mainly as a result of the financial crises (locally and globally). In 2019, the GHG emissions amount have decreased for 77% from 1990 level, and for 58% compared to 2016.

5.3.3 Aluminum production

In Macedonia, the largest industrial plant that had a complete process for the production of aluminium alloys, profiles, pipes and structures was closed in 2003. As a result, the aluminium production in the country was drastically reduced, and realized by several small production facilities. From 2014 there is no evident production of aluminium. The GHG emissions from this category have significantly reduced after 2003, at level below 1 Gg CO_2-eq.

5.3.4 Lead production

Lead production in Macedonia was realized until 2003 in a lead and zinc smelter that used to produce under IST (Imperial Smelt Technology). Since 2015, the SSO had reported production of crude lead in the country. As the industrial plant has started with operations in 2015, GHG emissions from this category have occurred again in the country, even though at low level, or 1.4 Gg CO_2-eq in 2015 and 2.3 Gg CO_2-eq in 2016. In the last two years the lead production has increased leading to higher emissions of 3.9 Gg CO_2-eq in 2017, 5.5 Gg CO_2-eq 2018 and 5.7 Gg CO_2-eq 2019.

5.3.5 Zinc production

The zinc production in Macedonia was realized until 2003 with pyrometallurgical process using Imperial Smelt Technology (IST), which allows for the simultaneous treatment of lead and zinc concentrates. The process resulted in the simultaneous production of lead and zinc and the release of non-energy CO_2 emissions. The GHG emissions from this category occurred until 2003.

5.4 Product uses as substitutes of ozone depleting substances

Hydrofluorocarbons (HFCs) and, to a very limited extent, perfluorocarbons (PFCs), are serving as alternatives to ozone depleting substances (ODS) being phased out under the Montreal Protocol. HFCs and PFCs are not controlled by the Montreal Protocol because they do not contribute to depletion of the stratospheric ozone layer. In Macedonia these gasses are mainly used for refrigeration and air conditioning. The HFCs and their blends are controlled by the Ministry of Environment and Physical Planning since 2000. Data for the period from 2000-2010 are based on issued import permits. Data from 2011-2014, used in previous BURs, was actual import taken from the EXIM system. All importers since 2011 should apply on-line through the www.exim.gov.mk system to obtain a valid import permit. The EXIM procedure applies for all refrigerants and it is very simple to monitor the real import. For this report the Ozone Unit of the MOEPP provided data on import of HFCs and HFC blends for the period 2012 -2019. These values were used to recalculate the emissions for these years.

The HFC emissions from this sector follow an increasing trend in the reported years, reaching the highest level of 279 CO_2-eq in 2019, and 234 CO_2-eq in 2016.

5.5 Recalculations

In this inventory, the emissions from the category Product uses as substitutes for ODS were recalculated based on the updated data on import of HFCs and blends provided by the Ozone Unit of the MOEPP. The data provided covered the period 2012 – 2019. Hence the recalculation was made for the period reported under the BUR3, i.e. 2012-2016, and for 2017, 2018 and 2019, new calculations were made. As a result, the HFC emissions reported in this inventory are lower than those reported under the BUR3 (Table 17).

Table 17. Recalculations for HFCs emissions, 2012 - 2016, (Gg CO_2-eq)

	2000	2005	2012	2013	2014	2015	2016
	BUR3						
HFC-23	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HFC-32	0.0	0.8	2.9	3.1	3.0	2.8	3.5
HFC-125	0.7	24.6	63.8	64.0	63.3	63.5	80.3
HFC-134a	3.0	45.0	56.2	56.5	60.8	71.8	127.9
HFC-143a	1.1	30.4	71.2	70.4	69.8	72.0	92.3
HFC-227ea	0.0	2.0	11.5	11.5	9.8	8.8	11.7
Total HFCs	**4.8**	**102.8**	**205.5**	**205.5**	**206.6**	**219.1**	**315.7**
	NC4						
HFC-23	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HFC-32	0.0	0.8	2.5	2.1	1.8	1.5	1.4
HFC-125	0.7	24.6	58.5	49.7	42.3	39.3	44.5
HFC-134a	3.0	45.0	56.3	55.7	55.7	70.6	123.1
HFC-143a	1.1	30.4	66.8	56.8	48.3	46.2	54.9
HFC-227ea	0.0	2.0	11.5	11.5	9.8	8.3	10.3
Total HFCs	**4.8**	**102.8**	**195.5**	**175.8**	**157.8**	**165.9**	**234.2**
Difference in Total HFCs emissions (BUR3-NC4)	**0.00**	**0.00**	**10.04**	**29.66**	**48.81**	**53.14**	**81.48**

5.6 Methodology and emission factors

The estimation of the greenhouse gases from all the categories in the IPPU sector was done in accordance to the 2006 IPCC guidelines (Tier 1, Tier 2) and with the usage of the IPCC Inventory Software.

Emission factors and other parameters with background documentation or technical references were derived from the IPCC Emission Factor Database (EFDB), which contains the IPCC default data and the 2006 IPCC Guidelines. The emission factors were compared to those used in the previous biennial report and national communications and are presented in the Table 18. Furthermore, country-specific emission factors were calculated for the subcategories of Cement Production, Steel Production and Ferro-alloy Production. These emission factors are given in the publication entitled *'National CO_2 and non-CO_2 emission factors for key sectors under IPCC and CORINAIR methodologies'*[3].

[3] Available at: http://www.unfccc.org.mk/content/Documents/INVENTORY/EFs%20EN.pdf

Table 18. Emission factors used for IPPU sector

Emission factor	NC4	Comment
Industrial Processes and Product Use	**CS, DF**	
Mineral Industry	**CS, DF**	
Cement production	CS	National CO_2 and non-CO_2 emission factors for key sectors under IPCC and CORINAIR methodologies
Lime production	DF	DF from 2006 IPCC guidelines
Glass Production	DF	DF from 2006 IPCC guidelines
Other Process Uses of Carbonates	DF	DF from 2006 IPCC guidelines
Ceramics	DF	DF from 2006 IPCC guidelines
Other Uses of Soda Ash	DF	DF from 2006 IPCC guidelines
Metal Industry	CS, DF	
Iron and Steel Production	CS	National CO_2 and non-CO_2 emission factors for key sectors under IPCC and CORINAIR methodologies
Ferroalloys Production	CS	National CO_2 and non-CO_2 emission factors for key sectors under IPCC and CORINAIR methodologies
Aluminium production	DF	DF from 2006 IPCC guidelines
Lead Production	DF	DF from 2006 IPCC guidelines
Zinc Production	DF	DF from 2006 IPCC guidelines
Product Uses as Substitutes for Ozone Depleting Substances	DF	
Refrigeration and Air Conditioning	DF	DF from 2006 IPCC guidelines
Refrigeration and Stationary Air Conditioning	DF	DF from 2006 IPCC guidelines

DF=Default, CS= Country Specific

5.7 Data sources

The data for preparation of the greenhouse gases inventory for the IPPU sector was generally collected from three main sources: the State Statistical Office, the Ministry of Environment and Physical Planning or directly from the industrial plants (Table 19).

Table 19. Data sources for IPPU sector

	Documents	Data provider
Mineral Industry		
Cement production	Annual report of the cement factory - Usje Titan SSO, Industrial production 1989 – 1992, 1993 – 1998, 1996 – 2000 SSO, Industry 2002 SSO, Industry 1999 – 2003 SSO, Industry 2000 – 2005 SSO, Industry 2002 – 2007 SSO, MakStat database 2007 -2019	Usje-Titan – Annual reports; SSO
Lime production		SSO
Glass Production		SSO
Other Process Uses of Carbonates		SSO
Ceramics		SSO
Other Uses of Soda Ash		SSO
Other		SSO
Metal Industry		
Iron and Steel Production	SSO, Industrial production 1989 – 1992, 1993 – 1998, 1996 – 2000 SSO, Industry 2002 SSO, Industry 1999 – 2003 SSO, Industry 2000 – 2005 SSO, Industry 2002 – 2007 SSO, MakSat database 2007 -2019	SSO
Ferroalloys Production		
Aluminium production		
Lead Production		
Zinc Production		
Product Uses as Substitutes for Ozone Depleting Substances		
Refrigeration and Air Conditioning	HCFC Management Phase out Plan- Report Ozone Unit – MOEPP (data for period 2012 - 2019)	MOEPP
Refrigeration and Stationary Air Conditioning		

6 Agriculture, forestry and other land use

Agriculture, Forestry, and Other Land Use (AFOLU) is unique among the sectors considering the numerous processes leading to emissions and removals of greenhouse gases, which can be widely dispersed in space and highly variable in time. The AFOLU sector has some unique characteristics concerning developing inventory methods. The factors governing emissions and removals can be both natural and anthropogenic (direct and indirect), and it cannot be easy to distinguish between causal factors clearly. For the AFOLU Sector, anthropogenic greenhouse gas emissions and removals by sinks are defined as all those occurring on 'managed land'. Managed land is land where human interventions and practices have been applied to perform production, ecological or social functions.

The AFOLU sector covers Livestock production activities; Land use in particular Forestland, Cropland, Grassland, Wetland, Settlements and other land; Aggregate sources and non-CO2 emissions sources on land; and Other.

Forests and forestland in Macedonia cover around 1.1 mil. ha and are characterized with great species diversity but low quality and small annual growth. More than 70% of the forests are coppice, 90% are deciduous, and almost 90% are state-owned. The most dominant species is Beech, and then various oak species. The total wood reserve is estimated at around 70 mil m3, and total annual growth is about 1,7 mil m3. A very large part of the land considered as a forest is a Mediterranean type of forest, characterized by small trees and bushes.

6.1 Emission trends

As one of the primary sources of GHG, the AFOLU sector produced total emissions of CO2-eq varying in a range from 11300.4 Gg in 2000 to the lowest -2125.1.3 Gg in 2014, followed by an significant variations for the period 2015 to 2019, which is mostly result to the year to year changes of emissions in forestland (Figure 27 and Table 20). Main emissions are produced in livestock sector. Cattle are the primary source of GHG among the ruminants. The majority of methane emission arouses from enteric fermentation (approx. 80%), while manure management contributes with only 15-18% of the total CH_4.emissions.

The forestry sector is the major contributor of GHG sinks in the Republic of Macedonia within the Land subsector of AFOLU, with the exception of several years when as a result of forest fires (burned areas), emissions from this category of land use were significantly above the annual average. The area of forestland, the species composition (conifers, broadleaved, mixed), as well as the annual increment and removals from the forests are relatively stable. Land as a part of AFOLU, and more specifically, Forestland, in most cases are significant sinks of GHG. In some years of the reporting period, like in 2005 (-2230.5 Gg CO_2-eq), 2014 (-3382.2 Gg CO_2-eq), and 2018 (-2255.4 Gg CO_2-eq) removals are notable. At the same time, years with significant numbers of forest fires and large burned areas of forest, contribute to increase of the GHG emmisions (2000 with 9842.7 Gg, 2017 with 1133.2 Gg, and 2019 with 1059.59 Gg).

The other land use, like Cropland, Grassland, Settlements, and Other land, participate in the emission of CO_2. In some periods, like in 2016-2019, it can be considered a significant GHG emissions source. This emission mainly results from the conversion of one to another category of land use, when significant amounts of above and below-ground biomass are rapidly removed and is considered a direct loss. The other areas, which remain under the same category of land use, gains, and losses, are in balance (Tier 1) and are considered carbon neutral.

For the non-CO_2 sources of GHG, it can be concluded that numerous management practices and inputs are resulting in a significant amount of GHG emissions, which total emission when summed up, differ in a wide range for specific periods. If we compare the period 1990-2016 where total emission of GHG are in ranges of from 307.8. Gg CO_2-eq in the year 2000 up to 369.1 Gg CO_2-eq, in 2016. In the last three years of the analyzed period (2017-2019), there is a severe increase of the emissions from non-CO2 sources, especially in the categories: direct and indirect emissions from managed soils and manure management. There are no severe changes in the overall emissions trend for the other two types of non-CO2 emissions urea application and rice cultivation. A significant source of non-CO_2 gases is managed soils, which contribute with a total AFOLU CO_2-equivalent emissions (excluding sinks from Forestry) in a range of 17.11% in 2000, up to 29.37 % in 2017.

Figure 27. GHG emissions (and removals) from AFOLU sector (in Gg CO_2-eq)

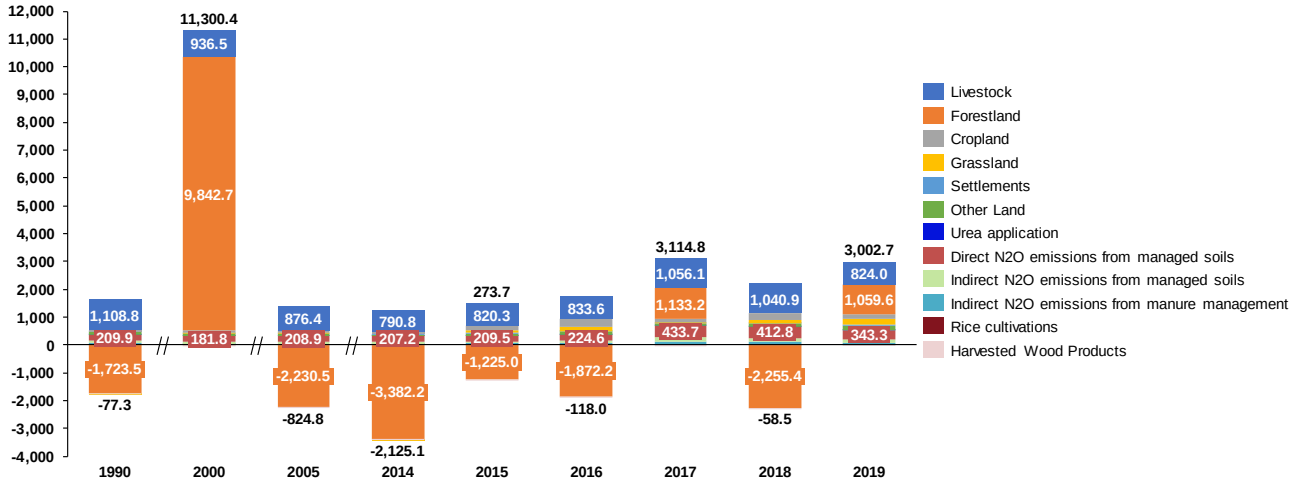


Table 20. GHG emissions and removals from AFOLU sector, by category (in Gg CO_2-eq)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
AFOLU	**-77.3**	**11300.4**	**-824.8**	**-2125.1**	**273.7**	**-118.0**	**3114.8**	**-58.5**	**3002.7**
Livestock	**1108.8**	**936.5**	**876.4**	**790.8**	**820.3**	**833.6**	**1056.1**	**1040.9**	**824.0**
Land	**-1544.8**	**10056.8**	**-2026.9**	**-3250.5**	**-888.7**	**-1319.1**	**1361.3**	**-1761.2**	**1634.4**
Forestland	-1723.5	9842.7	-2230.5	-3382.2	-1225.0	-1872.2	1133.2	-2255.4	1059.6
Cropland	52.2	93.0	74.5	78.2	139.8	256.9	122.6	265.9	198.7
Grassland	-3.5	6.9	40.8	-2.7	109.8	163.0	26.7	103.8	195.9
Settlements	9.5	18.3	14.2	22.9	18.2	6.3	7.4	6.8	16.8
Other Land	120.5	96.0	74.1	33.4	68.4	126.9	71.4	117.7	163.4
Aggregate sources and non-CO_2 emissions sources on land	**359.4**	**307.8**	**326.7**	**336.1**	**343.7**	**369.1**	**699.0**	**663.5**	**544.3**
Urea application	3.7	4.2	0.6	1.7	1.6	1.5	2.8	2.6	2.7
Direct N_2O emissions from managed soils	209.9	181.8	208.9	207.2	209.5	224.6	433.7	412.8	343.3
Indirect N_2O emissions from managed soils	81.3	67.6	76.3	74.6	74.6	80.8	148.3	139.5	114.3
Indirect N_2O emissions from manure management	35.3	31.5	28.8	28.6	34.6	38.9	98.1	93.7	67.5
Rice cultivations	29.2	22.6	12.1	24.0	23.3	23.4	16.3	15.0	16.5
Harvested Wood Products	**-0.7**	**-0.7**	**-1.0**	**-1.5**	**-1.5**	**-1.5**	**-1.6**	**-1.7**	**0.0**

6.2 Livestock

GHG emissions from livestock activities result from their physiological and activity concerning their production and manure management on the farms. There are differences in emissions in different species and types of production, production system, productivity level, farm-specific management, etc. National livestock production of cattle, sheep, goats, and horses is mainly characterized by production systems with low to moderate intensity. However, a part of dairy cows and most swine and poultry production systems are very intensive where emissions from manure management can be closely monitored. Tier 2 was used in dairy cattle and swine for emissions from enteric fermentation and manure management in this report. Simultaneously, as was the case in previous reports, Tier 1 methodology was applied for other species.

6.2.1 Emissions from livestock activities

Ruminants are the primary source of GHG emissions from livestock. In particular, dairy cows and other cattle are emitting the majority of GHGs. Sheep and goats (ruminants), horses, swine, and poultry, contribute significantly less to the sector's emissions. In 2017- 2019, CH_4 emissions were from 33 Gg (2017-18) to 28 Gg in 2019 (Figure 28). On average, most CH_4 emissions were from the enteric formation (88%), while manure management was contributing with 12%. Most CH_4 is produced by enteric fermentation and manure management in cattle (29 Gg enteric and 2 Gg manure), accounting for 80% of livestock's total methane emissions. Enteric fermentation from all other species (sheep, goat, horses, and swine) contributed about 16% of total CH_4 emission in the sector. On average, for the period, 55% of CH_4 emissions from manure management were produced in cattle, and 40% were coming from swine. All other species contributed for only 5% to CH_4 emission from manure management.

N_2O emissions were solely due to manure management. The emissions for the period 2017- 2019 were about 0.7 Gg in 2017 and 2018 and drop to 0.36 Gg in 2019 (Figure 29). The main emitters were swine farms, 84%, followed by cattle farms contributing with 13%. In previous reports, the emission of N_2O was 3-4 times lower when the Tier 1 methodology was applied.

In the assessment, emissions of CH_4 and N_2O were transferred into CO_2 equivalents (Table 21). The CH_4 emissions in 2017, 2018 and 2019 were 814.44; 838.16 and 715.47 Gg CO_2-eq, respectively. The emissions of N_2O over the years are relatively stable, around 41 Gg CO_2-eq until 2016. In the reporting period Tier 2 was applied for estimation of emissions in dairy cattle and swine, so the N_2O emissions were form 214.64 in 2017 to 108.53 Gg CO_2-eq in 2019. The total emissions due to livestock activity in 2017 were 1056.1 Gg CO_2-eq, while dropping in 2019 to 824.0 Gg CO_2-eq. The direct comparison with previously reported emissions is not applicable due to improvement of methodology used, and increased use of manure into bio gas production.

Figure 28. Emissions of CH_4 (in Gg CO_2-eq) from Enteric Fermentation and Manure Management

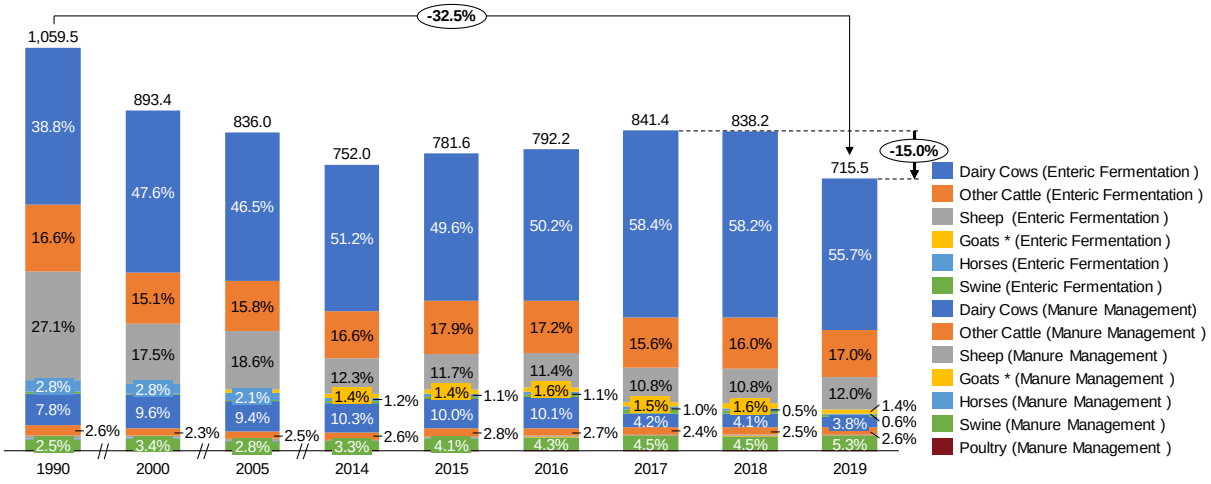


Figure 29. Emissions of N_2O (in Gg CO_2-eq) from Enteric Fermentation and Manure Management

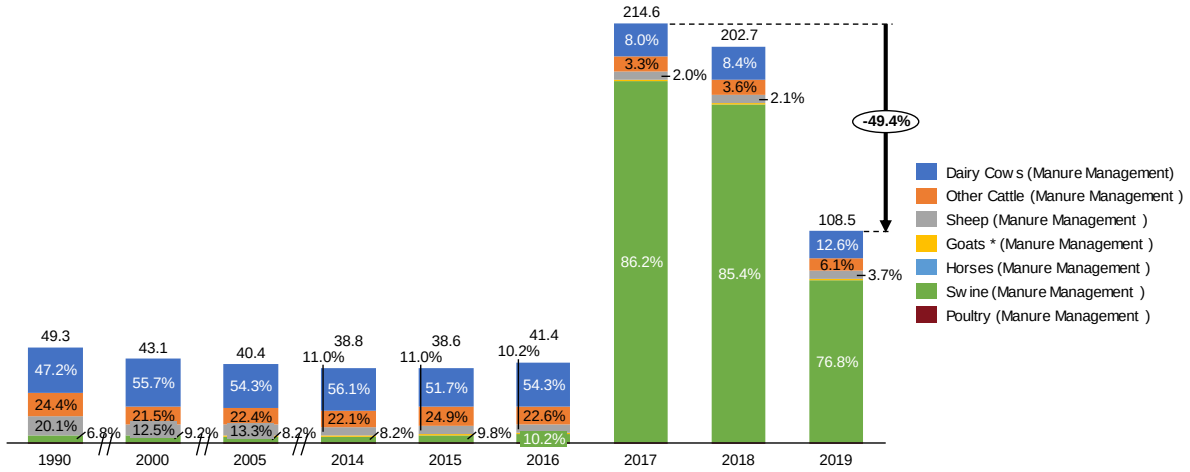


Table 21 Emissions of CH_4 and N_2O (in Gg) due to activities in livestock production

Categories	CH_4									N_2O								
	1990	2000	2005	2014	2015	2016	2017	2018	2019	1990	2000	2005	2014	2015	2016	2017	2018	2019
Enteric Fermentation	**36.33**	**29.88**	**28.23**	**25.01**	**25.78**	**26.06**	**29.73**	**29.62**	**25.08**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Cattle	23.47	22.41	20.83	20.39	21.12	21.36	24.88	24.88	20.82									
Dairy Cows	16.46	17.00	15.54	15.39	15.51	15.90	19.65	19.50	15.95									
Other Cattle	7.01	5.41	5.29	5.00	5.61	5.46	5.23	5.37	4.87									
Sheep	11.49	6.25	6.22	3.70	3.67	3.62	3.62	3.63	3.42					NA				
Goats *	0.00	0.00	0.31	0.41	0.44	0.51	0.50	0.55	0.40									
Horses	1.19	1.02	0.71	0.35	0.34	0.35	0.32	0.18	0.16									
Swine	0.18	0.20	0.16	0.17	0.21	0.23	0.40	0.38	0.27									
Manure Management	**6.05**	**5.85**	**5.21**	**5.07**	**5.48**	**5.63**	**3.93**	**3.90**	**3.54**	**0.17**	**0.14**	**0.14**	**0.13**	**0.13**	**0.14**	**0.72**	**0.68**	**0.36**
Cattle	4.41	4.27	3.96	3.88	4.00	4.06	2.21	2.22	1.84	0.12	0.11	0.10	0.10	0.10	0.11	0.08	0.08	0.07
Dairy Cows	3.32	3.43	3.14	3.11	3.13	3.21	1.40	1.39	1.09	0.08	0.08	0.07	0.07	0.07	0.08	0.06	0.06	0.05
Other Cattle	1.09	0.84	0.82	0.78	0.87	0.85	0.81	0.83	0.76	0.04	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02
Sheep	0.34	0.19	0.19	0.11	0.11	0.11	0.11	0.11	0.10	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
Goats *	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Horses	0.11	0.09	0.07	0.03	0.03	0.03	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Swine	1.07	1.22	0.93	0.99	1.28	1.37	1.52	1.50	1.53	0.01	0.01	0.01	0.01	0.01	0.01	0.62	0.58	0.28
Poultry	0.11	0.07	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total emissions	42.38	35.74	33.44	30.08	31.27	31.69	33.66	33.53	28.62	0.17	0.14	0.14	0.13	0.13	0.14	0.72	0.68	0.36
Total emissions (Gg CO_2.eq.)	**1059.53**	**893.43**	**835.98**	**751.99**	**781.64**	**792.16**	**841.44**	**838.16**	**715.47**	**49.25**	**43.09**	**40.42**	**38.78**	**38.62**	**41.39**	**214.64**	**202.73**	**108.53**

*Note: * Until 2006 the goats are included in the sheep category, IE-Included Elsewhere, NA- Not Applicable*

6.3 Land

The category Land contents Forest land, Cropland, Grassland, Settlements and Other land. Nevertheless, some of the categories are significant contributor to GHG emissions, but other like Forest land can be major CO_2 sink. For this report need, they were deeply analyzed separately.

6.3.1 Forest land

Forests and forest land in Republic of Macedonia cover around 1,1 mil. ha and are characterized with great species diversity, but low quality and small annual growth. More than 70% of the forests are coppice, 90% are deciduous and almost 90% are state owned. The most dominant species is Beech, and then various oak species. Total wood reserve is estimated on around 70 mil m^3, and total annual growth is around 1,7 mil m^3. Very large part of the land considered as forest, are Mediterranean type of forest, characterized with small trees and bushes.

In this report, the revision of the data from the BUR3 report for the forestry sector was made in several levels:

6.3.1.1 Total Forest Area

Data for the total forest area were found in the Statistical Yearbooks, from the State Statistical office, Forestry management plans (PE “Makedonski sumi”, other subjects that manage forests, Ministry of Agriculture, forestry and water economy) and Faculty of Forestry (different experts). All those different data were compared between themselves, and they all differ due to their different update year.

In order to improve the quality and consistency of data for areas under forestland, in this report additional data sources were used. In the previous report, the digital LU/LUC data from CORINE LC were used for calculation of areas under forestland and were checked against the official state data; while for the period before 2000 (when CORINE did not existed) SSO data were used. For this up-dated report, additional effort has been done to improve the land use land use change with developing of methodology for photointerpretation of satellite images from various sources (LandSAT, SENTINEL etc.). Years covered with this set of satellite image analysis is: 1989, 1990 and 2000, 2005, and the period 2014-2019. As for the periods 1991-1999, 2001-2003 and 2006-2012, due to the inexistence of quality imagery data, land use/land use change analysis were performed with statistical methods of interpolation, and were checked against auxiliary data sets, like: SSO data and CORINE land cover. Significantly better results were obtained in the past years, as a result to the existence of high resolution data sets (10m), like SENTINEL satellite images, while for the previous periods the only source of information freely available is LandSAT with 30 m resolution.

Based on this analysis, total forestland area increased from 958.388 ha (1990) to1.042.534 ha (2019), or more than 80.000 ha.

It is not possible to find difference in this sector on annual level because there is no legal obligation to evident them. Most of the data are collected on 10 year cycle, there is no recent forest inventory done, and there are really rear data that can be used with modern technology (satellite imaginary) and prompt evidence of the changes.

6.3.1.2 Areas by different tree species

The data for tree species composition in the forests was used from State Statistical office, compared with the data from the Forestry management plans from MAFWE, PE “Makedonski sumi” and other subjects that manage the forests. There were significant differences in data, so they were changed from the previous report, from 1990 to 2019.

In the previous reports the data for those categories of forest land were not taken into consideration. In this report, new categories of forestland were included in the IPCC software, established their area, growing stock, and used different emission and sink factors from other forest categories, from 1990 until 2019.

6.3.1.3 Growing stock

Revising the previous reports, it was noticed that used growing stock factors are not compatible with the national ones i.e. they are too high to implement for the country. The growing stock factors were therefore changed for conifer, broadleaved and mixed categories of forests, as well as for the two new categories

established in this report, using data from actual Forestry management plans, provided by the experts from UKIM Faculty of Forestry, Department of Forest growth and yield.

6.3.1.4 Land use changes from and to forestry

The analyze of the satellite images, also enables us to calculate the spatial conversions from one land use category to another, which is of crucial importance for calculation and estimation of the GHG emissions, and implementing of the Approach 3 and higher Tiers in selection of activity data. The vast part of emissions from land is result to these conversions from one land use category to another. So, if the national priority is to implement higher Tier methodology in assessment of the GHG emissions and removals in the forestry subsector, the intensive investing in research related to quantifying of national emission and reduction factors is required.

6.3.1.5 Forest for commercial use and firewood

Analyzing previous report, we noticed that in the worksheet, extraction of firewood was twice counted in tables Loss of carbon from wood removals and Loss of carbon from fuelwood removals. This was changed, and the whole series (1990 – 2019) has been updated.

6.3.1.6 Burned forest area

The data for the category Loss of carbon from disturbances was updated with combined data from the State statistical office, subjects that manage forests, MAFWE and Centre for crisis management. We found that there are big differences in some years between the different sources, and we used the most appropriate ones by Department of forest protection, from Faculty of Forestry.

6.3.1.7 Emission trends

Emissions in Republic of Macedonia from forestry sector are product of firewood consumption as well as the forest fires. The most constant producer of CO_2 emission are households that use firewood for heating. Forest fires are the second emitter of CO_2, but they are not constant, and their contribution varies greatly from year to year, depending on their number, and the area that they cover, as well as the species composition in burned areas. There are several years (2000, 2008, 2012, 2017 and 2019) where due to the huge number of forest fires and great burned area, forestry sector instead of removing, contributed into increase of the GHG emissions in the country.

Methodology used for estimation of the emission is Tier1, since there are no accurate data on annual level, improved using CORINE Land cover maps to establish annual land use changes. Also, the annual increment of different types of forests, were changed and used national averages for different categories of forests, provided by the experts from UKIM Faculty of Forestry, Department of Forest growth and yield. Default emission factors were used from the software.

Land use changes from forestry are shown in Table 22.

Table 22. Forestland area, ha

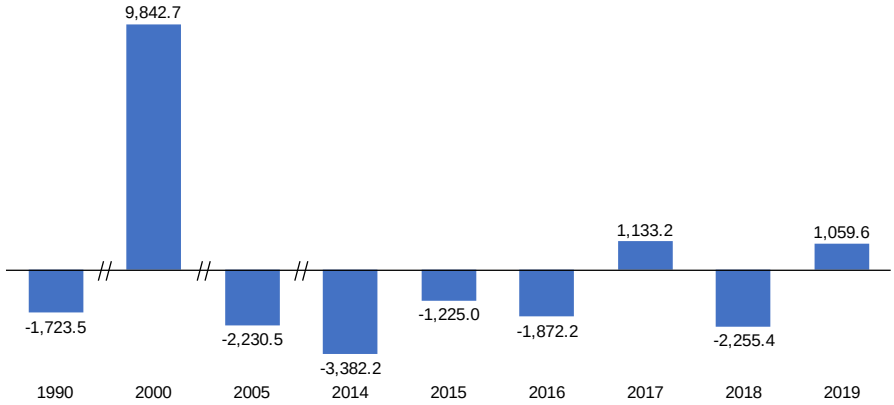
	1990	2000	2005	2014	2015	2016	2017	2018	2019
Forest remaining forest	953863	973487	991016	1020437	1024564	1026558	1031084	1033295	1037179
Land converted to forest land	4525	6789	5729	5210	3948	5807	3916	5841	5354
Total	**958388**	**980277**	**996745**	**1025647**	**1028512**	**1032365**	**1035000**	**1039136**	**1042533**

Trend of the emissions from this sector is shown in the time series in Table 23and Figure 30.Trend of the emissions from this sector is shown in the time series in.

Table 23. Emissions from forestry sector (CO_2-eq)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Forestry	-1723.5	9842.7	-2230.5	-3382.2	-1225.0	-1872.2	1133.2	-2255.4	1059.6

Figure 30. GHG emissions and removals from Forest land (in Gg CO2-eq)



6.3.2 Cropland

According to the National Statistical Office (NSO) methodology, cropland refers to cultivated land used for performing agricultural activities for producing of annual yields. In fact, land-use class Cropland covers the category of arable agricultural land, referring to a land where crop production takes place and which is sown with annual field crops: cereals, industrial crops, vegetables, and fodder crops, and perennial crops, like vineyards, orchards, and grasses (meadows and loans). This category includes fallow and uncultivated arable land. The categories Cropland and Pastures are the two components compiling the agricultural land.

According to the IPCC methodology, GHG emissions and removals resulting from the human activities related to land-use change, change of management practices, and inputs. If no changes occur, the cropland remaining cropland, under annual crops, is considered a system where emissions and removals are in equilibrium (carbon neutral). Significant alteration in carbon pools on cropland occurs during conversions of perennial to annual crops (uprooting) since the whole biomass according Tier 1 is considered immediate emission, or in a case of establishing of new plantation where annual sinks occur due to the bioaccumulation in the growing plants. A significant changes of carbon stocks in the SOC pool occurs due to alteration of management activities (change of FLU, FMG and FI.

6.3.2.1 Cropland area

In this report, estimations of cropland areas were done based on data available within several sources, like national data published in State Statistical Office (SSO) Year Books for the period 1990-2016, and the special publications of the SSO, “Field crops, orchards and vineyards” and “Macedonia in numbers” (2004-2016) and the digital database, MakStat (http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat/?rxid=46ee0f64-2992-4b45-a2d9-cb4e5f7ec5ef) for the period 2014-2018.

In this report, additional data sources were used to improve the quality and consistency of data for areas under cropland. In the previous report, the digital LU/LUC data from CORINE LC were used to calculate areas under Cropland and were checked against the official state data. Before 2000 (when CORINE did not exist), SSO data were used for areas under Cropland. Statistical data from the period of ’90 does not correspond to the IPCC land use classification because SSO data for that period contains data only for four categories: forestland and cropland, grassland, and other land. Most probably, for this reason, the total area under Cropland is reported as more than 620 000 ha, which is much higher than the areas of Cropland after the year 2000. In the previous report to overcome this problem with land use activity data, for the period before 2000 (not covered with CORINE data), an extrapolation of the areas under Cropland has been made, based on the period of 18 years (2000-2018) covered with CORINE LC data. For this up-dated report, an additional effort has been to improve the land use and land-use change data, by developing a methodology for photointerpretation of satellite images from various sources (LandSAT, SENTINEL, etc.). Years covered with this satellite image analysis are 1989, 1990 and 2000, 2005, and the period 2014-2019. As for the periods 1991-1999, 2001-2003, and 2006-2012, due to the inexistence of satellite images with sufficient quality, land use/land-use change analysis were performed with statistical methods of interpolation and was checked against auxiliary data sets, like SSO data and CORINE land cover.

It should be noted that the products obtained with the photointerpretation methodology developed for this exercise were additionally verified against field data (approx. 6000 points). In most cases, the validation check showed a high percentage (more than 70-80%) of overlapping of the actual land use with the land use identified with photointerpretation. Significantly better results were obtained in the past few years due to the

existence of high-resolution data sets (10m), like SENTINEL satellite images. At the same time, for the previous periods, the only source of information freely available is LandSAT with a 30 m resolution.

Based on this analysis, it can be seen that the total area of cropland in 1990 is estimated at 590832.9 ha and slightly decrees in the past 30 years up to 526764.6 in 2019, which is a decrease of more than 64000 ha of Cropland. It should be noted that the trend of decreasing is random, mining that Cropland is gradually lost in the past 30 years, which is probably the result of migration and abandonment of arable agricultural land that is occupied with bushes and forest vegetation.

The analysis of the satellite images also enables us to calculate the spatial conversions from other land use categories to Cropland, which is crucial for calculating and estimating the GHG emissions and implementing Approach 3 and higher Tiers in selecting activity data. The vast part of emissions from land is result to conversions from one land use category to another.

In terms of emission factors, the global ones were used for this inventory in the absence of national emission factors. This is a severe obstacle to accurate estimation of GHG emissions. Emissions factors are the second crucial component, in addition to activation data, for estimation of emissions/removals in Land subsector of AFOLU. The Inexistence of national emission factors and the use of global emission factors exclude any possibility for moving towards higher Tiers.

Therefore, if the national priority is to implement a higher Tier methodology in assessing the GHG emissions in the crop production subsector, an intensive investments in research related to quantifying national emission factors are required.

6.3.2.2 Perennial crops area

Areas under Perennial crops as a part of Cropland have significant importance in estimating the emissions and removals in this category of land use. As previously mentioned, perennial crops participate in yearly removals of CO_2 through accumulation in the above and below-ground biomass produced during the vegetation season. On the other side, when perennial plantations are uprooted (clearance), a massive emission of CO_2 occurs due to the decomposition of large quantities of aboveground and belowground biomass. For these reasons, accurate estimation of perennial crops is very important. In our country, areas planted with perennial crops are estimated as a sum of the land planted with orchards and vine grape planted land. Several data sources were used for collecting the needed data like, the special publication Field crops, orchards, and vineyards, published by the State statistical office of the Republic of Macedonia (period 2007-2018) and the Statistical Yearbook of Republic of Macedonia, for the period 1990 – 2006. For this report, to have a better overview of the dynamics of the newly established and uprooted perennial plantations, additional data were collected from the regional offices of the Ministry of Agriculture, Forestry and Water Economy, and the Paying agency.

6.3.2.3 Cropland Area remaining cropland

The cropland area that remains as cropland for the particular year was calculated based on the total cropland area from the previous year, reduced with an area of Cropland converted to other land use categories. In contrast, the entire land of Cropland for that particular year was calculated by summing up the areas identified as cropland remaining cropland with areas of land converted to Cropland from other land use categories. All these conversion analyses were based on temporal analyses and calculations obtained from photointerpretation of satellite images.

As for the Cropland Remaining Cropland the areas similarly like with the total area under Cropland are stable, but slightly decrease over time from 587231.21 ha in 1990 to 525441.15 in 2019, or total decrease of almost 62 thousand ha. of the Cropland land use category.

6.3.2.4 Conversion from one to other land use type

The area of converted land was estimated exclusively on the base of photointerpretation of satellite images data sets. Periods covered with this analysis were: 1989, 1990, 2000, 2005 and for each year in the period 2014-2019.

Conversions were calculated with subtraction of the territory designated as Cropland, from each consecutive data sets (e.g.1989-1990 differences). Newly identified areas within the category Cropland are considered as gains while the missing parts from the previous year are considered as losses. Special spatial analytical procedures, performed in GIS environment, enabled determining the origin of the gains and conversion path of losses. On this way, an estimation of areas of Cropland remaining Cropland and conversions of each land use category to Cropland and was performed.

Out of the data presented in Table 5 it can be noticed that the area of land converted to cropland vary in a narrow ranges of 1058.15 ha in 2014 up to 2311.93 in 2016. In 1990 the areas converted to Cropland has significantly higher values which I probably due to the influence of the coarse resolution of LandSat images used for analyzing of the LU/LUC for that period.

6.3.2.5 Emission trends

Emission from cropland are manly result to the conversions and changes in perennial plantations. Giving though that the converted areas, as previously explained, are changing in a very narrow boundaries over the analyzed periods, the emissions of CO_2 are varying in a narrow ranges as well. The intensity of emissions is mostly due to the conversion of areas under Forest land to Cropland, when a huge quantities of CO_2 are released from the above and belowground forest biomass. Such trend is more significant in the period after 2015, when more accurate graphical datasets become available, like SENTINEL products. The total yearly emissions with conversions vary in ranges of almost 266 Gg CO_2-eq. in 2018 up to only 52.23 Gg CO_2-eq. in 1990 which is more than 5 time increasing over the analyzed period.

The quantities of emitted CO_2 a very low and are mainly due to the changes in perennial crops. In all years except in several occasions (1990, 2005 and 2017) where an negative trends of CO_2 emissions(removals) occurs, which is result to the more intensive establishing of perennial plantations (especially orchards and vineyards), as a result of the policy of subsidizing the establishment of perennial plantations in the country (Table 25 and Figure 31).

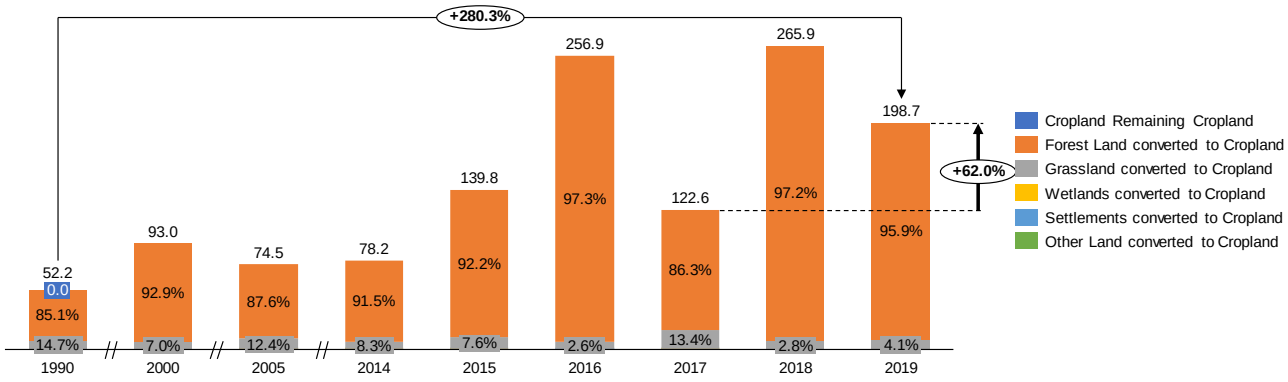
Table 24. Cropland, ha

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Cropland	**590832.9**	**580380.7**	**565252.0**	**543030.0**	**538035.7**	**535904.0**	**533692.3**	**530455.4**	**526764.6**
Cropland Remaining Cropland	587231.2	578265.4	563840.6	541971.9	536197.7	533592.1	531457.8	528162.6	525441.2
Land Converted to Cropland	3601.7	2115.3	1411.3	1058.2	1838.1	2311.9	2234.5	2292.8	1323.5

Table 25. Emissions from cropland (CO_2-eq)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Cropland, Gg CO_2-eq,	**52.23**	**93.03**	**74.52**	**78.16**	**139.79**	**256.88**	**122.63**	**265.94**	**198.65**
Cropland Remaining Cropland	0	0	0	0	0	0	0	0	0
Land Converted to Cropland	52.23	93.03	74.52	78.16	139.79	256.88	122.63	265.94	198.65
Forest Land converted to Cropland	*44.48*	*86.47*	*65.27*	*71.49*	*128.88*	*249.98*	*105.89*	*258.50*	*190.42*
Grassland converted to Cropland	*7.67*	*6.50*	*9.21*	*6.48*	*10.64*	*6.74*	*16.46*	*7.43*	*8.23*
Wetlands converted to Cropland	*0.09*	*0.06*	*0.02*	*0.07*	*0.09*	*0.00*	*0.08*	*0.01*	*0.00*
Settlements converted to Cropland	*0.00*	*0.00*	*0.02*	*0.11*	*0.18*	*0.16*	*0.20*	*0.00*	*0.00*
Other Land converted to Cropland	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*

Figure 31. GHG emissions from Cropland (in Gg CO_2-eq)



6.3.3 Grassland

Grassland together with the cultivated land represent the total agriculture land. Pastures covers areas on higher altitudes above the forests, known as high mountainous pastures, and areas in the lower parts used

for grazing of animals during the winter period. In the process of the photointerpretation of the satellite, images as a Grassland were considered all areas covered with the following categories of land use according CORINE LC: Pastures, Complex cultivation patterns and Natural land with significant areas of natural vegetation.

The majority of grassland is state owned and managed by its Public Enterprise or Pasture Management, while only small part of grassland is private owned. Grassland is used for grazing of animals on open filed predominantly sheep's, and on small areas a special breed of domestic cattle. Grassland in the past decades is undermanaged due to what in many cases grassland is degraded and unsuitable for sheep breeding.

Unlike cropland, which is under heavy pressure of the human activities, like unsuitable management practices and inputs, grassland can be threatened mainly from over grazing, especially in the summer period when grazing of the animals on an open field is particularly intensive. During wither period this pressure is much lower. According some recent studies, pastures as a important part of the areas under Grassland, and have a big production potential and sink of CO_2, if properly managed. In the same time, these areas can serve as a solid base for livestock activities, mostly sheep breeding. Unfortunately, in most cases there are no capital and systematic investments in pastures for increasing its productive potential.

In terms of emissions of GHG, according IPCC methodology, due to the low inputs and management practices for the areas designated as Grassland Remaining Grassland, in Tier 1 approach, grassland is considered as a system in equilibrium in terms of emissions/removals, due to what emissions are not reported. The only inputs on these areas is the urine and excrement deposition from grazing animals.

Main sources of GHG emission arouses during the conversion of other land to grassland, especially forest and cropland

6.3.3.1 Total Grassland

For this report in order to have better overview of the spatial distribution of Grassland and its temporal dynamics LandSAT and SENTINEL graphical data sets were used as a main source of information. In addition several auxiliary national data sources were used as well, like: CORINE Land Cover, State Statistic Office Year Books for the period 1990-2016, and the special publications of the SSO, Field crops, orchards and vineyards and Macedonia in numbers (2004-2016) and the digital data base, MakStat (http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat/?rxid=46ee0f64-2992-4b45-a2d9-cb4e5f7ec5e) for the period 2014-2016. As previously mentioned, almost 6000 ground points for field validation process were used to verify the accuracy of the process of photointerpretation of the satellite images.

Similarly, like with the Cropland, data obtained with the analysis of satellite images, where further interpolated in order to fill the gap years between two reporting periods in the data base. For all years analyzed with this report, estimations of the land use land use change based on a previously explained methodology, has been made for an each year and the year before, in order to calculate the conversions (1989-1990, 1999-2000, 2004-2005, 2013-2014). From the year, 2014 up to 2019 photointerpretation of satellite images has been made for each consecutive year.

According the results from the analysis, it can be noted that the total area of Grassland similarly like with the Copland, fluctuates in a very narrow ranges from slightly above 627 thousand ha. in 1990 to around 626-628 thousand ha. for the period 2014-2019 (Table 26).

In an absence of national emission factors, the global EFwere used, which is a serious obstacle in accurate estimation of the emissions of GHG, and excludes any possibility for moving towards higher Tier. The development of national emission factor as a prerequisite or implementing of higher Tier needs long-term and exact research activities.

6.3.3.2 Grassland remaining grassland

Grassland remaining Grassland, are areas designated as Grassland in at least two consecutive data sets gained with photointerpretation, all other changes are considered as gains and losses and are reported as conversions

6.3.3.3 Conversion from other land use types to grassland

As in the case with the areas of Cropland LU category, conversion were calculated through spatial and temporal analysis of LandSAT and Sentinel satellite imagery, based on the previously developed methodology of photointerpretation and verification of the results. Out of the data presented in Table 26. It can be noted that the areas converted to Grassland category of LU significantly variable and vay in a very broad ranges. If we compare two close periods like, year 2015 and 2016 the differences in converted areas to Grassland are more than a double. There is no reasonable explanation to this, except the fact that in 2016 the area of

Cropland converted to Grassland is significantly lower which might be result to a certain inconsistences in the graphical data sets used for analysis of the LU/LUC.

As mentioned before, the converted areas to Grassland from the other categories, were calculated for all years within this report, as well as any prior to each of the reported years, in order to calculate the conversions. All new areas identified compared to the previous year were marked as gains, coming from the other 5 land use categories.

6.3.3.4 Emission trends

Emissions from the areas of Grassland Remaining Grassland are not reported since removals and emissions, according Tier 1 approach, are in equilibrium (carbon neutral) in all CO_2 pools, like above and below ground biomass, dead wood and SOC. There are certain sources of non-CO_2 emissions coming from the burned areas of Grassland, but due to the absence of exact data of the burned areas, these emissions are not reported. The emission from the grassland is mainly caused by land use changes. Emissions trends from Grassland similarly like the area under this category significantly differ from -3.46 Gg-CO_2-eq in year 1990, up to 195,94 Gg- CO_2-eq. The values of CO_2 emissions, within the period 2014-2019 are significantly higher than to the previous period (1990-2014), which is result to the higher emissions coming from the conversions of areas under Forestland. Having in mind that the analysis of the conversions of LU were done on the base of remotely sensed data, it should be emphasized that in some cases burnt forest areas might be mistakenly reported as Grassland. This might be the explanation for the appearance in some years of a newly converted 100-190 ha of Forestland to Grassland (Table 27 and Figure 32).

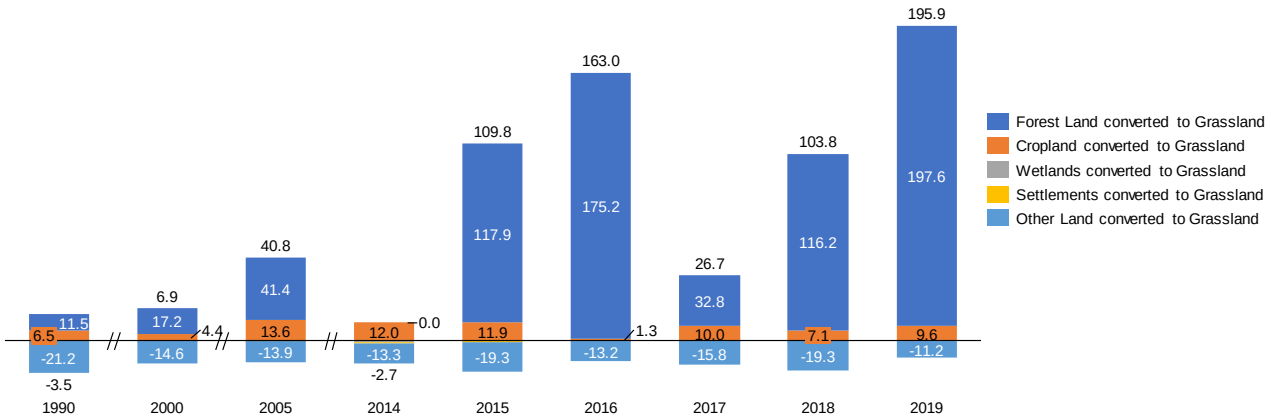
Table 26. Grassland area, ha

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Grassland	**627046.6**	**632047.9**	**631364.4**	**626206.9**	**628084.8**	**627483.6**	**627482.5**	**628355.0**	**626879.1**
Grassland Remaining Grassland	623842.7	629701.3	627239.2	622092.8	623437.2	625424.9	623927.3	624771.9	623234.4
Land Converted to Grassland	3204.0	2346.6	4125.2	4114.1	4647.5	2058.7	3555.2	3583.1	3644.7

Table 27. Emissions from grassland (CO_2-eq)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Grassland	**-3.46**	**6.87**	**40.83**	**-2.71**	**109.83**	**162.95**	**26.72**	**103.80**	**195.94**
Grassland Remaining Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land Converted to Grassland	-3.46	6.87	40.83	-2.71	109.83	162.95	26.72	103.80	195.94
Forest Land converted to Grassland	*11.46*	*17.20*	*41.41*	*0.00*	*117.89*	*175.18*	*32.84*	*116.17*	*197.60*
Cropland converted to Grassland	*6.49*	*4.39*	*13.63*	*12.02*	*11.94*	*1.28*	*9.98*	*7.06*	*9.58*
Wetlands converted to Grassland	*-0.24*	*-0.10*	*-0.32*	*-0.88*	*-0.32*	*-0.29*	*-0.27*	*-0.15*	*0.00*
Settlements converted to Grassland	*0.00*	*0.00*	*-0.01*	*-0.54*	*-0.37*	*0.00*	*0.00*	*0.00*	*0.00*
Other Land converted to Grassland	*-21.16*	*-14.62*	*-13.88*	*-13.31*	*-19.32*	*-13.21*	*-15.83*	*-19.28*	*-11.24*

Figure 32. GHG emissions from Grassland (in Gg CO_2-eq)



6.3.4 Wetland

Wetlands as a land use category in this reports, were identified and delineated from the satellite images used, taking in consideration the CORINE LC classification. The CORINE classes encompassed in the Wetland category of land use, are peat bogs and inland marches. The national Statistic does not report wetlands as a particular type of land use; due to what CLC is the only source of information for identifying categories of LU which falls within Wetland area.

It should be noted that these two land use classes of wetlands according CLC, covers area in the ranges of 15.3 to 15.9 thousands of hectares. According IPCC methodology, wetlands are defined as lands where the water table is artificially changed.

Following this definition, as wetlands in the country can be considered the small areas, which are left as remains of the reclaimed wetlands during the period of 50's and 60`is of the last century. In that period the big land, reclamation projects for drying the wetlands and drainage of the waterlogged soils were conducted in order to solve malaria problem, to create new fertile land for agriculture or to protect soils from waterlogging during the wet period of the year.

In addition, there are two small localities of peatland, which does not, covers more than 20 ha and are not used for commercial purposes.

6.3.4.1 Total Wetland

Estimation of total area of Wetland were accomplished with photointerpretation of satellite images and the classification adopted from CORINE LC. The total area of wetlands is varying in a narrow ranges from 53393.73 ha in 1990 to 54209.19 ha. in 2005, or a maximum difference of 815 ha.

Most of them are protected by low and serve as natural habitats for various plant and animal species. As most referent, are Katlanovo wetland, Ezerani Wetland and Monospitovo. As previously explained, linear regression was used to estimate the areas under Wetlands for years where satellite images for the country with sufficient quality, were not available.

Table 28. Wetland area, ha

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Wetland	**53393.7**	**53722.3**	**54209.2**	**53476.1**	**53461.2**	**53606.9**	**53566.3**	**53625.9**	**53625.9**
Wetland Remaining Wetland	53307.6	53685.4	53853.9	53315.0	53300.0	53291.1	53358.0	53472.5	53625.9
Land Converted to Wetland	86.2	36.9	355.3	161.1	161.2	315.8	208.3	153.4	0.0

6.3.4.2 Wetland remaining wetland

For the identification of the areas under Wetland Remaining Wetland category, the exact procedure was followed like in the formerly described cases of Cropland and Grassland.

6.3.4.3 Conversion from other land use types to wetland

Conversion of other land categories to Wetlands were determined with spatial and temporal analysis of satellite images for all reporting years, and any prior to each of the reported years, in order to calculate the conversions.

For the periods 1991-1999, 2001-2003 and 2006-2012 similarly like explained before linear regression model was used for extrapolation of results gained from satellite images for the reporting years.

6.3.4.4 Emission trends

Unfortunately, as already reported due to some unexpected malfunction of the IPCC software or the database, we were not able to run calculations for the emissions or sinks from the wetlands.

6.3.5 Settlements

Settlement is another category of land use that is not reported within the official national statistics of land use. For this reason, satellite images (LandSAT and Sentinel 2) data source were used to estimate the spatial distribution of the area of this category as well as its temporal dynamics. Similarly, like with the Wetlands, in order to identify which areas from the satellite images should be included within the category of Settlements, CORINE LC classification was used as an auxiliary dataset for this purpose. Several land use classes, out of

in total 31 CORINE LU class, were identified in order to outline the area under Settlements, like: Continuous and Discontinuous urban fabric, Green urban areas and Sport and leisure facilities.

6.3.5.1 Total Settlements

Total area under this category of land use is estimated on approx. of over 30 thousand ha, which significantly increases over time, especially in the period 1990-2014. Whiten this time frame the total areas of settlements is enlarged from 28701.9 ha in 1990 up to 42940.76 in 2014, which is increasing of more than 14,2 ha. (almost 50%), which is result to the intensive urbanization and conversion of other categories of land use into urban areas. This process of conversion is becoming very intensive and is serious problem since very often a fertile agricultural land is lost with soil sealing. In the next period up to 2019, the areas under this category of LU is continuously increasing. Unfortunately, as previously mentioned, there is no available historical statistical data for this category of land use, due to what we are not able to perform quality check of our results gained from satellite imagery photointerpretation (Table 29).

Due to the big mapping, units of the CLC data set and the big width of the linear objects, numerous villages from desegregated type are probably not considered as urban area. We are aware that the applied methodology is not fitting well to the area covered by infrastructure as result of applied methodology, but this was the best data source available for us. This is another fact to the need of annual monitoring of land use change. Such monitoring should be performed by some of the national institutions, applying methodology that will better fit national circumstances, like small size of some urban areas, existence of the complex of urban/agricultural land, etc. In addition, this will solve problem of annual data for land use changes, using real data, not estimated based on regression analyses. Such capacities exist in the country and it is matter of mobilization of the experts that can conduct such analyses on regular basis. This is of importance for land degradation convention and can provide reliable data on soil sealing in the country. Therefore, we recommend putting high priority on this issue in the future.

6.3.5.2 Settlements Area remaining Settlements

Settlement Remaining Settlements category of land use, are areas designated as Settlements in at least two consecutive satellite imagery data sets. All other changes are considered as gains and losses and are reported as conversions.

6.3.5.3 Conversion from one to other land use type

Like in the cases of the other land use categories, conversion were calculated through spatial and temporal analysis of satellite images photointerpretation, with methodology of identification verification and validation of certain LU categories specially developed for this exercise. Land converted to Settlements, as previously explained for the other categories of land use, was identified for each of the reporting years.

Similarly, like in the other categories of land use, the areas of converted areas to Settlement from other categories, for the periods 1991-1999, 2001-2003 and 2006-2012, were calculated with interpolation of data produced with the analysis of the satellite images for the reporting years and their predecessors

6.3.5.4 Emission trends

The emission from the settlements is mainly caused by land use changes. The category of Settlements Remaining Settlements is carbon neutral and some emissions that are quite low in comparison with other sectors are due to conversion of the land use types to settlements.

The land use changes and emission trends are calculated for the converted land for the reporting period 1990-2019. The quantities of the emitted CO2 is quite low and vary in a very broad the ranges of 22.89 Gg CO2-eq in 2014 up to only 6.30 in 2016 which is mainly due to the conversions of Cropland or in some cases Grassland to Settlements. During this conversions, certain quantities of CO_2 are emitted to the atmosphere, due to the cleaning of the vegetation. However, when settlements are established an urban vegetation and green areas are established as well, which should be taken into consideration. In this moment there are no reliable data for these areas nether appropriate procedure its estimation.

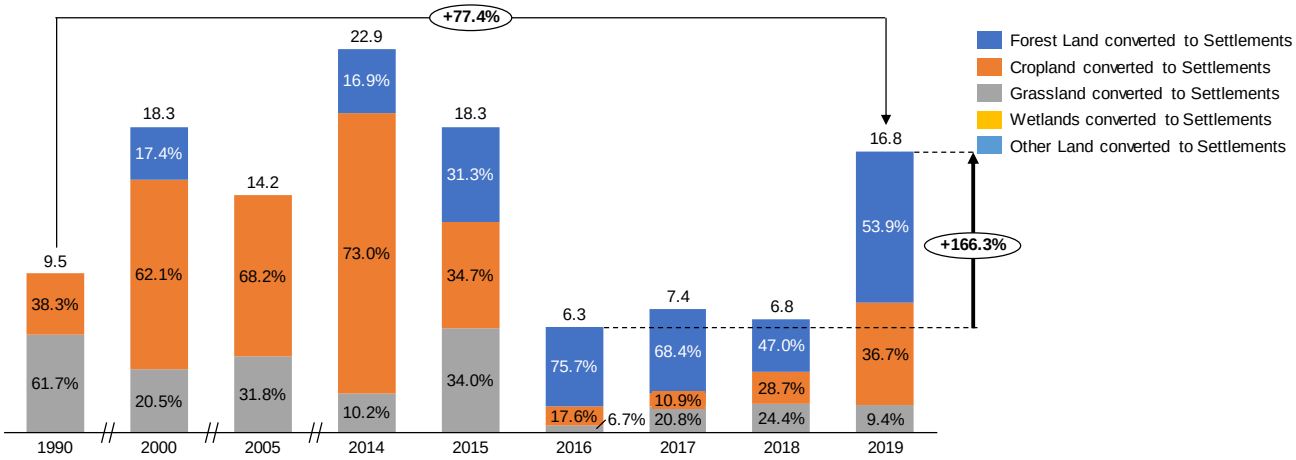
Table 29. Settlements area, ha

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Settlements	**28702.0**	**31782.3**	**36081.2**	**42940.8**	**43724.3**	**43843.6**	**43946.3**	**44200.6**	**44763.8**
Settlements Remaining Settlements	27996.6	30708.5	34985.1	41654.2	42721.1	43557.7	43668.3	43910.0	44200.6
Land Converted to Settlements	705.4	1073.8	1096.1	1286.6	1003.2	285.9	278.0	290.6	563.2

Table 30. Emissions from settlements (CO_2-eq)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Settlements, Gg CO_2-eq,	**9.46**	**18.25**	**14.15**	**22.89**	**18.24**	**6.30**	**7.37**	**6.77**	**16.78**
Settlements Remaining Settlements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land Converted to Settlements	9.46	18.25	14.15	22.89	18.24	6.30	7.37	6.77	16.78
Forest Land converted to Settlements	*0.00*	*3.17*	*0.00*	*3.86*	*5.72*	*4.77*	*5.04*	*3.18*	*9.05*
Cropland converted to Settlements	*3.62*	*11.34*	*9.65*	*16.70*	*6.33*	*1.11*	*0.80*	*1.94*	*6.16*
Grassland converted to Settlements	*5.84*	*3.74*	*4.50*	*2.33*	*6.20*	*0.42*	*1.53*	*1.65*	*1.57*
Wetlands converted to Settlements	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Other Land converted to Settlements	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*

Figure 33. GHG emissions from Settlements (in Gg CO_2-eq)



6.3.6 Other land

The land that is occupied by some other land use type than Forest Land, Cropland, Wetland and Settlements is reported as Other land. Such category does not exist in the documents provided by State Statistical Office, or any other national document. However, there is class other land in CORINE LC, but it is not same other land as needed in this analysis. Therefore, the other land class was calculated as a difference between the total territory of Republic of Macedonia and sum of the land use classes Forest Land, Cropland, Wetland and Settlements.

6.3.6.1 Total Other land

Data for the total other land was developed as mathematical difference between territory of the Republic of Macedonia and land use classes: Forest Land, Cropland, Wetland and Settlements. Total area of Other land has declined significantly over the period covered with these analysis, from almost 255 thousand ha. in 1990, down to bit less than 215.000 ha. in 2014, which is AN reduction of 40.000 ha. The highest intensity of decreasing is in the period 1990-2015, when according to our findings significant areas of Other land were converted to Forest land and Grassland.

6.3.6.2 Other land area remaining other land

The Other land area that remain as Other land in each year was calculated as a difference of the total other land area and the total land use changes from the all other land use types. Data for calculation of the Other land remaining as other land were obtained from the conversion analyses conducted by spatial and temporal analyses of LandSAT and SENTINEL 2 satellite images. Land use changes for Other land are shown in Table 31.

6.3.6.3 Conversion from one to other land use type

The conversions from one land type to settlements were estimated using the same approach as for the other land types, as explained before.

Table 31. Other land area, ha

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Other land	**254725.6**	**234295.7**	**228332.7**	**219809.0**	**219168.5**	**217724.1**	**217105.0**	**214954.0**	**216044.5**
Other land Remaining Other land	250285.9	230401.7	225015.2	217534.6	216446.2	215537.5	214887.7	213102.5	212697.1
Land Converted to Other land	4439.7	3894.0	3317.5	2274.4	2722.2	2186.6	2217.4	1851.5	3347.4

6.3.6.4 Emission trends

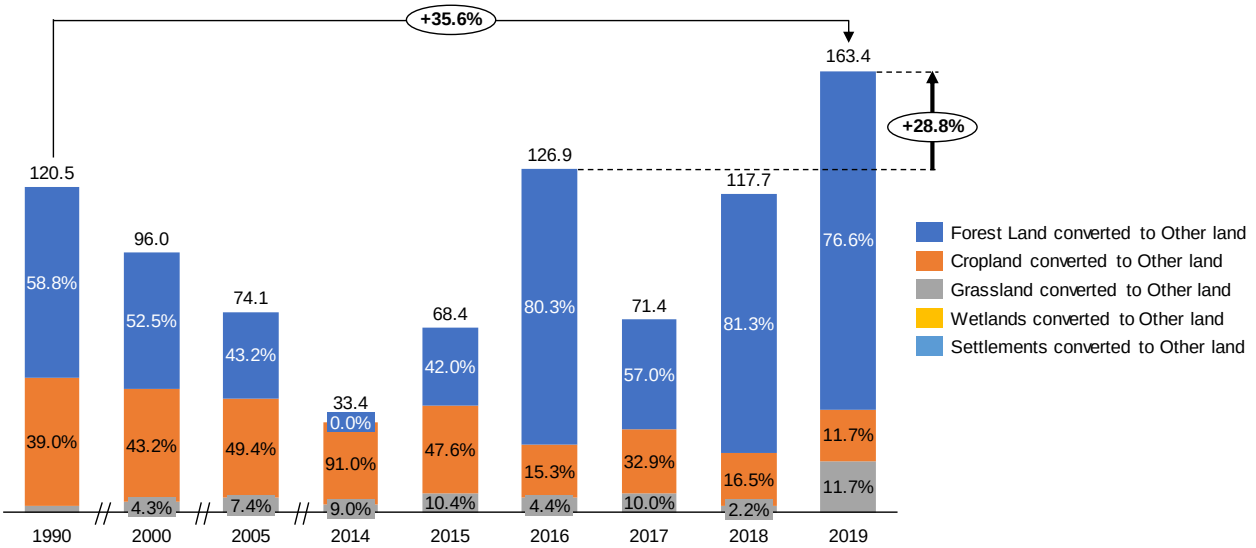
The emission from the Other land is mainly caused by land use changes. The Other land that remains as Other land is carbon neutral and some emissions that are very low in comparison with other sectors are due to conversion of the other land use types to Other land. The land use changes are estimated for the period from year 1990-2019. Emission trends are presented through 8 reporting years, within the concerned period (Table 32 and Figure 34) and the year before each of the reporting years, which enables to calculate the emissions (gains and losses) mainly through differences in LU and management practices.

Emissions trend from this category of land use is significantly variable, and fluctuate in a very vide ranges from only 33.37. Gg CO_2-eq in 2014, up to 163,40 Gg CO_2-eq in 2019. Out of the data presented in Table 32, it can be noticed that this variability of the emissions over the analyzed period is mostly result to the emissions aroused with conversions of forest land to Other land. In some years like 2014, when conversions of Forest land is absent, the emissions are significantly low. Still, it should be noted, that certain categories of land use, like: pastures, other land and certain sub-categories of Forest land, during the process of photointerpretation of satellite images can be very easily mixed, so this variability of the conversion of Forest land might be result to this reason.

Table 32. Emissions from Other land (CO_2-eq)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Other land, Gg CO_2-eq	**120.50**	**95.98**	**74.14**	**33.37**	**68.35**	**126.91**	**71.38**	**117.72**	**163.40**
Other land Remaining Other land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land Converted to Other land	120.50	95.98	74.14	33.37	68.35	126.91	71.38	117.72	163.40
Forest Land converted to Other land	*70.86*	*50.38*	*32.03*	*0.00*	*28.69*	*101.86*	*40.72*	*95.72*	*125.21*
Cropland converted to Other land	*46.99*	*41.49*	*36.63*	*30.37*	*32.53*	*19.47*	*23.50*	*19.47*	*19.13*
Grassland converted to Other land	*2.65*	*4.12*	*5.48*	*3.00*	*7.13*	*5.58*	*7.16*	*2.54*	*19.06*
Wetlands converted to Other land	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Other Land converted to Other land	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*

Figure 34. GHG emissions from Other land (in Gg CO_2-eq



6.4 Aggregate sources and non-CO_2 emissions sources on land

Non-CO_2 emission refers to the practices in the AFOLU sector, which result in an emission of so-called non-CO_2 GHG, like: NO_x, CO, CH_4. There are many management practices and inputs which a considered as important source of non-CO_2 emissions. The emissions considered here are from different sources, like:

- Emission from biomass burning on Land, especially burning of Forest and Pastures, as well as burning of agricultural by-products,
- N_2O direct and indirect emission from managed soils, including indirect N_2O emissions arousing from the inputs of N containing urea and mineral fertilizers, and liming which is a practice used for changing of soil reaction. In this case significant quantities of lime are used which provokes emission of non-CO_2 gases. Liming is not a common practice in the country. As a result of this and inexistence of data, liming is not reported.
- NOx emission manure management is another significant source of NOx

The emissions from all these sources, if considered separately are not very high, except direct N_2O emissions from managed soils, but when aggregated, they are much higher than direct CO_2 emissions from any category of land use.

The non-CO_2 emissions for the period 1990-2016 are slightly variable from 307.8 Gg CO_2-eq in 20000 up to 369.11 Gg CO_2 –eq in year 2016. For the past 3 years from 2017-2019, the non-CO_2 emissions are significantly higher, which is due to the increasing of the values of three key sources of non-CO2 gases: direct and indirect emissions from managed soils and indirect emission from manure management. Emissions for these three reporting years are threefold higher compared to the period 1990-2014 (Figure 35 and Table 33). This increase is most likely result to the newly adopted methodology of calculations in livestock sector (Tier-2) and the new version used for the calculation of these last three years of the inventory.

As for the other two sources of non-CO_2 emissions, urea application has it highest values in the period 1990-2000, then significantly decrease. In the period 2005-2016 its values are around 1.5-1.7 Gg CO_2 –eq, when the values rices again and in the past 3 years (2017-2019) are in the ranges of 2,6-2.8 Gg CO_2 –eq. Emissions from rice fields are also variable and vary in a ranges of 29.17 Gg CO_2 –eq in 1990 to only 12.11 Gg CO_2 –eq in 2015. In the period 2014-2016 are again above 20 Gg CO_2-eq, and in the past three years drops to around 15 Gg CO_2-eq. Emissions from rice fields, is directly dependent to the areas sown with this crop.

Figure 35. GHG emissions from Aggregate sources and non-CO_2 emissions sources on land (in Gg CO_2-eq)

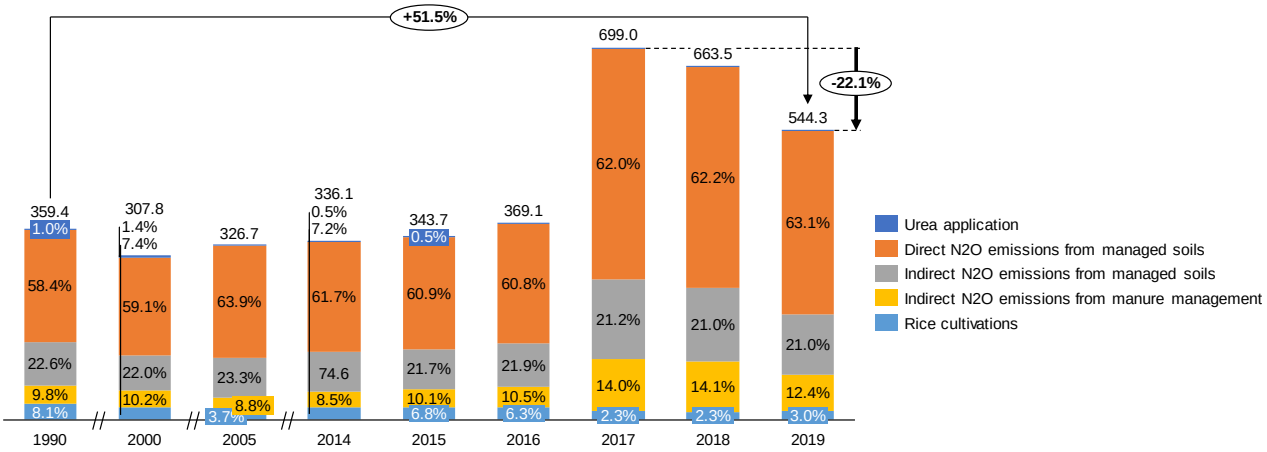


Table 33. GHG emissions from Aggregate sources and non-CO_2 emissions sources on land (in Gg CO_2-eq)

Categories	1990	2000	2005	2014	2015	2016	2017	2018	2019
Aggregate sources and non-CO_2 emissions sources on land	**359.4**	**307.8**	**326.7**	**336.1**	**343.7**	**369.1**	**699.0**	**663.5**	**544.3**
Urea application	3.7	4.2	0.6	1.7	1.6	1.5	2.8	2.6	2.7
Direct N2O emissions from managed soils	209.9	181.8	208.9	207.2	209.5	224.6	433.7	412.8	343.3
Indirect N_2O emissions from managed soils	81.3	67.6	76.3	74.6	74.6	80.8	148.3	139.5	114.3
Indirect N_2O emissions from manure management	35.3	31.5	28.8	28.6	34.6	38.9	98.1	93.7	67.5
Rice cultivations	29.2	22.6	12.1	24.0	23.3	23.4	16.3	15.0	16.5

6.4.1 Urea application

Urea is an important amendment in common agricultural practices, Urea 46%, is used for fast supplement of N to a growing plants in spring when plants inters intensive growing stages. The N in the urea is in amide form

($CO(NH_2)_2$), mining that the release of nitrogen is in close relation to the microbial activities of soil microflora. During this process the urea ($CO(NH_2)_2$) is converted into ammonium (NH_4^{+2}), hydroxyl ion (OH^-), and bicarbonate ($HCO3^-$), in the presence of water and urease enzymes. Similar to the soil reaction following addition of lime, bicarbonate that is formed evolves into CO_2 and water.

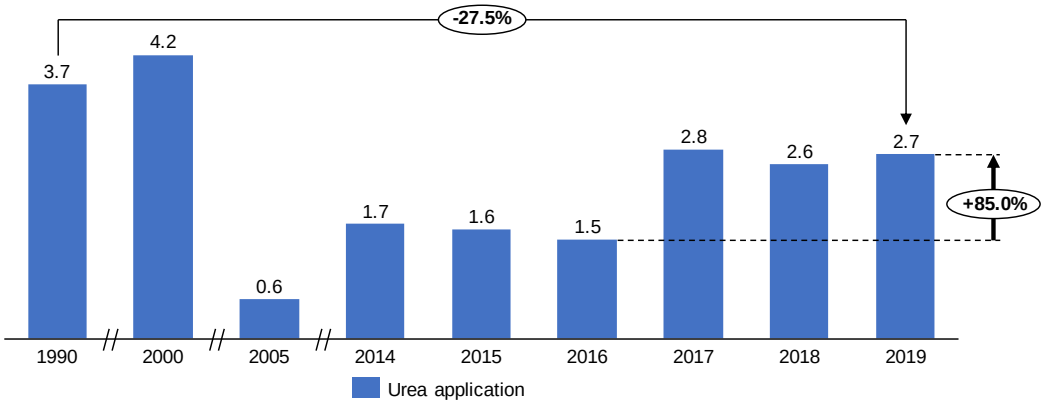
Emission from urea application as a source of non-CO_2 GHG, is very low and significantly variable. In the period 1990-2000 emissions have its highest values, while in the period 2005-2016 are much lower, in the ranges of 0.59 in 2005 to 1.69 in 2014 Gg CO_2-eq (Figure 36). The lower emission in this period is mostly result to the limited use of urea in agricultural production, mainly on cereals and vegetables, in early spring.

In the last 3 year of the reported period emissions, of non-CO_2 gases from this source are increasing again, and are above 2,5 Gg CO_2-eq in all three years 2017-2019.

Table 34. Emissions from land use, Urea application (CO2-eq) in Gg

Categories	1990	2000	2005	2014	2015	2016	2017	2018	2019
Urea application	3.74	4.18	0.59	1.69	1.61	1.47	2.79	2.57	2.71

Figure 36. GHG emissions from Urea applications (in Gg CO_2-eq)



6.4.2 Direct N_2O emissions from managed soils

Soil is very complex and dynamic media, where a enormous number of processes occurs in a short time. Most of the processes are result of the microbial activities or to the other parts of the living organisms which a part of the soil biodiversity. To this end, so called nitrogen turnover is a very complex process encompassing several phases that are directly related to the soil properties in certain moment (temperature, aeration, wetness, soil reaction, etc.) and its influence on microbial activity. Main processes of nitrogen turnover are nitrification, denitrification, ammonification, immobilization, and mineralization.

Nitrous oxide is produced naturally in soils through the processes of nitrification and de-nitrification. One of the main controlling factors in this reaction is the availability of inorganic N in the soil. An increase in available N through human-induced N additions, or change of land-use and/or management practices that mineralize soil organic N, enhances nitrification and de-nitrification rates which then increase the production of N2O.

For this reason, in the estimation of N2O emissions, human-induced net N additions to soils like synthetic or organic fertilizers, deposited manure, crop residues, or mineralization of N in soil organic matter following cultivation/land-use change on mineral soils are of crucial importance.

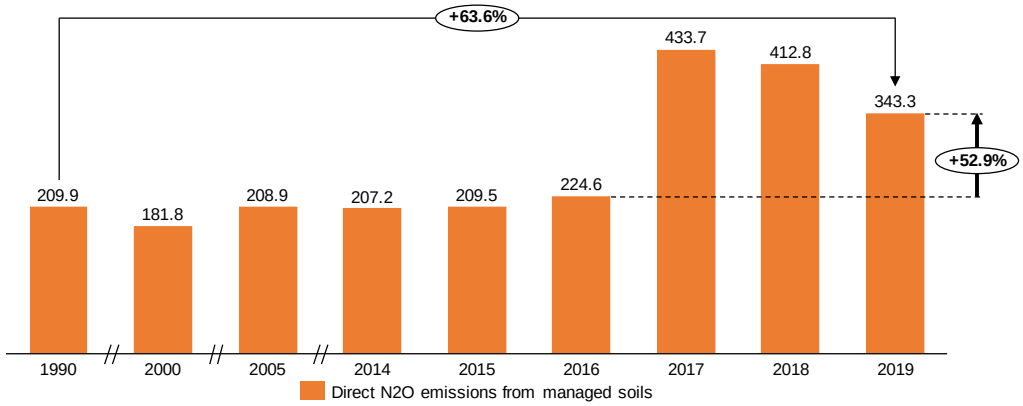
Direct N_2O emissions from managed soils are mainly caused by the intensive inputs of mineral nitrogen fertilizers, manure, and other organic amendments as well as the urine and dung deposits on pastures during grazing of animals on open field. The participation of these three sources of N is variable in the reporting years, hence in the year 1990 the majority of N_2O emissions arouse from organic fertilizers and urine and dung deposits by grazing animals, while in the year 2000 the participation of these three sources is almost equal. Starting from the year 2005 up to the 2019 the emissions arousing from mineral nitrogen fertilizers is increasing and prevails over the other two sources, reaching more than 105, 5 Gg CO_2-eq in the period 201-2019.

As for the trends of the total emission of N_2O from managed soils, it can be noticed that for the period 1990-2016, emissions has lowest values and vary in a very narrow ranges of 181.75 in 2000 up to 209.87 Gg CO2-eq in 1990. In the past three years, there is an abrupt increase of the non-CO_2 emissions, especially in values of the organic N applied as manure and urine and dung deposits from grazing animals. For both of these two sub-categories of emissions from managed soils, the values are three times higher in the period 2017-209, compared with the period 1990-2019. As mentioned before this is most probably due to the new methodology (Tier 2) applied on emissions estimations on dairy cattle and swine in livestock sector (Figure 37).

Table 35. Direct N2O Emissions from managed soils (CO2-eq) in Gg

Categories	1990	2000	2005	2014	2015	2016	2017	2018	2019
Direct N_2O emissions from managed soils	**209.87**	**181.75**	**208.92**	**207.24**	**209.46**	**224.55**	**433.66**	**412.75**	**343.27**
Inorganic N fertilizer application	32.80	52.85	84.72	95.66	91.99	105.48	105.48	105.48	105.48
Organic N applied as fertilizer (manure and sewage sludge)	68.25	58.55	54.25	52.39	52.25	58.14	166.74	146.58	101.36
Urine and dung N deposited on pasture, range and paddock by grazing animals	108.82	70.35	69.95	59.19	65.21	60.94	161.45	160.70	136.43

Figure 37. Direct N_2O emissions from managed soils (in Gg CO_2-eq)



6.4.3 Indirect N_2O emissions from managed soils

Managed soil can be a serious source of the so-called indirect N2O emissions. In general, there are two main processes related to the indirect emission o N2O: volatilization of N in the atmosphere and leaching/runoff of nitrogen.

In the both cases, the volatilization and leaching of N as NH_3 and oxides of N (NOx), is result to the:

- inputs of synthetic N fertilizers; organic N applied as fertilizer; urine and dung N deposited on pasture by grazing animals,
- N in crop residues and
- mineralization/immobilization associated with loss/gain of soil organic matter resulting from changes of land use or management of mineral soils.

Some of the inorganic N in or on the soil, mainly in the NO_3- form, may bypass biological retention mechanisms in the soil/vegetation system by transport in overland water flow (runoff) and/or flow through soil macro pores or pipe drains. Where NO_3- is present in the soil in excess of biological demand, e.g., under cattle urine patches, the excess leaches through the soil profile.

The nitrification and de-nitrification processes transform some of the NH_4^+ and NO_3^- to N_2O. This may take place in the groundwater below the land to which the N was applied, or in riparian zones receiving drain or runoff water, or in the ditches, streams, rivers and estuaries (and their sediments) into which the land drainage water eventually flows.

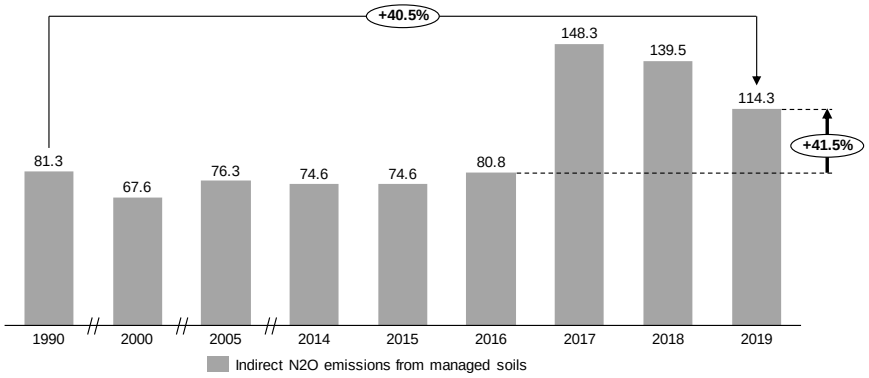
Emission trends

Out of data presented in Table 17 it can be concluded that indirect emissions from managed soil similarly like direct emissions for the period 1990-2016 are stable in all reporting years and vary in the ranges of 67.63 in the year 2000 up to the 81.33 Gg CO_2-eq in 1990. In the past three years as previously explained, the quantities of emitted non-CO_2 gases are doubled and fluctuate in a narrow array of 114.28 in 2019 to 148.25 Gg CO_2-eq in 2017.

Table 17. Indirect N_2O emissions from managed soils in CO_2-eq (Gg)

Categories	1990	2000	2005	2014	2015	2016	2017	2018	2019
Indirect N_2O emissions from managed soils	**81.33**	**67.63**	**76.28**	**74.57**	**74.63**	**80.75**	**148.25**	**139.46**	**114.28**
From atmospheric deposition of N volatilized from managed soils from agricultural inputs of N	36.54	29.03	31.41	30.03	30.25	32.42	64.18	60.04	48.20
From N leaching/runoff from managed soils	44.79	38.60	44.87	44.54	44.38	48.33	84.07	79.41	66.09

Figure 38. Indirect N_2O emissions from managed soils (in Gg CO_2-eq)



6.4.4 Indirect N_2O emissions from manure management

Manure management can be a serious source of N_2O emissions, especially when is not properly managed. The emissions are arousing from the process of volatilization of nitrogen in a form of ammonia NOx.

This portion of N_2O emissions is result to the mineralization of the organic nitrogen in animal excretions, and is most intensive in the process of the collection and storage. In a case of improper collection and storage, emissions of nitrogen through volatilization can be significant. For this purpose, appropriate and timely management of these two processes on farm is of crucial importance for reduction of N_2O emissions. Nitrogen losses begin at the point of excretion in houses and other animal production areas (e.g., milk parlors) and continue through on-site management in storage and treatment systems (i.e., manure management systems).

Nitrogen is also lost through runoff and leaching into soils in the phase of storage of the manure at outdoor areas, in feedlots and in pastures where animals are grazing.

The final step of manure management is application and incorporation in soils. If the process of application and incorporation is not organized in a timely manner, significant losses of N trough volatilization and leaching might occur on the field.

Emission trends

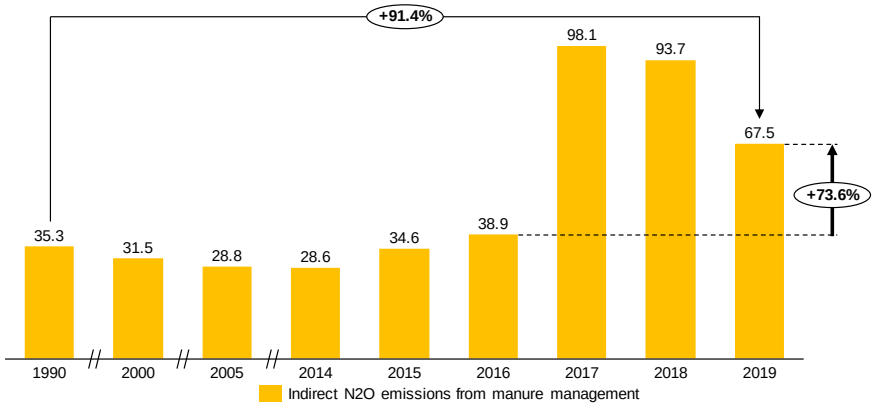
As previously mentioned, the N_2O emissions from manure management are mainly caused with improper management in the processes of collection, storage, application and incorporation in soil. Gg CO_2-eq In general, we can say that the indirect N_2O emissions from manure management are stabile by time. In 2016. In the past three years similarly like with the previous two sources of non-CO_2 emission, the figures sharply

rises from 28.83 in 2005 or 28.56 Gg CO2-eq in 2014, to more than 98 Gg CO_2-eq in 2017. As explained above, this is result to the new methodology of estimation in livestock sector.

Table 17. Indirect N_2O emissions from manure management in CO_2-eq (Gg)

Categories	1990	2000	2005	2014	2015	2016	2017	2018	2019
Indirect N_2O emissions from manure management	**35.27**	**31.54**	**28.83**	**28.56**	**34.64**	**38.90**	**98.08**	**93.75**	**67.51**
Indirect N2O emissions due to volatilisation from MM	34.68	31.16	28.44	28.21	25.91	30.16	95.08	92.69	66.77
Indirect N2O2 emissions due to leaching and runoff from MM	0.58	0.38	0.39	0.35	8.73	8.74	3.00	1.06	0.74

Figure 39. Indirect N_2O emissions from managed soils from manure management (in Gg CO_2-eq)



6.4.5 Rice cultivation

Area of rice growing land in this reported is sourced from the special publication Field crops, orchards and vineyards, published by State statistical office of the Republic of Macedonia (period 2007-2019) and the Statistical Yearbook of Republic of Macedonia, for the period 1990 – 2006.

Most part of the rice fields are situate in the vicinity of Kocani on both banks of Breglnica river. Small portions of rice field are situated in some other parts of the country, in the vicinity of Veles. The sown area of rice fields significantly fluctuate over time, and strongly depends to the weather conditions, especially water supply from Kalimanci dam. The rice growing land fluctuated with strong drop in the middle of nighties from almost 5 thousand hectares in year 1990, down to 1296 ha in year 1995. This was result of severe dry period in the nineties and particularly proclamation of the drought as national disaster in year 1993. After this abrupt reduction, areas of rice fields started to increase gradually, so the total areas in 2000 are almost 3900, ha, while in the period 2014-201 the areas under rice fields are more than 5000 ha. In the past three years, the total areas of rice fields is significantly reduces to approx. 3500 ha. The rice fields are important source of the GHG, particularly methane. The increase of the areas planted with rice, might become a significant source of GHG emission from crop production in the next period.

Table 36. Area of rice fields, ha

Categories	1990	2000	2005	2014	2015	2016	2017	2018	2019
Rice fields	4987	3871	2606	5174	5018	5040	3500	3222	3555

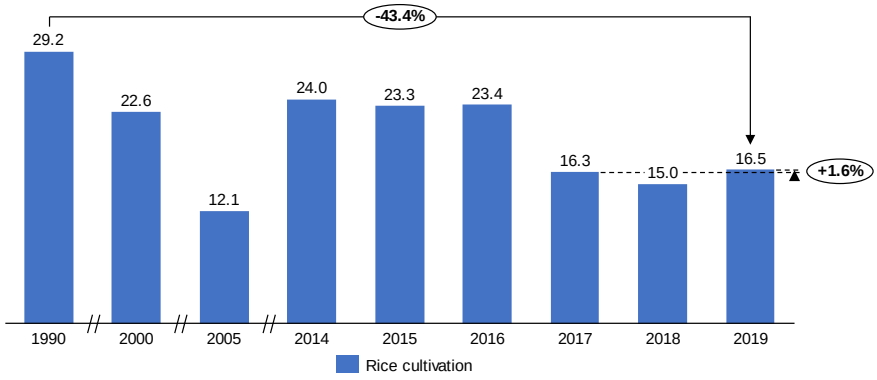
The trend of methane emissions from rice fields follows the trend of rice fields areas, as described above. Out of the data presented in Table 37), it can be noticed that the emissions of CH_4 for the period 1990-2016 are stable, The quantities of emmited methane are in the ranges of 29.17 Gg CO_2-eq in 1990 to 22.5 Gg CO_2-eq in 2000, except in 2005 when the emissions are significantly compared to the other years. This is result to the

reduction of areas of rice fields. In the past three years, methane emissions are stable and are much lower than the previous period, which as noted before is result to reduction of rice field areas. The emissions in the last three years is a bit lower than the previous period 1990-2016, an vary in a ranges of 14.97 in 2018 to 16.52 Gg CO_2-eq in 2019 (Table 37).

Table 37. Emissions from land use, methane emissions from rice cultivation (CO2-eq) in Gg

Categories	1990	2000	2005	2014	2015	2016	2017	2018	2019
Rice cultivations	29.17	22.65	12.11	24.05	23.32	23.42	16.27	14.97	16.52

Figure 40. Emissions of CH_4 from rice cultivation (in Gg CO_2-eq)



6.5 Recalculations

In this GHG inventory, the emissions reported in the previous inventory submission under the BUR3 were recalculated for several categories of the AFOLU sector. Table 38 presents the recalculated emissions and the differences from those reported in the BUR3 and explains the reasons in the comment column.

Table 38. Recalculations of the GHG emissions from AFOLU sector (in Gg CO_2-eq)

		Emissions (Gg CO2-eq)						Comment
		1990	2000	2005	2014	2015	2016	
AFOLU	**BUR3**	**4421.4**	**13848.7**	**1659.7**	**-2127.0**	**-2180.7**	**-2087.8**	Sum of all below
	NC4	**-76.6**	**11301.1**	**-823.7**	**-2123.6**	**275.2**	**-116.5**	
	Diff.	**4498.0**	**2547.7**	**2483.4**	**-3.4**	**-2455.8**	**-1971.3**	
Livestock	**BUR3**	1108.1	936.5	876.4	792.7	822.0	833.5	IPCC Inventory Software version (v 2.691), source data has not been changed, but emissions were differently calculated in manure management (see Release Note Ver.2.691).
	NC4	1108.8	936.5	876.4	790.8	820.3	833.6	
	Diff.	-0.7	0.0	0.0	1.9	1.7	-0.1	
Land	**BUR3**	2944.7	12613.0	476.2	-3234.2	-3316.3	-3281.1	**Sum of all below**
	NC4	-1544.8	10056.8	-2026.9	-3250.5	-888.7	-1319.1	
	Diff.	4489.5	2556.2	2503.1	16.2	-2427.6	-1962.0	
Forestland	**BUR3**	-509.8	9160.3	-2927.7	-3632.8	-3666.6	-3603.6	Differences in emissions in forestry sector are mainly occurring because of the double counting of firewood (in loss of carbon from wood removals and loss of carbon from fuelwood removals) from 1990 to 2000. Second factor is land conversion from different LU categories (explained in row cropland) in 2000, 2005, as well as the updated data for forest harvesting and forest fires in different years (2014, 2015 and 2016).
	NC4	-1723.5	9842.7	-2230.5	-3382.2	-1225.0	-1872.2	
	Diff.	1213.7	-682.3	-697.2	-250.6	-2441.7	-1731.5	
Cropland	**BUR3**	1627.4	1624.9	1616.2	34.8	28.8	31.2	Emissions/sinks on LU category cropland is due to the conversions from one to the other LU category. During the preparation of the 3-rd BUR national spatial LU data, which are indispensable for calculation of conversions, were not available. The only spatial data set was CORINE land cover, which is covering the period after year 2000. This database is giving an estimated for the LU/LUC for a time period of years. In the moment, there are four sets of data (2000, 2006, 2012 and 2018) available. A
	NC4	52.2	93.0	74.5	78.2	139.8	256.9	
	Diff.	1575.2	1531.8	1541.7	-43.4	-110.9	-225.7	

Grassland	**BUR3**	1780.4	1662.3	1638.7	32.3	27.9	25.8	specifics identified for the MKD CORINE dataset, is that the converted areas for the period 2000-2006 and 2000-2012 are much higher than for the period 2012-2018, which might be result to the adjustments and fine tuning of the categories or use of more precise satellite images. For these reasons, there are much higher values for emissions in this category for the reporting years 2000 and 2005 in comparison to the 2014, 2015 and 2016, where the emissions are minimal. It should be noted that the values for all years except year 2000, were calculated with interpolation, due to the lack of exact data for the reporting years. Similarly, for 1990, the data are calculated by extrapolation of the trend for the period 2000-2012. As for the data reported for the 4-th NC, the emissions/sinks are calculated on the base of the previously processed satellite images for the country, and calculation of the conversions between different categories. For each reporting year, converted areas and areas remaining in the same LU category were calculated as a difference between the remotely sensed data for each reporting year and the previous one. Different products of LandSat data were uses, due to what there are certain increase in year 2015 and 2016 which is due to the higher quality and availability of RS data. So, in general the difference are due to the lack of data for the period before 2000, significant differences in CORINE LC datasets and adoption of new methodology and approach in estimation of the LU categories and LUC.!
	NC4	-3.5	6.9	40.8	-2.7	109.8	163.0	
	Diff.	1783.8	1655.4	1597.9	35.0	-81.9	-137.2	
Settlements	**BUR3**	26.8	130.2	124.3	3.6	9.4	2.9	
	NC4	9.5	18.3	14.2	22.9	18.2	6.3	
	Diff.	17.3	111.9	110.1	-19.2	-8.9	-3.4	
Other Land	**BUR3**	19.9	35.4	24.8	327.9	284.2	262.6	
	NC4	120.5	96.0	74.1	33.4	68.4	126.9	
	Diff.	-100.6	-60.6	-49.4	294.5	215.8	135.7	
Aggregate sources and non-CO_2 emissions sources on land	**BUR3**	382.3	313.1	327.7	338.8	339.6	360.0	**Sum of all below**
	NC4	359.4	307.8	326.7	336.1	343.7	369.1	
	Diff.	22.9	5.4	1.0	2.7	-4.0	-9.1	
Urea application	**BUR3**	3.7	9.1	1.3	3.7	3.5	3.2	The differences are result to the technical error of improper entrance of data in the 3-rd BUR, which was identified and corrected during the preparation of the NC4 report
	NC4	3.7	4.2	0.6	1.7	1.6	1.5	
	Diff.	0.0	4.9	0.7	2.0	1.9	1.7	
Direct N_2O emissions from managed soils	**BUR3**	212.0	183.7	210.8	209.3	208.4	224.5	The differences are due to change in land surface and use of software versions (v 2.691), emissions were differently calculated in manure management (Release Note Ver.2.691).
	NC4	209.9	181.8	208.9	207.2	209.5	224.6	
	Diff.	2.1	1.9	1.9	2.1	-1.1	-0.1	
Indirect N_2O emissions from managed soils	**BUR3**	82.3	68.5	77.1	75.5	75.8	79.2	
	NC4	81.3	67.6	76.3	74.6	74.6	80.8	
	Diff.	0.9	0.8	0.8	0.9	1.2	-1.6	
Indirect N_2O emissions from manure management	**BUR3**	32.1	29.3	26.5	26.3	28.8	29.8	
	NC4	35.3	31.5	28.8	28.6	34.6	38.9	
	Diff.	-3.2	-2.3	-2.4	-2.3	-5.9	-9.1	
Rice cultivations	**BUR3**	52.3	22.7	12.1	24.1	23.2	23.4	Technical error in entrance of statistical data
	NC4	29.2	22.6	12.1	24.0	23.3	23.4	
	Diff.	23.1	0.0	0.0	0.0	-0.2	0.0	

6.6 Methodology and emission factors

6.6.1 Livestock

The emission intensities (emissions per unit of animal product) vary significantly between production units, even within similar production systems. This variability is due to different farming practices and supply chain management. To be able to distinguish different systems and practice levels deep descriptive data set is needed. Official sources of livestock data publicly available (State Statistical Office, Ministry of Agriculture Forestry, and Water Economy) are not providing sufficient data for higher Tier application than Tier 1. However, a survey was conducted in 2019-2020, covering 5-10% of the small dairy and pig farms. The report described in detail specifics of the type of production and feeding practices concerning breed used, manure management, and manure treatment. The practices were used for the large dairy and pig farms from

Integrated pollution prevention and control permits (IPPC). The emission factors were derived for specific breed and production systems and applied for the proportion of the total population. Also, a small part of the dairy cattle, swine, and poultry manure has been used for biogas digesters. Detailed emission factors used for GHG emissions inventory in livestock activities are given in Appendix I, part Emission factors (A I.3.3).

6.6.2 Land

6.6.2.1 Forestland

Emissions in Republic of Macedonia from forestry sector are product of firewood consumption as well as the forest fires. The most constant producer of CO_2 emission are households that use firewood for heating. Forest fires are the second emitter of CO_2, but they are not constant, and their contribution varies greatly from year to year, depending on their number, and the area that they cover, as well as the species composition in burned areas. There are several years (2000, 2008, 2012, 2017 and 2019) where due to the huge number of forest fires and great burned area, forestry sector instead of removing, contributed into increase of the GHG emissions in the country.

6.6.2.2 Cropland

Emissions from various categories of Land are significantly variable and are mostly result to conversions from one to another category of land use or changes in management practices and inputs. Moreover, the quantities of emitted CO2 are significantly dependant to the category of land use that has been converted to another LU category, or more precisely the quantities of aboveground and belowground biomass, that will be decomposed. In addition the quantities of emissions/sinks are closely related to the net productivity potential of certain LU type, which is again, closely related to the category of land use. In order to be able to quantify the areas under certain land use type and their conversions from one to another LU type, spatial data are needed. These data will give an answers for the areas under certain LU type or about the converted areas, which are the needed activity data when quantifying CO2 emissions, The only source of such spatial data on a country level are CORINE LC (COPERNICUS) data set, which has been used in the previous reports. Giving though that the update of this data set is every years,

GHG inventory in AFOLU sector relay on two major segments, activity data that encompasses all activities resulting from human impact, like: land use change, management practices and inputs and emission factors which refers to the effect of the human activities on the intensity of the GHG emissions and removals.

Methodology used for estimation of the emission from cropland is Tier1. In the past two reports some very valuable and important efforts has been done in order to move forward to the Tier 2 methodology in some parts of the inventory.

To this end, Land use/Land change data were calculated from a spatial graphical data source (LandSAT and SENTINEL 2 satellite images), enabling implementing of Approach 3 (Chapter 3 of IPCC GL) and Tier 2 level in the segment of the activity data - land use (land use category remain in the same land use category and land use category converted to other land use).

In the previous Report (Third Biannual Report) certain inconsistencies of the CORINE LC data set were detected which lead to a significant differences between three periods covered with this data set. These inconsistencies were particular significant, when calculating the conversion of one category of land use to another, especially in Cropland, Grassland and Forestland. For this reasons, and in order to improve the temporal and spatial accuracy of land use data, it was decided for the next period to put serious effort in developing of national graphical data source, which will be further on used as a referent source for updating of the whole national data base (1990-2019).

The classification methodology used in this study has been specially developed for North Macedonia. In addition to the satellite data (Landsat and Sentinel), build-up data, digital surface model, and slope data were used. Landsat – 5 imageries has been used for the period between 1988 – 2005, Landsat – 8 for 2014, while for the period between 2015 – 2019, yearly Sentinel – 2 imageries have been used. For consistency, the images were selected from the summer period (July - August) when cloudless images can be obtained and when the vegetation over the study area is fully grown. Before constructing the dataset, atmospheric and geometric pre-processing was performed to the satellite images. Also, two commonly used remote indices were added to the dataset, namely, Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI). The first index is used for vegetation, while the second is used for open water mapping and monitoring. Afterward, the images have been fused with the additional data. One of the most common methods to obtain land use – land cover information from satellite images is remote sensing image classification. Image classification converts the data into meaningful information. Depending on the supervision, classifications can be supervised and unsupervised, while depending on the data type, two

different classification types can be distinguished: pixel and object-based classification. As object-based classification has been proven to be superior over pixel-based classification, the satellite images were classified using object-based image analysis (OBIA). The OBIA was done using rule-set developed for the study area. In the first step of the OBIA segmentation was one where the pixels have been converted into small objects, allowing the system to detect and classify every pixel with water content. For that purpose, a threshold to the NDWI data has been set. Also, the cropland and urban area were limited using the Slope data classifying the flat areas. The urban layer has been integrated into the dataset, and as the urban layer is a binary image, we have classified the urban areas with a simple threshold. In order to simplify the image, a second segmentation with different parameters creating larger object has been processed. The created objects have been observed, and the threshold values have been determined. For the Forest class, both NDVI and brightness values have been used. From the sample inspection, it has been noticed that forests have significantly lower brightness than the other objects such as natural grassland, pastures, and cropland. The Natural Grassland class has been classified using NDVI and elevation threshold. As at some area, grasslands have a low slope, and an additional rule has been applied where high flat areas have been classified as Natural Grassland. Generally, using only spectral information, it is hard to distinguish pastures from some cropland areas. Thus, the main difference between these two classes is the slope. Pastures have been classified using NDVI threshold, while croplands have been classified using slope since part of the croplands does not contain any vegetation during the summer period and have low NDVI value. The accuracy assessment of the results was done using 5.031 random points, and have shown accuracy of 85% which is above the acceptable rate of 75% using middle spatial resolution remote sensing data.

Particular attention will be payed to build up the capacities of the institutions responsible for GHG inventory, to be able to perform photointerpretation and classification of satellite images, for regular updating of the land use/land database with accurate data.

In an absence of national emission factors, the global emission factors were used, recommended within the IPCC manuals or various category of land use. In Table 39 are indicated the emission factors used for estimation of: biomass carbon stock in perennial crops and conversions, soil organic carbon stock, emissions of methane from rice fields and urea application.

The most important challenge is to develop country specific emission factors for various land use types. Our research showed that there is not any scientific/expert paper on determination of the GHG emission factors from various land use types in the country. The serious efforts and investment in research activities is required in order to develop country specific emission factors associated with different land use types.

Table 39. Emissions factors used for GHG emissions inventory in Land

Emission factor	NC4	Comment
1. Cropland remaining cropland		
1a. Biomass carbon stock	• 2,1 t/ha biomass accumulation per year in perennial plantations (first 20 years) - ΔCG, • 63 t/ha biomass loss with clearance of perennial plantations - ΔCL	IPCC Guide – Chapter 5, Table 5.1 and 5.3
1.b Dead organic matter		In Tier 1 methodology Dead organic matter is not calculated
1.c Soil Organic Carbon	• 0.9 t/ha for stock exchange factor (land use) • 1 t/ha for stock exchange factor FMG (management) • 1 t/ha for stock exchange factor FI (input)	IPCC Guide Chapter 5, Table 5.5
1.1. Forest land converted to cropland	120 t/ha biomass loss with clearance during the conversion	IPCC Guide, Chapter 4 Tables 4.7 to 4.12
1.2. Grassland converted to cropland	6,5 t/ha biomass loss biomass loss with clearance during the conversion	IPCC Guide, Chapter 6, Table 6.4
2. Grassland Remaining Grassland		
2.a Biomass carbon stock		Grassland where there is no change in either type or intensity of management, biomass will be in an approximate steady-state
2.b Dead organic matter		The Tier 1 method assumes that the dead wood and litter stocks are at equilibrium,
2.c. Soil Organic Carbon	• 1,0 t/ha for stock exchange factor (land use) • 0.95 t/ha for stock exchange factor FMG (management) • 1,0 t/ha for stock exchange factor FI (input)	IPCC Guide Chapter 6, Table 6.2
2.1 Forest land converted to grassland	120 t/ha biomass loss with clearance during the conversion	IPCC Guide, Chapter 4 Tables 4.7 to 4.12
2.2 Cropland converted to grassland	10,0 t/ha biomass loss biomass loss with clearance during the conversion	IPCC Guide, Chapter 5, Table 5.1
3. Urea application	0.2 volatisation/leaching factor	IPCC Guide, Chapter 11 Table 11.3
3. Rice fields	1.3 Emission factor for CH_4 emission from continuously flooded fields	IPCC Guide, Chapter 11 Table 11.3

6.7 Data sources

6.7.1 Livestock

In the inventory of the GHG emission relevant to the livestock activities, the official data from State Statistical Office are used (MakStat database available online on:

http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat/MakStat__Zemjodelstvo__DobitocnoProizvodstvo.
Additionally, to meet Tier2 data from Food and Veterinary Agency (http://fva.gov.mk), MoEPP (https://www.moepp.gov.mk/), and the survey results were used.
The data provided in the online database is in entire agreement with FAO-stat and Eurostat. For the reported years in some livestock, species data for different categories were available, and it was used in the assessment. Data for GHG emissions inventory due to Livestock production activities are given in Appendix I, A I.1.3, Table 80. All numbers of heads are taken directly from sources except for broilers and turkey, where the data were corrected for annual cycles in compliance with (2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories).

Table 40. Data sources for GHG emissions inventory in Livestock activities

	Documents	Data provider
Livestock	MakStat Database online	State Statistical Office
	Internal report (on request)	Food and Veterinary Agency
	Online IPPC documents	MoEPP
	Survey report (on request)	UNDP

6.7.2 Land

6.7.2.1 Forestland

Data for the preparation of GHG inventory for the Forestry sector was collected from several main sources: State Statistical office, Ministry of Agriculture, forestry and water economy, Subjects that manage state and private owned forests, UKIM- Faculty of Forestry in Skopje, Center for management of crises, Firefighting union of Republic of Macedonia, expert opinions and other domestic and international sources. The sources of data for different categories are presented in Table 41.

Table 41. Data sources for Forestland

Forestry sector	Documents	Data provider
Forest area	SSO Yearbooks; Forestry management plans;	SSO; ESA-Copernicus product – SENTINEL 2, Subjects that manage forests (PE Makedonski sumi, National parks, Association of private forest owners), MAFWE;
Forest types	SSO Yearbooks; Forestry management plans	SSO; Subjects that manage forests (PE Makedonski sumi, National parks, Association of private forest owners), MAFWE;
Growing stock	Forestry management plans; Department of Forest growth and yield;	Subjects that manage forests (PE Makedonski sumi, National parks, Association of private forest owners), MAFWE; Faculty of forestry;
Land use change	SSO Yearbooks Satellite imagery	SSO Satellite imagery ESA-Copernicus product – SENTINEL 2
Removal from forests	SSO Yearbooks; Department of Forest operations and techniques, Faculty of Forestry Monthly and Annual Reports	SSO; Subjects that manage forests (PE Makedonski sumi, National parks, Association of private forest owners), MAFWE
Burned forest area	SSO Yearbooks, Annual reports, internal documents	Subjects that manage forests (PE Makedonski sumi, National parks, Association of private forest owners), MAFWE, Crisis Management Center, Macedonian fire protection unit

6.7.2.2 Land, Non-CO_2, Aggregate sources and non-CO_2 emissions sources on land

Data from several sources were used for preparation of the subsectors Land and the aggregate sources of non-CO_2 emissions. National data sources used were data from the annual publication of the SSO, as indicated in Table 23, and the digital database (http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat). In addition to this or calculation of the agricultural areas under perennial crops, data from the MAWE`s regional offices as well data from the Paying Agency were used as well.

For the calculation of the spatial and temporal land use/land use change in all IPSS categories of land use, the ESA-Copernicus product – SENTINEL 2 data sets were used as indicated in Table 42. (https://scihub.copernicus.eu/dhus/#/home - Copernicus Open Access Hub) and US Geological Survey data set (https://earthexplorer.usgs.gov/)

Mineral fertilizers and urea quantities, in the absence o national data were provides from two data sources, FAO-stat and the International Fertilizer Association Data base - IFA-stat (www.ifastat.org/databases/plant-nutrition).

Table 42. Data sources for Cropland, Grassland, Wetland, Settlement and Other land use, fertilizers and rice

	Documents	Data provider
Forest land remain Forestland **Cropland remain cropland area** **Grassland remain grassland area** **Wetlands remain wetlands area** **Settlements remain settlements area** **Other land remain other land area**	• Field crops, orchards and vineyards (2007-2017) • Statistical Yearbook of Republic of Macedonia (1990-2019) • LandSAT (1988, 1989,1990 , 1999, 2000, 2004, 2005, 2013, 2014), SENTINEL 2 (2015, 2016, 2017, 2018, 2019) • CORINE Land Cover (2000, 2006, 2012, 2018)	• State Statistical Office of Republic of Macedonia • US Geological Survey • European Space Agency • SENTINEL/ESA
Conversions in other category of land use	• LandSAT (1988, 1989,1990 , 1999, 2000, 2004, 2005, 2013, 2014), SENTINEL 2 (2015, 2016, 2017, 2018, 2019)	• US Geological Survey • European Space Agency • Expert work
Areas under permanent crops (vineyards and orchards)	• Field crops, orchards and vineyards (2007-2017) • Statistical Yearbook of Republic of Macedonia (1990-2019) • Yearly evidence of Regional Agricultural Offices, Regional Offices • Paying Agency	• State Statistical Office of Republic of Macedonia • Ministry of Agriculture, Forestry and Water Economy,
Rice growing Area	• Field crops, orchards and vineyards (2007-2017) • Statistical Yearbook of Republic of Macedonia (1990-2019) • MAK stat Database	• State Statistical Office of Republic of Macedonia-MAK stat Database
Annual crops area	• Own calculation based on: Field crops, orchards and vineyards (2007-2019) and Statistical Yearbook of Republic of Macedonia (1990-2006); cropland area minus permanent crop area minus rice growing area	• Expert team
Urea application	• FAO Digital Data Base • International Fertilizer Association Data base	• FAO-stat • IFA-stat

7 Waste

The categories reported under the waste sector are Solid Waste Disposal, Biological Treatment of Solid Waste, Incineration and Open Burning of Waste, and Waste Water Treatment and Discharge. The data categorization format is consistent with previous years to preserve the existing time series, except in sectors where data was introduced.

According to the National Waste Management Plan 2009 – 2015, the solid waste generated in Macedonia is mostly disposed on non-compliant landfills. The landfill Drisla, serving the Skopje region, with approximately 590 000 habitants, is the only permitted landfill in Macedonia and it is relatively well managed. At the municipal non-compliant landfills, dumpsites, or rural areas, the wastes are simply dumped by the Communal Enterprises with almost none standard landfilling activities, no operational costs, except some overheads and occasional waste consumption costs for the extinguishing of emerging landfill fires. There are around 50 operational municipal non-compliant landfills. The need for improvement of their waste management practices has been recognized in the national, regional, and local waste management strategic documents. Furthermore, there are around 1000 illegal disposal sites that need to be terminated. In accordance with the national legislative, the mayors of municipalities are obliged to provide yearly reports on the municipalities' management of non-hazardous waste. The hazardous waste generated by Macedonian mining and processing industries faced severe problems during the transition period, and many have stopped their activities, with no chance of being restarted (according to the latest data there are 8 active plants, 5 stopped with no real possibility of starting, 3 probably temporarily stopped, maybe someday they will be restarted). Their on-site process waste dumps were abandoned as well, and little or no information is available on the history of these dumpsites.

At the Drisla disposal site, a two-chamber medical waste incinerator was installed and started operating in 2000. Data on incinerated amounts of waste are available. The emissions caused by this activity are reported for the first time in the inventory under the BUR3. A few facilities for the biological treatment of organic wastes, including biogas and composting installations, have been installed in Macedonia, which vary in capacity and operation time. Emissions from the Biological Treatment of Solid Waste have been introduced for the first time in the BUR2 and were also reported in the subsequent BUR.

7.1 Emission trends

The calculations show that the Waste sector is one of the sectors with an increasing GHG emissions trend, achieving 635 Gg CO_2-eq in 2019, which is 56% more than the 1990-level or nearly 5% more than the 2016-level. Out of all the sectors, the Solid Waste Disposal category's emissions are most significant, participating with almost 80% in the total GHG emission in 2019 (Figure 41, Table 43). The second category with a considerable amount of GHG emissions is Wastewater Treatment and Discharge, which participates with around 17% in 2019. Incineration and open burning of waste category contribute to 3.6% of the total Waste sector emissions in the last five reported years. The CH_4 and N_2O emissions from the Biological Treatment of Solid Waste category do not contribute essentially to the overall emissions due to the small amount of reported composted waste. Around 92% of the GHG emissions in the last three years of the reporting period are CH_4, while N_2O and CO_2 participate with 7% and 1%, respectively (Figure 42). Detailed results by gases and categories are reported in Table 44.

Table 43. GHG emissions from the Waste sector, by category (Gg CO_2-eq)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Waste	**406.7**	**412.7**	**435.2**	**573.8**	**594.6**	**606.7**	**611.0**	**621.5**	**635.2**
Solid Waste Disposal	265.6	299.4	316.0	440.8	455.2	469.6	480.5	491.3	504.9
Biological Treatment of Solid Waste	0.0	0.0	0.0	0.8	1.2	1.0	0.5	0.3	0.0
Incineration and Open Burning of Waste	8.8	9.6	14.1	22.2	23.1	22.7	22.8	22.7	22.7
Wastewater Treatment and Discharge	132.3	103.6	105.1	109.9	115.1	113.4	107.3	107.2	107.6

The inventory under the BUR3 incorporated the recommendations from the BUR2. Based on it, the emissions from the Waste category are more than four times lower than the results from the BUR2. The improvements

made in the BUR3 are continued to be used in this inventory also. These include domestic waste generation rate for municipal solid waste and industrial waste, created based on the SSO data; waste composition based on the latest national waste management plans; and more industrial sectors included in the Industrial wastewater treatment and discharge sub-category based on SSO data. The same approach was applied in this inventory.

Figure 41. GHG emissions from the Waste sector, by category (in Gg CO_2-eq)

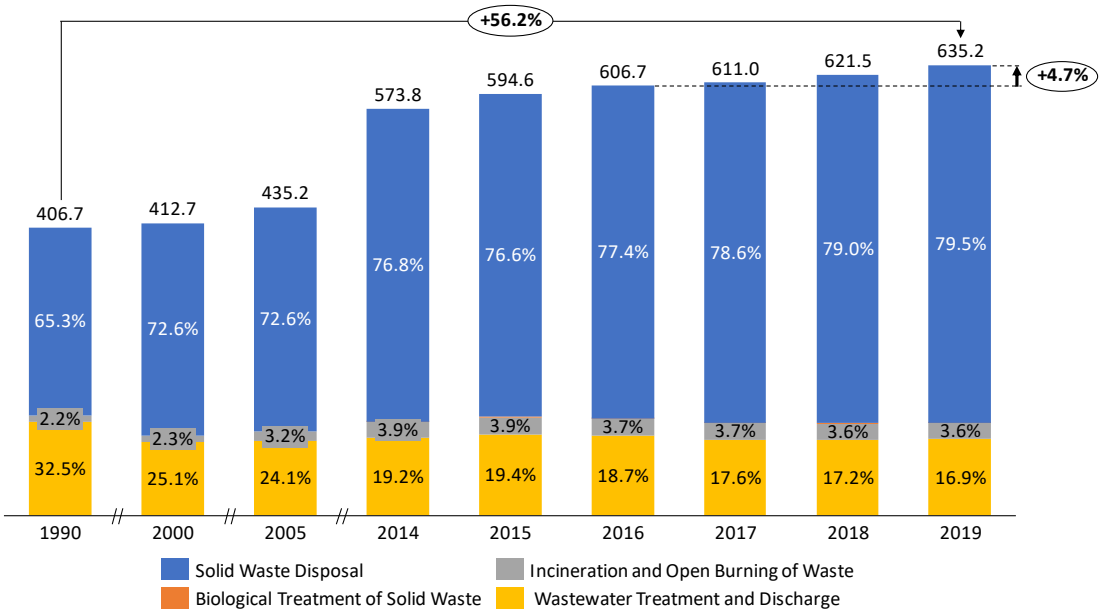


Figure 42. GHG emissions from the Waste sector, by gas (in Gg CO2-eq)

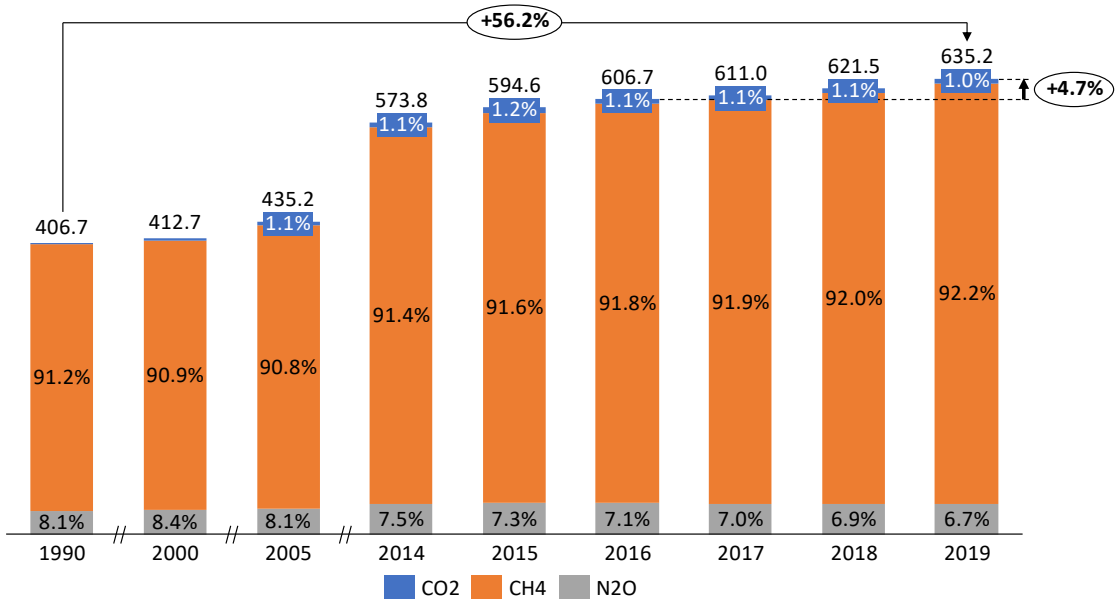


Table 44. GHG emissions from Waste sector, by category and by gas (in Gg CO_2-eq)

Categories	1990			2000			2005			2014			2015			2016			2017			2018			2019		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Waste	**2.9**	**370.8**	**33**	**3.2**	**375**	**34.5**	**4.8**	**395.1**	**35.3**	**6.5**	**524.4**	**42.9**	**6.9**	**544.5**	**43.2**	**6.7**	**556.9**	**43.1**	**6.7**	**561.4**	**42.9**	**6.6**	**572.0**	**42.9**	**6.6**	**585.8**	**42.7**
Solid Waste Disposal	**0**	**265.6**	**0**	**0**	**299.4**	**0**	**0**	**316**	**0**	**0**	**440.8**	**0**	**0**	**455.2**	**0**	**0**	**469.6**	**0**	**0**	**480.5**	**0**	**0**	**491.3**	**0**	**0**	**504.9**	**0**
Managed	NE																										
Unmanaged	NE																										
Uncategorized	NE																										
Biological Treatment of Solid Waste	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.5**	**0.3**	**0**	**0.7**	**0.5**	**0**	**0.6**	**0.4**	**0**	**0.3**	**0.2**	**0**	**0.2**	**0.1**	**0**	**0**	**0**
Incineration and Open Burning of Waste	2.9	5.9	0	3.2	6.4	0	4.8	9.3	0	6.5	12.4	3.3	6.9	12.8	3.4	6.7	12.7	3.4	6.7	12.7	3.4	6.6	12.7	3.4	6.6	12.7	3.4
Waste Incineration	NE	NE	NE	0.1	NE	NE	0.3	NE	NE	0.5	NE	NE	0.7	NE	NE	0.6	NE	NE	0.6	NE	NE	0.5	NE	NE	0.5	NE	NE
Open Burning of Waste	2.9	5.9	0	3.1	6.4	0	4.5	9.3	0	6	12.4	3.3	6.2	12.8	3.4	6.1	12.7	3.4	6.1	12.7	3.4	6.1	12.7	3.4	6.1	12.7	3.4
Wastewater Treatment and Discharge	**0**	99.3	33	**0**	69.1	34.5	**0**	69.7	35.3	**0**	70.7	39.2	**0**	75.8	39.3	**0**	74.1	39.3	0	68.0	39.3	0	67.8	39.4	0	68.3	39.4
Domestic	0	19.7	33	0	19.8	34.5	0	20.1	35.3	0	20.4	39.2	0	20.4	39.3	0	20.4	39.3	0	20.5	39.3	0	20.5	39.4	0	20.5	39.4
Industrial	0	79.6	0	0	49.4	0	0	49.7	0	0	50.3	0	0	55.4	0	0	53.6	0	0	47.6	0	0	47.4	0	0	47.8	0
Other	**NO**																										

7.1.1 Solid waste disposal

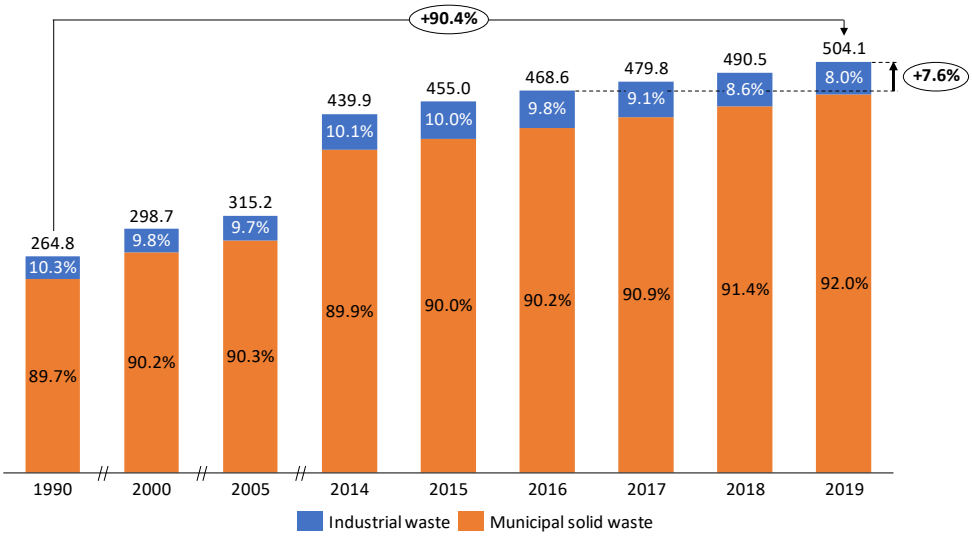
Treatment and disposal of municipal and industrial solid waste produces significant amounts CH_4. A waste by composition approach was applied in the First Order Decay (FOD) calculation. Macedonia is categorized as an Eastern European country, hence, the DOC parameter and methane generation rate constant (k) were assumed to be equal to their corresponding default values provided in the IPCC 2006 Guidelines. As it was mentioned above, based on the latest national waste management plans domestic shares for composition of municipal solid waste are created.

To calculate the total municipal solid waste created in each year, the time series on population data has been updated for 2017, 2018 and 2019. The data sources used for the revision are elaborated in detail in the Chapter 7.4. The average municipal solid waste per capita for the period 2017 to 2019 is 410.6 kg/cap/yr. Moreover, the ratio of collected and generated municipal solid waste was 76.6% in 2016, 80.8% in 2017, 73.2% in 2018, and 69.1% in 2019. However, having in mind that in SWDS there is a category Uncategorized SWDS (in the IPCC software), which according to our national methodology are damp site, a recalculation of the overall time series was made in the BUR3, and it was found that from the total MSW, 90% is going to SWDS, including the Uncategorized SWDS. The rest 10% of waste is reported in the category Open Burning of Waste. In addition, starting from 2006, annual share of different category of SWDS is made, based on the SSO data.

For the Industrial waste, in BUR3, it was decided to use the information for total waste generated by the manufacturing industries because the SSO data on industrial waste generation was not disaggregated by industry type. Therefore, in BUR3, the value of the Degradable Organic Carbon (DOC) factor was revised to be 1, in line with the 2006 IPCC Guidelines (Table 2.5 Chapter 2: Waste Generation, Composition and Management Data). The same approach was used in this inventory. The GDP data was updated for 2017, 2018, and 2019 using the SSO data.

The results show that the amount of CO_2-eq emissions from solid waste disposal have been constantly rising achieving 510 CO_2-eq in 2019 (Figure 43). Compared to 1990 CO_2-eq emissions in 2019 are 90% higher, while compare to 2016 around 8%. Municipal solid waste participates with around 90% over the reporting period.

Figure 43. Emissions of CH4 from Solid Waste Disposal (in Gg CO2-eq)



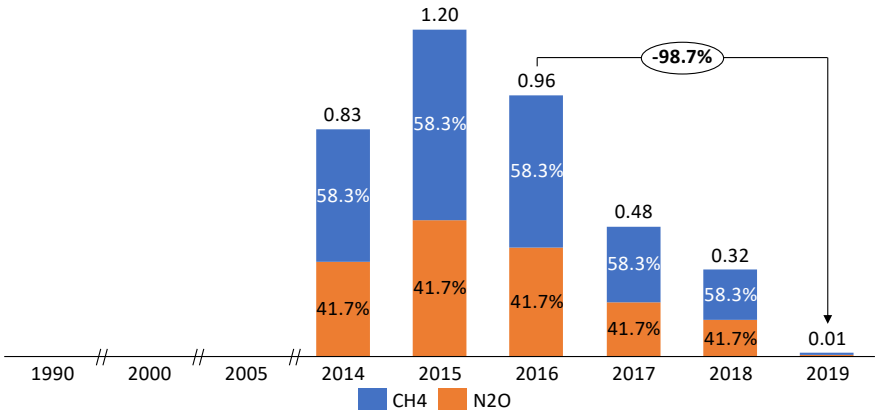
7.1.2 Biological treatment of solid waste

Biological treatment of solid waste in Macedonia is represented by the composting of waste. The existence of composting facilities has been acknowledged in the past, but it is only recently that data on the amount of composted waste has been reported. Methane is formed in anaerobic section from the compost, but it is oxidized to a large extent in aerobic sections of the compost. Composting can also produce emissions of N_2O. As no country-specific emission factors exist, default values have been used.

The emissions from composting have been estimated period, 2011 – 2019, but here only the years from 2014 to 2019 are reported. Observance shows that they are very low, i.e. around 1 Gg CO_2-eq, and decreasing in the last two years. Nevertheless, it may be concluded that the composting practice has become present to the extent that the amount of composted waste is worth reporting, which may be considered as progress. The

same cannot be stated for years prior to 2011. The amount of waste composted in 2016 is equal to 2,239 t, while 1,115 t and 745 t had been composted in 2017 and 2018, respectively. The amount of composted waste for 2019, was provided by MOEPP with note that the low value is mainly due to the lack of information from all municipalities. Around 58% of the GHG emissions from Biological treatment of solid waste are CH_4, while the rest are N_2O (Figure 44).

Figure 44. GHG emissions from Biological Treatment of Solid Waste (in Gg CO_2-eq)



7.1.3 Incineration and open burning of waste

Waste incineration is defined as the incineration of solid and liquid waste in controlled incineration facilities. The Drisla landfill is the only big landfill that has waste incineration facility and only medical waste is incinerated at this site. The greenhouse gas emissions from incineration of medical waste (since 2000) are taken into account in this report.

Open burning of waste can be defined as the burning of unwanted combustible materials such as paper, wood, plastics, textiles, rubber, waste oils and other debris in nature (open-air) or at non-compliant landfills or dumpsites, where smoke and other emissions are released directly into the air without any emission control activities. Open burning can also include incineration devices that do not control the combustion air to maintain an adequate temperature and do not provide sufficient residence time for complete combustion.

Following the recommendations from the IPCC 2006 Guidelines, the fraction of the population burning waste is assumed to be equal to the fraction of waste not deposited in landfills (including the Uncategorized SWDS). This approach was used for the values over the reporting period. The per capita daily waste generation corresponds to the national statistical data on annual per capita municipal waste.

The emissions of carbon dioxide, methane and nitrous oxide have been estimated for this category. Methane emissions are most significant and represent the majority of the total emissions of the gases emitted through open burning. These emissions participated with around 56% in the last five years, while the share of CO_2 and N_2O is 29% and 15%, respectively (Figure 45). Most of the emissions are coming from Open Burning of Waste (98%) (Figure 46).

Figure 45. GHG emissions from Incineration and Open Burning of Waste by gasses (in Gg CO_2-eq)

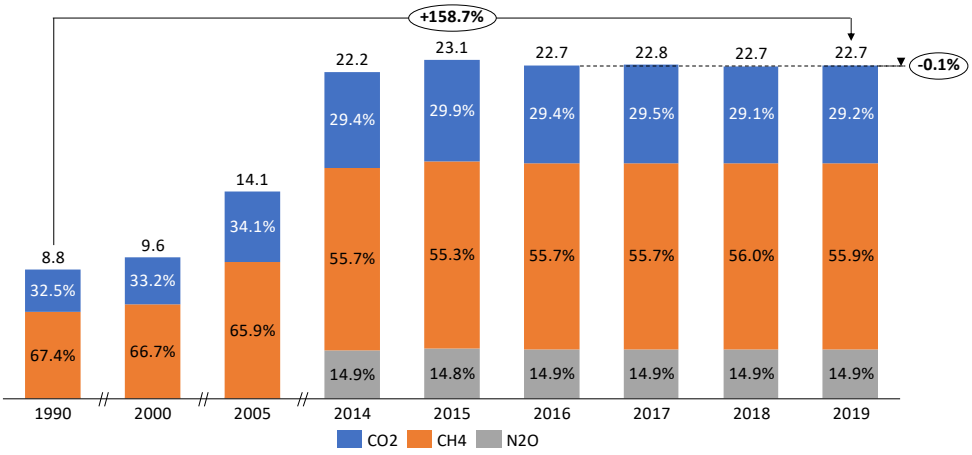
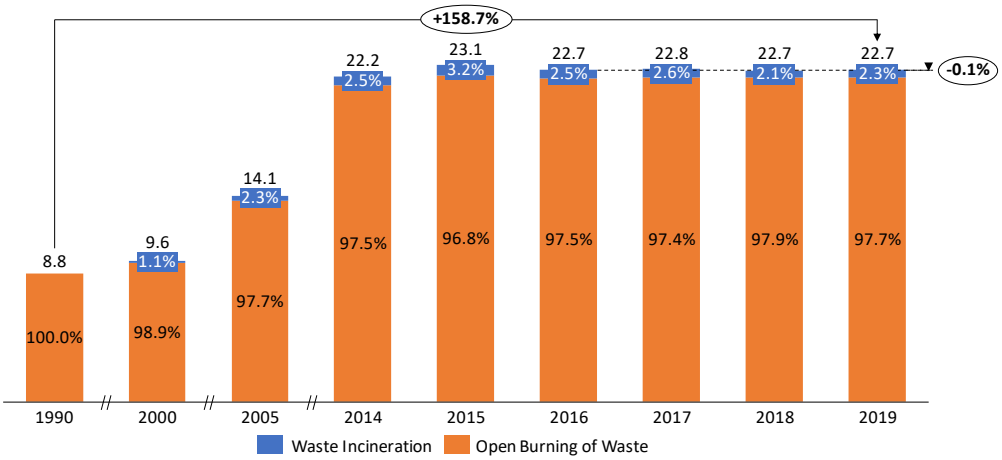


Figure 46. GHG emissions from Incineration and Open Burning of Waste by categories (in Gg CO_2-eq)



7.1.4 Wastewater treatment and discharge

Wastewater can be a source of CH_4 when treated or disposed anaerobically. It can also be a source of N_2O emissions. CO_2 emissions from wastewater are not considered in the IPCC Guidelines because these are of biogenic origin and should not be included in national total emissions.

Wastewater originates from a variety of domestic, commercial and industrial sources and may be treated on site (uncollected), sewered to a centralized plant (collected) or disposed untreated nearby or via an outfall. Domestic wastewater is defined as wastewater from household water use participating with around 50% in the overall emissions from the Wastewater treatment and discharge sub-category (Figure 47). Industrial wastewater emissions are from industrial practices only.

Domestic wastewater treatment and discharge is not a key source of GHG emissions, so the default parameters and emissions factors have been used. The GHG emissions in this category depend on the population size so the emissions gradually increase achieving around 60 CO_2-eq in 2019. Most of the of the emissions are N_2O (66%) associated with the degradation of nitrogenic components in the wastewater, such as urea, nitrate and protein while the rest 34% are CH_4 emissions (Figure 48). It should be noted that the GHG emissions from this category account for 55% of the emissions in the category Wastewater Treatment and Discharge.

The GHG emissions from industrial wastewater treatment and discharge have been estimated using the industrial production data. The recommendations from the BUR2 were incorporated in the BUR3, so based on SSO data more industrial sectors are introduced in the Industrial wastewater treatment and discharge sub-category.

The data have been classified in the following industrial sectors: Alcohol Refining, Beer & Malt, Coffee, Dairy Products, Meat & Poultry, Organic Chemicals, Petroleum Refineries, Plastics & Resins, Pulp & Paper (combined), Soap & Detergents, Starch Production, Sugar Refining, Vegetable Oils, Vegetables, Fruits & Juices, Wine & Vinegar. The correlation with the SSO data was made using the NACE codes. Furthermore, it is assumed that the generated wastewater and the chemical oxygen demand parameter correspond to the default values provided in the IPCC 2006 Guidelines.

Methane emissions account for all of the emissions which are the result of industrial wastewater treatment and discharge. The emissions in 2019 are 11% lower compared to 2016, and 40% lower compared to 1990. The share of emissions from industrial wastewater treatment and discharge out of the total emissions in the category Wastewater Treatment and Discharge are 47% in 2016, and around 44% in 2017, 2018 and 2019.

Figure 47. GHG emissions from Wastewater Treatment and Discharge, by category (Gg CO_2-eq)

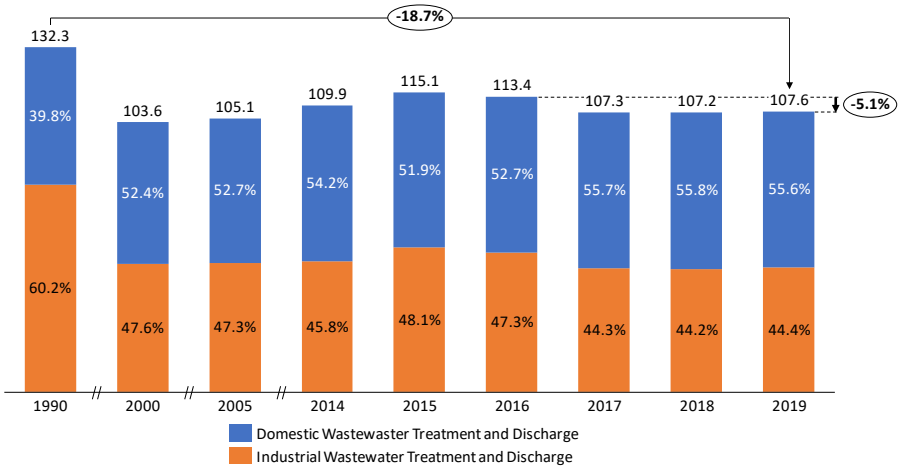
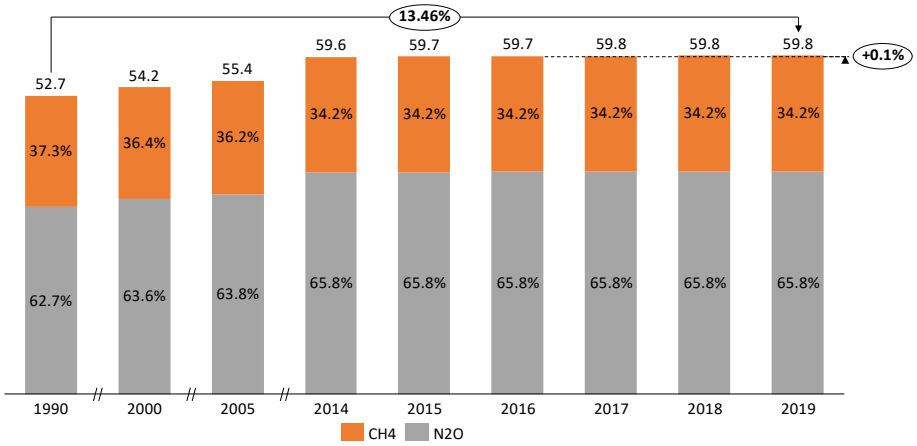


Figure 48. Emissions of CH_4 from Domestic Wastewater Treatment and Discharge, by gas (in Gg CO_2-eq)



7.2 Recalculations

Between the GHG inventory prepared in BUR3 and this inventory, the Drisla landfill published additional information on the amount of the medical waste incinerated at their site. From 2004 onward, besides the previously published amount, the company also included the number of medical waste boxes and added their amount to the waste incinerated. Therefore, GHG emissions from this category were recalculated based on the new activity data. Even though the increase in emission levels (compared to BUR3) is negligible, the recalculation is reported in this inventory (Table 45).

Table 45. Recalculation of emissions from incineration of clinical waste, 2004

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Clinical waste (t)													
BUR3	322.7	375.6	327.0	355.0	358.9	416.3	458.4	470.0	501.3	566.6	572.9	774.9	869.4
NC4	325.8	376.9	335.8	324.7	378.9	443.5	491.7	512.8	551.9	621.0	643.7	837.8	936.6
Difference	-3.1	-1.3	-8.8	30.3	-20.0	-27.2	-33.3	-42.8	-50.7	-54.5	-70.8	-63.0	-67.2
Emissions from Incineration of clinical waste (Gg CO2-eq)													
BUR3	0.28	0.33	0.29	0.31	0.32	0.37	0.40	0.41	0.44	0.50	0.50	0.68	0.54
NC4	0.29	0.33	0.30	0.29	0.33	0.39	0.43	0.45	0.49	0.55	0.57	0.74	0.58
Difference	**0.00**	**0.00**	**-0.01**	**0.03**	**-0.02**	**-0.02**	**-0.03**	**-0.04**	**-0.04**	**-0.05**	**-0.06**	**-0.06**	**-0.04**

7.3 Methodology and emission factors

In the inventory prepared in the BUR3 framework, the Solid Waste Disposal emissions are estimated in accordance with the IPCC 2006 Guidelines using the IPCC Inventory Software, which impose the First Order Decay (FOD) methodology. It produces a time-dependent emission profile that reflects the true pattern of the degradation process over time. Having in mind that solid waste disposal sites contribute the most to the

sector's emissions, as well as the fact that country specific historic data on the amount of disposed waste are available, Tier 2 methodology has been used. Recent documentation reporting the amount of composted waste has made the relevant data available for the period 2011-2019. Because biological treatment of solid waste is not a widespread practice in Macedonia so country specific emission factors have not been assessed so far. Consequently, Tier 1 was applied for the estimation for the gases emitted from biological treatment of solid waste. Following the IPCC 2006 Guidelines, the Incineration and Open Burning of Waste and the Wastewater Treatment and Discharge are not found to be key sectors, thus, Tier 1 methodologies have also been applied for these sectors.

The emission factors used to estimate the GHG emissions of the Waste sector have been taken to be equal to the default values provided in the IPCC 2006 Guidelines (Table 46). The default emission factors CH_4 and N_2O used since the BUR2 to estimate the emissions from composting activities are also used in this inventory.

Table 46. Emission factors used for Waste sector

Emission factor	NC4	Comment
Municipal Solid Waste	DF	IPCC 2006 Guidelines National Waste Management Plan 2009 - 2015
Biological Treatment of Solid Waste	DF	IPCC 2006 Guidelines
Incineration and Open Burning of Waste		
Open Burning of Waste	DF	IPCC 2006 Guidelines
Wastewater Treatment and Discharge		
Domestic Wastewater Treatment and Discharge	DF	IPCC 2006 Guidelines
Industrial Wastewater Treatment and Discharge	DF	IPCC 2006 Guidelines

7.4 Data sources

In the Solid Waste Disposal sector, the population and GDP data for the period 1990-2016 were revised as a part of BUR2 inventory process. In this inventory the population and GDP for 2015 - 2019 were taken from the SSO annual reports.

The State Statistical Office has issued annual reports on Municipal Waste for the reported years 2014 - 2018. It contains information on quantities on generated, collected and waste disposed in waste disposal sites. The Ministry of Environment and Physical Planning releases annual reports on State of the Environment which include the amounts of composted waste. The industry product used as input in the category Industrial Wastewater Treatment and Discharge was obtained from the State Statistical Office Yearbook. All other data was used from the IPCC 2006 Guidelines.

Table 47 contains all of the used data sources for the estimation of greenhouse gases in this inventory report.

Table 47. Data sources for Waste sector

	Documents	Data provider
Municipal Solid Waste	Municipal Waste for 2014, 2015, 2016, 2017, 2018 Estimation of Population of R. Macedonia GDP at current prices	SSO MAKStat database
Biological Treatment of Solid Waste	Annual Report on Quality of Environment 2015-2018 Internal data exchange - 2019	MOEPP
Incineration and Open Burning of Waste		Expert judgement
Waste incineration	Annual program of Drisla landfill for 2021	Drisla website (https://drisla.mk/)
Open Burning of Waste	Municipal Waste for 2014, 2015, 2016, 2017, 2018	SSO
Wastewater Treatment and Discharge		
Domestic Wastewater Treatment and Discharge	Estimation of Population of R. Macedonia World Population Prospects: The 2017 Revision	MAKStat database United Nations Population Division
Industrial Wastewater Treatment and Discharge	MakStat database SSO 2007-2019 Statistical review: Industry and Energy 2002-2007 Statistical review: Industry and Energy 1999-2003 The industry in the Republic of Macedonia 1996-2000 The industry in the Republic of Macedonia 1993-1998 The industry in the Republic of Macedonia 1987-1992	SSO

8 Precursors and indirect emissions

The Decision 17/CP.8, annex, paragraph 16, stipulates that Non-Annex I Parties are encouraged, as appropriate, to report on anthropogenic emissions by sources of indirect GHGs, such as CO, NOx and NMVOC, while in Decision 17/CP.8, annex, paragraph 17, other gases not controlled by the Montreal Protocol, such as SOx, included in the Revised 1996 IPCC Guidelines may be included at the discretion of the Parties.

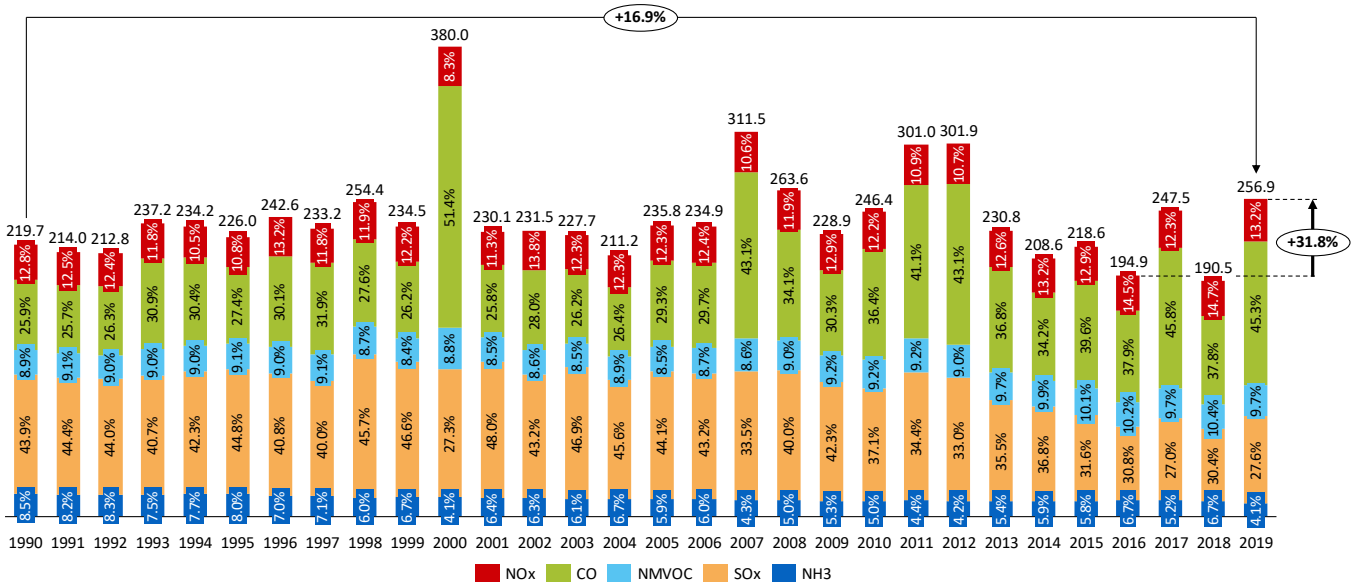
The most recent 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 7: Precursors and Indirect Emissions introduces ways to adopt methodologies to calculate the non-GHG emissions, provides a link to relevant methodology chapters in the EMEP/CORINAIR Emission Inventory Guidebook. Some of the methodologies and emission factors in the EMEP/CORINAIR Guidebook are technology-specific and are relevant to conditions and categories in both developed and developing countries.

In the BUR2, the emissions of NOx, CO, NMVOC and SO_2 were estimated for the period 1990 – 2014. In the BUR3, the emission for 2015 and 2016 year have been estimated, in line with the methodology in the latest EMEP/EEA air pollutant emission inventory guidebook, 2019. In addition, review and recalculation for come categories for the period 1990-2014 was done. Also, the NH_3 emissions have been included, where applicable. This update of the BUR3 NIR includes the estimates for 2017, 2018 and 2019.

8.1 Emission trends

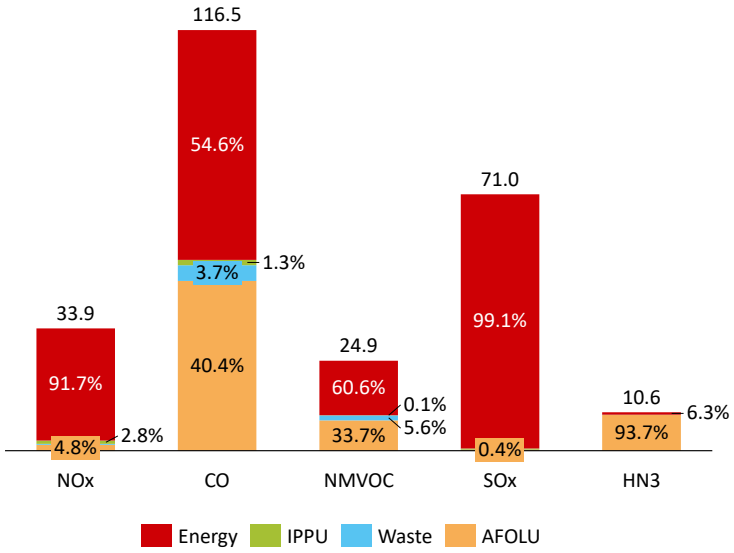
The results for precursors and indirect emissions show that they are increased by 16.9% and 31.8% in 2019 compared to 1990 and 2016 respectively (Figure 49). At average the emissions are around 200 Gg/year, but there are peaks in 2000, 2007, 2008, 2011 and 2012 mainly as a results of forest fires. The highest numbers are estimated for 2000, 380 Gg. SO_2 participates with around 50% over the entry reporting period, but in the last five years it shares is below 40%, as a result of reduction in electricity production from lignite, as well as fuel change (oil for heat production is replaced with natural gas). CO is the second contributor, participating with around 30%, with peak in the years with more forest fires and is also increasing in the last years due to the enlarged road transportation. NH_3 as a gas that is introduced in the inventory in BUR3, participate with around 6% during the reporting period.

Figure 49. Emissions of NOx, CO, NMVOC, SO_2 and NH_3 in the period 1990 – 2019 (in Gg)



The assessment of the sectoral precursors and indirect emissions, shows that during the entire reporting period, Energy sector is the most significant contributor in all of them except in NH_3. In 2019, this sector is a source of almost all SO_2 and NO_x emissions, 99.1 and 91.7%, respectively (Figure 50). At the same time the energy sector participate with 54.6% in CO and 60.6% in NMVOC. AFOLU is the second contributor with around 94% share in NH_3, 33.4% in NMVOC and 40.4% in CO. Waste participate with 3.7% in CO most as a result of open burning of waste.

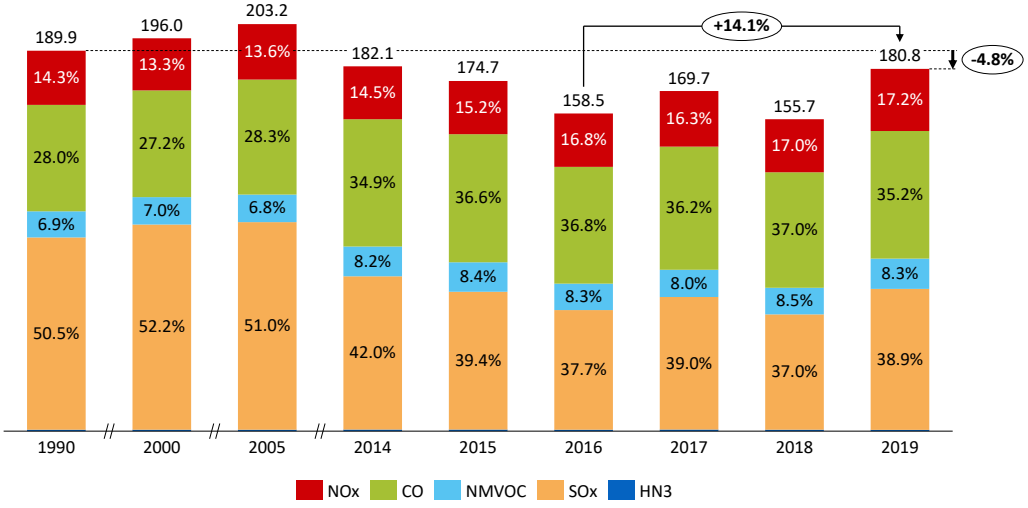
Figure 50. Emissions precursors and indirect GHG emissions (in Gg) and share of by sectors (in %) in the year 2019



8.2 Energy

The SO_2 emissions are the dominant form in the combustion emissions at around 50% or greater during the overall reporting period (Figure 51). These emissions are in direct correlation with the combustion of lignite used for electricity generation. On the other hand, as a result of the biomass consumption in the households, CO emissions are the second in dominance, above 30% in 2014 until 2019. The overall number of precursors and indirect emissions is increased for 14% in 2019 compared to 2016. In 2019, the emissions are increased by 14.1% compared to 2016, but decreased by 5% compared to 1990.

Figure 51. Emissions of NOx, CO, NMVOC, SO_2 and NH_3 from the Energy sector (in Gg)



Electricity production from lignite is the main source of SO_2 emissions participating with at least 89% in the reporting period (Figure 52). Furthermore, it is responsible for the 32.5% of NOx emissions in 2019 (Figure 53). Manufacturing Industries and Construction is the second biggest contributor to NOx in the period between 1990 and 2014, with share that varies between 34% and 17%, after which the sector Transport is responsible for the majority of the NOx emission between 2015 and 2019 (43.5% in 2019). The SO_x emissions in Manufacturing industries and construction are varying between 7% and 10%. Far behind these two categories are all other. In the NOx emissions for the last five years, the Non-specified category participates with average share of 5%, Fugitive emissions from oil and natural gas with 5%, and Other Sectors with 2%. On the other hand, the contribution of these three categories in SO_x emissions is almost zero. Comparing to 1990, in 2019

SO_2 emissions are reduced by almost 27%, but the NOx emissions in 2019 are increased by 15% compared to 1990. The detailed emissions by categories and subcategories are presented in Table 48.

Figure 52. SO_2 emissions from the Energy sector, by category (in Gg)

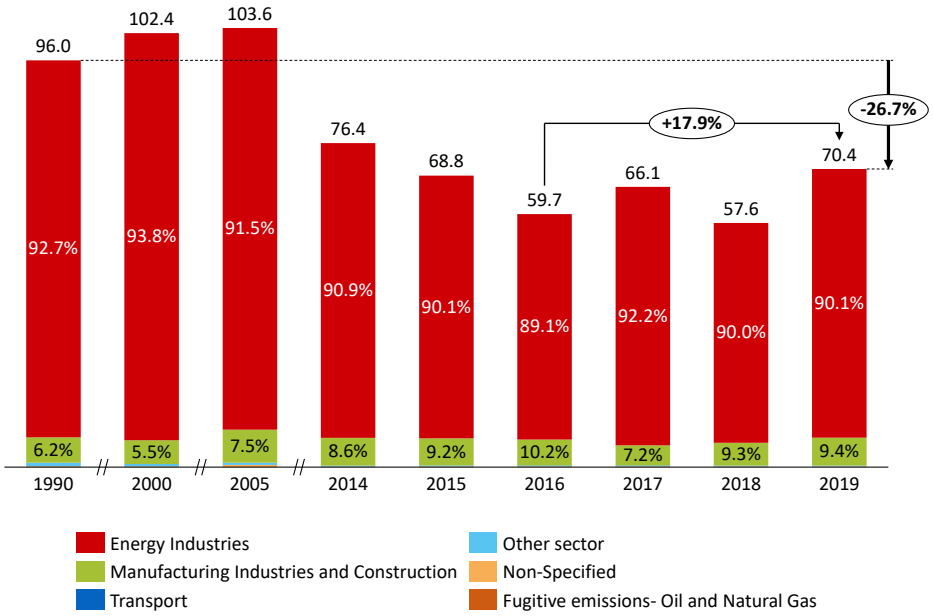
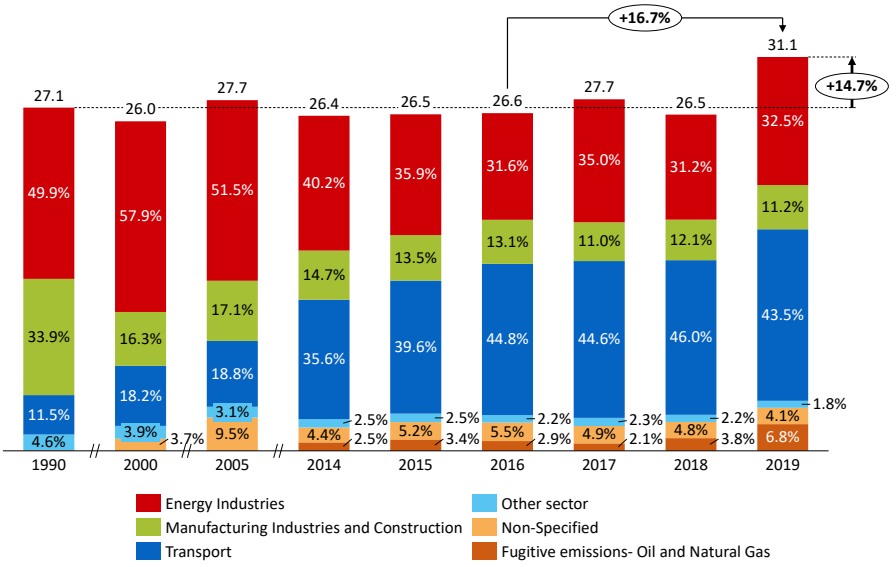


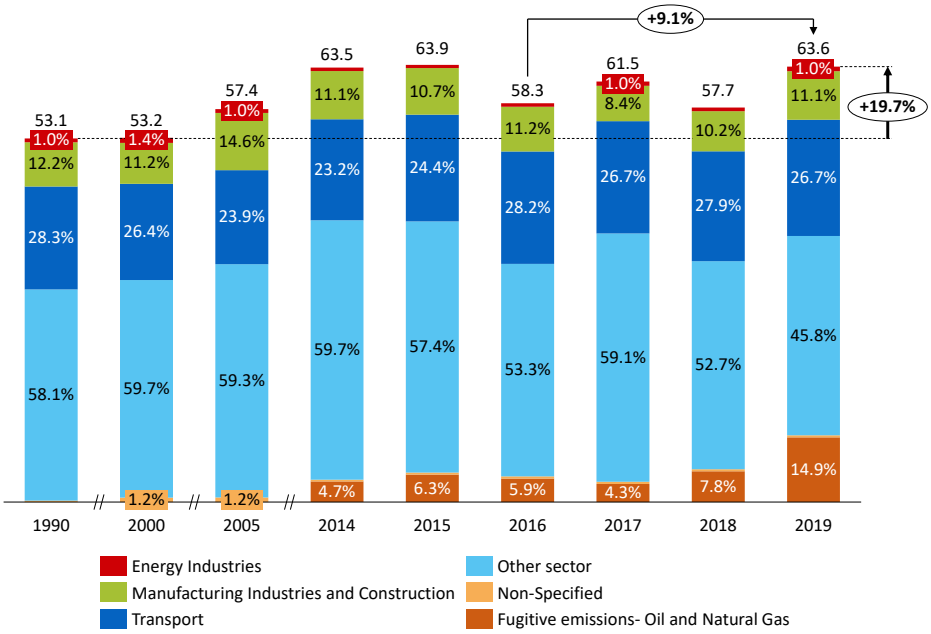
Figure 53. NOx emissions from the Energy sector, by category, (in Gg)



Note: Transport emissions are calculated using Tier 1

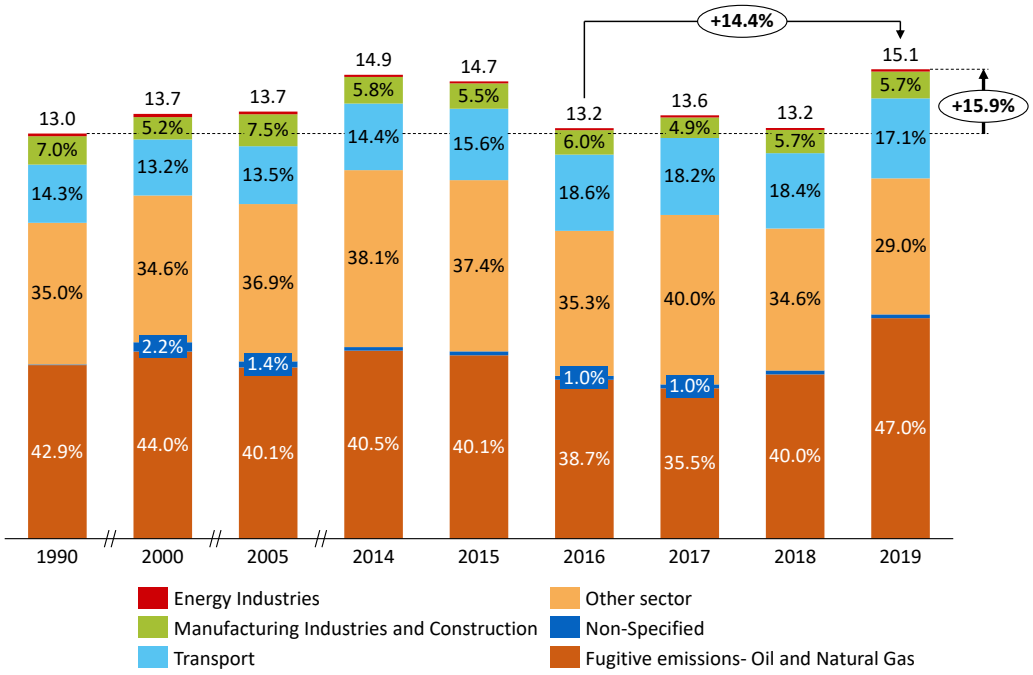
For the CO and NMVOC emissions, the situation is opposite to the previous one (SO_2 and NO_x). Most of the CO and NMVOC emissions are coming from the category Other Sectors and Transport. The share of this category in CO emissions varies between 45% and 60% in the period 2014 - 2019 (Figure 54, Table 49). In the category Fugitive emissions, the NMVOC emissions have share of about 40% in the last five years (Figure 55, Table 49). The contribution of the category Other Sectors is the next one with average share of 35% shares for NMVOC and 25% for CO in the Transport in the last five years. Manufacturing Industries and Construction is contributing with 11% of the CO emissions and 6% from the NMVOC emissions. The participation of the other categories is negligible.

Figure 54. CO emissions from the Energy sector, by category (in Gg)



Note: Transport emissions are calculated using Tier 1

Figure 55. NMVOC emissions from the Energy sector, by category (in Gg)



Note: Transport emissions are calculated using Tier 1

The subcategory Road Transportation is also a significant source of the NO_x, CO, NMVOC, and SO_2 emissions in most of the countries, and furthermore is identified as a key source of GHG emissions in Macedonia. This update of the BUR3 NIR includes the emissions of precursors and indirect gases of the subcategory Road transportation of Macedonia that have been estimated for the period between 1990 and 2019 in line with IPCC 2006 and EEA methodology for estimation of the emissions of precursors and indirect gases of the road transportation. The emissions of the subcategory Petroleum Refining are included in the category Other Energy Industries.

Table 48. Emissions of NO_x, CO from the Fuel Combustion Activities (in Gg)

Categories	NO_x									CO								
	1990	2000	2005	2014	2015	2016	2017	2018	2019	1990	2000	2005	2014	2015	2016	2017	2018	2019
Fuel Combustion Activities	27.1	26.0	27.7	25.8	25.7	25.9	27.1	25.5	29.0	53.2	53.3	57.4	60.5	59.9	54.9	58.8	53.2	54.2
Energy Industries	13.5	15.0	14.2	10.6	9.5	8.4	9.7	8.3	10.1	0.5	0.7	0.6	0.5	0.5	0.5	0.6	0.5	0.7
Main Activity Electricity and Heat Production	13.5	15.0	14.2	10.6	9.5	8.4	9.7	8.3	10.1	0.5	0.7	0.6	0.5	0.5	0.5	0.6	0.5	0.7
Electricity Generation	12.4	13.7	13.6	10.3	9.2	7.9	9.0	7.7	9.4	0.4	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.3
Combined Heat and Power Generation	0.8	0.2	0.1	0.2	0.1	0.4	0.6	0.5	0.6	0.1	0.0	0.0	0.1	0.1	0.2	0.3	0.2	0.3
Heat Plants	0.3	1.1	0.5	0.1	0.2	0.1	0.1	0.1	0.1	0.0	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Manufacture of Solid Fuels and Other Energy Industries	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufacture of Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other Energy Industries	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manufacturing Industries and Construction	9.2	4.2	4.7	3.9	3.6	3.5	3.1	3.2	3.5	6.5	6.0	8.4	7.1	6.8	6.6	5.2	5.9	7.1
Transport	3.1	4.7	5.2	9.4	10.5	11.9	12.4	12.2	13.5	15.0	14.1	13.7	14.8	15.6	16.4	16.4	16.1	17.0
Domestic Aviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Road Transportation	3.1	4.7	5.2	9.4	10.5	11.9	12.4	12.2	13.5	15.0	14.0	13.7	14.8	15.6	16.4	16.4	16.1	17.0
Railways	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Sectors	1.2	1.0	0.8	0.7	0.7	0.6	0.6	0.6	0.6	30.9	31.8	34.1	37.9	36.7	31.1	36.3	30.4	29.1
Residential	0.7	0.5	0.5	0.5	0.5	0.4	0.5	0.4	0.4	30.7	31.6	34.0	37.8	36.6	30.9	36.2	30.3	29.0
Agriculture/Forestry/Fishing/Fish Farms, Stationary	0.6	0.5	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Non-Specified	0.0	1.0	2.6	1.2	1.4	1.5	1.4	1.3	1.3	0.2	0.6	0.7	0.3	0.3	0.3	0.3	0.3	0.3

Note: NO – Not occurring; NE – Not estimated; IE – Included elsewhere

NOTE: Tier 1 applied for transport

Table 49. Emissions of NMVOC, SO2 and NH_3 from the Fuel Combustion Activities (in Gg)

Categories	NMVOC									SO_2									NH3								
	1990	2000	2005	2014	2015	2016	2017	2018	2019	1990	2000	2005	2014	2015	2016	2017	2018	2019	1990	2000	2005	2014	2015	2016	2017	2018	2019
Fuel Combustion Activities	7.4	7.6	8.2	8.9	8.8	8.1	8.8	7.9	8.0	96.0	102.4	103.6	76.4	68.8	59.7	66.1	57.6	70.3	0.7	0.7	0.7	0.8	0.8	0.7	0.8	0.7	0.7
Energy Industries	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	89.0	96.1	94.8	69.5	62.0	53.2	61.0	51.9	63.4	NO	NO	NO	NO	NO	NO	NO	NO	NO
Main Activity Electricity and Heat Production	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	89.0	96.1	94.6	69.5	62.0	53.2	61.0	51.9	63.4	NO	NO	NO	NO	NO	NO	NO	NO	NO
Electricity Generation	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.1	84.6	91.5	92.5	69.3	62.0	53.2	61.0	51.9	63.4	NO	NO	NO	NO	NO	NO	NO	NO	NO
Combined Heat and Power Generation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	1.0	0.6	0.1	0.0	0.0	0.0	0.0	0.0	NO	NO	NO	NO	NO	NO	NO	NO	NO
Heat Plants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	3.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0	NO	NO	NO	NO	NO	NO	NO	NO	NO
Manufacture of Solid Fuels and Other Energy Industries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	NO	NO	NO	NO	NO	NO	NO	NO	NO
Manufacture of Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other Energy Industries	0	0	0	0	0	0	0	0	0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	NO	NO	NO	NO	NO	NO	NO	NO	NO
Manufacturing Industries and Construction	0.9	0.7	1.0	0.9	0.8	0.8	0.7	0.7	0.9	6.0	5.6	7.8	6.5	6.4	6.1	4.7	5.4	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport	1.9	1.8	1.9	2.1	2.3	2.5	2.5	2.4	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Domestic Aviation	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NO	NO	NO	NO	NO	NO	NO	NO	NO
Road Transportation	1.9	1.8	1.9	2.1	2.3	2.5	2.5	2.4	2.6	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Railways	0	0	0	0	0	0	0	0	0	NO	NO	NO	NO	NO	NO	NO	NO	NO	0	0	0	0	0	0	0	0	0
Other Sectors	4.6	4.7	5.1	5.7	5.5	4.7	5.4	4.6	4.4	0.8	0.6	0.5	0.2	0.3	0.2	0.2	0.2	0.2	0.5	0.5	0.6	0.7	0.6	0.5	0.6	0.5	0.5
Residential	4.5	4.7	5.0	5.7	5.5	4.6	5.4	4.5	4.3	0.6	0.4	0.4	0.2	0.2	0.2	0.2	0.1	0.1	0.5	0.5	0.6	0.7	0.6	0.5	0.6	0.5	0.5
Agriculture/Forestry/ Fishing/Fish Farms, Stationary	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	NO	NO	NO	NO	NO	NO	NO	NO	NO
Non-Specified	0.0	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.5	0.1	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: NO – Not occurring; NE – Not estimated; IE – Included elsewhere

8.2.1 Methodology and emission factors

The IPCC Guidelines contain links to information on methods, used under other agreements and conventions, for the estimation of emissions of tropospheric precursors which may be used to supplement the reporting of emissions and removal of greenhouse gases. Table 7.1 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 7: Precursors and Indirect Emissions provides a link between the IPCC categories and the corresponding methodology chapters in EMEP/CORINAIR guidebook. In this BUR, the latest EMEP/EEA air pollutant emission inventory guidebook from 2019 was used. The estimation of precursors and indirect emissions of the Energy sector is done using the Tier 1 methodology. The reason behind that is that the higher Tier methodologies require detailed characteristics of the fuels used in combination with onsite measurements or other detailed parameters, which were not available in the period of preparation of the BUR3.

Table 50. Emission factors used for estimation of the emissions of Precursors and Indirect emissions of the Energy sector

Emission factor	NC4	Comment
Energy sector	Tier 1 EF EMEP/EEA air pollutant emission inventory guidebook 2019	Tier 1 methodology applied. Not enough onsite measurement data and detailed parameters for application of higher Tier methodologies.

8.2.2 Data sources

All activity data for the period 1990-1997, as well as 2003 and 2004, are taken from the International Energy Agency database, while the remaining period is covered with data from the national energy balances published by the State Statistical Office (Table 51).

Table 51. Data sources for estimation of the emissions of Precursors and Indirect emissions of the Energy sector

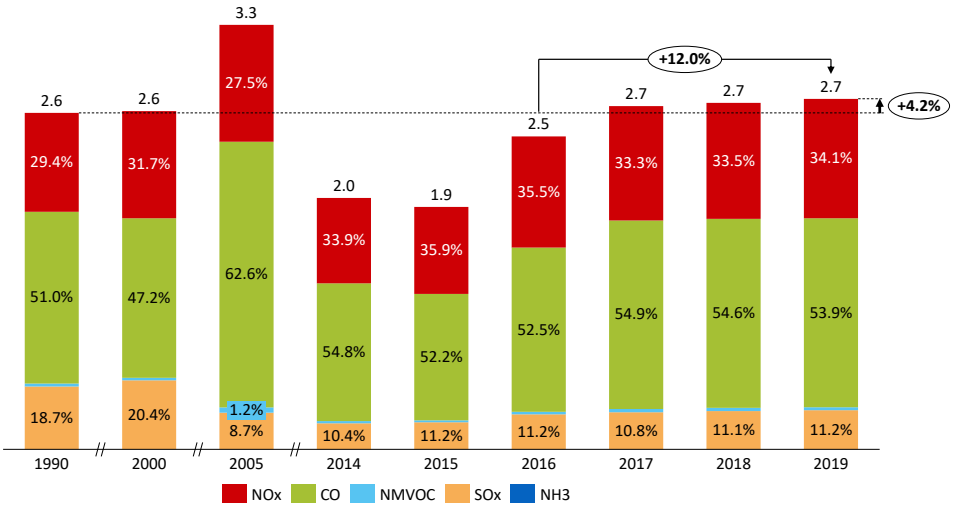
	Documents	Data provider
Energy sector	IEA Database, (annual databases from 1990-1997, 2003 and 2004) Energy balance, Final data, (1998-2002 publications, 2005-2019 MAKSTAT database) COPERT Database (fuel consumption data) (2014-2018)	International Energy Agency SSO MOEPP

8.3 IPPU

During the preparation of the IPPU non-GHG emissions part of the inventory under the BUR3, it was found that there is a big gap in the emissions for the entire reporting period. Although activity data have been available in the software for the period 1990 – 2001, the non-GHG emissions from Iron and steel were not calculated. In addition, for several categories, different emission factors have been used. Therefore, the overall period before 2015 was revised.

The Non-GHG emissions from IPPU are very small compared to the emissions from the Energy industries sector. The peak of the emissions is in 2000 achieving 3.3 Gg, while in 2019 the emissions are 2.7 Gg or 12% more compared to 2016 (Figure 56). Most of the emissions are CO, which participates with 53.9% in 2019, followed by NOx with around 34% and SOx with 11%.

Figure 56. Emissions of NOx, CO, NMVOC and SO_2 from the IPPU sector (in Gg)



Mineral and metal industries are the only ones that have created the non-GHG emission in the IPPU category. Almost all NO_x and SO_2 emissions are produced by the cement production in the Mineral industry, 96.6% and 88% in 2019 (Figure 57, Figure 58). The share of the Mineral industry is also dominant in the NMVOC and CO emissions participating with around 53% and 72%, respectively (Figure 59, Figure 60). As a result of the higher clinker production the NOx emissions in the last five years are increased by 40% , while the SO_2 emissions are increased by 50% during this five year period. In 2019, the NOx emissions increased for 7.5%, and the SOx emissions by 12%, compared to 2016. The peak of the iron and steel production in 2005 led to the highest CO and NMVOC emissions from this sub-category. In that year the share of the Metal industry in CO was 52.9% while in NMVOC was around 71.7%.

Figure 57. NOx emissions from the IPPU sector, by category (in Gg)

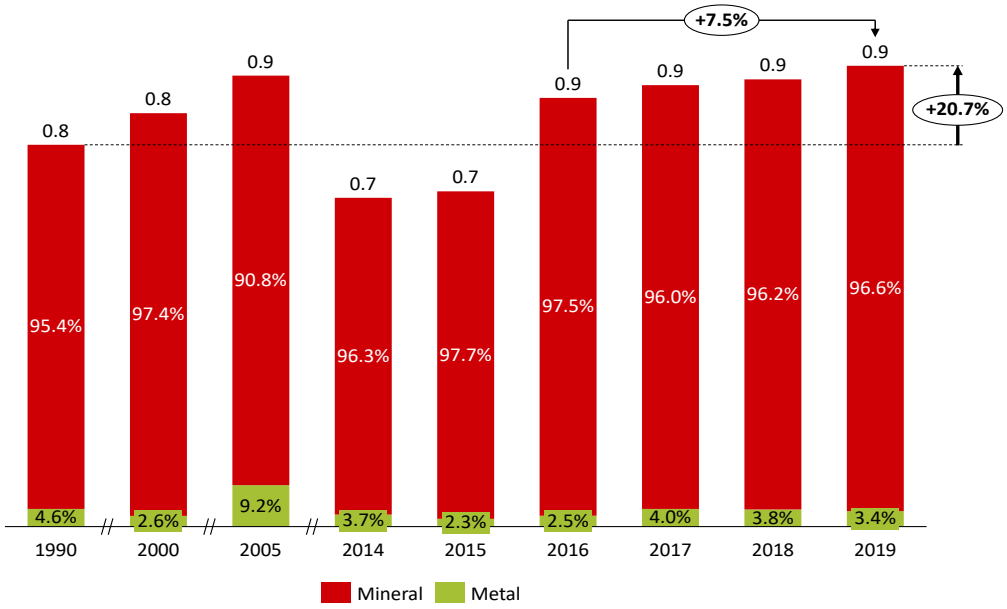


Figure 58. SO_2 emissions from the IPPU sector, by category (in Gg)

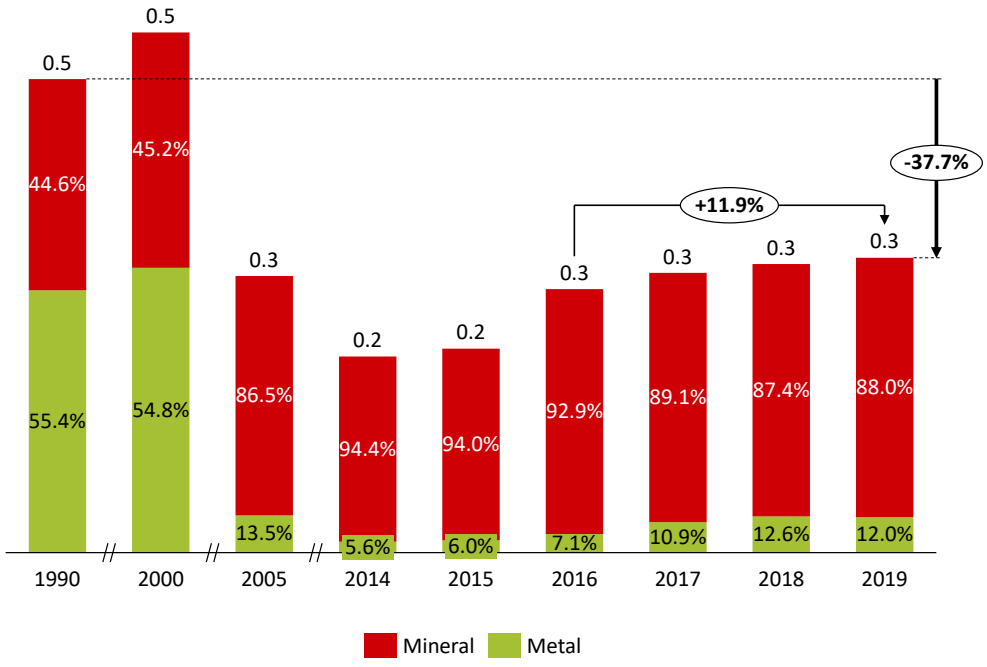


Figure 59. NMVOC emissions from the IPPU sector, by category (in Gg)

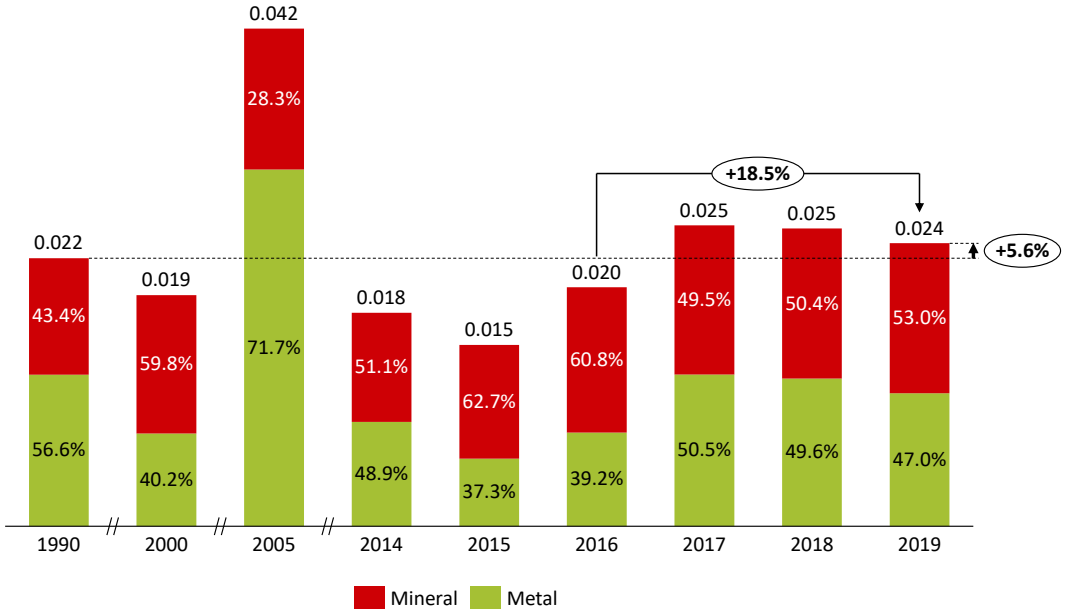
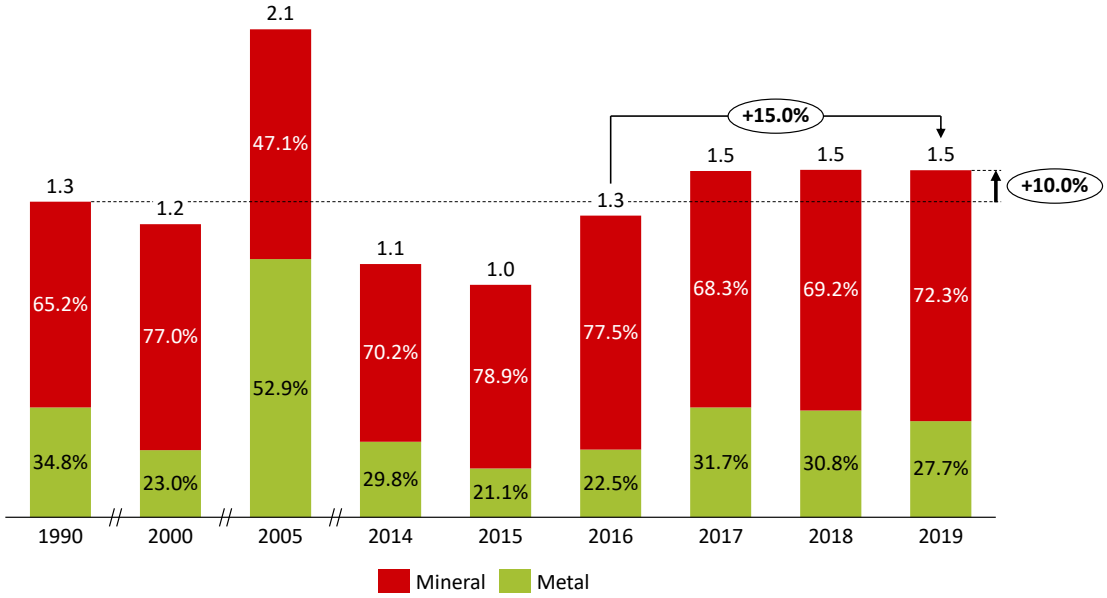


Figure 60. CO emissions from the IPPU sector, by category (in Gg)



8.3.1 Methodology and emission factors

The Tier 1 approach was used to calculate the emissions of precursors and indirect emission from IPPU sector (Table 52).

Table 52. Emission factors used for estimation of the emissions of Precursors and Indirect emissions of the IPPU sector

Emission factor	NC4	Comment
Mineral industry	EMEP/EEA air pollutant emission inventory guidebook 2019 Table 3.1 Tier 1 emission factors for source category 2.A.1 Cement production. Table 3-24 Tier 2 emission factors for source category 1.A.2.f.i, Cement production (1.A.2 Manufacturing industries and construction (combustion)) Table 3.1 Tier 1 emission factors for source category 2.A.2 Lime production. Table 3-23 Tier 2 emission factors for source category 1.A.2.f.i, Lime production (1.A.2 Manufacturing industries and construction (combustion)) Table 3.1 Tier 1 emission factors for source category 2.A.3 Glass production	
Metal industry	EMEP/EEA air pollutant emission inventory guidebook 2019 Table 3.15 Tier 2 emission factors for source category 2.C.1 Iron and steel production, steel making, electric arc furnace steel plant. Table 3.1 Tier 1 emission factors for source category 2.C.5 Lead production	

8.3.2 Data sources

The activity data used for each industry is production per year (tons/year) as given in five-year data reports on the industrial production in Macedonia from the State Statistical Office.

Table 53. Data sources for estimation of the emissions of Precursors and Indirect emissions of the IPPU sector

	Documents	Data provider
Mineral industry	Cement Industry clinker production Industry (1990-1995, 1996-2001, 2002-2006, 2006-2010, 2011-2016), MAKSTAT 2007-2019	MOEPP SSO
Metal industry	Industry (1990-1995, 1996-2001, 2002-2006, 2006-2010, 2011-2016), MAKSTAT 2007-2019	SSO

8.4 AFOLU

In the sector AFOLU, the NOx and NMVOC emissions are occurring from the category Agriculture, category Manure management, while in category Forestry and Other Land Use, all emissions are originating from the category Aggregate sources and non-CO_2 emissions sources on land: subcategory Biomass burning in Forest land (forest fires).

The non-GHG emissions from AFOLU vary during the reporting period, mostly depending on forest fires. The peak of the emissions of 178 Gg is achieved in 2000 (Figure 61), which is a result of the biggest forest fires in the overall reporting period. CO emissions participate with almost 80% in 2000. Compared to 2016 the non-GHG emissions in 2019 are higher for 140%. The second contributor in the overall non-GHG emissions is NH_3 from manure management, participating with almost 44% in 2016 and 15% in 2019.

The results by categories shows that:

- During the analysed period emissions of NOx are typically in the range 0.1-1.6Gg, with exception of the year 2000, where the emissions are 4.7 Gg, due to extensive forest fires and area burned in the country (Figure 62).
- The SO_2 emissions are in the range 0.1-0.3 Gg, while in 2000 they reached 0.9 Gg. All SO_2 emissions are produced by forest fires (Figure 63).
- NMVOCs are in the range 5.9 – 8.4 Gg/year, while in the year 2000 they are estimated on 19 Gg (Figure 64).

- CO emissions are in range 0.4-47 Gg, but in years 2000 they were 138 Gg, because of the fires (Figure 65).
- All NH3 are results of manure management activities. In 2019 they are lower for 44% compared to 1990, while for 19% lower from 2016 (Figure 66)

Figure 61. Emissions of NOx, CO, NMVOC, SO_2 and NH_3 from the AFOLU sector (in Gg)

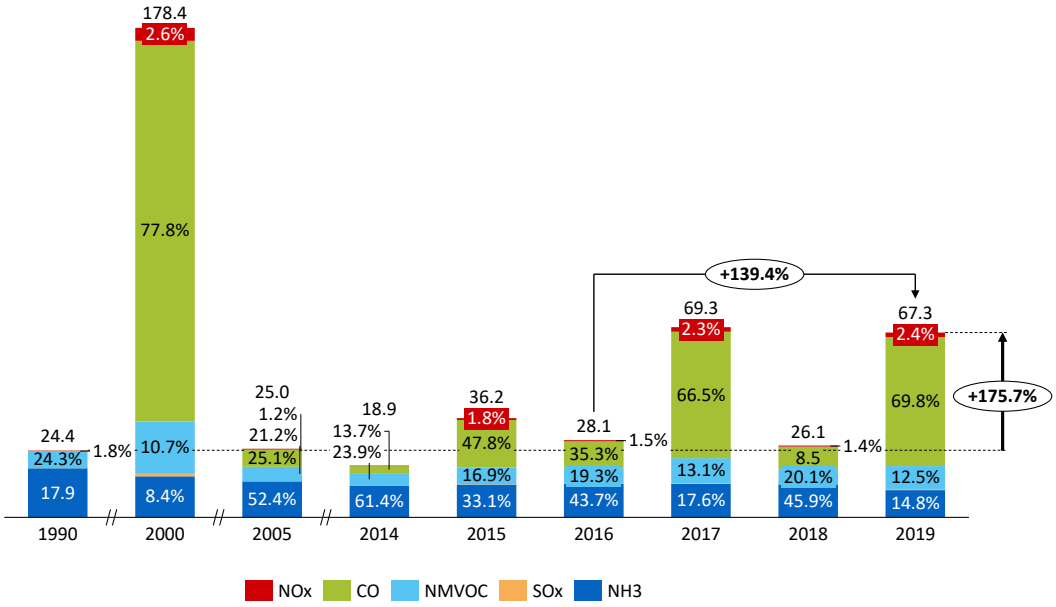


Figure 62. NOx emissions from the AFOLU sector, by category (in Gg)

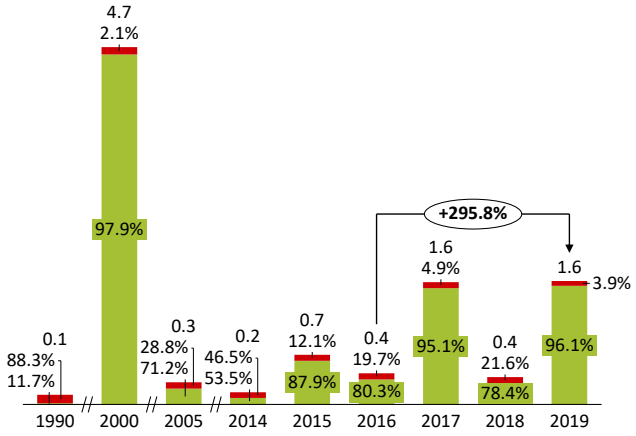


Figure 63. SO_2 emissions from the AFOLU sector, by category (in Gg)

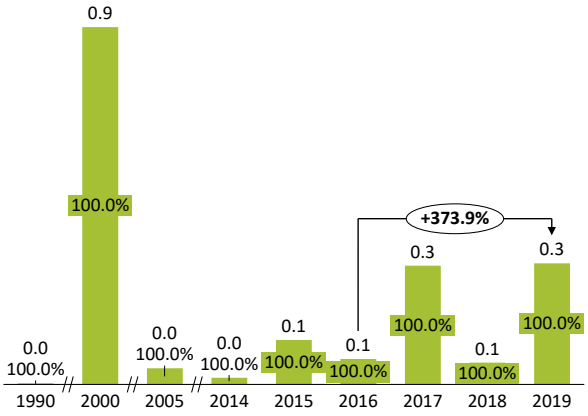


Figure 64. NMVOC emissions from the AFOLU sector, by category (in Gg)

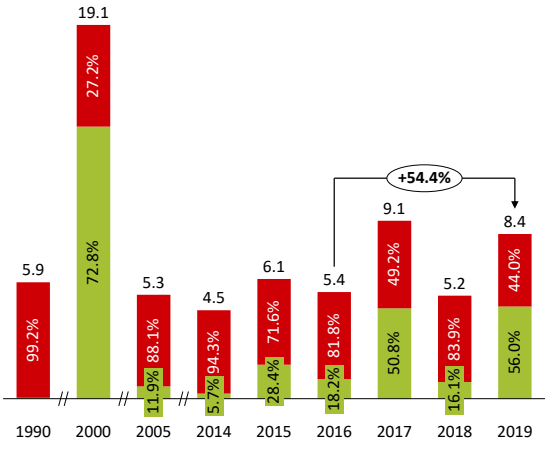


Figure 65. CO emissions from the AFOLU sector, by category (in Gg)

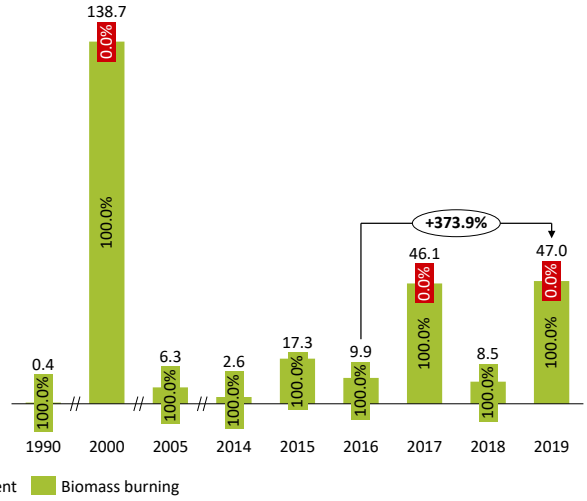
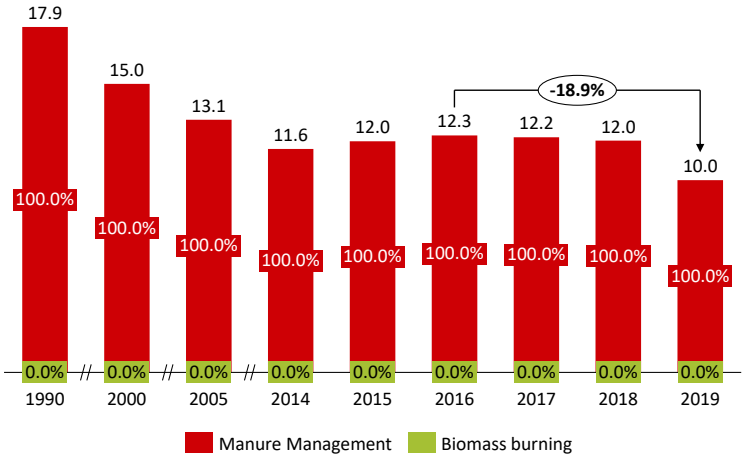


Figure 66. NH_3 emissions from the AFOLU sector, by category (in Gg)



8.4.1 Methodology and emission factors

Emissions of NMVOCs occur from silage, manure in livestock buildings, outside manure storages, field application of manure and from grazing animals. There is a lack of emissions estimates related to feeding with silage, outdoor manure stores, manure application, and grazing animals, due to lack of appropriate activity data.

Emissions of NH_3, NO, and NMVOCs arise from the excreta of agricultural livestock that are deposited in and around buildings and collected as liquid slurry, solid manure or litter-based farmyard manure. These emissions occur from buildings housing livestock and outdoor yard areas, from manure storages, after manure land spreading and during grazing.

The subcategory Biomass burning in forests includes emissions from (naturally or man-induced) burning of non-managed and managed forests and other vegetation, excluding agricultural burning of stubble, etc. This includes domestic fires (fuel wood-, crop residue-, dung and charcoal burning) as well as open vegetation fires (forest, shrub-, grass- and cropland burning).

The Tier 1 approach was used to calculate the emissions of precursors and indirect emission from AFOLU sector (Table 54).

Table 54. Emission factors used for estimation of the emissions of Precursors and Indirect emissions of the AFOLU sector

Emission factor	NC4
Manure Management	EMEP/EEA pollutant emission inventory Guidebook 2019; 3.B Manure management Table 3.2. Default Tier 1 EF (EF_{NH3}) for calculation of NH_3 emissions from manure management Table 3.3 Default Tier 1 EFs for NO (as NO_2) from stored manure Table 3.4 Default Tier 1 EFs for NMVOCs Table 3.5 Default Tier 1 estimates of EF for particle emissions from livestock husbandry (housing)
Emissions from biomass burning	EMEP/EEA pollutant emission inventory Guidebook 2019; 11.B Forest fires Table 3-1 Tier 1 emission factors for source category 11.B Forest fires

8.4.2 Data sources

The activity data used for manure management are livestock populations provided by SSO. For biomass burning the activity data are the areas burned (forests). Data on forest fires were obtained from MAFWE, State Inspectorate for Forestry and Hunting and the Crisis Management Centre (Table 55).

Table 55. Data sources for estimation of the emissions of Precursors and Indirect emissions of the IPPU sector

	Documents	Data provider
Livestock-Manure Management	Total number of livestock & poultry in Macedonia	SSO –MAKSTAT database
Biomass burning in forests	SSO Yearbooks, Annual reports, internal documents	Enterprises that manage forests (PE Makedonski sumi, National parks, Association of private forest owners), MAFWE, CMC (Center for Management of Crisis), FFU (Firefighting Union))

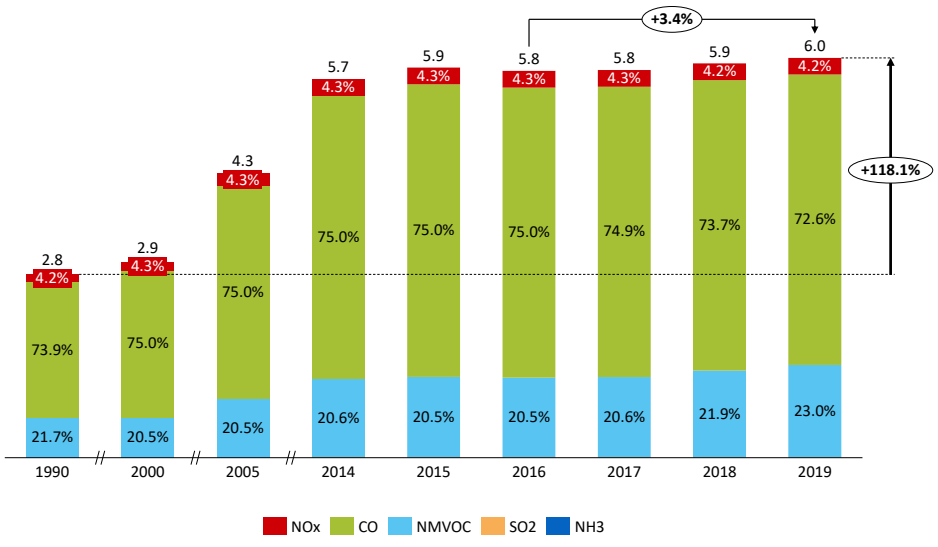
8.5 Waste

In the Waste sector, the emissions of NO_x, CO, and SO_2 are produced by open burning of waste, by the solid waste incineration processes (mainly medical waste), as well as by the incineration of sludge from wastewater treatment. NMVOC emissions can originate from wastewater treatment plants and open burning of waste.

During the preparation of the precursors and indirect emissions from waste under the BUR3, it was found that there are inconsistencies in the data and factors used in the period 1990-2014. Having in mind that better data are available, the revision of the times series was made. For example for Domestic wastewater treatment and discharge, lower factor for waste generation per capita was used. This factor is revised according to the data that SSO is publishing starting from 2016.

In 2019, the amount of precursors and indirect emissions is more than double compared to 1990 (Figure 67). The increase is coming from the Open burning of waste at the dump sites. CO is the dominant one with a participation of around 75% during the overall reporting period, while the second one is NMVOC with 21%.

Figure 67. Emissions of NO_x, CO, NMVOC and SO_2 from the Waste sector (in Gg)



Although there is an incinerator at Drisla landfill, the emissions are negligible and almost the overall amount of NOx, CO, and SO_2 emissions are generated by the subcategory Open burning of waste at the dumpsites (Table 56). On the other hand, the category Solid waste disposal is contributing with more than 87% in the NMVOC in 2018 and 2019.

Table 56. Emissions of NOx, CO emissions from the Waste sector (in Gg)

Categories	NOx									CO								
	1990	2000	2005	2014	2015	2016	2017	2018	2019	1990	2000	2005	2014	2015	2016	2017	2018	2019
Waste	0.12	0.13	0.18	0.24	0.25	0.25	0.25	0.25	0.25	2.03	2.21	3.20	4.26	4.39	4.35	4.36	4.36	4.36
Solid Waste Disposal	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Biological Treatment of Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Incineration and Open Burning of Waste	0.12	0.13	0.18	0.24	0.25	0.25	0.25	0.25	0.25	2.03	2.21	3.20	4.26	4.39	4.35	4.36	4.36	4.36
Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Open Burning of Waste	0.12	0.13	0.18	0.24	0.25	0.25	0.25	0.25	0.25	2.03	2.21	3.20	4.26	4.39	4.35	4.36	4.36	4.36
Wastewater Treatment and Discharge	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Domestic Wastewater	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Industrial Wastewater	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

NE – Not Occurring

Table 57. Emissions of NMVOC, SO_2 and NH_3 emissions from the Waste sector (in Gg)

Categories	NMVOC									SO_2									NH_3								
	1990	2000	2005	2014	2015	2016	2017	2018	2019	1990	2000	2005	2014	2015	2016	2017	2018	2019	1990	2000	2005	2014	2015	2016	2017	2018	2019
Waste	0.60	0.60	0.87	1.17	1.20	1.19	1.20	1.30	1.38	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Solid Waste Disposal	0.55	0.55	0.80	1.07	1.11	1.09	1.10	1.20	1.29	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Biological Treatment of Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Incineration and Open Burning of Waste	0.04	0.05	0.07	0.09	0.10	0.10	0.10	0.10	0.10	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	NO	NO	NO	NO	NO	NO	NO	NO	NO
Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO	NO	NO
Open Burning of Waste	0.04	0.05	0.07	0.09	0.10	0.10	0.10	0.10	0.10	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	NO	NO	NO	NO	NO	NO	NO	NO	NO
Wastewater Treatment and Discharge	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Domestic Wastewater	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Industrial Wastewater	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

NE – Not Occurring

8.5.1 Methodology and emission factors

For all categories in the waste sector the default Tier 1 emission factors are used, except for the category Biological treatment of waste – composting for which Tier 2 emission factors are applied.

Regarding wastewater handling, emissions are calculated from both domestic wastewater treatment and industrial wastewater treatment. Starting from 2017, the State Statistical Office is issuing a report on Public water supply and Public sewage. This report contains information about the quantities of total discharged wastewater, non-purified wastewater and purified wastewater, which were used to calculate the share of wastewater treated. On the other hand, the quantities of discharged wastewater from households together

with the number of populations, provide information about the domestic wastewater per capita. This information was used to calculate the total amount of domestic wastewater produced and treated in the period between 2015 and 2019. The same methodology is applied for the period before 2015. In addition, for the industrial wastewater treatment, it was noted that in the activity data instead of wastewater generated in m^3, the industrial production in tones is used, so it was corrected.

Table 58. Emission factors used for estimation of the emissions of Precursors and Indirect emissions of the Waste sector

Emission factor	NC4	Comment
Waste incineration of clinical waste	Table 3-1 from EMEP/EEA Air Pollutant Emission Inventory Guidebook 2019, Chapter 5.C.1.b.iii Clinical waste incineration	
Open burning of waste	Table 3-1 from EMEP/EEA Air Pollutant Emission Inventory Guidebook 2019, Chapter 5.C.2 Open burning of wastes	
Wastewater handling	Table 3-1 from EMEP/EEA Air Pollutant Emission Inventory Guidebook 2019, Chapter 5.D. Wastewater handling	

8.5.2 Data sources

The main data source is the State Statistical Office, as well as relevant reports from the institutions as MOEPP (Table 59).

Table 59. Data sources for estimation of the emissions of Precursors and Indirect emissions of the Waste sector

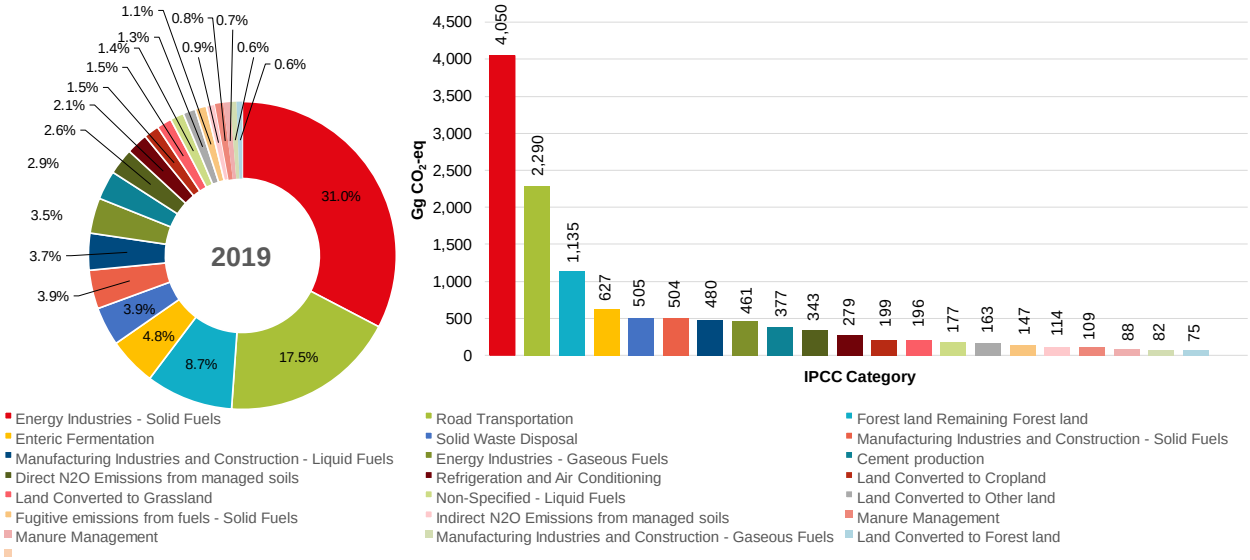
	Documents	Data provider
Waste incineration of clinical waste	Drisla landfill data on incineration of medical waste	Drisla web site, MOEPP reports on environment 2000-2019
Open burning of waste	Report on non-compliant landfilling in the R Macedonia, 2011 Municipal waste	MOEPP, SSO
Wastewater handling	Public water supply and Public sewage, Utilisation and protection of water against pollution in industry, Industrial production	SSO

9 Key category analysis

The analysis of key categories that contribute the most to the absolute level of national emissions and removals (level assessment) and to the trend of emissions and removals (trend assessment) is conducted using Approach 1. According to this approach, key categories are identified using a pre-determined cumulative emissions threshold. When summed together in descending order of magnitude, key categories are those that add up to 95% of the total level/trend.

The level assessment is performed for 1990 as a base year and 2019 as the latest year. The results in Gg CO_2-eq and percentages (up to 95%) for 2019 are shown in Figure 68. Consequently, the categories with the highest (absolute) values of Gg CO_2-eq (both emissions and removals) include Energy Industries – Solid Fuels (31%) (Energy sector), Road Transportation (17.5%) (Energy sector), Forest Land Remaining Forest Land (8.7%) (AFOLU sector), Enteric Fermentation (4.8%) (AFOLU sector), Solid Waste Disposal (3.9%) (Waste sector) and Manufacturing Industries and Construction – Solid Fuels (3.9%) (Energy sector). Usually, the Forest land category is relevant for sinks, but the estimates for 2019 show emissions from this category due to forest fires/wildfires. The level assessment of key categories in 1990 and 2019 is given in detail in Appendix III.

Figure 68. Level assessment of key categories and their contribution in 2019



The trend assessment of source categories is executed, taking 1990 as the base year and 2019 as the latest inventory year. The purpose of this trend assessment is to emphasize the categories whose trend is significantly different from the trend of the overall inventory, regardless of whether the category trend is increasing or decreasing or is a sink or source. The results in percentages (up to 95%) presented in Figure 69 show that Energy Industries-solid fuels category participates with 25.7%, followed by Forest Land Remaining Forest Land with 19.4%, Road Transportation with 11%, Manufacturing Industries and Construction – Liquid Fuels with 8.5% and Other Sectors –Liquid Fuels with 5.1%. An overview of the trend assessment relating to 1990 and 2019 is given in Appendix III.

The identified key categories, with both level and trend assessment, for 2019 are summarized in Table 60. For two of the four categories identified as key in the inventory only with the trend assessment (2.C.3 Aluminium production - PFCs; and 2.C.6 Zinc Production - CO_2), such processes no longer exist in the country. There has been no zinc production since 2003, and for aluminium production, there was a significant drop after 2003 when the biggest firm was closed, and no such activity occurs after 2012.

Figure 69. Contribution of key categories to the Trend (1990, 2019) in percentages

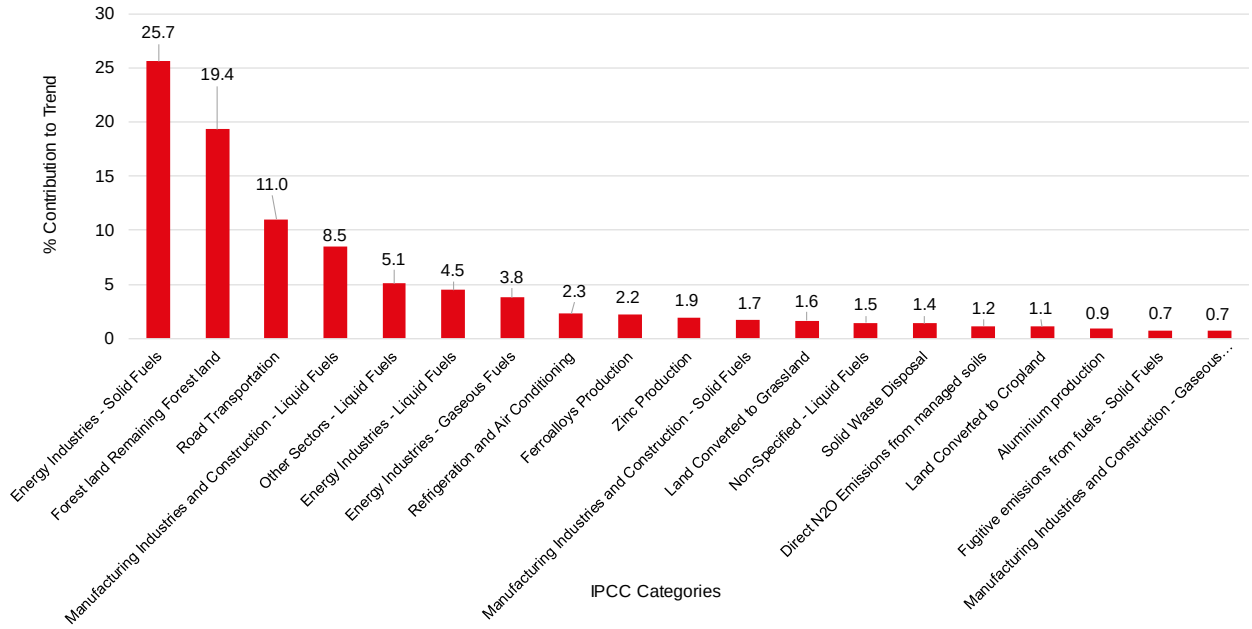


Table 60. Summary of key category analysis in 2019

	IPCC Category code	IPCC Category	Greenhouse gas	Identification Criteria	Comment
1	1.A.1	Energy Industries - Solid Fuels	CO2	L1, T1	
2	1.A.3.b	Road Transportation	CO2	L1, T1	
3	3.B.1.a	Forest land Remaining Forest land	CO2	L1, T1	
4	3.A.1	Enteric Fermentation	CH4	L1	
5	4.A	Solid Waste Disposal	CH4	L1, T1	
6	1.A.2	Manufacturing Industries and Construction - Solid Fuels	CO2	L1, T1	
7	1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CO2	L1, T1	
8	1.A.1	Energy Industries - Gaseous Fuels	CO2	L1, T1	
9	2.A.1	Cement production	CO2	L1	
10	3.C.4	Direct N2O Emissions from managed soils	N2O	L1, T1	
11	2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	L1, T1	
12	3.B.2.b	Land Converted to Cropland	CO2	L1, T1	
13	3.B.3.b	Land Converted to Grassland	CO2	L1, T1	
14	1.A.5	Non-Specified - Liquid Fuels*	CO2	L1, T1	
15	3.B.6.b	Land Converted to Other land	CO2	L1	
16	1.B.1	Fugitive emissions from fuels - Solid Fuels	CH4	L1, T1	
17	3.C.5	Indirect N2O Emissions from managed soils	N2O	L1	
18	3.A.2	Manure Management	N2O	L1	
19	3.A.2	Manure Management	CH4	L1	
20	1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CO2	L1, T1	
21	3.B.1.b	Land Converted to Forest land	CO2	L1	
22	1.A.4	Other Sectors - Liquid Fuels**	CO2	T1	
23	1.A.1	Energy Industries - Liquid Fuels	CO2	T1	
24	2.C.2	Ferroalloys Production	CO2	T1	
25	2.C.6	Zinc Production	CO2	T1	*NO since 2003*
26	2.C.3	Aluminium production	PFCs	T1	*NO since 2012*

Notation keys: L = key category according to level assessment; T = key category according to trend assessment; L1 – Level assessment, Approach 1; T1 – Trend assessment, Approach 1; NO = Not Occurring;
**Non-specified - as a category under the Fuel combustion activities in Energy sector*
***Other sectors – as a category under the Fuel combustion activities in Energy sector, consisted of the subcategories Commercial/Institutional, Residential and Agriculture/Forestry/Fishing/Fish farms*

10 Uncertainty analysis

In each analysis, the accuracy of input data is very important because they dictate the precision of the results. The reduction of the uncertainty in the input data may greatly increases the reliability of the result. This is a major reason for making uncertainty analyses, as they are seen as a means to help prioritize national efforts to reduce the uncertainty of inventories in the future. Therefore, the uncertainty analyses are an essential part of the GHG inventory.

There are two basic approaches for determining uncertainty of the inventories: Approach 1 (Error Propagation method) and Approach 2 (which is actually an implementation of the Monte Carlo method). As a well-established practice in the previous inventory reports, both of these methods are implemented for the purpose of this inventory, and also a comparison between them is made.

The Approach 1 is based upon Error Propagation method and it is very easy to use because it is already implemented in the IPCC Inventory Software. This uncertainty tool of the software calculates the uncertainty of the whole inventory for a given year, as well as uncertainty in trend between a year of interest and a base year. Although, the software does not determine disaggregated results at sector level, they can be calculated in spreadsheet software implementing the well-known equations for Approach 1 - Error Propagation method. For the purposes of this inventory, this method was implemented in Excel, so that uncertainty results by sector are calculated.

The second approach according to which the uncertainty can be calculated is the Monte Carlo method. According to this method, random values of the input variables are selected from within their probability density function and the corresponding output is calculated. This procedure is repeated many times or until the mean and the distribution of the output variables do not change. The input variables may include activity data, emission factors, conversion factors etc. and the output variable is the quantity of emissions.

After a review made on a number of recent inventories (including inventories of Annex I countries), it can be concluded that in very few of them Approach 2 is implemented, because it is more complex than Approach 1, and on the other hand requires greater skills to connect the Monte Carlo simulation with the IPCC Inventory Software.

As this approach is not implemented in the IPCC 2006 software, for the inventory in BUR2 a separate model was developed in MATLAB. This model directly uses the database of the Inventory (created through the IPCC Inventory Software), calculates random values for each input variable (according to their probability density function) and as a result computes the emissions.

Concerning the uncertainty calculations in the previous national reports, in the Second National Communication uncertainty is done using both methods for the Energy sector for 2000. In the Third National Communication Approach 2 is used for determining the uncertainty in the IPPU sector for the years 2003 to 2009, while in the First Biennial Update Report Approach 1 is used for the inventory for 2012 and for calculating uncertainty in trend for the years 1990 and 2012. In BUR2 and BUR3 reports both, Approach 1 and Approach 2, are applied for each sector of the inventory for 2014, 2015 and 2016. In this report, again both approaches are applied, for all sectors, for 2017, 2018, and 2019.

10.1 Input data

In order to calculate the uncertainty of the emissions for each sector separately, as well as the uncertainty of the total annual emissions, it is first needed to define uncertainty values for the input data. The IPCC Inventory Software allows input of uncertainty for activity data and emission factors. Based on these data the software automatically calculates uncertainty using the Error Propagation method (Approach 1). The disadvantage of this approach is that in certain sectors where activity data and emission factor is composed of multiple inputs that have different uncertainty, those have to be summarized in just two values for activity data and emission factors. Therefore, this introduces further uncertainty in the calculations. As stated previously, for the Monte Carlo method (Approach 2) a special tool has been created, which allows input of uncertainty for each input data separately.

The input data in the Energy sector, according to the Guidelines, as well as according to the confidentiality of the available resources in Macedonia is the most reliable. Accordingly, the values of the uncertainty for activity data and emission factors are set to 5% in both methods (Table 61). Additionally, in the IPPU sector the same input data for uncertainty are used in both methods (Table 61). In these two sectors, the calculations of the

emissions mainly depend only on the two inserted values for activity data and emission factors, therefore it was decided to use uncertainty only for these two variables.

Table 61. Input data for uncertainty in the IPCC Inventory Software and Monte Carlo method for Energy and Industrial Processes and Product Use sectors (in %)

	Activity data uncertainty	Emission factors uncertainty
Energy	5	5
Industrial Processes and Product Use		
Mineral Industry		
Cement production	10	3
Glass Production	5	30
Other Process Uses of Carbonates		
Ceramics	3	5
Other Uses of Soda Ash	3	5
Other	3	5
Chemical Industry		
Soda Ash Production	5	5
Metal Industry		
Iron and Steel Production	10	5 (CO_2)
Ferroalloys Production	5	5 (CO_2 and CH_4)
Aluminium production	2	10 (CO_2) and 50 (PFC)
Product Uses as Substitutes for Ozone Depleting Substances		
Refrigeration and Air Conditioning		
Refrigeration and Stationary Air Conditioning	5	5 (HFC)

For the other two sectors - AFOLU and Waste, as activity data and emission factors are mainly calculated on the basis of multiple input data, as well as according to the directions given in the Guidelines, in the Monte Carlo method the uncertainty for each input data is entered separately (as presented in Table 62 and Table 63). When entering uncertainty in IPCC Inventory Software for these two sectors, an approximation is made to represent all these values for uncertainty by only two values by subcategory, given in Table 64.

In order to determine the input values for uncertainty in each sector, the corresponding Guidelines were followed. In most of the cases, the default IPCC values are used, however for the Livestock sub-category activity data a lower level of uncertainty is used because in the Republic of North Macedonia there are subsidies for livestock, so the number of livestock is reported by the owners which reduced the level of uncertainty.

Table 62. Input data for uncertainty in the Monte Carlo method for AFOLU sector (in %)

	Uncertainty
AFOLU	
Livestock	
Number of animals	5
Emission Factor	30
Land	
Forest Land	
Wood/firewood removal	20
Area	20
Fraction of biomass lost in disturbance	15
Biomass conversion and expansion factor	5
Ratio of below-ground biomass to above-ground biomass	5
Carbon fraction of dry matter	5
Cropland, Grassland, Settlement and Other Land	
Area	20
Annual biomass carbon growth	75
Annual loss of biomass carbon	75
Dead wood/litter stock, under the old land-use category	10
Stock change factor for land-use system	20
Stock change factor for management regime	15
Stock change factor for C input	20

Table 63. Input data for uncertainty in the Monte Carlo method for Waste sector (in %)

	Uncertainty
Waste	
Solid Waste Disposal	
Total Municipal Solid Waste	20
Fraction of MSW_T sent to SWDS	20
Degradable Organic Carbon	20
Fraction of Degradable Organic Carbon Decomposed	20
Methane Correction Factor	
= 1.0	10
= 0.8	20
= 0.5	20
= 0.4	30
= 0.6	50
Fraction of CH_4 in generated Landfill Gas (F) = 0.5	5
GDP	5
Waste Generation Rate	10

Table 64. Input data for uncertainty in the IPCC Inventory Software for AFOLU and Waste sectors (in %)

	Activity data uncertainty	Emission factors uncertainty
AFOLU		
Livestock	5	30
Land		
Forest land		
Forest land remaining Forest land	20	10
Land Converted to Forest land	10	10
Cropland, Grassland, Settlement and Other Land		
Land remaining Land	20	50
Land Converted to other Land	10	50
Waste	20	20

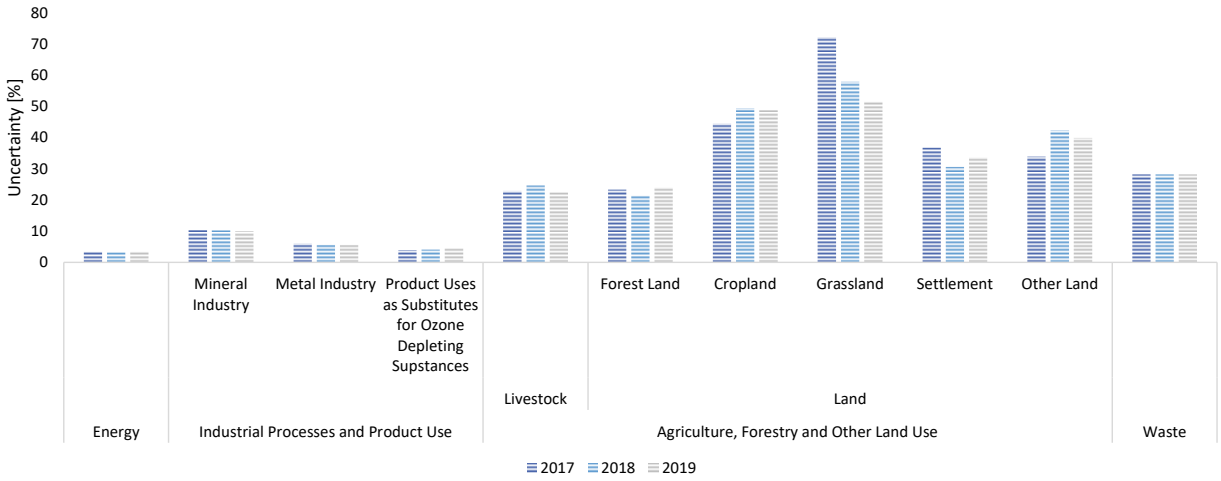
For the Monte Carlo method it is assumed that each input variable has normal distribution.

10.2 Results

10.2.1 Error propagation method (Approach 1)

When using the Error Propagation method for calculating the uncertainty for each sector separately, the obtained results indicate that the AFOLU sector has the highest uncertainty (Figure 70). Immediately after this sector is the sector Waste. A characteristic of these two sectors is that uncertainty in certain subcategories reaches over 40% and in 2017 the uncertainty in the sub-category grassland is around 70%. On the other hand, the sector with the lowest uncertainty is the Energy sector of about 3.4%. This sector is followed by the IPPU sector, where the Metal Industry has the utmost uncertainty of around 10%.

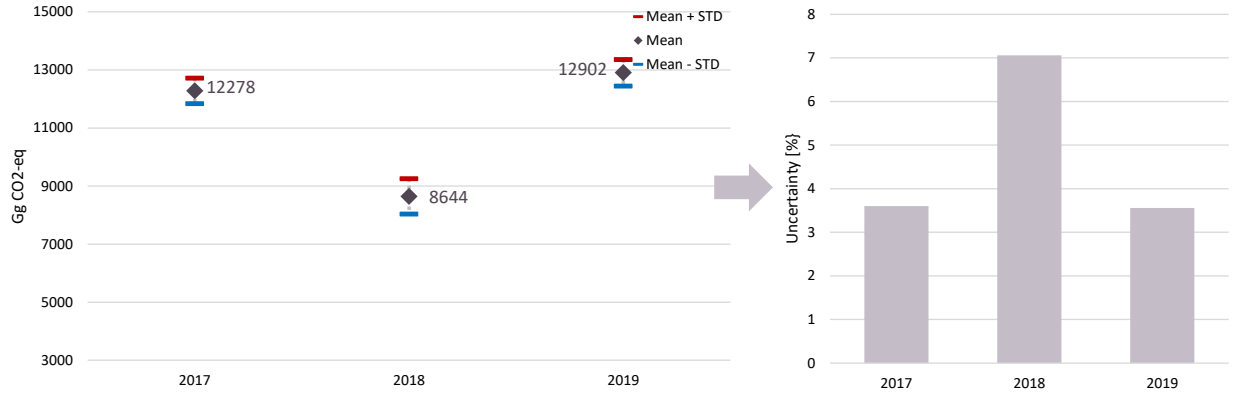
Figure 70. Uncertainty for 2017, 2018 and 2019 using Error Propagation method by subcategory



As a result of the different share of the individual subcategories in each analyzed year, the total annual uncertainty is different (Figure 71). The decrease of the share of the AFOLU sector (which have the highest uncertainty) in 2018 and 2019 compared to 2017, as well as the share of the sectors in the total CO_2-eq emission contributes to corresponding decrease of the total annual uncertainty.

The results show that the average deviation from the total annual emissions for 2017 is around ±442 Gg CO_2-eq, while for 2018 and 2019 it is around ±610 Gg CO_2-eq and ±459 Gg CO_2-eq, respectively (Figure 71).

Figure 71. Total yearly emissions (and standard deviation) and total uncertainty for 2017, 2018 and 2019 using Error Propagation method

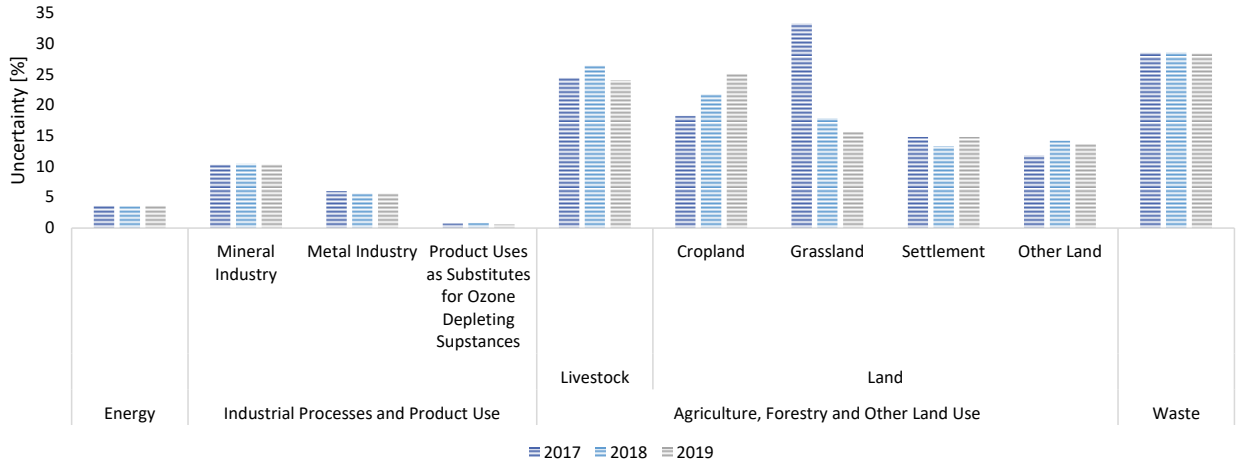


10.2.2 Monte Carlo method (Approach 2)

The opportunity in the Monte Carlo method to insert uncertainty for each input variable separately, especially in the AFOLU and Waste sectors, changes the obtained results compared to the Error Propagation method. According to this Approach, by far the largest uncertainty is in the Waste sector, which is around 30% in all the three analyzed years (Figure 72). This sector is followed by the AFOLU sector, where the greatest average uncertainty is in the Livestock subcategories of about 25% while the highest annual uncertainty is in the Grassland subcategories achieve 33% in 2017. On the other hand, Energy again has the lowest uncertainty, followed by the IPPU sector.

Because uncertainty is calculated as a quotient when dividing the standard deviation to the mean value in each of the subcategories, and because the range of values in the Forestry subcategory contains both positive and negative numbers, this metric does not represent a value for the Forestry subcategory that can be compared with other subcategories, so it is left out of Figure 72. However, this subcategory is included in the total emissions, where the results are positive for each iteration and each year.

Figure 72. Uncertainty for 2017, 2018 and 2019 using Monte Carlo method by subcategory

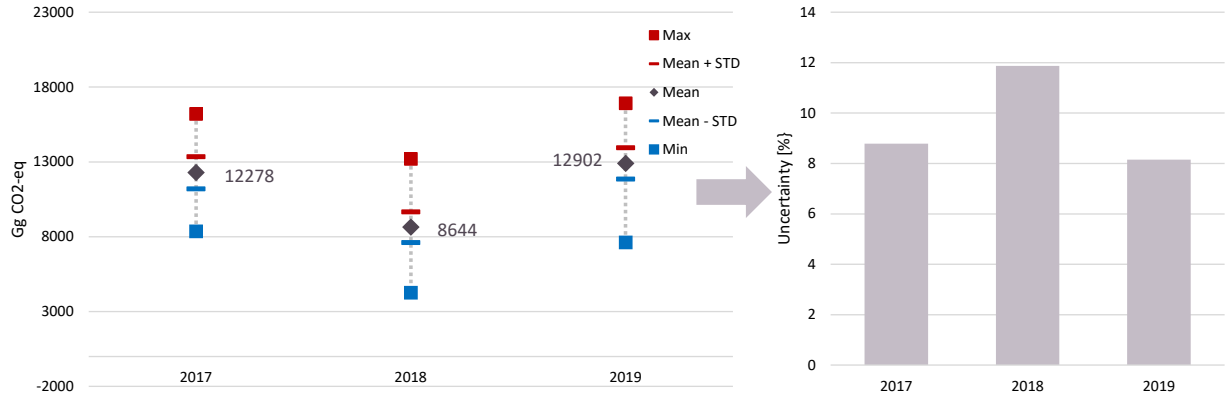


In order to obtain results from the Monte Carlo method 20,000 iterations were made. It is very important to note that the resulting annual average value is approximately the same as the calculated total emissions using the IPCC software. This shows that the number of iterations is quite sufficient and that the method converged to the final solution.

By using this approach, an information may be obtained for the theoretical minimum and maximum emissions for each year, representing the highest possible error introduced in the input data (Figure 73). However, more important is the information for the average deviation of the annual emissions, which for 2017 is approximately ± 1080 Gg CO_2-eq, while for 2018 and 2019 it is approximately ± 1026 Gg CO_2-eq and ± 1051 Gg CO_2-eq, respectively.

As with the Error Propagation method, the decrease in the share of the sectors with greater uncertainty and emissions, also decreases the total annual uncertainty in 2017 and 2019 compared to 2018.

Figure 73. Total yearly emissions and total uncertainty for 2017, 2018 and 2019 using Monte Carlo method

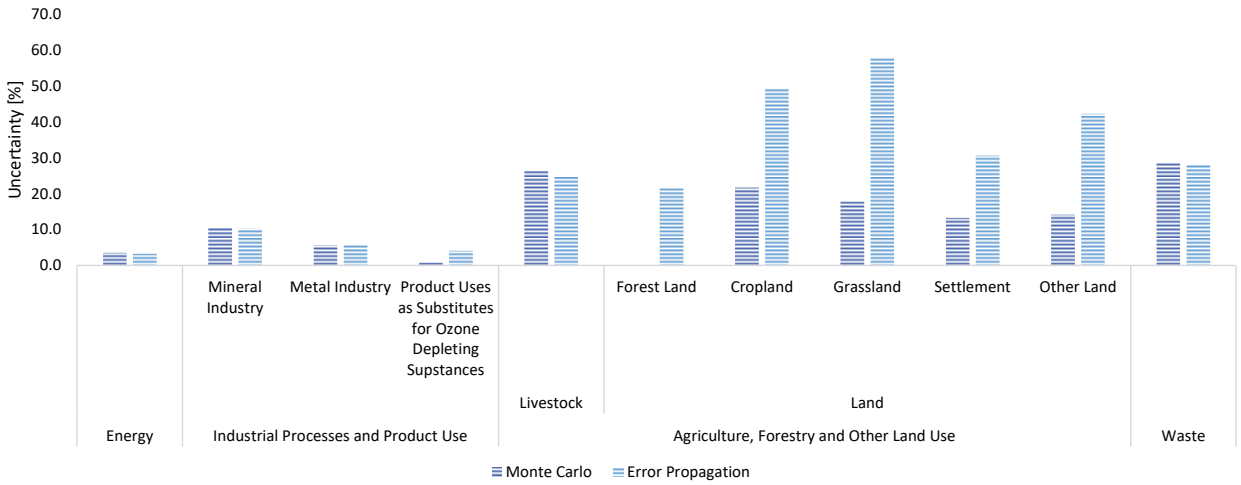


10.2.3 Comparison between Error Propagation method (Approach 1) and Monte Carlo method (Approach 2)

If we compare the Monte Carlo and the Error Propagation method, by subcategory (Figure 74), it may be noted that there are no significant differences in the obtained results for the Energy and IPPU sectors, except for the Product Uses as Substitutes for Ozone Depleting Substances subcategory. According to the Monte Carlo method, there is uncertainty of the input data (in this case only of imports), which in the final emissions for that year participate with a small percentage, while the greater part comes from the emissions from previous years.

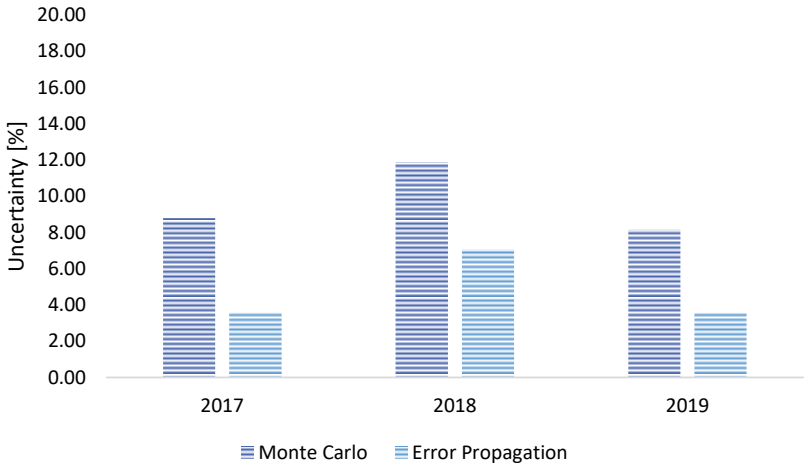
However, there are major differences in the other two sectors, due to the inability to accurately set uncertainty to all variables in the IPCC Inventory Software, i.e. the fact that all the uncertainty should be reduced to only two values (for activity data and emission factors), as previously mentioned.

Figure 74. Comparison of Monte Carlo and IPCC Inventory Software method by subcategory for 2018



Obviously, these differences in the emissions by subcategory when using the two approaches leads to different uncertainty in the total annual emissions (Figure 75). However, it can be concluded that the trend of uncertainty by year in the both methods is the same, i.e. increases with the increase of the share of sectors with higher uncertainty.

Figure 75. Comparison of the total yearly uncertainty between the Monte Carlo method and IPCC Inventory Software method



From the finding that the mean emissions from all iterations in the Monte Carlo method is nearly equal to the actual estimates of the emissions and that in this method individual uncertainty for each variable may be used (which is according to the Guidelines), it can be concluded that the results obtained from Approach 2 are much more relevant.

As it is presented, the highest uncertainty is in the Waste sector. This is primarily due to the large number of variables that have uncertainty, such as the total amount of municipal waste, the fraction of that amount sent to SWDS percentage wear landfill, methane correction factor, GPD and waste generation rate.

Furthermore, there is great uncertainty in the Livestock subcategory. Following are the remaining subcategories from the AFOLU sector, where the main source of uncertainty are the areas of each type of land, as well as the areas that have been converted to other area type. However, according to the Guidelines there is also high uncertainty in the values for annual biomass carbon growth and annual loss of biomass carbon.

11 QA/QC and Verification Activities

The implementation of Quality Assurance and Quality Control (QA/QC) procedures is an important part of the development of national GHG inventories. As described in the IPCC Good Practice Guidance and the latest IPCC Guidelines (2006), an adequate QA/QC program ensures

- Continuous improvement
- Transparency,
- Consistency,
- Comparability,
- Completeness,
- Accuracy and
- Timeliness

of the national GHG inventories.

Quality Assurance and Quality Control measures are two distinct types of activities. The IPCC defines each as follows:

- Quality Assurance (QA) – a planned system of review procedures conducted by personnel NOT involved in the inventory development process.
- Quality Control (QC) – a system of routine technical activities implemented by the inventory development team to measure and control the quality of the inventory as it is prepared.

An effective QA/QC plan contains the following elements:

- GHG Inventory team,
- General QC activities and procedures,
- Source-specific QC activities and procedures (optional, as resources allow),
- QA review procedures.

The QA/QC procedures presented in the BUR2 are also applied in BUR3. The QA/QC activities of the national GHG inventory process are based on the in-depth analyses of the inventory compilation practices in the country (used in the previous BURs) and the relevant international best practices.

11.1 Personnel involved in QA/QC activities

11.1.1 Chief Technical Advisor (CTA)

The CTA is a national expert who has substantial experience in GHG inventory development and leadership quality. CTA is in charge for the following:

- Supervises the overall inventory process
- Provides advice and approval on the following GHG Inventory elements:
  - Input data collecting mechanisms,
  - Time series,
  - Emission factors,
  - Methodologies for emission calculation,
  - Reporting format,
  - Best practices (key sources analyses, uncertainty management).
- Checks, proposes corrective actions (if any) and approves the National Inventory Report (NIR).

11.1.2 Inventory Development Team (IDT)

At least one IDT member should be responsible for each GHG Inventory sector. At least one IDT member should be assigned a responsibility for compilation of the overall GHG inventory and at least one IDT member for conducting Key Sources analyses and Uncertainty management. IDT members conduct the following:

- Collect input data (activity data and emission factors),
- Calculate sectoral emissions,
- Conduct QC activities and procedures,

- Re-calculate sectoral emissions implementing the corrective actions proposed by Quality Assurance Team (QAT),
- Conduct Key Sources analyses and Uncertainty management,
- Implement corrective actions proposed by QAT regarding Key Sources analyses and Uncertainty management,
- Compile the overall inventory,
- Implement corrective actions proposed by QAT regarding the overall inventory
- Develop NIR,
- Implement corrective actions proposed by CTA regarding the NIR.

The IDT members that collect input data (i.e. identify/verify data sources and document the input data) and calculate the sectoral emissions are called “Enterer”, while the IDT members that conduct QC activities and procedures are called “Checker”.

11.1.3 QA team (QAT)

The QAT members have previous experience in GHG inventory development (were involved in the preparation of the previous GHG inventories). At least one QAT member should be responsible for each GHG Inventory sector. At least one QAT member should be assigned a responsibility to check and verify the overall GHG inventory and at least one QAT member to check and verify Key Sources analyses and Uncertainty management. QAT members conduct the following:

- Check, propose corrective actions (if any) and verify the sectoral emissions,
- Check, propose corrective actions (if any) and verify the overall GHG inventory,
- Check, propose corrective actions (if any) and verify the Key Sources analyses and Uncertainty management.

Table 65. NC4 GHG inventory team

Expert (contact info)	Role	Responsibility
Acad. Gligor Kanevce **kanevce@manu.edu.mk**	**IDT & QAT Leader**	Leading the overall inventory development
Natasa Markovska **natasa@manu.edu.mk**	**CTA**	Supervision and Monitoring Approval of NIR and other reports QA/QC activities
Verica Taseska-Gjorgievska **verica@manu.edu.mk**	**IDT Member** **QAT Member** **Compilation of overall inventory and NIR**	Sectors: Energy, Waste, IPPU, Precursors and Indirect emissions (QC, development of the sectoral chapters) Key category analysis Sectors: AFOLU
Aleksandar Dedinec **dedinec@manu.edu.mk**	**IDT Member** **QAT Member**	Sectors: Energy, Waste, IPPU, Precursors and Indirect emissions (QC, development of the sectoral chapters) Key category and Uncertainty analysis Sectors: AFOLU
Aleksandra Dedinec **aleksandra.kanevche@finki.ukim.mk**	**IDT Member** **QAT Member**	Sectors: Waste (QC, development of the sectoral chapters) Uncertainty analysis Sectors: AFOLU
Emilija Mihajloska **emilija.mihajloska@sdewes.org**	**IDT Member**	Sectors: Energy, Waste, IPPU, Precursors and Indirect emissions (collecting and entering data, development of the sectoral chapters) Key category analysis
Sreten Andonov **sreten_andonov@yahoo.com**	**IDT Member**	Sector: AFOLU (collecting and entering data for Livestock, development of the sectoral chapter)
Ljupco Nestorovski **nestorovskil@hotmail.com**	**IDT Member**	Sector: AFOLU (collecting and entering data for Forestry, development of the sectoral chapter)

Nikola Nikolov **nnikolov@sf.ukim.edu.mk**	**IDT Member**	Sector: AFOLU (QC for Forestry, development of the sectoral chapter)
Dusko Mukaetov **d.mukaetov@zeminst.edu.mk**	**IDT Member**	Sector: AFOLU (QC for Land Use, development of the sectoral chapter)
Ordan Cukaliev **cukaliev@gmail.com**	**IDT Member**	Sector: AFOLU (QC for Land Use, development of the sectoral chapter)
Hristina Poposka **hristinapoposka@hotmail.com**	**IDT Member**	Sector: AFOLU (collecting and entering data for Land Use, development of the sectoral chapter)
Dusko Nedelkovski **duskosk8@yahoo.com**	**IDT Member**	Sector: AFOLU (collecting and entering data for Land Use, development of the sectoral chapter)
Gordana Kaplan **kaplangorde@gmail.com**	**IDT Member**	Sector: AFOLU (development of spatial digital data base)
Ivan Mincev **i_mincev@yahoo.com**	**IDT Member**	Sector: AFOLU (development of spatial digital data base)
Vjekoslav Tanaskovic **vtanaskovic@fznh.ukim.edu.mk**	**IDT Member**	Sector: AFOLU (QC for Land Use, development of the sectoral chapter)
Elena Gavrilova **egavrilova.mk@gmail.com**	**QAT Member**	QA activities: Energy, Waste, IPPU and Precursors and Indirect emissions
Marjan Mihajlov **m.mihajlov@maneko.com.mk**	**QAT Member**	QA activities: Waste

11.2 Quality Control

Tier 1 approach which requires a minimum set of QC activities and procedures have been implemented by the IDT members for all sectors to ensure that basic standards of quality are met. These standards generally focus on:

- Data gathering, processing, input, and handling,
- Data documentation and archiving,
- Emissions calculation.

Table 66. NC4 Tier 1 QC activities and procedures for all sectors

Data gathering, input, and handling checks	
QC Activities	**Procedures**
Check that assumptions and criteria for the selection of activity data and emission factors are documented.	• Cross-check descriptions of activity data and emission factors with information on categories and ensure that these are properly recorded and archived.
Check for transcription errors in data input and reference.	• Confirm that bibliographical data references are properly cited in the internal documentation • Cross-check a sample of input data from each category (either measurements or parameters used in calculations) for transcription errors. • Utilize electronic data where possible to minimize transcription errors. • Use IPCC Inventory Software to minimize user/entry error.
Check that emissions/removals are calculated correctly.	• Reproduce a representative sample of emissions/removals calculations. • If models are used, selectively mimic complex model calculations with abbreviated calculations to judge relative accuracy.
Check that parameter and emission/removal units are correctly recorded and that appropriate conversion factors are used.	• Check that units are properly labeled in calculation sheets. • Check that units are correctly carried through from beginning to end of calculations. • Check that conversion factors are correct. • Check that temporal and spatial adjustment factors are used correctly.
Check the integrity of database files.	• To extent possible, confirm that the appropriate data processing steps are correctly represented in the database. • To extent possible, confirm that data relationships are correctly represented in the database. • Ensure that data fields are properly labeled and have the correct design specifications.

	• Ensure that adequate documentation of database and model structure and operation are archived.
Check for consistency in data between categories.	• Identify parameters (e.g., activity data, constants) that are common to multiple categories and confirm that there is consistency in the values used for these parameters in the emissions/removals calculations.
Check that the movement of inventory data among processing steps is correct.	• Check that emissions/removals data are correctly aggregated from lower reporting levels to higher reporting levels when preparing summaries. • Check that emissions/removals data are correctly transcribed between different intermediate products.
Data documentation	
QC Activities	**Procedures**
Review of internal documentation and archiving.	• Check that there is detailed internal documentation to support the estimates and enable duplication of calculations. • Check that every primary data element has a reference for the source of the data (via cell comments or another system of notation). • Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review. • Check that the archive is closed and retained in secure place following completion of the inventory • Check integrity of any data archiving arrangements of outside organizations involved in inventory preparation.
QC Activities	**Procedures**
Check methodological and data changes resulting in recalculations.	• Check methodological and data changes resulting in recalculations. • Check for consistency in the algorithm/method used for calculations throughout the time series. • Reproduce a representative sample of emission calculations to ensure mathematical correctness.
Check time series consistency	• Check for temporal consistency in time series input data for each category. • Check for consistency in the algorithm/method used for calculations throughout the time series. • Check that the effects of mitigation activities have been appropriately reflected in time series calculations.
Check completeness	• Confirm that estimates are reported for all categories and for all years from the appropriate base year over the period of the current inventory. • For subcategories, confirm that the entire category is being covered. • Proved clear definition of 'Other' type categories. • Check that known data gaps that result in incomplete category emissions/removals estimates are documented, including qualitative evaluation of the importance of the estimate in relation to total net emissions (e.g. subcategories classified as 'not estimated').
Trend checks	• For each category, compare current inventory estimates to previous estimates, if available. If there are significant changes or departures from expected trends, re-check estimates and explain any difference. Significant changes in emissions or removals from previous years may indicate possible input or calculation errors. • Check value of implied emission factors (aggregate emissions/removals divided by activity data) across time series. Are changes in emissions or removals being captured? • Check if there any unusual or unexplained trends noticed for activity data or other parameters across the time series.

Source: This list has been adapted from IPCC Good Practice Guidance and the 2006 IPCC Guidelines for National GHG Inventories.

11.3 Quality Assurance and Verification

The quality assurance (QA) activities are performed at the inventory evaluation stage i.e. after the implementation of QC procedures to the finalized inventory. The GHG inventory quality is assured introducing external expert review conducted by QAT members. They check, and if needed, propose corrective actions and verify the following:

- Adequacy of the selected activity data and emission factors,
- Adequacy of the applied methodologies,
- Accuracy and consistency of the calculated emissions,
- Adequacy of the data documentation,
- Correctness of the conducted Key Sources analysis and Uncertainty Management.

As a final step, the CTA checks the National Inventory Report, if needed proposes corrective actions and verifies the National Inventory Report once the proposed corrective actions are implemented by the IDT members.

According to the IPCC Good Practice Guidance and Uncertainty Management in the National GHG Inventories, the priority in the QA process should be given to the key source categories, as well as source categories where significant changes in methods or data.

An expert peer review was conducted for QA of the national GHG estimates of the sectors Energy, IPPU and Waste.

The table provided below this paragraph contains the information of the sector specific data (Energy, IPPU and Waste) reviewed when the QA procedures were carried out.

Table 67. QA procedures implemented in the Energy, IPPU and in the Waste sector

Data Type	QA Activity	Remarks / Comments / Examples
Activity Data Check	Check for transcription, typographical error and error transposition.	Compare the national data source with the inventory data contained in the IPCC Inventory Software
	Compare with official published data	Compare the national energy related data (the data of the Energy balances published by the SSO and the data published by ESM), the annual data on industrial production (published by SSO) and the national waste related data (the Waste related data published by the SSO and the Regional Waste studies published by MOEPP) with the AD contained in the IPCC Inventory Software
	Identify and fix outliers in data inputs (including checking the inclines and spikes in the trend)	Data which don't fall under the realistic range and are suspected as inaccurate are assessed and if necessary are removed and replaced with data from international sources or derived from expert judgment
	Compare with other international data	Compare the Energy related data with the data published by the IEA
	Check the documentation of all sources, data format and assumptions for easy reference	Keeping records on the data source and assumptions used in each data sheet of the IPCC Inventory Software.
	Assure if the Party is able to provide an overview of the overall waste generation and treatment in the country	Assure that an overview of waste generation and treatment is provided and AD on all types of solid waste been collected (MSW, sludge, industrial and other waste)
	Ensure that the AD are provided in the appropriate units	Check the background table for each category and ensure the consistency and the accuracy of the AD units
	Check if the activity data for estimating of the GHG emissions are equal for the activity data used to estimate the emissions of precursors and indirect emissions	Export the activity data from each worksheet in the IPCC 2006 database and compare with the AD provided in the tables for estimation of the emissions of precursors and indirect emissions
Emission factors	Check the implied emission factors (time series)	Ensure consistency check of the use of the EF
	Double check in regards to the country specific EF published in the EFDB and compare with the EF of the other countries	Ensure that the country specific EF in use are in the ranges provided by the IPCC guidelines
	Check if the EFs used for estimation of the emissions of precursors and indirect emissions are consistent, comparable and transparently documented	Check if the EFs used for estimation of the emissions of precursors and indirect emissions are in line with the EMEP/CORINAIR Emission Inventory Guidebook. In case CS EFs are used, check the background materials, the estimation methodology, the EF range and the comparability with other national reports
Calculation by the IPCC	Cross check all steps involved in the calculation	Ensure that all steps used for determining, estimating and deriving data are accurate, transparent and internally consistent

Inventory Software	Check the documentation of sources and correct use of units	Check if the documentation template records are appropriately fulfilled
	Check completeness of the data coverage	Ensuring that all relevant gases for all the activities were covered
	Check if the excluded other non-energy use of fuels from activity data in energy sector is reported under the IPPU sector (in case emissions occurs from these non-energy uses)	Ensuring that the excluded from the Energy sector is accounted in the sector IPPU
Results (emissions)	Check the differences between the recalculated estimates and verify if proper justifications for the recalculated estimates are provided	Identification of changes, revisions and reallocations in order to improve accuracy and the transparency of the emission estimates
	Identify and fix outliers in the results	Checking for inconsistency of the emission trends and levels
	Check the difference between the sectorial and the reference approach in the Energy Sector	Ensure consistency between the emission estimates and the allocation of carbon in the sectoral and in the reference approach
	Check the completeness, use of notation keys and confidential information	Check if complete estimates are provided and if notation keys are used where no estimates are provided
	Creativeness of the use of the notation keys	Check if the appropriate notation keys are in use
	Verify the assumptions, corrections, data and sources	Ensure consistency, transparency, facilitate repeatability and easy retrieval
Documentation	Check the improvement list, recommendations and encouragements provided (internal and external)	Check if the recommendations and the encouragements of the technical assessments / reviews have been taken into consideration and implemented

Four steps quality verification process of the GHG inventory has been introduced:

- Two steps on national level (inventory team and a national UNFCCC certified reviewer – procedures described above)
- Two steps on international level (by the Global Support Programme and technical analysis as part of the UNFCCC international consultation and analysis process for non-annex I countries).

Recommendations provided by the Global Support Programme and the Technical Analysis of the UNFCCC ICA Process have been implemented in the GHG development process and in the NIR to the extent possible. However, some of the recommendations for improvement shall be included in subsequent national BURs.

11.4 QA/QC implementation in the current GHG Inventory process

11.4.1 The process in a nutshell

Step 1: Allocation of roles (CTA, IDT members, QAT members)

Step 2: Defining the GHG Inventory components

For each sector, the corresponding IDT member, in consultation with CTA, Project manager and MOEPP decides upon:

- Input data collecting mechanisms
- Time series
- Emission factors (National/IPCC defaults)
- Methodologies for emission calculation

The following is taken into account: Current practices of the inventory compilation in the country, country specifics and relevant international best practices

Step 3: Activity data collection

For each sector, the corresponding IDT member collects data from the official publications and reports and/or contacts the identified institutions (data sources) for obtaining data. The IDT members should reference the inventory data sources and describe procedures and arrangements undertaken to collect and archive data for the preparation of national GHG inventories.

Step 4: Data input, documenting and calculating of emissions (Tier 1 QC procedures undertaken in parallel)

The IDT members use IPCC Inventory Software for National Greenhouse Gas Inventories to enter activity data and emission factors, document data and calculate emissions. This IPCC tool enables all-inclusive documentation of data, as well as includes functionalities for detailed Quality Check. In parallel, the IDT members implement all Tier 1 QC activities and procedures, as described previously.

Step 5: QA at sectoral level

QAT members check, and if needed, propose corrective actions and verify the adequacy of the selected activity data and emission factors, adequacy of the applied methodologies, accuracy and consistency of the calculated emissions and adequacy of the data documentation.

Step 6: Compilation of overall inventory

This activity is undertaken by one of the IDT members.

Step 7: QA of overall inventory summary

One QAT member checks, propose corrective actions and verifies accuracy and consistency of the overall inventory.

Step 8: Conduct key category analyses

This activity is undertaken by IDT member(s). Key sources analysis is conducted applying methodology from IPCC 2006 Guidelines. Dedicated chapter is also included in the NIR.

Step 9: Uncertainty management (as decided)

CTA and IDT member(s) decide the target sector(s) for uncertainty management taking into account the results of the key sources analysis and other country specifics. The corresponding IDT member(s) conducts the uncertainty management analysis applying methodology from IPCC 2006 Guidelines. Dedicated chapter is also included in the NIR.

Step 10: QA of key sources analysis and uncertainty management

One QAT member checks, proposes corrective actions and verifies the accuracy and consistency of the key sources analysis and uncertainty management.

Step 11: Drafting the sectoral chapters of NIR

For each sector, this activity is undertaken by the corresponding IDT member.

Step 12: Draft summary inventory chapter

This activity is undertaken by the IDT members (the same as in Step 6).

Step 13: QA of NIR

CTA checks, proposes corrective actions and approves the NIR.

Step 14: Reporting

MOEPP is in charge for GHG emissions reporting. In accordance to its international (including also European) and national obligations, the MOEPP should prescribe the reporting format to be followed by the IDT members. All the reports should be approved by CTA.

11.4.2 Reporting, documentation and archiving procedures

The documentation on the data source, the choice of the emission factors and other information relevant for the GHG estimates are documented in the IPCC 2006 inventory database (as Worksheet remarks).

All GHG inventory documents are stored electronically on the server of the Ministry of Environment and Physical Planning and in the database of the Macedonian Academy of Sciences and Arts. This includes quality system documents, reports, original data from data providers, the IPCC Inventory Software files, CRF Reporter database files, the data submitted to the UNFCCC and spreadsheets of the emissions inventory. Furthermore, the decisions reached by the coordinating team, the results of key category and uncertainty analysis, the internal and external review documents, as well as inventory development processes and guidelines materials are documented and archived in the database. The geographical database used for preparing the AFOLU inventory and the digitized maps of land use classification are also stored on the server to assure proper documenting materials for the estimates and the procedures applied in the sector.

After each submission of the national inventory to UNFCCC a complete copy of the full database is archived by the Ministry of Environment and Physical Planning, which is the single location where archives of GHG submissions and all supporting reference material is stored and maintained. Backups of each submission and supportive material are also kept as separate CDs.

11.4.3 Ensuring sustainability

Summing up, the Macedonian inventory process, organized in a way as presented in the previous section, meets the necessary technical conditions for ensuring sustainability, since:

- A strong focus is put on documenting essential information in a concise format;
- Activities and tasks are standardized and clear procedures stipulated;
- Roles and responsibilities of all players are clearly defined.

On top, worth mentioning in this regard are the training materials on GHG inventory preparation developed and constantly updated by the GHG inventory team. These materials are rather country-specific, and being based on personal experience gathered and lessons learned during the GHG inventory preparation in Macedonian conditions, would provide clear guidance for newcomers in the process. Additionally, capacity building activities have been implemented and two new people within the CBIT team were trained on development of GHG inventories.

12 Good practices, improvements and recommendations

The Summary report of the Technical analysis of the Macedonian BUR2 (TASR.2) stated that the country has reported all elements of the required information on greenhouse gases per the BUR guidelines (conclusions summarized in Table 1 of Annex I of the TASR.2) and commended North Macedonia for the level and detail of the information provided in the NIR. Therefore, this NIR was developed in the same manner, following the good practices from the previous BURs. During the preparation of this NIR, the BUR3 Technical analysis was not completed; for that reason, the Inventory team will consider the TASR3 recommendations in the next NIR.

12.1 Energy

Good practices (***GP)***/Improvements (***I***) in the NC4:

- ***I:*** The GHG emissions from the Road Transportation were recalculated at a more disaggregated level, by subcategories available in the IPCC Inventory software, which include: passenger cars (with and without 3- way catalysts), light-duty trucks (with and without 3-way catalysts), heavy-duty trucks and busses and motorcycles, evaporative emissions from vehicles, and emissions associated with catalytic converter use in road vehicles, i.e. urea-based catalysts. The emissions were estimated based on the fuel consumption by type of vehicle (derived from the COPERT database data from the National Road Transport Emission Inventory).
- ***GP:*** The category *Diesel and Heating Oil* used in the Energy balances until 2011 has been separated into *Road Diesel* and *Heating & Other fuel oil* in the updated Energy balances from 2005 onwards. Similarly, the *Biomass* category has been separated into *Biomass* and *Wood Wastes, Wood Briquettes and Pellets* and *Wood of fruit trees and other plant residues*. The advantage of the disaggregation has been reflected in this NIR and different NCVs are used in the IPCC Inventory Software for all of these categories.
- ***GP/I:*** National emission factors are used for lignite, residual fuel oil and natural gas in Energy sector, Fuel combustion activities. The county-specific emission factors for natural gas was updated for 2017, 2018 and 2019.
- ***GP:*** The average CO_2 emission factor from the 2019 Refinements to the 2006 IPCC Guidelines was taken into account for the fugitive emissions from fuels, specifically surface mines.

Recommendations for future inventories:

- Secure and constant channels for acquiring data on composition and carbon content of fuels should be established with relevant institutions in order to facilitate the estimation of country specific emission factors. This can be achieved by signing some kind of agreement, for instance, a Memorandum of Understanding.
- Considering that several biogas power plants are operating in the country, their electricity production should also be included in the subsequent inventories. Since there is no reliable information on biogas production, it is suggested that the subsequent BURs further investigate the biogas production processes in the country. It would be helpful to have a separate study for each of the few biogas plants, bearing in mind that this type of technology is expected to be used more in the future.

12.2 IPPU

Good practices (***GP***)/Improvements (***I***) in the NC4::

- ***I:*** The HFCs emissions have been recalculated for the period 2012 – 2016, and new calculations have been made for 2017 -2019, using the updated data on import of HFCs and blends provided by the Ozone Unit of the MOEPP

Recommendations for future inventories:

- More detailed data regarding the carbon content of the feedstock in the following sectors: cement production, lime production and steel production. These data can be gathered directly from the industrial plants.

- Segregated data for the F-gas emissions from refrigeration and air-conditioning for the specific part of the equipment life-cycle. These data should be collected by the Ministry of Environment and Physical Planning.
- F-gas emissions from fire protection, aerosols and solvents or reiteration that emissions from these categories are not occurring in the country.
- N_2O emissions from medical appliances.
- SF_6 emissions from use and disposal of electrical equipment.

12.3 AFOLU

▪ Livestock

Good practices/improvements:

- Inventory of the GHG emissions in livestock for the current report was done with background data from State Statistical Office. Data for small dairy and swine farms were classified according to the survey findings in late 2019. There were results for breed used, farm management and feeding system, and manure management system in the survey. The survey enabled the use of Tier 2 for dairy cattle and swine, the highest emitters of GHG in livestock. Also, data for manure used in biogas power plants were considered. Since 2015 two power plants of 3 MW each and one plant of 1 MW have been operational. The first two plans in biogas digesters use corn silage and manure from two dairy farms. Liquid manure of 440 m^3 has been collected daily (50 t daily manure and the rest is technical water). The last one (1 MW power plant) use 9 t poultry manure (layers) and 5-10 t liquid swine manure. During the emission estimation, the corresponding manure quantities from dairy cattle, swine, and layers were assigned under anaerobic digesters.

Recommendations for future inventories:

- In preparation for the next emission inventory of GHG in livestock, a new survey should be conducted for the needs of Tier 2 application, unless other sources (State Statistical Office, MAFWE, MoEPP, FVA) would provide the required data.

▪ Land use

The inventory of the GHG emissions for the BUR3 or the sector-agriculture, was based to the available national data from the SSO and Ministry of Agriculture, Forestry and Water Economy (MAFWE) and international data sources, like LandSAT (USGS), SENTINEL 2 (ESA_Copernicus) and FAO-Stat.

Data from the SSO and satellite images were used in order to estimate the area under certain land use category and its dynamics, which serve as activity data according IPCC methodology. Official data published by SSO refers to the area under certain Land Use type for a given year, while data for the areas converted from one to another category of land use were calculated on the base of the available graphical data sets (LandSAT and SENTINEL 2 satellite images).

The improvement of the assessment of GHG emissions from agricultural sector is important, particularly in establishing consistent data series Land use change has been calculated for the years 1989-1990, 1999-2000, 2004-2005, 2013-2019, while for the periods 1991-1998, 2001-2003 and 2006-2012, interpolation has been made in order to fill the gap years Based on the data gained with satellite images processing and interpolation the whole data base has been updated for the period 1990-2019.

The classification methodology used in this study has been specially developed for North Macedonia. In addition to the satellite data (Landsat and Sentinel), build-up data, digital surface model, and slope data were used. Landsat – 5 imageries has been used for the period between 1988 – 2005, Landsat – 8 for 2014, while for the period between 2015 – 2019, yearly Sentinel – 2 imageries have been used. Before constructing the dataset, atmospheric and geometric pre-processing was performed to the satellite images. Also, two commonly used remote indices were added to the dataset, namely, Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI). The first index is used for vegetation, while the second is used for open water mapping and monitoring. Afterward, the images have been fused with the additional data. One of the most common methods to obtain land use – land cover information from satellite images is remote sensing image classification. Image classification converts the data into meaningful information. Depending on the supervision, classifications can be supervised and unsupervised, while depending on the data type, two different classification types can be distinguished: pixel and object-based classification. As object-based classification has been proven to be superior over pixel-based classification, the satellite images were classified using object-based image analysis (OBIA). The OBIA was done using

rule-set developed for the study area. In the first step of the OBIA segmentation was one where the pixels have been converted into small objects, allowing the system to detect and classify every pixel with water content. For that purpose, a threshold to the NDWI data has been set. Also, the cropland and urban area were limited using the Slope data classifying the flat areas. The urban layer has been integrated into the dataset, and as the urban layer is a binary image, we have classified the urban areas with a simple threshold. In order to simplify the image, a second segmentation with different parameters creating larger object has been processed. The created objects have been observed, and the threshold values have been determined. For the Forest class, both NDVI and brightness values have been used. From the sample inspection, it has been noticed that forests have significantly lower brightness than the other objects such as natural grassland, pastures, and cropland. The Natural Grassland class has been classified using NDVI and elevation threshold. As at some area, grasslands have a low slope, and an additional rule has been applied where high flat areas have been classified as Natural Grassland. Generally, using only spectral information, it is hard to distinguish pastures from some cropland areas. Thus, the main difference between these two classes is the slope. Pastures have been classified using NDVI threshold, while croplands have been classified using slope since part of the croplands does not contain any vegetation during the summer period and have low NDVI value. The accuracy assessment of the results was done using 5.031 random points, and have shown accuracy of 85% which is above the acceptable rate of 75% using middle spatial resolution remote sensing data.

As planned, the following remote sensing (RS) and earth observation (EO) activities is expected to be achieved for the next inventory reports:

- Regular (annual basis) assessment of the land use based on satellite imagery from the current year.
- Maintaining data derived from this activity in geo-data base and make it available for public
- Comparing data obtained from this activity with data provided by state statistical office
- Estimating land use changes on annual basis

This improvement in LU/LUC will allow moving forward in certain cases towards Tier 2, with regards to the activity data in Land subsector of AFOLU. In addition to the LU/LUC data, other activity data sets that needs to be improved, are:

a) Mineral fertilizers use – types and quantities used
b) Manure –quantity, quality and management
c) Plant organic residues and by-products-quantity and management

In order to move to higher Tier`s in the other sectors, an in addition to the proposed measures for development and improving of the existing LU/LUC data set and other activity data, particular attention should be paid to the development of national emission factors for assessing GHG emissions/removals taking into consideration:

a) Field measurement of GHG emissions under various land use types, land management practices, and inputs,,
b) SOC dynamics under certain land use, management practices, and inputs
c) Annual biomass productivity of perennial crops measurements (orchards, vineyards, forage, etc.)

This is complicated task and there is no other choice than building national capacities on assessing of this data that is not readily available in the country. This is serious gap that should be overcome through investment in capacity building, particularly in institutions from agricultural and environmental sector.

▪ Forestry

Good practices/improvements:

- Implemented satellite images for land use change from and to Forest land (CORINE Land Cover) for 2000, 2006, 2012 and 2018, implementation of data from satellite imagery (ESA-Copernicus product – SENTINEL 2, 1990 -2019) for forest area land use change.
- Improved data for commercial and firewood removals
- Improved and updated data for burned forest area, using data from three different sources
- Improved data for annual growth and yield of different types of forests

Recommendations for future inventories:

- Forest inventory (PE “Nacionalni sumi”, MAFWE, Faculty of Forestry)
- Installation of software for annual evidence of the Land use change
- Develop local tables for annual growth of different species
- Develop system for monitoring the natural disturbance and prompt evidence
- Collect data for other non-wood products

12.4 Waste

Good practices (***GP***)/Improvements (***I***) in the NC4:

- ***I*****:** The emissions from incineration of clinical waste have been recalculated for period 2000 -2019, based on the updated activity data available from the SWDS where the incineration is performed (SWDS Drisla).
- ***GP:*** More industry sectors have been introduced in the subcategory Industrial wastewater treatment and discharge based on SSO data. The data have been classified in the following industrial sectors: Alcohol Refining, Beer & Malt, Coffee, Dairy Products, Meat & Poultry, Organic Chemicals, Petroleum Refineries, Plastics & Resins, Pulp & Paper (combined), Soap & Detergents, Starch Production, Sugar Refining, Vegetable Oils, Vegetables, Fruits & Juices, Wine & Vinegar. The correlation with the SSO data was made using the NACE codes. At the same time a revision of the overall time series has been made and the inconsistencies identified in the previous BUR were corrected.

Recommendations for future inventories:

- Currently, for the Solid waste disposal there are no data on waste production by industry type. It is recommended for the next inventories to disaggregate the data for waste generated from manufacturing industries by industry types, in order to be able to use the default values of DOC and fossil carbon contents in industrial waste for specific industry types (as per the IPCC 2006 Guidelines, Vol. 5, Ch. 2, Table 2.5). This should be done in close collaboration with the SSO.
- To include data on sludge generation from waste water treatment plants (WWTP). Currently, some of the input data to estimate these emissions are not available for all WWTP. Therefore, it is essential to study the current situation of the WWTP in terms of their operating status, type of treatment, wastewater treatment capacity, etc.

12.5 Improvement Plan

This chapter summarizes the recommendations for improving future GHG inventories (Table 68), provided by the Inventory Development Team in the previous chapters, as an Improvement plan. The plan focuses on enhancing the data gathering processes that will enable using country-specific emission factors or other parameters required for determining greenhouse gas emissions by applying higher Tiers. Considering that obtaining such data is not an easy process, especially when the inventory development is a project-funded activity, the timeframe of this plan is not fixed to the following inventory. Still, its purpose is to highlight the issues that can be gradually improved in future inventories. Therefore, the plan presents a more general aspect of improvements that could be made, without specifying details. The plan also includes categories for which emissions were not estimated in the previous inventories (due to lack of information). Even though these categories might not be key sources of emissions, the inventory team should explore the possibilities to the extent possible (i.e., if reliable and consistent data become available) to include them in the future GHG inventories.

Table 68. Improvement plan of future NIRs

Sector/Category	Improvement	Description of improvement	Basis of Planned Improvement
Energy / Fuel combustion activties	Establishment of secure and constant data flow channels with the relevant institutions, on the composition and carbon content of fuels they use.	Secure and constant channels for acquiring data on composition and carbon content of fuels should be established with relevant institutions in order to facilitate the estimation of country specific emission factors. This can be achieved by signing some kind of agreement, for instance, a Memorandum of Understanding.	Continuous improvement (towards implementation higher tiers)
Energy / Fuel combustion activities / Energy Industries	Inclusion of the electricity production of the existing biogas power plants in the subsequent inventories.	Recognizing that there are several existing biogas power plants, their electricity production should also be considered in the following inventories, especially if more of these power plants will become available in the future. Since there is no available data on the amount of biogas used for electricity production,	Continuous improvement

		developing a separate study for the existing biogas power plants is recommended.	
Energy / Fuel combustion activities / Transport	Improvement of the non-GHG emissions reporting from Road transportation using COPERT estimations.	A national inventory of non-GHG emission is developed for Road transport, for period 2014-2018, by applying Tier 2 method with COPERT tool. The estimated emissions with COPERT could be incorporated in the next inventory. Also, those estimated could be used to revise the time-series for non-GHG emissions from road transport, to the extent possible.	Continuous improvement
IPPU/ Mineral and Metal Industry	Establishment of continuous data flows with the relevant institutions in the metal and mineral industry.	The frequently update of the methods used for emissions estimation would require more detailed data regarding the carbon content of the feedstock in the mineral and metal industries: (e.g., cement production, lime production and steel production). These data can be gathered directly from the industrial plants.	Continuous improvement (towards implementation of higher tiers)
IPPU / Product Uses as Substitutes for Ozone Depleting Substances	Segregation of data for the F-gas emissions from refrigeration and air-conditioning for the specific part of the equipment life-cycle.	The Ministry of Environment and Physical Planning provides data on the imported amounts of F-gases and blends without disaggregation by equipment required for the GHG inventory. Therefore, possibilities for segregated data for the F-gas emissions from refrigeration and air-conditioning for the specific part of the equipment life-cycle should be further explored.	Continuous improvement
IPPU / Product Uses as Substitutes for Ozone Depleting Substances	Analysis on the availability of data to estimate F-gas emissions from fire protection and aerosols.	The F-gas emissions from fire protection and aerosols are not estimated in the country. The availability of data to estimate these emissions should be further investigated or to reiterate that emissions from these categories are not estimated in the country.	Continuous improvement
IPPU / Other Product Manufacture and Use	Analysis on the availability of data to estimate emissions from Other Product Manufacture and Use.	To investigate the availability of data to estimate N_2O emissions from medical appliances or reiterate that these emissions are not estimated in the country. Also, to investigate the availability of data to estimate SF6 emissions from the use and disposal of electrical equipment. Information on the SF6 use in the electrical equipment could be requested from the energy industry companies.	Continuous improvement
AFOLU / Livestock	Conducting surveys to gather information required for application of higher tier methods.	In preparation for the following inventory of GHG emissions in livestock, a new survey should be conducted for the needs of Tier 2 application, unless other sources (State Statistical Office, MAFWE, MoEPP, FVA) would provide the required data.	Continuous improvement (towards implementation of higher tiers)
AFOLU / Land	Continuation of the remote sensing (RS) and earth observation (EO) activities in the next inventory reports.	Following RS and EO activities are expected to be achieved: • Regular (annual basis) assessment of the land use based on satellite imagery from the current year. • Maintaining data derived from this activity in geo-data base and make it available for public • Comparing data obtained from this activity with data provided by State Statistical Office • Estimating land use changes on annual basis.	Improvement in LU/LUC that will allow moving forward in certain cases towards Tier 2, with regards to the activity data in Land subsector of AFOLU
AFOLU / Aggregate sources and non-CO_2 emissions sources on land	Establishing connection with the relevant institutions on the availability of data required for the GHG inventory.	In addition to the LU/LUC data, other activity data sets that needs to be improved, are: • Mineral fertilizers use – types and quantities used • Manure – quantity, quality and management • Plant organic residues and by-products-quantity and management.	Continuous improvement
AFOLU / Land	Gathering data to improve the methods used for assessing GHG emissions/removals	Particular attention should be paid to the development of national emission factors for assessing GHG emissions/removals taking into consideration: • Field measurement of GHG emissions under: various land use types, land management practices and inputs,	Continuous improvement (towards implementation of higher tiers)

		• SOC dynamics under certain lad use, management practices and Inputs • Annual biomass productivity of perennial crops measurements (orchards, vineyards, forage, etc.) This serious gap should be overcome through investment in capacity building, particularly in agricultural and environmental sector institutions.	
AFOLU / Land / Forest Land	Gathering data to improve the methods used for assessing GHG emissions/removals	Collaboration with the relevant institution is necessary to establish data collection activities, such as: • Forest inventory (PE "Nacionalni sumi", MAFWE, Faculty of Forestry) • Installation of software for annual evidence of the Land use change • Develop local tables for the annual growth of different species • Develop a system for monitoring the natural disturbance and prompt evidence • Collect data for other non-wood products	Continuous improvement
Waste / Solid Waste Disposal Sites (SWDS)	Establishing connection with the relevant institutions on the availability of data required for the GHG inventory.	To be able to use the default values of DOC and fossil carbon contents in industrial waste for specific industry types (as per the IPCC 2006 Guidelines, Vol. 5, Ch. 2, Table 2.5), it is necessary to disaggregate the data for waste generated from manufacturing industries by industry types This should be done in close collaboration with the SSO.	Continuous improvement
Waste / SWDS, Wastewater Treatment and Discharge	Gathering relevant information necessary to include data on sludge generation from wastewater treatment plants (WWTP).	Currently, some of the required input information to include the sludge are not available for all WWTP. Therefore, it is necessary first to gather information on the current situation of the WWTP in terms of operating status, type of treatment, wastewater treatment capacity, etc.	Continuous improvement

12.6 Gender aspect

UNDP under the projects "Macedonia's Fourth National Communication and Third Biennial Update Report on Climate Change under the UNFCCC", and "Strengthening institutional and technical Macedonian capacities to enhance transparency in the framework of the Paris Agreement" (CBIT project) has introduced a methodology of integrating the UNFCCC gender references (Paris Agreement and Gender Action Plan of the UNFCCC) into the Macedonian methodology of reporting to the UNFCCC.

Namely, an in-depth Analysis on intersection of gender and climate change in the Republic of North Macedonia was developed, focusing on the inclusion of the gender perspective into the national climate change policies was conducted, with a view to international standards, national institutional set-up, an overview and analysis of the gender based roles, needs, challenge and barriers of women and men in 4 sectors: Energy use in households, Transport, Agriculture and ICT (information and computer technologies). The Analysis showed that there are gender based behavioral aspects indicating different activities of women and men as GHG emitters.

Women are still a de facto marginalized and vulnerable group, due to higher poverty rates among them, less access to resources such as money, loans and property rights, and less involvement in decision-making processes. Women are also in most cases (as opposed to men) victims of double or multiple discrimination (gender correlated with ethnicity, religious, educational background, place of residence, (un) employment, age, etc.). which puts them in an even more difficult position when it comes to tackling or combating climate change, in particular access to services, services, adaptation and mitigation information for and from climate change.

In that regard, the socio-economic status, as well as the behavioral aspect, based upon the gender based roles, in the family and society, must be considered as elements and indicators of analyzing the GHG emissions upon gender.

The following examples are clearly showing the gender based differences in the behavioral aspect:

Household energy use. There is a serious lack of data, gender-based analysis and identification of gender-based differences in household energy use at national level, still, several studies have identified strong definitions of energy use in households based on their gender segregation. Women perform most of the household chores, cooking, washing and cleaning and laundry use (when available). Thus, their activities can affect the household's total energy consumption on a daily basis. But although women are more likely to use energy because of their gender roles in the home, they are not involved in deciding what type of energy (source) and appliances will be used. In countries of traditional gender, it is usually men who decide what type of appliances to buy or what type of energy will be used to heat the home.

Gender differences and roles in the agricultural sector. Agriculture is most directly affected and totally dependent on climate change and its negative impacts as crops and livestock are susceptible to even the slightest climate variations. In this regard, it must be emphasized the situation with developing countries, whose agriculture is highly dependent on weather conditions, rainfall and affecting planting, disease spread, increased exposure to heat stress, changes in precipitation, erosion due to increased rainfall, etc. The gender perspective in the agricultural sector is particularly pronounced, ranging from gender labour segregation (vertical and horizontal in agriculture), unequal access to productive resources, opportunities, information systems, but also deeper gender stereotypes of the roles of women and men in the family, access to education, social protection, banking services, ownership division (agricultural land), etc.

Gender differences and roles in the transport sector. In the Republic of North Macedonia, the share of transport in final energy consumption increased from 24% in 2012 to 32.5% in 2015. Of the three subcategories (road, rail and air traffic), the most dominant is road traffic, with 97% participation. In the total percentage of motor vehicle owners, women account for 15% at the state level, while in the Skopje region it is slightly higher at 21%. The small percentage of women car owners contributes to the fact that women are often users of public transport for day-to-day responsibilities. A gender perspective in transport policy is important not only to reduce inequality between women and men, but also to support environmental development, as women are increasingly adopting ecological models of mobility.

In parallel, transport numbers are clearly showing gender based differences. Recent data obtained from Ministry of Interior demonstrates that 71% of car owners are men and 13% are women thus forming at least two assumptions: One is that women tend to use more environmentally friendly means of transport or use more often the public transport services and secondly this number is due to the lack access of financial capital necessary to buy a vehicle which correlates with the greater unemployment rates for women. Nonetheless, this can be related with the inheritance practices that the family vehicle is usually inherited by the son rather than the daughter, which is case with land ownership.

We must highlight, that although there are no official sex-disaggregated statistics on the GHG emitters at individual (personal) level, but still, the available sex-disaggregated data are showing differences in certain aspects of the GHG emissions where we can see the gender-based differences in activities, patterns and behaviors – strictly depending on the poverty criteria as well as on gender-based roles in the family and society.

In that context, in the Republic of North Macedonia, there are two sources of data disaggregated by sex and related to climate change and GHG emissions. The first one is the Macedonian gender and climate change indicators encompassing section on Gender and the National GHG Inventory, and the second one is the Narrative Study – Gender and Climate Change, Macedonia – micronarratives encompassing behavioral and socio-economic context. Vulnerability in this context refers to socio-economic vulnerability which, as mentioned above, contributes towards, and represents a basis for (in)ability of both women and men to practice low-level of GHG emitting patterns. The most evident example are the vulnerable households heating patterns where poverty and social vulnerability have a direct share in higher greenhouse gas emissions. In other words, socially vulnerable families use heating sources that emit greenhouse gases and are not energy efficient and sustainable.

Methodology for data collection and analysis of the GHG Inventories refers to the technical aspects and are analyzing only emissions and are not related to the social dimension, i.e. the different activities of women and men that contribute to GHG emissions. At the same time, there are only recommendations that inventories should be gender responsive, but there is no official classification in place. Such classification of indicators should be sex disaggregated in order to support the gender aspect of the GHG emissions. However, greenhouse gas emissions come from and are managed by human activity, and at the same time affect (negatively) the human being, due to which the analyzes cannot be separated from the social dimension, i.e. from the gender-based differences on several levels: economy, decision making, behavior, etc. Gender analysis of sectors in the inventories can contribute to much more realistic and transparent planning of measures to reduce GHG emissions.

Appendix I Activity data, methodology and emission factors

A I.1 Activity data

A I.1.1 Energy

Table 69. Activity data used in energy sector for 1990 (in TJ)

	Solid fuels						Liquid fuels					Gaseous fuels	Biomass
2006 IPCC Categories	Lignite	Coking coal	Sub-bituminous coal	Anthracite	Coke Oven Coke / Lignite Coke	Other bituminoous coal	Residual fuel oil	Motor gasoline	Gas/Diesel oil	LPG	Jet kerosene	Natural gas	Wood/Wood waste
1.A - Fuel Combustion Activities	53978.5	3079.1	0.0	0.0	0.0	318.5	20221.3	7132.3	11025.6	1886.0	0.0	0.0	7356.0
1.A.1 - Energy Industries	51118.7	0.0	0.0	0.0	0.0	0.0	6221.6	0.0	0.0	0.0	0.0	0.0	0.0
1.A.1.a - Main Activity Electricity and Heat Production	51118.7	0.0	0.0	0.0	0.0	0.0	6221.6	0.0	0.0	0.0	0.0	0.0	0.0
1.A.1.a.i - Electricity Generation	50329.3						40.4						
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	789.4						3959.2						
1.A.1.a.iii - Heat Plants							2222.0						
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.A.1.c.ii - Other Energy Industries													
1.A.2 - Manufacturing Industries and Construction	2424.9	3079.1	0.0	0.0	0.0	318.5	11399.7	0.0	2641.2	1886.0	0.0	0.0	0.0
1.A.2.a - Iron and Steel	2202.9	212.4				318.5	3759.9			874.0			
1.A.2.b - Non-Ferrous Metals		2866.8					520.0		298.2	46.0			
1.A.2.c - Chemicals							920.0		85.2				
1.A.2.d - Pulp, Paper and Print													
1.A.2.e - Food Processing, Beverages and Tobacco	68.3						280.0		340.8				
1.A.2.f - Non-Metallic Minerals							880.0		170.4	828.0			
1.A.2.g - Transport Equipment													
1.A.2.h - Machinery	34.2									92.0			
1.A.2.i - Mining (excluding fuels) and Quarrying							280.0		298.2				

1.A.2.j - Wood and wood products													
1.A.2.k - Construction													
1.A.2.l - Textile and Leather	102.5						120.0						
1.A.2.m - Non-specified Industry	17.1						4639.9		1448.4	46.0			
1.A.3 - Transport	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7132.3	3741.0	0.0	0.0	0.0	0.0
1.A.3.a - Civil Aviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.A.3.a.ii - Domestic Aviation													
1.A.3.b - Road Transportation								7132.3	3440.0				
1.A.3.c - Railways									301.0				
1.A.4 - Other Sectors	208.8	0.0	0.0	0.0	0.0	0.0	2599.9	0.0	4643.4	0.0	0.0	0.0	7356.0
1.A.4.a - Commercial/Institutional													
1.A.4.b - Residential	208.8						2079.9		3280.2				7356.0
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	0.0	0.0	0.0	0.0	0.0	0.0	520.0	0.0	1363.2	0.0	0.0	0.0	0.0
1.A.4.c.i - Stationary							520.0		1363.2				
1.A.5 - Non-Specified	226.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.A.5.a - Stationary	226.1												
Memo Items													
International Bunkers													
1.A.3.a.i - International Aviation (International Bunkers)											220.5		

Table 70. Activity data used in energy sector for 2000 (in TJ)

	Solid fuels				Liquid fuels					Gaseous fuels	Biomass
2006 IPCC Categories	Lignite	Coke Oven Coke / Lignite Coke	Other bituminoous coal	Residual fuel oil	Motor gasoline	Gas/Diesel oil	LPG	Petroleum Coke	Jet kerosene	Natural gas	Wood/Wood waste
1.A - Fuel Combustion Activities	54587.4	2363.5	1869.0	14041.9	6387.0	13294.4	1539.4	2759.5	10.2	2277.3	8897.8
1.A.1 - Energy Industries	54264.9	0.0	12.6	9681.6	0.0	719.9	116.4	0.0	0.0	1983.6	352.0
1.A.1.a - Main Activity Electricity and Heat Production	54262.7	0.0	12.6	9681.6	0.0	552.2	115.4	0.0	0.0	1983.6	348.9
1.A.1.a.i - Electricity Generation	53212.9			4238.8		3.2					

1.A.1.a.ii - Combined Heat and Power Generation (CHP)	387.5			786.2						332.9	
1.A.1.a.iii - Heat Plants	662.2		12.6	4656.5		549.0	115.4			1650.7	348.9
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	2.3	0.0	0.0	0.0	0.0	167.7	0.9	0.0	0.0	0.0	3.1
1.A.1.c.ii - Other Energy Industries	2.3					167.7	0.9				3.1
1.A.2 - Manufacturing Industries and Construction	18.9	2363.5	1856.4	3188.1	0.2	2335.4	680.9	2759.5	10.2	293.7	80.3
1.A.2.a - Iron and Steel	14.2	289.3	1856.4	1140.8		1.8	556.5	1064.0		27.3	
1.A.2.b - Non-Ferrous Metals		2046.4		125.3		603.9	41.9				
1.A.2.c - Chemicals											
1.A.2.d - Pulp, Paper and Print						0.1	0.2				0.5
1.A.2.e - Food Processing, Beverages and Tobacco		27.8		15.4		1593.6	5.8				13.2
1.A.2.f - Non-Metallic Minerals	1.1			1891.8		28.4	60.2	1695.4	10.2	225.5	17.4
1.A.2.g - Transport Equipment											
1.A.2.h - Machinery					0.2	28.1	13.4				8.2
1.A.2.i - Mining (excluding fuels) and Quarrying				2.6		38.3				40.9	0.9
1.A.2.j - Wood and wood products											
1.A.2.k - Construction											
1.A.2.l - Textile and Leather	3.4					1.5	2.9				1.5
1.A.2.m - Non-specified Industry	0.3			12.3		39.6					38.6
1.A.3 - Transport	0.0	0.0	0.0	0.0	6340.3	7298.9	93.2	0.0	0.0	0.0	0.0
1.A.3.a - Civil Aviation	0.0	0.0	0.0	0.0	1.2	12.7	0.0	0.0	0.0	0.0	0.0
1.A.3.a.ii - Domestic Aviation					1.2	12.7					
1.A.3.b - Road Transportation					6339.1	7106.1	93.2				
1.A.3.c - Railways						180.1					
1.A.4 - Other Sectors	245.7	0.0	0.0	1172.2	46.6	1600.5	301.3	0.0	0.0	0.0	7617.5
1.A.4.a - Commercial/Institutional											
1.A.4.b - Residential	235.3					1093.3	300.9				7617.5
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	10.4	0.0	0.0	1172.2	46.6	507.2	0.4	0.0	0.0	0.0	0.0
1.A.4.c.i - Stationary	10.4			1172.2	46.6	507.2	0.4				
1.A.5 - Non-Specified	57.9	0.0	0.0	0.0	0.0	1339.7	347.5	0.0	0.0	0.0	848.0
1.A.5.a - Stationary	57.9					1339.7	347.5				848.0

Memo Items											
International Bunkers											
1.A.3.a.i - International Aviation (International Bunkers)									1231.4		

Table 71. Activity data used in energy sector for 2005 (in TJ)

	Solid fuels				Liquid fuels							Gaseous fuels	Biomass
2006 IPCC Categories	Lignite	Coking coal	Sub-bituminous coal	Coke Oven Coke / Lignite Coke	Residual fuel oil	Motor gasoline	Gas/Diesel oil	LPG	Refinery gas	Petroleum Coke	Jet kerosene	Natural gas	Wood/Wood waste
1.A - Fuel Combustion Activities	58845.0	68.0	1714.4	460.5	9819.8	5135.1	14685.8	2100.2	92.5	3723.3	0.0	2637.9	8647.2
1.A.1 - Energy Industries	55385.7	0.0	0.0	0.0	3530.6	0.0	91.6	0.0	92.5	0.0	0.0	549.6	1.7
1.A.1.a - Main Activity Electricity and Heat Production	55385.4	0.0	0.0	0.0	3197.8	0.0	1.9	0.0	0.0	0.0	0.0	549.6	0.0
1.A.1.a.i - Electricity Generation	55002.6				145.9		1.9						
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	382.8				10.2		0.0						
1.A.1.a.iii - Heat Plants					3041.7							549.6	
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	0.3	0.0	0.0	0.0	332.8	0.0	89.7	0.0	92.5	0.0	0.0	0.0	1.7
1.A.1.c.ii - Other Energy Industries	0.3				332.8		89.7		92.5				1.7
1.A.2 - Manufacturing Industries and Construction	2907.4	68.0	1714.4	460.5	4345.4	0.0	1483.6	272.4	0.0	3723.3	0.0	1966.5	296.0
1.A.2.a - Iron and Steel	2628.0	68.0	1712.1	444.6	1741.9		302.3	20.7		1064.0		1430.7	82.8
1.A.2.b - Non-Ferrous Metals					0.7		21.6	0.5					
1.A.2.c - Chemicals					173.2		17.4					119.1	
1.A.2.d - Pulp, Paper and Print	0.6				39.9		14.3					75.5	1.9
1.A.2.e - Food Processing, Beverages and Tobacco			2.2	15.6	622.1		457.9	12.6				255.7	11.3
1.A.2.f - Non-Metallic Minerals	0.0				1260.6		79.4	195.5		2659.2		79.7	5.0
1.A.2.g - Transport Equipment													
1.A.2.h - Machinery	16.4			0.3	119.6		58.7	15.3					2.9
1.A.2.i - Mining (excluding fuels) and Quarrying							152.0						2.0
1.A.2.j - Wood and wood products													
1.A.2.k - Construction													

1.A.2.l - Textile and Leather	262.0				249.4		87.3	4.4					62.6
1.A.2.m - Non-specified Industry	0.3				138.0		292.7	23.6				5.8	127.5
1.A.3 - Transport	0.0	0.0	0.0	0.0	0.0	5118.7	7919.0	1267.8	0.0	0.0	0.0	0.0	0.0
1.A.3.a - Civil Aviation	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.A.3.a.ii - Domestic Aviation						1.3							
1.A.3.b - Road Transportation						5117.4	7807.2	1267.8					
1.A.3.c - Railways							111.8						
1.A.4 - Other Sectors	253.8	0.0	0.0	0.0	933.9	16.4	1399.0	387.4	0.0	0.0	0.0	0.0	8220.5
1.A.4.a - Commercial/Institutional													
1.A.4.b - Residential	249.5						1318.9	381.1					8179.2
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	4.4	0.0	0.0	0.0	933.9	16.4	80.1	6.3	0.0	0.0	0.0	0.0	41.4
1.A.4.c.i - Stationary	4.4				933.9	16.4	80.1	6.3					41.4
1.A.5 - Non-Specified	298.1	0.0	0.0	0.0	1010.0	0.0	3792.6	172.5	0.0	0.0	0.0	121.9	128.9
1.A.5.a - Stationary	298.1				1010.0		3792.6	172.5				121.9	128.9
Memo Items													
International Bunkers													
1.A.3.a.i - International Aviation (International Bunkers) (2)											281.9		

Table 72. Activity data used in energy sector for 2014 (in TJ)

	Solid fuels					Liquid fuels					Gaseous fuels	Biomass
2006 IPCC Categories	Lignite	Coking coal	Sub-bituminous coal	Coke Oven Coke / Lignite Coke	Residual fuel oil	Motor gasoline	Gas/Diesel oil	LPG	Petroleum Coke	Jet kerosene	Natural gas	Wood/Wood waste
1.A - Fuel Combustion Activities	41717.3	167.4	3186.3	39.7	4913.9	4472.8	20167.8	2898.1	2842.3	0.0	4622.1	9912.6
1.A.1 - Energy Industries	40856.2	0.0	0.0	0.0	1753.3	0.0	79.7	0.0	0.0	0.0	3218.3	3.3
1.A.1.a - Main Activity Electricity and Heat Production	40856.2	0.0	0.0	0.0	1651.0	0.0	0.0	0.0	0.0	0.0	3218.3	0.0
1.A.1.a.i - Electricity Generation	40774.1				1651.0							
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	82.0										1537.0	
1.A.1.a.iii - Heat Plants											1681.4	
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	21.2	17.8	0.0	0.0	630.1	0.0	1958.7	481.2	2211.9	0.0	239.4	176.7
1.A.1.c.ii - Other Energy Industries					102.3		79.7					3.3

1.A.2 - Manufacturing Industries and Construction	766.1	167.4	3186.3	39.7	2796.4	0.0	1820.2	353.4	2842.3	0.0	1195.2	281.6
1.A.2.a - Iron and Steel	702.9	148.9	3186.3	32.3	1975.0		112.8	21.0	630.5		763.6	3.4
1.A.2.b - Non-Ferrous Metals							0.8	2.4			38.4	0.1
1.A.2.c - Chemicals					46.9		19.6	0.0			36.3	
1.A.2.d - Pulp, Paper and Print	0.3	0.7			9.1		8.6	0.5			15.2	0.2
1.A.2.e - Food Processing, Beverages and Tobacco	0.4			3.4	273.3		298.3	101.9			203.4	188.9
1.A.2.f - Non-Metallic Minerals	0.1	17.8			369.0		115.3	192.8	2211.9		38.7	0.7
1.A.2.g - Transport Equipment												
1.A.2.h - Machinery	0.1			4.0	16.5		21.9	31.6			95.4	6.4
1.A.2.i - Mining (excluding fuels) and Quarrying							547.7	0.0				6.2
1.A.2.j - Wood and wood products												
1.A.2.k - Construction												
1.A.2.l - Textile and Leather	62.2				74.0		162.9	2.6			1.9	45.0
1.A.2.m - Non-specified Industry	0.2				32.5		532.3	0.5			2.2	30.7
1.A.3 - Transport	0.0	0.0	0.0	0.0	0.0	4456.3	16048.5	1994.1	0.0	0.0	6.2	0.0
1.A.3.a - Civil Aviation	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0
1.A.3.a.ii - Domestic Aviation						2.4						
1.A.3.b - Road Transportation						4453.9	15936.6	1994.1			6.2	
1.A.3.c - Railways							111.8					
1.A.4 - Other Sectors	74.0	0.0	0.0	0.0	205.5	16.4	455.6	262.1	0.0	0.0	1.7	9454.9
1.A.4.a - Commercial/Institutional												
1.A.4.b - Residential	37.3						178.5	261.2			1.7	9398.2
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	36.7	0.0	0.0	0.0	205.5	16.4	277.1	0.9	0.0	0.0	0.0	56.7
1.A.4.c.i - Stationary	36.7				205.5	16.4	277.1	0.9				56.7
1.A.5 - Non-Specified	21.1	0.0	0.0	0.0	158.8	0.0	1763.7	288.4	0.0	0.0	200.6	172.7
1.A.5.a - Stationary	21.1				158.8		1763.7	288.4			200.6	172.7
Memo Items												
International Bunkers												
1.A.3.a.i - International Aviation (International Bunkers) (2)										519.5		

Table 73. Activity data used in energy sector for 2015 (in TJ)

	Solid fuels				Liquid fuels						Gaseous fuels	Biomass
2006 IPCC Categories	Lignite	Coking coal	Sub-bituminous coal	Coke Oven Coke / Lignite Coke	Residual fuel oil	Motor gasoline	Gas/Diesel oil	LPG	Petroleum Coke	Jet kerosene	Natural gas	Wood/Wood waste
1.A - Fuel Combustion Activities	37096.8	325.0	3241.0	15.0	4327.4	4574.3	22521.0	3285.4	2706.0	0.2	4630.6	9095.3
1.A.1 - Energy Industries	36447.5	0.0	0.0	0.0	1580.9	0.0	59.1	0.0	0.0	0.0	3325.9	1.9
1.A.1.a - Main Activity Electricity and Heat Production	36447.5	0.0	0.0	0.0	1571.8	0.0	0.0	0.0	0.0	0.0	3325.9	0.0
1.A.1.a.i - Electricity Generation	36447.5				1571.8							
1.A.1.a.ii - Combined Heat and Power Generation (CHP)											1471.4	
1.A.1.a.iii - Heat Plants											1854.6	
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	0.0	0.0	0.0	0.0	9.1	0.0	59.1	0.0	0.0	0.0	0.0	1.9
1.A.1.c.ii - Other Energy Industries					9.1		59.1					1.9
1.A.2 - Manufacturing Industries and Construction	573.8	325.0	3198.7	15.0	2207.4	0.0	1859.5	432.9	2706.0	0.0	1076.5	238.8
1.A.2.a - Iron and Steel	501.5	147.6	2626.6	6.2	1373.6		112.8	17.5	1115.0		665.7	4.0
1.A.2.b - Non-Ferrous Metals							1.4	42.0				
1.A.2.c - Chemicals					67.8		19.7	0.1			36.9	
1.A.2.d - Pulp, Paper and Print	0.3				16.9		7.0	3.3			15.4	0.2
1.A.2.e - Food Processing, Beverages and Tobacco					316.7		304.4	91.2			214.1	182.2
1.A.2.f - Non-Metallic Minerals	0.3	177.5	572.1		300.1		119.3	242.3	1591.0		34.1	0.8
1.A.2.g - Transport Equipment												
1.A.2.h - Machinery	0.0			8.8	16.3		32.6	33.6			103.8	7.4
1.A.2.i - Mining (excluding fuels) and Quarrying							573.1	0.0				3.0
1.A.2.j - Wood and wood products												
1.A.2.k - Construction												
1.A.2.l - Textile and Leather	71.5				80.7		124.3	2.4			2.5	15.5
1.A.2.m - Non-specified Industry	0.3				35.2		565.0	0.4			4.0	25.7
1.A.3 - Transport	0.0	0.0	0.0	0.0	0.0	4557.0	18140.1	2260.4	0.0	0.0	0.6	0.0
1.A.3.a - Civil Aviation	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0
1.A.3.a.ii - Domestic Aviation						2.8						

1.A.3.b - Road Transportation						4554.2	18059.4	2260.4			0.6	
1.A.3.c - Railways							80.6					
1.A.4 - Other Sectors	45.0	0.0	42.3	0.0	225.8	17.3	468.4	293.9	0.0	0.2	2.6	8673.5
1.A.4.a - Commercial/Institutional												
1.A.4.b - Residential			42.3				177.1	292.8			2.6	8616.8
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	45.0	0.0	0.0	0.0	225.8	17.3	291.3	1.1	0.0	0.2	0.0	56.7
1.A.4.c.i - Stationary	45.0				225.8	17.3	291.3	1.1		0.2		56.7
1.A.5 - Non-Specified	30.5	0.0	0.0	0.0	313.3	0.0	1993.9	298.2	0.0	0.0	224.9	181.1
1.A.5.a - Stationary	30.5				313.3		1993.9	298.2			224.9	181.1
Memo Items												
International Bunkers												
1.A.3.a.i - International Aviation (International Bunkers) (2)										582.3		

Table 74. Activity data used in energy sector for 2016 (in TJ)

2006 IPCC Categories	Lignite	Coking coal	Sub-bituminous coal	Coke Oven Coke / Lignite Coke	Residual fuel oil	Motor gasoline	Gas/Diesel oil	LPG	Petroleum Coke	Jet kerosene	Natural gas	Wood/Wood waste
1.A - Fuel Combustion Activities	31713.5	762.3	4167.5	42.9	3645.5	4597.9	25902.8	3603.6	1293.7	1.1	7239.6	7606.5
1.A.1 - Energy Industries	31319.6	0.0	0.0	0.0	1132.4	0.0	63.0	0.0	0.0	0.0	5701.8	1.1
1.A.1.a - Main Activity Electricity and Heat Production	31319.6	0.0	0.0	0.0	1121.5	0.0	0.0	0.0	0.0	0.0	5701.8	0.0
1.A.1.a.i - Electricity Generation	31319.6				1121.5							
1.A.1.a.ii - Combined Heat and Power Generation (CHP)											4556.3	
1.A.1.a.iii - Heat Plants											1145.5	
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	0.0	0.0	0.0	0.0	10.9	0.0	63.0	0.0	0.0	0.0	0.0	1.1
1.A.1.c.ii - Other Energy Industries					10.9		63.0					1.1
1.A.2 - Manufacturing Industries and Construction	289.6	762.3	4167.5	42.9	1979.7	0.0	1878.1	479.2	1293.7	0.0	1293.3	257.6
1.A.2.a - Iron and Steel	251.6	112.5	2537.9	40.3	1122.0		69.1	14.3	1064.0		875.0	2.4
1.A.2.b - Non-Ferrous Metals							1.5	52.7				
1.A.2.c - Chemicals					55.4		19.5	0.0				39.3
1.A.2.d - Pulp, Paper and Print	0.2	649.8	1629.6		8.9		5.0	5.6			14.2	2.0

1.A.2.e - Food Processing, Beverages and Tobacco					312.4		293.0	96.0			232.6	152.8
1.A.2.f - Non-Metallic Minerals	0.2				323.4		118.9	255.9	229.6		44.1	1.0
1.A.2.g - Transport Equipment												
1.A.2.h - Machinery	0.0			2.6	21.2		64.0	46.4			114.4	10.9
1.A.2.i - Mining (excluding fuels) and Quarrying							552.1	0.0				0.6
1.A.2.j - Wood and wood products												
1.A.2.k - Construction												
1.A.2.l - Textile and Leather	37.2				102.1		118.8	4.6			2.9	15.2
1.A.2.m - Non-specified Industry	0.4				34.3		636.3	3.7			10.1	33.5
1.A.3 - Transport	0.0	0.0	0.0	0.0	0.0	4580.3	21357.8	2481.1	0.0	0.0	6.6	0.0
1.A.3.a - Civil Aviation	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0
1.A.3.a.ii - Domestic Aviation						2.8						
1.A.3.b - Road Transportation						4577.5	21271.5	2481.1			6.6	
1.A.3.c - Railways							86.2					
1.A.4 - Other Sectors	74.5	0.0	0.0	0.0	221.2	17.6	467.5	321.7	0.0	1.1	3.8	7174.1
1.A.4.a - Commercial/Institutional												
1.A.4.b - Residential	38.2						161.6	320.5			3.8	7122.9
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	36.4	0.0	0.0	0.0	221.2	17.6	305.9	1.1	0.0	1.1	0.0	51.2
1.A.4.c.i - Stationary	36.4				221.2	17.6	305.9	1.1		1.1		51.2
1.A.5 - Non-Specified	29.8	0.0	0.0	0.0	312.2	0.0	2136.4	321.6	0.0	0.0	234.1	173.7
1.A.5.a - Stationary	29.8				312.2		2136.4	321.6			234.1	173.7
Memo Items												
International Bunkers												
1.A.3.a.i - International Aviation (International Bunkers) (2)										664.0		

Table 75. Activity data used in energy sector for 2017 (in TJ)

2006 IPCC Categories	Lignite	Coking coal	Sub-bituminous coal	Coke Oven Coke / Lignite Coke	Residual fuel oil	Motor gasoline	Gas/Diesel oil	LPG	Petroleum Coke	Jet kerosene	Natural gas	Wood/Wood waste
1.A - Fuel Combustion Activities	36517.5	728.4	2943.8	29.4	3103.9	4567.8	26960.2	3589.9	1069.6	1.2	9463.6	8251.3
1.A.1 - Energy Industries	35987.8	0.0	0.0	0.0	993.3	0.0	45.9	0.0	0.0	0.0	7618.0	0.9
1.A.1.a - Main Activity Electricity and Heat Production	35987.8	0.0	0.0	0.0	978.0	0.0	0.0	0.0	0.0	0.0	7618.0	0.0
1.A.1.a.i - Electricity Generation	35987.8				978.0							
1.A.1.a.ii - Combined Heat and Power Generation (CHP)											6501.4	
1.A.1.a.iii - Heat Plants											1116.7	
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	0.0	0.0	0.0	0.0	15.3	0.0	45.9	0.0	0.0	0.0	0.0	0.9
1.A.1.c.ii - Other Energy Industries					15.3		45.9					0.9
1.A.2 - Manufacturing Industries and Construction	374.7	728.4	2943.8	29.4	1558.3	0.0	1741.2	489.1	1069.6	0.0	1563.7	88.1
1.A.2.a - Iron and Steel	96.5	186.1	2382.0	29.4	709.0		70.2	5.1	913.5		1049.1	1.4
1.A.2.b - Non-Ferrous Metals							1.6	54.1				
1.A.2.c - Chemicals					62.9		16.8	0.1			42.2	0.0
1.A.2.d - Pulp, Paper and Print	0.3				12.5		5.7	5.1			16.3	0.2
1.A.2.e - Food Processing, Beverages and Tobacco					273.0		259.4	91.2			241.6	59.6
1.A.2.f - Non-Metallic Minerals	228.7	542.3	561.8		329.2		117.9	277.8	156.1		60.9	0.1
1.A.2.g - Transport Equipment												
1.A.2.h - Machinery	0.0				15.5		98.2	47.6			139.8	4.0
1.A.2.i - Mining (excluding fuels) and Quarrying					0.0		544.5	0.0				0.1
1.A.2.j - Wood and wood products												
1.A.2.k - Construction												
1.A.2.l - Textile and Leather	48.8				104.0		107.4	4.6			2.9	15.4
1.A.2.m - Non-specified Industry	0.4				52.2		519.6	3.4			10.9	7.3
1.A.3 - Transport	0.0	0.0	0.0	0.0	0.0	4550.3	22639.7	2452.7	0.0	0.0	8.9	0.0
1.A.3.a - Civil Aviation	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0
1.A.3.a.ii - Domestic Aviation						3.8						
1.A.3.b - Road Transportation						4546.4	22588.1	2452.7			8.9	
1.A.3.c - Railways							51.6					

1.A.4 - Other Sectors	104.0	0.0	0.0	0.0	255.9	17.5	495.9	327.9	0.0	1.2	6.3	8000.1
1.A.4.a - Commercial/Institutional												
1.A.4.b - Residential	62.3						176.5	326.4			6.3	7944.2
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	41.7	0.0	0.0	0.0	255.9	17.5	319.4	1.6	0.0	1.2	0.0	55.9
1.A.4.c.i - Stationary	41.7				255.9	17.5	319.4	1.6		1.2		55.9
1.A.5 - Non-Specified	51.1	0.0	0.0	0.0	296.3	0.0	2037.6	320.2	0.0	0.0	266.8	162.1
1.A.5.a - Stationary	51.1				296.3		2037.6	320.2			266.8	162.1
Memo Items												
International Bunkers												
1.A.3.a.i - International Aviation (International Bunkers) (2)										874.7		

Table 76. Activity data used in energy sector for 2018 (in TJ)

2006 IPCC Categories	Lignite	Coking coal	Sub-bituminous coal	Coke Oven Coke / Lignite Coke	Residual fuel oil	Motor gasoline	Gas/Diesel oil	LPG	Petroleum Coke	Jet kerosene	Natural gas	Wood/Wood waste
1.A - Fuel Combustion Activities	31995.1	2443.4	1797.3	6.2	3144.0	4481.9	26645.5	3634.8	1122.4	1.1	9432.1	6700.6
1.A.1 - Energy Industries	31455.2	0.0	0.0	0.0	982.9	0.0	81.1	0.0	0.0	0.0	7618.0	0.5
1.A.1.a - Main Activity Electricity and Heat Production	31455.2	0.0	0.0	0.0	978.0	0.0	0.0	0.0	0.0	0.0	7618.0	0.0
1.A.1.a.i - Electricity Generation	31455.2				978.0							
1.A.1.a.ii - Combined Heat and Power Generation (CHP)											6501.4	
1.A.1.a.iii - Heat Plants											1116.7	
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	0.0	0.0	0.0	0.0	4.8	0.0	81.1	0.0	0.0	0.0	0.0	0.5
1.A.1.c.ii - Other Energy Industries					4.8		81.1					0.5
1.A.2 - Manufacturing Industries and Construction	384.8	2443.4	1797.3	6.2	1814.5	0.0	1633.4	560.9	1122.4	0.0	1527.9	77.6
1.A.2.a - Iron and Steel	175.0	211.6	1676.9	6.2	913.3		79.6	8.2	867.0		995.1	0.7
1.A.2.b - Non-Ferrous Metals							1.6	53.3				
1.A.2.c - Chemicals					54.5		22.7	0.1			39.8	0.0
1.A.2.d - Pulp, Paper and Print					8.5		5.5	4.5			16.6	0.8
1.A.2.e - Food Processing, Beverages and Tobacco					248.5		251.8	111.4			240.9	48.2
1.A.2.f - Non-Metallic Minerals	177.2	2231.9	120.4		375.2		120.0	320.0	250.3		66.7	0.1

1.A.2.g - Transport Equipment												
1.A.2.h - Machinery	0.0				32.6		47.5	55.4			157.4	5.2
1.A.2.i - Mining (excluding fuels) and Quarrying					0.0		541.6	1.7	5.1			0.0
1.A.2.j - Wood and wood products												
1.A.2.k - Construction												
1.A.2.l - Textile and Leather	32.6				117.9		90.1	2.3			3.4	14.1
1.A.2.m - Non-specified Industry	0.1				64.0		473.0	4.1			8.0	8.4
1.A.3 - Transport	0.0	0.0	0.0	0.0	0.0	4464.4	22547.3	2448.9	0.0	0.0	29.5	0.0
1.A.3.a - Civil Aviation	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0
1.A.3.a.ii - Domestic Aviation						1.7						
1.A.3.b - Road Transportation						4462.8	22455.5	2448.9			29.5	
1.A.3.c - Railways							91.8					
1.A.4 - Other Sectors	104.0	0.0	0.0	0.0	185.2	17.5	467.6	301.6	0.0	1.1	7.7	6470.2
1.A.4.a - Commercial/Institutional												
1.A.4.b - Residential	62.3						161.5	299.9			7.7	6412.6
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	41.7	0.0	0.0	0.0	185.2	17.5	306.1	1.6	0.0	1.1	0.0	57.6
1.A.4.c.i - Stationary	41.7				185.2	17.5	306.1	1.6		1.1		57.6
1.A.5 - Non-Specified	51.1	0.0	0.0	0.0	161.5	0.0	1916.2	323.4	0.0	0.0	248.9	152.3
1.A.5.a - Stationary	51.1				161.5		1916.2	323.4			248.9	152.3
Memo Items												
International Bunkers												
1.A.3.a.i - International Aviation (International Bunkers) (2)										986.8		

Table 77. Activity data used in energy sector for 2019 (in TJ)

2006 IPCC Categories	Lignite	Coking coal	Sub-bituminous coal	Coke Oven Coke / Lignite Coke	Residual fuel oil	Motor gasoline	Gas/Diesel oil	LPG	Petroleum Coke	Jet kerosene	Natural gas	Wood/Wood waste
1.A - Fuel Combustion Activities	37934.0	2262.3	2660.4	17.5	2977.1	4583.0	28627.3	3763.7	1768.5	1.2	10126.2	7771.3
1.A.1 - Energy Industries	37541.3	0.0	0.0	0.0	693.6	0.0	51.3	0.0	0.0	0.0	8357.0	0.3
1.A.1.a - Main Activity Electricity and Heat Production	37541.3	0.0	0.0	0.0	684.5	0.0	0.0	0.0	0.0	0.0	8357.0	0.0
1.A.1.a.i - Electricity Generation	37541.34				684.5							
1.A.1.a.ii - Combined Heat and Power Generation (CHP)											7229.7	
1.A.1.a.iii - Heat Plants											1127.3	
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	0.0	0.0	0.0	0.0	9.2	0.0	51.3	0.0	0.0	0.0	0.0	0.3
1.A.1.c.ii - Other Energy Industries					9.2		51.3					0.3
1.A.2 - Manufacturing Industries and Construction	321.2	2262.3	2660.4	17.5	1891.6	0.0	1664.3	573.0	1768.5	0.0	1483.1	314.5
1.A.2.a - Iron and Steel	130.2	43.4	2660.4	17.5	983.1		90.2	9.4	1066.6		934.1	95.7
1.A.2.b - Non-Ferrous Metals							1.8	47.7			-	0.1
1.A.2.c - Chemicals					62.7		23.1	0.1			38.0	0.2
1.A.2.d - Pulp, Paper and Print					10.6		6.0	4.4			19.8	3.3
1.A.2.e - Food Processing, Beverages and Tobacco	0.5				308.4		258.5	119.6			235.7	152.9
1.A.2.f - Non-Metallic Minerals	165.2	2218.8			219.7		134.3	331.3	701.9		76.6	0.6
1.A.2.g - Transport Equipment												0.0
1.A.2.h - Machinery					158.4		53.1	53.5			166.2	10.2
1.A.2.i - Mining (excluding fuels) and Quarrying							526.8	0.9	0.0		-	0.7
1.A.2.j - Wood and wood products												0.0
1.A.2.k - Construction												0.0
1.A.2.l - Textile and Leather	25.3				95.8		79.8	2.2			4.2	16.0
1.A.2.m - Non-specified Industry					53.0		490.8	3.9			8.4	34.8
1.A.3 - Transport	0.0	0.0	0.0	0.0	0.0	4565.1	24549.4	2567.6	0.0	0.0	29.5	0.0
1.A.3.a - Civil Aviation	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0
1.A.3.a.ii - Domestic Aviation						2.6						
1.A.3.b - Road Transportation						4562.6	24439.4	2567.6			29.5	
1.A.3.c - Railways							110.0					

1.A.4 - Other Sectors	49.1	0.0	0.0	0.0	196.4	17.8	459.9	288.1	0.0	1.2	7.7	7276.9
1.A.4.a - Commercial/Institutional												
1.A.4.b - Residential	25.6						148.9	286.4			7.7	7219.0
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	23.4	0.0	0.0	0.0	196.4	17.8	311.0	1.7	0.0	1.2	0.0	57.9
1.A.4.c.i - Stationary	23.4				196.4	17.8	311.0	1.7		1.2		57.9
1.A.5 - Non-Specified	22.3	0.0	0.0	0.0	195.4	0.0	1902.3	335.0	0.0	0.0	248.9	179.6
1.A.5.a - Stationary	22.3				195.4		1902.3	335.0			248.9	179.6
Memo Items												
International Bunkers												
1.A.3.a.i - International Aviation (International Bunkers) (2)										1170.1		

A I.1.2 IPPU

Table 78. Activity data used in Industrial processes sector

Categories	1990	2000	2005	2014	2015	2016	2017	2018	2019
2.A - Mineral Industry									
2.A.1 - Cement production (t)	732926	870188	886529	686497	695923	882222	945393	952790	955430
2.A.2 - Lime production (t)	47000	15397	15009	10836	8003	9125	1399	6834	29236
2.A.3 - Glass Production	1648	230	68	56	45	241	273	275	366
2.A.4 - Other Process Uses of Carbonates									
2.A.4.a - Ceramics* (t)	5929	919.9	676.7	27.8	21.6	35.7	10.3	12.4	11.5
2.A.4.b - Other Uses of Soda Ash (t)	6457	3488	3128	2572	2516	2462	2409	2357	2306.3
2.C - Metal Industry									
2.C.1 - Iron and Steel Production (t)	274993	168386	647036	189248	122632	170091	275323	267968	241260
2.C.2 - Ferroalloys Production (t)	85193	57842	79390	91067	63747	35038	7196	10285	15319
2.C.3 - Aluminium production (t)	5487	3763	20	NO					
2.C.5 - Lead Production (t)	53826	56077	NO		2648	4472	7486	10576	10962
2.C.6 - Zinc Production (t)	108275	126992	NO						

*Clay consumption

Table 79. Activity data used for Product uses as substitutes for ODS

	Import per year (kg)							
	2012	2013	2014	2015	2016	2017	2018	2019
HFC-23	0.0	0.0	0.0	0.0	0.0	20.0	45.0	0.0
HFC - 32 (CH2F2)	5.7	6.0	6.3	6.6	8.6	732.7	1212.1	15.8
HFC-125 (CHF2CF2)	14.5	14.8	15.2	18.3	28.1	72.2	39.8	35.5
HFC-134a (CH2FCF3)	31704.1	36854.2	38874.3	40894.6	44031.9	107408.6	115827.9	68879.0
HFC-143a	10.2	10.2	10.3	13.6	22.7	45.0	20.6	22.6
HFC-152a	0	0	0	0	0	100000	14980	51000
HFC-227ea	0	0	0	0	80	0	20545	0
HFC-236fa	0	0	0	0	0	0	0	50

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Table 80. Activity data used for GHG emissions inventory in Livestock (number of heads)

Species and categories	1990	2000	2005	2014	2015	2016	2017	2018	2019
Dairy Cows	166237	171745	156950	155432	156699	160603	164781	163514	133740
Other Cattle	120937	93223	91235	86175	96743	94165	90255	92667	84050
Sheep	2297115	1250686	1244000	619839	599869	607622	607622	613300	570887
Sheep <1 Y				113671	123426	116933	116933	113690	113671
Goats			62190	81346	88064	101669	90673	98854	70255
Horses	66282	56486	39651	19371	18784	19263	17951	10041	8952
Swine	178537	204135	155753	23511	20857	28671	26574	23729	16956
Finishers				141542	174586	202758	202197	195538	135770
Poultry	5728981	3713369	2617012	1939879	1761145	1865769	1840173	1828287	1562089
Layers				1884289	1423841	1705948	1770504	1736208	1385743
Broilers (year equivalent)				4355	51256	15998	3363	4215	19786
Turkey (year equivalent)				3690	2910	10070	5053	6620.	4806.
Other poultry				19477	17908	36245	36039	49178	43452

Table 81. Activity data used for GHG emissions inventory in Forest land (ha)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Forest land (total)	**958388.25**	**980276.62**	**996744.87**	**1025646.73**	**1028512.33**	**1032365.43**	**1035000.08**	**1039136.04**	**1042533.61**
Forest land Remaining Forest land	953863.53	973487.29	991015.62	1020436.68	1024564.38	1026558.11	1031083.78	1033294.95	1037179.39
Land Converted to Forest land	4524.72	6789.33	5729.25	5210.05	3947.95	5807.32	3916.3	5841.09	5354.22
Cropland converted to Forest Land	*65.15*	*2369.23*	*3470.38*	*2420.03*	*2025.98*	*2897.23*	*1135.16*	*2782.99*	*1536.05*
Grassland converted to Forest Land	*2607.79*	*1783.1*	*1052.1*	*1807.76*	*739.35*	*1548.56*	*1468.6*	*1685.62*	*2691.41*
Wetlands converted to Forest Land	*4.89*	*0*	*14.31*	*84.05*	*10.74*	*15.26*	*62.97*	*29.32*	*0*
Settlements converted to Forest Land	*0*	*0*	*0*	*53.18*	*34.81*	*0*	*0*	*0*	*0*
Other Land converted to Forest Land	*1846.89*	*2637*	*1192.46*	*845.03*	*1137.07*	*1346.27*	*1249.57*	*1343.16*	*1126.76*

Table 82. Activity data used for GHG emissions inventory in Cropland (ha)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Cropland (total)	**590832.9**	**580380.7**	**565252.0**	**543030.0**	**538035.7**	**535904.0**	**533692.3**	**530455.4**	**526764.6**
Cropland Remaining Cropland	587231.2	578265.4	563840.6	541971.9	536197.7	533592.1	531457.8	528162.6	525441.2
Land Converted to Cropland	3601.7	2115.3	1411.3	1058.2	1838.1	2311.9	2234.5	2292.8	1323.5
Forest Land converted to Cropland	*282.7*	*562.3*	*440.3*	*221.3*	*399.7*	*765.9*	*678.1*	*789.6*	*579.0*
Grassland converted to Cropland	*585.2*	*545.8*	*703.3*	*514.9*	*877.3*	*543.1*	*1256.2*	*598.6*	*654.9*
Wetlands converted to Cropland	*58.9*	*38.6*	*12.2*	*48.2*	*63.1*	*0.0*	*55.1*	*8.6*	*0.0*
Settlements converted to Cropland	*0.0*	*0.0*	*13.0*	*76.6*	*117.4*	*106.0*	*134.2*	*0.0*	*0.0*
Other Land converted to Cropland	*2674.9*	*968.6*	*242.5*	*197.2*	*380.5*	*897.0*	*111.0*	*896.0*	*89.6*

Table 83. Activity data used for GHG emissions inventory in Grassland (ha)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Grassland (total)	**627046.6**	**632047.9**	**631364.4**	**626206.9**	**628084.8**	**627483.6**	**627482.5**	**628355.0**	**626879.1**
Grassland Remaining Grassland	623842.7	629701.3	627239.2	622092.8	623437.2	625424.9	623927.3	624771.9	623234.4
Land Converted to Grassland	3204.0	2346.6	4125.2	4114.1	4647.5	2058.7	3555.2	3583.1	3644.7
Forest Land converted to Grassland	*81.0*	*127.0*	*301.0*	*318.0*	*396.9*	*589.4*	*232.2*	*391.0*	*665.0*
Cropland converted to Grassland	*1211.7*	*905.0*	*2554.6*	*2479.2*	*2463.9*	*263.2*	*1884.8*	*1456.8*	*1976.4*
Wetlands converted to Grassland	*21.9*	*9.6*	*29.7*	*80.4*	*29.4*	*26.6*	*24.8*	*13.9*	*0.0*
Settlements converted to Grassland	*0.0*	*0.0*	*1.2*	*48.2*	*32.7*	*0.0*	*0.0*	*0.0*	*0.0*
Other Land converted to Grassland	*1889.4*	*1305.0*	*1238.7*	*1188.3*	*1724.7*	*1179.4*	*1413.4*	*1721.4*	*1003.3*

Table 84. Activity data used for GHG emissions inventory in Wetlands (ha)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Wetland (total)	**53393.73**	**53722.31**	**54209.19**	**53476.10**	**53461.17**	**53606.91**	**53566.34**	**53625.86**	**53625.86**
Wetland Remaining Wetland	53307.58	53685.38	53853.89	53314.98	53300.00	53291.09	53358.04	53472.50	53625.86
Land Converted to Wetland	86.15	36.93	355.30	161.12	161.17	315.82	208.29	153.35	0.00

Table 85. Activity data used for GHG emissions inventory in Settlements (ha)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Settlements (total)	**28701.96**	**31782.27**	**36081.23**	**42940.76**	**43724.29**	**43843.6**	**43946.31**	**44200.62**	**44763.81**
Settlements Remaining Settlements	27996.6	30708.49	34985.13	41654.2	42721.1	43557.7	43668.3	43910	44200.6
Land Converted to Settlements	705.36	1073.78	1096.1	1286.56	1003.19	285.9	278.01	290.62	563.21
Forest Land converted to Settlements	*0*	*21.3*	*0*	*11.97*	*17.72*	*14.77*	*15.63*	*9.85*	*28.04*
Cropland converted to Settlements	*215.11*	*673.57*	*573.2*	*991.81*	*375.88*	*65.82*	*47.34*	*115.03*	*365.85*
Grassland converted to Settlements	*490.25*	*313.71*	*377.7*	*195.14*	*520.11*	*35.45*	*128.67*	*138.65*	*132.12*
Wetlands converted to Settlements	*0*	*1.33*	*14.9*	*47.78*	*54.56*	*56.76*	*58.94*	*0.37*	*0*
Other Land converted to Settlements	*0*	*63.87*	*130.3*	*39.86*	*34.92*	*113.1*	*27.43*	*26.72*	*37.2*

Table 86. Activity data used for GHG emissions inventory in Other Land (ha)

	1990	2000	2005	2014	2015	2016	2017	2018	2019
Other land (total)	**254725.57**	**234295.71**	**228332.72**	**219808.96**	**219168.46**	**217724.11**	**217105.02**	**214953.96**	**216044.45**
Other land Remaining Other land	250285.87	230401.73	225015.21	217534.58	216446.22	215537.53	214887.67	213102.48	212697.1
Land Converted to Other land	4439.7	3893.98	3317.51	2274.38	2722.24	2186.58	2217.35	1851.48	3347.35
Forest Land converted to Other land	*1516.81*	*1075.1*	*672.91*	*166.18*	*130.43*	*463.01*	*185.08*	*435.09*	*569.15*
Cropland converted to Other land	*2691.53*	*2463.95*	*2127.7*	*1803.78*	*1932.27*	*1156.23*	*1367.93*	*1156.23*	*1135.96*
Grassland converted to Other land	*228.4*	*354.93*	*472.2*	*258.79*	*614.05*	*481.08*	*617.29*	*218.55*	*1642.24*
Wetlands converted to Other land	*2.96*	*0*	*8.8*	*32.94*	*18.31*	*71.43*	*47.05*	*41.61*	*0*
Other Land converted to Other land	*0*	*0*	*35.9*	*12.69*	*27.18*	*14.83*	*0*	*0*	*0*

A I.1.4 Waste

Table 87. Population used for estimation of GHG emission from Municipal Solid Waste and Domestic Wastewater Treatment and Discharge

Population (in millions)															
Year	**1950**	**1951**	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**	**1959**	**1960**	**1961**	**1962**	**1963**	**1964**
	1.225	1.25151	1.27801	1.30451	1.3133	1.32208	1.33087	1.33965	1.34843	1.35722	1.366	1.406	1.43013	1.45426	1.4784
Year	**1965**	**1966**	**1967**	**1968**	**1969**	**1970**	**1971**	**1972**	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**
	1.50253	1.52666	1.55079	1.57492	1.59905	1.69151	1.70866	1.72345	1.73755	1.75334	1.77241	1.79556	1.82192	1.84932	1.87465
Year	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
	1.89573	1.9115	1.92273	1.93128	1.93991	1.95049	1.96419	1.98006	1.99847	1.99934	1.99623	1.98846	1.97703	1.96492	1.94593
Year	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
	1.94382	1.94909	1.96064	1.97605	1.99168	**2.00487**	2.01492	2.02255	2.02677	2.03254	2.03686	2.04194	2.04518	2.04862	2.05272
Year	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**					
	2.05728	2.05979	2.06229	2.06577	2.06917	2.071278	2.07371	2.075301	2.077130	2.076255					

Table 88. Other activity data used for estimation of GHG emission from Municipal Solid Waste

IPCC Regional Default		National								
		1990	2000	2005	2014	2015	2016	2017	2018	2019
Waste per capita (kg/cap/yr)	520	197	197	281	370	380	376	379	412	441
% to SWDS	90	90	90	90	90	90	90	90	90	90

Table 89. Composition of waste going to the Municipal solid waste disposal sites

food (%)	garden (%)	paper (%)	wood (%)	textile (%)	nappies (%)	other (%)
36.73	10.72	10.84	0.39	3.68	5.03	32.61

Table 90. GDP (in $ million) used for estimation of GHG emission from Industrial Waste

GDP ($ million)															
Year	**1970**	**1971**	**1972**	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**
	1,219	1,326	1,384	1,802	2,494	2,800	3,174	3,882	4,648	5,863	6,031	5,941	5,402	5,517	5,934
Year	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
	6,338	6,910	7,425	7,776	8,390	7,871	2,916	2,739	2,963	3,560	4,707	4,413	3,720	3,580	3,673
Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
	3,587	3,437	3,791	4,756	5,514	5,987	6,558	8,160	9,834	9,314	9,339	10,395	9,745	10,818	11,362
Year	**2015**	**2016**	**2017**	**2018**	**2019**										
	10,065	10,672	11,307	12,683	12,547										

Table 91. Other activity data used for estimation of GHG emission from Industrial Waste

National								
	1990	2000	2005	2014	2015	2016	2017	2018	2019
Waste Generation Rate (Gg/$mGDP/yr)	0.139	0.139	0.139	0.144	0.139	0.02	0.031	0.042	0.042
% to SWDS	90	90	90	59.2	58.7	19.0	19.6	20.2	20.2

Table 92. Total annual amount of solid waste treated by biological treatment facilities (in Gg)

Biological Treatment System	Waste Category	Type of Waste	Waste basis	1990	2000	2005	2014	2015	2016	2017	2018	2019
Composting	Municipal Solid Waste	Total MSW	Dry	NO			1.945	2.807	2.239	1.115	0.745	0.03

Table 93. Activity data for waste incineration

	2000	2005	2014	2015	2016	2017	2018	2019
Clinical waste (t)	114.90	376.92	643.68	837.82	936.64	961.81	778.47	839.93

Table 94. Activity data used for estimation of the GHG emissions from Open burning of waste

Parametar	Unit	1990	2000	2005	2014	2015	2016	2017	2018	2019
Population - P	(Capita)	1996227	2004873	2036855	2069172	2071278	2073710	2075301	2077132	2076255
Fraction of Population Burning Waste - P frac	(Fraction)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Per Capita Waste Generation - MSWp	(kg waste/ capita/day)	0.5	0.54	0.77	1.01	1.04	1.03	1.03	1.03	1.03
Fraction of the waste amount burned relative to the total amount of waste treated - Bfrac	(Fraction)	1	1	1	1	1	1	1	1	1
Number of days by year	(Day)	365	365	365	365	365	365	365	365	365

A I.2 Methods applied

Table 95. Methods and tiers applied in the preparation of the GHG Inventory (for 2019)

Categories	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method used	Emiss. factor	Method used	Emiss. factor	Method used	Emiss. factor	Method used	Emiss. factor	Method used	Emiss. factor	Method used	Emiss. factor
1 - Energy	**T1, T2**	**CS, DF**	**T1**	**DF**	**T1**	**DF**						
1.A - Fuel Combustion Activities	T1, T2	CS, DF	T1	DF	T1	DF						
1.A.1 - Energy Industries	T2	CS	T1	DF	T1	DF						
1.A.2 - Manufacturing Industries and Construction	T1, T2	CS, DF	T1	DF	T1	DF						
1.A.3 - Transport	T1, T2	CS, DF	T1	DF	T1	DF						
1.A.4 - Other Sectors	T1, T2	CS, DF	T1	DF	T1	DF						
1.A.5 - Non-Specified	T1, T2	CS, DF	T1	DF	T1	DF						
1.B - Fugitive emissions from fuels	T1	DF	T1	DF								
1.B.1 - Solid Fuels			T1	DF								
1.B.2 - Oil and Natural Gas	T1	DF	T1	DF								
2 - Industrial Processes and Product Use	**T1, T2**	**CS, DF**					**T1**	**DF**	**T1**	**DF**	**NO,NE**	**NO, NE**
2.A - Mineral Industry	T1, T2	CS, DF										
2.A.1 - Cement production	T2	CS										
2.A.2 - Lime production	T1	DF										
2.A.3 - Glass Production	T1	DF										
2.A.4 - Other Process Uses of Carbonates	T1	DF										
2.A.5 - Other (please specify)	NO	NO	NO	NO								
2.B - Chemical Industry	T1	DF										
2.B.1 - Ammonia Production	NO	NO										
2.B.2 - Nitric Acid Production					NO	NO						
2.B.3 - Adipic Acid Production					NO	NO						
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production					NO	NO						
2.B.5 - Carbide Production	NO	NO	NO	NO								
2.B.6 - Titanium Dioxide Production	NO	NO										
2.B.7 - Soda Ash Production	NO	NO										
2.B.8 - Petrochemical and Carbon Black Production	NO	NO										
2.B.9 - Fluorochemical Production												
2.B.10 - Other (Please specify)												
2.C - Metal Industry	T2	CS	T1	DF					NO	NO		
2.C.1 - Iron and Steel Production	T2	CS	NO	NO								
2.C.2 - Ferroalloys Production	T2	CS	T1	DF								
2.C.3 - Aluminium production	NO	NO							NO	NO		
2.C.4 - Magnesium production	NO	NO										
2.C.5 - Lead Production	T1	DF										
2.C.6 - Zinc Production	NO	NO										
2.C.7 - Other (please specify)												
2.D - Non-Energy Products from Fuels and Solvent Use												
2.D.1 - Lubricant Use	NE	NE										
2.D.2 - Paraffin Wax Use	NE	NE										
2.D.3 - Solvent Use												
2.D.4 - Other (please specify)	NO	NO										
2.E - Electronics Industry							NO	NO	NO	NO	NO	NO

2.E.1 - Integrated Circuit or Semiconductor							NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display									NO	NO	NO	NO
2.E.3 - Photovoltaics									NO			
2.E.4 - Heat Transfer Fluid									NO			
2.E.5 - Other (please specify)							NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances							**T1**	**DF**				
2.F.1 - Refrigeration and Air Conditioning							T1	DF				
2.F.2 - Foam Blowing Agents							NO	NO				
2.F.3 - Fire Protection							NO	NO	NO	NO		
2.F.4 - Aerosols							NO	NO				
2.F.5 - Solvents							NO	NO	NO	NO		
2.F.6 - Other Applications (please specify)												
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
2.G.1 - Electrical Equipment									NE	NE		
2.G.2 - SF6 and PFCs from Other Product Uses									NO	NO	NE	NE
2.G.3 - N_2O from Product Uses					NE	NE						
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
2.H - Other												
2.H.1 - Pulp and Paper Industry												
2.H.2 - Food and Beverages Industry												
2.H.3 - Other (please specify)												
3 - Agriculture, Forestry, and Other Land Use	**T1**	**DF**	**T1**	**DF**	**T1**	**DF**						
3.A - Livestock	NO	NO	T1, T2	DF	T1, T2	DF						
3.A.1 - Enteric Fermentation			T1, T2	DF								
3.A.2 - Manure Management			T1, T2	DF	T1, T2	DF						
3.B - Land	T1	DF										
3.B.1 - Forest land	T1	DF										
3.B.2 - Cropland	T1	DF										
3.B.3 - Grassland	T1	DF										
3.B.4 - Wetlands	NE	NE			NE	NE						
3.B.5 - Settlements	T1	DF										
3.B.6 - Other Land	T1	DF										
3.C - Aggregate sources and non-CO_2 emissions sources on land	T1	DF	T1	DF	T1	DF						
3.C.1 - Emissions from biomass burning			NE	NE	NE	NE						
3.C.2 - Liming	NE	NE										
3.C.3 - Urea application	T1	DF										
3.C.4 - Direct N_2O emissions from managed soils					T1	DF						
3.C.5 - Indirect N_2O emissions from managed soils					T1	DF						
3.C.6 - Indirect N_2O emissions from manure management					T1	DF						
3.C.7 - Rice cultivations			T1	DF								
3.C.8 - Other (please specify)												
3.D - Other	T1	DF										
3.D.1 - Harvested Wood Products	T1	DF										

3.D.2 - Other (please specify)												
4 - Waste	**T1**	**DF**	**T1, T2**	**DF**	**T1**	**DF**						
4.A - Solid Waste Disposal			T2	DF								
4.B - Biological Treatment of Solid Waste			T1	DF								
4.C - Incineration and Open Burning of Waste	T1	DF	T1	DF	T1	DF						
4.D - Wastewater Treatment and Discharge			T1	DF	T1	DF						
4.E - Other (please specify)												
5 - Other												
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH3					NE	NE						
5.B - Other (please specify)												
Memo Items												
International Bunkers												
1.A.3.a.i - International Aviation (International Bunkers)	T1	DF	T1	DF	T1	DF						
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO	NO	NO	NO						

T1 - Tier1 approach, T2 - Tier2 approach, CS - Country specific, DF – Default factor, NO - Not occurring, NE - Not estimated

A I.3 Emission factors

A I.3.1 Energy

Table 96. Emission factors used in Energy sector (in kg/TJ)

Fuel	CO_2	CH_4	N_2O
Coking coal	94,600	10	1.5
Other Bituminous Coal	94,600	10	1.5
Sub-bituminous Coal	96,100	10	1.5
Lignite	107,879*	1(10)**	1.5
Crude oil	73,333		
Residual fuel oil	78,049*	3	0.6
Gas / Diesel oil	74,100	3	0.6
Motor gasoline	69,300	0.5	2
Jet kerosene	71,500	0.5	2
LPG	63,100	1	0.1
Petroleum coke	97,500	3	0.6
Natural gas* **	55,066*	1	0.1
Biomass	112,000	30	4

* Country Specific Emission Factor (CS EF)

**Default CH_4 EF for lignite in Energy industries is 1 kg/TJ and in Manufacturing Industries and Construction is 10 kg/TJ

***The country-specific emission factor for natural gas in the table is used until 2016. **After 2016 the CS EF was updated with the following values: 55,521.7 kg/TJ (2017), 55,598.5 kg/TJ (2018) and 55,778.1 kg/TJ (2019)**

Note: The default IPCC EF for CH_4 and N_2O are used. For some of the fuels, the values differ between the IPCC categories in the Energy sector (not all are included in table above).

A I.3.2 IPPU

Table 97. Emission factors used for IPPU sector

Categories	CO_2	CH_4	CF_4	C_2F_6
	(t gas/ t product)	(kg gas/ t product)	(kg gas/ t product)	(kg gas/ t product)
Mineral Industry				
Cement production	0.54			
Lime production	0.75			
Glass Production	0.20			
Other Process Uses of Carbonates				
Ceramics	0.44			
Other Uses of Soda Ash	0.41			
Metal Industry				
Iron and Steel Production	0.09			
Ferroalloys Production	4.16	1.00		
Aluminium production	1.60		1.60	0.40
Lead Production	0.52; 0.25			
Zinc Production	1.72			

A I.3.3 AFOLU

Table 98. Emission factors used for GHG emissions inventory in livestock activities

Emission factor	NC4	Comment
Livestock		
Dairy cows (enteric - CH_4)	kg/head/year	
	52.138	LW=250 kg, No pasture
	50.022	LW=250 kg, 5 months pasture
	93.494	LW=250 kg, 7 months pasture
	94.417	LW=600 kg, No pasture
	143.770	LW=600 kg, 5 months pasture
	113.328	LW=600 kg, 7 months pasture
	102.703	LW=550 kg, No pasture
	66.669	LW=550 kg, 5 months pasture
	122.492	LW=550 kg, 7 months pasture
	108.371	LW=650 kg, No pasture
	135.943	LW=650 kg, 5 months pasture
	145.964	LW=650 kg, 7 months pasture
	91.182	LW=500 kg, No pasture
	116.473	LW=500 kg, 5 months pasture
	130.427	LW=500 kg, 7 months pasture
Other cattle (enteric- CH_4)	58 kg/head/year	
Sheep (enteric- CH_4)	5 kg/head/year	40kg live weight
Sheep < 1 Y (enteric- CH_4)	5 kg/head/year	Sheep < 1 Y with 28kg live weight
Goat (enteric- CH_4)	5 kg/head/year	
Horses (enteric- CH_4)	18 kg/head/year	
Swine (enteric- CH_4)	kg/head/year	180 kg live weight
Fatteners	1.865	Large farms (FI=1.541 kg/day)
Fatteners	1.636	Small farms (FI=1.352 kg/day)
Sows	3.993	Large farms (FI=3.3 kg/day)
Sows	3.993	Small farms (FI=3.3 kg/day)
Dairy cows (manure - CH_4)	20 kg/head/year	Dairy cows (manure - N_2O)
	0.35 kg/1000 kg/day 18% liquid slurry (40% N loss); 67% solid storage slurry (40% N loss); 1% daily spread slurry (22% N loss) 13% pasture 0.005 Direct N_2O - N	
Dairy cows (manure - CH_4)	kg/head/year	
	4.663	LW=250 kg, No pasture
	3.859	LW=250 kg, 5 months pasture
	7.082	LW=250 kg, 7 months pasture
	9.508	LW=600 kg, No pasture
	10.144	LW=600 kg, 5 months pasture
	6.397	LW=600 kg, 7 months pasture
	35.098	LW=550 kg, No pasture
	4.764	LW=550 kg, 5 months pasture
	7.561	LW=550 kg, 7 months pasture
	8.539	LW=650 kg, No pasture
	9.591	LW=650 kg, 5 months pasture

	9.001	LW=650 kg, 7 months pasture
	3.805	LW=500 kg, No pasture
	7.965	LW=500 kg, 5 months pasture
	8.050	LW=500 kg, 7 months pasture
Dairy cows (manure NO_2)	(Annual N excretion kg N/animal/yr)	0.005 Direct N_2O - N
Solid	53.294	LW=250 kg, No pasture
	59.423	LW=250 kg, 5 months pasture
	95.474	LW=250 kg, 7 months pasture
	98.346	LW=600 kg, No pasture
	138.294	LW=600 kg, 5 months pasture
	108.474	LW=600 kg, 7 months pasture
	102.199	LW=550 kg, No pasture
	82.763	LW=550 kg, 5 months pasture
	116.395	LW=550 kg, 7 months pasture
	106.476	LW=650 kg, No pasture
	135.302	LW=650 kg, 5 months pasture
	136.629	LW=650 kg, 7 months pasture
	92.061	LW=500 kg, No pasture
	111.993	LW=500 kg, 5 months pasture
	124.231	LW=500 kg, 7 months pasture
Liquid/Slurry	98.346	LW=600 kg, No pasture
	102.199	LW=550 kg, No pasture
Anaerobic digester	98.346	LW=600 kg, No pasture (0.000 Direct N_2O – N)
Other cattle (manure- N_2O)	0.35 kg/1000 kg/day 18% liquid slurry (40% N loss); 67% solid storage slurry (40% N loss); 1% daily spread slurry (22% N loss) 13% pasture 0.005 Direct N_2O - N	
Sheep (manure- CH_4)	0.15 kg/head/year	t
Sheep (manure- N_2O)	0.9 kg/1000 kg/day 20% solid storage 80% pasture 0.005 Direct N_2O - N	40 kg live weigh
Sheep < 1 Y (manure- CH_4)	0.15 kg/head/year	Sheep < 1 Y with 28kg live weight
Sheep < 1 Y (manure- N_2O)	0.9 kg/1000 kg/day 20% solid storage 80% pasture 0.005 Direct N_2O - N	Sheep < 1 Y with 28kg live weight
Goat (manure- CH_4)	0.17 kg/head/year	
Goat (manure- N_2O)	1.28 kg/1000 kg/day 20% solid storage 80% pasture 0.005 Direct N_2O - N	
Horses (manure- CH_4)	1.64 kg/head/year	
Horses (manure- N_2O)	100% pasture	
Swine manure - CH_4	kg CH4/(head*yr)	
Fatteners	14.044	Large farms (FI=1.541 kg/day)
Fatteners	2.918	Small farms (FI=1.352 kg/day)
Sows	43.465	Large farms (FI=3.3 kg/day)
Sows	9.896	Small farms (FI=3.3 kg/day)
Swine manure- N_2O	(Annual N excretion kg N/animal/yr)	Direct N_2O – N Dry lot 0.02; Liquid/Slurry- 0.005; Uncovered anaerobic lagoon – 0.000; Pit storage below – 0.002; Anaerobic digester – 0.000.
Fatteners	197.1	
Sows	248.2	
Poultry (manure- CH_4)	-	1.8 kg live weight
Poultry (manure- N_2O)	-	1.8 kg live weight
Layers (manure- CH_4)	0.2 kg/head/year	1.8 kg live weight

Layers (manure- N_2O)	0.82 kg/1000 kg/day 100% Poultry litter (50% N loss); 0.001 Direct N_2O - N	1.8 kg live weight
Broilers (manure- CH_4)	0.2 kg/head/year	0.9 kg live weight
Broilers (manure- N_2O)	1.1 kg/1000 kg/day 100% Poultry litter (50% N loss); 0.001 Direct N_2O - N	0.9 kg live weight, specific factors for broilers were used
Turkey (manure- CH_4)	0.9 kg/head/year	6.8 kg live weight, specific factors for Turkey were used
Turkey (manure- N_2O)	0.74 kg/1000 kg/day 100% Poultry litter (50% N loss); 0.001 Direct N_2O - N	6.8 kg live weight, specific factors for Turkey were used
Other (manure- CH_4)	0.2 kg/head/year	1.8 kg live weight
Other (manure- N_2O)	0.82 kg/1000 kg/day 100% Poultry litter (50% N loss); 0.001 Direct N_2O - N	1.8 kg live weight

Table 99. Emission factors used for GHG emissions inventory in Land

Emission factor	NC4	Comment
4. Cropland remaining cropland		
1a. Biomass carbon stock	• 2,1 t/ha biomass accumulation per year in perennial plantations (first 20 years) - ΔCG, • 63 t/ha biomass loss with clearance of perennial plantations - ΔCL	IPCC Guide – Chapter 5, Table 5.1 and 5.3
1.b Dead organic matter		In Tier 1 methodology Dad organic matter is not calculated
1.c Soil Organic Carbon	0.9 t/ha for stock exchange factor (land use) 1 t/ha for stock exchange factor F_{MG} (management) 1 t/ha for stock exchange factor F_I (input)	IPCC Guide Chapter 5, Table 5.5
4.1. Forest land converted to cropland	120 t/ha biomass loss with clearance during the conversion	IPCC Guide, Chapter 4 Tables 4.7 to 4.12
4.2. Grassland converted to cropland	6,5 t/ha biomass loss biomass loss with clearance during the conversion	IPCC Guide, Chapter 6, Table 6.4
5. Grassland Remaining Grassland		
2.a Biomass carbon stock		Grassland where there is no change in either type or intensity of management, biomass will be in an approximate steady-state
2.b Dead organic matter		The Tier 1 method assumes that the dead wood and litter stocks are at equilibrium,
2.c. Soil Organic Carbon	1,0 t/ha for stock exchange factor (land use) 0.95 t/ha for stock exchange factor F_{MG} (management) 1,0 t/ha for stock exchange factor F_I (input)	IPCC Guide Chapter 6, Table 6.2
2.1 Forest land converted to grassland	120 t/ha biomass loss with clearance during the conversion	IPCC Guide, Chapter 4 Tables 4.7 to 4.12
2.2 Cropland converted to grassland	10,0 t/ha biomass loss biomass loss with clearance during the conversion	IPCC Guide, Chapter 5, Table 5.1
3. Urea application	0.2 volatisation/leaching factor	IPCC Guide, Chapter 11 Table 11.3
6. Rice fields	1.3 Emission factor for CH4 emission from continuously flooded fields	IPCC Guide, Chapter 11 Table 11.3

A I.3.4 Waste

Figure 76. Parameters used for methane calculations from Solid Waste Disposal

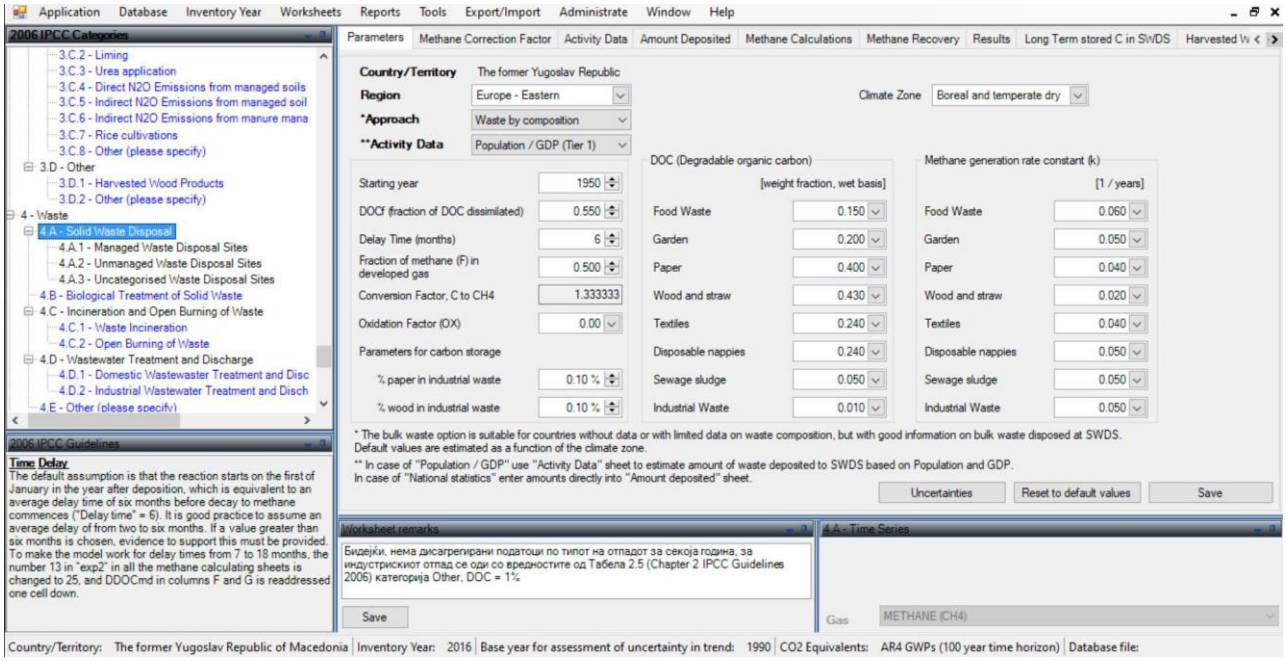

Table 100. Methane correction factor and distribution of waste by type of SWDS

	Unmanaged – shallow	Unmanaged – deep	Managed – anaerobic	Managed – semi-aerobic	Uncategorized SWDS
Methane correction factor (MCF)	0.4	0.8	1	0.5	0.6
Fixed distribution (%)	12	46	16	0	26
Year distribution (%)					
2007	13.9	42.8	12.9	0	30.4
2008	13.4	41.9	14.9	0	29.8
2009	14.1	40.2	16.5	0	29.2
2010	14.8	38.7	17.8	0	28.7
2011	15.3	37.4	18.8	0	28.5
2012	13.5	38.3	19.6	0	28.6
2013	10.9	40.2	20.2	0	28.7
2014	8.5	42.1	20.9	0	28.5
2015	7.9	42.6	21.6	0	27.9
2016	7.2	42.9	22.2	0	27.7
2017	7.4	42.7	22.8	0	27.1
2018	6.8	43	23.1	0	27.1
2019	6.1	43	23.2	0	27.7

Table 101. Emission factors used for biological treatment of solid waste

	Emission Factor (g/ kg waste treated)	
	CH_4	**N_2O**
Composting/Total MSW	10	0.6

Table 102. Parameters used for estimation of GHG emissions from Open burning of waste

Parameter	Unit	
Dry Matter Content - dm	(Fraction)	0.97
Fraction of Carbon in Dry Matter - CF	(Fraction)	0.38
Fraction of Fossil Carbon in Total Carbon - FCF	(Fraction)	0.1
Oxidation Factor - OF	(Fraction)	0.58
Methane Emission Factor	(kg CH_4/Gg Wet Waste)	6500
Nitrous Oxide Emission Factor	(kg N_2O/Gg Dry Waste)	150

Table 103. Parameters used for estimation of emissions from Domestic and Industrial Wastewater Treatment and Discharge

Estimation of CH_4 emission factor for Domestic Wastewater	
Type of treatment or discharge	Sea, river and lake discharge
Maximum methane producing capacity - B0 (kg CH_4/kg BOD)	0.6
Methane correction factor for each treatment system - MCFj	0.1
Fraction of Population Income Group - Ui (Fraction)	Rural 0.4; Urban 0.6
Degree of utilization - Tij (Fraction)	0.3
Estimation of emissions of indirect N_2O from Domestic Wastewater	
Estimation of nitrogen in effluent	
Per capita protein consumption (Protein) (kg/person/Year)	28.91
Fraction of nitrogen in protein (Fnpr) (kg N/kg Protein)	0.16
Fraction of non-consumption protein (Fnon-con) (-)	1.4
Fraction of industrial and commercial co-discharged protein (Find-com) (-)	1.25
Emission Factor (kg N_2O-N/kg N)	0.005
Estimation of CH_4 emission factor for Industrial Wastewater	
Type of treatment or discharge	Sea, river and lake discharge
Maximum Methane Producing Capacity (B0) (kg CH_4/kg COD)	0.25

Appendix II Detailed tables of the GHG Inventory

Table 104. Detailed results for 1990

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2*	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors	Other halogenated gases without CO2 equivalent conversion factors	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	8601.95	68.53	1.55	NA, NO, NE	91.65	NA, NO	NA, NO	NA, NO	28.09	56.96	19.56	96.47
1 - Energy	9301.54	10.10	0.18	NA	NA	NA	NA	NA	27.08	53.14	13.02	95.97
1.A - Fuel Combustion Activities	9295.93	2.59	0.18	NA	NA	NA	NA	NA	27.08	53.14	7.44	95.97
1.A.1 - Energy Industries	6171.33	0.07	0.08	NA	NA	NA	NA	NA	13.51	0.54	0.09	88.96
1.A.2 - Manufacturing Industries and Construction	1763.39	0.10	0.02	NA	NA	NA	NA	NA	9.18	6.47	0.92	5.99
1.A.3 - Transport	771.97	0.07	0.05	NA	NA	NA	NA	NA	3.11	15.05	1.87	NE
1.A.4 - Other Sectors	566.40	2.34	0.03	NA	NA	NA	NA	NA	1.24	30.87	4.56	0.82
1.A.5 - Non-Specified	22.84	0.00	0.00	NA	NA	NA	NA	NA	0.04	0.21	0.02	0.20
1.B - Fugitive emissions from fuels	5.62	7.51	NA	NA	NA	NA	NA	NA	NA, NO	NA, NO	5.58	0.00
1.B.1 - Solid Fuels	5.62	7.48	NA	NA	NA	NA	NA	NA	NA	NA	5.58	NA
1.B.2 - Oil and Natural Gas	NO	0.03	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.00
1.B.3 - Other emissions from Energy Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.2 - Injection and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.3 - Other	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2 - Industrial Processes and Product Use	839.27	0.05	NA, NO	NA, NO	91.65	NA, NO	NA, NO	NA, NO	0.78	1.34	0.02	0.49
2.A - Mineral Industry	333.10	NA, NO	NA, NO	NA	NA	NA	NA	NA	0.74	0.88	0.01	0.22
2.A.1 - Cement production	293.75	NA	NA	NA	NA	NA	NA	NA	0.67	0.79	0.01	0.20
2.A.2 - Lime production	33.72	NA	NA	NA	NA	NA	NA	NA	0.06	0.09	NO	0.02
2.A.3 - Glass Production	0.33	NA	NA	NA	NA	NA	NA	NA	0.01	NO	NO	0.00
2.A.4 - Other Process Uses of Carbonates	5.30	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B - Chemical Industry	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.B.1 - Ammonia Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.2 - Nitric Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.3 - Adipic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.9 - Fluorochemical Production	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	506.17	0.05	NA, NO	NA, NO	91.65	NA, NO	NA, NO	NA, NO	0.04	0.47	0.01	0.27
2.C.1 - Iron and Steel Production	24.75	NO	NA	NA	NA	NA	NA	NA	0.04	0.47	0.01	0.02
2.C.2 - Ferroalloys Production	264.32	0.05	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO

2.C.3 - Aluminium production	8.78	NA	NA	NA	91.65	NA	NA	NO	0.00	0.00	NO	0.00
2.C.4 - Magnesium production	NO	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO
2.C.5 - Lead Production	22.09	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.11
2.C.6 - Zinc Production	186.23	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.15
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NE, NA, NO	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.1 - Lubricant Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.3 - Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.E - Electronics Industry	NA, NO	NA, NO	NA, NO	NA, NO	NO	NO, NA	NA, NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display	NA	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	NO	NA, NO	NA, NO	NA	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning	NA	NA	NA	NO	NA	NA	NA	NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents	NA	NA	NA	NO	NA	NA	NA	NO	NO	NO	NO	NO
2.F.3 - Fire Protection	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.F.4 - Aerosols	NA	NA	NA	NO	NA	NA	NA	NO	NO	NO	NO	NO
2.F.5 - Solvents	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.F.6 - Other Applications (please specify)	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NA, NO	NA, NO	NA, NE, NO	NA, NO	NE, NA, NO	NE, NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.G.1 - Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses	NA	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.3 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-1541.72	43.55	1.26	NA	NA	NA	NA	NA	0.13	0.45	5.91	NO
3.A - Livestock		42.38	0.17	NA	NA	NA	NA	NA	0.11	NO	5.87	NO
3.A.1 - Enteric Fermentation	NA	36.33	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.A.2 - Manure Management	NA	6.05	0.17	NA	NA	NA	NA	NA	0.11	NO	5.87	NO
3.B - Land	-1544.77	NA	NA, NE	NA	NA	NA	NA	NA	NA, NO	NA, NO	NA, NO	NA, NO
3.B.1 - Forest land	-1723.50	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.2 - Cropland	52.23	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.3 - Grassland	-3.46	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.4 - Wetlands	NE	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.5 - Settlements	9.46	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.6 - Other Land	120.50	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	3.74	1.17	1.10	NA	NA	NA	NA	NA	0.02	0.45	0.05	NO
3.C.1 - Emissions from biomass burning	NA	NE	NE	NA	NA	NA	NA	NA	0.02	0.45	0.05	NO
3.C.2 - Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.3 - Urea application	3.74	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO

3.C.4 - Direct N2O Emissions from managed soils	NA	NA	0.70	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	0.27	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	0.12	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.7 - Rice cultivation	NA	1.17	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.8 - Other (please specify)	NA	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D - Other	-0.69	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-0.69	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4 - Waste	2.86	14.83	0.11	NA	NA	NA	NA	NA	0.12	2.03	0.60	0.00
4.A - Solid Waste Disposal	NA	10.62	NA	NA	NA	NA	NA	NA	NO	NO	0.55	NO
4.B - Biological Treatment of Solid Waste	NA	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	2.86	0.24	0.00	NA	NA	NA	NA	NA	0.12	2.03	0.05	0.00
4.D - Wastewater Treatment and Discharge		3.97	0.11	NA	NA	NA	NA	NA	NO	NO	0.00	NO
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	15.77	0.00	0.00						NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	15.77	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.5.c - Multilateral Operations	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Note: NO = Not occurring, NA = Not Applicable, NE = Not Estimated

**CO_2 net emissions (emissions minus removals)*

Table 105. Detailed results for 2000

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO2*	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors	Other halogenated gases without CO2 equivalent conversion factors	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	20292.78	62.87	1.39	4.77	62.86	NA, NO	NA, NO	NA, NO	31.68	195.40	33.33	102.96
1 - Energy	9409.54	11.19	0.19	NA	NA	NA	NA	NA	26.00	53.24	13.66	102.41
1.A - Fuel Combustion Activities	9403.49	3.11	0.19	NA	NA	NA	NA	NA	26.00	53.24	7.64	102.41
1.A.1 - Energy Industries	6958.21	0.10	0.09	NA	NA	NA	NA	NA	15.05	0.74	0.11	96.07
1.A.2 - Manufacturing Industries and Construction	1075.41	0.07	0.01	NA	NA	NA	NA	NA	4.24	5.99	0.71	5.63
1.A.3 - Transport	986.44	0.27	0.05	NA	NA	NA	NA	NA	4.74	14.06	1.80	NE
1.A.4 - Other Sectors	256.38	2.39	0.03	NA	NA	NA	NA	NA	1.01	31.80	4.72	0.56
1.A.5 - Non-Specified	127.05	0.29	0.00	NA	NA	NA	NA	NA	0.95	0.65	0.30	0.14
1.B - Fugitive emissions from fuels	6.05	8.08	NA	NA	NA	NA	NA	NA	NA, NO	NA, NO	6.01	0.00
1.B.1 - Solid Fuels	6.05	8.06	NA	NA	NA	NA	NA	NA	NA	NA	6.01	NA
1.B.2 - Oil and Natural Gas	NO	0.02	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.00
1.B.3 - Other emissions from Energy Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO

1.C.1 - Transport of CO2	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.2 - Injection and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.3 - Other	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2 - Industrial Processes and Product Use	819.76	0.04	NA, NO	4.77	62.86	NA, NO	NA, NO	NA, NO	0.84	1.25	0.02	0.54
2.A - Mineral Industry	361.83	NA, NO	NA, NO	NA	NA	NA	NA	NA	0.82	0.96	0.01	0.25
2.A.1 - Cement production	348.77	NA	NA	NA	NA	NA	NA	NA	0.80	0.93	0.01	0.24
2.A.2 - Lime production	11.17	NA	NA	NA	NA	NA	NA	NA	0.02	0.03	NO	0.01
2.A.3 - Glass Production	0.05	NA	NA	NA	NA	NA	NA	NA	0.00	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	1.85	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B - Chemical Industry	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.B.1 - Ammonia Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.2 - Nitric Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.3 - Adipic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.9 - Fluorochemical Production	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	457.93	0.04	NA, NO	NA, NO	62.86	NA, NO	NA, NO	NA, NO	0.02	0.29	0.01	0.30
2.C.1 - Iron and Steel Production	15.15	NO	NA	NA	NA	NA	NA	NA	0.02	0.29	0.01	0.01
2.C.2 - Ferroalloys Production	195.36	0.04	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.3 - Aluminium production	6.02	NA	NA	NA	62.86	NA	NA	NO	0.00	0.00	NO	0.00
2.C.4 - Magnesium production	NO	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO
2.C.5 - Lead Production	22.97	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.12
2.C.6 - Zinc Production	218.43	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.17
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NE, NA, NO	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.1 - Lubricant Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.3 - Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display	NA	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	4.77	NA, NO	NA	NA	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning	NA	NA	NA	4.77	NA	NA	NA	NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents	NA	NA	NA	NE	NA	NA	NA	NO	NO	NO	NO	NO
2.F.3 - Fire Protection	NA	NA	NA	NE	NE	NA	NA	NO	NO	NO	NO	NO
2.F.4 - Aerosols	NA	NA	NA	NO	NA	NA	NA	NO	NO	NO	NO	NO
2.F.5 - Solvents	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.F.6 - Other Applications (please specify)	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use												

2.G.1 - Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses	NA	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.3 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	10060.28	36.64	1.09	NA	NA	NA	NA	NA	4.72	138.71	19.05	NO
3.A - Livestock		35.74	0.14	NA	NA	NA	NA	NA	0.10	NO	5.18	NO
3.A.1 - Enteric Fermentation	NA	29.88	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.A.2 - Manure Management	NA	5.85	0.14	NA	NA	NA	NA	NA	0.10	NO	5.18	NO
3.B - Land	10056.80	NA	NA, NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.1 - Forest land	9842.66	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.2 - Cropland	93.03	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.3 - Grassland	6.87	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.4 - Wetlands	NE	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.5 - Settlements	18.25	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.6 - Other Land	95.98	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	4.18	0.91	0.94	NA	NA	NA	NA	NA	4.62	138.71	13.87	NO
3.C.1 - Emissions from biomass burning	NA	NE	NE	NA	NA	NA	NA	NA	4.62	138.71	13.87	NO
3.C.2 - Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.3 - Urea application	4.18	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils	NA	NA	0.61	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	0.23	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	0.11	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.7 - Rice cultivation	NA	0.91	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.8 - Other (please specify)	NA	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D - Other	-0.70	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-0.70	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4 - Waste	3.20	15.00	0.12	NA	NA	NA	NA	NA	0.13	2.21	0.60	0.00
4.A - Solid Waste Disposal	NA	11.98	NA	NA	NA	NA	NA	NA	NO	NO	0.56	NO
4.B - Biological Treatment of Solid Waste	NA	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	3.20	0.26	0.00	NA	NA	NA	NA	NA	0.13	2.21	0.05	0.00
4.D - Wastewater Treatment and Discharge		2.77	0.12	NA	NA	NA	NA	NA	NO	NO	0.00	NO
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	88.05	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	88.05	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.5.c - Multilateral Operations	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Note: NO = Not occurring, NA = Not Applicable, NE = Not Estimated

**CO_2 net emissions (emission minus removals)*

Table 106. Detailed results for 2005

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	Net CO2*	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors	Other halogenated gases without CO2 equivalent conversion factors	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	7660.91	60.38	1.50	102.84	0.33	NO, NA	NO, NA	NO, NA	29.06	68.99	19.95	103.91
1 - Energy	8926.70	10.58	0.19	NA	NA	NA	NA	NA	27.67	57.43	13.73	103.62
1.A - Fuel Combustion Activities	8921.16	3.18	0.19	NA	NA	NA	NA	NA	27.67	57.43	8.23	103.62
1.A.1 - Energy Industries	5913.37	0.07	0.09	NA	NA	NA	NA	NA	14.25	0.56	0.09	94.80
1.A.2 - Manufacturing Industries and Construction	1349.75	0.09	0.01	NA	NA	NA	NA	NA	4.74	8.37	1.03	7.78
1.A.3 - Transport	1021.88	0.28	0.05	NA	NA	NA	NA	NA	5.21	13.73	1.86	NE
1.A.4 - Other Sectors	228.16	2.57	0.03	NA	NA	NA	NA	NA	0.85	34.09	5.06	0.54
1.A.5 - Non-Specified	407.99	0.18	0.00	NA	NA	NA	NA	NA	2.63	0.68	0.19	0.50
1.B - Fugitive emissions from fuels	5.54	7.40	NA	NA	NA	NA	NA	NA	0.00	0.00	5.50	0.00
1.B.1 - Solid Fuels	5.54	7.38	NA	NA	NA	NA	NA	NA	NA	NA	5.50	NA
1.B.2 - Oil and Natural Gas	NO	0.02	NA	NA	NA	NA	NA	NA	0.00	0.00	0.00	0.00
1.B.3 - Other emissions from Energy Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.2 - Injection and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.3 - Other	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2 - Industrial Processes and Product Use	756.70	0.07	NA, NO	102.84	0.33	NA, NO	NA, NO	NA, NO	0.92	2.08	0.04	0.29
2.A - Mineral Industry	368.05	NA, NO	NA, NO	NA	NA	NA	NA	NA	0.83	0.98	0.01	0.25
2.A.1 - Cement production	355.32	NA	NA	NA	NA	NA	NA	NA	0.81	0.95	0.01	0.24
2.A.2 - Lime production	11.13	NA	NA	NA	NA	NA	NA	NA	0.02	0.03	NO	0.01
2.A.3 - Glass Production	0.01	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.00
2.A.4 - Other Process Uses of Carbonates	1.60	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B - Chemical Industry	NO,NA	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.B.1 - Ammonia Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.2 - Nitric Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.3 - Adipic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.9 - Fluorochemical Production	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	388.65	0.07	NA, NO	NA, NO	0.33	NA, NO	NA, NO	NA, NO	0.08	1.10	0.03	0.04

2.C.1 - Iron and Steel Production	58.23		NA	NA	NA	NA	NA	NA	0.08	1.10	0.03	0.04
2.C.2 - Ferroalloys Production	330.39	0.07	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.3 - Aluminium production	0.03	NA	NA	NA	0.33	NA	NA	NO	0.00	0.00	NO	0.00
2.C.4 - Magnesium production	NO	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.6 - Zinc Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NE, NA, NO	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.1 - Lubricant Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.3 - Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.E - Electronics Industry	NA, NO	NA, NO	NA, NO	NA, NO	NO	NA, NO	NA, NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display	NA	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	102.84	NA, NE, NO	NA	NA	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning	NA	NA	NA	102.84	NA	NA	NA	NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents	NA	NA	NA	NE	NA	NA	NA	NO	NO	NO	NO	NO
2.F.3 - Fire Protection	NA	NA	NA	NE	NE	NA	NA	NO	NO	NO	NO	NO
2.F.4 - Aerosols	NA	NA	NA	NO	NA	NA	NA	NO	NO	NO	NO	NO
2.F.5 - Solvents	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.F.6 - Other Applications (please specify)	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NA, NO	NA, NO	NA, NE, NO	NA, NO	NE, NA, NO	NE, NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.G.1 - Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses	NA	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.3 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-2027.31	33.92	1.19	NA	NA	NA	NA	NA	0.29	6.28	5.30	NO
3.A - Livestock	NA	33.44	0.14	NA	NA	NA	NA	NA	0.08	NO	4.67	NO
3.A.1 - Enteric Fermentation	NA	28.23	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.A.2 - Manure Management	NA	5.21	0.14	NA	NA	NA	NA	NA	0.08	NO	4.67	NO
3.B - Land	-2026.86	NA	NA, NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.1 - Forest land	-2230.50	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.2 - Cropland	74.52	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.3 - Grassland	40.83	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.4 - Wetlands	NE	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.5 - Settlements	14.15	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.6 - Other Land	74.14	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	0.59	0.48	1.05	NO	NO	NO	NO	NO	0.21	6.28	0.63	NO
3.C.1 - Emissions from biomass burning	NA	NE	NE	NA	NA	NA	NA	NA	0.21	6.28	0.63	NO
3.C.2 - Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO

3.C.3 - Urea application	0.59	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils	NA	NA	0.70	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	0.26	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	0.10	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.7 - Rice cultivation	NA	0.48	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.8 - Other (please specify)	NA	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D - Other	-1.04	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-1.04	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4 - Waste	4.82	15.80	0.12	NA	NA	NA	NA	NA	0.18	3.20	0.87	0.01
4.A - Solid Waste Disposal	NA	12.64	NA	NA	NA	NA	NA	NA	NO	NO	0.80	NO
4.B - Biological Treatment of Solid Waste	NA	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	4.82	0.37	0.00	NA	NA	NA	NA	NA	0.18	3.20	0.07	0.01
4.D - Wastewater Treatment and Discharge		2.79	0.12	NA	NA	NA	NA	NA	NO	NO	0.00	NO
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	20.16	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	20.16	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.5.c - Multilateral Operations	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Note: NO = Not occurring, NA = Not Applicable, NE = Not Estimated

**CO_2 net emissions (emission minus removals)*

Table 107. Detailed results for 2014

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	**Net CO2***	**CH4**	**N2O**	**HFCs**	**PFCs**	**SF6**	**Other halogenated gases with CO2 equivalent conversion factors**	**Other halogenated gases without CO2 equivalent conversion factors**	**NOx**	**CO**	**NMVOCs**	**SO2**
Total National Emissions and Removals	5159.40	62.48	1.51	157.79	NA, NO	NA, NO	NA, NO	NA, NO	27.50	71.43	20.62	76.65
1 - Energy	7726.87	10.39	0.20	NA	NA	NA	NA	NA	26.43	63.50	14.92	76.43
1.A - Fuel Combustion Activities	7721.65	3.44	0.20	NA	NA	NA	NA	NA	25.76	60.49	8.87	76.43
1.A.1 - Energy Industries	4726.93	0.05	0.06	NA	NA	NA	NA	NA	10.63	0.51	0.07	69.51
1.A.2 - Manufacturing Industries and Construction	1122.05	0.07	0.01	NA	NA	NA	NA	NA	3.88	7.05	0.86	6.55
1.A.3 - Transport	1623.41	0.37	0.08	NA	NA	NA	NA	NA	9.42	14.76	2.14	NE
1.A.4 - Other Sectors	74.80	2.87	0.04	NA	NA	NA	NA	NA	0.66	37.90	5.69	0.25
1.A.5 - Non-Specified	174.46	0.08	0.00	NA	NA	NA	NA	NA	1.17	0.27	0.11	0.13
1.B - Fugitive emissions from fuels	5.22	6.95	NA	NA	NA	NA	NA	NA	0.67	3.01	6.05	0.01
1.B.1 - Solid Fuels	5.22	6.95	NA	NA	NA	NA	NA	NA	NA	NA	5.19	NA
1.B.2 - Oil and Natural Gas	0.00	0.00	NA	NA	NA	NA	NA	NA	0.67	3.01	0.86	0.01
1.B.3 - Other emissions from Energy Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO

1.C.1 - Transport of CO2	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.2 - Injection and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.3 - Other	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2 - Industrial Processes and Product Use	676.27	0.07	NA, NO	157.79	NA, NO	NA, NO	NA, NO	NA, NO	0.67	1.08	0.02	0.20
2.A - Mineral Industry	281.67	NA, NO	NA, NO	NA	NA	NA	NA	NA	0.64	0.76	0.01	0.19
2.A.1 - Cement production	274.19	NA	NA	NA	NA	NA	NA	NA	0.63	0.74	0.01	0.19
2.A.2 - Lime production	6.39	NA	NA	NA	NA	NA	NA	NA	0.02	0.02	NO	0.00
2.A.3 - Glass Production	0.01	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.00
2.A.4 - Other Process Uses of Carbonates	1.08	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B - Chemical Industry	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.B.1 - Ammonia Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.2 - Nitric Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.3 - Adipic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.9 - Fluorochemical Production	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	394.60	0.07	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.03	0.32	0.01	0.01
2.C.1 - Iron and Steel Production	17.03	NO	NA	NA	NA	NA	NA	NA	0.03	0.32	0.01	0.01
2.C.2 - Ferroalloys Production	377.56	0.07	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.3 - Aluminium production	NO	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.6 - Zinc Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NE, NA, NO	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.1 - Lubricant Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.3 - Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.E - Electronics Industry	NA, NO	NA,NO	NA, NO	NA, NO	NO	NA, NO	NA, NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display	NA	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	157.79	NA, NE, NO	NA	NA	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning	NA	NA	NA	157.79	NA	NA	NA	NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents	NA	NA	NA	NE	NA	NA	NA	NO	NO	NO	NO	NO
2.F.3 - Fire Protection	NA	NA	NA	NE	NE	NA	NA	NO	NO	NO	NO	NO
2.F.4 - Aerosols	NA	NA	NA	NO	NA	NA	NA	NO	NO	NO	NO	NO
2.F.5 - Solvents	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.F.6 - Other Applications (please specify)	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NA, NO	NA, NO	NA, NE, NO	NA, NO	NE, NA, NO	NE, NA,NO	NO	NO	NO	NO	NO	NO

2.G.1 - Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses	NA	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2.H - Other	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.3 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-3250.27	31.04	1.17	NA	NA	NA	NA	NA	0.16	2.59	4.51	NO
3.A - Livestock	NA	30.08	0.13	NA	NA	NA	NA	NA	0.08	NO	4.25	NO
3.A.1 - Enteric Fermentation	NA	25.01	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.A.2 - Manure Management	NA	5.07	0.13	NA	NA	NA	NA	NA	0.08	NO	4.25	NO
3.B - Land	-3250.48	NA	NA, NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.1 - Forest land	-3382.19	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.2 - Cropland	78.16	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.3 - Grassland	-2.71	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.4 - Wetlands	NE	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.5 - Settlements	22.89	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.6 - Other Land	33.37	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	1.69	0.96	1.04	NA	NA	NA	NA	NA	0.09	2.59	0.26	NO
3.C.1 - Emissions from biomass burning	NA	NE	NE	NA	NA	NA	NA	NA	0.09	2.59	0.26	NO
3.C.2 - Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.3 - Urea application	1.69	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils	NA	NA	0.70	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	0.25	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	0.10	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.7 - Rice cultivation	NA	0.96	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.8 - Other (please specify)	NA	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D - Other	-1.48	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-1.48	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4 - Waste	6.55	20.97	0.14	NA	NA	NA	NA	NA	0.24	4.26	1.17	0.01
4.A - Solid Waste Disposal	NA	17.63	NA	NA	NA	NA	NA	NA	NO	NO	1.08	NO
4.B - Biological Treatment of Solid Waste	NA	0.02	0.00	NA	NA	NA	NA	NA	NO	0.00	NO	NO
4.C - Incineration and Open Burning of Waste	6.55	0.50	0.01	NA	NA	NA	NA	NA	0.24	4.26	0.09	0.01
4.D - Wastewater Treatment and Discharge		2.83	0.13	NA	NA	NA	NA	NA	NO	NO	0.00	NO
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	37.14	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	37.14	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.5.c - Multilateral Operations	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Note: NO = Not occurring, NA = Not Applicable, NE = Not Estimated

CO_2 net emissions (emission minus removals)

Table 108. Detailed results for 2015

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2*	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors	Other halogenated gases without CO2 equivalent conversion factors	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	7080.43	63.77	1.54	165.92	NA, NO	NA, NO	NA, NO	NA, NO	28.13	86.59	21.99	69.02
1 - Energy	7395.04	9.75	0.20	NA	NA	NA	NA	NA	26.54	63.90	14.70	68.80
1.A - Fuel Combustion Activities	7390.26	3.38	0.20	NA	NA	NA	NA	NA	25.65	59.89	8.80	68.79
1.A.1 - Energy Industries	4242.83	0.04	0.06	NA	NA	NA	NA	NA	9.53	0.47	0.06	62.02
1.A.2 - Manufacturing Industries and Construction	1058.05	0.07	0.01	NA	NA	NA	NA	NA	3.59	6.82	0.81	6.36
1.A.3 - Transport	1801.83	0.40	0.09	NA	NA	NA	NA	NA	10.50	15.60	2.30	NE
1.A.4 - Other Sectors	81.05	2.78	0.04	NA	NA	NA	NA	NA	0.66	36.70	5.51	0.26
1.A.5 - Non-Specified	206.49	0.09	0.00	NA	NA	NA	NA	NA	1.38	0.31	0.13	0.15
1.B - Fugitive emissions from fuels	4.78	6.36	NA	NA	NA	NA	NA	NA	0.89	4.01	5.89	0.01
1.B.1 - Solid Fuels	4.78	6.36	NA	NA	NA	NA	NA	NA	NA	NA	4.75	NA
1.B.2 - Oil and Natural Gas	0.00	0.00	NA	NA	NA	NA	NA	NA	0.89	4.01	1.15	0.01
1.B.3 - Other emissions from Energy Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.2 - Injection and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.3 - Other	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2 - Industrial Processes and Product Use	567.09	0.05	NA, NO	165.92	NA, NO	NA, NO	NA, NO	NA, NO	0.68	1.00	0.02	0.21
2.A - Mineral Industry	291.20	NA, NO	NA, NO	NA	NA	NA	NA	NA	0.67	0.79	0.01	0.20
2.A.1 - Cement production	285.42	NA	NA	NA	NA	NA	NA	NA	0.65	0.78	0.01	0.20
2.A.2 - Lime production	4.72	NA	NA	NA	NA	NA	NA	NA	0.01	0.02	NO	0.00
2.A.3 - Glass Production	0.01	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.00
2.A.4 - Other Process Uses of Carbonates	1.05	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B - Chemical Industry	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.B.1 - Ammonia Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.2 - Nitric Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.3 - Adipic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.9 - Fluorochemical Production	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	275.89	0.05	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.02	0.21	0.01	0.01
2.C.1 - Iron and Steel Production	11.04	NO	NA	NA	NA	NA	NA	NA	0.02	0.21	0.01	0.01
2.C.2 - Ferroalloys Production	263.47	0.05	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.3 - Aluminium production	NO	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO

2.C.4 - Magnesium production	NO	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO
2.C.5 - Lead Production	1.38	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.01
2.C.6 - Zinc Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NE, NA, NO	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.1 - Lubricant Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.3 - Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.E - Electronics Industry	NA, NO	NA, NO	NA, NO	NA, NO	NO	NA, NO	NA, NO	NO	NO	NO	NO	
2.E.1 - Integrated Circuit or Semiconductor	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display	NA	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	165.92	NA, NE, NO	NA	NA	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning	NA	NA	NA	165.92	NA	NA	NA	NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents	NA	NA	NA	NE	NA	NA	NA	NO	NO	NO	NO	NO
2.F.3 - Fire Protection	NA	NA	NA	NE	NE	NA	NA	NO	NO	NO	NO	NO
2.F.4 - Aerosols	NA	NA	NA	NE	NA	NA	NA	NO	NO	NO	NO	NO
2.F.5 - Solvents	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.F.6 - Other Applications (please specify)	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NA, NO	NA, NO	NA, NE, NO	NO	NE, NA, NO	NE, NA, NO	NO	NO	NO	NO	NO	NO
2.G.1 - Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses	NA	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.3 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-888.60	32.20	1.20	NA	NA	NA	NA	NA	0.66	17.30	6.08	NO
3.A - Livestock	NA	31.27	0.13	NA	NA	NA	NA	NA	0.08	NO	4.35	NO
3.A.1 - Enteric Fermentation	NA	25.78	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.A.2 - Manure Management	NA	5.48	0.13	NA	NA	NA	NA	NA	0.08	NO	4.35	NO
3.B - Land	-888.74	NA	NA, NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.1 - Forest land	-1224.95	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.2 - Cropland	139.79	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.3 - Grassland	109.83	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.4 - Wetlands	NE	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.5 - Settlements	18.24	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.6 - Other Land	68.35	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	1.61	0.93	1.07	NA	NA	NA	NA	NA	0.58	17.30	1.73	NO
3.C.1 - Emissions from biomass burning	NA	NE	NE	NA	NA	NA	NA	NA	0.58	17.30	1.73	NO
3.C.2 - Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.3 - Urea application	1.61	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO

3.C.4 - Direct N2O Emissions from managed soils	NA	NA	0.70	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	0.25	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	0.12	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.7 - Rice cultivation	NA	0.93	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.8 - Other (please specify)	NA	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D - Other	-1.48	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-1.48	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4 - Waste	6.90	21.78	0.14	NA	NA	NA	NA	NA	0.25	4.39	1.20	0.01
4.A - Solid Waste Disposal	NA	18.21	NA	NA	NA	NA	NA	NA	NO	NO	1.11	NO
4.B - Biological Treatment of Solid Waste	NA	0.03	0.00	NA	NA	NA	NA	NA	NO	0.00	NO	NO
4.C - Incineration and Open Burning of Waste	6.90	0.51	0.01	NA	NA	NA	NA	NA	0.25	4.39	0.10	0.01
4.D - Wastewater Treatment and Discharge		3.03	0.13	NA	NA	NA	NA	NA	NO	NO	0.00	NO
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	41.64	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	41.64	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.5.c - Multilateral Operations	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Note: NO = Not occurring, NA = Not Applicable, NE = Not Estimated

**CO_2 net emissions (emission minus removals)*

Table 109. Detailed results for 2016

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2*	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors	Other halogenated gases without CO2 equivalent conversion factors	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	6396.43	63.43	1.63	234.24	NA, NO	NA, NO	NA, NO	NA, NO	28.16	73.86	19.84	59.98
1 - Energy	7175.45	8.51	0.20	NA	NA	NA	NA	NA	26.63	58.30	13.20	59.69
1.A - Fuel Combustion Activities	7171.31	2.98	0.20	NA	NA	NA	NA	NA	25.87	54.86	8.09	59.69
1.A.1 - Energy Industries	3785.76	0.04	0.05	NA	NA	NA	NA	NA	8.41	0.51	0.06	53.18
1.A.2 - Manufacturing Industries and Construction	1029.89	0.08	0.01	NA	NA	NA	NA	NA	3.48	6.56	0.79	6.11
1.A.3 - Transport	2055.56	0.43	0.10	NA	NA	NA	NA	NA	11.93	16.42	2.46	NE
1.A.4 - Other Sectors	81.23	2.35	0.03	NA	NA	NA	NA	NA	0.59	31.05	4.66	0.24
1.A.5 - Non-Specified	218.86	0.09	0.00	NA	NA	NA	NA	NA	1.46	0.32	0.13	0.16
1.B - Fugitive emissions from fuels	4.15	5.52	NA	NA	NA	NA	NA	NA	0.77	3.44	5.11	0.01

1.B.1 - Solid Fuels	4.15	5.52	NA	NA	NA	NA	NA	NA	NA	NA	4.12	NA
1.B.2 - Oil and Natural Gas	0.00	0.00	NA	NA	NA	NA	NA	NA	0.77	3.44	0.98	0.01
1.B.3 - Other emissions from Energy Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.2 - Injection and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.3 - Other	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2 - Industrial Processes and Product Use	533.42	0.02	NA, NO	234.24	NA, NO	NA, NO	NA, NO	NA, NO	0.87	1.29	0.02	0.27
2.A - Mineral Industry	371.12	NA, NO	NA, NO	NA	NA	NA	NA	NA	0.85	1.00	0.01	0.26
2.A.1 - Cement production	364.65	NA	NA	NA	NA	NA	NA	NA	0.84	0.98	0.01	0.25
2.A.2 - Lime production	5.38	NA	NA	NA	NA	NA	NA	NA	0.01	0.02	NO	0.00
2.A.3 - Glass Production	0.05	NA	NA	NA	NA	NA	NA	NA	0.00	NO	NO	0.00
2.A.4 - Other Process Uses of Carbonates	1.04	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B - Chemical Industry	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.B.1 - Ammonia Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.2 - Nitric Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.3 - Adipic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.9 - Fluorochemical Production	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	162.31	0.02	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.02	0.29	0.01	0.02
2.C.1 - Iron and Steel Production	15.31	NO	NA	NA	NA	NA	NA	NA	0.02	0.29	0.01	0.01
2.C.2 - Ferroalloys Production	144.67	0.02	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.3 - Aluminium production	NO	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO
2.C.5 - Lead Production	2.33	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.01
2.C.6 - Zinc Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NE, NA, NO	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.1 - Lubricant Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.3 - Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.E - Electronics Industry	NA, NO	NA, NO	NA, NO	NA, NO	NO	NA, NO	NA, NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display	NA	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	234.24	NA, NE, NO	NA	NA	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning	NA	NA	NA	234.24	NA	NA	NA	NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents	NA	NA	NA	NE	NA	NA	NA	NO	NO	NO	NO	NO

2.F.3 - Fire Protection	NA	NA	NA	NE	NE	NA	NA	NO	NO	NO	NO	NO
2.F.4 - Aerosols	NA	NA	NA	NO	NA	NA	NA	NO	NO	NO	NO	NO
2.F.5 - Solvents	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.F.6 - Other Applications (please specify)	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NA, NO	NA, NO	NA, NE, NO	NA, NO	NE, NA, NO	NE, NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.G.1 - Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses	NA	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.3 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-1319.13	32.62	1.29	NA	NA	NA	NA	NA	0.08		5.43	
3.A - Livestock	NA	31.69	0.14	NA	NA	NA	NA	NA	0.08		4.44	
3.A.1 - Enteric Fermentation	NA	26.06	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.A.2 - Manure Management	NA	5.63	0.14	NA	NA	NA	NA	NA	0.08	NO	4.44	NO
3.B - Land	-1319.11	NA	NA, NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.1 - Forest land	-1872.15	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.2 - Cropland	256.88	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.3 - Grassland	162.95	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.4 - Wetlands	NE	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.5 - Settlements	6.30	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.6 - Other Land	126.91	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	1.47	0.94	1.16	NA	NA	NA	NA	NA	0.33	9.92	0.99	NO
3.C.1 - Emissions from biomass burning	NA	NE	NE	NA	NA	NA	NA	NA	0.33	9.92	0.99	NO
3.C.2 - Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.3 - Urea application	1.47	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils	NA	NA	0.75	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	0.27	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	0.13	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.7 - Rice cultivation	NA	0.94	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.8 - Other (please specify)	NA			NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D - Other	-1.49	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-1.49	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4 - Waste	6.69	22.28	0.14	NA	NA	NA	NA	NA	0.25	4.35	1.19	0.01
4.A - Solid Waste Disposal	NA	18.78	NA	NA	NA	NA	NA	NA	NO	NO	1.10	NO
4.B - Biological Treatment of Solid Waste	NA	0.02	0.00	NA	NA	NA	NA	NA	NO	0.00	NO	NO
4.C - Incineration and Open Burning of Waste	6.69	0.51	0.01	NA	NA	NA	NA	NA	0.25	4.35	0.10	0.01
4.D - Wastewater Treatment and Discharge		2.96	0.13	NA	NA	NA	NA	NA	NO	NO	0.00	NO
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Memo Items (5)												
International Bunkers	47.48	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	47.48	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.5.c - Multilateral Operations	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Note: NO = Not occurring, NA = Not Applicable, NE = Not Estimated

**CO_2 net emissions (emission minus removals)*

Table 110. Detailed results for 2017

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	**Net CO2***	**CH4**	**N2O**	**HFCs**	**PFCs**	**SF6**	**Other halogenated gases with CO2 equivalent conversion factors**	**Other halogenated gases without CO2 equivalent conversion factors**	**NOx**	**CO**	**NMVOCs**	**SO2**
Total National Emissions and Removals	9483.10	65.62	3.36	153.87	NA, NO	NA, NO	NA, NO	NA, NO	30.50	113.40	23.89	66.43
1 - Energy	7680.05	8.85	0.21	NA	NA	NA	NA	NA	27.73	61.46	13.61	66.13
1.A - Fuel Combustion Activities	7675.94	3.39	0.21	NA	NA	NA	NA	NA	27.15	58.82	8.78	66.12
1.A.1 - Energy Industries	4382.90	0.05	0.06	NA	NA	NA	NA	NA	9.71	0.62	0.07	60.97
1.A.2 - Manufacturing Industries and Construction	870.98	0.06	0.01	NA	NA	NA	NA	NA	3.06	5.17	0.66	4.75
1.A.3 - Transport	2135.52	0.44	0.11	NA	NA	NA	NA	NA	12.37	16.40	2.47	NE
1.A.4 - Other Sectors	78.90	2.74	0.04	NA	NA	NA	NA	NA	0.65	36.30	5.45	0.24
1.A.5 - Non-Specified	207.65	0.09	0.00	NA	NA	NA	NA	NA	1.37	0.32	0.13	0.16
1.B - Fugitive emissions from fuels	4.10	5.46	NA	NA	NA	NA	NA	NA	0.59	2.64	4.83	0.01
1.B.1 - Solid Fuels	4.10	5.46	NA	NA	NA	NA	NA	NA	NA	NA	4.08	NA
1.B.2 - Oil and Natural Gas	0.00	0.00	NA	NA	NA	NA	NA	NA	0.59	2.64	0.76	0.01
1.B.3 - Other emissions from Energy Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.2 - Injection and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.3 - Other	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2 - Industrial Processes and Product Use	433.87	0.00		153.87	NA, NO	NA, NO	NA, NO	NA, NO	0.90	1.48	0.03	0.29
2.A - Mineral Industry	376.30	NA, NO	NA,NO	NA	NA	NA	NA	NA	0.86	1.01	0.01	0.26
2.A.1 - Cement production	374.41	NA	NA	NA	NA	NA	NA	NA	0.86	1.01	0.01	0.26
2.A.2 - Lime production	0.83	NA	NA	NA	NA	NA	NA	NA	0.00	0.00	NO	
2.A.3 - Glass Production	0.05	NA	NA	NA	NA	NA	NA	NA	0.00	NO	NO	0.00
2.A.4 - Other Process Uses of Carbonates	1.00	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B - Chemical Industry	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.B.1 - Ammonia Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.2 - Nitric Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.3 - Adipic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO

2.B.7 - Soda Ash Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.9 - Fluorochemical Production	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	57.57	0.00	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.04	0.47	0.01	0.03
2.C.1 - Iron and Steel Production	24.78	NO	NA	NA	NA	NA	NA	NA	0.04	0.47	0.01	0.02
2.C.2 - Ferroalloys Production	28.90	0.00	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.3 - Aluminium production	NO	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO
2.C.5 - Lead Production	3.89	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.02
2.C.6 - Zinc Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NE, NA, NO	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.1 - Lubricant Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.3 - Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.E - Electronics Industry	NA, NO	NA, NO	NA, NO	NO	NO	NA, NO	NA, NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display	NA	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	153.87	NA, NE, NO	NA	NA	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning	NA	NA	NA	153.87	NA	NA	NA	NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents	NA	NA	NA	NE	NA	NA	NA	NO	NO	NO	NO	NO
2.F.3 - Fire Protection	NA	NA	NA	NE	NE	NA	NA	NO	NO	NO	NO	NO
2.F.4 - Aerosols	NA	NA	NA	NO	NA	NA	NA	NO	NO	NO	NO	NO
2.F.5 - Solvents	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.F.6 - Other Applications (please specify)	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NA, NO	NA, NO	NA, NE, NO	NA, NO	NE, NA, NO	NE, NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.G.1 - Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses	NA	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NA, MO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.3 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	1362.48	34.31	3.00	NA	NA	NA	NA	NA	1.62	46.10	9.05	NO
3.A - Livestock		33.66	0.72	NA	NA	NA	NA	NA	0.08	NO	4.44	NO
3.A.1 - Enteric Fermentation	NA	29.73	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.A.2 - Manure Management	NA	3.93	0.72	NA	NA	NA	NA	NA	0.08	NO	4.44	NO
3.B - Land	1361.32	NA	NA, NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.1 - Forest land	1133.22	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.2 - Cropland	122.63	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.3 - Grassland	26.72	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.4 - Wetlands	NE	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO

3.B.5 - Settlements	7.37	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.6 - Other Land	71.38	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	2.79	0.65	2.28	NA	NA	NA	NA	NA	1.54	46.10	4.61	NO
3.C.1 - Emissions from biomass burning	NA			NA	NA	NA	NA	NA	1.54	46.10	4.61	NO
3.C.2 - Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.3 - Urea application	2.79	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils	NA	NA	1.46	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	0.50	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	0.33	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.7 - Rice cultivation	NA	0.65	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.8 - Other (please specify)	NA			NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D - Other	-1.63	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-1.63	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4 - Waste	6.71	22.46	0.14	NA	NA	NA	NA	NA	0.25	4.36	1.20	0.01
4.A - Solid Waste Disposal	NA	19.22	NA	NA	NA	NA	NA	NA	NO	NO	1.10	NO
4.B - Biological Treatment of Solid Waste	NA	0.01	0.00	NA	NA	NA	NA	NA	NO	0.00	NO	NO
4.C - Incineration and Open Burning of Waste	6.71	0.51	0.01	NA	NA	NA	NA	NA	0.25	4.36	0.10	0.01
4.D - Wastewater Treatment and Discharge		2.72	0.13	NA	NA	NA	NA	NA	NO	NO	0.00	NO
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	62.56	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	62.56	0.00	0.00	NA	NA	NA	NA	NA				
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.5.c - Multilateral Operations	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Note: NO = Not occurring, NA = Not Applicable, NE = Not Estimated

**CO_2 net emissions (emission minus removals)*

Table 111. Detailed results for 2018

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	**Net CO2***	**CH4**	**N2O**	**HFCs**	**PFCs**	**SF6**	**Other halogenated gases with CO2 equivalent conversion factors**	**Other halogenated gases without CO2 equivalent conversion factors**	**NOx**	**CO**	**NMVOCs**	**SO2**
Total National Emissions and Removals	5857.78	65.43	3.19	198.42	NA, NO	NA, NO	NA, NO	NA, NO	28.04	71.98	19.81	57.94
1 - Energy	7158.73	8.42	0.20	NA	NA	NA	NA	NA	26.52	57.67	13.21	57.63
1.A - Fuel Combustion Activities	7154.71	3.07	0.20	NA	NA	NA	NA	NA	25.52	53.17	7.93	57.62
1.A.1 - Energy Industries	3823.82	0.04	0.05	NA	NA	NA	NA	NA	8.28	0.54	0.06	51.89
1.A.2 - Manufacturing Industries and Construction	935.37	0.07	0.01	NA	NA	NA	NA	NA	3.20	5.86	0.75	5.37
1.A.3 - Transport	2127.81	0.56	0.11	NA	NA	NA	NA	NA	12.20	16.07	2.43	NE

1.A.4 - Other Sectors	75.66	2.30	0.03	NA	NA	NA	NA	NA	0.57	30.41	4.57	0.21
1.A.5 - Non-Specified	192.04	0.09	0.00	NA	NA	NA	NA	NA	1.27	0.30	0.12	0.14
1.B - Fugitive emissions from fuels	4.02	5.35	NA	NA	NA	NA	NA	NA	1.00	4.50	5.28	0.01
1.B.1 - Solid Fuels	4.02	5.35	NA	NA	NA	NA	NA	NA	NA	NA	4.00	NA
1.B.2 - Oil and Natural Gas	0.00	0.00	NA	NA	NA	NA	NA	NA	1.00	4.50	1.29	0.01
1.B.3 - Other emissions from Energy Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.2 - Injection and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.3 - Other	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2 - Industrial Processes and Product Use	452.78	0.00	NA, NO	198.42	NA, NO	NA, NO	NA, NO	NA, NO	0.91	1.48	0.03	0.30
2.A - Mineral Industry	381.83	NA, NO	NA, NO	NA	NA	NA	NA	NA	0.87	1.02	0.01	0.26
2.A.1 - Cement production	376.77	NA	NA	NA	NA	NA	NA	NA	0.86	1.01	0.01	0.26
2.A.2 - Lime production	4.03	NA	NA	NA	NA	NA	NA	NA	0.01	0.01	NO	0.00
2.A.3 - Glass Production	0.05	NA	NA	NA	NA	NA	NA	NA	0.00	NO	NO	0.00
2.A.4 - Other Process Uses of Carbonates	0.98	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B - Chemical Industry	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.B.1 - Ammonia Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.2 - Nitric Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.3 - Adipic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.7 - Soda Ash Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.9 - Fluorochemical Production	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	70.95	0.00	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.04	0.46	0.01	0.04
2.C.1 - Iron and Steel Production	24.12		NA	NA	NA	NA	NA	NA	0.04	0.46	0.01	0.02
2.C.2 - Ferroalloys Production	41.33	0.00	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.3 - Aluminium production	NO	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO
2.C.5 - Lead Production	5.50	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.02
2.C.6 - Zinc Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NE, NA, NO	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.1 - Lubricant Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.3 - Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.E - Electronics Industry	NA, NO	NA, NO	NA, NO	NA, NO	NO	NA, NO	NA, NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display	NA	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	198.42	NA	NA	NA	NO	NO	NO	NO	NO

2.F.1 - Refrigeration and Air Conditioning	NA	NA	NA	198.42	NA	NA	NA	NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents	NA	NA	NA	NE	NA	NA	NA	NO	NO	NO	NO	NO
2.F.3 - Fire Protection	NA	NA	NA	NE	NE	NA	NA	NO	NO	NO	NO	NO
2.F.4 - Aerosols	NA	NA	NA	NO	NA	NA	NA	NO	NO	NO	NO	NO
2.F.5 - Solvents	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.F.6 - Other Applications (please specify)	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NA, NO	NA, NO	NA, NE, NO	NA, NO	NE, NA, NO	NE, NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.G.1 - Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses	NA	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NA, NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.3 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-1760.34	34.13	2.85	NA	NA	NA	NA	NA	0.36	8.47	5.28	NO
3.A - Livestock		33.53	0.68	NA	NA	NA	NA	NA	0.08	NO	4.44	NO
3.A.1 - Enteric Fermentation	NA	29.62	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.A.2 - Manure Management	NA	3.90	0.68	NA	NA	NA	NA	NA	0.08	NO	4.44	NO
3.B - Land	-1761.16	NA	NA, NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.1 - Forest land	-2255.39	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.2 - Cropland	265.94	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.3 - Grassland	103.80	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.4 - Wetlands	NE	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.5 - Settlements	6.77	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.6 - Other Land	117.72	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	2.57	0.60	2.17	NA	NA	NA	NA	NA	0.28	8.47	0.85	NO
3.C.1 - Emissions from biomass burning	NA	NE	NE	NA	NA	NA	NA	NA	0.28	8.47	0.85	NO
3.C.2 - Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.3 - Urea application	2.57	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils	NA	NA	1.39	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	0.47	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	0.31	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.7 - Rice cultivation	NA	0.60	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.8 - Other (please specify)	NA	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D - Other	-1.75	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-1.75	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4 - Waste	6.60	22.88	0.14	NA	NA	NA	NA	NA	0.25	4.36	1.30	0.01
4.A - Solid Waste Disposal	NA	19.65	NA	NA	NA	NA	NA	NA	NO	NO	1.20	NO
4.B - Biological Treatment of Solid Waste	NA	0.01	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	6.60	0.51	0.01	NA	NA	NA	NA	NA	0.25	4.36	0.10	0.01
4.D - Wastewater Treatment and Discharge		2.71	0.13	NA	NA	NA	NA	NA	NO	NO	0.00	NO
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Memo Items (5)													
International Bunkers	70.57	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	
1.A.3.a.i - International Aviation (International Bunkers)	70.57	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.5.c - Multilateral Operations	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Note: NO = Not occurring, NA = Not Applicable, NE = Not Estimated

**CO_2 net emissions (emission minus removals)*

Table 112. Detailed results for 2019

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
Categories	**Net CO2***	**CH4**	**N2O**	**HFCs**	**PFCs**	**SF6**	**Other halogenated gases with CO2 equivalent conversion factors**	**Other halogenated gases without CO2 equivalent conversion factors**	**NOx**	**CO**	**NMVOCs**	**SO2**
Total National Emissions and Removals	10332.55	61.84	2.50	278.88	NA, NO	NA, NO	NA, NO	NA, NO	33.90	116.45	25.64	70.64
1 - Energy	8204.72	9.13	0.23	NA	NA	NA	NA	NA	31.06	63.58	15.09	70.32
1.A - Fuel Combustion Activities	8200.31	3.26	0.23	NA	NA	NA	NA	NA	28.96	54.11	8.00	70.30
1.A.1 - Energy Industries	4569.54	0.05	0.06	NA	NA	NA	NA	NA	10.11	0.66	0.08	63.43
1.A.2 - Manufacturing Industries and Construction	1065.58	0.08	0.01	NA	NA	NA	NA	NA	3.47	7.05	0.85	6.54
1.A.3 - Transport	2297.86	0.84	0.13	NA	NA	NA	NA	NA	13.53	16.99	2.57	NE
1.A.4 - Other Sectors	74.34	2.21	0.03	NA	NA	NA	NA	NA	0.56	29.13	4.38	0.20
1.A.5 - Non-Specified	192.98	0.08	0.00	NA	NA	NA	NA	NA	1.29	0.29	0.12	0.14
1.B - Fugitive emissions from fuels	4.41	5.87	NA	NA	NA	NA	NA	NA	2.10	9.47	7.09	0.02
1.B.1 - Solid Fuels	4.41	5.87	NA	NA	NA	NA	NA	NA	NA	NA	4.38	NA
1.B.2 - Oil and Natural Gas	0.00	0.00	NA	NA	NA	NA	NA	NA	2.10	9.47	2.71	0.02
1.B.3 - Other emissions from Energy Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.2 - Injection and Storage	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.C.3 - Other	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2 - Industrial Processes and Product Use	484.12	0.00	NA, NO	278.88	NA, NO	NA, NO	NA, NO	NA, NO	0.94	1.48	0.02	0.31
2.A - Mineral Industry	395.17	NA, NO	NA, NO	NA	NA	NA	NA	NA	0.90	1.07	0.01	0.27
2.A.1 - Cement production	376.89	NA	NA	NA	NA	NA	NA	NA	0.86	1.01	0.01	0.26
2.A.2 - Lime production	17.25	NA	NA	NA	NA	NA	NA	NA	0.04	0.06	NO	0.01
2.A.3 - Glass Production	0.07	NA	NA	NA	NA	NA	NA	NA	0.00	NO	NO	0.00
2.A.4 - Other Process Uses of Carbonates	0.96	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B - Chemical Industry	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.B.1 - Ammonia Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.2 - Nitric Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.3 - Adipic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	NA	NA	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO

2.B.7 - Soda Ash Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.8 - Petrochemical and Carbon Black Production	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.B.9 - Fluorochemical Production	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	88.95	0.00	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	0.03	0.41	0.01	0.04
2.C.1 - Iron and Steel Production	21.71	NO	NA	NA	NA	NA	NA	NA	0.03	0.41	0.01	0.01
2.C.2 - Ferroalloys Production	61.54	0.00	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.3 - Aluminium production	NO	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.C.4 - Magnesium production	NO	NA	NA	NA	NA	NO	NA	NO	NO	NO	NO	NO
2.C.5 - Lead Production	5.70	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	0.02
2.C.6 - Zinc Production	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NE, NA, NO	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.1 - Lubricant Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NE	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.3 - Solvent Use	NA	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.E - Electronics Industry	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display	NA	NA	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid	NA	NA	NA	NA	NO	NA	NA	NO	NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NA	NA	NA	278.88	NA, NE, NO	NA	NA	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning	NA	NA	NA	278.88	NA	NA	NA	NO	NO	NO	NO	NO
2.F.2 - Foam Blowing Agents	NA	NA	NA	NE	NA	NA	NA	NO	NO	NO	NO	NO
2.F.3 - Fire Protection	NA	NA	NA	NE	NE	NA	NA	NO	NO	NO	NO	NO
2.F.4 - Aerosols	NA	NA	NA	NO	NA	NA	NA	NO	NO	NO	NO	NO
2.F.5 - Solvents	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.F.6 - Other Applications (please specify)	NA	NA	NA	NO	NO	NA	NA	NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NA, NO	NA, NO	NA, NE, NO	NA, NO	NE, NA, NO	NE, NA, NO	NA, NO	NA, NO	NO	NO	NO	NO
2.G.1 - Electrical Equipment	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses	NA	NA	NA	NA	NE	NE	NA	NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses	NA	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.1 - Pulp and Paper Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.2 - Food and Beverages Industry	NO	NO	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
2.H.3 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	1637.07	29.28	2.13	NA	NA	NA	NA	NA	1.65	47.03	9.14	NO
3.A - Livestock		28.62	0.36	NA	NA	NA	NA	NA	0.08	NO	4.44	NO
3.A.1 - Enteric Fermentation	NA	25.08	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.A.2 - Manure Management	NA	3.54	0.36	NA	NA	NA	NA	NA	0.08	NO	4.44	NO
3.B - Land	1634.36	NA	NA, NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.1 - Forest land	1059.59	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.2 - Cropland	198.65	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.3 - Grassland	195.94	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO

3.B.4 - Wetlands	NE	NA	NE	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.5 - Settlements	16.78	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.B.6 - Other Land	163.40	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	2.71	0.66	1.76	NA	NA	NA	NA	NA	1.57	47.03	4.70	NO
3.C.1 - Emissions from biomass burning	NA	NE	NE	NA	NA	NA	NA	NA	1.57	47.03	4.70	NO
3.C.2 - Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.3 - Urea application	2.71	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils	NA	NA	1.15	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.5 - Indirect N2O Emissions from managed soils	NA	NA	0.38	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management	NA	NA	0.23	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.7 - Rice cultivation	NA	0.66	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.C.8 - Other (please specify)	NA	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D - Other	NO	NA, NO	NA, NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	NO	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
4 - Waste	6.64	23.43	0.14	NA	NA	NA	NA	NA	0.25	4.36	1.38	0.01
4.A - Solid Waste Disposal	NA	20.19	NA	NA	NA	NA	NA	NA	NO	NO	1.29	NO
4.B - Biological Treatment of Solid Waste	NA	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
4.C - Incineration and Open Burning of Waste	6.64	0.51	0.01	NA	NA	NA	NA	NA	0.25	4.36	0.10	0.01
4.D - Wastewater Treatment and Discharge		2.73	0.13	NA	NA	NA	NA	NA	NO	NO	0.00	NO
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
Memo Items (5)												
International Bunkers	83.68	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	83.68	0.00	0.00	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO
1.A.5.c - Multilateral Operations	NO	NO	NO	NA	NA	NA	NA	NA	NO	NO	NO	NO

Note: NO = Not occurring, NA = Not Applicable, NE = Not Estimated

**CO_2 net emissions (emission minus removals)*

Appendix III Detailed tables of the key category analysis

Table 113 and Table 114 present in details the level assessment of key categories in 1990 and 2019, respectively, where:

- **|Ex,t|** is absolute value of emission or removal estimate of source or sink category *x* in year *t*
- **Lx,t** is level assessment for source or sink *x* in latest inventory year (year *t*).

Table 115 gives an overview of the trend assessment relating to 1990 and 2019, where:

- **Ex,t** and **Ex,0** is real values of estimates of source or sink category *x* in years *t* and 0, respectively
- **Tx,t** is trend assessment of source or sink category *x* in year *t* as compared to the base year (year 0)

Table 113. Level assessment of key categories in 1990

IPCC Category code	IPCC Category	GHG	1990 Ex,t (Gg CO2 Eq)	|Ex,t| (Gg CO2 Eq)	Lx,t	Cumulative Total of Lx,t
1.A.1	Energy Industries - Solid Fuels	CO2	5689.78	5689.78	0.42	0.42
3.B.1.a	Forest land Remaining Forest land	CO2	-1654.78	1654.78	0.12	0.54
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CO2	1197.05	1197.05	0.09	0.62
1.A.3.b	Road Transportation	CO2	749.67	749.67	0.05	0.68
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CO2	566.33	566.33	0.04	0.72
1.A.4	Other Sectors - Liquid Fuels	CO2	545.31	545.31	0.04	0.76
3.A.1	Enteric Fermentation	CH4	492.32	492.32	0.04	0.80
1.A.1	Energy Industries - Liquid Fuels	CO2	481.55	481.55	0.04	0.83
2.A.1	Cement production	CO2	293.75	293.75	0.02	0.85
4.A	Solid Waste Disposal	CH4	265.61	265.61	0.02	0.87
2.C.2	Ferroalloys Production	CO2	264.32	264.32	0.02	0.89
1.B.1	Fugitive emissions from fuels - Solid Fuels	CH4	186.96	186.96	0.01	0.91
2.C.6	Zinc Production	CO2	186.23	186.23	0.01	0.92
3.C.4	Direct N2O Emissions from managed soils	N2O	160.49	160.49	0.01	0.93
3.B.6.b	Land Converted to Other land	CO2	120.50	120.50	0.01	0.94
4.D	Wastewater Treatment and Discharge	CH4	99.25	99.25	0.01	0.95

Table 114. Level assessment of key categories in 2019

IPCC Category code	IPCC Category	GHG	2019 Ex,t (Gg CO2 Eq)	|Ex,t| (Gg CO2 Eq)	Lx,t	Cumulative Total of Lx,t
1.A.1	Energy Industries - Solid Fuels	CO2	4050.50	4050.50	0.31	0.31
1.A.3.b	Road Transportation	CO2	2289.53	2289.53	0.18	0.49
3.B.1.a	Forest land Remaining Forest land	CO2	1135.04	1135.04	0.09	0.57
3.A.1	Enteric Fermentation	CH4	627.07	627.07	0.05	0.62
4.A	Solid Waste Disposal	CH4	504.85	504.85	0.04	0.66
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CO2	504.08	504.08	0.04	0.70
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CO2	479.71	479.71	0.04	0.73
1.A.1	Energy Industries - Gaseous Fuels	CO2	461.10	461.10	0.04	0.77
2.A.1	Cement production	CO2	376.89	376.89	0.03	0.80
3.C.4	Direct N2O Emissions from managed soils	N2O	343.27	343.27	0.03	0.83
2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	278.88	278.88	0.02	0.85
3.B.2.b	Land Converted to Cropland	CO2	198.65	198.65	0.02	0.86
3.B.3.b	Land Converted to Grassland	CO2	195.94	195.94	0.02	0.88
1.A.5	Non-Specified - Liquid Fuels	CO2	177.39	177.39	0.01	0.89
3.B.6.b	Land Converted to Other land	CO2	163.40	163.40	0.01	0.90
1.B.1	Fugitive emissions from fuels - Solid Fuels	CH4	146.80	146.80	0.01	0.91
3.C.5	Indirect N2O Emissions from managed soils	N2O	114.28	114.28	0.01	0.92
3.A.2	Manure Management	N2O	108.53	108.53	0.01	0.93
3.A.2	Manure Management	CH4	88.40	88.40	0.01	0.94
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CO2	81.78	81.78	0.01	0.94
3.B.1.b	Land Converted to Forest land	CO2	-75.45	75.45	0.01	0.95

Table 115. Trend assessment of key categories (1990, 2019)

IPCC Category code	IPCC Category	GHG	1990 Year Estimate Ex0 (Gg CO2 eq)	2019 Year Estimate Ext (Gg CO2 eq)	Trend Assessment (Txt)	% Contribution to Trend	Cumulative Total of Contrib. to Trend
1.A.1	Energy Industries - Solid Fuels	CO2	5689.7803	4050.4972	0.2283	0.2565	0.2565
3.B.1.a	Forest land Remaining Forest land	CO2	-1654.7831	1135.0434	0.1723	0.1936	0.4501
1.A.3.b	Road Transportation	CO2	749.6666	2289.5336	0.0982	0.1104	0.5604
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CO2	1197.0549	479.7074	0.0752	0.0845	0.6450
1.A.4	Other Sectors - Liquid Fuels	CO2	545.3109	68.9283	0.0452	0.0508	0.6958
1.A.1	Energy Industries - Liquid Fuels	CO2	481.5518	57.9480	0.0401	0.0451	0.7409
1.A.1	Energy Industries - Gaseous Fuels	CO2	0.0000	461.0986	0.0337	0.0379	0.7787
2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	0.0000	278.8790	0.0204	0.0229	0.8016
2.C.2	Ferroalloys Production	CO2	264.3158	61.5370	0.0199	0.0223	0.8239
2.C.6	Zinc Production	CO2	186.2330	0.0000	0.0172	0.0193	0.8432
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CO2	566.3343	504.0839	0.0153	0.0172	0.8605
3.B.3.b	Land Converted to Grassland	CO2	-3.4595	195.9379	0.0145	0.0163	0.8767
1.A.5	Non-Specified - Liquid Fuels	CO2	0.0000	177.3895	0.0130	0.0146	0.8913
4.A	Solid Waste Disposal	CH4	265.6058	504.8538	0.0124	0.0140	0.9053
3.C.4	Direct N2O Emissions from managed soils	N2O	160.4862	343.2678	0.0103	0.0116	0.9168
3.B.2.b	Land Converted to Cropland	CO2	52.2322	198.6515	0.0097	0.0109	0.9277
2.C.3	Aluminium production	PFCs	91.6548	0.0000	0.0084	0.0095	0.9372
1.B.1	Solid Fuels	CH4	186.9622	146.7962	0.0065	0.0073	0.9445
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CO2	0.0000	81.7844	0.0060	0.0067	0.9512

Appendix IV Detailed tables of the uncertainty analysis

Table 116. Base year for assessment of uncertainty in trend: 1990, Year T: 2017

2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2 equivalent)	Year T emissions or removals (Gg CO2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)
1.A - Fuel Combustion Activities												
1.A.1.a.i - Electricity Generation - Liquid Fuels	CO2	3.13	76.35	5.00	5.00	7.07	0.00	0.01	0.01	0.03	0.05	0.00
1.A.1.a.i - Electricity Generation - Liquid Fuels	CH4	0.00	0.07	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.i - Electricity Generation - Liquid Fuels	N2O	0.01	0.17	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.i - Electricity Generation - Solid Fuels	CO2	5610.05	3882.98	5.00	5.00	7.07	4.71	0.26	0.36	1.30	2.58	8.33
1.A.1.a.i - Electricity Generation - Solid Fuels	CH4	1.26	0.90	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.i - Electricity Generation - Solid Fuels	N2O	22.50	16.09	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	CO2	306.44	0.00	5.00	5.00	7.07	0.00	0.03	0.00	0.17	0.00	0.03
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	CH4	0.30	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	N2O	0.71	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	CO2	79.73	0.00	5.00	5.00	7.07	0.00	0.01	0.00	0.04	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	CH4	0.02	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	N2O	0.35	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Gaseous Fuels	CO2	0.00	357.09	5.00	5.00	7.07	0.04	0.03	0.03	0.17	0.24	0.08
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Gaseous Fuels	CH4	0.00	0.16	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Gaseous Fuels	N2O	0.00	0.19	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.iii - Heat Plants - Liquid Fuels	CO2	171.98	0.00	5.00	5.00	7.07	0.00	0.02	0.00	0.10	0.00	0.01
1.A.1.a.iii - Heat Plants - Liquid Fuels	CH4	0.17	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.iii - Heat Plants - Liquid Fuels	N2O	0.40	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.iii - Heat Plants - Gaseous Fuels	CO2	0.00	61.33	5.00	5.00	7.07	0.00	0.01	0.01	0.03	0.04	0.00
1.A.1.a.iii - Heat Plants - Gaseous Fuels	CH4	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.iii - Heat Plants - Gaseous Fuels	N2O	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.1.c.ii - Other Energy Industries - Liquid Fuels	CO2	0.00	5.14	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Liquid Fuels	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Liquid Fuels	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Biomass	CO2	0.00	0.11	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Liquid Fuels	CO2	346.16	157.00	5.00	5.00	7.07	0.01	0.02	0.01	0.12	0.10	0.03
1.A.2.a - Iron and Steel - Liquid Fuels	CH4	0.30	0.13	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Liquid Fuels	N2O	0.70	0.32	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Solid Fuels	CO2	272.72	156.62	5.00	5.00	7.07	0.01	0.02	0.01	0.08	0.10	0.02
1.A.2.a - Iron and Steel - Solid Fuels	CH4	0.68	0.41	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Solid Fuels	N2O	1.22	0.73	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Gaseous Fuels	CO2	0.00	57.62	5.00	5.00	7.07	0.00	0.01	0.01	0.03	0.04	0.00
1.A.2.a - Iron and Steel - Gaseous Fuels	CH4	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Gaseous Fuels	N2O	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Biomass	CO2	0.00	0.17	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	CO2	65.25	3.55	5.00	5.00	7.07	0.00	0.01	0.00	0.03	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	CH4	0.06	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	N2O	0.15	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Solid Fuels	CO2	271.19	0.00	5.00	5.00	7.07	0.00	0.03	0.00	0.15	0.00	0.02
1.A.2.b - Non-Ferrous Metals - Solid Fuels	CH4	0.72	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Solid Fuels	N2O	1.28	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Liquid Fuels	CO2	77.52	6.48	5.00	5.00	7.07	0.00	0.01	0.00	0.04	0.00	0.00
1.A.2.c - Chemicals - Liquid Fuels	CH4	0.08	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Liquid Fuels	N2O	0.18	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Gaseous Fuels	CO2	0.00	2.32	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Biomass	CO2	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CO2	0.00	1.75	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.2.d - Pulp, Paper and Print - Solid Fuels	CO2	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Solid Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Solid Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Gaseous Fuels	CO2	0.00	0.90	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Biomass	CO2	0.00	0.32	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CO2	46.92	50.48	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.03	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CH4	0.05	0.05	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	N2O	0.11	0.11	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CO2	6.90	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CH4	0.02	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	N2O	0.03	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	CO2	0.00	13.27	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	CO2	0.00	20.72	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	CH4	0.00	0.14	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	N2O	0.00	0.22	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	CO2	132.98	67.69	5.00	5.00	7.07	0.00	0.01	0.01	0.04	0.04	0.00
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	CH4	0.10	0.05	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	N2O	0.21	0.12	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Solid Fuels	CO2	0.00	224.25	5.00	5.00	7.07	0.02	0.02	0.02	0.11	0.15	0.03
1.A.2.f - Non-Metallic Minerals - Solid Fuels	CH4	0.00	0.58	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Solid Fuels	N2O	0.00	1.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Gaseous Fuels	CO2	0.00	3.34	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Biomass	CO2	0.00	0.05	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Liquid Fuels	CO2	5.81	9.92	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.2.h - Machinery - Liquid Fuels	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Liquid Fuels	N2O	0.00	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.2.h - Machinery - Solid Fuels	CO2	3.45	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Solid Fuels	CH4	0.01	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Solid Fuels	N2O	0.02	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Gaseous Fuels	CO2	0.00	7.68	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.2.h - Machinery - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Biomass	CO2	0.00	1.16	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Biomass	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Biomass	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	CO2	43.77	42.08	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.03	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	CH4	0.04	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	N2O	0.10	0.10	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Biomass	CO2	0.00	0.06	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	CO2	9.29	15.93	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	CH4	0.01	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	N2O	0.02	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Solid Fuels	CO2	10.35	3.29	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Solid Fuels	CH4	0.03	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Solid Fuels	N2O	0.05	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Gaseous Fuels	CO2	0.00	0.16	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Biomass	CO2	0.00	2.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Biomass	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Biomass	N2O	0.00	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Liquid Fuels	CO2	469.36	46.01	5.00	5.00	7.07	0.00	0.05	0.00	0.24	0.03	0.06
1.A.2.m - Non-specified Industry - Liquid Fuels	CH4	0.46	0.05	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Liquid Fuels	N2O	1.09	0.11	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	CO2	1.72	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	N2O	0.01	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Gaseous Fuels	CO2	0.00	0.60	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.2.m - Non-specified Industry - Biomass	CO2	0.00	3.80	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Biomass	CH4	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Biomass	N2O	0.00	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CO2	15.77	62.56	5.00	5.00	7.07	0.00	0.00	0.01	0.02	0.04	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	N2O	0.13	0.52	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CO2	0.00	0.26	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CO2	555.43	1284.16	5.00	5.00	7.07	0.52	0.06	0.12	0.29	0.85	0.81
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CH4	0.77	7.74	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	N2O	9.17	17.61	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CO2	28.64	48.47	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.03	0.00
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CH4	0.31	0.59	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	N2O	0.40	0.49	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CO2	56.61	179.15	5.00	5.00	7.07	0.01	0.01	0.02	0.05	0.12	0.02
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CH4	0.42	0.44	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	N2O	0.83	2.77	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CO2	4.44	12.62	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CH4	0.03	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	N2O	0.07	0.20	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CO2	96.62	597.29	5.00	5.00	7.07	0.11	0.05	0.06	0.23	0.40	0.21
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CH4	0.15	0.80	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N2O	1.51	9.36	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Gaseous Fuels	CO2	0.00	0.49	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Gaseous Fuels	CH4	0.00	1.32	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Gaseous Fuels	N2O	0.00	0.49	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	CO2	2.98	2.32	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	CH4	0.04	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	N2O	0.04	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	CO2	4.45	2.95	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	CH4	0.05	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	N2O	0.06	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.c - Railways - Liquid Fuels	CO2	22.30	6.31	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.00	0.00
1.A.3.c - Railways - Liquid Fuels	CH4	0.03	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.c - Railways - Liquid Fuels	N2O	2.57	0.73	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.4.b - Residential - Liquid Fuels	CO2	404.05	33.23	5.00	5.00	7.07	0.00	0.04	0.00	0.21	0.02	0.04
1.A.4.b - Residential - Liquid Fuels	CH4	1.34	0.08	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	N2O	0.96	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Solid Fuels	CO2	21.09	4.12	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.00	0.00
1.A.4.b - Residential - Solid Fuels	CH4	1.57	0.31	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Solid Fuels	N2O	0.09	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Gaseous Fuels	CO2	0.00	0.35	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Biomass	CO2	823.87	1007.32	5.00	5.00	7.07	0.32	0.00	0.09	0.01	0.67	0.45
1.A.4.b - Residential - Biomass	CH4	55.17	67.45	5.00	5.00	7.07	0.00	0.00	0.01	0.00	0.04	0.00
1.A.4.b - Residential - Biomass	N2O	8.77	10.72	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.4.c.i - Stationary - Liquid Fuels	CO2	141.26	38.11	5.00	5.00	7.07	0.00	0.01	0.00	0.06	0.03	0.00
1.A.4.c.i - Stationary - Liquid Fuels	CH4	0.47	0.13	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Liquid Fuels	N2O	0.34	0.09	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Solid Fuels	CO2	0.00	3.09	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Solid Fuels	CH4	0.00	0.23	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Solid Fuels	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Biomass	CO2	0.00	6.27	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Biomass	CH4	0.00	0.42	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Biomass	N2O	0.00	0.07	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Liquid Fuels	CO2	0.00	188.96	5.00	5.00	7.07	0.01	0.02	0.02	0.09	0.13	0.02
1.A.5.a - Stationary - Liquid Fuels	CH4	0.00	0.61	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Liquid Fuels	N2O	0.00	0.41	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Solid Fuels	CO2	22.84	4.03	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.00	0.00
1.A.5.a - Stationary - Solid Fuels	CH4	0.06	0.30	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Solid Fuels	N2O	0.10	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Gaseous Fuels	CO2	0.00	14.65	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.5.a - Stationary - Gaseous Fuels	CH4	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Gaseous Fuels	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Biomass	CO2	0.00	21.25	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.5.a - Stationary - Biomass	CH4	0.00	1.42	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Biomass	N2O	0.00	0.23	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.vi - Urea-based catalysts	CO2	0.49	1.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1 - Fugitive Emissions from Fuels - Solid Fuels												
1.B.1.a.i.1 - Mining	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1.B.1.a.i.1 - Mining	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.2 - Post-mining seam gas emissions	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.2 - Post-mining seam gas emissions	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.3 - Abandoned underground mines	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.1 - Mining	CO2	5.62	4.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.1 - Mining	CH4	175.28	127.98	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
1.B.1.a.ii.2 - Post-mining seam gas emissions	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.2 - Post-mining seam gas emissions	CH4	11.69	8.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2 - Fugitive Emissions from Fuels - Oil and Natural Gas												
1.B.2.a.iii.1 - Exploration	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.1 - Exploration	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.1 - Exploration	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.4 - Refining	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.4 - Refining	CH4	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.4 - Refining	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.b.i - Venting	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.b.i - Venting	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.b.i - Venting	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C - CO2 Transport Injection and Storage												
1.C.1.a - Pipelines	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1.b - Ships	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1.c - Other (please specify)	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.2.a - Injection	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.2.b - Storage	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.3 - Other	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A - Mineral Industry												
2.A.1 - Cement production	CO2	293.75	374.41	10.00	3.00	10.44	0.10	0.00	0.04	0.01	0.50	0.25
2.A.2 - Lime production	CO2	33.72	0.83	15.00	3.00	15.30	0.00	0.00	0.00	0.01	0.00	0.00
2.A.3 - Glass Production	CO2	0.33	0.05	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.a - Ceramics	CO2	2.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.b - Other Uses of Soda Ash	CO2	2.68	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.c - Non Metallurgical Magnesia Production	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.d - Other (please specify)	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B - Chemical Industry												

2.B.1 - Ammonia Production	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.2 - Nitric Acid Production	N2O	0.00	0.00	2.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.3 - Adipic Acid Production	N2O	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	N2O	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.5 - Carbide Production	CO2	0.00	0.00	5.00	10.00	11.18	0.00	0.00	0.00	0.00	0.00	0.00
2.B.5 - Carbide Production	CH4	0.00	0.00	5.00	10.00	11.18	0.00	0.00	0.00	0.00	0.00	0.00
2.B.6 - Titanium Dioxide Production	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.7 - Soda Ash Production	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.a - Methanol	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.a - Methanol	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.b - Ethylene	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.b - Ethylene	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.d - Ethylene Oxide	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.d - Ethylene Oxide	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.e - Acrylonitrile	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.e - Acrylonitrile	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.f - Carbon Black	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.f - Carbon Black	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	(CF3)2CFOCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3OCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHClOCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2CF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2CH2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2 CF2OCH2CH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C4F9OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C4F9OC2H5	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2OCF2OC2F4OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00

2.B.9.a - By-product emissions	CHF2OCF2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2OCF2CF2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFOCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFOCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2OCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CH2OCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2OCF2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2OCH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2OCH2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFCF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2CF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2OCH2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2CH2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	(CF3)2CHOCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	(CF3)2CHOCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2F2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFCHFCF2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CH2F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCF2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCH2F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3CH2F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCF2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CHFCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2CF2CH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF4	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C2F6	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00

2.B.9.a - By-product emissions	C3F8	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C4F10	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	c-C4F8	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C5F12	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C6F14	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	SF6	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	NF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2Br2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHCl3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3Cl	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2Cl2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2CH2OH	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	(CF3)2CHOH	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	-(CF2)4CH(OH)-	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3 I	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2OCH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3OCF(CF3)CF2O CF2OCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHBrF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	SF5CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C - Metal Industry												
2.C.1 - Iron and Steel Production	CO2	24.75	24.78	10.00	5.00	11.18	0.00	0.00	0.00	0.00	0.03	0.00
2.C.1 - Iron and Steel Production	CH4	0.00	0.00	10.00	5.00	11.18	0.00	0.00	0.00	0.00	0.00	0.00
2.C.2 - Ferroalloys Production	CO2	264.32	28.90	5.00	5.00	7.07	0.00	0.03	0.00	0.13	0.02	0.02
2.C.2 - Ferroalloys Production	CH4	1.32	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.C.3 - Aluminium production	CO2	8.78	0.00	2.00	5.00	5.39	0.00	0.00	0.00	0.00	0.00	0.00
2.C.3 - Aluminium production	CF4	64.88	0.00	2.00	5.00	5.39	0.00	0.01	0.00	0.04	0.00	0.00
2.C.3 - Aluminium production	C2F6	26.78	0.00	2.00	5.00	5.39	0.00	0.00	0.00	0.01	0.00	0.00
2.C.4 - Magnesium production	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.4 - Magnesium production	SF6	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.5 - Lead Production	CO2	22.09	3.89	10.00	5.00	11.18	0.00	0.00	0.00	0.01	0.01	0.00
2.C.6 - Zinc Production	CO2	186.23	0.00	10.00	5.00	11.18	0.00	0.02	0.00	0.10	0.00	0.01
2.D - Non-Energy Products from Fuels and Solvent Use												
2.D.1 - Lubricant Use	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D.2 - Paraffin Wax Use	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E - Electronics Industry												
2.E.1 - Integrated Circuit or Semiconductor	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00

2.E.1 - Integrated Circuit or Semiconductor	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	CHF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	NF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display	NF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.3 - Photovoltaics	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.3 - Photovoltaics	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.4 - Heat Transfer Fluid	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances												
2.F.1.a - Refrigeration and Stationary Air Conditioning	CHF3	0.00	0.06	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH2F2	0.00	1.53	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CHF2CF3	0.00	35.81	5.00	5.00	7.07	0.00	0.00	0.00	0.02	0.02	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH2FCF3	0.00	64.94	5.00	5.00	7.07	0.00	0.01	0.01	0.03	0.04	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH3CHF2	0.00	1.86	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CF3CH3	0.00	41.34	5.00	5.00	7.07	0.00	0.00	0.00	0.02	0.03	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CF3CHFCF3	0.00	8.33	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
2.F.4 - Aerosols	CH2FCF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CH3CHF2	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CF3CHFCF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CF3CH2CF2CH3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CF3CHFCHFCF2CF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CHF2CH2CF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.5 - Solvents	CF3CH2CF2CH3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.5 - Solvents	CF3CHFCHFCF2CF3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.5 - Solvents	C6F14	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2F2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH3F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CHFCHFCF2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CHF2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH3CHF2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00

2.F.6 - Other Applications (please specify)	CHF2CH2F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CH3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CHFCF3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CH2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF2CHF2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCH2F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH3CH2F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CHFCF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CH2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CH2CF2CH3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C2F6	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C4F10	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	c-C4F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C5F12	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G - Electrical Equipment												
2.G.1.a - Manufacture of Electrical Equipment	SF6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	CF4	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C2F6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C3F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C4F10	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	c-C4F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C5F12	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C6F14	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	SF6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	CF4	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C2F6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C3F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C4F10	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	c-C4F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C5F12	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C6F14	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	SF6	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00

2.G.1.c - Disposal of Electrical Equipment	CF4	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C2F6	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C3F8	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C4F10	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	c-C4F8	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C5F12	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C6F14	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C4F10	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	c-C4F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C5F12	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C4F10	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	c-C4F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C5F12	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	SF6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	CF4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C2F6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C3F8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C4F10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	c-C4F8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C5F12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C6F14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.a - Medical Applications	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.b - Propellant for pressure and aerosol products	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.c - Other (Please specify)	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other												
3.A - Livestock												

3.A.1.a.i - Dairy Cows	CH4	0.00	491.25	5.00	30.00	30.41	1.40	0.05	0.05	1.38	0.33	2.02
3.A.1.a.ii - Other Cattle	CH4	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.b - Buffalo	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.c - Sheep	CH4	287.14	90.57	5.00	30.00	30.41	0.05	0.02	0.01	0.71	0.06	0.50
3.A.1.d - Goats	CH4	0.00	12.59	5.00	30.00	30.41	0.00	0.00	0.00	0.04	0.01	0.00
3.A.1.e - Camels	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.f - Horses	CH4	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.g - Mules and Asses	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.h - Swine	CH4	0.00	9.93	5.00	30.00	30.41	0.00	0.00	0.00	0.03	0.01	0.00
3.A.1.j - Other (please specify)	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.a.i - Dairy cows	CH4	0.00	34.96	5.00	30.00	30.41	0.01	0.00	0.00	0.10	0.02	0.01
3.A.2.a.i - Dairy cows	N2O	0.00	17.06	5.00	30.00	30.41	0.00	0.00	0.00	0.05	0.01	0.00
3.A.2.a.ii - Other cattle	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.a.ii - Other cattle	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.b - Buffalo	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.b - Buffalo	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.c - Sheep	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.c - Sheep	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.d - Goats	CH4	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.d - Goats	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.e - Camels	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.e - Camels	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.f - Horses	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.f - Horses	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.g - Mules and Asses	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.g - Mules and Asses	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.h - Swine	CH4	26.78	8.20	5.00	30.00	30.41	0.00	0.00	0.00	0.07	0.01	0.00
3.A.2.h - Swine	N2O	3.37	0.74	5.00	30.00	30.41	0.00	0.00	0.00	0.01	0.00	0.00
3.A.2.i - Poultry	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.i - Poultry	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.j - Other (please specify)	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.j - Other (please specify)	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B - Land												
3.B.1.a - Forest land Remaining Forest land	CO2	-1654.78	1182.40	20.00	10.00	22.36	4.37	0.30	0.11	2.96	3.14	18.62
3.B.1.b.i - Cropland converted to Forest Land	CO2	-1.21	-17.00	20.00	10.00	22.36	0.00	0.00	0.00	0.01	0.05	0.00
3.B.1.b.ii - Grassland converted to Forest Land	CO2	-45.18	-22.75	20.00	10.00	22.36	0.00	0.00	0.00	0.03	0.06	0.00

3.B.1.b.iii - Wetlands converted to Forest Land	CO2	-0.06	-0.29	20.00	10.00	22.36	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1.b.iv - Settlements converted to Forest Land	CO2	0.00	0.00	20.00	10.00	22.36	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1.b.v - Other Land converted to Forest Land	CO2	-22.28	-9.15	20.00	10.00	22.36	0.00	0.00	0.00	0.02	0.02	0.00
3.B.2.a - Cropland Remaining Cropland	CO2	0.00	0.00	20.00	50.00	53.85	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.i - Forest Land converted to Cropland	CO2	44.48	105.89	10.00	50.00	50.99	0.18	0.00	0.01	0.25	0.14	0.08
3.B.2.b.ii - Grassland converted to Cropland	CO2	7.67	16.46	10.00	50.00	50.99	0.00	0.00	0.00	0.03	0.02	0.00
3.B.2.b.iii - Wetlands converted to Cropland	CO2	0.09	0.08	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.iv - Settlements converted to Cropland	CO2	0.00	0.20	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.v - Other Land converted to Cropland	CO2	4.00	0.17	10.00	50.00	50.99	0.00	0.00	0.00	0.02	0.00	0.00
3.B.3.a - Grassland Remaining Grassland	CO2	0.00	0.00	20.00	50.00	53.85	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.i - Forest Land converted to Grassland	CO2	11.46	32.84	10.00	50.00	50.99	0.02	0.00	0.00	0.09	0.04	0.01
3.B.3.b.ii - Cropland converted to Grassland	CO2	6.49	9.98	10.00	50.00	50.99	0.00	0.00	0.00	0.01	0.01	0.00
3.B.3.b.iii - Wetlands converted to Grassland	CO2	-0.24	-0.27	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.iv - Settlements converted to Grassland	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.v - Other Land converted to Grassland	CO2	-21.16	-15.83	10.00	50.00	50.99	0.00	0.00	0.00	0.04	0.02	0.00
3.B.4.a.i - Peatlands remaining peatlands	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4.a.i - Peatlands remaining peatlands	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4.b.i - Land converted for peat extraction	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4.b.ii - Land converted to flooded land	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.a - Settlements Remaining Settlements	CO2	0.00	0.00	20.00	50.00	53.85	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.b.i - Forest Land converted to Settlements	CO2	0.00	5.04	10.00	50.00	50.99	0.00	0.00	0.00	0.02	0.01	0.00
3.B.5.b.ii - Cropland converted to Settlements	CO2	3.62	0.80	10.00	50.00	50.99	0.00	0.00	0.00	0.02	0.00	0.00
3.B.5.b.iii - Grassland converted to Settlements	CO2	5.84	1.53	10.00	50.00	50.99	0.00	0.00	0.00	0.03	0.00	0.00
3.B.5.b.iv - Wetlands converted to Settlements	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.b.v - Other Land converted to Settlements	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.6.b.i - Forest Land converted to Other Land	CO2	70.86	40.72	10.00	50.00	50.99	0.03	0.00	0.00	0.20	0.05	0.04
3.B.6.b.ii - Cropland converted to Other Land	CO2	46.99	23.50	10.00	50.00	50.99	0.01	0.00	0.00	0.15	0.03	0.02
3.B.6.b.iii - Grassland converted to Other Land	CO2	2.65	7.16	10.00	50.00	50.99	0.00	0.00	0.00	0.02	0.01	0.00
3.B.6.b.iv - Wetlands converted to Other Land	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.6.b.v - Settlements converted to Other Land	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.C - Aggregate sources and non-CO2 emissions sources on land												
3.C.1.a - Biomass burning in forest lands	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.a - Biomass burning in forest lands	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.b - Biomass burning in croplands	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.b - Biomass burning in croplands	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.c - Biomass burning in grasslands	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.C.1.c - Biomass burning in grasslands	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.d - Biomass burning in all other land	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.d - Biomass burning in all other land	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.2 - Liming	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.3 - Urea application	CO2	3.74	2.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.4 - Direct N2O Emissions from managed soils	N2O	39.65	236.71	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00
3.C.5 - Indirect N2O Emissions from managed soils	N2O	13.57	67.51	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
3.C.6 - Indirect N2O Emissions from manure management	N2O	3.47	12.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.7 - Rice cultivation	CH4	29.17	16.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.D - Other												
3.D.1 - Harvested Wood Products	CO2	-0.69	-1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.A - Solid Waste Disposal												
4.A - Solid Waste Disposal	CH4	265.61	480.46	20.00	20.00	28.28	1.15	0.02	0.05	0.31	1.28	1.72
4.B - Biological Treatment of Solid Waste												
4.B - Biological Treatment of Solid Waste	CH4	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	N2O	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste												
4.C.1 - Waste Incineration	CO2	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CO2	2.86	6.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CH4	5.92	12.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	N2O	0.00	3.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D - Wastewater Treatment and Discharge												
4.D.1 - Domestic Wastewaster Treatment and Discharge	CH4	19.67	20.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D.1 - Domestic Wastewaster Treatment and Discharge	N2O	33.04	39.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D.2 - Industrial Wastewater Treatment and Discharge	CH4	79.58	47.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.E - Other (please specify)												
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3												
5.B - Other (please specify)												
Total												
		Sum(C): 10652.099	Sum(D): 12649.732				Sum(H): 13.084					Sum(M): 33.529
							Uncertainty in total inventory: 3.617					Trend uncertainty: 5.790

Table 117. Base year for assessment of uncertainty in trend: 1990, Year T: 2018

2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2 equivalent)	Year T emissions or removals (Gg CO2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)
1.A - Fuel Combustion Activities												
1.A.1.a.i - Electricity Generation - Liquid Fuels	CO2	3.13	42.46	5.00	5.00	7.07	0.00	0.00	0.00	0.02	0.03	0.00
1.A.1.a.i - Electricity Generation - Liquid Fuels	CH4	0.00	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.i - Electricity Generation - Liquid Fuels	N2O	0.01	0.10	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.i - Electricity Generation - Solid Fuels	CO2	5610.05	3393.97	5.00	5.00	7.07	7.62	0.10	0.31	0.51	2.22	5.17
1.A.1.a.i - Electricity Generation - Solid Fuels	CH4	1.26	0.79	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.i - Electricity Generation - Solid Fuels	N2O	22.50	14.06	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	CO2	306.44	0.00	5.00	5.00	7.07	0.00	0.02	0.00	0.11	0.00	0.01
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	CH4	0.30	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	N2O	0.71	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	CO2	79.73	0.00	5.00	5.00	7.07	0.00	0.01	0.00	0.03	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	CH4	0.02	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	N2O	0.35	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Gaseous Fuels	CO2	0.00	325.66	5.00	5.00	7.07	0.07	0.03	0.03	0.15	0.21	0.07
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Gaseous Fuels	CH4	0.00	0.15	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Gaseous Fuels	N2O	0.00	0.17	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.iii - Heat Plants - Liquid Fuels	CO2	171.98	0.00	5.00	5.00	7.07	0.00	0.01	0.00	0.06	0.00	0.00
1.A.1.a.iii - Heat Plants - Liquid Fuels	CH4	0.17	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.iii - Heat Plants - Liquid Fuels	N2O	0.40	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.iii - Heat Plants - Gaseous Fuels	CO2	0.00	55.34	5.00	5.00	7.07	0.00	0.01	0.01	0.03	0.04	0.00
1.A.1.a.iii - Heat Plants - Gaseous Fuels	CH4	0.00	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.iii - Heat Plants - Gaseous Fuels	N2O	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Liquid Fuels	CO2	0.00	6.39	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Liquid Fuels	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Liquid Fuels	N2O	0.00	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Biomass	CO2	0.00	0.06	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.1.c.ii - Other Energy Industries - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Liquid Fuels	CO2	346.16	162.26	5.00	5.00	7.07	0.02	0.01	0.01	0.05	0.11	0.01
1.A.2.a - Iron and Steel - Liquid Fuels	CH4	0.30	0.14	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Liquid Fuels	N2O	0.70	0.33	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Solid Fuels	CO2	272.72	199.54	5.00	5.00	7.07	0.03	0.00	0.02	0.01	0.13	0.02
1.A.2.a - Iron and Steel - Solid Fuels	CH4	0.68	0.52	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Solid Fuels	N2O	1.22	0.93	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Gaseous Fuels	CO2	0.00	54.92	5.00	5.00	7.07	0.00	0.01	0.01	0.03	0.04	0.00
1.A.2.a - Iron and Steel - Gaseous Fuels	CH4	0.00	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Gaseous Fuels	N2O	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Biomass	CO2	0.00	11.32	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.2.a - Iron and Steel - Biomass	CH4	0.00	0.08	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Biomass	N2O	0.00	0.12	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	CO2	65.25	3.49	5.00	5.00	7.07	0.00	0.00	0.00	0.02	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	CH4	0.06	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	N2O	0.15	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Solid Fuels	CO2	271.19	0.00	5.00	5.00	7.07	0.00	0.02	0.00	0.10	0.00	0.01
1.A.2.b - Non-Ferrous Metals - Solid Fuels	CH4	0.72	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Solid Fuels	N2O	1.28	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Liquid Fuels	CO2	77.52	5.94	5.00	5.00	7.07	0.00	0.01	0.00	0.03	0.00	0.00
1.A.2.c - Chemicals - Liquid Fuels	CH4	0.08	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Liquid Fuels	N2O	0.18	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Gaseous Fuels	CO2	0.00	2.20	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Biomass	CO2	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CO2	0.00	1.36	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Gaseous Fuels	CO2	0.00	0.91	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.2.d - Pulp, Paper and Print - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Biomass	CO2	0.00	0.31	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CO2	46.92	45.09	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.03	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CH4	0.05	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	N2O	0.11	0.09	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CO2	6.90	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CH4	0.02	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	N2O	0.03	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	CO2	0.00	13.30	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	CO2	0.00	18.81	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	CH4	0.00	0.13	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	N2O	0.00	0.20	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	CO2	132.98	82.78	5.00	5.00	7.07	0.00	0.00	0.01	0.01	0.05	0.00
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	CH4	0.10	0.06	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	N2O	0.21	0.14	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Solid Fuels	CO2	0.00	240.65	5.00	5.00	7.07	0.04	0.02	0.02	0.11	0.16	0.04
1.A.2.f - Non-Metallic Minerals - Solid Fuels	CH4	0.00	0.63	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Solid Fuels	N2O	0.00	1.13	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Gaseous Fuels	CO2	0.00	3.68	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Biomass	CO2	0.00	0.06	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Liquid Fuels	CO2	5.81	9.57	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.2.h - Machinery - Liquid Fuels	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Liquid Fuels	N2O	0.00	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Solid Fuels	CO2	3.45	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Solid Fuels	CH4	0.01	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Solid Fuels	N2O	0.02	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Gaseous Fuels	CO2	0.00	8.68	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.2.h - Machinery - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.2.h - Machinery - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Biomass	CO2	0.00	1.11	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Biomass	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Biomass	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	CO2	43.77	40.74	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.03	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	CH4	0.04	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	N2O	0.10	0.10	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Biomass	CO2	0.00	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	CO2	9.29	16.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	CH4	0.01	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	N2O	0.02	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Solid Fuels	CO2	10.35	3.29	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Solid Fuels	CH4	0.03	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Solid Fuels	N2O	0.05	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Gaseous Fuels	CO2	0.00	0.19	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Biomass	CO2	0.00	2.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Biomass	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Biomass	N2O	0.00	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Liquid Fuels	CO2	469.36	40.31	5.00	5.00	7.07	0.00	0.03	0.00	0.16	0.03	0.02
1.A.2.m - Non-specified Industry - Liquid Fuels	CH4	0.46	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Liquid Fuels	N2O	1.09	0.10	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	CO2	1.72	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	N2O	0.01	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Gaseous Fuels	CO2	0.00	0.44	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Biomass	CO2	0.00	3.86	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Biomass	CH4	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Biomass	N2O	0.00	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CO2	15.77	70.57	5.00	5.00	7.07	0.00	0.01	0.01	0.03	0.05	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	N2O	0.13	0.59	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CO2	0.00	0.11	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CO2	555.43	1313.50	5.00	5.00	7.07	1.14	0.08	0.12	0.40	0.86	0.90
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CH4	0.77	7.88	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	N2O	9.17	17.98	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CO2	28.64	39.64	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.03	0.00
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CH4	0.31	0.50	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	N2O	0.40	0.39	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CO2	56.61	176.39	5.00	5.00	7.07	0.02	0.01	0.02	0.06	0.12	0.02
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CH4	0.42	0.42	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	N2O	0.83	2.73	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CO2	4.44	10.15	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CH4	0.03	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	N2O	0.07	0.16	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CO2	96.62	573.31	5.00	5.00	7.07	0.22	0.05	0.05	0.23	0.37	0.19
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CH4	0.15	0.77	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N2O	1.51	8.99	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Gaseous Fuels	CO2	0.00	1.64	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Gaseous Fuels	CH4	0.00	4.42	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Gaseous Fuels	N2O	0.00	1.63	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	CO2	2.98	1.95	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	CH4	0.04	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	N2O	0.04	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	CO2	4.45	2.79	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	CH4	0.05	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	N2O	0.06	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.c - Railways - Liquid Fuels	CO2	22.30	6.80	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.00	0.00
1.A.3.c - Railways - Liquid Fuels	CH4	0.03	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.c - Railways - Liquid Fuels	N2O	2.57	0.78	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	CO2	404.05	30.90	5.00	5.00	7.07	0.00	0.03	0.00	0.14	0.02	0.02
1.A.4.b - Residential - Liquid Fuels	CH4	1.34	0.08	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	N2O	0.96	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Solid Fuels	CO2	21.09	3.19	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.00	0.00
1.A.4.b - Residential - Solid Fuels	CH4	1.57	0.24	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.4.b - Residential - Solid Fuels	N2O	0.09	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Gaseous Fuels	CO2	0.00	0.43	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Biomass	CO2	823.87	843.62	5.00	5.00	7.07	0.47	0.02	0.08	0.08	0.55	0.31
1.A.4.b - Residential - Biomass	CH4	55.17	56.49	5.00	5.00	7.07	0.00	0.00	0.01	0.01	0.04	0.00
1.A.4.b - Residential - Biomass	N2O	8.77	8.98	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.4.c.i - Stationary - Liquid Fuels	CO2	141.26	38.54	5.00	5.00	7.07	0.00	0.01	0.00	0.03	0.03	0.00
1.A.4.c.i - Stationary - Liquid Fuels	CH4	0.47	0.13	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Liquid Fuels	N2O	0.34	0.09	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Solid Fuels	CO2	0.00	2.60	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Solid Fuels	CH4	0.00	0.19	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Solid Fuels	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Biomass	CO2	0.00	6.46	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Biomass	CH4	0.00	0.43	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Biomass	N2O	0.00	0.07	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Liquid Fuels	CO2	0.00	175.04	5.00	5.00	7.07	0.02	0.02	0.02	0.08	0.11	0.02
1.A.5.a - Stationary - Liquid Fuels	CH4	0.00	0.56	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Liquid Fuels	N2O	0.00	0.38	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Solid Fuels	CO2	22.84	3.27	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.00	0.00
1.A.5.a - Stationary - Solid Fuels	CH4	0.06	0.24	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Solid Fuels	N2O	0.10	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Gaseous Fuels	CO2	0.00	13.73	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.5.a - Stationary - Gaseous Fuels	CH4	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Gaseous Fuels	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Biomass	CO2	0.00	20.61	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.5.a - Stationary - Biomass	CH4	0.00	1.38	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Biomass	N2O	0.00	0.22	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.vi - Urea-based catalysts	CO2	0.49	1.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1 - Fugitive Emissions from Fuels - Solid Fuels												
1.B.1.a.i.1 - Mining	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.1 - Mining	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.2 - Post-mining seam gas emissions	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.2 - Post-mining seam gas emissions	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.3 - Abandoned underground mines	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00

1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.1 - Mining	CO2	5.62	4.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.1 - Mining	CH4	175.28	125.50	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
1.B.1.a.ii.2 - Post-mining seam gas emissions	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.2 - Post-mining seam gas emissions	CH4	11.69	8.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2 - Fugitive Emissions from Fuels - Oil and Natural Gas												
1.B.2.a.iii.1 - Exploration	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.1 - Exploration	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.1 - Exploration	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.4 - Refining	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.4 - Refining	CH4	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.4 - Refining	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.b.i - Venting	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.b.i - Venting	CH4	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.b.i - Venting	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C - CO2 Transport Injection and Storage												
1.C.1.a - Pipelines	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1.b - Ships	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1.c - Other (please specify)	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.2.a - Injection	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.2.b - Storage	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.3 - Other	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A - Mineral Industry												
2.A.1 - Cement production	CO2	293.75	376.77	10.00	3.00	10.44	0.20	0.01	0.03	0.04	0.49	0.24
2.A.2 - Lime production	CO2	33.72	4.03	15.00	3.00	15.30	0.00	0.00	0.00	0.01	0.01	0.00
2.A.3 - Glass Production	CO2	0.33	0.05	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.a - Ceramics	CO2	2.62	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.b - Other Uses of Soda Ash	CO2	2.68	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.c - Non Metallurgical Magnesia Production	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.d - Other (please specify)	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B - Chemical Industry												
2.B.1 - Ammonia Production	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.2 - Nitric Acid Production	N2O	0.00	0.00	2.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.3 - Adipic Acid Production	N2O	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	N2O	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.5 - Carbide Production	CO2	0.00	0.00	5.00	10.00	11.18	0.00	0.00	0.00	0.00	0.00	0.00

2.B.5 - Carbide Production	CH4	0.00	0.00	5.00	10.00	11.18	0.00	0.00	0.00	0.00	0.00	0.00
2.B.6 - Titanium Dioxide Production	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.7 - Soda Ash Production	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.a - Methanol	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.a - Methanol	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.b - Ethylene	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.b - Ethylene	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.d - Ethylene Oxide	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.d - Ethylene Oxide	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.e - Acrylonitrile	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.e - Acrylonitrile	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.f - Carbon Black	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.f - Carbon Black	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	(CF3)2CFOCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3OCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHClOCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2CF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2CH2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2 CF2OCH2CH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C4F9OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C4F9OC2H5	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2OCF2OC2F4OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2OCF2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2OCF2CF2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFOCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFOCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2OCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00

2.B.9.a - By-product emissions	CHF2CH2OCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2OCF2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2OCH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2OCH2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFCF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2CF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2OCH2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2CH2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	(CF3)2CHOCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	(CF3)2CHOCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2F2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFCHFCF2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CH2F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCF2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCH2F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3CH2F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCF2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CHFCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2CF2CH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF4	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C2F6	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C3F8	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C4F10	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	c-C4F8	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C5F12	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C6F14	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00

2.B.9.a - By-product emissions	SF6	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	NF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2Br2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHCl3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3Cl	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2Cl2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2CH2OH	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	(CF3)2CHOH	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	-(CF2)4CH(OH)-	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3 I	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2OCH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3OCF(CF3)CF2O CF2OCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHBrF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	SF5CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C - Metal Industry												
2.C.1 - Iron and Steel Production	CO2	24.75	24.12	10.00	5.00	11.18	0.00	0.00	0.00	0.00	0.03	0.00
2.C.1 - Iron and Steel Production	CH4	0.00	0.00	10.00	5.00	11.18	0.00	0.00	0.00	0.00	0.00	0.00
2.C.2 - Ferroalloys Production	CO2	264.32	41.33	5.00	5.00	7.07	0.00	0.02	0.00	0.08	0.03	0.01
2.C.2 - Ferroalloys Production	CH4	1.32	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.C.3 - Aluminium production	CO2	8.78	0.00	2.00	5.00	5.39	0.00	0.00	0.00	0.00	0.00	0.00
2.C.3 - Aluminium production	CF4	64.88	0.00	2.00	5.00	5.39	0.00	0.00	0.00	0.02	0.00	0.00
2.C.3 - Aluminium production	C2F6	26.78	0.00	2.00	5.00	5.39	0.00	0.00	0.00	0.01	0.00	0.00
2.C.4 - Magnesium production	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.4 - Magnesium production	SF6	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.5 - Lead Production	CO2	22.09	5.50	10.00	5.00	11.18	0.00	0.00	0.00	0.01	0.01	0.00
2.C.6 - Zinc Production	CO2	186.23	0.00	10.00	5.00	11.18	0.00	0.01	0.00	0.07	0.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use												
2.D.1 - Lubricant Use	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D.2 - Paraffin Wax Use	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E - Electronics Industry												
2.E.1 - Integrated Circuit or Semiconductor	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	CHF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	NF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00

2.E.2 - TFT Flat Panel Display	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display	NF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.3 - Photovoltaics	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.3 - Photovoltaics	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.4 - Heat Transfer Fluid	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances												
2.F.1.a - Refrigeration and Stationary Air Conditioning	CHF3	0.00	0.14	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH2F2	0.00	1.29	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CHF2CF3	0.00	35.17	5.00	5.00	7.07	0.00	0.00	0.00	0.02	0.02	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH2FCF3	0.00	99.94	5.00	5.00	7.07	0.01	0.01	0.01	0.05	0.07	0.01
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH3CHF2	0.00	1.86	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CF3CH3	0.00	43.47	5.00	5.00	7.07	0.00	0.00	0.00	0.02	0.03	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CF3CHFCF3	0.00	16.56	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
2.F.4 - Aerosols	CH2FCF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CH3CHF2	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CF3CHFCF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CF3CH2CF2CH3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CF3CHFCHFCF2CF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CHF2CH2CF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.5 - Solvents	CF3CH2CF2CH3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.5 - Solvents	CF3CHFCHFCF2CF3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.5 - Solvents	C6F14	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2F2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH3F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CHFCHFCF2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CHF2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH3CHF2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CH2F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CH3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CHFCF3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CH2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF2CHF2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00

2.F.6 - Other Applications (please specify)	CH2FCH2F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH3CH2F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CHFCF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CH2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CH2CF2CH3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C2F6	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C4F10	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	c-C4F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C5F12	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G - Electrical Equipment												
2.G.1.a - Manufacture of Electrical Equipment	SF6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	CF4	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C2F6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C3F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C4F10	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	c-C4F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C5F12	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C6F14	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	SF6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	CF4	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C2F6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C3F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C4F10	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	c-C4F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C5F12	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C6F14	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	SF6	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	CF4	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C2F6	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C3F8	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C4F10	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	c-C4F8	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00

2.G.1.c - Disposal of Electrical Equipment	C5F12	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C6F14	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C4F10	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	c-C4F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C5F12	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C4F10	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	c-C4F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C5F12	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	SF6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	CF4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C2F6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C3F8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C4F10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	c-C4F8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C5F12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C6F14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.a - Medical Applications	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.b - Propellant for pressure and aerosol products	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.c - Other (Please specify)	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other												
3.A - Livestock												
3.A.1.a.i - Dairy Cows	CH4	0.00	487.56	5.00	30.00	30.41	2.91	0.05	0.05	1.35	0.32	1.93
3.A.1.a.ii - Other Cattle	CH4	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.b - Buffalo	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.c - Sheep	CH4	287.14	90.87	5.00	30.00	30.41	0.10	0.01	0.01	0.39	0.06	0.15
3.A.1.d - Goats	CH4	0.00	13.75	5.00	30.00	30.41	0.00	0.00	0.00	0.04	0.01	0.00

3.A.1.e - Camels	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.f - Horses	CH4	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.g - Mules and Asses	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.h - Swine	CH4	0.00	9.49	5.00	30.00	30.41	0.00	0.00	0.00	0.03	0.01	0.00
3.A.1.j - Other (please specify)	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.a.i - Dairy cows	CH4	83.12	0.00	5.00	0.00	5.00	0.00	0.01	0.00	0.00	0.00	0.00
3.A.2.a.i - Dairy cows	N2O	23.25	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.05	0.00	0.00
3.A.2.a.ii - Other cattle	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.a.ii - Other cattle	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.b - Buffalo	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.b - Buffalo	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.c - Sheep	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.c - Sheep	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.d - Goats	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.d - Goats	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.e - Camels	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.e - Camels	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.f - Horses	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.f - Horses	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.g - Mules and Asses	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.g - Mules and Asses	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.h - Swine	CH4	26.78	8.59	5.00	30.00	30.41	0.00	0.00	0.00	0.04	0.01	0.00
3.A.2.h - Swine	N2O	3.37	0.75	5.00	30.00	30.41	0.00	0.00	0.00	0.01	0.00	0.00
3.A.2.i - Poultry	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.i - Poultry	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.j - Other (please specify)	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.j - Other (please specify)	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B - Land												
3.B.1.a - Forest land Remaining Forest land	CO2	-1654.78	-2175.36	20.00	10.00	22.36	31.31	0.08	0.20	0.78	5.68	32.89
3.B.1.b.i - Cropland converted to Forest Land	CO2	-1.21	-41.06	10.00	10.00	14.14	0.00	0.00	0.00	0.04	0.05	0.00
3.B.1.b.ii - Grassland converted to Forest Land	CO2	-45.18	-25.86	10.00	10.00	14.14	0.00	0.00	0.00	0.01	0.03	0.00
3.B.1.b.iii - Wetlands converted to Forest Land	CO2	-0.06	-0.13	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1.b.iv - Settlements converted to Forest Land	CO2	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1.b.v - Other Land converted to Forest Land	CO2	-22.28	-12.97	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.02	0.00
3.B.2.a - Cropland Remaining Cropland	CO2	0.00	0.00	20.00	50.00	53.85	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.i - Forest Land converted to Cropland	CO2	44.48	258.50	10.00	50.00	50.99	2.30	0.02	0.02	1.03	0.34	1.17

3.B.2.b.ii - Grassland converted to Cropland	CO2	7.67	7.43	10.00	50.00	50.99	0.00	0.00	0.00	0.01	0.01	0.00
3.B.2.b.iii - Wetlands converted to Cropland	CO2	0.09	0.01	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.iv - Settlements converted to Cropland	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.v - Other Land converted to Cropland	CO2	4.00	0.63	10.00	50.00	50.99	0.00	0.00	0.00	0.01	0.00	0.00
3.B.3.a - Grassland Remaining Grassland	CO2	0.00	0.00	20.00	50.00	53.85	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.i - Forest Land converted to Grassland	CO2	11.46	116.17	10.00	50.00	50.99	0.46	0.01	0.01	0.49	0.15	0.27
3.B.3.b.ii - Cropland converted to Grassland	CO2	6.49	7.06	10.00	50.00	50.99	0.00	0.00	0.00	0.01	0.01	0.00
3.B.3.b.iii - Wetlands converted to Grassland	CO2	-0.24	-0.15	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.iv - Settlements converted to Grassland	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.v - Other Land converted to Grassland	CO2	-21.16	-19.28	10.00	50.00	50.99	0.01	0.00	0.00	0.01	0.03	0.00
3.B.4.a.i - Peatlands remaining peatlands	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4.a.i - Peatlands remaining peatlands	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4.b.i - Land converted for peat extraction	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4.b.ii - Land converted to flooded land	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.a - Settlements Remaining Settlements	CO2	0.00	0.00	20.00	50.00	53.85	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.b.i - Forest Land converted to Settlements	CO2	0.00	3.18	10.00	50.00	50.99	0.00	0.00	0.00	0.01	0.00	0.00
3.B.5.b.ii - Cropland converted to Settlements	CO2	3.62	1.94	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.b.iii - Grassland converted to Settlements	CO2	5.84	1.65	10.00	50.00	50.99	0.00	0.00	0.00	0.01	0.00	0.00
3.B.5.b.iv - Wetlands converted to Settlements	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.b.v - Other Land converted to Settlements	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.6.b.i - Forest Land converted to Other Land	CO2	70.86	95.72	10.00	50.00	50.99	0.32	0.00	0.01	0.18	0.12	0.05
3.B.6.b.ii - Cropland converted to Other Land	CO2	46.99	19.47	10.00	50.00	50.99	0.01	0.00	0.00	0.08	0.03	0.01
3.B.6.b.iii - Grassland converted to Other Land	CO2	2.65	2.54	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.6.b.iv - Wetlands converted to Other Land	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.6.b.v - Settlements converted to Other Land	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.C - Aggregate sources and non-CO2 emissions sources on land												
3.C.1.a - Biomass burning in forest lands	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.a - Biomass burning in forest lands	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.b - Biomass burning in croplands	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.b - Biomass burning in croplands	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.c - Biomass burning in grasslands	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.c - Biomass burning in grasslands	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.d - Biomass burning in all other land	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.d - Biomass burning in all other land	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.2 - Liming	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.3 - Urea application	CO2	3.74	2.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.C.4 - Direct N2O Emissions from managed soils	N2O	82.19	107.92	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
3.C.5 - Indirect N2O Emissions from managed soils	N2O	28.63	35.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.6 - Indirect N2O Emissions from manure management	N2O	18.41	1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.7 - Rice cultivation	CH4	29.17	14.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.D - Other												
3.D.1 - Harvested Wood Products	CO2	-0.69	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.A - Solid Waste Disposal												
4.A - Solid Waste Disposal	CH4	265.61	491.28	20.00	20.00	28.28	2.56	0.03	0.05	0.51	1.28	1.91
4.B - Biological Treatment of Solid Waste												
4.B - Biological Treatment of Solid Waste	CH4	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	N2O	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste												
4.C.1 - Waste Incineration	CO2	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CO2	2.86	6.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CH4	5.92	12.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	N2O	0.00	3.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D - Wastewater Treatment and Discharge												
4.D.1 - Domestic Wastewaster Treatment and Discharge	CH4	19.67	20.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D.1 - Domestic Wastewaster Treatment and Discharge	N2O	33.04	39.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D.2 - Industrial Wastewater Treatment and Discharge	CH4	79.58	47.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.E - Other (please specify)												
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3												
5.B - Other (please specify)												
Total												
		Sum(C): 10830.998	Sum(D): 8692.424				Sum(H): 49.887					Sum(M): 45.477
							Uncertainty in total inventory: 7.063					Trend uncertainty: 6.744

Table 118. Base year for assessment of uncertainty in trend: 1990, Year T: 2019

2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2 equivalent)	Year T emissions or removals (Gg CO2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)
1.A - Fuel Combustion Activities												
1.A.1.a.i - Electricity Generation - Liquid Fuels	CO2	3.13	53.43	5.00	5.00	7.07	0.00	0.00	0.00	0.02	0.04	0.00
1.A.1.a.i - Electricity Generation - Liquid Fuels	CH4	0.00	0.05	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.i - Electricity Generation - Liquid Fuels	N2O	0.01	0.12	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.i - Electricity Generation - Solid Fuels	CO2	5610.05	4050.50	5.00	5.00	7.07	4.62	0.27	0.38	1.35	2.67	8.97
1.A.1.a.i - Electricity Generation - Solid Fuels	CH4	1.26	0.94	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.i - Electricity Generation - Solid Fuels	N2O	22.50	16.78	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	CO2	306.44	0.00	5.00	5.00	7.07	0.00	0.04	0.00	0.18	0.00	0.03
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	CH4	0.30	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	N2O	0.71	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	CO2	79.73	0.00	5.00	5.00	7.07	0.00	0.01	0.00	0.05	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	CH4	0.02	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	N2O	0.35	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Gaseous Fuels	CO2	0.00	398.69	5.00	5.00	7.07	0.04	0.04	0.04	0.19	0.26	0.10
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Gaseous Fuels	CH4	0.00	0.18	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Gaseous Fuels	N2O	0.00	0.21	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.iii - Heat Plants - Liquid Fuels	CO2	171.98	0.00	5.00	5.00	7.07	0.00	0.02	0.00	0.10	0.00	0.01
1.A.1.a.iii - Heat Plants - Liquid Fuels	CH4	0.17	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.iii - Heat Plants - Liquid Fuels	N2O	0.40	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.iii - Heat Plants - Gaseous Fuels	CO2	0.00	62.41	5.00	5.00	7.07	0.00	0.01	0.01	0.03	0.04	0.00
1.A.1.a.iii - Heat Plants - Gaseous Fuels	CH4	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.a.iii - Heat Plants - Gaseous Fuels	N2O	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Liquid Fuels	CO2	0.00	4.52	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Liquid Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Liquid Fuels	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Biomass	CO2	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1.c.ii - Other Energy Industries - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.1.c.ii - Other Energy Industries - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Liquid Fuels	CO2	346.16	188.03	5.00	5.00	7.07	0.01	0.02	0.02	0.11	0.12	0.03
1.A.2.a - Iron and Steel - Liquid Fuels	CH4	0.30	0.16	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Liquid Fuels	N2O	0.70	0.38	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Solid Fuels	CO2	272.72	274.85	5.00	5.00	7.07	0.02	0.01	0.03	0.03	0.18	0.03
1.A.2.a - Iron and Steel - Solid Fuels	CH4	0.68	0.71	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Solid Fuels	N2O	1.22	1.27	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Gaseous Fuels	CO2	0.00	51.51	5.00	5.00	7.07	0.00	0.00	0.00	0.02	0.03	0.00
1.A.2.a - Iron and Steel - Gaseous Fuels	CH4	0.00	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Gaseous Fuels	N2O	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Biomass	CO2	0.00	10.72	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.2.a - Iron and Steel - Biomass	CH4	0.00	0.07	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Biomass	N2O	0.00	0.11	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	CO2	65.25	3.14	5.00	5.00	7.07	0.00	0.01	0.00	0.04	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	CH4	0.06	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	N2O	0.15	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Solid Fuels	CO2	271.19	0.00	5.00	5.00	7.07	0.00	0.03	0.00	0.16	0.00	0.02
1.A.2.b - Non-Ferrous Metals - Solid Fuels	CH4	0.72	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Solid Fuels	N2O	1.28	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Biomass	CO2	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.b - Non-Ferrous Metals - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Liquid Fuels	CO2	77.52	6.61	5.00	5.00	7.07	0.00	0.01	0.00	0.04	0.00	0.00
1.A.2.c - Chemicals - Liquid Fuels	CH4	0.08	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Liquid Fuels	N2O	0.18	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Gaseous Fuels	CO2	0.00	2.10	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Biomass	CO2	0.00	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CO2	0.00	1.55	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Gaseous Fuels	CO2	0.00	1.09	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.2.d - Pulp, Paper and Print - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Biomass	CO2	0.00	0.36	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CO2	46.92	50.78	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.03	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CH4	0.05	0.05	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	N2O	0.11	0.10	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CO2	6.90	0.05	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CH4	0.02	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	N2O	0.03	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	CO2	0.00	13.00	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	CO2	0.00	17.13	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	CH4	0.00	0.11	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	N2O	0.00	0.18	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	CO2	132.98	116.46	5.00	5.00	7.07	0.00	0.00	0.01	0.02	0.08	0.01
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	CH4	0.10	0.09	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	N2O	0.21	0.20	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Solid Fuels	CO2	0.00	226.63	5.00	5.00	7.07	0.01	0.02	0.02	0.11	0.15	0.03
1.A.2.f - Non-Metallic Minerals - Solid Fuels	CH4	0.00	0.60	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Solid Fuels	N2O	0.00	1.07	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Gaseous Fuels	CO2	0.00	4.22	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Biomass	CO2	0.00	0.07	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.f - Non-Metallic Minerals - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Liquid Fuels	CO2	5.81	19.74	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.2.h - Machinery - Liquid Fuels	CH4	0.00	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Liquid Fuels	N2O	0.00	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Solid Fuels	CO2	3.45	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Solid Fuels	CH4	0.01	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Solid Fuels	N2O	0.02	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Gaseous Fuels	CO2	0.00	9.17	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.2.h - Machinery - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.2.h - Machinery - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Biomass	CO2	0.00	1.15	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Biomass	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.h - Machinery - Biomass	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	CO2	43.77	39.11	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.03	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	CH4	0.04	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	N2O	0.10	0.09	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Biomass	CO2	0.00	0.07	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Biomass	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.i - Mining (excluding fuels) and Quarrying - Biomass	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	CO2	9.29	13.53	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	CH4	0.01	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	N2O	0.02	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Solid Fuels	CO2	10.35	2.56	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Solid Fuels	CH4	0.03	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Solid Fuels	N2O	0.05	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Gaseous Fuels	CO2	0.00	0.23	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Biomass	CO2	0.00	1.79	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Biomass	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Biomass	N2O	0.00	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Liquid Fuels	CO2	469.36	40.76	5.00	5.00	7.07	0.00	0.05	0.00	0.25	0.03	0.06
1.A.2.m - Non-specified Industry - Liquid Fuels	CH4	0.46	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Liquid Fuels	N2O	1.09	0.10	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	CO2	1.72	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	N2O	0.01	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Gaseous Fuels	CO2	0.00	0.46	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Biomass	CO2	0.00	3.89	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Biomass	CH4	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Biomass	N2O	0.00	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CO2	15.77	83.68	5.00	5.00	7.07	0.00	0.01	0.01	0.03	0.06	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CH4	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	N2O	0.13	0.70	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CO2	0.00	0.18	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CO2	555.43	1343.00	5.00	5.00	7.07	0.51	0.06	0.13	0.30	0.89	0.88
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CH4	0.77	7.94	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	N2O	9.17	18.45	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CO2	28.64	58.28	5.00	5.00	7.07	0.00	0.00	0.01	0.01	0.04	0.00
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CH4	0.31	0.72	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	N2O	0.40	0.59	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CO2	56.61	193.50	5.00	5.00	7.07	0.01	0.01	0.02	0.06	0.13	0.02
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CH4	0.42	0.47	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	N2O	0.83	3.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CO2	4.44	10.79	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CH4	0.03	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	N2O	0.07	0.17	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CO2	96.62	673.35	5.00	5.00	7.07	0.13	0.05	0.06	0.26	0.44	0.26
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CH4	0.15	0.90	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N2O	1.51	10.56	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Gaseous Fuels	CO2	0.00	4.05	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Gaseous Fuels	CH4	0.00	10.85	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Gaseous Fuels	N2O	0.00	4.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	CO2	2.98	1.91	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	CH4	0.04	0.02	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	N2O	0.04	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	CO2	4.45	2.87	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	CH4	0.05	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	N2O	0.06	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.c - Railways - Liquid Fuels	CO2	22.30	8.15	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.3.c - Railways - Liquid Fuels	CH4	0.03	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.c - Railways - Liquid Fuels	N2O	2.57	0.94	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	CO2	404.05	29.11	5.00	5.00	7.07	0.00	0.04	0.00	0.22	0.02	0.05
1.A.4.b - Residential - Liquid Fuels	CH4	1.34	0.07	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	N2O	0.96	0.04	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Solid Fuels	CO2	21.09	2.59	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.00	0.00
1.A.4.b - Residential - Solid Fuels	CH4	1.57	0.19	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00

1.A.4.b - Residential - Solid Fuels	N2O	0.09	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Gaseous Fuels	CO2	0.00	0.46	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Gaseous Fuels	CH4	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Gaseous Fuels	N2O	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Biomass	CO2	823.87	808.71	5.00	5.00	7.07	0.18	0.02	0.08	0.10	0.53	0.29
1.A.4.b - Residential - Biomass	CH4	55.17	54.15	5.00	5.00	7.07	0.00	0.00	0.01	0.01	0.04	0.00
1.A.4.b - Residential - Biomass	N2O	8.77	8.61	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.4.c.i - Stationary - Liquid Fuels	CO2	141.26	39.82	5.00	5.00	7.07	0.00	0.01	0.00	0.06	0.03	0.00
1.A.4.c.i - Stationary - Liquid Fuels	CH4	0.47	0.13	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Liquid Fuels	N2O	0.34	0.09	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Solid Fuels	CO2	0.00	2.37	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Solid Fuels	CH4	0.00	0.18	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Solid Fuels	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Biomass	CO2	0.00	6.49	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Biomass	CH4	0.00	0.43	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.i - Stationary - Biomass	N2O	0.00	0.07	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Liquid Fuels	CO2	0.00	177.39	5.00	5.00	7.07	0.01	0.02	0.02	0.08	0.12	0.02
1.A.5.a - Stationary - Liquid Fuels	CH4	0.00	0.57	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Liquid Fuels	N2O	0.00	0.39	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Solid Fuels	CO2	22.84	2.26	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.00	0.00
1.A.5.a - Stationary - Solid Fuels	CH4	0.06	0.17	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Solid Fuels	N2O	0.10	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Gaseous Fuels	CO2	0.00	13.33	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.5.a - Stationary - Gaseous Fuels	CH4	0.00	0.03	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Gaseous Fuels	N2O	0.00	0.01	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Biomass	CO2	0.00	20.12	5.00	5.00	7.07	0.00	0.00	0.00	0.01	0.01	0.00
1.A.5.a - Stationary - Biomass	CH4	0.00	1.35	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Biomass	N2O	0.00	0.21	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.vi - Urea-based catalysts	CO2	0.49	1.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1 - Fugitive Emissions from Fuels - Solid Fuels												
1.B.1.a.i.1 - Mining	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.1 - Mining	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.2 - Post-mining seam gas emissions	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.2 - Post-mining seam gas emissions	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.3 - Abandoned underground mines	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00

1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.1 - Mining	CO2	5.62	4.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.1 - Mining	CH4	175.28	137.62	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
1.B.1.a.ii.2 - Post-mining seam gas emissions	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.2 - Post-mining seam gas emissions	CH4	11.69	9.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2 - Fugitive Emissions from Fuels - Oil and Natural Gas												
1.B.2.a.iii.1 - Exploration	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.1 - Exploration	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.1 - Exploration	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.4 - Refining	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.4 - Refining	CH4	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a.iii.4 - Refining	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.b.i - Venting	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.b.i - Venting	CH4	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.b.i - Venting	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C - CO2 Transport Injection and Storage												
1.C.1.a - Pipelines	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1.b - Ships	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1.c - Other (please specify)	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.2.a - Injection	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.2.b - Storage	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.3 - Other	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A - Mineral Industry												
2.A.1 - Cement production	CO2	293.75	376.89	10.00	3.00	10.44	0.09	0.00	0.04	0.00	0.50	0.25
2.A.2 - Lime production	CO2	33.72	17.25	15.00	3.00	15.30	0.00	0.00	0.00	0.01	0.03	0.00
2.A.3 - Glass Production	CO2	0.33	0.07	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.a - Ceramics	CO2	2.62	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.b - Other Uses of Soda Ash	CO2	2.68	0.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.c - Non Metallurgical Magnesia Production	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.d - Other (please specify)	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B - Chemical Industry												
2.B.1 - Ammonia Production	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.2 - Nitric Acid Production	N2O	0.00	0.00	2.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.3 - Adipic Acid Production	N2O	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	N2O	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.5 - Carbide Production	CO2	0.00	0.00	5.00	10.00	11.18	0.00	0.00	0.00	0.00	0.00	0.00

2.B.5 - Carbide Production	CH4	0.00	0.00	5.00	10.00	11.18	0.00	0.00	0.00	0.00	0.00	0.00
2.B.6 - Titanium Dioxide Production	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.7 - Soda Ash Production	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.a - Methanol	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.a - Methanol	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.b - Ethylene	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.b - Ethylene	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.d - Ethylene Oxide	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.d - Ethylene Oxide	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.e - Acrylonitrile	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.e - Acrylonitrile	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.f - Carbon Black	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.f - Carbon Black	CH4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	(CF3)2CFOCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3OCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHClOCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2CF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2CH2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2 CF2OCH2CH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C4F9OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C4F9OC2H5	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2OCF2OC2F4OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2OCF2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2OCF2CF2OCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFOCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFOCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2OCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00

2.B.9.a - By-product emissions	CHF2CH2OCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2OCF2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2OCH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2OCH2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFCF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2CF2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2OCH2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2CH2OCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	(CF3)2CHOCHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	(CF3)2CHOCH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2F2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFCHFCF2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CH2F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCF2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCH2F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3CH2F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCF2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CHFCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2CF2CH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF4	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C2F6	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C3F8	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C4F10	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	c-C4F8	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C5F12	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C6F14	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00

2.B.9.a - By-product emissions	SF6	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	NF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2Br2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHCl3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3Cl	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2Cl2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CF2CH2OH	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	(CF3)2CHOH	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	-(CF2)4CH(OH)-	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3 I	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF2OCH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3OCF(CF3)CF2O CF2OCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHBrF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	SF5CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C - Metal Industry												
2.C.1 - Iron and Steel Production	CO2	24.75	21.71	10.00	5.00	11.18	0.00	0.00	0.00	0.00	0.03	0.00
2.C.1 - Iron and Steel Production	CH4	0.00	0.00	10.00	5.00	11.18	0.00	0.00	0.00	0.00	0.00	0.00
2.C.2 - Ferroalloys Production	CO2	264.32	61.54	5.00	5.00	7.07	0.00	0.02	0.01	0.12	0.04	0.02
2.C.2 - Ferroalloys Production	CH4	1.32	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.C.3 - Aluminium production	CO2	8.78	0.00	2.00	5.00	5.39	0.00	0.00	0.00	0.01	0.00	0.00
2.C.3 - Aluminium production	CF4	64.88	0.00	2.00	5.00	5.39	0.00	0.01	0.00	0.04	0.00	0.00
2.C.3 - Aluminium production	C2F6	26.78	0.00	2.00	5.00	5.39	0.00	0.00	0.00	0.02	0.00	0.00
2.C.4 - Magnesium production	CO2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.4 - Magnesium production	SF6	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.5 - Lead Production	CO2	22.09	5.70	10.00	5.00	11.18	0.00	0.00	0.00	0.01	0.01	0.00
2.C.6 - Zinc Production	CO2	186.23	0.00	10.00	5.00	11.18	0.00	0.02	0.00	0.11	0.00	0.01
2.D - Non-Energy Products from Fuels and Solvent Use												
2.D.1 - Lubricant Use	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D.2 - Paraffin Wax Use	CO2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E - Electronics Industry												
2.E.1 - Integrated Circuit or Semiconductor	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	CHF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	NF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00

2.E.2 - TFT Flat Panel Display	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display	NF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.3 - Photovoltaics	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.3 - Photovoltaics	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.4 - Heat Transfer Fluid	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances												
2.F.1.a - Refrigeration and Stationary Air Conditioning	CHF3	0.00	0.00	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH2F2	0.00	2.34	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CHF2CF3	0.00	48.05	5.00	5.00	7.07	0.00	0.00	0.00	0.02	0.03	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH2FCF3	0.00	151.45	5.00	5.00	7.07	0.01	0.01	0.01	0.07	0.10	0.01
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH3CHF2	0.00	2.53	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CF3CH3	0.00	54.59	5.00	5.00	7.07	0.00	0.01	0.01	0.03	0.04	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CF3CH2CF3	0.00	0.07	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CH2FCF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CH3CHF2	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CF3CHFCF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CF3CH2CF2CH3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CF3CHFCHFCF2CF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CHF2CH2CF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.5 - Solvents	CF3CH2CF2CH3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.5 - Solvents	CF3CHFCHFCF2CF3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.5 - Solvents	C6F14	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2F2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH3F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CHFCHFCF2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CHF2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH3CHF2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CH2F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CH3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CHFCF3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CH2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF2CHF2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00

2.F.6 - Other Applications (please specify)	CH2FCH2F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH3CH2F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CHFCF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CH2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CH2CF2CH3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C2F6	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C4F10	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	c-C4F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C5F12	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G - Electrical Equipment												
2.G.1.a - Manufacture of Electrical Equipment	SF6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	CF4	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C2F6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C3F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C4F10	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	c-C4F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C5F12	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C6F14	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	SF6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	CF4	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C2F6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C3F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C4F10	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	c-C4F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C5F12	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C6F14	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	SF6	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	CF4	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C2F6	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C3F8	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C4F10	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	c-C4F8	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00

2.G.1.c - Disposal of Electrical Equipment	C5F12	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C6F14	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C4F10	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	c-C4F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C5F12	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C4F10	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	c-C4F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C5F12	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	SF6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	CF4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C2F6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C3F8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C4F10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	c-C4F8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C5F12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C6F14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.a - Medical Applications	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.b - Propellant for pressure and aerosol products	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.c - Other (Please specify)	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other												
3.A - Livestock												
3.A.1.a.i - Dairy Cows	CH4	0.00	398.72	5.00	30.00	30.41	0.83	0.04	0.04	1.12	0.26	1.31
3.A.1.a.ii - Other Cattle	CH4	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.b - Buffalo	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.c - Sheep	CH4	287.14	85.57	5.00	30.00	30.41	0.04	0.03	0.01	0.76	0.06	0.58
3.A.1.d - Goats	CH4	0.00	10.08	5.00	30.00	30.41	0.00	0.00	0.00	0.03	0.01	0.00

3.A.1.e - Camels	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.f - Horses	CH4	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.g - Mules and Asses	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.h - Swine	CH4	0.00	6.80	5.00	30.00	30.41	0.00	0.00	0.00	0.02	0.00	0.00
3.A.1.j - Other (please specify)	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.a.i - Dairy cows	CH4	0.00	27.18	5.00	30.00	30.41	0.00	0.00	0.00	0.08	0.02	0.01
3.A.2.a.i - Dairy cows	N2O	0.00	13.65	5.00	30.00	30.41	0.00	0.00	0.00	0.04	0.01	0.00
3.A.2.a.ii - Other cattle	CH4	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.a.ii - Other cattle	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.b - Buffalo	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.b - Buffalo	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.c - Sheep	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.c - Sheep	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.d - Goats	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.d - Goats	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.e - Camels	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.e - Camels	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.f - Horses	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.f - Horses	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.g - Mules and Asses	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.g - Mules and Asses	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.h - Swine	CH4	26.78	10.87	5.00	30.00	30.41	0.00	0.00	0.00	0.06	0.01	0.00
3.A.2.h - Swine	N2O	3.37	0.96	5.00	30.00	30.41	0.00	0.00	0.00	0.01	0.00	0.00
3.A.2.i - Poultry	CH4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.i - Poultry	N2O	0.00	0.00	5.00	30.00	30.41	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.j - Other (please specify)	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.j - Other (please specify)	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B - Land												
3.B.1.a - Forest land Remaining Forest land	CO2	-1654.78	1135.04	20.00	10.00	22.36	3.63	0.30	0.11	2.98	2.99	17.84
3.B.1.b.i - Cropland converted to Forest Land	CO2	-1.21	-23.45	10.00	10.00	14.14	0.00	0.00	0.00	0.02	0.03	0.00
3.B.1.b.ii - Grassland converted to Forest Land	CO2	-45.18	-41.88	10.00	10.00	14.14	0.00	0.00	0.00	0.01	0.06	0.00
3.B.1.b.iii - Wetlands converted to Forest Land	CO2	-0.06	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1.b.iv - Settlements converted to Forest Land	CO2	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1.b.v - Other Land converted to Forest Land	CO2	-22.28	-10.12	10.00	10.00	14.14	0.00	0.00	0.00	0.02	0.01	0.00
3.B.2.a - Cropland Remaining Cropland	CO2	0.00	0.00	20.00	50.00	53.85	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.i - Forest Land converted to Cropland	CO2	44.48	190.42	10.00	50.00	50.99	0.53	0.01	0.02	0.63	0.25	0.46

3.B.2.b.ii - Grassland converted to Cropland	CO2	7.67	8.23	10.00	50.00	50.99	0.00	0.00	0.00	0.01	0.01	0.00
3.B.2.b.iii - Wetlands converted to Cropland	CO2	0.09	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.iv - Settlements converted to Cropland	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.v - Other Land converted to Cropland	CO2	4.00	0.13	10.00	50.00	50.99	0.00	0.00	0.00	0.02	0.00	0.00
3.B.3.a - Grassland Remaining Grassland	CO2	0.00	0.00	20.00	50.00	53.85	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.i - Forest Land converted to Grassland	CO2	11.46	197.60	10.00	50.00	50.99	0.57	0.02	0.02	0.85	0.26	0.80
3.B.3.b.ii - Cropland converted to Grassland	CO2	6.49	9.58	10.00	50.00	50.99	0.00	0.00	0.00	0.01	0.01	0.00
3.B.3.b.iii - Wetlands converted to Grassland	CO2	-0.24	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.iv - Settlements converted to Grassland	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.v - Other Land converted to Grassland	CO2	-21.16	-11.24	10.00	50.00	50.99	0.00	0.00	0.00	0.07	0.01	0.01
3.B.4.a.i - Peatlands remaining peatlands	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4.a.i - Peatlands remaining peatlands	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4.b.i - Land converted for peat extraction	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4.b.ii - Land converted to flooded land	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.a - Settlements Remaining Settlements	CO2	0.00	0.00	20.00	50.00	53.85	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.b.i - Forest Land converted to Settlements	CO2	0.00	9.05	10.00	50.00	50.99	0.00	0.00	0.00	0.04	0.01	0.00
3.B.5.b.ii - Cropland converted to Settlements	CO2	3.62	6.16	10.00	50.00	50.99	0.00	0.00	0.00	0.01	0.01	0.00
3.B.5.b.iii - Grassland converted to Settlements	CO2	5.84	1.57	10.00	50.00	50.99	0.00	0.00	0.00	0.03	0.00	0.00
3.B.5.b.iv - Wetlands converted to Settlements	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.b.v - Other Land converted to Settlements	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.6.b.i - Forest Land converted to Other Land	CO2	70.86	125.21	10.00	50.00	50.99	0.23	0.00	0.01	0.17	0.17	0.06
3.B.6.b.ii - Cropland converted to Other Land	CO2	46.99	19.13	10.00	50.00	50.99	0.01	0.00	0.00	0.18	0.03	0.03
3.B.6.b.iii - Grassland converted to Other Land	CO2	2.65	19.06	10.00	50.00	50.99	0.01	0.00	0.00	0.07	0.03	0.01
3.B.6.b.iv - Wetlands converted to Other Land	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.B.6.b.v - Settlements converted to Other Land	CO2	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
3.C - Aggregate sources and non-CO2 emissions sources on land												
3.C.1.a - Biomass burning in forest lands	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.a - Biomass burning in forest lands	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.b - Biomass burning in croplands	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.b - Biomass burning in croplands	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.c - Biomass burning in grasslands	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.c - Biomass burning in grasslands	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.d - Biomass burning in all other land	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.d - Biomass burning in all other land	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.2 - Liming	CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.3 - Urea application	CO2	3.74	2.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.C.4 - Direct N2O Emissions from managed soils	N2O	82.19	213.33	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00
3.C.5 - Indirect N2O Emissions from managed soils	N2O	28.63	61.82	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
3.C.6 - Indirect N2O Emissions from manure management	N2O	18.41	10.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.7 - Rice cultivation	CH4	29.17	16.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.D - Other												
3.D.1 - Harvested Wood Products	CO2	-0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.A - Solid Waste Disposal												
4.A - Solid Waste Disposal	CH4	265.61	504.85	20.00	20.00	28.28	1.15	0.02	0.05	0.33	1.33	1.88
4.B - Biological Treatment of Solid Waste												
4.B - Biological Treatment of Solid Waste	CH4	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	N2O	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste												
4.C.1 - Waste Incineration	CO2	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	CH4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	N2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CO2	2.86	6.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CH4	5.92	12.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	N2O	0.00	3.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D - Wastewater Treatment and Discharge												
4.D.1 - Domestic Wastewaster Treatment and Discharge	CH4	19.67	20.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D.1 - Domestic Wastewaster Treatment and Discharge	N2O	33.04	39.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D.2 - Industrial Wastewater Treatment and Discharge	CH4	79.58	47.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.E - Other (please specify)												
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3												
5.B - Other (please specify)												
Total												
		Sum(C): 10724.633	Sum(D): 13327.339				Sum(H): 12.656					Sum(M): 34.149
							Uncertainty in total inventory: 3.558					Trend uncertainty: 5.844