



**National Centre for
Emissions Management**
Institute of Environmental Protection
National Research Institute

www.kobize.pl

MINISTRY OF CLIMATE AND ENVIRONMENT

POLAND'S INFORMATIVE INVENTORY REPORT 2026

Submission under the UNECE CLRTAP and NEC Directive
Air pollutant emissions in Poland 1990 – 2024

Warsaw 2026

Poland's Informative Inventory Report 2026**Submission under the UN ECE Convention on Long-range Transboundary Air Pollution and Directive (EU) 2016/2284****Air pollutant emissions in Poland 1990 – 2024**

Report elaborated by:

National Centre for Emissions Management (KOBiZE)

at the Institute of Environmental Protection – National Research Institute

Authors:

Katarzyna Bebkiewicz

Paulina Bździuch

Zdzisław Chłopek

Paulina Grzelak

Iwona Kargulewicz

Anna Olecka

Janusz Rutkowski

Jacek Skośkiewicz

Mariusz Walęzak

Sylwia Waśniewska

Dagna Zakrzewska

Marcin Żaczek

Proofreading: Anna Paczosa, Robert Jeszke

Photo on the cover: Sylwia Waśniewska

Funded by
**NATIONAL FUND
FOR ENVIRONMENTAL PROTECTION
AND WATER MANAGEMENT**

Contents

EXECUTIVE SUMMARY	6
ES1. INTRODUCTION	6
ES2. OVERVIEW OF EMISSION TRENDS	6
ES3. THE MAIN DIFFERENCES IN THE INVENTORY SINCE THE LAST SUBMISSION	9
1 INTRODUCTION	10
1.1 NATIONAL INVENTORY BACKGROUND	10
1.2 INSTITUTIONAL ARRANGEMENTS	11
1.3 INVENTORY PREPARATION PROCESS	12
1.4 METHODS AND DATA SOURCES	12
1.5 KEY CATEGORIES	13
1.6 QA/QC AND VERIFICATION METHODS	15
1.7 GENERAL UNCERTAINTY EVALUATION	16
1.8 ASSESSMENT OF COMPLETENESS	18
2 EXPLANATION OF KEY TRENDS	19
2.1 SO ₂ EMISSIONS	19
2.2 NO _x EMISSIONS	21
2.3 NMVOC EMISSIONS	23
2.4 NH ₃ EMISSIONS	25
2.5 CO EMISSIONS	27
2.6 PM EMISSIONS	29
2.6.1 TSP emissions	29
2.6.2 PM ₁₀ emissions	31
2.6.3 PM _{2.5} emissions	33
2.6.4 BC emissions	35
2.7 POP EMISSIONS	36
2.7.1 PCDD/F emissions	36
2.7.2 HCB emissions	38
2.7.3 PCB emissions	40
2.7.4 PAH emissions	42
2.8 HEAVY METAL EMISSIONS	44
3 ENERGY (NFR SECTOR 1)	50
3.1 SOURCE CATEGORY DESCRIPTION	50
3.2 ENERGY INDUSTRIES (NFR SECTOR 1A1)	51
3.2.1 Source category description	51
3.2.2 Methodological issues	53
3.2.3 Emission trends for NFR sector 1A1	56
3.2.4 Uncertainties and time-series consistency	59
3.2.5 Source-specific QA/QC and verification	59
3.2.6 Source-specific recalculations	60
3.2.7 Source-specific planned improvements	60
3.3 MANUFACTURING INDUSTRIES AND CONSTRUCTION (NFR SECTOR 1A2)	61
3.3.1 Source category description	61
3.3.2 Methodological issues	63
3.3.3 Emission trends for NFR sector 1A2	68
3.3.4 Uncertainties and time-series consistency	70
3.3.5 Source-specific QA/QC and verification	71
3.3.6 Source-specific recalculations	71
3.3.7 Source-specific planned improvements	71
3.4 TRANSPORT (NFR SECTOR 1A3)	72
3.4.1 Source category description	72
3.4.2 Methodological issues	73
3.4.3 Emission trends for NFR sector 1A3	79

3.4.4	Uncertainties and time-series consistency	81
3.4.5	Source-specific QA/QC and verification	82
3.4.6	Source-specific recalculations	82
3.4.7	Source-specific planned improvements	82
3.5	OTHER SECTORS (NFR SECTOR 1A4)	83
3.5.1	Source category description	83
3.5.2	Methodological issues	86
3.5.3	Emission trends for NFR sector 1A4	89
3.5.4	Uncertainties and time-series consistency	92
3.5.5	Source-specific QA/QC and verification	92
3.5.6	Source-specific recalculations	92
3.5.7	Source-specific planned improvements	92
3.6	OTHER STATIONARY AND MOBILE SOURCES (NFR SECTOR 1A5)	93
3.7	FUGITIVE EMISSIONS (NFR SECTOR 1B)	94
3.7.1	Source category description	94
3.7.2	Methodological issues	96
3.7.3	Emission trends for NFR sector 1B	98
3.7.4	Uncertainties and time-series consistency	100
3.7.5	Source-specific QA/QC and verification	101
3.7.6	Source-specific recalculations	101
3.7.7	Source-specific planned improvements	101
4	INDUSTRIAL PROCESSES AND PRODUCT USE (NFR SECTOR 2)	102
4.1	SOURCE CATEGORY DESCRIPTION	102
4.2	MINERAL PRODUCTS (NFR SECTOR 2A)	103
4.2.1	Source category description	103
4.2.2	Methodological issues	104
4.2.3	Emission trends for NFR sector 2A	106
4.2.4	Uncertainties and time-series consistency	107
4.2.5	Source-specific QA/QC and verification	108
4.2.6	Source-specific recalculations	108
4.2.7	Source-specific planned improvements	108
4.3	CHEMICAL INDUSTRY (NFR SECTOR 2B)	109
4.3.1	Source category description	109
4.3.2	Methodological issues	110
4.3.3	Emission trends for NFR sector 2B	111
4.3.4	Uncertainties and time-series consistency	112
4.3.5	Source-specific QA/QC and verification	113
4.3.6	Source-specific recalculations	113
4.3.7	Source-specific planned improvements	113
4.4	METAL PRODUCTION (NFR SECTOR 2C)	114
4.4.1	Source category description	114
4.4.2	Methodological issues	115
4.4.3	Emission trends for NFR sector 2C	116
4.4.4	Uncertainties and time-series consistency	118
4.4.5	Source-specific QA/QC and verification	119
4.4.6	Source-specific recalculations	119
4.4.7	Source-specific planned improvements	119
4.5	SOLVENTS USE (NFR SECTOR 2D)	120
4.5.1	Source category description	120
4.5.2	Methodological issues	121
4.5.3	Emission trends for NFR sector 2D	125
4.5.4	Uncertainties and time-series consistency	127
4.5.5	Source-specific QA/QC and verification	128
4.5.6	Source-specific recalculations	128
4.5.7	Source-specific planned improvements	128
4.6	OTHER PRODUCT USE (NFR SECTOR 2G)	129
4.6.1	Source category description	129

4.6.2	<i>Methodological issues</i>	130
4.6.3	<i>Emission trends for the NFR sector 2G</i>	130
4.6.4	<i>Uncertainties and time-series consistency</i>	132
4.6.5	<i>Source-specific QA/QC and verification</i>	133
4.6.6	<i>Source-specific recalculations</i>	133
4.6.7	<i>Source-specific planned improvements</i>	133
4.7	OTHER PRODUCTS (NFR SECTORS 2H AND 2I)	134
4.7.1	<i>Source category description</i>	134
4.7.2	<i>Methodological issues</i>	134
4.7.3	<i>Emission trends for NFR sectors 2H – 2I</i>	137
4.7.4	<i>Uncertainties and time-series consistency</i>	138
4.7.5	<i>Source-specific QA/QC and verification</i>	138
4.7.6	<i>Source-specific recalculations</i>	138
4.7.7	<i>Source-specific planned improvements</i>	139
5	AGRICULTURE (NFR SECTOR 3).....	140
5.1	SOURCE CATEGORY DESCRIPTION	140
5.2	OVERVIEW OF AGRICULTURE SECTOR IN 2024	140
5.3	MANURE MANAGEMENT (NFR SECTOR 3B).....	141
5.3.1	<i>Source category description</i>	141
5.3.2	<i>Methodological issues</i>	143
5.3.3	<i>Emission trends for NFR sector 3B</i>	152
5.4	AGRICULTURAL SOILS (NFR SECTOR 3D).....	153
5.4.1	<i>Source category description</i>	153
5.4.2	<i>Methodological issues</i>	154
5.4.3	<i>Emission trends for NFR sector 3D</i>	161
5.5	FIELD BURNING OF AGRICULTURAL RESIDUES (NFR SECTOR 3F)	163
5.5.1	<i>Source category description</i>	163
5.5.2	<i>Methodological issues</i>	163
5.5.3	<i>Emission trends for NFR sector 3F</i>	164
5.6	UNCERTAINTIES AND TIME-SERIES CONSISTENCY	166
5.7	SOURCE-SPECIFIC QA/QC AND VERIFICATION	166
5.8	SOURCE-SPECIFIC RECALCULATIONS	167
5.9	SOURCE-SPECIFIC PLANNED IMPROVEMENTS	167
6	WASTE (NFR SECTOR 5).....	168
6.1	SOURCE CATEGORY DESCRIPTION	168
6.2	SOLID WASTE DISPOSAL ON LAND (NFR SECTOR 5A)	169
6.2.1	<i>Source category description</i>	169
6.2.2	<i>Methodological issues</i>	169
6.2.3	<i>Emission trends for NFR sector 5A</i>	170
6.2.4	<i>Uncertainties and time-series consistency</i>	170
6.2.5	<i>Source-specific QA/QC and verification</i>	170
6.2.6	<i>Source-specific recalculations</i>	170
6.2.7	<i>Source-specific planned improvements</i>	170
6.3	BIOLOGICAL TREATMENT OF WASTE (NFR SECTOR 5B)	171
6.3.1	<i>Source category description</i>	171
6.3.2	<i>Methodological issues</i>	171
6.3.3	<i>Emission trends for NFR sector 5B</i>	172
6.3.4	<i>Uncertainties and time-series consistency</i>	173
6.3.5	<i>Source-specific QA/QC and verification</i>	173
6.3.6	<i>Source-specific recalculations</i>	173
6.3.7	<i>Source-specific planned improvements</i>	173
6.4	INCINERATION AND OPEN BURNING OF WASTE (NRF SECTOR 5C)	174
6.4.1	<i>Source category description</i>	174
6.4.2	<i>Methodological issues</i>	175
6.4.3	<i>Emission trends for NFR sector 5C</i>	176
6.4.4	<i>Uncertainties and time-series consistency</i>	178

6.4.5	Source-specific QA/QC and verification.....	178
6.4.6	Source-specific recalculations.....	178
6.4.7	Source-specific planned improvements.....	178
6.5	WASTEWATER HANDLING (NFR SECTOR 5D)	179
6.5.1	Source category description	179
6.5.2	Methodological issues.....	179
6.5.3	Emission trends for NFR sector 5D	180
6.5.4	Uncertainties and time-series consistency	181
6.5.5	Source-specific QA/QC and verification.....	181
6.5.6	Source-specific recalculations.....	181
6.5.7	Source-specific planned improvements.....	181
6.6	OTHER WASTE (NFR SECTOR 5E)	182
6.6.1	Source category description	182
6.6.2	Methodological issues.....	182
6.6.3	Emission trends for NFR sector 5E.....	183
6.6.4	Uncertainties and time-series consistency	184
6.6.5	Source-specific QA/QC and verification.....	184
6.6.6	Source-specific recalculations.....	184
6.6.7	Source-specific planned improvements.....	184
7	OTHER AND NATURAL EMISSIONS	185
7.1	FOREST FIRES (NFR SECTOR 11B).....	185
7.2	OTHER NATURAL SOURCES (NFR SECTOR 11C)	185
8	RECALCULATIONS AND IMPROVEMENTS.....	186
8.1	RECALCULATIONS	186
8.2	PLANNED IMPROVEMENTS.....	189
9	PROJECTIONS.....	190
9.1	METHODS AND DATA SOURCES.....	190
9.1.1	Energy industries (NFR sector 1A1)	191
9.1.2	Manufacturing industries and Construction (NFR sector 1A2)	195
9.1.3	Road transport (NFR sector 1A3b)	199
9.1.4	Off-road transport (NFR sectors 1A3a,c,d,e).....	205
9.1.5	Other sectors (NFR sector 1A4)	210
9.1.6	Fugitive emissions from fuels (NFR sector 1B).....	216
9.1.7	Industrial processes (NFR sectors 2A, 2B, 2C, 2H)	219
9.1.8	Solvents and other products use (NFR sectors 2D, 2G).....	224
9.1.9	Agriculture (NFR sector 3)	228
9.1.10	Waste (NFR sector 5)	235
9.2	ESTIMATED EMISSION PROJECTIONS.....	239
9.2.1	Projected NO _x emissions	239
9.2.2	Projected SO ₂ emissions	240
9.2.3	Projected NMVOC emissions	242
9.2.4	Projected NH ₃ emissions.....	244
9.2.5	Projected PM _{2.5} emissions.....	246
9.2.6	Projected BC emissions.....	248
9.3	SUMMARY.....	250
10	GRIDDED EMISSIONS AND LPS	251
10.1	GRIDDED EMISSIONS	251
10.1.1	Public power (GNFR A_PublicPower)	252
10.1.2	Industry (GNFR B_Industry).....	252
10.1.3	Other stationary combustion (GNFR C_OtherStationaryComb).....	252
10.1.4	Fugitive Emissions (GNFR D_Fugitive).....	253
10.1.5	Solvents (GNFR E_Solvents)	253
10.1.6	Road transport (GNFR F_RoadTransport).....	253
10.1.7	National navigation (GNFR G_Shipping).....	254

10.1.8	Aviation (LTO) (GNFR H_Aviation)	254
10.1.9	Off road mobile sources (GNFR I_Offroad)	254
10.1.10	Waste (GNFR J_Waste)	254
10.1.11	Agricultural livestock (GNFR K_AgriLivestock)	255
10.1.12	Agricultural soils (GNFR L_AgriOther)	255
10.1.13	Natural emissions (GNFR N_natural)	255
10.1.14	Aviation (Cruise) (GNFR O_AviCruise)	255
10.1.15	International navigation (GNFR P_IntShipping)	255
10.1.16	Results of gridded data	255
10.2	LPS DATA	258
11	ABBREVIATIONS	260
12	REFERENCES	265

Appendices

APPENDIX 1. KEY CATEGORY ANALYSIS.....	273
APPENDIX 2. METHODOLOGY OF BIOGENIC NATURAL VOC (BVOC) EMISSION ESTIMATES	284
APPENDIX 3. ASSESSMENT OF COMPLETENESS.....	288
APPENDIX 4. NATIONAL ENERGY BALANCE FOR 2024 IN EUROSTAT FORMAT	290
APPENDIX 5. ACTIVITY DATA	297
APPENDIX 6. EMISSION FACTORS	334
APPENDIX 7. 2025 TECHNICAL REVIEW OF NATIONAL EMISSION INVENTORIES.....	368
APPENDIX 8. UNCERTAINTY ANALYSIS OF EMISSIONS OF SELECTED AIR POLLUTANTS	379
APPENDIX 9. SUMMARY INFORMATION ON CONDENSABLES IN PM	380
APPENDIX 10. THE STRUCTURE OF HEATING DEVICES OPERATED IN THE SMALL COMBUSTION SECTOR (NFR 1A4).....	383

EXECUTIVE SUMMARY

ES1. Introduction

Poland's Informative Inventory Report 2026 (IIR 2026) contains results of emission inventories for the years from 1990 to 2024, including descriptions of methods, data sources, performed QA/QC activities, key categories analysis and a trend analysis.

IIR 2026 was prepared to fulfil reporting obligations of:

- The UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP),
- Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC,
- National statistics.

The national inventory covers the emission of the following pollutants:

- sulphur oxides (SO_x), expressed as sulphur dioxide (SO₂),
- nitrogen oxides (NO_x),
- ammonia (NH₃),
- carbon monoxide (CO),
- particulate matter, including:
 - total suspended particulates – TSP,
 - particulate matter fraction PM₁₀,
 - particulate matter fraction PM_{2.5},
 - black carbon - BC,
- non-methane volatile organic compounds (NMVOCs),
- heavy metals (HMs),
- persistent organic pollutants (POPs), including:
 - dioxins and furans (PCDD/F),
 - hexachlorobenzene (HCB),
 - polychlorinated biphenyls (PCB),
 - polycyclic aromatic hydrocarbons (PAHs).

The methodology used to estimate emissions is in line with the EMEP/EEA Air Pollutant Emission Inventory Guidebook. Emission inventories have been reported in the obligatory reporting template (NFR 2019-1 format). A detailed description of the methodology and results of the inventory of air pollution emissions is provided in Chapters 3-7 of this report.

For the purposes of this report, the terms “sector” and “category” are used interchangeably.

ES2. Overview of emission trends

All emission trends are analysed and explained in detail in Chapter 2. Inventory results and changes in emissions at the country level for air pollutants are presented in Table ES.1.

Table ES.1. Comparison of total pollutant emissions in selected years

Pollutant	Unit	1990	2005	2020	2023	2024	2024/ 1990 [%]	2024/ 2005 [%]	2024/ 2023 [%]
SO ₂	kt	2 687.54	1 107.77	348.29	269.17	245.61	-90.9	-77.83	-8.75
NO _x	kt	1 105.68	835.72	565.46	503.34	476.84	-56.9	-42.94	-5.27
NMVOC	kt	791.14	818.67	729.95	606.17	614.38	-22.3	-24.95	1.35
NH ₃	kt	510.83	348.04	338.95	313.93	317.61	-37.8	-8.74	1.17
CO	kt	4 030.73	3 574.37	2 761.30	2 182.59	1 971.96	-51.1	-44.83	-9.65
TSP	kt	1387.59	604.99	522.21	435.36	410.08	-70.4	-32.22	-5.81
PM ₁₀	kt	786.73	445.88	400.74	321.30	300.27	-61.8	-32.66	-6.54
PM _{2.5}	kt	421.99	322.98	304.41	233.67	214.05	-49.3	-33.72	-8.39
BC	kt	22.64	21.36	18.12	14.75	13.53	-40.2	-36.66	-8.25
Pb	t	542.06	268.35	253.20	221.47	222.24	-59.0	-17.19	0.34
Cd	t	11.78	9.53	10.71	9.29	9.31	-21.0	-2.35	0.18
Hg	t	14.68	9.82	7.60	5.14	4.75	-67.6	-51.61	-7.43
As	t	144.27	15.94	12.13	10.30	10.10	-93.0	-36.61	-1.88
Cr	t	55.71	41.42	33.72	31.80	30.98	-44.4	-25.21	-2.58
Cu	t	200.60	216.35	298.90	314.68	313.83	56.4	45.06	-0.27
Ni	t	199.93	105.63	64.17	60.30	58.44	-70.8	-44.67	-3.07
Zn	t	786.92	516.65	538.96	474.90	463.03	-41.2	-10.38	-2.50
HCB	kg	82.88	11.72	3.43	3.55	3.26	-96.1	-72.20	-8.17
PCB	kg	206.66	171.49	142.64	125.25	125.23	-39.4	-26.98	-0.02
BaP	t	120.16	109.07	91.54	68.03	60.07	-50.0	-44.93	-11.70
BbF	t	122.45	108.41	93.62	70.50	62.80	-48.7	-42.08	-10.92
BkF	t	52.08	48.20	44.55	34.08	30.58	-41.3	-36.55	-10.27
IP	t	41.07	39.44	36.15	27.05	24.22	-41.0	-38.59	-10.46
PAHs*	t	341.48	310.38	271.39	203.55	180.66	-47.1	-41.79	-11.25
PCDD/F	g i-TEQ	374.06	348.19	332.54	261.04	231.89	-38.0	-33.40	-11.17

* The sum of the individual PAHs differs from the total PAHs, because for some subcategories the total amount of PAHs is calculated instead of its components. This is due to the available emission factors for subcategories.

Emissions of all air pollutants (except copper) have decreased significantly since 1990. In the case of major pollutants (SO₂, NO_x and particulate matter) the reductions were caused by the decline of the heavy industry and lower share of coal in combusted fuels in the late 1980s and early 1990s. The most significant decreases were noted in combustion processes in the 1A1. *Energy industries*. It was the result of the improvement of plants technical parameters to meet more stringent standards resulting from Poland's accession to the EU, for example the 2001/80/EC¹ Directive and the 2010/75/EU Directive (IED²). Plant operators also gradually took steps to adjust (until August 16, 2021) large combustion plants to meet the requirements established in the best available techniques (BAT) conclusions (EU Commission Implementing Decision 2021/2326 of 30.11.2021³).

Since the late 1990s, the largest source of NO_x emissions has been the combustion of fuels in road transport, from which emissions have been steadily increasing, mainly due to increase in the number of vehicles and their transport activity. In the last few years the situation in this sector is improving by the increasing share of vehicles with the higher Euro quality standards

¹ Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants

² Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)

³ Commission Implementing Decision (EU) 2021/2326 of 30 November 2021 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants

as well as an increasing share of hybrid and electric vehicles.

When analysing the scale and impact of PM emission, two fractions – filterable and condensable - should be taken into consideration. Information for all sectors, on whether the PM10 and PM2.5 emission factors include or exclude the condensable component is given in Appendix 9.

The largest source of particular matter emissions (significant share of which is the condensable fraction) in Poland are stationary combustion processes, mostly in sector 1A4. *Other sources* (mainly from fuel combustion in the household sector). As including condensable fraction in emission calculations is crucial when assessing the impact of this sector on the annual particular matter emissions, emission factors include both filterable and condensable components.

Trends of main pollutants emissions are shown in figures ES.1 and ES.2.

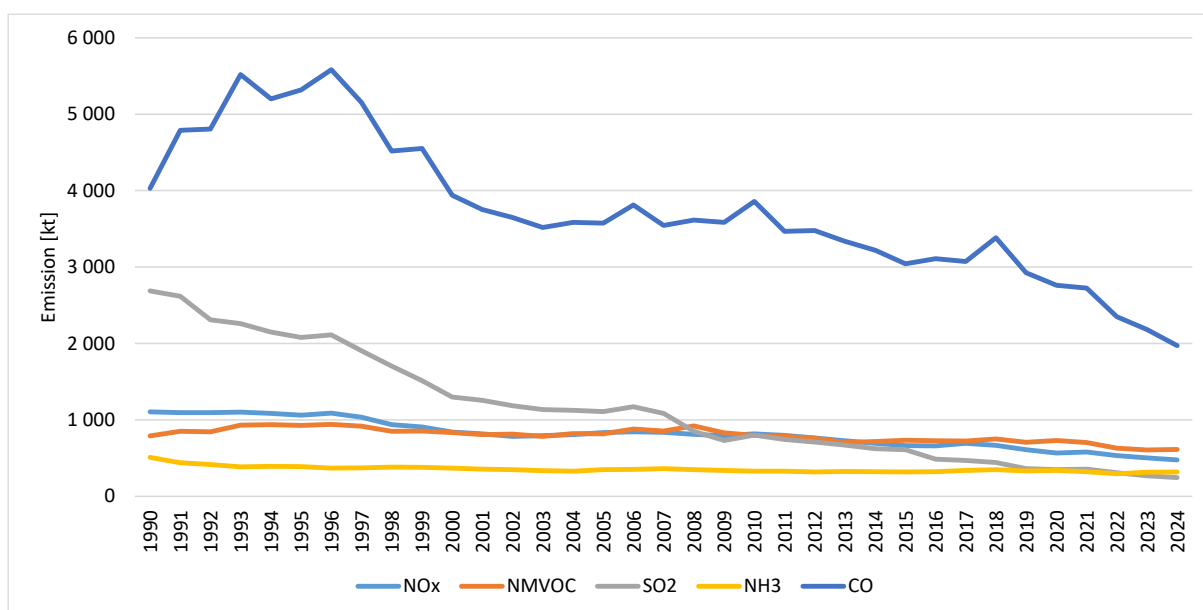


Figure ES. 1. Emission of main air pollutants in years 1990 – 2024

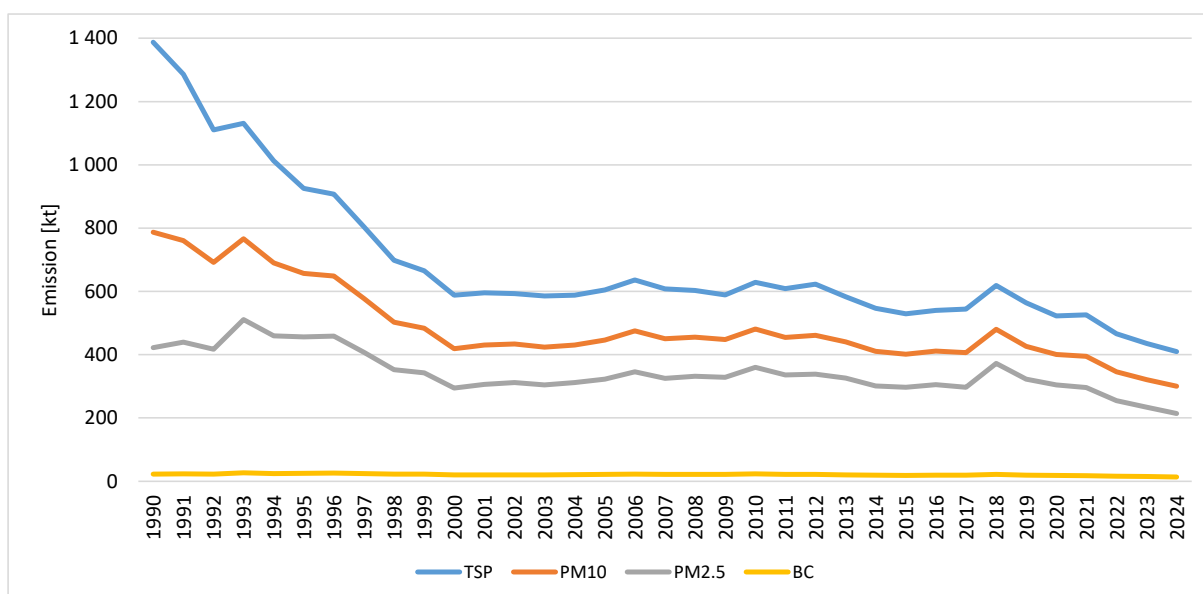


Figure ES. 2. Emission of particular matter in years 1990 – 2024

ES3. The main differences in the inventory since the last submission

Emissions for all years starting from 1990 were recalculated and described in this report. Detailed sectoral information on performed recalculations is presented in Chapters 3-6 and Chapter 8.1.

In 2026 the methodology was updated based on:

- recommendations resulting from 2025 NECD Comprehensive Review of Polish Inventory (Final Review Report 2025) i.e. the methodology for estimating emissions was verified in several sectors and new, previously unaccounted, emission sources were added,
- activity data and emission factors update according to the latest available data.

Due to methodological changes, emission levels have changed in many categories in relation to the emissions reported last year, in the entire emission trend since 1990. Table ES.2 summarizes the total emissions submitted in 2025 and 2026 for years 2005 and 2023.

Table ES.2. Total pollutant emissions submitted in 2025 and 2026 for years 2005 and 2023

Pollutant	Unit	2005			2023		
		Submission 2025	Submission 2026	Changes [%]	Submission 2025	Submission 2026	Changes [%]
SO ₂	kt	1 106.6	1 107.8	0.1	273.3	269.2	-1.5
NO _x	kt	839.4	835.7	-0.4	492.0	503.3	2.3
NMVOC	kt	848.3	818.7	-3.5	640.2	606.2	-5.3
NH ₃	kt	345.5	348.0	0.7	310.5	313.9	1.1
CO	kt	3 593.8	3 574.4	-0.5	2 140.3	2 182.6	2.0
TSP	kt	602.2	605.0	0.5	431.4	435.4	0.9
PM ₁₀	kt	445.9	445.9	0.0	321.3	321.3	0.0
PM _{2.5}	kt	323.0	323.0	0.0	233.4	233.7	0.1
BC	kt	21.4	21.4	0.0	14.4	14.7	2.7
Pb	t	268.3	268.4	0.0	221.2	221.5	0.1
Cd	t	9.5	9.5	0.2	9.3	9.3	0.3
Hg	t	9.8	9.8	0.2	5.1	5.1	0.4
As	t	15.9	15.9	0.2	10.3	10.3	0.4
Cr	t	41.4	41.4	0.1	31.6	31.8	0.5
Cu	t	216.3	216.3	0.0	311.4	314.7	1.0
Ni	t	105.6	105.6	0.0	60.1	60.3	0.4
Zn	t	516.6	516.6	0.0	474.0	474.9	0.2
HCB	kg	11.7	11.7	0.0	3.5	3.5	0.0
PCB	kg	172.1	171.5	-0.4	127.0	125.3	-1.4
PAHs	t	310.3	310.4	0.0	203.4	203.6	0.1
PCDD/F	g I-TEQ	348.2	348.2	0.0	260.6	261.0	0.2

The largest change (decrease in emissions) compared to the 2025 submission was observed in the case of NMVOC emissions. The main reason was the reduction in emissions in sector 3B. *Agricultural soils*, resulting from the use of lower parameters (indicated in the EMEP/EEA 2023 guidelines) related to feeding silage to cattle.

The change in NMVOC emissions was also influenced by the implementation of recommendations from the national inventory review, which resulted in corrections to some NMVOC emission factors in subsectors 1A2d. *Pulp, paper and print* and 2D3i. *Other solvent use*.

1 INTRODUCTION

Poland's Informative Inventory Report 2026 (IIR 2026) contains information on Poland's emission inventories for the years from 1990 to 2024, including descriptions of methods, data sources, performed QA/QC activities, key categories analysis and a trend analysis.

Emission estimates in Poland account for:

- Sulphur dioxide (SO₂),
- Nitrogen oxides (NO_x),
- Ammonia (NH₃),
- Carbon monoxide (CO),
- Particulate matter (black carbon - BC, particulate matter - PM_{2.5} and PM₁₀ and total suspended particulates - TSP),
- Non-methane volatile organic compounds (NMVOCs),
- Heavy metals (HMs – Cd, Pb, Hg, As, Cr, Cu, Ni, Zn),
- Persistent organic pollutants (POPs) including dioxins (PCDD/F), hexachlorobenzene (HCB), polychlorinated biphenyls (PCB) and polycyclic aromatic hydrocarbons (PAH).

Preparation of IIR Report fulfils Poland's obligations deriving from:

- UN ECE Convention on Long-range Transboundary Air Pollution, signed in November 1979 in Geneva,
- Directive 2016/2284 of the European Parliament and the Council on National Emissions Ceilings (NECD).

Emission inventories have been reported in the obligatory reporting template (NFR 2019-1 format), in accordance to revised guidelines for reporting emissions and projections data under the Convention.

The structure of the report is compliant with the template of an Informative Inventory Report to CLRTAP. For each pollutant or group of pollutants the report includes inter alia:

- Key categories analysis,
- Trends of national totals and NFR key sectors,
- Methodology of emission estimates.

1.1 National Inventory Background

Emission estimates are predominantly based on official Polish statistics, e.g. energy statistics, agricultural statistics, transport statistics, industry statistics and emission factors (nationally developed factors as well as internationally recommended ones).

Poland generally implements the Guidelines for reporting emissions and projections data under the Convention on Long-Range Transboundary Air Pollution (CLRTAP) under the Economic Commission for Europe (UNECE).

1.2 Institutional arrangements

The inventory system currently existing in Poland is presented in Figure 1.1.

The Polish Ministry of Climate and Environment takes the overall responsibility and submits the inventory report to CLRTAP and European Union. In 2010, based on new law⁴, the inventory team was constituted as Emission Inventory Unit (ZIE) and located in the National Centre for Emissions Management (KOBiZE), part of the Institute of Environmental Protection – National Research Institute-PIB) (IOŚ–PIB). ZIE develops the inventory reports and is also responsible for the final quality control and quality assurance (QA/QC) of submitted data.

After its completion the inventory is reviewed by the Ministry of Climate and Environment, officially approved and sent to CLRTAP and EEA. Emission inventories are the basis for preparation of Air Emissions Accounts (AEA) according to NACE classification which are sent via Statistics Poland (GUS) to Eurostat.

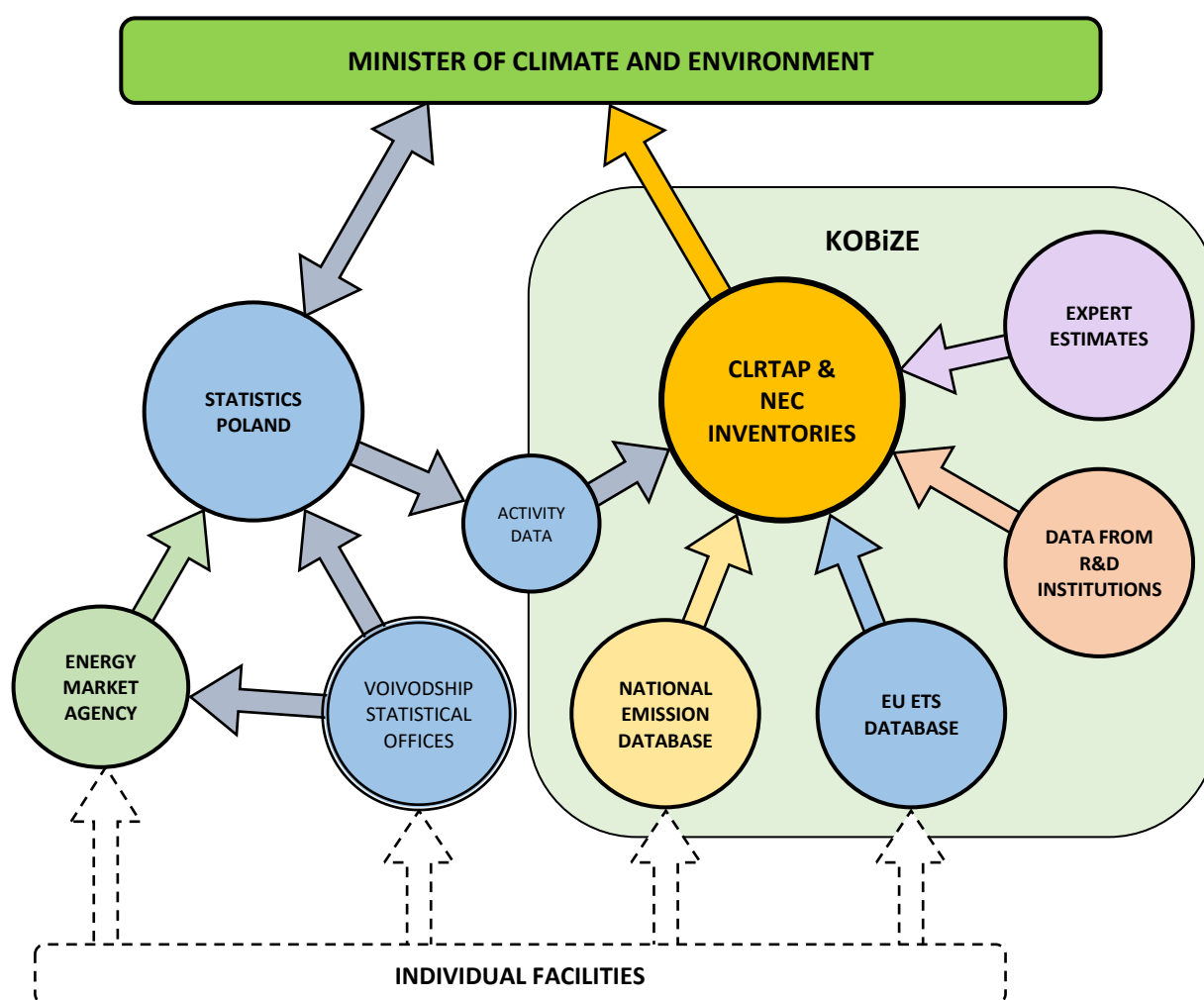


Figure 1.1. Scheme of the national air emission inventory system

⁴ The Act of 17th July 2009 on the System to Manage the Emissions of Greenhouse Gases and Other Substances (USZE)

1.3 Inventory preparation process

The emission estimates are based on methodologies described in EMEP/EEA Air Pollutant Emission Inventory Guidebook (EMEP/EEA EIG). Wherever necessary and possible, domestic methodologies and emission factors have been developed to reflect country specific conditions. The most important features of the inventory preparation and archiving are briefly summarized below:

- activity data was mostly sourced from official public statistics (GUS, Eurostat) or, when required data was not directly available, from (commissioned) research reports or expert estimates; in particular detailed categories, estimates made by individual industries or market players were also used if available;
- emission factors for the main emission categories were sourced from EMEP/EEA EIG or, where it was possible, domestic emission factors were used;
- all activity data, emission factors and resulting emission data is stored in a database in KOBIZE; the database is constantly updated and extended to meet constantly changing requirements for emission reporting, with respect to UNFCCC and CLRTAP as well as their protocols.

To prepare the emission inventory ZIE collaborates with a number of institutions as well as individual experts. The collaborating institutions are *inter alia*: Statistics Poland (GUS), Energy Market Agency (ARE), Institute of Technology and Life Sciences-National Research Institute (ITP-PIB), National Research Institute of Animal Production (IZ-PIB).

1.4 Methods and data sources

The emissions inventory presented in this report follows the recommended EMEP/EEA Emission Inventory Guidebook. According to the guidebook country specific methods of emission estimation have been used, where appropriate and feasible, ensuring more accurate emission data especially regarding key categories. For categories where emissions do not occur or are not estimated the appropriate abbreviations were used in tables.

More detail description of methodologies used in Polish air pollutant inventory is presented in sections 3–7.

The inventory methods comply also (to the extent possible) with the recommendations obtained during the last and previous inventory reviews.

Emissions from the fuel combustion (1A. Energy category) were evaluated based on fuel consumption estimates and respective emission factors. Data on fuel consumption for stationary and mobile sources with disaggregation into fuel type and source category was sourced from official fuel balances elaborated by Statistics Poland and reported to Eurostat pursuant to Article 4 of Regulation of the European Parliament and of the Council (EC) No. 1099/2008 of 22nd October 2008 on energy statistics.

One of the steps of estimating emission from the 1A. Energy category is the preparation of energy budgets for main fuels (energy carriers). These budgets are prepared based on the national energy balances published by Statistics Poland and Energy Market Agency. The tables of the national energy balance include detailed information on the ins and outs of all the energy carriers used in Poland, as well as information on their conversions to other energy carriers and on their direct consumption. The data for international bunker is also assessed.

The example of evaluation of hard coal consumption is given in Table 1.1.

Basic information on activity data regarding NFR categories derives from Eurostat and Statistics Poland (GUS) databases. The activity data that was not available in GUS, has been developed by experts commissioned specifically for the emission inventory purposes.

Table 1.1. Hard coal consumption in Poland in 2024

National fuel balance	Hard coal	
	kt*	TJ*
In	52 298	1 264 212
From national sources	44 176	1 063 065
1) Indigenous production	43 945	1 057 066
2) transformation output and return	231	5 999
3) Stock decrease	0	0
Import	8 122	201 147
Out	52 298	1 264 212
National consumption	50 137	1 198 996
1) Transformation input	40 537	957 903
a) Input for secondary fuel production	10 013	295 538
b) Fuel combustion	30 524	662 365
2) Direct consumption	9 600	241 093
Non-energy use	13	338
Combusted directly	9587	240 755
Combusted in Poland	40 111	903 121
Stock increase	-1 130	-29 019
Export	4 508	124 586
Losses and statistical differences	-1 217	-30 350

* Due to rounding, the sum of the components may slightly differ from the total

The Eurostat database containing domestic data provided by GUS is the main source of activities for *Energy* sector, covering stationary and mobile sources. Detailed information on fuel use is presented in Appendix 5.

Emission factors for remaining categories are in most cases implemented from the EMEP/EEA Emission Inventory Guidebook 2023 or from domestic research reports. The sources of particular emission factors are presented below in the sectoral chapters. All emission factors used for 2024 estimates are presented in Appendix 6.

The inventory team (*Emission Inventory Unit*), as a subunit of KOBIZE, has access to individual data of entities reporting to the National Emission Database of greenhouse gases and other substances carried out by KOBIZE IOŚ-PIB. The entities report directly to it, by the end of February, information on emissions and related parameters for the previous year. This ensures availability of data concerning major sources of emissions in stationary combustion sectors (NFR 1A1, 1A2) as well as from specific industrial processes. Such data is - after verification - successively included into emission inventory where possible.

To ensure consistency with reports, which are submitted to UNFCCC, activity data (fuels use, goods production) is harmonized with GHG inventories.

1.5 Key Categories

Key category analysis for air emissions is based on the EMEP/EEA Emission Inventory Guidebook 2023. The simplest approach, based on contribution to emission level, is used to highlight which sources of emissions are the most important. In this approach, key categories are sources, which sum up to 80% of the total country emission of a particular pollutant.

In this report level assessments were performed for the following pollutants: NO_x, CO, SO₂,

NH₃, NMVOC, TSP, main heavy metals and POPs.

Table 1.2 presents the general information on identified key categories in the national inventory for 2023. Categories under 1A. *Stationary combustion* are the main source of emissions of most pollutants. Sector 2C. *Metal industry* is the main source of Pb emissions. Agriculture sectors (3B, 3D) are the main sources of emissions for NH₃. The complete tables with level and trend assessments for 1990 and 2024 are given in Appendix 1.

Table 1.2. Key category analysis results in 2024

Pollutant	Key categories (Sorted from high to low)										Total
SO ₂	1A4bi	1A1a	1A2f	1A4ci							81.2%
	38.3%	36.3%	3.5%	3.1%							
NO _x	1A1a	1A3biii	1A3bi	1A4bi	3Da1	1A3bii	1A4cii	3Da2a	1A4ai		81.3%
	17.8%	15.1%	12.0%	10.6%	7.9%	5.9%	5.6%	4.0%	2.4%		
NH ₃	3Da2a	3Da1	3B1a	3B3	3B4gii	3B1b					82.3%
	32.00%	16.60%	14.50%	7.30%	6.90%	5.00%					
NMVOC	1A4bi	2D3d	3B1a	2D3a	1B1a	2D3i	2D3g	1A3bi	3B1b	3B4gii	81.3%
	17.4%	10.3%	8.0%	7.9%	7.1%	6.2%	5.9%	5.1%	3.6%	1.8%	
	3B4gii	3B4gii	1A3bv	2D3h	1B2b	3B4gi					
	2.5%	2.50%	2.1%	2.1%	1.6%	1.5%					
CO	1A4bi	1A3bi	1A4ci								81.8%
	61.00%	16.50%	4.30%								
TSP	1A4bi	3Dc	2A5b	2A5a	2D3b	1B1a	1A4ci	3B4gi	1A3bvi		80.2%
	45.00%	7.10%	6.2%	6.10%	4.40%	3.40%	3.0%	2.70%	2.3%		
PM10	1A4bi	3Dc	1A4ci	2A5a	2A5b	1A3bvi	1B1a				81.8%
	58.60%	9.7%	3.90%	2.7%	2.5%	2.40%	2.00%				
PM2.5	1A4bi	1A4ci									81.2%
	76.20%	5.00%									
Pb	2C1	2C5	1A3bvi	1A4bi	1A1a	2C6					84.2%
	26.20%	19.20%	12.80%	11.40%	8.80%	5.80%					
Hg	1A1a	2C6	1A4bi	5C1bv	2C5	2C1	2D3a				83.3%
	45.70%	9.8%	9.10%	5.30%	4.5%	4.50%	4.40%				
Cd	1A4bi	2C1	1A1a	2C5	2C6	1A1b	1A2gviii	2G			81.0%
	28.60%	14.20%	8.20%	7.50%	6.90%	6.00%	4.90%	4.70%			
DIOX	1A4bi	5E	1A4ci								81.2%
	64.00%	12.60%	4.60%								
PAH	1A4bi										83.2%
	83.20%										
HCB	1A4bi	1A1a	3Df								80.3%
	31.20%	25.3%	23.80%								
	1A1 Energy industries			1A2 Manufacturing industries			1A3 Transport				
	1A4 Other sectors		1B Fugitive		2 IPPU	3 Agriculture		5 Waste			

1.6 QA/QC and verification methods

The programme for Quality Assurance and Quality Control has been elaborated to improve and assure high quality of the Polish annual greenhouse gas inventory. Rules of the programme apply also to the emissions inventory prepared for the UN ECE Convention on Long-range Transboundary Air Pollution. The QA/QC programme contains tasks and responsibilities as well as the time schedule for performance of the QA/QC procedures. In 2009 QA/QC plan has been extended by automated back-up of inventory databases on separate server.

The Polish inventory is developed in two main steps. The first step is performing calculations approximately 10 – 11 months after the end of the inventoried year (n–1) depending primarily on the availability of required activity data. The initial check of activity data and estimation procedures is then performed. As soon as the official statistics are available data is revised and final inventory is prepared.

The calculated emissions figures for a given year are compared to the respective figures from previous years (time series), and outliers are scrutinized in more detail. After the verification stage had been completed, the final inventory files are prepared together with the accompanying reports.

When finalized, the inventory is reviewed by the Ministry of Climate and Environment, including internal consultations with ministry departments. Then inventory data is officially approved.

The national inventory team – *Emission Inventory Unit* (ZIE) which is responsible for preparation of emission inventories, is also responsible for coordination and implementing the QA/QC activities to improve consistency and completeness of the inventories. These activities include RepDab⁵ check procedure and taking into account recommendations resulting from three stages of the CEIP technical review of submitted data.

The present QA/QC programme has been elaborated in parallel to QA/QC programme for GHG inventories in line with Chapter 6 of the 2006 *IPCC Guidelines for National GHG Inventories*, Quality control (QC). Present QA/QC programme consists of double internal checking and external peer review conducted by the Ministry of Climate and Environment. Since 2010 selected activities and emission volumes have derived from the National Emission Database (NED). For consistency maintenance, the data derived from the NED is verified or consulted with independent sectoral expert.

Data management and archiving

All activity data, emission factors and resulting emission data is stored in the inventory databases, which are constantly updated and extended to meet the requirements for emission reporting, with respect to UNFCCC and CLRTAP as well as their protocols.

Inventory databases are automatically archived on a separate backup server. Access to emission data for selected years, sectors and pollutants is possible via Internet. Inventory results are accessible from the EEA EIONET Central Data Repository (CDR) at [EIONET website](#). Inventory reports are presented for downloading also at [KOBIZE website](#).

⁵ RepDab is an electronic tool to check the format, completeness and internal consistency of submissions of non-gridded emission data submitted to the secretariat of the Convention on Long-range Transboundary Air Pollution (CLRTAP) and submitted to the European Commission (ETC-ACC/EC) under the National Emissions Ceilings (NEC) Directive.

1.7 General uncertainty evaluation

In the 2026 submission, Poland carried out a qualitative and quantitative uncertainty analysis for the following substances: NO_x, NMVOC, SO₂, NH₃, PM_{2.5}, PM₁₀, TSP, BC, CO, Pb, Cd, Hg, PCDD/PCDF, PAHs, HCB and PCBs.

The results of the uncertainty analysis are evaluated with regard to finding potential for further improvements in the inventory process. To identify areas for potential improvement uncertainty analysis is investigated together with key category analysis – this approach allows to prioritize the needs by their importance.

The uncertainty assessment process was based on the Tier 1 methodology described in the EMEP/EEA Emission Inventory Guidebook 2023. The Tier 1 methodology calculations are based on the base year (1990) and the reference year emissions, and uncertainties that concern the activity factor and emission factors for each NFR sector. The uncertainty level was calculated for each substance separately for each NFR, then an overall uncertainty level for the inventory data was calculated. Combined uncertainties are presented in each chapter of the IIR. Emissions uncertainties are presented in Table 1.3 and in Figure 1.2.

Uncertainty values for the activity and emission factors were based on EMEP/EEA EIG taking into consideration the opinion of inventory compilers.

The results of the Approach 1 uncertainty analysis are presented in detail in Appendix 8 (Excel format).

Table 1.3. Emission uncertainties

Pollutant	Unit	Total emission 2024	Uncertainty 2024 [%]	Trend uncertainty 1990/2024 [%]
NO _x	kt	476.84	19.3	5.0
NMVOC	kt	614.38	16.2	6.8
SO _x	kt	245.61	12.1	1.0
NH ₃	kt	317.61	41.5	6.0
PM _{2.5}	kt	214.05	26.9	6.6
PM ₁₀	kt	300.27	27.0	6.7
TSP	kt	410.08	22.7	5.5
BC	kt	13.53	20.6	6.8
CO	kt	1 971.96	25.0	6.8
Pb	t	222.24	20.2	8.1
Cd	t	9.31	19.7	11.9
Hg	t	4.75	28.6	6.2
PCDD/F	g I-TEQ	231.89	50.6	5.3
PAHs	t	180.66	63.6	4.8
HCB	kg	3.26	38.6	3.3
PCBs	kg	125.23	19.1	1.3

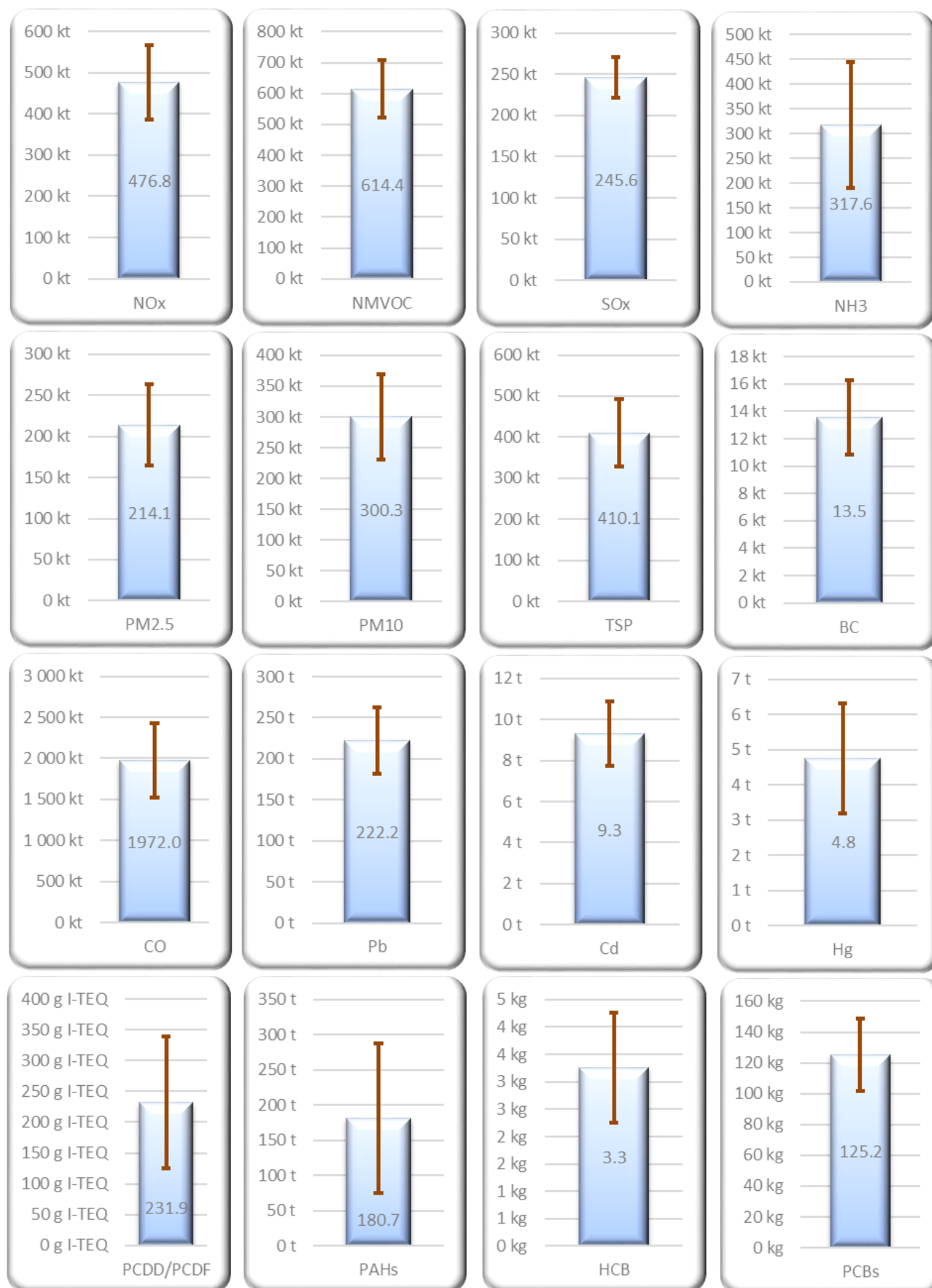


Figure 1.2. Emissions for 2024 with uncertainties bars

1.8 Assessment of Completeness

The Polish emission inventory includes calculation of emissions from all relevant sources recommended by the mandatory guidebook. The completeness for each pollutant and major sources is discussed briefly in Appendix 3.

2 EXPLANATION OF KEY TRENDS

The description below applies to trends of air pollutant emissions in the period 1990-2024. Recalculations of emission data performed from 1990 eliminate earlier time series inconsistencies. Due to the lack of direct statistics for historical years, some activity data was interpolated or based on available information for other years and may be subject to recalculation.

Improvements of methodology applied for 1990-2024 estimates are described in Chapters 3 – 7 (Sectoral Methodologies) and in Chapter 8 (Recalculations and Improvements). In some cases, due to methodology changes, the country emission trend differs from the trend reported in the 2025 submission. The reasons were described in the relevant chapters.

Following recommendations resulting from 2025 NECD Comprehensive Review of Polish inventory, methodological issue for several sources were updated. The main changes introduced are listed in Appendix 7, with the reference to chapters of the IIR report. Explanation of NFR codes is presented in table 11.2 in Chapter 11.

Due to rounding, the percentage shares of individual categories in the national emission shown in the figures in this chapter, may not sum up to 100%.

2.1 SO₂ emissions

The trend of sulphur dioxide emissions is influenced mainly by the combustion processes in sectors 1A1. *Energy industries*, 1A2. *Manufacturing industries and construction* and 1A4. *Other sectors* which contribute to 95% of total Poland's SO₂ emissions. The shares of sectors in the national SO₂ emissions in 2024 are shown in Figure 2.2.

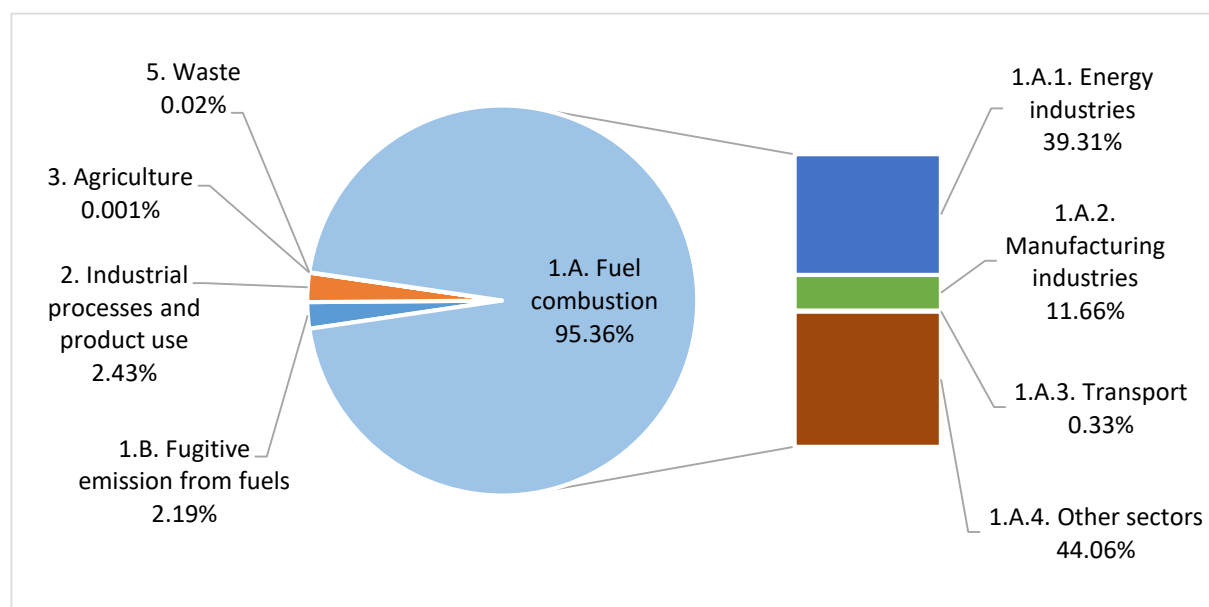
Emissions of SO₂ decreased by 91% between 1990 and 2024. Most of the reductions were caused by the decline of the heavy industry in the late 1980s and early 1990s. In late 1990s the emissions decreased due to the diminished share of coal (both hard and brown) among fuels used for power and heat generation. During the mentioned period of time a number of power plants equipped with desulphurization installations increased. This resulted in a decrease in emissions from sector 1A1a. *Public electricity and heat production* and a decrease in the share of this sector in the total national emissions. The emissions trend in 1990-2024 is shown in Figure 2.2.

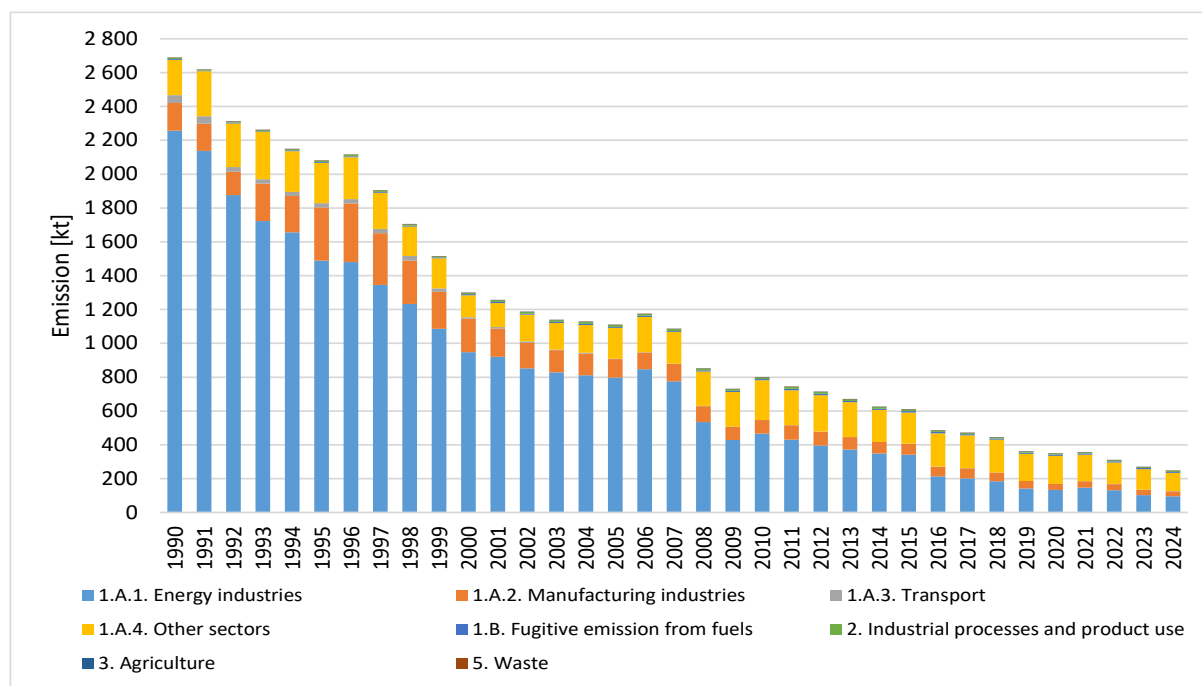
The most significant decreases were noted in combustion processes in the 1A1. *Energy industries*. It was the result of the improvement of plants technical parameters to meet more stringent standards resulting from Poland's accession to the EU, for example the 2001/80/EC Directive and the 2010/75/UE Directive (IED). Plant operators also gradually took steps to adjust (until August 16, 2021) large combustion plants to meet the requirements established in the best available techniques (BAT) conclusions (EU Commission Implementing Decision 2021/2326 of 30.11.2021).

Compared to the year 2023, in 2024 emissions of sulphur dioxide decreased by 9%, which was caused by a decrease in fuel consumption in the sector 1A4. *Other sectors* and 1A1a. *Public electricity and heat production*. The disaggregation of SO₂ emissions in NFR is given below in Table 2.1.

Table 2.1. SO₂ emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	kt	kt	kt	kt	kt
Total	2 687.54	1 107.77	348.29	269.17	245.61
1. Energy	2 680.17	1 096.47	341.23	263.29	239.60
A. Fuel combustion	2 675.86	1 090.39	334.42	257.21	234.22
1. Energy industries	2 257.60	797.68	133.33	103.71	96.54
2. Manufacturing industries and construction	163.82	109.43	36.02	30.14	28.64
3. Transport	45.24	1.24	0.63	0.78	0.81
4. Other sectors	209.20	182.04	164.45	122.57	108.22
B. Fugitive emissions from fuels	4.31	6.08	6.80	6.08	5.38
1. Solid fuels	0.01	0.01	0.01	0.01	0.01
2. Oil and natural gas	4.30	6.07	6.80	6.07	5.37
2. Industrial processes and product use	7.33	11.26	7.00	5.81	5.96
A. Mineral industry	0.00	0.00	0.00	0.00	0.00
B. Chemical industry	4.06	4.40	4.37	3.50	3.60
C. Metal industry	2.07	5.85	1.82	1.45	1.47
D. Other solvent and product use	0.00	0.00	0.00	0.00	0.00
G. – L. Other	1.20	1.00	0.81	0.86	0.89
3. Agriculture	0.02	0.01	0.01	0.00	0.00
B. Manure management	0.00	0.00	0.00	0.00	0.00
D. Agricultural soils	0.00	0.00	0.00	0.00	0.00
F. Field burning of agricultural residues	0.02	0.01	0.01	0.00	0.00
5. Waste	0.03	0.03	0.06	0.06	0.06
A. Solid waste disposal on land	0.00	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	0.03	0.03	0.06	0.06	0.06
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00
E. Other waste	0.00	0.00	0.00	0.00	0.00

Figure 2.1. Share of SO₂ emissions in 2024

Figure 2.2. SO₂ emissions in 1990-2024

2.2 NO_x emissions

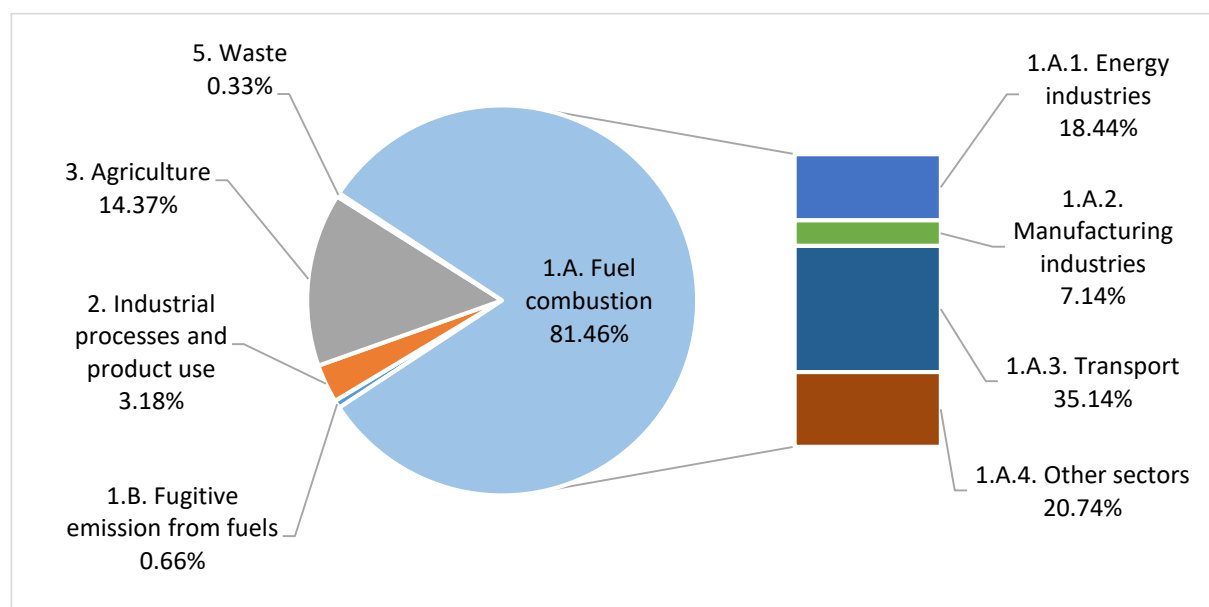
The major sources of NO_x emissions in 2024 are sectors: 1A3. *Transport* (road transport is responsible for most of the emissions), 1A4. *Other sectors* (stationary combustion in households) and 1A1. *Energy industries*. The shares of sectors in the national NO_x emissions in 2024 are shown in Figure 2.3.

Between 1990 and 2024 emissions of NO_x decreased by 57%. Similarly to sulphur dioxide, most of the reductions were caused by the decline of the heavy industry and lower share of coal in combusted fuels in the late 1980s and early 1990s. Since the late 1990s, the largest source of NO_x emissions has been the combustion of fuels in road transport, from which emissions have been steadily increasing until 2017. This is mainly due to increase in the number of vehicles by 182.5% since 1990. The decrease in NO_x emissions from 2017 is caused by the increasing share of vehicles with the latest Euro quality standards. Decrease in NO_x emissions was also caused by a decrease of NO_x emissions from 1A1a. *Public electricity and heat production* as a result of the improvement of plants technical parameters to meet more stringent standards resulting from Poland's accession to the EU, for example the 2001/80/EC Directive and the 2010/75/UE Directive (IED) and the requirements established in the best available techniques (BAT) conclusions (EU Commission Implementing Decision 2021/2326 of 30.11.2021).

Compared to the year 2023, in 2024 NO_x emissions decreased by 5%. This was mainly due to the reduction of NO_x emissions from household heating sector and road transport sector. NO_x emissions in the road transport sector decreased compared to the previous year due to the renewal of the vehicle age structure (an increasing share of vehicles meeting higher emission standards and a decreasing number of vehicles meeting lower environmental requirements), as well as an increasing share of hybrid and electric vehicles. The decrease in NO_x emissions in sector 1A4. *Other sectors* was caused by a decrease in fuel consumption (mainly hard coal and lignite) in households and diesel fuel used in agricultural (off-road) vehicles. The emissions trend in 1990-2024 is shown in Figure 2.4. The disaggregation of NO_x emissions in NFR is given in Table 2.2.

Table 2.2. NO_x emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	kt	kt	kt	kt	kt
Total	1 105.68	835.72	565.46	503.34	476.84
1. Energy	989.55	753.32	476.44	417.51	391.56
A. Fuel combustion	988.28	751.54	473.03	414.39	388.43
1. Energy industries	577.04	293.81	113.75	92.94	87.91
2. Manufacturing industries and construction	65.87	59.88	40.15	35.75	34.06
3. Transport	200.64	214.09	199.48	179.03	167.55
4. Other sectors	144.74	183.76	119.65	106.68	98.91
B. Fugitive emissions from fuels	1.27	1.78	3.41	3.12	3.13
1. Solid fuels	0.01	0.01	0.01	0.01	0.01
2. Oil and natural gas	1.26	1.78	3.40	3.11	3.12
2. Industrial processes and product use	12.88	14.54	16.27	13.32	15.18
A. Mineral industry	0.00	0.00	0.00	0.00	0.00
B. Chemical industry	7.90	11.39	12.54	9.99	11.83
C. Metal industry	4.28	2.19	2.79	2.43	2.37
D. Other solvent and product use	0.00	0.00	0.00	0.00	0.00
G. – L. Other	0.70	0.97	0.94	0.90	0.99
3. Agriculture	101.97	66.74	71.11	70.79	68.54
B. Manure management	9.04	5.86	4.93	4.95	5.39
D. Agricultural soils	92.85	60.81	66.15	65.81	63.14
F. Field burning of agricultural residues	0.08	0.07	0.03	0.02	0.01
5. Waste	1.28	1.11	1.64	1.72	1.55
A. Solid waste disposal on land	0.00	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	1.28	1.11	1.64	1.72	1.55
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00
E. Other waste	0.00	0.00	0.00	0.00	0.00

Figure 2.3. Share of NO_x emissions in 2024

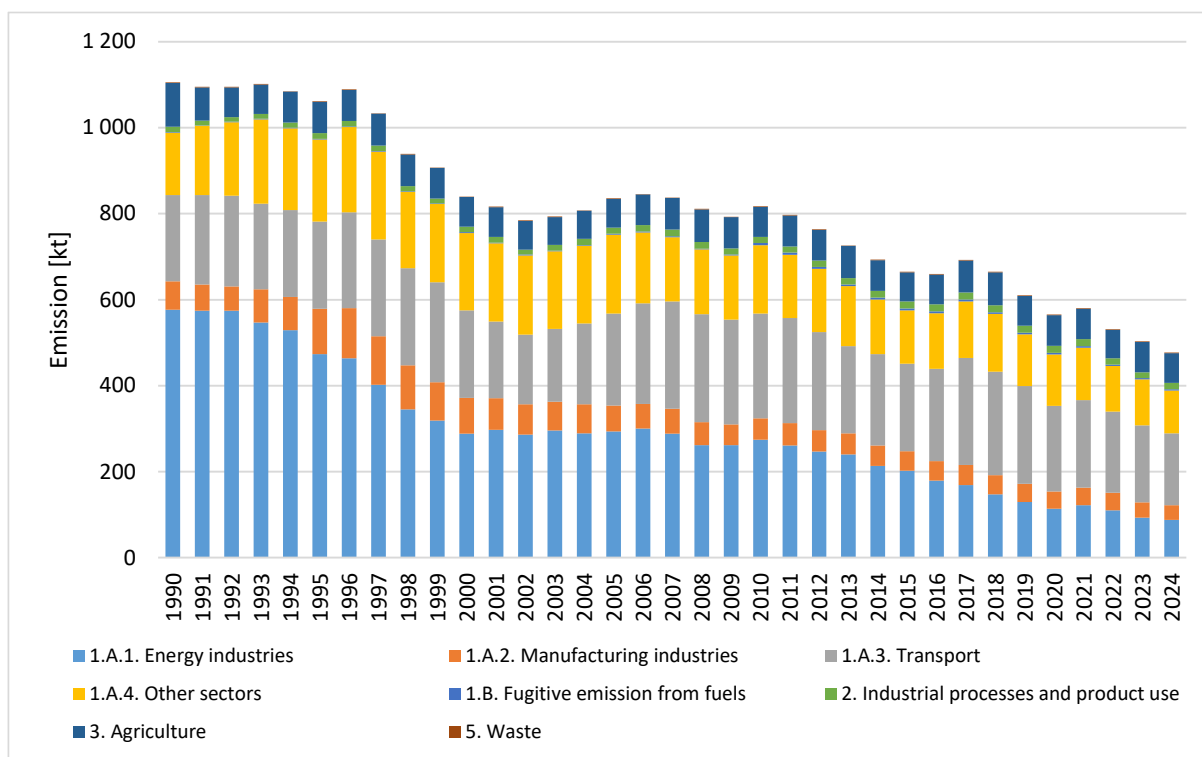


Figure 2.4. NOx emissions in 1990-2024

2.3 NMVOC emissions

In 2024 categories 2D. *Other solvent and product use*, 3. *Agriculture*, 1A4. *Other sectors* and 1B. *Fugitive emissions from fuels* have the highest share in the total emissions of NMVOCs.

Natural sources – *Forest fires, Managed and unmanaged forestland* (NFR 11B and 11C), were a source of emissions of 276 kt of NMVOCs. Emissions from the natural sources are not included in the country total. The shares of sectors in the national NMVOC emissions in 2024 are shown in Figure 2.5.

Between 1990 and 2024 emissions of NMVOC decreased by 22%. Compared to the year 2023, in 2024 NMVOC emissions increased by 1%, which was mainly caused by a significant increase in the consumption of solvent-based paints in subcategory 2D. *Use of solvents and other products*, and a 25% increase in the poultry population in subcategory 3B. *Manure management*. The emissions trend in 1990-2024 is shown in Figure 2.6. The largest decrease in emissions between 2023 and 2024 occurred in sector 1A4. *Other sectors*, which was due to lower consumption of solid fuels in households.

The disaggregation of NMVOC emissions in NFR is given in Table 2.3.



Table 2.3. NMVOC emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	kt	kt	kt	kt	kt
Total	791.14	818.67	729.95	606.17	614.38
1. Energy	529.77	450.64	332.54	275.51	255.83
A. Fuel combustion	368.73	335.45	255.14	204.42	187.01
1. Energy industries	7.37	2.73	3.07	3.01	2.93
2. Manufacturing industries and construction	23.80	17.18	13.77	12.21	11.79
3. Transport	178.08	139.25	63.86	57.10	51.95
4. Other sectors	159.47	176.30	174.44	132.10	120.33
B. Fugitive emissions from fuels	161.05	115.19	77.40	71.10	68.82
1. Solid fuels	131.62	90.08	52.77	46.76	43.41
2. Oil and natural gas	29.43	25.11	24.63	24.33	25.41
2. Industrial processes and product use	126.68	271.00	275.67	206.69	227.93
A. Mineral industry	0.00	0.00	0.00	0.00	0.00
B. Chemical industry	1.49	2.84	5.68	4.90	5.32
C. Metal industry	1.89	1.07	0.91	0.67	0.74
D. Other solvent and product use	117.32	259.92	260.07	192.21	212.52
G. – L. Other	5.98	7.17	9.00	8.91	9.34
3. Agriculture	132.40	95.66	121.10	123.33	130.05
B. Manure management	125.28	90.22	114.09	116.08	123.21
D. Agricultural soils	7.10	5.43	7.00	7.24	6.84
F. Field burning of agricultural residues	0.02	0.01	0.01	0.00	0.00
5. Waste	2.29	1.37	0.65	0.64	0.58
A. Solid waste disposal on land	1.92	1.03	0.17	0.13	0.12
C. Incineration and open burning of waste	0.33	0.31	0.45	0.48	0.43
D. Wastewater handling	0.04	0.03	0.03	0.03	0.03
E. Other waste	0.00	0.00	0.00	0.00	0.00
11. Natural emissions (not included in Total)	228.22	243.10	279.30	277.56	276.46

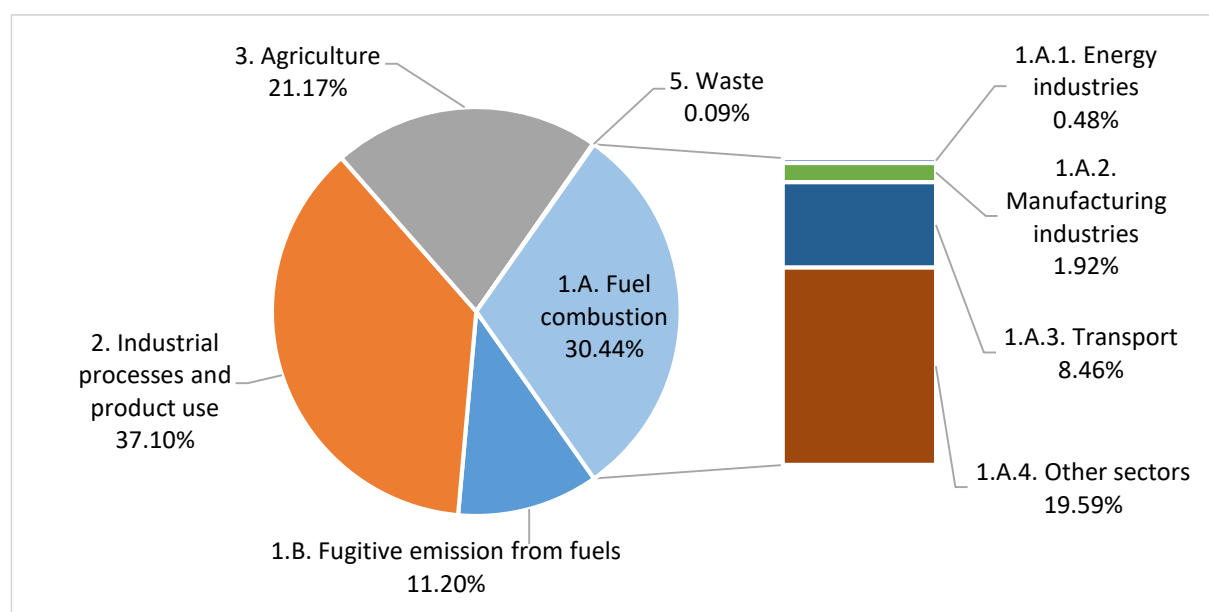


Figure 2.5. Share of NMVOC emissions in 2024

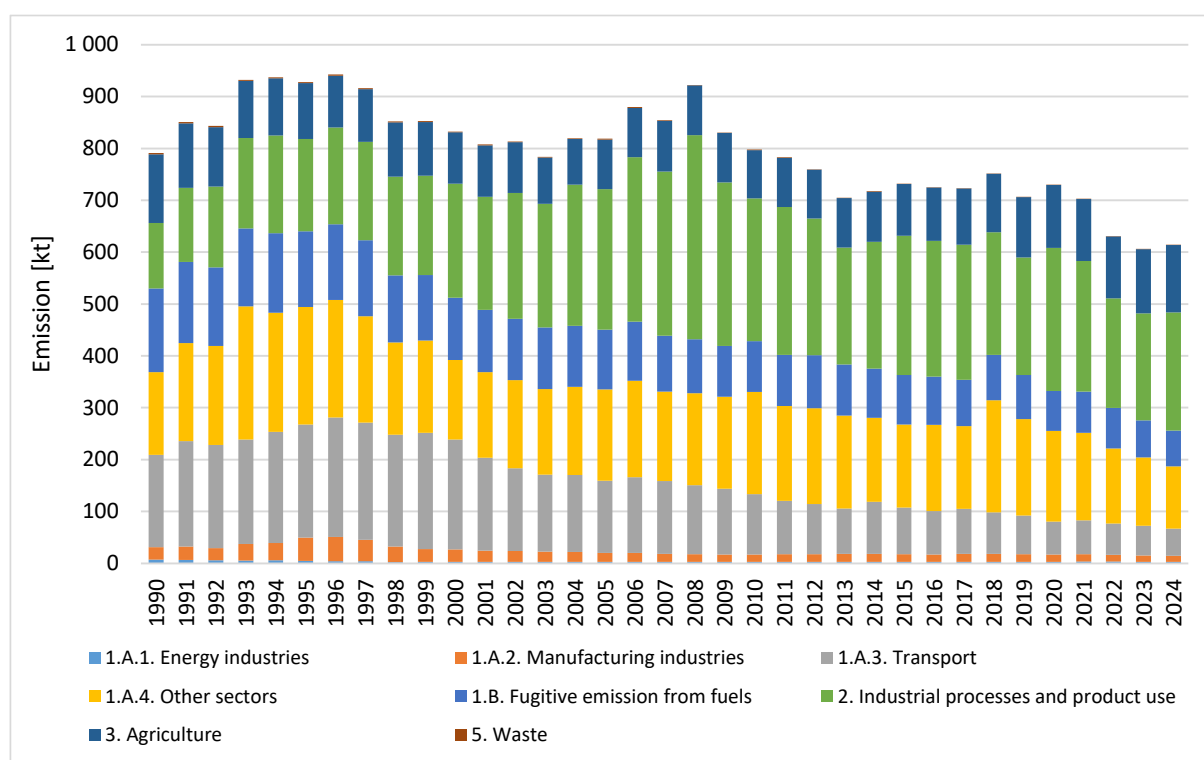


Figure 2.6. Emissions of NMVOC in 1990-2024

2.4 NH₃ emissions

The major source of ammonia emissions is sector 3. *Agriculture* (96% of total NH₃ emissions). The largest share of emissions (55%) is associated with the use of mineral and organic fertilizers (3D), and 41% with livestock manure management (3B). The shares of sectors in the national NH₃ emissions in 2024 are presented in Figure 2.7. The disaggregation of NH₃ emissions in NFR is presented in Table 2.4.

Ammonia emissions have decreased by 38% in the period since 1990, and the largest decrease in NH₃ emissions occurred in the years 1990-1993. Over the last 20 years, ammonia emissions from agriculture have fluctuated slightly, depending on the volume of agricultural production. Compared to the previous year, ammonia emissions increase by 1% in 2024, mainly due to an increase in the poultry population (by 25%).

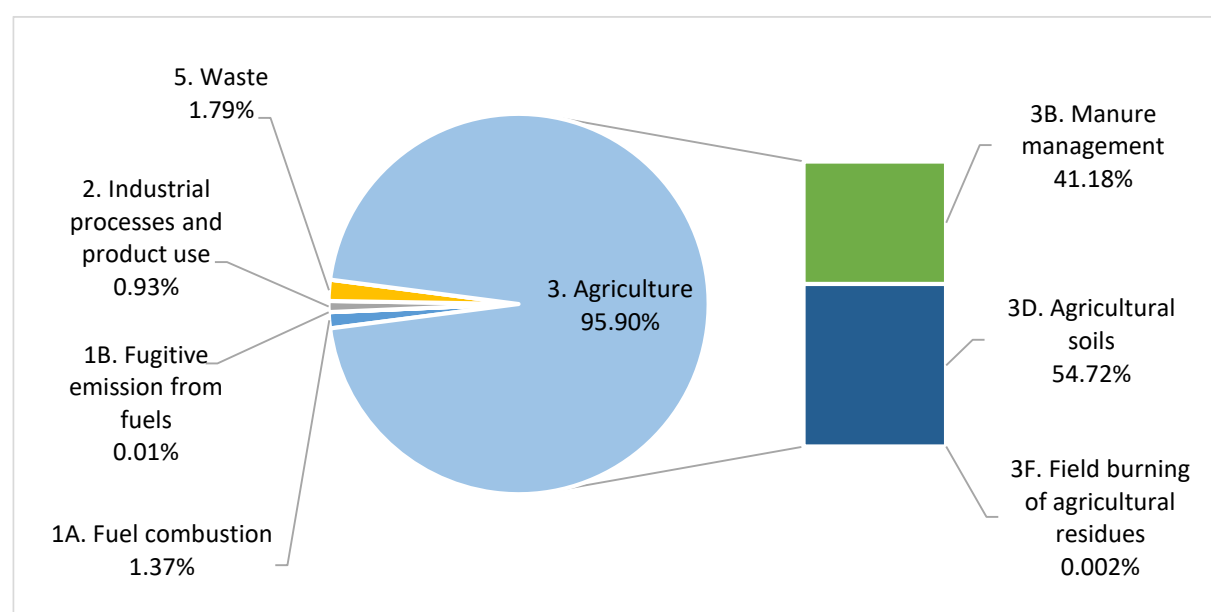
Since 2021, due to the amendment of the Act of 2020 on fertilizers and fertilization, part of the urea, in granulated form, is used with a urease inhibitor, what causes a gradual decrease in ammonia emissions from the use of mineral fertilizers - in the period 2020-2024 this decrease amounted to 32%, with a simultaneous decrease in the consumption of nitrogen fertilizers by 8%.

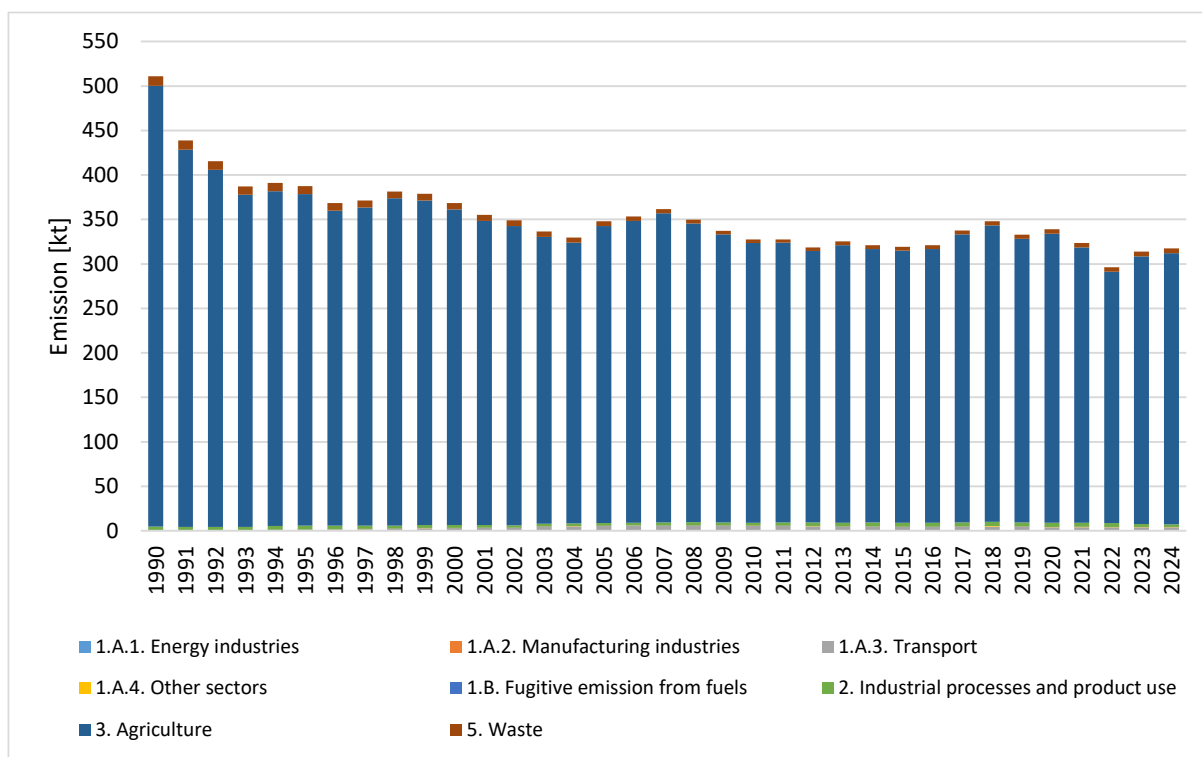
The emissions trend in 1990-2023 is presented in Figure 2.8.



Table 2.4. NH₃ emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	kt	kt	kt	kt	kt
Total	510.83	348.04	338.95	313.93	317.61
1. Energy	0.40	5.81	4.56	4.53	4.36
A. Fuel combustion	0.35	5.78	4.53	4.50	4.34
1. Energy industries	0.01	0.01	0.03	0.03	0.03
2. Manufacturing industries and construction	0.01	0.04	0.10	0.08	0.08
3. Transport	0.12	5.37	3.94	4.03	3.90
4. Other sectors	0.21	0.36	0.47	0.36	0.33
B. Fugitive emissions from fuels	0.05	0.03	0.03	0.03	0.03
1. Solid fuels	0.05	0.03	0.03	0.03	0.03
2. Oil and natural gas	0.00	0.00	0.00	0.00	0.00
2. Industrial processes and product use	4.53	3.03	4.37	3.01	2.96
A. Mineral industry	0.00	0.00	0.00	0.00	0.00
B. Chemical industry	4.09	2.71	4.22	2.82	2.77
C. Metal industry	0.00	0.00	0.00	0.00	0.00
D. Other solvent and product use	0.02	0.01	0.01	0.01	0.01
G. – L. Other	0.42	0.31	0.14	0.18	0.19
3. Agriculture	495.41	333.66	325.10	300.90	304.59
B. Manure management	218.10	150.60	129.15	121.92	130.80
D. Agricultural soils	277.23	182.99	195.91	178.96	173.78
F. Field burning of agricultural residues	0.08	0.07	0.04	0.02	0.01
5. Waste	10.50	5.53	4.92	5.49	5.70
A. Solid waste disposal on land	0.00	0.00	0.00	0.00	0.00
B. Biological treatment of waste	0.05	0.23	1.94	2.60	2.84
C. Incineration and open burning of waste	0.00	0.00	0.00	0.00	0.00
D. Wastewater handling	10.45	5.29	2.98	2.89	2.86
E. Other waste	0.00	0.00	0.00	0.00	0.00

Figure 2.7. Share of NH₃ emissions in 2024

Figure 2.8. NH₃ emissions in 1990-2024

2.5 CO emissions

In 2024, the largest source of carbon monoxide emissions was the combustion of fuels in category 1A4. *Other sectors* (which include small combustion sources, such as households, institutions etc.), responsible for 68% of national carbon monoxide emissions. Sector 1A3. *Transport* is also a significant source of carbon monoxide emissions – 19% of national CO emissions. The shares of sectors in the national CO emissions in 2024 are shown in Figure 2.9. The disaggregation of CO emissions in NFR is given below in Table 2.5.

From 1990 to 2024 the emission of CO has decreased by about 51%. Compared to the year 2023, in 2024 emission of CO decreased by 10%. The highest decrease in emissions in 2024 compared to 2023 occurred in sector 1A4. *Other sectors* and results from lower solid fuels consumption and the introduction of modern heating devices. A significant decrease in CO emissions was also recorded in sector 1A3: *Transport*, resulting mainly from the systematic replacement of the oldest, high-emission vehicles with a fleet meeting higher emission standards and electric vehicles. The emissions trend in 1990-2024 is presented in Figure 2.10.



Table 2.5. CO emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	kt	kt	kt	kt	kt
Total	4 030.73	3 574.37	2 761.30	2 182.59	1 971.96
1. Energy	3 955.15	3 507.65	2 695.93	2 121.50	1 911.83
A. Fuel combustion	3 948.23	3 502.79	2 690.94	2 116.45	1 906.90
1. Energy industries	117.30	67.31	53.81	57.95	57.90
2. Manufacturing industries and construction	198.59	178.86	153.95	124.61	118.92
3. Transport	1 572.91	1 151.03	477.91	427.24	380.63
4. Other sectors	2 059.42	2 105.59	2 005.27	1 506.64	1 349.45
B. Fugitive emissions from fuels	6.92	4.86	5.00	5.05	4.93
1. Solid fuels	6.22	3.87	3.58	3.68	3.50
2. Oil and natural gas	0.71	1.00	1.42	1.37	1.43
2. Industrial processes and product use	56.37	48.45	40.51	34.90	36.84
A. Mineral industry	0.00	0.00	0.00	0.00	0.00
B. Chemical industry	13.02	11.96	16.95	14.59	14.25
C. Metal industry	34.91	30.48	21.18	17.54	19.74
D. Other solvent and product use	0.00	0.00	0.00	0.00	0.00
G. – L. Other	8.44	6.01	2.37	2.76	2.86
3. Agriculture	2.30	1.93	0.98	0.63	0.18
B. Manure management	0.00	0.00	0.00	0.00	0.00
D. Agricultural soils	0.00	0.00	0.00	0.00	0.00
F. Field burning of agricultural residues	2.30	1.93	0.98	0.63	0.18
5. Waste	16.92	16.34	23.88	25.55	23.10
A. Solid waste disposal on land	0.00	0.00	0.00	0.00	0.00
B. Biological treatment of waste	0.04	0.18	0.71	0.80	0.89
C. Incineration and open burning of waste	16.87	16.16	23.17	24.75	22.21
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00
E. Other waste	0.00	0.00	0.00	0.00	0.00

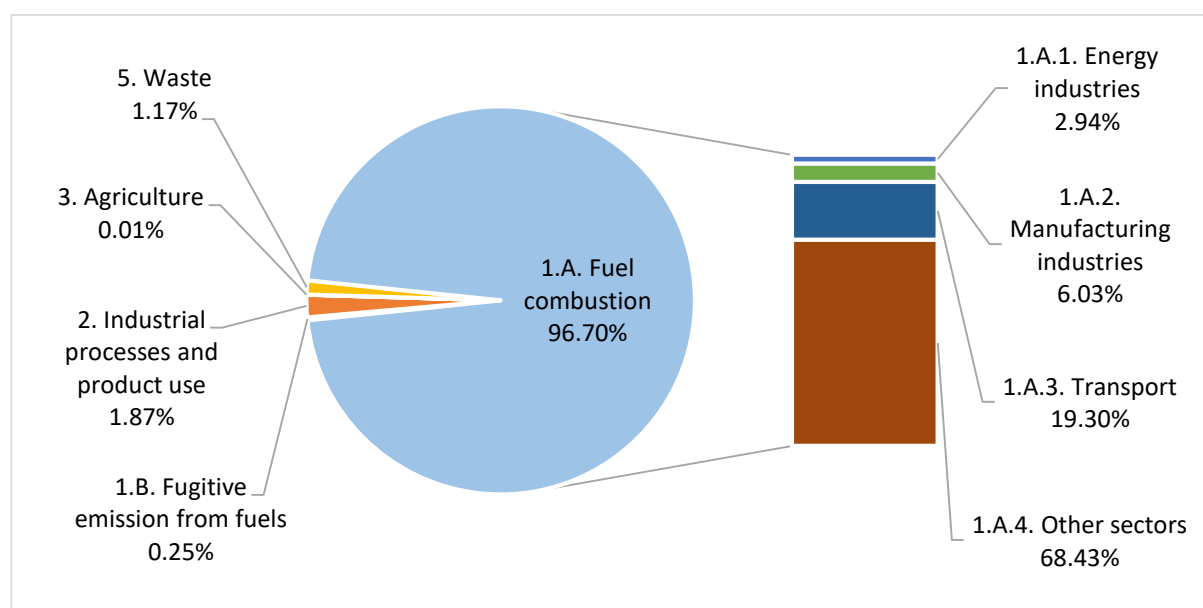


Figure 2.9. Share of CO emissions in 2024

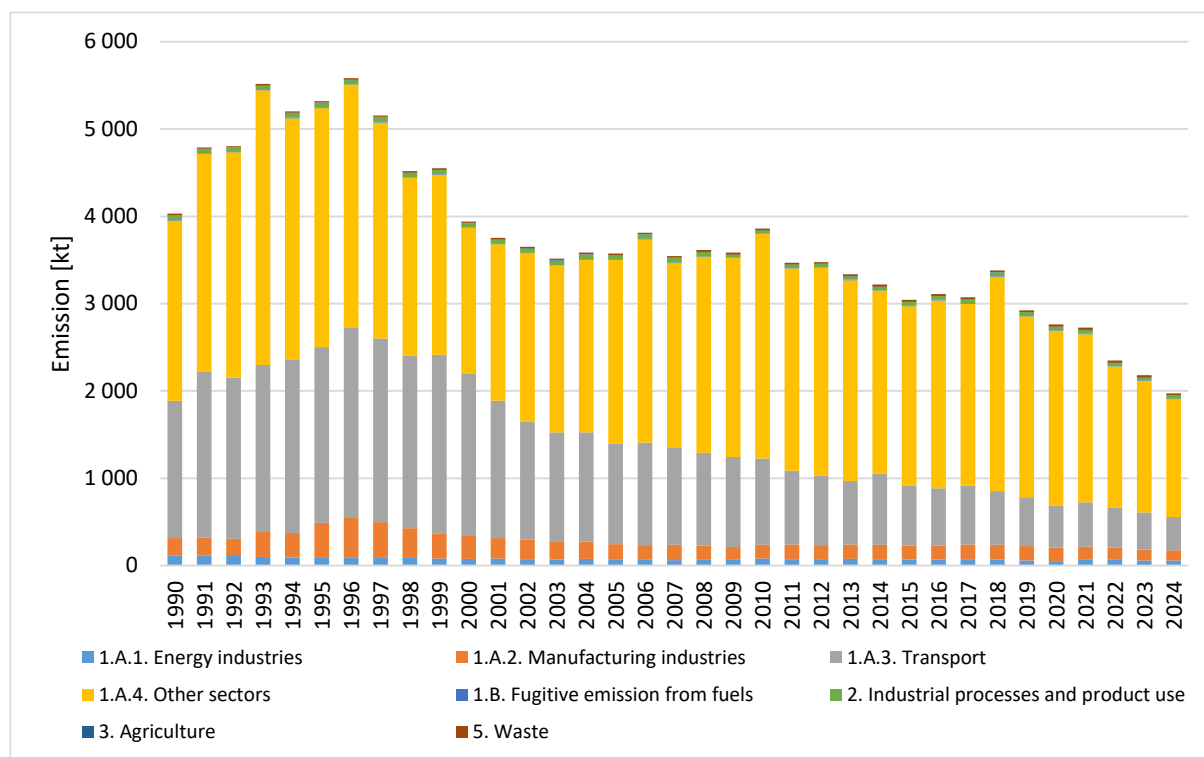


Figure 2.10. CO emissions in 1990-2024

2.6 PM emissions

When analysing the scale and impact of PM emission, two fractions – filterable and condensable - should be taken into consideration.

The condensable fraction, apart from inorganic compounds, consists also of organic compounds formed in the combustion process. After the exhaust gases leave the chimney, they are cooled and diluted. As a result, together with the filterable fraction, they may condense and form the so-called primary atmospheric aerosol. Appendix 9 presents information of which emission factors of PM_{2.5}, PM₁₀ and TSP include the condensable component in addition to the filterable fraction.

Fuel combustion in sector 1A4. *Other sources* is the largest source of particular matter emissions, significant share of which is the condensable fraction (especially in the case of biomass combustion). The largest share in PM emissions have old, high-emission heat sources used for energy purposes in the household and municipal sector, which should be (and are) gradually replaced with highly efficient ones. As including condensable fraction in emission calculations is crucial when assessing the impact of this sector on the annual particular matter emissions, emission factors include both filterable and condensable component.

2.6.1 TSP emissions

The main source of total suspended particulates (TSP) emissions in Poland are stationary combustion processes, which account for the majority of national emissions. Category 1A4. *Other sectors* have the largest share in TSP emissions in the stationary source group – about 50%. Emissions from sector 2. *Industrial processes* account for 22% of total emissions, the largest share derives from category 2A. *Mineral products*. Sector 3. *Agriculture* is also a large source, accounting for 15% of total TSP emissions. The shares of sectors in the national TSP emissions in 2024 are shown in Figure 2.11. The disaggregation of TSP emissions in NFR is

given below in Table 2.6.

Since 1990 TSP emissions have decreased by 70%. Similarly to sulphur dioxide and nitrogen oxides, most of the reductions were caused by the decline of the heavy industry and lower share of coal in combusted fuels in the late 1980s and early 1990s. In 2024, emissions decreased by 6% compared to 2023. The largest decrease in TSP emissions in relation to 2023 occurred in category 1A4. *Other sectors*, which was due to lower consumption of solid fuels in households and the introduction of modern heating devices. The emissions trend in 1990-2024 is presented in Figure 2.12.

Table 2.6. TSP emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	kt	kt	kt	kt	kt
Total	1387.59	604.99	522.21	435.36	410.08
1. Energy	1185.18	457.90	362.69	278.23	253.43
A. Fuel combustion	1138.13	425.66	342.11	259.45	235.88
1. Energy industries	790.63	71.92	10.95	5.98	5.39
2. Manufacturing industries and construction	26.88	22.18	7.35	6.31	5.97
3. Transport	13.16	15.13	20.14	20.63	20.38
4. Other sectors	307.46	316.43	303.67	226.52	204.13
B. Fugitive emissions from fuels	47.05	32.24	20.58	18.78	17.56
1. Solid fuels	46.97	32.13	20.42	18.63	17.40
2. Oil and natural gas	0.08	0.11	0.15	0.15	0.16
2. Industrial processes and product use	116.90	77.66	93.24	94.25	89.35
A. Mineral industry	86.74	44.04	53.15	59.22	52.84
B. Chemical industry	6.77	6.23	7.78	5.79	6.57
C. Metal industry	7.65	2.76	2.68	2.60	2.94
D. Other solvent and product use	9.35	16.93	22.33	18.76	18.87
G. – L. Other	6.39	7.70	7.29	7.88	8.13
3. Agriculture	82.19	65.56	61.58	58.22	63.10
B. Manure management	44.11	34.06	33.82	30.89	34.02
D. Agricultural soils	37.88	31.34	27.68	27.28	29.07
F. Field burning of agricultural residues	0.20	0.17	0.09	0.06	0.02
5. Waste	3.31	3.87	4.69	4.66	4.19
A. Solid waste disposal on land	0.02	0.01	0.01	0.01	0.00
C. Incineration and open burning of waste	1.23	1.17	1.68	1.80	1.61
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00
E. Other waste	2.06	2.69	3.01	2.85	2.58

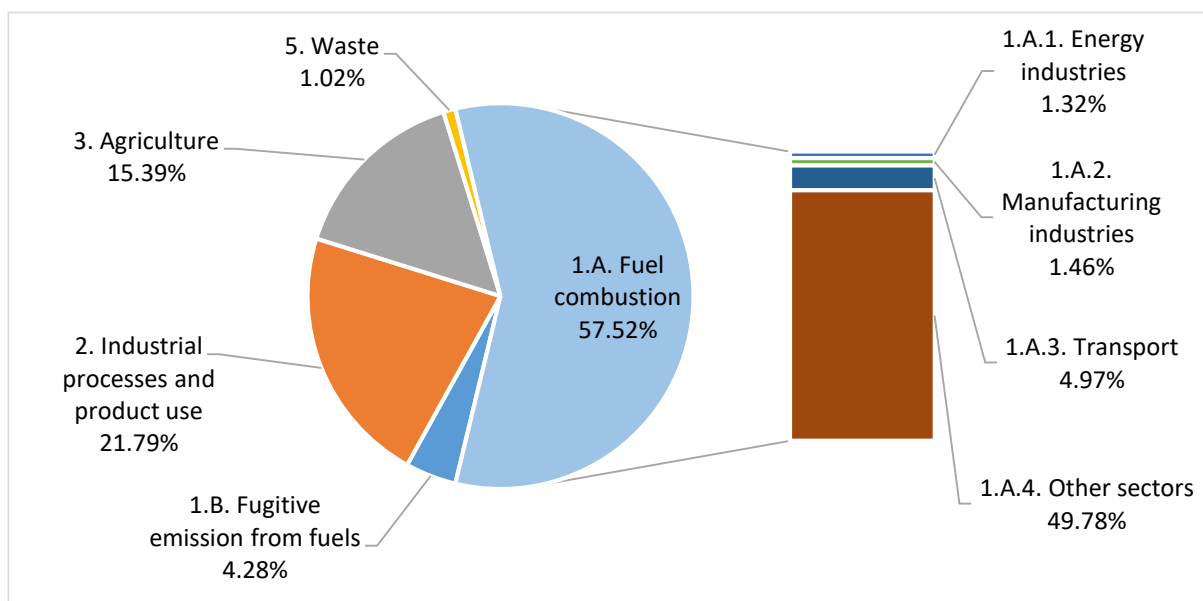


Figure 2.11. Share of TSP emissions in 2024

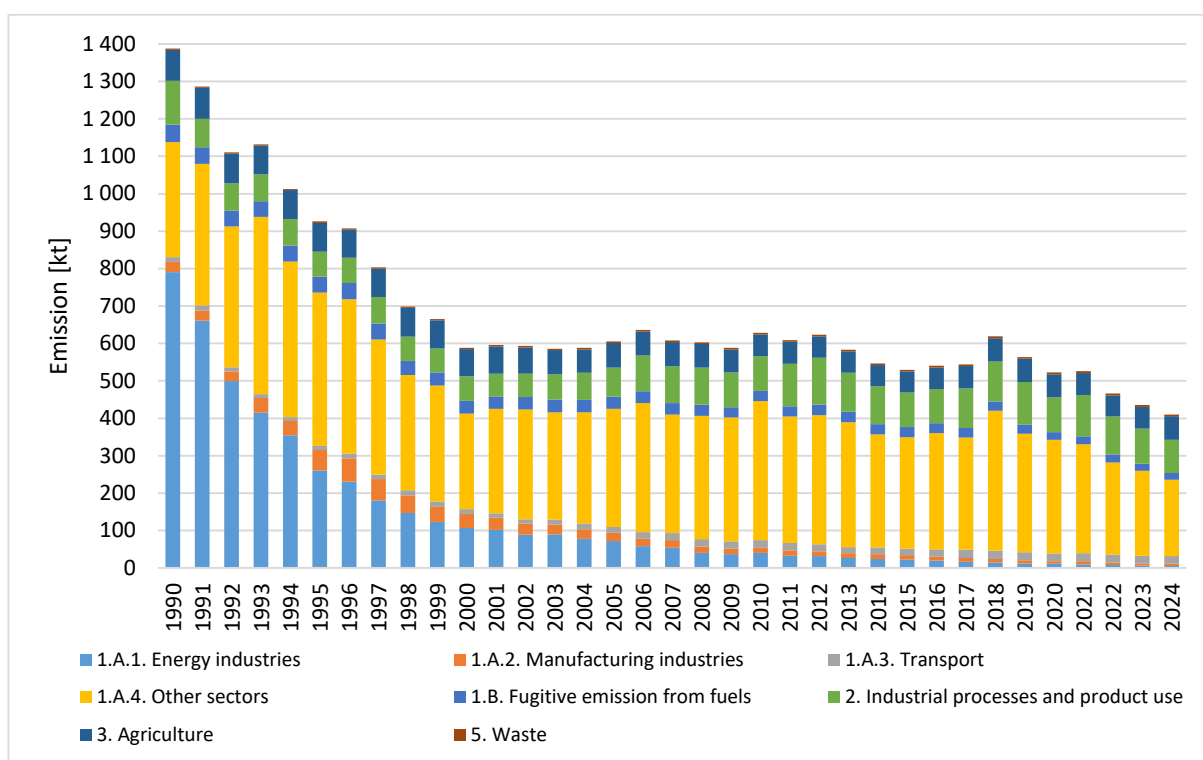


Figure 2.12. Emissions of TSP in 1990-2024

2.6.2 PM10 emissions

The main source of PM10 emissions in Poland, similarly to TSP, are stationary combustion processes, mostly in category 1A4. *Other sectors* – 65% (mainly from fuel combustion in the household sector). The next largest sources are sectors 3. *Agriculture* – 14% and 2. *Industrial processes* – 9%. The shares of sectors in the national PM10 emissions in 2024 are shown in Figure 2.13. The disaggregation of PM10 emissions in NFR is given below in Table 2.7.

PM10 emissions in 2024 have decreased by 62% since 1990 and by 7% compared to the previous year. The largest decrease in PM10 emissions compared to the previous year, as in the case of TSP emissions, was related to the lower consumption of solid fuels in category 1A4.

Other sectors and the introduction of modern heating devices in households. The emissions trend in 1990-2024 is presented in Figure 2.14.

Table 2.7. PM10 emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	kt	kt	kt	kt	kt
Total	786.73	445.88	400.74	321.30	300.27
1. Energy	652.23	373.23	326.44	248.78	226.53
A. Fuel combustion	631.91	359.23	317.45	240.58	218.85
1. Energy industries	311.95	29.61	7.44	4.11	3.94
2. Manufacturing industries and construction	25.42	21.01	6.97	5.99	5.67
3. Transport	11.98	12.76	15.42	15.35	14.99
4. Other sectors	282.56	295.85	287.61	215.13	194.25
B. Fugitive emissions from fuels	20.31	14.01	8.99	8.19	7.68
1. Solid fuels	20.25	13.92	8.86	8.07	7.55
2. Oil and natural gas	0.06	0.09	0.13	0.12	0.13
2. Industrial processes and product use	76.83	26.63	29.38	29.47	28.12
A. Mineral industry	63.05	15.39	17.65	19.38	17.49
B. Chemical industry	2.69	2.66	3.52	2.31	2.55
C. Metal industry	5.28	1.66	1.57	1.55	1.79
D. Other solvent and product use	2.00	3.60	4.74	4.00	4.03
G. – L. Other	3.81	3.32	1.91	2.22	2.26
3. Agriculture	54.41	42.18	40.27	38.45	41.47
B. Manure management	16.33	10.68	12.51	11.11	12.39
D. Agricultural soils	37.88	31.34	27.68	27.28	29.07
F. Field burning of agricultural residues	0.20	0.16	0.08	0.05	0.02
5. Waste	3.27	3.83	4.64	4.60	4.14
A. Solid waste disposal on land	0.01	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	1.20	1.14	1.63	1.75	1.57
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00
E. Other waste	2.06	2.69	3.01	2.85	2.58

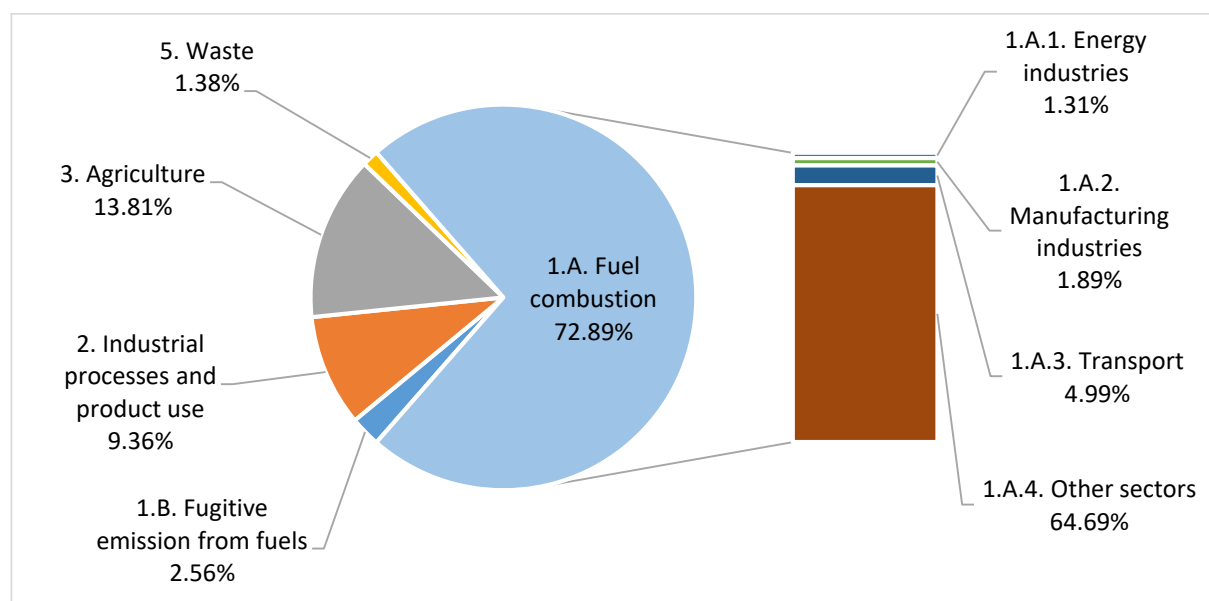


Figure 2.13. Share of PM10 emissions in 2024

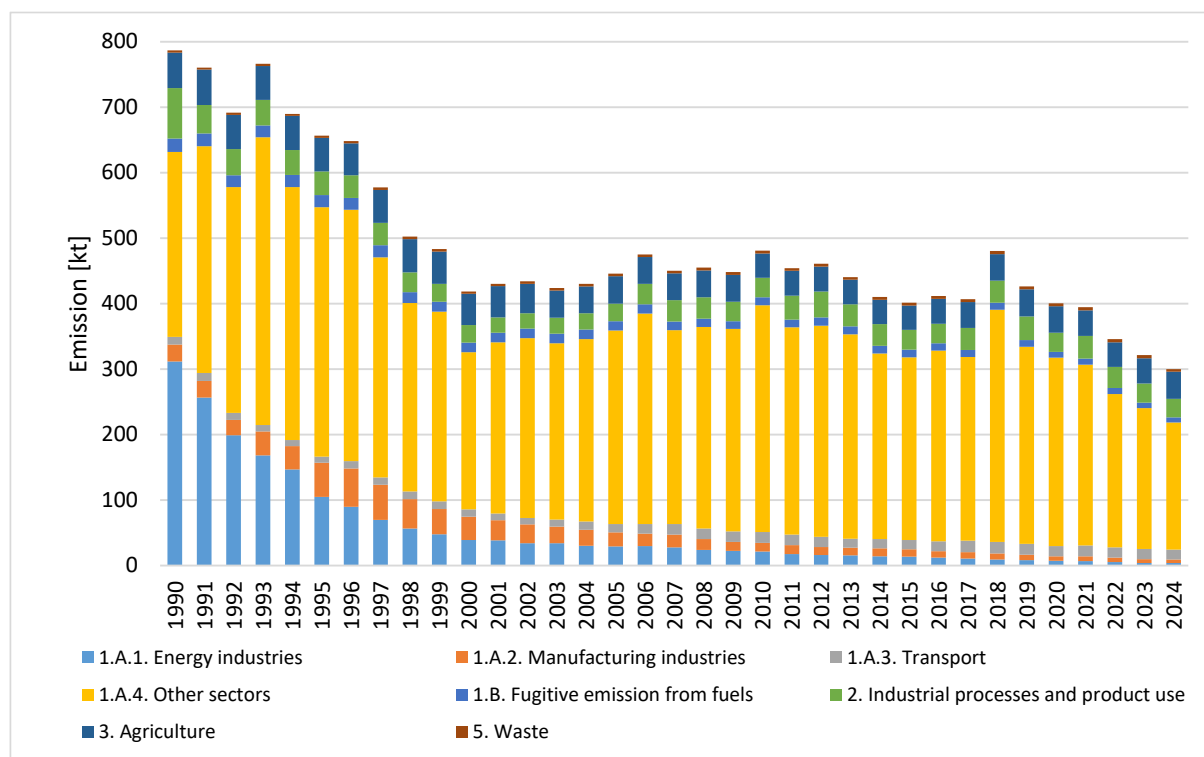


Figure 2.14. Emissions of PM10 in 1990-2024

2.6.3 PM2.5 emissions

The main source of PM2.5 emissions are sources constituting category 1A. *Fuel combustion*, which accounts for 92% of total emissions of this pollution in 2024. The largest share of PM2.5 emissions results from the activities of sector 1A4. *Other sectors* (84%) and is mainly associated with the burning of coal and wood in households. The shares of sectors in the national PM2.5 emissions in 2024 are presented in Figure 2.15. The disaggregation of PM2.5 emissions in NFR is presented below in Table 2.8.

PM2.5 emissions in 2024 decreased by 49% in the period from 1990. In 2024, decrease by 9% in the volume of PM2.5 emissions was recorded compared to the previous year. The largest decrease in PM2.5 emissions compared to the previous year was related to the lower consumption of solid fuels in category 1A4. *Other sectors* and the introduction of modern heating devices in households. The emissions trend in 1990-2024 is presented in Figure 2.16.

Table 2.8. PM2.5 emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	kt	kt	kt	kt	kt
Total	421.99	322.98	304.41	233.67	214.05
1. Energy	372.34	306.31	287.66	217.89	198.34
A. Fuel combustion	369.40	304.28	286.23	216.54	197.06
1. Energy industries	91.92	10.19	3.62	2.09	2.01
2. Manufacturing industries and construction	23.59	19.61	6.54	5.64	5.33
3. Transport	10.86	10.47	10.93	10.35	9.90
4. Other sectors	243.04	264.01	265.13	198.47	179.82
B. Fugitive emissions from fuels	2.94	2.02	1.44	1.35	1.28
1. Solid fuels	2.91	1.99	1.39	1.30	1.23
2. Oil and natural gas	0.03	0.04	0.05	0.05	0.05
2. Industrial processes and product use	40.49	8.78	8.02	7.34	7.53
A. Mineral industry	31.18	2.64	2.76	2.88	2.70
B. Chemical industry	2.00	1.98	2.62	1.72	1.90
C. Metal industry	4.00	1.16	0.98	0.88	1.02

NFR	1990	2005	2020	2023	2024
	kt	kt	kt	kt	kt
D. Other solvent and product use	0.28	0.49	0.64	0.54	0.55
G. – L. Other	3.04	2.52	1.02	1.31	1.37
3. Agriculture	5.98	4.14	4.20	3.96	4.15
B. Manure management	3.68	2.22	2.57	2.37	2.49
D. Agricultural soils	2.11	1.76	1.56	1.54	1.64
F. Field burning of agricultural residues	0.19	0.16	0.08	0.05	0.01
5. Waste	3.18	3.75	4.52	4.48	4.03
A. Solid waste disposal on land	0.00	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	1.11	1.06	1.52	1.62	1.46
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00
E. Other waste	2.06	2.69	3.01	2.85	2.58

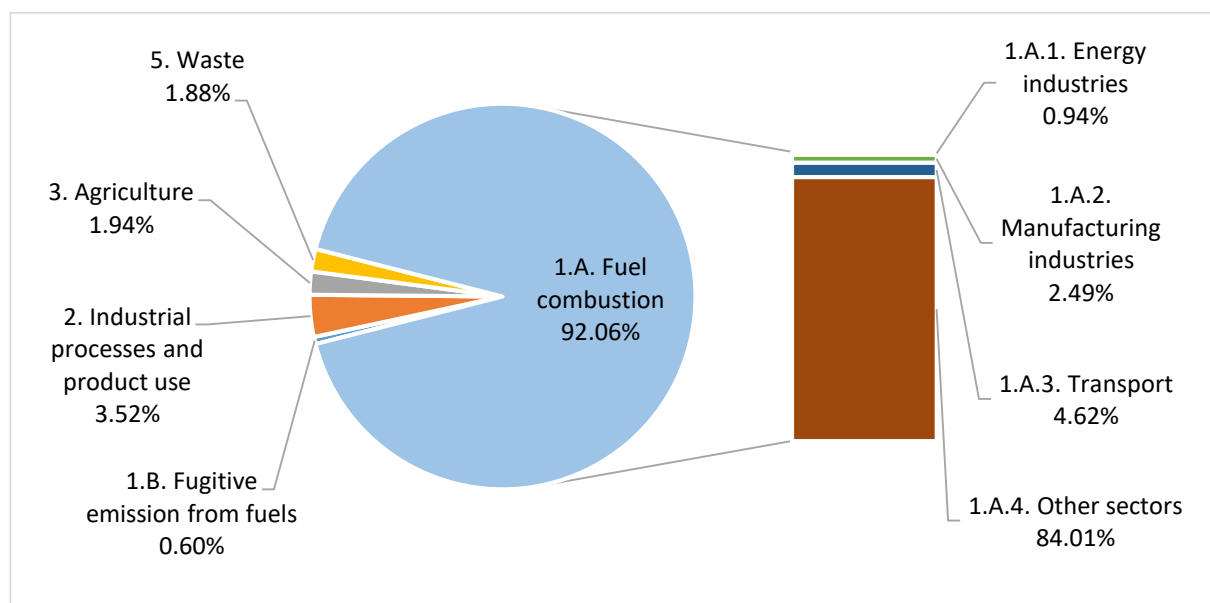


Figure 2.15. Share of PM2.5 emissions in 2024

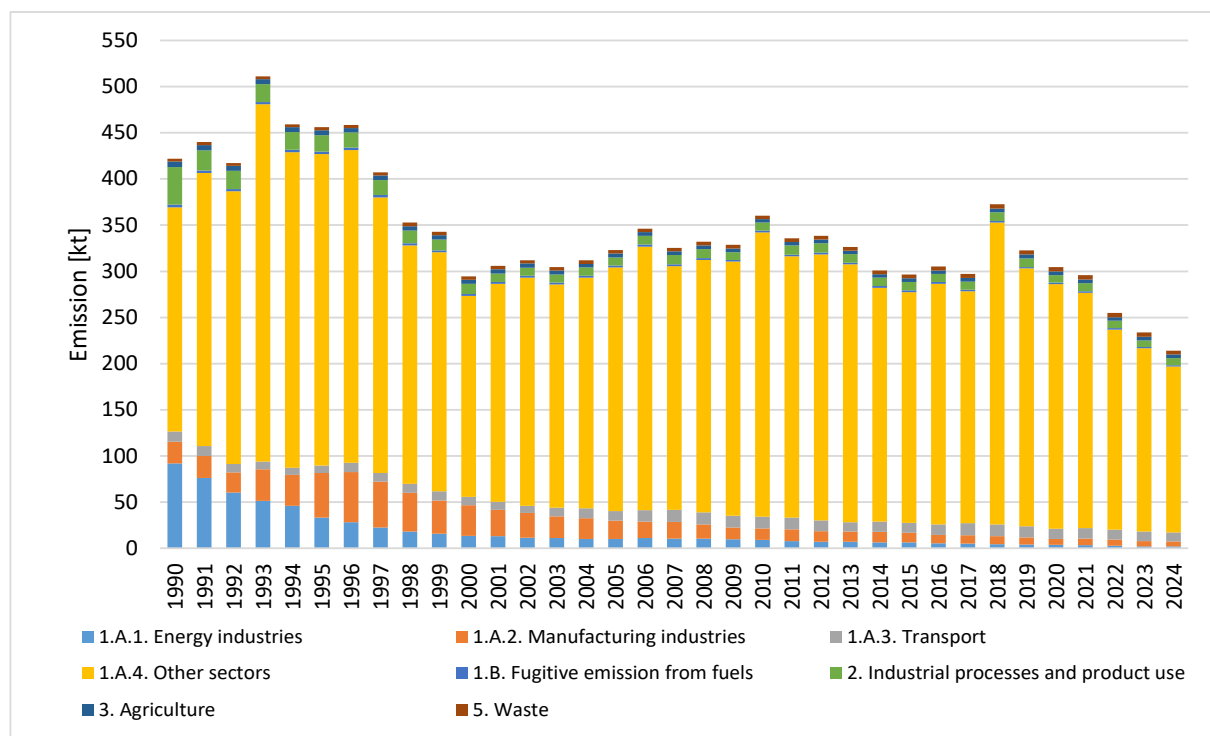


Figure 2.16. Emissions of PM2.5 in 1990-2024

2.6.4 BC emissions

The main source of black carbon (BC) emissions in Poland are stationary combustion processes in sector 1A4. *Other sectors* – 61% (mainly associated with the burning of coal and wood in households) and sector 1A3. *Transport* – 26% (emissions mainly from road transport). The shares of sectors in the national BC emissions in 2024 are shown in Figure 2.17. The disaggregation of BC emissions in NFR is presented below in Table 2.9.

BC emissions have decreased by 40% since 1990, while compared to 2023 emissions in 2024 decreased by 8%. The emissions trend in 1990-2024 is presented in Figure 2.18.

Table 2.9. BC emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	kt	kt	kt	kt	kt
Total	22.64	21.36	18.12	14.75	13.53
1. Energy	19.92	19.90	16.99	13.46	12.30
A. Fuel combustion	19.51	19.64	16.75	13.22	12.07
1. Energy industries	1.71	0.33	0.15	0.11	0.11
2. Manufacturing industries and construction	0.63	0.61	0.23	0.22	0.20
3. Transport	4.95	4.62	4.45	3.84	3.54
4. Other sectors	12.21	14.08	11.92	9.05	8.22
B. Fugitive emissions from fuels	0.40	0.25	0.23	0.24	0.23
1. Solid fuels	0.40	0.25	0.23	0.24	0.23
2. Oil and natural gas	0.00	0.00	0.00	0.00	0.00
2. Industrial processes and product use	2.24	1.00	0.49	0.60	0.62
A. Mineral industry	0.90	0.02	0.01	0.01	0.01
B. Chemical industry	0.02	0.01	0.02	0.01	0.01
C. Metal industry	0.07	0.01	0.01	0.01	0.02
D. Other solvent and product use	0.01	0.03	0.03	0.03	0.03
G. – L. Other	1.23	0.93	0.41	0.54	0.55
3. Agriculture	0.02	0.01	0.01	0.00	0.00
B. Manure management	0.00	0.00	0.00	0.00	0.00
D. Agricultural soils	0.00	0.00	0.00	0.00	0.00
F. Field burning of agricultural residues	0.02	0.01	0.01	0.00	0.00
5. Waste	0.47	0.44	0.64	0.68	0.61
A. Solid waste disposal on land	0.00	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	0.47	0.44	0.64	0.68	0.61
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00
E. Other waste	0.00	0.00	0.00	0.00	0.00

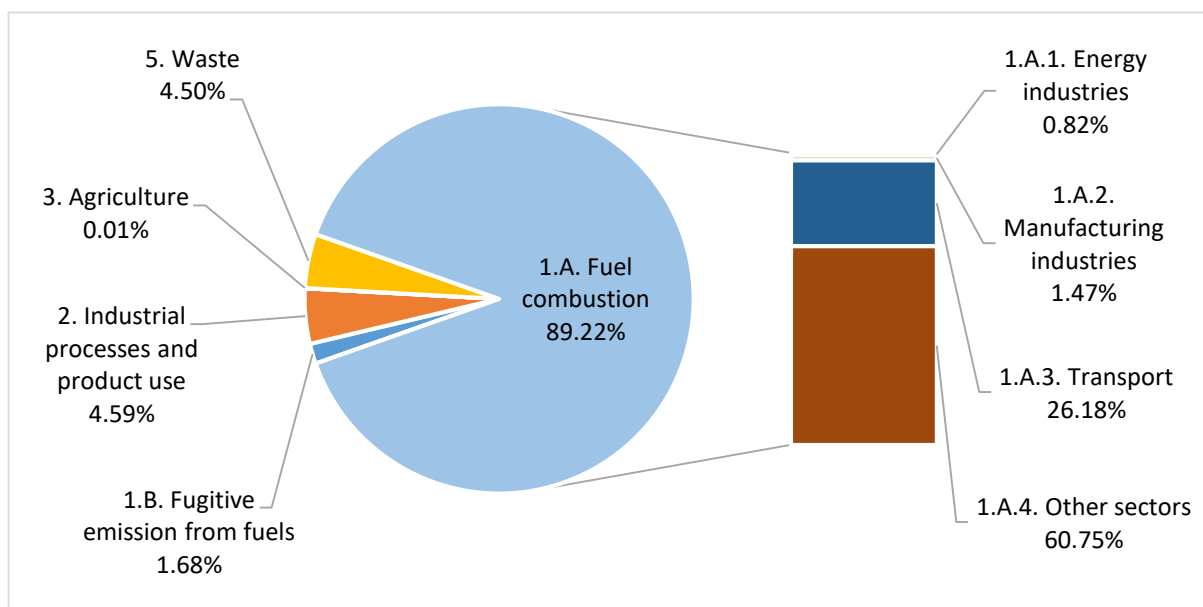


Figure 2.17. Share of BC emissions in 2024

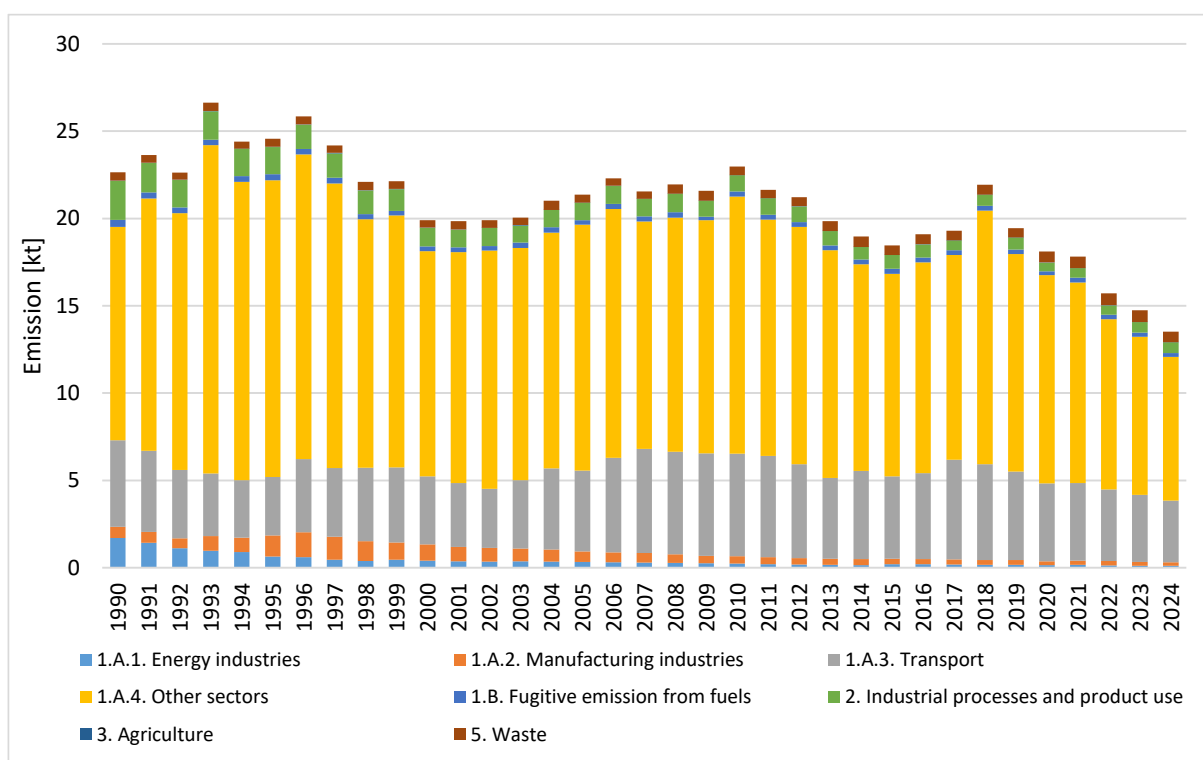


Figure 2.18. Emissions of BC in 1990 – 2024

2.7 POP emissions

2.7.1 PCDD/F emissions

The main source of PCDD/F emissions in 2024 is category 1A4. *Other sectors*, which accounts for 71% of national emissions. Within this category, emissions from combustion processes in furnaces used in households are dominant. A significant part of PCDD/F emissions (14% of national emissions) originates from sources classified into category 5. *Waste*, including fires in landfills, buildings (both residential and industrial) and cars. Emissions from building fires are dominant in this category, however, calculations of emissions are subject to great uncertainty

due to the generalization of the methodology consisting in a simplified division into fires of detached buildings, terraced houses, blocks and industrial buildings. The shares of sectors in the national PCDD/F emissions in 2024 are presented in Figure 2.19. The disaggregation of PCDD/F emissions in NFR is presented below in Table 2.10.

Emission of dioxins and furans has decreased by 38% since 1990. This emission in 2024 decreased compared to 2023 – by 11%. Changes in emissions between following years in particular sectors result mainly from changes in activity data (e.g. fuel consumption, number of fires) and changes in combustion technologies, which affect the emission factors used in the calculations. The largest decrease in PCDD/F emissions occur in category 1A4. *Other sectors* due to the decrease in the consumption of solid fuels and the introduction of modern heating devices in households.

The PCDD/F emissions trend in 1990-2024 is presented in Figure 2.20.

Table 2.10. PCDD/F emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	g I-TEQ	g I-TEQ	g I-TEQ	g I-TEQ	g I-TEQ
Total	374.06	348.19	332.54	261.04	231.89
1. Energy	296.43	271.51	266.98	205.24	187.18
A. Fuel combustion	292.36	268.97	264.62	202.81	184.86
1. Energy industries	25.10	10.77	11.36	10.60	10.24
2. Manufacturing industries and construction	1.80	3.35	5.98	4.96	4.89
3. Transport	1.74	4.82	6.33	5.62	5.25
4. Other sectors	263.72	250.02	240.94	181.64	164.49
B. Fugitive emissions from fuels	4.07	2.54	2.37	2.43	2.31
1. Solid fuels	4.05	2.52	2.33	2.40	2.28
2. Oil and natural gas	0.02	0.02	0.03	0.03	0.03
2. Industrial processes and product use	15.50	11.39	16.00	12.63	12.02
A. Mineral industry	0.21	0.36	0.72	0.71	0.72
B. Chemical industry	0.00	0.00	0.00	0.00	0.00
C. Metal industry	12.81	7.84	11.06	7.85	7.90
D. Other solvent and product use	1.12	0.82	1.61	1.54	1.01
G. – L. Other	1.36	2.36	2.61	2.54	2.39
3. Agriculture	0.02	0.01	0.01	0.00	0.00
B. Manure management	0.00	0.00	0.00	0.00	0.00
D. Agricultural soils	0.00	0.00	0.00	0.00	0.00
F. Field burning of agricultural residues	0.02	0.01	0.01	0.00	0.00
5. Waste	62.11	65.28	49.55	43.17	32.70
A. Solid waste disposal on land	0.00	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	2.66	2.52	3.61	3.86	3.47
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00
E. Other waste	59.45	62.76	45.94	39.30	29.23

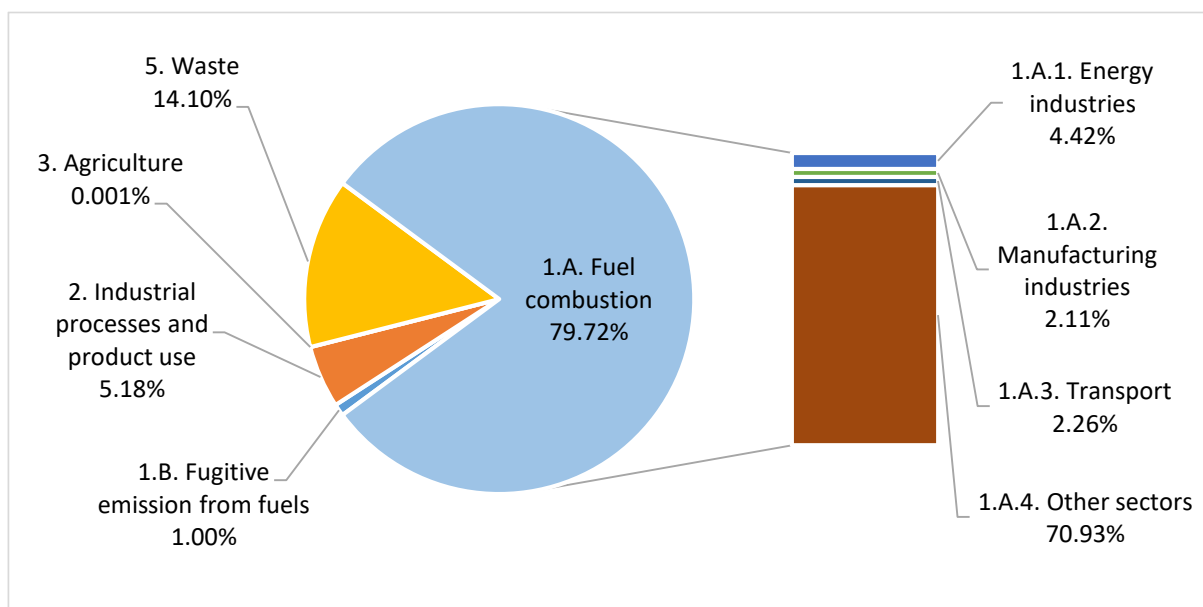


Figure 2.19. Share of PCDD/F emissions in 2024

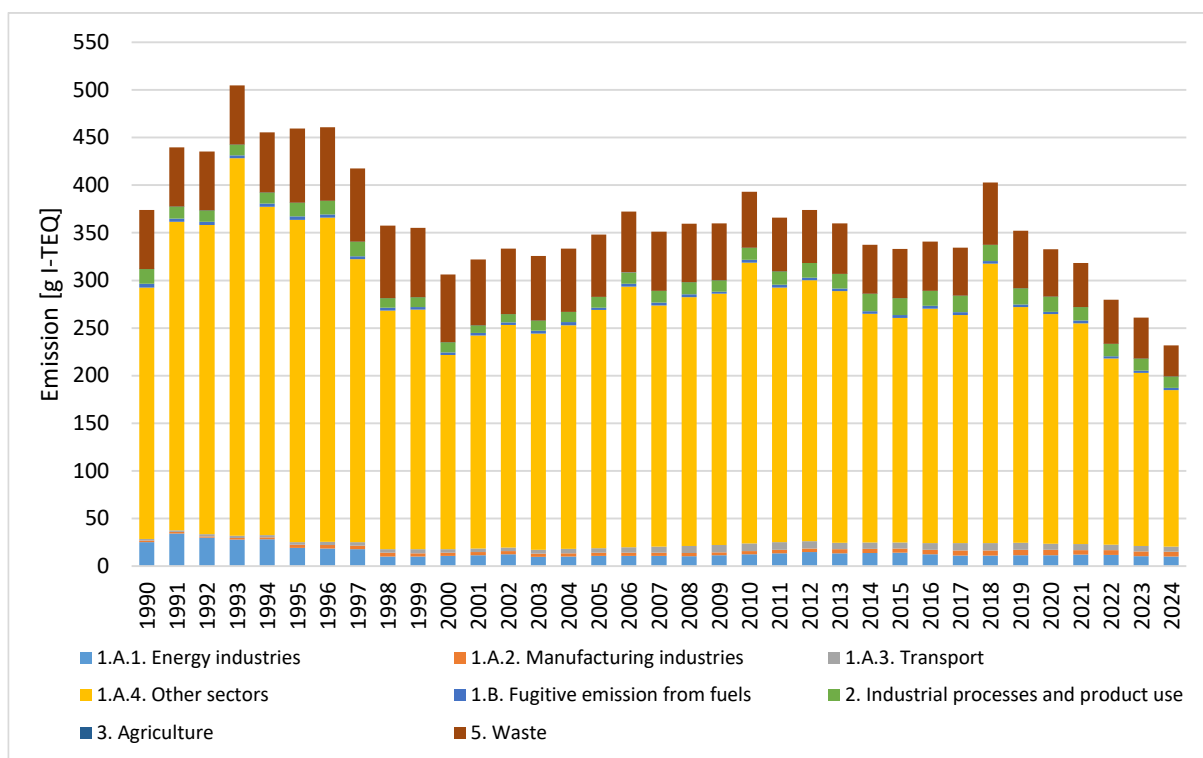


Figure 2.20. Emissions of PCDD/F in 1990-2024

2.7.2 HCB emissions

The largest contribution to the national total of HCB emissions derives from category 1A4. *Other sectors* – 35%. Sectors with a significant share of HCB emissions are also 1A1. *Energy industries* – 25% and 3. *Agriculture* – 24%. The shares of sectors in the national HCB emissions in 2024 are presented in Figure 2.21. Table 2.11 presents the respective emission estimates in NFR classification.

HCB emissions decreased by 96% since 1990. The sharp decrease in HCB emissions between 1999/2000 is related to reduced maximum HCB-concentration (impurity factor) in chlorothalonil used in Europe as presented in the EMEP/EEA EIG 2023 (Chapter 3.D.f, 3.I,

Annex 7, Table 4). The total national HCB emission decreased significantly again in 2020 (compared to 2019 by 77%). This is related to the withdrawal (by the end of 2019) of chlorothalonil from use in plant protection products, in line with Commission Implementing Regulation (EU) 2019/677. HCB emission in 2024 decreased compared to 2023 by 8% as a result of drop in amount of plant protection products used (containing active substances contaminated with HCB), in subcategory 3D. *Agricultural soils*.

As the consumption data for the above-mentioned substances is available in public statistics since 2011 only, the HCB emissions in this category for the years before 2011 were estimated (in line with the recommendation resulting from the review) based on the correlation of the size of agricultural land, the area of which has decreased by 24% since 1990, with the use of the above-mentioned substances in recent years.

The emissions trend in 1990-2024 is presented in Figure 2.22.

Table 2.11. HCB emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	kg	kg	kg	kg	kg
Total	82.88	11.72	3.43	3.55	3.26
1. Energy	1.78	1.80	2.66	2.38	2.29
A. Fuel combustion	1.78	1.80	2.66	2.38	2.29
1. Energy industries	1.19	0.76	0.94	0.89	0.82
2. Manufacturing industries and construction	0.12	0.20	0.38	0.31	0.30
3. Transport	0.01	0.01	0.01	0.01	0.01
4. Other sectors	0.47	0.84	1.33	1.17	1.15
B. Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00
1. Solid fuels	0.00	0.00	0.00	0.00	0.00
2. Oil and natural gas	0.00	0.00	0.00	0.00	0.00
2. Industrial processes and product use	0.55	0.27	0.20	0.15	0.17
A. Mineral industry	0.00	0.00	0.00	0.00	0.00
B. Chemical industry	0.00	0.00	0.00	0.00	0.00
C. Metal industry	0.55	0.27	0.20	0.15	0.17
D. Other solvent and product use	0.00	0.00	0.00	0.00	0.00
G. – L. Other	0.00	0.00	0.00	0.00	0.00
3. Agriculture	80.55	9.64	0.55	0.99	0.78
B. Manure management	0.00	0.00	0.00	0.00	0.00
D. Agricultural soils	80.55	9.64	0.55	0.99	0.78
F. Field burning of agricultural residues	0.00	0.00	0.00	0.00	0.00
5. Waste	0.00	0.00	0.02	0.02	0.03
A. Solid waste disposal on land	0.00	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	0.00	0.00	0.02	0.02	0.03
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00
E. Other waste	0.00	0.00	0.00	0.00	0.00

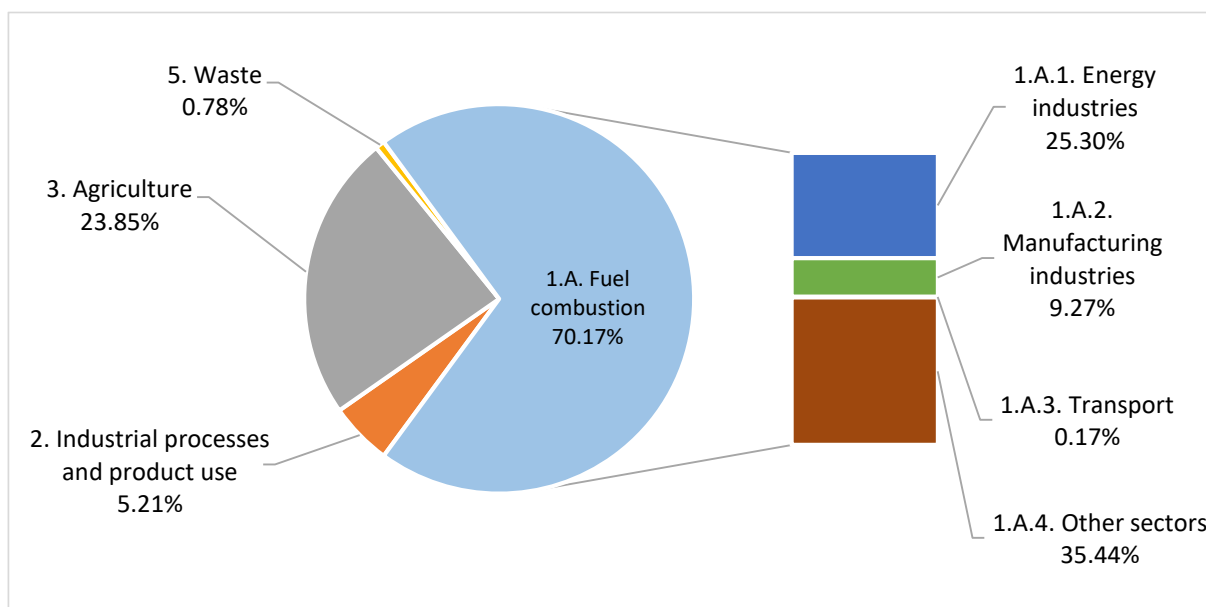


Figure 2.21. Share of HCB emissions in 2024

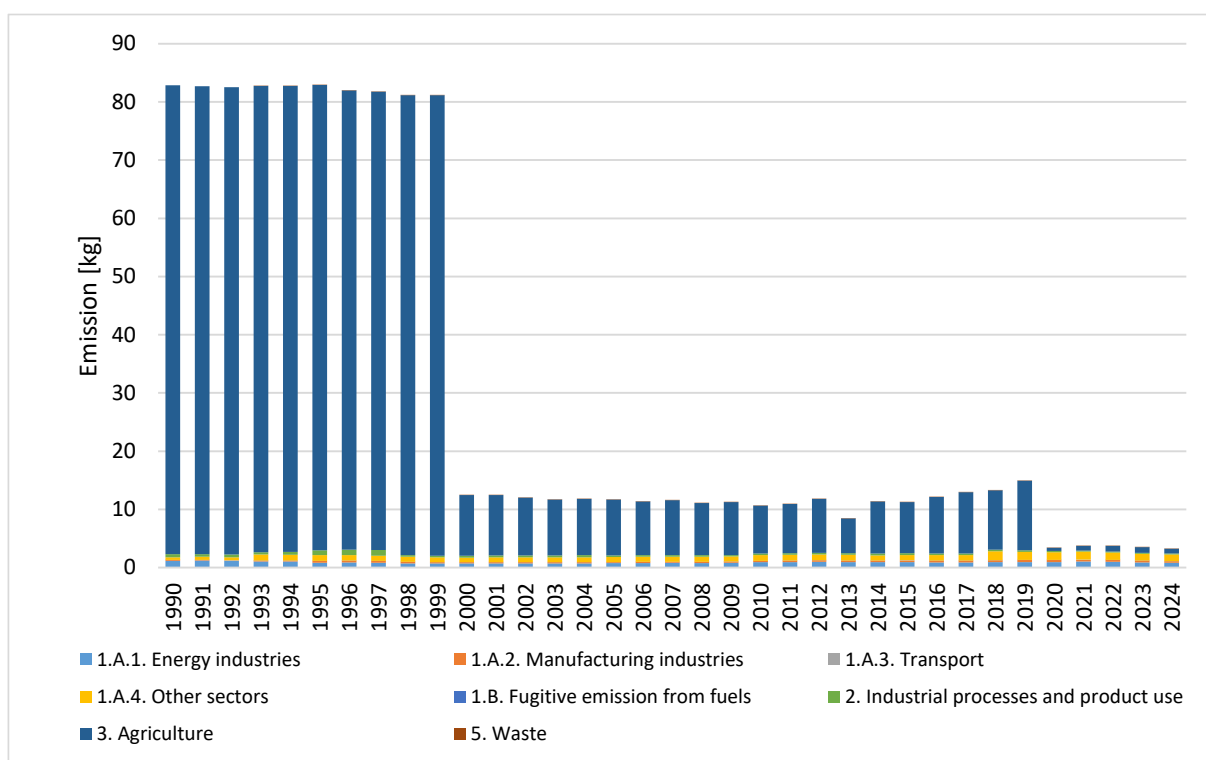


Figure 2.22. Emissions of HCB in 1990-2024

2.7.3 PCB emissions

Category 1A1. *Energy industries* is the dominant source of PCB emissions, constituting 70% of the total national PCB emissions. An important source of PCB emissions in 2024 is also category 2. *Industrial processes* – 22%. The shares of sectors in the national PCB emissions in 2024 are presented in Figure 2.23. Table 2.12 presents the respective emission estimates in NFR classification.

PCB emissions decreased by 39% since 1990. In the following years 2023 and 2024, PCB emissions remain at a similar level, with slight changes in individual sectors resulting from changes in fuel consumption. The emissions trend in 1990-2024 is presented in Figure 2.24.

Table 2.12. PCB emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	kg	kg	kg	kg	kg
Total	206.66	171.49	142.64	125.25	125.23
1. Energy	161.80	139.46	110.96	97.35	97.34
A. Fuel combustion	161.80	139.46	110.96	97.35	97.34
1. Energy industries	148.50	128.08	99.50	87.70	88.18
2. Manufacturing industries and construction	9.37	7.67	7.98	7.01	6.81
3. Transport	0.00	0.00	0.00	0.00	0.00
4. Other sectors	3.92	3.72	3.48	2.64	2.36
B. Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00
1. Solid fuels	0.00	0.00	0.00	0.00	0.00
2. Oil and natural gas	0.00	0.00	0.00	0.00	0.00
2. Industrial processes and product use	44.86	32.02	31.61	27.83	27.82
A. Mineral industry	0.00	0.00	0.00	0.00	0.00
B. Chemical industry	0.00	0.00	0.00	0.00	0.00
C. Metal industry	44.86	32.02	31.61	27.83	27.82
D. Other solvent and product use	0.00	0.00	0.00	0.00	0.00
G. – L. Other	0.00	0.00	0.00	0.00	0.00
3. Agriculture	0.00	0.00	0.00	0.00	0.00
B. Manure management	0.00	0.00	0.00	0.00	0.00
D. Agricultural soils	0.00	0.00	0.00	0.00	0.00
F. Field burning of agricultural residues	0.00	0.00	0.00	0.00	0.00
5. Waste	0.00	0.01	0.07	0.07	0.07
A. Solid waste disposal on land	0.00	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	0.00	0.01	0.07	0.07	0.07
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00
E. Other waste	0.00	0.00	0.00	0.00	0.00

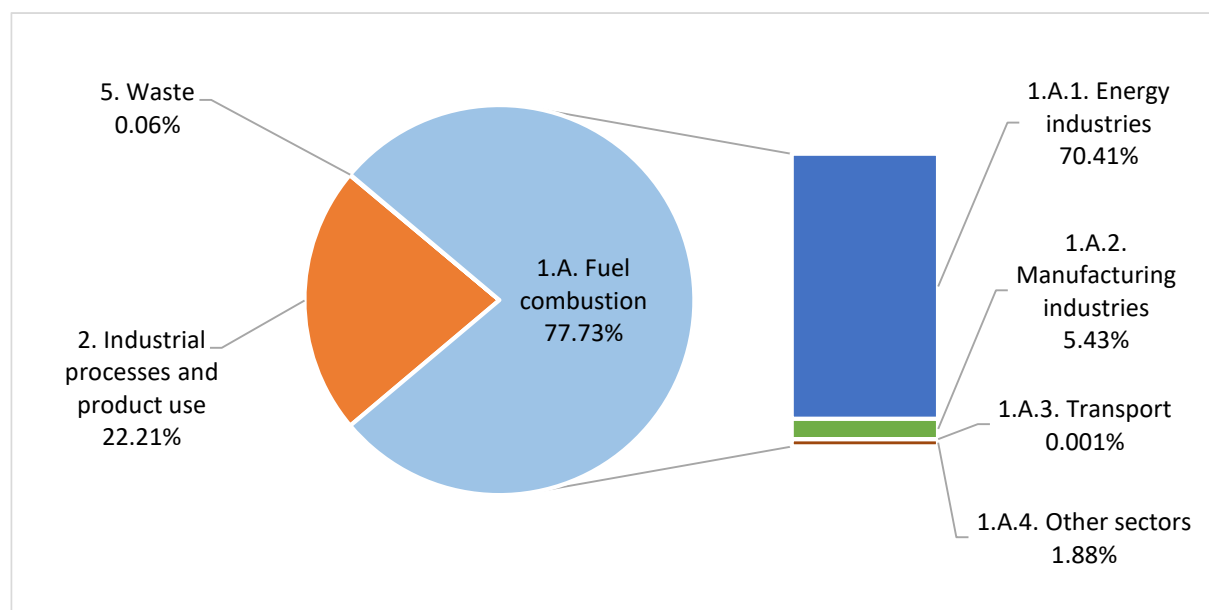


Figure 2.23. Share of PCB emissions in 2024

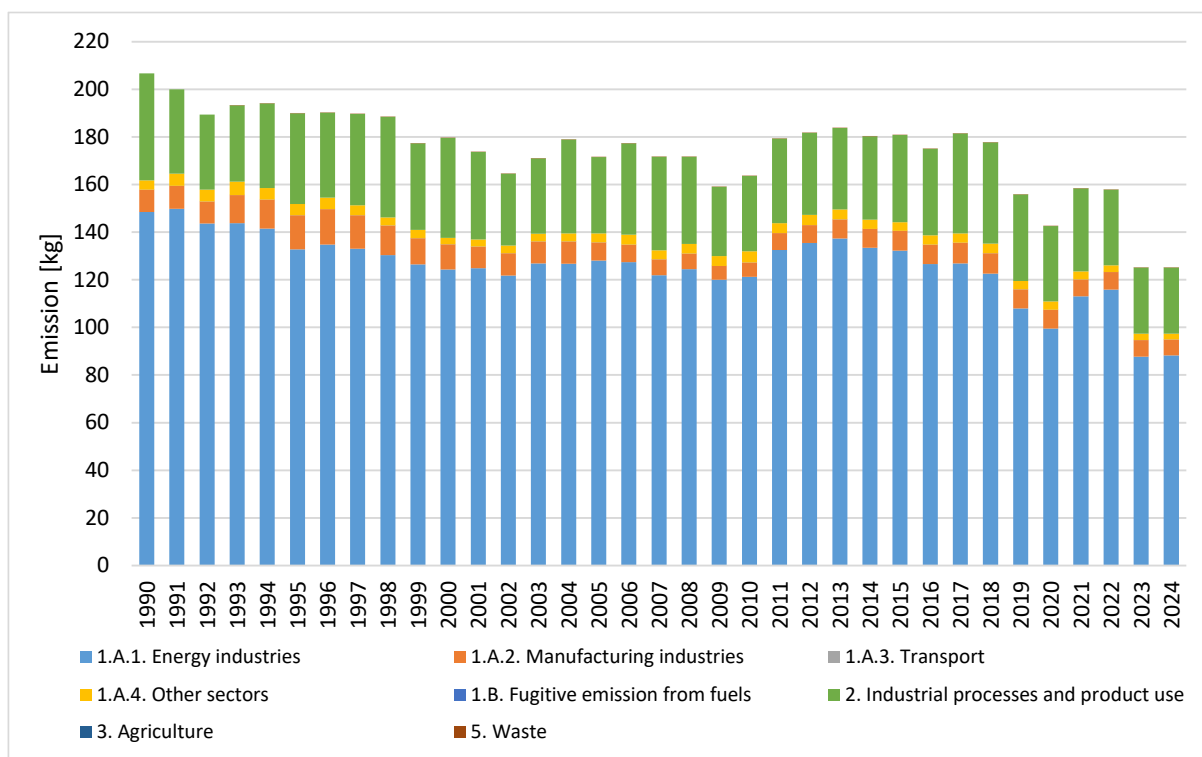


Figure 2.24. Emissions of PCB in 1990-2024

2.7.4 PAH emissions

The crucial share of PAH emissions (almost 93%) originates from category 1A4. *Other sectors*, with the largest share of household emissions – up to 89%. The shares of sectors in the national PAH emissions in 2024 are presented in Figure 2.25. Table 2.13 presents the respective emission estimates in NFR classification.

The emissions of PAHs are estimated based on the assessment of the emission of four indicator compounds from this group: (benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indene(1,2,3 cd)pyrene).

PAH emissions have decreased by 47% since 1990 and by 11% compared to the level of emissions from 2023. The change in PAH emissions was mainly caused by a general decrease in emissions from the household sector, which is associated with a reduction in the consumption of hard coal and biomass. The largest contribution to the change in the national PAH emissions in 2024 was the decrease in PAH emissions from the household sector, which is related to the decrease in the consumption of hard coal and the introduction of modern heating devices for fuels combustion. The emissions trend in 1990-2024 is presented in Figure 2.26.

Table 2.13. PAH emissions in selected years according to NFR classification

NFR	1990	2005	2020	2023	2024
	t	t	t	t	t
Total	341.48	310.38	271.39	203.55	180.66
1. Energy	331.03	300.35	261.25	194.74	173.28
A. Fuel combustion	323.86	295.90	257.13	190.50	169.25
1. Energy industries	1.00	0.29	0.29	0.27	0.27
2. Manufacturing industries and construction	0.47	0.46	0.49	0.39	0.37
3. Transport	0.87	0.59	1.37	1.46	1.48
4. Other sectors	321.53	294.55	254.97	188.38	167.13
B. Fugitive emissions from fuels	7.16	4.45	4.13	4.24	4.03
1. Solid fuels	7.16	4.45	4.13	4.24	4.03
2. Oil and natural gas	0.00	0.00	0.00	0.00	0.00
2. Industrial processes and product use	7.03	6.77	5.54	3.91	3.81
A. Mineral industry	0.00	0.00	0.00	0.00	0.00
B. Chemical industry	0.00	0.00	0.00	0.00	0.00
C. Metal industry	6.11	5.06	3.43	2.68	2.81
D. Other solvent and product use	0.90	1.70	2.11	1.21	0.99
G. – L. Other	0.02	0.02	0.01	0.01	0.01
3. Agriculture	0.05	0.07	0.03	0.02	0.01
B. Manure management	0.00	0.00	0.00	0.00	0.00
D. Agricultural soils	0.00	0.00	0.00	0.00	0.00
F. Field burning of agricultural residues	0.05	0.07	0.03	0.02	0.01
5. Waste	3.36	3.18	4.56	4.88	3.57
A. Solid waste disposal on land	0.00	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	3.36	3.18	4.56	4.88	3.57
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00
E. Other waste	0.00	0.00	0.00	0.00	0.00

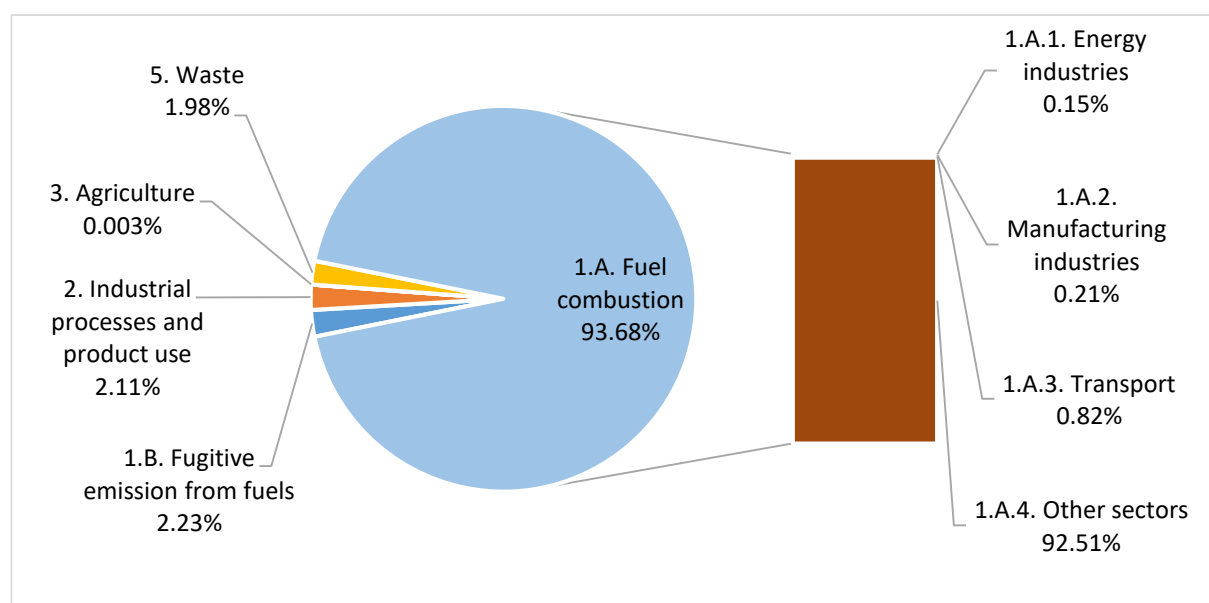


Figure 2.25. Share of PAH emissions in 2024

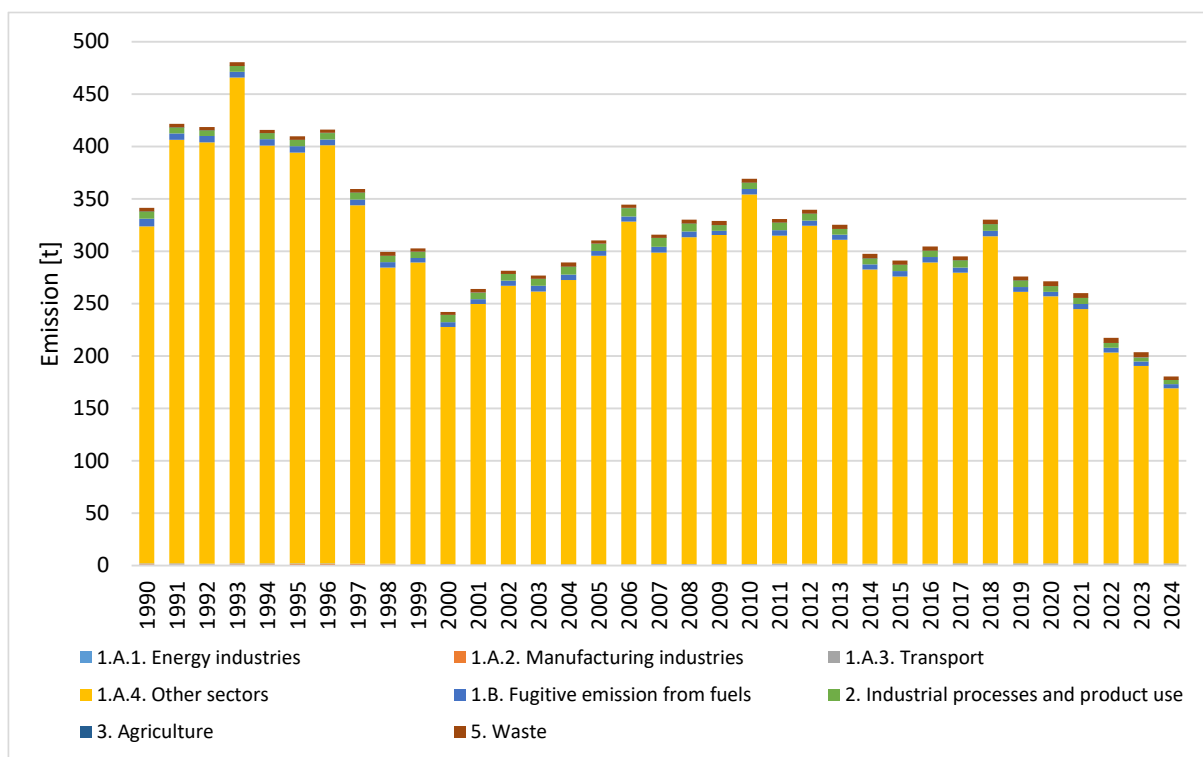


Figure 2.26. Emissions of PAHs in 1990-2024

2.8 Heavy metal emissions

The dominant source of lead and cadmium emissions is sector 2. *Industrial processes*, the share of which in total lead emissions constitutes 56% and cadmium – 39%. Arsenic and mercury emissions from this sector also remain at a significant level of 27% and 24% respectively. In the case of mercury, arsenic and nickel, the largest source is the combustion of fuels in sector 1A1. *Energy industries* – 47%, 44% and 54% respectively. Sector 1A4. *Other sectors* contributes the largest share in zinc emissions – 32%. Sector 1A3. *Transport* is the source of the largest copper emissions (74%) which is emitted mainly from tribological processes in road transport. The shares of sectors in the national HM emissions in 2024 are shown in Figure 2.27. Table 2.14 and Table 2.15 present the respective emission estimates in NFR classification. Figure 2.28 to Figure 2.35 present annual emissions of heavy metals in the years 1990-2024.

Table 2.14. HM (Pb, Cu, Zn, As) emissions in selected years according to NFR classification [t]

NFR	Pb		Cu		Zn		As	
	1990	2024	1990	2024	1990	2024	1990	2024
Total	542.06	222.24	200.60	313.83	786.92	463.03	144.27	10.10
1. Energy	353.34	96.81	176.10	278.72	685.74	388.78	19.97	7.24
A. Fuel combustion	348.17	93.84	175.44	278.32	682.75	387.08	19.80	7.13
1. Energy industries	105.37	20.79	63.39	15.14	409.12	78.71	14.07	4.40
2. Manufacturing industries and construction	33.08	14.74	20.28	7.92	135.48	86.73	3.31	1.27
3. Transport	153.11	28.80	52.61	233.05	16.97	74.99	0.07	0.33
4. Other sectors	56.61	29.50	39.16	22.21	121.17	146.65	2.34	1.13
B. Fugitive emissions from fuels	5.17	2.97	0.66	0.40	2.99	1.70	0.18	0.10
1. Solid fuels	5.14	2.89	0.65	0.37	2.97	1.67	0.18	0.10
2. Oil and natural gas	0.04	0.08	0.02	0.03	0.01	0.03	0.00	0.00

NFR	Pb		Cu		Zn		As	
	1990	2024	1990	2024	1990	2024	1990	2024
2. Industrial processes and product use	188.58	125.25	24.40	34.99	96.50	68.15	124.17	2.70
A. Mineral industry	2.26	6.15	0.01	0.03	0.39	1.33	0.23	0.68
B. Chemical industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Metal industry	185.63	114.20	16.48	0.55	91.57	46.91	123.93	2.01
D. Other solvent and product use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G. – L. Other	0.69	4.90	7.92	34.41	4.54	19.91	0.00	0.01
3. Agriculture	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
B. Manure management	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Agricultural soils	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F. Field burning of agricultural residues	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
5. Waste	0.14	0.18	0.10	0.12	4.66	6.09	0.13	0.17
A. Solid waste disposal on land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	0.13	0.17	0.05	0.07	4.66	6.09	0.11	0.14
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Other waste	0.01	0.01	0.04	0.05	0.00	0.00	0.02	0.02

Table 2.15. HM (Cd, Hg, Cr, Ni) emissions in selected years according to NFR classification [t]

NFR	Cd		Hg		Cr		Ni	
	1990	2024	1990	2024	1990	2024	1990	2024
Total	11.78	9.31	14.68	4.75	55.71	30.98	199.93	58.44
1. Energy	6.47	5.61	12.00	3.33	37.16	28.82	149.11	51.91
A. Fuel combustion	6.37	5.54	11.83	3.23	34.86	27.53	147.42	50.86
1. Energy industries	4.58	1.38	10.26	2.21	18.03	5.41	99.32	31.61
2. Manufacturing industries and construction	0.45	1.00	0.58	0.35	5.04	3.27	32.28	7.98
3. Transport	0.04	0.13	0.04	0.13	2.41	10.77	0.48	1.66
4. Other sectors	1.29	3.03	0.95	0.53	9.39	8.08	15.35	9.61
B. Fugitive emissions from fuels	0.10	0.07	0.17	0.11	2.30	1.30	1.69	1.05
1. Solid fuels	0.09	0.05	0.16	0.09	2.30	1.29	1.62	0.91
2. Oil and natural gas	0.01	0.01	0.01	0.02	0.00	0.00	0.07	0.14
2. Industrial processes and product use	5.24	3.65	2.66	1.15	18.52	2.12	50.81	6.53
A. Mineral industry	0.11	0.34	0.00	0.01	0.29	0.83	0.43	1.73
B. Chemical industry	0.74	0.20	0.98	0.00	0.00	0.00	0.00	0.00
C. Metal industry	3.81	2.67	1.47	0.93	18.05	0.42	49.79	3.19
D. Other solvent and product use	0.00	0.00	0.21	0.21	0.00	0.00	0.02	0.02
G. – L. Other	0.59	0.44	0.00	0.00	0.19	0.87	0.58	1.60
3. Agriculture	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Manure management	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Agricultural soils	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F. Field burning of agricultural residues	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Waste	0.04	0.05	0.01	0.27	0.02	0.03	0.00	0.00
A. Solid waste disposal on land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Incineration and open burning of waste	0.03	0.04	0.00	0.25	0.00	0.01	0.00	0.00
D. Wastewater handling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
E. Other waste	0.01	0.02	0.01	0.02	0.02	0.02	0.00	0.00

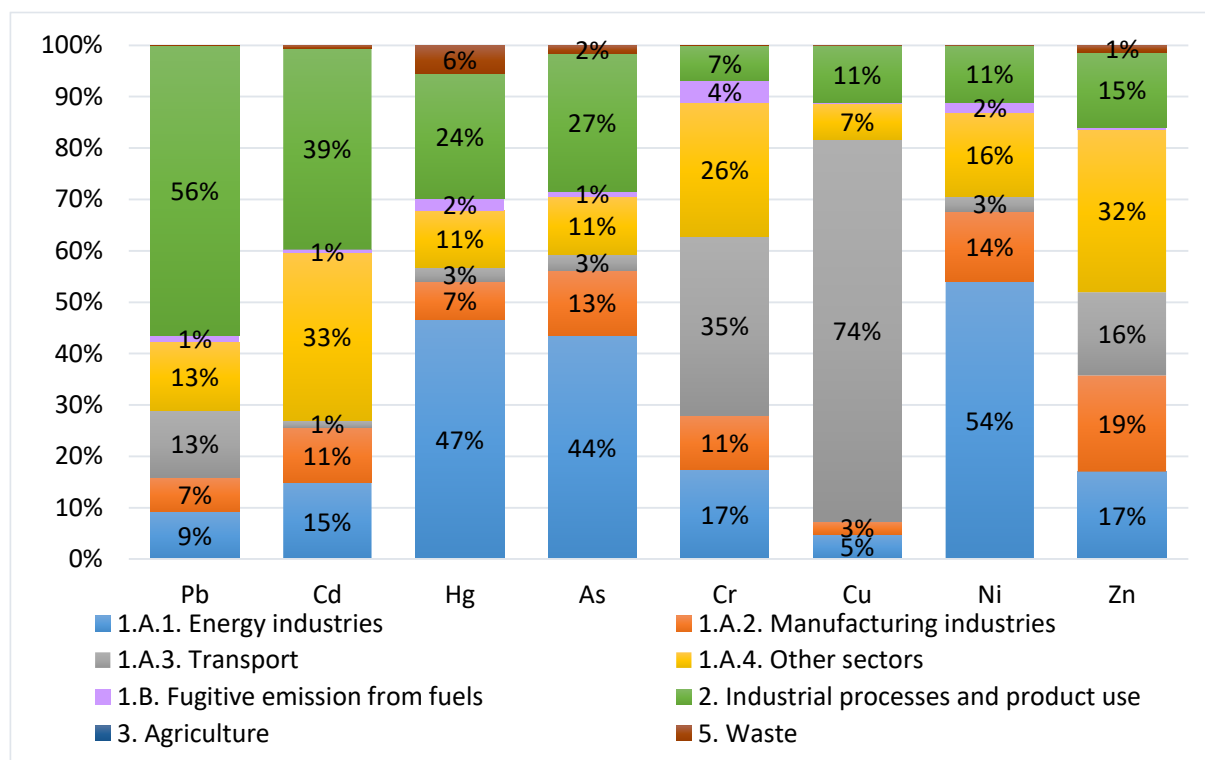


Figure 2.27. Share of HM emissions in 2024

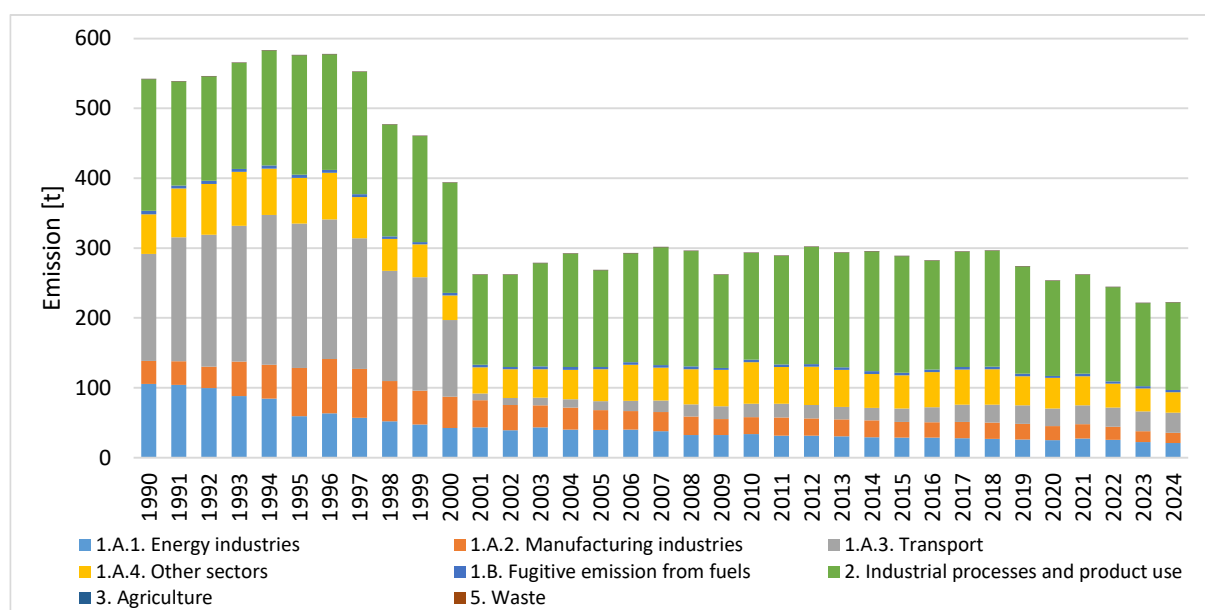


Figure 2.28. Emissions of Pb in 1990-2024

Drop of Pb emissions in sector 1A3. *Transport* in 2001 results from new limit of lead contents in fuels (Figure 2.28).

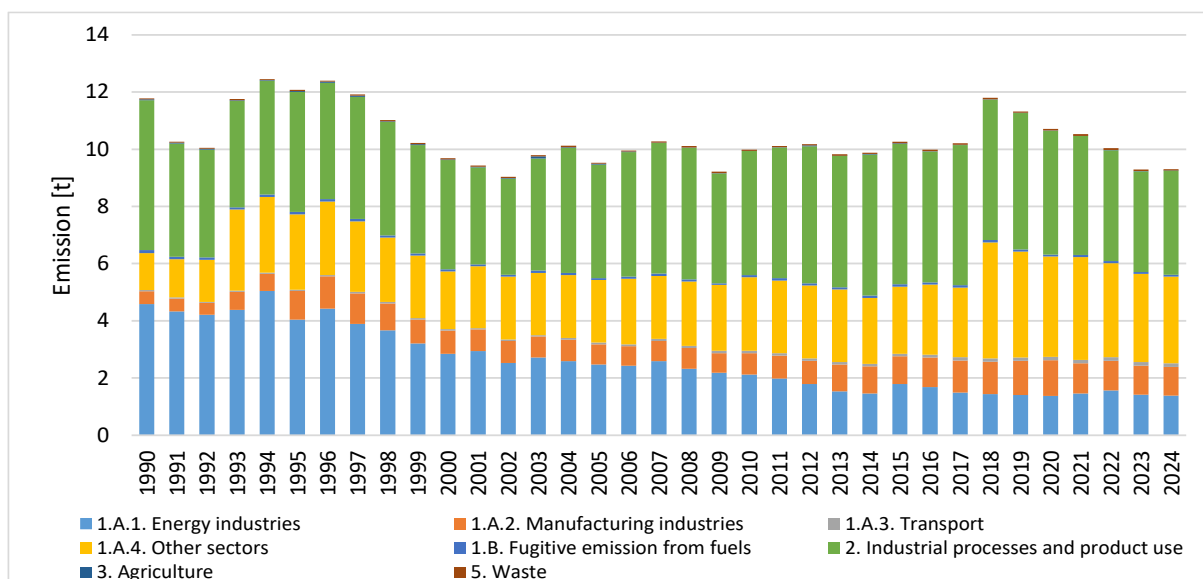


Figure 2.29. Emissions of Cd in 1990-2024

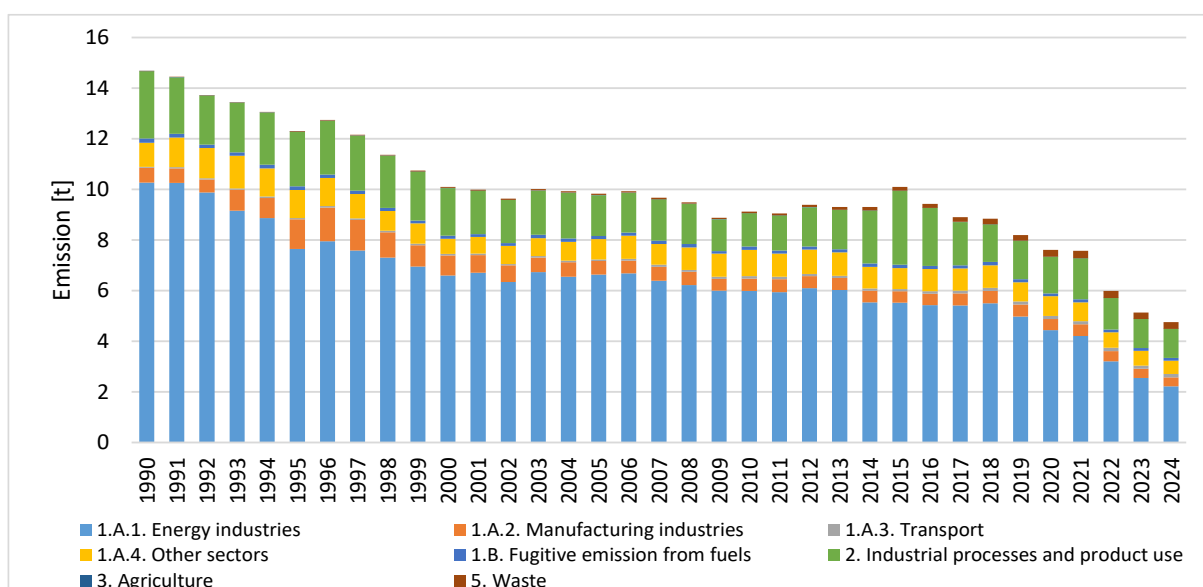


Figure 2.30. Emissions of Hg in 1990-2024

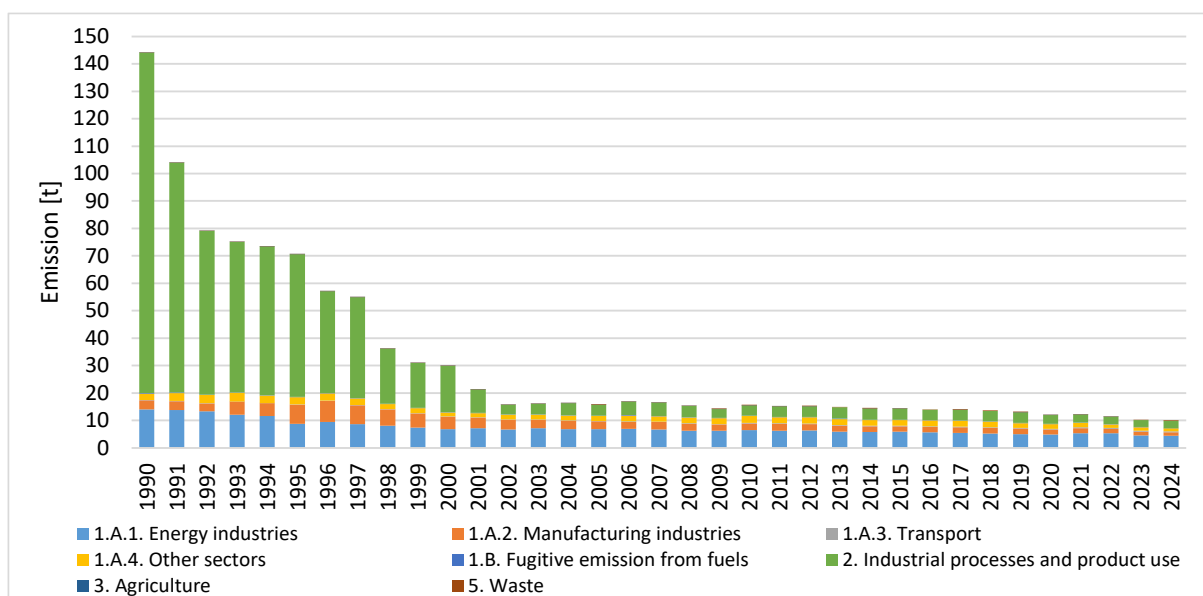


Figure 2.31. Emissions of As in 1990-2024



The gradual decrease in As emissions in category 2. *Industrial processes and product use* is related to the shutdown of open-hearth furnaces in the metallurgy sector. Steel production in open-hearth furnaces was continued until 2002.

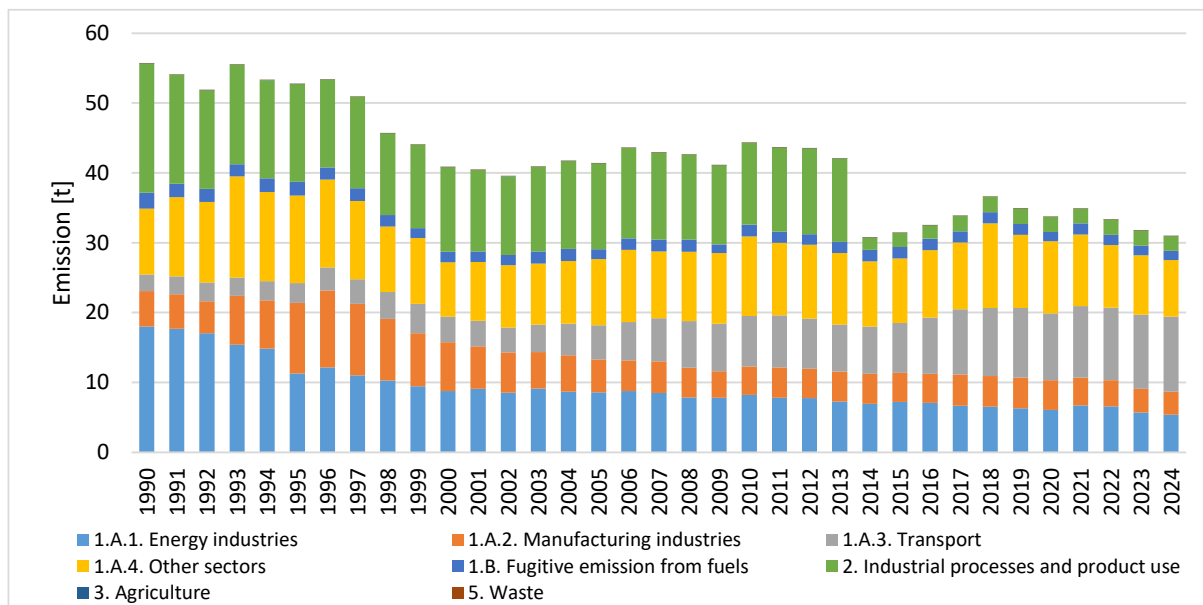


Figure 2.32. Emissions of Cr in 1990-2024

Copper emission comes mainly from tribological processes (friction processes) in road transport and its increase is related to the increased number of road vehicles and their traffic (Figure 2.33).

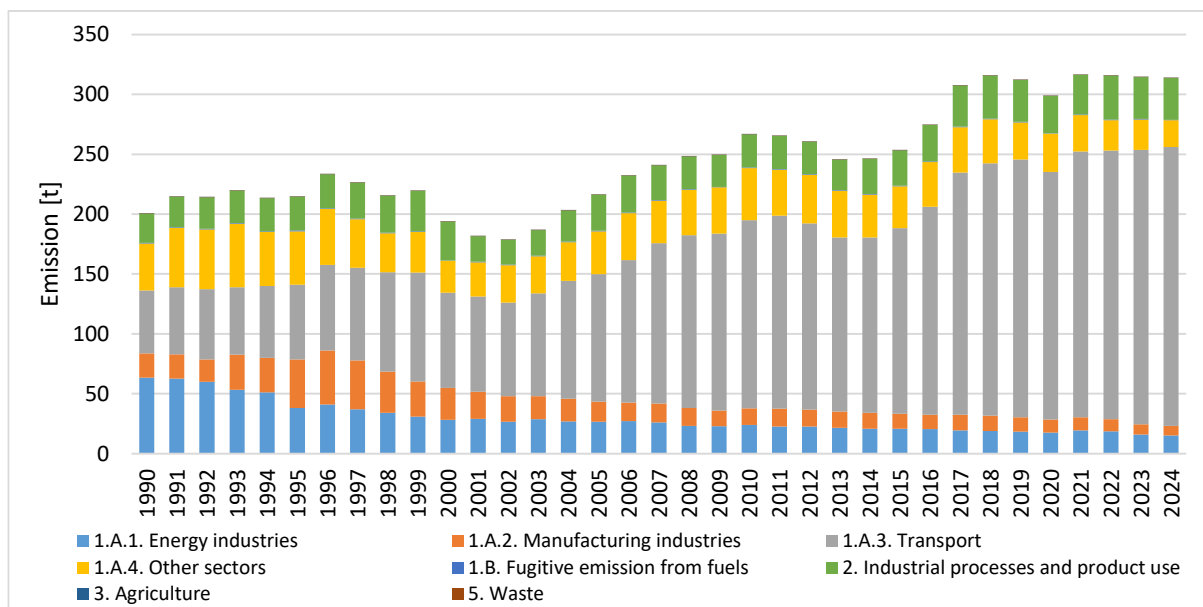


Figure 2.33. Emissions of Cu in 1990-2024

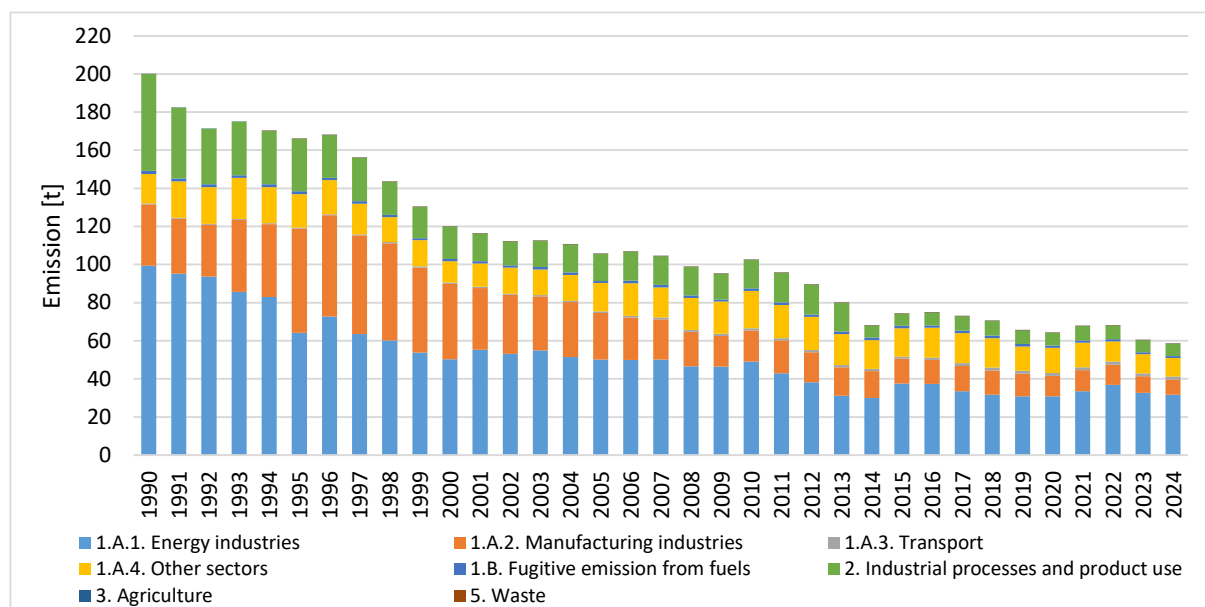


Figure 2.34. Emissions of Ni in 1990-2024

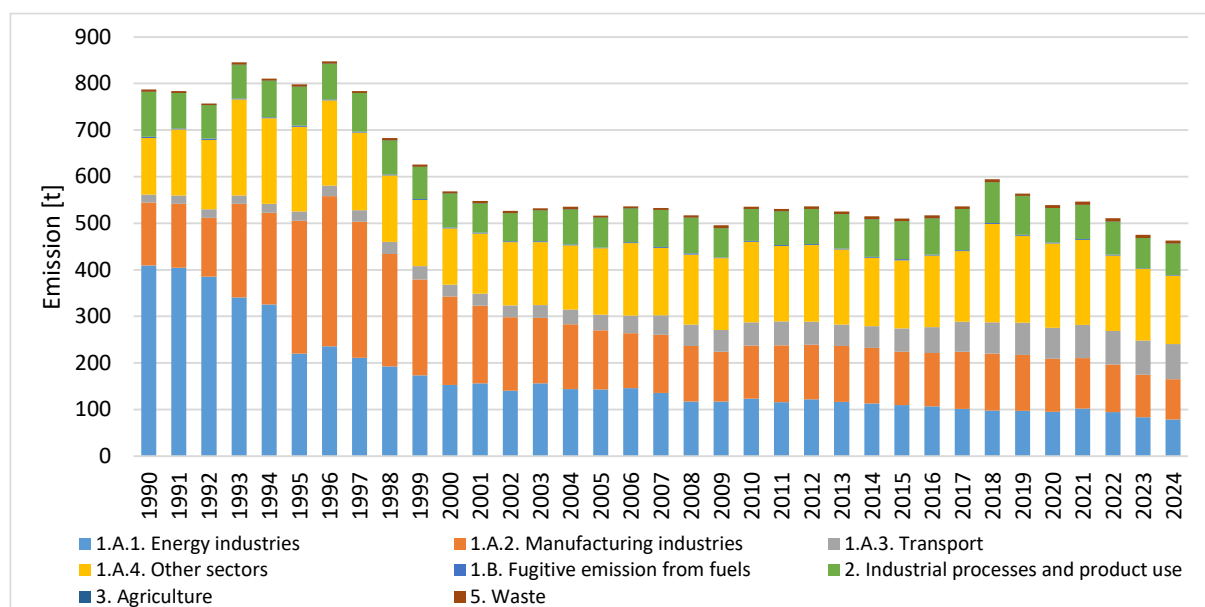


Figure 2.35. Emissions of Zn in 1990-2024



3 ENERGY (NFR SECTOR 1)

3.1 Source category description

Energy sector consists of the following main subcategories:

- 1A. *Fuel combustion*;
- 1B. *Fugitive emissions from fuels*.

The Energy sector, especially sector 1A. *Fuel combustion*, is one of the most important sources of pollutant emissions.

Shares of emissions from category 1. *Energy* in the country total for the individual pollutants in 2024 are shown in Figure 3.1.

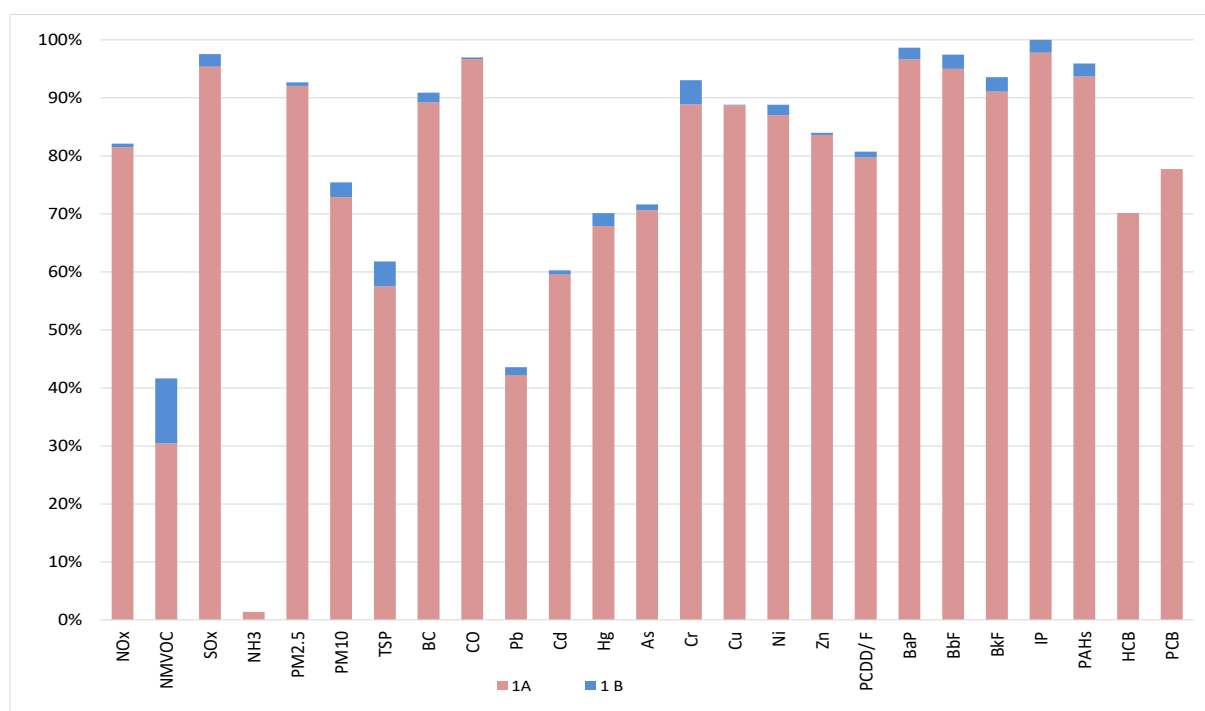


Figure 3.1. Shares of emissions from category 1. *Energy* in the country total in 2024

Combustion as a source of pollutant emissions occurs in the following category groups:

- 1A1. *Energy industries*
- 1A2. *Manufacturing industries and construction*
- 1A3. *Transport*
- 1A4. *Other sectors*
- 1A5. *Other stationary and mobile*

Emissions in 1B. *Fugitive emissions* sector consists of the following main subcategories:

- 1B1. *Fugitive emission from solid fuels*;
- 1B2. *Fugitive emission from oil and natural gas*.

Emissions of pollutants from fuel combustion sector are mainly estimated on the basis of fuel quantities according to data included in the energy balance submitted by GUS to Eurostat database and the relevant emission factors. Energy balance for year 2024 is presented in Appendix 4. Energy data is harmonized with Poland's GHG inventory for the UNFCCC.

Generally, the emission calculations were based on the following equation:

$$E = \sum (EF_{ab} * A_{ab})$$

where:

- E - emission
- EF - emission factor
- A - fuel consumption
- a - fuel type,
- b – sector.

Activity data (fuel use) for this sector comes from energy statistics (Eurostat database). For some pollutants (SO₂, NO_x, CO, TSP) aggregated emission data from reports submitted to the National Emission Database by power plants is directly included in the inventory, without the use of emission factors.

Similar method was used for off-road forms of transport. For road transport emissions COPERT 5 software was used.

3.2 Energy Industries (NFR sector 1A1)

3.2.1 Source category description

Emissions in 1A1. *Energy industries* category are estimated for each detailed sub-categories as follows:

a) 1A1a. *Public electricity and heat production* divided into:

- public power plants, combined heat and power plants,
- district heating plants,
- industrial plants,

b) 1A1b. *Petroleum refining*,

c) 1A1c. *Manufacture of solid fuels and other energy industries* divided into:

- manufacture of solid fuels (coke-oven plants, gas-works plants, mines, patent fuel/briquetting plants),
- oil and gas extraction and other energy industries.

Emissions from subcategories 5C1a and 5C1bi-iv (*incineration of municipal, industrial and medical waste and sewage sludge*) are also reported under category 1A1a, as analysis of facility data from Central Waste System, BDO Waste Database, report Waszczyłko (2021) and Association of Employers of Industrial and Medical Waste Thermal Processing Plants for Health and Environmental Protection confirmed that waste is incinerated in those facilities for energy purposes.

The following subcategories in sector 1A1 have been identified as key source:

Table 3.1. Key source categories in sector 1A1

	NFR	Method	EF	Pollutant
1A1a	Public electricity and heat production	T2/T1	CS/D	SO ₂ , NO _x , Pb, Cd, Hg, HCB
1A1b	Petroleum refining	T2/T1	CS/D	Cd

CS – country specific; D - default

Shares of emissions from the 1A1 category in the country total for certain pollutants in 2024 are shown in Figure 3.2.

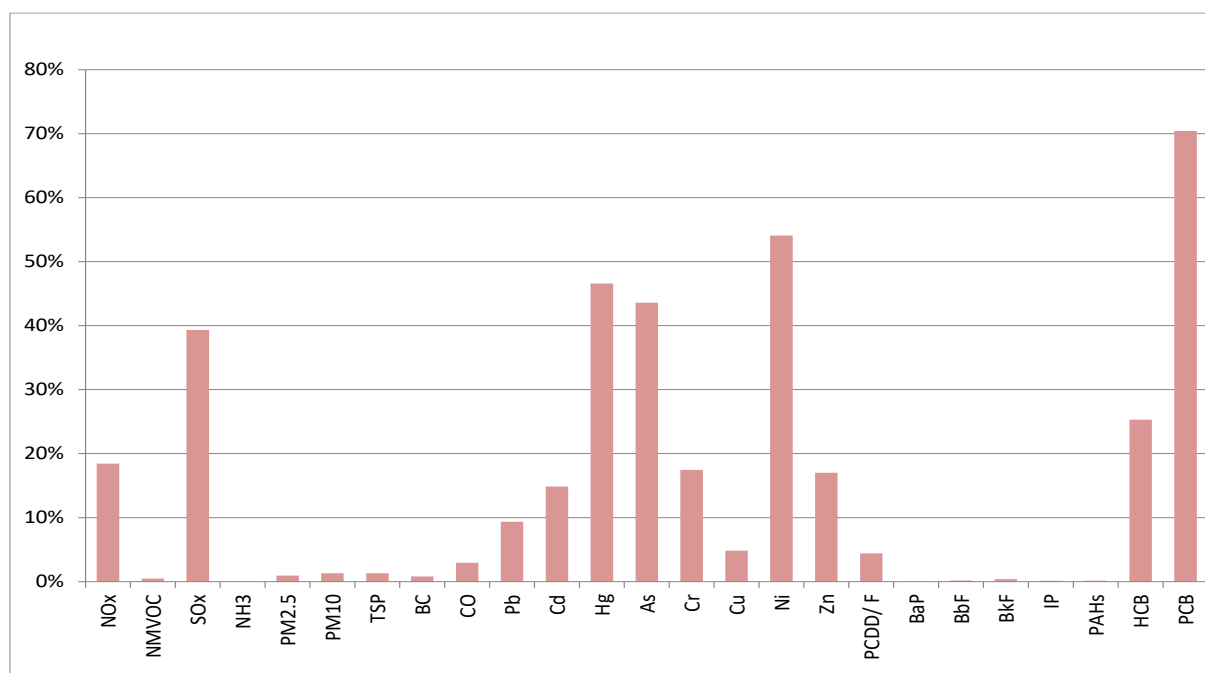


Figure 3.2. Shares of emissions from the 1A1 category in the country total in 2024

The data in Figure 3.3 and Figure 3.4 shows that the use of solid fuels is dominant in 1A1 category – mainly hard coal and lignite. In 2024, the use of solid fuels accounted for 73% of all fuels used in that sector. Despite such a significant share of solid fuels, a slow downward trend can be seen since the late 1990s (from 94% in 1990), which is also the result of the gradual replacement of fossil fuels with zero-emission energy sources. At the same time an increased share of natural gas and biomass is observed.

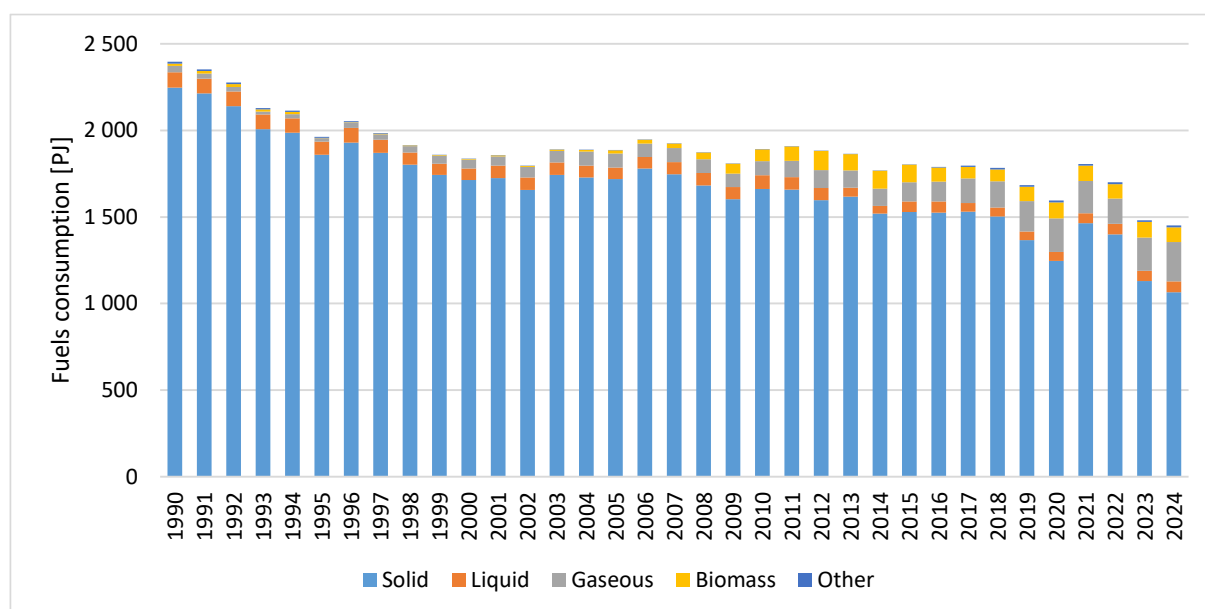


Figure 3.3. Fuel consumption in the 1A1 category [PJ]

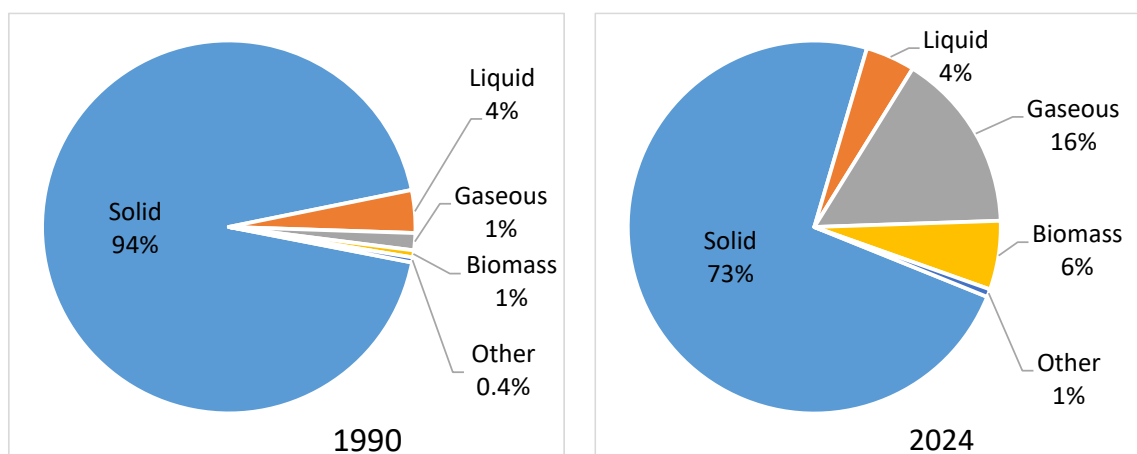


Figure 3.4. Share of fuel consumption in the 1A1 category in years 1990 and 2024

3.2.2 Methodological issues

The methodology of emission estimation in 1A1 category corresponds with the methodology described above for fuel combustion in stationary sources (Chapter 3). Activity data (fuel use) for this sector comes from energy statistics. For some pollutants (SO₂, NO_x, CO, TSP) aggregated emission data from reports submitted to the National Emission Database by power plants is included.

Detailed information on fuel consumption and applied emission factors for emission source subcategories is presented in Appendices 5 and 6. Information on whether the emission factors used for PM₁₀ and PM_{2.5} include or exclude the condensable component is given in Appendix 9. Data on industrial waste incinerators abatement shares and efficiencies are given in Appendices 5 and 6 in tables A5.4 and A6.11.

3.2.2.1 1A1a. Public electricity and heat production

This category includes emissions from the combustion of fuels for the purposes of electricity and heat generation by power plants, combined heat and power plants, district heating plants and industrial power plants (emissions from production of both heat and electrical power for sale to the public). Moreover, emissions from incineration of municipal, industrial and medical waste and sewage sludge (subcategories 5C1a and 5C1bi-iv) are reported under category 1A1a, as analysis of facility data from Central Waste System (CSO), BDO Waste Database (BDO), report Waszczyłko (2021) and Association of Employers of Industrial and Medical Waste Thermal Processing Plants for Health and Environmental Protection confirmed that waste is incinerated in those facilities for energy purposes.

Activity data (fuel use) for this sector comes from energy statistics (Eurostat database). The data in Figure 3.5 shows that the use of solid fuels is dominant in 1A1a category – mainly hard coal and lignite.

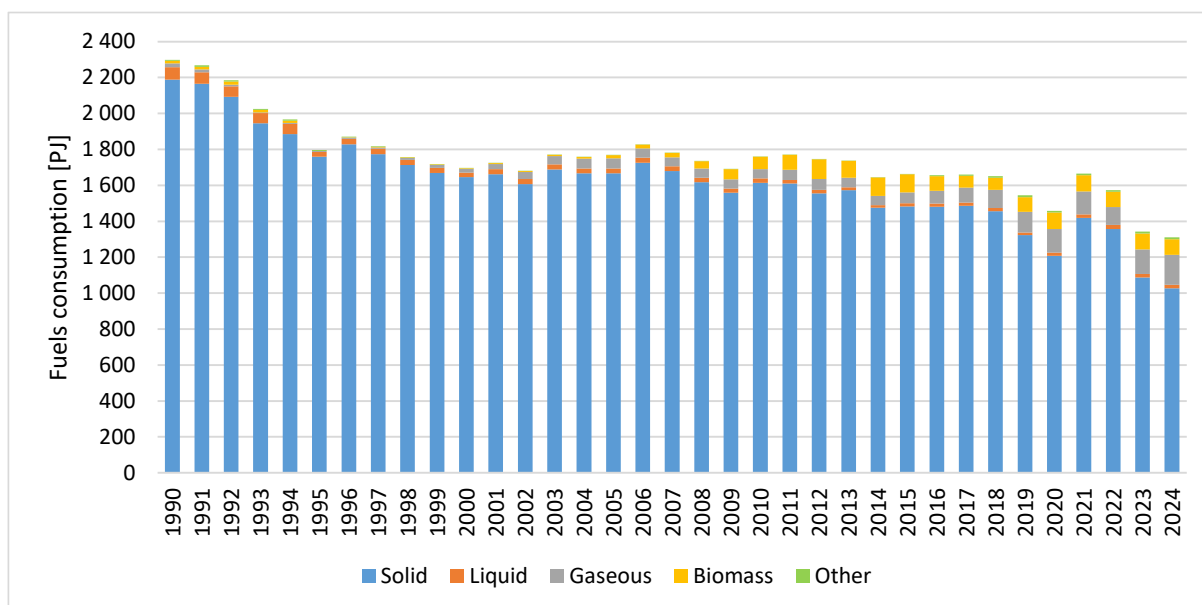


Figure 3.5. Fuel consumption in the 1A1a category [PJ]

For SO₂, NO_x, CO and TSP aggregated emission data from reports submitted to National Emission Database by power plants and combined heat and power plant is directly included in the inventory, without the use of emission factors. Emissions of other pollutants from public power plants and combined heat and power plant were estimated using emission factors based on national studies (country specific emission factors) and EMEP/EEA inventory guidebook. Detailed information on the emission factors used and their references is given in Appendix 6.

Emissions from district heating plants and industrial plants were estimated using emission factors based on national studies (country specific emission factors) and EMEP/EEA inventory guidebook. SO₂ emission factors for oil fuels are based on the sulphur content in the fuel. Detailed information on the emission factors used and their references is given in Appendix 6.

3.2.2.2 1A1b. Petroleum refining

This activity covers emissions released from production and combustion processes within a refinery including on-site combustion for the generation of electricity and heat for own use. Combustion processes include the heating of crude and petroleum products without contact between flame and products. Electrical and thermal energy is typically generated by combined heat and power (CHP) or cogeneration facilities at the refinery.

Emissions from production processes such as thermal cracking and catalyst regenerator units as well as venting, flaring and fugitive emissions are included in sector 1.B.2.

Activity data (fuel use) for this sector comes from energy statistics (Eurostat database). The data in Figure 3.6 shows that the use of liquid and gaseous fuels is dominant in 1A1b category.

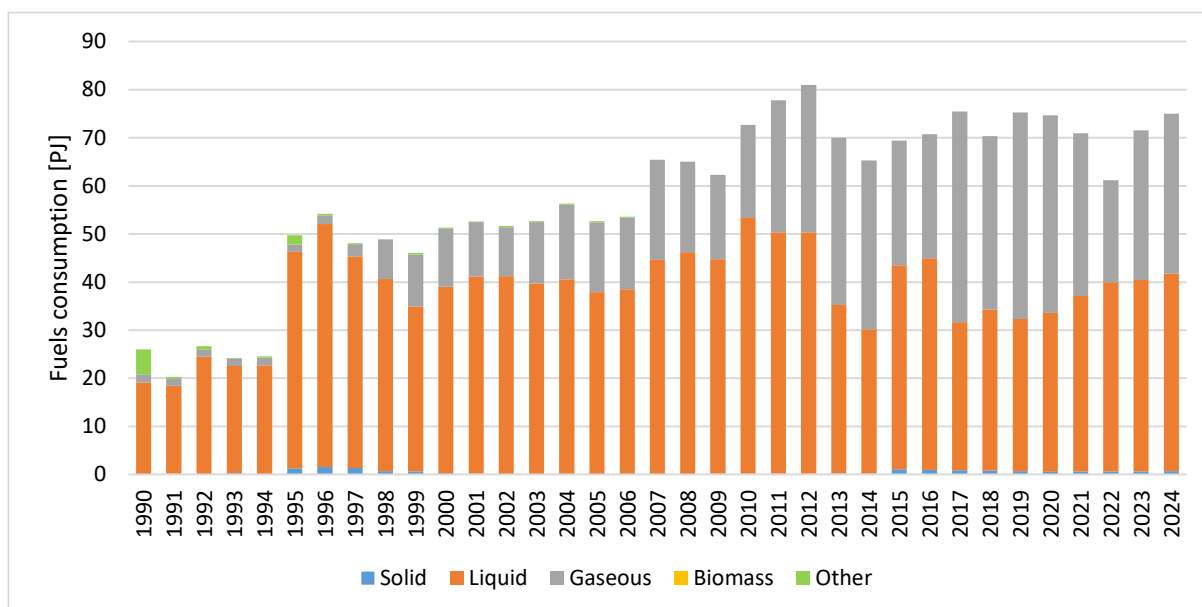


Figure 3.6. Fuel consumption in the 1A1b category [PJ]

For SO₂, NO_x, CO and TSP aggregated emission data from the air pollutant emission reports (OS-1) submitted by entities to the Statistics Poland were used (TERT recommendation for SO₂ emissions - PL-1A1b-2022-0001). The PM₁₀ and PM_{2.5} emissions were calculated as a share of the TSP emission in proportion to the share of emission factors of these pollutants for fuel oil from the EMEP/EEA inventory guidebook.

OS-1 is the report on the emission of air pollutants and on the condition of purification devices. The obligation to provide statistical data results from Art. 30 para 1 point 3 of the Act of 29 June 1995 on public statistics (Journal of Laws of 2016, item 1068, as amended) and the Regulation of the Council of Ministers of 28 July 2016 on the program of statistical surveys of official statistics for 2017 (Journal of Laws, item 1426, as amended).

Emissions of other pollutants from this sector were estimated using emission factors based on national studies (country specific emission factors) and from the EMEP/EEA inventory guidebook. Detailed information on the emission factors used and their references is presented in Appendix 6.

3.2.2.3 1A1c. Manufacture of solid fuels and other energy industries

This sector covers emissions associated with combustion in the coke-oven plants, gas-works plants, mines, patent fuel/briquetting plants and other industries not mentioned above like oil and gas extraction. Fugitive emissions from extinction (quenching) and door leakage is covered in sector 1.B.

Activity data (fuel use) for this sector comes from energy statistics (Eurostat database). The data in Figure 3.7 shows that the use of solid fuels is dominant in 1A1c category.

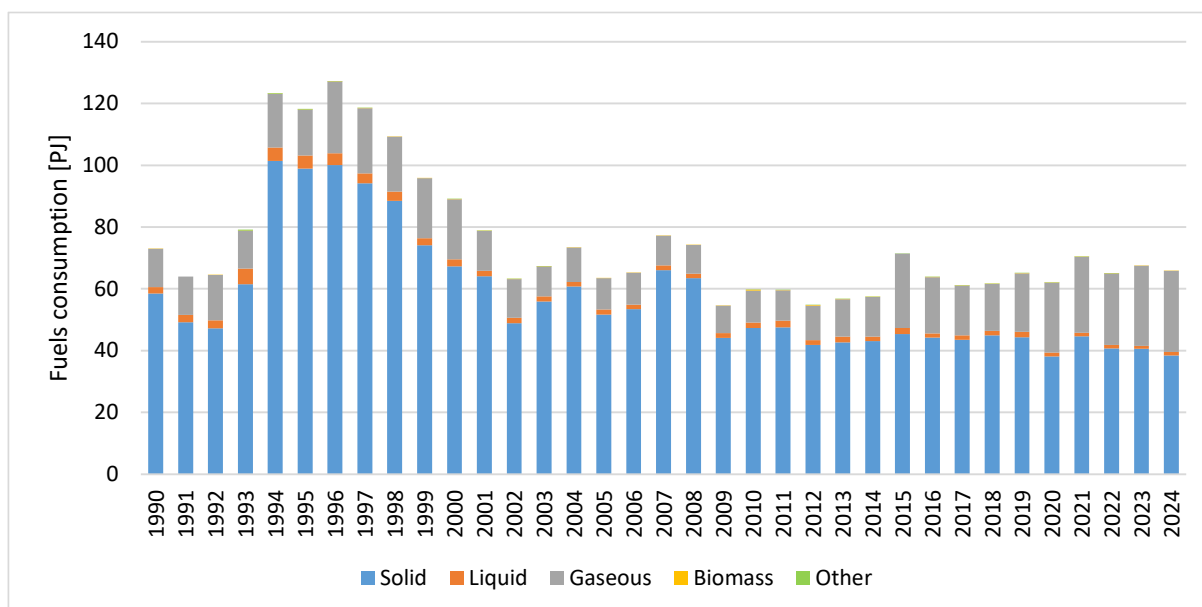


Figure 3.7. Fuel consumption in the 1A1c category [PJ]

For SO₂, NO_x, CO and TSP aggregated emission data from the air pollutant emission reports (OS-1) submitted by entities to the Statistics Poland were used. The PM₁₀ and PM_{2.5} emissions were calculated as a share of the TSP emission in proportion to the share of emission factors of these pollutants for hard coal from the EMEP/EEA inventory guidebook.

Emissions of other pollutants from this sector were estimated using emission factors based on national studies and from the EMEP/EEA inventory guidebook. Detailed information on the emission factors used and their references is given in Appendix 6.

3.2.3 Emission trends for NFR sector 1A1

Emissions of most pollutants from this sector have been systematically decreasing since the 1990s. In late 1990s the emissions decreased due to the diminished share of coal (both hard and brown) among fuels used for power and heat generation. The most significant decreases was the result of the improvement of plants technical parameters to meet more stringent standards resulting from Poland's accession to the EU, for example the 2001/80/EC Directive and the 2010/75/UE Directive (IED). Plant operators also gradually took steps to adjust (until August 16, 2021) large combustion plants to meet the requirements established in the best available techniques (BAT) conclusions (EU Commission Implementing Decision 2021/2326 of 30.11.2021). Trends of pollutant emissions for Public electricity and heat production are shown in the figures below (Figure 3.8 - Figure 3.13).

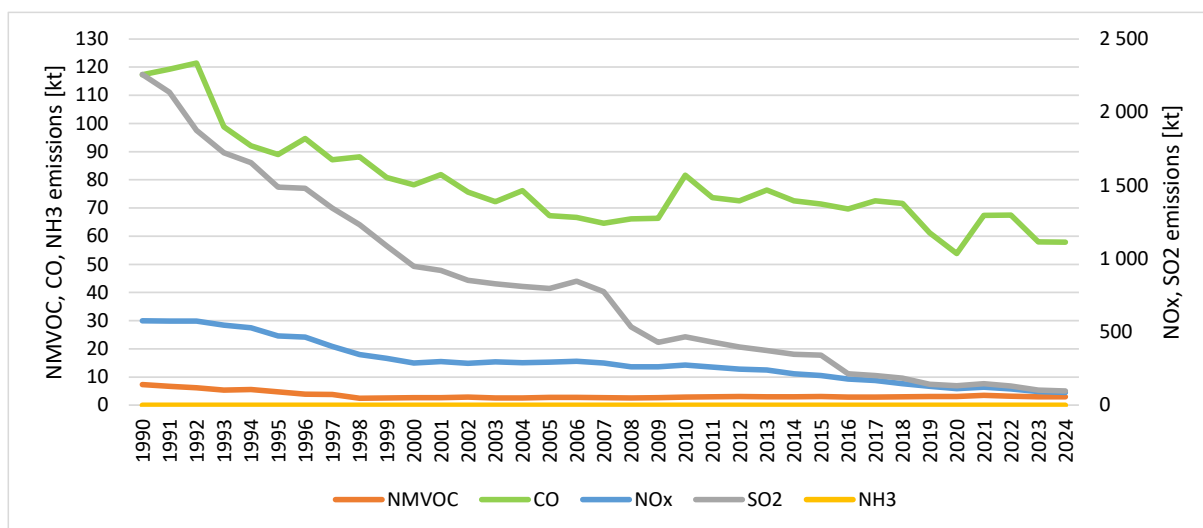
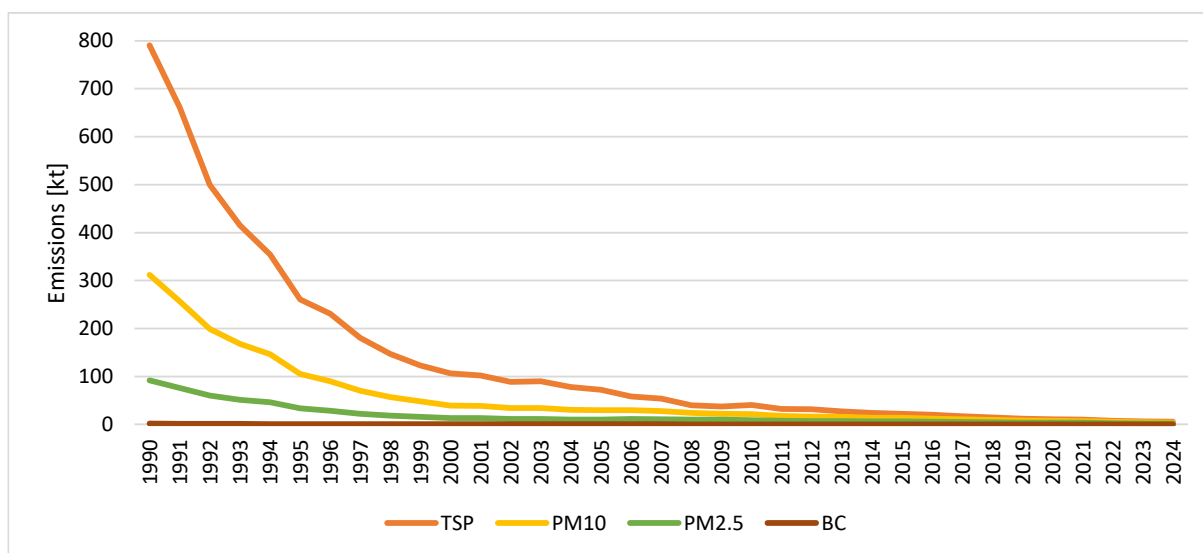

 Figure 3.8. SO₂, NO_x, CO and NMVOC emissions for 1A1 category in 1990-2024


Figure 3.9. PM emissions for 1A1 category in 1990-2024

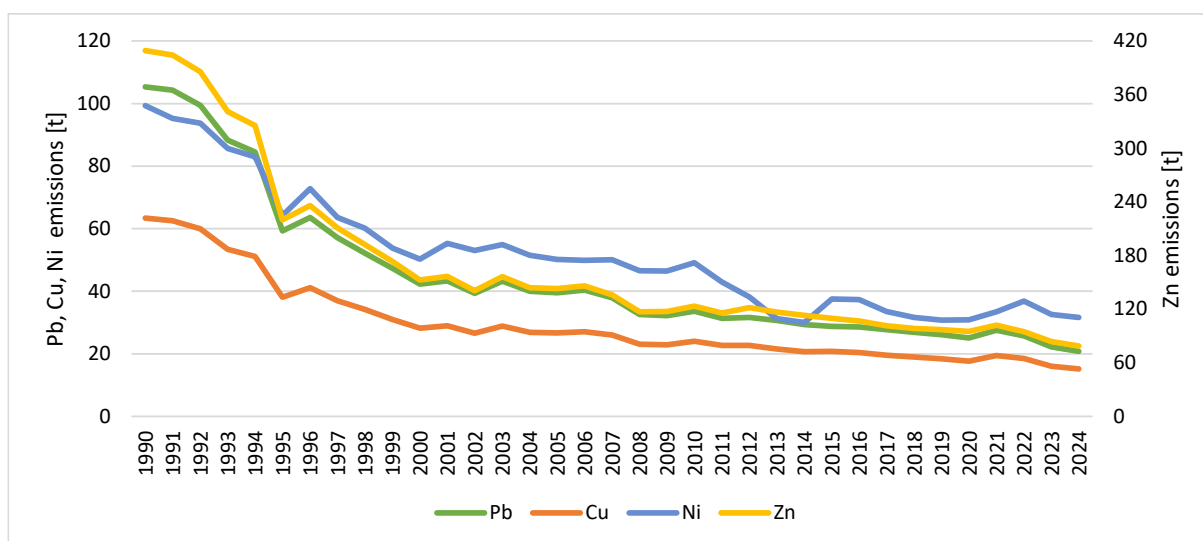


Figure 3.10. Pb, Cu, Ni and Zn emissions for 1A1 category in 1990-2024



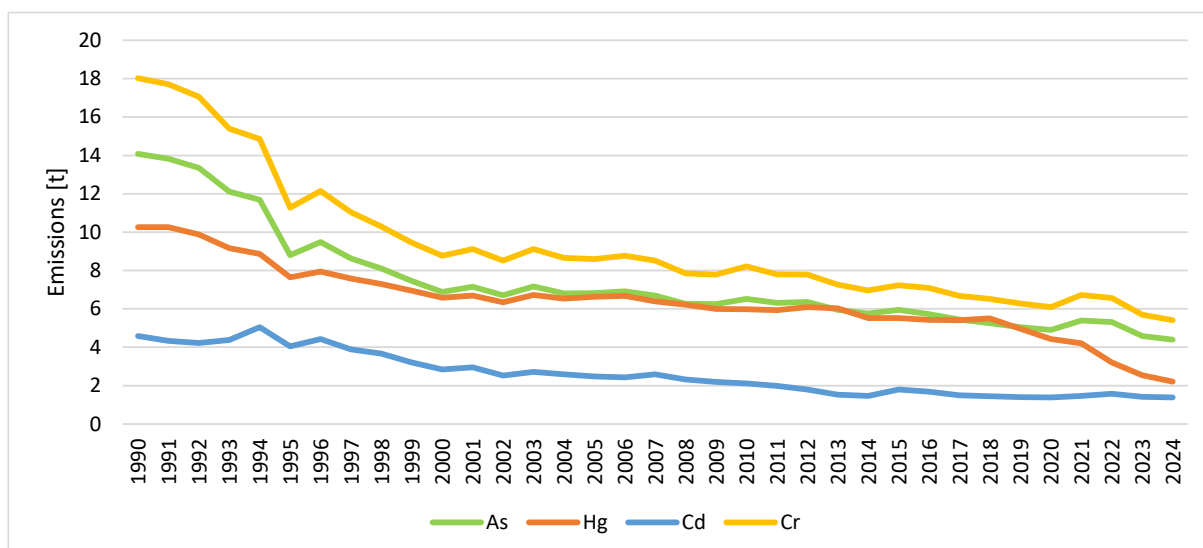


Figure 3.11. As, Hg, Cd and Cr emissions for 1A1 category in 1990-2024

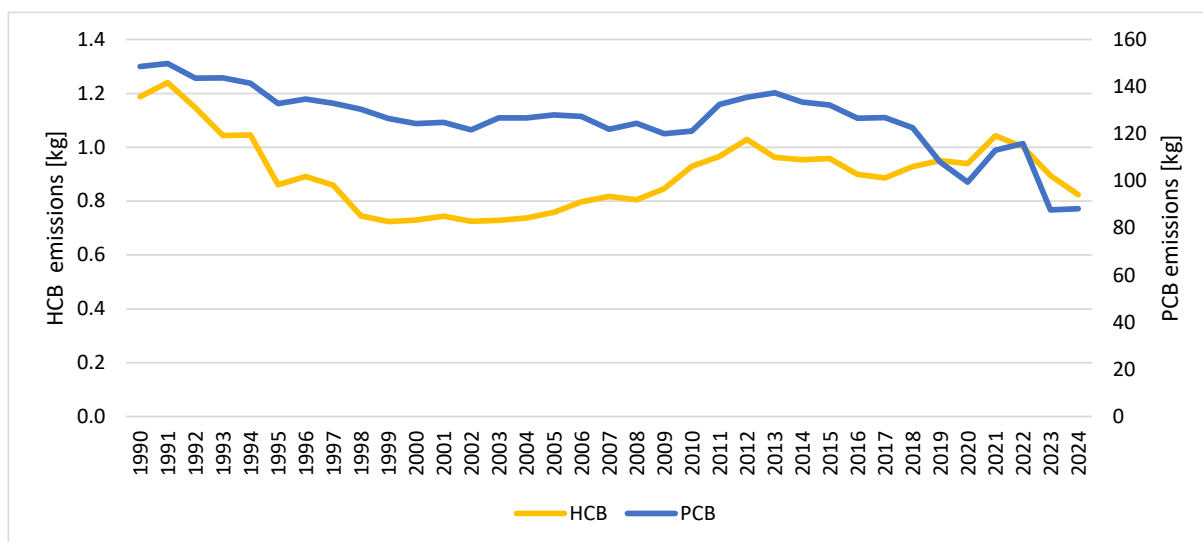


Figure 3.12. PCB and HCB emissions for 1A1 category in 1990-2024

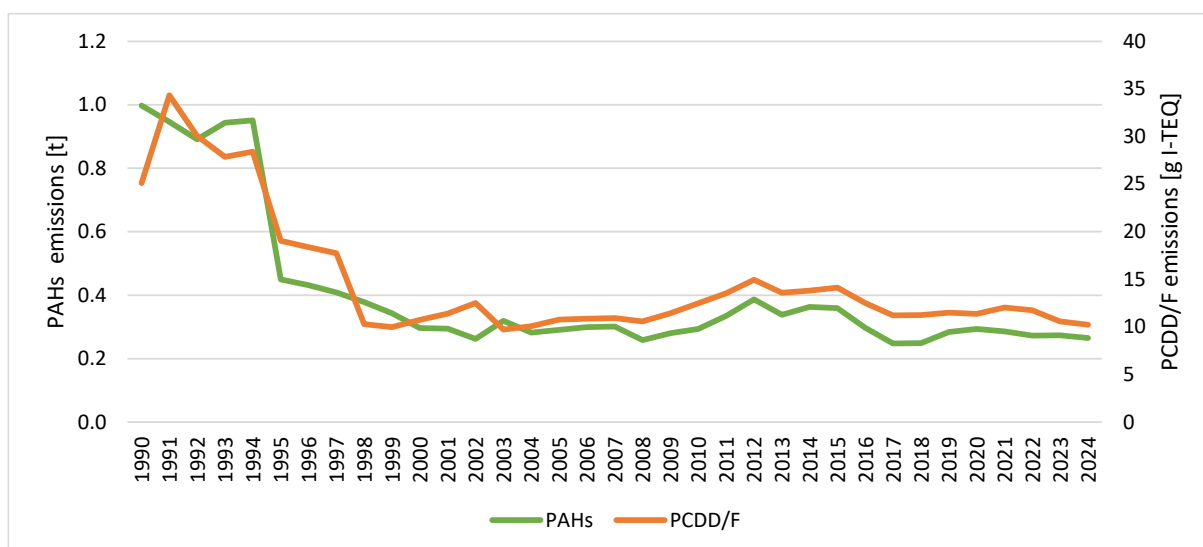


Figure 3.13. PCDD/F and PAH emissions for 1.A.1 category in 1990-2024

3.2.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 1A1. *Energy industries* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 1A1 are provided below. Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 3.2. Results of the uncertainty analysis for NFR sector 1A1

NFR sector		NO _x	NM VOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP	BC
1A1a	Public electricity and heat production	22.0%	30.0%	12.0%	30.0%	30.0%	27.0%	20.0%	31.0%
1A1b	Petroleum refining	30.0%	30.0%	20.1%	49.0%	50.0%	50.0%	50.0%	50.0%
1A1c	Manufacture of solid fuels and other energy industries	30.0%	30.0%	20.1%		50.0%	50.0%	50.0%	25.1%
NFR sector		CO	Pb	Cd	Hg	PCDD/F	PAHs	HCB	PCBs
1A1a	Public electricity and heat production	26.0%	36.0%	26.0%	57.0%	54.0%	54.0%	54.0%	22.1%
1A1b	Petroleum refining	50.0%	56.0%	64.0%	48.0%	97.0%	97.0%	97.0%	60.0%
1A1c	Manufacture of solid fuels and other energy industries	50.0%	50.0%	39.0%	41.0%	83.0%	83.0%	83.0%	83.0%

3.2.5 Source-specific QA/QC and verification

Activity data used in the air pollutant inventory concerning energy sector comes from Eurostat Database which is fed by the Statistics Poland. It should be underlined that data in this database is fully consistent and based on the questionnaires sent by Polish national statistics. GUS is responsible for QA/QC of collected and published data. Activity data applied in AP inventory are regularly checked and updated if necessary according to adjustments made in Eurostat Database.

The data on the consumption of fuels and energy for national statistics derives from reports, which enterprises are obliged to submit to the Statistics Poland. This is conducted through the reporting portal. The forms for all statistical reports are available on [GUS website](#).

The main energy forms are G-03 and G-02. Based on the data collected via the reporting portal, a database is created from which information for national energy balances elaboration and filling out questionnaires reporting Polish energy data to international statistical institutions (Eurostat, IEA, OECD) are taken. This ensures data consistency. Data from individual reports is subject to cross-check procedures. There are also algorithms comparing the data from the reporting year with the previous submission. Questionnaires with data on fuel and energy consumption reported to Eurostat, IEA and OECD are also subject to verification by these institutions. The questions regarding data from the entire long-term time series are directed to GUS. Doubts are clarified and, if necessary, the data is corrected (the entire adjusted trend is submitted in the questionnaire to the above-mentioned statistical organizations). Therefore the data in the mentioned databases can be treated as consistent, coherent and verified.

One of the quality control elements of activity data check in national AP inventories is preparation of fuel balances (see Appendix 4). For the main fuels (i.e. hard coal, lignite) calorific values are analysed to avoid significant errors. Close cooperation is developed between inventory experts and institutions responsible for energy data. Any doubtful fuel

consumption values are systematically verified - it is often required to obtain additional confirmation of data by installations/entities submitting the energy questionnaire. In case of any doubts energy data is also validated based on Poland's Energy Statistics published annually.

Calculations in energy sector were examined with focus on formulas, units and trends consistency.

3.2.6 Source-specific recalculations

The following changes have been made in sector 1A1:

- activity data on fuel consumption for years 1990-2023 was updated due to changes made in Eurostat database.

3.2.7 Source-specific planned improvements

No specific improvements are planned in this sector.

3.3 Manufacturing Industries and Construction (NFR sector 1A2)

3.3.1 Source category description

This category includes emissions from combustion of fuels in industry, also for the generation of electricity and heat for own use in these industries.

Emissions in 1A2. *Manufacturing industries and construction* category are estimated for each fuel in detailed sub-categories as follows:

- 1A2a. *Iron and steel*
- 1A2b. *Non-ferrous metals*
- 1A2c. *Chemicals*
- 1A2d. *Pulp, paper and print*
- 1A2e. *Food processing, beverages and tobacco*
- 1A2f. *Non-metallic minerals*
- 1A2g. *Other (other sources of emissions not included in the preceding source categories).*

The following subcategories in sector 1A2 have been identified as key source:

Table 3.3. Key source categories in sector 1A2

NFR		Method	EF	Pollutant
1A2f	Non-metallic minerals	T2/T1	D/CS	SOx
1A2g.viii	Other	T1	D	Cd

D - default

Shares of emissions from the 1A2 category in the country total for the individual pollutants in 2024 are shown in Figure 3.14. Shares of pollutant emissions from this category are below 19%.

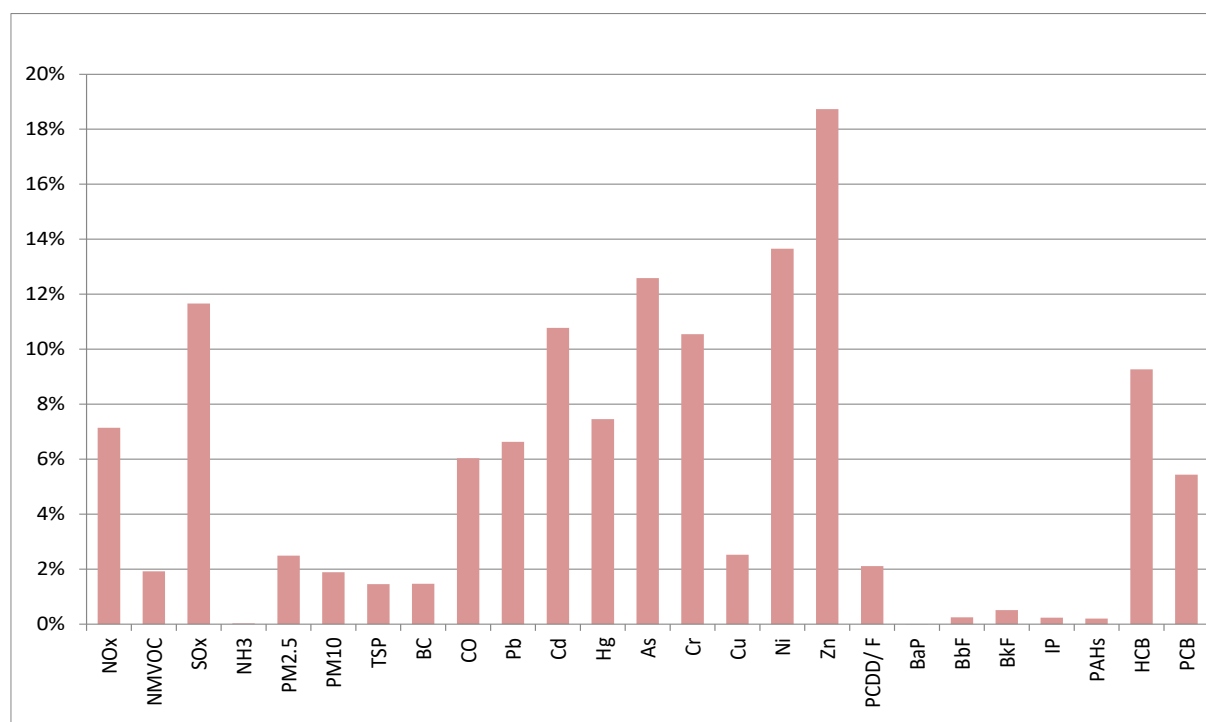


Figure 3.14. Shares of emissions from the 1A2 category in the country total in 2024

The data in Figure 3.15 and Figure 3.16 shows that the use of gaseous and solid fuels is dominant in 1A2 category. In 2024, the use of gaseous fuels accounted for 42% whereas solid fuels accounted for 24% of the entire energy of all fuels used in that sector. Since the late 1990s a slow downward trend of solid fuel consumption can be seen (from 61% in 1990). At the same time an increased share of natural gas and biomass is observed in the last decade.

A significant increase in fuel consumption between 1994 and 1995 is the result of algorithm change in classification of fuel consumption for particular parts of national Energy balance. For the years before 1995 all fuels consumed for energy and heat production in Autoproducer CHP Plants were included in Transformation input in Autoproducer CHP Plants and reported under 1A1a subcategory. Starting from 1995 the fuel consumption for non-commercial heat production (heat not sold to third parties) was classified as part of final energy consumption in individual subsectors and reported in 1A2 category. This methodology change was described in Energy Statistic of OECD Countries (in Part I: Methodology as country notes for "Electricity and Heat"). Mentioned modification in national energy statistic is noticeable also in Eurostat database. In terms of air pollutant emission inventory analysed change resulted in reallocation of part of emission from 1A1a into 1A2 category.

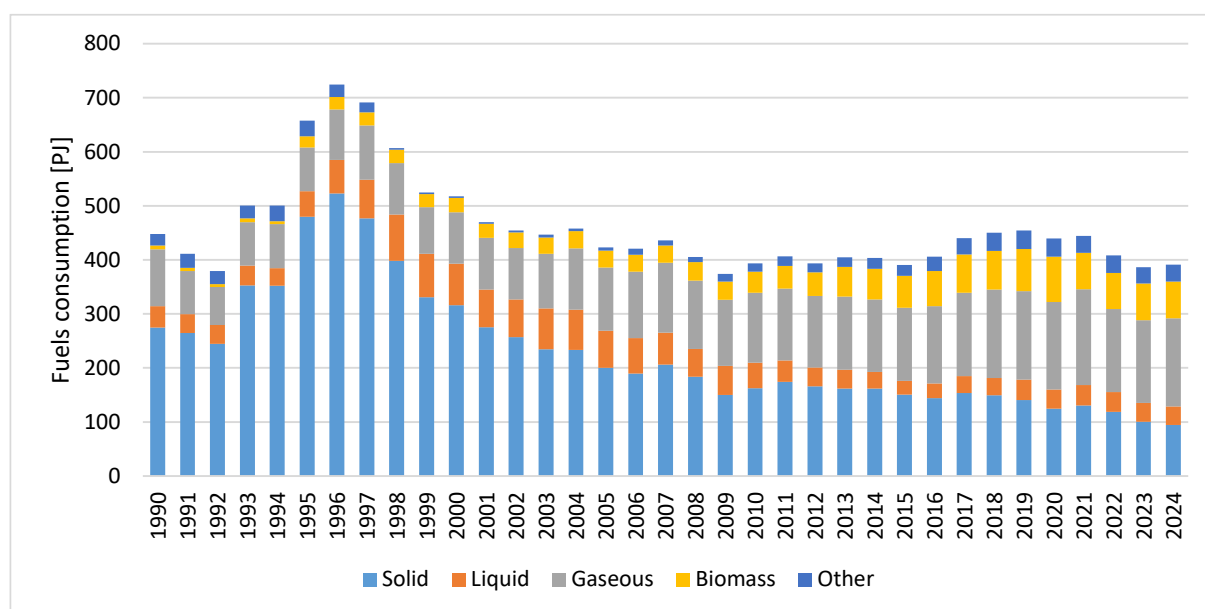


Figure 3.15. Fuel consumption in the 1A2 category [PJ]

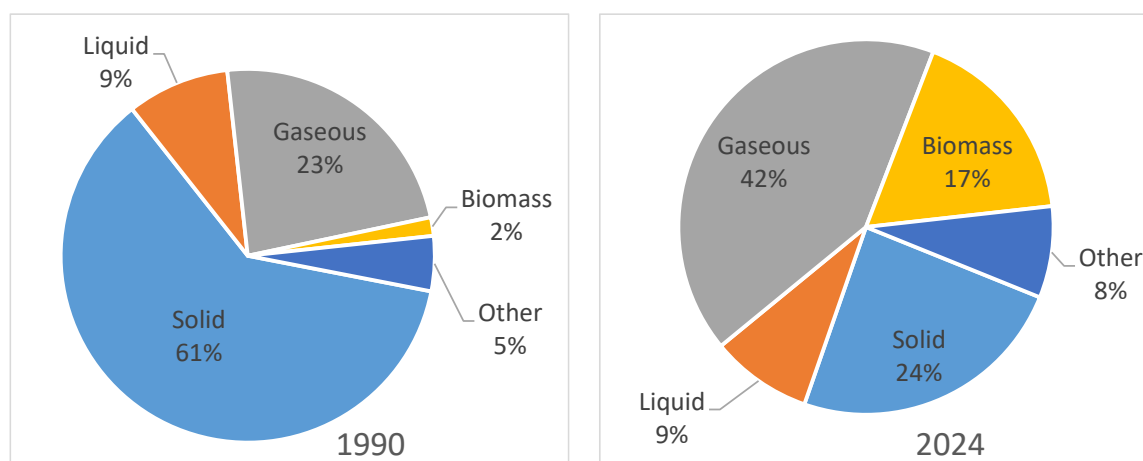


Figure 3.16. Share of fuel consumption in the 1A2 category in years 1990 and 2024

3.3.2 Methodological issues

The methodology of emission estimation in 1A2 category corresponds with the methodology described for fuel combustion in stationary sources (Chapter 3.2.2). Activity data on fuel use for this sector comes from energy statistics.

Detailed information on fuel consumption and applied emission factors for emission source subcategories are presented in Appendices 5 and 6. Information on whether the emission factors used for PM10 and PM2.5 include or exclude the condensable component is given in Appendix 9.

3.3.2.1 1A2a Iron and steel

This category includes emissions from fuel combustion in iron and steel industry. Activity data on fuel use comes from Eurostat database. The use of gaseous and solid fuels is dominant in 1A2a category (Figure 3.17). An explanation of the increase in fuel consumption since 1995 is given in Chapter 3.3.1

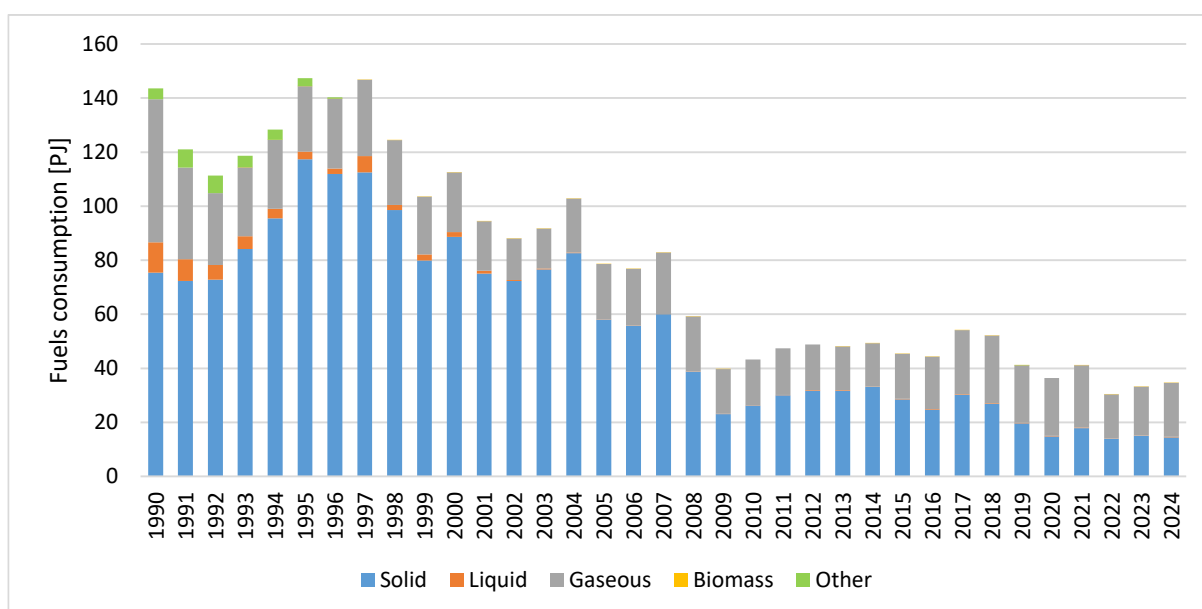


Figure 3.17. Fuel consumption in the 1A2a category [PJ]

Emissions from this sector were estimated using emission factors based on national studies (country specific emission factors) and EMEP/EEA inventory guidebook. SO₂ emission factors for coal and oil fuels are country specific, based on the sulphur content in the fuel. Detailed information on the emission factors used and their references is given in Appendix 6.

3.3.2.2 1A2b Non-ferrous metals

This category includes emissions from fuel combustion in non-ferrous metals industry. Combustion is relevant to primary production of many metals. Apart from primary metal production there are combustion activities used for melting, casting and heat-treatment furnaces.

Activity data on fuel use comes from Eurostat database. The use of gaseous and solid fuels is dominant in 1A2b category (Figure 3.18). An explanation of the increase in fuel consumption since 1995 is given in Chapter 3.3.1

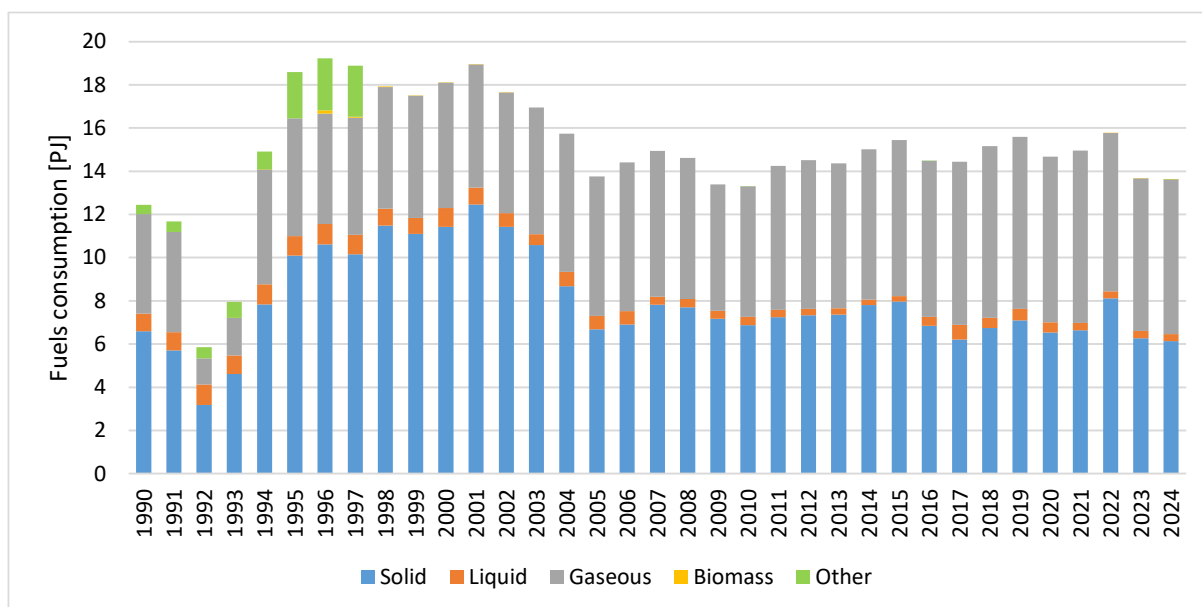


Figure 3.18. Fuel consumption in the 1A2b category [PJ]

Emissions from this sector were estimated using emission factors based on national studies (country specific emission factors) and EMEP/EEA inventory guidebook. SO₂ emission factors for coal and oil fuels are country specific, based on the sulphur content in the fuel. Detailed information on the emission factors used and their references is given in Appendix 6.

3.3.2.3 1A2c Chemicals

This category includes emissions from fuel combustion in chemical industry. Combustion in the chemicals sector ranges from conventional fuels in boiler plant and recovery of process by-products using thermal oxidisers to process-specific combustion activities (for example catalytic oxidation of ammonia during nitric acid manufacture).

Activity data on fuel use comes from Eurostat database. The use of solid fuels is dominant in 1A2c category (Figure 3.19). An explanation of the increase in fuel consumption since 1995 is given in Chapter 3.3.1

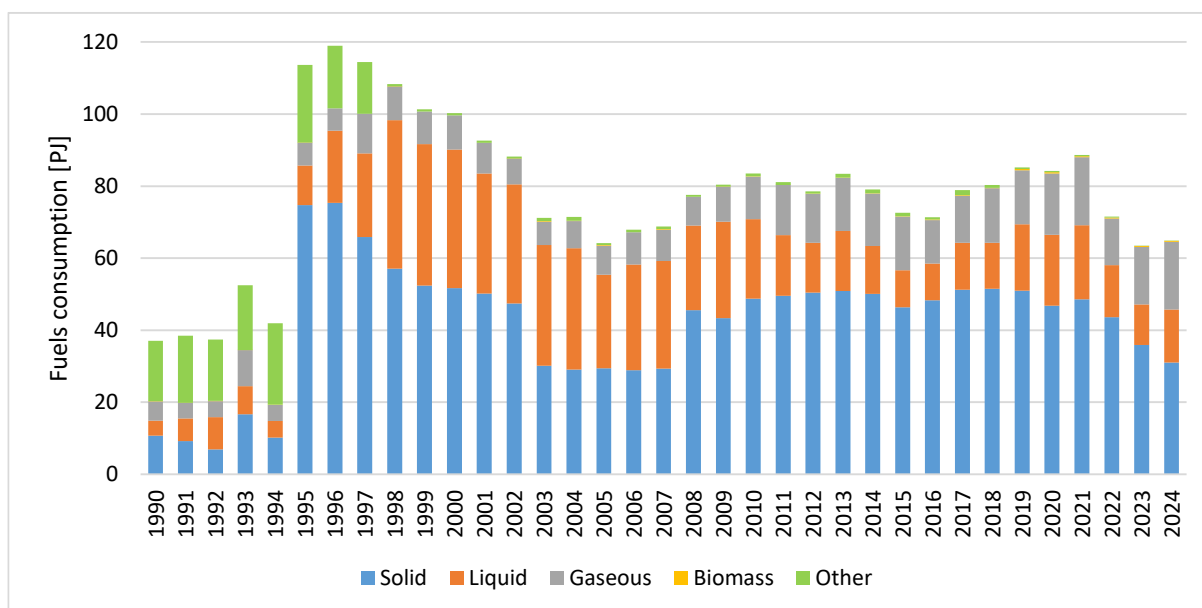


Figure 3.19. Fuel consumption in the 1A2c category [PJ]

Emissions from this sector were estimated using emission factors based on national studies (country specific emission factors) and EMEP/EEA inventory guidebook. SO₂ emission factors for brown coal and oil fuels are country specific, based on the sulphur content in the fuel.

Country specific NO_x, SO₂ and TSP emission factors for hard coal were developed based on emission data reported by entities to the National Emission Database (NED). Data on fuel consumption and the real air pollution emissions for the years 2011-2024 were analysed from a number of installations classified in a given industry according to the NACE code. This allowed for the development of emission factors that best reflect the state of the technology in Poland. The PM₁₀ and PM_{2.5} emission factors were then calculated as a share of the TSP emission factor based on the Guidebook EFs for sector 1A2. Detailed information on the emission factors used and their references is given in Appendix 6.

3.3.2.4 1A2d Pulp, paper and print

This category includes emissions from fuel combustion in paper industry. The production of pulp and paper requires considerable amounts of steam and power.

Activity data on fuel use comes from Eurostat database. The use of biomass is dominant in 1A2d category (Figure 3.20). An explanation of the increase in fuel consumption since 1995 is given in Chapter 3.3.1

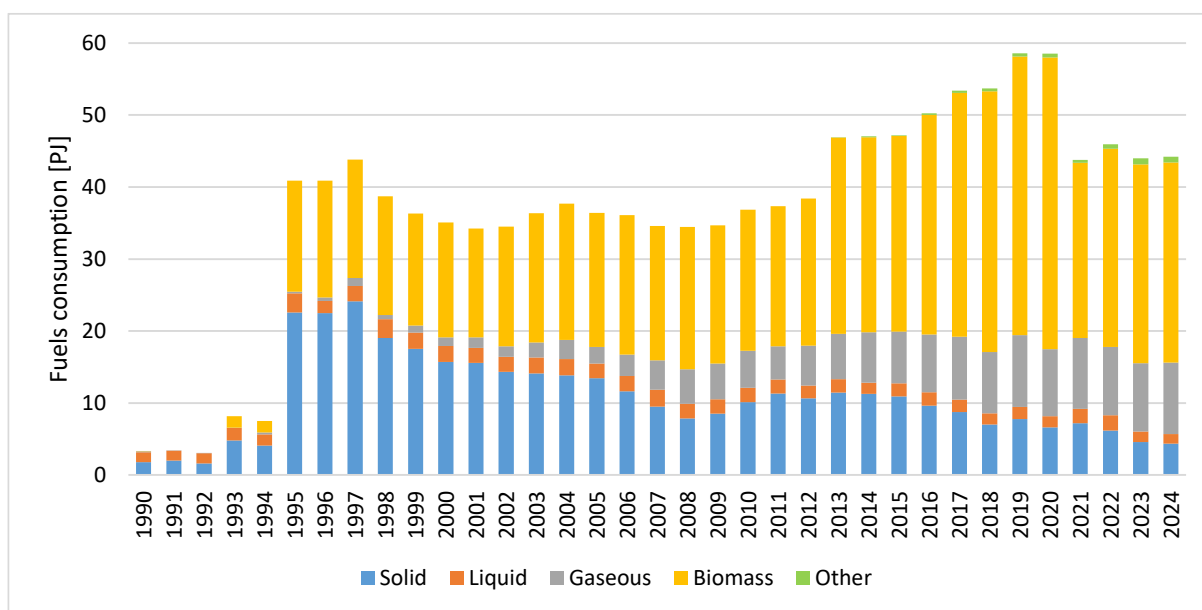


Figure 3.20. Fuel consumption in the 1A2d category [PJ]

Emissions from this sector were estimated using emission factors based on national studies (country specific emission factors) and EMEP/EEA inventory guidebook. SO₂ emission factors for oil fuels are country specific, based on the sulphur content in the fuel.

Country specific NO_x, SO₂ and TSP emission factors for hard coal and NO_x and TSP emission factors for biomass were developed based on emission data reported by entities to the National Emission Database (NED). Data on fuel consumption and the real air pollution emissions from the years 2011-2024 were analyzed from a number of installations classified in a given industry according to the NACE code. This allowed for the development of emission factors that best reflect the state of the technology in Poland. The PM₁₀ and PM_{2.5} emission factors were calculated as a share of the TSP emission factor based on the Guidebook EFs for sector 1A2. Detailed information on the emission factors used and their references is given in Appendix 6.

3.3.2.5 1A2e Food processing, beverages and tobacco

This category includes emissions from fuel combustion in food industry. Food processing can require considerable amounts of heat, steam and power. Process residues may often be dried for fuel use or prepared for animal feed.

Activity data on fuel use comes from Eurostat database. The use of gaseous and solid fuels are dominant in 1A2e category (Figure 3.21). An explanation of the increase in fuel consumption since 1995 is given in Chapter 3.3.1

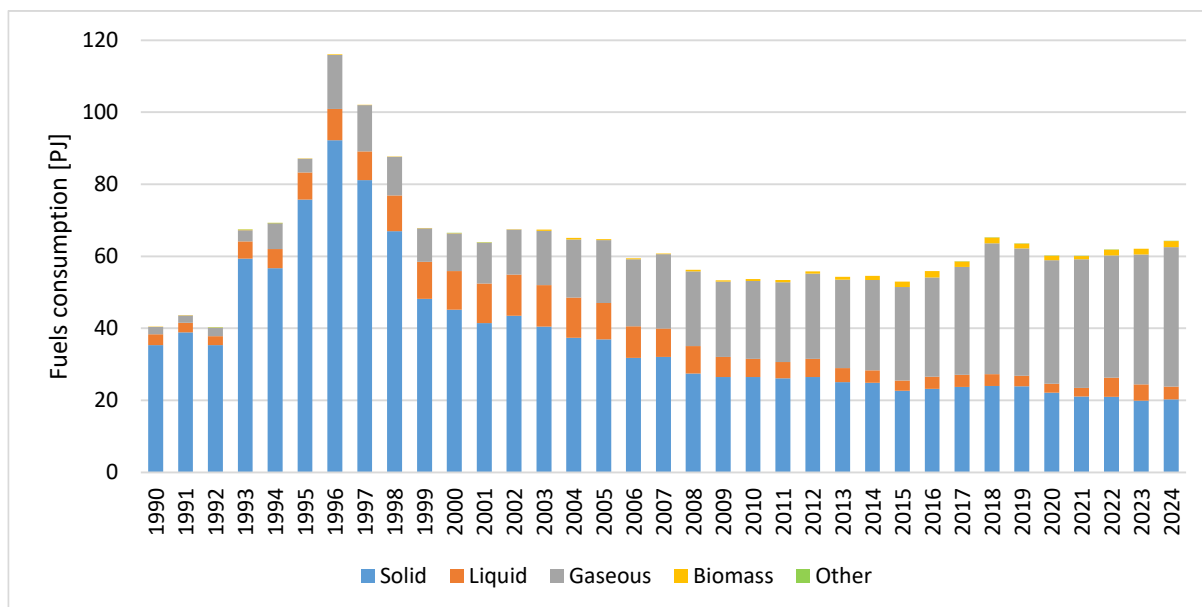


Figure 3.21. Fuel consumption in the 1A2e category [PJ]

Emissions from this sector were estimated using emission factors based on national studies (country specific emission factors) and EMEP/EEA inventory guidebook. SO₂ emission factors for coal and oil fuels are country specific, based on the sulphur content in the fuel.

Country specific NO_x, SO₂ and TSP emission factors for hard coal were developed based on emission data reported by entities to the National Emission Database (NED). Data on fuel consumption and the real air pollution emissions for the years 2011-2024 were analyzed from a number of installations classified in a given industry according to the NACE code. This allowed for the development of emission factors that best reflect the state of the technology in Poland. The PM₁₀ and PM_{2.5} emission factors were then calculated as a share of the TSP emission factor based on the Guidebook EFs for sector 1A2. Detailed information on the emission factors used and their references is given in Appendix 6.

3.3.2.6 1A2f Non-metallic minerals

This category includes emissions from fuel combustion in mineral industry, including i.a.: cement, lime, asphalt, glass, mineral wool, bricks and tiles, fine ceramic material.

Activity data on fuel use comes from Eurostat database. The use of gaseous and other (industrial and municipal waste) fuels are dominant in 1A2f category (Figure 3.22).

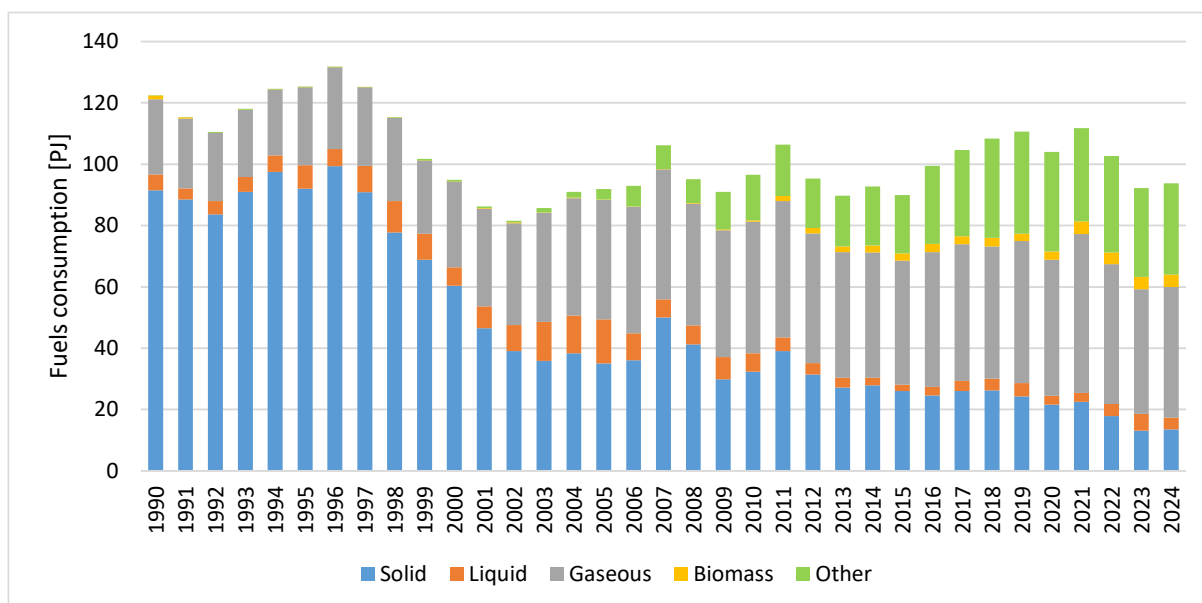


Figure 3.22. Fuel consumption in the 1A2f category [PJ]

Emissions from this sector were estimated using emission factors based on national studies (country specific emission factors) and EMEP/EEA inventory guidebook. SO₂ emission factors for coal and oil fuels are country specific based on the sulphur content in the fuel. Detailed information on the emission factors used and their references is given in Appendix 6.

NMVOC emissions from this category are calculated using T2 method based on clinker production data (TERT recommendation PL-1A2f-2024-0001).

3.3.2.7 1A2giii Other

This category includes emissions from fuel combustion in other sources not included in the preceding source categories. This category includes emissions from machine industry, transport equipment, mining industry, wood industry, construction, textile industry and others. Activity data on fuel use comes from Eurostat database. The use of biomass and gaseous fuels are dominant in 1A2giii category (Figure 3.23). An explanation of the increase in fuel consumption since 1995 is given in Chapter 3.3.1

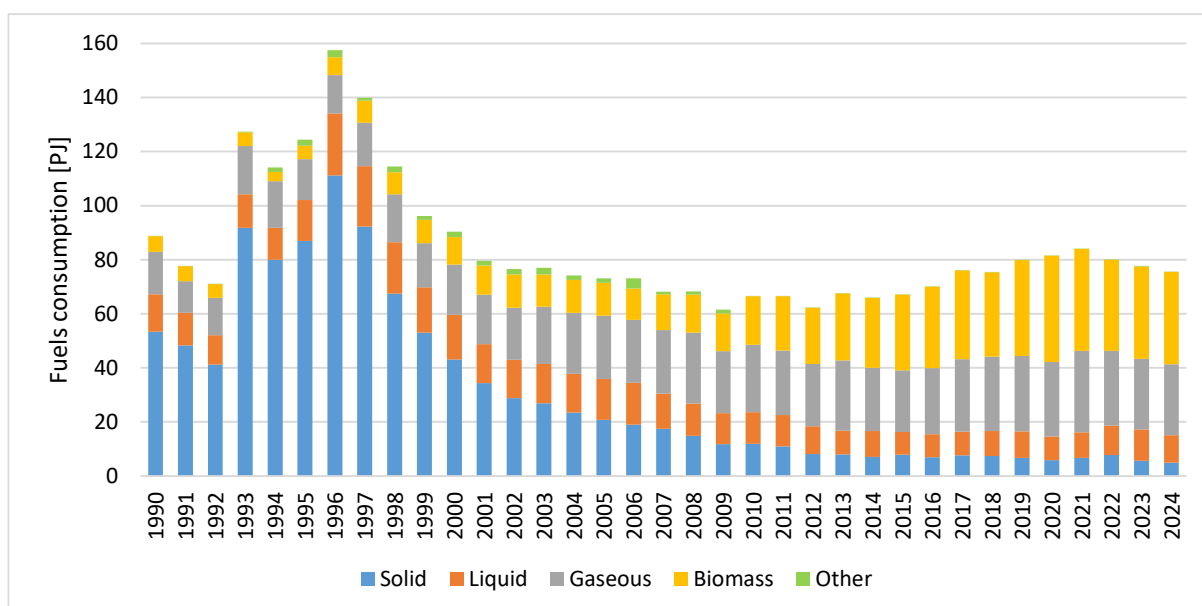


Figure 3.23. Fuel consumption in the 1A2giii category [PJ]

Emissions from this sector were estimated using emission factors based on national studies (country specific emission factors) and EMEP/EEA inventory guidebook. SO₂ emission factors for coal and oil fuels are country specific, based on the sulphur content in the fuel.

Country specific NMVOC and TSP emission factors for biomass were developed based on emission data reported by entities to the National Emission Database (NED). Data on fuel consumption and the real air pollution emissions from the years 2011-2024 were analyzed from a number of installations classified in a given industry according to the NACE code. This allowed for the development of emission factors that best reflect the state of the technology in Poland. The PM₁₀ and PM_{2.5} emission factors were calculated as a share of the TSP emission factor based on the Guidebook EFs for sector 1A2 (TERT recommendation). Detailed information on the emission factors used and their references is given in Appendix 6.

3.3.3 Emission trends for NFR sector 1A2

Trends of pollutant emissions for Manufacturing Industries and Construction (stationary) are shown in figures below (Figure 3.24 - Figure 3.29). Significant increase in air pollutant emissions in the 1990s is the result of algorithm change in classification of fuel consumption for particular parts of national Energy balance. For the years before 1995 all fuels consumed for energy and heat production in Autoproducer CHP Plants were included in Transformation input in Autoproducer CHP Plants and reported under 1A1a subcategory. Starting from 1995 the fuel consumption for non-commercial heat production (heat not sold to third parties) was classified as part of final energy consumption in individual subsectors and reported in 1A2 category.

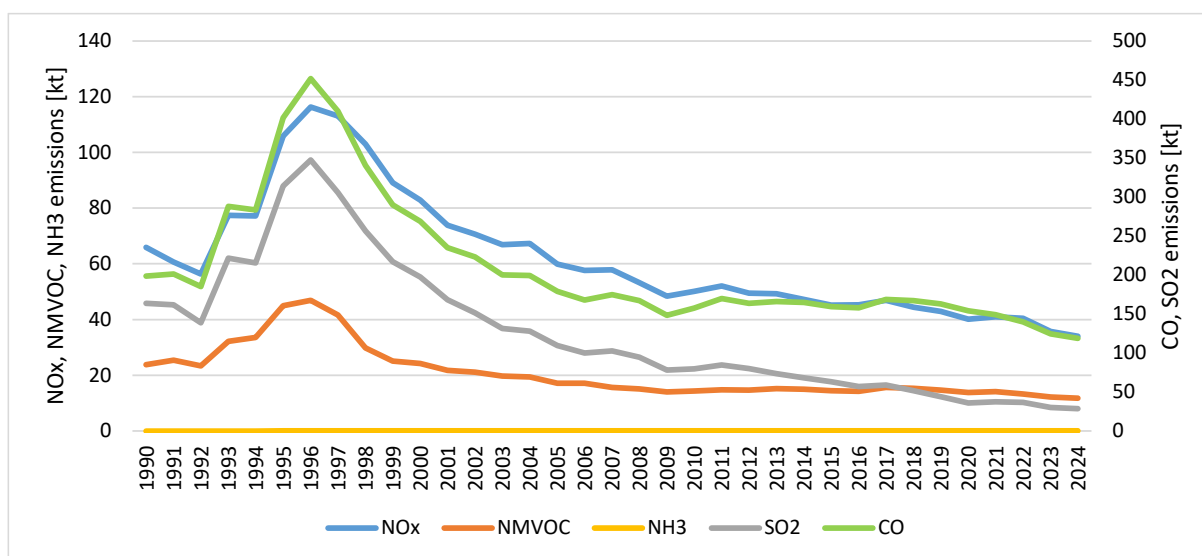


Figure 3.24. SO₂, NO_x, NH₃, CO and NMVOC emissions for 1A2 category in 1990-2024

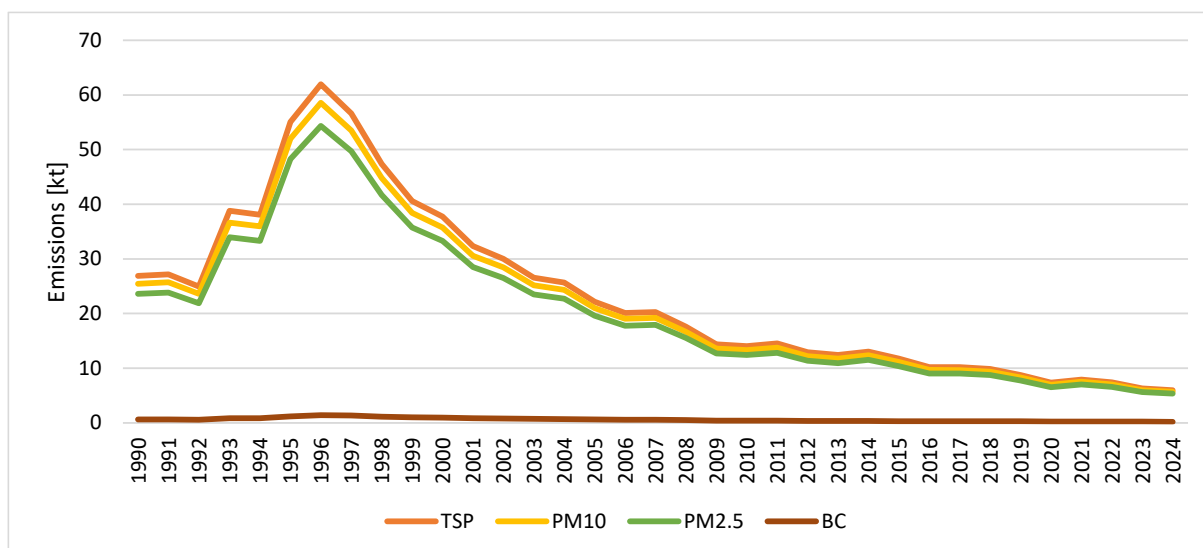


Figure 3.25. PM emissions for 1A2 category in 1990-2024

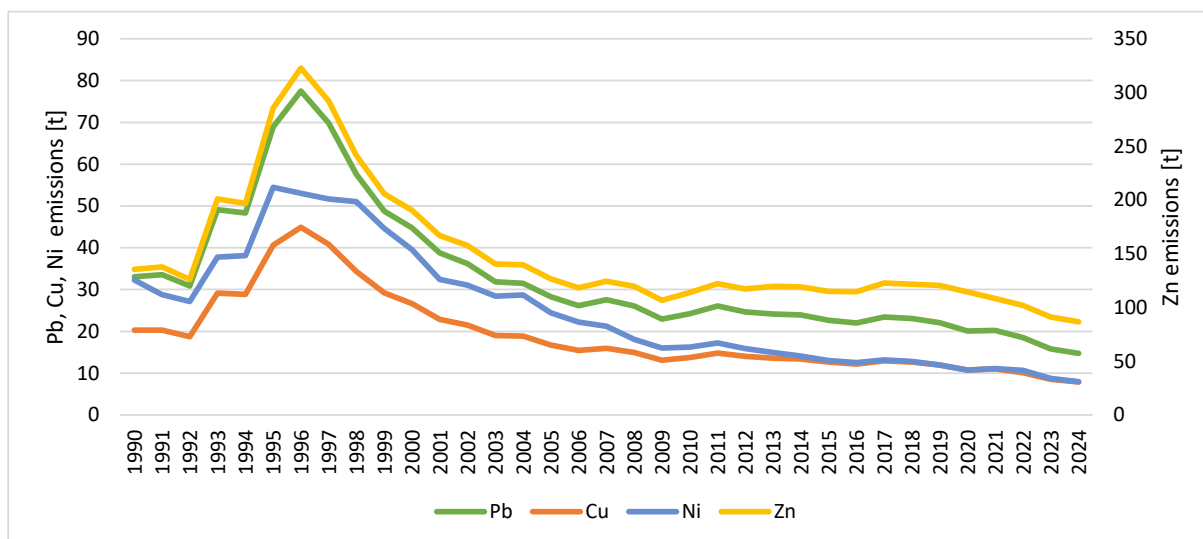


Figure 3.26. Pb, Cu, Ni and Zn emissions for 1A2 category in 1990-2024

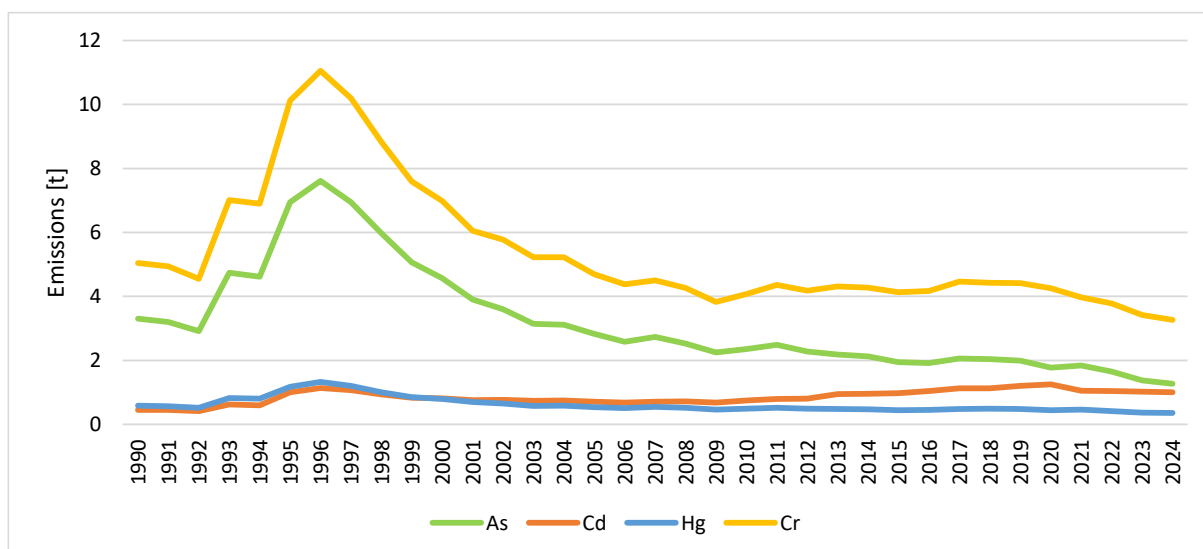


Figure 3.27. As, Cd, Hg and Cr emissions for 1A2 category in 1990-2024



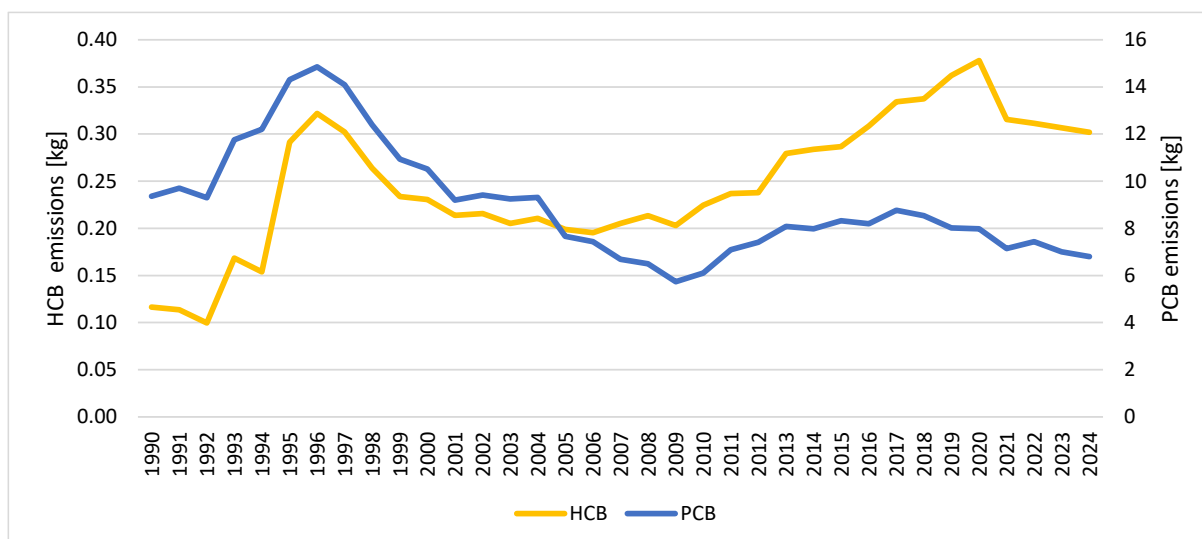


Figure 3.28. PCB and HCB emissions for 1A2 category in 1990-2024

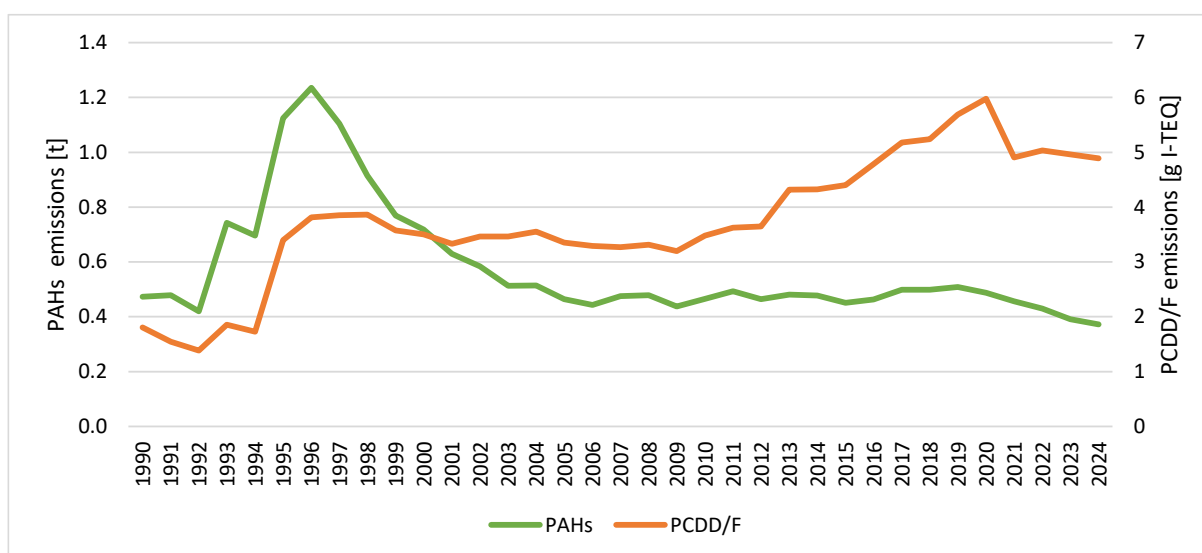


Figure 3.29. PCDD/F and PAH emissions for 1A2 category in 1990-2024

Decrease in HCB and PCDD/F emissions in 2021 is related to much lower biomass consumption in the 1A2d sector (by 44%).

3.3.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 1A2. *Manufacturing industries and construction* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 1A2 are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 3.4. Results of the uncertainty analysis for NFR sector 1A2

NFR subsector		NO _x	NM VOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP	BC
1A2a	Iron and steel	26.1%	50.0%	20.1%	20.1%	70.0%	70.0%	70.0%	70.0%
1A2b	Non-ferrous metals	26.1%	50.0%	20.1%	22.1%	70.0%	70.0%	70.0%	70.0%
1A2c	Chemicals	26.1%	50.0%	20.1%	20.1%	70.0%	70.0%	70.0%	70.0%
1A2d	Pulp, Paper and Print	26.1%	50.0%	20.1%	20.1%	70.0%	70.0%	70.0%	70.0%
1A2e	Food processing, beverages and tobacco	26.1%	50.0%	20.1%	20.1%	70.0%	70.0%	70.0%	70.0%
1A2f	Non-metallic minerals	26.1%	50.0%	20.1%	20.1%	70.0%	70.0%	70.0%	70.0%
1A2gviii	Other	26.1%	50.0%	20.1%	20.1%	70.0%	70.0%	70.0%	70.0%
NFR subsector		CO	Pb	Cd	Hg	PCDD/F	PAHs	HCb	PCBs
1A2a	Iron and steel	70.0%	90.0%	90.0%	90.0%	100.0%	100.0%	100.0%	75.0%
1A2b	Non-ferrous metals	70.0%	90.0%	90.0%	90.0%	100.0%	100.0%	100.0%	75.0%
1A2c	Chemicals	70.0%	90.0%	90.0%	90.0%	100.0%	100.0%	100.0%	75.0%
1A2d	Pulp, Paper and Print	70.0%	90.0%	90.0%	90.0%	100.0%	100.0%	100.0%	75.0%
1A2e	Food processing, beverages and tobacco	70.0%	90.0%	90.0%	90.0%	100.0%	100.0%	100.0%	75.0%
1A2f	Non-metallic minerals	70.0%	90.0%	90.0%	90.0%	100.0%	100.0%	100.0%	75.0%
1A2gviii	Other	70.0%	90.0%	90.0%	90.0%	100.0%	100.0%	100.0%	75.0%

3.3.5 Source-specific QA/QC and verification

For further details please see Chapter 3.2.5.

3.3.6 Source-specific recalculations

The following changes have been made in sector 1A2:

- for category 1A2 - the sulphur content in hard coal has been corrected based on the latest data,
- for category 1A2d - for biomass, Tier 2 NMVOC emission factor from the 2023 EMEP/EEA Guidebook, Chapter 1A1, Table 3-15 was used (TERT recommendation PL-1A2d-2025-0001),
- for category 1A2d – for years 2013 – 2023 the SO_x emission factor for hard coal was corrected based on data from the National Emission Database,
- for category 1A2gviii - country specific NO_x emission factors for diesel oil were used from the study prepared by KOBIZE for the purposes of reporting pollutant emissions to the National Emission Database (TERT recommendation PL-1A2gviii-2025-0002),
- for category 1A2gviii - for years 2016 – 2023 the TSP emission factor for biomass was corrected based on data from the National Emission Database, which also influenced the PM₁₀ and PM_{2.5} emission factors,
- activity data on fuel consumption for years 1990-2023 was updated due to changes made in Eurostat database.

3.3.7 Source-specific planned improvements

Further work on the development of national emission factors is expected.

3.4 Transport (NFR sector 1A3)

3.4.1 Source category description

Estimations of emissions in 1A3. *Transport* are carried out for each fuel in sub-categories listed below:

- 1A3a. *Domestic and International Aviation (civil)*
- 1A3b. *Road Transportation*
- 1A3c. *Railways*
- 1A3d. *Navigation*
- 1A3ei. *Other Transportation (Pipeline transport)*

The following subcategories in sector 1A3 have been identified as key source.

Table 3.5. Key source categories in sector 1A3

NFR		Method	EF	Pollutant
1A3bi	Passenger cars	T3	D	NOx, NMVOC, CO
1A3bii	Light duty vehicles	T3	D	NOx
1A3biii	Heavy duty vehicles and buses	T3	D	NOx
1A3bv	Gasoline evaporation	T3	D	NMVOC
1A3bvi	Automobile tyre and brake wear	T3	D	TSP, Pb, PM10

CS – country specific; D – default

Shares of emissions from the 1A3 category in the country total for certain pollutants in 2024 are shown in Figure 3.30. Shares of most pollutant emissions from this category are below 36% (except for copper, whose share is 74.3%).

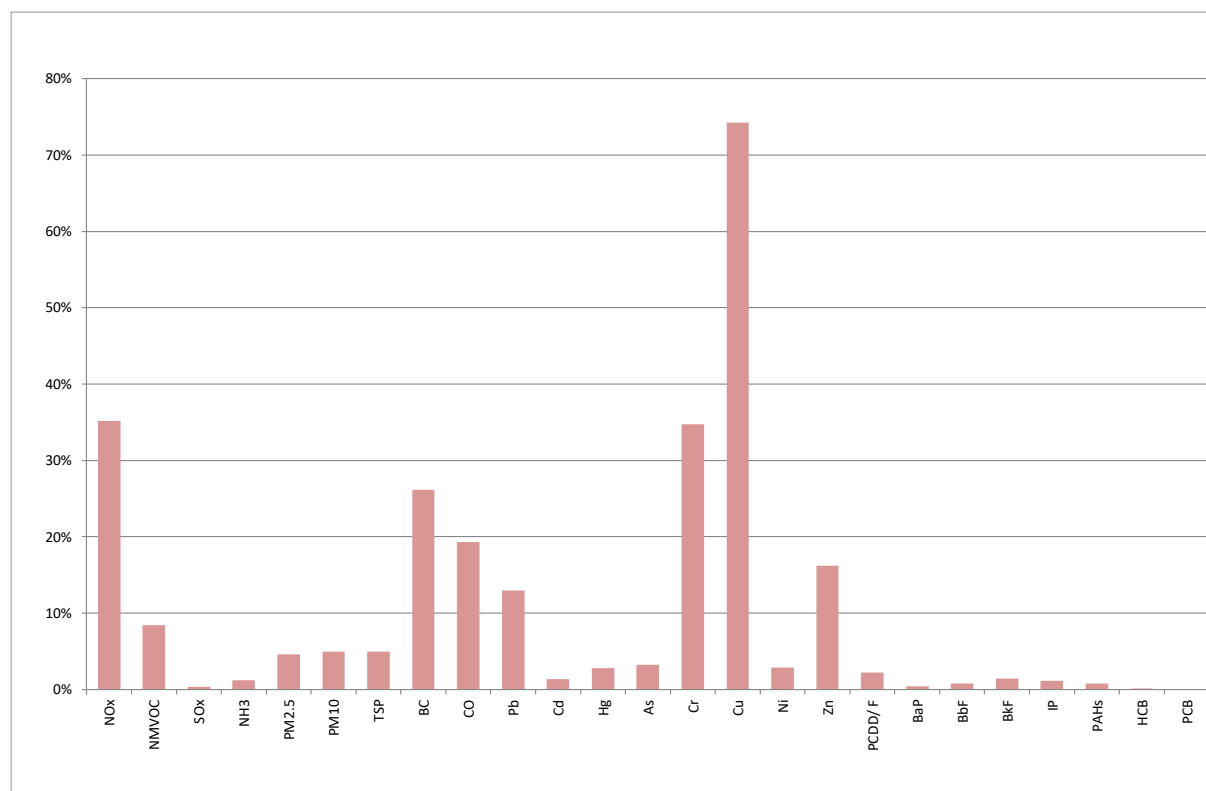


Figure 3.30. Shares of emissions from the 1A3 category in the country total in 2024

3.4.1.1 Domestic and international aviation (civil) (NFR sector 1A3a)

Domestic aviation includes emissions from passenger and freight traffic that departs and arrives in the same country (commercial, private, agriculture, etc.). It excludes fuel used at airports for ground transport and fuel for stationary combustion at airports.

International aviation includes emissions from passenger and freight traffic that departs and arrives between different countries (commercial, private, agriculture, etc.). It excludes the use of fuel at airports for ground transport and fuel for stationary combustion at airports.

Pollutant emissions from both categories are calculated taking into account two phases of the flight: LTO and CRUISE.

3.4.1.2 Road Transportation (NFR sector 1A3b)

This category includes emissions from all types of vehicles such as: passenger cars, light and heavy duty vehicles, buses, motorcycles and mopeds. Poland applied software COPERT to the official reporting of national emissions within the framework cooperation in the European Union. The COPERT methodology is part of the EMEP/EEA air pollutant emission inventory guidebook for the calculation of air pollutant emissions and is consistent with the 2006 IPCC Guidelines for the calculation of greenhouse gas emissions. The use of a software tool to calculate road transport emissions allows for a transparent and standardized, hence consistent and comparable data collecting and emissions reporting procedure, in accordance with the requirements of international conventions and protocols as well as EU legislation.

3.4.1.3 Railways (NFR sector 1A3c)

This category includes emissions from railway transport for both freight and passenger traffic routes. Railway locomotives used in Poland are diesel and electric. Steam locomotives were in use in Poland until 1998.

Electric locomotives are powered by electricity generated at stationary power plants. This chapter does not cover these indirect emissions for locomotives – these are accounted for in sector 1A1. *Energy industries*.

3.4.1.4 Navigation (NFR sector 1A3d)

This category relates to inland and marine domestic navigation and includes emissions from fuels used by vessels of all flags that depart and arrive in the same country (excluding fishing). Due to very limited number of vessels, emission from International maritime navigation under Polish flag is low as compared to other countries. To ensure completeness fuel use data for International maritime navigation (Memo Item) already available in Polish energy statistics has been used to estimate these emissions.

3.4.1.5 Other transportation (NFR sector 1A3ei)

Pipeline transport contains combustion related emissions from the operation of pump stations and maintenance of pipelines.

3.4.2 Methodological issues

The methodology used for estimation of pollutant emissions in the national inventory for mobile sources for the entire time series 1990-2024 is factor based – data on fuel used is multiplied by the corresponding emission factors.

3.4.2.1 International Aviation LTO (civil) (NFR sector 1A3ai(i))

For the years 1990-2024 data on jet kerosene consumption is sourced from the Eurostat database. Jet kerosene given in Polish energy statistics is reported as International aviation although includes the whole amount of jet kerosene used for domestic and international purposes. To split jet kerosene use Eurocontrol data were applied. The total amount of jet kerosene used by Poland – calculated by Eurocontrol is similar to the one reported by Poland to Eurostat. To stay in line with Eurostat database (and Polish statistics) only the share of domestic and international fuel use were used based on Eurocontrol data. Table 3.6 presents Eurocontrol data of jet kerosene used in Poland for international and domestic purposes, the share of domestic and international use with the Eurostat data for comparison.

Table 3.6. Eurocontrol and Eurostat data of jet kerosene used in Poland and the share of domestic and international use in years 2005-2024

Jet kerosene use	Unit	2005	2006	2007	2008	2009	2010	2011
- domestic	kt	21.86	24.78	26.94	26.16	24.30	28.61	31.43
- international	kt	303.44	383.80	455.51	516.92	456.41	481.94	483.51
Total	kt	325.30	408.58	482.44	543.08	480.71	510.55	514.93
Eurostat	kt	311.00	415.00	432.00	519.00	470.00	495.00	485.00
Share								
- domestic	%	6.72	6.07	5.58	4.82	5.05	5.60	6.10
- international	%	93.28	93.93	94.42	95.18	94.95	94.40	93.90
Total	%	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Jet kerosene use	Unit	2012	2013	2014	2015	2016	2017	2018
- domestic	kt	45.75	34.21	38.84	34.36	34.21	36.89	35.78
- international	kt	499.64	526.34	559.45	596.54	679.55	1266.92	1457.94
Total	kt	545.39	560.55	598.28	630.90	713.76	1303.81	1493.72
Eurostat	kt	537	524	590	646	685	852	1008
Share								
- domestic	%	8.39	6.10	6.49	5.45	4.79	2.83	2.40
- international	%	91.61	93.90	93.51	94.55	95.21	97.17	97.60
Total	%	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Jet kerosene use	Unit	2019	2020	2021	2022	2023	2024	
- domestic	kt	35.34	17.65	18.98	34.65	41.67	40.51	
- international	kt	1529.36	603.11	785.77	864.35	1063.44	1181.97	
Total	kt	1564.71	620.76	804.75	899.00	1105.11	1222.48	
Eurostat	kt	1077	459	574	978	1189	1340	
Share								
- domestic	%	2.26	2.84	2.36	3.85	3.77	3.31	
- international	%	97.74	97.16	97.64	96.15	96.23	96.69	
Total	%	100.00	100.00	100.00	100.00	100.00	100.00	

Due to the lack of Eurocontrol data for the years before 2005, the share for years 1990-2004 was assumed as a 5-years average from Eurocontrol data for years 2005-2009. The 5-years average, taken from the closest years to data lack period, was evaluated as the most representative in consultations with experts in the area of transport and energy. The share of 94.35% was then accepted for the whole period before 2005. Such assumption seems to be reliable and not affecting accuracy of the inventory.

All activities and emission factors applied for International Aviation are shown in Appendix 5

and 6 respectively.

3.4.2.2 Domestic aviation LTO (civil) (NFR sector 1A3a(ii))

For the years 1990-2024 data on aviation gasoline and jet kerosene consumption is sourced from the Eurostat database. The methodology to split jet kerosene used for domestic and international purposes is described in the chapter above. For the LTO cycle it was assumed that 30% of the fuel is used for that part of flight.

In Poland the Orlen Group is the only supplier of aviation gasoline. It offers AVGAS 100LL aviation gasoline. In the safety data sheet there is an information about the content of Pb in fuel and it is 0.756 g/kg. On the basis of EF and activity data, Poland calculated the Pb emissions from 1A3a(ii).

All activities and emission factors applied for Domestic Aviation are shown in Appendix 5 and 6 respectively.

3.4.2.3 Road Transportation (NFR sector 1A3b)

Calculations for the year 2024 and recalculations of 1990-2023 data were performed in model COPERT 5 version 5.8.1. All emission factors are default values from COPERT 5.

Emission estimates for this category are based on:

- fuel consumption,
- number of vehicles per vehicle category, weight or engine size and emission control technology,
- mileage per vehicle class,
- mileage share per road class (urban, rural and highways),
- average speed per vehicle type and per road class,
- monthly temperature (min and max),
- fuel characteristics.

Data on fuel consumption for the years 1990-2024 comes from Eurostat database. Consumption of each type of fuel (used in road transport) in energy statistics is given without distinguishing on individual vehicle types. Therefore, for the purpose of emission inventory, fuel consumption was disaggregated based on COPERT 5 calculations – mass of statistical and calculated fuel consumption is equal.

All activities (fuels consumption) applied for Road Transport are shown in Appendix 5.

Official statistics publish the amount of CNG/LNG consumption starting from year 2015. Taking into account that the CNG/LNG fuel use and number of CNG/LNG buses and passenger cars in Poland is still relatively small (from 689 buses and 1 138 passenger cars in 2015) therefore, it can be assumed that emissions in years before 2015 was rather insignificant. The increase in the consumption of LNG and CNG is also the result of the introduction of a zero rate of excise duty on those fuels in January 2019.

The number of vehicles and the mileage per vehicle category, weight or engine size and emission control technology comes from Polish Central Vehicle and Driver Register system (CEPiK) and Statistics Poland. The number of vehicles according to categories and fuel type is shown in Figure 3.31.

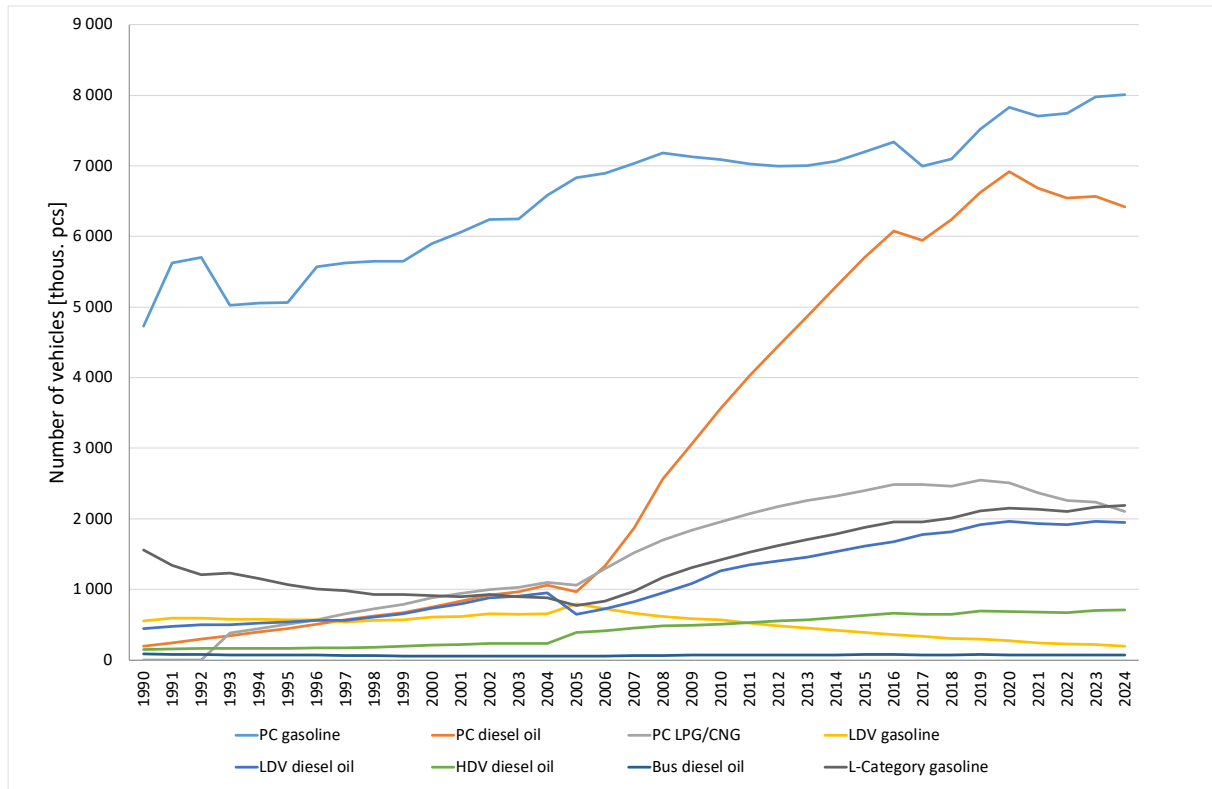


Figure 3.31. Number of vehicles in 1990-2024

Speed and share in different travel conditions comes from literature and on the basis of own research. Average annual mileage for the main categories in 2024 is presented in Figure 3.32. Mileage share and speed per road class are shown in Figure 3.33 and Figure 3.34. Estimations were prepared using information from the national publications.

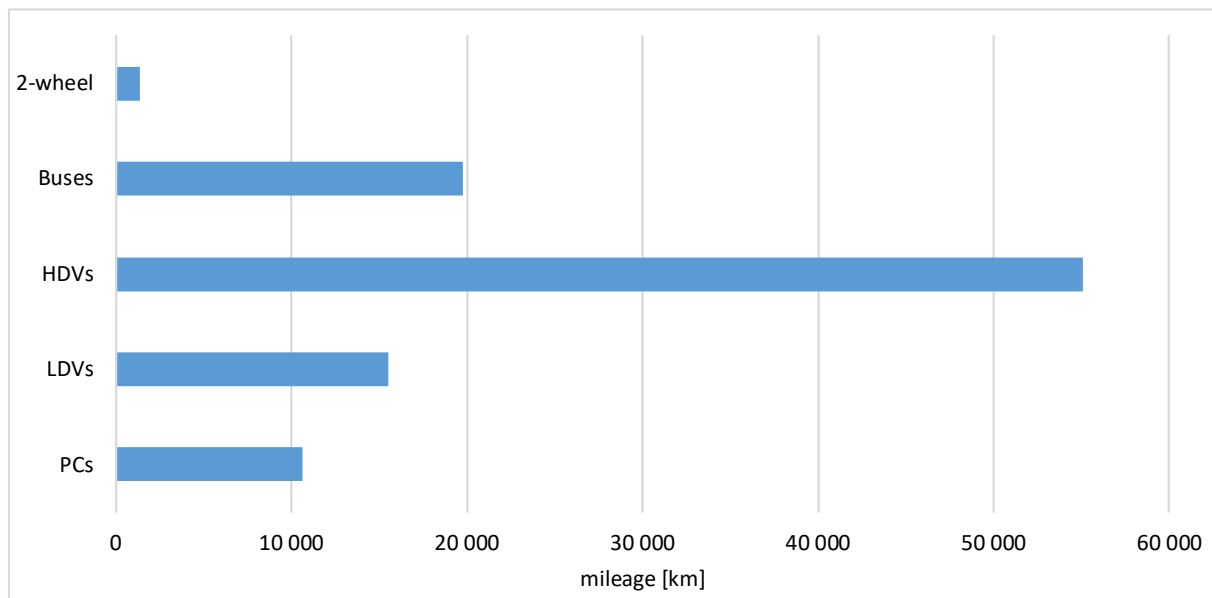


Figure 3.32. Annual mileage driven by vehicles in 2024

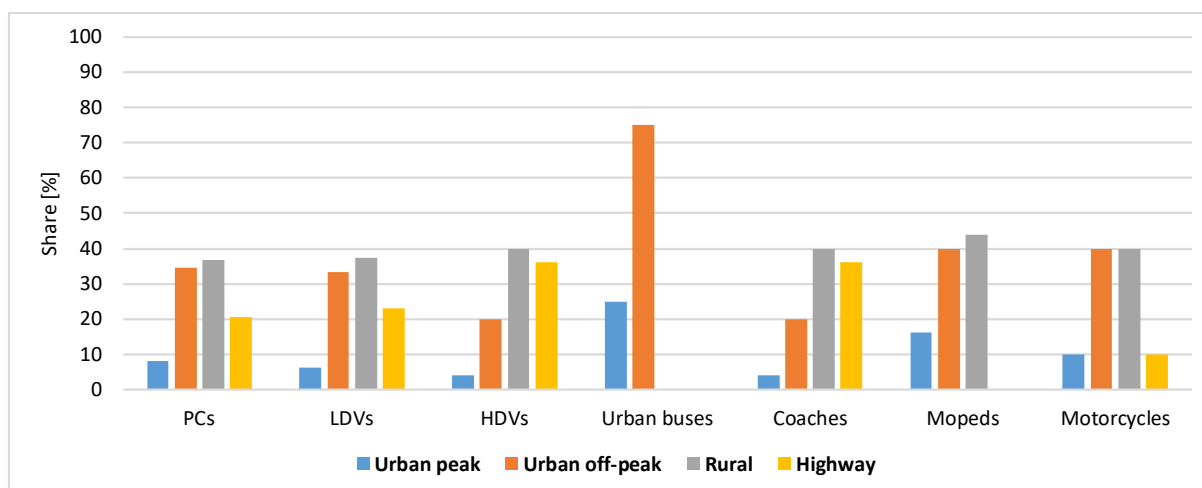


Figure 3.33. Mileage share per road class (urban peak and off-peak, rural and highways) in 2024

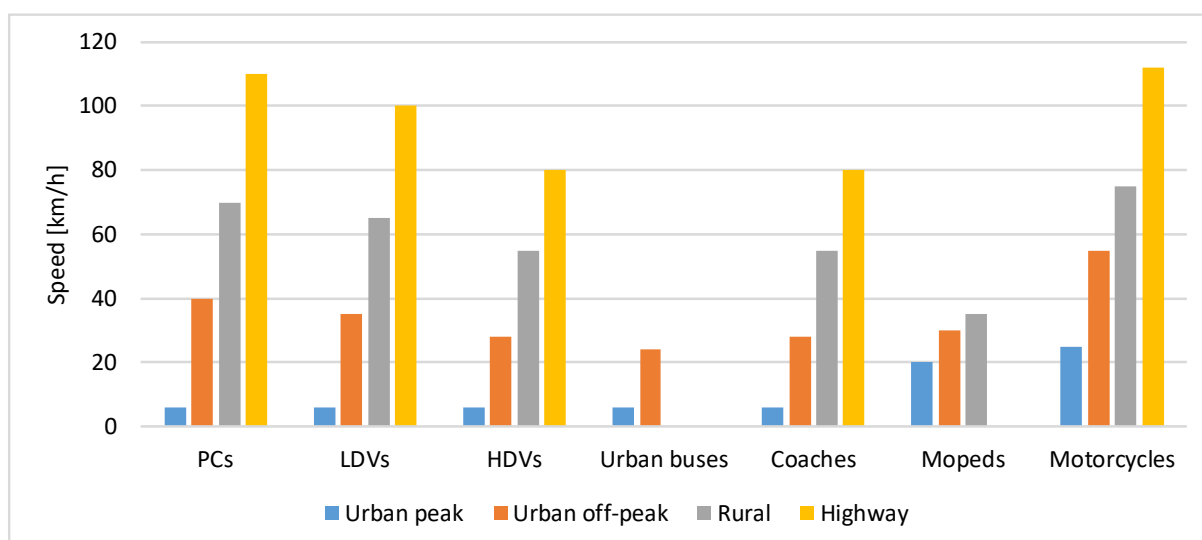


Figure 3.34. The average speed per road class (urban peak and off-peak, rural and highways) in 2024

3.4.2.4 Railways (NFR sector 1A3c)

This category includes emissions from railway transport for both freight and passenger traffic routes. Railway locomotives used in Poland are diesel and electric. With reference to the question raised during 2018 Review, Poland explained that steam locomotives were in use in Poland only up to year 1998. Therefore for later years 'NO' notation key has been used for emission from solid fuels use (steam locomotives were used rather occasionally for sightseeing). Also national statistics confirm this state as no data concerning coal use by locomotives is reported.

Electric locomotives are powered by electricity generated at stationary power plants as well as other sources. The corresponding emissions are covered under the Stationary Combustion sector.

All activities and emission factors applied for Railways are shown in Appendix 5 and 6 respectively.

3.4.2.5 *Navigation (NFR sector 1A3d)*

Due to very limited number of vessels, emission from International maritime navigation under Polish flag is small as compared to other countries. To ensure completeness fuel use data for International maritime navigation (Memo Item) already available in Polish energy statistics has been used to estimate these emissions.

The structure of fuels used in Navigation has been calculated based on G-03 energy questionnaires and statistical data on levels of international vs. domestic shipping activity.

All activities and emission factors applied for National navigation are shown in Appendix 5 and 6 respectively.

3.4.2.6 *Other transportation (NFR sector 1A3ei)*

Pipeline transport contains combustion related emissions from the operation of pump stations and maintenance of pipelines. Since 2000, when the Jamal gas pipeline was completed, the amount of this fuel increased sharply from 21 TJ in 1999 to 2498 TJ in 2000. Significant decrease of natural gas consumption since 2022 was caused by the war outbreak in Ukraine in February 2022.

All activities and emission factors applied for Pipelines transport are shown in Appendix 5 and 6 respectively.

3.4.2.7 *'MEMO' ITEMS*

Estimation of emissions in 'Memo' items are carried out for each fuel in sub-categories listed below:

- 1A3ai(ii). *International aviation - cruise (civil)*,
- 1A3aii(ii). *Domestic aviation - cruise (civil)*,
- 1A3di(i). *International maritime navigation*.

3.4.2.7.1 *International aviation - cruise (civil) (NFR sector 1A3ai(ii))*

The methodology description can be found in Chapter 3.4.2.1. For the cruise cycle it was assumed that 88% of the fuel is used for that part of flight.

All activities and emission factors applied for International aviation are shown in Appendix 5 and 6 respectively.

3.4.2.7.2 *Domestic aviation - cruise (civil) (NFR sector 1A3aii(ii))*

For the years 1990-2024 data on aviation gasoline and jet kerosene consumption is sourced from the Eurostat database. The methodology to split jet kerosene used for domestic and international purposes is described above. For the cruise cycle it was assumed that 68% of the fuel is used for that part of flight.

All activities and emission factors applied for International aviation are shown in Appendix 5 and 6 respectively.

3.4.2.7.3 *International maritime navigation (NFR sector 1A3di(i))*

Due to very limited number of vessels, emission from International maritime navigation under Polish flag is small as compared to other countries. To ensure completeness fuel use data for

International maritime navigation (Memo Item) already available in Polish energy statistics has been used to estimate these emissions.

All activities and emission factors applied for International navigation are shown in Appendix 5 and 6 respectively.

3.4.3 Emission trends for NFR sector 1A3

Trends of pollutant emissions for sector 1A3. *Transport* are shown in figures below (Figure 3.35 - Figure 3.41). A decrease in SO₂ emissions results from new limit of sulphur contents in fuels. A decrease in Pb emissions results from a new limit of lead contents in fuels.

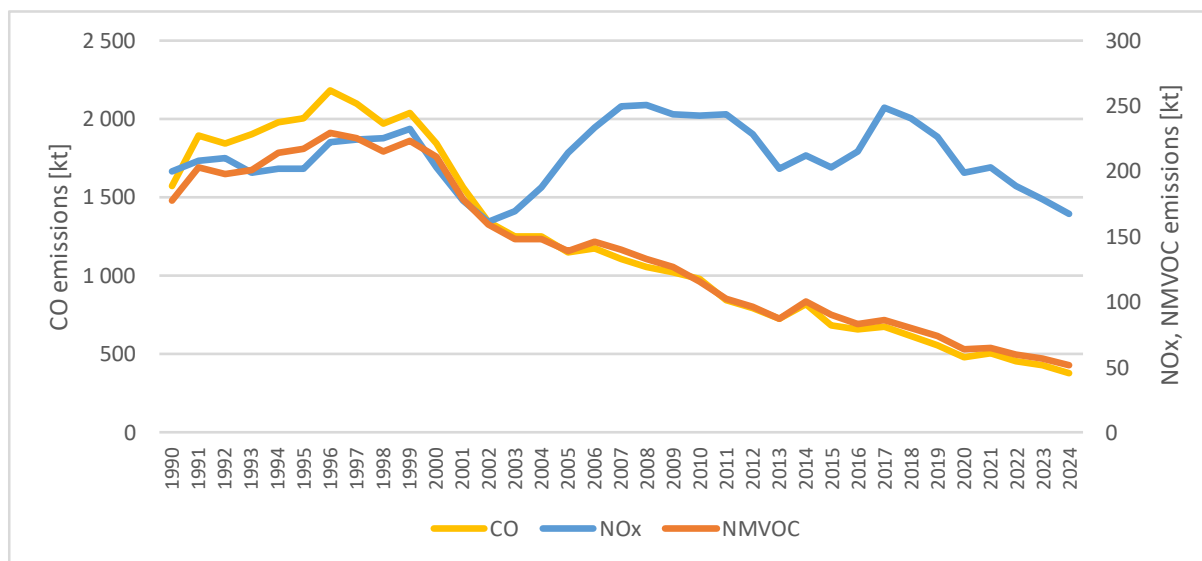


Figure 3.35. CO, NOx, NMVOC emissions for 1A3 category in 1990-2024

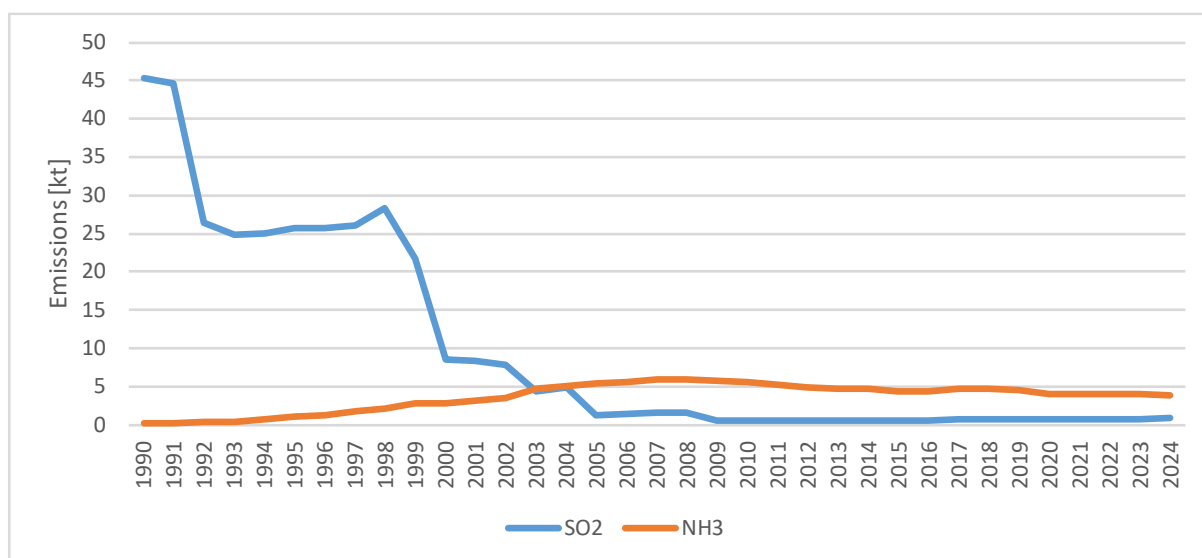


Figure 3.36. SO₂ and NH₃ emissions for 1A3 category in 1990-2024

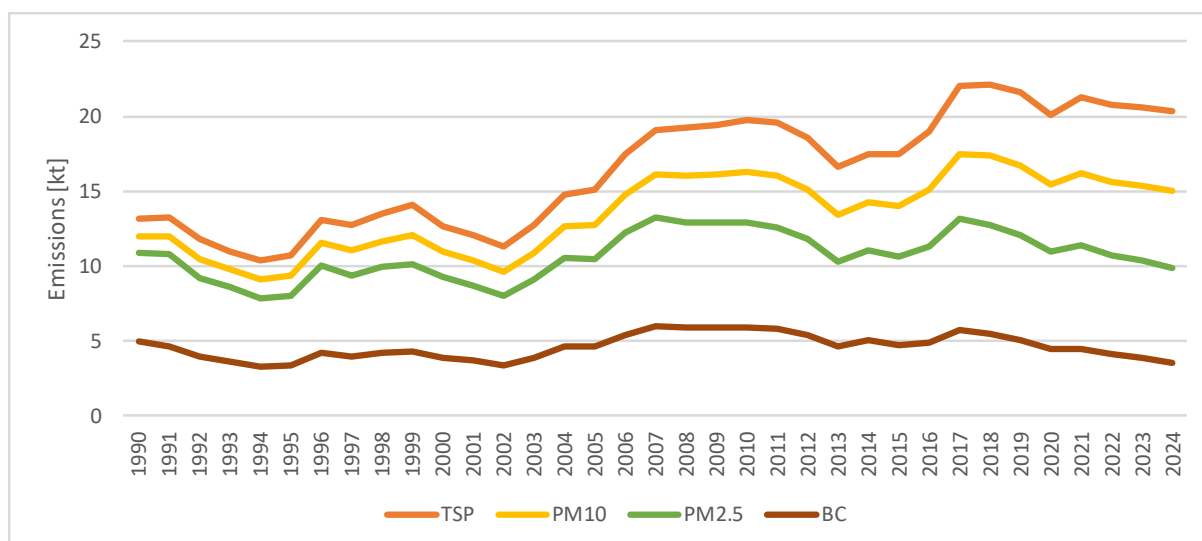


Figure 3.37. Particulates and BC emissions for 1A3 category in 1990-2024

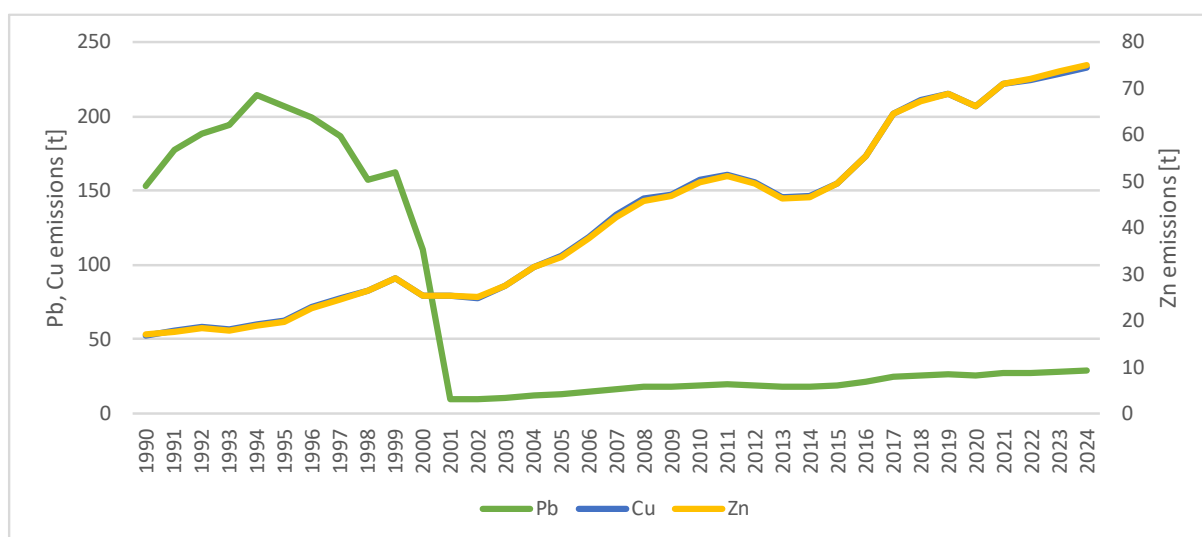


Figure 3.38. Pb, Cu and Zn emissions for 1A3 category in 1990-2024

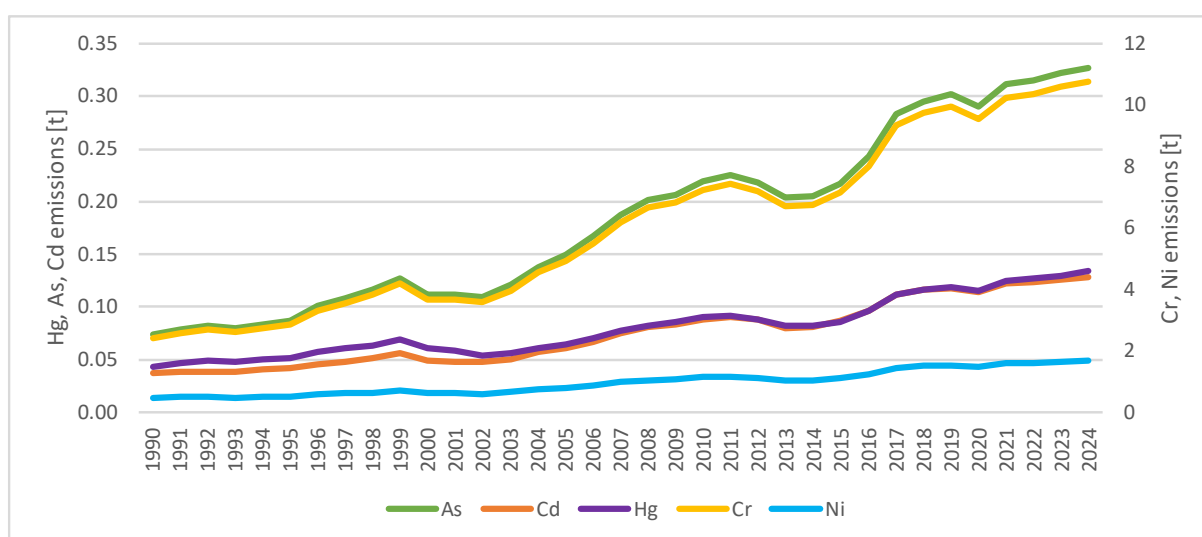


Figure 3.39. As, Cr, Cd, Hg and Ni emissions for 1A3 category in 1990-2024

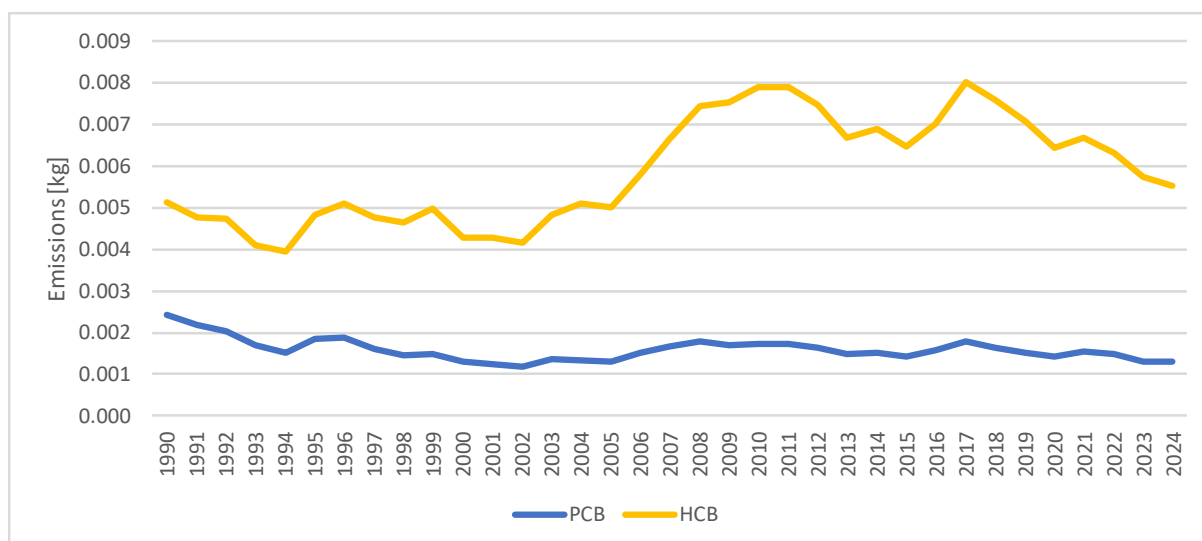


Figure 3.40. HCB and PCB emissions for 1A3 category in 1990-2024

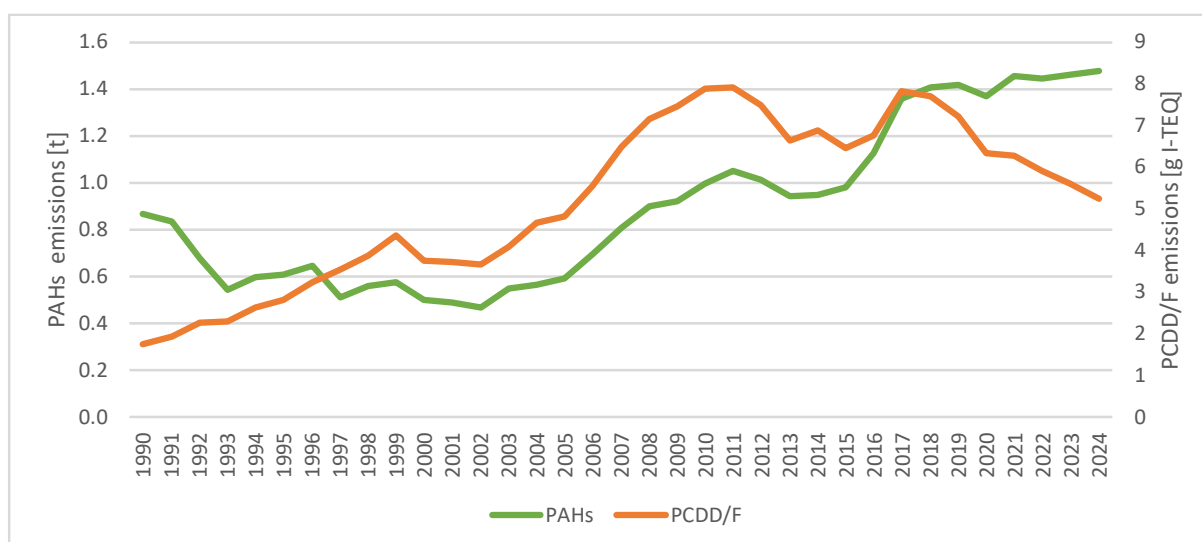


Figure 3.41. PAHs and PCDD/F emissions for 1A3 category in 1990-2024

3.4.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 1A3. *Transport* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 1A3 are provided below. Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 3.7. Results of the uncertainty analysis for NFR sector 1A3

NFR subsector		NOx	NM VOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP	BC
1A3ai(i)	International aviation LTO (civil)	112.0%	112.0%	86.0%		50.1%	50.1%	50.1%	63.0%
1A3ai(ii)	Domestic aviation LTO (civil)	50.0%	98.0%	25.1%		72.0%	72.0%	72.0%	63.0%
1A3bi	Road transport: Passenger cars	70.0%	49.0%	19.1%	83.0%	70.0%	70.0%	70.0%	70.0%
1A3bii	Road transport: Light duty vehicles	70.0%	46.0%	22.1%	66.0%	70.0%	70.0%	70.0%	70.0%
1A3biii	Road t.: Heavy duty vehicles and buses	70.0%	59.0%	20.1%	66.0%	70.0%	70.0%	70.0%	70.0%
1A3biv	Road transport: Mopeds & motorcycles	30.1%	73.0%	23.1%	78.0%	100.0%	100.0%	100.0%	100.0%
1A3bv	Road transport: Gasoline evaporation		90.0%						
1A3bvi	Road t.: Automobile tyre & brake wear					70.0%	70.0%	70.0%	70.0%
1A3bvii	Road t.: Automobile road abrasion					70.0%	70.0%	70.0%	70.0%

NFR subsector		NO _x	NM VOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP	BC
1A3c	Railways	50.0%	100.0%	30.1%	50.0%	100.0%	100.0%	100.0%	100.0%
1A3di(ii)	International inland waterways								
1A3dii	National navigation (shipping)	36.1%	78.0%	27.1%		72.0%	72.0%	72.0%	72.0%
1A3ei	Pipeline transport	50.0%	70.0%	70.0%		72.0%	72.0%	72.0%	72.0%
NFR subsector		CO	Pb	Cd	Hg	PCDD/F	PAHs	HCB	PCBs
1A3ai(i)	International aviation LTO (civil)	86.0%							
1A3aii(i)	Domestic aviation LTO (civil)	96.0%	62.0%						
1A3bi	Road transport: Passenger cars	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%
1A3bii	Road transport: Light duty vehicles	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%
1A3biii	Road t.: Heavy duty vehicles and buses	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%	70.0%
1A3biv	Road transport: Mopeds & motorcycles	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1A3bv	Road transport: Gasoline evaporation								
1A3bvi	Road t.: Automobile tyre & brake wear		70.0%	70.0%			70.0%		
1A3bvii	Road t.: Automobile road abrasion								
1A3c	Railways	100.0%		50.0%			100.0%		
1A3di(ii)	International inland waterways						71.0%		
1A3dii	National navigation (shipping)	72.0%	100.0%	45.0%	100.0%	71.0%	71.0%	71.0%	71.0%
1A3ei	Pipeline transport	72.0%							

3.4.5 Source-specific QA/QC and verification

Activity data used in the pollutant emission inventory concerning the sector comes from yearbooks published by the Statistics Poland (GUS). GUS is responsible for QA/QC of collected and published data. For further details please see Chapter 3.2.5.

3.4.6 Source-specific recalculations

The following recalculations have been implemented:

- the update of number of vehicles and vehicles mileage in road transport based on data from Polish Central Vehicle and Driver Register database;
- the update of meteorological data on average minimum and maximum ambient temperatures and update and supplement of average humidity according to Institute of Meteorology and Water Management - National Research Institute;
- the update of activity of diesel fuel consumption in 2022 and 2023;
- the application of the PAH emission calculation methodology in line with the 2023 EMEP/EEA Guidebook on the speciation of tyre and brake wear for PAHs, using TSP emissions (calculated in the COPERT model) according to TERT recommendation PL-1A3bvi-2025-0001;
- the update of the PM_{2.5} emission factor according to following TERT recommendations: PL-1A3dii-2025-0001 and PL-1A3dii-2025-0002.

3.4.7 Source-specific planned improvements

Poland is working on determining real speed values and the shares of these speeds in various categories of road transport. The results of this work will be used to perform emission calculations.

Poland makes an effort to improve consistency between different datasets produced by the Statistics Poland and the Central Register of Vehicles (between 2004 and 2005).

3.5 Other sectors (NFR sector 1A4)

3.5.1 Source category description

The category encompasses stationary fuel combustion emission sources (1A4ai, 1A4bi and 1A4ci) as well as mobile off-road machinery and other machinery (1A4cii) and fishing (1A4ciii).

Emissions generated by 1A4. *Other Sectors* are calculated based on fuel consumption provided for sub-categories given below:

- 1A4ai. *Commercial/Institutional*
- 1A4bi. *Residential*
- 1A4ci. *Agriculture/Forestry/Fishing*
- 1A4cii. *Agriculture – mobile sources: off-road vehicles and other machinery*
- 1A4ciii. *Fishing*

The following subcategories in sector 1A4 have been identified as key source:

Table 3.8. Key source categories in sector 1A4

NFR code	Method	EF	Pollutant
1A4ai. <i>Commercial/Institutional</i>	T2 / T1	CS / D	NOx
1A4bi <i>Residential</i>	T2 / T1	CS / D	NOx, SO ₂ , NMVOC, CO, TSP, PM ₁₀ , PM _{2.5} , Pb, Cd, Hg, PCDD/F, PAH, HCB
1A4ci <i>Agriculture/Forestry/Fishing</i>	T2 / T1	CS / D	SO ₂ , CO, TSP, PM ₁₀ , PM _{2.5} , PCDD/F
1A4cii <i>Off-road vehicles and other machinery</i>	T2	D	NOx

CS – country specific; D - default

Stationary fuel combustion emission sources (1A4ai, 1A4bi and 1A4ci)

The small combustion installations included in this chapter are mainly intended for heating and provision of hot water in residential and commercial/institutional sectors. Secondary activities extend to the use of cooking appliances within residential and commercial sectors. In the agricultural sector the heat generated by the installations is used also for crops drying and for heating greenhouses.

Mobile fuel combustion emission sources (1A4cii and 1A4ciii)

Mobile fuel combustion emission sources encompass off-road vehicles and other machinery used in agriculture, forestry and fishing.

Shares of emissions from the 1A4 category in the country total for the particular pollutants in 2024 are shown in Figure 3.42. Subsector 1A4b. *Residential* is by far the largest contributor to emissions from this category.

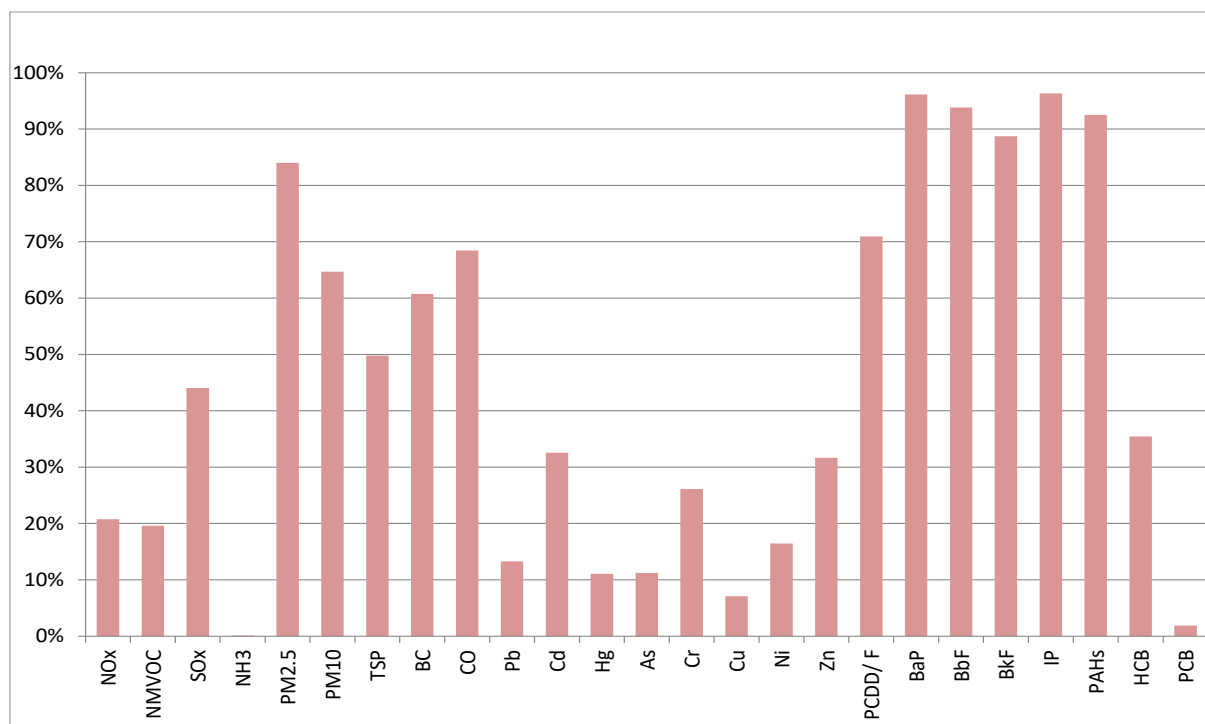


Figure 3.42. Shares of emissions from the 1A4 category in the country total in 2024

The data in Figure 3.43 and Figure 3.44 shows that the use of solid fuels is dominant in 1A4 category. In 2024, the use of solid fuels accounted for 23% of the entire energy of all fuels used in that sector. Since the late 1990s a slow downward trend of solid fuel consumption can be seen (from 64% in 1990). At the same time an increased share of natural gas, liquid fuels and biomass increased is observed.

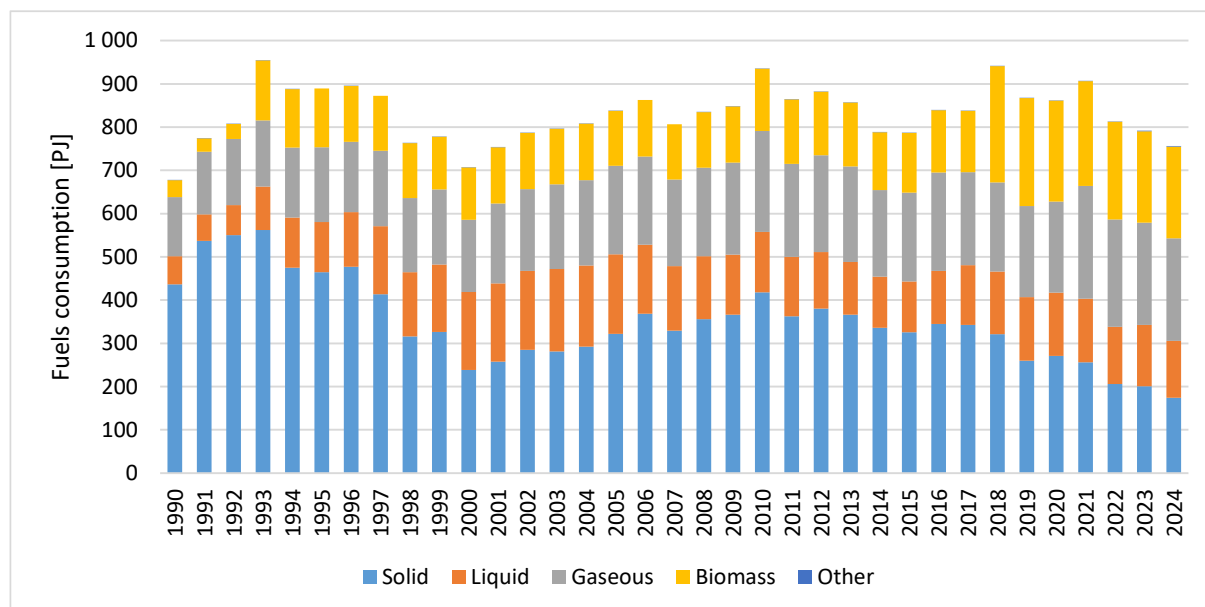


Figure 3.43. Fuel consumption in the 1A4 category [PJ]

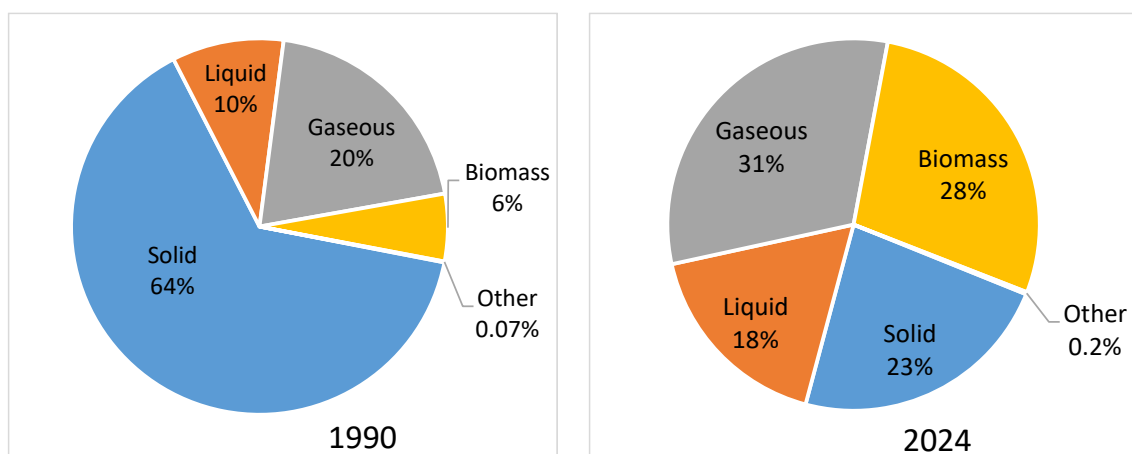


Figure 3.44. Share of fuel consumption in the 1A4 category in 1990 and 2024

3.5.1.1 Other Sectors – Commercial/Institutional (1A4ai)

The detailed data on fuels usage by stationary sources in sub-category 1A4ai. *Other Sectors – Commercial/Institutional* over the 1990-2024 period is presented in Appendix 5.

Applied emission factors are presented in Appendix 6. Emission factors derive from the report concerning emission factors for solid fuels (IChPW, 2020-2021).

Detailed description of emission factors is presented in Chapter 3.5.6.

3.5.1.2 Other Sectors – Residential (NFR sector 1A4bi)

The detailed data on fuel usage by stationary sources in sub-category 1A4bi. *Residential* over the 1990-2024 period is presented in Appendix 5.

Applied emission factors are presented in Appendix 6. Emission factors derive from the report concerning emission factors for solid fuels (IChPW, 2020-2021).

Detailed description of emission factors is presented in Chapter 3.5.6.

3.5.1.3 Other Sectors – Agriculture/Forestry/Fishing – stationary (NFR sector 1A4ci)

The detailed data on fuels usage by stationary sources in sub-category 1A4ci. *Agriculture/Forestry/ Fishing* over the 1990-2024 period is presented in Appendix 5.

Applied emission factors are presented in Appendix 6. Emission factors derive from the report concerning emission factors for solid fuels (IChPW, 2020-2021).

Detailed description of emission factors is presented in Chapter 3.5.6.

3.5.1.4 Other Sectors – Agriculture/Forestry/Fishing – mobile sources

Mobile sources included in the national inventory in category 1A4 encompass:

1. Machinery and off-road transport in agriculture (sub-category 1A4cii);
2. Fishing (sub-category 1A4ciii).

The amounts of fuels used in the above listed sub-categories in the 1990-2024 period are presented in Appendix 5. Applied emission factors are presented in Appendix 6.

Recalculations implemented for this category are described in Chapter 3.5.6.

3.5.2 Methodological issues

General information

The methodology for emission estimation in 1A4 subcategory corresponds with the methodology described for fuel combustion in stationary sources.

Emission factors for solid fuels have been implemented based on the expert study commissioned by KOBiZE and prepared by the Institute of Energy and Fuel Processing Technology (ITPE): "Development of emission factors for solid fuel combustion sources in the municipal and housing sector. MODULE I, II and III" Zabrze, 2021.

The emission factors reflect the state-of-the-art knowledge of combustion technologies, heating devices, fuels and general trends in this sector. They have been verified, updated and developed for all pollutants in the period of 1990-2040. Since 2020 emission factors are prepared in two scenarios: WM (with measures) and WAM (with additional measures deriving from the National Energy and Climate Plan (NECP PL), the implementation of which has started). The calculations starting from 2022 were prepared based on WAM scenario.

To develop the EFs ITPE has established its own methodology (a model) for estimating aggregated emission factors, including key elements from the point of view of heating sources operation. The methodology is used in estimates for each of the considered sub-sectors and pollutants. Based on the methodology, a statistical and emission model has been developed – combining the emission volume, fuel quality and consumption, individual emission factors and statistics on the market share of devices. As a result Poland obtained new EFs which are based on previously used EFs however updated and taking into consideration more parameters which influence emission levels, including measurements.

The basic pollutant emission factors were developed based on ITPE measurements performed over the years in the conditions of device's real operation, as well as on scientific literature and studies provided by KOBiZE. During measurements performed under real operation conditions, also samples of fuel purchased and typically used by users were burned and analyzed.

Aggregated emission factors for solid fuels (hard coal, brown coal, coke and semi-coke, wood and waste wood) developed for individual years were estimated for each fuel and type of equipment. The following parameters describing the operation of individual devices and meteorological conditions in the statistical year were also implemented in the statistical model:

- percentage of households using particular types of devices for the production of heat and hot water (also in Appendix 10),
- average installed thermal powers of these devices,
- power overestimation degree of heating devices,
- power utilization factors characteristic for individual groups of devices,
- average working time of devices during the year in each group,
- efficiency of devices in each group,
- dynamics of the air temperature and other parameters influencing the heat demand during the heating season,
- real operation conditions (presuming non-optimal operation conditions by some users).

Emission volumes from sector 1A4 are calculated based on Poland's official energy balance reported to Eurostat. The energy balance includes data on fuel use with regards to fuel type only. There is no fuel use split between different types of devices in official statistics.

Therefore, due to the fact that 1A4 category is a key category for almost all pollutants, the EFs used to calculate emissions must be aggregated to encompass numerous information that influences the emission volume. Such aggregation includes, among others, fuel consumption split into different types of devices. The aggregated EFs are calculated as an average value of EFs for different types of devices weighted with fuels used in those devices. As a result, the methodology of calculations is considered Tier 2 methodology.

The emission factors for HCB have not been implemented due to the fact that they are significantly higher than the default emission factors from EMEP/EEA EIG 2019 (especially in case of hard coal combustion). It is the opinion of Poland that the new HCB emission factors require further investigation and confirmation.

Heat production using solid fuels in Poland is specific due to the large share of fuels with different quality parameters and the large-scale use of outdated, manually operated heating devices. Therefore emission factors presented in Appendix 10 cannot be compared with values proposed in the EMEP/EEA Guidebooks. In the case of hard coal combustion, the proposed value of the emission factor is very high (for ex. 514 g/GJ for 2022), but is within the upper limit of the EF (95% confidence Upper interval) proposed by EMEP at the level of 1000 g/GJ (Table 3-20 Tier 2 emission factors for small non-residential sources (> 50 kWth to ≤ 1 MWth) boilers burning coal fuels), which means that cases of coal burning with such high emissions are also recorded in other EU countries. For wood burning in 1.A.4.c.i subsector (Agriculture / forestry / fishing), it is incorrect to attribute PM_{2.5} emission with boilers with a capacity above 1 MW. Small boilers (<50 kW, Table 3-43 Tier 2 emission factors for source category 1.A.4.b.i, conventional boilers < 50 kW burning wood and similar wood waste) are much more often used in this sector. For this group of devices, the emission factor proposed by EMEP has a limit value of 1000 g/GJ, which exceeds the value considered in Appendix 10. In the case of brown coal, the high value of particulates emission factors is caused by the very poor quality of the fuel used in southern Poland, with its calorific value dropping to approximately 6 MJ/kg and high moisture content. Due to this, this coal cannot currently be burned in individual devices.

Condensables

In case of emission factors for TSP, PM₁₀ and PM_{2.5}, the condensable fraction is included in addition to the filterable fraction. The condensable fraction, apart from inorganic compounds, consists also of organic compounds formed in the combustion process. After the exhaust gases leave the chimney, they are cooled and diluted. As a result, together with the filterable fraction, they may condense and form so-called primary atmospheric aerosol. Combustion of solid fuels in sector 1A4. *Other sources* is a major source of particular matter emissions, the significant share of which is the condensable fraction (especially in the case of biomass combustion). Therefore, including condensable fraction in emission calculations is crucial when assessing the impact of this sector on the annual particular matter emissions.

Emission factors of the filterable and condensable fraction of suspended particular matter for coal fuels for devices other than those covered by the requirements of PN-EN 303-5: 2012 and devices meeting the ecodesign⁶ requirements operating in 1.A.4.bi, were developed on the

⁶ Commission Regulation (EU) 2015/1188 of 28 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for local space heaters; Commission Regulation (EU) 2015/1185 of 24 April 2015 implementing Directive 2009/125/EC of the European Parliament

basis of data collected during measurements performed under actual operating conditions. The applied methodology, used to determine the PM emission factors from the combustion of solid fuels in various heating devices, includes determining the concentrations of:

- filterable PM - using the "heated filter" method (apparatus compliant with EN - 13284 1) directly from the flue gas stack,
- total organic compounds (condensable fraction) – using the method described below.

During the measurement, the flue gases from the heating device are sampled from the measuring stub by a measuring probe heated to 120°C and equipped with a particular matter filter. After passing through the particular matter filter, the gases are first cooled in a scrubber immersed in water with ice, where condensation occurs, and then directed to a set of glass scrubbers equipped with sorbents of organic compounds (XAD2 resin scrubber and active carbon scrubber), on which organic compounds emitted from the combustion process are adsorbed. The concentration of the condensable fraction is measured throughout the entire measurement period. During sampling, the volume and temperature of the gas are recorded.

The organic compounds adsorbed on XAD2 and on activated carbon as well as the organic compounds in the condensate are independently extracted with an organic solvent (acetone) which is then evaporated to dryness. Organic compounds, after evaporation of the solvent, are weighed with an accuracy of 0.0001 g. The masses obtained are then converted into concentrations. The calculated concentrations of the emitted total organic pollutants (condensable fraction), converted into the emission factor, are summed up. The PM collected from the probe walls, after evaporation of the solvent, is weighed and added to the mass of filtered PM collected on the filter installed in the measuring probe.

The filterable particulate matter emission factors for wood biomass equipment operated in 1.A.4.bi and for solid fuel equipment operated in 1.A.4.ai and 1.A.4.ci are derived from the EMEP/EEA Guidebooks 2016 and 2023, as well as from national studies on aggregate emission factors.

Condensable PM emission factors for equipment from subsectors 1.A.4.ai and 1.A.4.ci, were derived partly from data obtained from measurements under laboratory conditions according to the methodology described above or estimated based on FTSP / PM ratios available for equipment operated in subsector 1.A.4.bi.

The emission factors of PM₁₀ and PM_{2.5} for heating devices operated in sub-sector 1.A.4.bi were calculated on the basis of constant shares:

- 89% for PM₁₀ and 69% for PM_{2.5} for coal fuels,
- 95% PM₁₀ and 90% PM_{2.5} for firewood and wood waste,
- 84% PM₁₀ and 58% PM_{2.5} for wood pellets.

The shares were determined on the basis of measurement data from tests performed on a group of heating devices combusting hard coal and wood biomass in laboratory conditions.

Measurement conditions

The PM measurements were performed – depending on the individual operating characteristics of the boiler by the owner – in different time modes, and in most cases they

and of the Council with regard to ecodesign requirements for solid fuel local space heaters; Commission Delegated Regulation (EU) 2015/1186 of 24 April 2015 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of local space heaters

covered the main part of the firing-up phase, except for combustion initiation of kindling. The measurements were completed immediately before the second charge, so the final phase of the combustion cycle is included.

Moreover, heating devices were operated during the tests by people who constantly supervise and operate them, but did not have training and deeper knowledge in the field of combustion processes and running heating devices of this type, but have only general experience resulting from practice. The observations show that in most cases they were only able to partially comply with the common recommendations for the combustion of solid fuels. Therefore, it should be stated that the obtained factors contain the "human component" reflected in the diversified operational and technical knowledge, and are also dependent on the technical condition of used equipment and the quality of consumed fuel.

In the case of wood combustion, due to lack of a sufficient number of own measurements for both the filtered and condensable fractions, aggregated emission factors for PM were estimated based on the values recommended by the EMEP EEA 2016 and 2019 Guidebooks. The authors of the study did not introduce any modifications to those values.

Treated wood was not taken into account when estimating the emission factors as it is waste which, in accordance with the provisions of the Polish Waste Act, cannot be incinerated outside of specialized plants.

The entire methodology of developing the emission factors is described in the aforementioned expert study.

Detailed information on fuel consumption and applied emission factors for subsectors included in 1A4 subcategory are presented in Appendices 5 and 6.

3.5.3 Emission trends for NFR sector 1A4

Trends of pollutant emissions for 1A4 sector are shown in figures below (Figure 3.45 - Figure 3.51). The sudden emission increase for most pollutants in 2018 results from the update of the fuel balance for the years 2018-2020, which was carried out by Statistics Poland at the beginning of 2022. The correction consisted in roughly doubling the amount of solid biomass used in households for 2018-2020 compared to the previous balance. This change had a large impact on the air pollutants emission.

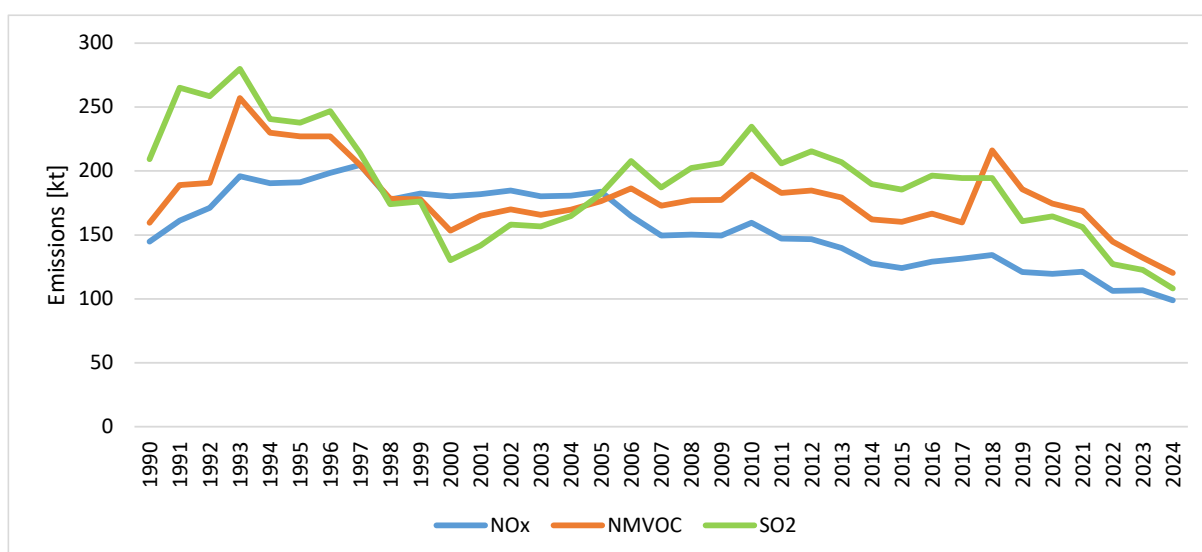


Figure 3.45. NOx, NMVOC and SO₂ emissions for 1A4 category in 1990-2024

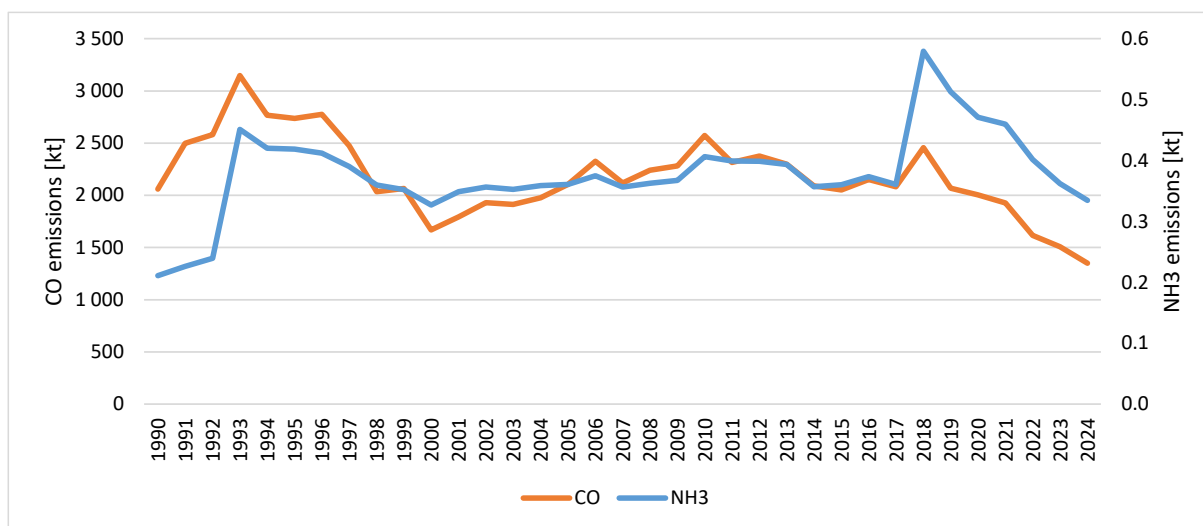
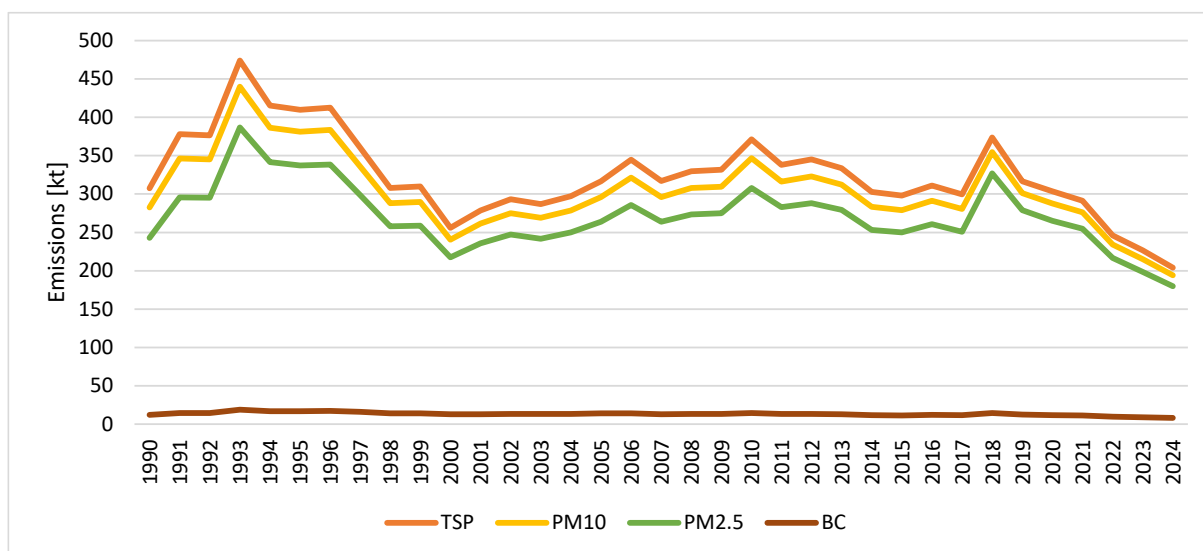
Figure 3.46. CO and NH₃ emissions for 1A4 category in 1990-2024

Figure 3.47. Particulates and black carbon emissions for 1A4 category in 1990-2024

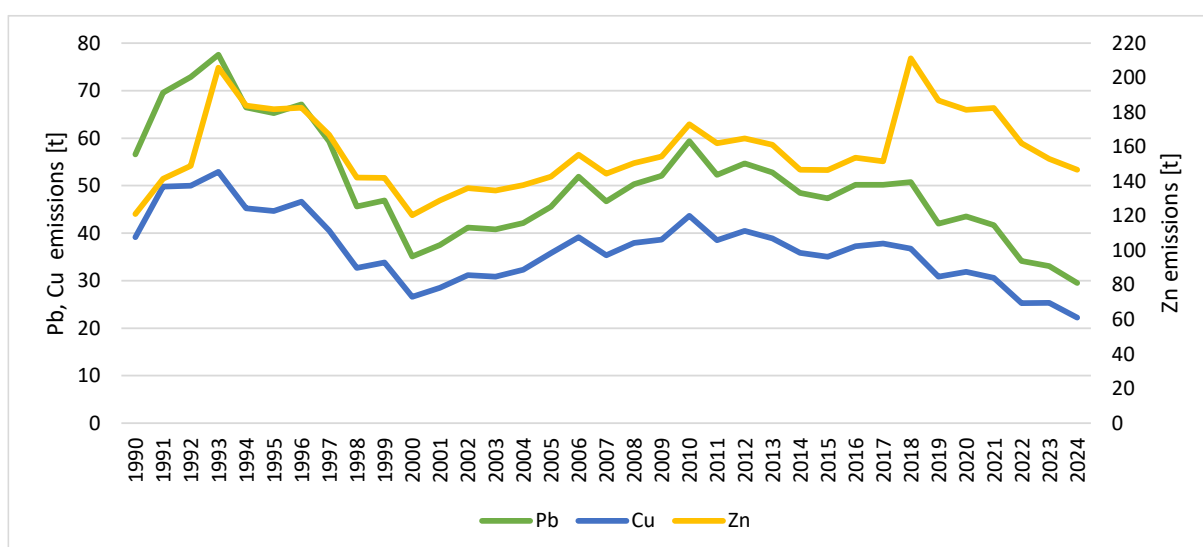


Figure 3.48. Pb, Cu and Zn emissions for 1A4 category in 1990-2024

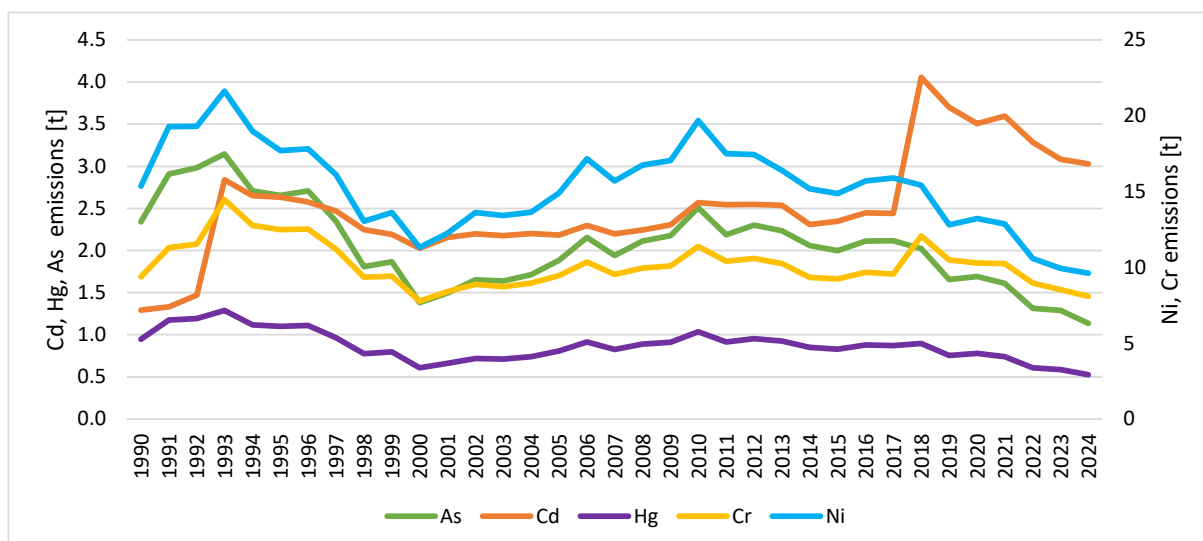


Figure 3.49. As, Cd, Hg, Cr and Ni emissions for 1A4 category in 1990-2024

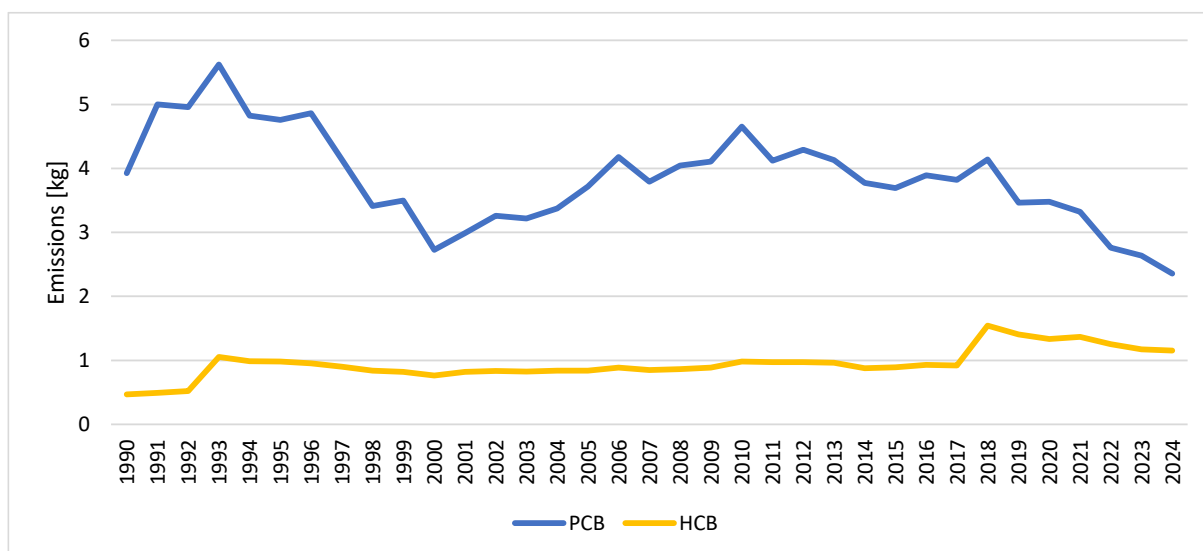


Figure 3.50. HCB and PCB emissions for 1A4 category in 1990-2024

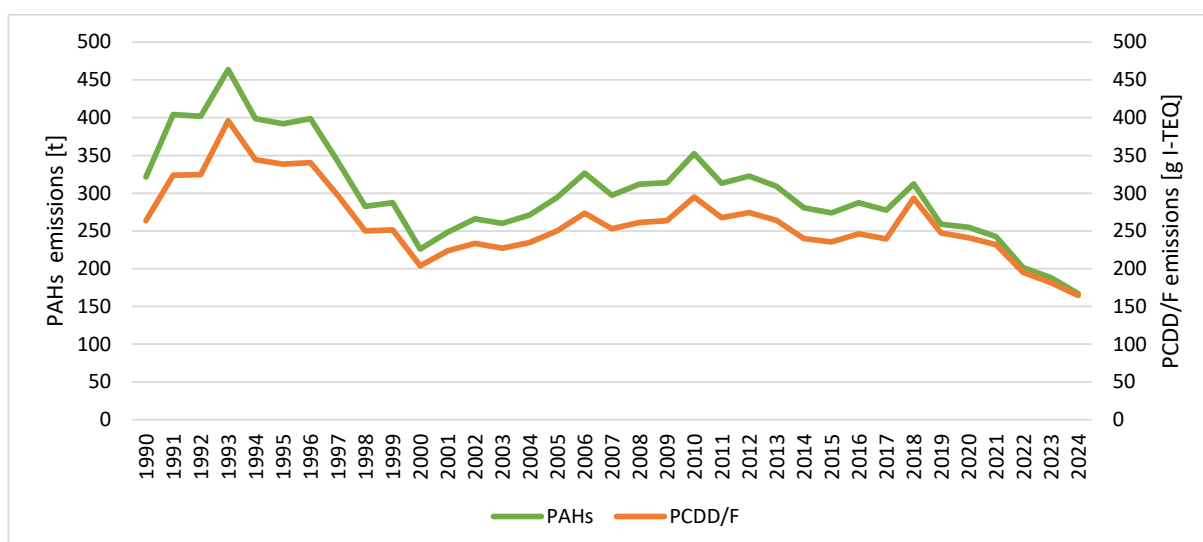


Figure 3.51. PAHs and PCDD/F emissions for 1A4 category in 1990-2024

3.5.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 1A4. *Other sectors* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 1A4 are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 3.9. Results of the uncertainty analysis for NFR sector 1A4

NFR subsector		NO _x	NM ₁₀ VOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP	BC
1A4ai	Commercial/Institutional: Stationary	18.1%	32.1%	26.1%	30.1%	41.0%	40.0%	41.0%	40.0%
1A4bi	Residential: Stationary	20.1%	35.0%	29.1%	43.0%	35.0%	38.0%	39.0%	35.0%
1A4ci	Agriculture/Forestry/Fishing: Stationary	23.1%	34.1%	26.1%	42.0%	35.1%	40.0%	41.0%	35.1%
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	43.0%	86.0%	28.1%	46.0%	91.0%	91.0%	91.0%	91.0%
1A4ciii	Agriculture/Forestry/Fishing: National fishing	37.1%	73.0%	28.1%		73.0%	73.0%	73.0%	73.0%
NFR subsector		CO	Pb	Cd	Hg	PCDD/F	PAHs	HCB	PCBs
1A4ai	Commercial/Institutional: Stationary	37.0%	69.0%	52.0%	64.0%	54.0%	54.0%	54.0%	54.0%
1A4bi	Residential: Stationary	36.0%	66.0%	53.0%	60.0%	76.0%	76.0%	76.0%	76.0%
1A4ci	Agriculture/Forestry/Fishing: Stationary	35.1%	59.0%	55.0%	63.0%	93.0%	93.0%	93.0%	90.0%
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	90.0%		46.0%			91.0%		
1A4ciii	Agriculture/Forestry/Fishing: National fishing	73.0%	60.0%	37.1%	63.0%	100.0%		100.0%	100.0%

3.5.5 Source-specific QA/QC and verification

For detailed information please see Chapter 3.2.5.

3.5.6 Source-specific recalculations

Activity data on fuel consumption for years 1990-2023 was updated due to changes made in Eurostat database both for stationary and mobile sources of emission.

3.5.7 Source-specific planned improvements

For liquid and gaseous fuels combusted in the 1A4 sector, Poland intends to develop CS EFs in the future. The exact timeframe for these works will be determined taking into consideration financial capabilities.

3.6 Other stationary and mobile sources (NFR sector 1A5)

Category 1A5 includes all remaining emissions from fuel combustion that are not specified elsewhere. It includes emissions from fuel delivered to the military in the country and delivered to the military of other countries that are not engaged in multilateral operations.

Poland does not report any emissions under category 1A5. As specific activity data for NFR categories 1A5a and 1A5b is difficult to obtain (especially with respect to potential confidentiality issues) notation key IE is used to indicate that military emissions (mobile and stationary) are included elsewhere as emissions are allocated in 1A4a and 1A3 (aviation and road). All stationary emissions from military are reported in sector 1A4a and all mobile military emissions are reported under 1A3 (aviation and road).

At the time being there was no supportive data that could allow to separate fuels used under 1A5 from 1A3 or 1A4 categories. Nevertheless, if any analyses or information become available the attempt would be made to split those subcategories. The expected change in emissions is minor so this is not the priority task in the inventory work.

3.7 Fugitive emissions (NFR sector 1B)

3.7.1 Source category description

Sector 1B. *Fugitive emissions* includes fugitive emissions from production, processing, transformation, transmission and storage of fossil fuel and venting and flaring operations. This section includes information on methodologies, activity data, emission factors, recalculations and planned improvements for sector 1B. *Fugitive emissions*.

1B. *Fugitive emissions* sector consists of the following main subcategories:

- 1B1. *Fugitive emission from solid fuels*;
- 1B2. *Fugitive emission from oil and natural gas*.

The following subcategories in sector 1B have been identified as key source:

Table 3.10. Key source categories in sector 1B

NFR		Method	EF	Pollutant
1B1a	Coal mining and handling	T1/T2	D	NMVOC, TSP, PM10
1B2b	Solid fuel transformation	T1/T2	D	NMVOC

CS – country specific; D – default

Shares of emissions from the 1B category in the country total for the particular pollutants in 2024 are shown in Figure 3.52. Shares of pollutant emissions from this category are below 12% (most of pollutants do not exceed 3%).

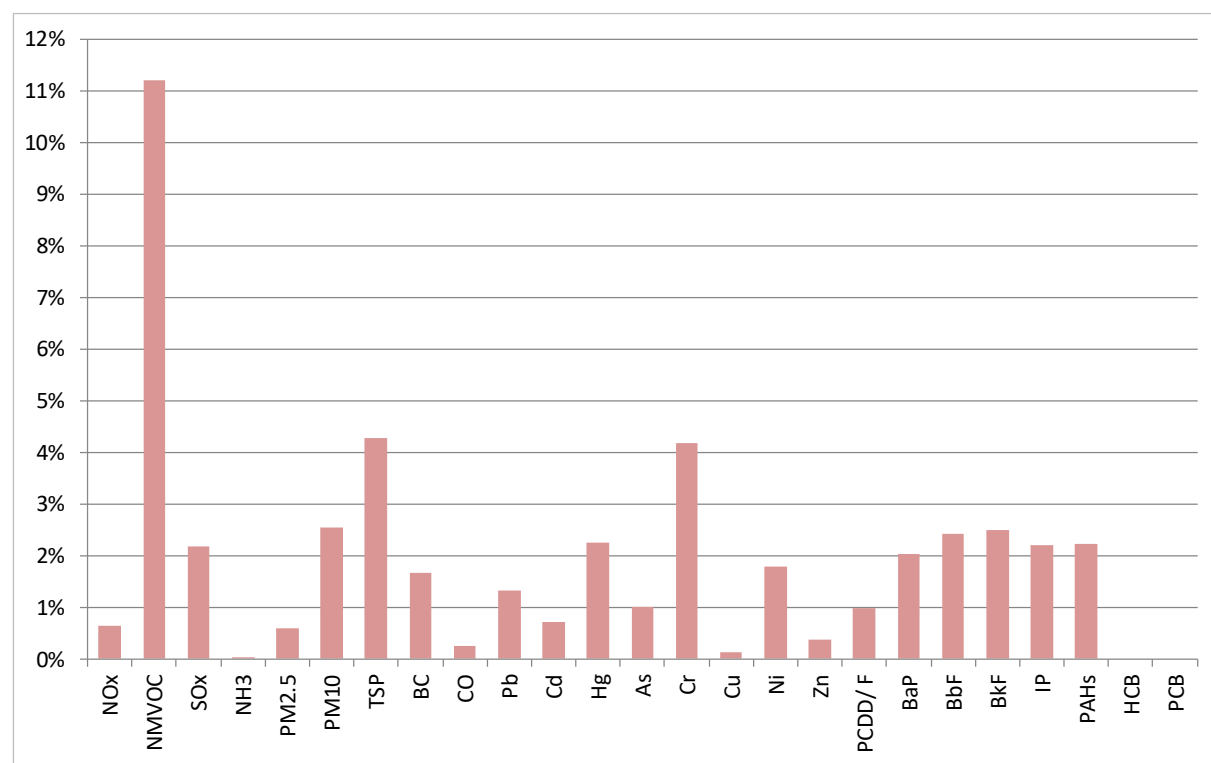


Figure 3.52. Shares of emissions from the 1B category in the country total in 2024

The activity data used for calculation of fugitive emissions from solid fuels category for 1990-2024 derives from Eurostat database following the ERT recommendations. The activity data is consistent with the data presented in the GHG's inventory submission and therefore meets the QA/QC requirements arising from IPCC Guidelines and EMEP/EEA Guidelines in terms of durability and consistency of methodology.

3.7.1.1 Fugitive emission from solid fuels (NFR sector 1B1)

Fugitive emission from solid fuels derives from:

- 1B1a. *Coal mining and handling*

Coal mining and handling (both underground and opencast) results mainly in fugitive emissions of methane, volatile organic compounds and particulate matter that occur during mining and post mining activities as well as coal handling. Moreover fugitive emission from imported coal is included.

- 1B1b. *Solid fuel transformation*

This category includes emissions from coke ovens. The coke oven is a major source of fugitive emissions. In this section emissions of: sulphur oxides (SO₂), nitrogen oxides (NO_x), volatile organic compounds (non-methane volatile organic compounds – NMVOC), carbon monoxide (CO), ammonia (NH₃), particulate matter, heavy metals and polycyclic aromatic hydrocarbons (PAHs) were calculated.

- 1B1c. *Other fugitive emissions from solid fuel*

In this category emission from coke handling was included.

In Poland the large share of emission in 1B category results from coal mining and handling. The annual amounts of extracted hard coal and brown coal are presented in Figure 3.53. The main reason that the coal extraction has been decreasing since late 1980s is the declining demand for hard coal and brown coal in economy.

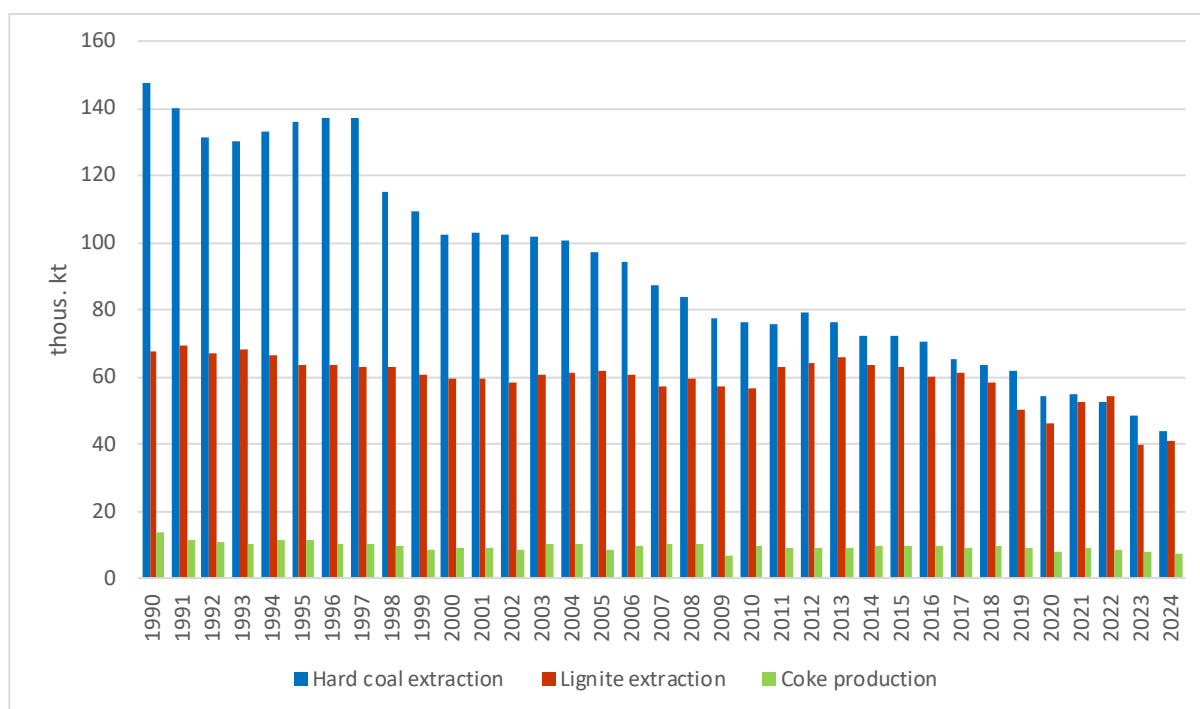


Figure 3.53. Hard coal extraction, brown coal extraction and coke production in 1990-2024

Detailed activity data used in sub-category 1B1. *Fugitive emissions from solid fuels* for the years 1990-2024 are presented in Appendix 5. Applied emission factors are presented in Appendix 6.

3.7.1.2 Fugitive emissions from oil and natural gas (NFR sector 1B2)

This chapter concerns fugitive emissions resulting from the exploration, treatment, loading and distribution of liquid and gaseous fossil fuels.

Fugitive emission from oil and gas includes fugitive emissions from:

- 1B2ai. *Oil exploration, production and loading*
Fugitive emissions derive from exploration, primary treatment and then loading of crude oil for further transport (both from on-shore and off-shore facilities).
- 1B2aiv. *Oil refining/storage*
Fugitive emissions resulting from activities conducted in petroleum refining industry.
- 1B2av. *Transport of oil product*
Fugitive emissions encompass activities conducted at refinery dispatch stations and transportation of fuels to marketing terminals and depots and further to service stations. Due to vapour pressure, at this stage the transport of gasoline is the main source of emissions.
- 1B2b. *Gas exploration, production, loading, treatment and distribution*
This category includes fugitive emissions from gas exploration, treatment, loading and distribution. Fugitive emissions from coke oven gas system were also included. Emission from gas production includes the emissions from on-shore as well as off-shore activities.
- 1B2c. *Venting and flaring*
For this category pollutant emissions from flaring in oil refineries were estimated based on throughput as activity data.

Detailed activity data used in sub-categories 1B1 and 1B2 for the years 1990-2023 are presented in Appendix 5. Applied emission factors are presented in Appendix 6.

3.7.2 Methodological issues

3.7.2.1 Fugitive emission from solid fuels (NFR sector 1B1)

- 1B1a. Coal mining and handling

The extraction and treatment of coal result mainly in emissions of methane. However, also non-methane volatile organic compounds (NMVOC) and particulate matter are emitted.

Tier 1/Tier 2 method has been used for calculation of fugitive emissions from this category.

Activity data (coal production) used for calculation of fugitive emissions of NMVOC, TSP, PM10 and PM2.5 from underground and open cast mining was taken from Eurostat database. The activity data is consistent with the data presented in the GHG's inventory submission.

Particulate emissions from coal storage and handling have been estimated based on hard coal production, imported hard coal and imported brown coal. The humidity of brown coal is approximately 50% and it is excavated as a muddy substance. Then it is loaded on a conveyor (maximum 20 km) and transported directly to a power plant. Brown coal in Poland is neither handled for a very long period of time nor transported over longer distances. Considering humidity, PM2.5 emission from a conveyor transport of brown coal is negligible.

Emission factors used for estimation of emissions derive from EIG 2023 (Appendix 6).

– 1B1b. Solid fuel transformation

Fugitive emissions from this category are calculated based on Tier 1 methodology and with a „top-down“ approach by multiplying process specific activity data with the corresponding default emission factors from EIG 2023.

Activity data (coke production) was sourced from Eurostat database and is consistent with the GHG's inventory submission.

– 1B1c. Coke handling

Fugitive emissions resulting from coke handling are included in this category. Activity data (coke production) was sourced from Eurostat database. Emission factors were applied according to CEPMEIP database.

3.7.2.2 Fugitive emissions from oil and natural gas (NFR sector 1B2)

– 1B2a. Oil - Exploration, production, transport of oil product

This sector contains fugitive emissions from the exploration, treatment, loading and also distribution of liquid fossil fuels.

- *1B2ai. Fugitive emissions from oil: Exploration, production, transport*

Fugitive emissions from crude oil extraction and production are calculated according to Tier 2 EMEP/EEA methodology. Activity data (crude oil production) was divided into on-shore and off-shore production. Emission factors have been taken from EIG 2023.

Fugitive emissions from liquid fuel distribution include emissions from marine terminals and other handling and storage. To estimate emissions from distribution of oil products *Tier 1* method has been used. Activity data (total import of oil and its annual consumption) was taken from the Polish Energy Statistics, whereas emission factors were applied according to EIG 2023.

- *1B2aiv. Refining and storage*

Tier 1 method has been used for calculation of fugitive emissions from refining and storage. Activity data (crude oil input to refinery) was taken from Eurostat database and emission factors have been taken from EIG 2023. The exception are NO_x and SO₂ for which emissions have been sourced from the National Emission Database (the Database has been collecting data since 2010). Prior to 2010 proxy data has been used (refinery crude oil throughput). Emission factors for NO_x (0.035 kg/t crude oil input) and SO₂ (0.245 kg/t crude oil input) were sourced from EIG 2023.

The most significant decrease was noted in NO_x and SO₂ emissions. It has resulted from the improvement of technical parameters of the plants to meet more stringent standards of the 2010/75/UE Directive (IED).

- *1B2av. Distribution of oil products*

This sub-category encompasses NMVOC emissions from refinery dispatch stations and transportation of oil to marketing terminals and depots and further to service stations. To estimate NMVOC emissions from distribution of oil products *Tier 1* method has been used. Activity data (total annual consumption of gasoline and motor and aviation gasoline) was taken from Polish Energy Statistic and emission factors were implemented based on EIG 2023. The Tier 1 emission factor is significantly dependent on the implementation of Stage I and Stage II. Therefore emission factors were prepared based on information about the

implementation process in Poland for Stage I and Stage II. Until the implementation of Directive 94/63/EC (EU, 1994), the indicator was 4.5 kg/Mg of gasoline handled, and there was no vapour recovery. From 1994, Stage I was gradually introduced, and by 2005, it was already at 100%. Stage II was implemented in Poland in 2006, reaching 99% in 2018. Reductions were based on Polish regulations and expert judgment. The emission factor was 0.7 kg/Mg of gasoline handled in 2024.

– **1B2b. Emissions from natural gas**

This sector deals with the fugitive emissions from the exploration, treatment, loading as well as distribution of gas fossil fuels.

Tier 2 method has been used for calculation of fugitive emissions. Activity data (natural gas extraction) was taken from Eurostat database and emission factors have been taken from EIG 2023. Activity data (natural gas production) was divided into on-shore and off-shore production.

This category also includes fugitive emissions from gas distribution networks. Activity data (gas consumption) was sourced from Polish Energy Statistic. Activity data used for calculation of fugitive emissions from coke oven gas system was taken from Eurostat database. This activity data is consistent with the GHG's inventory submission. Emission factors come from Polish publication (IETU).

– **1B2c. Venting and flaring**

Tier 1 method has been used for calculation of fugitive emissions from this category. Activity data (refinery feed) used for calculations was taken from Eurostat database and is consistent with the GHG's inventory submission. Emission factors for all pollutants have been taken from EIG 2023.

3.7.3 Emission trends for NFR sector 1B

Trends of pollutant emissions for 1B sector are shown in the figures below (Figure 3.54 - Figure 3.59). SO₂ and NO_x emissions from 2010 comes directly from National Database. The decrease in emissions of most pollutants in 2009 is related to the lower production of coke.

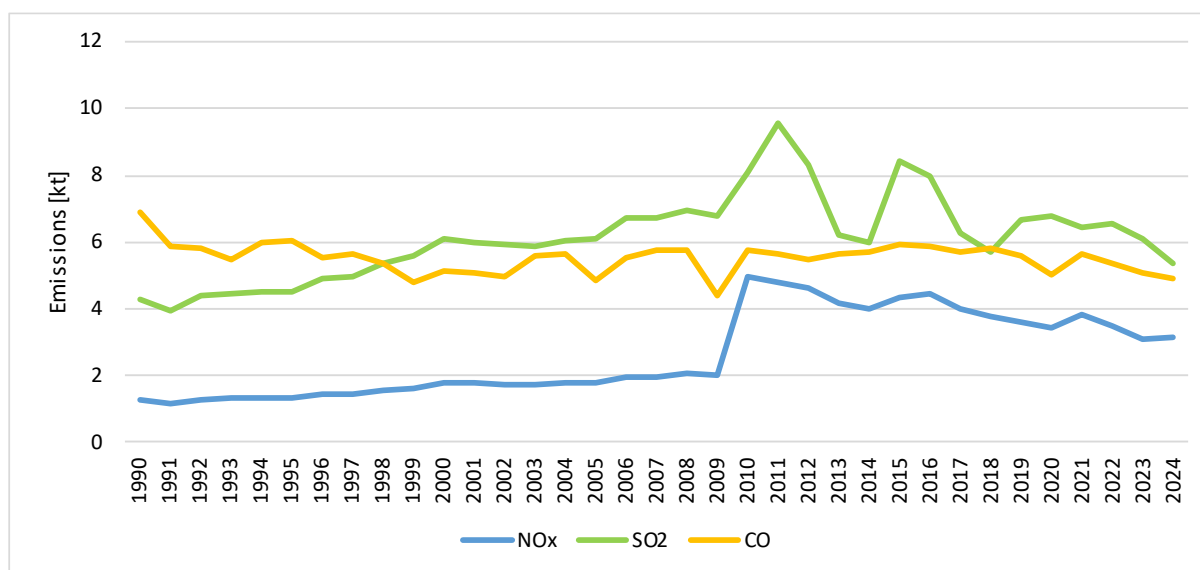


Figure 3.54. NO_x, SO₂ and CO emissions for 1B category in 1990-2024

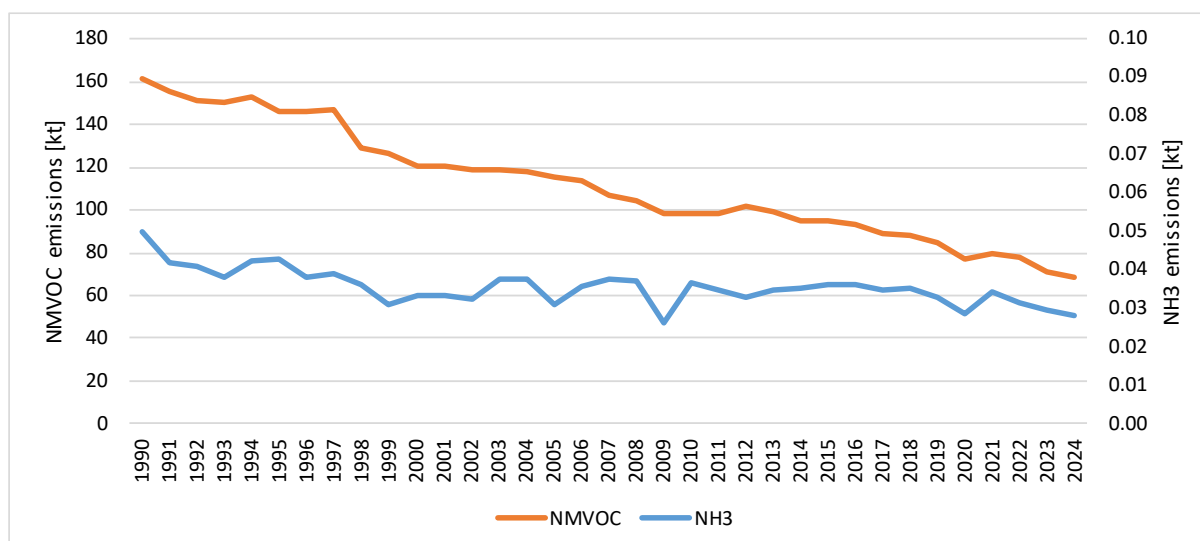
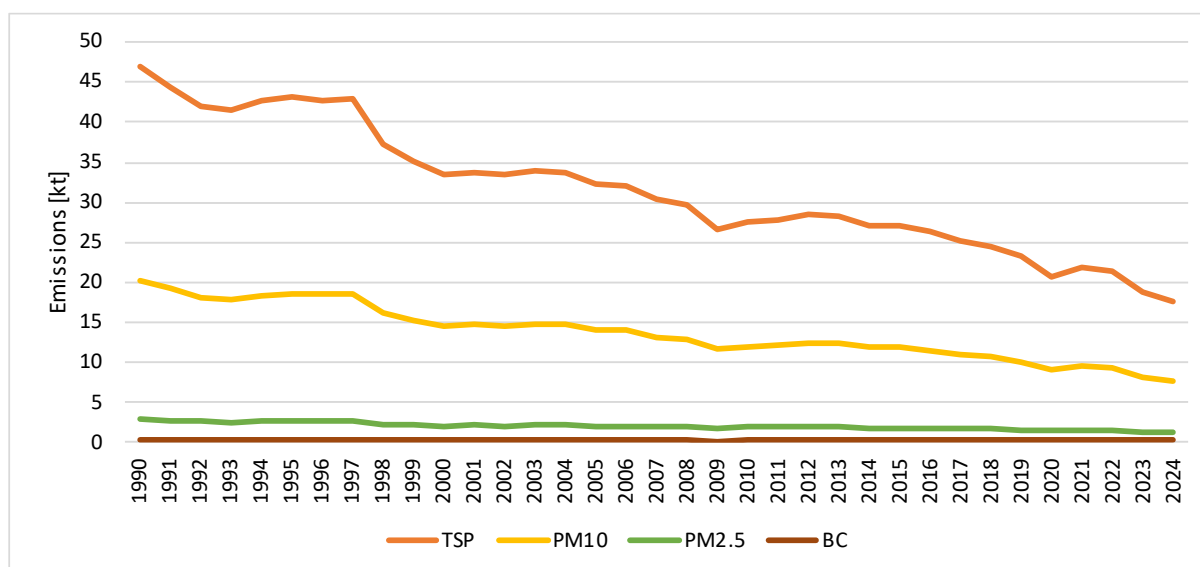

 Figure 3.55. NMVOC and NH₃ emissions for 1B category in 1990-2024


Figure 3.56. Particulates emissions for 1B category in 1990-2024

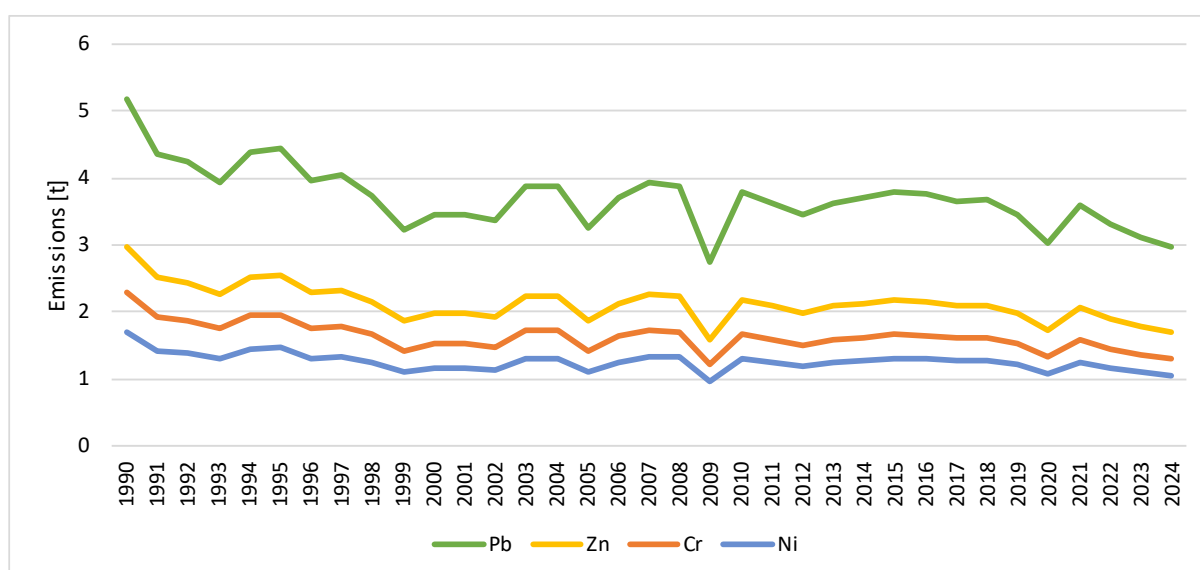


Figure 3.57. Pb, Zn, Cr and Ni emissions for 1B category in 1990-2024



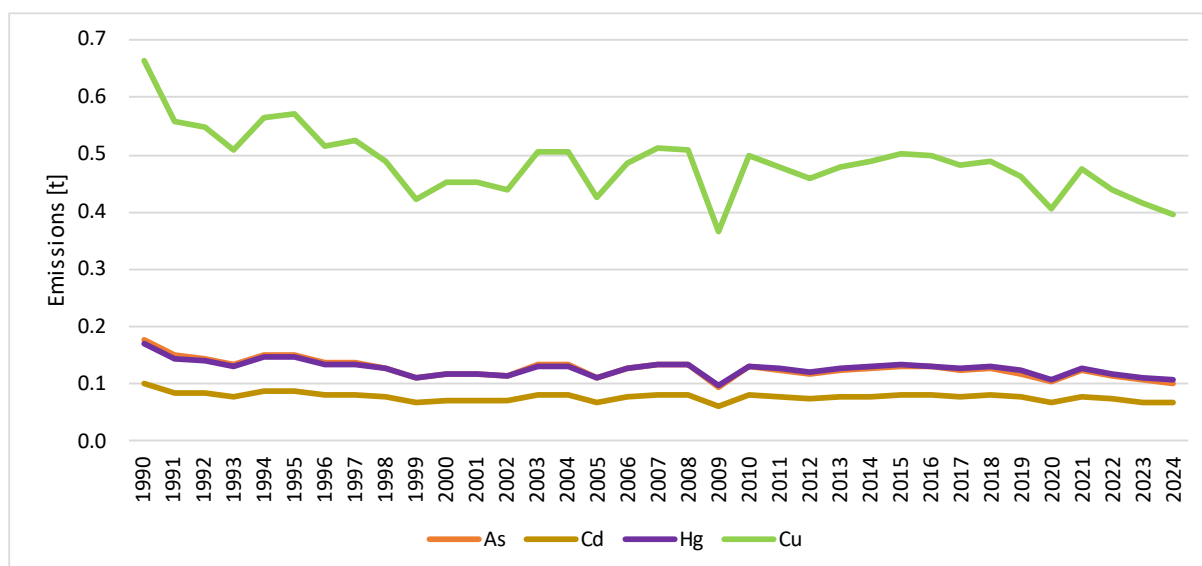


Figure 3.58. As, Cd, Hg and Cu emissions for 1B category in 1990-2024

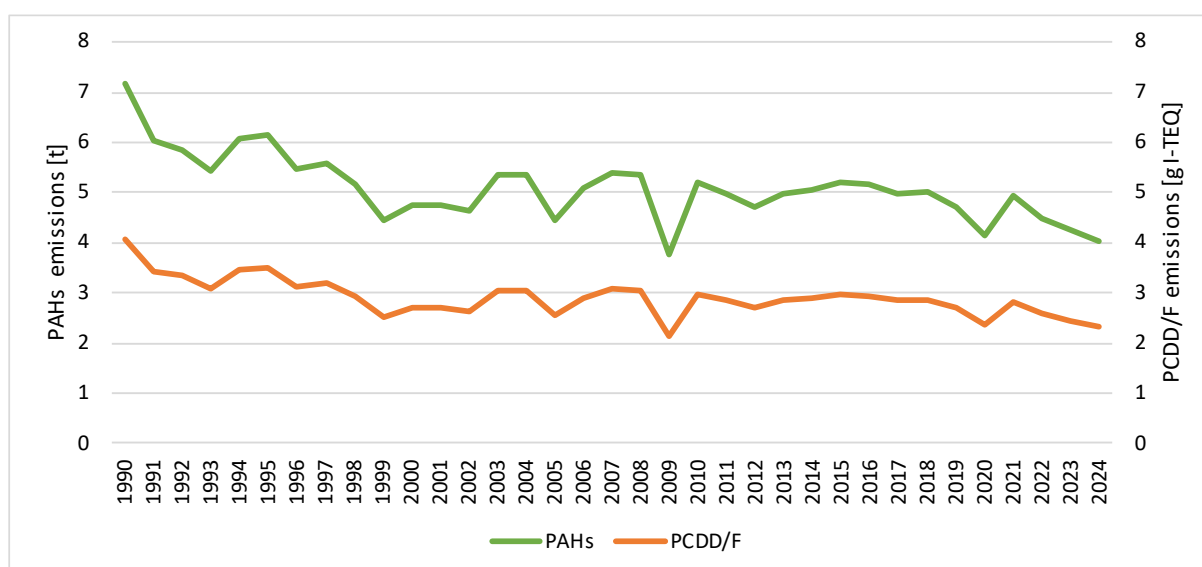


Figure 3.59. PCDD/F and PAH emissions for 1B category in 1990-2024

3.7.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 1B. *Fugitive emissions* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 1B are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 3.11. Results of the emission uncertainty analysis for NFR sector 1B

NFR subsector		NO _x	NMVOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP
1B1a	Fugitive emission from solid fuels: Coal mining and handling		50.0%			27.1%	27.1%	27.1%
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	30.1%	50.0%	70%	50%	50%	50%	50%
1B1c	Other fugitive emissions from solid fuels					50%	50%	50%
1B2ai	Fugitive emissions oil: Exploration, production, transport		50.0%					
1B2aiv	Fugitive emissions oil: Refining and storage	30.1%	39.1%	70%		98%	68%	82%
1B2av	Distribution of oil products		38.1%					
1B2b	Fugitive emissions from natural gas		32.1%					
1B2c	Venting and flaring (oil, gas, combined oil and gas)	80.0%	74.0%	49%				
NFR subsector		BC	CO	Pb	Cd	Hg	PCDD/F	PAHs
1B1a	Fugitive emission from solid fuels: Coal mining and handling							
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	50%	50%	70%	70%	70%	100%	100%
1B1c	Other fugitive emissions from solid fuels							
1B2ai	Fugitive emissions oil: Exploration, production, transport							
1B2aiv	Fugitive emissions oil: Refining and storage		54%	93%	84%	87%	102%	
1B2av	Distribution of oil products							
1B2b	Fugitive emissions from natural gas							
1B2c	Venting and flaring (oil, gas, combined oil and gas)		81%					

3.7.5 Source-specific QA/QC and verification

Activity data used in the inventory concerning sector 1B is derived from:

- Eurostat database which is provided with data by the Statistics Poland (GUS),
- Polish Geological Institute – National Research Institute (PIG-PIB).

GUS and PIG-PIB are responsible for QA/QC of collected and published data. Activity data applied in inventory is regularly checked and updated if necessary according to adjustments made in Eurostat database. These data therefore meets the requirements of data quality (QA/QC) arising from EIG 2023 in terms of durability and consistency of methodology. It shall be noted that the same set of data is used for calculations of GHG emissions.

Statistical quality checking related to the assessment of emission, activity data and trends has been performed. For further details please see Chapter 3.2.5.

3.7.6 Source-specific recalculations

No recalculations of emission estimates occurred.

3.7.7 Source-specific planned improvements

No specific improvements are planned in this sector.

4 INDUSTRIAL PROCESSES AND PRODUCT USE (NFR SECTOR 2)

4.1 Source category description

The pollutant emission sources in the *Industrial processes and Product Use* (IPPU) sector involve:

- 2A. Mineral Products
- 2B. Chemical Industry
- 2C. Metal Production
- 2D. Other solvent and product use
- 2G. Use of tobacco and fireworks
- 2H. Other industry production
- 2I. Wood processing

The IPPU sector is a considerable source of NMVOCs and HMs. The NMVOC emissions are driven by the use of solvents for various purposes, and the HM emissions are caused by processes in metal industries. Shares of emissions from the NFR 2 category in the country total for the particular pollutants in 2024 are shown in Figure 4.1.

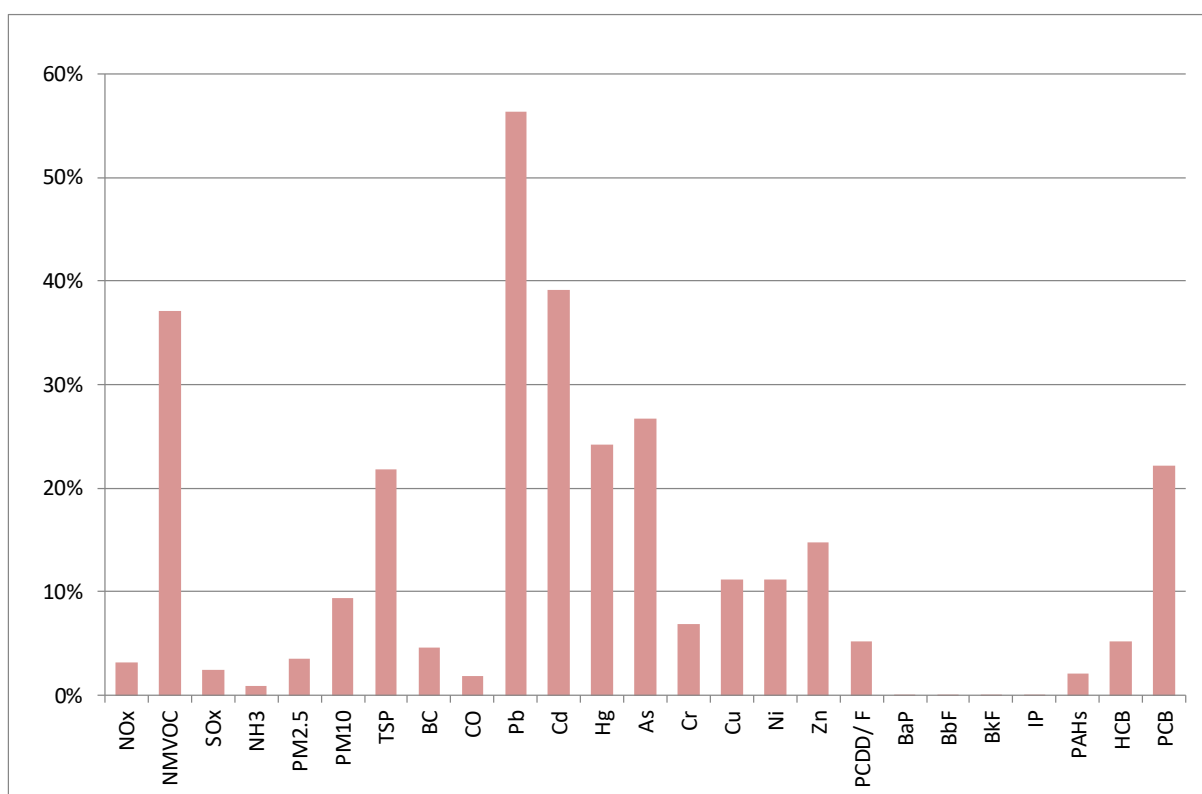


Figure 4.1. Shares of emissions from the NFR 2 category in the country total in 2024

4.2 Mineral Products (NFR sector 2A)

4.2.1 Source category description

The pollutant emission sources related to production processes in mineral industry cover: PM, BC, HMs and PCDD/F. Estimation of emissions in 2A. *Mineral products* was carried out for sub-categories listed below:

- 2A1. *Cement production,*
- 2A2. *Lime (calx), gypsum production,*
- 2A3. *Production of glass (incl. flat glass, container glass, glass fiber and lead crystal glass)*
- 2A5a. *Quarrying of minerals (other than coal) and ores (copper and zinc-lead),*
- 2A5b. *Construction and demolition (incl. apartments construction, non-residential construction, road construction).*

The key categories from NFR 2A are specified in Table 4.1.

Table 4.1. Key categories from NFR 2A

NFR		Method	EF	Pollutant
2A5a	Quarrying and mining of minerals other than coal	T2	D	TSP, PM10
	Quarrying and mining of copper and zinc-lead ores	T1		
2A5b	Construction and demolition	T1	D	TSP, PM10

D – default

According to the recommendation resulting from the 2019 NECD Comprehensive Review of Polish inventory, the emission associated with the transport of cement was reallocated from category 2L to category 2A1.

Shares of emissions from the NFR 2A category in the country total for the particular pollutants in 2024 are shown in Figure 4.2. Shares of pollutant emissions from this category are below 13% (most of the pollutants do not exceed 4%).

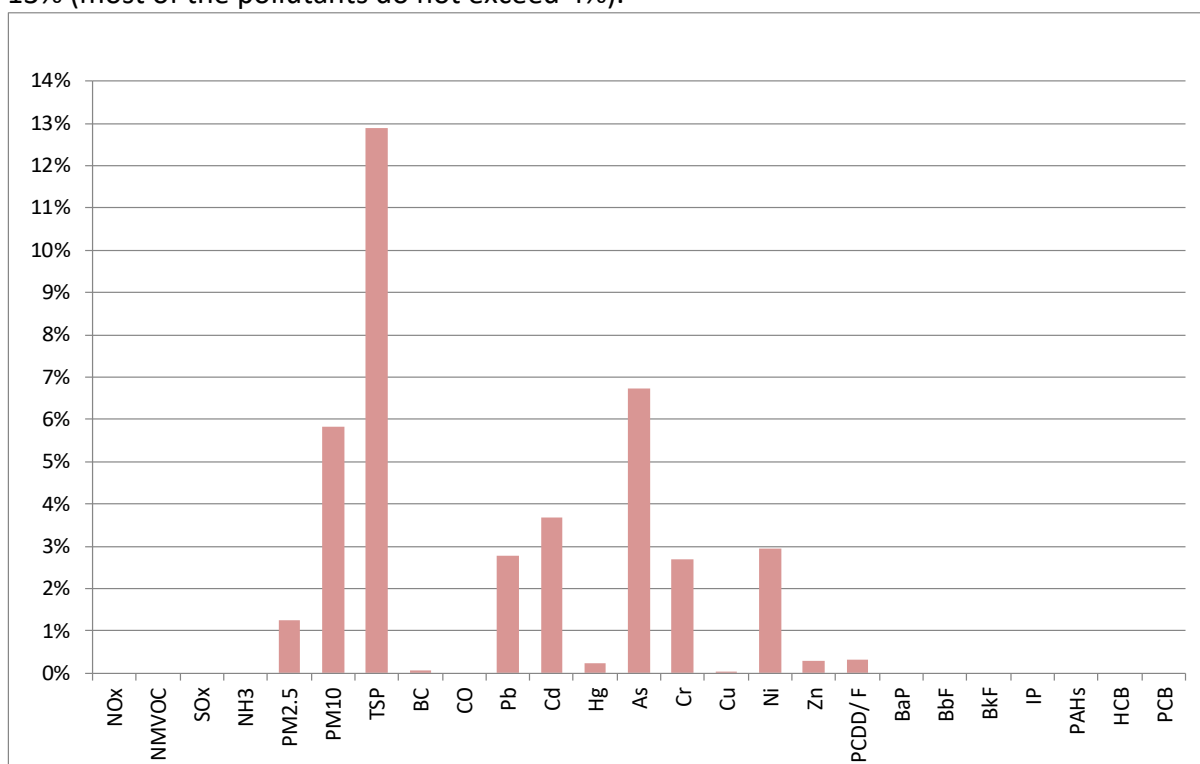


Figure 4.2. Shares of emissions from the NFR 2A category in the country total in 2024

4.2.2 Methodological issues

Emission calculations for all subsectors of 2A category (except 2A1 – cement production, 2A5a – quarrying and mining of minerals other than coal and 2A5b – construction and demolition) were based on the following equation from the EMEP/EEA Guidebook 2023:

$$E = \sum (AR_{\text{production}} * EF_{\text{pollutant}})$$

Where:

E – the emission of the specified pollutant

AR – the activity rate for the production

EF – the emission factor for the pollutant

Emissions from three subsectors of 2A category (cement, lime and glass production) are often a combination of combustion and process emissions. If it was not possible to separate the process and combustion emissions, it was decided to include these pollutants in the combustion sector 1A2. This mainly concerns emissions of the main pollutants - NO_x, SO₂, CO and NMVOC.

For category 2A1. *Cement production*, aggregated TSP emission data from reports submitted by cement plants to the National Emission Database are directly included in the inventory, without the use of emission factors. The TSP emission reported by cement plants relate to clinker and cement production facilities. PM₁₀ and PM_{2.5} emissions have been calculated as a share of the TSP emission in proportion as the share of the emission factors for these pollutants from the EMEP/EEA inventory guidebook (EF PM₁₀/EF TSP and EF PM_{2.5}/EF TSP). The BC emission is calculated using the EMEP/EEA 2023 emission factor.

In accordance with the recommendation of the review [PL-2A5a-2023-0001], the methodology for the calculation of particulate matter emissions from category 2A5a (quarrying and mining of minerals other than coal) was updated based on the EMEP/EEA 2023 Tier 2 calculation model.

The quarrying and mining of minerals other than coal constitute a relevant source of particulate matter emissions (TSP, PM₁₀ and PM_{2.5}). These minerals are divided into the following major categories:

- Crushed Rock,
- Sand and Gravel,
- Recycled aggregates.

Poland continues with the approach of the last submission. The country has been divided into 16 regions (Poland's 16 voivodships) and the activity data required for the Tier 2 model has been prepared for each region.

In its last submission, Poland reviewed the number of quarries operating in the country since 1990 that allowed to identify the updated production of crushed rock, sand and gravel and the updated number and size of quarries. Poland has also obtained detailed meteorological data since 1990.

The activity data are taken from the Polish Geological Institute and the meteorological data are taken from the Institute of Meteorology and Water Management. Data from recycled aggregates have not been included due to lack of data.

In addition to the quarrying of crushed rock, sand and gravel, there are also copper ore and

zinc-lead ore mines in Poland. Due to the lack of a Tier 2 methodology for this activity, Poland estimates the emissions from the mining of copper ore and zinc-lead ores according to Tier 1 approach for category 2A5a. The Polish activity data used to calculate the Tier 1 emissions comes from GUS statistical yearbooks - Production of industrial products.

The total emissions of the pollutants reported under the category *2A5a Quarrying and mining of minerals other than coal* are the sum of:

- the emissions from the quarrying of crushed rock, sand & gravel (Tier 2 approach),
- and the emissions from the mining of copper ore and zinc-lead ore (Tier 1 approach).

Calculation of particulate matter emission from subcategory *2A5b. Construction and demolition* was based on the following equation from the EMEP/EEA Guidebook 2023:

$$E = A_{\text{affected}} * EF * d * (1 - CE) * \frac{24}{PE} * \frac{s}{9\%}$$

Where:

A_{affected} – affected area, calculated as the number of structures built (apartments, non-residential and roads) multiplied by the corresponding conversion factor, [m²]

EF – emission factor, [kg/m²]

d – duration of construction, [year]

CE – efficiency of emission control measures, [-]

PE – Thornthwaite precipitation-evaporation index, [-]

s – soil silt content [%]

The values of the parameters used in the calculations are shown in the table below.

Table 4.2. Parameters used to calculate emission from subcategory 2A5b

Type of construction	Footprint area (m ²)	Duration of construction (d)	Control efficiency of applied emission reduction measures (CE)	Thornthwaite precipitation evaporation index (PE)	Soil silt content (s)
Apartment construction	65	0.75 (9 months)	0	120	20%
Non-residential construction	800	0.83 (10 months)	0.5		
Road construction	36000	1 (12 months)	0.5		

Activity data for sector 2A5b comes from GUS statistical yearbooks, General Office of Building Control (GUNB) and General Directorate for National Roads and Motorways (GDDKiA).

Activity data for sector 2A. *Mineral Products* are given in Appendix 5 to the IIR.

Applied emission factors for subcategory 2A are presented in Appendix 6 to the IIR. Information on whether the emission factors used for PM₁₀ and PM_{2.5} include or exclude the condensable component is given in Appendix 9.



4.2.3 Emission trends for NFR sector 2A

The trend of pollutant emissions for *Mineral Products* is shown below in Figure 4.3 – Figure 4.6. The largest impact on the PM emissions trend has the subcategory 2A5b, especially road construction. The fluctuations in the trend of PM emissions are related to the changes in the length of newly built roads.

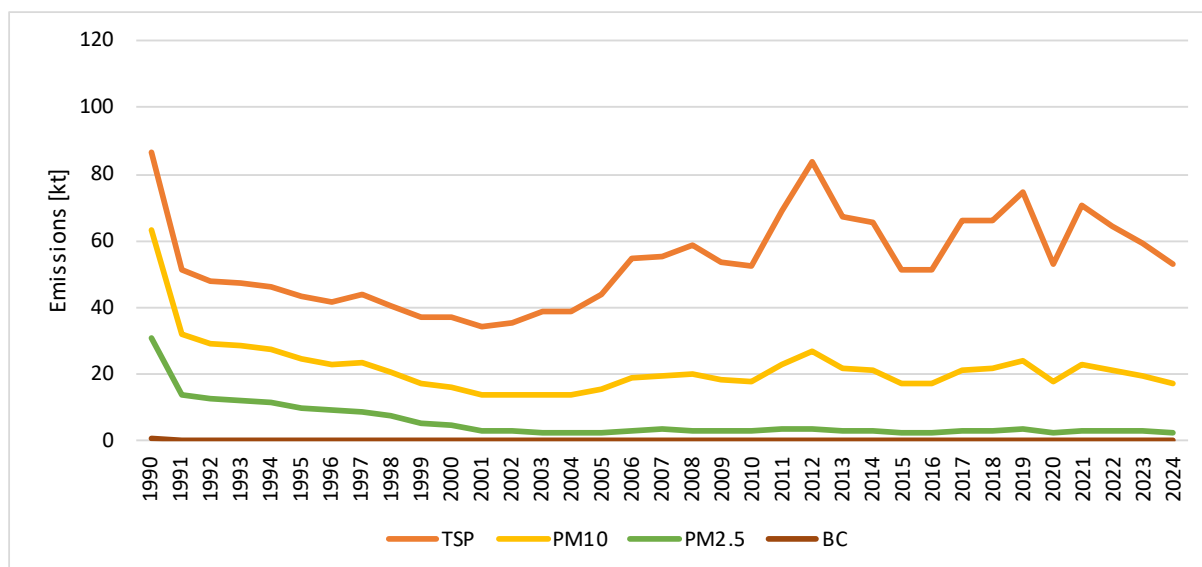


Figure 4.3. Particulates and black carbon (BC) emissions for 2A category in 1990-2024

Significant increase in Pb, Cr and As emissions in 2015, 2020 and 2023 is the result of increased production of container glass. Significant decrease in Ni emissions in 2015 is the result of decreased production of flat glass.

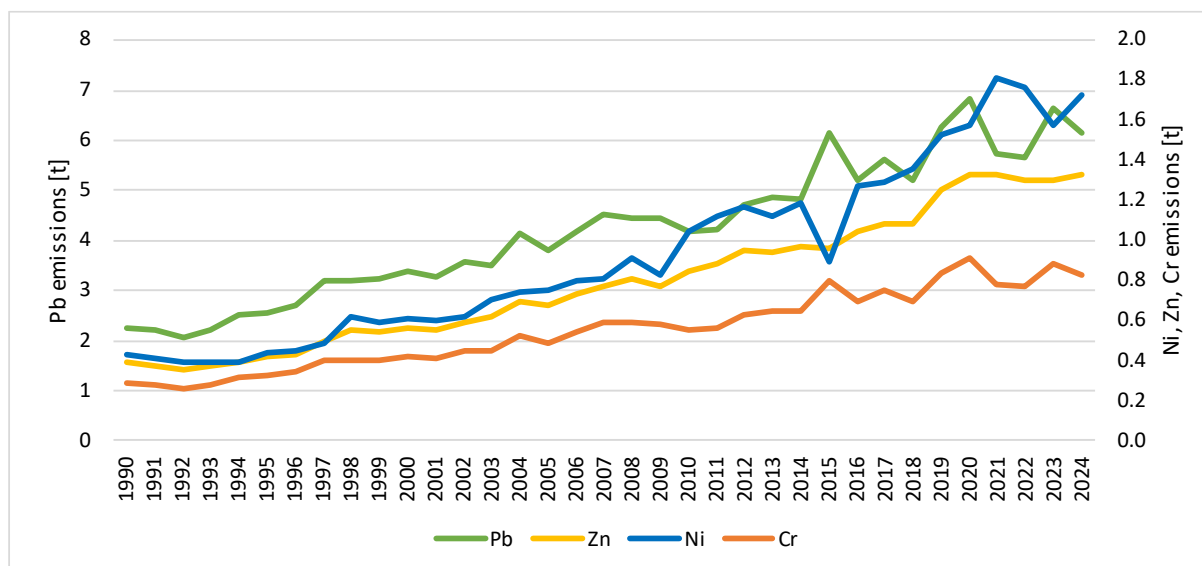


Figure 4.4. Pb, Zn, Ni and Cr emissions for 2A category in 1990-2024

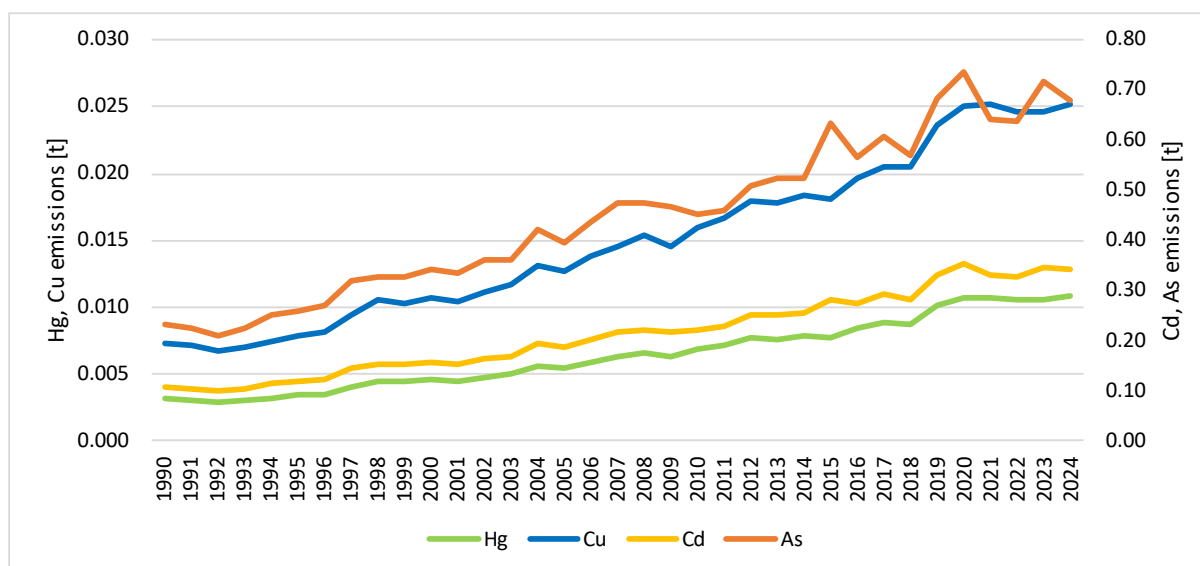


Figure 4.5. Hg, Cu, Cd and As emissions for 2A category in 1990-2024

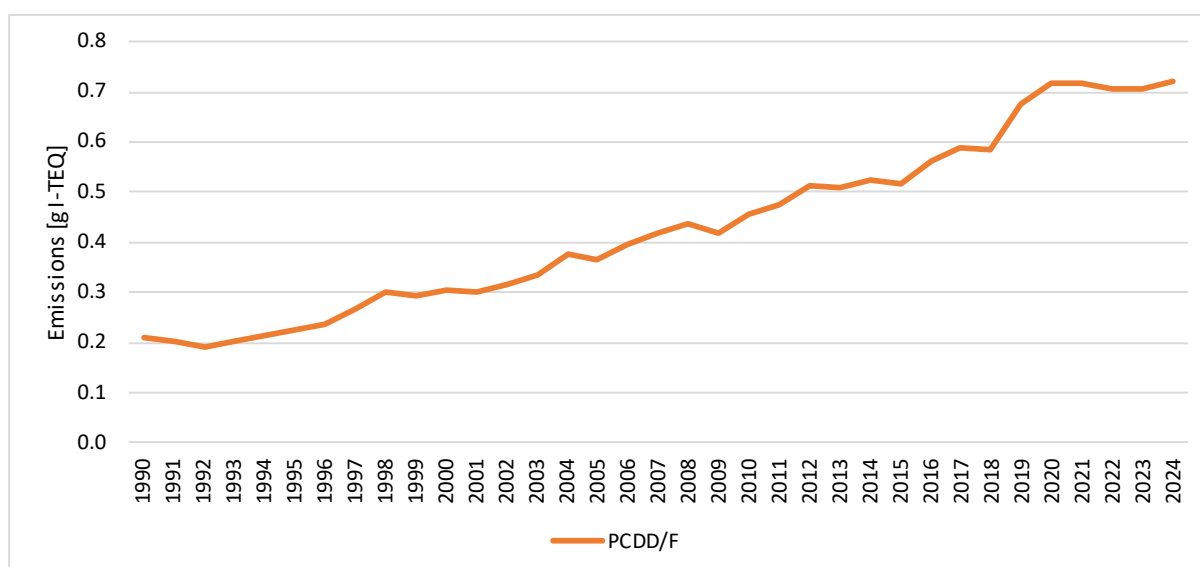


Figure 4.6. PCDD/F emissions for 2A category in 1990-2024

4.2.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 2A. *Mineral products* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 2A are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 4.3. Results of the emission uncertainty analysis for NFR 2A

NFR subsector		PM2.5	PM10	TSP	BC	Pb	Cd	Hg	PCDD/F
2A1	Cement production	40%	40%	25.1%	50%				
2A2	Lime production	50%	50%	50.0%	60%				
2A3	Glass production	50%	50%	50.0%	60%	70%	70%	70%	73%
2A5a	Quarrying and mining of minerals other than coal	50%	50%	50.0%					
2A5b	Construction and demolition	100%	100%	100%					

4.2.5 Source-specific QA/QC and verification

For detailed information please see Chapter 3.2.5.

4.2.6 Source-specific recalculations

The following change was made in sector 2A:

- the activity data and emissions for the subcategory 2A3 have been updated in 2023 due to a change in glass fibre production data in the national statistics.

4.2.7 Source-specific planned improvements

As there are no guidelines available for category 2A6. *Other mineral products*, emission estimates can be done only after major methodological work including:

- 1) identification of emission sources,
- 2) identification which phases of the production processes may cause emission and of which pollutants,
- 3) checking, whether the emission is or not included in EFs for another category,
- 4) checking national emission database (NED) on the emissions reported by industrial plants if there is any process emission reported (separately from the combustion),
- 5) working out EFs for every process, where needed.

In accordance with TERT recommendations, the possibilities of obtaining activity data and emission factors for this category are being investigated.

Poland makes effort to separate the production of glass wool to improve methodology for sector 2A3.

4.3 Chemical Industry (NFR sector 2B)

4.3.1 Source category description

The pollutant emission sources related to production processes in mineral industry cover: NO_x, SO₂, NMVOC, NH₃, CO, PM, BC, Cd. Estimations of emissions in 2B. *Chemical Industry* are carried out in sub-categories listed below:

- 2B1. Ammonia production,
- 2B2. Nitric acid production,
- 2B3. Adipic acid production (production is not occurring since 1995),
- 2B4. Calcium carbide production (production is not occurring since 2008),
- 2B6. Titanium dioxide production,
- 2B7. Soda Ash Production and Use,
- 2B10a. Chemical industry: Other including production of sulphuric acid, fertilizers (NPK – nitric, phosphate, potassium, ammonium sulphate, ammonium nitrate, urea), carbon black, ethylene, propylene, polyethylene, polyvinylchloride, polypropylene, polystyrene, formaldehyde, and chlorine production (mercury cell technology of production is not occurring since 2009),
- 2B10b. Storage, handling and transport of chemical products (emissions in this category are reported in the other categories of the 2B sector).

There are no key categories from the NFR sector 2B.

Shares of emissions from the NFR 2B category in the country total for the particular pollutants in 2024 are shown in Figure 4.7. Shares of pollutant emissions from this category are below 2.5% (most of the pollutants do not exceed 1.5%).

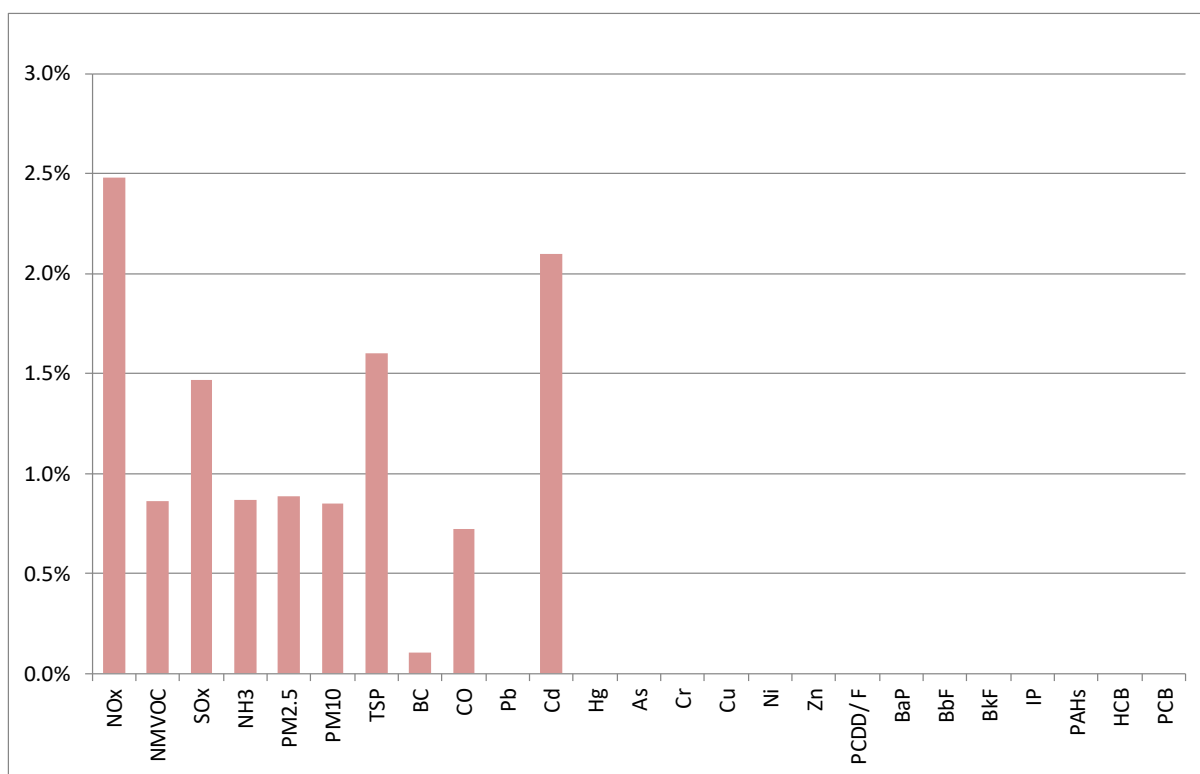


Figure 4.7. Shares of emissions from the 2B category in the country total in 2024

4.3.2 Methodological issues

The emission calculations for all subsectors of 2B category were based on the following equation from the EMEP/EEA Guidebook 2023:

$$E = \sum (AR_{\text{production}} * EF_{\text{pollutant}})$$

where:

E – the emission of the specified pollutant

AR – the activity rate for the production

EF – the emission factor for the pollutant

Activity data for this sector comes from GUS statistical yearbooks - Production of industrial products. The activity data used in sub-category 2B. *Chemical Industry* for the years 1990-2023 is presented in Appendix 5.

The chemical industry consists of a large number of different processes in which fuels are used for energy purposes but also as chemical feedstock. This means that the categorisation of emissions in combustion and non-combustion is not always simple. Such split is difficult to obtain, so emissions from production processes are reported under the present source category (2B) and emissions from combustion are reported in the industrial combustion source category 1A2c.

To estimate emissions domestic and default emission factors are used. Applied emission factors for subcategory 2B are presented in Appendix 6 to the report.

The emission factor for Polyethylene was calculated using default factors for Polyethylene LDPE and Polyethylene HDPE, using the information provided by the Polish Chamber of Chemical Industry (PIPC) – polyethylene is produced in proportion LDPE:HDPE = 1:2.7. Then the summary emission factor is equal to:

$$EF = \frac{1}{3.7} * (EF_{LDPE} + 2.7 * EF_{HDPE})$$

where:

EF – calculated emission factor for the pollutant

EF_{LDPE} – default emission factor for Polyethylene Low Density

EF_{HDPE} – default emission factor for Polyethylene High Density

Information on whether the emission factors used for PM10 and PM2.5 include or exclude the condensable component is given in Appendix 9.

4.3.3 Emission trends for NFR sector 2B

Trends of pollutant emissions for *Chemical Industry* are shown in the figures below (Figure 4.8 - Figure 4.11).

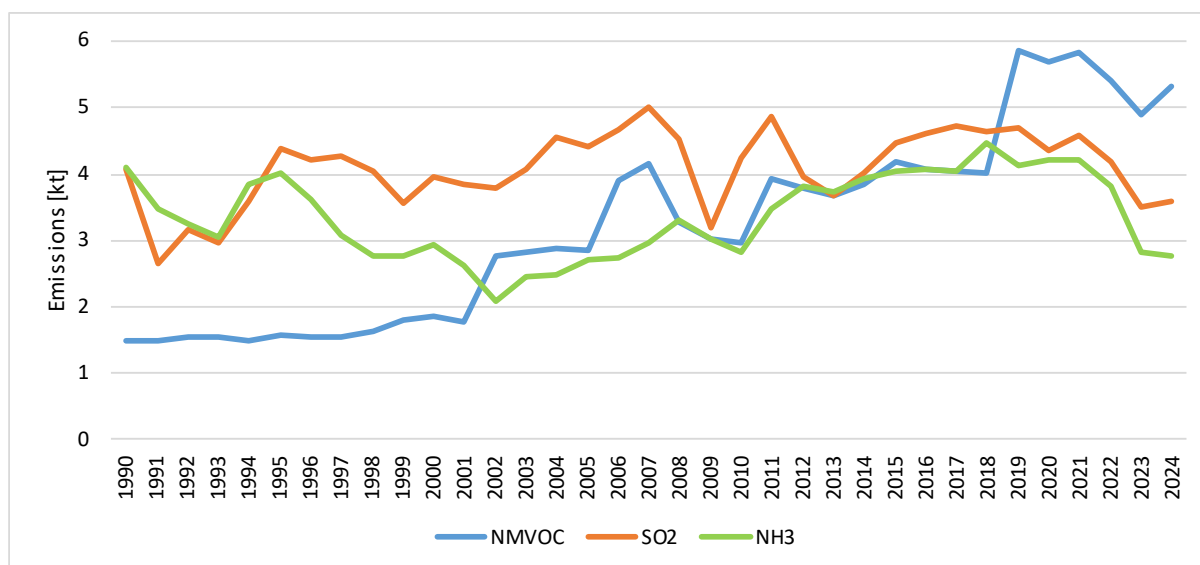


Figure 4.8. SO₂, NMVOC and NH₃ emissions for 2B category in 1990-2024

The decrease in SO₂ emissions in 2009 is the result of lower production of chemical products (black carbon, sulphuric acid and titanium white). Increase in NMVOC emissions in 2019 is the result of increased production of formaldehyde.

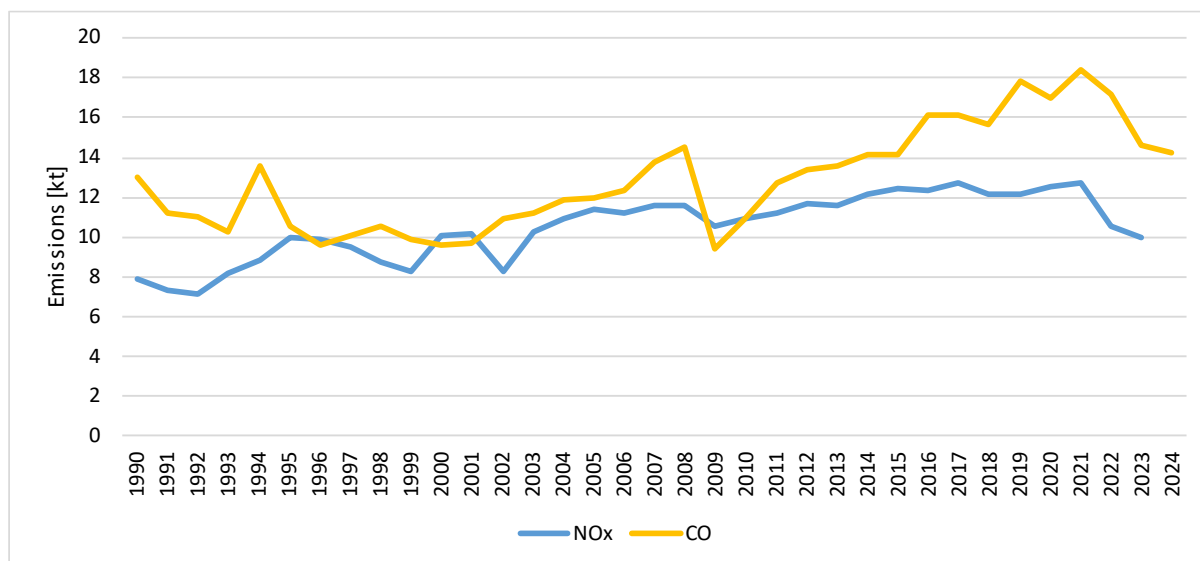


Figure 4.9. NO_x and CO emissions for 2B category in 1990-2024

The decrease in CO emissions in 2009 is the result of lower soda ash production, which increased again in subsequent years. The observed decrease in emissions of all pollutants in 2022, 2023 and 2024 is due to lower production, mainly of soda ash, urea, formaldehyde, titanium dioxide, carbon black and sulphuric acid.

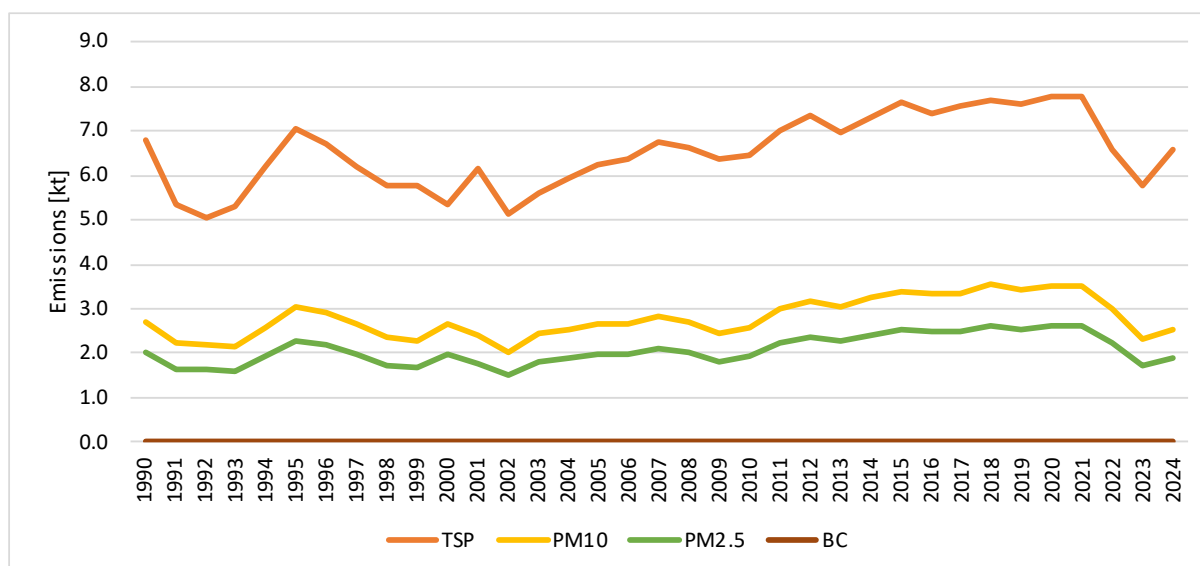


Figure 4.10. Particulates and black carbon emissions for 2B category in 1990-2024

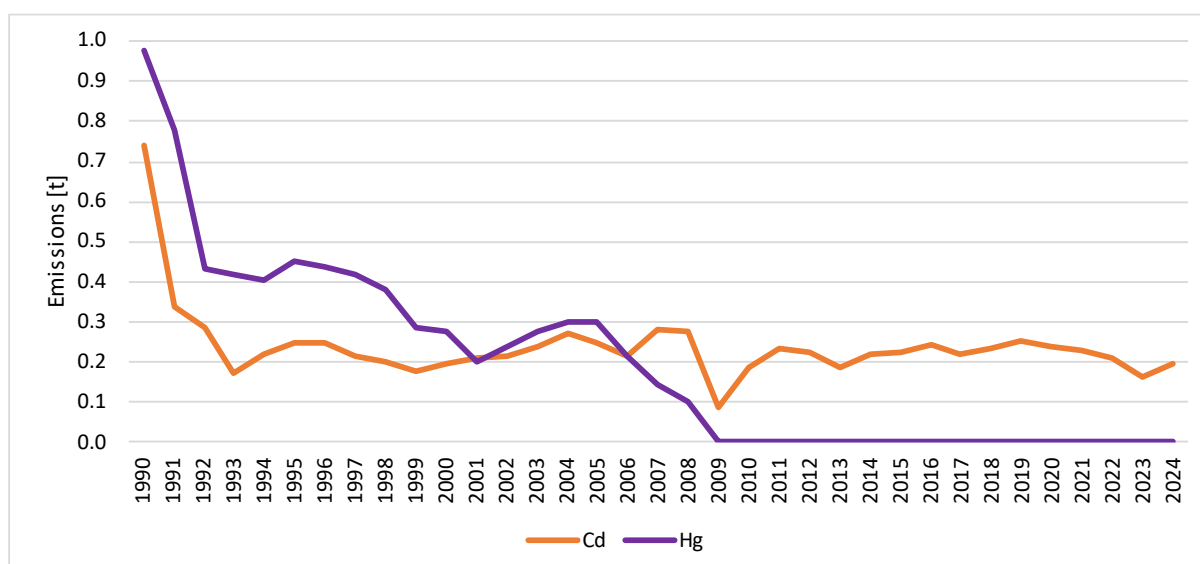


Figure 4.11. Cd and Hg emissions for 2B category in 1990-2024

The production of chlorine using the mercury method was terminated in 2009. Therefore there are no Hg emissions from this category as of this year.

4.3.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 2B. *Chemical industry* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 2B are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 4.4. Results of the emission uncertainty analysis for NFR sector 2B

NFR subsector		NO _x	NM VOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP	BC	CO	Cd
2B1	Ammonia production	30.0%			50.0%					50.0%	
2B10a	Chemical industry	30.1%	35.1%	30.1%	47.0%	10.2%	10.2%	10.2%	63.0%	48.0%	70.0%
2B2	Nitric acid production	30.0%									
2B6	Titanium dioxide production	20.0%		20.0%				30.0%			
2B7	Soda ash production				50.0%			50.0%		50.0%	

4.3.5 Source-specific QA/QC and verification

For detailed information please see Chapter 3.2.5.

4.3.6 Source-specific recalculations

The following changes were made in sector 2B:

- the activity data and emissions for the subcategory 2B1 have been updated in 2023 due to a change in ammonia production data in the national statistics.
- the activity data and emissions for the subcategory 2B10a have been updated in 2023 and 2019 due to a change in NPK fertilizers production data in the national statistics.
- the activity data and emissions for the subcategory 2B10a have been updated in 2023 due to a change in polyethylene, polyvinylchloride and polypropylene production data in the national statistics.

4.3.7 Source-specific planned improvements

No specific improvements are planned in this sector.



4.4 Metal Production (NFR sector 2C)

4.4.1 Source category description

The pollutant emission sources related to production processes in the metal industry cover all pollutants except NH₃.

Estimation of the emissions in 2C. *Metal Production* are carried out in sub-categories listed below:

- 2C1. *Iron and Steel Production (production in open hearth furnaces is not occurring since 2003),*
- 2C2. *Ferroalloys Production,*
- 2C3. *Aluminium Production (primary aluminium production is not occurring since 2009),*
- 2C4. *Magnesium production – there is no magnesium production in Poland,*
- 2C5. *Lead production, including batteries,*
- 2C6. *Zinc production,*
- 2C7a. *Copper production,*
- 2C7c. *Other metal production.*

The key categories from the NFR 2C are specified in Table 4.5.

Table 4.5. Key categories from NFR 2C

	NFR	Method	EF	Pollutant
2C1	Iron and steel production	T2	CS	Pb, Hg, Cd
2C5	Lead production	T2	CS	Pb, Hg, Cd
2C6	Zinc production	T2	CS	Pb, Hg, Cd

CS – country specific

Shares of emissions from the NFR 2C category in the country total for the particular pollutants in 2024 are shown in Figure 4.12. Shares of pollutant emissions from this category are below 30% (only Pb emissions reached above 50%).

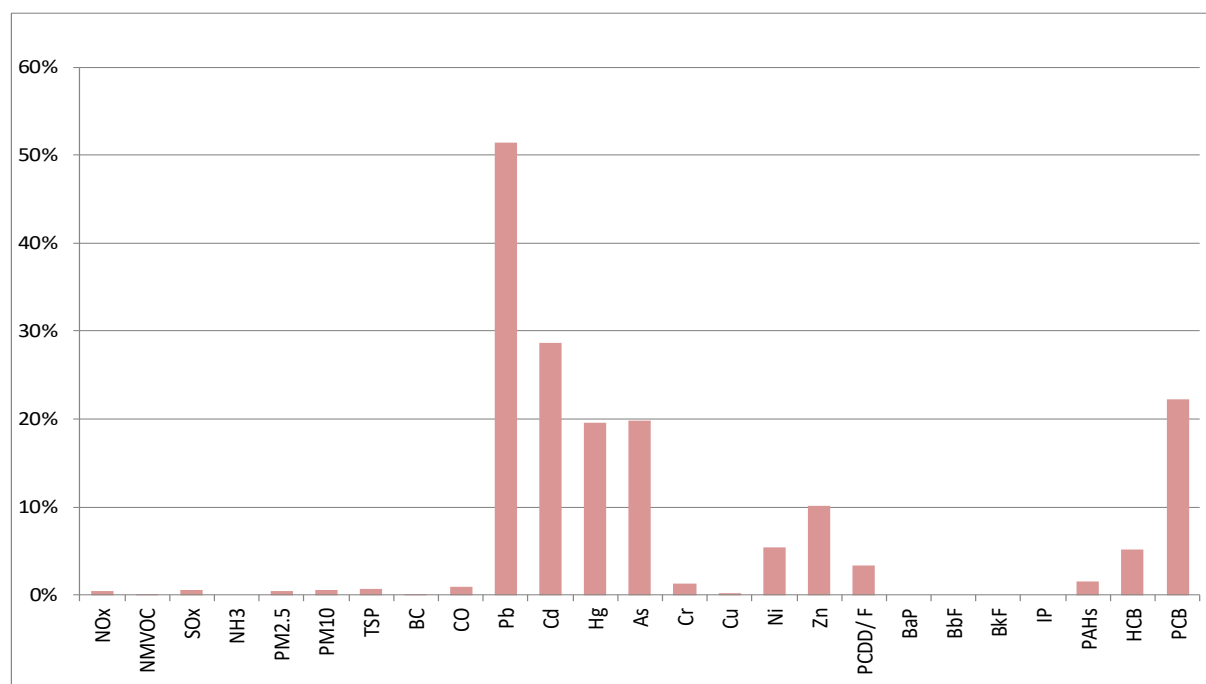


Figure 4.12. Shares of emissions from the 2C category in the country total in 2024

4.4.2 Methodological issues

Activity data for this sector (except categories: 2C7a. *Primary and secondary copper production* and 2C7c. *Other metal products*) comes from the statistical yearbooks (Production of industrial products and Materials management) and it is presented in Appendix 5.

Activity data and emissions for the primary and secondary production of copper and other metal products (silver and gold) were obtained from producer's smelters and plants, and from the National Database on emissions of greenhouse gases and other substances. Activity data were collected by the manufacturer for the period 1990 – 2024 and it is confidential. Emission data for many pollutants have been measured and collected for the period 2001 – 2024. For other pollutants (mainly heavy metals), measurements have been started in accordance with legal obligations (mostly since 2014). These pollutants have been adequately included in the inventory. For the years before emissions were measured, activity-based emissions calculations and Tier 1 emission factors were used.

Furthermore, in accordance with the EMEP/EEA 2023 guidelines, the calculation of PCB emissions for category 2C3 has been revised. In accordance with the approach Tier 2 for aluminium production, the emission of polychlorinated biphenyls (PCB) is not applicable.

In the reference to the recommendation of TERT PL-2C3-2025-0001 on the calculation of PCDD/F emissions and the application of the emission factor from the 2023 EMEP/EEA guidebook, the following changes were made:

- following a comprehensive evaluation of the available data, Poland implemented the PCDD/F emission factor from the Tier 2 EMEP/EEA guidelines for secondary aluminium production for calculations of emission in the years 1990-1996;
- since 1997, in the context of the Parcom Decision 96/1 and the withdrawal of hexachloroethane from use, Poland has applied the note under Table 3-4 in the 2023 EMEP/EEA guidebook, according to which PCDD/F emissions are not applicable.

Emissions were calculated using the following equation, except for those categories where emissions were reported directly by the manufacturer:

$$E = \sum (AR_{\text{production}} * EF_{\text{pollutant}})$$

where:

E – the emission of the specified pollutant

AR – the activity rate for the production

EF – the emission factor for the pollutant

To estimate emissions domestic and default emission factors are used. Applied emission factors for subcategory 2C are presented in Appendix 6. Information on whether the emission factors used for PM10 and PM2.5 include or exclude the condensable component is given in Appendix 9.

Emissions from some subsectors of 2C category are often a combination of combustion and process emissions. If it was not possible to split the process and combustion emissions, it was decided to include such emissions entirely in the combustion sector 1A2. This mainly concerns emissions of the pollutants: NO_x, SO₂, CO and NMVOC. The exceptions are categories 2C7a and 2C7c, where it was not possible to separate process and combustion emissions. The available data on fuels combusted in processes 2C7a and 2C7c allowed to separate and subtract the emissions from category 1A2 and to include the emissions reported by the

producers (fuel combustion emissions and process emissions) in the total for categories 2C7a and 2C7c.

4.4.3 Emission trends for NFR sector 2C

Trends of pollutant emissions for sector 2C. *Metal Production* are shown below in figures below (Figure 4.13- Figure 4.18). The noticeable increase in NO_x and CO emissions throughout the trend is due to the inclusion of emissions of these pollutants (from combustion and industrial processes) in categories 2C7a and 2C7c. The significant decrease in CO emissions in 2009 is the result of the closure of primary aluminium production in Poland.

The variations in SO₂ emissions (and emissions of other pollutants, in particular Cu, Cr, Ni and As) are due to several factors in category 2C7a:

- between 1990 and 2000, emissions were calculated using activity data and the Tier 1 emission factor,
- from 2001 onwards, measured emissions from the smelters were taken into account, which were significantly higher than those determined from emission factors,
- at the end of 2016 and the beginning of 2017, there was a change in the copper production technology at one of the smelters, which resulted in a significant decrease in emissions of all pollutants, especially SO₂,
- since 2017, the copper smelters have been implementing solutions in response to the Commission Implementing Decision (EU) 2016/1032 of 13 June 2016 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for the non-ferrous metals industries (notified under document C(2016) 3563).

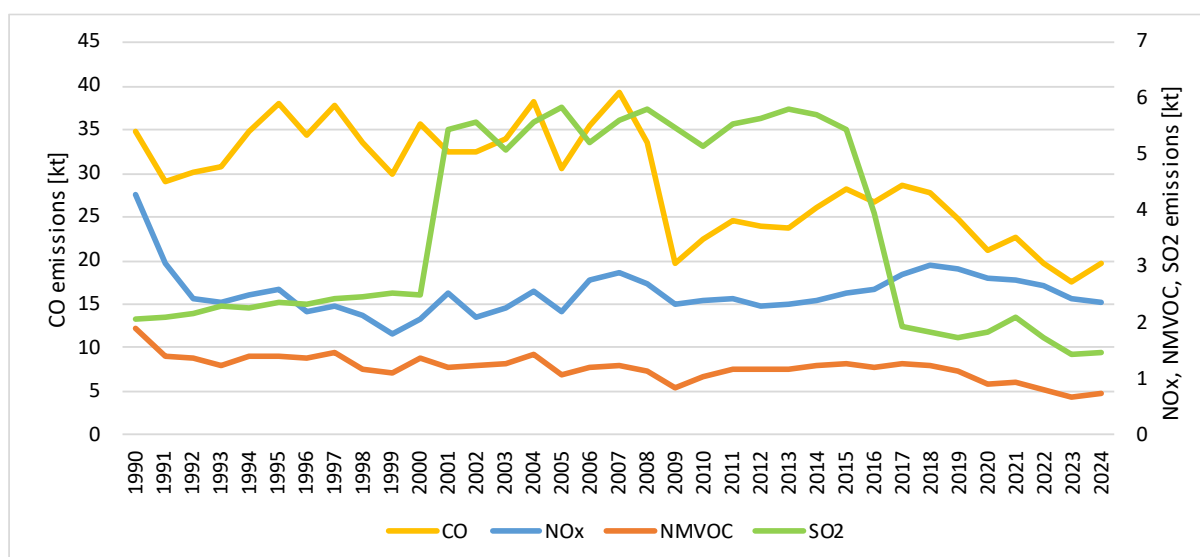


Figure 4.13. Emissions of the NEC pollutants, and CO for 2C category in 1990-2024

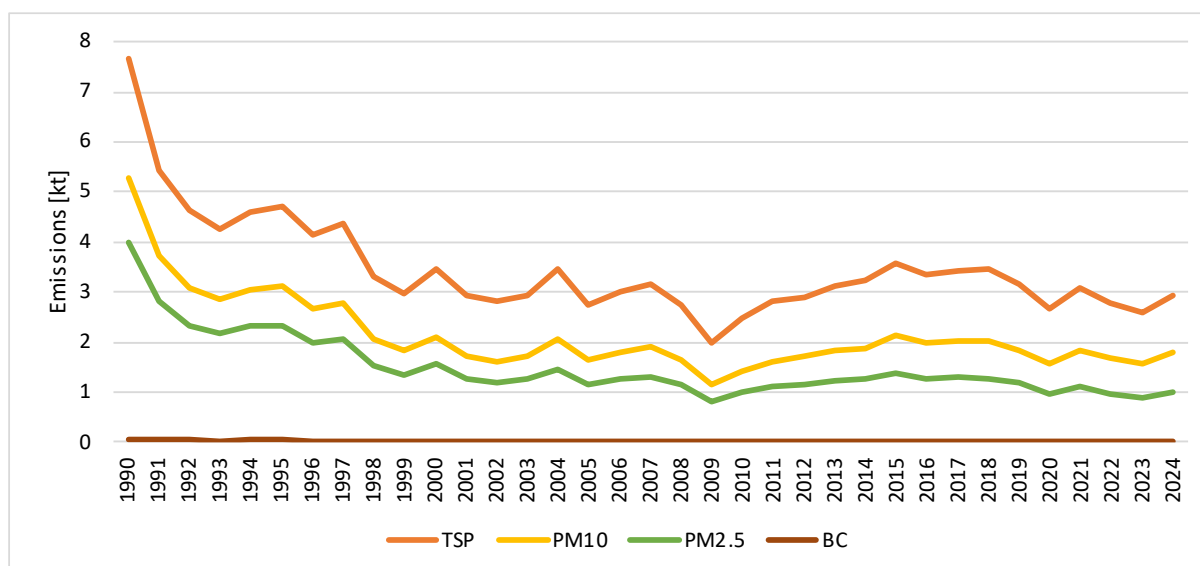


Figure 4.14. Emissions of particulates and black carbon (BC) for 2C category in 1990-2024

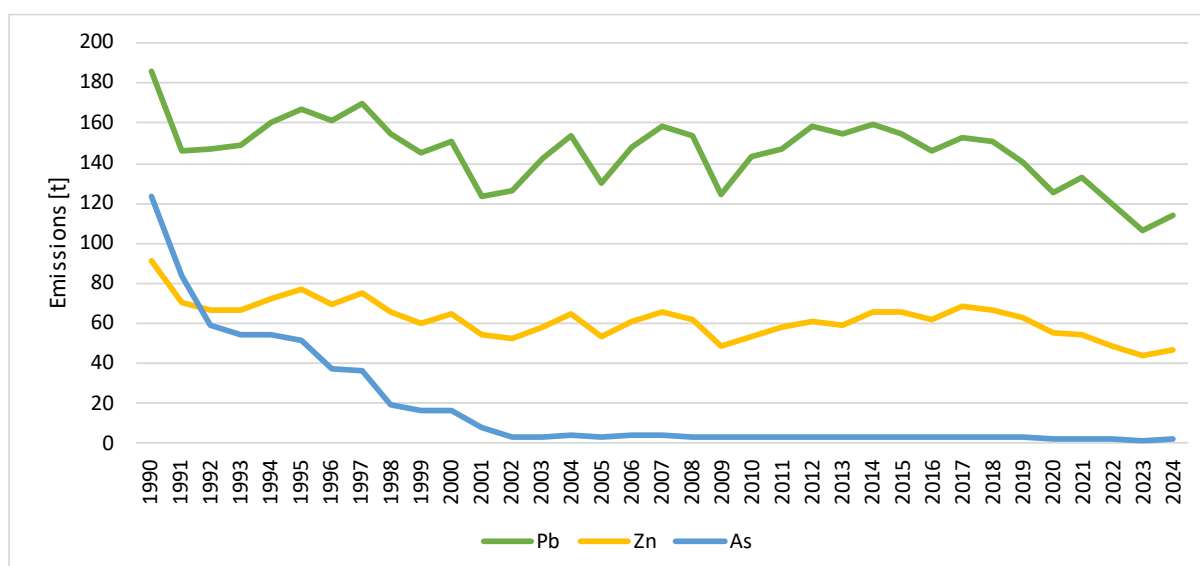


Figure 4.15. Emissions of Pb, Zn, and As for 2C category in 1990-2024

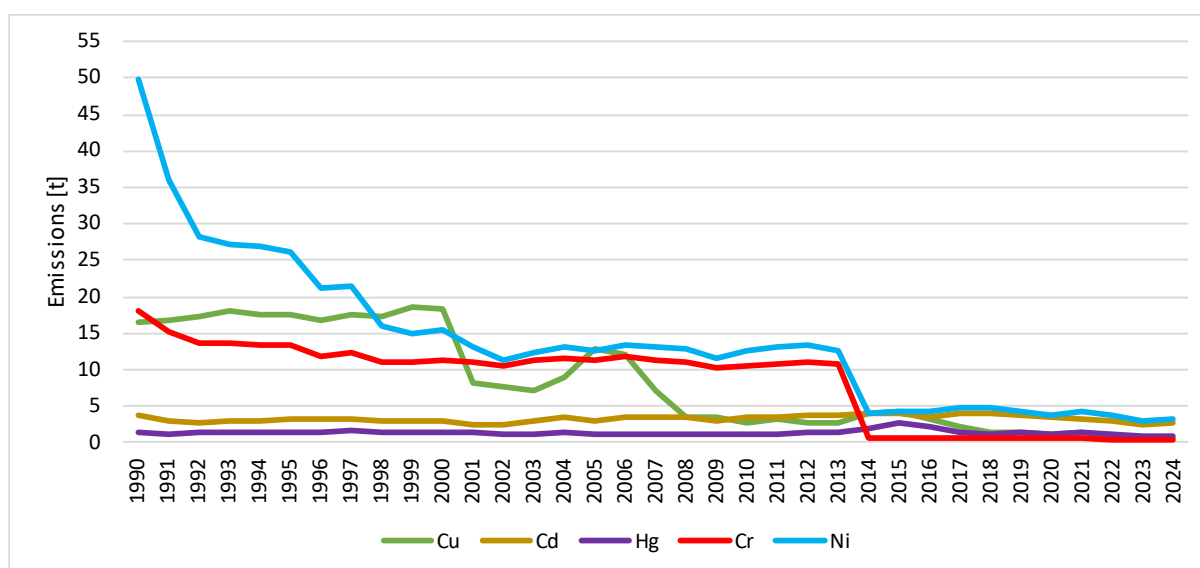


Figure 4.16. Emissions of Cu, Cd, Hg, Cr and Ni for 2C category in 1990-2024



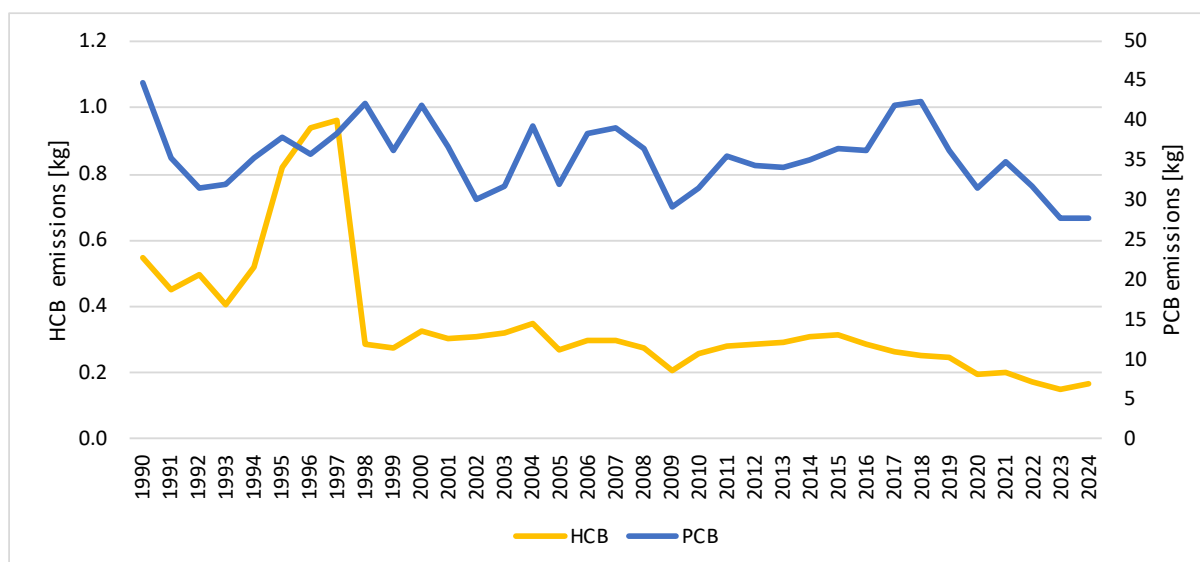


Figure 4.17. Emissions of HCB and PCB for 2C category in 1990-2024

The increase in HCB and PCDD/F emissions until 1997 was due to an increase of secondary aluminium production, while the decrease in emissions in 1998 was the results of the implementation of Parcom Decision 96/1 on the phasing-out of the use of hexachloroethane in the non-ferrous metal industry.

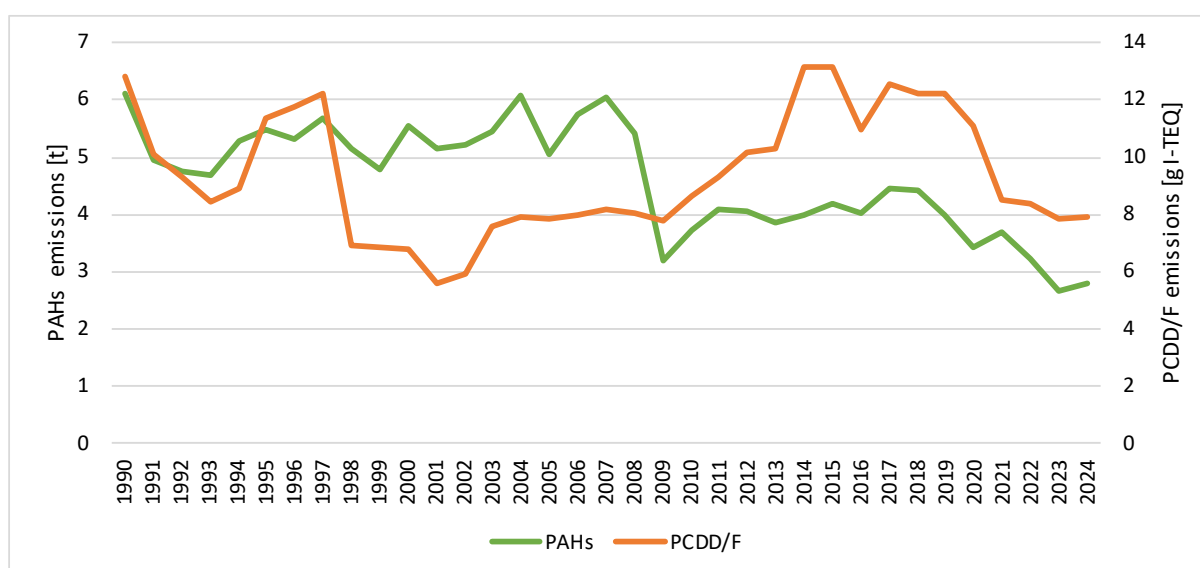


Figure 4.18. PCDD/F and PAH emissions for 2C category in 1990-2024

4.4.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 2C. *Metal production* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 2C are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 4.6. Results of the emission uncertainty analysis for NFR sector 2C

NFR subsector		NO _x	NMVOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP	BC
2C1	Iron and steel production	20.1%	34.1%	30.1%		23.1%	23.1%	21.1%	50.0%
2C2	Ferroalloys production					31.1%	31.1%	40.0%	42.0%
2C3	Aluminium production					50.0%	50.0%	50.0%	70.0%
2C5	Lead production			20.1%		50.0%	50.0%	50.0%	
2C6	Zinc production			20.1%		50.0%	50.0%	50.0%	
2C7a	Copper production	15.0%		15.0%		25.0%	25.0%	15.0%	35.0%
2C7c	Other metal production	19.0%		19.0%				19.0%	
NFR subsector		CO	Pb	Cd	Hg	PCDD/F	PAHs	HCB	PCBs
2C1	Iron and steel production	39.1%	26.1%	38.1%	58.0%	99.0%	99.0%	99.0%	53.0%
2C2	Ferroalloys production		70.0%						
2C3	Aluminium production								
2C5	Lead production		70.0%	70.0%	70.0%	99.0%			87.0%
2C6	Zinc production		70.0%	70.0%	70.0%	99.0%			85.0%
2C7a	Copper production	15.0%	20.0%	20.0%	20.0%	99.0%		99.0%	57.0%
2C7c	Other metal production	19.0%	19.0%	19.0%	19.0%				

4.4.5 Source-specific QA/QC and verification

For detailed information please see Chapter 3.2.5.

4.4.6 Source-specific recalculations

As a result of the analyses and methodological work carried out for sector 2C for the period 1990–2023, the following changes have been introduced:

- the activity data and emissions for the subcategory 2C1 have been revised for the years 2020–2022, owing to an amendment in the steel production data (steel production in electric arc furnaces) in the national statistics,
- an analysis of data and methodology for subcategory 2C3 aluminium production was performed, resulting in an adjustment to the calculation of PCB emissions for 1990–2023 (applying NA notation key) and the calculation of PCDD/F emissions for 1990–1996, until hexachloroethane was phased out in 1997.

4.4.7 Source-specific planned improvements

Further work is planned in relation to sector 2C7c to acquire the missing historical emissions data.

4.5 Solvents Use (NFR sector 2D)

4.5.1 Source category description

The use of solvents is one of the main sources of NMVOC emissions and includes the following subcategories:

- 2D3a. Domestic solvent use including fungicides
- 2D3b. Road paving with asphalt
- 2D3c. Asphalt roofing
- 2D3d. Coating applications
- 2D3e. Degreasing
- 2D3f. Dry cleaning
- 2D3g. Chemical Products
- 2D3h. Printing
- 2D3i. Other Solvent use

The key categories from the NFR 2D are specified in Table 4.7.

Table 4.7. Key categories from NFR 2D

	NFR	Method	EF	Pollutant
2D3a	Domestic solvent use including fungicides	T2a, T1	CS, D	NMVOC, Hg
2D3b	Road paving with asphalt	T1	D	TSP
2D3d	Coating applications	T2	CS	NMVOC
2D3g	Chemical Products	T2	D/CS	NMVOC
2D3h	Printing	T2	D	NMVOC
2D3i	Other solvent and product use	T2	D/CS	NMVOC

CS – country specific; D – default

Shares of emissions from the 2D category in the country total for the particular pollutants in 2024 are shown in Figure 4.19. Shares of pollutant emissions from this category are below 5% (only NMVOC emissions exceed almost 35%).

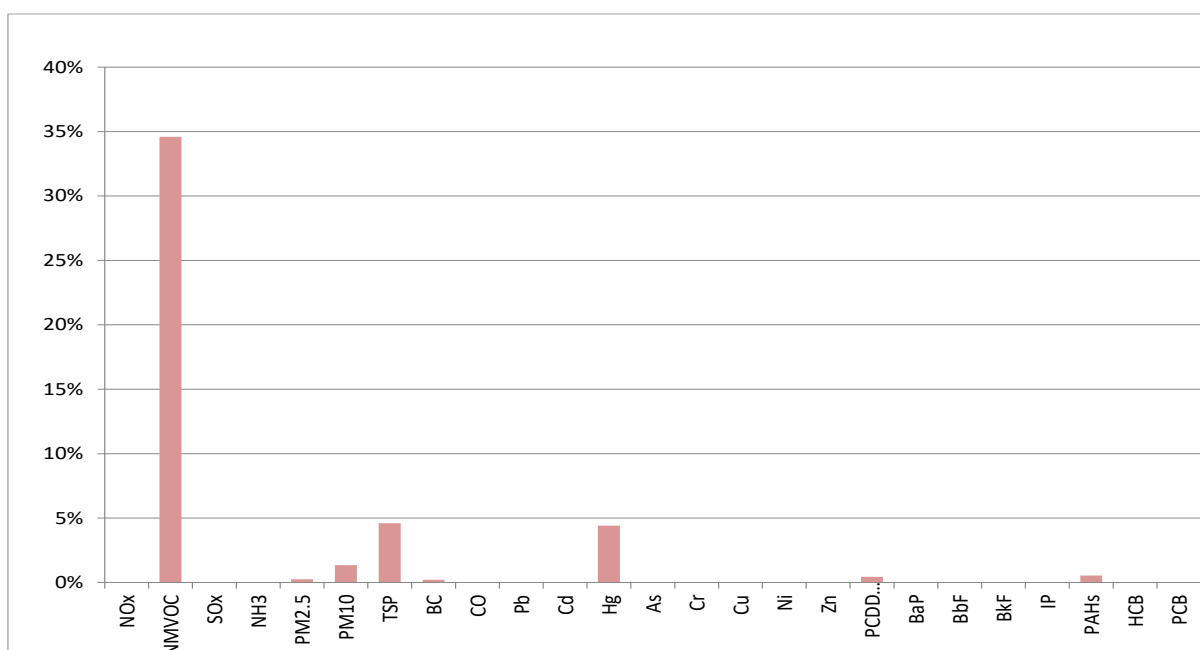


Figure 4.19. Shares of emissions from the 2D category in the country total in 2024

4.5.2 Methodological issues

– 2D3a. Domestic solvent use including fungicides

Domestic solvent use including fungicides includes emissions of NMVOCs and other pollutants (e.g. Hg) arising from the domestic use of solvent-containing products. Many of these products are also used in industry and commerce.

For calculation of fugitive emissions of NMVOC from this category special Tier 2a methodology from EMEP/EEA Guidebook 2023 was applied. NMVOC emissions data were obtained from European Solvents Industry Group (ESIG). The data are available for the years 2013-2022. Using the population figures from Statistics Poland, emission factors for NMVOC were calculated. For years preceding 2013, the average factor for 2013-2015 was assumed. Also correction factors C (for the non-solvent NMVOC emission, equal to 1.11) and F (solvent fraction not considered in the ESIG methodology, equal to 1.11) were applied. The population is used as activity data according to the statistical yearbook [GUS].

Emission factor used for calculation of Hg emission from fluorescent lamps was taken from EMEP/EEA Guidebook 2016 using a Tier 1 approach.

– 2D3b. Road paving with asphalt

Asphalt for road paving is commonly referred to as bitumen, asphalt cement, asphalt concrete or road oil and is produced in petroleum refineries. The annual statistical weight of asphalt produced for road paving is used to calculate emissions of NMVOCs, BC and PM from this source category.

Tier 1 method has been used for calculation of fugitive emissions from this category. The national asphalt production is used as activity data and was taken from Eurostat database.

Emission factors used for calculation of fugitive emissions of NMVOC, TSP, PM 2.5, PM10 and BC were taken from EMEP/EEA Guidebook 2023.

– 2D3c. Asphalt roofing

The asphalt roofing industry manufactures saturated felt, roofing and siding shingles, and roll roofing and sidings. Tier 1 method has been used for calculation of fugitive emissions from this category. Most of these products are used in roofing and other building applications. This source category covers emissions of NMVOC, CO, BC and PM from all related facilities. The national production of shingles is used as activity data.

– 2D3d. Coating applications

Paints are used within the industrial and domestic sectors. Traditionally, the term 'paint' has often been used to describe pigmented coating materials only, thus excluding clear coatings such as lacquers and varnishes. However, here the term 'paint' includes all materials applied as a continuous layer to a surface with the exception of glues and adhesives which are covered by another NFR source category.

The methodology for calculation of emissions resulting from 2D3d. *Coating applications* is based on production, import and export amounts of paints. Based on these statistical data the amount of paints has been split into two categories: water based and solvents based. Taking into consideration the legislation (Solvent's Directive) Poland assumes that the majority of solvent-based paints has been used for industrial use and water-based paints have been used domestically for decorative use.

Activity data for this sector comes from statistical yearbook [GUS] and import-export balances and NMVOC emission factors have been developed by the Institute for Ecology of Industrial Areas (IETU).

– **2D3e. Degreasing**

Degreasing is a process of products cleaning from water-insoluble substances such as grease, fats, oils, waxes, carbon deposits, fluxes and tars. The metal-working industries are the major users of solvent degreasing. Solvent degreasing is also used in industries such as printing and production of chemicals, plastics, rubber, textiles, glass, paper and electric power.

To calculate emissions from 2D3e. *Degreasing* it was assumed that "metals degreasing" includes also solvents used for other purposes in industrial processes. Poland has changed the methodology to Tier 2. Currently it is not possible to include industrial processes separately in the inventory (e.g., electronic industry, textile, leather, etc.). In this regard and due to recommendation (PL-2D3e-2017-0001) Poland has analyzed data received from ESIG and IIASA. The emission factors relate to the entire category. It is impossible to divide data according to industrial processes. However, Poland is still investigating possibilities of obtaining divided data and use of the most common organic solvents for degreasing in industry.

It was assumed that the volume of used NMVOC from this category is equal to half of the domestic consumption of complex organic solvents based on butyl acetate and other complex organic solvents.

The emission factor until 2004 is derived from EMEP/EEA Guidebook 2023 and is equal 1 t/solvent. Starting from 2005 the emission factors have been obtained from IIASA and are as follows:

- 2005 – 0.937 t/solvent,
- 2010 – 0.887 t/solvent,
- 2015 – 0.809 t/solvent,
- 2020 – 0.744 t/solvent,
- 2025 – 0.669 t/solvent.

EFs for other years have been interpolated, e.g. EF for 2024 is equal 0.684 t/solvent.

– **2D3f. Dry cleaning**

Dry cleaning refers to any process conducted to remove contamination from furs, leather, down leathers, textiles or other objects made of fibres, using organic solvents. The most significant pollutants from dry cleaning are non-methane volatile organic compounds (NMVOCs), including chlorinated solvents.

Tier 1 method has been used for calculation of fugitive emissions from this category. Activity data (population) used for calculation of fugitive emissions of NMVOC was taken from statistical yearbook and emission factors have been developed by the Institute for Ecology of Industrial Areas (IETU).

– **2D3g. Chemical products**

Category 2D3g. *Chemical products* covers the emissions from the use of various chemical products in manufacturing or processing of other chemical products. The category includes NMVOC emissions from:

- Polyvinylchloride processing,
- Polystyrene foam processing,
- Rubber processing,
- Pharmaceutical products manufacturing,
- Paints manufacturing,
- Tyres production,
- Manufacture of shoes,
- Asphalt blowing.

This category includes also NH₃ emissions from leather tanning.

Tier 2 method has been used for calculation emissions from this category. Activity data was taken from Eurostat database. Applied emission factors are presented in Appendix 6.

In case of asphalt blowing, the amount of produced air blown asphalt was identified from the ETS installations for period 2005-2024. To identify emissions in this category for the period 1990-2004, the 10-year mean share of oxidized bitumen in total bitumen production for years 2005-2014 was calculated based on ETS data and related to total 1990-2004 production. The EFs applied in emission calculation comes from EMEP/EEA EIG 2023.

– **2D3h. Printing**

The printing industry is an important manufacturing industry in most European countries. Printing involves the use of inks which may contain organic solvents. These inks can be diluted before use. Different inks have different portions of organic solvents and require dilution to different extents. Printing can also require the use of cleaning solvents and organic dampeners. Ink solvents, diluents, cleaners and dampeners may all make a significant contribution to emissions from industrial printing. Printing processes convert original text and pictures into an image on a carrier and the main process types are named according to how this image is carried.

The methodology used to calculate emissions from 2D3h. *Printing* is based on production, import and export amounts of printing Inks. For years from 1990 to 2001 data on production, import and export was sourced from the Statistics Poland. Since 2002 data was sourced from Eurostat. Poland received data on the share of printing technologies from the Polish Chamber of Printing. The following process type occur in Poland:

- Heatset,
- Publication Gravure,
- Narrow Web Flexography,
- Packaging Flexography,
- Packaging Gravure.

Activity data is stratified according to the shares of different printing technologies. Data on the technology shares was obtained from the Polish Chamber of Printing. Tier 2 emission factors were taken from EMEP/EEA 2023 guidebook and applied according to different processes. Due to lack data regarding abatement technologies that may occur in the country, Poland took a conservative approach and considered the following:

- from 1994 to 2004 we assumed that there was no abatement technology before Poland's accession to the European Union,

- from 2004 till 2021 we assumed a growing linear trend of introducing abatement technologies to reach in 2025 a 100% share of the lowest (indicated in the Guidebook) abatement factor for every printing process. We assumed that in 2025 all printing processes will have to be abated as BAT conclusions for this sector have to be implemented no later than in December 2024. We assumed also a growing technological progress in printing considering policies and measures related to (and resulting from) the Solvent Emission Directive and NEC Directive.

– **2D3i. Other solvent use**

Other solvent and product use includes emissions arising from the following activities:

- Oil extraction,
- Wood preservation,
- Application of glues and adhesives.

Preservation of wood

Preservation of wood considers industrial processes for the impregnation with, or immersion of timber to protect it against fungal and insect attack and also against weathering. There are three main types of preservative: creosote, organic solvent-based (often referred to as 'light organic solvent-based preservatives (LOSP)') and water-borne. Wood preservatives may be supplied for both industrial and domestic use. This activity in category 2D3i only covers industrial use. In Poland, wood preservation in large production plants is primarily carried out using autoclaves that allow vacuum-pressure treatment with various protective agents. Emissions from preservation of wood were estimated based on a Tier 2 approach in accordance with the 2023 EMEP/EEA Guidebook. The activity data considered in this category is the consumption of wood. Since data obtained from Statistics Poland (GUS) are provided in cubic meters (m³), they were converted into kilograms of impregnation of wood preservatives consumption based on 2023 EMEP/EEA Guidebook. According to the 2023 EMEP Guidebook, for creosote type wood preservative, 1 m³ of wood requires 75 kg of creosote. For solvent borne and water borne preservative, 1 m³ of wood requires 24 kg of wood preservative. Due to the lack of data on the market share of wood preservation, the data from "Wood Preservation with chemicals – Best Available Technics" were adopted. The share of wood preservative is 71% waterborne preservative, 18% solvent borne preservative and 11% creosote preservative. Emission factors were taken from 2023 EMEP/EEA Guidebook. Since there is no available data in Poland about abatement technologies efficiencies, Poland has not cover it. However Poland will make effort to contact with industry associations and explore the possibility of obtaining such data.

Application of glues and adhesives

NMVOC emission from this category was calculated using a Tier 2 method agreed during the 2025 review with TERT.

Activity data for this category is the solvent content in glues and adhesives. This content in glues is calculated based on:

- Eurostat data on sales, imports and exports of glues,
- data on average share of glues containing solvents (30-65%),
- data on average content of solvents in glues containing solvents (33-50%)
- assessed average share of solvents in all glues (20%)

Activity data for adhesives (self-adhesive products like strips, plates, foil and other products) include:

- Eurostat data on sales, imports and exports of adhesives (in tonnes of products),
- assumed average content of glues in adhesive products (10%),
- assumed correction factor for double counting, as part of glues used in adhesives may be already included in statistical data for glues (50%),
- average solvent content in glues used in adhesives – the same as in glues (20%).

The emission factor used is the Tier 2 EF related to solvent content (562 g/kg solvent) from the EIG 2023.

Detail activity data used in sub-category 2D. *Solvent use* is presented in Appendix 5. Applied emission factors are presented in Appendix 6.

4.5.3 Emission trends for NFR sector 2D

Trends of pollutant emissions for 2D sector are shown below in figures below (Figure 4.20 - Figure 4.23). The observed declines in the trend in 2022 are related to reduce activities, mostly in production. They predominantly concern the categories 2D3a. *Domestic solvent use including fungicides*, 2D3d. *Coating applications*, and 2D3g. *Chemical products*.

Interannual variations in the NMVOC time series are related to the fluctuations of activity data in category 2D3d Coating applications. This includes consumption of water-based paints and solvent-based paints, which takes into account production, import and export of these paints. In 2008, the rise in activity was due to the increased share of imported solvent-based paints in the market. In contrast, in 2013, the increased share of exported solvent-based paints led to a decrease in the overall consumption of solvent-based paints. The peak in 2020 was caused by ethanol use in category 2D3a Domestic solvent use. Another increase in emissions in 2024 was caused by a significant increase (by 95%) in the consumption of solvent-based paints.

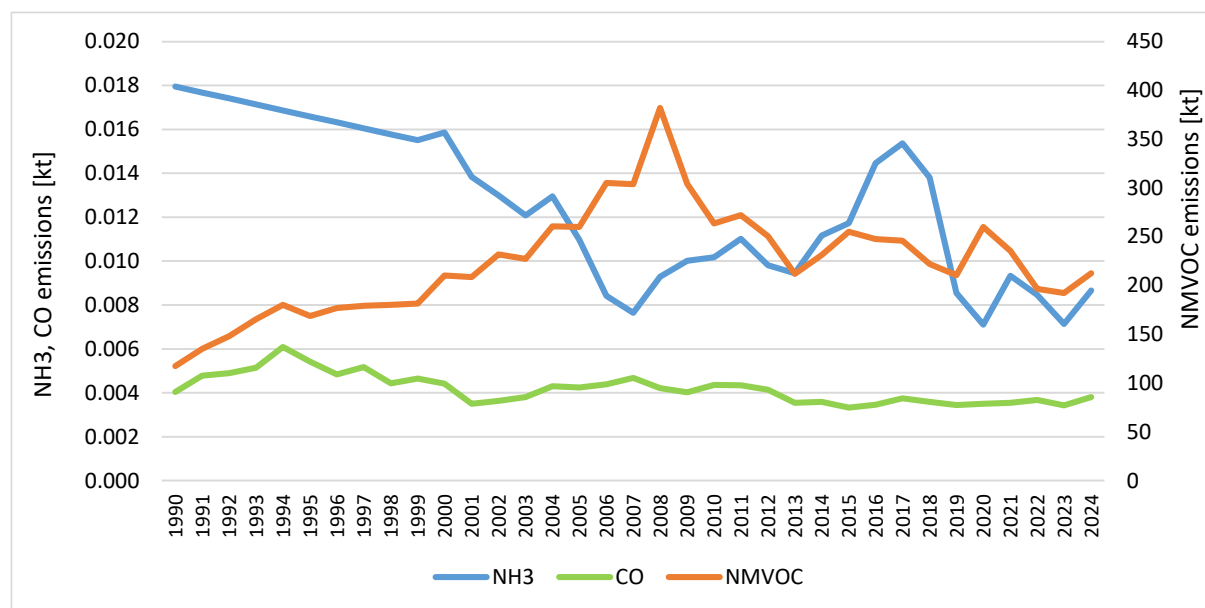


Figure 4.20. NH₃, CO and NMVOC emissions for 2D category in 1990-2024



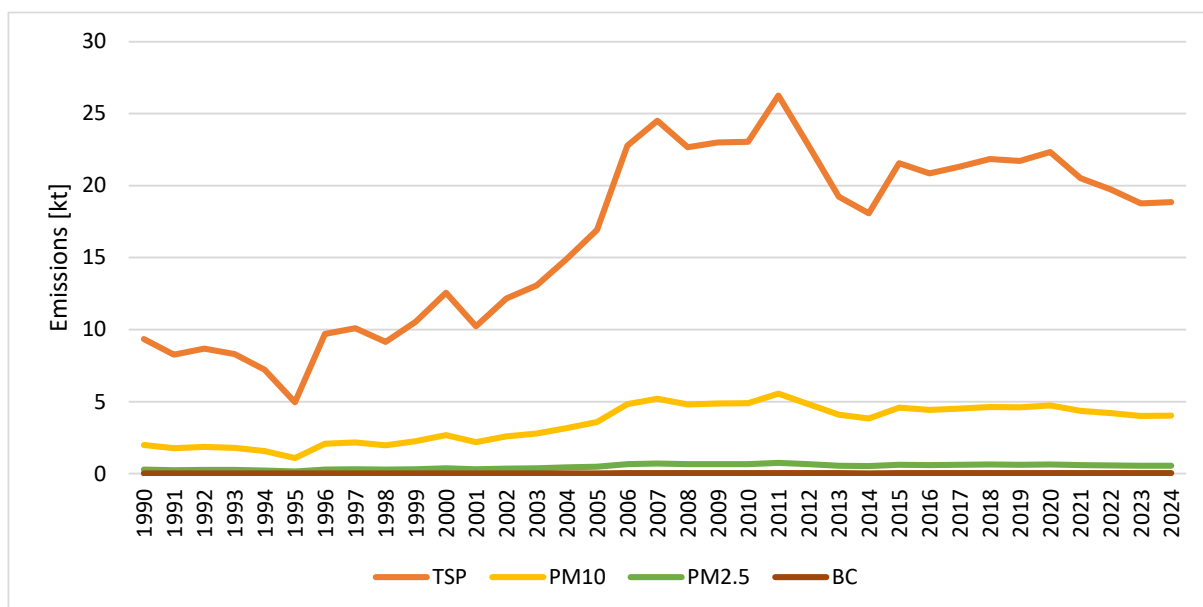


Figure 4.21. PMs and BC emissions for 2D category in 1990-2024

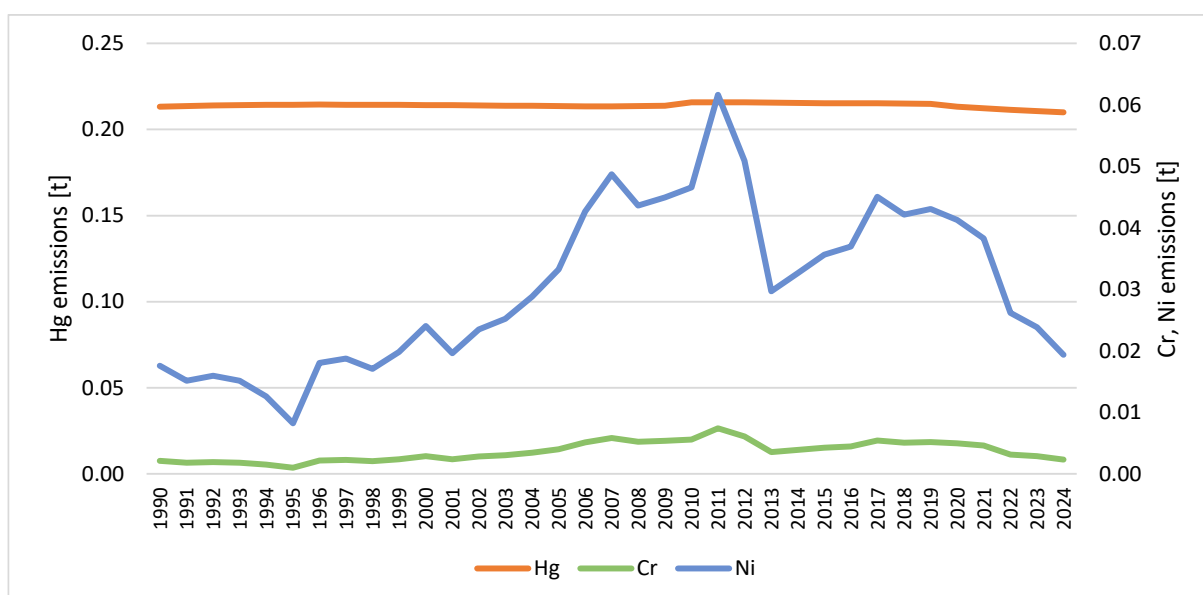


Figure 4.22. Hg, Cr and Ni emissions for 2D category in 1990-2024

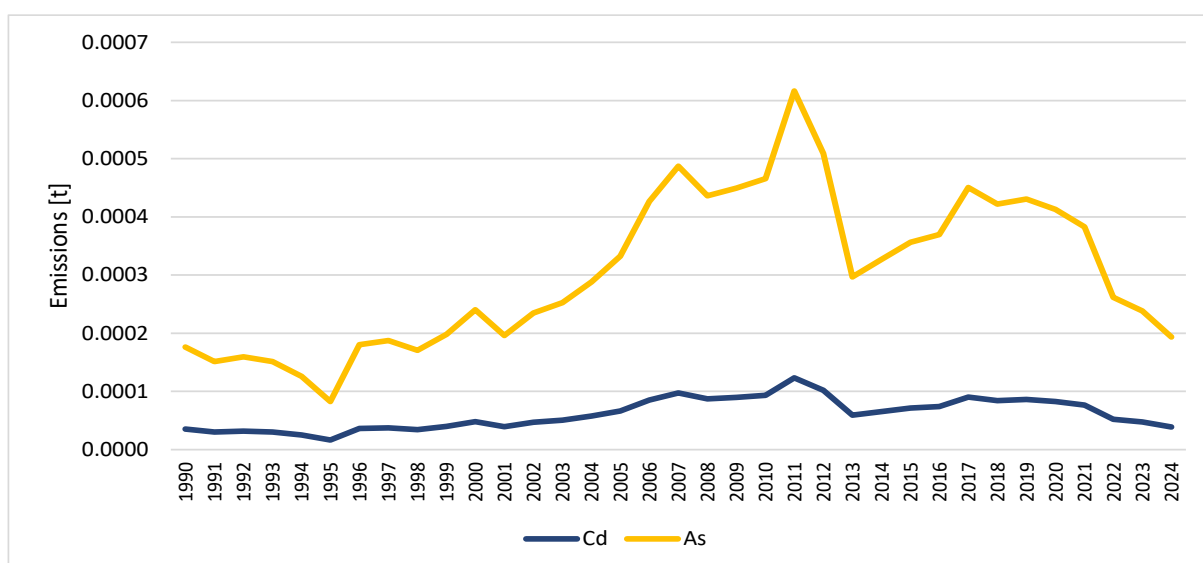


Figure 4.23. Cd and As emissions for 2D category in 1990-2024

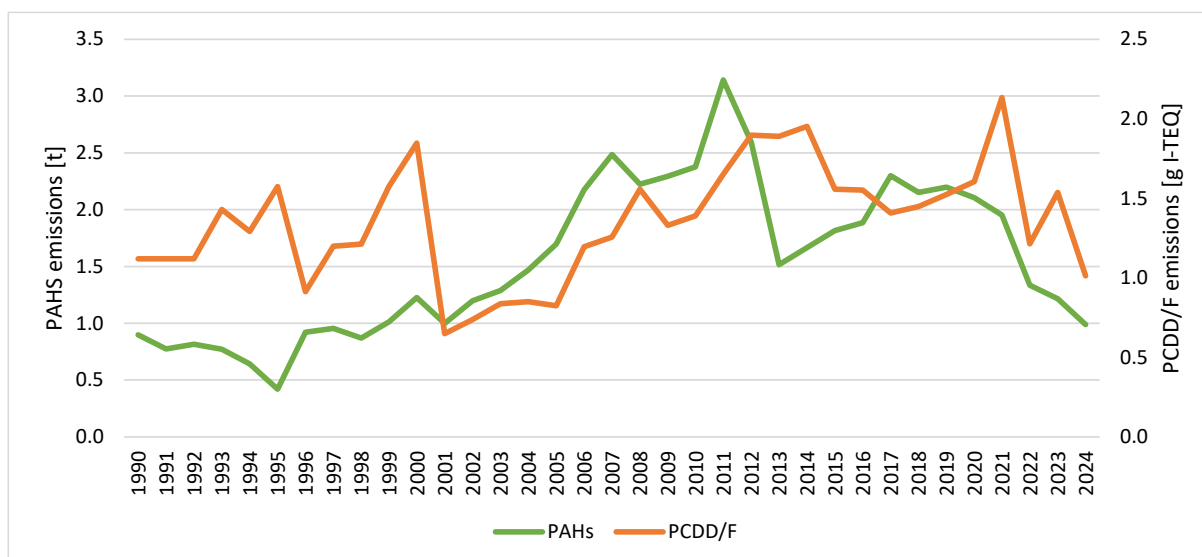


Figure 4.24. PAHs and PCDD/F emissions for 2D category in 1990-2024

4.5.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 2D. *Solvent use* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 2D are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 4.8. Results of the emission uncertainty analysis for NFR sector 2D

NFR subsector		NMVOC	NH ₃	PM _{2.5}	PM ₁₀	TSP	BC
2D3a	Domestic solvent use including fungicides	30.1%					
2D3b	Road paving with asphalt	100.0%		86.0%	67.0%	106.0%	61.0%
2D3c	Asphalt roofing	50.0%		84.0%	83.0%	67.0%	62.0%
2D3d	Coating applications	28.1%					
2D3e	Degreasing	30.8%					
2D3f	Dry cleaning	30.1%					
2D3g	Chemical products	19.1%	50.0%			100.0%	
2D3h	Printing	51.0%					
2D3i	Other solvent use	31.0%					
NFR subsector		CO	Cd	Hg	PCDD/F	PAHs	HCB
2D3a	Domestic solvent use including fungicides			98.0%			
2D3b	Road paving with asphalt						
2D3c	Asphalt roofing	88.0%					
2D3d	Coating applications						
2D3e	Degreasing						
2D3f	Dry cleaning						
2D3g	Chemical products		83.0%			108.0%	
2D3h	Printing						
2D3i	Other solvent use				70.5%	100.3%	

4.5.5 Source-specific QA/QC and verification

Activity data used in the GHG inventory concerning sector 2D is sourced from national statistics prepared by the Statistics Poland [GUS].

The Statistics Poland is responsible for QA/QC of collected and published data. Activity data applied in inventory is regularly checked and updated if necessary according to adjustments made in Eurostat database.

These data therefore meet the requirements of data quality (QA/QC) arising from IPCC Guidelines and EMEP/EEA Guidelines in terms of durability and consistency of methodology.

Statistical quality checking related to the assessment of emission, activity data and trends has been performed. For further details please see Chapter 3.2.5.

4.5.6 Source-specific recalculations

Following recalculations have been introduced in subcategory 2D3i. *Other solvent and product use*:

- based on the information obtained on the solvent content in glues and adhesives, the methodology for estimating emissions from this category was updated to the Tier 2 level in accordance with the EMEP/EEA guidelines (TERT recommendation PL-2D3i-2024-0002);
- activity data for wood preservation was corrected for the years 1990-2023.

4.5.7 Source-specific planned improvements

The following improvements are planned in 2D sector:

- 2D3d. *Coating application* – due to the ERT recommendation (Party-2024-2D3d-1) Poland is conducting its own methodological work and is investigating possibilities of obtaining new necessary data. It is currently not possible to provide a specific timeframe. However, progress will be regularly reported in subsequent reports presented.
- 2D3g. *Chemical products* – due to the TERT recommendation (PL-2D3g-2023-0001) and ERT recommendation (Party-2024-2D3g-1) Poland makes effort to improve completeness of the emission estimates for this category. Poland is working to establish contact with representatives of industrial entities that could assist in obtaining necessary activity data to estimate NMVOC emission. It is currently not possible to provide timeframe. However, progress will be regularly reported in subsequent reports presented.
- 2D3i. *Other solvent and product use* – due to the TERT recommendation (PL-2D3i-2024-0001) Poland contacted with IIASA in order to obtain necessary data. Unfortunately, the data received cannot be used in current form. Additionally, Poland needs to conduct a more detailed analysis of the provided data. Poland continues to make effort to improve the methodology in this category. Progress will be regularly reported in subsequent reports presented. Also Poland works on improving the methodology for NMVOC emission from oil extraction (Tier 2 approach).

4.6 Other product use (NFR sector 2G)

4.6.1 Source category description

Emissions in subcategory 2G. *Other product use* have been estimated for activities listed below:

- *Use of tobacco* (tobacco in cigarettes used in a given year),
- *Use of fireworks* (fireworks, signalling flares, rain rockets, fog signals and other pyrotechnic articles used in a given year),
- There are also SO₂, Pb, Cd, Cr, Cu, Ni, Se and Zn emissions from lubricant use in vehicles included in this subcategory.

The key categories from the NFR 2G are specified in Table 4.9.

Table 4.9. Key categories from NFR 2G

NFR		Method	EF	Pollutant
2G	Other product use	T3/T1	D	Cd

The method for 2G category being a key category for Cd was marked T3/T1. The Tier 3 method is used in subcategory 2G to calculate emissions of SO₂, Pb, Cd, Cr, Cu, Ni, Se and Zn from the use of lubricants in vehicles (road transport). Emissions of pollutants from the use of lubricants in vehicles for this subcategory were calculated using the COPERT model, which is considered a Tier 3 methodology⁷. Emissions from the use of tobacco and fireworks were calculated using a T1 method. The main sources of Cd emissions in 2G category are the use of tobacco (55.8% in 2024) and the use of lubricants in road traffic (42% in 2024).

Shares of emissions from the NFR 2G category in the country total for the particular pollutants in 2024 are shown below in Figure 4.24. Shares of almost all pollutant emissions from this category in the country total do not exceed 5% (only Cu emissions almost reached 11%). The main source of Cu emission in this category is lubricant use in vehicles (91% of the Cu emission in cat. 2G).

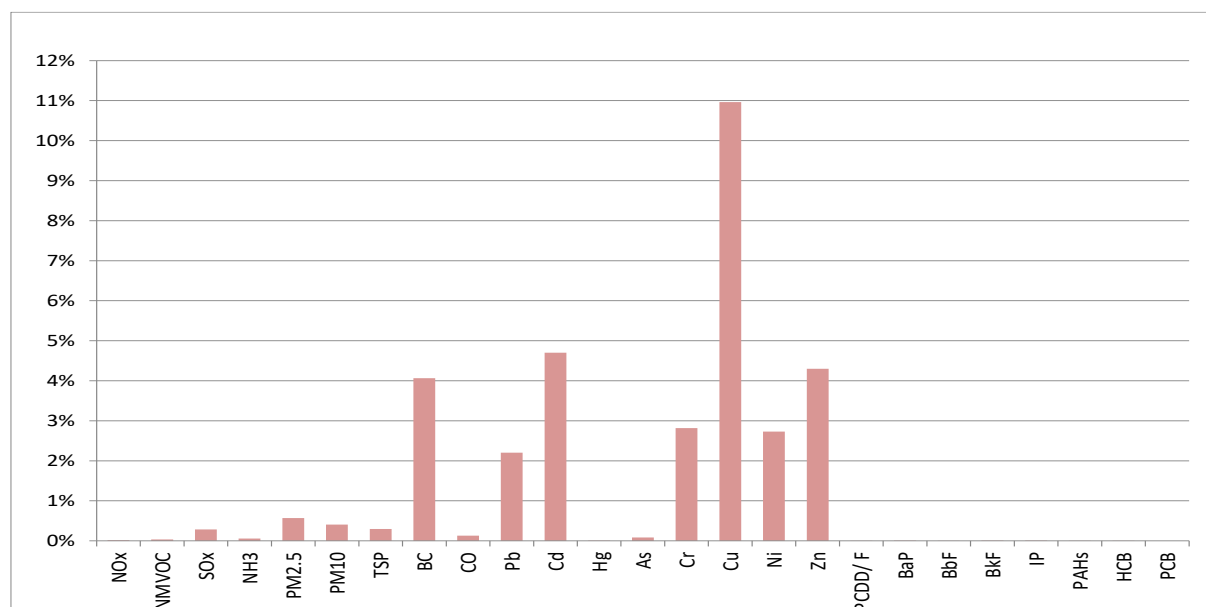


Figure 4.25. Shares of pollutant emission from the 2G category in the country total in 2024

⁷ <https://copert.emisia.com/copert/methodology/>



4.6.2 Methodological issues

Emissions from tobacco use have been calculated for all years based on data regarding:

- Number of cigarettes used in Poland per person (source: Statistics Poland),
- Population in Poland (source: Statistics Poland),
- Tobacco content in one cigarette (source: EMEP/EEA EIG 2023).

For every year tobacco consumption was calculated using the equation:

$$\text{Tobacco consumption} = \text{Cigarettes used per person} \times \text{Population} \times \text{tobacco content in one cigarette}$$

Most of EFs were obtained from EMEP/EEA Emission Inventory Guidebook 2023. Four EFs missing in the Guidebook (for Pb, Hg, As and Cr) were derived from Norwegian publications of 2001 and 2003 quoted in Norwegian Emission Inventory Reports.

The activity data were provided by Statistics Poland (Polish central statistical office). The number of cigarettes per person was constantly declining over the years starting from 2648 cigarettes per person in 1990 and reaching its lowpoint of 879 cigarettes in 2020. In 2021-2024 the use grew to 1207 cigarettes per person, which can be probably partially attributed to public tax policies aimed at tightening the tax system and reducing the grey economy.

Emissions from the use of fireworks were calculated based on statistical data regarding imports and exports of fireworks. The production data published by Eurostat show either lack of data or no production of fireworks in Poland in 1995-2023.

The activity in category 2G. *Use of fireworks* fell significantly in 2019-2021 most probably due to COVID-19 pandemic. In 2022 the activity returned to the 2018 level and in 2023-2024 fell again. The long-term trend is, however, slightly growing in Poland.

Pollutant emissions from lubricant use in vehicles for this subcategory were calculated using COPERT model.

4.6.3 Emission trends for the NFR sector 2G

Trends of pollutant emissions for 2G sector are shown in figures below (Figure 4.25 - Figure 4.30). Emissions of HCB and PCB were not estimated due to lack of emission factors.

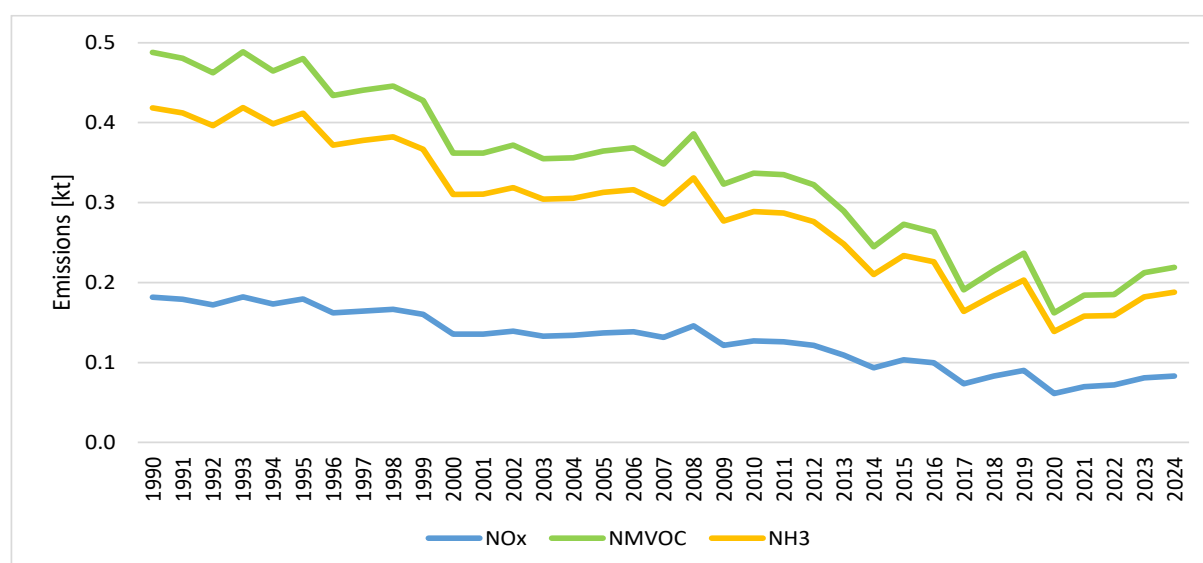


Figure 4.26. NOx, NMVOC and NH₃ emissions from the 2G category in 1990-2024

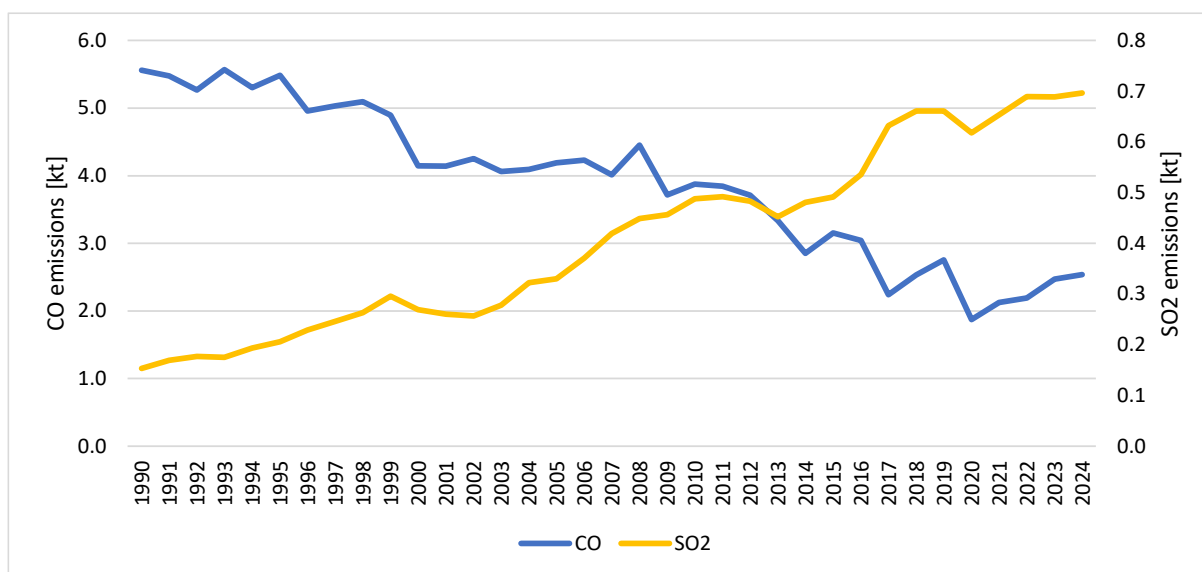
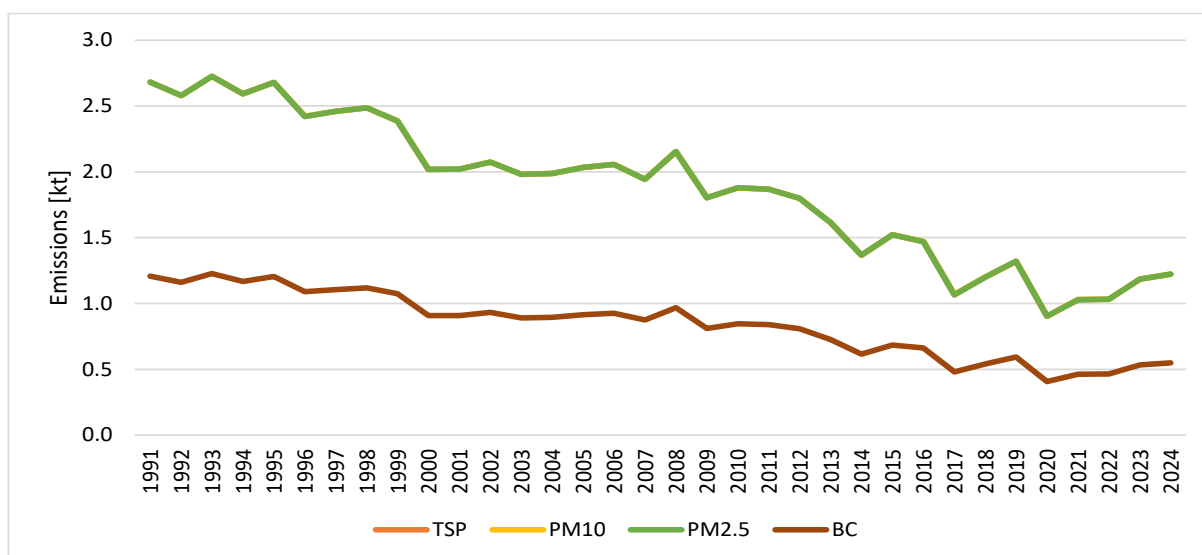
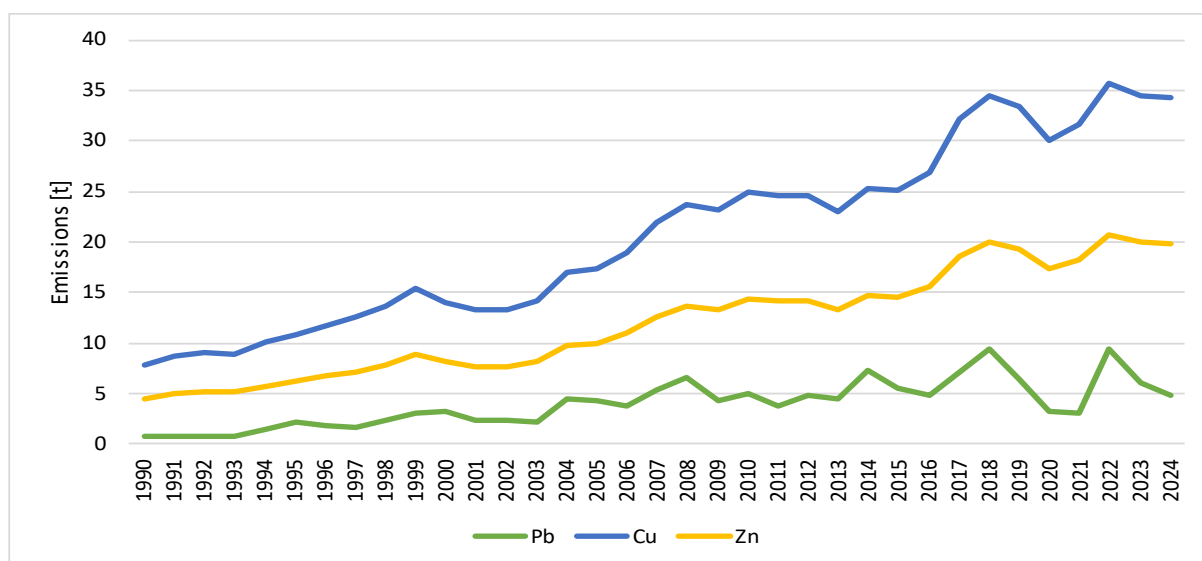

 Figure 4.27. CO and SO₂ emissions from the 2G category in 1990-2024

 Figure 4.28. PMs and BC emissions from the 2G category in 1990-2024 (TSP, PM₁₀ and PM_{2.5} emissions are very similar therefore they overlap on the graph)


Figure 4.29. Pb, Cu and Zn emissions from the 2G category in 1990-2024

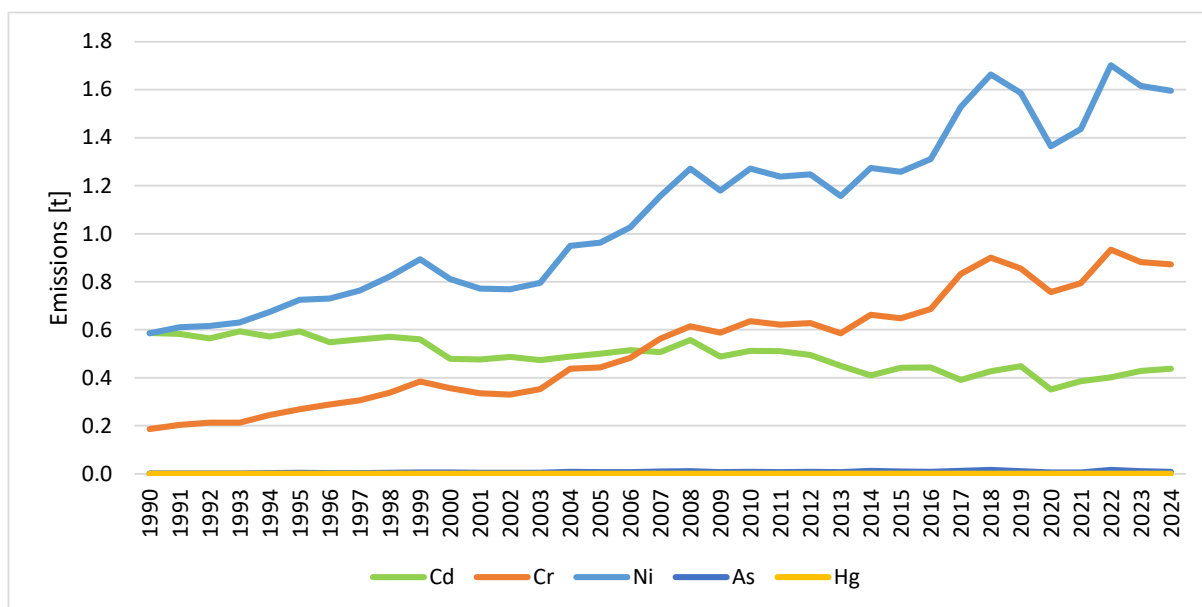


Figure 4.30. Cd, Cr, Ni, As and Hg emissions from the 2G category in 1990-2024

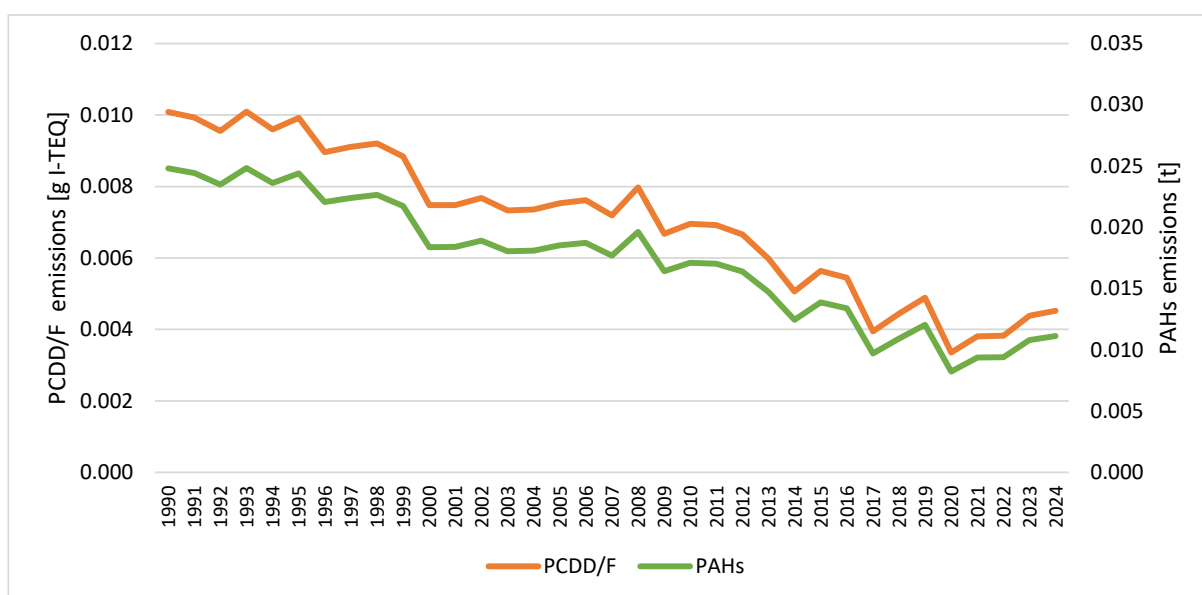


Figure 4.31. PCDD/F emissions from the 2G category in 1990-2024

4.6.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 2G. *Other product use* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 2G are provided below.

Table 4.10. Results of the uncertainty analysis for NFR sector 2G

NFR subsector		NO _x	NM VOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP
2G	Other product use	71.6%	71.6%	70.6%	64.6%	50.8%	50.8%	50.8%
NFR subsector		BC	CO	Pb	Cd	Hg	PCDD/F	PAHs
2G	Other product use	70.6%	71.6%	71.6%	71.6%	71.6%	100.4%	100.4%

4.6.5 Source-specific QA/QC and verification

For detailed information please see Chapter 3.2.5.

4.6.6 Source-specific recalculations

No recalculations have been made in this subcategory.

4.6.7 Source-specific planned improvements

No specific improvement is planned in category 2G.



4.7 Other products (NFR sectors 2H and 2I)

4.7.1 Source category description

Estimation of emissions in the current chapter was carried out in the sub-categories listed below:

- 2H1. *Pulp and paper industry (including chipboards),*
- 2H2. *Food and beverages industry,*
- 2I. *Wood processing.*

There is no key categories from the NFR sectors 2H and 2I.

The pollutant emission sources related to production processes in other industry production and wood processing cover NO_x, SO₂, NMVOC, CO, PM, BC, and PCDD/F. Category 2L is currently removed and considered emissions are reallocated to categories 2A1 and 1B. Shares of emissions from the NFR 2H and 2I categories in the country total for the particular pollutants in 2024 are shown below in Figure 4.31. Shares of most pollutant emissions from this category are below 1%, except NMVOC, TSP and PCDD/F.

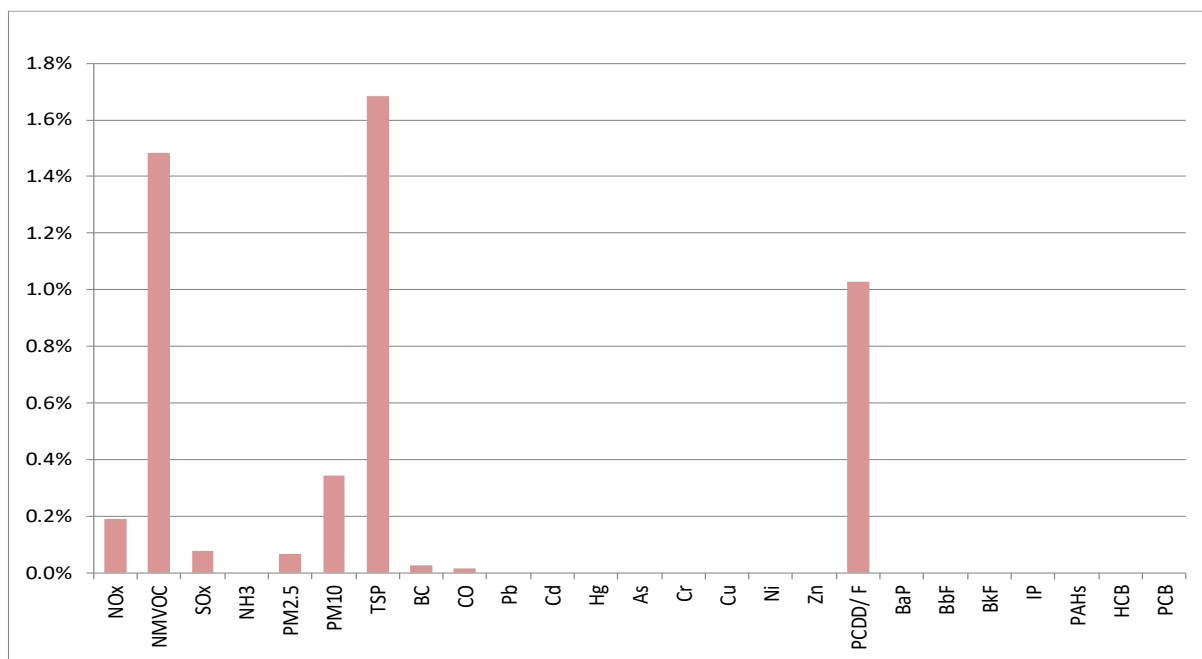


Figure 4.32. Shares of emissions from the 2H and 2I categories in the country total in 2024

4.7.2 Methodological issues

Generally, the emission calculations were based on the following equation:

$$E = \sum (AR_{\text{production}} * EF_{\text{pollutant}})$$

Where:

- E – the emission of the specified pollutant
- AR – the activity rate for the production
- EF – the emission factor for this pollutant

Activity data is presented in Appendix 5. To estimate emissions for subcategories 2H and 2I domestic and default emission factors are used, which are presented in Appendix 6. Information on whether the emission factors used for PM₁₀ and PM_{2.5} include or exclude the condensable component is given in Appendix 9.

4.7.2.1 2H1. Pulp and paper

This chapter covers emissions from pulp and paper production. Pulp and paper production consists of three major processing steps: pulping, bleaching and paper production. The type of pulping and the amount of bleaching used depends on the nature of the feedstock and the desired qualities of the end product. Emissions from paper and pulp production include non-methane volatile organic compounds (NMVOC), sulphur oxides (SO₂), particulates, nitrogen oxides (NO_x) and carbon monoxide (CO).

Emissions in subcategory 2H1. *Pulp and paper industry* have been estimated for activities listed below:

- *Chipboards* (Chipboards and similar boards of wood or wood-based materials used in a given year),
- *Paper pulp (Kraft process)* (Wood pulp used in a given year).

In line with recommendation PL-2H1-2022-0001, Poland has revised the methodology used to calculate the emissions of pollutants produced during the Kraft process of paper production. Poland contacted paper manufacturers and requested relevant data. Following an analysis of the availability of production and emission data, Poland adopted the following approach to calculate TSP, CO, NO_x, and SO₂ emissions:

- due to gaps in the trend data and data confidentiality, production data has been derived from public statistics,
- for the years 1990–1995, emission factors were taken from the EMEP/EEA 2023 guidebook,
- for the years 2010–2024, emission factors were determined as three-year averages based on emission data reported by plants to the national emissions database,
- for the years 1996–2009, linear interpolation of emission factors was used due to a lack of emission data. This period was chosen because an analysis of historical records showed that plants underwent privatisation and modernisation after 1995.

From 1996 to 2024, the emissions of PM₁₀ and PM_{2.5} have been calculated as a proportion of the total suspended particulate (TSP) emission. This calculation has been derived from the EMEP/EEA inventory guidebook (EF PM₁₀/EF TSP and EF PM_{2.5}/EF TSP), which provides the share of the emission factors for these pollutants. The BC and NMVOC emissions are calculated using the EMEP/EEA 2023 emission factor.

4.7.2.2 2H2. Food and beverages industry

This chapter addresses NMVOC, PM₁₀ and PCDD/F emissions from food and beverages manufacturing, except emissions from vegetable oil extraction. Emissions from food manufacturing include all processes in the food production chain which occur after the slaughtering of animals and the harvesting of crops. Emissions from drink manufacturing include the production of alcoholic beverages, especially wine, beer and spirits.

NMVOC emissions in subcategory 2H2. *Food and beverages industry* have been estimated for the following activities:

- *Bread*,

- *Wine,*
- *Beer,*
- *Spirits,*
- *Sugar,*
- *Slaughter products - cattle and calves,*
- *Slaughter products – pigs,*
- *Slaughter products – poultry,*
- *Slaughter products – fish,*
- *Margarine and fat spreads, excluding liquid margarine,*
- *Coffee roasting,*
- *Prepared feeds for farm animals,*
- *Prepared pet foods,*
- *Handling of agricultural products (grains, soya).*

In the current submission, Poland has calculated TSP emissions for the subcategory 2H2 – *handling of agricultural products (grains, soya)* – in accordance with the recommendation PL-2H2-2022-0001. The *handling of agricultural products (grains and soya)* subcategory was implemented in the national inventory since the last submission, and the activity data (production of grains and soya) comes from sector NFR 3D. Due to the update of activity data in the sector 3D, PM10 emissions have also been updated.

Emissions PCDD in subcategory 2H2. *Food and beverages industry* includes the following subcategories

- *Smoke houses (excl. afterburning),*
- *Smoke houses (incl. afterburning).*

Emissions from smoke houses have been calculated for all years based on statistical data regarding production of cured poultry meat (including sausage), cured poultry meat, cured meat products and smoked fish.

All of EFs are taken from the EMEP/EEA Emission Inventory Guidebook 2023. According to the EMEP/EEA Emission Inventory Guidebook 2023, for the activities in the food industry, it is assumed that abatement equipment reduces NMVOC emissions by 90%, and therefore the default emission factors have been corrected accordingly.

Domestic and default emission factors are used to estimate emissions for subcategories 2H and are presented in Appendix 6. Information on whether the emission factors used for PM10 and PM2.5 include or exclude the condensable fraction is given in Appendix 9.

4.7.2.3 2I. Wood processing

This chapter presents emission estimation for wood processing. This source category include particulate matter emissions. Emissions in subcategory 2I. *Wood processing* have been estimated for activity *Sawn wood*. The activity data has been updated in the current submission. This is the result of recommendations (PL-2025-2-3) following the review of projected emission data submitted under the UNECE LRTAP Convention. The activity data has been harmonised with the data used to calculate greenhouse gas emissions from sector 4 and to determine activity projections. Production data from 1990 to 1998 was obtained from the FAOSTAT database. Data from 1999 onwards was provided by the Center of Wood Technology – Poznań Institute of Technology.

Emissions have been calculated for all years based on statistical data, using the assumed average wood volumetric density (600 kg/m³). EFs in this sector are derived from the

EMEP/EEA Emission Inventory Guidebook 2023 and are presented in Appendix 6.

4.7.3 Emission trends for NFR sectors 2H – 2I

Trends of pollutant emissions for *Other Products* are shown below in figures below (Figure 4.32 – Figure 4.34).

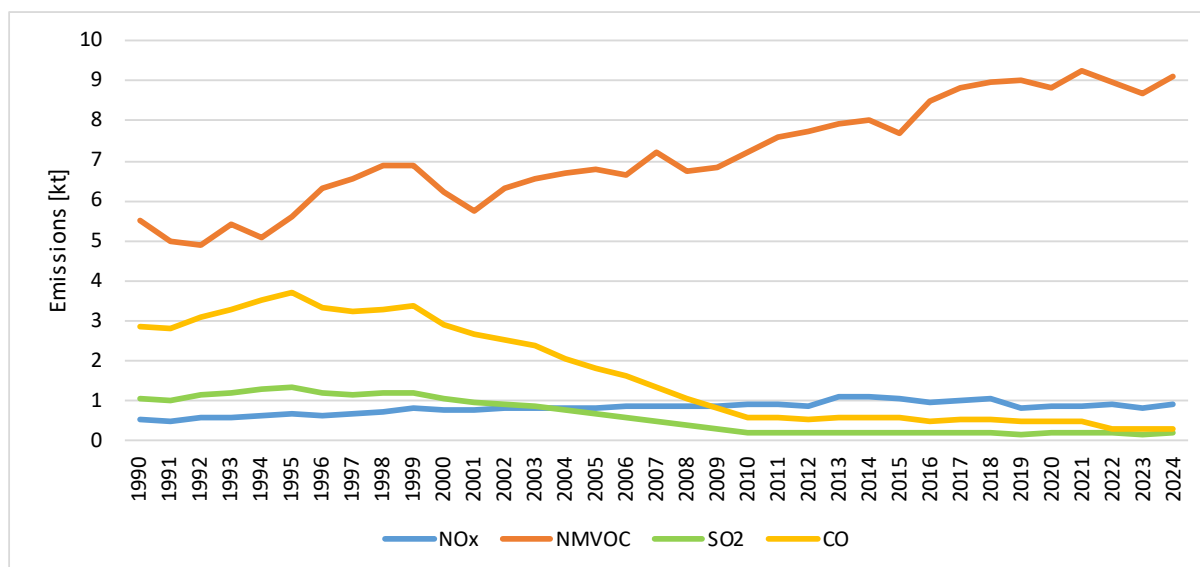


Figure 4.33. The NEC pollutants and CO emissions from the 2H and 2I categories in 1990-2024

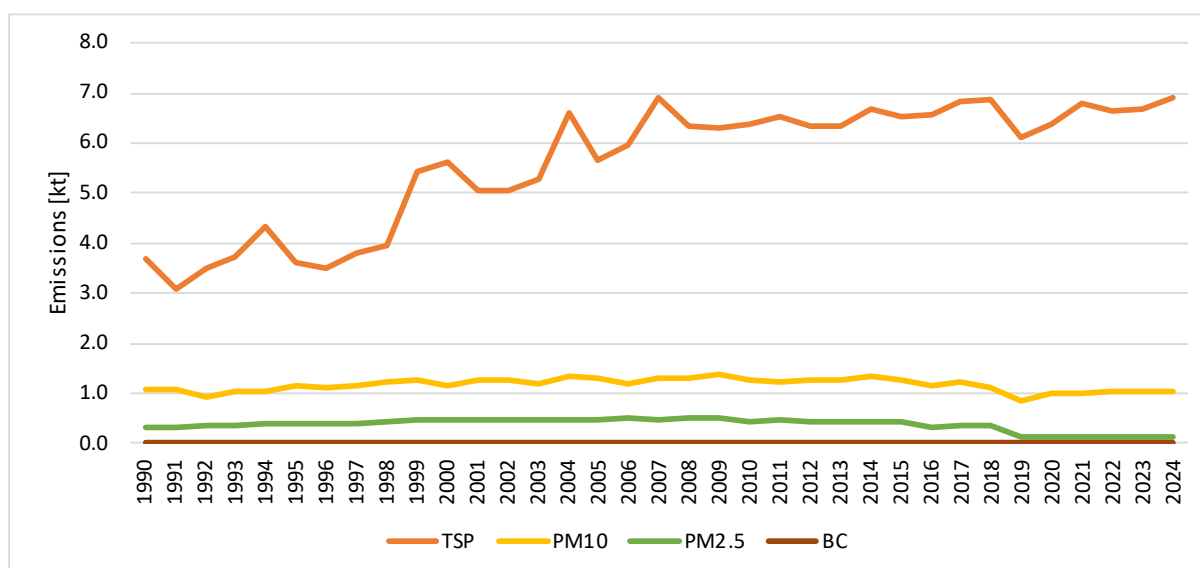


Figure 4.34. PMs and BC emissions from the 2H and 2I categories in 1990-2024



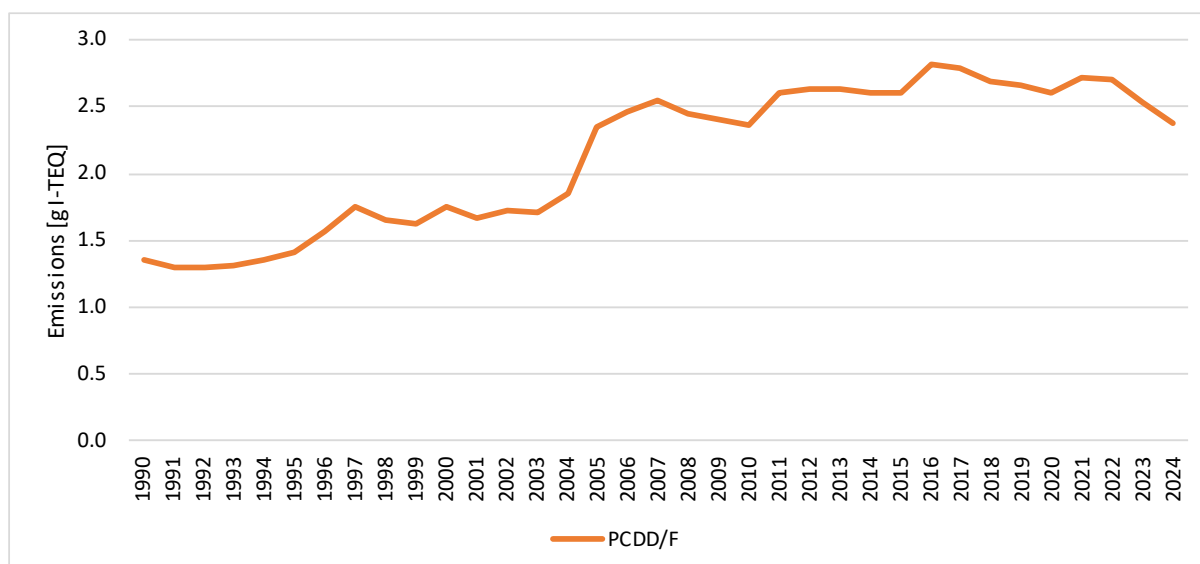


Figure 4.35. PCDD/F and PAHs emissions from the 2H and 2I categories in 1990-2024

4.7.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sectors 2H and 2I was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 2H and 2I are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 4.11. Results of the uncertainty analysis for NFR sector 2H and 2I

	NFR subsector	NO _x	NMVOC	SO ₂	PM _{2.5}	PM ₁₀	TSP	BC	CO	PCDD/F
2H1	Pulp and paper industry	30.1%	50.0%	30.1%	50.0%	50.0%	50.0%	50.0%	50.0%	
2H2	Food and beverages industry		36.1%			150%	150%			91.0%
2I	Wood processing						100.0%			

4.7.5 Source-specific QA/QC and verification

For detailed information please see Chapter 3.2.5.

4.7.6 Source-specific recalculations

As a result of the analyses and methodological work carried out for sector 2H and I, the following changes have been introduced:

- PM₁₀ and TSP emissions from handling of agricultural products (2H2) has been calculated for the period 1990-2023, as a result of PL-2H2-2022-0001 recommendation of the review of National Air Pollutant Emission Inventory Data 2025 under Directive (EU) 2016/2284,
- Activity data and emissions for wood processing category (2I) has been updated for the period 1990 – 2023, as a result of PL-2025-2-3 recommendation of the review of projected emission data submitted under the UNECE LRTAP Convention,

- Activity data and emissions for pulp and paper industry (2H1) has been updated for the period 1996-2023 as a results of PL-2H1-2022-0001 recommendation of the review of National Air Pollutant Emission Inventory Data 2025 under Directive (EU) 2016/2284.

4.7.7 Source-specific planned improvements

It is planned to obtain relevant data from cakes, biscuits and cereal production.

5 AGRICULTURE (NFR SECTOR 3)

5.1 Source category description

The pollutant emission sources in 3. *Agriculture* sector involve:

- 3B. *Manure management*
- 3D. *Agricultural soils*
 - 3Da. *Inorganic and organic N-fertilizers*
 - 3Dc. *Farm-level agricultural operations*
 - 3De. *Cultivated crops*
 - 3Df. *Use of pesticides*
- 3F. *Field burning of agricultural residues*

The agriculture sector is responsible for 96% national ammonia emissions and are connected with number of animals, crop production and volume of mineral N fertilizers applied. Therefore main influence on interannual NH₃ emissions change has the fluctuations of livestock population and amount of nitrogen fertilizers used.

Agriculture is also the key source of HCB emissions (24%) related to use of active substances applied in pesticides such as chlorothalonil, clopyralid and picloram, which contain HCB impurity.

Shares of emissions from the NFR 3 category in the country total for the particular pollutants in 2024 are shown in Figure 5.1.

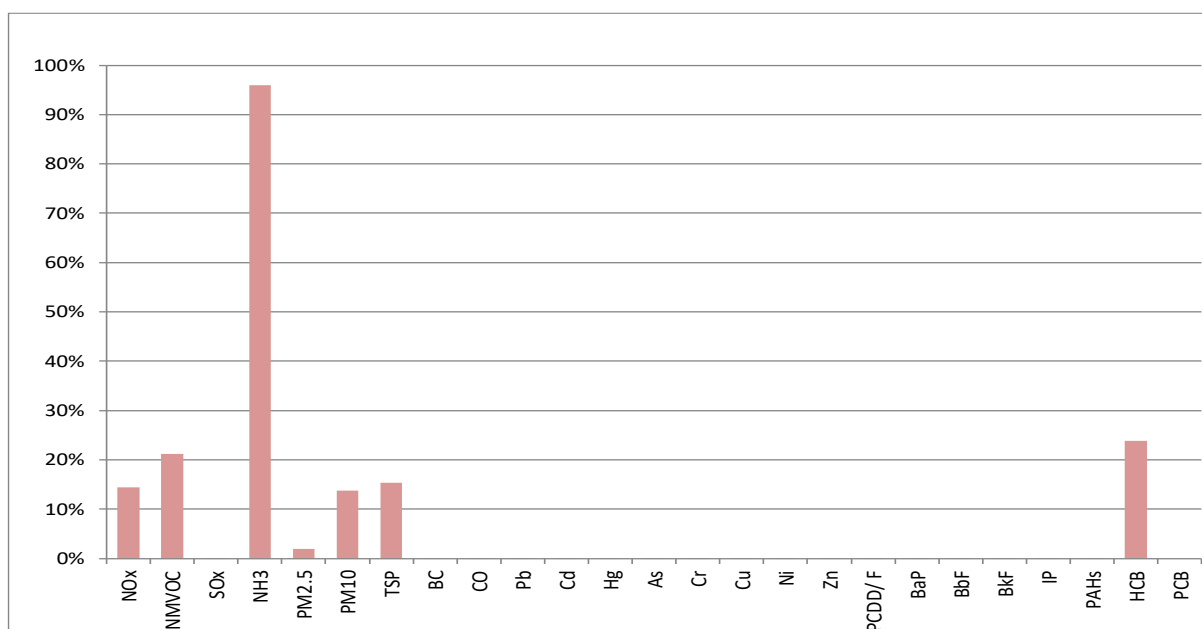


Figure 5.1. Shares of emissions from the NFR 3 category in the country total in 2024

5.2 Overview of Agriculture sector in 2024

The value of global agricultural production in 2024 (in current prices) compared to 2023 fell by 2.2% as a result of the decrease in crop production by 7.3%. In addition to changes in the volume of products of plant origin, the volume of global agricultural production was affected

by changes in prices of agricultural products correlated with domestic supply and changes in prices occurring on foreign, primarily EU agricultural markets.

The sown area in 2024 was 11.1 million ha, which means a slight increase (by 0.4%) compared to the previous year. The sowing structure was dominated by cereals (64.0% of the total sown area), fodder crops (13.8%) and industrial crops (12.6%). Harvests and yields of the main agricultural crops in 2024 were lower. Comparing to the previous year, the decrease of harvests was recorded for total cereals, rape and turnip rape, fruit from fruit trees and bushes in orchards, as well as fruit from berry plantations. The harvests of sugar beets and potatoes were higher than a year ago. Vegetable harvests remained at a similar level compared to the previous year. Variable weather conditions during the growing season with uneven rainfall distribution, both temporally and territorially, were not favourable for crops in 2024.

The total cattle population amounted 6.3 million heads and was slightly lower than in previous year. Decline in the number of cattle herd occurred in the group of cattle aged 2 years and more (by 3.7%). The pig population amounted 9.1 million heads and was 3.2% lower than a year ago. The number of all weight and use groups decreased over the year except sows. The largest decrease was observed in the number of piglets (by 5.5%). With the decrease in livestock purchasing prices, the profitability of pigs fattening declined compared to the previous year.

Year-over-year purchase prices of rape and turnip rape, most fruit, live cattle and cow's milk increased. However, the prices of cereals, sugar beets, potatoes, most vegetables, live pig and poultry and chicken eggs decreased. In 2024, the procurement volume of basic crop products (most cereals, rape and turnip rape, fruits and vegetables) was lower in comparison to the previous year. The higher than the last year volumes were recorded for sugar beets and potatoes. In animal production, the procurement volumes increased for milk, poultry and beef as well as slightly for pork. Egg volumes decreased from the level of the previous year. On private farms, with the increase in prices of sold agricultural products per year by 0.4% accompanied by the rise in the prices of purchased goods and services acquired for current agricultural production and for consumption and investment by 4.9%, price relation („price gap”) of sold agricultural products to the prices of purchased goods and services was more favourable than the year before and amounted 95.8 [GUS 2025n].

It should be noted that after the sustained increases in poultry production since 2017, in 2021 a distinct decrease in poultry production was recorded. The lower production of poultry meat in 2021 was primarily the result of the spread of the avian influenza virus and the related reduction of the poultry stock. Smaller sales opportunities for poultry products in the domestic and foreign markets also had a significant impact on the reduction of production as a result of logistical difficulties in trade due to the coronavirus pandemic in the first half of 2021. Since 2023 poultry population exceeded 200 million again.

5.3 Manure Management (NFR sector 3B)

5.3.1 Source category description

The pollutant emission sources in manure related to livestock management cover: NH₃, NO_x, NMVOC and PM. The overview of methods, EFs and key categories from the NFR 3B are specified in Table 5.1.

Table 5.1. Overview of methods, EFs and key categories from NFR 3B

	NFR	Method	EF	Key category
3B1a	Manure management - Dairy cattle	T2 (NH ₃ , NO _x , NMVOC) T1 (TSP, PM ₁₀ , PM _{2.5})	CS (NH ₃ , NO _x , NMVOC) D (TSP, PM ₁₀ , PM _{2.5})	NH ₃ , NMVOC
3B1b	Manure management - Non-dairy cattle	T2 (NH ₃ , NO _x , NMVOC) T1 (TSP, PM ₁₀ , PM _{2.5})	CS (NH ₃ , NO _x , NMVOC) D (TSP, PM ₁₀ , PM _{2.5})	NH ₃ , NMVOC
3B2	Manure management - Sheep	T2 (NH ₃ , NO _x) T1 (NMVOC, TSP, PM ₁₀ , PM _{2.5})	CS (NH ₃ , NO _x) D (NMVOC, TSP, PM ₁₀ , PM _{2.5})	–
3B3	Manure management - Swine	T2 (NH ₃ , NO _x) T1 (NMVOC, TSP, PM ₁₀ , PM _{2.5})	CS (NH ₃ , NO _x) D (NMVOC, TSP, PM ₁₀ , PM _{2.5})	NH ₃
3B4a	Manure management - Buffalo	–	–	–
3B4d	Manure management - Goats	T2 (NH ₃ , NO _x) T1 (NMVOC, TSP, PM ₁₀ , PM _{2.5})	CS (NH ₃ , NO _x) D (NMVOC, TSP, PM ₁₀ , PM _{2.5})	–
3B4e	Manure management - Horses	T2 (NH ₃ , NO _x) T1 (NMVOC, TSP, PM ₁₀ , PM _{2.5})	CS (NH ₃ , NO _x) D (NMVOC, TSP, PM ₁₀ , PM _{2.5})	–
3B4f	Manure management - Mules and asses	–	–	–
3B4gi	Manure management - Laying hens	T2 (NH ₃ , NO _x) T1 (NMVOC, TSP, PM ₁₀ , PM _{2.5})	CS (NH ₃ , NO _x) D (NMVOC, TSP, PM ₁₀ , PM _{2.5})	NMVOC, TSP
3B4gii	Manure management - Broilers	T2 (NH ₃ , NO _x , NMVOC) T1 (TSP, PM ₁₀ , PM _{2.5})	CS (NH ₃ , NO _x , NMVOC) D (TSP, PM ₁₀ , PM _{2.5})	NH ₃ , NMVOC
3B4giii	Manure management - Turkeys	T2 (NH ₃ , NO _x) T1 (NMVOC, TSP, PM ₁₀ , PM _{2.5})	CS (NH ₃ , NO _x) D (NMVOC, TSP, PM ₁₀ , PM _{2.5})	–
3B4giv	Manure management - Other poultry	T2 (NH ₃ , NO _x) T1 (NMVOC, TSP, PM ₁₀ , PM _{2.5})	CS (NH ₃ , NO _x) D (NMVOC, TSP, PM ₁₀ , PM _{2.5})	–
3B4h	Manure management - Other animals (rabbits and fur animals)	T1 (NH ₃ , NO _x , NMVOC, TSP, PM ₁₀ , PM _{2.5})	D (NH ₃ , NO _x , NMVOC, PM TSP, PM ₁₀ , PM _{2.5})	–

CS – country specific; D – default

Shares of emissions from the NFR 3B category in the country total for the particular pollutants in 2024 are shown in Figure 5.2. The highest shares of pollutant emissions from this category are 41% for NH₃ and 20% for NMVOC emissions.

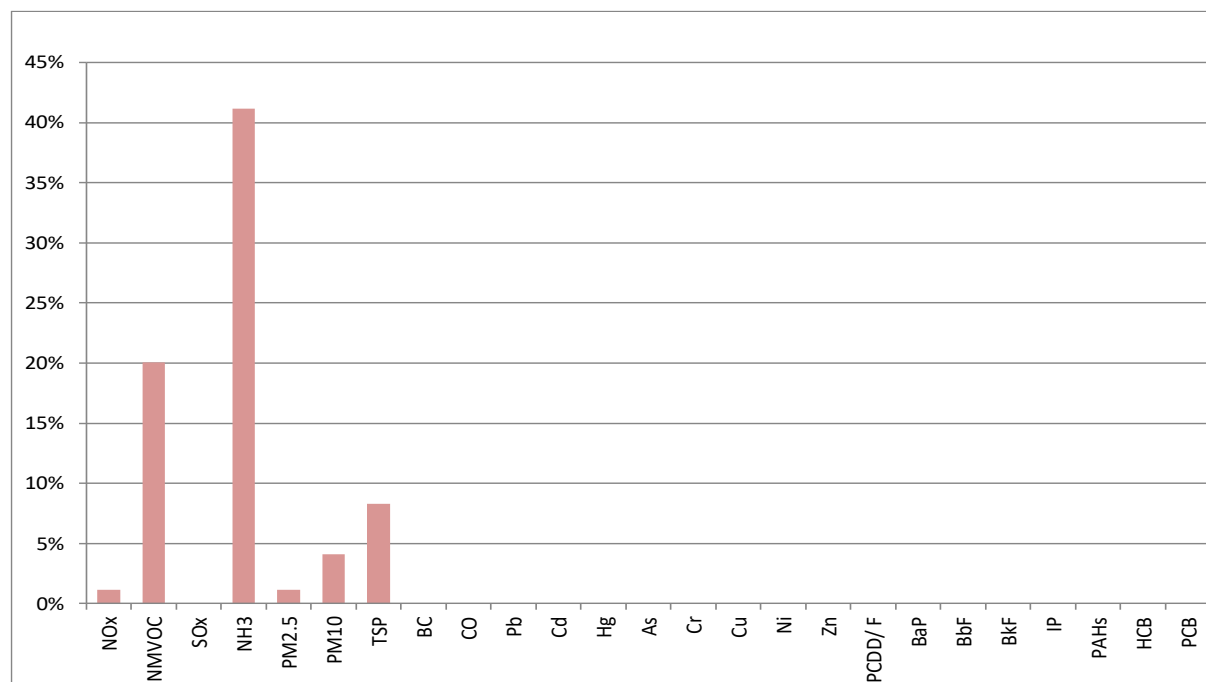


Figure 5.2. Shares of emissions from the 3B category in the country total in 2024

5.3.2 Methodological issues

Livestock population

Data on animal population is collected by Statistics Poland and is published on an annual basis in Statistical Yearbook of the Republic of Poland [GUS (1990-2025)] but also in other agricultural statistical publications and the Local Bank Data in the Statistics Poland [GUS 2025i].

Generally population of major livestock is available on an annual basis. It should be noted that in Poland the June sample survey is a common date for collecting data by national statistics on all main livestock numbers and covers entire trend since 1990. The exception here is swine population for which data in 1998-2013 was collected also in summer but in July. It should be mentioned that for the last years sample surveys for cattle, sheep and poultry are performed twice a year (June, December) while for swine - three times a year (March, June and December) but the dates for additional sampling are not consistent and use to change since 1990. On the other hand population of horses and goats was collected once a year, in June, only. Additionally, for the first years of the inventoried series, only one annual number of livestock is available (June) for all main animal categories. In conclusion, application of the June survey results is justified and in fact the only one available to ensure time series consistency. Even more - comparison of differences in livestock population in the surveyed months performed for the same year indicated that summer populations are the highest in most of cases of the given year, thus use of other statistical data could lead to underestimation of the emission. The population data on livestock applied for CLRTAP and GHG inventories correlates also with the numbers available in the FAO database what can be checked for consistency.

Trends of animal population in 1988–2024 are given in Table 5.2. As relates to goats population some lack of data is noticed for 1990-1995 and 1997, so data for 1996 was taken for the period 1990–1995 and for 1997 the average value for 1996 and 1998 was calculated. Since 1998 up to 2013 goats population is available on an annual basis.

The goats and horses population, since 2013, has been collected every 3 years. Therefore repeated data for 2013-2015 were used only for the middle year like 2014 and the same data for 2016-2018 were used for 2017. For the years between interpolation was used (2015, 2016). In 2022 the results of Agricultural Census 2020 on livestock population were published so those data for goats and horses were employed for both years 2020 and 2021 (as no new data for horses and goats for 2021 in the national statistics appeared) so the interpolation was made for 2018 and 2019. Data on goats population was published again on an annual basis since 2022.

Additionally data on rabbits and fur animals population is available in public statistics only for selected years like: 1983 and 1996, 2002, 2010, 2013, 2016 and 2021 when Agricultural Censuses were performed or other periodic studies were published containing required data. Those data from 2021 are repeated for 2022. Population of rabbits for 2023 was taken from national statistics [GUS 2025m] and duplicated for 2024. Interpolation was used for in-between years. Statistical data as referenced above related to rabbits covers female rabbits capable for reproduction. Fur-bearing animals include also female animals of: foxes, minks, polecats, nutrias, polecat-ferrets, chinchilla and yenots.

Poultry population since 2022 was taken from Statistics Poland as of December because no data for June was available.

Table 5.2. Trends of livestock population since 1990

Years	Livestock population [thousands]										
	Dairy cattle	Non-dairy cattle	Sheep	Goats	Horses	Swine	Rabbits	Other fur animals	Poultry		
									Laying hens	Broilers	Other poultry
1990	4 919	5 516	4 159	179	941	19 464	1 091	399	55 686	132 485	36 694
1991	4 577	5 739	3 234	179	939	21 868	1 091	357	53 427	128 193	34 473
1992	4 257	5 130	1 870	179	900	22 086	1 091	314	49 418	115 636	34 081
1993	3 983	4 267	1 268	179	841	18 860	1 091	272	47 819	112 420	34 467
1994	3 863	3 964	870	179	622	19 466	1 091	230	51 278	116 569	33 549
1995	3 579	3 660	713	179	636	20 418	1 091	187	48 799	110 300	30 885
1996	3 461	3 833	552	179	569	17 964	1 091	145	56 302	136 471	14 707
1997	3 490	3 727	491	182	558	18 135	1 054	164	54 746	130 195	16 300
1998	3 542	3 675	453	186	561	19 168	1 017	183	53 241	127 709	20 413
1999	3 418	3 817	392	181	551	18 538	981	201	53 245	125 929	23 333
2000	3 098	3 413	362	177	550	17 122	944	220	52 337	122 307	23 692
2001	3 005	3 137	343	172	546	17 105	907	239	55 314	128 085	22 810
2002	2 873	2 985	345	193	330	18 629	870	257	51 759	123 316	23 708
2003	2 898	2 729	338	192	333	18 605	840	281	44 549	88 846	12 926
2004	2 796	2 660	318	176	321	16 988	811	305	43 001	76 810	11 331
2005	2 795	2 591	316	142	312	18 112	781	329	51 153	83 271	18 374
2006	2 824	2 557	301	130	307	18 881	751	353	47 746	77 124	16 937
2007	2 787	2 688	332	144	329	18 129	721	377	49 509	83 563	17 548
2008	2 806	2 782	324	136	325	15 425	691	401	50 724	78 063	16 708
2009	2 688	2 909	286	119	298	14 279	661	425	49 396	74 733	16 697
2010	2 656	2 950	258	108	264	14 865	632	449	48 727	69 118	14 351
2011	2 626	3 012	251	112	254	13 509	550	427	47 059	80 482	16 016
2012	2 578	3 068	267	90	222	11 581	468	404	52 455	60 969	17 172
2013	2 531	3 136	223	86	215	11 162	386	382	49 893	73 619	17 179
2014	2 479	3 199	201	82	207	11 724	374	601	41 769	88 092	16 910
2015	2 444	3 329	228	63	215	11 640	362	820	45 629	100 493	17 303
2016	2 332	3 441	239	54	207	10 865	350	1 039	47 072	121 960	18 742
2017	2 374	3 516	261	44	185	11 353	426	1 707	50 160	127 480	19 897
2018	2 429	3 607	277	47	176	11 828	502	2 375	53 931	128 269	24 028
2019	2 461	3 769	273	51	166	10 781	578	3 044	54 628	128 493	27 243
2020	2 468	3 772	288	54	157	11 433	654	3 712	51 088	134 625	29 273
2021	2 388	3 836	289	54	157	11 033	730	4 380	45 598	118 771	25 895
2022	2 208	3 876	290	60	157	9 611	730	4 380	44 101	132 480	22 326
2023	2 338	4 012	278	61	158	9 436	644	4 380	49 031	146 114	23 158
2024	2 336	4 236	299	63	158	9 132	644	4 380	57 473	187 207	24 183

Ammonia and nitric oxide emissions from manure management were estimated with the use of *Manure Management N-flow Tool* elaborated based on Tier 2 method (mass flow approach) published in Chapter 3.4.1 of 3B. *Manure Management* of EMEP/EEA EIG 2023. Those calculations cover NH₃ and NO₂ emissions from livestock husbandry for subcategories: 3B, 3Da2a, 3Da3 and also 5B2 (anaerobic digesters), for which ammonia emissions are reported under 5B2 category (see Chapter 6.3.2.2).

Here animal population was applied, CS nitrogen excretion rates (N_{ex}) characteristic for livestock categories (described below) as well as CS data on the animal waste management systems (AWMS). This data set is consistent with the one used for GHG emission estimation [NID 2026]. TAN fractions and other parameters and factors, like nitrogen contained in bedding material or NH₃ and NO₂ emission factors related to specific manure management systems are taken from EMEP/EEA EIG 2023.

Animal Waste Management Systems (AWMS)

Country specific data on the animal waste management systems (AWMS) come from [Walczak 2006, 2009, 2011, 2012, 2013]. The fractions of manure managed in given AWMS for cattle were assessed on an annual basis for periods 1988-2002 and 2004-2012, data for 2003 was interpolated between 2002 and 2004. The share of pastures and solid storage were assessed for the key years: 1988-1989 and for 2004-2012 and the values in-between were interpolated (Based on new data for cattle and swine developed on the basis of Agricultural Census 2020, updated information for liquid and solid management systems were elaborated for 2020 and repeated in the following years. The interpolation was used for period between 2012 and 2020 (see Table 5.3).

Table 5.3). As concerns swine manure management systems the share of liquid and solid storage was estimated based on AWMS shares and pigs population for age categories for 1988 [Walczak 2006]. Data for 2004-2012 was taken from [Walczak 2011, 2012, 2013]. Data for years between 1988 and 2004 interpolation was made.

The data on AWMS shares for livestock has been prepared by the National Research Institute of Animal Production where the database has been established. The database covers livestock population together with their waste management systems (solid, liquid) to determine impact of animal production on natural environment. This database covers animal breeding according to groups (technological and age) for Poland and has been constructed based on livestock monitoring on farms across country in frames of Multiannual Program: "Protection and management of national genetic resources of livestock in the sustainable use conditions" in 2011-2015. Based on Agricultural Census 2020 the National Research Institute of Animal Production elaborated AWMS data for cattle and swine, that were initially applied in calculations. For the years between 2012 and 2020 interpolation was used while for years 2021-2023 – data from 2020 were used. For swine significantly growing share of liquid systems is observed while in case of cattle – slight changes are visible.

For other animals permanent shares of AWMS for entire inventoried period were assumed based on data assessed for 2004-2012: for sheep - 40% on pastures and 60% solid storage, for goats: 44% on pastures and 56% on solid storage and for horses: 22% and 78% respectively. For poultry the following AWMS shares were established: 11% on litter-free systems and 89% on solid storage [Walczak 2011, 2012, 2013].

According to the results of the Agricultural Census conducted in June 2020 [GUS 2022], the number of farms in 2020 was 1,317.4 thousand. Out of this number, 99.4% (1,309.9 thousand) were individual farms, which owned 91.3% of the total agricultural land and 90.8% of the total conversion units of large livestock on farms. In 2020, the trend of a decrease in the number of farms with a simultaneous increase in their average area, recorded for many years, continued. Compared to Agricultural Census results from 2010, the number of farms decreased by approx. 192 thousands (by 12.7%). This was caused by a decrease in the number of farms in the area groups of agricultural land (AL) from 1 to 20 ha. The deepest decrease concerned the area group of 1-2 ha of AL (by over ¼) and 5-10 ha of AL (by over 16%). The smallest number of farms decreased in the group of 2-3 ha of agricultural land. It should be noted that generally in Poland prevail small farms where 52% farms have up to 5 ha and 74% below 10 ha, and only 3% above 50 ha in 2020.

In the 2010-2020 decade, the number of the smallest farms with an area of up to 1 ha of agricultural land increased (by 1.6%) and the largest farms belonging to the area groups of 20 ha and more of agricultural land. The largest number of farms was added in the area group of

50 ha and more AL (over 50%). The observed trend of a decrease in the number of farms was reflected in an increase in the average area of agricultural land per farm - from 9.85 ha in 2010 to 11.35 ha in 2020. This increase was mainly due to the increase in the average area in farms with an area of 20–50 ha of agricultural land.

Among all farms, 1,311.9 thous. (99.6%) had agricultural land and 582.1 thous. (approx. 44%) kept livestock. On average in the country, one farm keeping livestock had: 23 head of cattle, 131 head of swine, 4.4 head of horses, 7.2 head of goats, 30.9 head of sheep and 615.5 poultry birds.

Solid manure was used by 482.8 thous. farms, slurry – 139.4 thousand as well as 110.6 thous. farms used poultry manure for fertilization. Natural fertilization was used mainly by farms specializing in field crops, while and slurry was used by farms specializing in rearing animals fed with roughage. It follows the proportion of solid and liquid systems of livestock maintenance where solid one prevail [GUS 2022].

Based on new data for cattle and swine developed on the basis of Agricultural Census 2020, updated information for liquid and solid management systems were elaborated for 2020 and repeated in the following years. The interpolation was used for period between 2012 and 2020 (see Table 5.3).

Table 5.3. Fractions of manure managed in given AWMS for cattle and swine [%]

Year	Dairy cattle			Other cattle			Swine		
	liquid	solid	pasture	liquid	solid	pasture	liquid	solid	pasture
1990	2.7	76.1	21.2	3.2	79.2	17.6	22.4	77.6	0.0
1991	2.7	76.9	20.4	5.1	77.7	17.2	22.5	77.5	0.0
1992	2.5	77.9	19.6	5.0	78.2	16.8	22.5	77.5	0.0
1993	2.3	78.9	18.8	4.4	79.2	16.4	22.6	77.4	0.0
1994	2.3	79.7	18.0	4.2	79.8	16.0	22.6	77.4	0.0
1995	2.3	80.4	17.2	3.8	80.6	15.6	22.7	77.3	0.0
1996	2.1	81.5	16.4	3.4	81.4	15.2	22.7	77.3	0.0
1997	2.4	82.0	15.6	3.0	82.2	14.8	22.8	77.2	0.0
1998	2.1	83.1	14.8	3.4	82.2	14.4	22.8	77.2	0.0
1999	3.3	82.7	14.0	3.7	82.3	14.0	22.9	77.1	0.0
2000	3.7	83.1	13.2	4.0	82.4	13.6	23.0	77.0	0.0
2001	3.7	83.9	12.4	4.3	82.6	13.2	23.0	77.0	0.0
2002	6.8	81.6	11.6	4.4	82.8	12.8	23.1	76.9	0.0
2003	8.6	80.5	10.8	4.5	83.1	12.4	23.1	76.9	0.0
2004	10.5	79.5	10.0	5.2	83.0	11.8	23.2	76.8	0.0
2005	10.6	79.4	10.0	5.2	82.8	12.0	24.0	76.0	0.0
2006	10.3	79.7	10.0	5.2	83.1	11.7	24.4	75.6	0.0
2007	10.7	79.2	10.0	4.8	83.1	12.0	25.0	75.0	0.0
2008	10.9	79.1	10.0	4.9	83.1	11.9	24.9	75.1	0.0
2009	10.8	79.2	10.0	4.8	83.1	12.0	25.9	74.1	0.0
2010	10.1	79.6	10.3	5.1	82.9	12.1	25.5	74.5	0.0
2011	10.6	79.1	10.3	5.2	82.9	11.9	24.9	75.1	0.0
2012	10.5	79.2	10.3	5.1	82.9	12.0	24.3	75.7	0.0
2013	10.8	79.2	10.0	5.2	82.3	12.5	28.7	71.3	0.0
2014	11.0	79.2	9.8	5.4	81.6	13.0	33.2	66.8	0.0
2015	11.3	79.2	9.5	5.6	81.0	13.4	37.6	62.4	0.0
2016	11.6	79.2	9.2	5.7	80.4	13.9	42.0	58.0	0.0
2017	11.8	79.2	9.0	5.9	79.7	14.4	46.4	53.6	0.0
2018	12.1	79.2	8.7	6.1	79.1	14.9	50.9	49.1	0.0
2019	12.3	79.2	8.4	6.2	78.4	15.4	55.3	44.7	0.0
Since 2020	12.6	79.3	8.2	6.4	77.8	15.9	59.7	40.3	0.0

Nitrogen excretion rates (Nex)

Data on animals' nitrogen excretion rates (kg N/head/year) is mostly country specific ones [IUNG 2014, Pastuszak, Igras 2012], except of fur bearing animals which were taken from on 2006 IPCC GLs (Table 5.4, Table 5.5). Following review recommendation Nex for dairy cattle, but also for other cattle subcategories, were recalculated based on the 2006 IPCC GLs methodology (equation 10.31 and 10.32) with gross energy (GE) as calculated in GHG inventory [NID 2025] and percent of crude protein in diet (CP%) based on country study [Walczak 2020; 2022] (Table 5.5). The same Nex parameters are used in GHG inventory.

Country specific Nex values are generally in line with parameters published by EMEP/EEA for most livestock categories. The basis for assessment of Nitrogen excretion rates (Nex) by [IUNG 2014, Pastuszak, Igras 2012] constitutes the standard amounts of nitrogen in faeces and urine determined for different groups of livestock animals grounded on standard quantity, sort and digestibility of fodder applied.

Table 5.4. Country specific nitrogen excretion rates (Nex) for cattle and swine in selected years [kg N/animal]

Livestock categories	1990	1995	2000	2005	2010	2015	2020	2022	2023	2024
Dairy cattle > 2 years	102.42	101.85	102.81	105.43	105.81	111.40	114.38	121.70	122.01	127.78
Young cattle <1 year	44.34	45.41	47.32	46.43	45.49	44.51	44.53	44.67	44.67	44.67
Young cattle 1-2 years	64.11	64.23	62.20	59.95	59.57	56.76	55.62	55.95	55.95	55.95
Heifers > 2 years	56.89	57.07	54.93	52.86	53.05	51.93	51.21	51.47	51.47	51.47
Bulls > 2 years	83.00	85.93	88.48	87.16	85.86	85.12	84.91	85.89	85.89	85.89
Other cattle (weighted mean)	53.98	54.71	54.51	53.00	53.08	51.42	51.31	51.44	51.60	51.59
Swine (weighted mean)	9.97	9.97	10.03	9.86	10.07	10.43	10.91	10.95	10.84	10.99

Table 5.5. Nitrogen excretion rates (Nex) for other livestock used in emission calculations in 1990–2024 [kg N/animal]

Livestock categories	Nex	Reference
Swine:		
Piglets (< 20 kg)	2.6	CS [IUNG, 2014]
Piglets (20-50 kg)	9.0	CS [IUNG, 2014]
Fattening pigs (> 50 kg)	15.0	CS [IUNG, 2014]
Butcher hogs	18.0	CS [IUNG, 2014]
Sows	20.0	CS [IUNG, 2014]
Sheep	9.5	CS [IUNG, 2014]
Horses	55.0	CS [IUNG, 2014]
Goats	8.0	CS [IUNG, 2014]
Hens	0.725	CS [Pastuszak, Igras 2012]
Broilers	0.435	CS [Pastuszak, Igras 2012]
Turkeys	1.554	CS [Pastuszak, Igras 2012]
Ducks	1.381	CS [Pastuszak, Igras 2012]
Geese	1.640	CS [Pastuszak, Igras 2012]
Rabbits	8.10	D [2006 IPCC table 10.19]
Minks and polecats	4.59	D [2006 IPCC table 10.19]
Foxes, racoons	12.09	D [2006 IPCC table 10.19]

The Nex values for Poland for sheep and goats are among group of countries with lower factor then the default ones. The country specific Nex values were established based on livestock categories raised in Poland as well as country specific conditions and international literature and research. Sheep (as well as goats) in Poland are fed on pastures for around half a year and housed for another half. Sheep and goats are fed mostly on roughage from extensive pastures

and meadows. Winter feeding covers hay, straw and root crops. Additional protein fodder is not widely applied among sheep and goats, if applied it is limited to lambs. It should be mentioned here that Nex is established for entire group of sheep of which about 30% are lambs and other immature animals.

Ammonia abatement techniques

When using Tier 2 method during calculations of NH₃ emissions from manure management the effect of some abatement measures were taken into account (Table 5.6) following method described in Chapter 3.5 in part 3B. *Manure Management* of EMEP/EEA EIG 2023.

Table 5.6. NH₃ abatement techniques in livestock breeding and manure management applied in selected years

NH ₃ abatement techniques	% of animal population covered in years					NH ₃ emission reducing potential [%]
	2005	2010	2014	2018	Since 2021	
Swine partially slated floor	0.0	11.9	15.6	15.6	14.7	20
Laying hens solid manure fast removal	0.6	28.0	32.3	30.1	29.6	32
Laying hens solid manure ventilation	0.0	12.1	14.3	11.6	10.2	32
Cattle solid manure cover	0.5	2.3	2.8	2.8	2.8	80
Swine solid manure cover	0.9	12.7	15.3	13.2	9.3	80
Laying hens solid manure cover	0.0	1.14	1.34	1.02	0.94	80
Broilers solid manure cover	0.2	0.5	0.7	0.6	0.5	80
Cattle slurry cover	0.0	43.5	44.8	89.0	100	80
Swine slurry cover	0.0	61.8	67.2	93.4	100	80
Dairy cattle protein feeding	0.0	14.2	17.6	20.9	25.0	15
Laying hens 3-phase feeding	0.0	23.3	27.4	28.2	29.8	20
Broilers 5-phase feeding	0.0	38.5	42.1	42.9	43.4	20
Fattening pigs 4-phase feeding	0.0	14.7	18.5	19.3	25.1	30
Piglets 3-phase feeding	0.0	10.2	14.7	15.3	18.7	30

For the purpose of the air pollution inventory the list of reduction techniques was identified by the National Research Institute of Animal Production (NRIAP), which is supervised by the Ministry of Agriculture and Rural Development, in 2016 and updated in 2022, within the scope of their application in production practice. The selection of techniques was made on the basis of the confirmed effects described in the EMEP/EEA and IIASA methodologies. The identification of the application in domestic animal husbandry and the quantitative determination of the scope of implementation in practice were carried out on the basis of the synthesis of integrated databases of the Statistics Poland (including the general agricultural census) and the NRIAP. Publicly available data from various sources, including Ministry of Agriculture and Rural Development, on production, sales and the feed market were also used. The calculations covered three selected years: 2005, 2010, 2014, 2018 and 2021 and interpolation was used for the years between. Data for 2021 were duplicated in 2022 and 2023. Data on reduction measures started in 2005 as such actions were introduced mostly after joining the EU in May 2004. The developed values were converted into the percentage share of the individual livestock species.

The reasons for the emergence of new technologies of a reducing nature in domestic livestock farms include only the system of direct payments, investments in farms and the need to reduce production costs by implementing modern breeding technologies. These technologies, intended for the European market, have certain basic reduction solutions cooperating with cost reduction. For example, the introduction of multiphase feeding, and thus the reduction of the dispersion of nitrogen compounds, results from the high prices of feed protein. While

optimizing feeding costs (on average accounting for 70% of production costs), breeders, instead of one feed with a high protein content, introduce 2-5 mixtures with a lower protein concentration, adapted to the decreasing nutritional needs of growing animals.

The implementation of abatement techniques was estimated based on expert opinion which was supported by data provided by the Department of Agriculture in the Statistics Poland, covering data on farms, amount of livestock stands and types of manure management. Estimations were made based on analysing the following data from GUS:

- Cattle, total amount of stands: 7,158,243
- Swine, partially slated floor – total amount of stands: 10,865,320,
- Laying hens and broilers, manure fast removal and manure ventilation – total amount of stands 19,123,760,
- Farms breeding cattle, swine and broilers on solid manure, including deep litter maintenance – total number: 374,911,
- Farms breeding cattle and swine, slurry cover – total number: 155,816.

Also impact of the regulations introduced by the so-called "Nitrate program" and BAT (IED directive) were taken into account (the verification of integrated permits carried out by Voivodeship Inspectorates of Environmental Protection) in describing the share of livestock herds covered with the reduction measures.

On the basis of the conducted analyses, the following reduction techniques were identified:

- partially slated floor for swine - up to 20% reduction [UNECE: 15-20% for finishers - sows],
- manure drying systems in cage laying hens - 32.01% emission reduction according to EMEP / EEA and IIASA [UNECE 2014a: 35-40%],
- quick manure removal system in laying hens - 32.01% emission reduction according to EMEP / EEA and IIASA [UNECE 2014a: 50-80%],
- covering slurry tanks and solid manure plates - up to 80% emission reduction by EMEP / EEA and IIASA [UNECE 2014a: 40-80%],
- multiphase feeding of poultry and pigs, allowing to specify the nitrogen content in the feed to the nutritional needs of animals of different ages - emission reduction effect according to EMEP / EEA and IIASA - 29.88% pigs, 20% poultry,
- feeding of cattle with a higher proportion of enteric protein for highly intensive dairy herds - emission reduction effect to 15.21% dairy cattle,
- cattle – time spent on pastures from 180 days up to 210 days since 2014.

As it could be seen above emission reduction coefficients are within the range published by UNECE or lower [UNECE 2014a]. As the legal obligations related to the necessity of covering the slurry tanks were introduced it is established (ordinance of the Council of Ministers of 12.02.2020, as updated by the one of 31.01.2023 (Journal of laws 2023 item 244) regarding acceptance of the "Action programme to reduce water pollution caused by nitrates from agricultural sources and to prevent further pollution"), that 100% of such tanks are covered in 2019 and interpolation was made between 2014 and 2019. Information on reduction measures and its effects was also elaborated for the purpose of preparation of the [GPG 2020].

NH₃ and NO₂ emission factors

Comparison of default NH₃ and NO_x EFs as published in part 3B. *Manure Management* of EMEP/EEA EIG 2023 in Table 3.1 and CS implied emission factors is given in Appendix 6. The

CS implied emission factors since 1990 is given in Table 5.7 and Table 5.8.

It should be noticed that EFs for cattle increases in time due to increasing share of slurry systems. In case of dairy cattle EFs raises significantly also due to increasing Nex parameter in time related to improving milkiness. Abatement measures incorporated in calculations are visible the most in case of fattening pigs.

Table 5.7. Country specific NH₃ implied emission factors from housing, storage and yards [kg NH₃/animal/year]

Source	1990	1995	2000	2005	2010	2015	2020	2022	2023	2024
Dairy cattle	13.172	14.217	15.422	16.161	15.572	16.576	17.157	18.521	18.568	19.677
Other cattle	5.176	5.320	5.375	5.267	4.739	4.084	3.964	3.975	3.991	3.990
Fattening pigs	2.918	2.913	2.927	2.889	2.560	2.420	2.280	2.266	2.244	2.276
Sows	5.968	5.964	5.961	5.959	5.762	5.801	5.879	5.887	5.884	5.883
Hens	0.165	0.165	0.165	0.165	0.145	0.141	0.142	0.142	0.142	0.142
Broilers	0.130	0.130	0.130	0.130	0.119	0.118	0.118	0.118	0.118	0.118
Other poultry	0.586	0.586	0.586	0.586	0.586	0.588	0.588	0.588	0.588	0.589
Source	1990-2024									
Sheep	1.235									
Horses	13.073									
Goats	0.877									
Fur animals	0.020									

Table 5.8. Country specific NO₂ implied emission factors from housing and storage and yards [kg NO₂/animal/year]

Source	1990	1995	2000	2005	2010	2015	2020	2022	2023	2024
Dairy cattle	0.693	0.697	0.704	0.728	0.750	0.766	0.797	0.824	0.813	0.830
Other cattle	0.294	0.291	0.289	0.298	0.302	0.302	0.308	0.308	0.308	0.307
Fattening pigs	0.080	0.080	0.080	0.080	0.079	0.079	0.079	0.079	0.080	0.079
Sows	0.131	0.131	0.131	0.131	0.130	0.130	0.130	0.130	0.129	0.129
Hens	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
Broilers	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Other poultry	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
Source	1990-2024									
Sheep	0.387									
Horses	0.482									
Goats	0.027									
Fur animals	0.001									

NM VOC emission factors

Following review recommendation, NMVOC emissions from cattle and broilers breeding have been estimated based on Tier 2 method. For other livestock husbandry Tier 1 method and default EFs from Table 3.4 from EMEP/EEA EIG 2023 are used. The shares of animals fed with silage are given in Table 5.9. Here data for cattle covers differentiated shares within the trend since 1990 while for sheep, goats and horses average shares of silage feeding is assumed for entire series since 1990.

Table 5.9. Shares of silage feeding of livestock

Livestock	Share with silage feeding
Dairy cattle	0.11 in 1990 – 0.57 in 2024
Other cattle	0.23 in 1990 – 0.76 in 2024
Sheep & Goats	0.175 for 1990-2024
Horses	0.125 for 1990-2024

Tier 2 method for NMVOC emissions calculation was established for dairy cattle (3B1a) and other cattle (3B1b) fed with silage, using equations 48–54 from EMEP/EEA EIG 2023. For

broilers (3B4gii) NMVOC emissions estimation the equations 55-60 were applied. Parameters used for NMVOC emission calculation for cattle and broilers are presented in Table 5.10, NMVOC emission factors for other livestock are given in Table 5.11.

Calculated NMVOC emissions from livestock husbandry are reported in 3B category (therefore IE is given in the Annex I in subcategories 3Da2a and 3Da3). As concerns parameter describing the maximum proportion of silage possible in the feed composition ($\text{Frac-max}_{\text{silage}}$) the value of 0.5 has been used in NMVOC emission calculation as recommended default value in EMEP/EEA EIG 2023.

Table 5.10. Parameters used to estimate NMVOC emissions from manure management according to Tier 2 method in 2024

Parameters	Dairy cattle	Other cattle	Broilers
Gross feed intake [MJ/year/head]	113 694	43 777	-
Vs [kg/year/head]	-	-	3.65
ENMVOC.silage store [kg/year/head]	2.613	0.465	0
ENMVOC.silage feeding [kg/year/head]	10.451	1.861	0
ENMVOC.house [kg/year/head]	3.685	0.656	0.033
ENMVOC.manure_store [kg/year/head]	5.236	1.172	0.029
ENMVOC.appl. [kg/year/head]	8.973	1.824	0.019
ENMVOC.graz [kg/year/head]	0.064	0.174	0

Table 5.11. NMVOC emission factors in livestock breeding [kg NMVOC/animal/year]

Source	1990	1995	2000	2005	2010	2015	2020	2022	2023	2024
Dairy cattle (T2)	19.870	20.667	22.501	23.758	24.430	26.542	27.532	29.255	29.367	31.022
Other cattle (T2)	6.727	6.818	6.954	6.903	6.631	6.059	6.097	6.098	6.152	6.151
Broilers (T2)	0.082	0.082	0.082	0.082	0.081	0.081	0.081	0.081	0.081	0.081
Source	1990-2024									
Fattening pigs (T1)	0.551									
Sows (T1)	1.704									
Sheep (T1)	0.188									
Horses (T1)	4.713									
Goats (T1)	0.556									
Laying hens (T1)	0.165									
Other poultry (T1)	0.489									
Rabbits (T1)	0.059									
Other fur animals (T1)	1.941									

PM emission factors

Emission factors for TSP, PM₁₀ and PM_{2.5} for manure management category are those published in EMEP/EEA EIG 2023 (Table 3.5, Chapter 3B), covering all animals raised. Applied emission factors are shown in Appendix 6. EFs for other cattle and other poultry are calculated as weighted mean for different animal subcategories based on their population. The TSP, PM₁₀ and PM_{2.5} emissions are limited to the time spent in buildings (excluding % of the year spent on pastures). This calculation is implemented in a way that emissions are diminished by share of time spent by given livestock on pastures (Table 5.3).

5.3.3 Emission trends for NFR sector 3B

Trends of pollutant emissions for 3B sector are shown below in figures (Figure 5.3 and Figure 5.4). Ammonia emissions in 3B decreased by 40.0% between 1990–2024 and by 13.2% between 2005–2024 as well as NO₂ emissions drop by 40.3% and 8.0% respectively. Here different factors influenced interannual changes like: animal population, changing shares of AWMS systems including time spent on pastures as well as Nex parameters fluctuations or abatement techniques implemented. In case of NMVOC drop in emissions occurred in 1990–2024 by 1.7% and increase in emissions was observed in 2005–2024 by 36.6%, here mostly changes in silage feeding of cattle triggered emission trends.

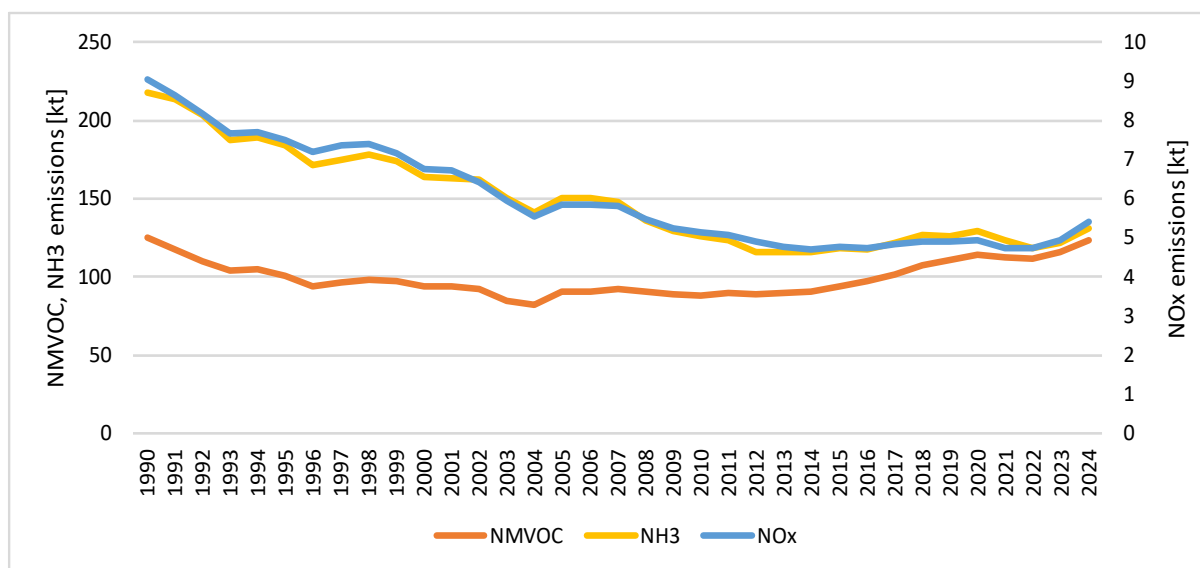


Figure 5.3. NO_x, NMVOC and NH₃ emissions for 3B category in 1990-2024

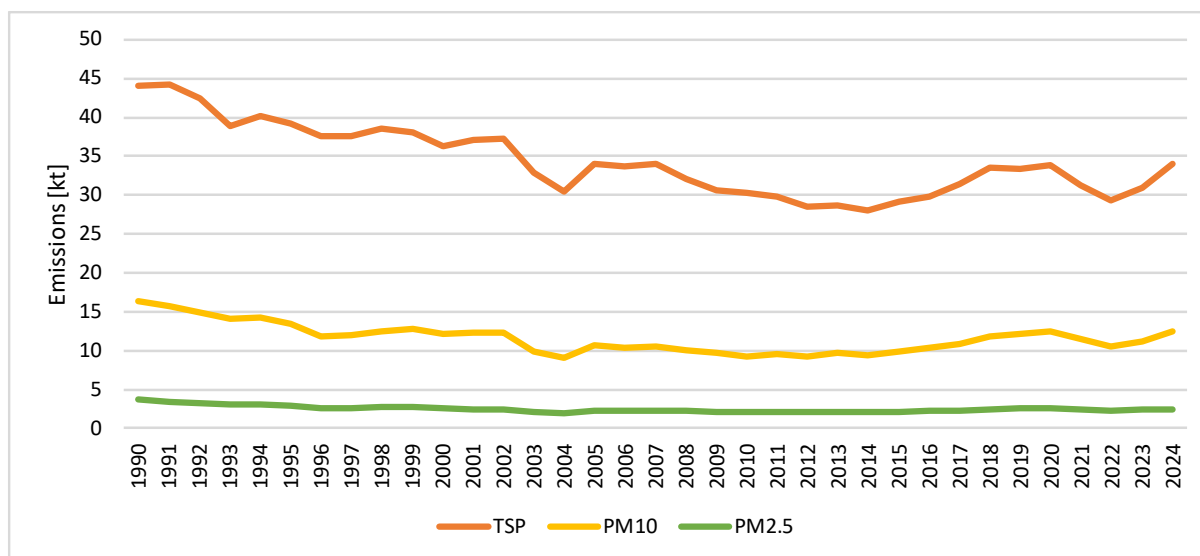


Figure 5.4. TSP, PM₁₀ and PM_{2.5} emissions for 3B category in 1990-2024

5.4 Agricultural Soils (NFR sector 3D)

5.4.1 Source category description

The pollutant emissions in agricultural soils involve: NH_3 and NO_x from the application of synthetic nitrogen fertilizers, NH_3 and NO_x from manure applied to soils as well as from sewage sludge applied to soils, NMVOCs from crop cultivation, PM_{10} , $\text{PM}_{2.5}$, TSP from agricultural operations and HCB from pesticides use.

The overview of methods, EFs and key categories from the NFR 3D are specified in Table 5.12.

Table 5.12. Overview of methods, EFs and key categories from NFR 3D

NFR code	Method	EF	Key category
3Da1	Inorganic N-fertilizers (includes also urea application)	T2 (NH_3) T1 (NO_x)	D/CS NH_3
3Da2a	Animal manure applied to soils	T2 (NH_3 , NO_x)	CS NH_3
3Da2b	Sewage sludge applied to soils	T1 (NH_3 , NO_x)	D –
3Da2c	Other organic fertilisers applied to soils (including compost)	–	–
3Da3	Urine and dung deposited by grazing animals	T2 (NH_3 , NO_x)	CS –
3Da4	Crop residues applied to soils	–	–
3Db	Indirect emissions from managed soils	–	–
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	T2 (TSP, PM_{10} , $\text{PM}_{2.5}$)	D TSP, PM_{10}
3Dd	Off-farm storage, handling and transport of bulk agricultural products	–	–
3De	Cultivated crops	T2 (NMVOC)	D –
3Df	Use of pesticides	T1 (HCB)	D HCB

CS – country specific; D – default

Shares of emissions from the NFR 3D category in the country total for the particular pollutants in 2024 are shown in Figure 5.5. The most significant shares of pollutant emissions from this category is NH_3 (55%), remaining substances shares are below 24%.

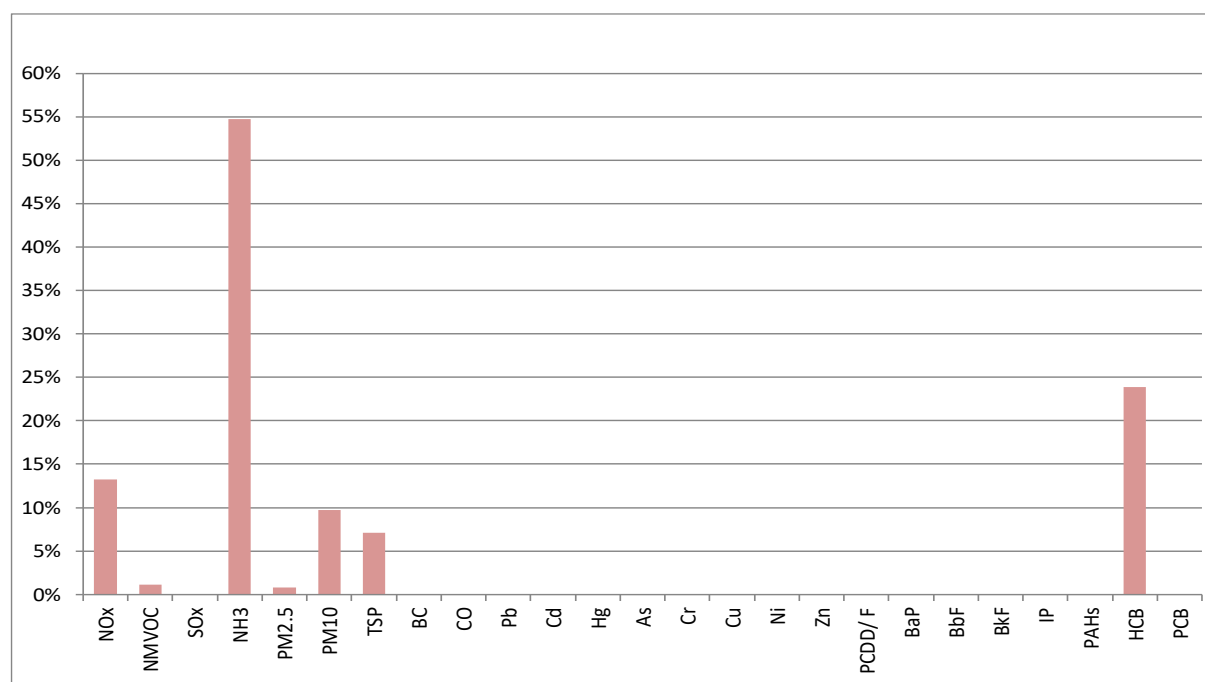


Figure 5.5. Shares of emissions from the 3D category in the country total in 2024

5.4.2 Methodological issues

5.4.2.1 Inorganic N-fertilizers (NFR sector 3Da1)

NH₃ and NO_x emissions from synthetic fertilizers were estimated based on the amount of nitrogen synthetic fertilizers applied to agricultural fields.

Data regarding consumption of mineral fertilizers is developed by Statistics Poland (GUS) on the basis of reporting and sample surveys, i.e. regular surveys on the structure of agricultural holdings (R-SGR) carried out every three years and the June Agricultural Surveys (R-CzBR) conducted between researches R- SGR. The data based on information collected in sample surveys include:

- generalized results of the sample survey conducted in individual farms,
- information obtained from the whole population of agricultural farms of legal persons and organizational units without legal personality.

As the data on fertilizer use does not cover the calendar year but the farming year (covering period since 1 July year x-1 up to 30 June year x), data for 2020 is established for farming year 2019/2020 etc. For farming year 2009/10 the data on fertilizers and tractors was compiled on the basis of the results of the Agricultural Census of 2010. The survey results are presented according to the seat of the farm user.

Since 2020 Statistics Poland started to publish data on mineral fertilizers use every 3 years [GUS 2024], therefore data for 2021, 2022 and 2024 were taken from [IFASTAT database] where historical data are, in general, in line with national statistics. Nitrogen fertilizers use in Poland is given in Table 5.13.

Table 5.13. Nitrogen fertilizers use since 1990 in Poland [kt N]

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1274	735	619	683	758	836	852	890	891	862	861	895	862	832	895
2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
895	996	1056	1142	1095	1028	1091	1095	1179	1098	1004	1043	1151	1179	994
2020	2021	2022	2023	2024										
1034	1038	940	1040	949										

Ammonia emissions from mineral fertilizers applied to soils have been recalculated following the ERT 2020 recommendation. Update of deriving the country specific NH₃ EF is based on the Tier 2 method and default EFs for specific Nitrogen fertilizers NH₃ published in Table 3.2 of the *3D Crop production and agricultural soils* of EMEP/EEA EIG 2023, Chapter 3.4, using domestic structure of nitrogen fertilizers application published by the International Fertilizer Association [IFASTAT database]. It should be noted here that data for Poland published in the IFA database is the same but shifted by one year comparing to the data published by Statistics Poland and used in the inventory what is related to the fact that fertilizers are published in national statistics for farming years. It means that in the IFA database amount of N fertilizer published as 2018 are those published by national statistics for 2018/2019 farming year.

The EFs for cool climate (as given in Table 10A-4 in Chapter 10 of the 2006 IPCC GLs) are applied as the annual average temperature in Poland span from about 8°C in north-east up to about 11°C in south-west. Data on soil reaction in Poland is published on an annual basis by the Statistics Poland [GUS 2025h]. In 2024 the structure of soil reaction at farmland soils in Poland was as following: very to slightly acid – 72%, neutral soils – 19% and alkaline soils (>

7.2 pH) – 9%. Such structure was applied in calculation of weighted mean Emission Factor for NH₃ from inorganic fertilizers for 2024 (Table 5.14).

Table 5.14. Calculation of EFs for NH₃ from mineral fertilizers based on Tier 2 method (EMEP/EEA EIG 2023, Chapter 3D, Table 3-2, cool climate)

N Fertilizer per form	EF NH ₃ (g NH ₃ /kg N)		Implied NH ₃ EFs (g NH ₃ /kg N)
	91%	9%	
	normal pH	high PH	
Ammonium nitrate	24	52	26.52
Ammonium phosphate	84	187	93.27
Ammonium sulphate	84	187	93.27
CAN	24	52	26.52
NPK* compound	84	187	26.52
Nitrogen solutions	87	161	93.66
Other N straight	84	187	93.27
Other NP	84	187	93.27
Urea	195	206	195.99

* EF for Ammonium nitrate is used for mixtures of NPK according to annotation (d) under table 3.2 from EMEP/EEA EIG 2023, 3D Chapter

In case of NPK fertilizers, based on information collected from *Grupa Azoty* (Polish association of fertilizers producers), it cannot be confirmed that they are MAP/DAP based products, therefore the EFs for AN are used for mixtures of NPK fertilizers.

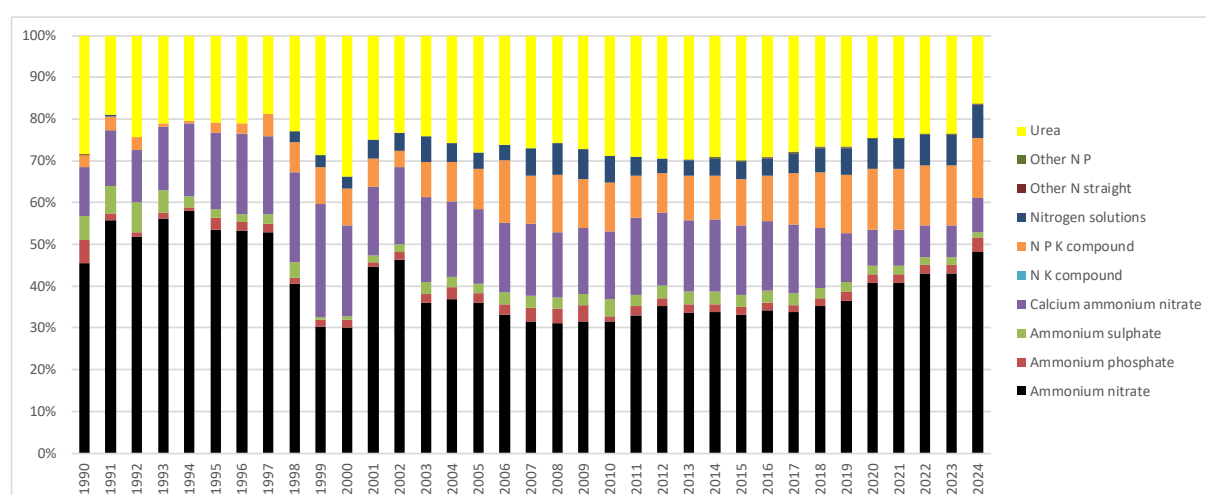


Figure 5.6. Nitrogen fertilizers shares according to form used in Poland

In line with NECD recommendations contained in the Annex III Part 2 point A3b) the ban on the use of urea in granulated form without a urease inhibitor or without a biodegradable coating was imposed by the amendment on 2 December 2020 to the *Act on Fertilisers and Fertilisation* (from 2007). The obligation has come into effect since 1 August 2021. This solution improves fertilisation efficiency and air protection.

Based on information obtained from Statistics Poland, 22% of urea sold in 2021, and 60% in 2022, 41% in 2023 and 33% in 2024 contained urease inhibitors contributing to the reduction of NH₃ emissions from the fertilizer used. Use of urea with biodegradable coating still is close to zero.

According to the information from the national statistics, the abatement measure related urea-based fertilizers was taken into account when establishing the NH₃ EF where emission

reduction factor of 70% for solid urea with urease inhibitors was adopted from Table 15 in UNECE 2014a. This factor can be also confirmed by country publication based on field measurements [Marcinkowski T., Kierończyk M. 2015] dealing with inhibitors applied with solid and liquid urea. Considering the emission reduction level of 70% and share of urea stabilised with urease inhibitor the implied NH_3 EF for urea amounts to 58.80 g NH_3 /kg N in 2024.

Taking into account all above mentioned assumptions (Table 5.14 and Figure 5.6) the weighted mean NH_3 emission factor for Poland was calculated for entire time series (Table 5.15).

Table 5.15. Implied emission factors (IEFs) related to Nitrogen fertilizers use since 1990 in Poland [kg NH_3 /kg N]

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
0.082	0.064	0.072	0.066	0.063	0.065	0.064	0.060	0.070	0.078	0.087	0.073	0.071
2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
0.074	0.076	0.079	0.076	0.080	0.079	0.081	0.083	0.082	0.082	0.082	0.082	0.083
2016	2017	2018	2019	2020	2021	2022	2023	2024				
0.082	0.080	0.079	0.079	0.075	0.068	0.055	0.061	0.055				

For NO_x emissions from inorganic fertilizers the default EF from EMEP/EEA EIG 2023 was used as of 0.04 t NO_2 /t N fertilizer.

5.4.2.2 Animal manure applied to soils (NFR sector 3Da2a)

The NH_3 and NO_x emissions related to animal manure application on soils are calculated separately for each livestock category using mass flow approach based on EMEP/EEA EIG 2023 and related *Manure Management N-flow Tool* taking into account manure management systems and application techniques. More information is given in Chapter 5.2.2. Ammonia emission factors related to manure application are given in Table 5.16 while NO_2 IEFs are given in Table 5.17.

Table 5.16. Country specific NH_3 implied emission factors from animal manure application [kg NH_3 /animal/year]

Source	1990	1995	2000	2005	2010	2015	2020	2022	2023	2024
Dairy cattle	12.217	12.011	12.534	15.052	14.778	16.158	17.073	18.536	18.601	19.791
Other cattle	4.784	4.804	4.683	4.568	4.211	3.792	3.955	3.968	3.983	3.981
Fattening pigs	1.448	1.455	1.471	1.456	1.446	1.691	2.095	2.077	2.051	2.080
Sows	2.188	2.196	2.203	2.210	2.347	2.468	2.724	2.720	2.715	2.712
Laying hens	0.139	0.139	0.139	0.139	0.136	0.135	0.134	0.134	0.134	0.000
Broilers	0.039	0.039	0.039	0.039	0.036	0.036	0.036	0.036	0.036	0.036
Source	1990-2024									
Sheep	0.472									
Horses	5.135									
Goats	0.353									
Other poultry	0.181									
Fur animals	0.010									

Table 5.17. Country specific NO₂ implied emission factors from animal manure application [kg NO₂/animal/year]

Source	1990	1995	2000	2005	2010	2015	2020	2022	2023	2024
Dairy cattle	2.889	2.990	3.134	3.334	3.282	3.434	3.537	3.710	3.718	3.860
Other cattle	0.885	0.892	0.884	0.863	0.796	0.711	0.718	0.719	0.721	0.721
Fattening pigs	0.297	0.297	0.298	0.295	0.286	0.297	0.313	0.311	0.308	0.312
Sows	0.627	0.627	0.627	0.628	0.635	0.629	0.619	0.619	0.619	0.619
Laying hens	0.021	0.021	0.021	0.021	0.021	0.020	0.020	0.020	0.020	0.020
Broilers	0.012	0.012	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.011
Source	1990-2024									
Sheep	0.041									
Horses	1.206									
Goats	0.160									
Other poultry	0.036									

5.4.2.3 Sewage sludge applied to soils (NFR sector 3Da2b)

The emissions of NH₃ and NO_x from sewage sludge application on agricultural soils was estimated using Tier 1 method and emission factors given in the EMEP/EEA EIG 2023, 3D): 0.13 t NH₃/t N applied (Table 3.1) and 0.04 t NO₂/t N applied (Appendix 2).

Activity data on the amount of sewage sludge applied on the fields comes from national statistics [GUS 2025h] and regards both - industrial and municipal sewage sludge applied in cultivation of all crops marketed, including crops designed to produce fodder as well as this applied in cultivation of plants intended for compost production. As the consistent reporting of data concerning application of sewage sludge in agriculture in the public statistics starts in 2003, the activities since 1988 were supplemented based on annual mean changes of AD in 2003–2009 where constant increasing trend was noted (NID 2026). Diminishing trend back to 1988 corresponds to the number of people using sewage treatment plants that ranges from 11 million in 1988 through 19 million in 1998 and almost 28 million in 2015 where this number was more than doubled in 1988-2015. Also the number of municipal sewage treatment plants increased from 558 in 1988 up to 1923 in 1998 and 3268 in 2015. Activity data on sewage sludge used in Agriculture is given in Table 5.18.

Table 5.18. Sewage sludge used as fertilizer on agricultural soils in Poland [kt N]

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0.86	1.01	1.15	1.30	1.44	1.59	1.73	1.88	2.02	2.17	2.31	2.46	2.60	2.75	3.26
2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
3.34	3.60	4.28	4.73	4.96	4.39	4.61	4.73	4.38	4.60	4.56	4.35	3.99	4.18	4.53
2020	2021	2022	2023	2024										
4.98	5.18	5.26	4.96	5.11										

5.4.2.4 Urine and dung deposited by grazing animals (3Da3)

The NH₃ and NO_x emissions related to animal excreta left on pastures are calculated separately for each livestock category using mass flow approach based on EMEP/EEA EIG 2023 and related *Manure Management N-flow Tool* taking into account manure management systems. More information is given in Chapter 5.2.2. Ammonia emission factors related to urine and dung left by livestock on pastures are given in Table 5.19 while NO₂ IEFs are given in Table 5.20.

Table 5.19. Country specific NH₃ implied emission factors from excreta deposited by grazing livestock [kg NH₃/animal/year]

Source	1990	1995	2000	2005	2010	2015	2020	2022	2023	2024
Dairy cattle	2.215	1.788	1.387	1.077	1.089	1.049	0.919	0.976	0.978	1.024
Other cattle	2.715	2.752	2.742	2.666	2.893	3.018	3.011	3.019	3.028	3.027
Source	1990-2024									
Fattening pigs	0									
Sows	0									
Hens	0									
Broilers	0									
Sheep	0.210									
Horses	3.156									
Goats	0.194									
Other poultry	0									

Table 5.20. Country specific NO_x implied emission factors from excreta deposited by grazing livestock [kg NO₂/animal/year]

Source	1990	1995	2000	2005	2010	2015	2020	2022	2023	2024
Dairy cattle	0.869	0.701	0.544	0.422	0.427	0.412	0.360	0.383	0.384	0.402
Other cattle	1.065	1.079	1.075	1.045	1.134	1.183	1.181	1.184	1.188	1.187
Source	1990-2024									
Fattening pigs	0									
Sows	0									
Hens	0									
Broilers	0									
Sheep	0.154									
Horses	0.495									
Goats	0.142									
Other poultry	0									
Fur animals	0									

5.4.2.5 Crop residues applied to soils (NFR sector 3Da4)

Following inventory improvement plan as well as recommendation (PL-3Da4-2025-0001) and updated EMEP/EEA Guidebook on 2023, a new source of ammonia emission was estimated. As the amount of N content in crop residues was calculated within the GHG inventory using T2 method (NID 2025), the same data was applied within underlining AP inventory.

The NH₃ EF_{cropresidues} has been derived from the model of de Ruijter and Huijsmans (2019) as described in the EMEP/EEA GB 2023, chapter 3.D Agricultural soils, *Ammonia emissions from crop residues*, and depends on the N concentration in crop residues (N_{AG(T)}). Ammonia calculations, based on above mentioned method, relates to such crops like: pulses, legumes, tuber crops and grass. Selected parameters and related ammonia emissions, which amounted to 3.627 kt NH₃ in 2024, are presented in Table 5.21.

Table 5.21. Parameters and NH₃ emissions related to crop residues left on the field

Crop	Dry Matter Fraction (DM)	N content of the aboveground biomass (N _{AG})	Ammonia Emission In 2024 [kt NH ₃]
pulses edible	0.86	0.018	0.1532
pulses feed	0.85	0.020	0.4640
potatoes	0.25	0.020	0.0940
sugar beet	0.16	0.026	2.8958
hey from greenland	0.23	0.020	0.0011
hey from pulses	0.23	0.020	0.0001
hey from legumes	0.23	0.027	0.0191
Total NH ₃ emission			3.627

5.4.2.6 Agricultural operations (NFR sector 3Dc)

Following recommendation (PL-3Dc-2023-0001) the Tier 2 method for calculation of PM₁₀ and PM_{2.5} emissions has been applied for 3Dc subcategory as this is the key category. The default EFs for each operation come from the EMEP/EEA EIG 2023 (*3D Crop production and agricultural soils*) Tables: 3.5 (see Table 5.22) and 3.7 (see Table 5.23) for wet climate conditions. The number of times that each operation is performed for each crop type during the course of a year has been established based on typical Poland's agricultural conditions and additionally were consulted with information presented by neighbouring countries like Czech Republic and Slovakia (Table 5.24). Soil ploughing and harrowing at the crop areas are usually made 4 times a year. Generally ploughing and harrowing of grasslands is practiced rarely, according to information from the Institute of grassland melioration it could be assumed that every 20 years therefore parameter 0.05 yearly is assumed. According to Statistics Poland grass harvesting is made usually 3 times a year. The implied EFs for each crop is given in Table 5.25. Area of arable land and grassland is given in Table 5.27.

Table 5.22. EFs for agricultural crop operations, in kg / ha PM₁₀, wet climate conditions

Crop	Soil cultivation	Harvesting	Cleaning	Drying
wheat	0.25	2.7	0.19	0.56
rye	0.25	2.0	0.16	0.37
barley	0.25	2.3	0.16	0.43
oat	0.25	3.4	0.25	0.66
other arable	0.25	0	0	0
grass	0.25	0.25	0	0

Table 5.23. Tier 2 EFs for agricultural crop operations, in kg / ha PM_{2.5}, wet climate conditions

Crop	Soil cultivation	Harvesting	Cleaning	Drying
wheat	0.015	0.02	0.009	0.168
rye	0.015	0.015	0.008	0.111
barley	0.015	0.016	0.008	0.129
oat	0.015	0.025	0.0125	0.198
other arable	0.015	0	0	0
grass	0.015	0.01	0	0

Table 5.24. Number of times the operation is performed

Crop	Soil cultivation	Harvesting	Cleaning	Drying
wheat	4	1	1	1
rye	4	1	1	1
barley	4	1	1	1
oat	4	1	1	1
other arable	4	1	1	1
grass	0.05	3	0	0

Table 5.25. Implied EFs for PM₁₀/TSP and PM_{2.5}

Crop	PM ₁₀ / TSP IEF [kg/ha]	PM _{2.5} IEF [kg/ha]
wheat	4.45	0.26
rye	3.53	0.19
barley	3.89	0.21
oat	5.31	0.30
other arable	1.00	0.06
grass	0.76	0.03

As no EFs for TSP for Tier 2 method are available we assume that PM₁₀ emissions are equal to TSP. Otherwise TSP emissions from 3Dc calculated with Tier 1 method would be lower than PM₁₀ emissions calculated with Tier 2 method.

5.4.2.7 Cultivated crops (NFR sector 3De)

NMVOC emissions from cultivated crops, following recommendation PL-3De-2025-0001, have been recalculated for wider list of plants, covering all main crops and grass (15°C), based on emission factors given in Chapter 3D in EMEP/EEA EIG 2023, Table 3.4, country specific mean dry matter of crop per ha for mentioned crops and crop distribution in Poland. Example of calculation of NMVOC EF for 2024 is given in Table 5.26. Such weighted mean NMVOC EFs vary from 0.38 kg NMVOC/ha/yr in 1990 up to 0.49 kg NMVOC/ha/yr in 2024. Activity data for this source category constitutes the area of arable land and grassland from national statistics (Table 5.27).

Table 5.26. Estimation of CS NMVOC emission factor for 2024 in Poland

Crop	NMVOC EF [kg/kg dm/hour]	Fraction of the year emitting	NMVOC [kg dm/yr]	Mean dry matter of crop [t dm/ha]	NMVOC [kg/ha/yr]	Crops distribution	Weighted mean EF [kg NMVOC /ha/yr]
wheat	2.60E-08	0.3	6.82E-05	3.47	0.24	0.20	0.046
rye	1.41E-07	0.3	3.70E-04	3.07	1.14	0.06	0.064
barley	2.60E-08	0.3	6.82E-05	3.73	0.25	0.06	0.015
oats	2.60E-08	0.3	6.82E-05	2.73	0.19	0.04	0.008
triticale	2.60E-08	0.3	6.82E-05	3.78	0.26	0.09	0.024
cereal mixed	2.60E-08	0.3	6.82E-05	2.84	0.19	0.02	0.004
millet & buckwheat	2.60E-08	0.3	6.82E-05	1.38	0.09	0.01	0.001
crops other	2.60E-08	0.3	6.82E-05	2.24	0.15	0.00	0.000
maize	2.60E-08	0.3	6.82E-05	3.83	0.26	0.10	0.027
maize for green fodder	2.60E-08	0.3	6.82E-05	24.13	1.65	0.05	0.087
pulses edible	2.60E-08	0.3	6.82E-05	2.14	0.15	0.02	0.002
pulses feed	2.60E-08	0.3	6.82E-05	1.75	0.12	0.03	0.003
potatoes	2.60E-08	0.3	6.82E-05	7.55	0.51	0.02	0.008
sugar beet	2.60E-08	0.3	6.82E-05	10.61	0.72	0.02	0.017
rape & agrimony	2.02E-07	0.3	5.30E-04	2.82	1.49	0.08	0.124
field vegetables	2.60E-08	0.3	6.82E-05	5.44	0.37	0.01	0.005
Grass (15°C)	1.03E-08	0.5	4.51E-05	5.91	0.27	0.19	0.050
NMVOC IEF 2024							0.485

Table 5.27. Agricultural land area since 1990 in Poland [Mha]

Land type	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Arable land	14.39	14.36	14.34	14.31	14.30	14.29	14.09	14.06	14.11	14.13	13.68
Grassland	4.06	4.04	4.04	4.05	4.06	4.05	4.13	4.14	4.06	4.03	3.87
Land type	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Arable land	13.67	13.07	12.65	12.68	12.08	12.36	11.75	11.97	12.00	10.80	11.04
Grassland	3.86	3.56	3.27	3.37	3.39	3.22	3.27	3.18	3.18	3.23	3.29
Land type	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Arable land	10.87	10.76	10.90	10.89	10.81	10.91	11.01	11.05	11.15	11.13	11.10
Grassland	3.21	3.21	3.12	3.09	3.18	3.17	3.15	3.13	3.20	3.14	3.08
Land type	2023	2024									
Arable land	11.08	11.08									
Grassland	3.01	3.01									

5.4.2.8 Use of pesticides (NFR sector 3Df)

Three active substances were identified to be used in pesticides in Poland: chlorothalonil, clopyralid and picloram. As the data on use of these active substances is available only since 2011 in the national statistics, it was decided to complete the trend of HCB emissions concerning impurity factor of active substances used in specific pesticides back to 1990 based on relation of substance use with arable land presented in Table 5.27. No additional data on

pesticides use before 2011 were collected. As the data on use of active substances collected in national statistics is confidential for selected years this data is not presented in the report.

Tier 1 approach from the EMEP/EEA EIG 2023 Chapter 3.D.f, 3.I was used here as described in Chapter 7.4.1 (7 Annex). Impurity factors of HCB concentration for 3 active substances described above were taken from Table 4 in the 7 Annex (Table 5.28). As clopyralid is used in the EU since 2010, so HCB emissions from this substance started in 2010.

According to COMMISSION IMPLEMENTING REGULATION (EU) 2019/677 of 29 April 2019 *concerning the non-renewal of the approval of the active substance chlorothalonil, in accordance with Regulation (EC) No 1107/2009 of the European Parliament and of the Council concerning the placing of plant protection products on the market, and amending Commission Implementing Regulation (EU) No 540/2011* chlorothalonil has been withdrawn in late 2019 from agricultural use and therefore no AD for this active substance occurred since 2020.

Table 5.28. Maximum HCB-concentration (impurity factor) in active substances used in emission calculations [mg/kg]

Active substances	1990-1999	2000	Since 2010
Chlorothalonil	300	40	40
Clopyralid	not used in the EU	not used in the EU	2.5
Picloram	50	50	50

Trend of HCB emissions from pesticides use in Poland is presented in Figure 5.9. Sudden drop in HCB emissions between years 1999 and 2000 is related to change in maximum HCB-concentration (Table 5.28) in chlorothalonil applied in Europe. Additionally ban on chlorothalonil use since 2020 triggered further drop in HCB emissions from this source, where HCB emissions from this source are around 1 kg for the last years.

5.4.3 Emission trends for NFR sector 3D

Trends of pollutant emissions for 3D sector are shown below in figures (Figure 5.7 - Figure 5.9). In this category various NH₃ sources influence interannual changes in emissions. The biggest impact has here animal manure application to soils together with excreta left on pastures by grazing livestock and mineral fertilizers use. Significant drop in NH₃ and NO_x emissions in early 1990-ties is related to sudden drop in inorganic fertilizers use and livestock population after economy transformation started in 1989. Generally ammonia emissions in 3D decreased by 37.3% between 1990–2024 and by 5.0% between 2005–2024 while PM emissions dropped by about 23% and 7% respectively. Quite significant drop in NH₃ emissions in recent years is related to use of solid urea with urease inhibitors.

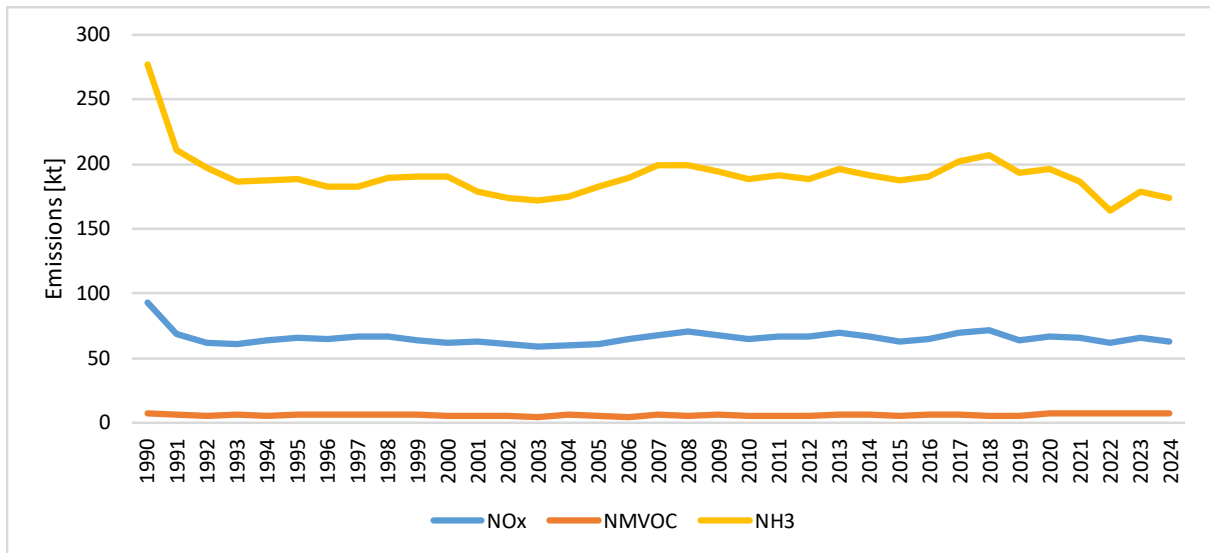


Figure 5.7. NO_x, NMVOC and NH₃ emissions for 3D category in 1990-2024

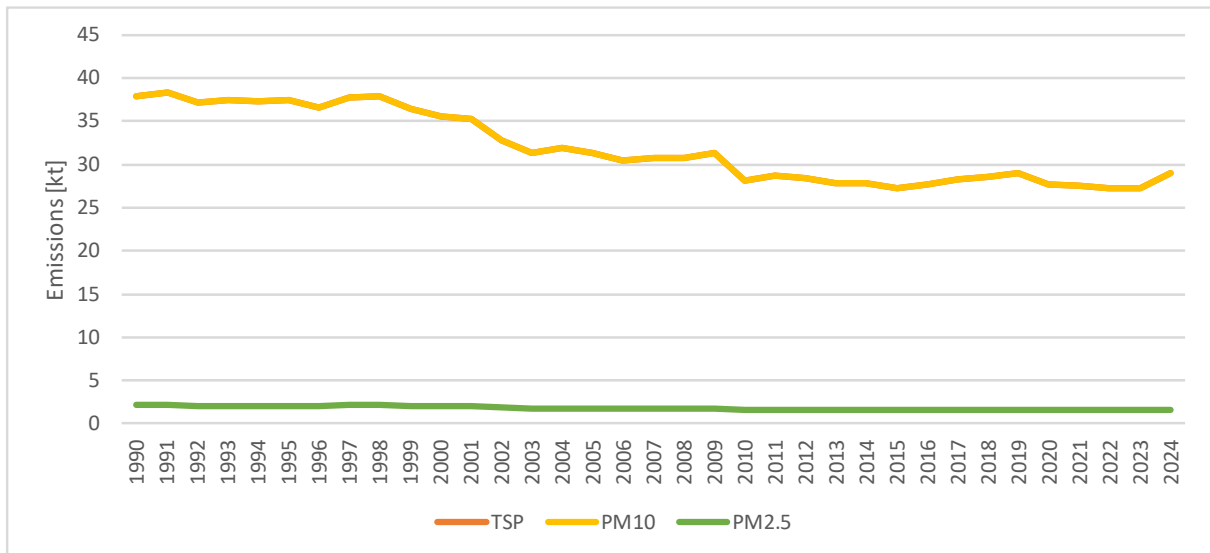


Figure 5.8. TSP, PM₁₀ and PM_{2.5} emissions for 3D category in 1990-2023 (TSP=PM₁₀)

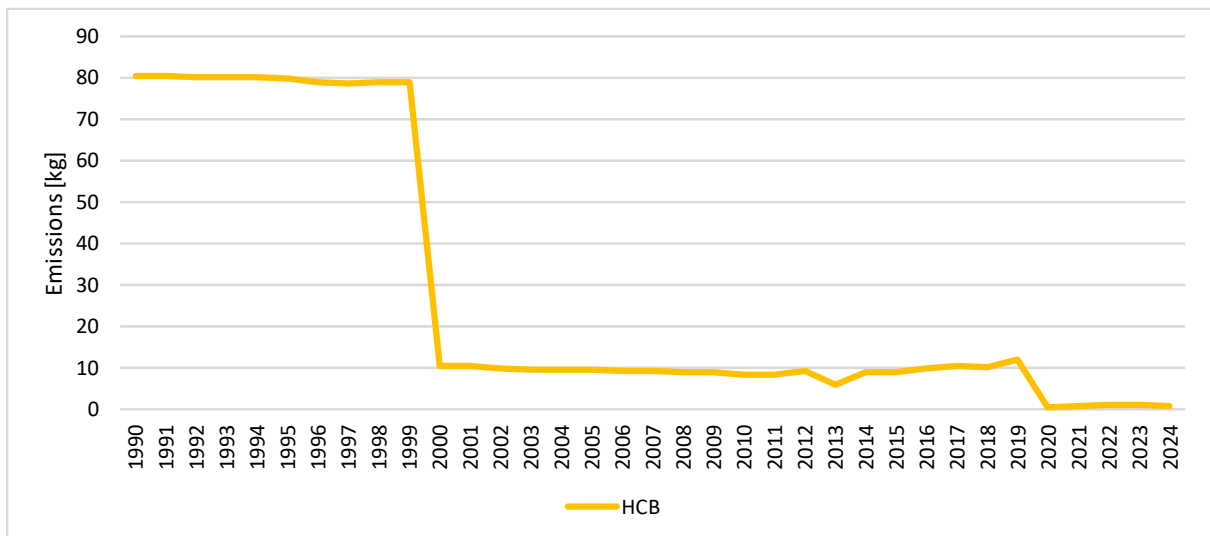


Figure 5.9. HCB emissions for 3D category in 1990-2024

5.5 Field Burning of Agricultural Residues (NFR sector 3F)

5.5.1 Source category description

The pollutant emissions related to on-field burning of stubble include almost all substances reported under CLRTAP. Shares of emissions from the NFR 3F category in the country total for the particular pollutants in 2024 are insignificant (below 0.1%). The overview of methods, EFs and key categories from NFR 3F is given in Table 5.29.

Table 5.29. Overview of methods, EFs and key categories from NFR 3F

NFR code		Method	EF	Pollutant	Key category
3F	Field burning of agricultural residues	T1	D	SO _x , NO _x , NH ₃ , NMVOC, CO, TSP, PM ₁₀ , PM _{2.5} , BC, Pb, Cd, Hg, As, Cr, Cu, Ni, Zn, PCDD/F, PAHs	–

5.5.2 Methodological issues

Estimation of pollutant emissions related to this category is based on the area of agricultural crops, meadows and stubbles fired in a given year. The amount of crop residue burned resulting in emissions is calculated based on equation (2) from Chapter 3.2.3. in part 3F. *Field burning of agricultural residues* in EMEP/EEA EIG 2023:

$$AR_{residue\_burnt} = A * Y * s * d * pb * Cf$$

where:

- A** (ha) – the area of land on which crops are grown whose residues are burned,
- Y** (kg ha⁻¹ fresh weight) – the average yield of those crops (e.g. grain),
- s** – the ratio between the mass of crop residues and the crop yield,
- d** – the dry matter content of that yield,
- pb** – proportion of those residues that are burned (as opposed to being incorporated in the soil, consumed by livestock on the field or removed from the field for use elsewhere),
- Cf** – the combustion factor (proportion of the fuel present at the time of the fire that is actually burned).

Table 5.30. Area of agricultural crops, meadows and stubbles where fires occurred [ha]

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
42 991	42 991	42 991	42 991	37 208	39 275	53 919	54 369	32 795	40 380	28 943
2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
34 038	35 435	109 624	39 331	36 149	28 998	16 652	19 696	13 031	9 855	15 691
2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
39 639	10 640	23 817	32 513	9 043	10 140	12 924	18 903	18 378	5 072	13 758
2023	2024									
11 845	3 368									

Activity data for 2024 comes from Statistics Poland's yearbook on environment [GUS 2025h] and for previous years – from analogous publications (Table 5.30). Parameters like: Y – are taken from agricultural national statistics, while: s, d, pb – come from country case studies and are applied also in GHG emissions inventories. The weighted mean EF calculated for agricultural areas fired is 0.8006 t per 1 ha.

The corresponding emission factors for pollutants accompanying on-field burning of stubble are given in Appendix 6 and come from the EMEP/EEA EIG 2023 Chapter 3.2.2. in part 3F. *Field burning of agricultural residues* (Table 3-1).

5.5.3 Emission trends for NFR sector 3F

Trends of pollutant emissions for category 3F. *Field burning of agricultural residues* are shown in Figure 5.10 - Figure 5.14. Peak of emissions in 2003 is related to significant area of agricultural crops, meadows and stubbles covered with fires in this year.

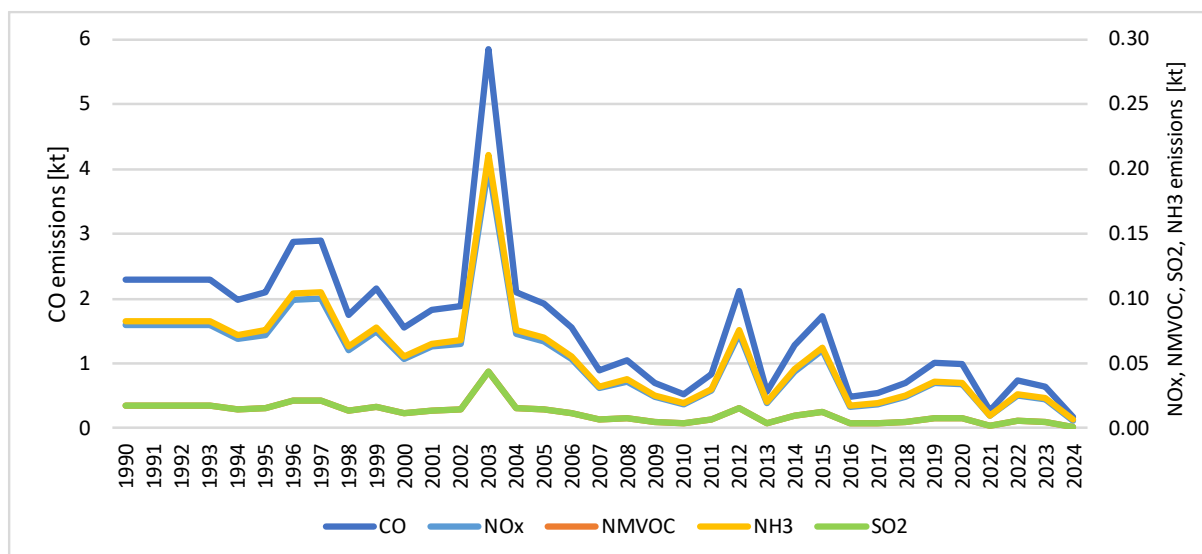


Figure 5.10. NO_x, NMVOC, SO₂, NH₃, and CO emissions for 3F category in 1990-2024

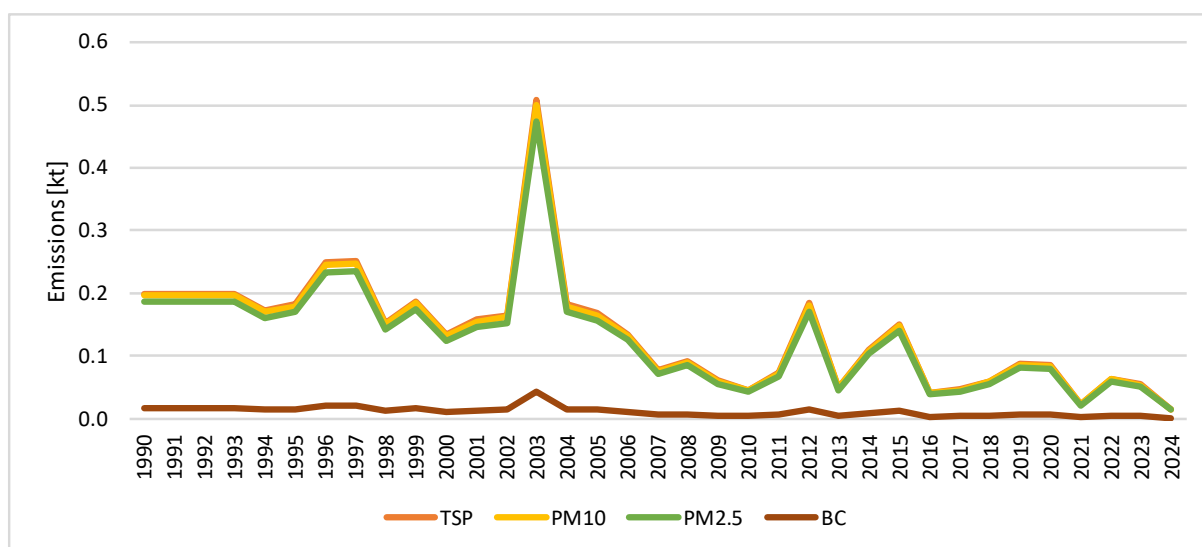


Figure 5.11. Particulate matter emissions for 3F category in 1990-2024 (TSP=PM₁₀)

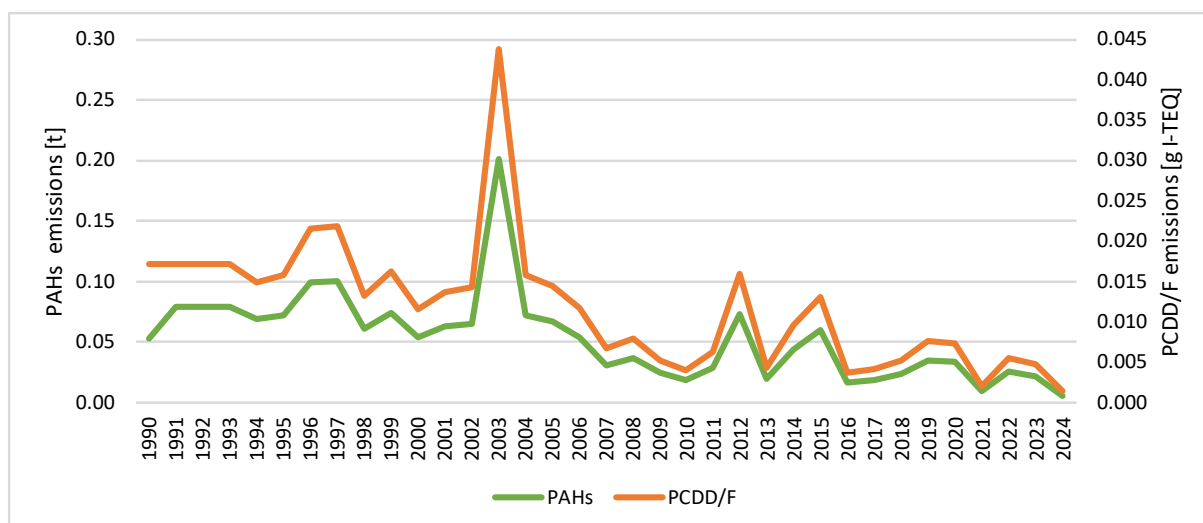


Figure 5.12. PCDD/F and PAHs emissions for 3F category in 1990-2024

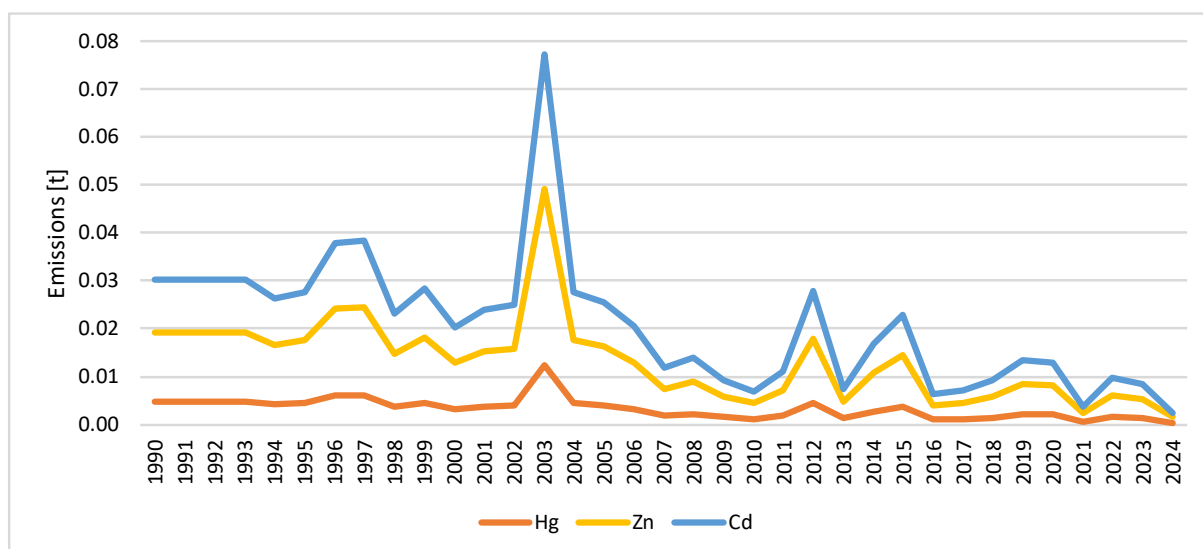


Figure 5.13. Hg, Zn, and Cd and As emissions for 3F category in 1990-2024

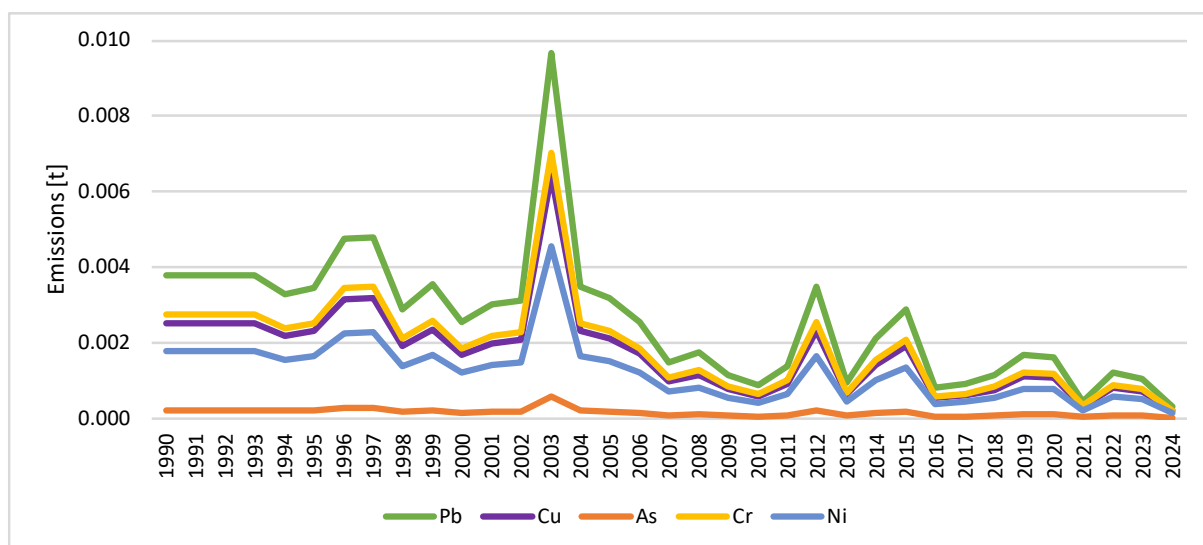


Figure 5.14. Pb, Cu, As, Cr and Ni emissions for 3F category in 1990-2024



5.6 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 3. *Agriculture* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 3 are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 5.31. Results of the uncertainty analysis for NFR sector 3

NFR subsector		NO _x	NM _{VOC}	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP	
3B1a	Manure management - Dairy cattle	100.0%	140.0%		100.0%	100.0%	100.0%	100.0%	
3B1b	Manure management - Non-dairy cattle	100.0%	120.0%		100.0%	100.0%	100.0%	100.0%	
3B2	Manure management - Sheep	100.0%	160.0%		100.0%	100.0%	100.0%	100.0%	
3B3	Manure management - Swine	100.0%	140.0%		100.0%	100.0%	100.0%	100.0%	
3B4d	Manure management - Goats	100.0%	150.0%		100.0%	100.0%	100.0%	100.0%	
3B4e	Manure management - Horses	100.0%	150.0%		100.0%	100.0%	100.0%	100.0%	
3B4gi	Manure management - Laying hens	100.1%	150.1%		100.1%	100.1%	100.1%	100.1%	
3B4gii	Manure management - Broilers	100.1%	150.1%		100.1%	100.1%	100.1%	100.1%	
3B4giii	Manure management - Turkeys	100.1%	150.1%		100.1%	100.1%	100.1%	100.1%	
3B4giv	Manure management - Other poultry	100.1%	150.1%		100.1%	100.1%	100.1%	100.1%	
3B4h	Manure management - Other animals (please specify in the IIR)	100.1%	140.1%		100.1%	150.1%	150.1%	150.1%	
3Da1	Inorganic N-fertilizers (includes also urea application)	100.0%			100.0%				
3Da2a	Animal manure applied to soils	190.1%			100.1%				
3Da2b	Sewage sludge applied to soils	380.0%			104.0%				
3Da3	Urine and dung deposited by grazing animals	380.0%			160.1%				
3Da4	Crop residues applied to soils				161.3%				
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products					150.0%	150.0%	150.0%	
3De	Cultivated crops		220.0%						
3F	Field burning of agricultural residues	98.0%	150.0%	150.0%	150.0%	150.0%	150.0%	150.0%	
NFR subsector		BC	CO	Pb	Cd	Hg	PCDD/F	PAHs	HCB
3Df	Use of pesticides								110.0%
3F	Field burning of agricultural residues	150.0%	150.0%	150.0%	150.0%	150.0%	100.0%	150.0%	

5.7 Source-specific QA/QC and verification

Activity data related to livestock population comes from national statistics prepared by the Statistics Poland. Also activity data related to mineral fertilisers use (except 2021, 2022 and 2024) or crop production comes from national statistics prepared by the Statistics Poland. Data such as livestock population, crop production, nitrogen fertilizers use and others is available in several publications and electronic database that were cross-checked.

Emphasis was put on data consistency between sub-categories and between sectors using agricultural data. Emission factors and methodology is compared with international literature and other countries methods/EF applied. Calculations were examined with focus on formulas,

units and trends consistency. Also consistency with data applied for GHG inventory in Agricultural sector is crosschecked.

5.8 Source-specific recalculations

The following recalculations were implemented in the Agriculture sector influencing emissions:

NH₃ and NO_x:

- Update of data related to fat content in milk for dairy cattle for 2021-2023 (based on national statistics) what influenced Gross Energy and Nex parameters;
- Addition of a new source *3Da4 crop residues applied to soils* based on EMEP/EEA GB 2023;
- Update of share of manure used in the anaerobic digesters in 2023 for all livestock ;

NMVOC:

- Change of parameter describing the maximum proportion of silage possible in the feed composition ($\text{Frac-max}_{\text{silage}}$) from the value of 1 to 0.5 in NMVOC emission calculation as recommended default value in EMEP/EEA EIG 2023.

PM:

- Correction of AD for livestock for horses and rabbits for 2023 based on national statistics;
- Update of crop production for selected plants for 2021-2023 based on national statistics.

5.9 Source-specific planned improvements

No specific improvements are planned for the time being.

6 WASTE (NFR SECTOR 5)

6.1 Source category description

The following subcategories from sector 5 have been included in the pollutant inventory:

- 5A. *Solid waste disposal on land,*
- 5B. *Biological treatment of waste:*
 - 5B1. *Composting,*
 - 5B2. *Anaerobic digestion at biogas facilities,*
- 5C. *Incineration and open burning of waste:*
 - 5C1bv. *Cremation,*
 - 5C2. *Open burning of agricultural waste,*
- 5D. *Wastewater handling (including latrines),*
- 5E. *Other waste handling: Unintentional fires (including: unintentional house fires, car fires and landfill fires).*

Shares of emissions from the NFR sector 5 in the country total for the particular pollutants in 2024 are shown in Figure 6.1. Shares of most pollutant emissions from this category are below 7% (only PCDD/F emissions are over 16%).

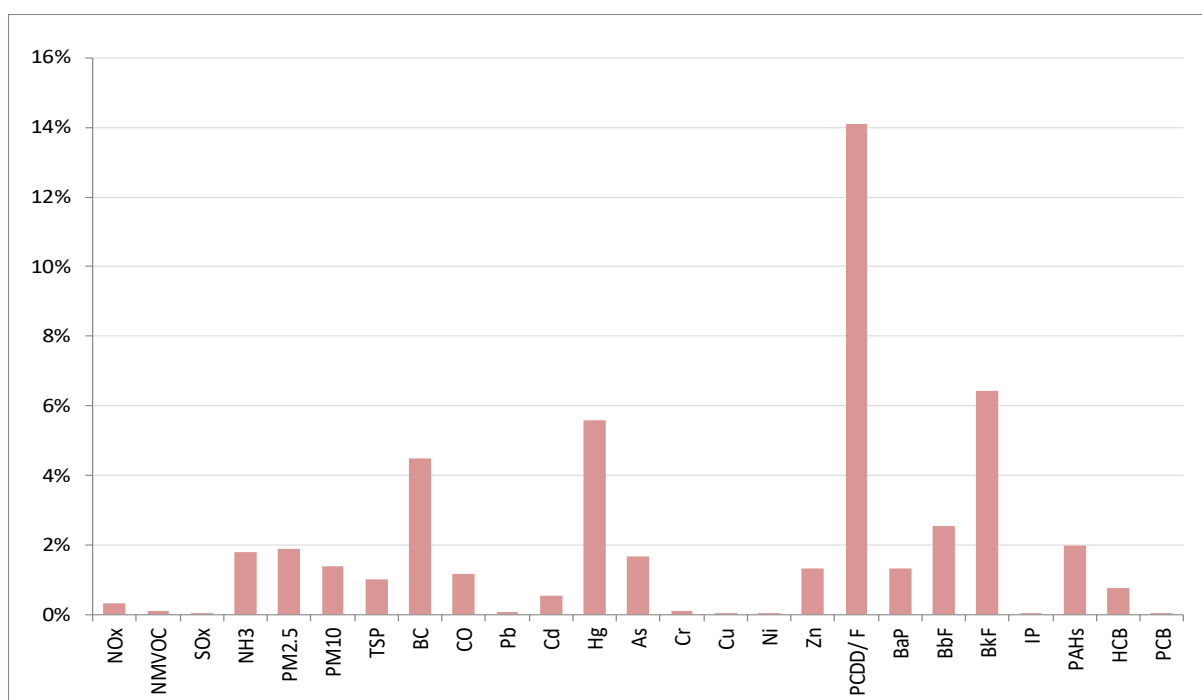


Figure 6.1. Shares of emissions from the NFR 5 category in the country total in 2024

Data from BDO Waste Database (BDO), applied in 5A and 5B are under constant verification by Marshal Offices, as facilities have 5 years to update their reports to base. Therefore it is expected that estimates basing on BDO data will be recalculated in upcoming reports.

6.2 Solid waste disposal on land (NFR sector 5A)

6.2.1 Source category description

This subcategory includes emissions of air pollutants from municipal and industrial solid waste treatment by disposal on land.

Shares of emissions of the particular pollutants from NFR 5A category in the country total in 2024 are shown in Figure 6.2. Shares of pollutant emissions from this category are below 0.02% of Poland's total.

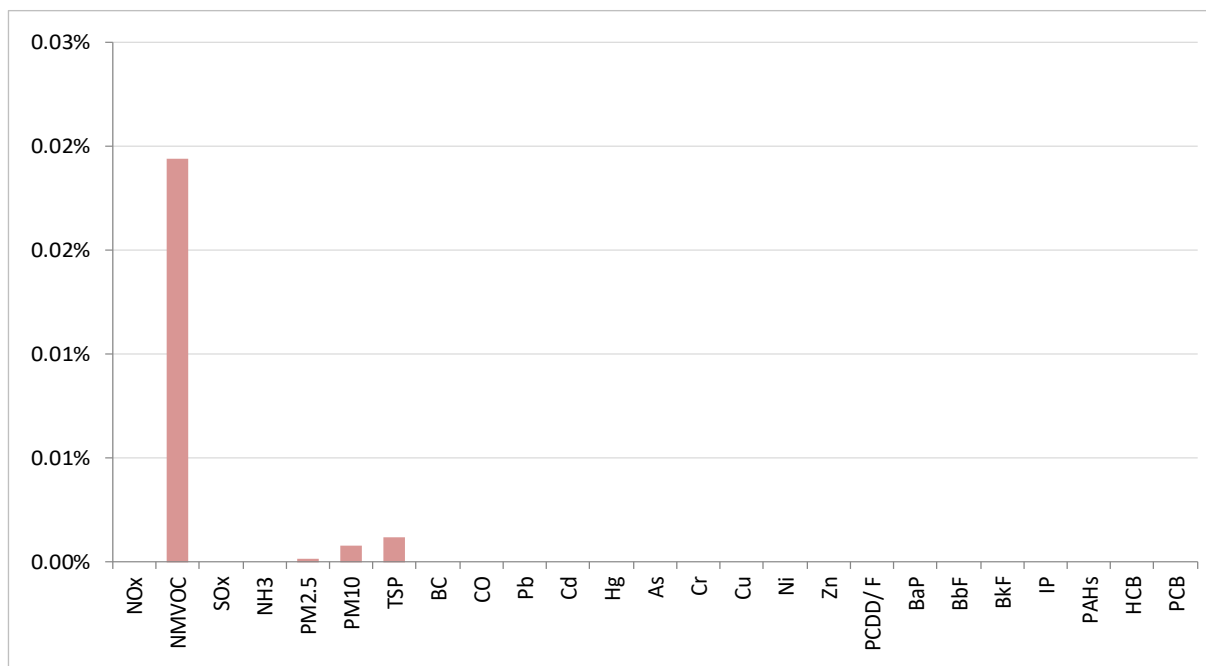


Figure 6.2. Shares of emissions from the NFR 5A category in the country total in 2024

6.2.2 Methodological issues

Emissions from NFR sector 5A are estimated with application of default methodology, described in EMEP/EEA EIG 2023.

Activity Data

Activity data applied in emission inventory is derived from national statistics made publically available by Statistics Poland in *Environment* yearbooks (1990-2005), from facility reports collected in Central Waste System (2006-2018) and in BDO Waste Database (2019-2024).

Data on methane emissions applied to estimate NMVOC emission factor is provided in NIR 2026 POL greenhouse gas inventory for 1988-2024 submitted under the United Nations Framework Convention on Climate Change and the Kyoto Protocol.

All used activity data is presented in Appendix 5.

Emission Factors

Air pollutant emissions from NFR sector 5 are estimated based on default EMEP/EEA EIG 2023 emission factors.

Tables with applied emission factors are presented in Appendix 6.

6.2.3 Emission trends for NFR sector 5A

Trends of pollutant emissions for category 5A. *Solid waste disposal on land* are shown in figure below (Figure 6.3).

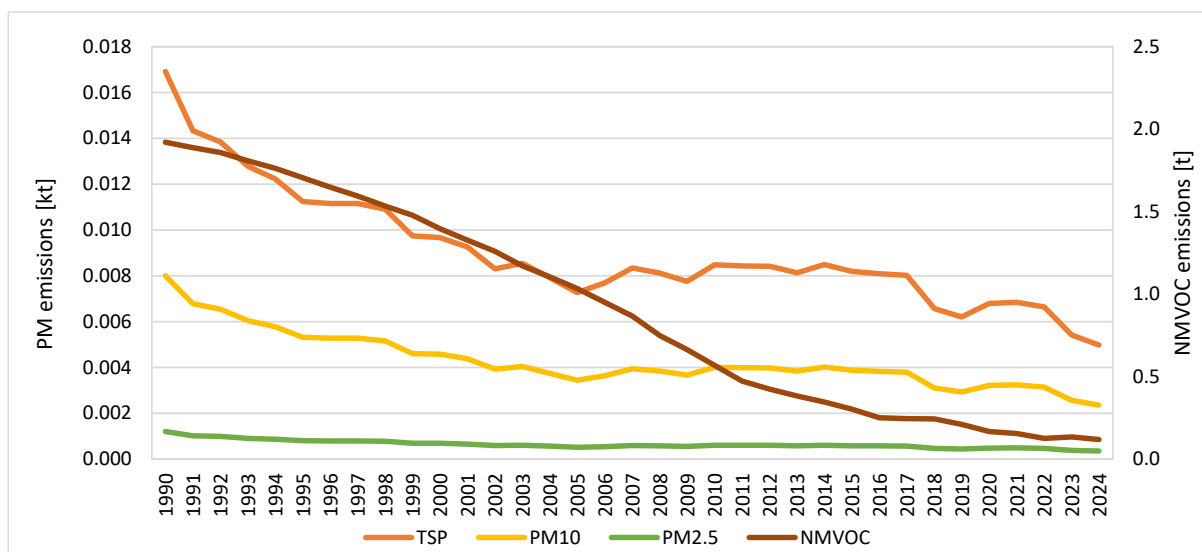


Figure 6.3. TSP, PM10, PM2.5 and NMVOC emissions for sector 5A category in 1990-2024

Trends of emissions of particulate matter are driven by decrease of amounts of municipal and industrial landfilled waste. Trend of NMVOC emissions is driven by trend of methane emissions described in NIR 2026 POL report.

6.2.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 5A. *Solid waste disposal on land* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 5A are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 6.1. Results of the uncertainty analysis for NFR sector 5A

NFR subsector		NMVOC	PM2.5	PM10	TSP
5A	Biological treatment of waste - Solid waste disposal on land	30.1%	150.0%	150.0%	150.0%

6.2.5 Source-specific QA/QC and verification

For further details please see Chapter 3.2.5.

6.2.6 Source-specific recalculations

Application of default EIG 2023 emission factor for NMVOC (TERT recommendation PL-5A-2025-0001).

6.2.7 Source-specific planned improvements

Further analysis on amounts of landfilled mineral waste following TERT recommendation in observation PL-5A-2025-0002 from 2025 review.

6.3 Biological treatment of waste (NFR sector 5B)

6.3.1 Source category description

The following subcategories have been included in the pollutant inventory:

- 5B1. *Composting*,
- 5B2. *Anaerobic digestion at biogas facilities*.

Shares of emissions of the particular pollutants from NFR 5B category in the country total in 2024 are shown in Figure 6.4. Shares of pollutant emissions from this category are below 0.9% of Poland's total.

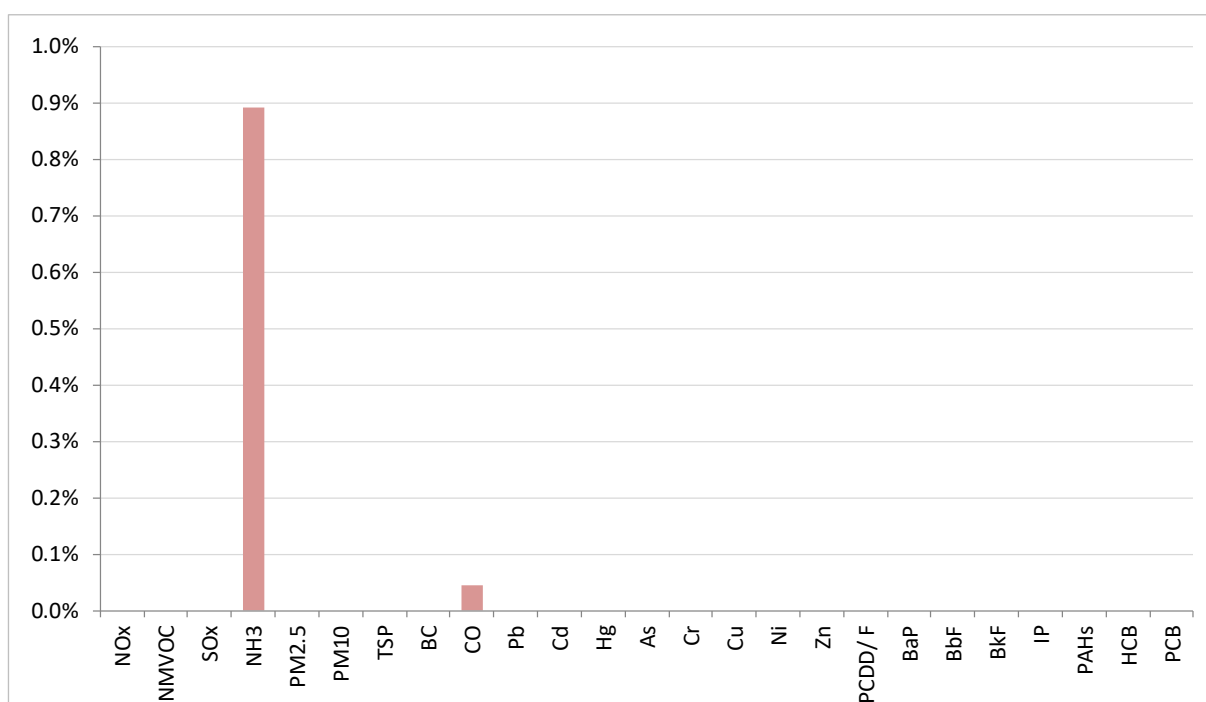


Figure 6.4. Shares of emissions from the NFR 5B category in the country total in 2024

6.3.2 Methodological issues

Emissions from NFR sector 5B are estimated with application of default methodology described in EMEP/EEA EIG 2023.

6.3.2.1 Composting (NFR sector 5B1)

In following subcategory are presented emissions of CO and NH₃ from composting facilities. Domestic composting is not included because of lack of information on amounts of treated waste.

Activity Data

Activity data, applied for current Polish emission inventory come from:

- Statistics Poland *Environment* yearbooks (1990-2005),
- Central Waste System (2006-2018),
- BDO Waste Database (2019-2024).

All applied activity data is presented in Appendix 5.



Emission Factors

Poland estimates emissions from NFR sector 5B1 using default EMEP/EEA EIG 2023 *Tier 2* emission factors. Tables with applied emission factors are presented in Appendix 6.

6.3.2.2 Anaerobic digestion at biogas facilities (NFR sector 5B2)

NH₃ emissions from anaerobic digestion were estimated:

- from agricultural biogas facilities:
 - jointly with NH₃ emissions from manure management, using N-flow tool (see Chapter 5.2.2) for substrates: livestock manure,
 - using default EMEP/EEA EIG 2023 *Tier 1* methodology for rest of substrates,
- from municipal biogas facilities,
- from biogas facilities at wastewater treatment plants.

Activity Data

Data on share of livestock manure applied in agricultural biogas installations covers period since 2011 and comes from National Centre for Agriculture Support (KOWR) and national statistics (Table 6.2).

Data on substrates digested in municipal biogas facilities and plants digesting in WWTP are derived from facility reports collected in Central Waste System (CSO) for years 2002-2018 and from BDO Waste Database (BDO) for years 2019-2024.

Table 6.2. Share of manure used in anaerobic digestion facilities

Manure	2011	2012	2013	2014	2015	2016	2017	2018
Slurry	0.01207	0.01532	0.02053	0.02561	0.02678	0.03617	0.03158	0.03477
Solid	0.00024	0.00060	0.00080	0.00102	0.00126	0.00215	0.00198	0.00240
Manure	2019	2020	2021	2022	2023	2024		
Slurry	0.03454	0.03070	0.03085	0.03078	0.03972	0.04558		
Solid	0.00238	0.00301	0.00291	0.00296	0.00394	0.00421		

N contents in 27 kinds of digested substrates in agricultural biogas plants are derived from 48 CS studies on facility data (listed in chapter 12. *References*).

Applied activity data on mass of digested substrate (w.m.) and N content are presented in Appendix 5.

Emission Factors

Poland estimates emissions from NFR sector 5B2 using default EMEP/EEA EIG 2023 *Tier 1* emission factors and in case of animal manure – applying N-flow tool (see Chapter 5.2.2). Tables with applied emission factors are presented in Appendix 6.

6.3.3 Emission trends for NFR sector 5B

Trends of pollutant emissions for category 5B. *Biological treatment of waste* are shown in Figure 6.5.

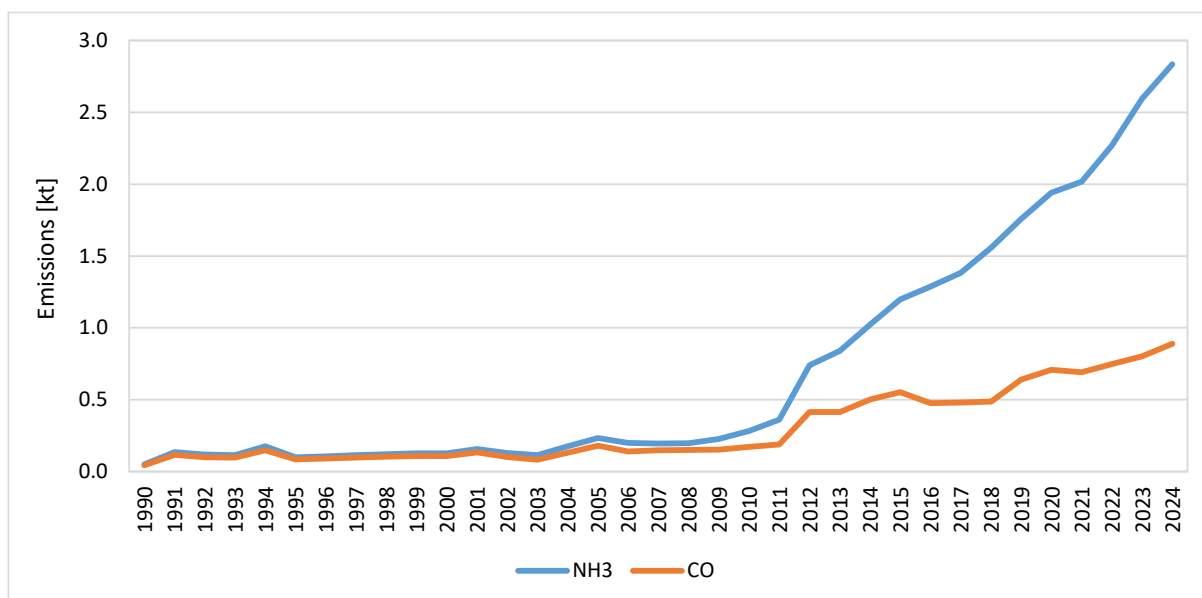


Figure 6.5. NH₃ emissions for sector 5B category in 1990-2024

Significant increase of emissions is caused by increase of amount of composting and biogas facilities resulting in growth of amounts of treated waste.

6.3.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 5B. *Biological treatment of waste* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 5B are provided below.

Performed recalculations of data (for 2011-2023) ensured consistency for whole time-series.

Table 6.3. Results of the uncertainty analysis for NFR sector 5B2

NFR subsector		NH ₃	CO
5B1	Biological treatment of waste - Composting	60.0%	60.0%
5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities	100.0%	

6.3.5 Source-specific QA/QC and verification

For further details please see Chapter 3.2.5.

6.3.6 Source-specific recalculations

Recalculations are based on update of activity data (AD) on composted waste in BDO database and slight amendment of AWMS share for livestock.

6.3.7 Source-specific planned improvements

Further investigation on N content in substrates digested in biogas plants.



6.4 Incineration and open burning of waste (NRF sector 5C)

6.4.1 Source category description

The following subcategories from sector 5C have been included in the pollutant inventory:

- 5C1bv. *Cremation*,
- 5C2. *Open burning of agricultural waste*.

Emissions from categories:

- 5C1a. *Municipal waste incineration*,
- 5C1bi. *Industrial waste incineration*,
- 5C1biii. *Clinical waste incineration*,
- 5C1biv. *Sewage sludge incineration*,

are reported under category 1A1a, as analysis of facility data from Central Waste System (CSO), BDO Waste Database (BDO), report Waszczyłko (2021) and Association of Employers of Industrial and Medical Waste Thermal Processing Plants for Health and Environmental Protection confirmed that waste is incinerated in those facilities with energy recovery.

The following subcategories in sector 5C have been identified as key source:

Table 6.4. Key source categories in sector 5C

NFR		Method	EF	Pollutant
5C1bv	Cremation	T1	D	Hg

Shares of emissions of the particular pollutants from NRF 5C category in the country total in 2024 are shown in Figure 6.6. Shares of pollutant emissions from this category are below 7% of Poland's total.

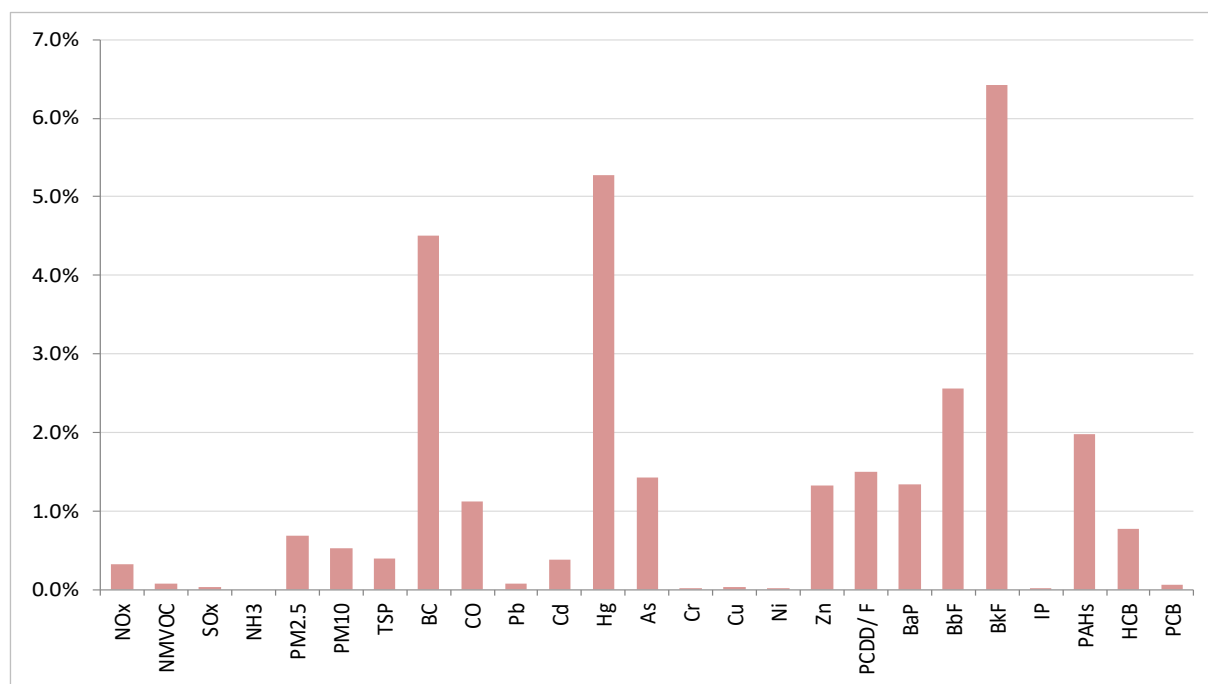


Figure 6.6. Shares of emissions from the NRF 5C category in the country total in 2024

6.4.2 Methodological issues

Emissions from NFR sector 5C are estimated with application of default methodology described in EMEP/EEA EIG 2023.

6.4.2.1 Waste incineration (NFR sector 5C1)

Sector 5C1 includes emissions of air pollutants from subcategory NFR 5C1bv *Cremation*.

6.4.2.1.1 Cremation (NFR sector 5C1bv)

Activity Data

Emissions from category 5C1bv. *Cremation* were calculated based on the number of cremations in Poland in years 1990-2023. The number of cremations was assessed based on:

- international cremation statistics prepared by The Cremation Society⁸,
- national information regarding number of crematoria set up in Poland published by the funeral industry companies,
- sectoral information on trends in burial customs, especially during COVID pandemic,
- information on average annual number of cremations per one crematorium obtained from the funeral industry representative.

Number of cremations grew significantly in recent years – by 22% in 2020 and by 16% in 2021 – mainly due to the increased number of deaths caused by COVID-19 pandemic. This growth of cremations was confirmed within the cremation industry in Poland. In 2022 the number of cremations decreased by 9% along with the decreased amount of deaths and decreased also by 5% in 2023. In 2024 the number of cremations grew by nearly 4%, along with the increased number of crematoria. The number of crematoria operating in Poland grew significantly since early nineties reaching 79 in 2024 (over five times more than in 2011 and 22% more than in 2020).

Emission Factors

Emission factors used to assess the emissions from category 5C1bv are Tier1 EFs from EMEP/EEA Emission Inventory Guidebook 2023. There are no T2 emission factors for the cremation of human bodies in EMEP/EEA EIG 2023.

6.4.2.2 Open burning of wastes (NFR sector 5C2)

Activity Data

The amount of biomass of agricultural residues burnt is estimated based on crop production which comes from public statistics [GUS 2025j], 1997 Revised IPCC methodology and country studies [Łoboda 1994, IUNG 2012] where experimental and literature data as well as default emission factors were used to assess biomass burned.

Activity data cover burning of residues from all kinds of crops, including orchards (apples, pears, plums, cherries and others), fruit bushes (raspberries, currants, gooseberries and others) and also soft fruits (like strawberries) and vegetables. As relates to forest residues –

⁸ <https://www.cremation.org.uk/statistics>

slash (as usable lumber - mainly poles) and firewood (such as branch wood) collected are covered by 1A4 subcategory (biomass combustion). Additionally according to article 30 point 3 of the Forestry Act (as of 28th Sep. 1991), it is strictly prohibited to burn off the forest topsoil and plant residues in forests within 100 metres from the forest. The same methodology and AD are used for GHG emissions calculations [NIR 2025].

Emission Factors

All emission factors, except CO and NO_x, come from EMEP/EEA Air pollutant emission inventory guidebook (EIG 2023), Chapter 5.C.2, table 3-1. CO and NO_x emissions are estimated based on CS parameters in line with GHG emissions. Tables with applied emission factors are presented in Appendix 6. NFR Sector 5.

6.4.3 Emission trends for NFR sector 5C

Trends of pollutant emissions for category 5C. *Waste incineration* are shown in Figure 6.7 - Figure 6.12.

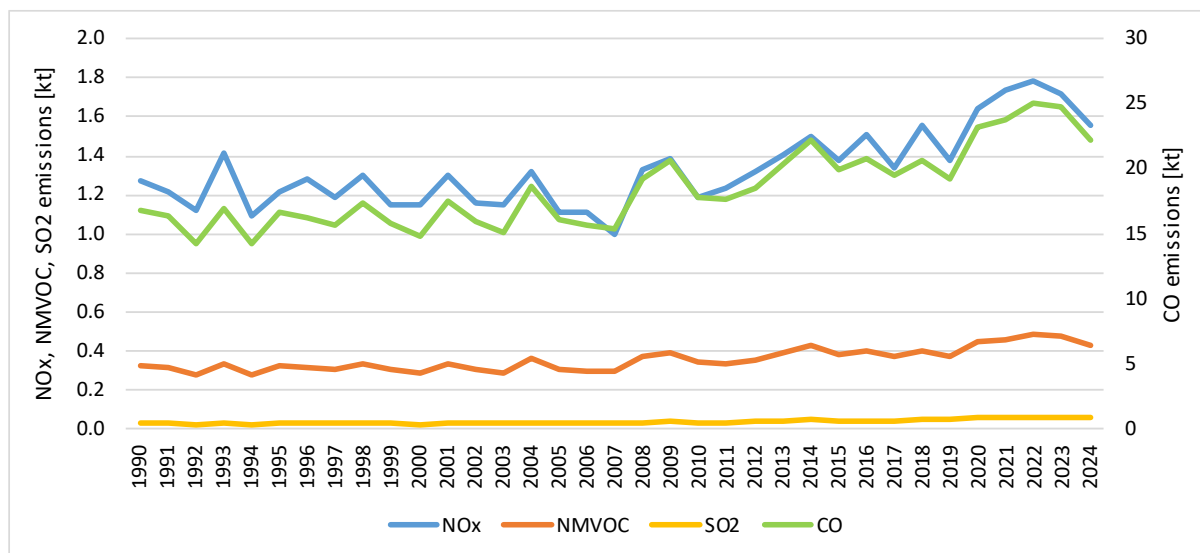


Figure 6.7. NO_x, CO, SO₂ and NMVOC emissions for 5C category in 1990-2024

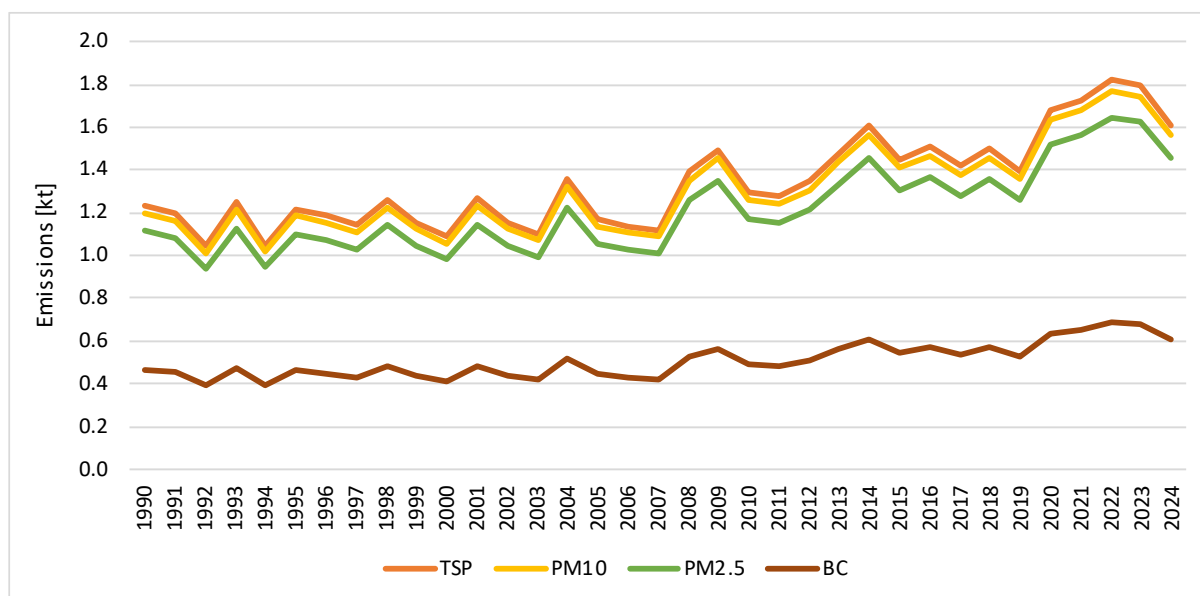


Figure 6.8. PM and BC emissions for 5C category in 1990-2024

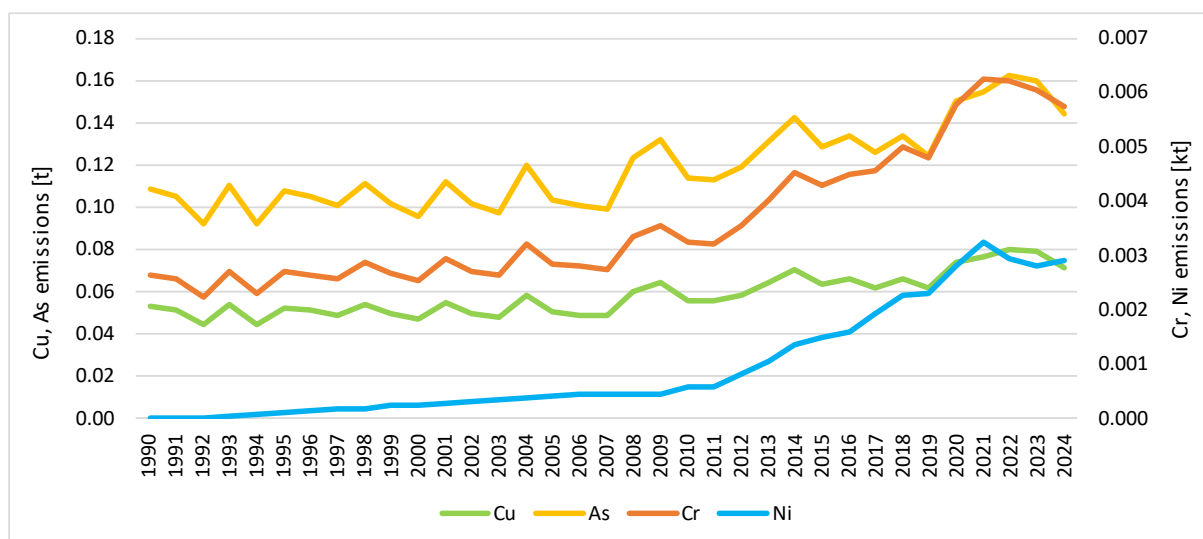


Figure 6.9. Cu, As, Cr and Ni emissions for 5C category in 1990-2024

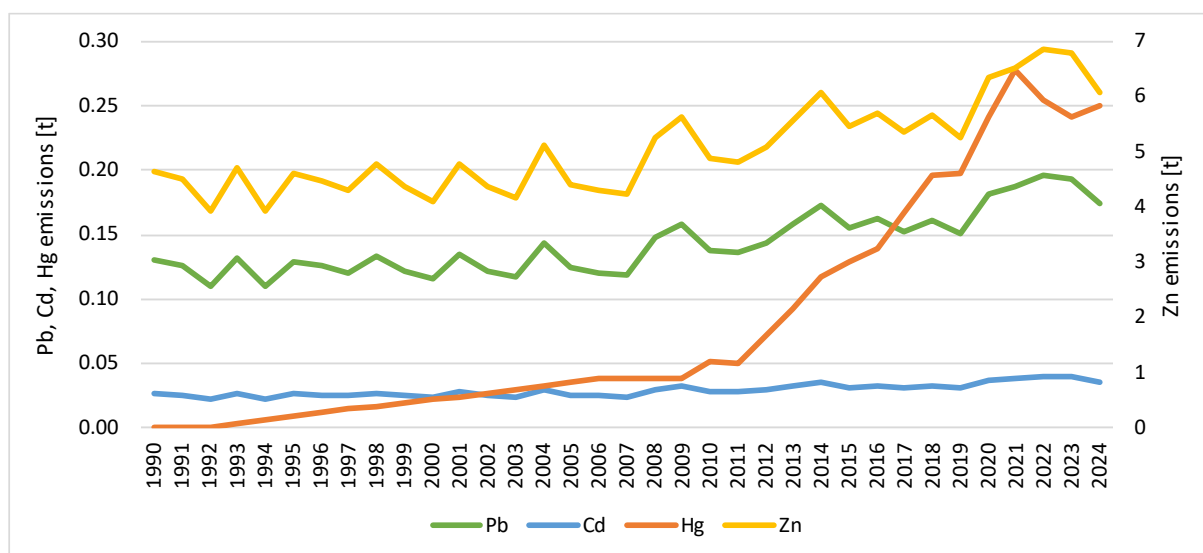


Figure 6.10. Cd, Pb, Zn and Hg emissions for 5C category in 1990-2024

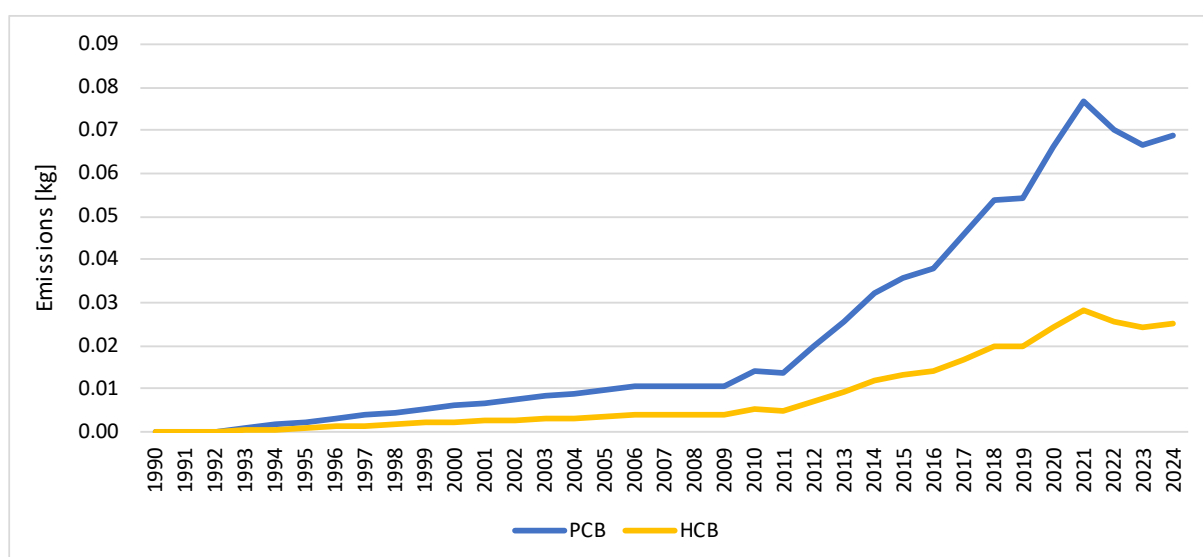


Figure 6.11. PCB and HCB emissions for 5C category in 1990-2024

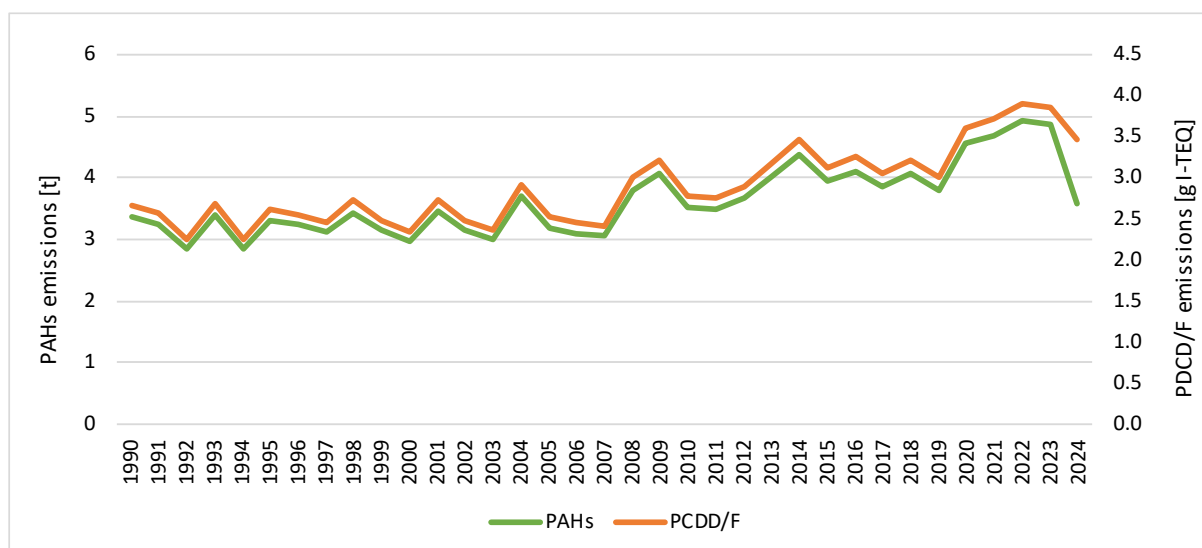


Figure 6.12. PCDD/F and PAHs emissions for 5C category in 1990-2024

6.4.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 5C. *Incineration and open burning of waste* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 5C are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 6.5. Results of the uncertainty analysis for NFR sector 5C

NFR subsector		NO _x	NMVOC	SO ₂	NH ₃	PM _{2.5}	PM ₁₀	TSP	BC
5C1bv	Cremation	71.0%	51.0%	32.1%		50.0%	50.0%	50.0%	
5C2	Open burning of waste	50.6%	50.6%	50.6%		50.6%	50.6%	50.6%	52.6%
NFR subsector		CO	Pb	Cd	Hg	PCDD/F	PAHs	HCB	PCBs
5C1bv	Cremation	51.0%	71.0%	71.0%	71.0%	100.0%	100.0%	100.0%	120.0%
5C2	Open burning of waste	50.6%	83.4%	82.4%		94.3%	94.3%		

6.4.5 Source-specific QA/QC and verification

For further details please see Chapter 3.2.5.

6.4.6 Source-specific recalculations

The following recalculations were implemented:

- 5C2. *Open burning of agriculture residues* – adding a new small group of crops.

6.4.7 Source-specific planned improvements

Evaluation of trend of split between with and without energy recovery between 1A Fuel Combustion Activities and 5C Waste Incineration following TERT recommendation from observation PL-5C-2025-0001 of 2025 review.

6.5 Wastewater handling (NFR sector 5D)

6.5.1 Source category description

The following subcategories from sector 5D have been included in the pollutant inventory:

- 5D1. *Domestic wastewater handling* (including *Latrines*),
- 5D2. *Industrial wastewater handling*.

Shares of emissions of the particular pollutants from NFR 5D category in the country total in 2024 are shown in Figure 6.13. Shares of pollutant emissions from this category are below 1.0% of Poland's total.

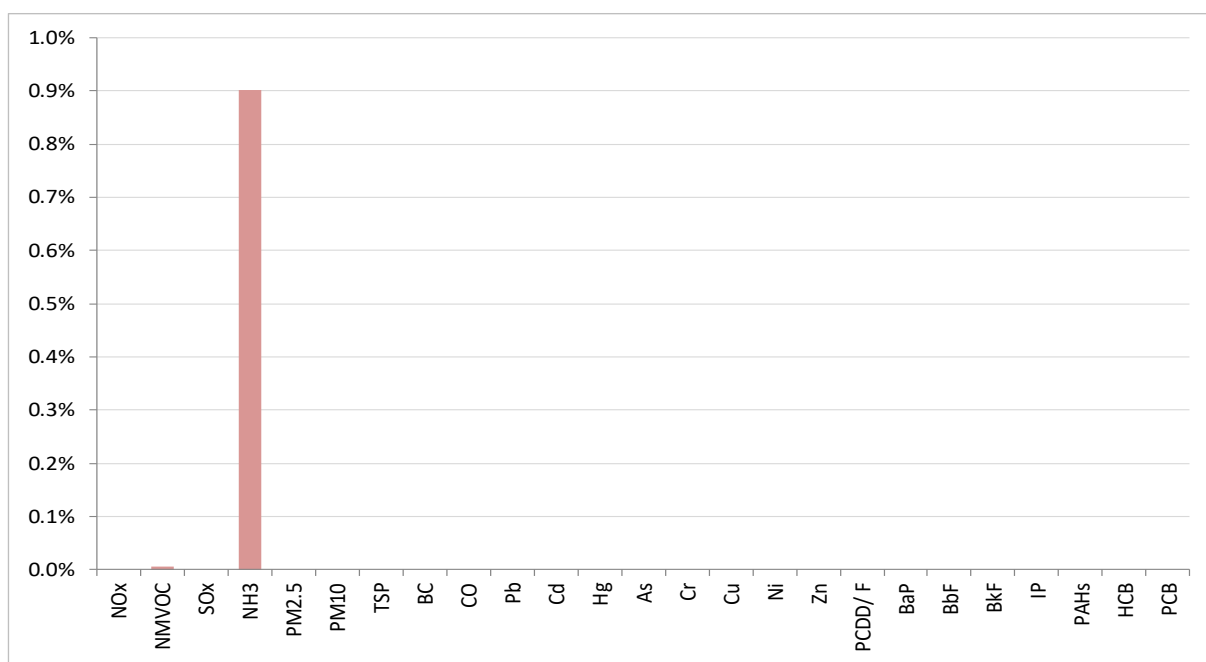


Figure 6.13. Shares of emissions from the NFR 5D category in the country total in 2024

6.5.2 Methodological issues

6.5.2.1 Domestic wastewater handling (NFR sector 5D1)

This subcategory includes emissions of air pollutants from municipal wastewater treatment processes taking place in:

- Municipal wastewater treatment plants (NMVOC),
- Latrines (NH₃).

Air pollutant emissions from NFR sector 5D1 are estimated based on default methodology described in EMEP/EEA air pollutant emission inventory guidebook – EIG 2023.

Activity Data

Activity data regarding municipal wastewater treatment, applied for current Polish emission inventory, is derived from national statistics made publically available by Statistics Poland in *Environment yearbooks* [GUS 2025h].

NH₃ emission from category 5D1. *Latrines* was assessed based on statistical data on the number of people using latrines (that is with no access to a flushable toilet). These data were

published by Statistics Poland based on national censuses on population and housing. The censuses were conducted in 2002, 2011 and 2021. The data for the years before, between, and after the censuses were extra- and interpolated.

All used activity data are presented in Appendix 5.

Emission Factors

Air pollutant emissions from NFR sector 5D1 were estimated based on default EIG 2023 *Tier 2* emission factors.

Tables with applied emission factors are presented in Appendix 6.

6.5.2.2 Industrial wastewater handling (NFR sector 5D2)

This subcategory includes emissions of air pollutants from industrial wastewater treatment processes.

Air pollutant emissions from NFR sector 5D2 are estimated based on default methodology described in EMEP/EEA air pollutant emission inventory guidebook 2023.

Activity Data

Activity data, applied for current Polish emission inventory are derived from national statistics made publically available by Statistics Poland in *Environment* yearbooks. Applied activity data is presented in Appendix 5.

Emission Factors

Air pollutant emissions from NFR sector 5D2 are estimated with application of default EIG 2023 *Tier 2* emission factors. Tables with applied emission factors for this category are presented in Appendix 6.

6.5.3 Emission trends for NFR sector 5D

Trends of pollutant emissions for category 5D. *Wastewater handling* are shown in figure below (Figure 6.14).

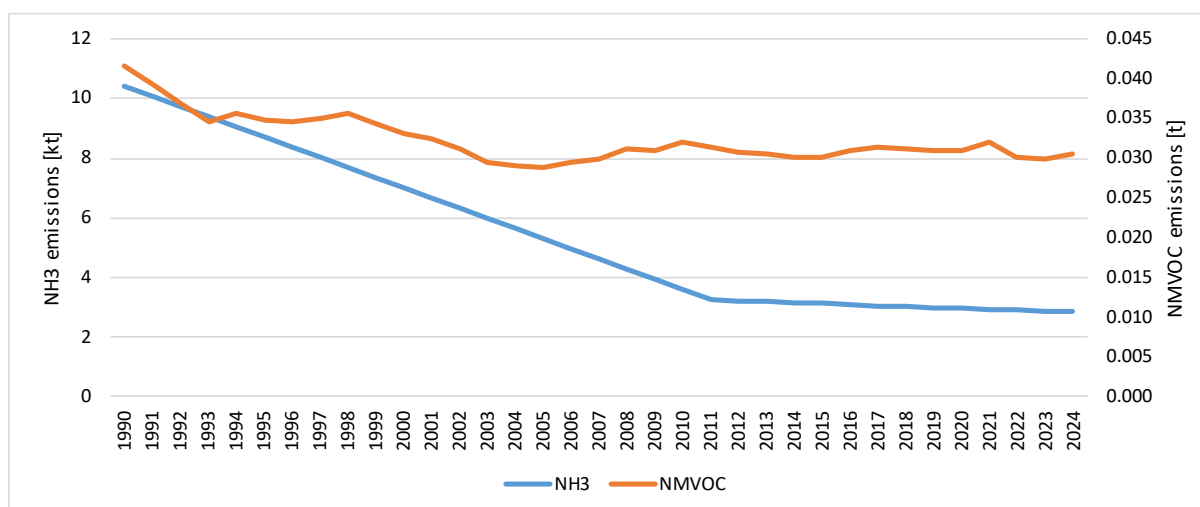


Figure 6.14. NH₃ and NMVOC emissions for 5D category in 1990-2024

6.5.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 5D. *Wastewater handling* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 5D are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for the whole time-series.

Table 6.6. Results of the uncertainty analysis for NFR sector 5D

NFR subsector		NMVOC	NH ₃
5D1	Domestic wastewater handling	215.0%	30.1%
5D2	Industrial wastewater handling	215.0%	

6.5.5 Source-specific QA/QC and verification

For further details please see Chapter 3.2.5.

6.5.6 Source-specific recalculations

As in 2024 Statistics Poland published new data related to the use of latrines in Poland, the activity data and emissions from domestic wastewater handling – latrines were recalculated.

6.5.7 Source-specific planned improvements

No further improvements are planned in this sector.



6.6 Other waste (NFR sector 5E)

6.6.1 Source category description

This subcategory includes emissions of air pollutants from:

- unintentional house fires,
- unintentional car fires,
- unintentional landfill fires.

The following subcategories in sector 5E have been identified as key source:

Table 6.7. Key source categories in sector 5E

NFR		Method	EF	Pollutant
5E	Other waste	T2	D	PCDD/F

Shares of emissions from NFR 5E category in the country total in 2024 are shown in Figure 6.15. Shares of most pollutant emissions from this category are below 1.5% (only PCDD/F emission exceeds 12.6%).

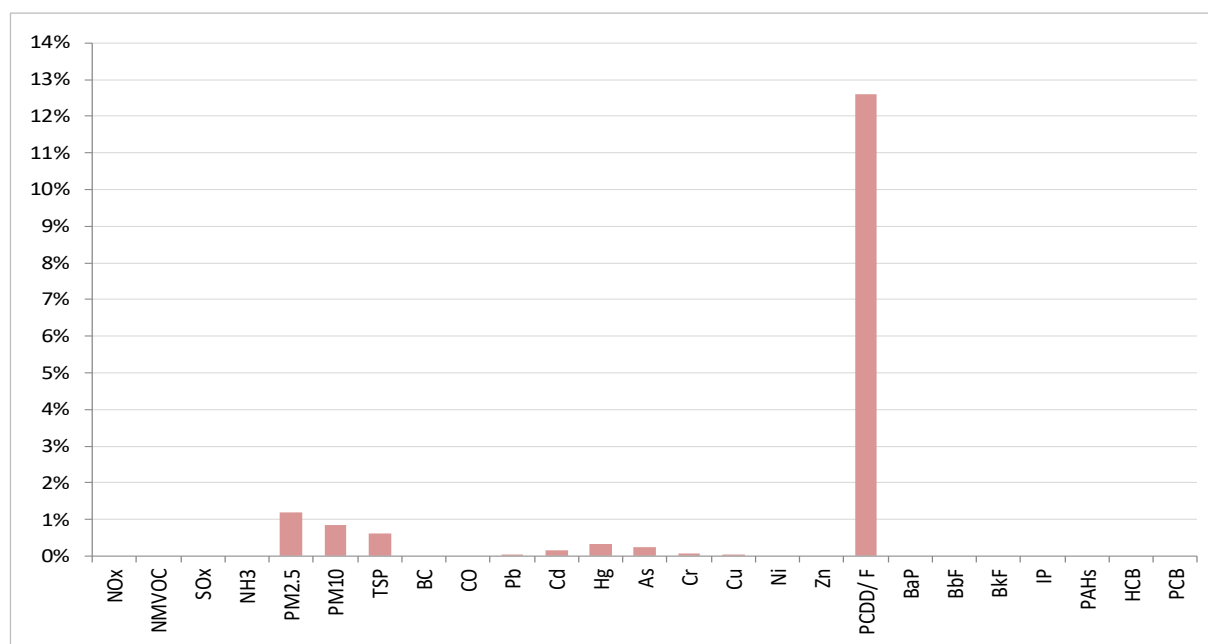


Figure 6.15. Shares of emissions from the NFR 5E category in the country total in 2024

6.6.2 Methodological issues

Air pollutant emissions from NFR sector 5E are estimated based on default methodology described in EMEP/EEA air pollutant emission inventory guidebook – EIG 2023.

Activity Data

Activity data, applied for current Polish emission inventory are derived from fire statistics made by National Headquarters of the State Fire Service.

All used activity data is presented in Appendix 5.

Emission Factors

Air pollutant emissions from NFR sector 5E are estimated with application of:

- Default EMEP/EEA EIG 2023 *Tier 2* emission factors for pollutants: TSP, PM10, PM2.5, PCDD/F, Pb, Cd, Hg, As, Cr, Cu;
- Costner P. (2006) emission factors for PCDD/F from landfill fires.

Tables with applied emission factors are presented in Appendix 6.

6.6.3 Emission trends for NFR sector 5E

Trend of pollutant emissions for category 5E. *Unintentional fires* are shown in figure below (Figure 6.16).

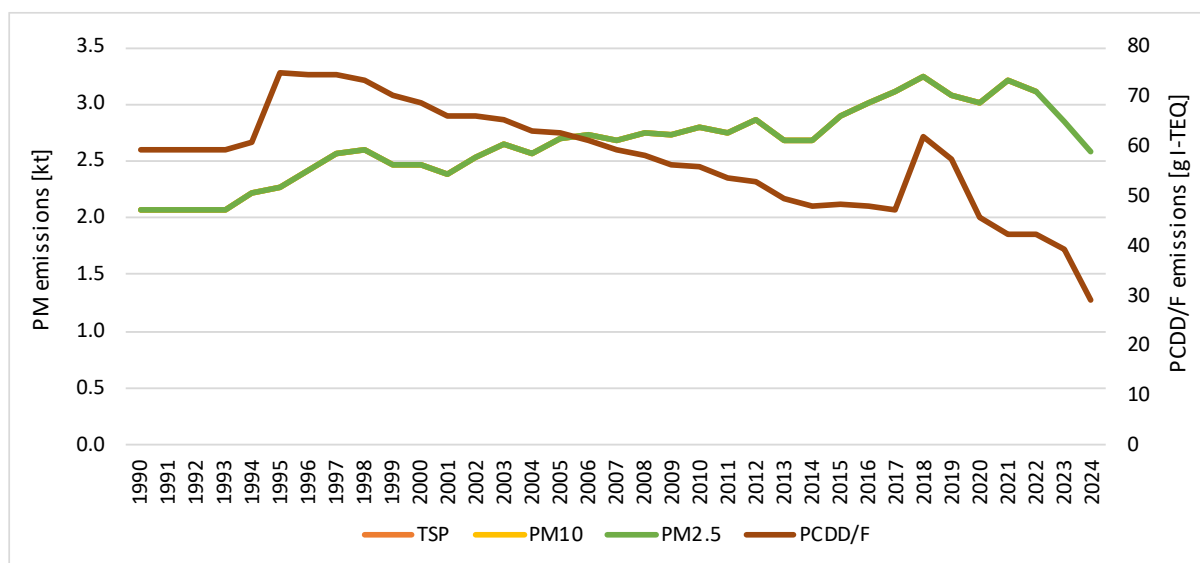


Figure 6.16. PCDD/F and PM emissions for 5E category in 1990-2024 (TSP = PM10 = PM2.5)

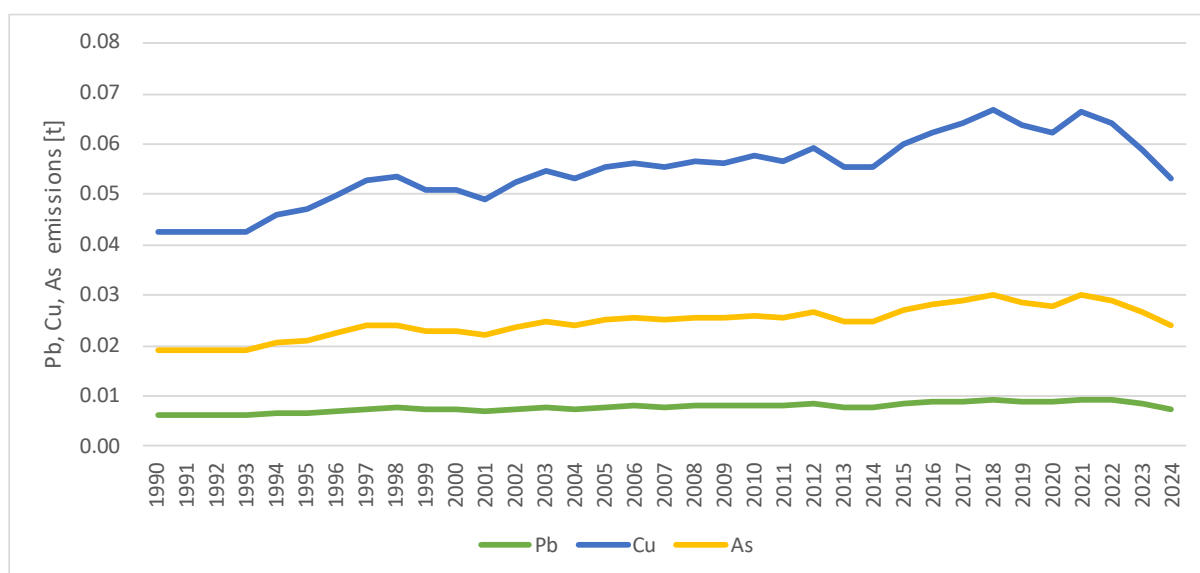


Figure 6.17. Pb, Cu and As emissions for 5E category in 1990-2024



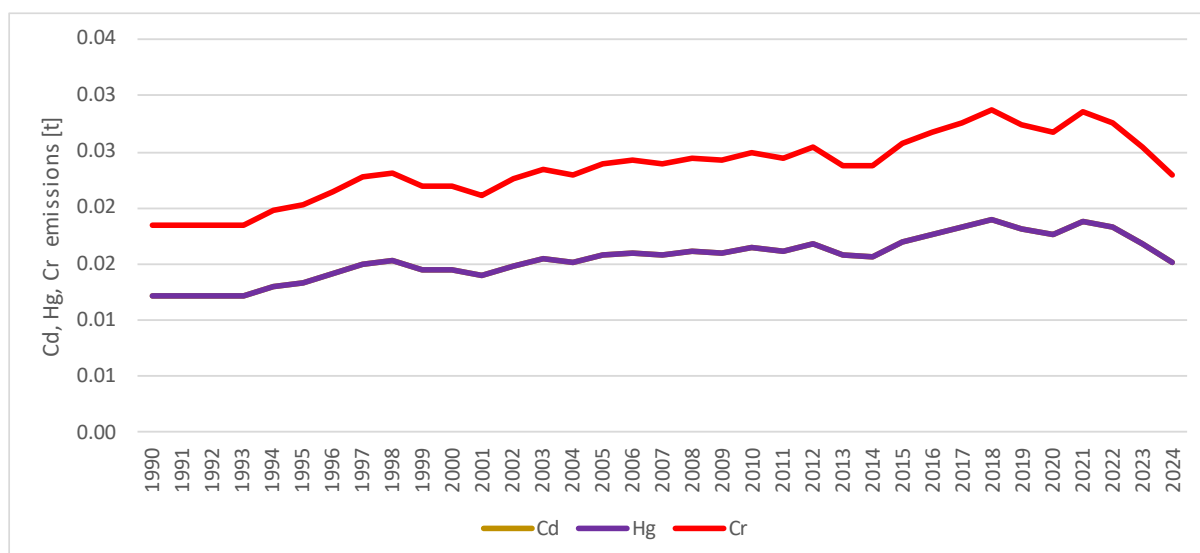


Figure 6.18. Cr, Cd and Hg emissions for 5E category in 1990-2024 (Cd = Hg)

6.6.4 Uncertainties and time-series consistency

The uncertainty analysis for the year 2024 for sector 5E. *Other waste* was carried out using Approach 1 described in the EMEP/EEA Emission Inventory Guidebook 2023 (see Chapter 1.7). More detailed calculations (including qualitative uncertainty estimates for most pollutants) are included in Appendix 8. The results of the sector uncertainty analysis for NFR Sector 5E are provided below.

Performed recalculations of data (for 1990-2023) ensured consistency for whole time-series.

Table 6.8. Results of the uncertainty analysis for NFR sector 5E

NFR subsector		PM2.5	PM10	TSP	Pb	Cd	Hg	PCDD/F
5E	Other waste (please specify in the IIR)	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	100.0%

6.6.5 Source-specific QA/QC and verification

For further details please see Chapter 3.2.5.

6.6.6 Source-specific recalculations

Pb, Cd, Hg, As, Cr, Cu emissions were added (TERT recommendation PL-5E-2025-0001).

6.6.7 Source-specific planned improvements

No improvements are planned in upcoming submissions.

7 OTHER AND NATURAL EMISSIONS

The category *Other and Natural emissions* includes emissions that have not been included in the national totals.

7.1 Forest fires (NFR sector 11B)

This chapter describes emissions from (natural or maninduced) burning of non-managed and managed forests and other vegetation, excluding agricultural burning of stubble, etc. Estimations from forest fires considered as unintentional include NMVOC, NO_x, CO, TSP, PM₁₀, PM_{2.5}, BC and PCDD/F emissions.

Activity data was derived from national statistics made publically available by Statistics Poland and are listed in Appendix 5.

For calculating the emissions of wildfires a country specific Tier 2 approach was used. The mass of carbon emitted M(C) was calculated using the following equation

$$M(C)=CF*A*B*\beta$$

where:

CF = average fraction of carbon in fuel wood;

A = forest area burnt in [m²];

B = mean above-ground biomass of fuel material per unit area in [kg/m²];

β = burning efficiency (fraction burnt) of the above-ground biomass.

The data on forest areas burnt for the period 1990 to 2024 has been taken from national statistics made publically available by Statistics Poland. In accordance with the IPCC 2006 Guidance a burning efficiency (β) of 0.45 was used. The emissions for the pollutants were calculated by multiplying the mass of carbon with the respective emission factors listed in Appendix 6.

7.2 Other natural sources (NFR sector 11C)

Further explanation is provided in Appendix 2.

Estimated emissions from managed broadleaf, mixed and coniferous forests include NMVOC.

Activity data was derived from national statistics that have been made publically available by Statistics Poland and are listed in Appendix 5. Tables with applied emission factors are presented in Appendix 6.



8 RECALCULATIONS AND IMPROVEMENTS

In 2026 recalculations of data from 1990 have been provided – therefore completeness and consistency of the extended emission inventory have been maintained. Emission inventory of air pollutants - though generally complete - still needs improvements of some elements.

8.1 Recalculations

Detail sectoral information on performed recalculations is presented in Chapters 3-6 dedicated to source categories. Summary of changes recommended during 2023 NECD Comprehensive Review of Polish Inventory is presented in Appendix 7.

Recalculations of data are provided each year for the whole period from 1990, compliant with actual methodology. In 2026 the methodology was updated based on:

- recommendations resulting from 2025 NECD Comprehensive Review of Polish Inventory (Final Review Report 2025) i.e. the methodology for estimating emissions was verified in several sectors (fuel combustion in the paper industry, consumption of solvents for wood impregnation, glues and adhesives) and emission sources not previously included in the inventory were added (plant residues left on the soil - a new emission source introduced in the latest EMEP-EEA guidelines),
- activity data and emission factors update according to the latest available data.

The most important changes introduced in the methodology across sectors are listed below.

1A2. Manufacturing industries and construction:

- for category 1A2 - the sulphur content in hard coal has been corrected based on the latest data,
- for category 1A2d - for biomass, Tier 2 NMVOC emission factor from the 2023 EMEP/EEA Guidebook, Chapter 1A1, Table 3-15 was used (TERT recommendation PL-1A2d-2025-0001),
- for category 1A2d – for years 2013 – 2023 the SO_x emission factors for hard coal were corrected based on data from the National Emission Database,
- for category 1A2gviii - country specific NO_x emission factors for diesel oil were used from the study prepared by KOBiZE for the purposes of reporting pollutant emissions to the National Emission Database (TERT recommendation PL-1A2gviii-2025-0002),
- for category 1A2gviii - for years 2016 – 2023 the TSP emission factors for biomass were corrected based on data from the National Emission Database, which also influenced the PM₁₀ and PM_{2.5} emission factors.

1A3. Transport:

- the update of number of vehicles and vehicles mileage in road transport based on data from Polish Central Vehicle and Driver Register database;
- the application of the PAH emission calculation methodology in line with the 2023 EMEP/EEA Guidebook on the speciation of tyre and brake wear for PAHs, using TSP emissions (TERT recommendation PL-1A3bvi-2025-0001);

- the update of the PM_{2.5} emission factor (TERT recommendations PL-1A3dii-2025-0001 and PL-1A3dii-2025-0002).

2. Industrial processes and Product Use:

- the activity data and emissions for the subcategory 2C1. *Iron and Steel Production* have been revised for the years 2020-2022, owing to an amendment in the steel production data (steel production in electric arc furnaces) in the national statistics;
- an analysis of data and methodology for subcategory 2C3. *Aluminium Production* aluminium production was performed, resulting in an adjustment to the calculation of PCB emissions for 1990–2023 (applying NA notation key) and the calculation of PCDD/F emissions for 1990–1996, until hexachloroethane was phased out in 1997;
- in subcategory 2D3i. *Other solvent and product use* T2 NMVOC emission factors for application of glues and adhesives was used (TERT recommendation PL-2D3i-2024-0002);
- in subcategory 2D3i. *Other solvent and product use* activity data for wood preservation was corrected for the years 1990-2023;
- PM₁₀ and TSP emissions from handling of agricultural products (2H2) has been calculated for the period 1990-2023 (TERT recommendation PL-2H2-2022-0001);
- activity data and emissions for wood processing category (2I) has been updated for the period 1990 – 2023 (CLRTAP review recommendation PL-2025-2-3);
- activity data and emissions for pulp and paper industry (2H1) has been updated for the period 1996-2023 (TERT recommendation PL-2H1-2022-0001).

3. Agriculture:

- addition of a new source 3Da4 *crop residues applied to soils* based on EMEP/EEA GB 2023;
- update of share of manure used in the anaerobic digesters in 2023 for all livestock ;
- change of parameter describing the maximum proportion of silage possible in the feed composition (Frac-max_{silage}) from the value of 1 to 0.5 in NMVOC emission calculation as recommended default value in EMEP/EEA EIG 2023.

5. Waste

- 5A. *Solid waste disposal on land* - application of default EIG 2023 emission factor for NMVOC (TERT recommendation PL-5A-2025-0001);
- 5B. *Biological treatment of waste* - update of activity data (AD) on composted waste in BDO database and slight amendment of AWMS share for livestock;
- 5C2. *Open burning of agriculture residues* – adding a new small group of crops;
- 5E. *Other waste* - Pb, Cd, Hg, As, Cr, Cu emissions were added (TERT recommendation PL-5E-2025-0001).

Due to methodological changes, emission levels have changed in many categories in relation to the emissions reported last year, in the entire emission trend since 1990. Table 8.1 summarizes the total emissions submitted in 2025 and 2026 for years 2005 and 2023.

Table 8.1. Total pollutant emissions submitted in 2025 and 2026 for years 2005 and 2023

Pollutant	Unit	2005			2023		
		Submission 2025	Submission 2026	Changes [%]	Submission 2025	Submission 2026	Changes [%]
SO ₂	kt	1 106.6	1 107.8	0.1	273.3	269.2	-1.5
NO _x	kt	839.4	835.7	-0.4	492.0	503.3	2.3
NMVOG	kt	848.3	818.7	-3.5	640.2	606.2	-5.3
NH ₃	kt	345.5	348.0	0.7	310.5	313.9	1.1
CO	kt	3 593.8	3 574.4	-0.5	2 140.3	2 182.6	2.0
TSP	kt	602.2	605.0	0.5	431.4	435.4	0.9
PM ₁₀	kt	445.9	445.9	0.0	321.3	321.3	0.0
PM _{2.5}	kt	323.0	323.0	0.0	233.4	233.7	0.1
BC	kt	21.4	21.4	0.0	14.4	14.7	2.7
Pb	t	268.3	268.4	0.0	221.2	221.5	0.1
Cd	t	9.5	9.5	0.2	9.3	9.3	0.3
Hg	t	9.8	9.8	0.2	5.1	5.1	0.4
As	t	15.9	15.9	0.2	10.3	10.3	0.4
Cr	t	41.4	41.4	0.1	31.6	31.8	0.5
Cu	t	216.3	216.3	0.0	311.4	314.7	1.0
Ni	t	105.6	105.6	0.0	60.1	60.3	0.4
Zn	t	516.6	516.6	0.0	474.0	474.9	0.2
HCB	kg	11.7	11.7	0.0	3.5	3.5	0.0
PCB	kg	172.1	171.5	-0.4	127.0	125.3	-1.4
PAHs	t	310.3	310.4	0.0	203.4	203.6	0.1
PCDD/F	g I-TEQ	348.2	348.2	0.0	260.6	261.0	0.2

The largest change (decrease in emissions) compared to the 2025 submission was observed in the case of NMVOC emissions. The main reason was the reduction in emissions in sector 3B. *Agricultural soils*, resulting from the use of lower parameters (indicated in the EMEP/EEA 2023 guidelines) related to feeding silage to cattle.

The change in NMVOC emissions was also influenced by the implementation of recommendations from the national inventory review, which resulted in corrections to some NMVOC emission factors in subsectors:

- 1A2d. *Pulp, paper and print* - Tier 2 NMVOC emission factor for biomass was used (TERT recommendation PL-1A2d-2025-0001);
- 2D3i. *Other solvent use* - based on the information obtained on the solvent content in glues and adhesives, the methodology for estimating emissions from this category was updated to the Tier 2 level in accordance with the EMEP/EEA guidelines (TERT recommendation PL-2D3i-2024-0002).

The figure below shows a comparison of the national NMVOC emission trends in the years 1990–2023 in reports from 2025 and 2026.

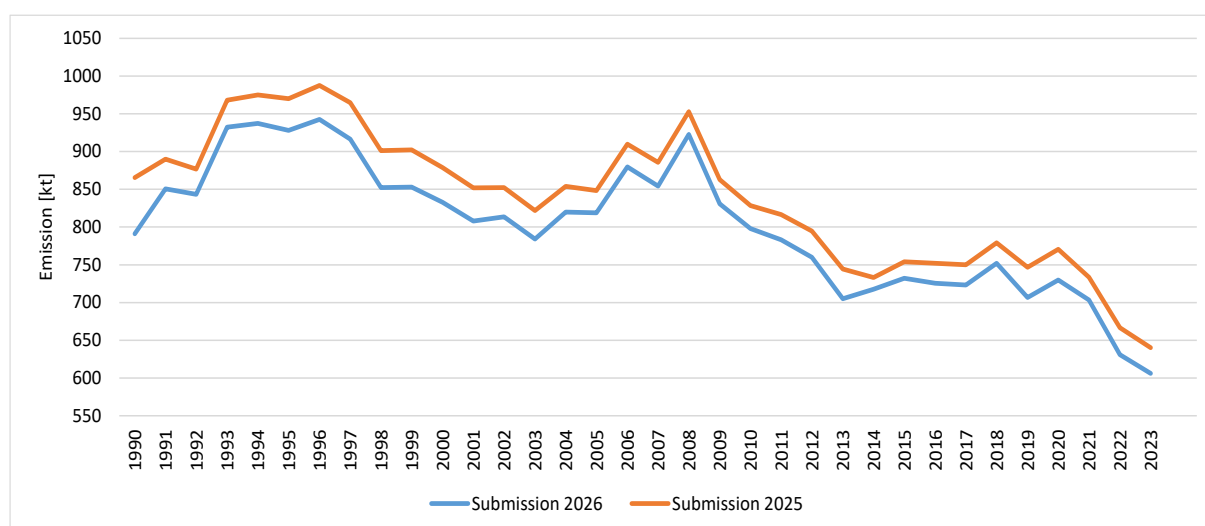


Figure 8.1. NMVOC emission trends in submissions 2025 and 2026

8.2 Planned improvements

Despite performed recalculations, inventory improvement is still possible; planned programme of improvement is focused on the main following tasks:

- further methodology development by applying higher tier of estimation methodology,
- further work on the development of national emission factors,
- gathering additional activity data to verify the trend 1990-2024.

Detailed sectoral information on planned improvements is included in sectoral Chapters 3-6.



9 PROJECTIONS

Last submission: 15.03.2025

The adoption of the NEC Directive in December 2016 (2016/2284) resulted in the obligation to report (in a two-year cycle) projections of emissions of selected air pollutants for the years 2020, 2025 and 2030 and - if data is available - for 2040 and 2050. This applies to the following pollutants:

- Nitrogen oxides (NO_x);
- Sulphur compounds expressed as sulphur dioxide (SO₂);
- Non-methane volatile organic compounds (NMVOC);
- Ammonia (NH₃)
- Particular matter - PM_{2.5} fraction;
- Black carbon (BC), if available.

In order to fulfil this obligation, emission projections of the above-mentioned pollutants (including BC) were prepared for the years 2025, 2030, 2035, 2040, 2045 and 2050. The results of the analyses for individual pollutants are presented further in the study. According to the provisions of the NEC Directive (Annex IV, part 2, point 3), emission projections should be consistent with the national emission inventory for the year x-3, i.e. in this case with the emission inventory reported in 2024 for 2022.

Emission projections undergo the same QA/QC procedures as the air pollutant emission inventory (described in Chapter 1.6).

Emission projections (Annex IV) have been prepared in a new format adopted as a part of the revised Guidelines for reporting emissions and projections data under the LRTAP Convention by the Executive Body for the LRTAP Convention at its 42nd session (Geneva, 12–16 December 2022).

In the analysis, projections until 2050 were developed in two scenarios, in line with the applicable reporting principles set out in part 2 of the Annex IV to the NEC Directive:

- Scenario with existing measures (WM) - a scenario including measures implemented or adopted;
- Scenario with additional measures (WAM) - a scenario including also planned activities.

9.1 Methods and data sources

Emission projections are based on the prior determination of projected activity and – where available – technology changes for all categories. Projected activity changes were developed pursuant to article 9 of the Act of 17 July 2009 on the System for Managing Emissions of Greenhouse Gases and Other Substances (USZE) and took the form of a report “Projections of Activity Changes in Selected Economic Sectors – update 2024”. The report took into account relevant policies and measures as well as additional information from a number of sources, among others from industry associations, research institutions, sectoral experts and competent authorities, including ministries and other entities performing public tasks.

One of the most important analyses in the field of energy, used to develop activity projections

in several sectors, was the draft of the updated in 2024 "Poland's National Energy and Climate Plan until 2030" (NECP PL). The data contained in this analysis were applied to calculate projected emissions in the sectors related to fuel combustion, i.e.: 1A1, 1A2, 1A3 and 1A4 (fuel combustion in the energy, industry, transport and small combustion sources including residential sector).

The draft of the NECP update, including a new ambitious scenario and additional attachments was developed pursuant to Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action.

NECP presents the objectives, targets, policies and measures in five dimensions of the Energy Union:

- decarbonisation
- energy efficiency
- energy security
- internal energy market
- research, innovation and competitiveness.

Detailed description of data sources and methods of calculations regarding each sector are provided in the following chapters.

9.1.1 Energy industries (NFR sector 1A1)

In order to prepare the projection of the pollutant emissions from sector 1A1. *Energy Industries*, the following data were used:

- data on projected activities (fuel consumption) were adopted in two scenarios, WM and WAM, based on update of NECP PL developed in 2024,
- for sub-category 1A1a. *Public electricity and heat production*, NO_x, SO₂ and PM_{2.5} country specific emission factors were adopted as for 2022, based on national publications;
- for sub-category 1A1b. *Refineries* and 1A1c. *Manufacture of solid fuels and other energy industries*, for NO_x and SO₂ implied emission factors (IEFs) were used, estimated based on total emissions in 2022 and the sum of all fuels used in a given sector;
- all other emission factors for the 1A1 sector were adopted as for 2022, based on EMEP/EEA EIG 2023.

The emissions were calculated on the basis of the formula:

$$E = AD \times EF$$

where:

- E - emission of a pollutant [kt]
- AD - activity (fuel consumption) [TJ]
- EF - emission factor [g / TJ]

According to the assumptions of the update of NECP, fossil fuels will gradually be replaced by low- and zero-emission energy sources. For many years, hard coal has been the basis for energy production in Poland, but this trend is changing, as Poland continues the energy transformation process.

In the coming years, the use of coal will be gradually replaced by zero-emission fuels, and temporarily also by natural gas, which results especially in a reduction in NO_x, SO₂ and PM_{2.5} emissions. The tables below present emission projections from 1A1 sector. The year 2022 was added for comparison and represents the historical value of emissions according to the national emission inventory from the 2024 submission.

Table 9.1. Emissions projected in sector 1A1 in WM and WAM scenario [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
WM							
NO _x	110.47	99.48	72.93	58.94	36.92	23.48	20.44
NM VOC	3.22	3.41	3.37	3.08	2.54	1.85	1.71
SO ₂	131.04	101.59	65.55	48.51	26.51	15.00	12.78
NH ₃	0.024	0.024	0.024	0.025	0.025	0.026	0.025
PM _{2.5}	2.75	2.40	1.81	1.53	1.01	0.62	0.52
BC	0.14	0.13	0.12	0.11	0.09	0.07	0.07
WAM							
NO _x	110.47	97.16	62.33	41.90	23.09	14.40	14.82
NM VOC	3.22	3.45	3.26	2.68	1.75	1.17	1.16
SO ₂	131.04	97.44	53.87	32.96	14.13	8.45	8.64
NH ₃	0.024	0.024	0.025	0.024	0.026	0.026	0.026
PM _{2.5}	2.75	2.21	1.36	0.96	0.55	0.27	0.27
BC	0.14	0.12	0.10	0.08	0.07	0.05	0.05

The figures below show the trends of projected emissions for both scenarios. The year 2022 (displayed in green) was added for comparison and represents the historical emissions value according to the national emission inventory from the 2024 submission.

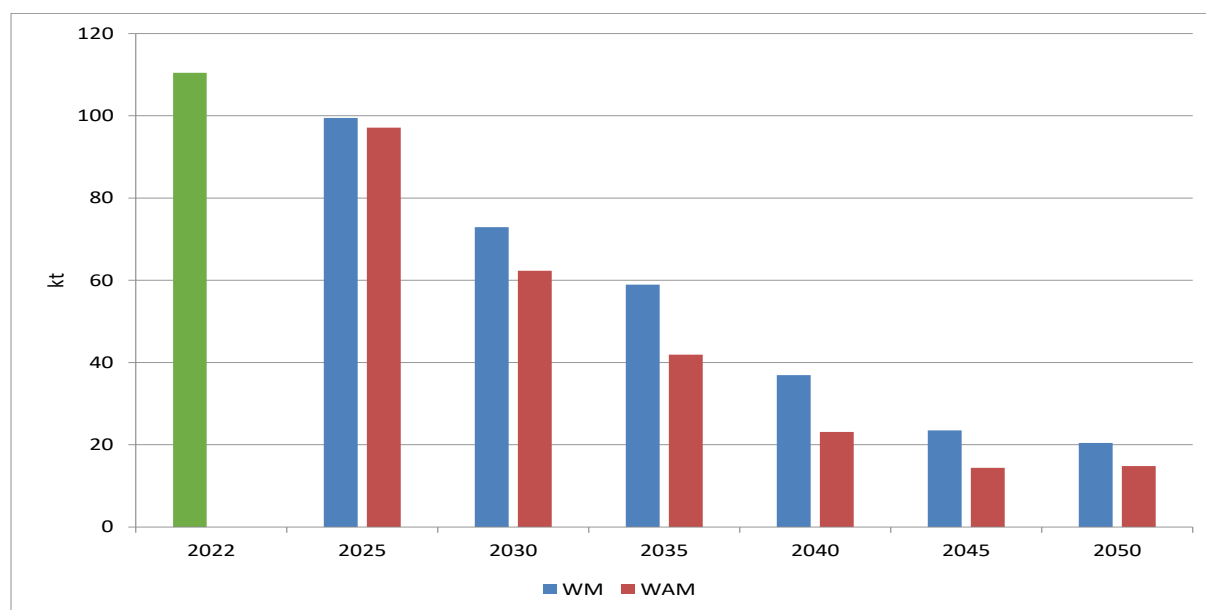


Figure 9.1. Comparison of projected NO_x emissions trends in both scenarios in sector 1A1

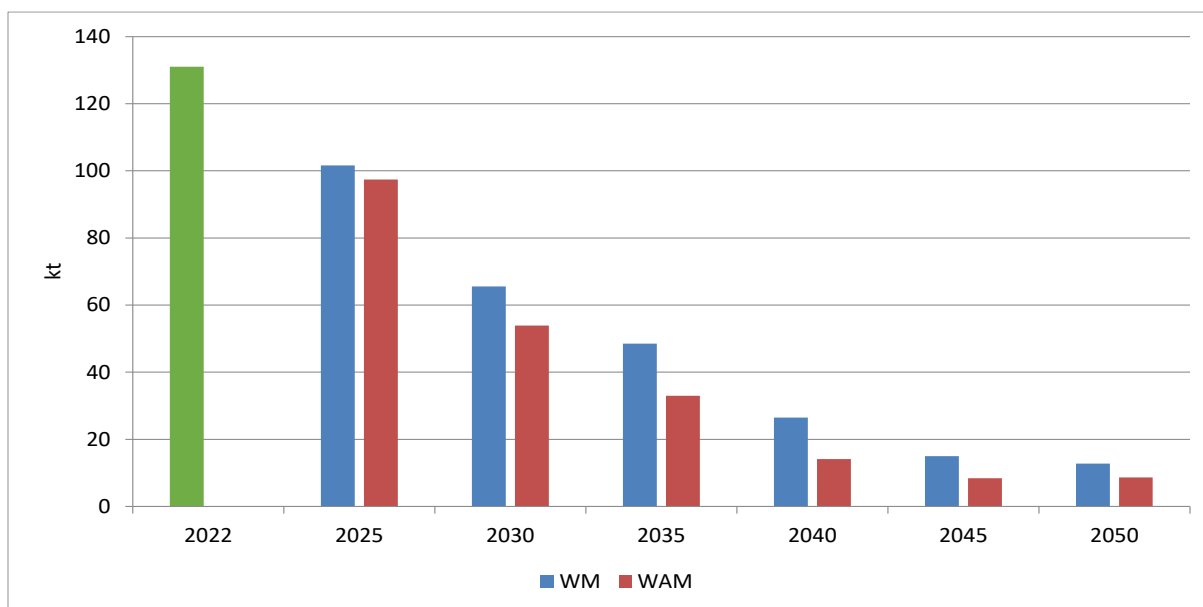


Figure 9.2. Comparison of projected SO₂ emissions trends in both scenarios in sector 1A1

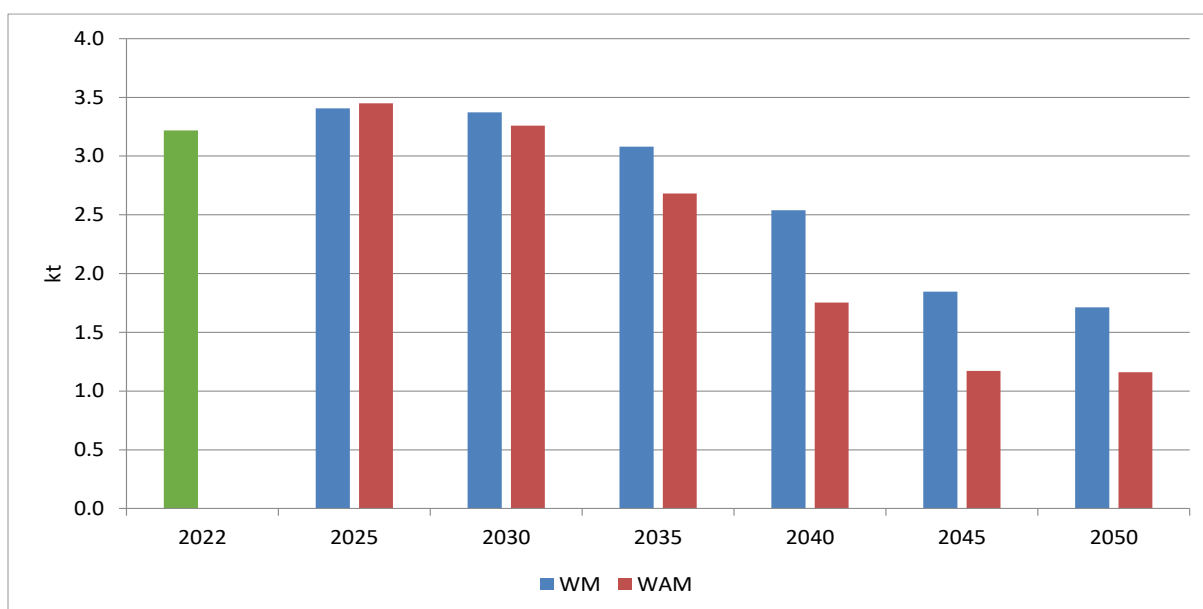


Figure 9.3. Comparison of projected NMVOC emissions trends in both scenarios in sector 1A1

The increase in NMVOC emissions in the first years of the projections results from the increase in the combustion of industrial waste, biomass and natural gas. In the subsequent years of the projections, the consumption of these fuels decreases and, consequently, the emission of this pollutant also decreases.

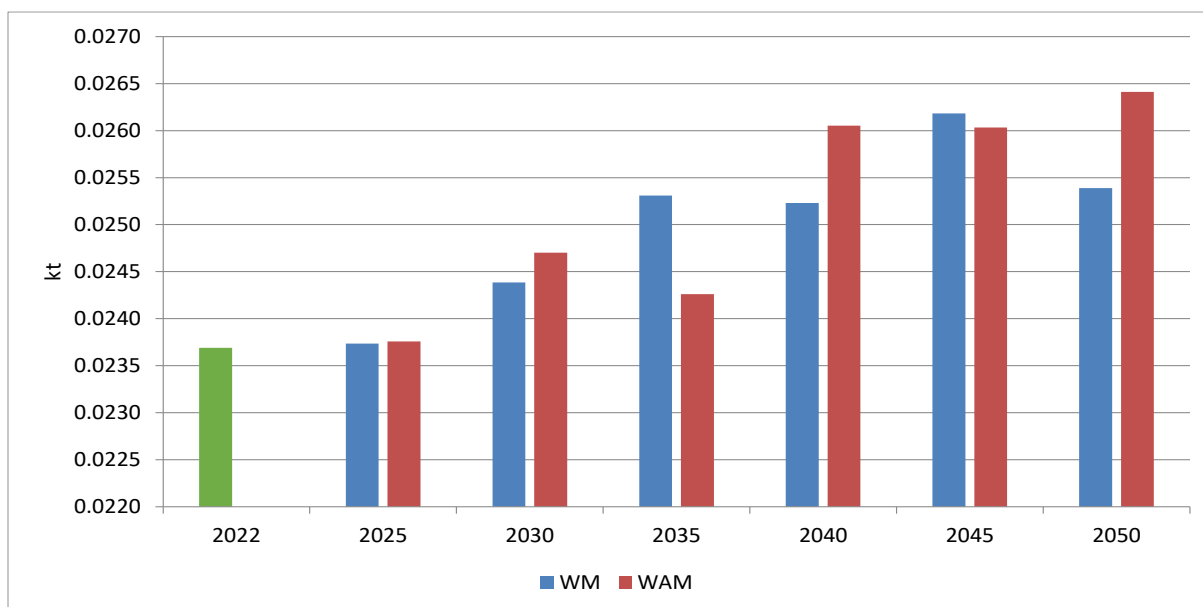


Figure 9.4. Comparison of projected NH₃ emissions trends in both scenarios in sector 1A1

The value of NH₃ emissions in sector 1A1 is insignificant, and its source is mainly biogas combustion in the power industry and processing of crude oil in refineries. While the input of crude oil decreases in the subsequent years of the projection, the consumption of biogas in the power industry systematically increases. As a result, the course of NH₃ emissions in the subsequent years has a variable trend.

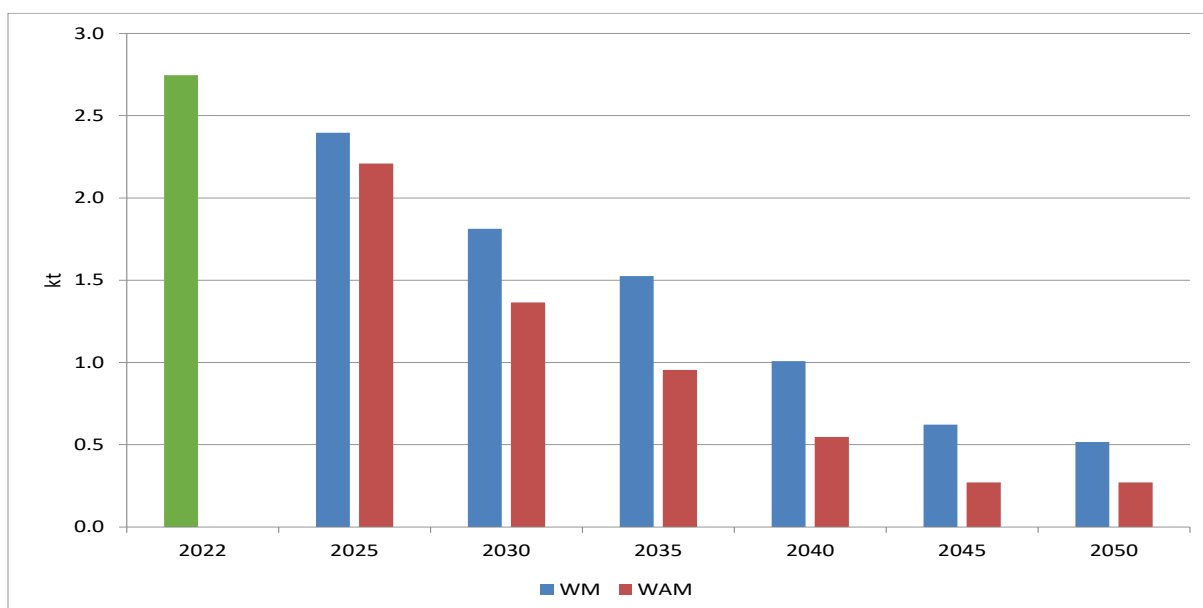


Figure 9.5. Comparison of projected PM_{2.5} emissions trends in both scenarios in sector 1A1

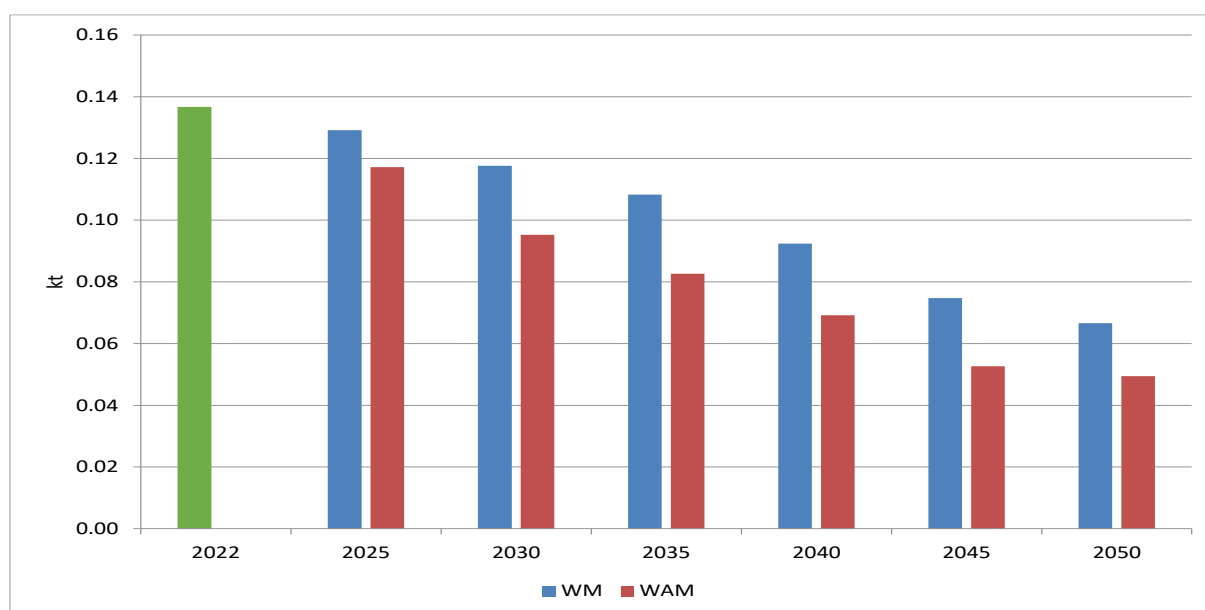


Figure 9.6. Comparison of projected BC emissions trends in both scenarios in sector 1A1

9.1.2 Manufacturing industries and Construction (NFR sector 1A2)

In order to prepare the projection of the pollutant emissions from sector 1A2 *Manufacturing industries and Construction*, the following data was used:

- data on projected activities (fuel consumption) were adopted in two scenarios, WM and WAM, based on update of NECP PL developed in 2024,
- all emission factors for the 1A2 sector were adopted as for 2022; most of EFs were based on EMEP/EEA EIG 2023 and selected EFs were developed based on data from the National Emissions Database.

In emission projections - contrary to emission inventory - there is only the total fuel consumption available for the whole sector 1A2, without division into subcategories. Therefore only projections for the whole category 1A2 were calculated and shown in Annex IV as emission in category 1A2a. It means that the emissions projected in 1A2a are the values for the entire category 1A2 and should be compared with total 1A2 historical emissions. For the remaining subcategories of the category 1A2 the notation key IE was entered in the Annex IV, meaning that the emissions from these subcategories are included in 1A2a.

The emissions were calculated on the basis of the formula:

$$E = AD \times EF$$

where:

- E - emission of a pollutant [kt]
- AD – activity (fuel consumption) [TJ]
- EF - emission factor [g/TJ]

As mentioned above in the description of projections for the NFR category 1A1, according to the assumptions of the updated NECP, fossil fuels will gradually be replaced by low- and zero-emission energy sources. This process will have a predominant influence on future emissions of the majority of air pollutants, especially NO_x, SO₂ and PM_{2.5}. The tables below present

emission projections from 1A2 sector. The year 2022 has been added for comparison and represents the historical value of emissions according to the national emission inventory from the 2024 submission.

Table 9.2. Emissions projected in sector 1A2 in both scenarios [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
WM							
NO _x	49.49	44.73	38.81	34.49	30.64	27.28	24.95
NM _{VOC}	36.07	38.39	35.96	33.88	32.42	31.29	30.48
SO ₂	43.73	29.63	18.39	12.61	9.65	8.01	7.19
NH ₃	0.079	0.119	0.121	0.119	0.119	0.118	0.119
PM _{2.5}	8.23	6.61	4.94	4.01	3.53	3.23	3.08
BC	0.29	0.21	0.17	0.14	0.13	0.12	0.12
WAM							
NO _x	49.49	43.58	33.94	27.75	22.43	18.24	15.34
NM _{VOC}	36.07	37.55	33.05	30.53	28.78	27.59	26.76
SO ₂	43.73	27.82	15.80	10.68	8.30	7.04	6.18
NH ₃	0.079	0.116	0.110	0.108	0.108	0.109	0.110
PM _{2.5}	8.23	6.29	4.36	3.51	3.11	2.87	2.74
BC	0.29	0.21	0.15	0.13	0.11	0.10	0.09

The figures below show the trends of projected emissions for both scenarios. The year 2022 (displayed in green) was added for comparison and represents the historical emissions value according to the national emission inventory from the 2024 submission.

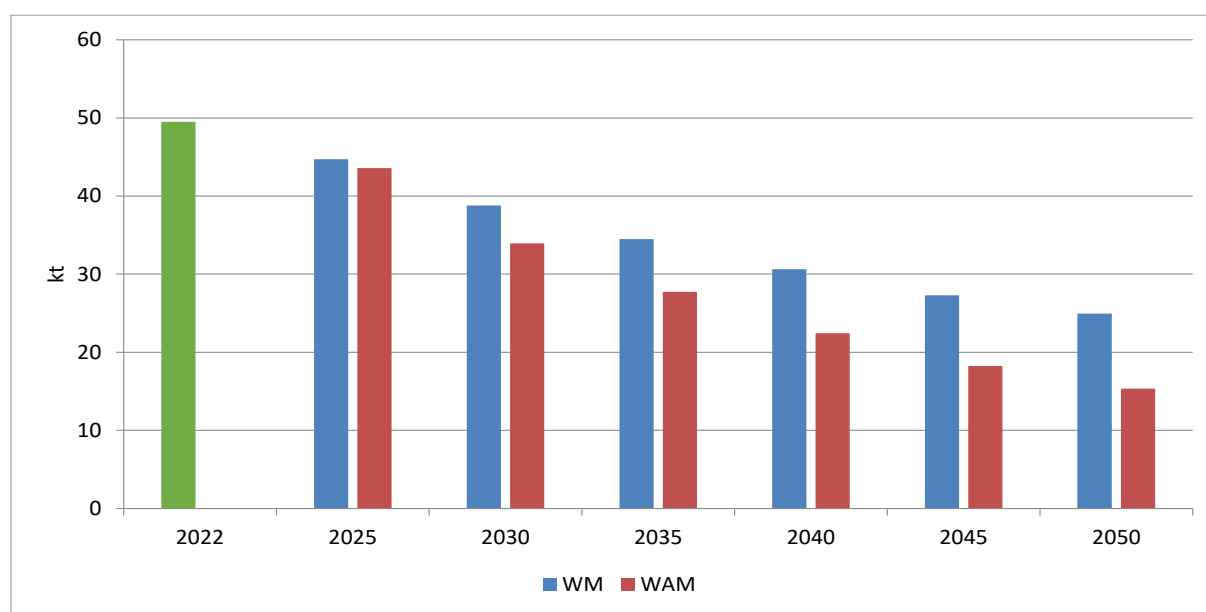


Figure 9.7. Comparison of projected NO_x emissions trends in both scenarios in sector 1A2

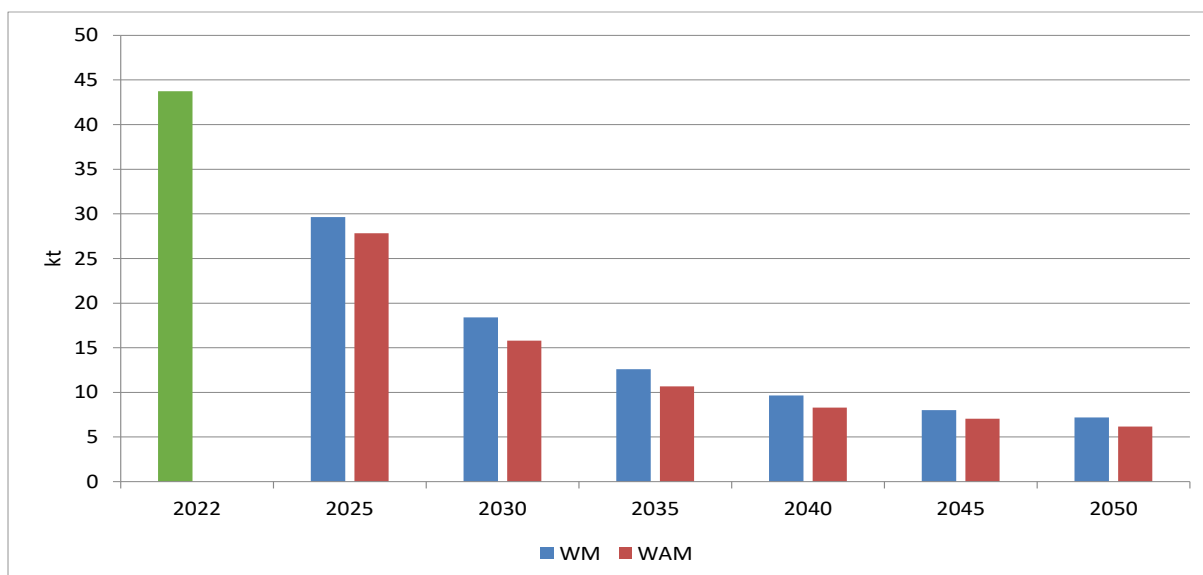


Figure 9.8. Comparison of projected SO₂ emissions trends in both scenarios in sector 1A2

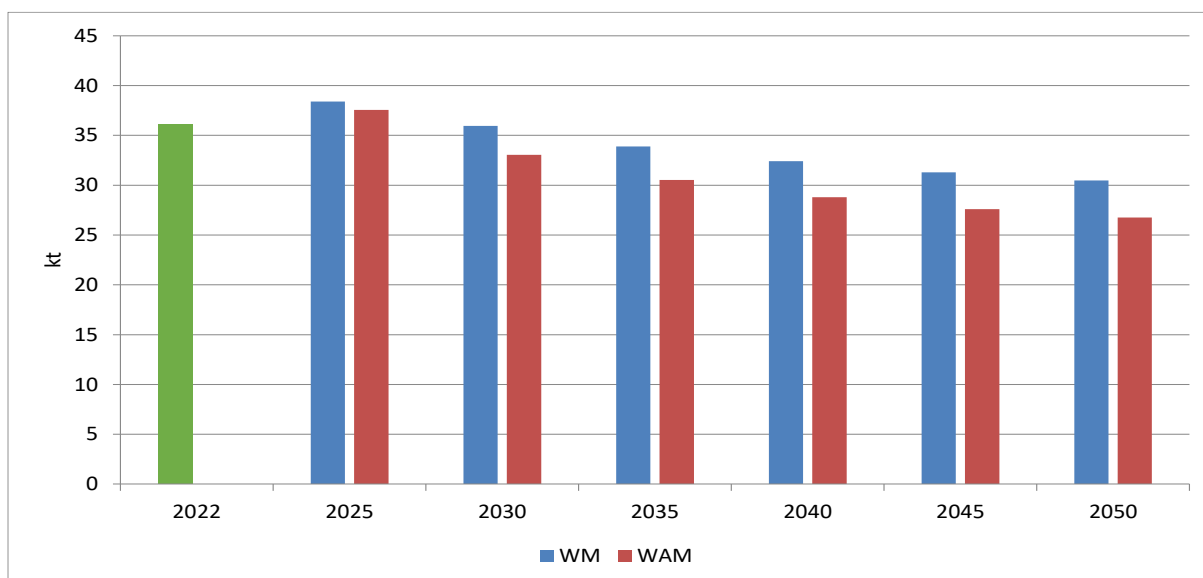


Figure 9.9. Comparison of projected NMVOC emissions trends in both scenarios in sector 1A2

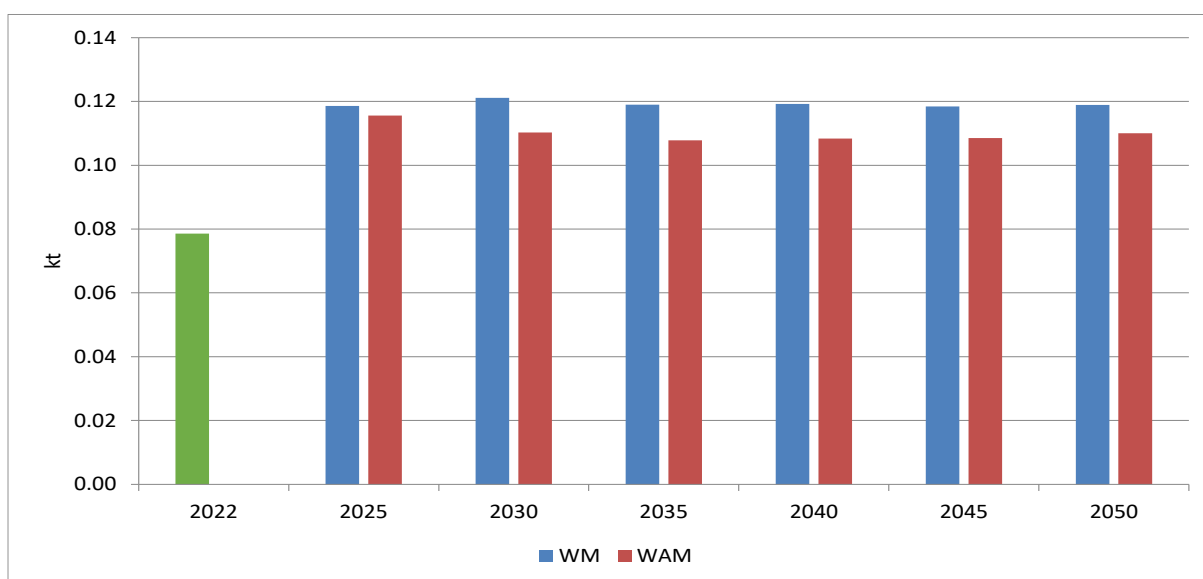


Figure 9.10. Comparison of projected NH₃ emissions trends in both scenarios in sector 1A2

The main source of NMVOC emissions is the combustion of biomass, industrial waste and natural gas, the consumption of which remains at a significant level in the projected years in both scenarios.

NH₃ emissions are related to the combustion of biomass, the share of which in the fuel mix is significant and remains at a constant level.

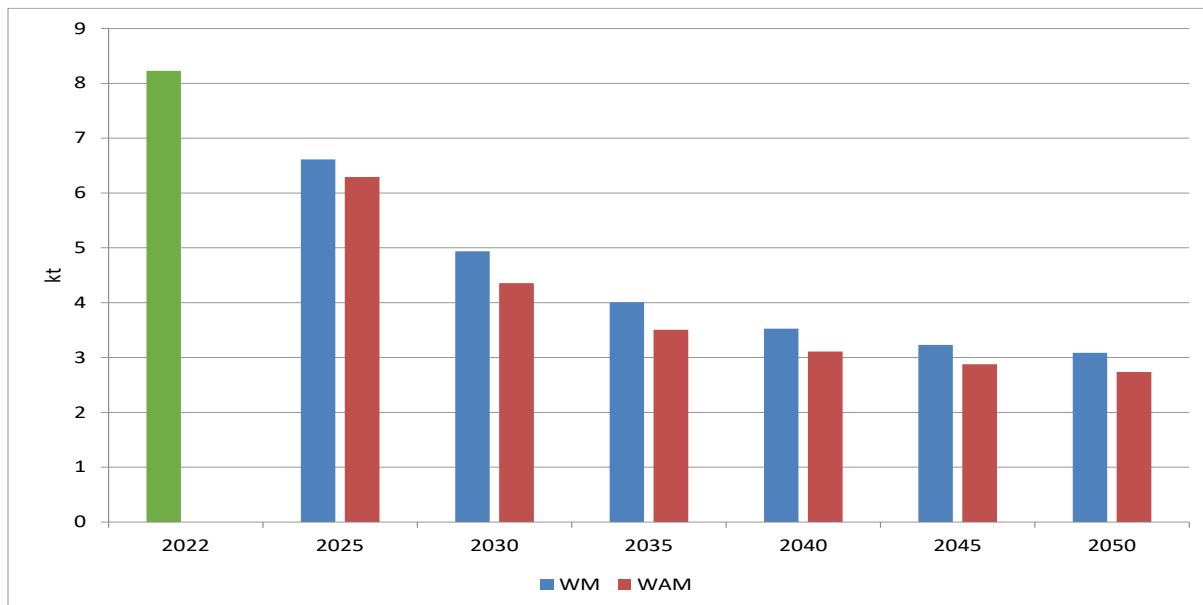


Figure 9.11. Comparison of projected PM_{2.5} emissions trends in both scenarios in sector 1A2

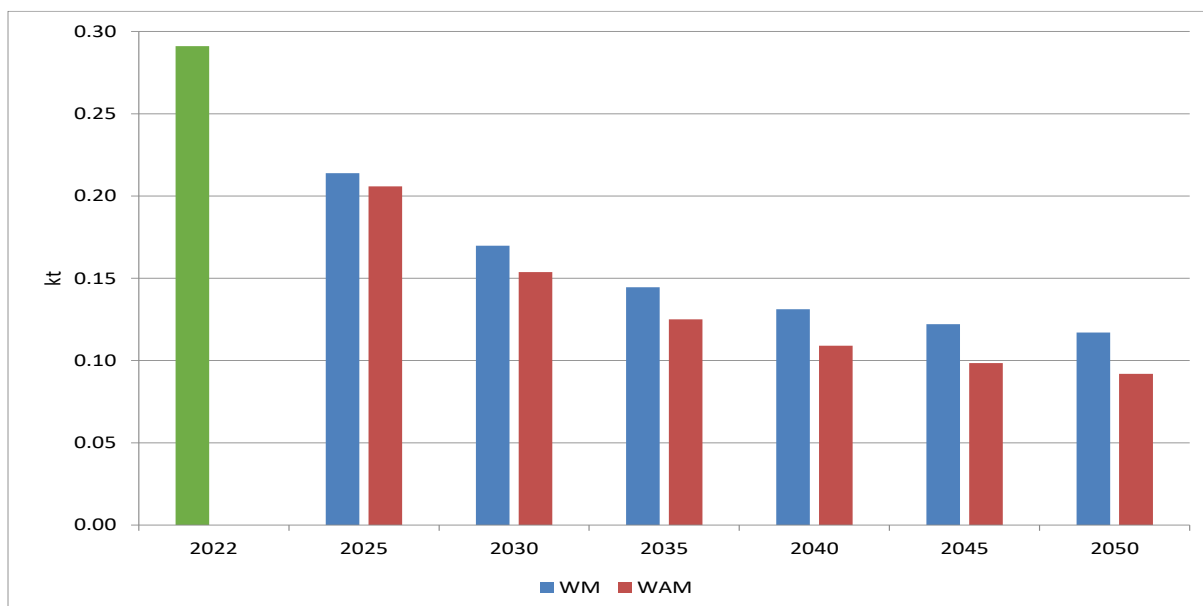


Figure 9.12. Comparison of projected BC emissions in both scenarios in sector 1A2

9.1.3 Road transport (NFR sector 1A3b)

In order to prepare the projections of pollutant emissions from sector 1A3b, the following data was used:

- The emission factors for all pollutants were adopted on the basis of the EMEP/EEA EIG 2023 using the COPERT 5.7 model.
- Data on projected activities (fuel consumption) in the road transport sector were adopted on the basis of "Poland's National Energy and Climate Plan until 2030" (update of NECP PL developed in 2024) in two scenarios: WEM (assumed in the projections as the WM scenario) and WAM).
- The data contained in the study entitled: "Development of forecasts of changes in activity in the road transport sector" (ITS, 2021) prepared by ITS and commissioned by the National Centre for Emissions Management (KOBiZE). This study includes an expert forecast of the number of vehicles until 2040 according to data from Polish Central Vehicle and Driver Register system (CEPiK). The study has been applied to the following types of vehicles: passenger cars, light duty vehicles, heavy duty vehicles, buses and L-category vehicles, split by type of energy carrier (petrol, diesel, LPG, CNG and electricity), as well as by ecological categories (emission standards). It also includes forecasted average annual mileage of vehicles. The structure and vehicle mileages used in the COPERT model were prepared based on corrected data from this study, divided into 430 categories required by the model.

The assumptions adopted for the projections in the WAM scenario are consistent with the directions of development of the sector resulting from strategic government documents at the level of the national economy (update of NECP PL updated in 2024) and in the transport sector (e.g. Strategy for Sustainable Development of Transport until 2030). Fuel consumption in the road transport sector, both in the WM and WAM scenarios, were based on the fuel consumption assumed in the updated NECP PL (2024 draft).

Moreover, the emission projections relate to vehicles really used only. This means that vehicles registered in the Central Vehicles and Drivers Register (CEPiK) with the status of "archival", were excluded. The forecast of activity changes took into account the introduction of the Euro 7 standard for passenger cars and light commercial vehicles and the Euro VII standard for heavy duty vehicles and city- and long-distance buses, respectively. The study assumed 2030 as the most likely date for the Euro 7/Euro VII standard to apply. All newly registered vehicles in Poland from that date will be considered to meet this standard.

The tables below present emission projections from 1A3 sector.

Table 9.3. NO_x and SO₂ emissions projected in sector 1A3b in **WM** scenario [kt]

Sector	NO _x							SO ₂						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	165.23	180.20	134.00	95.64	64.10	52.61	41.61	0.61	0.57	0.49	0.44	0.39	0.34	0.29
1A3bi Passenger cars	59.62	50.23	41.01	33.25	26.10	20.46	15.80	0.38	0.35	0.31	0.28	0.25	0.22	0.19
1A3bii Light duty vehicles	27.36	31.53	29.42	26.50	23.15	19.88	16.98	0.05	0.05	0.05	0.05	0.04	0.04	0.03
1A3biii Heavy duty vehicles and buses	77.74	98.03	63.31	35.74	14.81	12.24	8.81	0.17	0.16	0.13	0.11	0.10	0.08	0.07
1A3biv Mopeds & motorcycles	0.51	0.41	0.26	0.14	0.03	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00
1A3bv Gasoline evaporation	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1A3bvi Automobile tyre and brake wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1A3bvii Automobile road abrasion	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 9.4. NMVOC and NH₃ emissions projected in sector 1A3b in **WM** scenario [kt]

Sector	NMVOC							NH ₃						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	31.15	22.21	17.19	14.74	13.61	13.43	13.77	4.08	3.05	2.67	2.55	2.31	2.10	1.88
1A3bi Passenger cars	13.37	8.72	6.17	4.81	3.54	2.84	2.27	3.52	2.60	2.25	2.16	1.95	1.79	1.61
1A3bii Light duty vehicles	1.38	1.26	0.81	0.51	0.30	0.20	0.15	0.19	0.14	0.14	0.14	0.13	0.12	0.10
1A3biii Heavy duty vehicles and buses	2.28	2.78	1.72	1.03	0.60	0.51	0.42	0.37	0.30	0.28	0.25	0.23	0.19	0.16
1A3biv Mopeds & motorcycles	2.90	2.31	1.42	0.73	0.23	0.19	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1A3bv Gasoline evaporation	11.21	7.14	7.07	7.65	8.93	9.69	10.74	-	-	-	-	-	-	-
1A3bvi Automobile tyre and brake wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1A3bvii Automobile road abrasion	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 9.5. PM_{2.5} and BC emissions projected in sector 1A3b in **WM** scenario [kt]

Sector	PM _{2.5}							BC						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	10.43	10.01	8.22	6.98	6.35	5.42	4.87	4.25	4.09	3.02	2.23	1.67	1.31	1.08
1A3bi Passenger cars	2.39	1.81	1.34	0.97	0.66	0.44	0.28	1.92	1.48	1.09	0.78	0.52	0.34	0.20
1A3bii Light duty vehicles	0.82	0.94	0.64	0.41	0.25	0.18	0.14	0.65	0.74	0.51	0.34	0.21	0.15	0.12
1A3biii Heavy duty vehicles and buses	1.04	1.39	0.81	0.41	0.13	0.11	0.08	0.67	0.92	0.53	0.25	0.05	0.04	0.03
1A3biv Mopeds & motorcycles	0.05	0.05	0.03	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00
1A3bv Gasoline evaporation	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1A3bvi Automobile tyre and brake wear	4.19	3.98	3.71	3.56	3.66	3.23	3.02	0.92	0.87	0.82	0.79	0.82	0.73	0.68
1A3bvii Automobile road abrasion	1.94	1.84	1.70	1.61	1.65	1.45	1.35	0.08	0.07	0.07	0.06	0.06	0.06	0.05

Table 9.6. NO_x and SO₂ emissions projected in sector 1A3b in **WAM** scenario [kt]

Sector	NO _x							SO ₂						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	165.23	180.20	135.71	89.37	47.50	33.86	24.31	0.61	0.57	0.50	0.44	0.38	0.32	0.27
1A3bi Passenger cars	59.62	50.23	38.90	26.95	17.37	12.20	8.36	0.38	0.35	0.30	0.25	0.21	0.18	0.15
1A3bii Light duty vehicles	27.36	31.53	29.85	23.79	14.76	9.41	5.65	0.05	0.05	0.05	0.05	0.04	0.03	0.02
1A3biii Heavy duty vehicles and buses	77.74	98.03	66.49	38.31	15.28	12.18	10.23	0.17	0.16	0.14	0.13	0.12	0.10	0.09
1A3biv Mopeds & motorcycles	0.51	0.41	0.47	0.32	0.09	0.07	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1A3bv Gasoline evaporation	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1A3bvi Automobile tyre and brake wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1A3bvii Automobile road abrasion	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 9.7. NMVOC and NH₃ emissions projected in sector 1A3b in **WAM** scenario [kt]

Sector	NMVOC							NH ₃						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	31.15	22.21	19.35	16.06	12.85	11.87	11.76	4.08	3.05	2.79	2.63	2.37	2.01	1.71
1A3bi Passenger cars	13.37	8.72	6.47	4.62	2.86	1.60	0.93	3.52	2.60	2.33	2.18	1.94	1.64	1.39
1A3bii Light duty vehicles	1.38	1.26	0.97	0.51	0.15	0.04	0.01	0.19	0.14	0.16	0.16	0.15	0.12	0.10
1A3biii Heavy duty vehicles and buses	2.28	2.78	1.97	1.20	0.75	0.65	0.57	0.37	0.30	0.29	0.28	0.27	0.24	0.21
1A3biv Mopeds & motorcycles	2.90	2.31	2.74	1.80	0.72	0.54	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1A3bv Gasoline evaporation	11.21	7.14	7.20	7.93	8.38	9.03	9.76	-	-	-	-	-	-	-
1A3bvi Automobile tyre and brake wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1A3bvii Automobile road abrasion	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 9.8. PM2.5 and BC emissions projected in sector 1A3b in **WAM** scenario [kt]

Sector	PM2.5							BC						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	10.43	10.01	8.40	6.91	6.27	5.24	4.76	4.25	4.09	3.13	2.10	1.39	1.04	0.86
1A3bi Passenger cars	2.39	1.81	1.32	0.80	0.43	0.24	0.12	1.92	1.48	1.07	0.64	0.32	0.17	0.07
1A3bii Light duty vehicles	0.82	0.94	0.70	0.38	0.11	0.04	0.00	0.65	0.74	0.58	0.32	0.09	0.03	0.00
1A3biii Heavy duty vehicles and buses	1.04	1.39	0.90	0.45	0.13	0.11	0.09	0.67	0.92	0.58	0.27	0.04	0.03	0.02
1A3biv Mopeds & motorcycles	0.05	0.05	0.05	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
1A3bv Gasoline evaporation	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1A3bvi Automobile tyre and brake wear	4.19	3.98	3.72	3.58	3.81	3.30	3.09	0.92	0.87	0.82	0.80	0.86	0.74	0.70
1A3bvii Automobile road abrasion	1.94	1.84	1.71	1.66	1.77	1.55	1.45	0.08	0.07	0.07	0.07	0.07	0.06	0.06

The figures below show the trends of projected emissions for both scenarios. The year 2022 (displayed in green) has been added for comparison and represents the historical emissions value according to the national emission inventory from the 2024 submission.

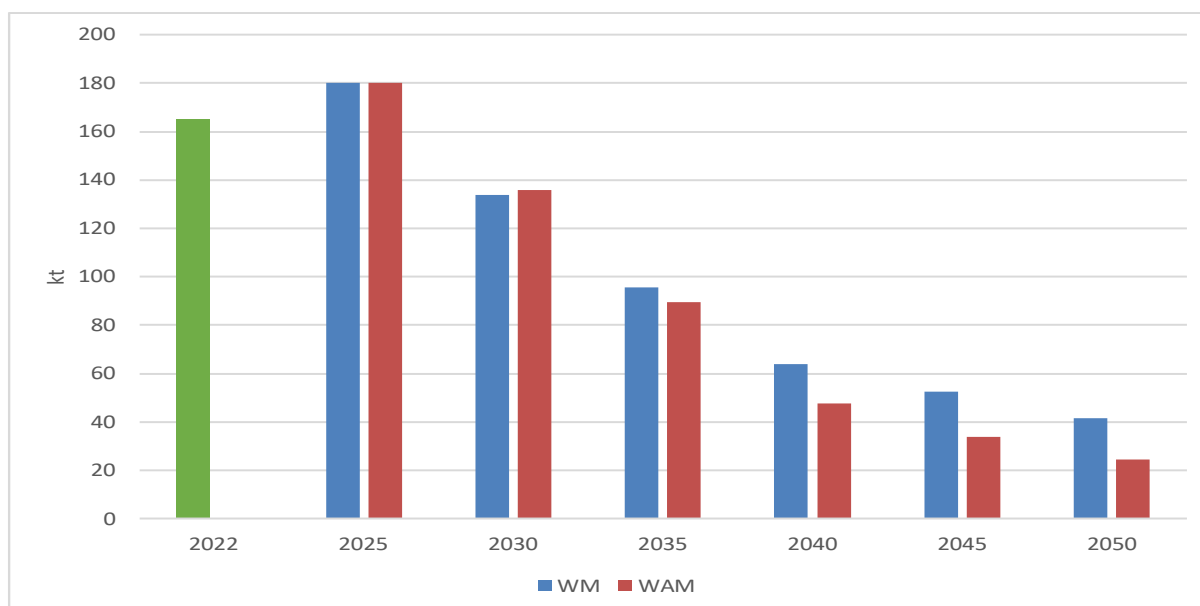


Figure 9.13. Comparison of projected NOx emissions trends in both scenarios in sector 1A3b

The increase in NOx emissions by 2025 is related to the increase in the number and intensity of use of vehicles, especially heavy duty vehicles, powered by diesel fuel with low emission standards. The systematic reduction of NOx emissions from 2030 is caused by the replacement of the vehicle fleet with a newer one (the emergence of the Euro 7/ Euro VII standard) and the reduction of diesel fuel consumption in favour of other fuels (including CNG).

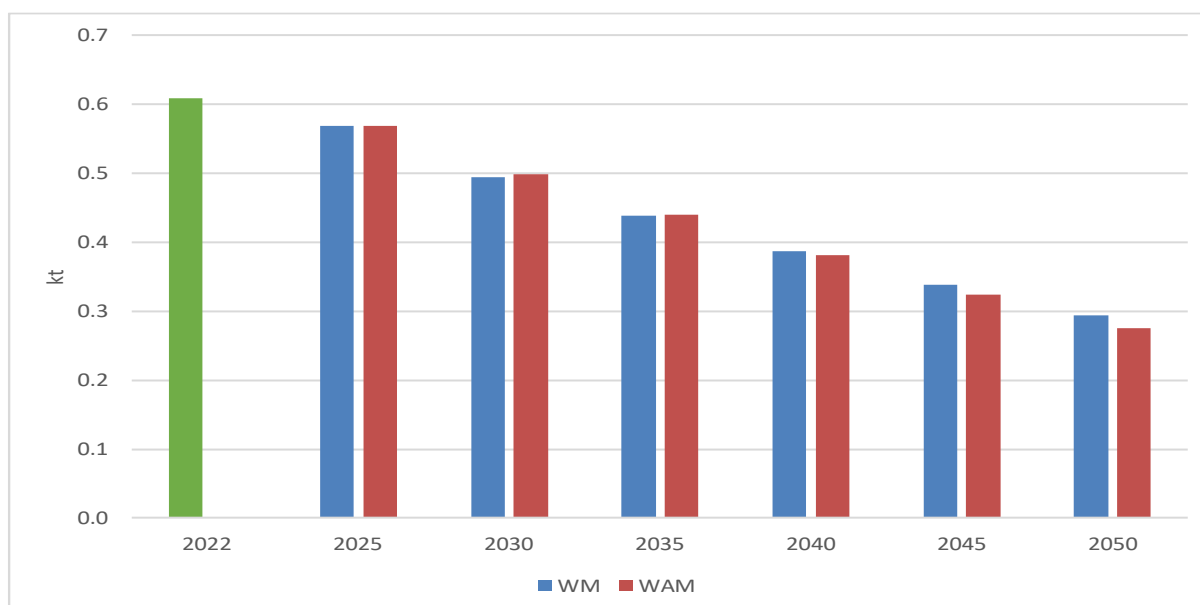


Figure 9.14. Comparison of projected SO₂ emissions trends in both scenarios in sector 1A3b

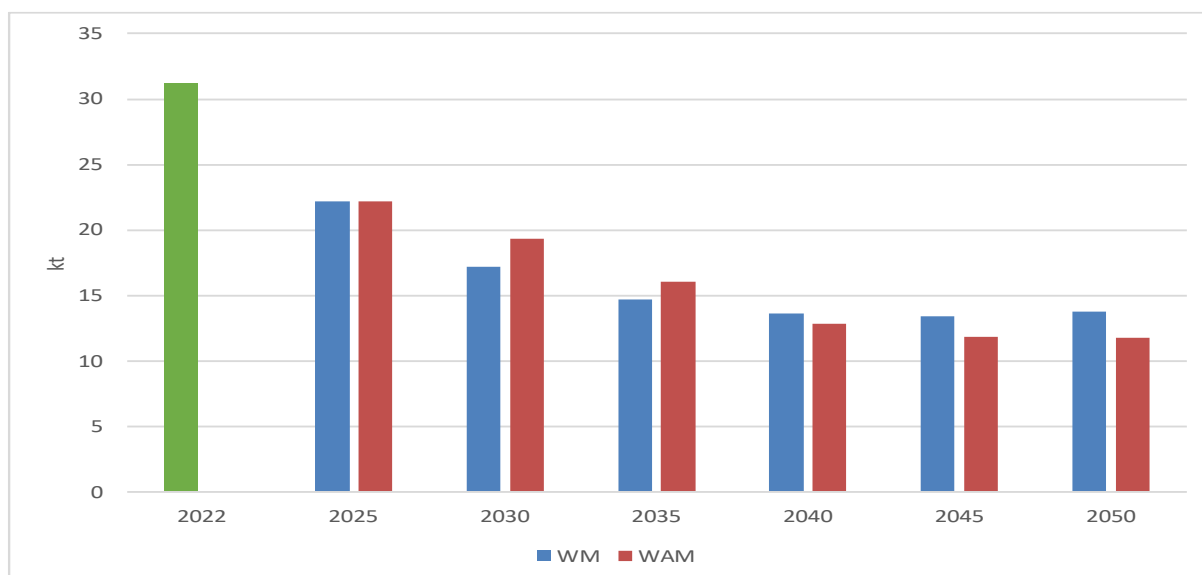


Figure 9.15. Comparison of projected NMVOC emissions trends in both scenarios in sector 1A3b

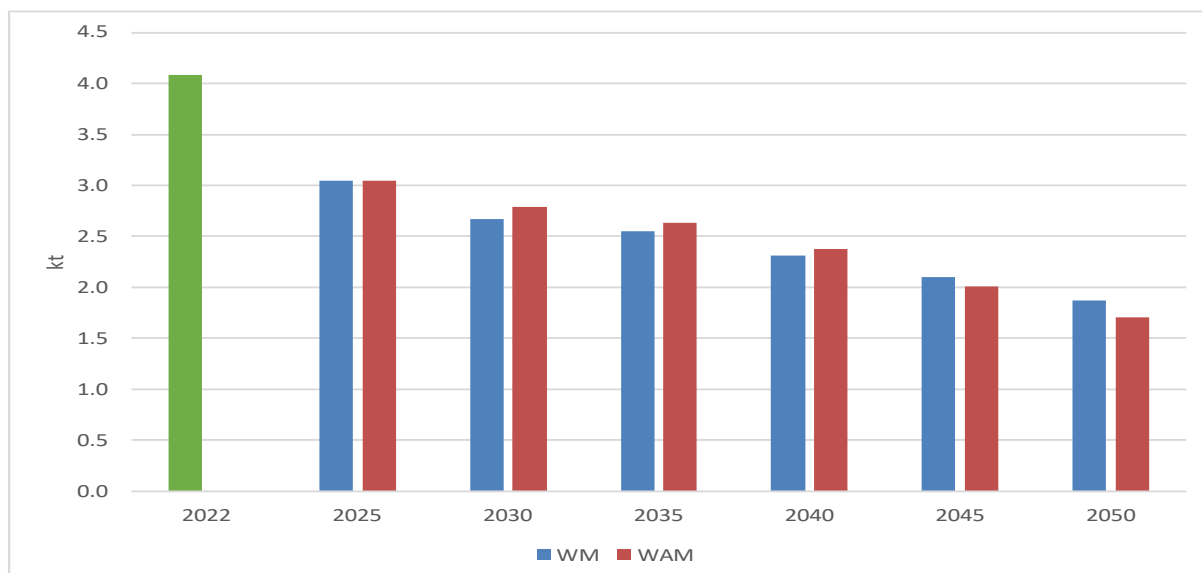


Figure 9.16. Comparison of projected NH₃ emissions trends in both scenarios in sector 1A3b

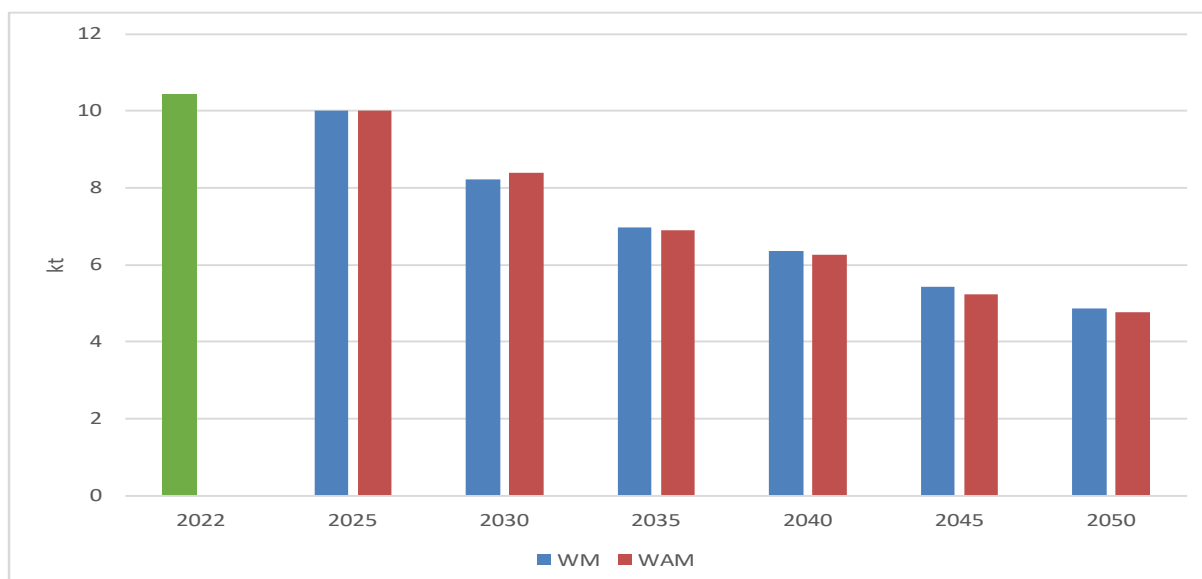


Figure 9.17. Comparison of projected PM_{2.5} emissions trends in both scenarios in sector 1A3b

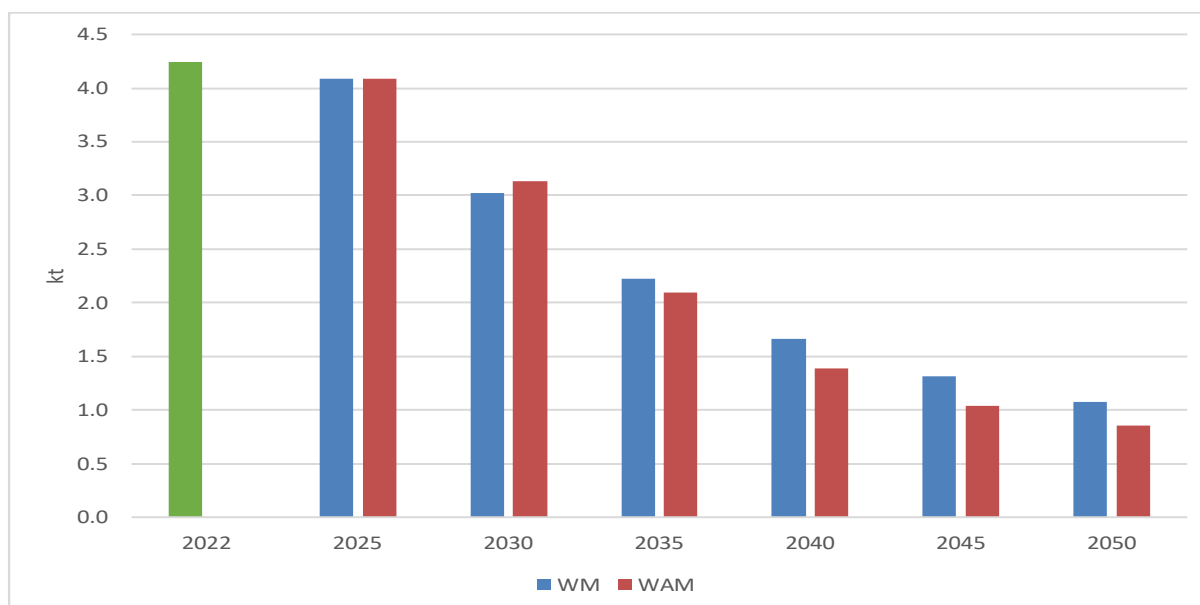


Figure 9.18. Comparison of projected BC emissions in both scenarios in sector 1A3b

9.1.4 Off-road transport (NFR sectors 1A3a,c,d,e)

In order to prepare the projection of the pollutant emissions from sector 1A3a (aviation), 1A3c (Railways), 1A3d (National navigation, shipping), 1A3e (Pipeline transport), the following data was used:

- the emission factors NO_x, PM_{2.5} and NMVOC, NH₃, based on EMEP/EEA EIG 2023 and national publications;
- SO₂ emission factors were adopted based on the sulphur content in fuel;
- the emission factor for BC was assumed as a percentage of PM_{2.5} emissions based on EMEP/EEA EIG 2023;
- data on projected activities (fuel consumption) were adopted in two scenarios, WM and WAM based on 2024 update of NECP PL.

The emissions were calculated using the equation:

$$E = AD \times EF$$

where:

E – emission of a pollutant [e.g. t]

AD – activity (fuel consumption) [e.g. PJ]

EF – emission factor [e.g. kg/t]

Update of NECP PL developed in 2024 was the source of data for the activities assumed in the calculations, i.e. fuel consumption in the sectors: 1A3a (aviation), 1A3c (railway); 1A3d (shipping), 1A3e (pipeline transport) in both considered scenarios WM and WAM.

The tables below present emission projections from 1A3a,c,d,e sector.



Table 9.9. NO_x and SO₂ emissions projected in sector 1A3a, 1A3c, 1A3d, 1A3e in **WM** scenario [kt]

Sector	NO _x							SO ₂						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	8.76	17.29	19.35	20.12	17.07	17.36	14.62	0.16	0.26	0.30	0.32	0.32	0.31	0.23
1A3aii(i) - International aviation LTO (civil)	3.18	2.26	2.50	2.63	2.68	2.48	1.55	0.12	0.18	0.20	0.21	0.21	0.19	0.12
1A3ai(i) - Domestic aviation LTO (civil)	0.10	0.40	0.49	0.57	0.59	0.60	0.56	0.01	0.04	0.05	0.06	0.06	0.06	0.06
1A3c - Railways	4.60	12.41	13.93	14.20	11.26	11.72	9.92	0.00	0.00	0.01	0.01	0.00	0.00	0.00
1A3d - National navigation (shipping)	0.65	1.25	1.40	1.58	1.53	1.59	1.66	0.02	0.03	0.04	0.04	0.04	0.04	0.04
1A3ei - Pipeline transport	0.24	0.97	1.03	1.13	1.01	0.97	0.93	0.00	0.01	0.01	0.01	0.01	0.01	0.01

Table 9.10. NMVOC and NH₃ emissions projected in sector 1A3a, 1A3c, 1A3d, 1A3e in **WM** scenario [kt]

Sector	NMVOC							NH ₃						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	0.54	1.60	1.79	1.87	1.57	1.60	1.38	0.001	0.002	0.002	0.002	0.002	0.002	0.001
1A3aii(i) - International aviation LTO (civil)	0.02	0.09	0.10	0.10	0.10	0.10	0.06	-	-	-	-	-	-	-
1A3ai(i) - Domestic aviation LTO (civil)	0.01	0.07	0.08	0.10	0.10	0.10	0.09	-	-	-	-	-	-	-
1A3c - Railways	0.41	1.10	1.24	1.26	1.00	1.04	0.88	0.001	0.002	0.002	0.002	0.002	0.002	0.001
1A3d - National navigation (shipping)	0.02	0.04	0.05	0.06	0.05	0.06	0.06	-	-	-	-	-	-	-
1A3ei - Pipeline transport	0.07	0.30	0.32	0.35	0.31	0.30	0.29	-	-	-	-	-	-	-

Table 9.11. PM_{2.5} and BC emissions projected in sector 1A3a, 1A3c, 1A3d, 1A3e in **WM** scenario [kt]

Sector	PM _{2.5}							BC						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	0.15	0.39	0.43	0.45	0.37	0.38	0.33	0.080	0.228	0.255	0.261	0.211	0.219	0.187
1A3aii(i) - International aviation LTO (civil)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001	0.002	0.002	0.002	0.002	0.002	0.001
1A3ai(i) - Domestic aviation LTO (civil)	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.000	0.002	0.003	0.003	0.004	0.004	0.003
1A3c - Railways	0.12	0.32	0.36	0.37	0.29	0.31	0.26	0.078	0.211	0.237	0.241	0.191	0.199	0.169
1A3d - National navigation (shipping)	0.01	0.02	0.02	0.03	0.03	0.03	0.03	0.000	0.012	0.013	0.014	0.013	0.013	0.014
1A3ei - Pipeline transport	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 9.12. NO_x and SO₂ emissions projected in sector 1A3a, 1A3c, 1A3d, 1A3e in **WAM** scenario [kt]

Sector	NO _x							SO ₂						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	8.76	16.54	18.42	19.07	16.12	16.43	13.72	0.16	0.26	0.28	0.31	0.31	0.30	0.22
1A3aii(i) - International aviation LTO (civil)	3.18	2.26	2.48	2.61	2.65	2.46	1.53	0.12	0.18	0.19	0.20	0.21	0.19	0.12
1A3ai(i) - Domestic aviation LTO (civil)	0.10	0.40	0.48	0.56	0.58	0.59	0.55	0.01	0.04	0.05	0.06	0.06	0.06	0.06
1A3c - Railways	4.60	12.41	13.93	14.20	11.26	11.72	9.92	0.00	0.00	0.01	0.01	0.00	0.00	0.00
1A3d - National navigation (shipping)	0.65	1.25	1.32	1.50	1.43	1.49	1.54	0.02	0.03	0.03	0.04	0.04	0.04	0.04
1A3ei - Pipeline transport	0.24	0.22	0.21	0.20	0.19	0.18	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 9.13. NMVOC and NH₃ emissions projected in sector 1A3a, 1A3c, 1A3d, 1A3e in **WAM** scenario [kt]

Sector	NMVOC							NH ₃						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	0.54	1.37	1.53	1.57	1.31	1.35	1.14	0.001	0.002	0.002	0.002	0.002	0.002	0.001
1A3aii(i) - International aviation LTO (civil)	0.02	0.09	0.10	0.10	0.10	0.10	0.06	-	-	-	-	-	-	-
1A3ai(i) - Domestic aviation LTO (civil)	0.01	0.07	0.08	0.10	0.10	0.10	0.09	-	-	-	-	-	-	-
1A3c - Railways	0.41	1.10	1.24	1.26	1.00	1.04	0.88	0.001	0.002	0.002	0.002	0.002	0.002	0.001
1A3d - National navigation (shipping)	0.02	0.04	0.05	0.05	0.05	0.05	0.06	-	-	-	-	-	-	-
1A3ei - Pipeline transport	0.07	0.07	0.06	0.06	0.06	0.06	0.05	-	-	-	-	-	-	-

Table 9.14. PM_{2.5} and BC emissions projected in sector 1A3a, 1A3c, 1A3d, 1A3e in **WAM** scenario [kt]

Sector	PM _{2.5}							BC						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	0.15	0.38	0.42	0.44	0.36	0.37	0.32	0.080	0.227	0.254	0.259	0.209	0.216	0.185
1A3aii(i) - International aviation LTO (civil)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001	0.002	0.002	0.002	0.002	0.002	0.001
1A3ai(i) - Domestic aviation LTO (civil)	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.000	0.002	0.003	0.003	0.004	0.004	0.003
1A3c - Railways	0.12	0.32	0.36	0.37	0.29	0.31	0.26	0.078	0.211	0.237	0.241	0.191	0.199	0.169
1A3d - National navigation (shipping)	0.01	0.02	0.02	0.03	0.03	0.03	0.03	0.000	0.012	0.012	0.012	0.012	0.012	0.011
1A3ei - Pipeline transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000



The figures below show the trends of projected emissions in both scenarios. The year 2022 (displayed in green) was added for comparison and represents the historical emissions value according to the national emission inventory from the 2024 submission.

The total increase in emissions of all pollutants from off-road transport by 2035 is caused by the forecasted increase in fuel consumption, especially in the railway sector 1A3c (Railways).

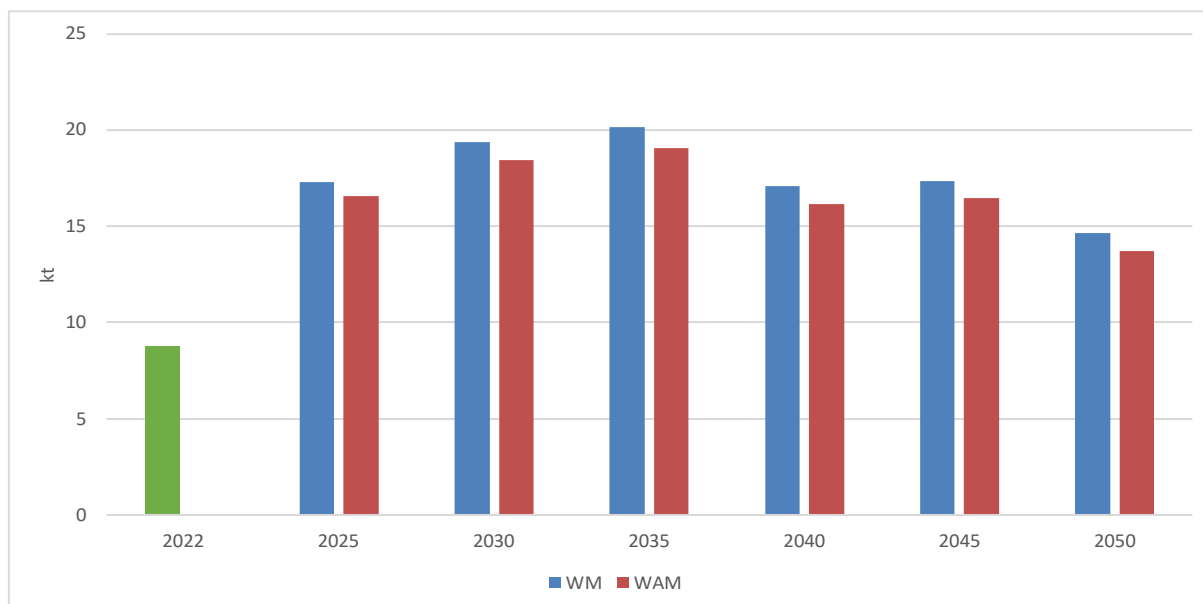


Figure 9.19. Comparison of projected NOx emissions trends in both scenarios in 1A3a,c,d,e

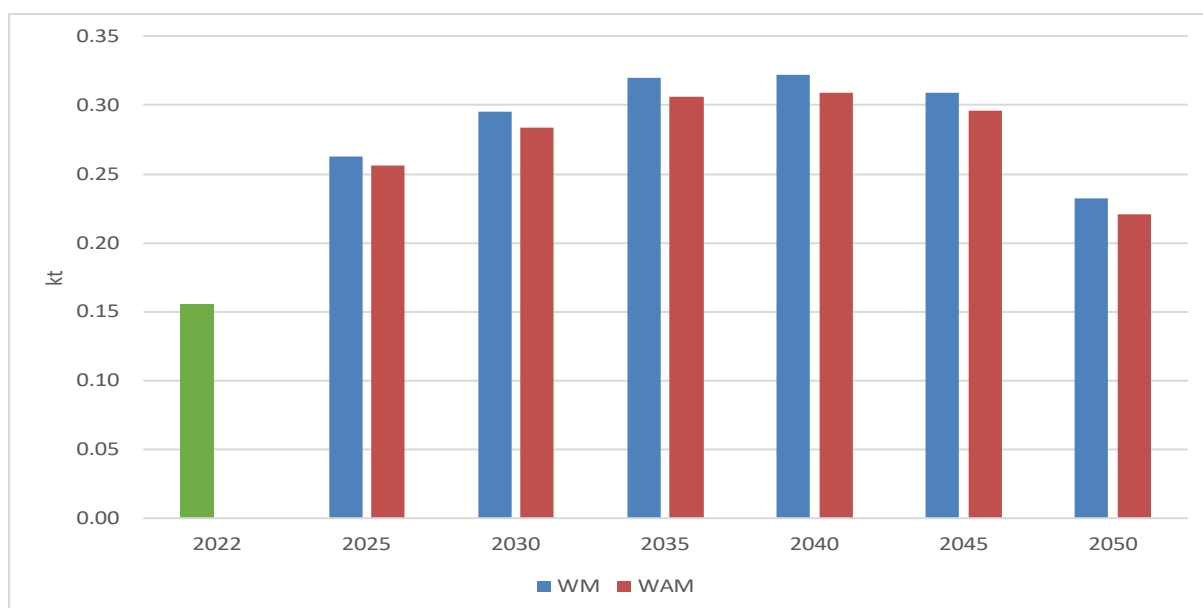


Figure 9.20. Comparison of projected SO₂ emissions trends in both scenarios in 1A3a,c,d,e

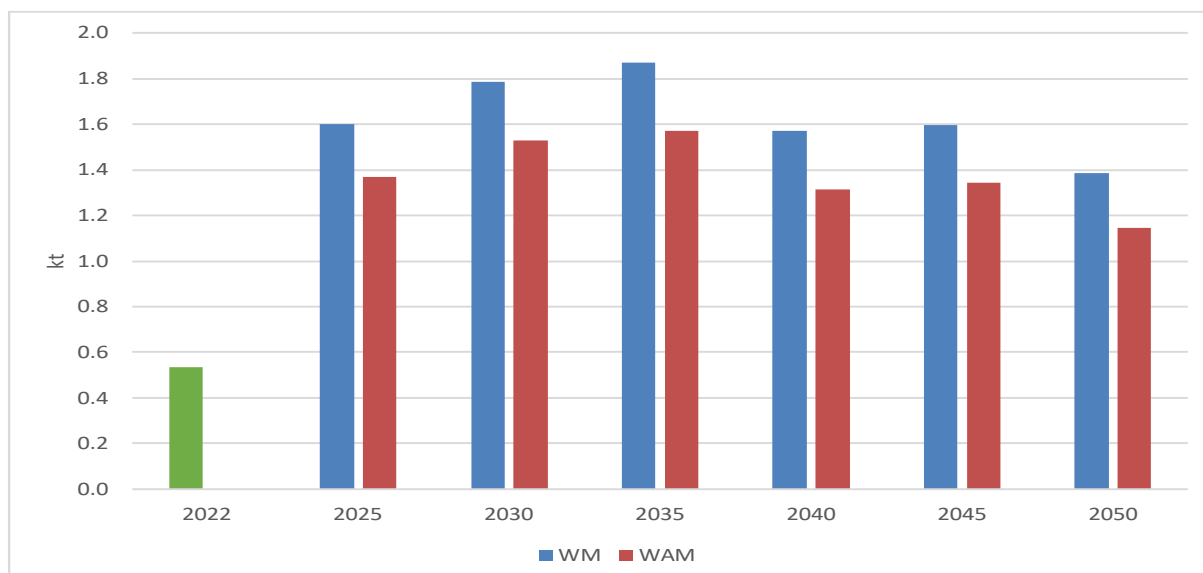


Figure 9.21. Comparison of projected NMVOC emissions trends in both scenarios in 1A3a,c,d,e

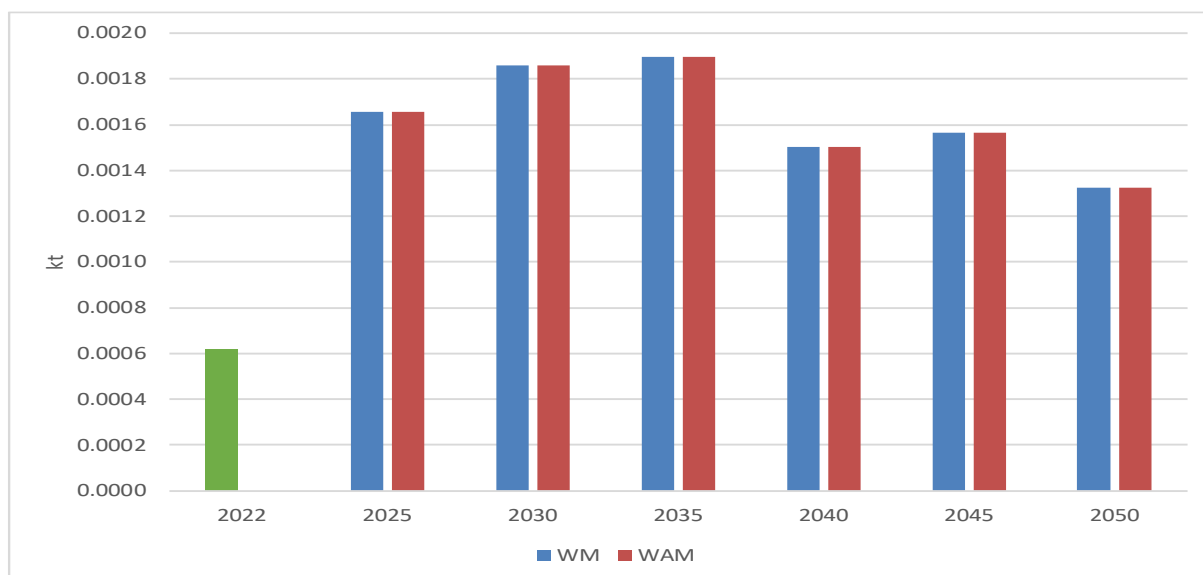


Figure 9.22. Comparison of projected NH₃ emissions trends in both scenarios in 1A3a,c,d,e

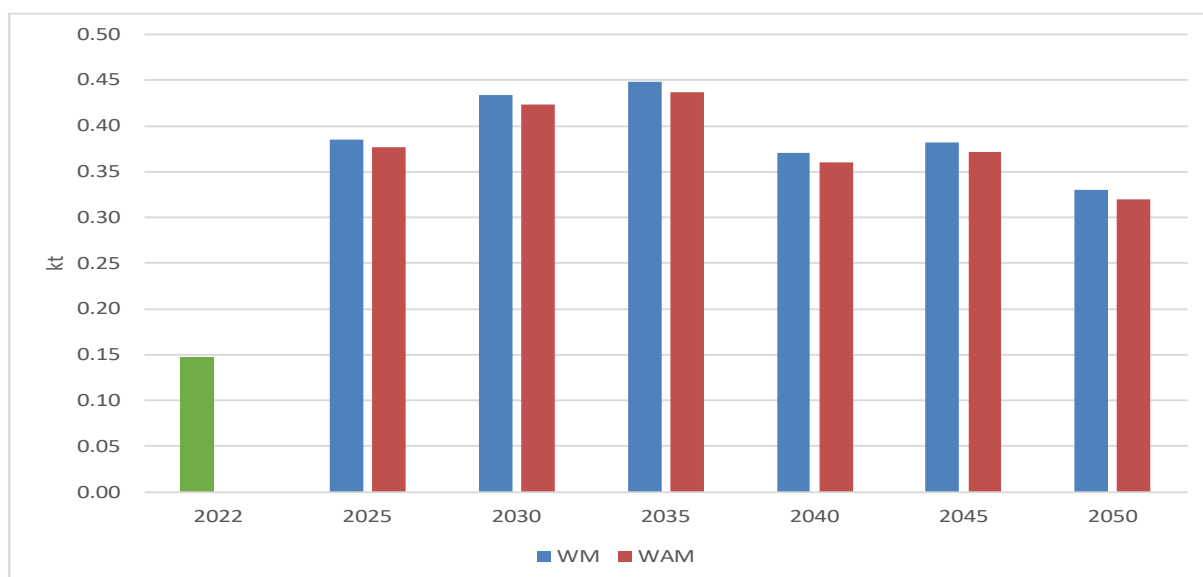


Figure 9.23. Comparison of projected PM_{2.5} emissions trends in both scenarios in 1A3a,c,d,e

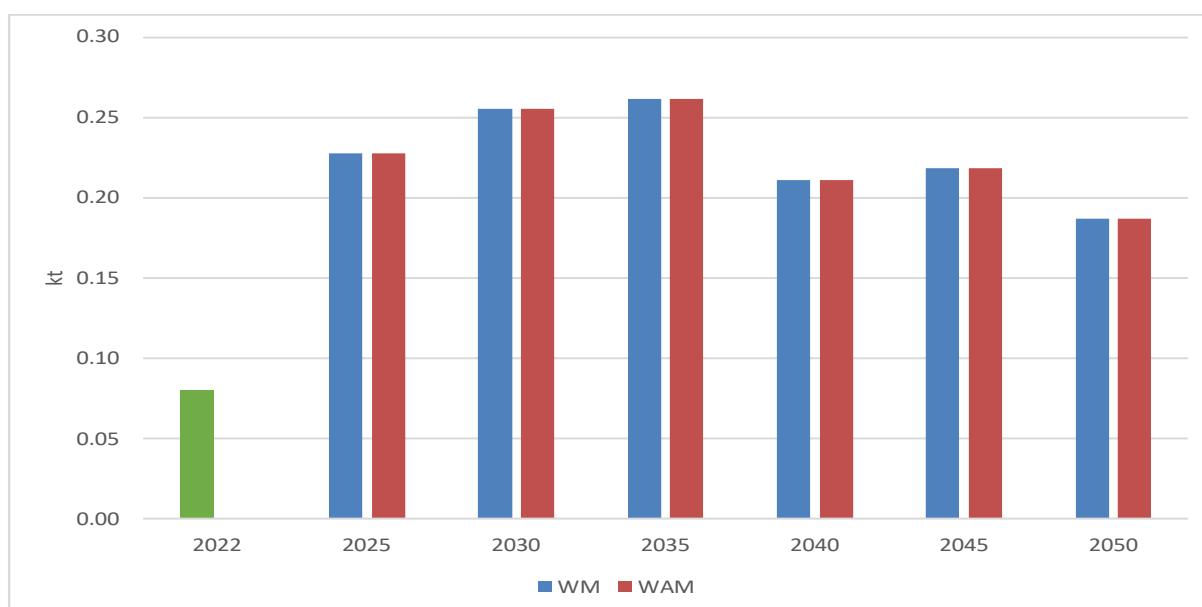


Figure 9.24. Comparison of projected BC emissions trends in both scenarios in 1A3a,c,d,e

9.1.5 Other sectors (NFR sector 1A4)

Data used in emission projections from the category 1A4. *Other sectors:*

- NO_x, SO₂, PM_{2.5}, NH₃, NMVOC and BC emission factors for solid fuels were adopted based on the analysis entitled “Development of emission factors for solid fuel combustion sources in the municipal and housing sector. MODULE I, II and III”, prepared by the Institute for Chemical Processing of Coal (present name: Institute of Energy and Fuel Processing Technology, ITPE) in 2020-2021. The analysis presents national aggregate emission factors until 2050 (TIER 2). In the case of dust, the emission factors also take into account the condensable fraction;
- NO_x, SO₂, PM_{2.5}, NH₃, NMVOC and BC emission factors for liquid and gaseous fuels were adopted on the basis of EMEP/EEA EIG 2023 (TIER 1);
- data on projected activities (fuel consumption) were adopted in two scenarios, WM and WAM, based on update of NECP PL developed in 2024.

The emissions were calculated using the equation:

$$E = AD \times EF$$

where:

E – emission of a pollutant [t]

AD – activity (fuel consumption) [PJ]

EF – emission factor [g / TJ]

The tables below present emission projections from 1A4 sector.

Table 9.15. NO_x, SO₂ and NMVOC emissions projected in sector 1A4 in **WM** scenario [kt]

Sector	NO _x							SO ₂							NMVOC						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUMA	106.92	97.49	83.70	75.88	66.65	57.92	50.09	128.07	101.59	56.57	29.31	18.48	10.38	3.40	148.35	97.11	47.16	7.76	6.79	5.80	4.89
1A4ai – Commercial/Institutional	12.09	10.90	9.71	8.87	7.79	6.52	5.22	7.85	8.06	4.37	2.61	1.97	1.24	0.54	5.44	4.91	3.15	2.06	1.82	1.52	1.22
1A4bi – Residential	55.70	45.56	34.82	29.47	23.36	18.14	13.68	108.62	81.74	44.19	21.27	12.21	5.97	0.67	130.35	80.35	36.59	2.39	1.87	1.42	1.04
1A4ci – Agriculture/Forestry/Fishing	5.43	6.97	6.68	6.56	6.01	5.39	4.77	11.49	11.67	7.89	5.31	4.19	3.05	2.09	9.91	9.22	4.93	0.98	0.91	0.81	0.72
1A4cii – Agriculture – mobile sources	26.50	25.90	24.34	22.82	21.32	19.70	18.25	0.04	0.04	0.04	0.03	0.03	0.03	0.03	2.48	2.42	2.28	2.13	1.99	1.84	1.71
1A4ciii – Fishing	7.21	8.17	8.17	8.17	8.17	8.17	8.17	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.17	0.20	0.20	0.20	0.20	0.20	0.20

Table 9.16. NH₃, PM_{2.5} and BC emissions projected in sector 1A4 in **WM** scenario [kt]

Sector	NH ₃							PM _{2.5}							BC						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUMA	0.41	0.27	0.14	0.03	0.02	0.02	0.02	221.98	143.76	66.70	8.40	7.07	5.78	4.61	9.94	6.78	3.48	1.02	0.91	0.81	0.71
1A4ai – Commercial/Institutional	0.0065	0.0057	0.0029	0.0010	0.0011	0.0010	0.0008	6.53	5.80	2.54	0.79	0.72	0.60	0.45	0.45	0.46	0.24	0.12	0.10	0.09	0.08
1A4bi – Residential	0.367	0.2280	0.1113	0.0086	0.0071	0.0056	0.0043	198.39	122.36	55.40	5.02	3.96	3.01	2.19	8.09	5.01	2.29	0.27	0.21	0.17	0.12
1A4ci – Agriculture/Forestry/Fishing	0.0254	0.0246	0.0138	0.0026	0.0025	0.0024	0.0023	16.00	14.54	7.75	1.65	1.51	1.35	1.18	0.78	0.71	0.39	0.11	0.10	0.09	0.09
1A4cii – Agriculture – mobile sources	0.0163	0.0159	0.0149	0.0140	0.0131	0.0121	0.0112	0.96	0.94	0.88	0.83	0.77	0.71	0.66	0.61	0.60	0.56	0.52	0.49	0.45	0.42
1A4ciii – Fishing	NE	NE	NE	NE	NE	NE	NE	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.00	0.01	0.01	0.01	0.01	0.01	0.01

Table 9.17. NO_x, SO₂ and NMVOC emissions projected in sector 1A4 in **WAM** scenario [kt]

Sector	NO _x							SO ₂							NMVOC						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUMA	106.92	97.82	79.93	70.19	61.12	53.21	46.25	128.07	108.63	57.65	25.19	14.45	7.65	2.03	148.35	99.45	45.47	7.01	6.05	5.08	4.29
1A4ai – Commercial/Institutional	12.09	9.89	7.42	5.92	4.74	3.86	3.03	7.85	7.86	4.12	2.19	1.64	0.98	0.21	5.44	5.08	2.94	1.34	1.09	0.89	0.70
1A4bi – Residential	55.70	47.01	32.98	26.29	20.55	15.93	11.80	108.62	88.28	44.79	17.48	8.97	5.03	0.95	130.35	81.64	34.17	2.24	1.76	1.35	0.99
1A4ci – Agriculture/Forestry/Fishing	5.43	6.85	6.52	6.50	5.84	5.06	4.50	11.49	12.37	8.62	5.39	3.72	1.51	0.75	9.91	10.11	5.87	1.09	0.99	0.79	0.68
1A4cii – Agriculture – mobile sources	26.50	25.90	24.34	22.82	21.32	19.70	18.25	0.04	0.04	0.04	0.03	0.03	0.03	0.03	2.48	2.42	2.28	2.13	1.99	1.84	1.71
1A4ciii - Fishing	7.21	8.17	8.67	8.67	8.67	8.67	8.67	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.17	0.20	0.21	0.21	0.21	0.21	0.21

Table 9.18. NH₃, PM_{2.5} and BC emissions projected in sector 1A4 in **WAM** scenario [kt]

Sector	NH ₃							PM _{2.5}							BC						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUMA	0.41	0.29	0.14	0.03	0.02	0.02	0.02	221.98	161.40	75.69	8.31	7.03	5.58	4.38	9.94	7.58	3.91	1.00	0.90	0.78	0.69
1A4ai – Commercial/Institutional	0.007	0.006	0.003	0.001	0.001	0.001	0.000	6.53	6.45	3.07	0.67	0.58	0.44	0.26	0.455	0.478	0.249	0.096	0.076	0.060	0.045
1A4bi – Residential	0.367	0.239	0.110	0.009	0.007	0.006	0.004	198.39	137.63	62.06	4.86	3.88	2.96	2.19	8.089	5.692	2.604	0.262	0.214	0.166	0.125
1A4ci – Agriculture/Forestry/Fishing	0.025	0.025	0.014	0.003	0.003	0.003	0.002	16.00	16.26	9.55	1.83	1.67	1.34	1.15	0.781	0.804	0.487	0.115	0.110	0.100	0.090
1A4cii – Agriculture – mobile sources	0.016	0.016	0.015	0.014	0.013	0.012	0.011	0.96	0.94	0.88	0.83	0.77	0.71	0.66	0.610	0.596	0.560	0.525	0.490	0.453	0.420
1A4ciii - Fishing	NE	NE	NE	NE	NE	NE	NE	0.11	0.12	0.13	0.13	0.13	0.13	0.13	0.005	0.005	0.006	0.006	0.006	0.006	0.006

The figures below show the trends of projected emissions for both scenarios. The year 2022 (displayed in green) has been added for comparison and represents the historical emission value according to the national emission inventory from the 2024 submission.

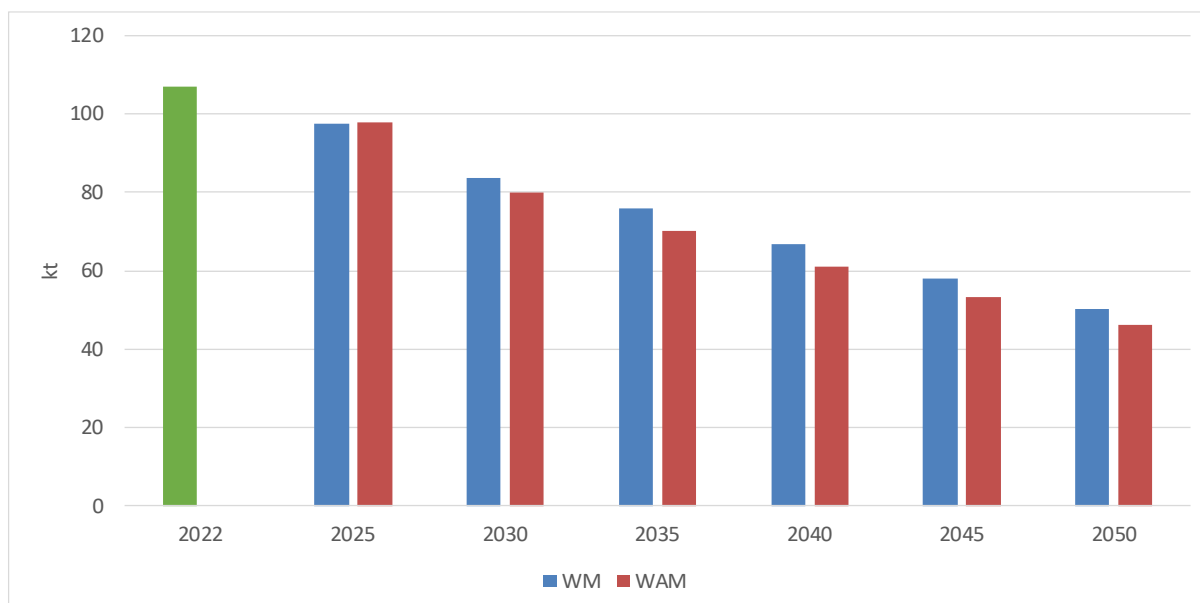


Figure 9.25. Comparison of projected NOx emissions trends in both scenarios in sector 1A4



Figure 9.26. Comparison of projected SO₂ emissions trends in both scenarios in sector 1A4

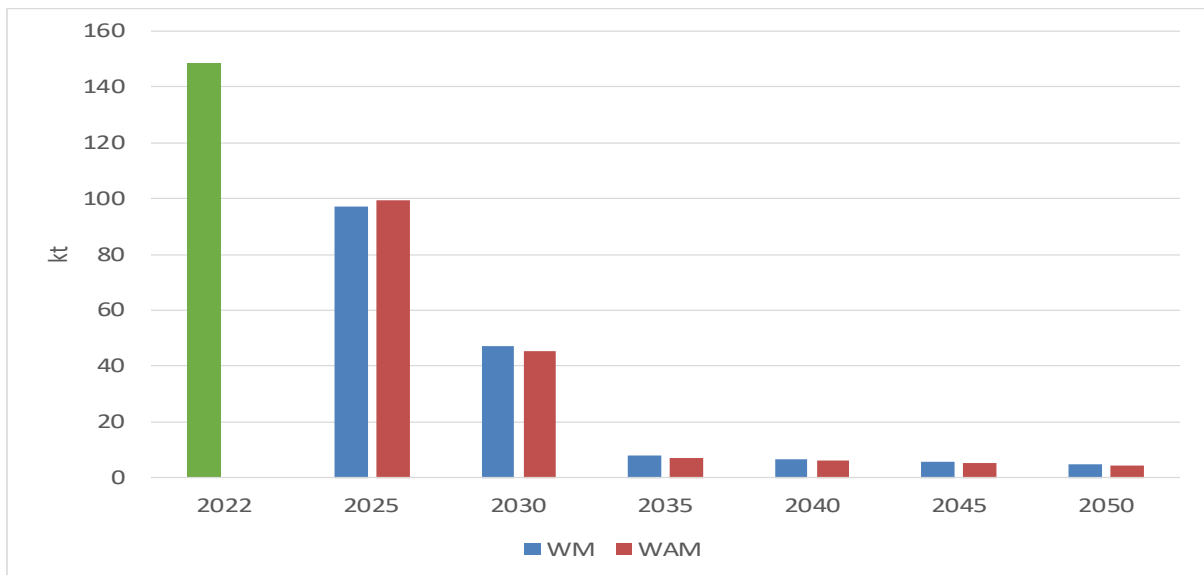


Figure 9.27. Comparison of projected NMVOC emissions trends in both scenarios in sector 1A4

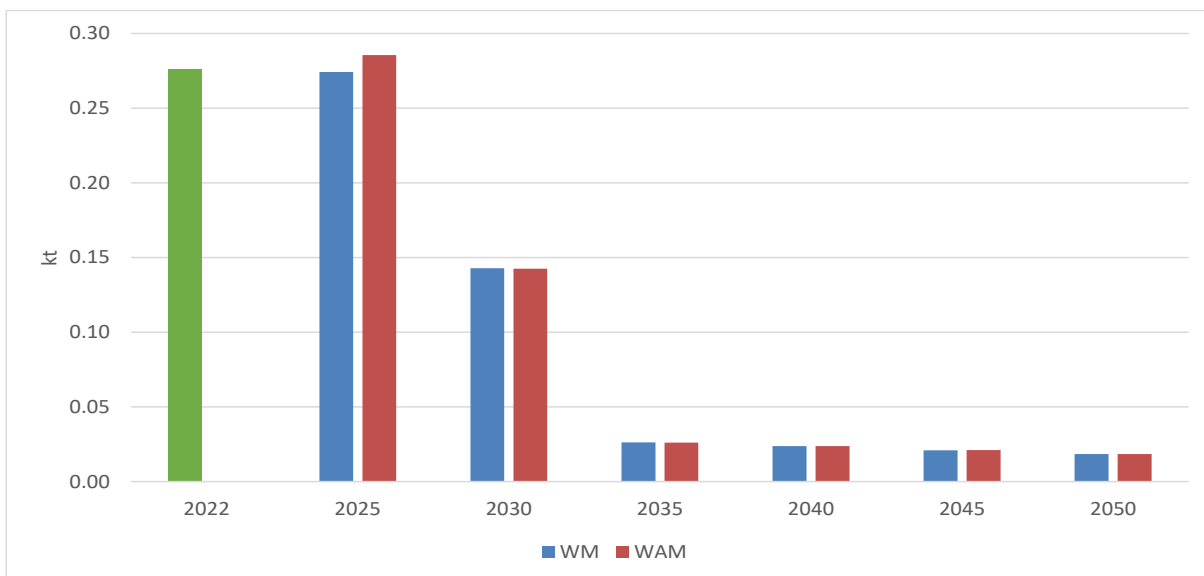


Figure 9.28. Comparison of projected NH₃ emissions trends in both scenarios in sector 1A4

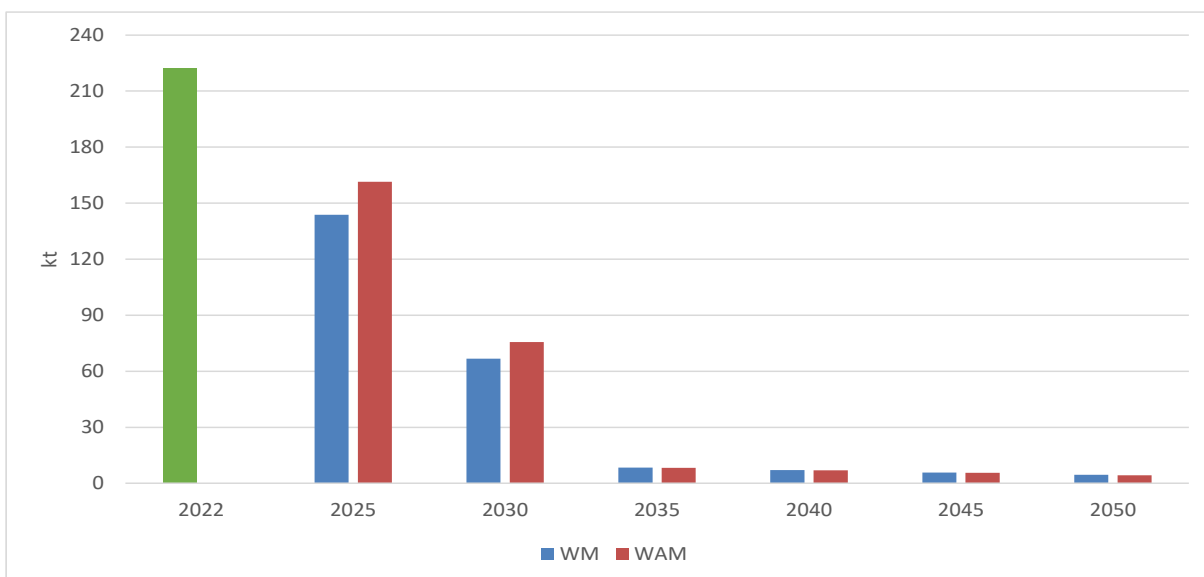


Figure 9.29. Comparison of projected PM_{2.5} emissions trends in both scenarios in sector 1A4

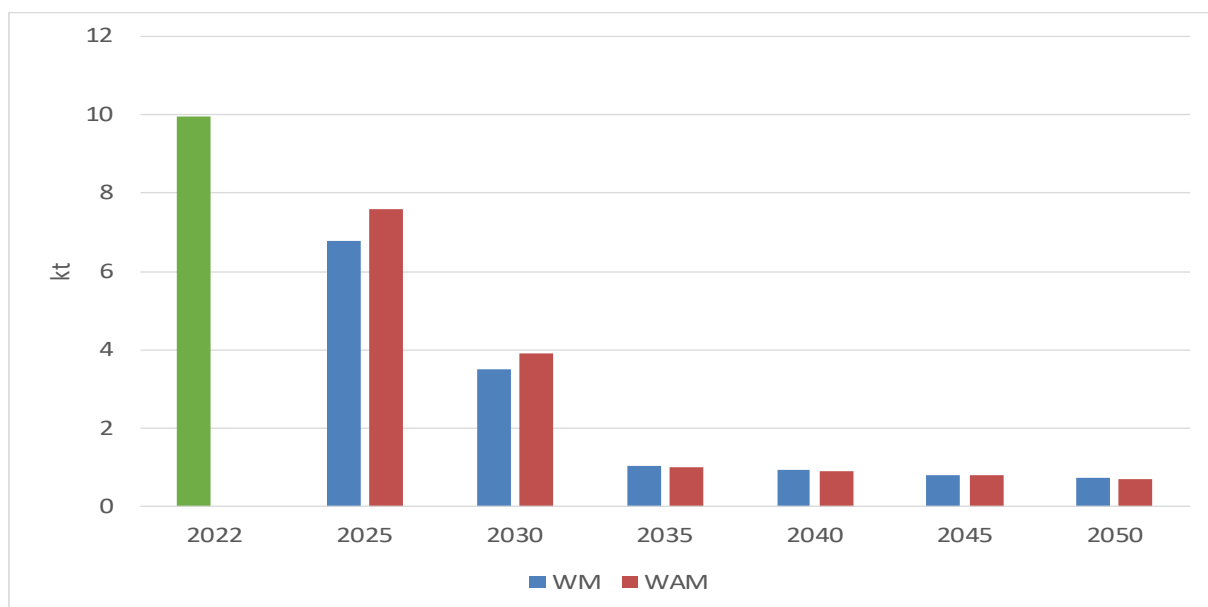


Figure 9.30. Comparison of projected BC emissions in both scenarios in sector 1A4

9.1.6 Fugitive emissions from fuels (NFR sector 1B)

To calculate projected emissions from sector 1B for 2025-2040, input data for domestic production of fuels was used. The data were based on update of NECP PL developed in 2024 for two scenarios: WM and WAM.

To estimate the projected emissions of pollutants in the 1B sector, the methodology used in the national emissions inventory [IIR 2024] was applied.

The emissions were calculated on the basis of the formula:

$$E = AD \times EF$$

where:

E – emission of a pollutant [e.g. t]

AD – activity (extraction volume) [e.g. PJ, kt]

EF – emission factor [e.g. kg/t]

The emission factors used for projections in sector 1B correspond to the values of the factors used in the national pollutant emission inventories (based mainly on EMEP / EEA EIG 2023 and CEPMEIP).

The emissions of individual pollutants calculated according to the above-described method is presented in the table below.

Table 9.19. Emissions projected in sector 1B in WM and WAM scenario [kt]

Pollutant	2020	2025	2030	2035	2040	2045	2050
WM							
NO _x	3.51	3.26	3.05	2.88	2.69	2.46	2.21
NM VOC	77.91	72.46	61.19	46.26	39.51	33.58	28.95
SO _x	6.58	6.09	5.71	5.39	5.03	4.59	4.14
NH ₃	0.0314	0.0307	0.0309	0.0309	0.0308	0.0305	0.0303
PM _{2.5}	1.52	1.38	1.13	0.89	0.80	0.74	0.70
BC	0.254	0.248	0.250	0.250	0.249	0.247	0.245
WAM							
NO _x	3.51	3.17	2.98	2.80	2.57	2.32	2.08
NM VOC	77.91	73.13	56.45	44.39	33.35	28.76	26.01
SO _x	6.58	5.93	5.57	5.24	4.81	4.33	3.88
NH ₃	0.0314	0.0293	0.0294	0.0296	0.0299	0.0297	0.0295
PM _{2.5}	1.52	1.33	1.03	0.85	0.73	0.70	0.68
BC	0.254	0.237	0.237	0.239	0.242	0.240	0.238

The figures below show the trends of projected emissions for both scenarios. The year 2022 was added for comparison and represents the historical emissions value according to the national emission inventory from the 2024 submission.

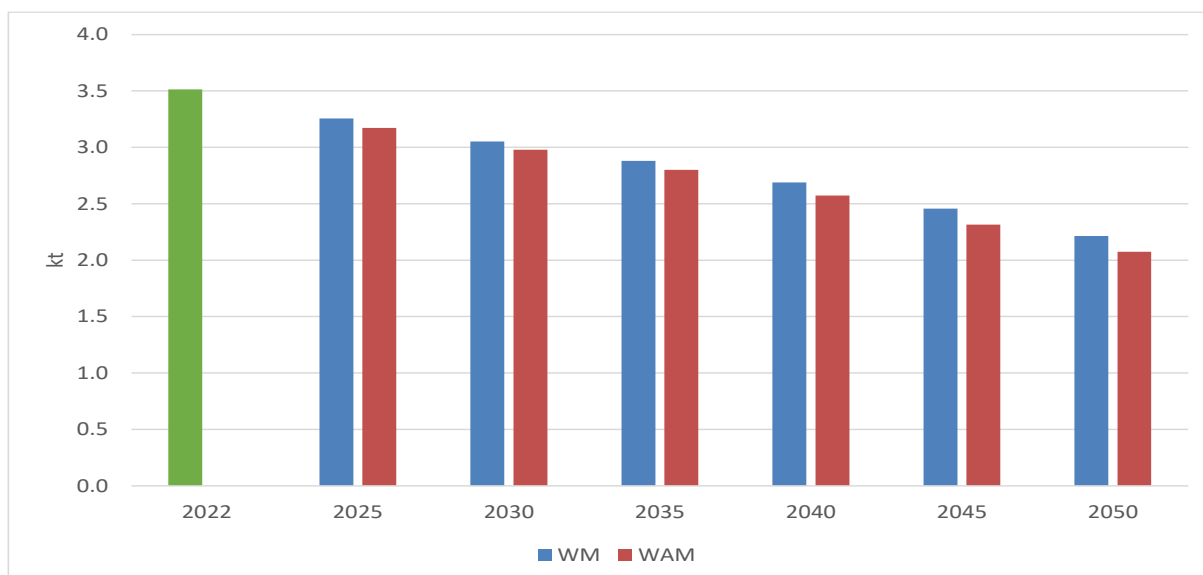


Figure 9.31. Comparison of projected NOx emissions trends in both scenarios in sector 1B

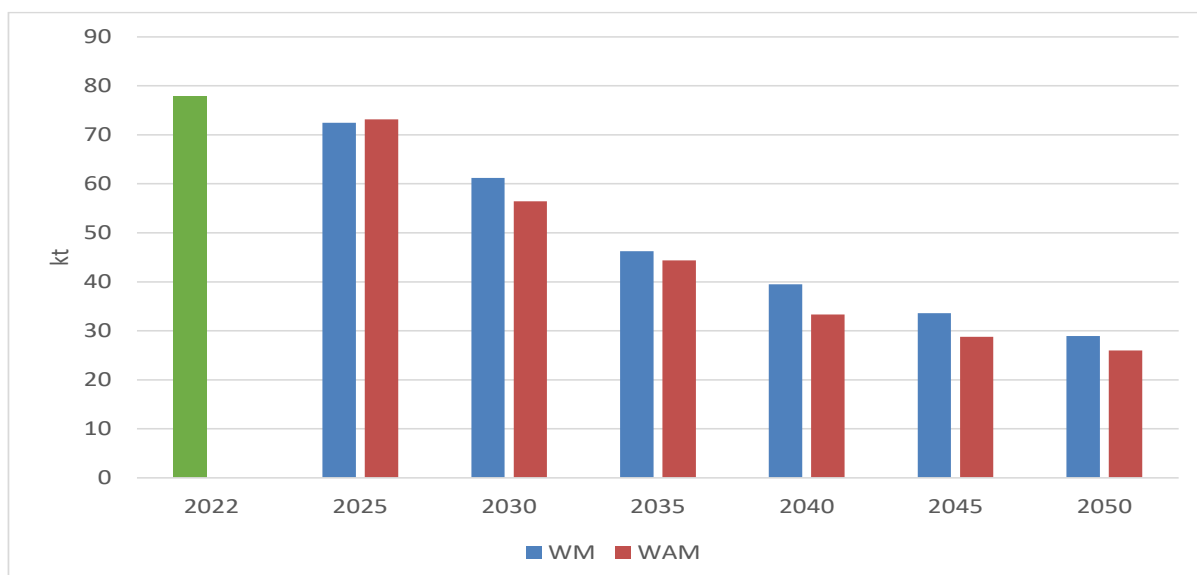


Figure 9.32. Comparison of projected NMVOC emissions trends in both scenarios in sector 1B



Figure 9.33. Comparison of projected SO₂ emissions trends in both scenarios in sector 1B



Figure 9.34. Comparison of projected NH_3 emissions trends in both scenarios in sector 1B

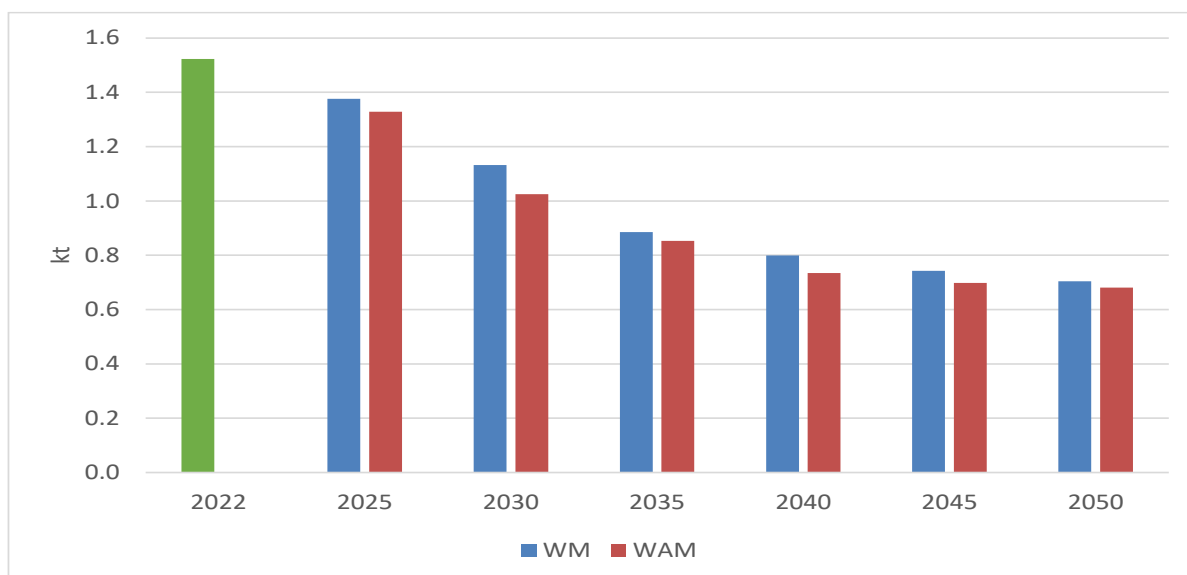


Figure 9.35. Comparison of projected $\text{PM}_{2.5}$ emissions trends in both scenarios in sector 1B

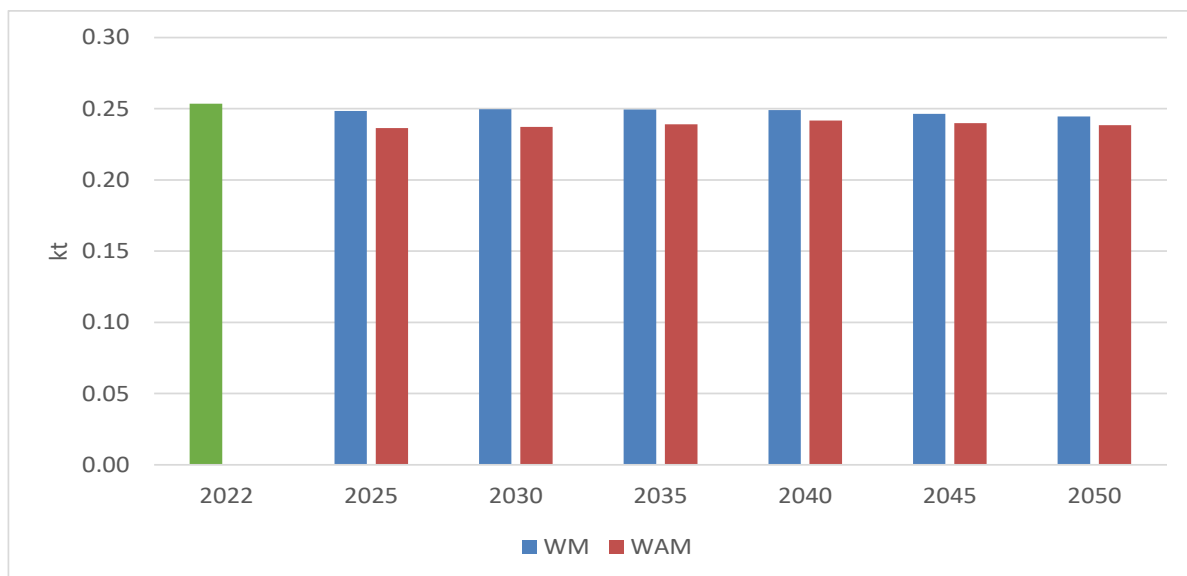


Figure 9.36. Comparison of projected BC emissions trends in both scenarios in sector 1B

9.1.7 Industrial processes (NFR sectors 2A, 2B, 2C, 2H)

The projections of pollutant emissions from sector 2. *Industrial processes and product use*, were based mainly on activity projections of emission sources, i.e. the volume of industrial production in the following years. The source of activity projections was the report "Projections of Activity Changes in Selected Economic Sectors – update 2024" (KOBiZE, 2024) and the updated NECP PL. For industrial production not included in the above data sources, the activity data for 2022 were taken as activity for the projection years 2025-2050 (in the case of a downward trend) or as a 3-year average (2020-2022, in the case of a fluctuating trend).

Due to little or no information regarding future implementation of the new production technologies and emission reduction technologies, the projection was prepared using emission factors from the current national emission inventory, prepared for the purposes of reporting under the LRTAP convention. All of the emission factors that were used in the calculations of the projections were adopted as for 2022 and are listed in Appendix 6 of the IIR 2024.

Projections of the pollutant emissions from sector 2 were prepared in WM and WAM scenarios.

While estimating pollutant emissions from the same emission categories as the categories covered by the greenhouse gases emission projections, to maintain consistency, the same activities were used for pollutant emission projections as it was in case of greenhouse gases emission projections.

The emissions for all subsectors of 2A category (except 2A1 – cement production, 2A5a - quarrying and mining of minerals other than coal and 2A5b – construction and demolition) were calculated on the basis of the formula from the EMEP/EEA Guidebook 2023:

$$E = \sum (AR_{\text{production}} * EF_{\text{pollutant}})$$

where:

- E – the emission of the specified pollutant
- AR – the activity rate for the production
- EF – the emission factor for the pollutant

In accordance with the recommendation from the review [PL-2A5a-2023-0001], the methodology for the calculation of particulate matter emissions from category 2A5a (quarrying and mining of minerals other than coal) was updated in IIR submission 2024 based on the EMEP/EEA 2023 Tier 2 calculation model. Therefore, the current emissions projections were updated and developed based on the new methodology for sector 2A5a.

The emission of the analysed pollutants from categories 2I, 2J, 2K, 2L is not estimated. The emissions previously reported in the 2L sector were PM_{2.5} emissions released into the air from the storage and transport of cement. Following the recommendation of the international review, emissions from the 2L sector have been included in the 2A1 sector.

The following tables present the emissions from each sub-sector for the WM and WAM scenarios, where available.

Table 9.20. Emissions projected in subsector 2A for WM scenario [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
PM2.5	3.30	3.46	3.51	3.55	3.59	3.59	3.60
BC	0.0069	0.0073	0.0074	0.0075	0.0077	0.0077	0.0078

Table 9.21. Emissions projected in subsector 2B for WM scenario [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NOx	12.73	15.10	15.32	15.54	15.77	16.00	16.22
SO ₂	4.20	4.55	4.74	4.93	5.11	5.13	5.15
NMVOC	5.42	6.37	6.40	6.43	6.47	6.47	6.47
NH ₃	3.82	3.86	4.07	4.29	4.52	4.77	5.03
PM2.5	1.98	2.04	2.19	2.34	2.51	2.70	2.89
BC	0.0199	0.0201	0.0215	0.0230	0.0247	0.0264	0.0282

Table 9.22. Emissions projected in subsector 2C for WM scenario [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NOx	1.42	1.74	1.73	1.73	1.71	1.69	1.68
SO ₂	2.76	2.56	2.54	2.50	2.48	2.44	2.42
NMVOC	0.81	0.87	0.81	0.77	0.73	0.71	0.69
PM2.5	1.09	1.09	1.05	1.02	1.00	0.98	0.96
BC	0.0142	0.0134	0.0132	0.0130	0.0127	0.0125	0.0123

Table 9.23. Emissions projected in subsector 2C for WAM scenario [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NOx	1.42	1.69	1.68	1.68	1.67	1.65	1.64
SO ₂	2.76	2.54	2.52	2.48	2.46	2.42	2.40
NMVOC	0.81	0.85	0.80	0.75	0.71	0.70	0.68
PM2.5	1.09	1.06	1.03	1.00	0.98	0.97	0.96
BC	0.0142	0.0129	0.0128	0.0126	0.0125	0.0124	0.0124

Table 9.24. Emissions projected in subsector 2H1 for WM scenario [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NOx	0.98	0.95	0.99	0.94	0.99	0.94	0.98
SO ₂	1.97	1.90	1.99	1.89	1.97	1.88	1.95
NMVOC	3.14	4.36	4.56	4.32	4.52	4.31	4.48
PM2.5	0.59	0.57	0.60	0.57	0.59	0.56	0.59
BC	0.015	0.015	0.016	0.015	0.015	0.015	0.015

Table 9.25. Emissions projected in subsector 2H1 for WAM scenario [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NOx	0.98	0.69	0.73	0.76	0.79	0.81	0.86
SO ₂	1.97	1.39	1.46	1.52	1.57	1.63	1.72
NMVOC	3.14	3.18	3.34	3.48	3.61	3.73	3.94
PM2.5	0.59	0.42	0.44	0.46	0.47	0.49	0.52
BC	0.015	0.011	0.011	0.012	0.012	0.013	0.013

Table 9.26. Emissions projected in subsector 2H2 for WM scenario [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NMVOC	5.01	5.02	5.04	5.04	5.02	4.96	4.91

The table below presents emission projections from industrial processes (NFR 2A, 2B, 2C, 2H).

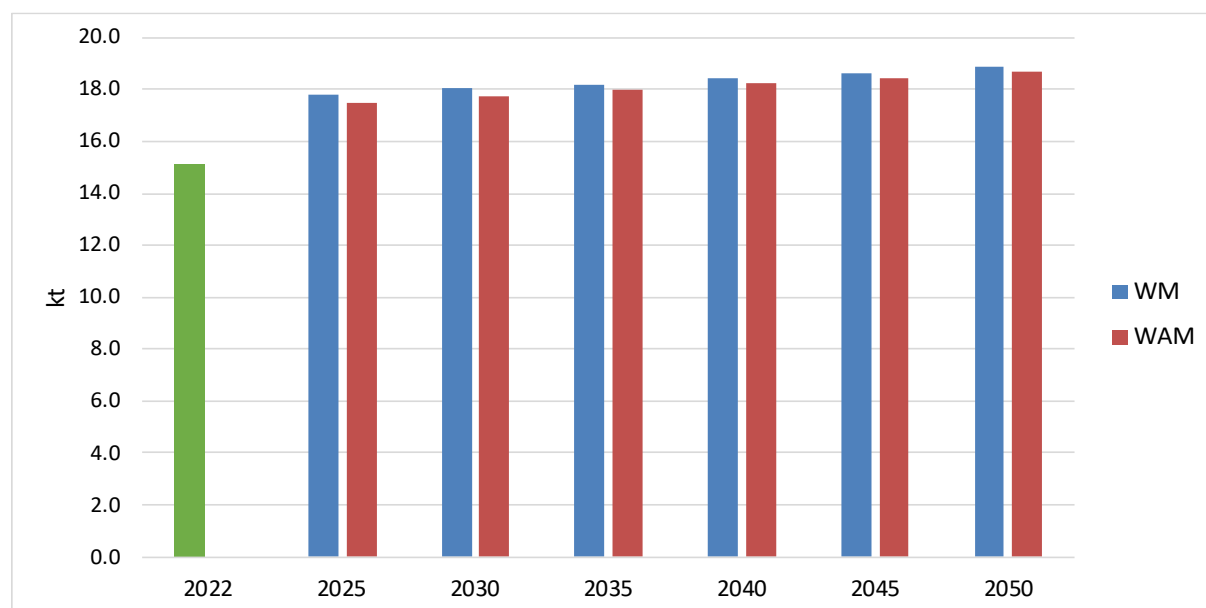
Table 9.27. Emissions projected in sectors: 2A, 2B, 2C, 2H for WM scenario [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NO _x	15.13	17.79	18.04	18.21	18.47	18.63	18.88
SO ₂	8.93	9.02	9.27	9.32	9.56	9.46	9.52
NM VOC	14.37	16.61	16.81	16.56	16.74	16.46	16.55
NH ₃	3.82	3.86	4.07	4.29	4.52	4.77	5.03
PM _{2.5}	6.97	7.16	7.34	7.48	7.69	7.83	8.04
BC	0.056	0.056	0.058	0.058	0.060	0.061	0.064

Table 9.28. Emissions projected in sectors: 2A, 2B, 2C, 2H for WAM scenario [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NO _x	15.13	17.48	17.73	17.98	18.23	18.46	18.72
SO ₂	8.93	8.48	8.72	8.93	9.14	9.18	9.27
NM VOC	14.37	15.42	15.57	15.70	15.81	15.86	16.00
NH ₃	3.82	3.86	4.07	4.29	4.52	4.77	5.03
PM _{2.5}	6.97	6.97	7.13	7.31	7.51	7.70	7.92
BC	0.056	0.051	0.053	0.055	0.057	0.059	0.062

The figures below show the trends of projected emissions. The year 2022 (presented in green) has been added for comparison and represents the historical emissions value according to the national emission inventory from the 2024 submission.

Figure 9.37. Projected NO_x emissions trends in sectors 2A, 2B, 2C, 2H

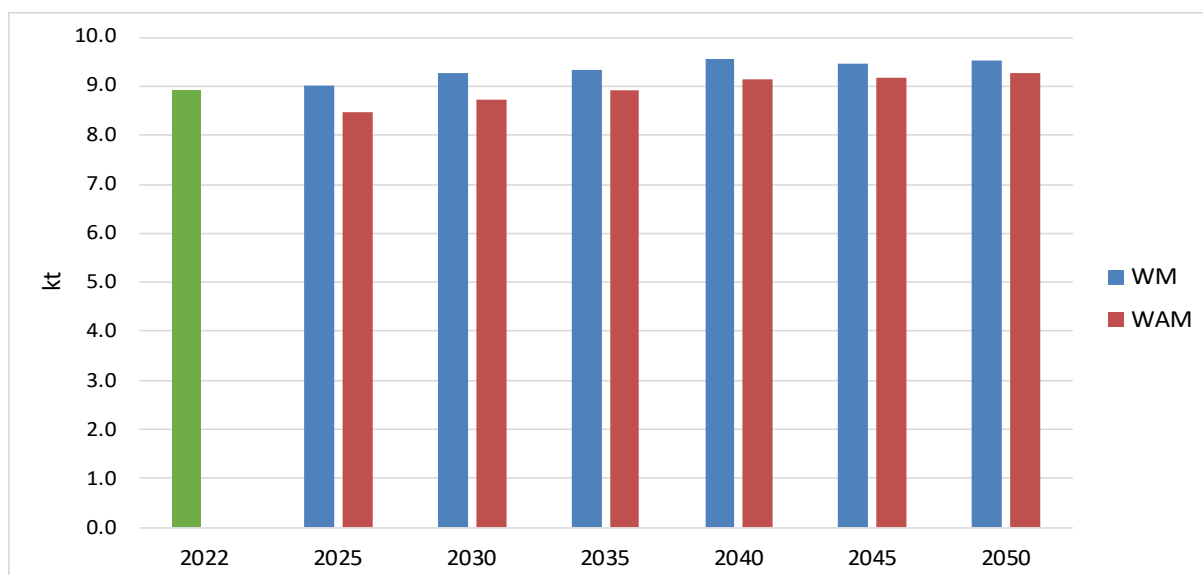


Figure 9.38. Projected SO₂ emissions trends in sectors 2A, 2B, 2C, 2H

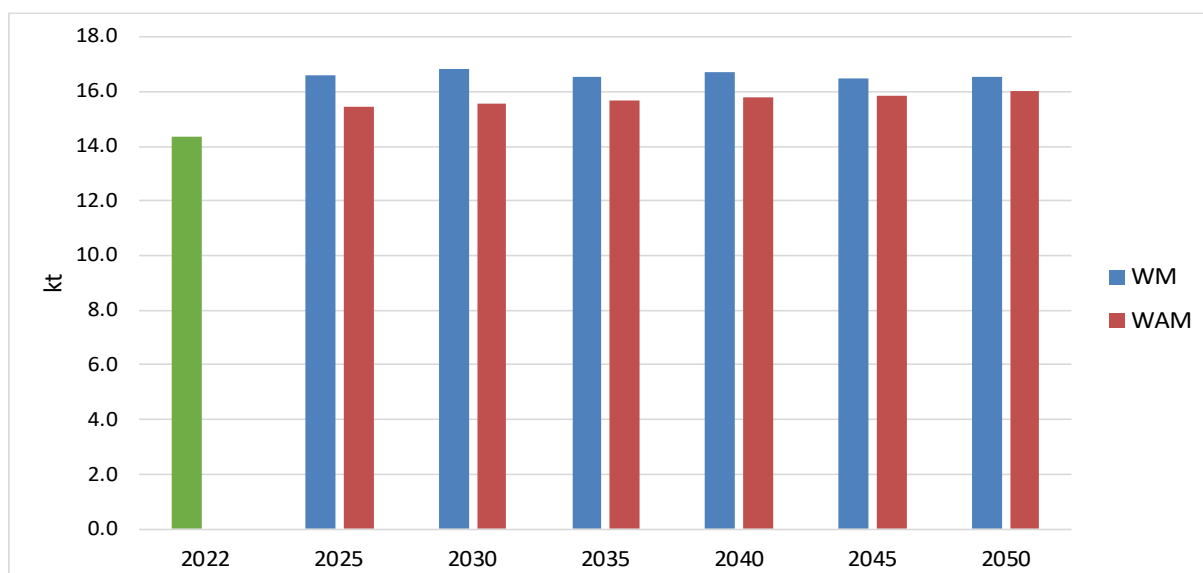


Figure 9.39. Projected NMVOC emissions trends in sectors 2A, 2B, 2C, 2H



Figure 9.40. Projected NH₃ emissions trends in sectors 2A, 2B, 2C, 2H

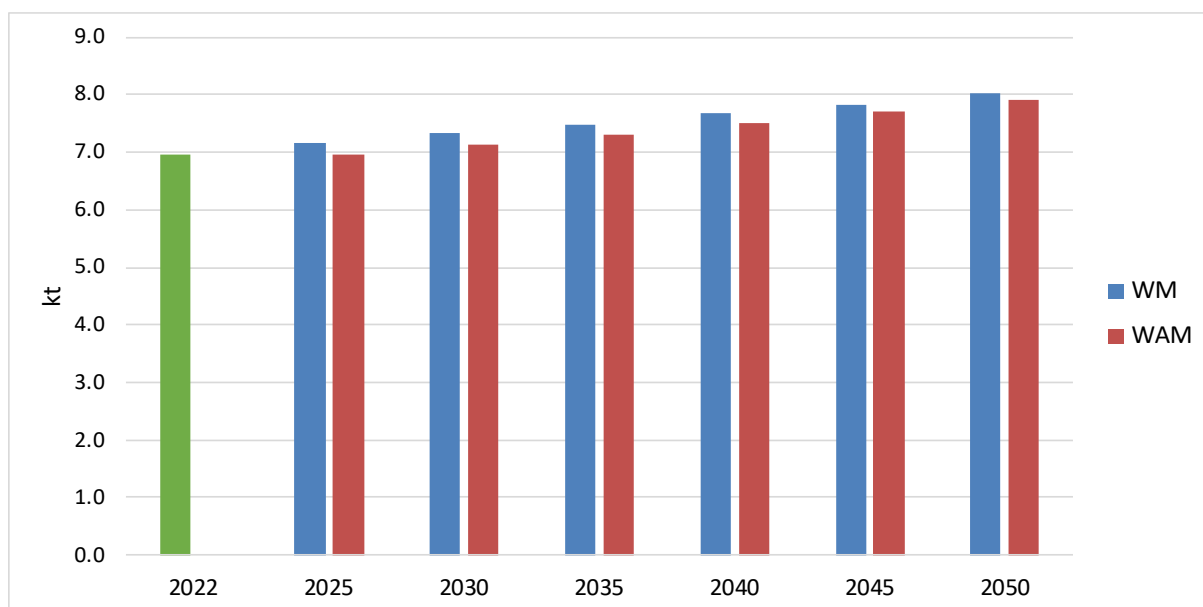


Figure 9.41. Projected PM_{2.5} emissions trends in sectors 2A, 2B, 2C, 2H

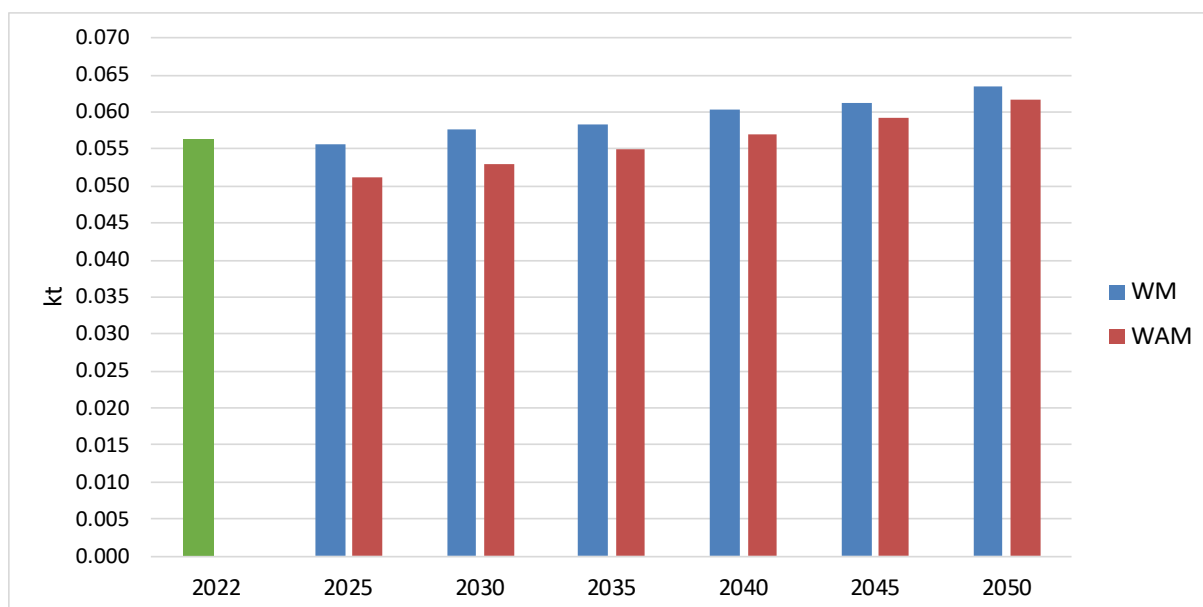


Figure 9.42. Projected BC emissions trends in sectors 2A, 2B, 2C, 2H

9.1.8 Solvents and other products use (NFR sectors 2D, 2G)

9.1.8.1 NFR category 2D - solvent use

Emission projections for category 2D were based on activity projections derived from updated NECP PL developed in 2024 and were prepared in WM scenario only.

To estimate the projected emissions of pollutants in 2D category, the methodology used in the national emissions inventory [IIR 2024] was used.

The emissions were calculated on the basis of the formula:

$$E = AD \times EF$$

where:

E – emission of a pollutant [e.g. kt]

AD – activity (production volume, number of inhabitants) [e.g. kt, thousands of inhabitants]

EF – emission factor [e.g. g/t]

The emission factors used for projections in sector 2D correspond to the values of the factors used in the national pollutant emission inventory (based on EMEP / EEA EIG 2023 and IETU).

The emissions of individual pollutants calculated according to the above-described method and on the basis of the above data is presented in the table below.

Table 9.29. Emission projected in sector 2D for WM scenario [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NM VOC	175.31	184.37	182.08	178.77	176.19	173.92	171.82
NH ₃	0.01	0.01	0.01	0.01	0.01	0.01	0.01
PM _{2.5}	0.57	0.64	0.64	0.64	0.64	0.64	0.64
BC	0.03	0.03	0.03	0.03	0.03	0.03	0.03

9.1.8.2 NFR category 2G - use of tobacco, fireworks and lubricants in motor vehicles

In case of subcategory “lubricant use in motor vehicles”, projections of SO₂ emissions in category 2G were developed in two scenarios: WM and WAM. Emission factors for all pollutants in this subcategory (lubricant use) were adopted on the basis of EMEP/EEA EIG 2023 using the COPERT 5.7 model. Data on expected activities (fuel consumption) were adopted in two scenarios, WM and WAM, based on updated NECP PL (2024).

Emission projections for category 2G for tobacco and fireworks were based on activity projections derived from the report “Projections of Activity Changes in Selected Economic Sectors – update 2024” (KOBiZE, 2024) and were prepared in one scenario only. Emission factors used for emission projections for fireworks and tobacco are equal to the values of the factors used in the national pollutant emission inventory (based on EMEP/EEA EIG 2023).

To estimate the projected emissions of pollutants in the 2G sector (except lubricant use), the methodology used in the national emissions inventory [IIR 2024] was applied.

The emissions were calculated on the basis of the formula:

$$E = AD \times EF$$

where:

E – emission of a pollutant [e.g. kt]

AD – activity (fuel consumption) [e.g. kt, thousands of inhabitants]

EF – emission factor [e.g. g/t]

The emissions of individual pollutants calculated according to the above-described method and on the basis of the above data is presented in the tables below.

Table 9.30. Emission projected in sector 2G – Tobacco use [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NO _x	0.069	0.076	0.066	0.058	0.050	0.050	0.050
NM VOC	0.185	0.203	0.178	0.155	0.136	0.136	0.136
NH ₃	0.159	0.174	0.152	0.133	0.116	0.116	0.116
PM _{2.5}	1.032	1.134	0.991	0.866	0.756	0.756	0.756
BC	0.464	0.510	0.446	0.390	0.340	0.340	0.340

Table 9.31. Emission projected in sector 2G – Fireworks [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NO _x	0.003	0.003	0.003	0.004	0.004	0.004	0.004
SO ₂	0.036	0.033	0.037	0.042	0.046	0.046	0.046
PM _{2.5}	0.00062	0.00056	0.00064	0.00072	0.00079	0.00079	0.00079

Table 9.32. Emissions projected in sector 2G – Lubricant use in motor vehicles (WM and WAM)

Pollutant	2022	2025	2030	2035	2040	2045	2050
SO ₂ WM	0.71	0.71	0.68	0.68	0.73	0.65	0.62
SO ₂ WAM	0.71	0.72	0.68	0.66	0.75	0.65	0.62

The table below presents emission projections from sectors 2D and 2G.

Table 9.33. Emissions projected in sector 2D and 2G [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NO _x	0.07	0.08	0.07	0.06	0.05	0.05	0.05
NM VOC	175.49	184.57	182.26	178.92	176.32	174.06	171.95
SO ₂ (WM)	0.75	0.74	0.72	0.72	0.77	0.69	0.67
SO ₂ (WAM)	0.75	0.75	0.71	0.71	0.79	0.69	0.67
NH ₃	0.17	0.19	0.16	0.15	0.13	0.13	0.13
PM _{2.5}	1.60	1.77	1.63	1.50	1.39	1.39	1.39
BC	0.50	0.55	0.48	0.42	0.38	0.38	0.38

The figures below show the trends of projected emissions. The year 2022 (displayed in green) was added for comparison and represents the historical emissions value according to the national emission inventory from the 2024 submission.



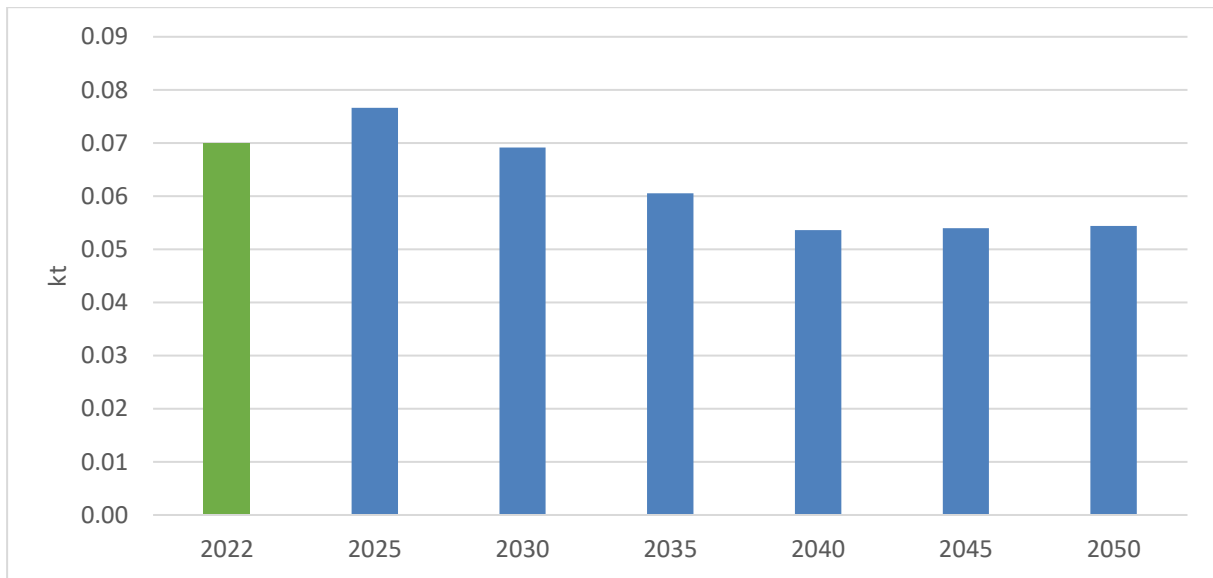


Figure 9.43. Projected NOx emissions trends in sectors 2D, 2G

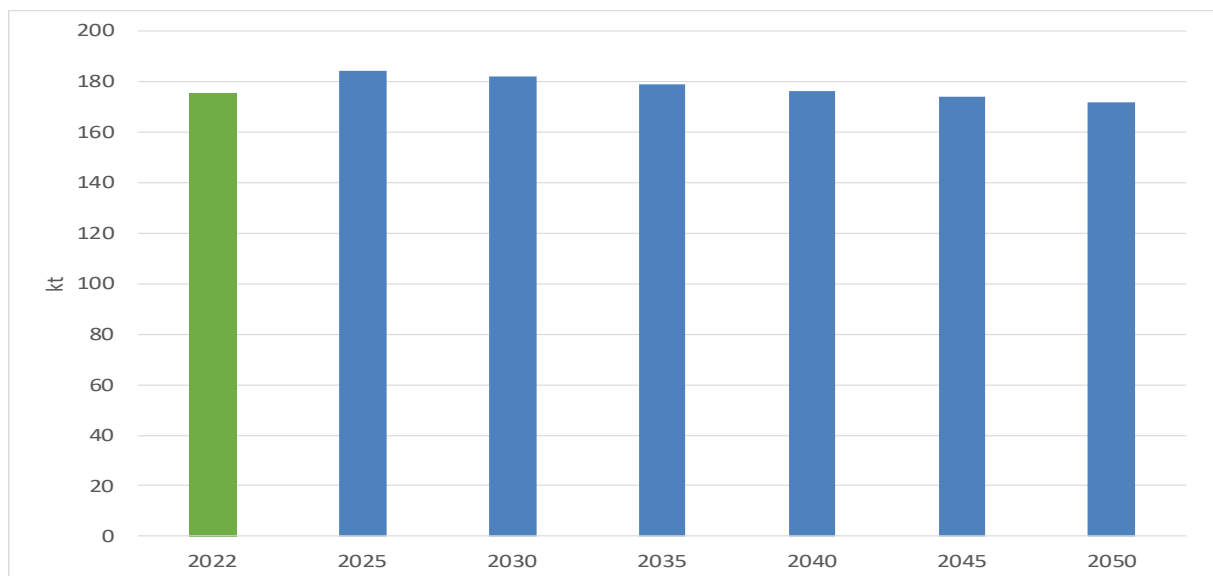


Figure 9.44. Projected NMVOC emissions trends in sectors 2D, 2G

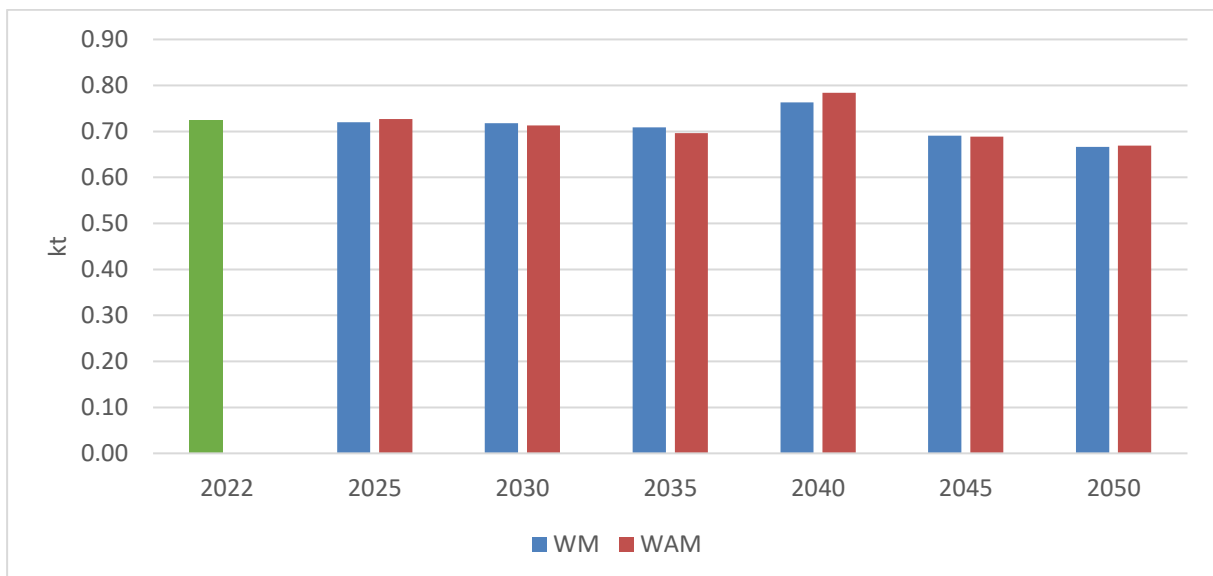


Figure 9.45. Comparison of projected SO₂ emissions trends in both scenarios in sectors 2D, 2G

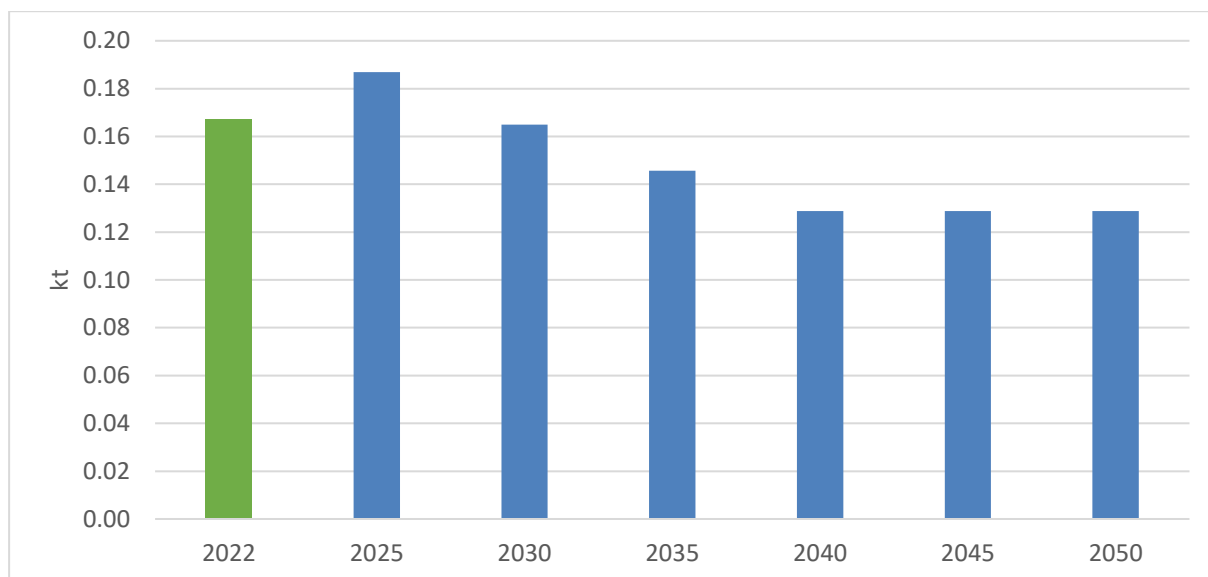


Figure 9.46. Projected NH₃ emissions trends in sectors 2D, 2G

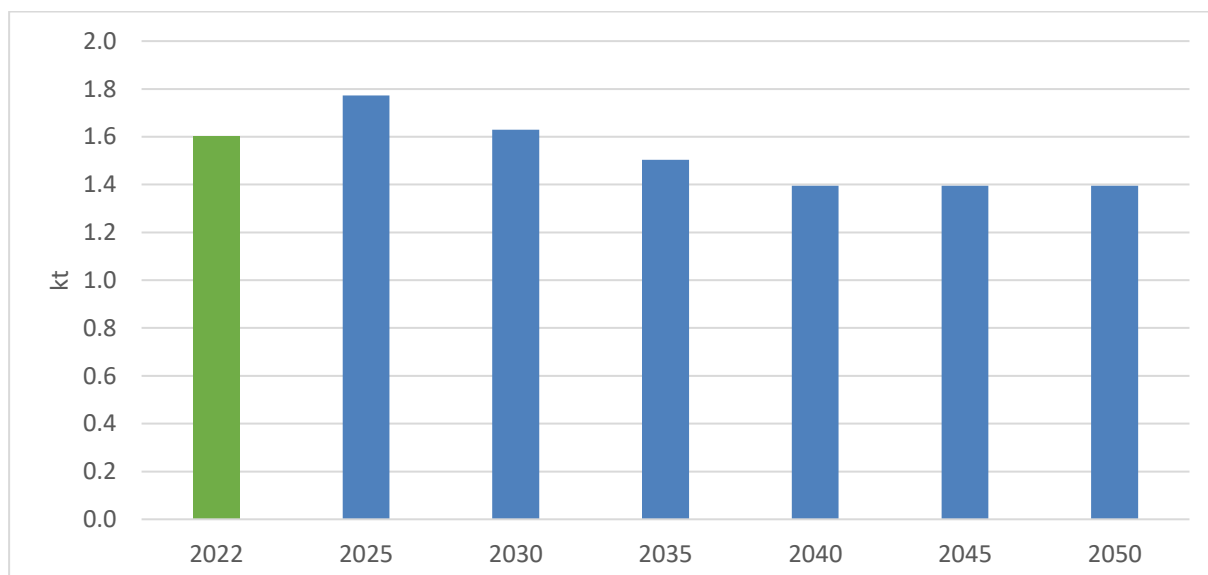


Figure 9.47. Projected PM_{2.5} emissions trends in sectors 2D, 2G

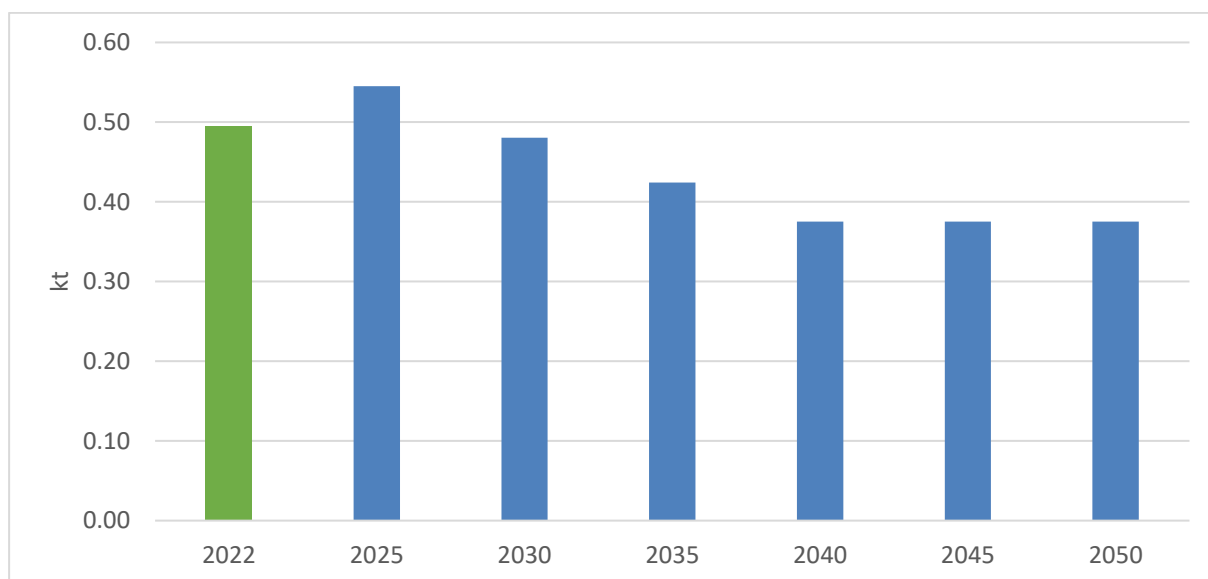


Figure 9.48. Projected BC emissions trends in sectors 2D, 2G

9.1.9 Agriculture (NFR sector 3)

Agriculture sector is the key source of ammonia emission in Poland, responsible for about 96% national emissions in 2022 of which manure management is responsible for 46% and inorganic and organic fertilizers applied to soils for 49%. Agriculture is also responsible for about 20% of NMVOC national emissions, for about 13% of NO_x emissions and trace amount of SO₂ as well as PM_{2.5} emissions.

As NMVOC and NO_x emissions from agriculture sectors 3B and 3D are not accounted for the purpose of complying with NEC ceilings for these substances since 2020, then NH₃ becomes the most important pollution requiring reduction measures in this sector.

The main data on projected activity changes in sector 3. Agriculture come from the report "Projections of Activity Changes in Selected Economic Sectors – update 2024" and were elaborated with the participation of the representatives of scientific institutes, specifically: the Institute of Agricultural and Food Economics – National Research Institute (IERiGŻ–PIB), the Institute of Horticulture – National Research Institute (InHort–PIB), the Institute of Soil Science and Plant Cultivation – National Research Institute (IUNG–PIB) and the National Research Institute of Animal Production (IZ–PIB) (Prandecki K. 2024) (Table 9.34).

Changes in individual activities in the agricultural sector may occur as a result of a wide range of factors, i.e. mainly economic and environmental conditions relating to the conduct of a given activity, the impact of agricultural policy and other legal acts regulating agricultural activities.

The WM scenario includes predicted agricultural activities affecting the volume of greenhouse gas emissions, taking into account adopted and already implemented policies and measures affecting this activity. The WAM scenario additionally includes planned activities that may affect agricultural activity. The demarcation point between the scenarios is the end of 2022. This approach is justified by the introduction of a new stage of the Common Agricultural Policy covering the years 2023-2027. This means that those activities that result from legal acts adopted and published before the end of 2022 are considered adopted and implemented. Acts adopted later, e.g. in 2023, despite the fact that they could already have entered into force, are included in the WAM scenario.

Table 9.34. Primary projected activity data for category 3. *Agriculture* according to the WM and WAM scenarios

Activity	Unit	2025	2030	2035	2040	2045	2050
WM							
Cattle population	thous. head	6 500	6 440	6 380	6 250	6 100	5 900
including dairy cattle	thous. head	2 290	2 260	2 240	2 200	2 150	2 070
Pig population	thous. head	9 850	9 900	9 800	9 700	9 500	9 100
Poultry population	thous. head	211 800	240 300	260 000	273 500	295 000	321 500
Nitrogen fertilizer use	thous. tonnes N	897.6	861.6	835.8	785.5	735.8	682.7
WAM							
Cattle population	thous. head	6 475	6 250	6 100	5 900	5 650	5 500
including dairy cattle	thous. head	2 285	2 210	2 170	2 100	2 000	1 950
Pig population	thous. head	9 820	9 600	9 500	9 300	9 000	8 800
Poultry population	thous. head	211 800	227 300	242 000	256 500	270 000	284 500
Nitrogen fertilizer use	thous. tonnes N	887.6	798.4	751.1	666.9	590.9	462.7

Source: Prandecki K. 2024

Projected emissions in agriculture categories were estimated based on methodology used in the national inventory [IIR 2024]. This means that NH₃ and NO₂ emissions from manure

management were estimated based on Tier 2 method (mass flow approach) as published in Chapter 3.3.1 in part 3B. *Manure Management* of EMEP/EEA EIG 2019 with country specific parameters where applicable.

Table 9.35. NH₃ abatement techniques in livestock breeding and manure management applied in 2021 and projected years for both scenarios

NH ₃ abatement techniques	% of animal population covered 2021-2050	NH ₃ emission reducing potential [%]
Swine partially slated floor	14.7	20
Laying hens solid manure fast removal	29.6	32
Laying hens solid manure ventilation	10.2	32
Cattle solid manure cover	2.8	80
Swine solid manure cover	9.3	80
Laying hens solid manure cover	0.94	80
Broilers solid manure cover	0.5	80
Cattle slurry cover	100	80
Swine slurry cover	100	80
Dairy cattle protein feeding	25.0	15
Laying hens 3-phase feeding	29.8	20
Broilers 5-phase feeding	43.4	20
Fattening pigs 4-phase feeding	25.1	30
Piglets 3-phase feeding	18.7	30

Projected activities change in both scenarios are supplemented with the reduction measures that are already in place (Table 9.35). In case of WAM scenario additional NH₃ reduction measure was taken into account, where slurry is applied to soils with using low-emission spreading techniques. This measure is presented with many others actions in the ADVISORY CODE OF GOOD AGRICULTURAL PRACTICE FOR LIMITING AMMONIA EMISSIONS developed under the Ministry of Agriculture and Rural Development in 2019. It is assumed that since 2030, 10% of slurry will be applied to soils using low-emission spreading techniques.

With regard to mineral fertilizers use, in relation to the amendment to the Fertilizers and Fertilization Act of 2020, indicating the need to use urea in granulated form only with a urease inhibitor or with a biodegradable coating, there is an assumption that in both scenarios 100% of urea is applied with inhibitors.

Including above given measures in WAM scenario allowed to achieve NH₃ emission abatement by 17% since 2005 in Agriculture sector alone. When taking into account WM scenario NH₃ emissions decrease by 13% in 2030 in relation to 2005. Projected emission changes of particular pollutants in WM scenario are given in Table 9.36, Table 9.37 and Table 9.38, while in WAM scenario in Table 9.39, Table 9.40 and Table 9.41.



Table 9.36. NO_x and SO₂ emissions projected in sector 3 in WM scenario [kt]

Sector	NO _x							SO ₂						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	67.34	66.2	65.31	64.67	62.63	60.86	58.71	0.006	0.005	0.005	0.005	0.005	0.005	0.005
3B Manure management	5.16	4.80	5.03	5.20	5.29	5.460	5.63	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3D Crop production and agricultural soils	62.15	61.38	60.27	59.45	57.32	55.38	53.07	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3F Field burning of agricultural residues	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.006	0.005	0.005	0.005	0.005	0.005	0.005

Table 9.37. NMVOC and NH₃ missions projected in sector 3 in WM scenario [kt]

Sector	NMVOC							NH ₃						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	120.19	122.91	122.36	123.27	123.90	126.08	127.42	265.29	269.87	274.56	278.46	277.67	279.44	279.02
3B Manure management	111.19	114.76	114.34	115.31	116.03	118.32	119.76	129.13	130.90	135.44	138.87	140.30	143.12	145.35
3D Crop production and agricultural soils	8.99	8.15	8.01	7.95	7.86	7.76	7.66	136.13	138.95	139.11	139.57	137.34	136.30	133.65
3F Field burning of agricultural residues	0.006	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.02	0.02	0.02	0.02	0.02

Table 9.38. PM_{2.5} and BC emissions projected in sector 3 in WM scenario [kt]

Sector	PM _{2.5}							BC						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	3.90	3.89	4.01	4.05	4.10	4.11	4.14	0.006	0.005	0.005	0.005	0.005	0.005	0.005
3B Manure management	2.30	2.29	2.41	2.48	2.53	2.56	2.61	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3D Crop production and agricultural soils	1.54	1.55	1.55	1.52	1.51	1.49	1.48	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3F Field burning of agricultural residues	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.006	0.005	0.005	0.005	0.005	0.005	0.005

Table 9.39. NO_x and SO₂ emissions projected in sector 3 in WAM scenario [kt]

Sector	NO _x							SO ₂						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	67.34	65.72	61.83	59.98	56.32	52.85	47.75	0.006	0.005	0.005	0.005	0.005	0.005	0.005
3B Manure management	5.16	4.79	4.85	4.97	5.03	5.08	5.19	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3D Crop production and agricultural soils	62.15	60.91	56.95	54.99	51.27	47.75	42.54	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3F Field burning of agricultural residues	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.006	0.005	0.005	0.005	0.005	0.005	0.005

Table 9.40. NMVOC and NH₃ missions projected in sector 3 in WAM scenario [kt]

Sector	NMVOC							NH ₃						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	120.19	115.34	107.60	108.24	108.20	107.74	108.22	265.29	267.87	262.94	263.54	259.85	256.10	252.89
3B Manure management	111.19	107.21	99.71	100.52	100.75	100.59	101.66	129.13	130.61	131.54	133.62	134.43	135.09	136.45
3D Crop production and agricultural soils	8.99	8.12	7.89	7.72	7.44	7.15	6.56	136.13	137.24	131.37	129.89	125.39	120.99	116.42
3F Field burning of agricultural residues	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.03	0.02	0.02	0.02	0.02	0.02	0.02

Table 9.41. PM_{2.5} and BC emissions projected in sector 3 in WAM scenario [kt]

Sector	PM _{2.5}							BC						
	2022	2025	2030	2035	2040	2045	2050	2022	2025	2030	2035	2040	2045	2050
SUM	3.90	3.88	3.98	3.95	3.95	3.94	3.90	0.006	0.005	0.005	0.005	0.005	0.005	0.005
3B Manure management	2.30	2.29	2.40	2.41	2.44	2.45	2.45	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3D Crop production and agricultural soils	1.54	1.54	1.52	1.49	1.46	1.43	1.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3F Field burning of agricultural residues	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.006	0.005	0.005	0.005	0.005	0.005	0.005

The figures below show the trends of projected emissions for both scenarios. The year 2022 (displayed in green) has been added for comparison and represents the historical emissions value according to the national emission inventory from the 2024 submission.

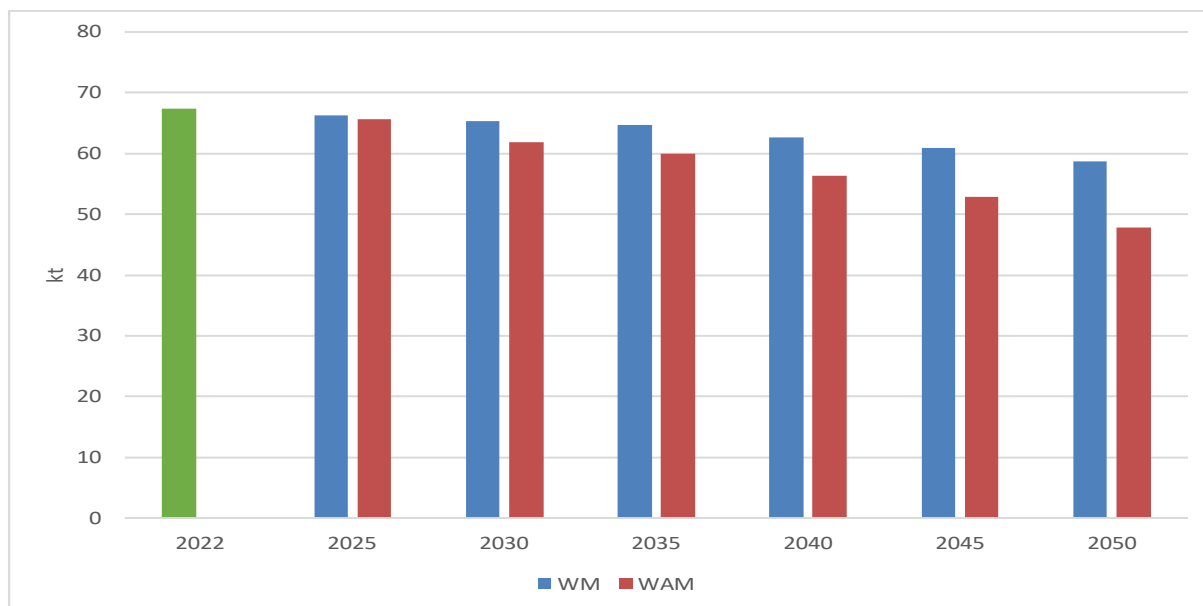


Figure 9.49. Projected NO_x emissions trends in sector 3 in both scenarios

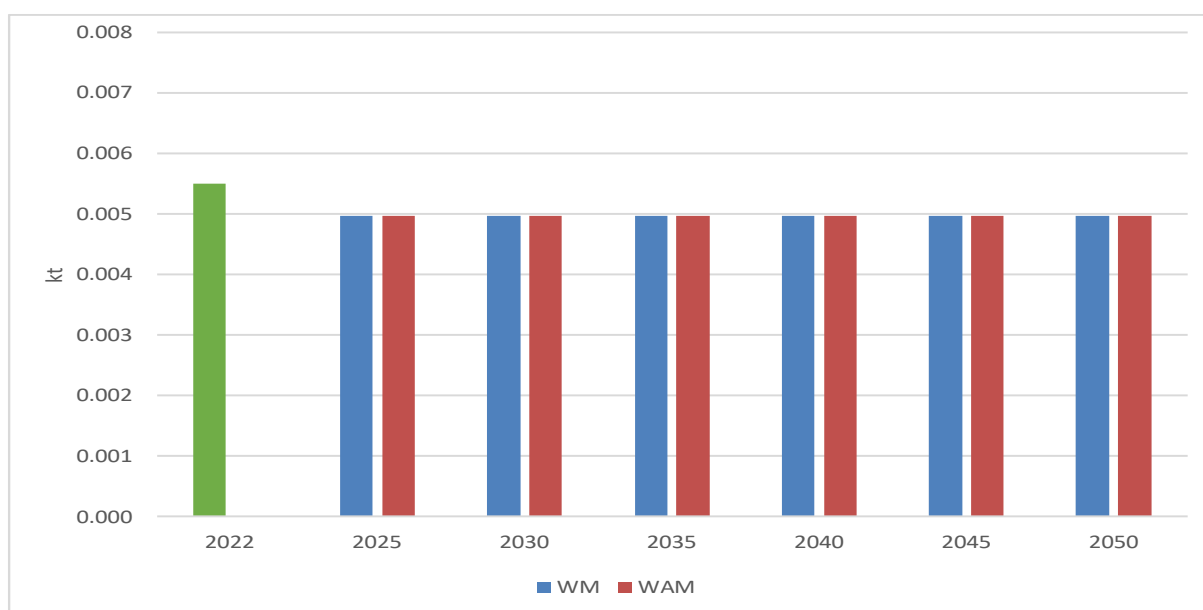


Figure 9.50. Projected SO₂ emissions trends in sector 3 in both scenarios

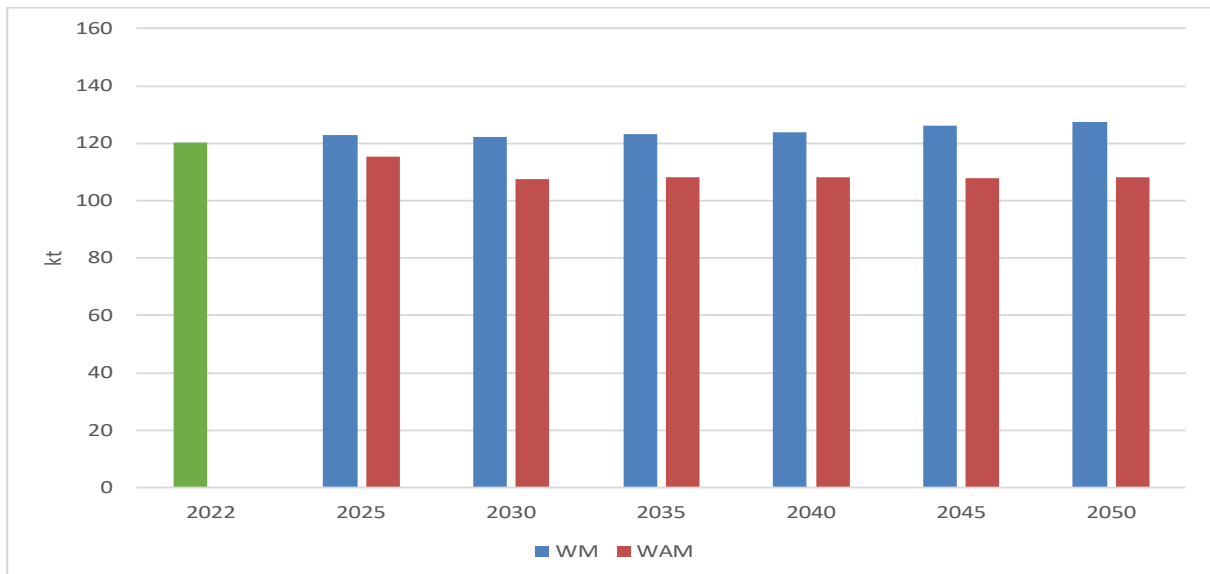


Figure 9.51. Projected NMVOC emissions trends in sector 3 in both scenarios

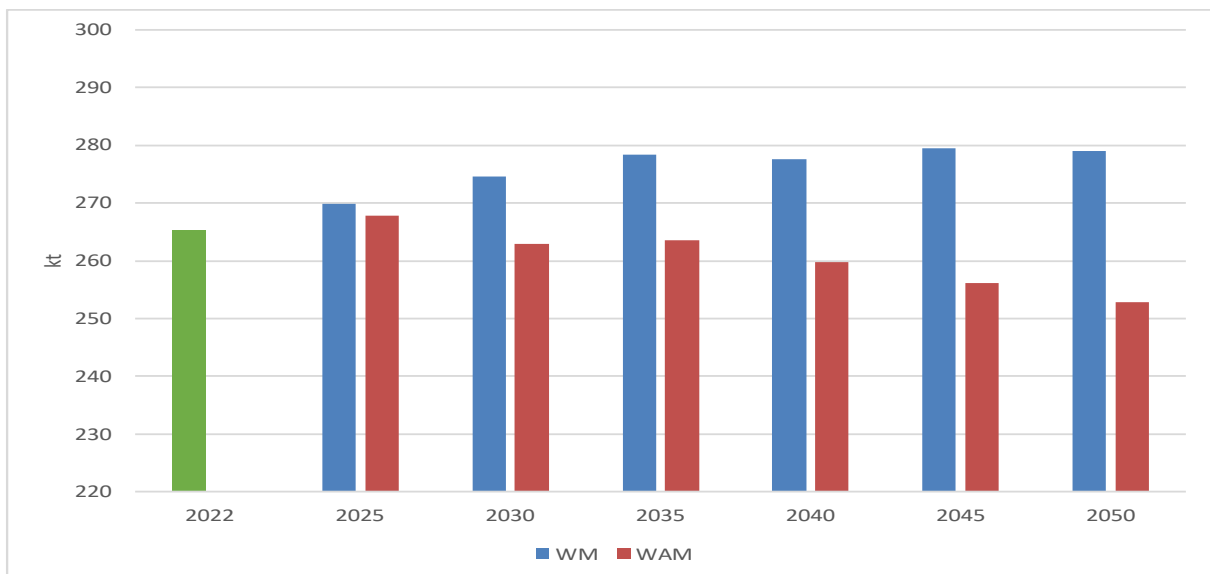


Figure 9.52. Comparison of projected NH₃ emissions trends in sector 3 in both scenarios

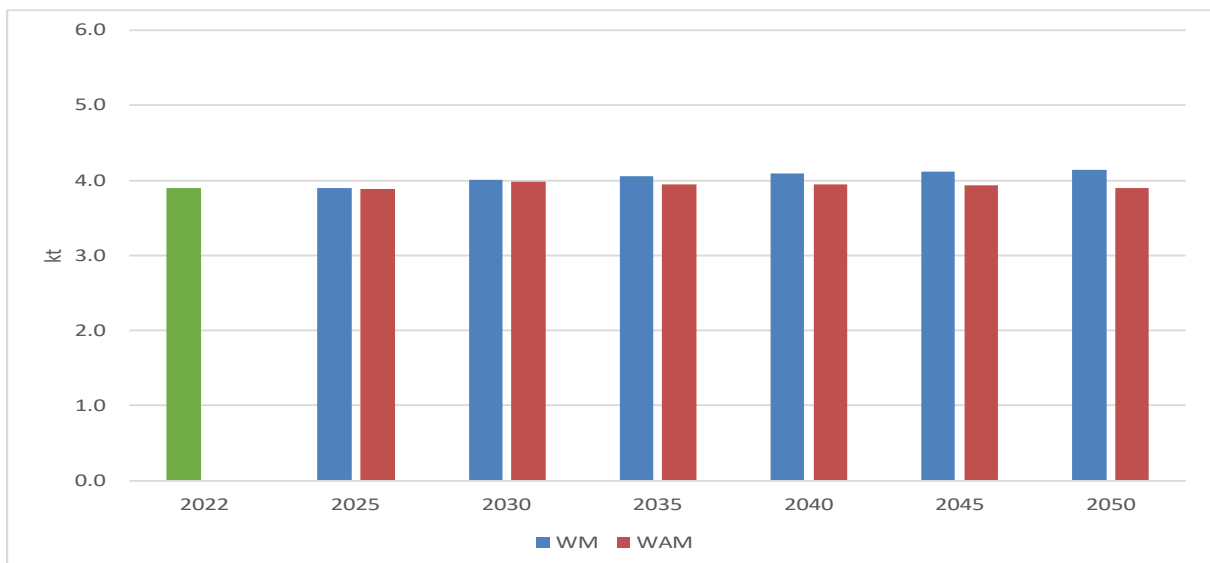


Figure 9.53. Projected PM_{2.5} emissions trends in sector 3 in both scenarios

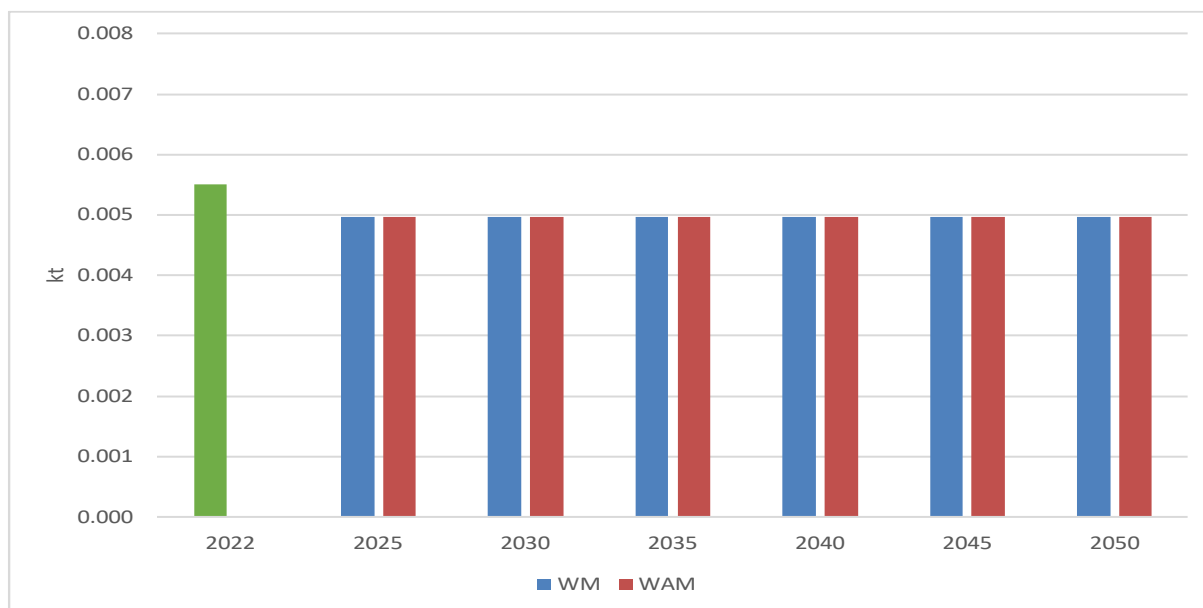


Figure 9.54. Projected BC emissions trends in sector 3 in both scenarios

9.1.10 Waste (NFR sector 5)

The waste sector accounts for a small share of the air pollutant emissions covered by the projections. Its share in total emissions is less than 1% for NO_x, NMVOC, SO₂ and NH₃ for all forecast years. In the case of PM_{2.5} and black carbon, these shares are higher and do not exceed 2% for all years covered by the emission projections.

The projections were based on the report "Update of projections of changes in activity data in the waste sector" (ZMiPGO IOŚ-PIB and ZPRE KOBIZE), which is based on the strategic document National Waste Management Plan 2028 (KPGO 2028).

The projections were estimated in the WM scenario, except for subcategories 5B2 and 5C2, which were estimated in the WM and WAM scenarios.

The emission factors and methodology used for the projections in sector 5 correspond to the values of the factors used in the national pollutant emission inventory – IIR 2024 submission.

Table 9.42. Projected emissions in sector 5 – WM [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
5A. Solid waste disposal on land							
NMVOC	0.67	0.43	0.22	0.10	0.04	0.01	0.01
PM _{2.5}	0.0011	0.0005	0.0005	0.0004	0.0004	0.0003	0.0002
5B1. Biological treatment of waste (composting)							
NH ₃	0.80	0.85	1.18	1.48	1.45	1.49	1.49
5B2. Biological treatment of waste (biogas plants)							
NH ₃	1.50	1.62	2.59	3.62	3.97	4.08	4.12
5C1. Incineration and open burning of waste (Cremation)							
NO _x	0.14	0.17	0.18	0.19	0.20	0.20	0.20
NMVOC	0.0022	0.0027	0.0029	0.0030	0.0032	0.0032	0.0032
SO ₂	0.019	0.024	0.025	0.026	0.028	0.028	0.028
PM _{2.5}	0.0059	0.0073	0.0077	0.0081	0.0085	0.0086	0.0086
5C2. Open burning of waste							
NO _x	1.45	1.63	1.60	1.62	1.66	1.70	1.74
NMVOC	0.47	0.47	0.46	0.46	0.47	0.47	0.48
SO ₂	0.042	0.042	0.041	0.041	0.042	0.042	0.043
PM _{2.5}	1.62	1.60	1.56	1.57	1.59	1.60	1.62
BC	0.68	0.67	0.65	0.66	0.67	0.67	0.68
5D. Wastewater handling							
NMVOC	0.03	0.03	0.03	0.03	0.03	0.03	0.03
NH ₃	0.94	0.85	0.71	0.57	0.42	0.28	0.14
5E. Other waste handling: Unintentional fires of buildings and cars							
PM _{2.5}	3.11	2.85	2.85	2.85	2.85	2.85	2.85

Table 9.43. Projected emissions in sector 5 – WAM [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
5A. Solid waste disposal on land							
NMVOC	0.67	0.43	0.22	0.10	0.04	0.01	0.01
PM _{2.5}	0.0011	0.0005	0.0005	0.0004	0.0004	0.0003	0.0002
5B1. Biological treatment of waste (composting)							
NH ₃	0.80	0.85	1.18	1.48	1.45	1.49	1.49
5B2. Biological treatment of waste (biogas plants)							
NH ₃	1.50	1.62	2.59	3.61	3.96	4.06	4.11
5C1. Incineration and open burning of waste (Cremation)							

Pollutant	2022	2025	2030	2035	2040	2045	2050
NO _x	0.14	0.17	0.18	0.19	0.20	0.20	0.20
NM VOC	0.0022	0.0027	0.0029	0.0030	0.0032	0.0032	0.0032
SO ₂	0.019	0.024	0.025	0.026	0.028	0.028	0.028
PM _{2.5}	0.0059	0.0073	0.0077	0.0081	0.0085	0.0086	0.0086
5C2. Open burning of waste							
NO _x	1.45	1.61	1.50	1.51	1.51	1.49	1.44
NM VOC	0.47	0.46	0.43	0.42	0.41	0.40	0.37
SO ₂	0.042	0.041	0.038	0.038	0.037	0.035	0.033
PM _{2.5}	1.62	1.57	1.46	1.44	1.40	1.35	1.24
BC	0.68	0.66	0.61	0.61	0.59	0.57	0.52
5D. Wastewater handling							
NM VOC	0.03	0.03	0.03	0.03	0.03	0.03	0.03
NH ₃	0.94	0.85	0.71	0.57	0.42	0.28	0.14
5E. Other waste handling: Unintentional fires of buildings and cars							
PM _{2.5}	3.11	2.85	2.85	2.85	2.85	2.85	2.85

Table 9.44. Aggregated projected emissions in sector 5 – WM [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NO _x	1.59	1.80	1.78	1.82	1.87	1.90	1.94
NMLZO	1.17	0.93	0.71	0.60	0.54	0.52	0.52
SO ₂	0.062	0.066	0.066	0.068	0.070	0.070	0.071
NH ₃	3.24	3.33	4.48	5.67	5.84	5.84	5.74
PM _{2.5}	4.73	4.46	4.42	4.43	4.45	4.47	4.49
BC	0.68	0.67	0.65	0.66	0.67	0.67	0.68

Table 9.45. Aggregated projected emissions in sector 5 – WAM [kt]

Pollutant	2022	2025	2030	2035	2040	2045	2050
NO _x	1.59	1.78	1.68	1.71	1.71	1.70	1.65
NMLZO	1.17	0.92	0.68	0.56	0.48	0.44	0.41
SO ₂	0.062	0.065	0.063	0.064	0.064	0.063	0.061
NH ₃	3.24	3.33	4.47	5.66	5.83	5.83	5.74
PM _{2.5}	4.73	4.43	4.32	4.31	4.26	4.21	4.11
BC	0.68	0.66	0.61	0.61	0.59	0.57	0.52

The figures below shows the trends of projected emissions. The year 2022 (displayed in green) has been added for comparison and represents the historical emissions value according to the national emission inventory from the 2024 submission.

Significant decreases of NM VOC emissions in WM scenario result from the assumed decrease in the amount of landfilled waste. Increase of NO_x and SO₂ emissions in WM scenario is a result of predicted increase of AD in *Cremation* subcategory. Decrease of emissions of all pollutants (except NH₃) in WAM scenario is driven by projected decrease of amounts of agricultural waste utilized by open burning. Increase of NH₃ emissions in both scenarios in years 2025-2040 is result of planned significant development of biological treatment sector.

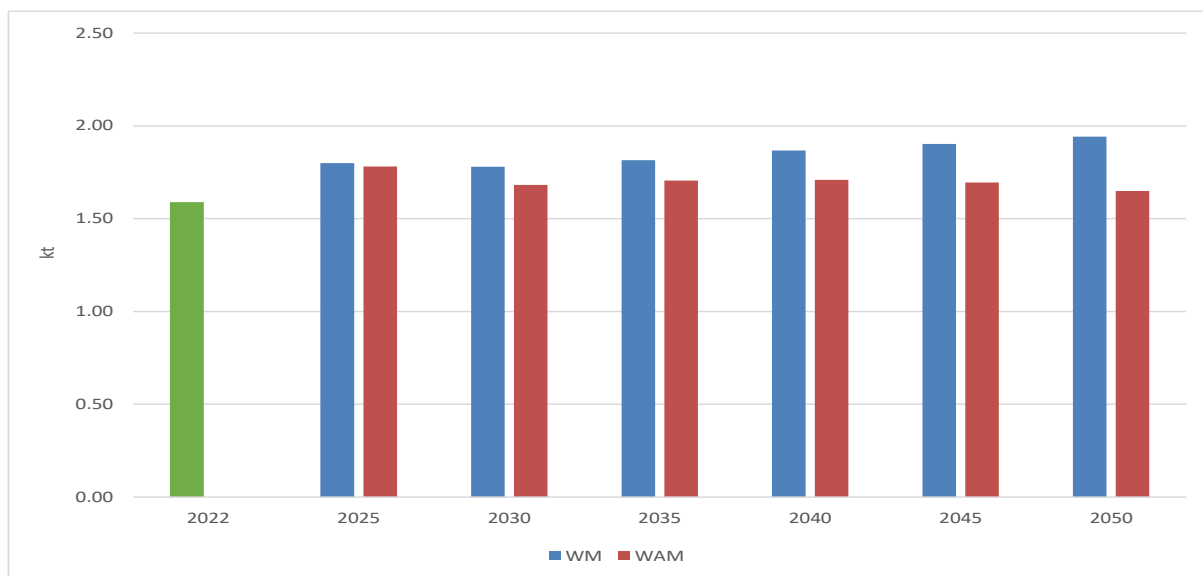


Figure 9.55. Projected NOx emissions trends in sector 5

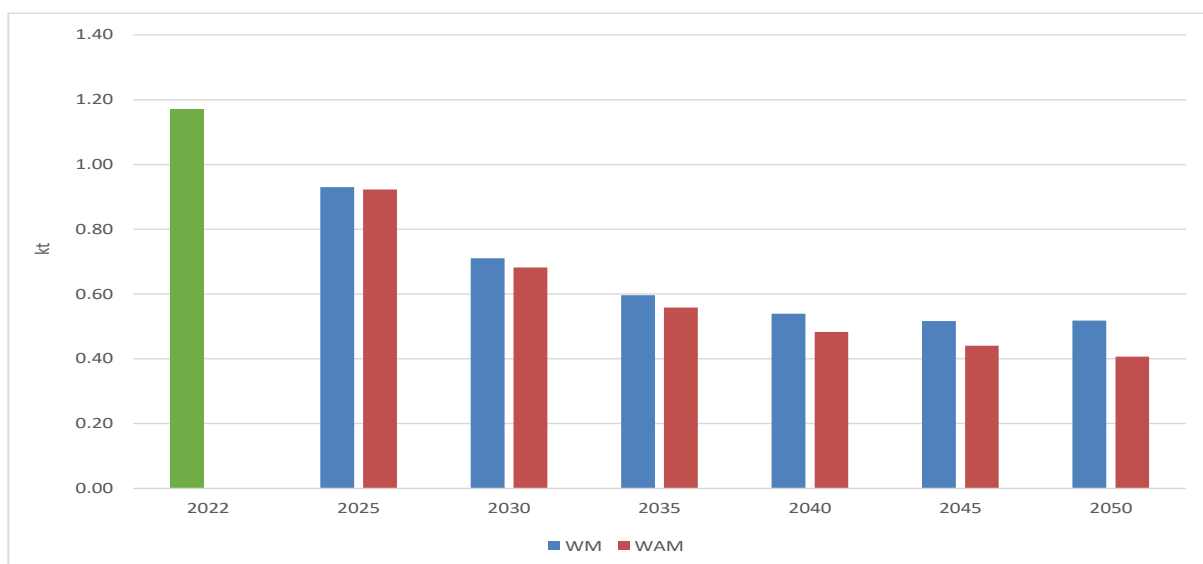


Figure 9.56. Projected NMVOC emissions trends in sector 5

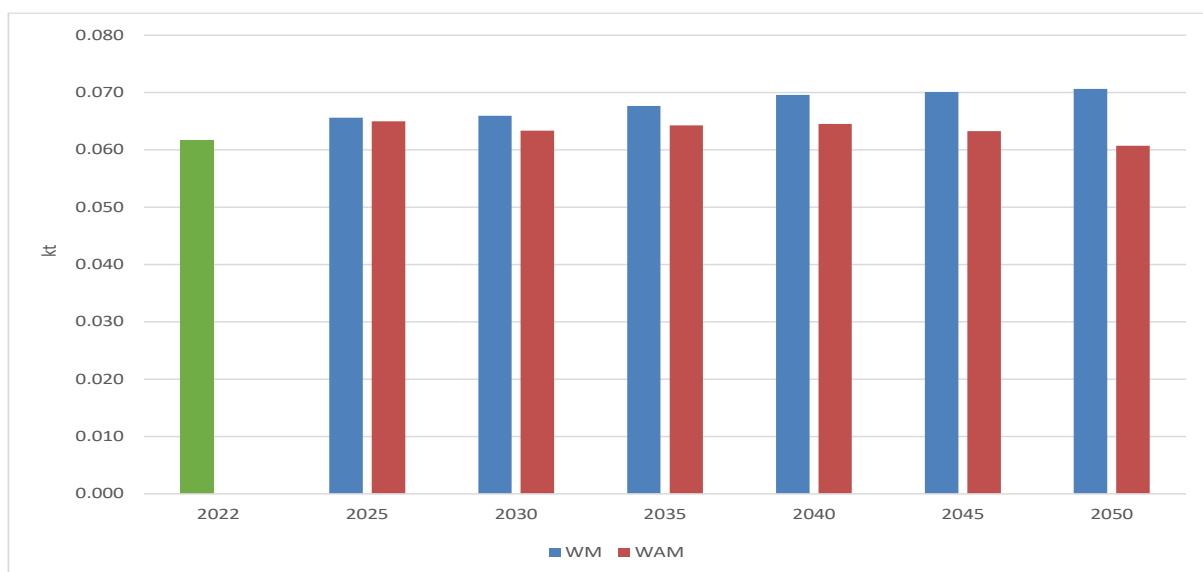


Figure 9.57. Projected SO₂ emissions trends in sector 5

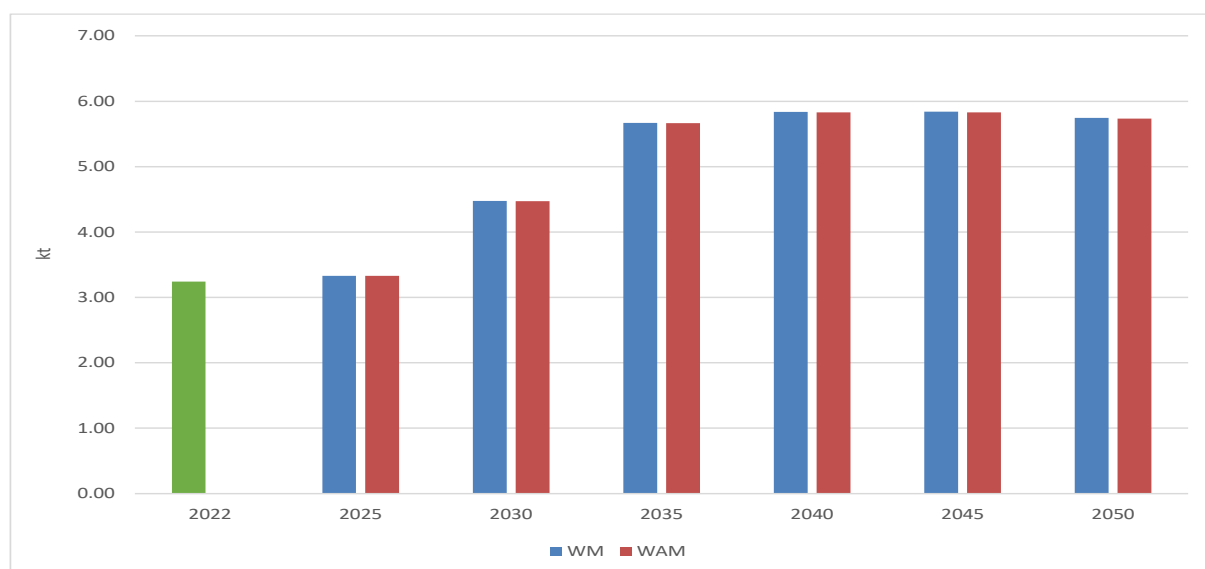


Figure 9.58. Projected NH₃ emissions trends in sector 5

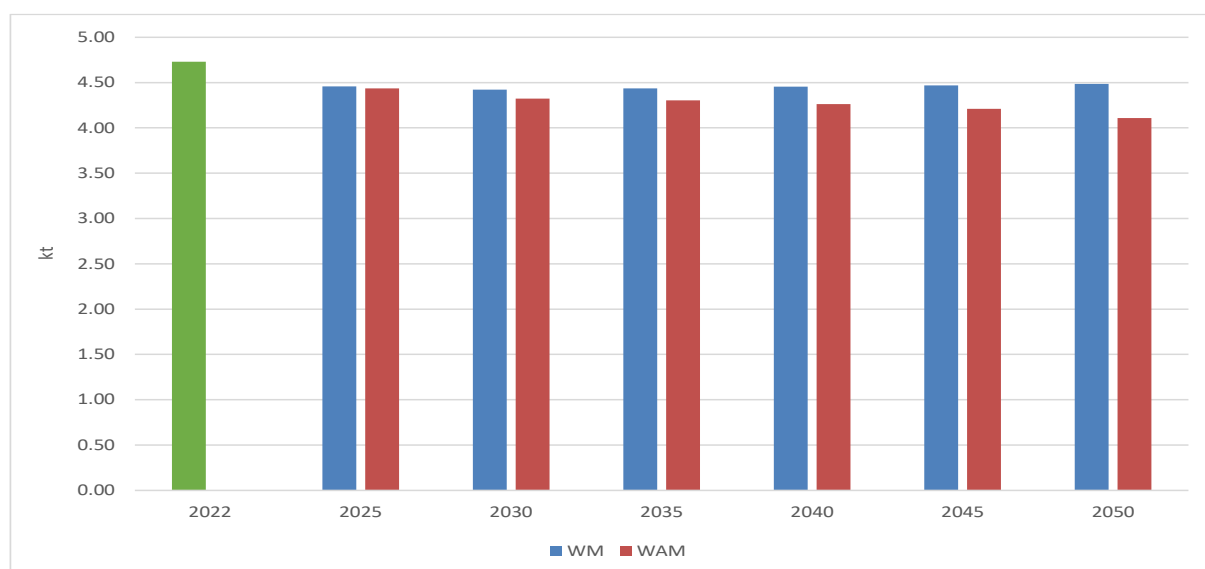


Figure 9.59. Projected PM_{2.5} emissions trends in sector 5

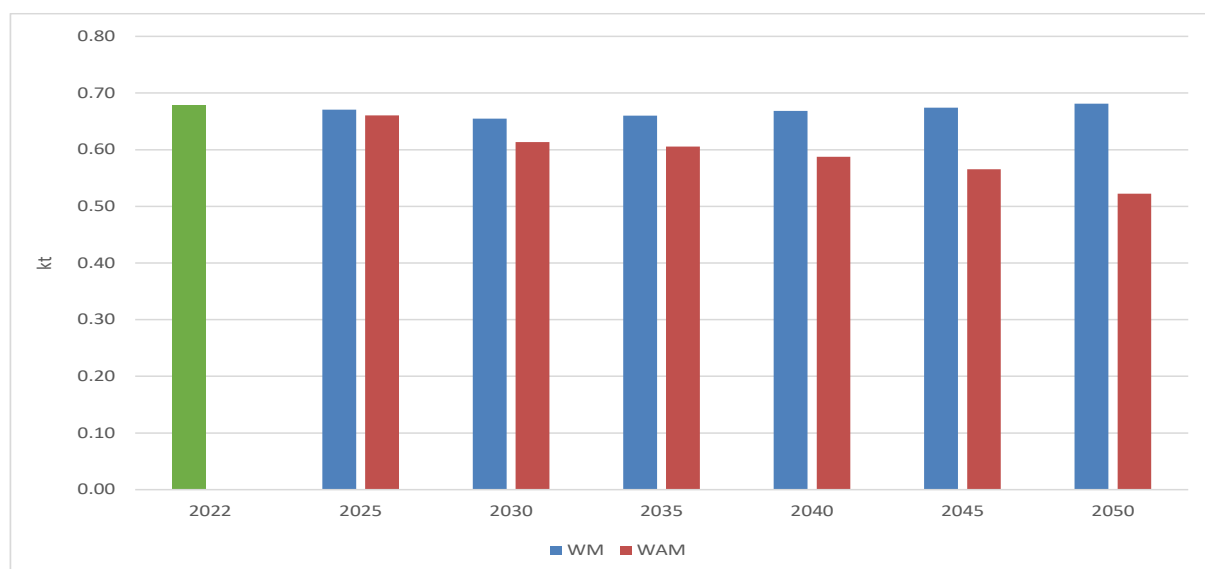


Figure 9.60. Projected BC emissions trends in sector 5

9.2 Estimated emission projections

This chapter presents emission projections of individual air pollutants and a comparison of the developed projections with the emission reduction levels resulting from the NEC Directive.

9.2.1 Projected NOx emissions

The largest source of nitrogen oxide emissions is the combustion of fuels: in the household and municipal sector (NFR 1A4), in energy industries (NFR 1A1) and in road transport (NFR 1A3b).

It should be mentioned here that pursuant to Art. 4 of the NEC Directive, NOx emissions from sectors 3B (manure management) and 3D (agricultural soils) are not covered by the reduction target set for EU Member States for 2020-2029 and from 2030 onward.

The tables below summarize NOx emissions in 2022 and the NOx emission projections for 2025, 2030, 2040, 2045 and 2050 by categories for both scenarios.

Table 9.46. Emission projections of NOx in **WM** scenario [kt]

GNFR	NOx emissions [kt]						
	2022	2025	2030	2035	2040	2045	2050
1A1 Energy industries	110.47	99.48	72.93	58.94	36.92	23.48	20.44
1A2 Manufacturing industries and construction	49.49	44.73	38.81	34.49	30.64	27.28	24.95
1A3b Road transport	165.23	180.20	134.00	95.64	64.10	52.61	41.61
1A3a,c,d,e Non-road transport	8.76	17.29	19.35	20.12	17.07	17.36	14.62
1A4 Other sectors	106.92	97.49	83.70	75.88	66.65	57.92	50.09
1B Fugitive emissions from fuels	3.51	3.26	3.05	2.88	2.69	2.46	2.21
2A,B,C,H,I,J,K,L Industrial processes	15.13	17.79	18.04	18.21	18.47	18.63	18.88
2D, 2G Solvents and other products use	0.07	0.08	0.07	0.06	0.05	0.05	0.05
3B Manure management*							
3D Agricultural soils*							
3F,I Field burning of agricultural residues and	0.03	0.02	0.02	0.02	0.02	0.02	0.02
5 Waste	1.59	1.80	1.78	1.82	1.87	1.90	1.94
TOTAL	461.21	462.13	371.77	308.07	238.48	201.71	174.82

* NOx emissions from NFR 3B and 3D are not included in total in the analysis of compliance with reduction targets

Table 9.47. Emission projections of NOx in **WAM** scenario [kt]

GNFR	NOx emissions [kt]						
	2022	2025	2030	2035	2040	2045	2050
1A1 Energy industries	110.47	97.16	62.33	41.90	23.09	14.40	14.82
1A2 Manufacturing industries and construction	49.49	43.58	33.94	27.75	22.43	18.24	15.34
1A3b Road transport	165.23	180.20	135.71	89.37	47.50	33.86	24.31
1A3a,c,d,e Non-road transport	8.76	16.54	18.42	19.07	16.12	16.43	13.72
1A4 Other sectors	106.92	97.82	79.93	70.19	61.12	53.21	46.25
1B Fugitive emissions from fuels	3.51	3.17	2.98	2.80	2.57	2.32	2.08
2A,B,C,H,I,J,K,L Industrial processes	15.13	17.48	17.73	17.98	18.23	18.46	18.72
2D, 2G Solvents and other products use	0.07	0.08	0.07	0.06	0.05	0.05	0.05
3B Manure management*							
3D Agricultural soils*							
3F,I Field burning of agricultural residues and	0.03	0.02	0.02	0.02	0.02	0.02	0.02
5 Waste	1.59	1.78	1.68	1.71	1.71	1.70	1.65
TOTAL	461.21	457.83	352.82	270.85	192.85	158.68	136.97

* NOx emissions from NFR 3B and 3D are not included in total in the analysis of compliance with reduction targets

The table below shows a comparison of NO_x emissions for 2022, 2025, 2030, 2035, 2040, 2045 and 2050 compared to the emission ceilings specified in Annex II to the NEC Directive. According to the projections, Poland will meet the emission ceilings in all years of the forecast in both scenarios.

Table 9.48. Comparison of NO_x emissions in 2022 and the projection years with the reduction levels required by the NEC Directive

	2005	2022	2025	2030	2035	2040	2045	2050
NO_x emission [kt]								
National emission inventory 2024	780	461						
Projections of national emissions for the WM scenario			462	372	308	238	202	175
Projections of national emissions for the WAM scenario			458	353	271	193	159	137
Emission reduction compared to 2005 [%]								
to be achieved by Poland in accordance with Directive 2016/2284		30%	34.5%	39%	39%	39%	39%	39%
in 2022 and projected in the WM scenario		40.8%	40.7%	52.3%	60.5%	69.4%	74.1%	77.6%
in 2022 and projected in the WAM scenario		40.8%	41.3%	54.7%	65.3%	75.3%	79.6%	82.4%

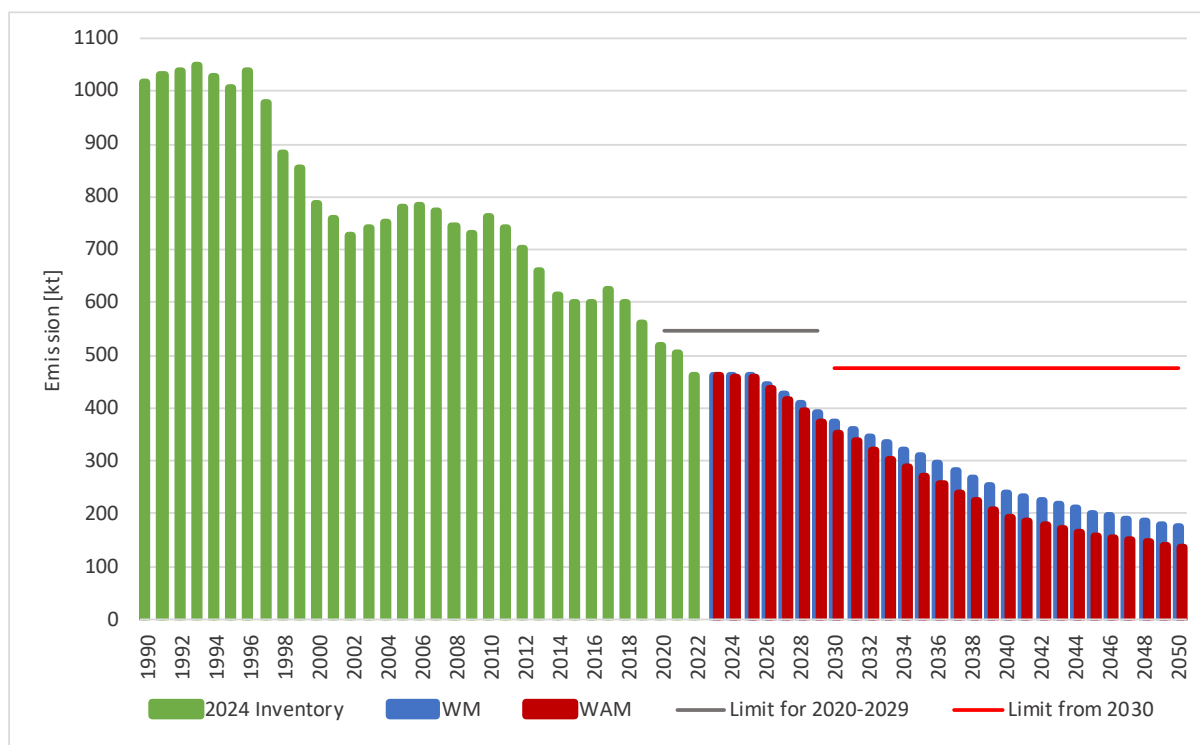


Figure 9.61 Historical and projected NO_x emission trends in both scenarios compared with emission ceilings

9.2.2 Projected SO₂ emissions

The main source of sulphur dioxide emissions is the energetic combustion of fuels (mainly hard coal) in stationary sources. The most important emission sources in this category are: *Energy industries* (NFR 1A1), *Manufacturing industries and construction* (NFR 1A2) and *Other sectors* (NFR 1A4). Road transport (NFR 1A3) is a negligible source of sulphur dioxide emissions due to the low sulphur content in liquid fuels.

The tables below summarize SO₂ emissions in 2022 and the SO₂ emission projections for 2025, 2030, 2035, 2040, 2045 and 2050 by categories in both scenarios.

Table 9.49. Emission projections of SO₂ in WM scenario [kt]

GNFR	SO ₂ emissions [kt]						
	2022	2025	2030	2035	2040	2045	2050
1A1 Energy industries	131.04	101.59	65.55	48.51	26.51	15.00	12.78
1A2 Manufacturing industries and construction	43.73	29.63	18.39	12.61	9.65	8.01	7.19
1A3b Road transport	0.61	0.57	0.49	0.44	0.39	0.34	0.29
1A3a,c,d,e Non-road transport	0.16	0.26	0.30	0.32	0.32	0.31	0.23
1A4 Other sectors	128.07	101.59	56.57	29.31	18.48	10.38	3.40
1B Fugitive emissions from fuels	6.58	6.09	5.71	5.39	5.03	4.59	4.14
2A,B,C,H,I,J,K,L Industrial processes	8.93	9.02	9.27	9.32	9.56	9.46	9.52
2D, 2G Solvents and other products use	0.75	0.74	0.72	0.72	0.77	0.69	0.67
3B Manure management	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3D Agricultural soils	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3F,I Field burning of agricultural residues and	0.01	0.00	0.00	0.00	0.00	0.00	0.00
5 Waste	0.06	0.07	0.07	0.07	0.07	0.07	0.07
TOTAL	319.92	249.57	157.07	106.68	70.79	48.86	38.30

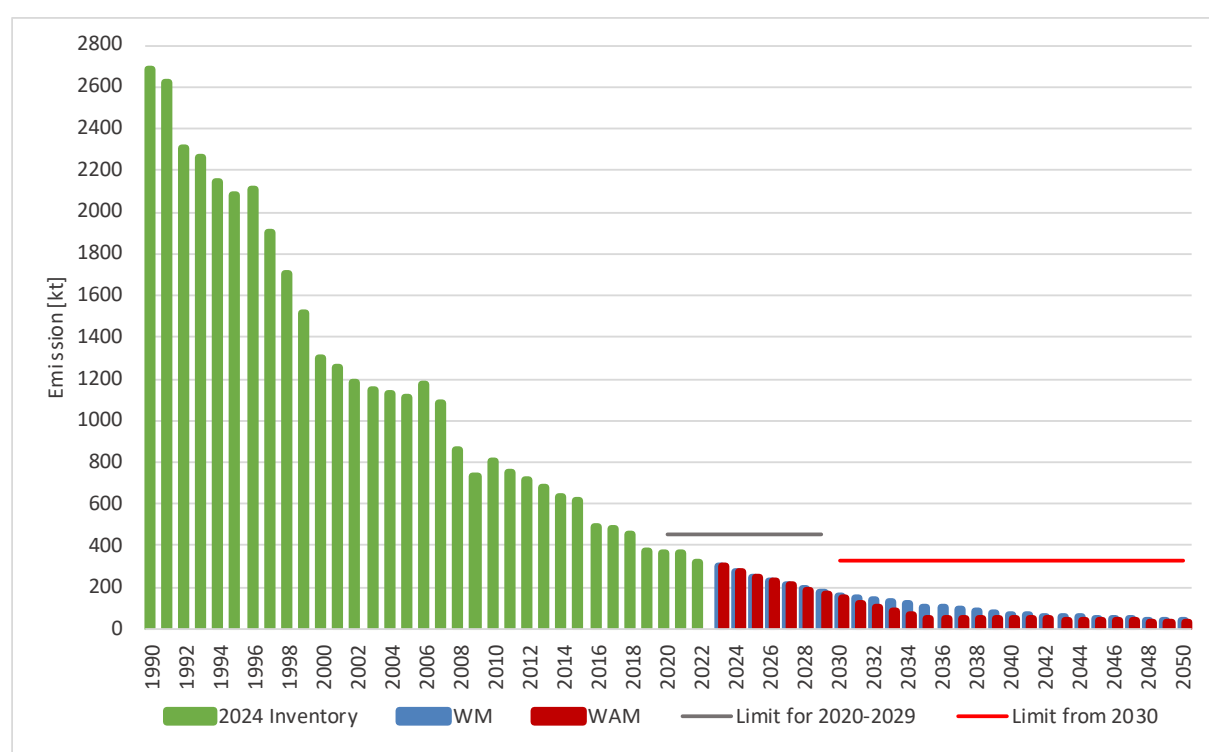
Table 9.50. Emission projections of SO₂ in WAM scenario [kt]

GNFR	SO ₂ emissions [kt]						
	2022	2025	2030	2035	2040	2045	2050
1A1 Energy industries	131.04	97.44	53.87	32.96	14.13	8.45	8.64
1A2 Manufacturing industries and construction	43.73	27.82	15.80	10.68	8.30	7.04	6.18
1A3b Road transport	0.61	0.57	0.50	0.44	0.38	0.32	0.27
1A3a,c,d,e Non-road transport	0.16	0.26	0.28	0.31	0.31	0.30	0.22
1A4 Other sectors	128.07	108.63	57.65	25.19	14.45	7.65	2.03
1B Fugitive emissions from fuels	6.58	5.93	5.57	5.24	4.81	4.33	3.88
2A,B,C,H,I,J,K,L Industrial processes	8.93	8.48	8.72	8.93	9.14	9.18	9.27
2D, 2G Solvents and other products use	0.75	0.75	0.71	0.71	0.79	0.69	0.67
3B Manure management	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3D Agricultural soils	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3F,I Field burning of agricultural residues and	0.01	0.00	0.00	0.00	0.00	0.00	0.00
5 Waste	0.06	0.06	0.06	0.06	0.06	0.06	0.06
TOTAL	319.92	249.95	143.18	84.51	52.39	38.03	31.23

The table below shows a comparison of SO₂ emissions for 2022, 2025, 2030, 2035, 2040, 2045 and 2050 compared to the emission ceilings specified in Annex II to the NEC Directive. According to the projections, Poland will meet the emission ceilings in all years of the forecast in both scenarios.

Table 9.51. Comparison of SO₂ emissions in 2022 and the projection years with the reduction levels required by the NEC Directive

	2005	2022	2025	2030	2035	2040	2045	2050
SO₂ emission [kt]								
National emission inventory 2024	1107	320						
Projections of national emissions for the WM scenario			250	157	107	71	49	38
Projections of national emissions for the WAM scenario			250	143	85	52	38	31
Emission reduction compared to 2005 [%]								
to be achieved by Poland in accordance with Directive 2016/2284		59%	64.5%	70%	70%	70%	70%	70%
in 2022 and projected in the WM scenario		71.1%	77.4%	85.8%	90.4%	93.6%	95.6%	96.5%
in 2022 and projected in the WAM scenario		71.1%	77.4%	87.1%	92.4%	95.3%	96.6%	97.2%

Figure 9.62. Historical and projected SO₂ emission trends in both scenarios compared with emission ceilings

9.2.3 Projected NMVOC emissions

Solvent use and other products use (NFR categories 2D and 2G) have the largest share (over 35%) in total emissions of NMVOC. The main source of emissions in this group is the use of paints. Other sectors (NFR 1A4) also have a significant share in the national NMVOC emission (30%). The main source of emissions in this category is the combustion of coal and wood.

It should be mentioned here that in accordance with Art. 4 of the NEC Directive, NMVOC emissions from sectors 3B (Manure management) and 3D (Agricultural soils) are not included in the reduction targets for EU Member States for 2020 and 2030.

The tables below summarize NMVOC emissions in 2022 and the NMVOC emission projections for 2025, 2030, 2035, 2040, 2045 and 2050 by categories in both scenarios.

Table 9.52. Emission projections of NMVOC in WM scenario [kt]

GNFR	NMVOC emissions [kt]						
	2022	2025	2030	2035	2040	2045	2050
1A1 Energy industries	3.22	3.41	3.37	3.08	2.54	1.85	1.71
1A2 Manufacturing industries and construction	36.07	38.39	35.96	33.88	32.42	31.29	30.48
1A3b Road transport	31.15	22.21	17.19	14.74	13.61	13.43	13.77
1A3a,c,d,e Non-road transport	0.54	1.60	1.79	1.87	1.57	1.60	1.38
1A4 Other sectors	148.35	97.11	47.16	7.76	6.79	5.80	4.89
1B Fugitive emissions from fuels	77.91	72.46	61.19	46.26	39.51	33.58	28.95
2A,B,C,H,I,J,K,L Industrial processes	14.37	16.61	16.81	16.56	16.74	16.46	16.55
2D, 2G Solvents and other products use	175.49	184.57	182.26	178.92	176.32	174.06	171.95
3B Manure management*							
3D Agricultural soils*							
3F,I Field burning of agricultural residues and	0.01	0.00	0.00	0.00	0.00	0.00	0.00
5 Waste	1.17	0.93	0.71	0.60	0.54	0.52	0.52
TOTAL	488.27	437.30	366.44	303.67	290.04	278.58	270.21

* NMVOC emissions from NFR 3B and 3D are not included in total in the analysis of compliance with reduction targets

Table 9.53. Emission projections of NMVOC in WAM scenario [kt]

GNFR	NMVOC emissions [kt]						
	2022	2025	2030	2035	2040	2045	2050
1A1 Energy industries	3.22	3.45	3.26	2.68	1.75	1.17	1.16
1A2 Manufacturing industries and construction	36.07	37.55	33.05	30.53	28.78	27.59	26.76
1A3b Road transport	31.15	22.21	19.35	16.06	12.85	11.87	11.76
1A3a,c,d,e Non-road transport	0.54	1.37	1.53	1.57	1.31	1.35	1.14
1A4 Other sectors	148.35	99.45	45.47	7.01	6.05	5.08	4.29
1B Fugitive emissions from fuels	77.91	73.13	56.45	44.39	33.35	28.76	26.01
2A,B,C,H,I,J,K,L Industrial processes	14.37	15.42	15.57	15.70	15.81	15.86	16.00
2D, 2G Solvents and other products use	175.49	184.57	182.26	178.92	176.32	174.06	171.95
3B Manure management*							
3D Agricultural soils*							
3F,I Field burning of agricultural residues and	0.01	0.00	0.00	0.00	0.00	0.00	0.00
5 Waste	1.17	0.92	0.68	0.56	0.48	0.44	0.41
TOTAL	488.27	438.07	357.61	297.43	276.72	266.18	259.49

* NMVOC emissions from NFR 3B and 3D are not included in total in the analysis of compliance with reduction targets

The table below shows a comparison of NMVOC emissions for 2022, 2025, 2030, 2035, 2040, 2045 and 2050 compared to the emission ceilings specified in Annex II to the NEC Directive. According to the projections, Poland will meet the emission ceilings in all years of the forecast in both scenarios.

Table 9.54. Comparison of NMVOC emissions in 2022 and the projection years with the reduction levels required by the NEC Directive

	2005	2022	2025	2030	2035	2040	2045	2050
NMVOC emission [kt]								
National emission inventory 2024	675	488						
Projections of national emissions for the WM scenario			437	366	304	290	279	270
Projections of national emissions for the WAM scenario			438	358	297	277	266	259
Emission reduction compared to 2005 [%]								
to be achieved by Poland in accordance with Directive 2016/2284		25%	25.5%	26%	26%	26%	26%	26%
in 2022 and projected in the WM scenario		27.7%	35.2%	45.7%	55.0%	57.0%	58.7%	60.0%
in 2022 and projected in the WAM scenario		27.7%	35.1%	47.0%	56.0%	59.0%	60.6%	61.6%

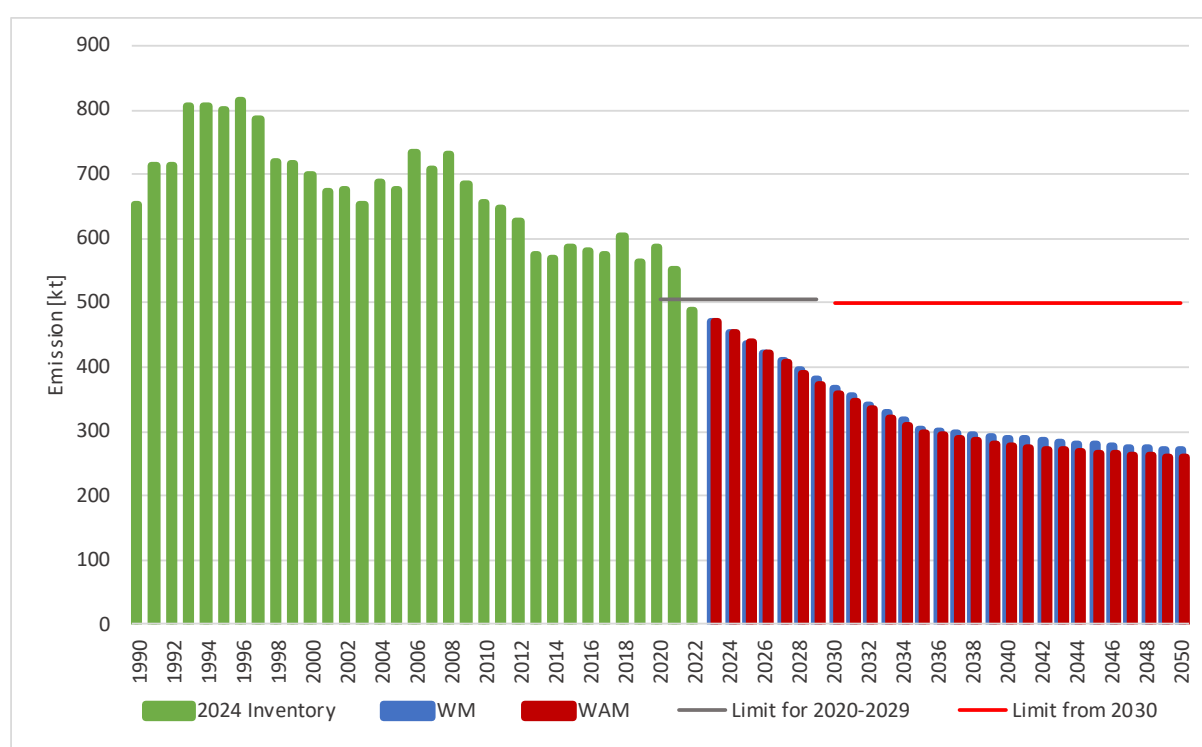


Figure 9.63. Historical and projected NMVOC emission trends in both scenarios compared with emission ceilings

9.2.4 Projected NH₃ emissions

The main source (approx. 96%) of ammonia emissions in 2022 was agriculture (NFR 3), of which two sources had the largest share in emission: livestock manure responsible for 46% of emissions in this sector (cat. 3B) and agricultural soils - including the use of natural and mineral fertilizers - (cat. 3D), which accounted for 49% of emissions.

Due to the fact that agriculture is the main source of ammonia emissions, and in the WM scenario the projected NH₃ emissions do not show a sufficient reduction in 2030, despite taking into account the currently undertaken reduction measures (indicated in the inventory report), a scenario with additional measures (WAM) for this sector was also prepared. It includes additional activities contributing to the reduction of NH₃ emissions in the agricultural

soils sector, indicated by the Ministry of Agriculture and Rural Development in the National Air Pollution Control Plan (NAPCP), which would be implemented by 2030 at the latest:

- 60% of slurry applied to soils with using low-emission spreading techniques,
- 90% of manure plowed in within 12 hours;

In addition, with regard to mineral fertilizers, two scenarios were used related to the amendment to the Fertilizers and Fertilization Act of 2020, indicating the need to use urea in granulated form only with a urease inhibitor or with a biodegradable coating. In the case of the WM scenario, it was assumed that the share of inhibitors and biodegradable coatings in urea would be 50% each, while in the case of the WAM scenario: 75% with an inhibitor, 25% coated.

The tables below summarize NH₃ emissions in 2022 and NH₃ emission projections for 2025, 2030, 2035, 2040, 2045 and 2050 by categories in both scenarios.

Table 9.55. Emission projections of NH₃ in WM scenario [kt]

GNFR	NH ₃ emissions [kt]						
	2022	2025	2030	2035	2040	2045	2050
1A1 Energy industries	0.02	0.02	0.02	0.03	0.03	0.03	0.03
1A2 Manufacturing industries and construction	0.08	0.12	0.12	0.12	0.12	0.12	0.12
1A3b Road transport	4.08	3.05	2.67	2.55	2.31	2.10	1.88
1A3a,c,d,e Non-road transport	0.001	0.002	0.002	0.002	0.002	0.002	0.001
1A4 Other sectors	0.41	0.27	0.14	0.03	0.02	0.02	0.02
1B Fugitive emissions from fuels	0.03	0.03	0.03	0.03	0.03	0.03	0.03
2A,B,C,H,I,J,K,L Industrial processes	3.82	3.86	4.07	4.29	4.52	4.77	5.03
2D, 2G Solvents and other products use	0.17	0.19	0.16	0.15	0.13	0.13	0.13
3B Manure management	129.13	130.90	135.44	138.87	140.30	143.12	145.35
3D Agricultural soils	136.13	138.95	139.11	139.57	137.34	136.30	133.65
3F,I Field burning of agricultural residues and	0.03	0.02	0.02	0.02	0.02	0.02	0.02
5 Waste	3.24	3.33	4.48	5.67	5.84	5.84	5.74
TOTAL	277.15	280.74	286.26	291.31	290.67	292.48	292.00

Table 9.56. Emission projections of NH₃ in WAM scenario [kt]

GNFR	NH ₃ emissions [kt]						
	2022	2025	2030	2035	2040	2045	2050
1A1 Energy industries	0.02	0.02	0.02	0.02	0.03	0.03	0.03
1A2 Manufacturing industries and construction	0.08	0.12	0.11	0.11	0.11	0.11	0.11
1A3b Road transport	4.08	3.05	2.79	2.63	2.37	2.01	1.71
1A3a,c,d,e Non-road transport	0.001	0.002	0.002	0.002	0.002	0.002	0.001
1A4 Other sectors	0.41	0.29	0.14	0.03	0.02	0.02	0.02
1B Fugitive emissions from fuels	0.03	0.03	0.03	0.03	0.03	0.03	0.03
2A,B,C,H,I,J,K,L Industrial processes	3.82	3.86	4.07	4.29	4.52	4.77	5.03
2D, 2G Solvents and other products use	0.17	0.19	0.16	0.15	0.13	0.13	0.13
3B Manure management	129.13	130.61	131.54	133.62	134.43	135.09	136.45
3D Agricultural soils	136.13	137.24	131.37	129.89	125.39	120.99	116.42
3F,I Field burning of agricultural residues and	0.03	0.02	0.02	0.02	0.02	0.02	0.02
5 Waste	3.24	3.33	4.47	5.66	5.83	5.83	5.73
TOTAL	277.15	278.75	274.74	276.46	272.89	269.02	265.68

The table below shows NH₃ emissions for 2022, 2025, 2030, 2035, 2040, 2045 and 2050 compared to the emission ceilings specified in Annex II to the NEC Directive. Achieving the ammonia reduction target of 17% in 2035 will require additional measures in the management of both organic and mineral fertilisers.

Table 9.57. Comparison of NH₃ emissions in 2022 and the projection years with the reduction levels required by the NEC Directive*

	2005	2022	2025	2030	2035	2040	2045	2050
NH₃ emission [kt]								
National emission inventory 2024	332	277						
Projections of national emissions for the WM scenario			281	286	291	291	292	292
Projections of national emissions for the WAM scenario			279	275	276	273	269	266
Emission reduction compared to 2005 [%]								
to be achieved by Poland in accordance with Directive 2016/2284		1%	9.0%	17%	17%	17%	17%	17%
in 2022 and projected in the WM scenario		16.6%	15.5%	13.9%	12.4%	12.5%	12.0%	12.1%
in 2022 and projected in the WAM scenario		16.6%	16.1%	17.3%	16.8%	17.9%	19.1%	20.1%

* insufficient emission reductions are marked in red

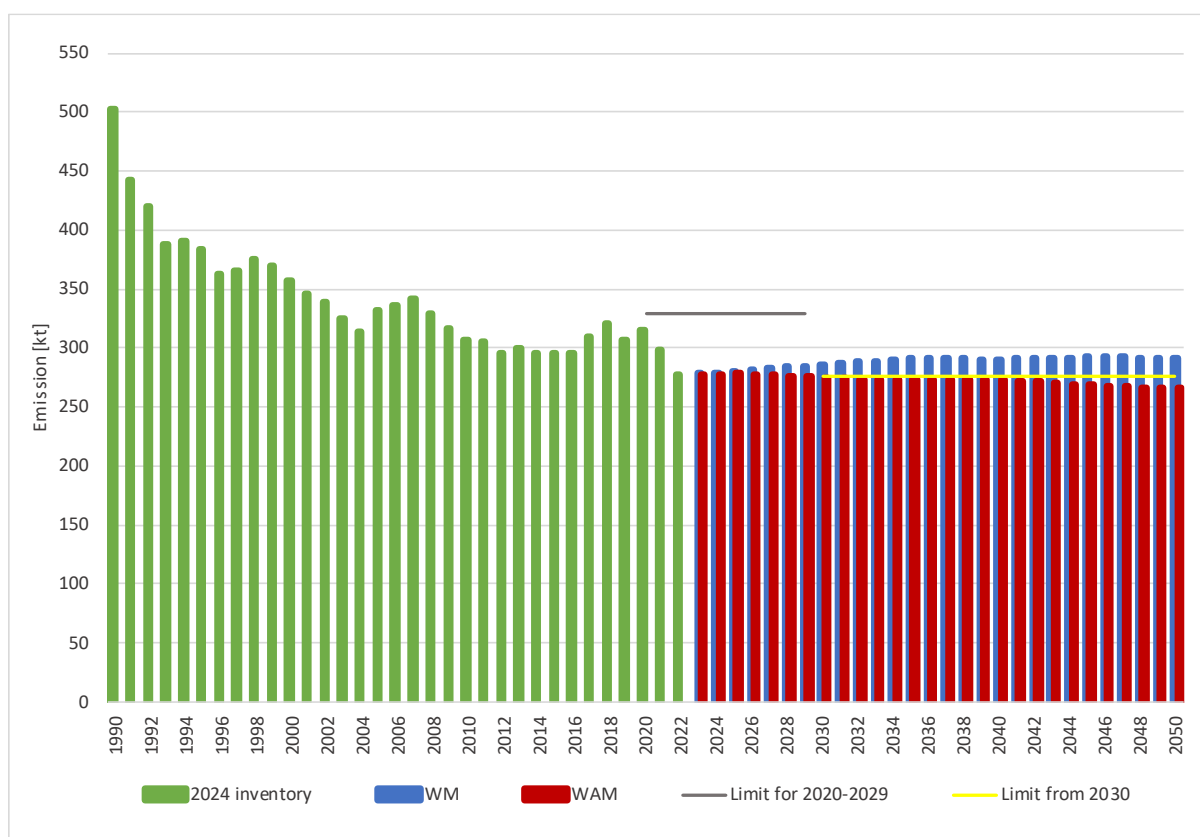


Figure 9.64. Historical and projected NH₃ emission trends in both scenarios compared with emission ceilings

9.2.5 Projected PM_{2.5} emissions

The main source of stationary PM_{2.5} emissions in Poland are fuel combustion processes (NFR 1A). The largest sources of PM_{2.5} emissions are coal and wood combustion in *Other sectors*

(NFR 1A4) and fuel combustion in *Manufacturing industries and construction* (NFR 1A2). A noticeable part of the emissions is also generated from road transport (NFR 1A3b).

The tables below summarize PM_{2.5} emissions in 2022 and the PM_{2.5} emission projections for 2025, 2030, 2035, 2040, 2045 and 2050 by categories in both scenarios.

Table 9.58. Emission projections of PM_{2.5} in WM scenario [kt]

GNFR	PM _{2.5} emissions [kt]						
	2022	2025	2030	2035	2040	2045	2050
1A1 Energy industries	2.75	2.40	1.81	1.53	1.01	0.62	0.52
1A2 Manufacturing industries and construction	8.23	6.61	4.94	4.01	3.53	3.23	3.08
1A3b Road transport	10.43	10.01	8.22	6.98	6.35	5.42	4.87
1A3a,c,d,e Non-road transport	0.15	0.39	0.43	0.45	0.37	0.38	0.33
1A4 Other sectors	221.98	143.76	66.70	8.40	7.07	5.78	4.61
1B Fugitive emissions from fuels	1.52	1.38	1.13	0.89	0.80	0.74	0.70
2A,B,C,H,I,J,K,L Industrial processes	6.97	7.16	7.34	7.48	7.69	7.83	8.04
2D, 2G Solvents and other products use	1.60	1.77	1.63	1.50	1.39	1.39	1.39
3B Manure management	2.30	2.29	2.41	2.48	2.53	2.56	2.61
3D Agricultural soils	1.54	1.55	1.55	1.52	1.51	1.49	1.48
3F,I Field burning of agricultural residues and	0.06	0.05	0.05	0.05	0.05	0.05	0.05
5 Waste	4.73	4.46	4.42	4.43	4.45	4.47	4.49
TOTAL	262.26	181.82	100.64	39.72	36.77	33.99	32.17

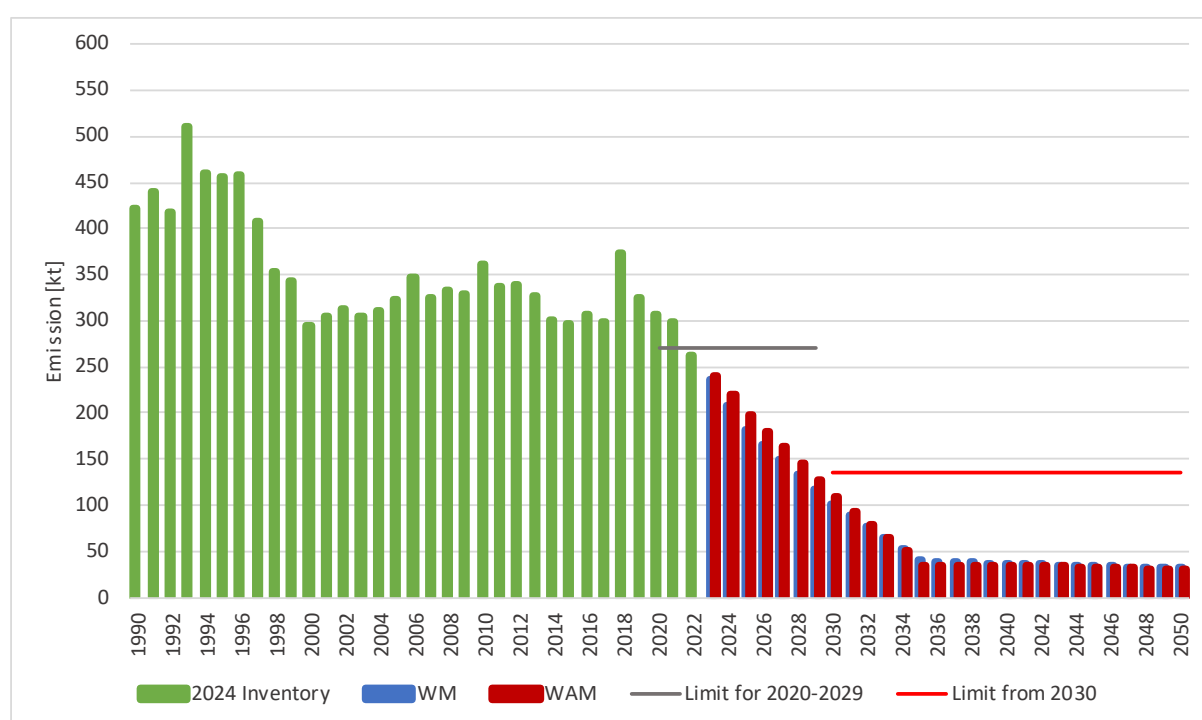
Table 9.59. Emission projections of PM_{2.5} in WAM scenario [kt]

GNFR	PM _{2.5} emissions [kt]						
	2022	2025	2030	2035	2040	2045	2050
1A1 Energy industries	2.75	2.21	1.36	0.96	0.55	0.27	0.27
1A2 Manufacturing industries and construction	8.23	6.29	4.36	3.51	3.11	2.87	2.74
1A3b Road transport	10.43	10.01	8.40	6.91	6.27	5.24	4.76
1A3a,c,d,e Non-road transport	0.15	0.38	0.42	0.44	0.36	0.37	0.32
1A4 Other sectors	221.98	161.40	75.69	8.31	7.03	5.58	4.38
1B Fugitive emissions from fuels	1.52	1.33	1.03	0.85	0.73	0.70	0.68
2A,B,C,H,I,J,K,L Industrial processes	6.97	6.97	7.13	7.31	7.51	7.70	7.92
2D, 2G Solvents and other products use	1.60	1.77	1.63	1.50	1.39	1.39	1.39
3B Manure management	2.30	2.29	2.40	2.41	2.44	2.45	2.45
3D Agricultural soils	1.54	1.54	1.52	1.49	1.46	1.43	1.40
3F,I Field burning of agricultural residues and	0.06	0.05	0.05	0.05	0.05	0.05	0.05
5 Waste	4.73	4.43	4.32	4.31	4.26	4.21	4.11
TOTAL	262.26	198.66	108.32	38.03	35.17	32.28	30.47

The table below shows a comparison of PM_{2.5} emissions for 2022, 2025, 2030, 2035, 2040, 2045 and 2050 compared to the emission ceilings specified in Annex II to the NEC Directive. According to the projections, Poland will meet the emission ceilings in all years of the forecast in both scenarios.

Table 9.60. Comparison of PM_{2.5} emissions in 2022 and the projection years with the reduction levels required by the NEC Directive

	2005	2022	2025	2030	2035	2040	2045	2050
PM_{2.5} emission [kt]								
National emission inventory 2024	323	262						
Projections of national emissions for the WM scenario			182	101	40	37	34	32
Projections of national emissions for the WAM scenario			199	108	38	35	32	30
Emission reduction compared to 2005 [%]								
to be achieved by Poland in accordance with Directive 2016/2284		16%	37.0%	58%	58%	58%	58%	58%
in 2022 and projected in the WM scenario		18.8%	43.7%	68.8%	87.7%	88.6%	89.5%	90.0%
in 2022 and projected in the WAM scenario		18.8%	38.5%	66.5%	88.2%	89.1%	90.0%	90.6%

Figure 9.65. Historical and projected PM_{2.5} emission trends in both scenarios compared with emission ceilings

9.2.6 Projected BC emissions

The main source of stationary BC emissions in Poland are fuel combustion processes. The largest sources of BC emissions are the combustion of hard coal and wood in other sectors (NFR 1A4). A significant volume of BC emissions is also generated from road transport (NFR 1A3b).

The tables below summarize BC emissions in 2022 and the BC emission projections for 2025, 2030, 2035, 2040, 2045 and 2050 by categories for both scenarios.

Table 9.61. Emission projections of BC in WM scenario [kt]

GNFR	BC emissions [kt]						
	2022	2025	2030	2035	2040	2045	2050
1A1 Energy industries	0.14	0.13	0.12	0.11	0.09	0.07	0.07
1A2 Manufacturing industries and construction	0.29	0.21	0.17	0.14	0.13	0.12	0.12
1A3b Road transport	4.25	4.09	3.02	2.23	1.67	1.31	1.08
1A3a,c,d,e Non-road transport	0.08	0.23	0.26	0.26	0.21	0.22	0.19
1A4 Other sectors	9.94	6.78	3.48	1.02	0.91	0.81	0.71
1B Fugitive emissions from fuels	0.25	0.25	0.25	0.25	0.25	0.25	0.24
2A,B,C,H,I,J,K,L Industrial processes	0.06	0.06	0.06	0.06	0.06	0.06	0.06
2D, 2G Solvents and other products use	0.50	0.55	0.48	0.42	0.38	0.38	0.38
3B Manure management	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3D Agricultural soils	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3F,I Field burning of agricultural residues and	0.01	0.00	0.00	0.00	0.00	0.00	0.00
5 Waste	0.68	0.67	0.65	0.66	0.67	0.67	0.68
TOTAL	16.18	12.96	8.50	5.16	4.38	3.90	3.53

Table 9.62. Emission projections of BC in WAM scenario [kt]

GNFR	BC emissions [kt]						
	2022	2025	2030	2035	2040	2045	2050
1A1 Energy industries	0.14	0.12	0.10	0.08	0.07	0.05	0.05
1A2 Manufacturing industries and construction	0.29	0.21	0.15	0.13	0.11	0.10	0.09
1A3b Road transport	4.25	4.09	3.13	2.10	1.39	1.04	0.86
1A3a,c,d,e Non-road transport	0.08	0.23	0.25	0.26	0.21	0.22	0.18
1A4 Other sectors	9.94	7.58	3.91	1.00	0.90	0.78	0.69
1B Fugitive emissions from fuels	0.25	0.24	0.24	0.24	0.24	0.24	0.24
2A,B,C,H,I,J,K,L Industrial processes	0.06	0.05	0.05	0.06	0.06	0.06	0.06
2D, 2G Solvents and other products use	0.50	0.55	0.48	0.42	0.38	0.38	0.38
3B Manure management	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3D Agricultural soils	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3F,I Field burning of agricultural residues and	0.01	0.00	0.00	0.00	0.00	0.00	0.00
5 Waste	0.68	0.67	0.65	0.66	0.67	0.67	0.68
TOTAL	16.18	13.72	8.97	4.95	4.02	3.55	3.23

For BC, no emission reduction targets are specified in Annex II to Directive 2016/2284.

Table 9.63. Comparison of PM2.5 emissions in 2022 and the projection years with the emission in 2005

	2005	2022	2025	2030	2035	2040	2045	2050
BC emission [kt]								
National emission inventory 2024	22	16						
Projections of national emissions for the WM scenario			13	8	5	4	4	4
Projections of national emissions for the WAM scenario			14	9	5	4	4	3
Emission reduction compared to 2005 [%]								
in 2022 and projected in the WM scenario		25.9%	40.7%	61.1%	76.4%	80.0%	82.2%	83.8%
in 2022 and projected in the WAM scenario		25.9%	37.3%	59.1%	77.6%	82.0%	84.3%	85.9%

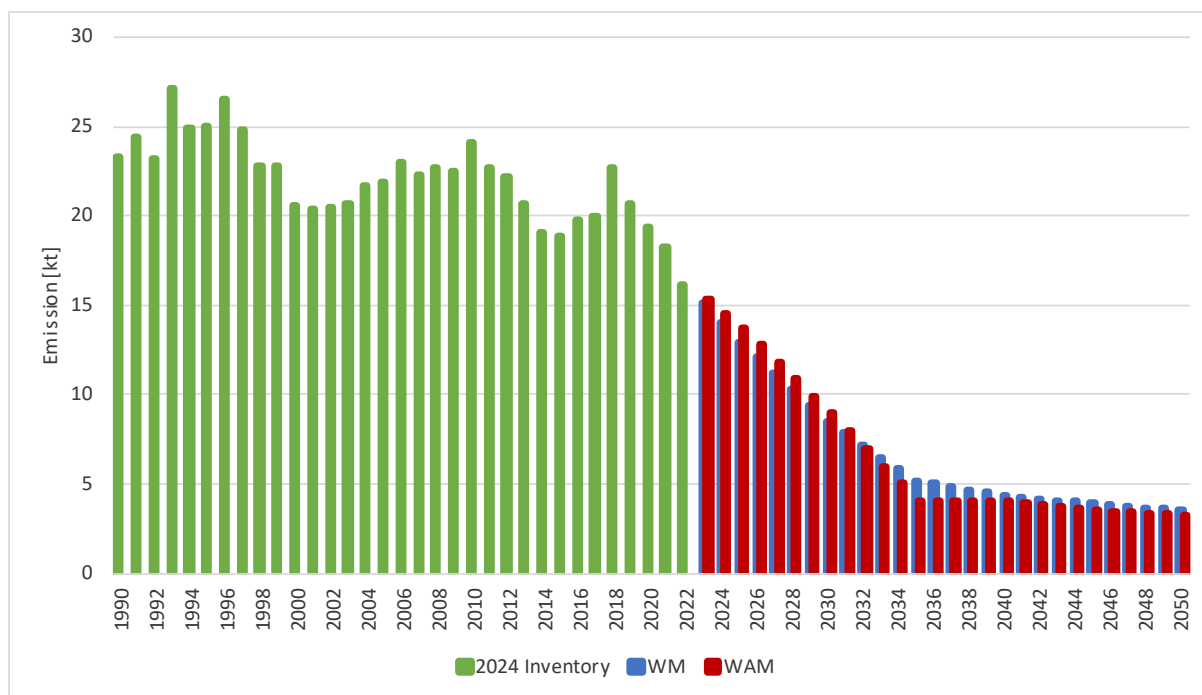


Figure 9.66. Historical and projected emission trends of BC in both scenarios

9.3 Summary

This chapter presents emission projections of selected pollutants (NO_x, SO₂, NMLZO, PM_{2.5}, NH₃ and BC) in the years 2025-2050 and their projected reductions since 2005. These reductions were compared to the minimum reduction requirements specified for Poland in the NEC Directive. In order to illustrate the trend, the paper also presents historical emissions since 1990.

Based on the adopted assumptions and the obtained emission projection results, it was estimated that in the projection years the emission ceilings specified in the NEC Directive will be met for all pollutants in the WAM scenario except for NH₃ in 2035, with NH₃ emissions in that year almost reaching the level required by the Directive.

It should be emphasized that for all air pollutants except ammonia, the greatest impact on the predicted emissions have the activity projections included in the 2024 update of the NECP PL. The projected fuel consumption included in the updated NECP PL decreases significantly over time, both in the WM and WAM scenarios. These decreases result in a significant projected decrease in pollutant emissions (except for ammonia).

10 GRIDDED EMISSIONS AND LPS

According to Table C in Annex I of NEC Directive EU Member States are obliged to report spatially allocated emissions (gridded data) and Large Point Sources (LPS) every four years, starting from 2017.

Following NECD obligations Poland submitted gridded and LPS data in 2025, and will submit next updated data by May 1st, 2029.

10.1 Gridded emissions

Last submission: 30.04.2025

The methodology used in the emissions mapping follows the 2023 EMEP/EEA emission inventory guidebook.

Mandatory reporting of gridded emissions covers 15 pollutants: NO_x (as NO₂), NMVOC, SO_x (as SO₂), NH₃, PM_{2.5}, PM₁₀, BC, CO, Pb, Cd, Hg, PCDD/PCDF, PAHs, HCB and PCBs. The grid data includes all emissions, including those reported in the LPS.

Data from various sources is converted to 0.1°x0.1° (long-lat) grid definition by means of Python programming language and PostGIS (an open source software program that adds support for geographic objects to the PostgreSQL object-relational database.)

The gridded emission sums for each NFR are aggregated to the GNFR gridded fields.

Table 10.1. Main data sources

Data owner	Data set	Contents
KOBiZE IOŚ-PIB	National Emission Database (NED)	National Emission Database IT system for reporting entities - built and maintained by KOBiZE since 2010. The user shall draw up and upload a report via internet for the previous calendar year. The base is updated annually.
KOBiZE IOŚ-PIB	Central Emission Database	Databases of surface, linear and point emissions, including the developed methodologies for determining the amount of these emissions and the collected data necessary to determine them for the purposes of mathematical modeling.
Main Office of Geodesy and Cartography	BDOT10K	A vector (object-oriented) database containing the spatial location of topographic objects along with their characteristics. The content and detail of the BDOT10k database corresponds to the topographic map in the scale 1: 10 000.
European Environmental Agency (EEA).	CORINE Land Cover (CLC)	Organized hierarchically in three levels of land cover class.
Statistics Poland	Population density	Data on the distribution of the population in 1 km ² obtained during the 2011 National Census of Population and Housing.
Gas Transmission Operator GAZ-SYSTEM S.A.	Information Exchange System	Map of transmission system.
The Council of Ministers of the Republic of Poland	Polish Classification of Business Activities	A conventionally adopted, hierarchically structured division of a set of types of socio-economic activity that is performed by individuals (economic entities).
Main Headquarters of the State Fire Service	3_2. Fires according to the facility code, occurrence by province, district, commune	Fires according to the facility code, occurrence by province, district, commune.



The detailed description of the methodology for each of the GNFR categories has been presented below.

10.1.1 Public power (GNFR A_PublicPower)

Detailed location information for this sector is available for large point sources. The remaining emissions have been disaggregated by the population density and location data of heat plants based on BDOT10K.

10.1.2 Industry (GNFR B_Industry)

This sector comprises many different categories of sources and therefore the available spatial data differ in individual categories. It includes categories related to combustion as well as production and transport of products.

The spatial distribution of emissions was made according to the following methodology:

- 1) The domestic emission for each NFR category was decreased by the LPS emission value.
 - If for a given pollutant the LPS emission exceeded the emission in a given NFR category, the national emission of each NFR in B_Industry was reduced proportionally to its share in B_Industry.
 - If for a given pollutant the LPS emission exceeded the total emission of this substance in B_Industry, then each NFR category in B_Industry was assigned an emission value equal to zero.
- 2) Then the emission of each substance, if its value is greater than zero, is broken down as follows:
 - 2A5b and 2D3c - Population density is used as an indicator of spatial distribution.
 - For the remaining NFR, point sources are used for the spatial distribution of emissions, the data comes from the National Emission Database, selected on the basis of NACE Rev. 2 and weighted by the emissions sent by them.

Ultimately, each field of the grid for B_Industry contains the sum of the emissions from NFR and LPS of a given field included in B_Industry.

10.1.3 Other stationary combustion (GNFR C_OtherStationaryComb)

This GNFR category covers combustion in three subsectors, i.e. commercial/institutional, residential and agriculture. The most important subsector in terms of emission is residential combustion.

For commercial/institutional plants, the distribution of emissions has been calculated using a surrogate based on the population density and the location of heat plants derived from BDOT10K.

For the distribution of emissions in the residential subsector, Poland has data on fuel mixes used in local administrative units (municipalities). The data comes from the official census kept by the Central Statistical Office and local information (e.g. city data). Each residential building

is assigned a fuel mix (coal, wood, gas, fuel oil) of the municipality or the fuel demand is 0 if the building is connected to a heating network or has more than 6 floors. The amount of emissions from the building is calculated on the basis of the area, number of stores, number of heating degrees days (HDD - data from the GEM-AQ model) and emission factors assigned to individual fuels. The sum of the emissions of buildings is aggregated to the grid area.

For the distribution of emissions from agriculture data on land use classes from CORINE Land Cover were used.

10.1.4 Fugitive Emissions (GNFR D_Fugitive)

This sector covers categories estimated as point sources (e.g. coal mining/handling, service stations and flaring) as well as area sources (e.g. natural gas distribution).

In most categories, the locations and production volumes derived from the NED were used to prepare surrogates for disaggregating emissions. For the remaining categories, the population density and location of mines based on BDOT10K were used.

10.1.5 Solvents (GNFR E_Solvents)

The spatial distribution of emissions was made according to the following methodology:

- 1) The domestic emission for each NFR category was decreased by the LPS emission value.
 - If for a given pollutant the LPS emission exceeded the emission in a given NFR category, the domestic emission of each NFR in E_Solvents was reduced proportionally to its share in E_Solvents.
 - If for a given pollutant the LPS emission exceeded the total emission of this substance in E_Solvents, then each NFR category in E_Solvents was assigned an emission value of zero.
- 2) Then the emission of each substance, if its value is greater than zero, is broken down as follows:
 - 2D3a, 2D3d, 2D3i and 2G - Population density is used as the distribution index.
 - 2D3e, 2D3f, 2D3g and 2D3h - point sources are used for the spatial distribution of emissions, the data comes from the National Emission Database and selected on the basis of NACE Rev. 2 and weighted by the emissions sent by them.

Ultimately, each of the grid fields for E_Solvents contains the sum of the emissions from NFR and LPS of a given field included in E_Solvents.

10.1.6 Road transport (GNFR F_RoadTransport)

The distribution of emissions in the GNFR has been developed based on a surrogate obtained from the Central Emission Base and advanced modeling methods, using e.g. BDOT10k, national traffic model, polynomial equations determined using COPERT 5, population density and the average number of vehicles per capita in a county.

10.1.7 National navigation (GNFR G_Shipping)

Distribution of emissions in the GNFR G (Shipping) is based on data on ship traffic intensity from the Baltic Marine Environment Protection Commission (HELCOM).

10.1.8 Aviation (LTO) (GNFR H_Aviation)

The distribution of emissions from Aviation is based on data from Statistics Poland. The share of traffic at individual airports in domestic and international traffic was calculated according to the following formulas:

- share of domestic traffic at airport_n (URKn) = total domestic traffic at airport_n / total domestic traffic for all airports,
- share of international traffic at airport_n (URMn) = total international traffic at airport_n / total international traffic for all airports.

10.1.9 Off road mobile sources (GNFR I_Offroad)

This GNFR category comprises several different activities such as railways, fishing and agricultural machinery.

The spatial distribution of emissions was made according to the following methodology:

- 1A3c (Railways) - all railway lines with non-electrified traction are downloaded from the Database of Topographic Objects (official data of the Head Office of Geodesy and Cartography), in each grid field the percentage of the line length in the grid area in the total length of the railway lines is calculated. The value of the emissions in each field is the calculated percentage multiplied by the national emissions.
- 1A3ei (Pipeline transport) - data on the location and capacity of gas pipelines are collected from the entity responsible for the transmission of natural gas in Poland. In each field of the grid, the percentage of the length of the gas pipelines in the total length of the gas pipeline lines (taking into account the diameter of the gas pipelines) is calculated. The value of the emissions in each field is the calculated percentage multiplied by the national emissions.
- 1A4cii (Agriculture / Forestry / Fishing: Off-road vehicles and other machinery) - all areas marked as 2 Farmland and 31 Forests are retrieved from the CORINE Land Cover database. For each area of the grid, the percentage of the areas with CLC in the mesh area in the total area of the areas with CLC is calculated. The value of the emissions in each field is the calculated percentage multiplied by the national emissions.
- 1A4ciii (Agriculture / Forestry / Fishing: National fishing) - from the Database of Topographic Objects (official data of the Head Office of Geodesy and Cartography), data on the location of all water ports are collected. For each grid box, the percentage of the number of water ports in the grid box in the total number of water ports is calculated. The value of the emissions in each field is the calculated percentage multiplied by the national emissions.

10.1.10 Waste (GNFR J_Waste)

Locations and production volumes taken from the NED were used to prepare surrogates for

disaggregating emissions in several categories. Information on the location and area of crematoria and landfills was determined based on BDOT10k. In addition, population density, data on land use classes from CORINE Land Cover and data on fires from the National Headquarters of the State Fire Service were used.

10.1.11 Agricultural livestock (GNFR K_AgriLivestock)

The distribution of emissions in the GNFR K has been developed based on a surrogate obtained from the Central Emission Base and advanced modeling methods, using e.g. livestock population - data of the General Agricultural Census from the Local Data Bank run by Statistics Poland.

10.1.12 Agricultural soils (GNFR L_AgriOther)

The distribution of emissions in the GNFR L has been developed based on data on different land use classes from CORINE Land Cover.

10.1.13 Natural emissions (GNFR N_natural)

The distribution of emissions in the GNFR N has been developed based on the surrogate obtained from data on land use classes from CORINE Land Cover and data on fires from the National Headquarters of the State Fire Service.

10.1.14 Aviation (Cruise) (GNFR O_AviCruise)

The distribution of emissions from Aviation is based on data from Statistics Poland. The share of traffic at individual airports in domestic and international traffic was calculated according to the following formulas:

- share of domestic traffic at airport_n (URK_n) = total domestic traffic at airport_n / total domestic traffic for all airports,
- share of international traffic at airport_n (URM_n) = total international traffic at airport_n / total international traffic for all airports.

10.1.15 International navigation (GNFR P_IntShipping)

The distribution of emissions in the GNFR P is based on data on ship traffic intensity from the Baltic Marine Environment Protection Commission (HELCOM).

10.1.16 Results of gridded data

This chapter presents the EMEP grid results for the main pollutants NO_x, SO₂, NMVOC, NH₃ and PM_{2.5} for 2023.

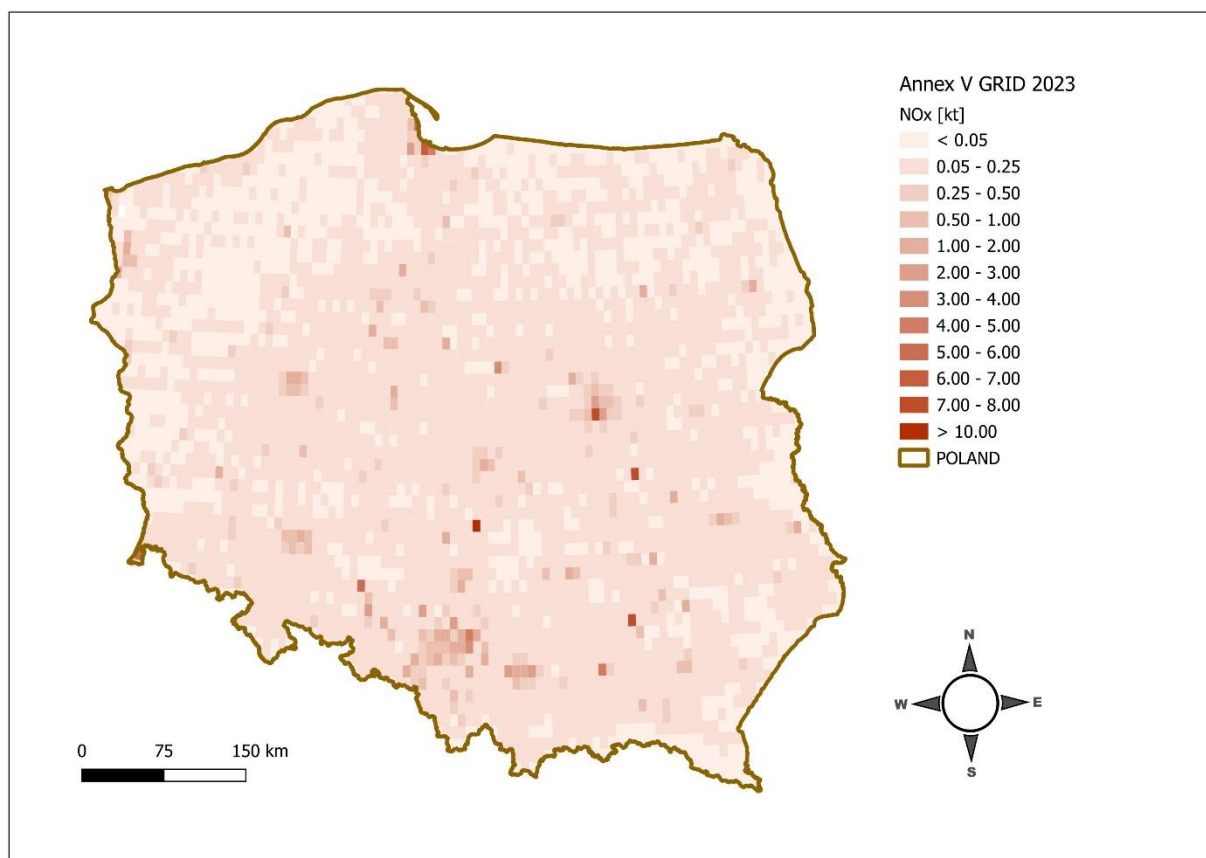


Figure 10.1. Spatial distribution of NOx emissions in 2023

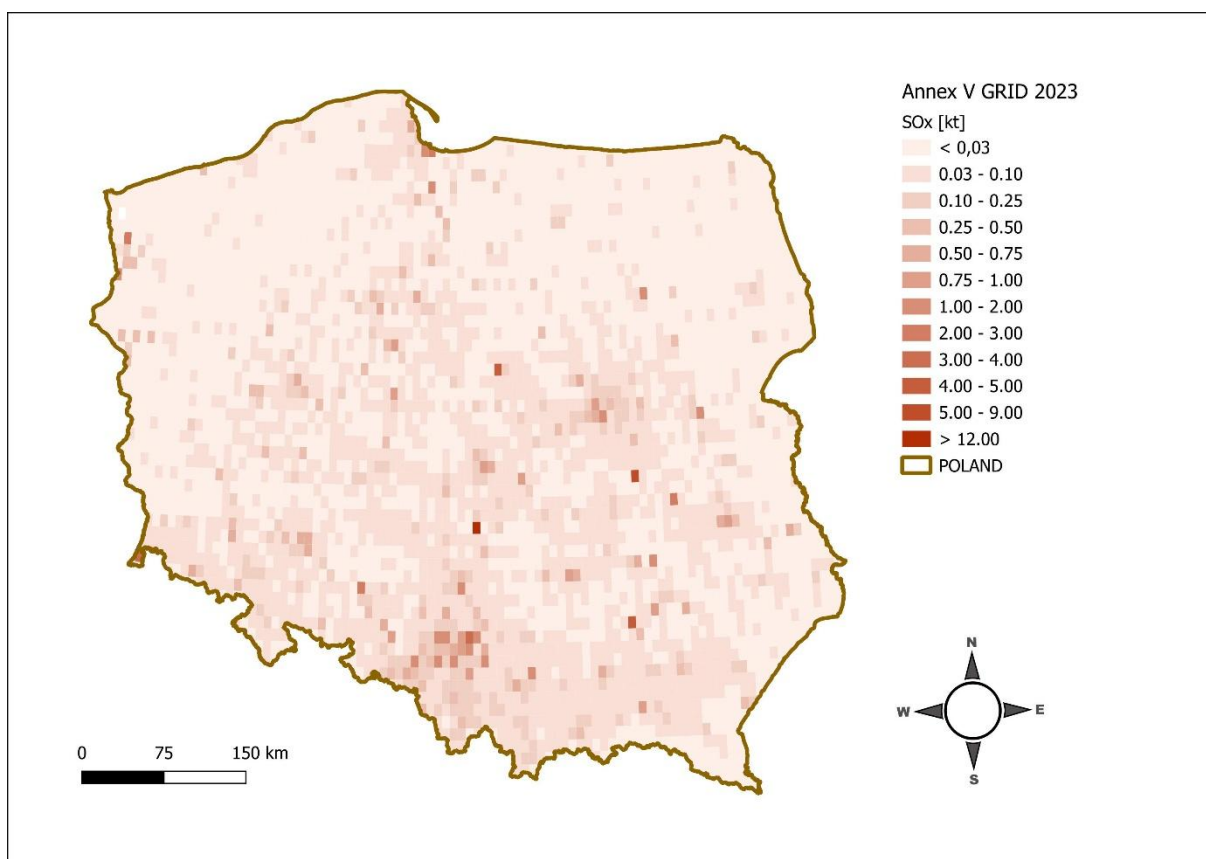


Figure 10.2. Spatial distribution of SOx emissions in 2023

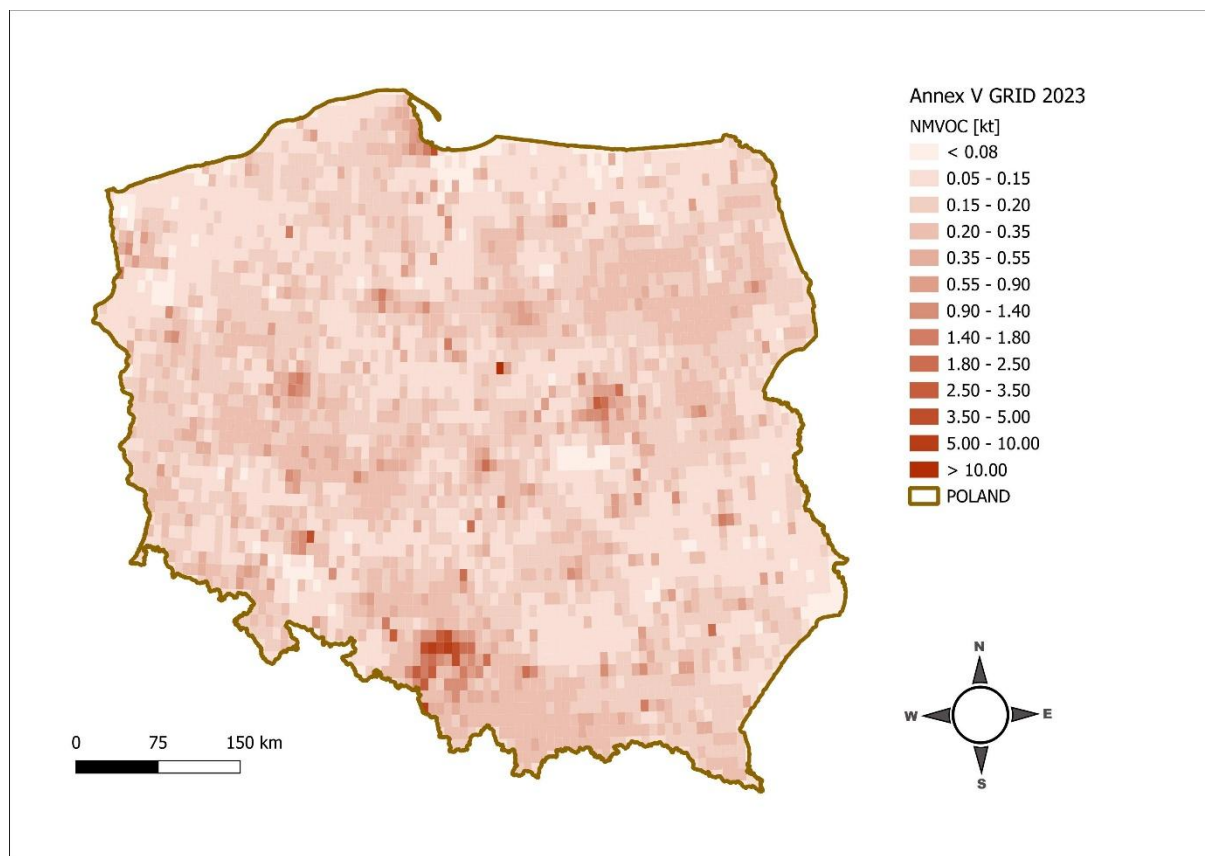


Figure 10.3. Spatial distribution of NMVOC emissions in 2023

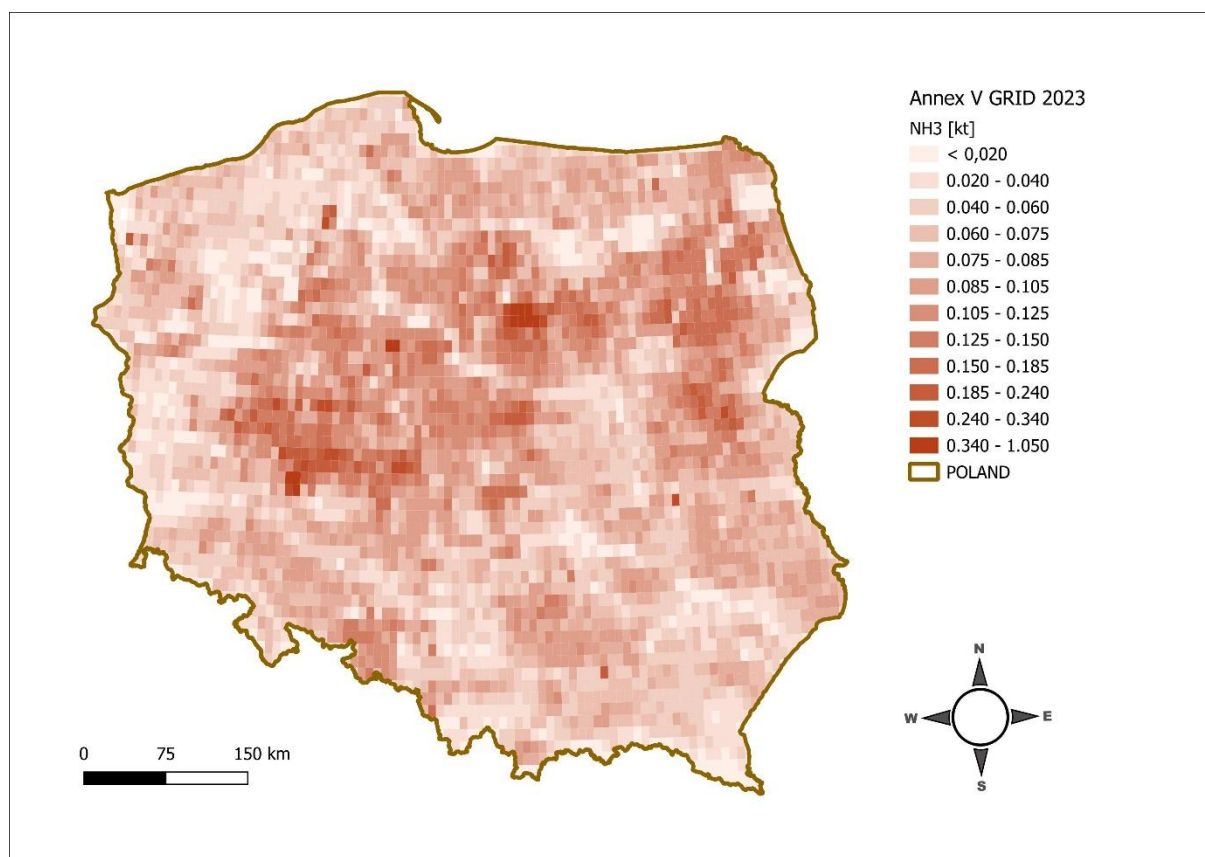
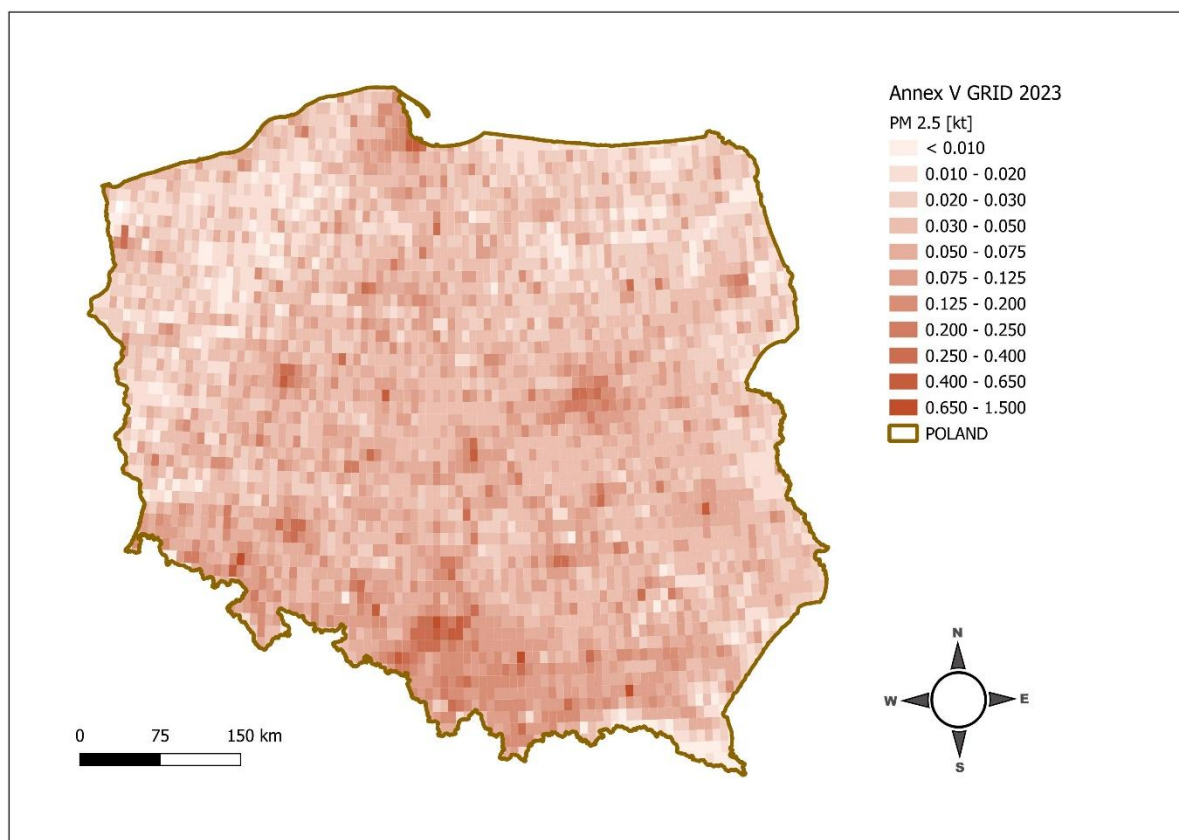


Figure 10.4. Spatial distribution of NH₃ emissions in 2023

Figure 10.5. Spatial distribution of PM_{2.5} emissions in 2023

10.2 LPS data

Last submission: 30.04.2025

Large point sources (LPS): LPS are defined in the EMEP reporting guidelines as facilities, whose combined emissions, within the limited identifiable area of the site premises, exceed pollutant emission thresholds presented in table below.

Table 10.2. List of pollutants to be reported for an LPS if the applicable threshold value is exceeded, based on thresholds specified in annex II to the E-PRTR Regulation

Pollutants	Thresholds in kilograms per year (kg/year)
SO ₂	150 000
NO _x	100 000
CO	500 000
NMVOC	100 000
NH ₃	10 000
PM _{2.5}	50 000
PM ₁₀	50 000
Pb	200
Cd	10
Hg	10
PAHs	50
PCDD/F	0.0001
HCB	10
PCBs	0.1

Emissions are aggregated from individual sites / processes in the facility as long as they are consistent with GNFR sector aggregations and are assigned to the appropriate stack height classes specified in the table below.

A set of LPS, GNFR and height class must only appear once.

Table 10.3. Stack height classes (physical height of stack) for categorization of LPS emissions reporting

Height class	Stack height
1	< 45 meters
2	≥ 45 meters < 100 meters
3	≥ 100 meters < 150 meters
4	≥ 150 meters < 200 meters
5	≥ 200 meters

Data on LPS has been derived from the National Emission Database and cross-checked with the emission data reported by LPS to the E-PRTR. In order to maintain consistency of these data with the emissions reported in Annex I, in accordance with the recommendations of Chapter A.7 Spatial mapping of emissions of the Guidebook 2023, the emissions of NH₃, PCDD/F and PAHs were adjusted to the emissions reported in Annex I.

The figure below shows LPS in 2023 by GNFR according to 2025 submission.

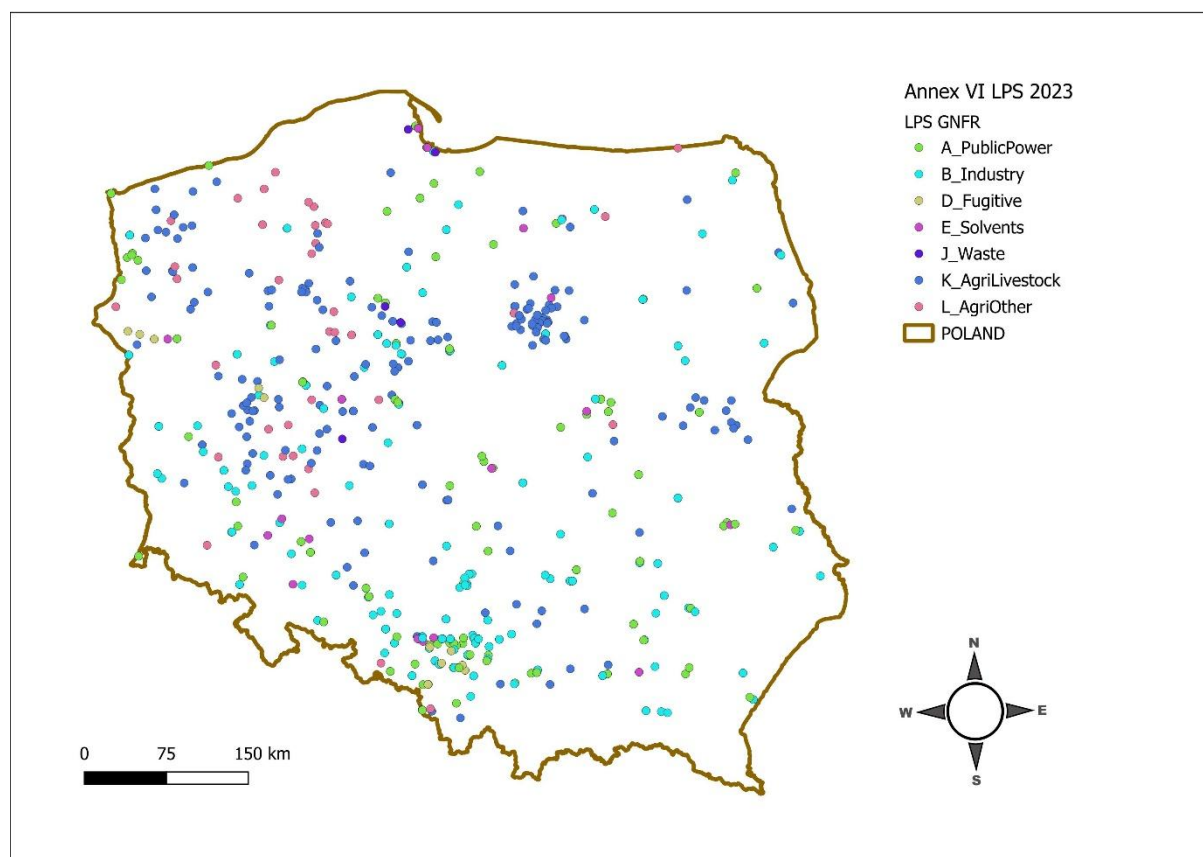


Figure 10.6. LPS in 2023 by GNFR

11 ABBREVIATIONS

Table 11.1. Abbreviations

Abbreviation	Full name
ARE	Energy Market Agency
AVGAS 100LL	Type of aviation gasoline
BDOT10K	A vector (object-oriented) database containing the spatial location of topographic objects along with their characteristics. Database run by the Main Office of Geodesy and Cartography.
BVOC	biogenic volatile organic compound
CEPiK	Central Vehicle and Driver Register
CEPMEIP	Coordinated European Programme on Particulate Matter Emission Inventories
CHP	Combined heat and power plants
CLRTAP	Convention on Long-range Transboundary Air Pollution
CNG/LNG	Compressed natural gas/ Liquefied natural gas
COPERT	Computer programme to calculate emissions from road transport
CORINAIR	EMEP/CORINAIR Emission Inventory Guidebook
CS	Country specific
EFs	Emission factors
EMEP/EEA EIG	EMEP/EEA Air Pollutant Emission Inventory Guidebook
EPA	U.S. Environmental Protection Agency
EU	European Union
Eurostat	Eurostat is the statistical office of the European Union
GNFR	An aggregated version of the NFR (Nomenclature For Reporting)
GUNB	General Office of Building Control
GUS	Statistics Poland
HCB	Hexachlorobenzene
HDV	Heavy duty vehicle
HM	Heavy metals
IchPW	Institute for Chemical Processing of Coal (<i>currently</i> Institute of Energy and Fuel Processing Technology – ITPE)
IE	Included elsewhere
IED	Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)
IETU	Institute of Ecology of Industrial Areas in Katowice
IMUZ	Institute for Land Reclamation and Grassland Farming
IOŚ-PIB	Institute of Environmental Protection - National Research Institute
ITS	Motor Transport Institute in Warsaw
ITPE	Institute of Energy and Fuel Processing Technology (<i>previously</i> Institute for Chemical Processing of Coal – IchPW)
KOBIZE	National Centre for Emissions Management
KPGO	National Waste Management Plan
LDV	Light duty vehicle
LPS	Large point sources
LTO	Landing Take-Off (LTO) cycle
NA	Not applicable
NED	National Emission Database of GHG and other substances - built and maintained by KOBIZE
NFR	Nomenclature for Reporting
NH ₃	Ammonia
NRIAP	National Research Institute of Animal Production
NMVOC	Non-methane volatile organic compounds
NO ₂	Nitrogen dioxide
NO _x	Nitrogen oxides
OECD	Organization for Economic Cooperation and Development
OVOC	Other volatile organic compound

Abbreviation	Full name
PAHs	Polycyclic aromatic hydrocarbons
PC	Passenger car
PCB	Polychlorinated biphenyl
PCDD/F	Dioxins and furans
PM10	particulate matter - particles of 10 µm or less in aerodynamic diameter
PM2.5	particulate matter - particles of 2.5 µm or less in aerodynamic diameter
POP	Persistent organic pollutants
R&D Institutions	Research and development institutions
RES	Renewable energy sources
SKP	Vehicle inspection stations
SO ₂	Sulphur dioxide
TSP	Total suspended particulates
UFG	Insurance Guarantee Fund
UNECE	United Nations Economic Commission for Europe
USZE	The Act of 17 th July 2009 on the System to Manage the Emissions of Greenhouse Gases and Other Substances
WAM	Scenario with additional measures
WM	Scenario with existing measures
XAD-2	Sorbents of organic compounds – resin
ZIE	Emission Inventory Unit in KOBiZE, IOŚ-PIB



Table 11.2. NFR codes

NFR	Sector name
1A1a	Public electricity and heat production
1A1b	Petroleum refining
1A1c	Manufacture of solid fuels and other energy industries
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel
1A2b	Stationary combustion in manufacturing industries and construction: Non-ferrous metals
1A2c	Stationary combustion in manufacturing industries and construction: Chemicals
1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print
1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals
1A2gvii	Mobile Combustion in manufacturing industries and construction
1A2gviii	Stationary combustion in manufacturing industries and construction: Other
1A3ai(i)	International aviation LTO (civil)
1A3aii(i)	Domestic aviation LTO (civil)
1A3bi	Road transport: Passenger cars
1A3bii	Road transport: Light duty vehicles
1A3biii	Road transport: Heavy duty vehicles and buses
1A3biv	Road transport: Mopeds & motorcycles
1A3bv	Road transport: Gasoline evaporation
1A3bvi	Road transport: Automobile tyre and brake wear
1A3bvii	Road transport: Automobile road abrasion
1A3c	Railways
1A3di(ii)	International inland waterways
1A3dii	National navigation (shipping)
1A3ei	Pipeline transport
1A3eii	Other
1A4ai	Commercial/institutional: Stationary
1A4aii	Commercial/institutional: Mobile
1A4bi	Residential: Stationary
1A4bii	Residential: Household and gardening (mobile)
1A4ci	Agriculture/Forestry/Fishing: Stationary
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery
1A4ciii	Agriculture/Forestry/Fishing: National fishing
1A5a	Other stationary (including military)
1A5b	Other, Mobile (including military, land based and recreational boats)
1B1a	Fugitive emission from solid fuels: Coal mining and handling
1B1b	Fugitive emission from solid fuels: Solid fuel transformation
1B1c	Other fugitive emissions from solid fuels
1B2ai	Fugitive emissions oil: Exploration, production, transport
1B2aiv	Fugitive emissions oil: Refining / storage
1B2av	Distribution of oil products
1B2b	Fugitive emissions from natural gas (exploration, production, processing, transmission, storage, distribution and other)
1B2c	Venting and flaring (oil, gas, combined oil and gas)
1B2d	Other fugitive emissions from energy production
2A1	Cement production
2A2	Lime production
2A3	Glass production
2A5a	Quarrying and mining of minerals other than coal
2A5b	Construction and demolition
2A5c	Storage, handling and transport of mineral products
2A6	Other mineral products
2B1	Ammonia production
2B2	Nitric acid production
2B3	Adipic acid production

NFR	Sector name
2B5	Carbide production
2B6	Titanium dioxide production
2B7	Soda ash production
2B10a	Chemical industry: Other
2B10b	Storage, handling and transport of chemical products
2C1	Iron and steel production
2C2	Ferroalloys production
2C3	Aluminium production
2C4	Magnesium production
2C5	Lead production
2C6	Zinc production
2C7a	Copper production
2C7b	Nickel production
2C7c	Other metal production
2C7d	Storage, handling and transport of metal products
2D3a	Domestic solvent use including fungicides
2D3b	Road paving with asphalt
2D3c	Asphalt roofing
2D3d	Coating applications
2D3e	Degreasing
2D3f	Dry cleaning
2D3g	Chemical products
2D3h	Printing
2D3i	Other solvent use
2G	Other product use
2H1	Pulp and paper industry
2H2	Food and beverages industry
2H3	Other industrial processes
2I	Wood processing
2J	Production of POPs
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)
2L	Other production, consumption, storage, transportation or handling of bulk products
3B1a	Manure management - Dairy cattle
3B1b	Manure management - Non-dairy cattle
3B2	Manure management - Sheep
3B3	Manure management - Swine
3B4a	Manure management - Buffalo
3B4d	Manure management - Goats
3B4e	Manure management - Horses
3B4f	Manure management - Mules and asses
3B4gi	Manure management - Laying hens
3B4gii	Manure management - Broilers
3B4giii	Manure management - Turkeys
3B4giv	Manure management - Other poultry
3B4h	Manure management - Other animals
3Da1	Inorganic N-fertilizers (includes also urea application)
3Da2a	Animal manure applied to soils
3Da2b	Sewage sludge applied to soils
3Da2c	Other organic fertilizers applied to soils (including compost)
3Da3	Urine and dung deposited by grazing animals
3Da4	Crop residues applied to soils
3Db	Indirect emissions from managed soils
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products
3Dd	Off-farm storage, handling and transport of bulk agricultural products



NFR	Sector name
3De	Cultivated crops
3Df	Use of pesticides
3F	Field burning of agricultural residues
3I	Agriculture other
5A	Biological treatment of waste - Solid waste disposal on land
5B1	Biological treatment of waste - Composting
5B2	Biological treatment of waste - Anaerobic digestion at biogas facilities
5C1a	Municipal waste incineration
5C1bi	Industrial waste incineration
5C1bii	Hazardous waste incineration
5C1biii	Clinical waste incineration
5C1biv	Sewage sludge incineration
5C1bv	Cremation
5C1bvi	Other waste incineration (please specify in the IIR)
5C2	Open burning of waste
5D1	Domestic wastewater handling
5D2	Industrial wastewater handling
5D3	Other wastewater handling
5E	Other waste
6A	Other (included in national total for entire territory)

12 REFERENCES

1. ARE (2025): Emitter. Emission of environmental pollutants in power plants and combined heat and power plants. Energy Market Agency, Warsaw 2024.
2. Asphalt Roofing Manufacturers Association, Environmental Task Force (1998): Polyaromatic Hydrocarbon Emissions from Asphalt Processing and Roofing Manufacturing Operations.
3. Atmoterm IŚ (2009): PRTR methodological guidelines for installations of intensive poultry breeding and husbandry (in Polish). Atmoterm Inżynieria Środowiska Sp. z o.o. Warszawa, 2009.
4. Barber J., Sweetman A., Jones K. (2005): Hexachlorobenzene - Sources, environmental fate and risk characterisation. EuroChlor, 2005, <https://www.eurochlor.org/wp-content/uploads/2019/04/sd9-hexachlorobenzene-final.pdf> [accessed: 2020-01-29].
5. BDO: BDO Waste Database.
6. Berdowski et al. (1995): Technical paper to the OSPARCOM-HELCOM-UNECE emission heavy metals and persistent organic pollutants, 1995.
7. Bernat K. (2014): Preparation of raw materials for fermentation and co-fermentation, conversion of waste from agri-food industry to biogas – a system approach, p. 79-102. UWM, Olsztyn, 2014. (in Polish)
8. Bizukojć W. (2014): Impact of the dairy industry on the environment. Standard methods of management of waste and post-production effluents, Innowacyjne rozwiązania w zakresie zagospodarowania odpadów na cele energetyczne dla przemysłu mleczarskiego, p. 18-31. Cbi Pro-Akademia, Łódź, 2014. (in Polish)
9. Bojakowska I. (2009): Cadmium in mineral resources of Poland and its potential emission in the environment. Ochrona Środowiska i Zasobów Naturalnych 40 (2009) 22-30, http://www.ios.edu.pl/pol/pliki/nr40/nr40_2.pdf [in Polish, with English abstract].
10. Borowski S. (2017): Cofermentation of organic waste from agricultural food production and municipal management with sewage sludge. PŁ, Łódź, 2017. (in Polish)
11. Center of Wood Technology – Poznań Institute of Technology – estimates of sawnwood production
12. CEPMEIP. Antoon Visschedijk et al. Coordinated European Programme on Particulate Matter Emission Inventories (CEPMEIP); <http://www.air.sk/tno/cepmeip/>
13. Chabiński i Szlęk (2014): Polish technology of heating installations ranging 1-50 MW. (in Polish)
14. Corning O. (1998): The Magnitude and Source of Air Emissions from Asphalt Blowing Operations, Asphalt Technology Laboratory, Summit, IL 60501, 1998.
15. Costner P., International POPs Elimination Network (2006): Update of Dioxin Emission Factors for Forest Fires, Grassland and Moor Fires, Open Burning of Agricultural Residues, Open Burning of Domestic Waste, Landfills and Dump Fires; https://ipen.org/sites/default/files/documents/ipen_dioxin_open_fires-en.pdf

16. Cracow University of Technology (2002): Report on measurements and estimation of concentration of PCDD/PCDFs, PCBs and HCB, Cracow University of Technology, Kraków, 2002.
17. CSO: Central Waste System database.
18. Czarnomski K., Izak E. (2009): Prowadzenie zbiorczych danych dla kraju dotyczących urządzeń z PCB (the inventory of equipments containing PCBs), Institute of Environmental Protection, 2009.
19. Czop M. (2012): Determining of basic fertilizing properties of household waste, archives of waste management and environmental protection, Vol. 14 Issue 4 (2012), p. 95-102. PŚ, Gliwice, 2012. (in Polish)
20. Czyżyk F. (2010): Guidelines on the use of by-products and recommended waste management in agriculture and the agri-food industry. ITP-PIB , Falenty, 2010. (in Polish)
21. Danish EPA, Ministry of Environment, Institute of Environmental Protection (2005): Opportunities for Reduction of Dioxin Emissions from the Metallurgical Sector in Poland, Warsaw, 2005; <http://www.dioksyny.pl/wp-content/uploads/Opportunities-for-reduction-of-dioxin-emissions-2005.pdf>.
22. Database of Central Waste Management System. Ministry of the Environment, 2019.
23. Dąbrowski W. (2014): Sewage, sludge and reject water balance in mlekovita dairy WWTP after modernization, Inżynieria i Ochrona Środowiska, p. 483-491. PB, Białystok, 2014. (in Polish)
24. EMEP/EEA Air Pollutant Emission Inventory Guidebook
<https://www.eea.europa.eu/publications/emep-eea-guidebook-2023>
25. Eurostat, Eurostat database <https://ec.europa.eu/eurostat/data/database>
26. Fire statistics: National Headquarters of the State Fire Service of Poland
http://www.straz.gov.pl/panstwowa_straz_pozarna/interwencje_psp
27. Food and Agriculture Organisation of the United Nations, Forestry Production and Trade <http://www.fao.org/faostat/en/#data>
28. Frąc M. (2012): Development of an innovative biopreparation to optimize the methane fermentation process of organic waste. IA PAN, Lublin, 2012. (in Polish)
29. Fudała J. (1993): NMVOC inventory for Poland in 1992 Institute for Ecology of Industrial Areas, Katowice (IETU).
30. Funeral Industry in Poland. Diagnosis and Challenges. CALPE, Warsaw, 2019.
31. Gawęcki K. (1963): The use of dried sugar beet pulps, molasses distillers' residue added, in the feeding of ruminants, p. 121-126. WSR, Poznań, 1963. (in Polish)
32. General Office of Building Control (2025): Construction Activities in 2024. GUNB, Warsaw, 2025.
33. GPG 2020. Good practice guidance for agriculture related to ammonia mitigation measures (2020), Ministry of Agriculture (in Polish):
<https://www.gov.pl/web/rolnictwo/kodeks-dobrej-praktyki-rolniczej-w-zakresie-ograniczania-emisji-amoniaku>

34. Grześkowiak A. (2001): Trends in mineral fertilizers selection. (in Polish) Zakłady Chemiczne Police SA. <http://www.ppr.pl/artykul.php?id=2905>
35. GUS (1990-2025): Statistical Yearbook of The Republic of Poland 1989-2025. GUS. Warsaw, 1990-2025.
36. GUS (2013): Results of Agricultural Census. GUS. Warsaw, 2013.
37. GUS (2022): Results of Agricultural Census. GUS. Warsaw, 2022.
38. GUS (2024): Means of production in agriculture in the 2022/2023 farming year. GUS, Warsaw, 2024.
39. GUS (2025a): Materials management in 2024. GUS. Warsaw, 2025.
40. GUS (2025b): Internal Market in 2024, Warsaw, 2025.
41. GUS (2025c): Energy statistics 2023, 2024. GUS. Warsaw, 2025.
42. GUS (2025d): Transport in 2024. GUS, Warsaw, 2025.
43. GUS (2025e): Production of industrial products. GUS. Warsaw, 2025.
44. GUS (2025f): Statistical Yearbook of Industry. GUS. Warsaw, 2025.
45. GUS (2025g): Construction results in 2024. Warsaw, 2025.
46. GUS (2025h): Environment 2024. GUS. Warsaw, 2025.
47. GUS (2025i): Local Data Bank. GUS. Warsaw, 2025.
48. GUS (2025j): Production of agricultural and horticultural crops in 2024. Warsaw, 2025.
49. GUS (2025k). Agriculture in 2024. GUS. Department of Agriculture. Warsaw 2025.
50. GUS (2025l): Livestock in 2024. GUS, Warsaw, 2025.
51. GUS (2025m): Characteristics of agricultural holdings in 2023. GUS, Warsaw, 2025.
52. GUS Knowledge Databases, Economic statistics, Foreign trade
<http://swaid.stat.gov.pl/EN/SitePages/StronaGlownaDBW.aspx>
53. Hławiczka S. (2001): Updating of emission factors used in national inventory heavy metals emission and comparison with emission factors from other European countries for LRTAP Convention, IETU, Katowice, 2001.
54. Hławiczka S. and Fudała, J. (2003): Distribution of Cd, Pb and Hg emissions among sectors of economy in Poland and the emission assessment for the years 1990-2000. In: L. Pawłowski, M.R. Dudzińska (eds.), Environmental Engineering Studies: Polish Research on the Way to the EU, Kluwer Academic/Plenum Publishers, 2003.
55. Hławiczka S., Kubica K. and Zielonka U. (2003): Partitioning factor of mercury during coal combustion in low capacity domestic heating units The Science of the Total Environment 312 (2003) 261–265, [https://doi.org/10.1016/S0048-9697\(03\)00252-3](https://doi.org/10.1016/S0048-9697(03)00252-3)
56. Hubner C. et. al. (2000): In Österreich eingesetzte verfahren zur dioxinminderung.
57. IChPW (2021): Development of emission factors for solid fuel combustion sources in the municipal and housing sector. MODULE I, II and III”. Zabrze, 2021 (expert study in Polish).
58. IETU (2002): Verification of the type and industry structure of domestic consumption of solvents. IETU, Katowice, 2002.



59. IETU (2010): Update of NMVOC and heavy metals LRTAP emissions inventory in 2008-2009. IETU, Katowice, 2010.
60. IFASTAT database. <https://www.ifastat.org/databases/plant-nutrition>
61. Informative Inventory Report (IIR) 2019. Norway, Norwegian Environment Agency, 2019.
62. Institute of Meteorology and Water Management, Meteorological yearbook, Warsaw, 2025. (in Polish)
63. Institute of Meteorology and Water Management, Measurement and observation data, Warsaw, 2025, https://danepubliczne.imgw.pl/data/dane_pomiarowo_obserwacyjne/
64. ITS (2021). Development of forecasts for changes in activity in the road transport sector. Final report. Motor Transport Institute in Warsaw (In Polish).
65. IUNG (2012). Factors describing residue to crop ratio for crops. Information from the Ministry of Agriculture and Rural Development, document nr RR.te.st-75/21/2012 (1345) on 16.04.2012.
66. IUNG (2014): Coefficients N, P, K 2014 new method OECD_Eurostat. Institute of Soil Science and Plant Cultivation, IUNG-PIB, Puławy, J. Kopiński, with update in 2018.
67. Jadczyzyn T. (2019): Agricultural use of waste in light of legal regulations. IUNG-PIB, Puławy, 2019. (in Polish)
68. Jankowska-Huflejt H. (2009): Evaluation of nutritive value of forages from grasslands on the background of soil richness and N, P, K balances in chosen organic farms, Journal of Research and Applications in Agricultural Engineering. IMUZ-PIB, Falenty, 2009. (in Polish)
69. Juściński (2013): Material and technology condidations and destruction and durability of rotary air and gas preheaters' construction elements. PhD thesis. Opole University of Technology (in Polish), 2013.
70. Karcz H. (2007): Method of thermal utilization of animal waste, Energetyka i Ekologia, p. 823-831. PW, Wrocław, 2007. (in Polish)
71. KOBiZE (2025): Pollutant emission factors from fuel combustion for sources with a nominal thermal power of up to 5 MW, used to automatically calculate emissions in reports to the National Emission Database for the years 2022-2024, Warsaw, 2025. (in Polish)
72. Kopeć M. (2014): The use of poultry slaughterhouse waste to produce compost, Inżynieria Ekologiczna, p. 143-150. Kraków, 2014. (in Polish)
73. Lewandowski (2021). Lewandowski J., Melka K. Emission factors from biomass combustion in power plants, public thermal plants and industrial thermal plants in the years 2000 – 2020 (expert study in Polish). Institute of Environmental Protection-National Research Institute IOŚ-PIB, Warsaw, 2021.
74. Lewandowski (2022). Lewandowski J., Melka K., Jabłoński M. Particular matter emission factors from brown coal combustion in public power plants and combined

- heat and power plants in the years 2000 – 2020 (expert study in Polish). Institute of Environmental Protection-National Research Institute IOŚ-PIB, Warsaw, 2022.
75. Lewandowski (2022). Lewandowski J., Melka K., Jabłoński M. Particular matter emission factors from hard coal combustion in public power plants and combined heat and power plants in the years 2000 – 2020 (expert study in Polish). Institute of Environmental Protection-National Research Institute IOŚ-PIB, Warsaw, 2022.
 76. Lewandowski (2022). Lewandowski J., Melka K., Kłeczek M. Emission factors for district heating plants in the years 2000 – 2021 with a perspective until 2040 (expert study in Polish). Institute of Environmental Protection-National Research Institute IOŚ-PIB, Warsaw, 2022.
 77. Łabętowicz J. (2003): Estimation of the fertilization value of raw brewers decoction and calibrated with phosphorus and potassium, p. 247-254. SGGW Warszawa, 2003. (in Polish)
 78. Łoboda (1994). Łoboda T., Pietkiewicz S. Estimation of amount of CH₄, CO, N₂O and NO_x released to atmosphere from agricultural residues burning in 1992 (in Polish). Warsaw Agricultural University, Warsaw, 1994.
 79. Marcinkowski T., Kierończyk M. (2015): Effectiveness of urease inhibitor NBPT in mitigation ammonia emission from urea and urea ammonium nitrate solutions (UAN) applied in mineral fertilization of plants. *Czasopismo Inżynierii Lądowej, Środowiska i Architektury. Journal of Civil Engineering, Environment and Architecture. JCEEA*, t. XXXII, z. 62 (3/I/15), July 2015, pp. 271-279.
 80. Micek P. (2003): Protective value of oat and its chemical composition and nutritive value as green forage or silage, p. 349-357. IHAR-PIB, Kraków, 2003. (in Polish)
 81. Michalska K. (2013): Economic and environmental aspects of converting waste into energy. Cbi Pro-Akademia, Konstantynów Łódzki, 2013. (in Polish)
 82. Myszograj S. (2012): Waste from rearing and slaughter of poultry – treat to the environment or feedstock for energy, *Environmental Medicine*, p. 106-115. UZ, Zielona Góra, 2012. (in Polish)
 83. National Centre for Emissions Management. National Emission Database reports (2010-2024).
 84. National Centre for Emissions Management. Waste Database reports (2019-2022).
 85. NILU (1999): Environmental Cycling of Selected Persistent Organic Pollutants (POPs) in the Baltic Region (POPCYCLING-Baltic), 1999.
 86. NIR (2025): Poland's National Inventory Report 2025. Greenhouse gas inventory 1988-2023. Submission under the UN FCCC and its Kyoto Protocol. Warsaw, 2025.
 87. Obrycka E. (2014): Social and economic benefits from building agricultural biogas plants, *Ekonomika i Organizacja Gospodarki Żywnościowej*, p. 163-176. SGGW, Warszawa, 2014. (in Polish)
 88. Owczuk M. (2013): The use of biodegradable waste to produce biogas as an alternative source of renewable energy, p. 133-144. UKSW, Warszawa, 2013. (in Polish)

89. PARCOM (1996): Oslo and Paris Conventions for the Prevention of Marine Pollution Joint Meeting of the Oslo and Paris Commissions, PARCOM Decision 96/1 (17 to 21 June 1996) on the phasing-out of the use of hexachloroethane in the non-ferrous metal industry;
90. Pastuszek M., Igras J. (2012): Temporal and special differences in emission of nitrogen and phosphorus from Polish territory to the Baltic Sea. National Marine Fisheries Research Institute, Institute of Soil Science and Plant Cultivation - State Research Institute, Fertilizer Research Institute. Gdynia-Puławy, 2012. ISBN 978-83-61650-08-9, ISBN 978-83-7562-107-5, ISBN 978-83-935354-0-8.
91. PGE: Survey of PGE Polish Energy Group (Polska Grupa Energetyczna S.A.) and KOBiZE on mercury emission factors from combustion installations, 2012.
92. PHU KRZYSZTOF, Krzysztof Wolicki, List of crematories in Poland as of 2 August, 2023, <http://krzysztof.waw.pl/index.php/pl/Lewe-menu/Krematoria-w-Polsce>
93. PIG-PIB. The balance of mineral resources deposits in Poland (1990–2024). Polish Geological Institute-National Research Institute, Warsaw, 2025 (in Polish)
94. Pikula D. (2015): The effect of many years of straw fertilization on plant yielding and soil fertility, p. 85-96. IUNG-PIB, Puławy, 2015. (in Polish)
95. Powalka M. (2013): The agricultural biogas sector in Poland as compared to other European Union member-countries. SGGW, Warszawa, 2013. (in Polish)
96. Prandecki K. 2024. Projections of Activity Changes in Selected Economic Sectors – update 2024. Warsaw. 2024 (in Polish, not published).
97. Pujso K. (1964): Studies on the mechanism of ammonia fixation by sugar beet pulp and others feedstuffs, p. 91-96. IFŻZ PAN, Bydgoszcz, 1964. (in Polish)
98. Romanowska-Duda Z. (2014): Alternative methods for treatment of dairy wastewater. Hydrophyte treatment plants, Innowacyjne Rozwiązania w Zakresie Zagospodarowania Odpadów na cele Energetyczne dla Przemysłu Mleczarskiego, p. 55-74. Cbi Pro-Akademia, Łódź, 2014. (in Polish)
99. Sadecka Z. (2016): The possibility of using organic substrates in the fermentation process, annual set the environment protection. UZ, Zielona Góra, 2016. (in Polish)
100. Saternus M. (2006): The primary aluminium technology, production, prospects. Rudy Metale R. 51, nr 6, 316-325 (in Polish, with English abstract).
101. Skotak et al. (2016): "Black carbon as indicator of the anthropogenic impact on environment and health, Przemysł Chemiczny, IOŚ-PIB, 03.2016, p. 548-553. (in Polish)
102. Skotak K., Degórska A., Ulańczyk R., Pecka T. (2016): Carbonaceous aerosol. An indicator of the human activity impact on environment and health / Sadza jako wskaźnik wpływu działalności człowieka na środowisko i zdrowie. PRZEMYSŁ CHEMICZNY vol. 1(3) 226 – 231.
103. Skowrońska M. (2012): Fertilizing use of stillage, Proceedings Of Ecopole. UP, Lublin, 2012. (in Polish)

104. Stala-Szlugaj K. (2013): PM Emission from Hard Coal Combustion in Heating Plants of Thermal Power Under 50 MW According to Obligatory Emission Standards. Annual Set The Environment Protection vol. 15 1689-1704. (in Polish)
105. Stępień W. (2022): Fertilizer production technologies. SGGW, Warszawa, 2022. (in Polish)
106. The Cremation Society, International Statistics 1996-2016;
<https://www.cremation.org.uk/statistics>
107. UNECE (2014). UNECE Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/125, 13 March 2014).
108. UNECE (2014a): Bittman, S., Dedina, M., Howard C.M., Oenema, O., Sutton, M.A., (eds), 2014, Options for Ammonia Mitigation: Guidance from the UNECE Task Force on Reactive Nitrogen, Centre for Ecology and Hydrology, Edinburgh, UK.
109. Walczak (2022): Update of identified NH₃ abatement techniques in livestock manure management. Working material prepared for the Ministry of Agriculture and Rural Areas. Instytut Zootechniki, Kraków, 2022. (in Polish)
110. Walczak J. (2003): Correction of N₂O emissions in agriculture, in: Realization of tasks of National Emission Centre in the emission inventory. Institute of Environmental Protection, 2003. (in Polish)
111. Walczak J. (2006): Elaboration of activity data and GHG emission factors in Polish agriculture (unpublished). Instytut Zootechniki, Kraków, 2006. (in Polish)
112. Walczak J. (2009): Estimation of factors for animal waste management system, used in the inventory of greenhouse gases emission from agriculture sector in 2007, (unpublished). Instytut Zootechniki, Kraków, 2009. (in Polish)
113. Walczak J. (2011): Assessment of livestock population and its animal waste management systems in Poland in 2004–2009 based on database of the National Research Institute of Animal Production for the purpose of GHG and other pollutants inventories. Instytut Zootechniki, Kraków, 2011. (in Polish)
114. Walczak J. (2012).: Assessment of livestock population and its animal waste management systems in Poland in 2010–2011 based on database of the National Research Institute of Animal Production for the purpose of GHG and other pollutants inventories. Instytut Zootechniki, Kraków, 2012. (in Polish)
115. Walczak J. (2013): Assessment of livestock population and its animal waste management systems in Poland in 2012 based on database of the National Research Institute of Animal Production for the purpose of GHG and other pollutants inventories. Instytut Zootechniki, Kraków, 2013. (in Polish)
116. Walczak J. (2016): Proposals of identified NH₃ abatement techniques in livestock manure management. Working material prepared for the Ministry of Agriculture and Rural Areas. Instytut Zootechniki, Kraków, 2016. (in Polish)
117. Walczak J. (2020): Elaboration of parameters for GHG emission estimation for agricultural sector. Kraków, 2020. (in Polish)

118. Walczak J. 2022. Update of NH₃ emission reduction measures related to livestock breeding in Poland. Kraków, 2022 (in Polish)
119. Waszczyłko (2021): Waszczyłko-Miłkowska B., Kamińska-Borak J. Incineration of municipal waste in Poland in 2020 – BDO data. IO-PIB, Warsaw, 2021. (in Polish)
120. Weather Information Service (OGIMET) <https://www.ogimet.com/home.phtml.en>
121. Westberg H.B., Seldén A.I., Bellander T. (1997): Emissions of Some Organochlorine Compounds in Experimental Aluminium Degassing with Hexachloroethane. Applied Occupational and Environmental Hygiene 12(3), 178-183, DOI: 10.1080/1047322X.1997.10389485.
122. Wielgościński G. (2009): Information on waste incinerated in Poland in 2008, Łódź, 2009.
123. Wolak p. (2012): Examination of chemical composition of sugar beet pulp – a by-product of sugar industry, Engineering Sciences And Technologies, p. 109-119. UE, Wrocław, 2012. (in Polish)
124. Zawadzki S. (red.) (1999): Soil science. Edition IV amended. Państwowe Wydawnictwo Rolnicze i Leśne, Warszawa, 1999, ISBN 830901703-0. (in Polish)
125. Żygadło M. (2016): The conversion of biomass into energy in farm biogas plant, Archives Of Waste Management And Environmental Protection, Vol. 18 Issue 2 (2016), p. 55-66. PŚk, Kielce, 2016. (in Polish)

Appendix 1. KEY CATEGORY ANALYSIS

Key source categories are sources that together contribute up to 80% of the level of reported emissions in Poland. For this report level assessments were carried out for the following pollutants: SO₂, NO_x, NMVOC, NH₃, CO, TSP, PM₁₀, PM_{2.5}, BC, Pb, Cd, Hg, dioxins and furans (PCDD/F), PAHs, and HCB. The level assessment was performed for the year 1990 and 2024. The key sources from the 2024 level assessment are presented in Table A1.1. Detailed analysis for the particular pollutants is presented in the tables below.

Table A1. 1 The largest key categories from the level assessment for 2024

Pollutant	Key categories (Sorted from high to low)										Total
SO ₂	1A4bi	1A1a	1A2f	1A4ci							81.2%
	38.3%	36.3%	3.5%	3.1%							
NO _x	1A1a	1A3biii	1A3bi	1A4bi	3Da1	1A3bii	1A4cii	3Da2a	1A4ai		81.3%
	17.8%	15.1%	12.0%	10.6%	7.9%	5.9%	5.6%	4.0%	2.4%		
NH ₃	3Da2a	3Da1	3B1a	3B3	3B4gii	3B1b					82.3%
	32.00%	16.60%	14.50%	7.30%	6.90%	5.00%					
NMVOC	1A4bi	2D3d	3B1a	2D3a	1B1a	2D3i	2D3g	1A3bi	3B1b	3B4gii	81.3%
	17.4%	10.3%	8.0%	7.9%	7.1%	6.2%	5.9%	5.1%	3.6%	1.8%	
	3B4gii	3B4gii	1A3bv	2D3h	1B2b	3B4gi					
	2.5%	2.50%	2.1%	2.1%	1.6%	1.5%					
CO	1A4bi	1A3bi	1A4ci								81.8%
	61.00%	16.50%	4.30%								
TSP	1A4bi	3Dc	2A5b	2A5a	2D3b	1B1a	1A4ci	3B4gi	1A3bvi		80.2%
	45.00%	7.10%	6.2%	6.10%	4.40%	3.40%	3.0%	2.70%	2.3%		
PM10	1A4bi	3Dc	1A4ci	2A5a	2A5b	1A3bvi	1B1a				81.8%
	58.60%	9.7%	3.90%	2.7%	2.5%	2.40%	2.00%				
PM2.5	1A4bi	1A4ci									81.2%
	76.20%	5.00%									
Pb	2C1	2C5	1A3bvi	1A4bi	1A1a	2C6					84.2%
	26.20%	19.20%	12.80%	11.40%	8.80%	5.80%					
Hg	1A1a	2C6	1A4bi	5C1bv	2C5	2C1	2D3a				83.3%
	45.70%	9.8%	9.10%	5.30%	4.5%	4.50%	4.40%				
Cd	1A4bi	2C1	1A1a	2C5	2C6	1A1b	1A2gviii	2G			81.0%
	28.60%	14.20%	8.20%	7.50%	6.90%	6.00%	4.90%	4.70%			
DIOX	1A4bi	5E	1A4ci								81.2%
	64.00%	12.60%	4.60%								
PAH	1A4bi										83.2%
	83.20%										
HCB	1A4bi	1A1a	3Df								80.3%
	28.0%	27.9%	25.2%								
	1A1 Energy industries			1A2 Manufacturing industries			1A3 Transport				
	1A4 Other sectors		1B Fugitive		2 IPPU	3 Agriculture		5 Waste			

1.1. Sulphur dioxide emissions

Four source categories have been identified for 2024 as key sources (level assessment) in SO₂ inventory in Poland. The most important of them are stationary combustion of fuels in residential sector (1A4bi) and public electricity and heat production (1A1a).

Table A1. 2 Level Assessment for sulphur dioxide emission sources in 1990 and 2024

Year	Key categories				Total (%)
1990	1A1a				82.8
	82.8%				
2024	1A4bi	1A1a	1A2f	1A4ci	81.2
	38.3%	36.3%	3.5%	3.1%	

The shares of sectors in the national SO₂ emissions are shown in Figure A1. 1.

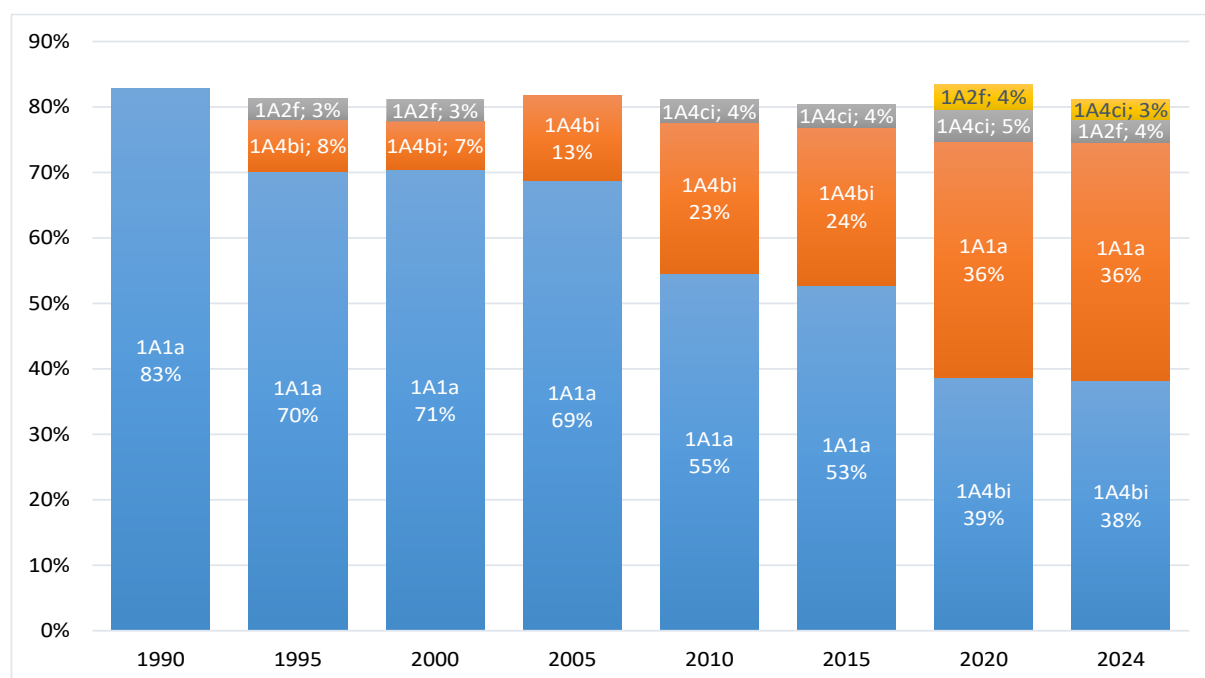


Figure A1. 1 Key categories for SO₂ emissions in selected years

1.2. Nitrogen oxides emission

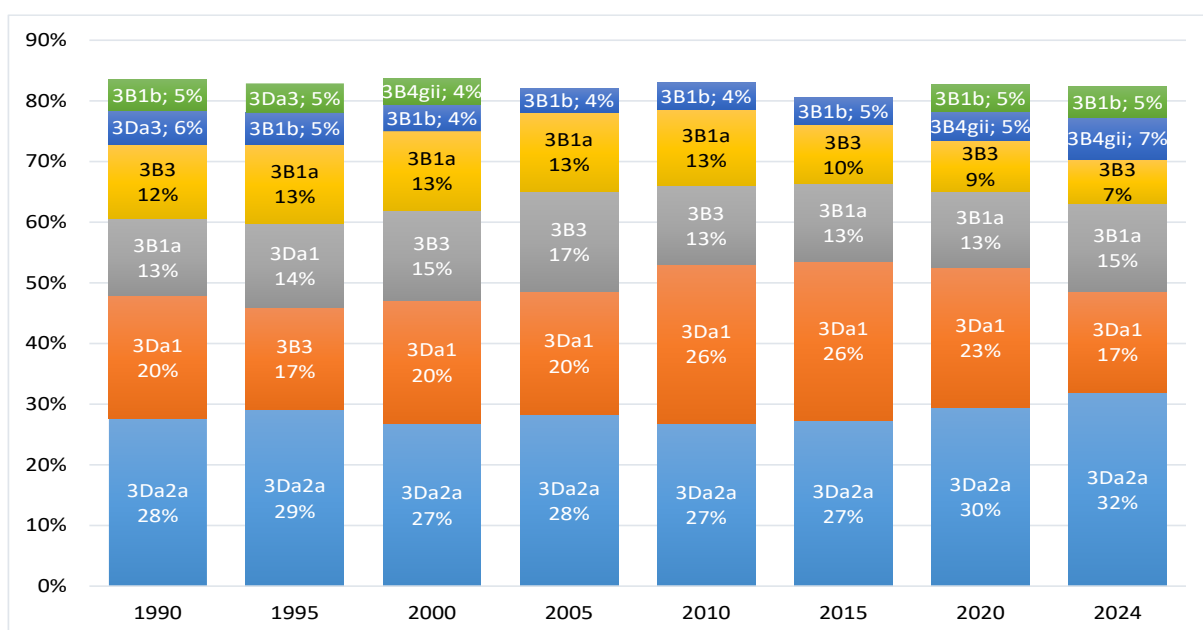
Nine source categories have been identified for 2024 as key sources (level assessment) in NO_x inventory in Poland. Road transport is the most important source of NO_x emissions – three subcategories are classified as key categories: 1A1biii (heavy duty vehicles and buses), 1A3bi (passenger cars) and 1A3bii (light duty vehicles). Stationary combustion of fuels for energy production in public power plants (1A1a) and households (1A4bi) is also important source of NO_x emission.

Table A1. 3 Level Assessment for nitrogen oxides emission sources in 1990 and 2024

Year	Key categories									Total (%)
1990	1A1a	1A3biii	1A3bi	1A4bi	3Da1	1A4cii	1A3bii			80.9
	50.9%	6.4%	5.8%	5.4%	4.6%	4.4%	3.4%			
2024	1A1a	1A3biii	1A3bi	1A4bi	3Da1	1A3bii	1A4cii	3Da2a	1A4ai	81.3
	17.8%	15.1%	12.0%	10.6%	7.9%	5.9%	5.6%	4.0%	2.4%	

The shares of sectors in the national NO_x emissions are shown in Figure A1. 2.

Year	Key categories						Total (%)
1990	3Da2a	3Da1	3B1a	3B3	3Da3	3B1b	83.6
	27.6%	20.3%	12.7%	12.2%	5.6%	5.20%	
2024	3Da2a	3Da1	3B1a	3B3	3B4gii	3B1b	82.3
	32.0%	16.6%	14.5%	7.3%	6.9%	5.0%	



1.4. Particulate matter emissions

1.4.1. TSP

Nine source categories have been identified for 2024 as key sources (level assessment) in TSP inventory in Poland. The most important of them is stationary combustion of fuels in residential sector (1A4bi).

Table A1. 5 Level Assessment for TSP emission sources in 1990 and 2024

Year	Key categories									Total (%)
1990	1A1a	1A4bi	2A1	1B1a						81.5
	56.7%	17.6%	4.3%	2.9%						
2024	1A4bi	3Dc	2A5b	2A5a	2D3b	1B1a	1A4ci	3B4gi	1A3bvi	80.2
	45.0%	7.1%	6.2%	6.1%	4.4%	3.4%	3.0%	2.7%	2.3%	

The shares of sectors in the national TSP emissions are shown in Figure A1. 4.

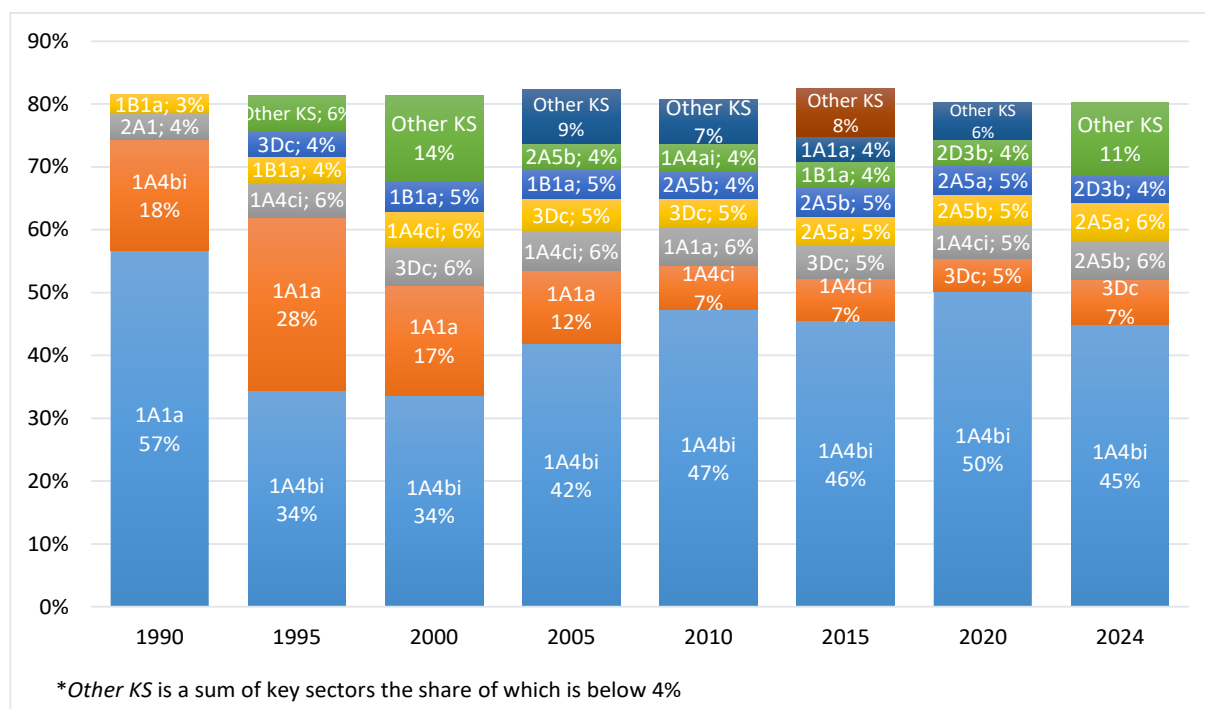


Figure A1. 4 Key categories for TSP emissions in selected years

1.4.2. PM10

Seven source categories have been identified for 2024 as key sources (level assessment) in PM10 inventory in Poland. The most important of them is stationary combustion of fuels in residential sector (1A4bi).

Table A1. 6 Level Assessment for PM10 emission sources in 1990 and 2024

Year	Key categories							Total (%)
1990	1A1a	1A4bi	2A1	3Dc	1A4ai			83.6
	39.1%	28.7%	6.9%	4.8%	4.1%			
2024	1A4bi	3Dc	1A4ci	2A5a	2A5b	1A3bvi	1B1a	81.8
	58.6%	9.7%	3.9%	2.7%	2.5%	2.4%	2.0%	

The shares of sectors in the national PM10 emissions are shown in Figure A1. 5.

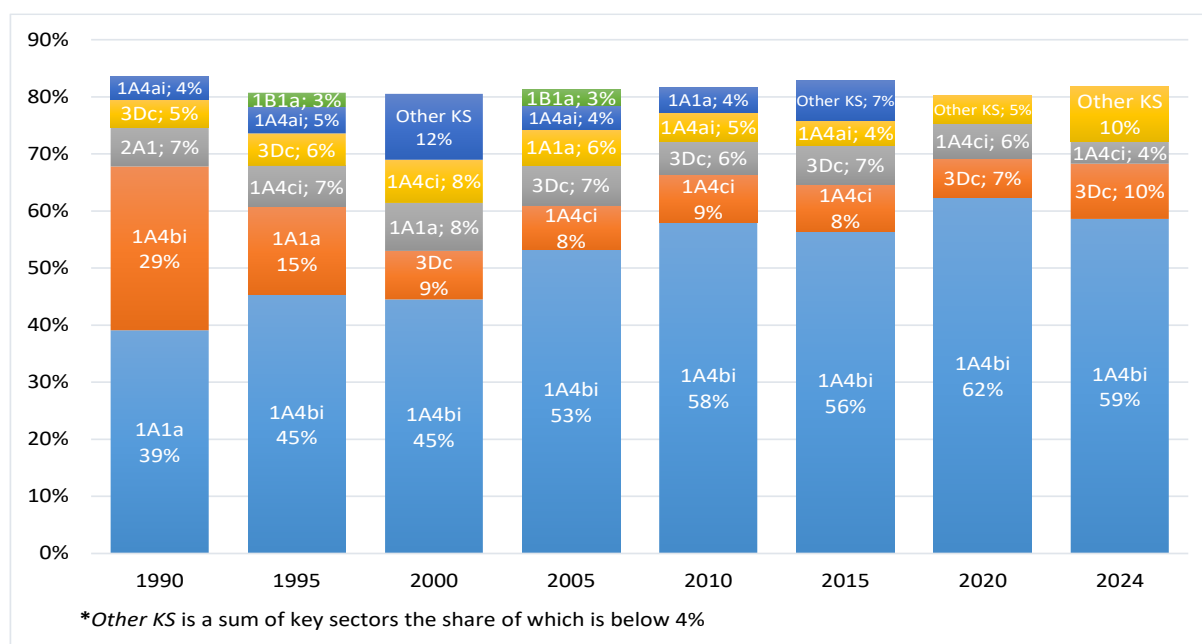


Figure A1. 5 Key categories for PM10 emissions in selected years

1.4.3. PM2.5

Two source categories have been identified for 2024 as key sources (level assessment) in PM2.5 inventory in Poland. The most important of them is stationary combustion of fuels in residential sector (1A4bi).

Table A1. 7 Level Assessment for PM2.5 emission sources in 1990 and 2024

Year	Key categories				Total (%)
1990	1A4bi	1A1a	2A1	1A4ai	80.7
	46.0%	21.1%	7.1%	6.5%	
2024	1A4bi	1A4ci			81.2
	76.2%	5.0%			

The shares of sectors in the national PM2.5 emissions are shown in Figure A1. 6.

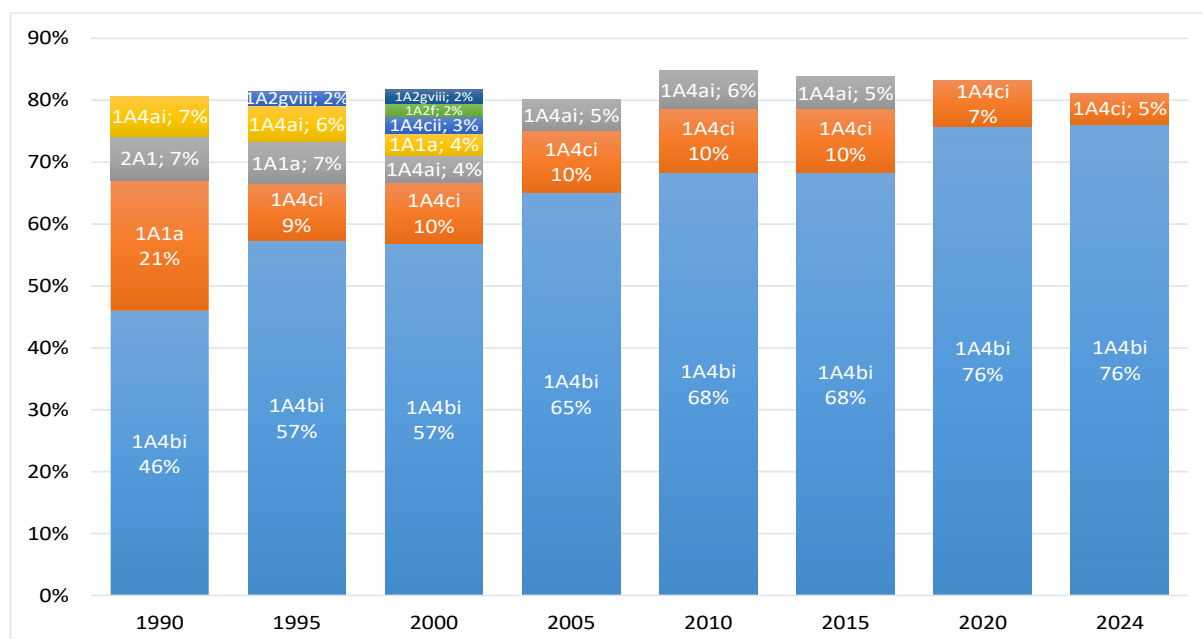


Figure A1. 6 Key categories for PM2.5 emissions in selected years

The shares of sectors in the national CO emissions are shown in Figure A1. 8.

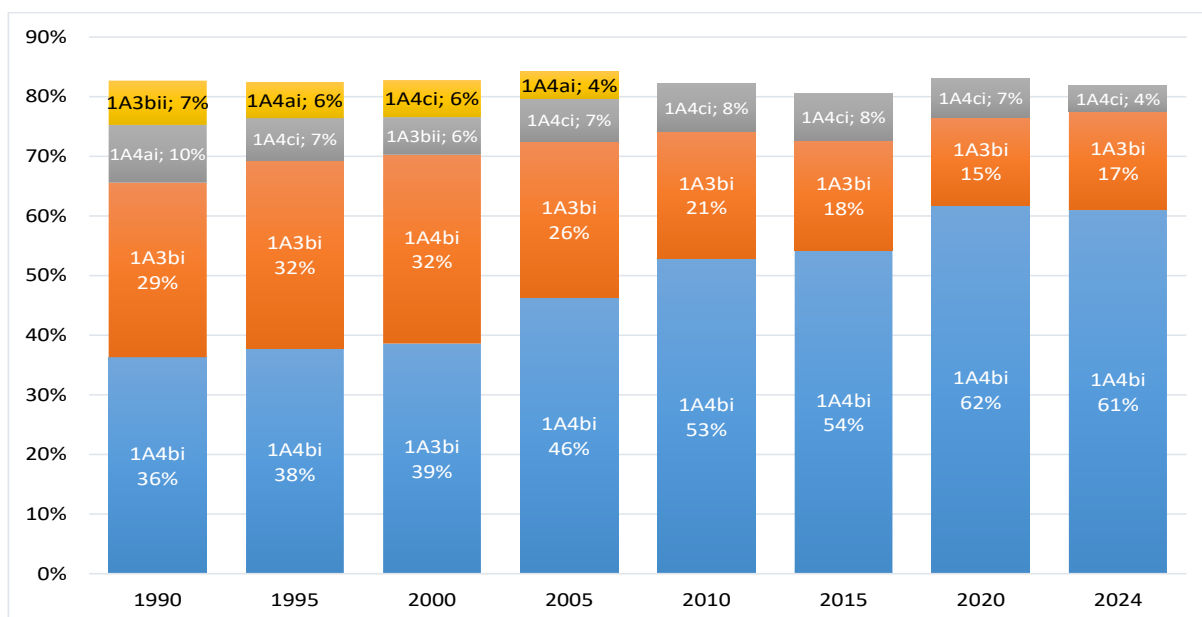


Figure A1. 8 Key categories for CO emissions in selected years

1.7. Main heavy metal emissions

Tables below include emission *Level Assessment* estimates for Cd, Hg, and Pb according to NFR classification.

1.7.1. Cadmium (Cd)

Eight source categories have been identified for 2024 as key sources (level assessment) in Cd inventory in Poland. The most important of them are: stationary combustion of fuels in households (1A4bi), Iron and steel, lead and zinc production (2C1, 2C5, 2C6) and combustion in sector 1A1a (public electricity and heat production).

Table A1. 10 Level Assessment for Cd emission sources in 1990 and 2024

Year	Key categories								Total (%)
1990	1A1a	2C1	1A4bi	2B10a	2C5	2G			82.3
	33.9%	23.5%	8.3%	6.3%	5.4%	5.0%			
2024	1A4bi	2C1	1A1a	2C5	2C6	1A1b	1A2gviii	2G	81.0
	28.6%	14.2%	8.2%	7.5%	6.9%	6.0%	4.9%	4.7%	

The shares of sectors in the national Cd emissions are shown in Figure A1. 9.



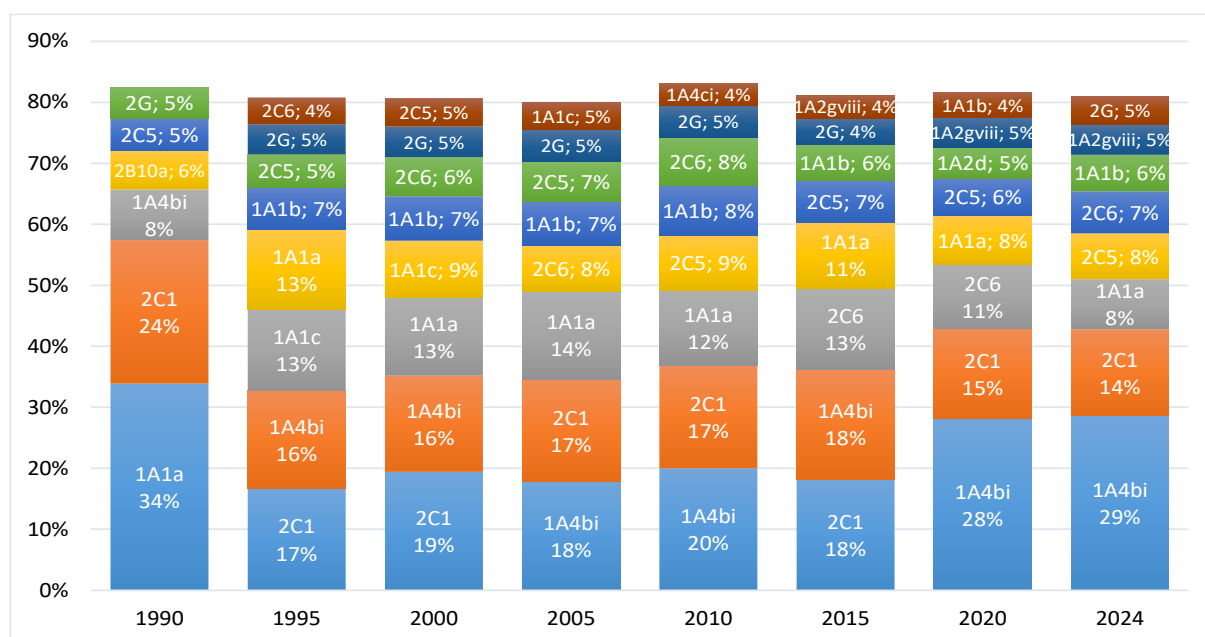


Figure A1. 9 Key categories for Cd emissions in selected years

1.7.2. Mercury (Hg)

Seven source categories have been identified as key sources (level assessment) for 2024 in Hg inventory in Poland. The most important of them is combustion in sector Public Electricity and Heat Production (1A1a).

Table A1. 11 Level Assessment for Hg emission sources in 1990 and 2024

Year	Key categories							Total (%)
1990	1A1a	2B10a	2C6					80.5
	69.3%	6.7%	4.5%					
2024	1A1a	2C6	1A4bi	5C1bv	2C5	2C1	2D3a	83.3
	45.7%	9.8%	9.1%	5.3%	4.5%	4.5%	4.4%	

The shares of sectors in the national Hg emissions are shown in Figure A1. 10.

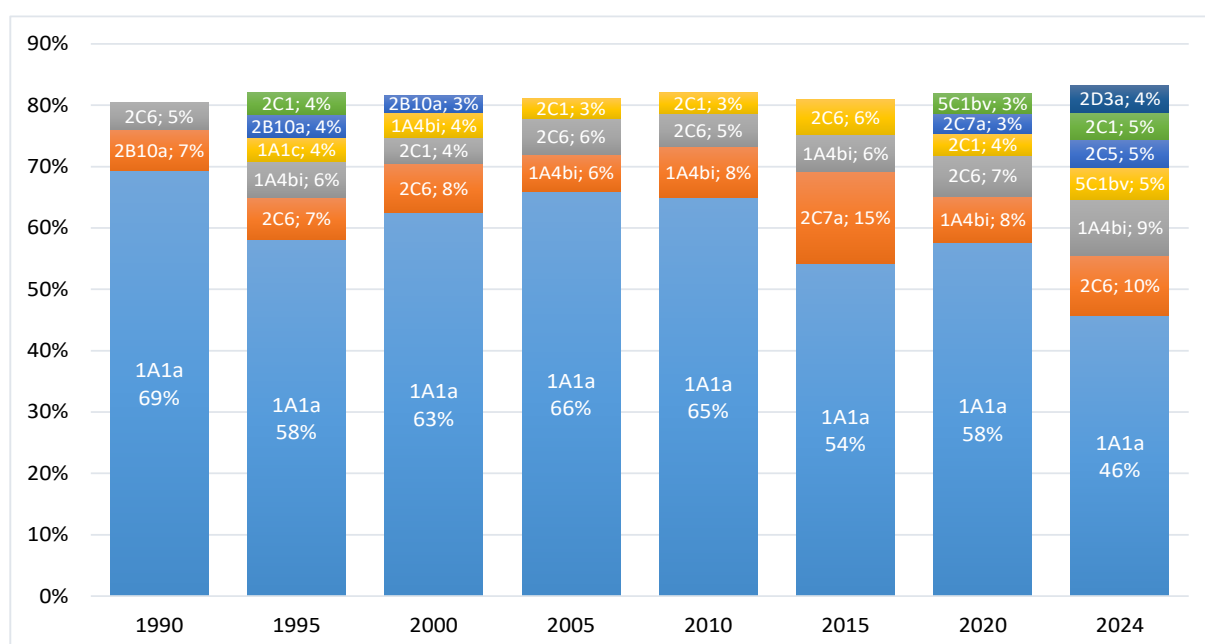


Figure A1. 10 Key categories for Hg emissions in selected years

1.7.3. Lead (Pb)

Six source categories have been identified as key sources (level assessment) for 2024 in Pb inventory in Poland. The most important of them are: Iron and steel production (2C1), Lead production (2C5), stationary combustion of fuels in households (1A4bi) and Road transport: Automobile tyre and brake wear (1A3bvi).

Table A1. 12 Level Assessment for Pb emission sources in 1990 and 2024

Year	Key categories						Total (%)
1990	2C1	1A3bi	1A1a	1A4bi	2C5	1A3bii	81.9
	23.0%	19.7%	19.0%	6.9%	6.8%	6.5%	
2024	2C1	2C5	1A3bvi	1A4bi	1A1a	2C6	84.2
	26.2%	19.2%	12.8%	11.4%	8.8%	5.8%	

The shares of sectors in the national Pb emissions are shown in Figure A1. 11.

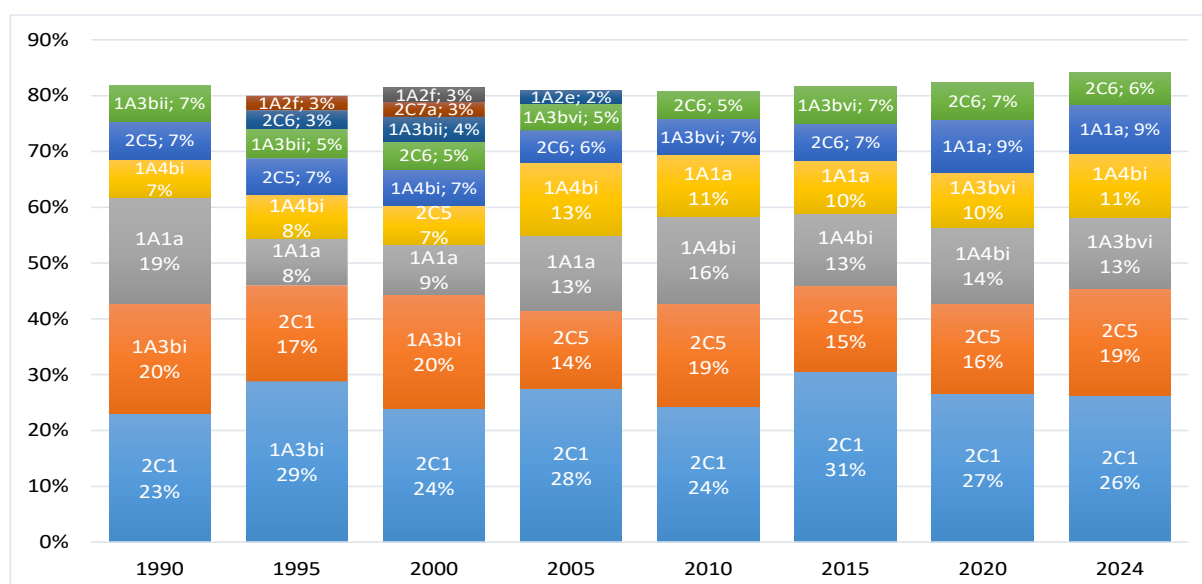


Figure A1. 11 Key categories for Pb emissions in selected years

1.8. PCDD/F emissions

Three source categories have been identified for 2024 as key sources (level assessment) in PCDD/F inventory in Poland. The most important is stationary combustion of fuels in households (1A4bi).

Table A1. 13 Level Assessment for PCDD/F emission sources in 1990 and 2024

Year	Key categories			Total (%)
1990	1A4bi	5E	1A4ai	81.3
	56.3%	15.9%	9.1%	
2024	1A4bi	5E	1A4ci	81.2
	64.0%	12.6%	4.6%	

The shares of sectors in the national PCDD/F emissions are shown in Figure A1. 12.



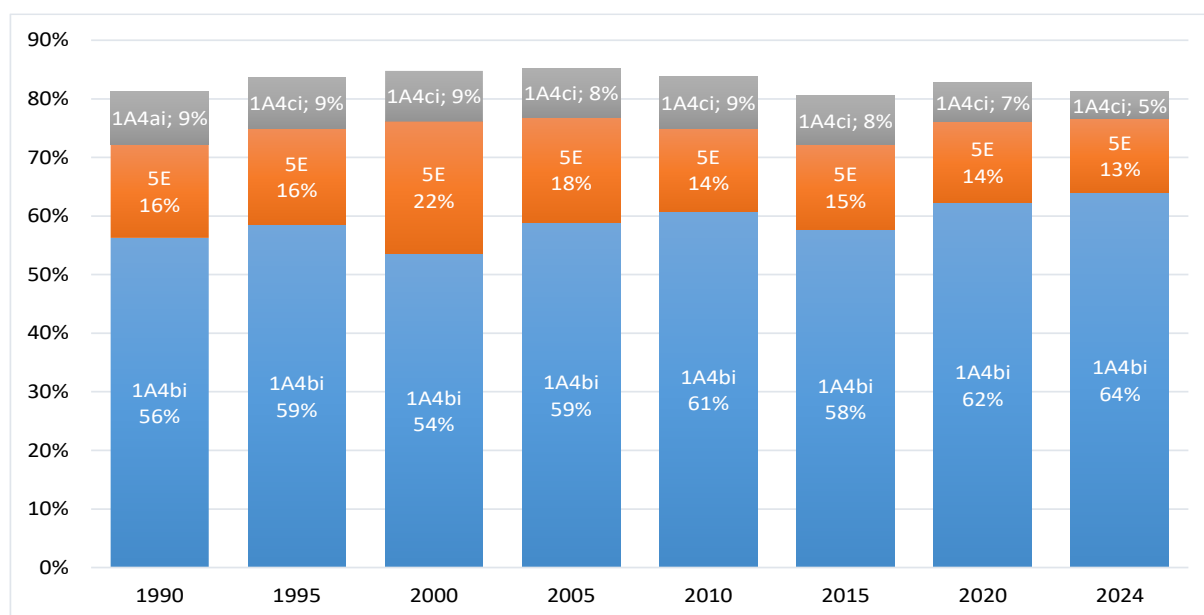


Figure A1. 12 Key categories for PCDD/F emissions in selected years

1.9. HCB emissions

Three source categories have been identified as key source (level assessment) for 2024 in HCB inventory in Poland. The most important of them are: stationary combustion of fuels in households (1A4bi), sector 3Df use of pesticides and public electricity and heat production (1A1a). The shares of sectors in the national HCB emissions are shown in Figure A1. 13.

Table A1. 14 Level Assessment for HCB emission sources in 1990 and 2024

Year	Key categories			Total (%)
1990	3Df			97.2
	97.2%			
2024	1A4bi	1A1a	3Df	80.3
	31.2%	25.3%	23.8%	

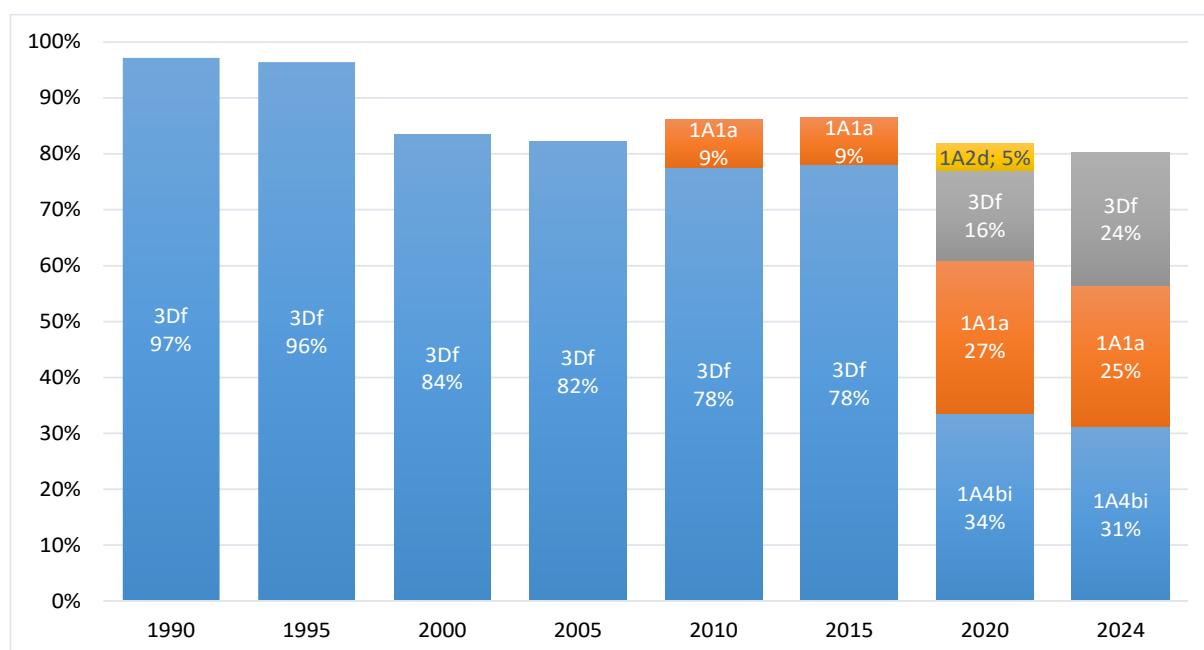


Figure A1. 13 Key categories for HCB emissions in selected years

1.10. PAH emissions

Only one source category have been identified as key source (level assessment) for 2024 in PAHs inventory in Poland. These is stationary combustion of fuels in households (1A4bi). The shares of sectors in the national PAH emissions in selected years are shown in Figure A1. 14.

Table A1. 15 Level Assessment for PAH emission sources in 1990 and 2024

Year	Key categories		Total (%)
1990	1A4bi	1A4ai	86.5
	73.8%	12.7%	
2024	1A4bi		83.2
	83.2%		

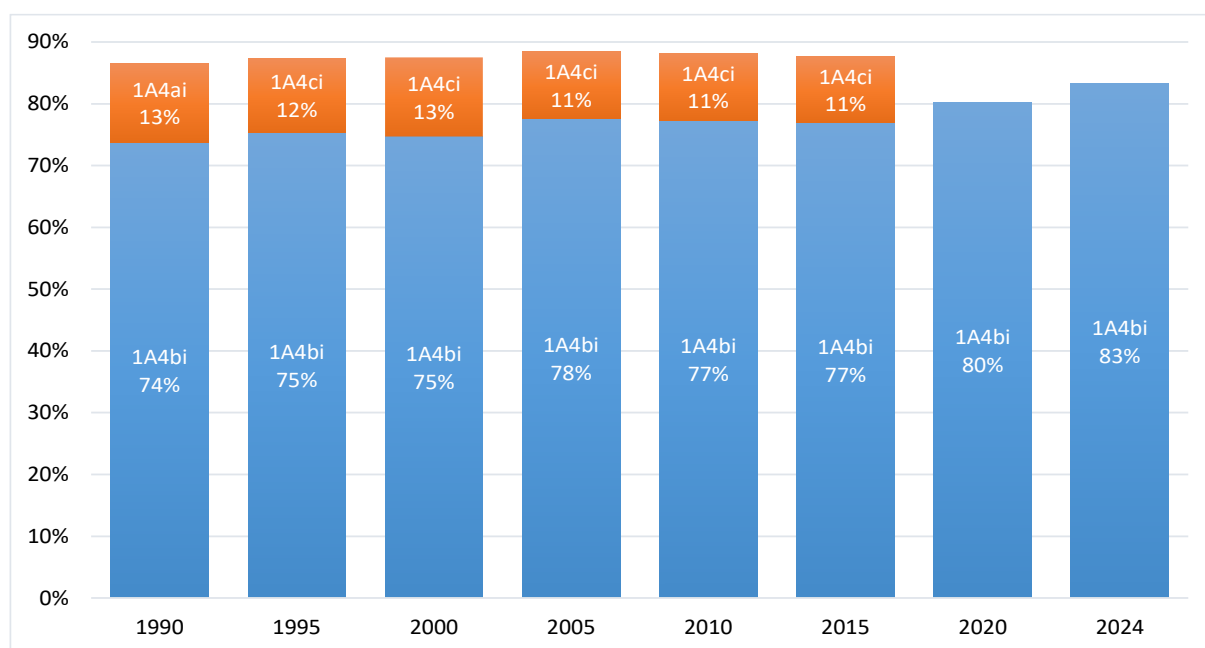


Figure A1. 14 Key categories for PAH emissions in selected years

Appendix 2. METHODOLOGY OF BIOGENIC NATURAL VOC (BVOC) EMISSION ESTIMATES

All methodologies for calculating biogenic emissions essentially involve multiplying an emissions factor for a type of vegetation by a statistic giving the amount of vegetation in the country or grid square. Two major alternatives for this are (1) to perform these calculations at a general or preferably species specific level (requiring for example separate statistics for Norway spruce, Douglas fir, etc.), or (2) to perform the calculations for different ecosystem types. In this latter method, each ecosystem is assumed to consist of a number of species, and the assigned emission rates attempt to give the average emissions from this category. Our ability to assess the impact of natural emissions on tropospheric oxidant levels is very dependent on the quality and quantity of available measurements. Measurements of natural emissions from vegetation have been improved considerably during the past decade as a result of advances in analytical methods and measurement techniques.

Emission estimation

Emissions identification of individual species is a difficult exercise, requiring consideration of variations in the species emitted at different periods of the year, and differences in species emitted by different plant species among other things. The simplified methodology consists of modifying equation is considering seasonal calculation. The simplified equation applied in calculation is as follows:

$$F = \epsilon * D * \gamma$$

Where:

D- foliar biomass estimates,

ϵ - is the average emission potentials ($\mu\text{g g}^{-1}\text{h}^{-1}$ at 30°C),

γ - represents the integrated value of γ over the growing season of the vegetation concerned.

Integrated values, γ -iso and γ -mts, have been provided in the section 4 of Chapter 11.C of the *EMEP/EEA air pollutant emission inventory guidebook 2019*. With this simplified methodology we could estimate, for example, the isoprene emissions from 1 km² of particular tree species (e.g. Q. robur) as simply:

$$\text{Emission} = \text{Area} * \epsilon * D * \gamma\text{-iso}$$

Vegetation coverage in terms of the vegetation types discussed in section 4 of Chapter 11C of the *EMEP/EEA air pollutant emission inventory guidebook 2019* was required, together with foliar biomass estimates (D), and estimates of growing seasons.

Integrated environmental correction factors (γ)

Table A2. 1. Country average values of integrated environmental correction factors, γ -iso and γ -mts for 6- and 12-month growing seasons (unit= hours)

Growing season	Integrated correction factor			
	[γ -mts] = [γ -ovoc]		[γ -iso]	
	6-month	12-month	6-month	12-month
Poland	736	912	558	669

Foliar biomass densities

For the simpler methodology, seasonal average foliar biomass densities were used. Default values are suggested below and in sections: 6 and 8 of Chapter 11C of the *EMEP/EEA air pollutant emission inventory guidebook 2019*.

Table A2. 2. Default foliar biomass densities; broadleaved species

Land use type	Foliar biomass density, D (gm ⁻²)
Oaks (<i>Quercus sp.</i>)	320
Birch (<i>Betula sp.</i>)	320
Poplar, aspen (<i>Populus sp.</i>)	320
Default deciduous	300
Evergreen deciduous	500

Table A2. 3. Default foliar biomass densities; coniferous species

Land use type	Foliar biomass density, D (gm ⁻²)
Norway spruce (<i>Picea abies</i>) < 55°N latitude	1600
Scots pine (<i>Pinus sylvestris</i>) < 60°N latitude	700
Other coniferous (<i>Pinus sp.</i>)	700
Fir (<i>Abies sp.</i>)	1400
Douglas fir (<i>Pseudotsuga menziessi</i>)	1000
Larch (<i>Larix sp.</i>)	300
Other coniferous	1000

Standard emission potentials (ε)

Emission potentials (ε) were required separately for isoprene, monoterpenes and other volatile organic compound (OVOC). Furthermore, for monoterpenes, two classes of behaviour were distinguished. For most trees, emissions are temperature-only dependant, controlled by the γ-mts environmental factor. Standard emission (γ) potentials have been applied separately for isoprene, terpenes, and OVOC, and this division represents the most important level of speciation. However, there are many species represented within the class of terpenes and OVOC covering a wide range of chemical behaviour.

Table A2. 4. Standard emission potentials (μg g-1h-1 at 30°C and PAR=1 000 μmol m-2 s-1) for European trees

Common name	Latin name	Iso. Terpenes			O-VOC
		ε-iso	ε-mtl	ε-mts	
Fir	<i>Abies</i>	0	0	3	1.5
Common alder	<i>Alnus</i>	0	0	1.5	1.5
Birch	<i>Betula</i>	0	0	0.2	1.5
Hornbeam	<i>Carpinus</i>	0	0	0.65	1.5
European beech	<i>Fagus</i>	0	0	0.65	1.5
Ash	<i>Fraxinus</i>	0	0	0	1.5
European larch	<i>Larix</i>	0	0	1.5	1.5
Spruce	<i>Picea sp.</i>	1	1.5	1.5	1.5
Scots pine	Scots pine	0	0	1.5	1.5
Poplar	<i>Populus</i>	60	0	0	1.5
Cherry	<i>Prunus</i>	0	0	0	1.5
Douglas Fir	<i>Pseudotsuga</i>	0	0	1.5	1.5
European oak	<i>Quercus robur</i>	60	0	0.2	1.5



Activity data and emission factors applied

The inventory incorporates default data on foliar biomass densities that became available in the last years for the main tree species in Poland. Furthermore, default bioclimatic correction factor was introduced to correct the foliar biomass densities of trees for the different plant growth conditions.

It shall be noted that accurate estimates of foliar biomass are important for quantifying biogenic volatile organic compound (BVOC) in forest ecosystems, but they are not reported either on regional or national inventories. Therefore the amount and composition of plant species that cover the land surface which are the primary control on the type and magnitude of BVOC flux were attributed to the available country specific plant species distribution. In this specific case foliar biomass densities values could only be applied when the area of the tree species by single species has been provided. Since the commercial forestry is at least well documented in Poland we were able to obtain relevant information from the in-country forest inventories.

Table A2. 5. Major tree species area distribution in 2024 (as of 31 December 2023)

Common name	[ha]
Scots pine	5 482 850
Spruce	451 035
Fir	318 187
Other	131 916
Coniferous	6 383 988
Beech	595 942
Oak	745 970
Hornbeam	110 712
Birch	607 901
Common alder	543 631
Poplar	9 019
Other	286 612
Broadleaved	2 899 787
Total	9 283 775

Data source: The data was prepared based on the Large-Area Forest Inventory conducted in 2020–2024 by the Office of Forest Management and Forest Geodesy. The data was converted into the area of forests of individual ownership categories provided by the Central Statistical Office as of December 31, 2022.

Uncertainty estimates

The identification and quantification of OVOC emissions from plants has proven one of the most difficult problems in evaluating total biogenic emissions. OVOC consists of a wide variety of compounds, many of which have been difficult to measure. With the limited screening studies available, it has been assumed to use the recommended emission rate of $1.5 \mu\text{g g}^{-1} \text{h}^{-1}$ is associated with a 10-fold range ($0.5\text{--}5 \mu\text{g g}^{-1} \text{h}^{-1}$) in possible emissions as the most appropriate.

Assessment of the uncertainties inherent in calculations of biogenic VOC emissions in Europe is rather difficult. It has been recognised that the minimum level of uncertainty in global biogenic emission estimates is a factor of three (Guenther et al., 1995⁹), but this is likely to

⁹ Guenther A., Hewitt C.N., Erickson D., Fall R., Geron C., Graedel T., Harley P., Klinger L., Lerdau M., McKay W.A., Pierce T., Scholes R., Steinbrecher R., Tallamraju R., Taylor J. and Zimmerman P., 1995. 'A global model of natural volatile organic compound emissions', *Journal of Geophysical Research*, 100, No D5, pp. 8873–8892.

represent a lower limit for the accuracy of European emission estimates. Furthermore, this figure relates to estimates of annual emissions. Uncertainties for episodic calculations must obviously be substantially greater.

Further/planned improvements

Emission factors and regional land-use knowledge remain the weakest links, with emission factors improvable only through additional measurements. We will prioritize collecting accurate land-use data, as "other wooded land" (OWL) categories often suffer from inconsistent definitions. For any inventory, specifying foliar biomass density for given vegetation areas proves most critical. Planned enhancements are focused on addressing remote sensing limitations with OWL's mosaic-like gradients, which currently reduce precision in detecting degradation or emissions from foliar biomass

Appendix 3. ASSESSMENT OF COMPLETENESS

In Table A3. 1 there are listed categories for which reliable activity data has not been gathered yet or the estimation methodology is still under verification. All other instances of NE keys in the inventory are due to the lack of appropriate emission factor in the EEA/EMEP Emission Inventory Guidebook.

Table A3. 1. Not estimated air pollutant emissions (notation key NE)

NFR code	NFR category	Pollutant	Reason for not estimating
1A3ai(i)	International aviation LTO (civil)	HMs and PAHs	lack of EFs
1A3aii(i)	Domestic aviation LTO (civil)	NH ₃ , HMs (except Pb), PAHs	lack of EFs
1A3bvi	Road transport: Automobile tyre and brake wear	Hg, PCDD/F, HCB, PCB, IP	lack of EFs
1A3bvii	Road transport: Automobile road abrasion	POPs	lack of EFs
1A3c	Railways	Pb, Hg, As, PCDD/F, BkF, IP	lack of EFs
1A3dii	National navigation (shipping)	NH ₃	lack of EFs
1A3ei	Pipeline transport	NH ₃	lack of EFs
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	PCDD/F, BkF, IP	lack of EFs
1A4ciii	Agriculture/Forestry/Fishing: National fishing	NH ₃ , PAHs	lack of EFs
2A3	Glass production	HCB, PAHs	lack of EFs
2B1	Ammonia production	NMVOC, SO _x , PM _{2.5}	lack of EFs
2B2	Nitric acid production	PM _{2.5}	lack of EFs
2B6	Titanium dioxide production	PM _{2.5} , PM ₁₀ , BC, HMs, POPs	lack of EFs
2B7	Soda ash production	PM _{2.5} , PM ₁₀ , BC	lack of EFs
2B10b	Storage, handling and transport of chemical products	HMs, POPs	lack of AD and EFs
2C1	Iron and steel production	BaP, BbF, BkF, IP	lack of EFs
2C2	Ferroalloys production	HMs (except Pb), PCDD/F, PAHs	lack of EFs
2C3	Aluminium production	HMs, POPs (except PCDD/F, PCB)	lack of EFs
2C5	Lead production	BC, Cr, Cu, Ni, PAHs, HCB	lack of EFs
2C6	Zinc production	BC, Cr, Cu, Ni, PAHs, HCB	lack of EFs
2C7a	Copper production	PAHs	lack of EFs
2C7c	Other metal production	NMVOC, NH ₃ , PM _{2.5} , PM ₁₀ , BC, POPs	lack of EFs
2G	Other product use	HCB, PCB	lack of EFs
2H1	Pulp and paper industry	NH ₃ , PAHs, HCB	lack of EFs
2H2	Food and beverages industry	PM _{2.5} , BC	lack of EFs
2I	Wood processing	PM ₁₀ , PM _{2.5}	lack of EFs
3Da4	Crop residues applied to soils	NO _x	lack of EFs
3Db	Indirect emissions from managed soils	NO _x , NH ₃	lack of EFs
3De	Cultivated crops	NO _x	lack of EFs
3F	Field burning of agricultural residues	HCB, PCB	lack of EFs
5A	Biological treatment of waste - Solid waste disposal on land	NH ₃ , CO, Hg	lack of EFs
5C1bv	Cremation	BC	lack of EFs
5C2	Open burning of waste	NH ₃ , Hg, Ni, IP, HCB	lack of EFs
5D1	Domestic wastewater handling	PMs, HMs	lack of EFs
5D2	Industrial wastewater handling	NH ₃ , PMs, HMs	lack of EFs
5E	Other waste	NO _x , NMVOC, SO ₂ , BC, CO, Ni, Zn, PAHs, HCB, PCB	lack of EFs
All		Se	Methodology under verification

Emission of some pollutants has not been positioned in the original emission source category but included in other NFR sub-category (usually on a higher level of aggregation). It is caused by difficulties in appropriate disaggregation of activity data. Such cases have been listed in Table A3. 2.

Table A3. 2 Air pollutant emissions included in other sub-categories (notation key IE)

NFR code	NFR category	Pollutant	Included in NFR
1A2gvii	Mobile combustion in manufacturing industries and construction	All	1A3b
1A3di(ii)	International inland waterways	All	1A3dii
1A4aii	Commercial/Institutional: Mobile	All (exl. PCDD/F, HCB, PCBs)	1A3b
1A4bii	Residential: Household and gardening (mobile)	All (excl. HCB, PCBs)	1A3b
1A5a	Other stationary (including military)	All	1A4ai
1A5b	Other, Mobile (including military, land based and recreational boats)	All	1A3b
1B2aiv	Fugitive emissions oil: Refining and storage	NH3	1A1b
2A1	Cement production	All (exl. PMs)	1A2f
2A2	Lime production	NOx, NMVOC, SO2, CO, Pb, Cd, Hg	1A2f
2A3	Glass production	NOx, SO2, NMVOC, NH3, CO	1A2f
2A5c	Storage, handling and transport of mineral products	PMs	1A2f
2B2	Nitric acid production	SO2, NMVOC, NH3	1A2c
2B6	Titanium dioxide production	NMVOC, NH3, CO	1A2c
2B10b	Storage, handling and transport of chemical products (please specify in the IIR)	NOx, SO2, NMVOC, NH3, PMs, CO	1A2c
2C1	Iron and steel production	NH3	1A2a
2C2	Ferroalloys production	NOx, SO2, NMVOC, NH3, CO	1A2b
2C3	Aluminium production	NOx, SO2, NMVOC, NH3, CO	1A2b
2C5	Lead production	NOx, NMVOC, NH3, CO	1A2b
2C6	Zinc production	NOx, NMVOC, NH3, CO	1A2b
2C7a	Copper production	NMVOC, NH3	1A2b
2C7d	Storage, handling and transport of metal products (please specify in the IIR)	PMs	1A2b
2L	Other production, consumption, storage, transportation or handling of bulk products	PMs	2A1
3Da2a	Animal manure applied to soils	NMVOC	3B
3Da3	Urine and dung deposited by grazing animals	NMVOC	3B

Table A3. 3 Air pollutant emissions not occurring (notation key NO)

NFR code	NFR category	Pollutant
1B2d	Other fugitive emissions from energy production	All
2B3	Adipic acid production	All
2B5	Carbide production	All
2C4	Magnesium production	All
2C7b	Nickel production	All
2H3	Other industrial processes	All
2J	Production of POPs	All
2K	Consumption of POPs and heavy metals	All
3B4a	Manure management - Buffalo	All
3B4f	Manure management - Mules and asses	All
3Da2c	Other organic fertilisers applied to soils	All
3I	Agriculture other	All
5C1a	Municipal waste incineration	All
5C1bi	Industrial waste incineration	All
5C1bii	Hazardous waste incineration	All
5C1biii	Clinical waste incineration	All
5C1biv	Sewage sludge incineration	All



Appendix 4. NATIONAL ENERGY BALANCE FOR 2024 IN EUROSTAT FORMAT

TJ 2024	Total	Solid fossil fuels	Anthracite	Coking coal	Other bituminous coal	Sub-bituminous coal	Lignite	Patent fuel	Coke oven coke	Gas coke	Coal tar	Brown coal briquettes
+ Primary production	2 209 159.9	1 393 432.1	0.0	330 204.5	726 861.8	0.0	336 365.8	Z	Z	Z	Z	Z
+ Recovered & recycled products	8 518.9	5 998.9	0.0	0.0	5 998.9	0.0	0.0	Z	Z	Z	Z	Z
+ Imports	2 505 210.6	208 273.1	500.6	57 171.6	143 474.4	0.0	1 391.2	361.2	5 092.8	0.0	246.3	35.0
- Exports	626 347.1	300 726.3	0.0	78 002.6	46 582.9	0.0	17.1	137.9	163 715.8	0.0	12 212.6	57.5
+ Change in stock	17 504.7	33 112.2	133.5	-3 216.7	32 102.6	0.0	-164.0	-2.1	3 860.1	0.0	317.2	81.7
= Gross available energy	4 114 047.0	1 340 090.1	634.1	306 156.7	861 854.8	0.0	337 575.9	221.2	-154 762.9	0.0	-11 649.0	59.2
- International maritime bunkers	7 498.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
= Gross inland consumption	4 106 548.4	1 340 090.1	634.1	306 156.7	861 854.8	0.0	337 575.9	221.2	-154 762.9	0.0	-11 649.0	59.2
- International aviation	55 747.1	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
= Total energy supply	4 050 801.2	1 340 090.1	634.1	306 156.7	861 854.8	0.0	337 575.9	221.2	-154 762.9	0.0	-11 649.0	59.2
Transformation input	3 147 287.8	1 348 209.9	0.0	296 734.0	661 169.0	0.0	335 472.9	0.0	54 833.9	0.0	0.0	0.0
+ Electricity & heat generation	1 483 363.4	997 852.3	0.0	1 196.3	661 169.0	0.0	335 472.9	0.0	14.0	0.0	0.0	0.0
+ Main activity producer electricity only	166 101.1	30 150.1	0.0	0.0	30 150.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Main activity producer CHP	1 029 146.5	870 627.1	0.0	0.0	535 326.2	0.0	335 300.9	0.0	0.0	0.0	0.0	0.0
+ Main activity producer heat only	94 635.7	68 528.9	0.0	0.0	68 351.1	0.0	163.8	0.0	14.0	0.0	0.0	0.0
+ Autoproducer electricity only	54 869.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Autoproducer CHP	120 813.4	24 668.9	0.0	292.4	24 376.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Autoproducer heat only	5 972.6	3 877.3	0.0	903.9	2 965.2	0.0	8.2	0.0	0.0	0.0	0.0	0.0
+ Electrically driven heat pumps	2.3	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electricity for pumped storage	5 088.8	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electricity for charging batteries	5 574.9	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Derived heat for electricity production	1 159.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	297 651.8	297 651.8	0.0	295 537.7	0.0	0.0	0.0	0.0	2 114.1	0.0	0.0	0.0
+ Blast furnaces	48 578.9	48 578.9	0.0	0.0	0.0	0.0	0.0	0.0	48 578.9	0.0	0.0	0.0
+ Refineries & petrochemical industry	1 260 719.8	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Liquid biofuels blended	52 811.2	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Not elsewhere specified	4 162.6	4 126.9	0.0	0.0	0.0	0.0	0.0	0.0	4 126.9	0.0	0.0	0.0
Transformation output	2 506 293.4	224 945.0	Z	Z	Z	Z	Z	0.0	212 994.2	0.0	11 950.8	0.0
+ Electricity & heat generation	880 189.7	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer electricity only	132 844.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer CHP	525 595.2	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer heat only	83 972.4	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer electricity only	54 869.1	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer CHP	73 369.6	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer heat only	4 538.4	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electrically driven heat pumps	7.3	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Pumped hydro	3 633.7	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Other sources	1 360.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	282 560.1	224 945.0	Z	Z	Z	Z	Z	Z	212 994.2	Z	11 950.8	Z
+ Blast furnaces	21 755.3	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Refineries & petrochemical industry	1 248 577.1	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Liquid biofuels blended	52 811.2	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Gas-to-liquids plants	20 400.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
Energy sector	247 900.5	2 916.8	0.0	1 771.0	1 104.3	0.0	41.0	0.0	0.5	0.0	0.0	0.0
+ Own use in electricity & heat generation	43 719.9	7.4	0.0	0.0	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Coal mines	20 366.9	462.5	0.0	0.0	421.0	0.0	41.0	0.0	0.5	0.0	0.0	0.0
+ Oil & natural gas extraction plants	22 699.3	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	40 978.4	1 771.0	0.0	1 771.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Gas works	167.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Petroleum refineries (oil refineries)	85 611.4	676.0	0.0	0.0	676.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Liquefaction & regasification plants (LNG)	3 014.5	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Not elsewhere specified (energy)	31 342.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Distribution losses	58 593.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Available for final consumption	3 103 312.9	213 908.3	634.1	7 651.7	199 581.5	0.0	2 062.0	221.2	3 396.9	0.0	301.7	59.2
Final non-energy consumption	212 177.4	2 039.4	0.0	0.0	337.7	0.0	0.0	0.0	1 400.0	0.0	301.8	0.0
+ Non-energy use industry/transformation/energy	196 602.7	2 039.4	0.0	0.0	337.7	0.0	0.0	0.0	1 400.0	0.0	301.8	0.0
+ Non-energy use in transport sector	5 019.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Non-energy use in other sectors	10 555.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final energy consumption	2 891 162.6	250 284.7	119.0	18.8	237 742.2	0.0	3 435.2	221.3	8 698.4	0.0	0.0	49.8
+ Industry sector	608 546.1	76 060.9	119.0	2.9	66 662.2	0.0	1 795.2	8.1	7 423.7	0.0	0.0	49.6
+ Iron & steel	54 697.0	2 947.4	0.0	0.0	2 573.5	0.0	0.0	3.4	370.6	0.0	0.0	0.0
+ Chemical & petrochemical	103 584.0	30 581.0	0.0	0.0	28 173.3	0.0	0.0	0.0	2 407.7	0.0	0.0	0.0
+ Non-ferrous metals	17 677.0	713.4	0.0	0.0	50.9	0.0	0.0	0.0	662.5	0.0	0.0	0.0
+ Non-metallic minerals	113 609.0	12 255.1	82.0	0.3	8 902.9	0.0	682.3	0.0	2 587.4	0.0	0.0	0.0
+ Transport equipment	19 070.5	241.7	0.0	0.0	241.5	0.0	0.0	0.1	0.1	0.0	0.0	0.0
+ Machinery	30 431.6	610.6	0.0	2.0	553.1	0.0	0.0	3.5	52.0	0.0	0.0	0.0
+ Mining & quarrying	19 080.8	813.3	33.9	0.1	429.3	0.0	108.6	0.0	241.3	0.0	0.0	0.0
+ Food, beverages & tobacco	96 155.2	20 270.5	3.0	0.4	19 226.7	0.0	0.1	0.1	1 040.3	0.0	0.0	0.0
+ Paper, pulp & printing	64 642.3	4 369.8	0.0	0.0	4 369.1	0.0	0.0	0.7	0.0	0.0	0.0	0.0
+ Wood & wood products	43 508.5	807.9	0.0	0.0	807.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Construction	7 605.8	1 322.9	0.0	0.1	216.1	0.0	996.2	0.3	60.6	0.0	0.0	49.6
+ Textile & leather	4 056.7	194.8	0.0	0.0	194.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Not elsewhere specified (industry)	34 427.8	932.4	0.0	0.0	923.2	0.0	8.0	0.0	1.2	0.0	0.0	0.0
+ Transport sector	1 020 301.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Rail	15 601.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Road	1 000 313.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Domestic aviation	2 124.1	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Domestic navigation	46.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Pipeline transport	2 215.4	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Not elsewhere specified (transport)	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	1 262 315.5	174 223.8	0.0	15.9	171 080.0	0.0	1 640.0	213.2	1 274.7	0.0	0.0	0.1
+ Commercial & public services	310 372.6	9 378.6	0.0	15.5	9 100.0	0.0	123.0	0.0	140.0	0.0	0.0	0.1
+ Households	822 145.0	151 426.0	0.0	0.0	148 980.0	0.0	1 312.0	0.0	1 134.0	0.0	0.0	0.0
+ Agriculture & forestry	129 661.6	13 418.1	0.0	0.4	12 998.9	0.0	205.0	213.2	0.7	0.0	0.0	0.0
+ Fishing	82.4	1.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Not elsewhere specified (other)	54.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Statistical differences	-27.1	-38 415.8	515.1	7 632.9	-38 498.4	0.0	-1 373.2	-0.1	-6 701.5	0.0	0.0	9.4

Poland's Informative Inventory Report 2026

TJ 2024	Manufactured gases	Gas works gas	Coke oven gas	Blast furnace gas	Other recovered gases	Peat and peat products	Peat	Peat products	Oil shale and oil sands	Oil and petroleum products	Crude oil
+ Primary production	Z	Z	Z	Z	Z	0.0	0.0	Z	0.0	34 364.6	34 244.0
+ Recovered & recycled products	Z	Z	Z	Z	Z	0.0	0.0	Z	0.0	2 520.0	Z
+ Imports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1 647 898.0	1 084 742.7
- Exports	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	251 826.4	7 788.5
+ Change in stock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-37 848.6	-10 047.7
= Gross available energy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1 395 107.6	1 101 150.6
- International maritime bunkers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7 498.7	Z
= Gross inland consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1 387 608.9	1 101 150.6
- International aviation	Z	Z	Z	Z	Z	Z	Z	Z	Z	55 747.1	0.0
= Total energy supply	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1 331 861.8	1 101 150.6
Transformation input	28 692.5	0.0	16 704.0	10 888.5	1 100.0	0.0	0.0	0.0	0.0	1 280 654.3	1 105 130.0
+ Electricity & heat generation	28 692.5	0.0	16 704.0	10 888.5	1 100.0	0.0	0.0	0.0	0.0	19 934.4	0.0
+ Main activity producer electricity only	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129.0	0.0
+ Main activity producer CHP	19 298.5	0.0	7 560.0	10 838.5	900.0	0.0	0.0	0.0	0.0	5 629.1	0.0
+ Main activity producer heat only	1 400.0	0.0	1 350.0	50.0	0.0	0.0	0.0	0.0	0.0	1 774.3	0.0
+ Autoproducer electricity only	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Autoproducer CHP	7 940.0	0.0	7 740.0	0.0	200.0	0.0	0.0	0.0	0.0	12 350.7	0.0
+ Autoproducer heat only	54.0	0.0	54.0	0.0	0.0	0.0	0.0	0.0	0.0	51.4	0.0
+ Electrically driven heat pumps	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electricity for pumped storage	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electricity for charging batteries	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Derived heat for electricity production	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Blast furnaces	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Refineries & petrochemical industry	Z	Z	Z	Z	Z	Z	Z	Z	Z	1 260 719.8	1 105 130.0
+ Liquid biofuels blended	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Not elsewhere specified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transformation output	79 370.4	0.0	57 615.1	18 554.1	3 201.2	0.0	Z	0.0	Z	1 268 977.1	0.0
+ Electricity & heat generation	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer electricity only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer CHP	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer heat only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer electricity only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer CHP	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer heat only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electrically driven heat pumps	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Pumped hydro	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Other sources	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	57 615.1	Z	57 615.1	Z	Z	Z	Z	Z	Z	Z	Z
+ Blast furnaces	21 755.3	Z	Z	18 554.1	3 201.2	Z	Z	Z	Z	Z	Z
+ Refineries & petrochemical industry	Z	Z	Z	Z	Z	Z	Z	Z	Z	1 248 577.1	0.0
+ Liquid biofuels blended	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Gas-to-liquids plants	Z	Z	Z	Z	Z	Z	Z	Z	Z	20 400.0	Z
Energy sector	36 191.1	0.0	36 191.1	0.0	0.0	0.0	0.0	0.0	0.0	42 241.4	0.0
+ Own use in electricity & heat generation	0.6	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	168.1	0.0
+ Coal mines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	870.2	0.0
+ Oil & natural gas extraction plants	Z	Z	Z	Z	Z	Z	Z	Z	Z	126.7	0.0
+ Coke ovens	36 190.4	0.0	36 190.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Gas works	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Petroleum refineries (oil refineries)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41 076.3	Z
+ Liquefaction & regasification plants (LNG)	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Not elsewhere specified (energy)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Distribution losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Available for final consumption	14 486.8	0.0	4 720.0	7 665.6	2 101.2	0.0	0.0	0.0	0.0	1 277 943.3	-3 979.4
Final non-energy consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	150 085.2	0.0
+ Non-energy use industry/transformation/energy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	134 510.6	0.0
+ Non-energy use in transport sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5 019.1	0.0
+ Non-energy use in other sectors	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10 555.5	0.0
Final energy consumption	14 486.8	0.0	4 720.0	7 665.6	2 101.2	0.0	0.0	0.0	0.0	1 108 566.3	0.0
+ Industry sector	14 486.8	0.0	4 720.0	7 665.6	2 101.2	0.0	0.0	0.0	0.0	34 186.4	0.0
+ Iron & steel	11 511.4	0.0	2 961.4	7 665.6	884.4	0.0	0.0	0.0	0.0	195.3	0.0
+ Chemical & petrochemical	447.6	0.0	447.6	0.0	0.0	0.0	0.0	0.0	0.0	14 721.7	0.0
+ Non-ferrous metals	1 291.5	0.0	74.7	0.0	1 216.8	0.0	0.0	0.0	0.0	329.7	0.0
+ Non-metallic minerals	1 234.4	0.0	1 234.4	0.0	0.0	0.0	0.0	0.0	0.0	3 831.8	0.0
+ Transport equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	904.9	0.0
+ Machinery	1.9	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	831.0	0.0
+ Mining & quarrying	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4 072.5	0.0
+ Food, beverages & tobacco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3 555.3	0.0
+ Paper, pulp & printing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1 340.6	0.0
+ Wood & wood products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	520.5	0.0
+ Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2 915.9	0.0
+ Textile & leather	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	274.1	0.0
+ Not elsewhere specified (industry)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	693.1	0.0
+ Transport sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	944 692.7	0.0
+ Rail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3 464.4	0.0
+ Road	Z	Z	Z	Z	Z	Z	Z	Z	Z	939 055.5	0.0
+ Domestic aviation	Z	Z	Z	Z	Z	Z	Z	Z	Z	2 124.1	0.0
+ Domestic navigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.9	0.0
+ Pipeline transport	Z	Z	Z	Z	Z	Z	Z	Z	Z	1.7	0.0
+ Not elsewhere specified (transport)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Other sectors	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129 687.3	0.0
+ Commercial & public services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16 889.1	0.0
+ Households	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22 154.0	0.0
+ Agriculture & forestry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90 551.0	0.0
+ Fishing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	39.2	0.0
+ Not elsewhere specified (other)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.0	0.0
Statistical differences	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19 291.7	-3 979.4

Poland's Informative Inventory Report 2026

TJ 2024	Natural gas liquids	Refinery feedstocks	Additives and oxygenates (excluding biofuel portion)	Other hydrocarbons	Refinery gas	Ethane	Liquefied petroleum gases	Motor gasoline (excluding biofuel portion)	Aviation gasoline	Gasoline-type jet fuel	Kerosene-type jet fuel (excluding biofuel portion)
+ Primary production	0.0	Z	120.6	0.0	Z	Z	Z	Z	Z	Z	Z
+ Recovered & recycled products	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Imports	0.0	75 533.2	1 607.6	0.0	Z	0.0	112 924.8	48 928.5	44.0	0.0	1 217.5
- Exports	0.0	0.0	0.0	0.0	Z	0.0	19 538.7	11 985.5	880.0	0.0	860.0
+ Change in stock	0.0	1 301.2	0.0	0.0	0.0	0.0	-332.7	-4 707.3	88.0	0.0	-591.6
= Gross available energy	0.0	76 834.4	1 728.2	0.0	0.0	0.0	93 053.4	32 235.8	-748.0	0.0	-234.1
- International maritime bunkers	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
= Gross inland consumption	0.0	76 834.4	1 728.2	0.0	0.0	0.0	93 053.4	32 235.8	-748.0	0.0	-234.1
- International aviation	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	1.5	0.0	55 745.6
= Total energy supply	0.0	76 834.4	1 728.2	0.0	0.0	0.0	93 053.4	32 235.8	-749.5	0.0	-55 979.8
Transformation input	0.0	98 519.4	1 509.4	20 400.0	5 890.4	0.0	2 500.4	0.0	0.0	0.0	0.0
+ Electricity & heat generation	0.0	0.0	0.0	0.0	1 594.0	0.0	49.5	0.0	0.0	0.0	0.0
+ Main activity producer electricity only	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Main activity producer CHP	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Main activity producer heat only	0.0	Z	Z	Z	0.0	0.0	37.5	0.0	0.0	0.0	0.0
+ Autoproducer electricity only	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Autoproducer CHP	0.0	Z	Z	Z	1 594.0	0.0	7.6	0.0	0.0	0.0	0.0
+ Autoproducer heat only	0.0	Z	Z	Z	0.0	0.0	4.4	0.0	0.0	0.0	0.0
+ Electrically driven heat pumps	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electricity for pumped storage	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electricity for charging batteries	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Derived heat for electricity production	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Blast furnaces	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Refineries & petrochemical industry	0.0	98 519.4	1 509.4	20 400.0	4 296.4	0.0	2 450.8	0.0	0.0	0.0	0.0
+ Liquid biofuels blended	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Not elsewhere specified	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transformation output	0.0	20 532.3	0.0	20 400.0	39 042.1	0.0	25 887.3	194 629.9	880.0	0.0	55 900.0
+ Electricity & heat generation	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer electricity only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer CHP	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer heat only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer electricity only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer CHP	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer heat only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electrically driven heat pumps	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Pumped hydro	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Other sources	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Blast furnaces	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Refineries & petrochemical industry	0.0	20 532.3	0.0	0.0	39 042.1	0.0	25 887.3	194 629.9	880.0	0.0	55 900.0
+ Liquid biofuels blended	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Gas-to-liquids plants	Z	Z	0.0	20 400.0	Z	Z	Z	Z	Z	Z	Z
Energy sector	0.0	0.0	0.0	0.0	20 186.0	0.0	134.4	1.6	0.0	0.0	0.0
+ Own use in electricity & heat generation	0.0	Z	Z	Z	0.0	0.0	0.6	0.9	0.0	0.0	0.0
+ Coal mines	0.0	Z	Z	Z	0.0	0.0	0.5	0.8	0.0	0.0	0.0
+ Oil & natural gas extraction plants	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Coke ovens	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Gas works	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Petroleum refineries (oil refineries)	Z	Z	Z	Z	20 186.0	0.0	133.4	0.0	0.0	0.0	0.0
+ Liquefaction & regasification plants (LNG)	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Not elsewhere specified (energy)	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Distribution losses	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Available for final consumption	0.0	-1 152.8	218.7	0.0	12 965.7	0.0	116 306.0	226 864.0	130.5	0.0	-79.8
Final non-energy consumption	0.0	Z	Z	Z	0.0	0.0	3 541.7	0.0	0.0	0.0	0.0
+ Non-energy use industry/transformation/energy	0.0	Z	Z	Z	0.0	0.0	3 541.7	0.0	0.0	0.0	0.0
+ Non-energy use in transport sector	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Non-energy use in other sectors	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final energy consumption	0.0	Z	Z	Z	12 965.7	0.0	111 162.9	226 864.0	249.1	0.0	1 891.9
+ Industry sector	0.0	Z	Z	Z	12 965.7	0.0	5 822.9	99.3	0.0	0.0	16.9
+ Iron & steel	0.0	Z	Z	Z	0.0	0.0	65.2	0.6	0.0	0.0	0.0
+ Chemical & petrochemical	0.0	Z	Z	Z	12 965.7	0.0	381.3	0.2	0.0	0.0	0.0
+ Non-ferrous metals	0.0	Z	Z	Z	0.0	0.0	29.8	0.0	0.0	0.0	0.0
+ Non-metallic minerals	0.0	Z	Z	Z	0.0	0.0	1 089.5	4.3	0.0	0.0	0.0
+ Transport equipment	0.0	Z	Z	Z	0.0	0.0	212.9	12.6	0.0	0.0	9.8
+ Machinery	0.0	Z	Z	Z	0.0	0.0	416.7	7.7	0.0	0.0	5.7
+ Mining & quarrying	0.0	Z	Z	Z	0.0	0.0	216.0	1.2	0.0	0.0	0.0
+ Food, beverages & tobacco	0.0	Z	Z	Z	0.0	0.0	2 357.2	7.6	0.0	0.0	1.2
+ Paper, pulp & printing	0.0	Z	Z	Z	0.0	0.0	161.6	1.3	0.0	0.0	0.0
+ Wood & wood products	0.0	Z	Z	Z	0.0	0.0	123.2	12.9	0.0	0.0	0.0
+ Construction	0.0	Z	Z	Z	0.0	0.0	109.8	48.9	0.0	0.0	0.0
+ Textile & leather	0.0	Z	Z	Z	0.0	0.0	201.3	0.5	0.0	0.0	0.0
+ Not elsewhere specified (industry)	0.0	Z	Z	Z	0.0	0.0	458.5	1.5	0.0	0.0	0.2
+ Transport sector	0.0	Z	Z	Z	0.0	0.0	84 180.0	226 680.3	249.1	0.0	1 875.0
+ Rail	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Road	0.0	Z	Z	Z	0.0	0.0	84 180.0	226 680.3	0.0	0.0	0.0
+ Domestic aviation	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	249.1	0.0	1 875.0
+ Domestic navigation	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Pipeline transport	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Not elsewhere specified (transport)	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Other sectors	0.0	Z	Z	Z	0.0	0.0	21 160.0	84.4	0.0	0.0	0.0
+ Commercial & public services	0.0	Z	Z	Z	0.0	0.0	1 380.0	0.0	0.0	0.0	0.0
+ Households	0.0	Z	Z	Z	0.0	0.0	17 940.0	0.0	0.0	0.0	0.0
+ Agriculture & forestry	0.0	Z	Z	Z	0.0	0.0	1 838.7	84.4	0.0	0.0	0.0
+ Fishing	0.0	Z	Z	Z	0.0	0.0	1.3	0.0	0.0	0.0	0.0
+ Not elsewhere specified (other)	0.0	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Statistical differences	0.0	-1 152.8	218.7	0.0	0.0	0.0	1 601.4	0.0	-118.6	0.0	-1 971.7

Poland's Informative Inventory Report 2026

TJ 2024	Other kerosene	Naphtha	Gas oil and diesel oil (excluding biofuel portion)	Fuel oil	White spirit and special boiling point industrial spirits	Lubricants	Bitumen	Petroleum coke	Paraffin waxes	Other oil products	Natural gas
+ Primary production	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	128 948.0
+ Recovered & recycled products	0.0	0.0	0.0	0.0	0.0	2 520.0	0.0	0.0	0.0	0.0	Z
+ Imports	86.0	0.0	285 782.7	1 727.1	2 854.0	14 115.1	9 741.3	1 126.2	4 094.4	3 372.8	562 289.2
- Exports	0.0	26 400.0	78 927.8	65 878.3	1 026.0	13 799.6	9 143.6	9 212.0	313.1	6 073.2	3 422.5
+ Change in stock	-2.0	1 320.0	-28 055.7	808.0	1 177.2	-597.4	-286.1	70.6	74.8	1 932.0	22 576.5
= Gross available energy	84.0	-25 080.0	178 799.3	-63 343.2	3 005.2	2 238.1	311.6	-8 015.2	3 856.1	-768.4	710 391.2
- International maritime bunkers	0.0	0.0	5 990.7	1 508.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
= Gross inland consumption	84.0	-25 080.0	172 808.6	-64 851.2	3 005.2	2 238.1	311.6	-8 015.2	3 856.1	-768.4	710 391.2
- International aviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z
= Total energy supply	84.0	-25 080.0	172 808.6	-64 851.2	3 005.2	2 238.1	311.6	-8 015.2	3 856.1	-768.4	710 391.2
Transformation input	0.0	18 861.4	3 665.1	14 918.5	0.0	3 360.0	0.0	0.0	14.6	5 885.1	167 218.5
+ Electricity & heat generation	0.0	0.0	3 372.4	14 918.5	0.0	0.0	0.0	0.0	0.0	0.0	167 182.7
+ Main activity producer electricity only	0.0	0.0	129.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16 290.0
+ Main activity producer CHP	0.0	0.0	1 392.2	4 236.9	0.0	0.0	0.0	0.0	0.0	0.0	85 005.2
+ Main activity producer heat only	0.0	0.0	1 620.4	116.3	0.0	0.0	0.0	0.0	0.0	0.0	14 813.5
+ Autoproducer electricity only	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Autoproducer CHP	0.0	0.0	200.0	10 549.1	0.0	0.0	0.0	0.0	0.0	0.0	50 103.2
+ Autoproducer heat only	0.0	0.0	30.8	16.2	0.0	0.0	0.0	0.0	0.0	0.0	970.8
+ Electrically driven heat pumps	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electricity for pumped storage	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electricity for charging batteries	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Derived heat for electricity production	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Blast furnaces	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Refineries & petrochemical industry	0.0	18 861.4	292.7	0.0	0.0	3 360.0	0.0	0.0	14.6	5 885.1	Z
+ Liquid biofuels blended	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Not elsewhere specified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.8
Transformation output	0.0	102 729.3	583 785.7	107 575.9	1 251.0	18 132.7	50 338.0	12 800.0	2 023.8	33 069.2	0.0
+ Electricity & heat generation	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer electricity only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer CHP	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer heat only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer electricity only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer CHP	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer heat only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electrically driven heat pumps	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Pumped hydro	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Other sources	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Blast furnaces	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Refineries & petrochemical industry	0.0	102 729.3	583 785.7	107 575.9	1 251.0	18 132.7	50 338.0	12 800.0	2 023.8	33 069.2	Z
+ Liquid biofuels blended	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Gas-to-liquids plants	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
Energy sector	0.3	0.0	1 159.4	20 724.7	0.0	0.0	0.0	0.0	0.0	34.9	59 439.6
+ Own use in electricity & heat generation	0.0	0.0	166.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	380.3
+ Coal mines	0.2	0.0	866.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	191.9
+ Oil & natural gas extraction plants	0.0	0.0	126.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21 944.2
+ Coke ovens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0
+ Gas works	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Petroleum refineries (oil refineries)	0.0	0.0	0.0	20 724.7	0.0	0.0	0.0	0.0	0.0	32.2	33 256.8
+ Liquefaction & regasification plants (LNG)	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	2 769.1
+ Not elsewhere specified (energy)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	886.3
Distribution losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	367.6
Available for final consumption	83.8	58 787.9	751 769.8	7 081.5	4 256.2	17 010.8	50 649.7	4 784.8	5 865.3	26 380.7	483 365.5
Final non-energy consumption	0.4	56 919.8	0.0	0.0	4 256.1	9 003.4	50 649.7	0.0	5 865.3	19 848.8	60 052.7
+ Non-energy use in industry/transformation/energy	0.4	56 919.8	0.0	0.0	214.6	971.9	50 649.7	0.0	2 363.8	19 848.8	60 052.7
+ Non-energy use in transport sector	0.0	0.0	0.0	0.0	0.0	5 019.1	0.0	0.0	0.0	0.0	0.0
+ Non-energy use in other sectors	0.0	0.0	0.0	0.0	4 041.6	3 012.4	0.0	0.0	3 501.5	0.0	0.0
Final energy consumption	86.1	0.0	751 001.6	1 999.5	0.0	0.0	0.0	2 314.8	0.0	30.9	404 279.9
+ Industry sector	3.0	0.0	10 953.6	1 979.4	0.0	0.0	0.0	2 314.8	0.0	30.9	163 275.3
+ Iron & steel	0.0	0.0	69.7	0.0	0.0	0.0	0.0	59.6	0.0	0.2	19 929.5
+ Chemical & petrochemical	0.5	0.0	1 297.3	75.5	0.0	0.0	0.0	0.0	0.0	1.2	18 773.0
+ Non-ferrous metals	0.0	0.0	37.6	261.8	0.0	0.0	0.0	0.4	0.0	0.0	7 171.2
+ Non-metallic minerals	0.1	0.0	503.7	119.4	0.0	0.0	0.0	2 114.9	0.0	0.0	42 601.8
+ Transport equipment	1.0	0.0	665.3	2.9	0.0	0.0	0.0	0.0	0.0	0.3	4 627.3
+ Machinery	0.9	0.0	391.6	7.5	0.0	0.0	0.0	0.0	0.0	1.0	9 138.5
+ Mining & quarrying	0.0	0.0	3 702.9	0.0	0.0	0.0	0.0	139.9	0.0	12.4	1 331.8
+ Food, beverages & tobacco	0.0	0.0	929.9	259.3	0.0	0.0	0.0	0.0	0.0	0.2	38 748.8
+ Paper, pulp & printing	0.3	0.0	360.4	816.4	0.0	0.0	0.0	0.0	0.0	0.7	9 898.5
+ Wood & wood products	0.0	0.0	303.4	81.0	0.0	0.0	0.0	0.0	0.0	0.0	1 544.8
+ Construction	0.0	0.0	2 431.8	311.0	0.0	0.0	0.0	0.0	0.0	14.4	1 407.8
+ Textile & leather	0.0	0.0	48.0	23.9	0.0	0.0	0.0	0.0	0.0	0.5	1 500.7
+ Not elsewhere specified (industry)	0.0	0.0	211.9	20.8	0.0	0.0	0.0	0.0	0.0	0.1	6 601.6
+ Transport sector	0.0	0.0	631 708.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3 836.8
+ Rail	0.0	0.0	3 464.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z
+ Road	0.0	0.0	628 195.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2 340.9
+ Domestic aviation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z
+ Domestic navigation	0.0	0.0	46.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z
+ Pipeline transport	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1 495.9
+ Not elsewhere specified (transport)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
+ Other sectors	83.1	0.0	108 339.8	20.0	0.0	0.0	0.0	0.0	0.0	0.0	237 167.8
+ Commercial & public services	29.1	0.0	15 480.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58 048.4
+ Households	0.0	0.0	4 214.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	177 271.7
+ Agriculture & forestry	0.0	0.0	88 607.9	20.0	0.0	0.0	0.0	0.0	0.0	0.0	1 844.6
+ Fishing	0.0	0.0	37.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2
+ Not elsewhere specified (other)	54.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Statistical differences	-2.7	1 868.2	768.2	5 082.0	0.0	8 007.4	0.0	2 470.0	0.0	6 501.0	19 032.9

Poland's Informative Inventory Report 2026

TJ 2024	Renewables and biofuels	Hydro	Tide, wave, ocean	Wind	Solar photovoltaic	Solar thermal	Geothermal	Primary solid biofuels	Charcoal	Biogases	Renewable municipal waste
+ Primary production	609 800.6	7 612.3	0.0	89 802.8	63 585.9	4 051.8	1 556.0	343 636.8	Z	17 105.1	5 065.6
+ Recovered & recycled products	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Imports	31 987.5	Z	Z	Z	Z	0.0	0.0	9 182.4	0.0	0.0	0.0
- Exports	22 684.4	Z	Z	Z	Z	0.0	0.0	8 981.0	0.0	0.0	0.0
+ Change in stock	-335.4	Z	Z	Z	Z	Z	Z	0.0	0.0	0.0	0.0
= Gross available energy	618 768.4	7 612.3	0.0	89 802.8	63 585.9	4 051.8	1 556.0	343 838.2	0.0	17 105.1	5 065.6
- International maritime bunkers	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
= Gross inland consumption	618 768.4	7 612.3	0.0	89 802.8	63 585.9	4 051.8	1 556.0	343 838.2	0.0	17 105.1	5 065.6
- International aviation	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
= Total energy supply	618 768.4	7 612.3	0.0	89 802.8	63 585.9	4 051.8	1 556.0	343 838.2	0.0	17 105.1	5 065.6
Transformation input	300 395.8	7 612.3	0.0	89 802.8	63 585.9	0.0	0.0	70 391.4	0.0	12 154.1	4 029.4
+ Electricity & heat generation	247 584.7	7 612.3	0.0	89 802.8	63 585.9	0.0	0.0	70 391.4	0.0	12 154.1	4 029.4
+ Main activity producer electricity only	119 532.0	7 601.5	0.0	89 802.8	8 727.7	0.0	0.0	13 400.0	Z	0.0	0.0
+ Main activity producer CHP	46 786.5	Z	Z	Z	Z	0.0	0.0	37 443.3	Z	7 868.8	1 474.4
+ Main activity producer heat only	8 090.6	Z	Z	Z	Z	0.0	0.0	8 080.6	Z	10.0	0.0
+ Autoproducer electricity only	54 869.1	10.8	0.0	0.0	54 858.3	0.0	0.0	0.0	Z	0.0	0.0
+ Autoproducer CHP	17 750.5	Z	Z	Z	Z	0.0	0.0	11 015.2	Z	4 229.9	2 505.4
+ Autoproducer heat only	556.1	Z	Z	Z	Z	0.0	0.0	452.4	Z	45.4	49.6
+ Electrically driven heat pumps	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electricity for pumped storage	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electricity for charging batteries	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Derived heat for electricity production	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Blast furnaces	0.0	Z	Z	Z	Z	Z	Z	Z	0.0	0.0	Z
+ Refineries & petrochemical industry	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Liquid biofuels blended	52 811.2	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Not elsewhere specified	0.0	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
Transformation output	52 811.2	Z	Z	Z	Z	Z	Z	Z	0.0	0.0	Z
+ Electricity & heat generation	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer electricity only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer CHP	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer heat only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer electricity only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer CHP	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer heat only	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electrically driven heat pumps	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Pumped hydro	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Other sources	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Blast furnaces	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Refineries & petrochemical industry	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Liquid biofuels blended	52 811.2	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Gas-to-liquids plants	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
Energy sector	27.8	Z	Z	Z	Z	0.0	0.0	27.8	0.0	0.0	0.0
+ Own use in electricity & heat generation	0.0	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
+ Coal mines	27.8	Z	Z	Z	Z	0.0	0.0	27.8	0.0	0.0	0.0
+ Oil & natural gas extraction plants	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	0.0	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
+ Gas works	0.0	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
+ Petroleum refineries (oil refineries)	0.0	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
+ Liquefaction & regasification plants (LNG)	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Not elsewhere specified (energy)	0.0	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
Distribution losses	0.0	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
Available for final consumption	371 156.0	0.0	0.0	0.0	0.0	4 051.8	1 556.0	273 419.0	0.0	4 951.0	1 036.1
Final non-energy consumption	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Non-energy use industry/transport/energy	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Non-energy use in transport sector	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Non-energy use in other sectors	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
Final energy consumption	371 100.6	Z	Z	Z	Z	4 051.8	1 556.0	273 365.7	0.0	4 949.3	1 036.1
+ Industry sector	67 920.5	Z	Z	Z	Z	0.0	0.0	66 037.1	0.0	1 144.6	738.7
+ Iron & steel	5.7	Z	Z	Z	Z	0.0	0.0	5.7	0.0	0.0	0.0
+ Chemical & petrochemical	260.5	Z	Z	Z	Z	0.0	0.0	204.5	0.0	56.0	0.0
+ Non-ferrous metals	0.7	Z	Z	Z	Z	0.0	0.0	0.7	0.0	0.0	0.0
+ Non-metallic minerals	4 014.9	Z	Z	Z	Z	0.0	0.0	4 014.9	0.0	0.0	0.0
+ Transport equipment	77.1	Z	Z	Z	Z	0.0	0.0	77.1	0.0	0.0	0.0
+ Machinery	81.7	Z	Z	Z	Z	0.0	0.0	81.7	0.0	0.0	0.0
+ Mining & quarrying	3.4	Z	Z	Z	Z	0.0	0.0	3.4	0.0	0.0	0.0
+ Food, beverages & tobacco	1 684.2	Z	Z	Z	Z	0.0	0.0	955.2	0.0	728.4	2.7
+ Paper, pulp & printing	27 812.2	Z	Z	Z	Z	0.0	0.0	26 774.8	0.0	301.4	736.0
+ Wood & wood products	29 519.9	Z	Z	Z	Z	0.0	0.0	29 489.1	0.0	30.8	0.0
+ Construction	67.7	Z	Z	Z	Z	0.0	0.0	37.7	0.0	30.0	0.0
+ Textile & leather	15.3	Z	Z	Z	Z	0.0	0.0	15.3	0.0	0.0	0.0
+ Not elsewhere specified (industry)	4 377.0	Z	Z	Z	Z	0.0	0.0	4 377.0	0.0	0.0	0.0
+ Transport sector	57 590.6	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
+ Rail	0.0	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
+ Road	57 590.6	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
+ Domestic aviation	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Domestic navigation	0.0	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
+ Pipeline transport	0.0	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Not elsewhere specified (transport)	0.0	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
+ Other sectors	245 589.5	Z	Z	Z	Z	4 051.8	1 556.0	207 328.6	0.0	3 804.7	297.4
+ Commercial & public services	11 750.9	Z	Z	Z	Z	217.7	389.0	6 166.8	0.0	3 261.1	297.4
+ Households	216 908.2	Z	Z	Z	Z	3 834.1	1 167.0	184 775.0	0.0	0.0	0.0
+ Agriculture & forestry	16 927.8	Z	Z	Z	Z	0.0	0.0	16 384.2	0.0	543.6	0.0
+ Fishing	2.6	Z	Z	Z	Z	0.0	0.0	2.6	0.0	0.0	0.0
+ Not elsewhere specified (other)	0.0	Z	Z	Z	Z	0.0	0.0	0.0	0.0	0.0	0.0
Statistical differences	55.4	0.0	0.0	0.0	0.0	0.0	0.0	53.3	0.0	1.7	0.0

TJ 2024	Pure biogasoline	Blended biogasoline	Pure biodiesels	Blended biodiesels	Pure bio jet kerosene	Blended bio jet kerosene	Other liquid biofuels	Ambient heat (heat pumps)	Non-renewable waste
+ Primary production	11 099.3	Z	37 725.0	Z	0.0	Z	4.9	28 555.1	42 174.6
+ Recovered & recycled products	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
+ Imports	2 163.2	1 961.0	15 862.5	2 818.4	0.0	0.0	0.0	Z	0.0
- Exports	986.1	0.0	12 717.2	0.0	0.0	0.0	0.0	Z	0.0
+ Change in stock	-159.7	0.0	-175.8	0.0	0.0	0.0	0.0	Z	0.0
= Gross available energy	12 116.7	1 961.0	40 694.5	2 818.4	0.0	0.0	4.9	28 555.1	42 174.6
- International maritime bunkers	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
= Gross inland consumption	12 116.7	1 961.0	40 694.5	2 818.4	0.0	0.0	4.9	28 555.1	42 174.6
- International aviation	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
= Total energy supply	12 116.7	1 961.0	40 694.5	2 818.4	0.0	0.0	4.9	28 555.1	42 174.6
Transformation input	12 116.7	0.0	40 694.5	0.0	0.0	0.0	3.8	4.9	9 851.7
+ Electricity & heat generation	0.0	0.0	0.0	0.0	0.0	0.0	3.8	4.9	9 851.7
+ Main activity producer electricity only	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Main activity producer CHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	1 800.0
+ Main activity producer heat only	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.5
+ Autoproducer electricity only	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Autoproducer CHP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	7 560.1
+ Autoproducer heat only	0.0	0.0	0.0	0.0	0.0	0.0	3.8	4.9	463.1
+ Electrically driven heat pumps	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electricity for pumped storage	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electricity for charging batteries	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Derived heat for electricity production	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
+ Blast furnaces	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	Z
+ Refineries & petrochemical industry	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
+ Liquid biofuels blended	12 116.7	Z	40 694.5	Z	0.0	Z	0.0	Z	Z
+ Not elsewhere specified	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transformation output	Z	12 116.7	Z	40 694.5	Z	0.0	Z	Z	Z
+ Electricity & heat generation	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer electricity only	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer CHP	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Main activity producer heat only	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer electricity only	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer CHP	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Autoproducer heat only	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Electrically driven heat pumps	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Pumped hydro	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Other sources	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Coke ovens	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Blast furnaces	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Refineries & petrochemical industry	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
+ Liquid biofuels blended	Z	12 116.7	Z	40 694.5	Z	0.0	Z	Z	Z
+ Gas-to-liquids plants	Z	Z	Z	Z	Z	Z	Z	Z	Z
Energy sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Own use in electricity & heat generation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Coal mines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Oil & natural gas extraction plants	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
+ Coke ovens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Gas works	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Petroleum refineries (oil refineries)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Liquefaction & regasification plants (LNG)	Z	Z	Z	Z	Z	Z	Z	Z	Z
+ Not elsewhere specified (energy)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
Distribution losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
Available for final consumption	0.0	14 077.7	0.0	43 512.9	0.0	0.0	1.1	28 550.2	32 322.8
Final non-energy consumption	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
+ Non-energy use industry/transformation/energy	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
+ Non-energy use in transport sector	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
+ Non-energy use in other sectors	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
Final energy consumption	0.0	14 077.7	0.0	43 512.9	0.0	0.0	0.7	28 550.2	32 314.1
+ Industry sector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30 858.3
+ Iron & steel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Chemical & petrochemical	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	51.1
+ Non-ferrous metals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Non-metallic minerals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	29 877.9
+ Transport equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Machinery	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.4
+ Mining & quarrying	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	69.4
+ Food, beverages & tobacco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Paper, pulp & printing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	798.3
+ Wood & wood products	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	30.3
+ Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.1
+ Textile & leather	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.2
+ Not elsewhere specified (industry)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	30.5
+ Transport sector	0.0	14 077.7	0.0	43 512.9	0.0	0.0	0.0	Z	0.0
+ Rail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Road	0.0	14 077.7	0.0	43 512.9	0.0	0.0	0.0	Z	0.0
+ Domestic aviation	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
+ Domestic navigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Pipeline transport	Z	0.0	Z	0.0	Z	0.0	Z	Z	Z
+ Not elsewhere specified (transport)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Other sectors	0.0	0.0	0.0	0.0	0.0	0.0	0.7	28 550.2	1 455.8
+ Commercial & public services	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1 418.2	1 455.8
+ Households	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27 132.1	0.0
+ Agriculture & forestry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Fishing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Z	0.0
+ Not elsewhere specified (other)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Statistical differences	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	8.7

TJ 2024	Industrial waste (non-renewable)	Non-renewable municipal waste	Nuclear heat	Heat	Electricity	Fossil energy	Bioenergy
+ Primary production	28 622.2	13 552.4	0.0	440.0	Z	1 598 919.3	414 636.6
+ Recovered & recycled products	Z	Z	Z	Z	Z	8 518.9	0.0
+ Imports	0.0	0.0	Z	0.0	54 762.8	2 456 153.1	34 513.6
- Exports	0.0	0.0	Z	0.0	47 687.6	588 798.1	24 884.1
+ Change in stock	0.0	0.0	Z	Z	Z	17 840.2	-335.4
= Gross available energy	28 622.2	13 552.4	0.0	440.0	7 075.3	3 492 633.2	423 930.7
- International maritime bunkers	Z	Z	Z	Z	Z	7 498.7	0.0
= Gross inland consumption	28 622.2	13 552.4	0.0	440.0	7 075.3	3 485 134.6	423 930.7
- International aviation	Z	Z	Z	Z	Z	55 747.1	0.0
= Total energy supply	28 622.2	13 552.4	0.0	440.0	7 075.3	3 429 387.4	423 930.7
Transformation input	1 288.9	8 562.9	0.0	1 599.0	10 666.1	2 843 407.7	140 034.2
+ Electricity & heat generation	1 288.9	8 562.9	0.0	1 599.0	10 666.1	1 232 294.5	87 223.0
+ Main activity producer electricity only	0.0	0.0	0.0	0.0	Z	46 569.1	13 400.0
+ Main activity producer CHP	200.0	1 600.0	0.0	0.0	Z	982 360.0	46 786.5
+ Main activity producer heat only	28.5	0.0	0.0	0.0	Z	86 545.2	8 090.6
+ Autoproducer electricity only	0.0	0.0	0.0	0.0	Z	0.0	0.0
+ Autoproducer CHP	797.2	6 762.9	0.0	440.0	Z	103 019.0	17 792.4
+ Autoproducer heat only	263.1	200.0	0.0	0.0	Z	5 416.5	551.2
+ Electrically driven heat pumps	Z	Z	Z	Z	2.3	1.6	0.1
+ Electricity for pumped storage	Z	Z	Z	Z	5 088.8	3 502.6	234.7
+ Electricity for charging batteries	Z	Z	Z	Z	5 574.9	3 837.2	257.2
+ Derived heat for electricity production	Z	Z	Z	1 159.0	Z	1 043.3	110.4
+ Coke ovens	Z	Z	Z	Z	Z	297 651.8	0.0
+ Blast furnaces	Z	Z	Z	Z	Z	48 578.9	0.0
+ Refineries & petrochemical industry	Z	Z	Z	Z	Z	1 260 719.8	0.0
+ Liquid biofuels blended	Z	Z	Z	Z	Z	0.0	52 811.2
+ Not elsewhere specified	0.0	0.0	Z	Z	Z	4 162.6	0.0
Transformation output	Z	Z	Z	259 608.4	620 581.3	2 234 132.6	106 158.8
+ Electricity & heat generation	Z	Z	Z	259 608.4	620 581.3	660 840.0	53 347.7
+ Main activity producer electricity only	Z	Z	Z	Z	132 844.0	91 435.3	6 127.8
+ Main activity producer CHP	Z	Z	Z	152 410.4	373 184.8	394 059.6	31 727.7
+ Main activity producer heat only	Z	Z	Z	83 972.4	Z	75 591.9	7 996.4
+ Autoproducer electricity only	Z	Z	Z	Z	54 869.1	37 765.9	2 531.0
+ Autoproducer CHP	Z	Z	Z	17 499.8	55 869.8	54 208.0	4 243.6
+ Autoproducer heat only	Z	Z	Z	4 538.4	Z	4 085.5	432.2
+ Electrically driven heat pumps	Z	Z	Z	7.3	Z	6.6	0.7
+ Pumped hydro	Z	Z	Z	Z	3 633.7	2 501.0	167.6
+ Other sources	Z	Z	Z	1 180.0	180.0	1 186.1	120.7
+ Coke ovens	Z	Z	Z	Z	Z	282 560.1	0.0
+ Blast furnaces	Z	Z	Z	Z	Z	21 755.3	0.0
+ Refineries & petrochemical industry	Z	Z	Z	Z	Z	1 248 577.1	0.0
+ Liquid biofuels blended	Z	Z	Z	Z	Z	0.0	52 811.2
+ Gas-to-liquids plants	Z	Z	Z	Z	Z	20 400.0	0.0
Energy sector	0.0	0.0	Z	23 295.7	83 788.2	219 430.3	6 111.1
+ Own use in electricity & heat generation	0.0	0.0	Z	5 850.0	37 313.4	31 505.2	2 278.3
+ Coal mines	0.0	0.0	Z	2 661.7	16 152.7	15 038.5	1 026.3
+ Oil & natural gas extraction plants	Z	Z	Z	0.0	628.4	22 503.4	29.0
+ Coke ovens	0.0	0.0	Z	774.5	2 231.5	40 205.6	176.7
+ Gas works	0.0	0.0	Z	16.5	151.1	118.9	8.5
+ Petroleum refineries (oil refineries)	0.0	0.0	Z	196.2	10 406.1	82 348.1	498.7
+ Liquefaction & regasification plants (LNG)	Z	Z	Z	0.0	245.4	2 938.0	11.3
+ Not elsewhere specified (energy)	0.0	0.0	Z	13 796.6	16 659.6	24 772.7	2 082.3
Distribution losses	0.0	0.0	Z	27 147.0	31 078.8	46 196.6	4 018.7
Available for final consumption	27 333.3	4 989.5	0.0	208 006.7	502 123.5	2 554 485.4	379 925.6
Final non-energy consumption	Z	Z	Z	Z	Z	212 177.4	0.0
+ Non-energy use industry/transport/energy	Z	Z	Z	Z	Z	196 602.7	0.0
+ Non-energy use in transport sector	Z	Z	Z	Z	Z	5 019.1	0.0
+ Non-energy use in other sectors	Z	Z	Z	Z	Z	10 555.5	0.0
Final energy consumption	27 289.6	5 024.5	Z	208 006.7	502 123.6	2 342 786.6	379 912.1
+ Industry sector	26 468.3	4 390.0	Z	29 689.7	192 068.3	477 793.2	79 607.4
+ Iron & steel	0.0	0.0	Z	2 029.7	18 078.0	48 853.7	1 032.8
+ Chemical & petrochemical	51.1	0.0	Z	11 804.7	26 944.2	93 746.6	2 627.5
+ Non-ferrous metals	0.0	0.0	Z	626.2	7 544.3	15 262.2	408.3
+ Non-metallic minerals	25 487.9	4 390.0	Z	949.6	18 843.6	103 625.6	4 974.5
+ Transport equipment	0.0	0.0	Z	1 255.6	11 963.8	15 138.8	748.6
+ Machinery	0.4	0.0	Z	1 701.2	18 066.2	24 548.7	1 077.1
+ Mining & quarrying	69.4	0.0	Z	2 130.6	10 659.8	15 542.0	698.0
+ Food, beverages & tobacco	0.0	0.0	Z	2 266.6	29 629.7	85 008.9	3 266.8
+ Paper, pulp & printing	798.3	0.0	Z	2 546.0	17 877.0	31 003.6	28 879.3
+ Wood & wood products	30.3	0.0	Z	2 685.8	8 399.4	11 102.4	30 163.1
+ Construction	0.1	0.0	Z	166.3	1 725.0	6 983.8	163.1
+ Textile & leather	0.2	0.0	Z	282.1	1 789.4	3 455.4	124.8
+ Not elsewhere specified (industry)	30.5	0.0	Z	1 245.3	20 547.9	23 521.5	5 443.4
+ Transport sector	0.0	0.0	Z	Z	14 180.9	958 290.1	58 244.7
+ Rail	0.0	0.0	Z	Z	12 137.1	11 818.3	559.9
+ Road	0.0	0.0	Z	Z	1 326.0	942 309.1	57 651.8
+ Domestic aviation	Z	Z	Z	Z	Z	2 124.1	0.0
+ Domestic navigation	0.0	0.0	Z	Z	Z	46.9	0.0
+ Pipeline transport	Z	Z	Z	Z	717.9	1 991.7	33.1
+ Not elsewhere specified (transport)	0.0	0.0	Z	Z	0.0	0.0	0.0
+ Other sectors	821.4	634.5	Z	178 317.0	295 874.3	906 703.3	242 059.9
+ Commercial & public services	821.4	634.5	Z	40 397.0	172 452.8	240 835.0	21 527.7
+ Households	0.0	0.0	Z	137 300.0	117 085.2	555 037.7	203 250.5
+ Agriculture & forestry	0.0	0.0	Z	620.0	6 300.0	110 708.1	17 277.4
+ Fishing	0.0	0.0	Z	0.0	36.3	68.5	4.2
+ Not elsewhere specified (other)	0.0	0.0	Z	0.0	0.0	54.0	0.0
Statistical differences	43.7	-35.0	0.0	0.0	0.0	Z	Z

Appendix 5. ACTIVITY DATA

I. NFR SECTOR 1 - ENERGY

I.1 Energy industries (NFR sector 1A1)

Table A5. 1. Fuel consumption [TJ] in 1A1a. *Public electricity and heat production - Public power*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	901 573	877 489	853 124	840 335	854 923	893 607	931 348	918 936	889 384	882 574	904 725	897 808	877 278	915 497	927 918	913 480	968 326
Lignite	550 804	557 422	545 139	548 814	537 834	528 123	531 967	529 890	534 754	520 682	504 643	511 862	493 728	517 949	513 985	533 690	525 529
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	260	253	250	202	140	103	1 661	1 690	2 014	5 877	10 336	14 264	22 590	28 306	35 913	39 884	36 018
Fuel wood and wood waste	0	0	0	0	0	0	1 159	1 147	1 381	1 256	1 298	1 181	1 126	2 001	3 837	9 641	13 430
Biogas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	21	18
Industrial wastes	167	1 477	1 173	505	246	468	154	229	0	0	503	645	1 205	4	4	0	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid petroleum gas (LPG)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Motor gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	129	129	129	129	86	86	86	129	86	129	215	215	387	344	172	129	129
Fuel oil	7 070	7 393	6 262	6 100	7 070	6 626	6 747	7 312	7 191	7 312	6 949	7 030	6 383	6 222	6 545	5 979	6 020
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	4	3	1	0	239	2 612	5 571	7 186	8 841	9 255	9 350	9 303	8 480	9 186	8 901	7 633	9 421
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	0	0	0	0	0	0	0	0	216	80	11	28	21	0	0	0	0
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hard coal	975 481	914 752	882 172	925 926	911 148	837 848	845 778	781 482	797 496	815 750	815 410	822 105	765 983	689 327	817 383	763 188	628 968
Lignite	500 867	520 894	493 757	477 156	516 759	526 928	539 384	513 171	507 638	484 540	496 589	465 727	394 713	364 209	433 300	442 136	326 013
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	36 794	38 740	39 365	37 896	41 207	42 631	31 474	32 434	42 007	47 058	51 961	51 457	55 687	67 559	73 915	50 213	76 506
Fuel wood and wood waste	17 471	30 428	46 497	54 804	65 520	92 840	73 237	84 159	81 982	59 860	40 290	42 043	53 324	60 015	55 430	50 239	56 047
Biogas	15	0	0	0	0	0	0	0	0	4 375	5 206	5 422	5 341	6 119	6 293	6 577	7 367
Industrial wastes	0	0	0	0	0	0	0	0	0	0	0	217	213	291	629	267	350
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	29	0	19	5	264	1 267	1 388	1 578	1 444	1 500
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	2	45	0	44	794	1 336	1 565	1 379
Other petroleum products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid petroleum gas (LPG)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Motor gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	129	301	476	303	650	433	476	433	817	645	1 025	1 202	1 619	1 482	1 736	1 540	1 458
Fuel oil	5 696	6 504	5 560	6 000	6 120	5 240	5 160	4 200	4 360	4 240	4 176	3 386	3 396	3 409	3 748	4 031	3 694
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	10 648	10 757	8 429	12 035	10 998	9 902	11 693	11 607	12 305	11 992	11 931	11 209	10 751	7 839	10 387	8 740	7 426
Blast furnace gas	0	7 595	5 787	8 316	9 166	8 740	8 689	11 257	16 242	14 630	15 884	16 215	13 887	11 370	11 756	11 235	9 600
Gas works gas	0	3 775	4 249	4 379	4 772	4 809	4 955	4 745	4 331	3 162	1 360	1 175	1 144	1 387	852	983	720



Fuel	2024																
Hard coal	565 476																
Lignite	335 301																
Hard coal briquettes	0																
Brown coal briquettes	0																
Crude oil	0																
Natural gas	101 295																
Fuel wood and wood waste	50 843																
Biogas	7 869																
Industrial wastes	200																
Municipal waste - non-biogenic fraction	1 600																
Municipal waste – biogenic fraction	1 474																
Other petroleum products	0																
Petroleum coke	0																
Coke	0																
Liquid petroleum gas (LPG)	0																
Motor gasoline	0																
Jet kerosene	0																
Aviation gasoline	0																
Diesel oil	1 521																
Fuel oil	4 237																
Refinery feedstocks	0																
Refinery gas	0																
Petroleum coke oven gas	7 560																
Blast furnace gas	10 839																
Gas works gas	900																

Table A5. 2. Fuel consumption [TJ] in 1A1a. *Public electricity and heat production - Industrial power*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	306 402	291 703	283 267	276 658	242 948	80 088	79 279	72 421	66 900	62 644	55 515	54 311	57 816	77 111	68 468	71 872	77 011
Lignite	1 228	1 137	955	985	929	348	433	276	69	34	17	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	2 705	2 087	1 639	2 081	2 733	2 537	1 860	1 034	2 070	2 271	2 187	2 709	3 804	4 658	4 691	4 915	4 385
Fuel wood and wood waste	10 408	11 105	13 041	13 323	13 749	924	1 219	1 499	1 789	1 614	1 628	3 058	2 878	2 742	3 606	5 922	5 357
Biogas	0	0	0	0	0	117	130	81	169	300	396	532	609	823	469	539	924
Industrial wastes	5 005	7 378	5 887	6 103	6 404	3 246	3 144	2 902	267	267	375	379	301	305	399	533	453
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	0	28	0	0	0	0	0	0	0	0	0	0	57	0	0	0	0
Liquid petroleum gas (LPG)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Motor gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	129	129	129	86	129	43	0	86	43	86	516	129	258	215	43	43	86
Fuel oil	43 915	39 794	38 946	40 400	40 966	10 302	9 736	10 989	10 948	12 847	10 585	14 504	14 625	16 322	17 574	17 008	18 220
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	990	743	644	842	1 238	50	0	0	0	0	0	0	0	0	149	495	545
Petroleum coke oven gas	5 297	5 586	7 154	7 715	11 999	9 309	7 515	8 367	3 975	5 909	6 779	6 710	7 160	7 821	3 310	3 576	4 833
Blast furnace gas	19 916	11 170	12 107	10 099	13 023	5 854	2 976	2 902	2 602	3 036	4 143	4 904	4 783	5 715	7 036	4 484	8 677
Gas works gas	0	0	0	0	0	0	0	0	3 041	2 425	2 344	2 290	3 088	2 589	3 640	4 750	4 815
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023

Hard coal	58 544	34 507	33 803	36 377	35 469	36 178	37 057	37 822	34 836	31 897	31 320	27 601	27 695	26 546	26 850	26 585	23 697
Lignite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	2 544	1 751	1 554	2 831	6 612	9 247	11 152	10 528	9 693	14 998	23 316	41 021	50 098	54 616	44 178	36 338	46 828
Fuel wood and wood waste	5 943	5 451	6 390	8 432	11 297	11 060	12 462	11 118	12 181	11 764	13 364	12 979	13 853	13 751	12 334	12 255	10 752
Biogas	1 139	2 004	2 172	2 763	3 312	4 204	4 872	5 718	6 298	2 856	3 010	3 160	3 282	3 478	3 362	3 669	3 874
Industrial wastes	422	192	314	354	344	292	292	377	601	366	477	590	603	758	735	895	832
Municipal waste - non-biogenic fraction	0	384	368	367	403	371	337	208	727	3 615	5 078	7 115	7 727	7 206	6 080	7 313	6 594
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	323	1 369	1 539	2 000	2 782	3 042	2 570	2 698
Other petroleum products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid petroleum gas (LPG)	0	0	0	0	0	0	0	0	0	0	0	2	4	4	9	3	0
Motor gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	43	43	43	43	43	43	43	43	43	43	71	127	72	48	61	200	94
Fuel oil	15 958	14 625	14 120	14 720	10 120	9 280	7 440	7 040	11 320	12 040	10 567	9 462	9 244	10 241	10 823	13 069	11 184
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	1 980	1 733	2 129	2 475	1 634	1 733	1 832	1 287	396	1 139	630	1 592	487	657	526	866	495
Petroleum coke oven gas	5 366	6 000	4 419	6 159	5 164	5 676	5 776	5 785	8 175	10 414	8 734	9 943	9 635	9 003	9 638	8 692	7 954
Blast furnace gas	6 395	2 609	1 943	1 638	1 835	2 588	3 040	2 680	0	0	0	0	0	0	0	0	0
Gas works gas	4 404	687	541	647	560	393	292	312	377	326	307	232	445	309	287	301	220
Fuel	2024																
Hard coal	24 669																
Lignite	0																
Hard coal briquettes	0																
Brown coal briquettes	0																
Crude oil	0																
Natural gas	50 103																
Fuel wood and wood waste	11 015																
Biogas	4 230																
Industrial wastes	797																
Municipal waste - non-biogenic fraction	6 763																
Municipal waste – biogenic fraction	2 505																
Other petroleum products	0																
Petroleum coke	0																
Coke	0																
Liquid petroleum gas (LPG)	8																
Motor gasoline	0																
Jet kerosene	0																
Aviation gasoline	0																
Diesel oil	200																
Fuel oil	10 549																
Refinery feedstocks	0																
Refinery gas	1 594																
Petroleum coke oven gas	7 740																
Blast furnace gas	0																
Gas works gas	200																

Table A5. 3. Fuel consumption [TJ] in 1A1a. *Public electricity and heat production - District heating plants*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	382 821	402 403	374 980	251 190	214 120	230 776	261 191	227 263	198 208	177 035	155 005	170 492	152 633	149 835	132 370	127 322	126 429
Lignite	2 922	2 574	2 376	802	339	544	580	469	387	345	333	355	309	300	289	288	288
Hard coal briquettes	1 958	252	91	46	45	0	0	45	0	0	0	0	0	0	0	0	0
Brown coal briquettes	125	53	181	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	18 676	13 989	7 673	824	1 221	2 098	3 636	5 225	6 684	8 062	9 104	11 269	12 306	12 532	13 023	12 300	12 474
Fuel wood and wood waste	4 163	3 279	4 224	460	302	398	278	647	503	528	535	647	805	1 056	1 470	1 665	1 796
Biogas	14	3	24	0	6	8	7	7	35	49	47	31	6	20	0	1	2
Industrial wastes	93	59	294	50	226	164	95	136	283	308	5	7	14	63	56	8	24
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	11 512	11 939	10 187	8 161	6 897	6 730	6 535	5 009	3 878	2 742	1 912	1 620	1 142	852	571	320	162
Liquid petroleum gas (LPG)	0	0	0	0	0	0	0	47	189	237	189	189	189	47	0	0	0
Motor gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	344	344	301	215	172	215	1 075	1 462	1 419	1 419	1 720	1 806	1 892	1 763	1 333	1 075	1 032
Fuel oil	15 029	14 706	11 756	9 130	8 120	9 171	11 514	9 252	7 555	6 262	4 444	5 777	4 848	4 282	1 616	1 091	1 050
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	1 825	1 966	1 708	429	909	907	889	897	881	914	965	1 067	780	1 025	280	314	286
Blast furnace gas	2 461	1 627	1 271	140	167	51	242	404	458	250	174	72	0	0	17	5	0
Gas works gas	167	129	335	85	37	21	5	2	2	2	35	20	0	3	54	56	61
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hard coal	117 895	115 909	122 788	139 900	113 076	121 909	116 375	106 165	99 896	106 417	103 437	101 556	97 196	97 169	107 170	94 733	81 424
Lignite	273	284	291	308	259	383	298	252	326	348	330	337	311	245	203	183	179
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	6	14	10	8	7	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	10 353	10 673	10 733	11 561	10 140	10 087	10 768	9 055	8 729	8 534	8 193	8 530	8 234	9 073	10 798	13 721	12 753
Fuel wood and wood waste	1 697	2 097	1 936	1 878	1 772	1 685	1 995	1 712	1 494	2 433	2 760	3 462	4 024	5 083	7 341	7 058	7 405
Biogas	4	21	27	15	16	15	15	14	16	16	16	18	19	51	47	93	50
Industrial wastes	18	17	0	88	114	128	89	93	92	179	194	178	324	216	324	346	274
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	106	132	199	405	137	109	97	109	77	83
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	16	9	6	6	4	11	0	33	47	40
Other petroleum products	0	0	0	60	0	31	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	135	81	27	55	26	26	27	27	0	0	12	38	30	27	42	41	28
Liquid petroleum gas (LPG)	0	0	0	0	0	0	0	0	0	0	8	8	8	6	8	12	38
Motor gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	602	516	476	563	390	390	433	433	387	516	725	571	511	637	1 822	1 629	1 255
Fuel oil	727	889	800	960	640	920	320	320	280	360	415	321	197	206	309	273	214
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	10	8	265	417	478	415	398	397	403	415	447	404	380	507	565	557	1 551
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	47	57	82	84	80
Gas works gas	59	40	38	46	25	0	60	12	15	22	27	39	0	0	0	0	2

Fuel	2024																

Hard coal	72 220																		
Lignite	172																		
Hard coal briquettes	0																		
Brown coal briquettes	0																		
Crude oil	0																		
Natural gas	15 784																		
Fuel wood and wood waste	8 533																		
Biogas	55																		
Industrial wastes	292																		
Municipal waste - non-biogenic fraction	200																		
Municipal waste – biogenic fraction	50																		
Other petroleum products	0																		
Petroleum coke	0																		
Coke	14																		
Liquid petroleum gas (LPG)	42																		
Motor gasoline	0																		
Jet kerosene	0																		
Aviation gasoline	0																		
Diesel oil	1 651																		
Fuel oil	132																		
Refinery feedstocks	0																		
Refinery gas	0																		
Petroleum coke oven gas	1 404																		
Blast furnace gas	50																		
Gas works gas	0																		

Table A5. 4. Industrial waste incineration abatement shares

Abatement shares	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Abatement technologies shares																		
High technology, continuous, controlled combustion	38%	41%	41%	41%	42%	43%	43%	43%	43%	44%	45%	45%	45%	44%	44%	44%	44%	44%
Controlled combustion; good APC system	33%	31%	29%	28%	26%	25%	24%	23%	22%	20%	19%	18%	17%	17%	16%	15%	14%	13%
Controlled combustion; minimal APC system	28%	29%	29%	30%	31%	31%	32%	33%	34%	35%	35%	36%	37%	38%	39%	40%	41%	42%
No APC system	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
HCB abatement shares																		
A	9%	9%	11%	12%	12%	14%	14%	15%	16%	16%	16%	18%	18%	19%	19%	19%	20%	21%
B	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%	2%	3%	3%	4%
C	3%	4%	4%	4%	5%	5%	6%	6%	7%	7%	8%	8%	9%	10%	11%	12%	13%	14%
D	87%	86%	84%	83%	82%	80%	79%	78%	76%	75%	74%	72%	71%	69%	67%	65%	63%	60%
E	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%

Abatement shares	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Abatement technologies shares																	
High technology, continuous, controlled combustion	44%	52%	51%	49%	49%	45%	60%	63%	62%	80%	78%	74%	76%	85%	89%	79%	77%
Controlled combustion; good APC system	13%	15%	14%	12%	11%	14%	9%	8%	8%	4%	5%	8%	15%	5%	4%	15%	16%
Controlled combustion; minimal APC system	43%	33%	35%	39%	40%	41%	31%	29%	30%	16%	17%	18%	9%	9%	7%	6%	7%
No APC system	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
HCB abatement shares																	
A	22%	35%	36%	34%	31%	22%	25%	27%	30%	16%	14%	16%	15%	17%	16%	18%	18%
B	6%	7%	6%	9%	8%	5%	11%	9%	10%	6%	4%	5%	6%	7%	7%	8%	6%
C	15%	9%	8%	9%	8%	16%	13%	15%	13%	52%	55%	48%	47%	53%	60%	49%	48%
D	57%	49%	49%	48%	53%	56%	51%	49%	47%	26%	27%	30%	32%	22%	17%	25%	28%
E	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table A5. 5. Fuel consumption [TJ] in 1A1b. *Petroleum refining*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	45	90	70	248	67	1 296	1 509	1 315	620	558	199	65	22	0	0	0	0
Lignite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	1 671	1 539	1 508	1 608	1 591	1 562	1 749	2 529	8 244	10 832	12 110	11 354	10 124	12 770	15 535	14 482	14 900
Fuel wood and wood waste	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biogas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial wastes	5 222	272	682	2	259	1 919	350	163	0	310	219	95	253	176	221	285	224
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	44	0	44	523	1 085	884	1 729	0	40	40	40	362	322	442
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid petroleum gas (LPG)	0	0	0	0	0	0	0	47	95	189	284	0	47	95	0	0	0
Motor gasoline	0	0	0	0	0	0	0	0	0	89	133	0	0	133	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	0
Diesel oil	43	43	0	86	86	172	172	215	344	43	903	301	645	215	989	258	645
Fuel oil	11 554	10 666	15 918	12 928	12 080	32 724	40 925	32 522	32 320	25 896	28 361	30 219	30 462	29 169	27 755	27 108	24 967
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	7 475	7 623	8 514	9 257	10 445	12 029	8 960	10 197	6 287	6 386	9 059	10 445	10 049	10 049	11 484	10 197	12 425
Petroleum coke oven gas	0	0	0	0	0	0	0	0	81	51	69	70	0	0	0	0	0
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hard coal	0	0	130	134	130	106	130	182	1 037	935	890	778	695	539	602	589	599
Lignite	0	0	0	0	42	16	48	16	8	0	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	20 816	18 816	17 511	19 363	27 467	30 639	34 778	35 102	25 958	25 801	43 844	36 056	42 920	41 086	33 795	21 204	31 131
Fuel wood and wood waste	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biogas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial wastes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	362	672	986	450	660	1 271	992	960	752	1 014	868	1 121	1 315	1 297	858	56	64
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid petroleum gas (LPG)	0	0	0	0	92	92	92	138	644	828	285	326	205	372	655	108	138
Motor gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	129	387	173	87	130	87	0	43	0	0	7	3	19	17	7	120	0
Fuel oil	29 532	29 452	30 360	32 240	29 400	22 280	14 840	14 680	22 520	21 480	17 947	16 732	16 227	16 214	17 543	22 132	20 338
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	14 603	15 692	13 118	20 394	19 899	26 483	19 157	14 157	18 513	20 691	11 630	15 309	13 886	15 180	17 461	16 968	19 305
Petroleum coke oven gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fuel	2024																
Hard coal	676																
Lignite	0																
Hard coal briquettes	0																
Brown coal briquettes	0																
Crude oil	0																
Natural gas	33 257																
Fuel wood and wood waste	0																
Biogas	0																
Industrial wastes	0																
Municipal waste - non-biogenic fraction	0																
Municipal waste – biogenic fraction	0																
Other petroleum products	32																
Petroleum coke	0																
Coke	0																
Liquid petroleum gas (LPG)	133																
Motor gasoline	0																
Jet kerosene	0																
Aviation gasoline	0																
Diesel oil	0																
Fuel oil	20 725																
Refinery feedstocks	0																
Refinery gas	20 186																
Petroleum coke oven gas	0																
Blast furnace gas	0																
Gas works gas	0																

Table A5. 6. Fuel consumption [TJ] in 1A1c. *Manufacture of solid fuels*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	90	67	47	825	2 634	1 619	2 005	282	69	28	0	0	56	84	4 715	2 825	2 469
Lignite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	0	0	181	269	462	518	398	570	744	540	424	253	65	10	0	0	0
Fuel wood and wood waste	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biogas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial wastes	0	0	0	0	233	184	126	138	0	0	0	0	0	0	0	0	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	379	246	24	84	468	171	401	56	0	0	0	0	0	104	50	26	0
Liquid petroleum gas (LPG)	95	95	95	47	47	47	47	0	0	0	0	0	0	0	0	0	0
Motor gasoline	0	0	0	44	89	89	44	44	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	0	0	43	1 161	1 161	860	817	688	344	43	86	0	0	0	0	0	0
Fuel oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	43 554	38 485	39 121	34 084	40 237	36 851	34 676	36 572	33 476	29 642	32 403	32 647	31 702	35 822	40 686	35 560	40 008
Blast furnace gas	3 961	1 995	1 430	2 123	2 488	1 954	1 582	1 893	1 695	847	840	149	86	21	30	42	45
Gas works gas	5	47	10	4	0	6	36	19	165	166	5	4	4	4	4	3	4
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023

Poland's Informative Inventory Report 2026

Hard coal	2 581	1 850	2 250	365	1 947	1 872	1 609	1 910	1 891	2 482	2 316	2 640	2 643	2 462	2 406	2 168	2 072
Lignite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	4	6	8	14	3	3	3	2	2	2	20	19	18	11	19	18	11
Fuel wood and wood waste	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biogas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial wastes	0	0	0	0	9	0	0	0	1	2	3	9	0	0	0	0	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	24	537	0	0	49	0	0	0	0	0	0	0	0	0	0	0	0
Liquid petroleum gas (LPG)	0	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Motor gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0
Fuel oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	43 584	44 646	32 390	43 511	41 007	38 516	40 094	40 177	42 278	40 522	40 297	41 132	39 758	34 910	41 444	37 914	37 899
Blast furnace gas	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	5	6	12	12	9	12	8	1	0	0	0	0	0	0	0	0	0
Fuel	2024																
Hard coal	1 771																
Lignite	0																
Hard coal briquettes	0																
Brown coal briquettes	0																
Crude oil	0																
Natural gas	11																
Fuel wood and wood waste	0																
Biogas	0																
Industrial wastes	0																
Municipal waste - non-biogenic fraction	0																
Municipal waste – biogenic fraction	0																
Other petroleum products	0																
Petroleum coke	0																
Coke	0																
Liquid petroleum gas (LPG)	0																
Motor gasoline	0																
Jet kerosene	0																
Aviation gasoline	0																
Diesel oil	0																
Fuel oil	0																
Refinery feedstocks	0																
Refinery gas	0																
Petroleum coke oven gas	36 190																
Blast furnace gas	0																
Gas works gas	0																

Table A5. 7. Fuel consumption [TJ] in 1A1c. *Other energy industries*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	10 204	7 799	6 249	22 937	54 335	57 112	60 404	54 510	52 483	42 932	33 267	30 513	15 834	19 004	14 555	12 868	10 624
Lignite	67	119	69	291	257	280	320	310	249	249	375	283	907	577	492	165	191
Hard coal briquettes	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	18	17	0	36	18	18	36	34	16	18	18	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	85	85	85	85	43	0	43	128	127	0	0
Natural gas	12 371	12 432	14 485	12 084	16 939	14 333	22 872	20 585	17 034	18 918	19 067	12 734	12 450	9 731	11 190	10 106	10 363
Fuel wood and wood waste	6	0	4	8	11	3	3	3	3	5	6	39	29	8	4	2	11
Biogas	0	0	0	0	0	1	11	28	23	22	27	12	18	18	16	12	15
Industrial wastes	0	0	0	311	2	0	32	0	0	0	10	8	5	13	0	0	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0
Other petroleum products	44	44	44	44	44	44	80	80	84	124	80	0	40	40	40	80	40
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	167	254	254	421	757	695	195	85	80	29	171	28	0	0	0	0	0
Liquid petroleum gas (LPG)	0	0	0	0	0	0	0	0	47	47	0	0	0	0	0	0	47
Motor gasoline	89	89	89	133	222	177	44	44	44	44	44	44	44	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	1 849	2 150	2 236	3 268	2 408	2 924	2 451	2 150	1 892	1 763	1 720	1 591	1 247	1 247	1 118	1 333	1 290
Fuel oil	40	40	81	364	283	162	162	81	525	162	242	81	364	242	162	283	40
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	4	3	0	520	252	186	429	428	233	230	231	464	326	273	254	159	119
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	0	133	0	116	0	0	25	0	3	2	0	0	0	0	0	0	0
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hard coal	18 421	14 210	8 385	2 230	2 982	742	676	676	1 037	1 039	791	708	1 717	656	708	482	513
Lignite	1 284	2 021	888	1 075	1 379	523	169	201	74	65	67	490	153	42	61	70	64
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	9 677	9 232	8 850	10 307	9 802	11 203	12 011	12 821	24 090	18 209	16 190	15 135	18 926	22 665	24 608	23 175	25 944
Fuel wood and wood waste	57	20	134	349	162	160	122	39	0	26	15	33	20	26	19	22	26
Biogas	28	17	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial wastes	0	0	0	2	1	1	2	2	1	3	3	3	1	1	1	1	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	40	32	29	30	60	62	32	0	0	0	20	15	14	11	10	10	9
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	0	56	0	0	0	0	0	0	0	0	4	1	1	1	0	29	1
Liquid petroleum gas (LPG)	47	0	0	0	0	0	0	0	0	0	11	13	2	2	2	1	2
Motor gasoline	0	0	0	0	0	0	0	0	0	0	32	34	25	15	7	6	5
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	1 247	1 376	1 516	1 645	2 078	1 472	1 819	1 429	1 892	1 376	1 334	1 272	1 684	1 126	1 150	1 108	975
Fuel oil	162	40	40	80	40	40	40	0	0	0	15	106	109	145	9	11	7
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	138	143	137	156	147	137	126	121	107	109	1	1	0	1	0	1	0
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fuel	2024																
Hard coal	428																
Lignite	41																
Hard coal briquettes	0																
Brown coal briquettes	0																
Crude oil	0																
Natural gas	26 172																
Fuel wood and wood waste	28																
Biogas	0																
Industrial wastes	0																
Municipal waste - non-biogenic fraction	0																
Municipal waste – biogenic fraction	0																
Other petroleum products	3																
Petroleum coke	0																
Coke	1																
Liquid petroleum gas (LPG)	1																
Motor gasoline	2																
Jet kerosene	0																
Aviation gasoline	0																
Diesel oil	1 159																
Fuel oil	0																
Refinery feedstocks	0																
Refinery gas	0																
Petroleum coke oven gas	1																
Blast furnace gas	0																
Gas works gas	0																

I.2 Stationary combustion in manufacturing industries (NFR sector 1A2)

Table A5. 8. Fuel consumption [TJ] in 1A2a. *Stationary combustion in manufacturing industries: Iron and steel*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	1 138	1 243	1 494	9 159	8 513	25 320	28 922	23 636	21 085	19 075	18 262	14 701	12 424	12 593	16 840	10 744	9 071
Lignite	0	19	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	23	23	23	0	0	23
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	52 851	33 974	26 568	25 562	25 487	24 239	25 898	28 278	23 993	21 440	22 024	18 329	15 463	14 827	19 964	20 455	20 998
Fuel wood and wood waste	0	0	0	16	14	5	6	4	6	4	3	6	3	4	4	2	1
Biogas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial wastes	4 079	6 756	6 497	4 272	3 757	2 941	498	0	0	0	0	0	0	0	0	0	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	0	0	44	44	657	44	0	88	0	0	0	0	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	9 568	19 593	22 076	27 128	33 104	26 669	24 368	28 401	23 197	20 900	20 906	16 288	20 126	21 368	22 096	14 900	12 479
Liquid petroleum gas (LPG)	0	0	0	0	0	0	0	47	0	47	189	189	237	189	142	0	0
Motor gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	172	129	172	344	559	774	903	559	301	344	516	172	129	129	129	86	129
Fuel oil	11 110	7 878	5 333	4 323	2 990	2 060	970	4 767	1 616	1 818	1 050	646	0	0	0	0	0
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	26 038	22 091	22 568	21 605	25 480	27 686	24 404	24 257	24 742	15 875	17 574	16 994	15 122	16 132	15 302	12 570	12 835
Blast furnace gas	36 484	27 903	25 909	25 676	28 350	37 610	34 205	36 120	29 520	24 034	31 874	26 768	23 876	25 282	26 721	18 896	20 226
Gas works gas	2 174	1 462	718	613	67	68	80	59	7	8	0	277	706	1 195	1 654	965	1 015
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hard coal	11 748	3 950	4 784	2 638	2 521	2 605	2 030	2 541	762	637	1 827	2 357	3 287	1 662	2 734	1 054	2 265
Lignite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	23	0	0	0	0	0	0	0	0	0	0	3
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	22 716	20 397	16 595	16 916	17 208	16 905	16 242	16 096	16 702	19 457	23 716	25 022	21 212	21 382	23 123	16 227	17 982
Fuel wood and wood waste	1	1	1	0	0	0	1	1	1	1	1	1	1	0	8	9	6
Biogas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial wastes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke	0	0	0	0	32	64	96	64	64	64	60	40	33	41	50	36	48
Coke	4 849	5 569	2 585	2 920	7 584	9 405	10 333	9 527	11 212	8 570	11 481	8 732	1 066	560	738	806	1 269
Liquid petroleum gas (LPG)	0	47	46	46	46	92	46	46	46	46	45	55	52	41	46	49	74
Motor gasoline	0	0	0	0	0	0	0	0	0	0	2	3	5	0	1	6	7
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	86	86	87	87	87	43	43	87	86	86	130	134	140	96	98	95	85
Fuel oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	13 885	9 850	5 296	8 378	8 420	8 231	8 518	9 014	5 555	4 361	4 981	5 282	4 436	4 058	5 329	4 703	4 367
Blast furnace gas	28 194	18 347	9 873	12 059	11 258	11 352	10 797	11 863	10 228	10 528	11 281	10 162	10 394	8 015	8 499	6 623	6 200
Gas works gas	1 313	993	474	187	203	47	28	99	770	607	554	351	477	517	525	717	856



Fuel	2024																
Hard coal	2 573																
Lignite	0																
Hard coal briquettes	3																
Brown coal briquettes	0																
Crude oil	0																
Natural gas	19 929																
Fuel wood and wood waste	6																
Biogas	0																
Industrial wastes	0																
Municipal waste - non-biogenic fraction	0																
Municipal waste – biogenic fraction	0																
Other petroleum products	0																
Petroleum coke	60																
Coke	371																
Liquid petroleum gas (LPG)	65																
Motor gasoline	1																
Jet kerosene	0																
Aviation gasoline	0																
Diesel oil	70																
Fuel oil	0																
Refinery feedstocks	0																
Refinery gas	0																
Petroleum coke oven gas	2 961																
Blast furnace gas	7 666																
Gas works gas	884																

Table A5. 9. Fuel consumption [TJ] in 1A2b. *Stationary combustion in manufacturing industries: Non-Ferrous Metals*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	455	565	850	1 916	1 771	4 172	4 285	3 907	3 331	3 117	3 108	3 790	2 560	2 115	1 092	24	24
Lignite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	4 599	4 633	1 213	1 745	5 321	5 447	5 108	5 424	5 639	5 660	5 814	5 700	5 589	5 868	6 402	6 464	6 880
Fuel wood and wood waste	0	0	0	1	1	0	149	42	26	10	11	5	1	0	0	0	0
Biogas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial wastes	439	483	514	729	823	2 150	2 411	2 361	0	0	0	0	0	0	0	0	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	0	0	0	0	44	0	0	0	0	0	0	40	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	5 706	4 953	2 149	2 659	6 061	5 927	6 324	6 248	5 983	5 919	6 050	6 111	6 132	5 937	5 821	5 693	5 929
Liquid petroleum gas (LPG)	0	0	0	0	0	0	47	0	0	0	47	95	47	47	47	47	47
Motor gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	43	43	129	86	129	172	215	215	258	172	258	172	172	129	172	172	172
Fuel oil	768	808	808	768	808	727	687	646	525	566	566	525	404	323	404	404	404
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	397	178	186	43	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	42	6	0	0	0	0	0	0	2 164	2 070	2 268	2 551	2 739	2 539	1 763	961	951

Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hard coal	570	0	0	0	250	114	113	91	23	68	85	394	748	438	462	244	264
Lignite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	6 740	6 537	5 846	6 039	6 670	6 890	6 703	6 950	7 225	7 226	7 555	7 958	7 958	7 663	7 982	7 320	7 071
Fuel wood and wood waste	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Biogas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial wastes	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	6 297	6 481	6 078	5 922	5 985	6 245	6 150	6 389	6 588	5 518	4 701	4 878	5 024	4 723	4 930	6 505	4 786
Liquid petroleum gas (LPG)	47	47	46	46	46	0	0	0	0	0	27	27	27	25	30	28	28
Motor gasoline	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	172	172	173	217	173	173	173	173	129	172	183	187	214	106	57	40	61
Fuel oil	162	162	160	120	120	120	120	80	120	240	463	258	292	337	257	260	249
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	0	0	0	0	39	43	39	51	47	53	86	72	69	75	87	77	70
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	949	1 220	1 086	960	967	928	1 066	1 275	1 316	1 202	1 337	1 394	1 255	1 303	1 158	1 288	1 146
Fuel	2024																
Hard coal	51																
Lignite	0																
Hard coal briquettes	0																
Brown coal briquettes	0																
Crude oil	0																
Natural gas	7 171																
Fuel wood and wood waste	1																
Biogas	0																
Industrial wastes	0																
Municipal waste - non-biogenic fraction	0																
Municipal waste – biogenic fraction	0																
Other petroleum products	0																
Petroleum coke	0																
Coke	4 789																
Liquid petroleum gas (LPG)	30																
Motor gasoline	0																
Jet kerosene	0																
Aviation gasoline	0																
Diesel oil	38																
Fuel oil	262																
Refinery feedstocks	0																
Refinery gas	0																
Petroleum coke oven gas	75																
Blast furnace gas	0																
Gas works gas	1 217																

Table A5. 10.Fuel consumption [TJ] in 1A2c. *Stationary combustion in manufacturing industries: Chemicals*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	7 216	6 623	4 550	13 125	7 945	70 221	71 191	63 913	54 992	50 522	50 115	48 485	45 458	27 959	26 665	27 446	25 398
Lignite	39	38	27	47	29	428	460	389	429	138	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	5 289	4 340	4 432	10 075	4 507	6 356	6 191	11 024	9 408	9 041	9 464	8 481	7 199	6 457	7 494	8 061	9 009
Fuel wood and wood waste	118	39	10	3	35	7	0	0	0	0	0	0	1	153	94	153	0
Biogas	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Industrial wastes	16 712	18 586	17 039	18 003	22 591	21 546	17 374	14 356	672	582	607	618	567	875	1 070	570	671
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	44	0	263	2 963	3 070	3 545	2 576	482	526	325	241	0	40	40
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	2 542	1 868	1 746	1 790	1 832	3 257	2 835	1 379	1 455	1 555	1 499	1 574	1 684	1 513	1 821	1 367	2 916
Liquid petroleum gas (LPG)	0	0	0	47	0	0	0	0	0	0	0	0	0	0	0	0	0
Motor gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	989	860	774	731	731	946	1 075	1 075	1 419	1 333	1 032	4 773	4 257	4 343	3 913	3 784	4 085
Fuel oil	2 747	1 899	2 788	2 505	3 636	8 242	9 413	9 454	17 736	15 837	13 655	7 434	7 716	7 151	7 353	3 919	3 878
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	396	3 465	5 445	4 455	198	1 584	6 584	9 653	18 513	19 602	23 315	20 543	20 741	21 830	22 424	18 266	21 335
Petroleum coke oven gas	701	522	440	1 548	276	729	784	140	174	131	50	150	285	635	606	608	547
Blast furnace gas	47	10	6	11	14	23	4	13	4	7	11	8	4	13	19	6	0
Gas works gas	214	192	133	126	110	70	52	0	0	0	0	0	0	0	0	0	0
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hard coal	26 780	43 781	42 011	47 304	47 704	46 768	47 308	46 501	42 588	44 241	49 090	49 068	48 164	43 772	45 948	41 048	33 179
Lignite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	8 754	7 950	9 707	11 807	13 886	13 568	14 696	14 500	14 861	12 068	13 021	15 171	14 969	17 034	18 888	12 927	15 933
Fuel wood and wood waste	121	0	58	58	53	131	50	103	88	138	99	142	370	352	253	261	277
Biogas	0	0	0	0	0	0	0	8	6	6	5	4	1	1	1	10	17
Industrial wastes	707	509	584	770	732	581	1 092	1 082	936	652	1 494	744	393	330	408	239	57
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	0	0	0	0	0	0	0	1	2	3	3	3	2	287
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	1 928	1 159	852	791	1 260	3 089	2 944	2 942	3 151	3 456	1 496	1 819	2 258	2 796	2 111	2 022	2 460
Liquid petroleum gas (LPG)	0	0	92	138	138	138	184	138	230	276	300	307	337	272	329	377	374
Motor gasoline	0	0	90	0	45	45	45	0	0	0	8	10	9	1	0	65	40
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	3 741	3 698	4 590	4 200	3 637	3 334	4 027	2 468	1 806	1 505	1 744	1 714	1 976	1 857	339	3 616	1 832
Fuel oil	3 596	646	1 080	600	720	560	440	400	560	400	348	332	282	204	257	179	186
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	22 473	19 157	20 889	17 177	12 276	9 702	11 979	10 296	7 722	8 019	10 697	10 367	15 804	17 298	19 658	10 257	8 549
Petroleum coke oven gas	658	654	483	627	616	595	639	645	624	598	623	613	580	256	493	528	291
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fuel	2024																
Hard coal	28 173																
Lignite	0																
Hard coal briquettes	0																
Brown coal briquettes	0																
Crude oil	0																
Natural gas	18 773																
Fuel wood and wood waste	204																
Biogas	56																
Industrial wastes	51																
Municipal waste - non-biogenic fraction	0																
Municipal waste – biogenic fraction	0																
Other petroleum products	2																
Petroleum coke	0																
Coke	2 408																
Liquid petroleum gas (LPG)	381																
Motor gasoline	0																
Jet kerosene	0																
Aviation gasoline	0																
Diesel oil	1 297																
Fuel oil	76																
Refinery feedstocks	0																
Refinery gas	12 966																
Petroleum coke oven gas	448																
Blast furnace gas	0																
Gas works gas	0																

Table A5. 11. Fuel consumption [TJ] in 1A2d. *Stationary combustion in manufacturing industries: Pulp, Paper and Print*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	1 548	1 741	1 379	4 524	3 836	22 318	22 233	23 979	18 936	17 528	15 696	15 564	14 317	14 050	13 797	13 430	11 592
Lignite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	101	61	26	61	250	232	455	1 096	563	1 007	1 211	1 445	1 461	2 094	2 657	2 288	2 976
Fuel wood and wood waste	1	0	0	1 585	1 610	15 437	16 243	16 472	16 476	15 545	15 938	15 138	16 622	17 950	18 957	18 611	19 379
Biogas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial wastes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	44	0	88	0	0	0	0	88	0	0	0	0	40	40
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	243	271	242	298	269	267	245	135	81	0	27	26	28	55	28	27	28
Liquid petroleum gas (LPG)	47	47	47	47	47	47	47	95	189	95	142	95	47	47	95	47	95
Motor gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	89	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	43	86	43	43	86	129	602	989	1 118	817	602	473	430	473	473	344	387
Fuel oil	1 293	1 212	1 333	1 576	1 414	2 384	1 050	1 050	1 333	1 333	1 374	1 495	1 576	1 616	1 697	1 616	1 616
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	3	3	2	3	2	2	1	0	0	0	0	0	0	0	0	0	0
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	3	14	2	0	0	0	4	0	0	0	0	0	0	0	0	0	0

Poland's Informative Inventory Report 2026

Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hard coal	9 452	7 850	8 515	10 086	11 301	10 643	11 460	11 291	10 922	9 628	8 744	7 024	7 751	6 637	7 194	6 183	4 558
Lignite	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	4 087	4 822	4 973	5 135	4 587	5 535	6 271	6 994	7 166	7 991	8 709	8 513	9 935	9 314	9 855	9 467	9 474
Fuel wood and wood waste	18 644	19 729	19 171	19 581	19 402	20 358	27 152	26 987	27 070	30 415	33 742	36 138	38 625	40 403	22 756	26 770	26 927
Biogas	0	0	18	49	73	83	91	105	86	111	139	96	105	109	170	182	245
Industrial wastes	0	0	0	0	0	0	37	125	108	190	295	360	427	531	406	608	840
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 374	581	448
Other petroleum products	0	0	0	0	0	0	0	0	0	0	3	1	1	1	1	1	1
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	28	28	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0
Liquid petroleum gas (LPG)	189	47	92	92	92	92	92	92	92	92	107	111	122	137	158	191	184
Motor gasoline	0	0	0	0	0	0	0	0	0	0	10	19	21	1	1	47	50
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	430	301	303	260	217	173	260	173	258	473	574	478	591	434	775	774	413
Fuel oil	1 737	1 656	1 600	1 640	1 680	1 520	1 520	1 280	1 480	1 320	1 058	930	990	942	1 063	1 123	849
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel	2024																
Hard coal	4 369																
Lignite	0																
Hard coal briquettes	1																
Brown coal briquettes	0																
Crude oil	0																
Natural gas	9 898																
Fuel wood and wood waste	26 775																
Biogas	301																
Industrial wastes	798																
Municipal waste - non-biogenic fraction	0																
Municipal waste – biogenic fraction	736																
Other petroleum products	1																
Petroleum coke	0																
Coke	0																
Liquid petroleum gas (LPG)	162																
Motor gasoline	1																
Jet kerosene	0																
Aviation gasoline	0																
Diesel oil	360																
Fuel oil	816																
Refinery feedstocks	0																
Refinery gas	0																
Petroleum coke oven gas	0																
Blast furnace gas	0																
Gas works gas	0																

Table A5. 12. Fuel consumption [TJ] in 1A2e. *Stationary combustion in manufacturing industries: Food Processing, Beverages and Tobacco*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	31 914	35 940	32 724	55 643	53 801	73 024	88 777	78 207	64 659	46 327	43 417	40 020	41 803	39 030	36 095	35 894	30 864
Lignite	58	19	18	369	195	265	380	250	317	237	191	149	192	175	129	92	74
Hard coal briquettes	0	0	0	163	162	46	25	0	0	0	0	0	0	0	0	0	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	1 970	1 985	2 339	3 171	7 180	3 839	15 051	12 927	10 694	9 255	10 494	11 363	12 490	15 075	16 164	17 456	18 623
Fuel wood and wood waste	91	94	72	151	56	82	94	75	101	69	49	62	60	323	373	214	239
Biogas	0	0	0	0	0	0	0	0	3	20	63	42	37	63	74	68	72
Industrial wastes	0	0	31	3	3	0	0	0	0	0	1	14	0	0	0	0	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	0	0	88	80	80	40	0	0	0	0	0	0	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	3 164	2 788	2 499	3 093	2 559	2 403	3 053	2 705	1 967	1 637	1 526	1 259	1 491	1 293	1 186	911	841
Liquid petroleum gas (LPG)	47	47	47	47	95	142	189	189	284	473	710	899	1 466	1 419	1 608	1 466	1 230
Motor gasoline	133	89	133	177	133	177	177	44	89	44	133	44	89	89	0	44	44
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	1 247	1 032	903	1 204	1 075	903	5 461	5 203	6 837	7 482	7 353	7 267	6 880	6 880	6 192	5 418	4 515
Fuel oil	1 656	1 495	1 333	3 313	3 959	6 181	2 747	2 424	2 707	2 303	2 545	2 747	2 990	3 070	3 313	3 192	2 949
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	111	125	124	102	3	25	4	0	0	0	0	0	0	0	0	0	0
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	51	14	1	1	0	0	3	0	0	0	0	0	0	0	0	0	0
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hard coal	31 164	26 777	25 813	25 903	25 613	26 172	24 724	24 429	22 011	22 555	22 972	23 170	23 123	21 423	20 313	20 112	18 941
Lignite	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	129	28
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	0	7	1	1	1	1	0
Brown coal briquettes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	20 614	20 725	20 950	21 610	22 127	23 705	24 474	25 093	26 009	27 589	29 944	36 319	35 407	34 270	35 687	33 965	36 056
Fuel wood and wood waste	164	365	192	441	534	436	664	747	1 134	1 383	1 072	1 244	780	650	405	989	951
Biogas	84	94	109	101	145	199	202	350	345	407	422	374	546	601	501	598	689
Industrial wastes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
Other petroleum products	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	907	650	632	600	509	306	361	448	624	646	726	759	740	679	704	766	896
Liquid petroleum gas (LPG)	946	1 041	966	828	782	690	828	966	966	1 104	1 195	1 135	1 005	1 044	1 143	1 615	2 120
Motor gasoline	44	44	45	45	0	0	0	0	0	43	16	41	18	7	3	184	196
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Diesel oil	4 085	4 515	3 161	2 901	2 382	2 944	1 992	1 516	1 290	1 419	1 473	1 358	1 233	942	883	2 633	1 880
Fuel oil	2 788	2 020	1 440	1 240	1 360	1 360	1 080	1 000	600	760	721	799	664	506	429	813	365
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fuel	2024																
Hard coal	19 230																
Lignite	0																
Hard coal briquettes	0																
Brown coal briquettes	0																
Crude oil	0																
Natural gas	38 749																
Fuel wood and wood waste	955																
Biogas	726																
Industrial wastes	0																
Municipal waste - non-biogenic fraction	0																
Municipal waste – biogenic fraction	3																
Other petroleum products	0																
Petroleum coke	0																
Coke	1 040																
Liquid petroleum gas (LPG)	2 357																
Motor gasoline	8																
Jet kerosene	0																
Aviation gasoline	1																
Diesel oil	930																
Fuel oil	259																
Refinery feedstocks	0																
Refinery gas	0																
Petroleum coke oven gas	0																
Blast furnace gas	0																
Gas works gas	0																

Table A5. 13. Fuel consumption [TJ] in 1A2f. *Stationary combustion in manufacturing industries: Non-metallic minerals*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	72 637	72 514	68 894	76 924	83 926	79 647	86 930	81 562	66 639	59 965	53 349	41 103	33 981	30 332	32 309	31 182	31 523
Lignite	156	150	91	161	117	163	150	185	153	69	57	9	19	0	0	0	0
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0
Brown coal briquettes	17	18	0	0	0	0	0	35	35	35	35	17	18	34	35	35	35
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	24 575	22 704	22 246	21 986	21 506	25 518	26 650	25 655	27 097	23 917	27 977	31 858	33 233	35 584	38 225	38 955	41 274
Fuel wood and wood waste	1 155	455	42	33	4	10	10	5	6	2	6	275	292	102	261	110	139
Biogas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial wastes	68	23	267	250	145	197	144	47	207	529	472	524	508	1 471	1 818	2 701	5 043
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	3	13	717	1 620
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other petroleum products	0	0	0	0	0	0	0	1 407	1 250	446	0	0	0	0	0	0	0
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	4 485	3 283	7 183	3 640
Coke	13 225	10 745	10 479	10 200	10 774	9 477	10 657	8 223	9 537	7 667	6 451	4 485	4 279	4 703	4 524	2 439	3 001
Liquid petroleum gas (LPG)	0	0	0	0	95	142	47	95	237	331	520	757	1 656	1 419	1 703	899	378
Motor gasoline	0	0	0	0	0	0	0	133	0	0	0	0	0	0	0	0	0
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	946	817	774	774	946	1 333	1 806	2 795	2 021	1 720	1 634	1 978	2 150	2 279	2 795	2 193	1 892
Fuel oil	4 202	2 828	3 596	4 000	4 363	6 141	3 798	4 161	6 747	5 979	3 919	4 363	4 646	4 565	4 525	4 121	2 909
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	2 101	1 821	1 341	1 234	482	887	509	353	988	804	413	897	767	746	1 505	1 370	1 465
Blast furnace gas	101	106	79	108	120	53	53	36	10	5	11	3	3	0	0	0	0
Gas works gas	3 270	3 137	2 706	2 392	2 090	1 788	1 033	501	330	304	0	0	0	0	0	0	0

Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hard coal	43 846	36 975	26 468	28 045	34 403	26 766	22 808	23 013	20 539	19 346	21 245	21 733	19 818	16 964	16 704	12 650	9 167
Lignite	0	63	0	224	283	549	347	487	545	584	646	688	721	598	985	565	512
Hard coal briquettes	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	0	0
Brown coal briquettes	35	35	0	0	0	0	157	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	42 465	39 696	41 394	42 874	44 490	42 350	40 911	40 872	40 516	43 982	44 577	43 117	46 329	44 359	51 813	45 555	40 718
Fuel wood and wood waste	116	223	285	299	348	407	498	724	623	511	176	216	208	295	4 046	3 829	4 010
Biogas	0	0	0	0	0	0	4	44	40	38	30	35	25	0	0	0	0
Industrial wastes	5 961	7 400	7 715	10 454	11 729	12 170	12 763	15 171	15 068	17 249	19 538	24 693	26 289	25 316	23 737	26 704	24 319
Municipal waste - non-biogenic fraction	1 776	378	4 419	4 512	5 017	3 913	3 752	4 060	4 011	8 179	8 588	7 682	6 982	7 193	6 741	4 747	4 660
Municipal waste – biogenic fraction	1	1	29	123	1 338	1 360	1 391	1 528	1 664	2 094	2 411	2 554	2 214	2 422	41	0	0
Other petroleum products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Petroleum coke	1 593	1 170	2 752	1 792	64	160	128	32	0	928	1 670	1 917	2 231	1 459	1 322	2 325	2 780
Coke	4 480	2 657	2 200	2 429	2 519	2 449	2 305	2 466	3 151	2 698	2 164	2 089	2 038	2 428	2 920	3 200	2 393
Liquid petroleum gas (LPG)	331	378	460	414	368	230	322	414	368	322	369	361	342	255	288	288	1 870
Motor gasoline	0	0	45	0	0	0	0	0	43	43	34	21	24	5	7	44	39
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel oil	1 849	2 193	1 992	1 992	2 338	1 862	1 472	1 299	1 290	1 247	1 032	1 395	1 616	944	1 113	959	538
Fuel oil	2 141	2 424	1 960	1 840	1 640	1 400	1 320	680	280	200	212	182	94	170	192	352	186
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	1 614	1 523	1 233	1 614	1 866	1 687	1 552	1 951	1 841	2 006	1 940	1 689	1 688	1 644	1 901	1 433	1 061
Blast furnace gas	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas works gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel	2024																
Hard coal	8 985																
Lignite	682																
Hard coal briquettes	0																
Brown coal briquettes	0																
Crude oil	0																
Natural gas	42 602																
Fuel wood and wood waste	4 015																
Biogas	0																
Industrial wastes	25 488																
Municipal waste - non-biogenic fraction	4 390																
Municipal waste – biogenic fraction	0																
Other petroleum products	0																
Petroleum coke	2 115																
Coke	2 587																
Liquid petroleum gas (LPG)	1 089																
Motor gasoline	4																
Jet kerosene	0																
Aviation gasoline	0																
Diesel oil	504																
Fuel oil	119																
Refinery feedstocks	0																
Refinery gas	0																
Petroleum coke oven gas	1 234																
Blast furnace gas	0																
Gas works gas	0																

Table A5. 14. Fuel consumption [TJ] in 1A2gviii. *Stationary combustion in manufacturing industries: Other*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Hard coal	38 515	36 641	29 690	80 735	73 256	81 015	105 124	88 132	65 259	49 965	40 661	31 997	26 863	25 046	21 926	20 047	18 023
Lignite	175	564	183	653	274	621	600	389	317	247	210	149	106	55	9	9	19
Hard coal briquettes	69	27	0	0	0	0	25	0	0	0	23	0	0	0	0	0	0
Brown coal briquettes	35	36	35	35	35	35	35	0	0	0	0	0	0	0	0	0	0
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	15 645	11 756	13 811	17 922	17 337	15 177	14 210	16 061	17 640	16 352	18 545	18 320	19 273	21 156	22 582	23 324	23 290
Fuel wood and wood waste	5 826	5 518	5 035	4 995	3 410	4 968	6 519	8 194	8 231	8 604	10 105	10 716	12 300	11 897	12 184	12 193	11 624
Biogas	0	0	0	0	0	2	1	1	2	0	0	0	0	0	0	0	0
Industrial wastes	22	12	134	298	1 593	2 294	2 675	1 133	2 080	1 482	2 075	1 802	2 078	2 503	1 661	1 700	3 789
Municipal waste - non-biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Other petroleum products	0	44	175	219	175	569	383	749	654	449	285	84	124	80	121	124	164
Petroleum coke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	12 143	9 527	10 371	9 902	6 276	5 259	5 370	3 760	1 913	2 756	2 141	2 151	1 850	1 705	1 076	590	841
Liquid petroleum gas (LPG)	142	95	95	95	142	47	142	426	473	804	1 514	1 135	1 135	1 277	1 372	1 372	1 277
Motor gasoline	1 108	1 285	886	930	532	1 019	620	2 171	753	354	310	177	133	222	177	177	222
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	0	0	0	0	0	0	0	0	88	88	88	88	44	44	44	44	88
Diesel oil	10 449	8 815	7 310	7 740	7 181	8 299	18 576	15 609	13 244	11 481	10 793	9 890	9 804	10 191	9 632	10 492	11 094
Fuel oil	2 182	1 858	2 424	3 353	3 757	5 090	3 232	3 313	3 798	3 596	3 636	3 111	2 868	2 747	2 909	2 949	2 666
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	1 674	984	734	475	55	49	22	10	11	6	5	20	16	117	436	110	62
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	0
Gas works gas	732	458	212	22	63	16	1	1	0	0	0	0	0	0	0	0	0
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hard coal	16 541	14 069	10 977	11 348	10 096	7 618	7 287	6 675	7 602	6 464	6 647	6 518	6 003	5 016	5 497	5 716	3 797
Lignite	0	9	163	89	363	269	431	159	182	319	659	649	569	668	901	1 318	1 123
Hard coal briquettes	0	0	0	0	23	0	0	0	0	0	4	3	1	2	9	6	5
Brown coal briquettes	18	70	95	68	184	81	35	30	30	30	55	60	50	43	48	42	56
Crude oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	23 540	26 264	22 861	24 965	23 874	23 020	26 035	23 394	22 751	24 488	26 750	27 581	27 911	27 473	30 170	27 690	26 122
Fuel wood and wood waste	13 235	14 043	14 004	17 901	20 051	20 854	24 842	25 929	27 937	30 034	32 860	31 082	35 447	39 326	37 596	33 612	34 139
Biogas	0	1	3	0	0	0	0	0	44	42	13	33	22	26	104	107	88
Industrial wastes	937	1 154	1 392	70	52	69	98	64	45	37	105	107	50	43	117	122	144
Municipal waste - non-biogenic fraction	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Municipal waste – biogenic fraction	5	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0
Other petroleum products	80	64	29	90	90	93	64	96	65	65	76	88	27	20	31	45	31
Petroleum coke	0	0	0	0	0	1 024	320	736	832	128	0	0	0	0	0	163	398
Coke	822	678	440	355	214	167	194	140	85	140	86	80	69	119	193	720	646
Liquid petroleum gas (LPG)	1 183	1 230	966	1 150	1 196	966	1 150	1 334	1 150	1 380	1 539	1 605	1 639	1 601	1 945	2 009	2 023
Motor gasoline	133	89	135	270	135	90	90	176	86	86	187	117	209	44	66	1 017	1 312
Jet kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aviation gasoline	88	44	43	43	43	0	43	43	0	43	22	20	12	16	15	15	15
Diesel oil	9 976	9 159	9 093	8 660	8 703	7 101	6 538	6 668	6 063	6 536	6 641	7 026	7 607	6 841	6 989	7 076	7 317
Fuel oil	1 495	1 293	1 280	1 480	1 480	960	560	560	200	240	391	359	293	280	394	474	467
Refinery feedstocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum coke oven gas	59	47	33	20	25	10	10	5	3	5	128	84	3	2	2	2	1
Blast furnace gas	0	0	6	9	12	4	4	2	0	0	0	0	0	0	0	0	0
Gas works gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fuel	2024																
Hard coal	3 402																
Lignite	1 113																
Hard coal briquettes	4																
Brown coal briquettes	50																
Crude oil	0																
Natural gas	26 153																
Fuel wood and wood waste	34 081																
Biogas	61																
Industrial wastes	131																
Municipal waste - non-biogenic fraction	0																
Municipal waste – biogenic fraction	0																
Other petroleum products	31																
Petroleum coke	140																
Coke	355																
Liquid petroleum gas (LPG)	1 738																
Motor gasoline	85																
Jet kerosene	0																
Aviation gasoline	16																
Diesel oil	7 755																
Fuel oil	447																
Refinery feedstocks	0																
Refinery gas	0																
Petroleum coke oven gas	2																
Blast furnace gas	0																
Gas works gas	0																

I.3 Transport (NFR sector 1A3)

Table A5. 15. Fuel consumption in 1A3ai(i). *International aviation LTO (civil)* [kt]

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Jet kerosene	26.37	27.23	29.56	29.44	29.81	32.14	37.78	33.85	34.47	30.79	32.75	32.26	31.65	34.22	33.61	37.71	50.68
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Jet kerosene	53.02	64.22	58.01	60.74	59.20	63.95	63.96	71.72	79.41	84.78	107.58	127.87	136.79	57.99	72.90	122.24	148.76
Fuel	2024																
Jet kerosene	168.43																

Table A5. 16. Fuel consumption in 1A3aii(i). *Domestic aviation LTO (civil)* [kt]

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Jet kerosene	1.21	1.25	1.36	1.36	1.37	1.48	5.22	4.68	4.76	4.25	4.52	4.46	4.37	4.73	4.64	6.27	7.55
Aviation gasoline	0.80	0.50	0.20	0.40	1.00	0.70	0.40	0.60	0.40	0.30	0.30	0.30	0.40	0.40	0.30	0.30	0.30
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Jet kerosene	7.24	7.50	7.13	8.32	8.88	13.51	9.59	11.49	10.56	9.85	7.23	7.24	7.30	3.92	4.06	11.31	13.45
Aviation gasoline	0.40	0.30	0.40	0.40	0.50	0.50	0.40	0.50	0.40	0.40	0.33	0.40	0.40	0.36	0.38	0.39	0.21
Fuel	2024																
Jet kerosene	13.32																
Aviation gasoline	0.57																



Table A5. 17. Fuel consumption in 1A3b. *Road transport* [TJ]

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Gasoline	134 318	156 689	166 169	169 758	187 876	190 446	199 084	214 988	219 196	243 827	219 728	203 824	186 636	178 263	180 966	174 675	179 194
Diesel oil	118 121	117 046	118 422	108 102	101 652	105 135	136 783	139 578	155 703	162 454	135 106	140 911	135 149	164 561	201 455	230 351	269 395
LPG	0	0	0	1 135	3 358	8 325	11 967	15 893	16 555	22 089	20 103	27 718	39 212	50 611	63 429	73 268	80 410
CNG/LNG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biodiesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	555	1 221
Bioethanol	0	0	0	0	0	0	0	0	0	0	0	0	0	1 188	567	1 431	2 322
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Gasoline	178 928	176 801	179 775	177 660	168 030	160 830	153 225	148 020	152 994	161 594	176 637	183 674	189 901	176 973	195 689	207 309	217 532
Diesel oil	323 962	353 374	365 972	402 820	421 915	401 954	369 436	379 221	407 382	484 266	578 096	592 497	598 364	581 158	629 143	621 465	623 078
LPG	82 775	81 309	76 038	76 360	73 968	73 876	73 278	73 830	74 980	79 396	84 251	85 390	89 010	79 810	83 490	86 480	86 940
CNG/LNG	0	0	0	0	0	0	0	0	669	611	466	535	718	817	1 164	1 169	1 637
Biodiesel	925	12 728	16 205	20 352	22 426	26 611	25 033	23 606	20 868	11 951	17 948	30 930	33 381	35 049	35 039	37 301	43 627
Bioethanol	3 024	5 346	7 049	7 102	6 728	5 794	6 034	5 562	6 426	7 020	7 375	7 236	7 843	7 663	8 709	9 711	10 201
Fuel	2024																
Gasoline	226 680																
Diesel oil	628 195																
LPG	84 180																
CNG/LNG	2 341																
Biodiesel	43 513																
Bioethanol	14 078																

Table A5. 18. Fuel consumption in 1A3c. *Railway transport* [kt]

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Diesel oil	414	316	247	243	275	268	225	202	190	180	165	161	153	161	161	158	145
Hard coal	141	75	15	13	7	6	8	8	6	0	0	0	0	0	0	0	0
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Diesel oil	143	125	120	111	115	107	99	89	82	82	84	101	84	81	88	79	81
Hard coal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel	2024																
Diesel oil	81																
Hard coal	0																

Table A5. 19. Fuel consumption in 1A3d. *Domestic navigation* [kt]

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Inland navigation - Diesel Oil	20.00	16.00	19.00	16.00	7.00	16.00	16.00	15.00	9.00	7.00	6.00	6.00	5.00	7.00	6.00	5.00	6.00
Marine - Diesel oil	5.50	4.34	2.82	1.94	2.32	2.21	1.66	0.65	0.62	0.58	0.57	0.46	0.45	0.73	0.53	0.70	0.73
Marine - fuel oil	22.55	20.67	13.68	8.54	10.69	10.75	9.94	3.21	3.93	3.51	3.41	3.28	3.27	4.46	2.11	1.50	1.99
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Inland navigation - Diesel Oil	5.00	5.00	3.00	3.00	3.00	3.00	3.00	3.00	2.00	2.00	4.57	1.97	1.83	1.01	1.09	1.09	1.09
Marine - Diesel oil	0.56	0.61	0.38	0.21	0.24	0.23	0.31	0.17	1.59	4.75	2.20	1.62	1.22	3.80	7.75	7.87	4.99
Marine - fuel oil	1.62	1.60	0.94	0.31	0.35	0.26	0.56	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel	2024																
Inland navigation - Diesel Oil	1.09																
Marine - Diesel oil	7.10																
Marine - fuel oil	0.00																

*Due to the changes in regulations regarding MARPOL Convention 1973/78/97 and implementation of Directive 2012/33/EU of the European Parliament and of the council of 21 November 2012 amending Council Directive 1999/32/EC as regards the sulphur content of marine fuels, high sulphur fuel oil was withdrawn from use. Instead low sulphur marine diesel oil (MDO) is used.

Table A5. 20. Fuel consumption in 1A3e. *Other transportation* [kt]

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Gasoline	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.30	44.30	44.30	44.30	44.30	0.00
Diesel oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.00	43.00	0.00	43.00	43.00	43.00	43.00
Natural gas	0.00	0.00	0.00	0.00	0.90	7.20	24.30	26.10	23.40	20.70	2 497.5	3 262.5	3 501.9	5 256.9	7 380.9	9 865.8	12 912.3
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Gasoline	44.30	0.00	45.00	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
Diesel oil	43.00	43.00	43.30	43.30	43.30	43.30	43.30	43.30	43.00	43.00	42.10	0.00	3.78	0.52	0.65	0.47	0.65
Natural gas	11 827.8	13 441.5	11 084.4	9 269.4	9 298.4	10 806.6	15 421.3	15 143.0	14 379.0	15 409.2	14 858.7	15 764.1	14 019.1	11 586.3	10 563.3	918.8	1 542.6
Fuel	2024																
Gasoline	0.00																
Diesel oil	1.68																
Natural gas	1 495.9																

Table A5. 21. Fuel consumption in 1A3ai(ii). *International aviation cruise – cruise* [kt]

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Jet kerosene	176.49	182.23	197.83	197.01	199.47	215.07	252.83	226.56	230.66	206.04	219.17	215.89	211.78	229.02	224.92	252.39	339.15
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Jet kerosene	354.86	429.78	388.23	406.52	396.20	428.00	428.06	479.98	531.41	567.39	719.93	855.73	915.47	388.12	487.86	818.05	995.56
Fuel	2024																
Jet kerosene	1 127.18																

Table A5. 22. Fuel consumption in 1A3aii(ii). *Domestic aviation – cruise* [kt]

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Jet kerosene	10.93	11.28	12.25	12.20	12.35	13.32	12.18	10.91	11.11	9.92	10.56	10.40	10.20	11.03	10.83	14.63	17.62
Aviation gasoline	7.20	4.50	1.80	3.60	9.00	6.30	3.60	5.40	3.60	2.70	2.70	2.70	3.60	3.60	2.70	2.70	2.70
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Jet kerosene	16.88	17.50	16.63	19.42	20.72	31.53	22.38	26.81	24.63	22.98	16.87	16.90	17.02	9.14	9.48	26.38	31.38
Aviation gasoline	3.60	2.70	3.60	3.60	4.50	4.50	3.60	4.50	3.60	3.60	3.00	3.60	3.60	3.24	3.42	3.52	1.88
Fuel	2024																
Jet kerosene	31.08																
Aviation gasoline	5.09																

Table A5. 23. Fuel consumption in 1A3di(ii). *International maritime navigation* [kt]

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Marine - Diesel oil	140.00	63.00	74.00	57.00	30.00	28.00	41.00	59.00	67.00	103.00	44.00	22.00	43.00	46.00	39.00	116.00	87.00
Marine - fuel oil	262.00	94.00	169.00	79.00	106.00	115.00	127.00	157.00	202.00	270.00	248.00	245.00	233.00	245.00	220.00	212.00	214.00
Fuel	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Marine - Diesel oil	50.00	49.00	64.00	54.00	67.00	66.00	76.00	75.00	144.00	129.00	210.84	189.24	191.97	211.52	280.19	229.88	220.00
Marine - fuel oil	204.00	233.00	190.00	167.00	106.00	80.00	65.00	73.00	47.00	53.00	52.94	77.56	80.61	86.41	63.68	38.74	38.31
Fuel	2024																
Marine - Diesel oil	139.32																
Marine - fuel oil	37.33																



I.4 Other sectors – stationary sources (NFR sector 1A4)

Table A5. 24. Fuel consumption [TJ] in 1A4ai. *Commercial/Institutional: Stationary*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Hard coal	54 547	62 166	54 214	50 334	34 666	34 267	25 608	18 696	16 200	15 104	13 355	13 460	21 676	21 539	22 502	25 405	29 320	25 291
Lignite				17	91	25	26	9	9	9								
Hard coal briquettes						255												
Brown coal briquettes	375			1 605	1 622	1 729	217	466	98	474	341		17					
Crude oil																		
Natural gas	13 787	10 977	11 190	11 548	9 573	13 260	18 771	24 256	32 769	37 697	38 567	49 971	61 001	67 057	69 564	68 410	63 517	65 489
Fuel wood and wood waste				12 312	11 719	11 560	10 046	9 028	8 437	8 553	8 514	5 736	5 747	5 752	6 028	6 171	4 580	5 482
Biogas	379	187	206	62	249	423	579	599	648	663	678	860	683	700	1 325	1 602	1 582	1 438
Industrial wastes	504	81	11	352	89		124		3	4	4	91	92	60	2	22		
Municipal waste - non-biogenic fract.											20		9	11				
Municipal waste – biogenic fraction											19		10	14	13	30	28	29
Other petroleum products						482	569	1 796	2 102	2 570	2 680	3 672	756	1 991	2 010			
Petroleum coke																		
Coke	33 714	27 952	39 634	32 890	26 880	25 224	25 627	28 355	12 621	12 229	8 255	3 801	8 099	8 197	5 794	2 625	2 825	2 535
Liquid petroleum gas (LPG)					1 372	804	804	1 797	1 608	2 129	2 365	3 358	3 453	5 676	5 156	4 730	5 392	5 061
Motor gasoline																		
Jet kerosene																		
Aviation gasoline																		
Diesel oil							989	4 300	6 235	7 654	13 373	15 050	19 135	16 813	14 319	13 244	23 306	22 919
Fuel oil								81										
Refinery feedstocks																		
Refinery gas																		
Petroleum coke oven gas	1 224	1 088	877	428	123	53	34	127									1	1
Blast furnace gas																		
Gas works gas	312	554	576	91	14	14	14	72	41	5	5	4	3	4	3	3	3	14
Fuel	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Hard coal	28 763	31 393	34 504	31 119	32 855	30 116	27 068	25 958	27 222	27 017	24 319	19 663	20 801	24 933	12 114	10 420	9 115	
Lignite			1 475	702	531	515	402	327	280	242	198	146	56	24	19	134	123	
Hard coal briquettes																		
Brown coal briquettes											340	301		1	0	0	0	
Crude oil																		
Natural gas	71 250	75 746	83 435	78 275	80 890	76 500	67 428	71 826	80 969	60 809	56 324	56 462	47 900	67 306	64 525	59 169	58 048	
Fuel wood and wood waste	5 020	7 104	8 029	7 818	6 833	7 433	6 556	7 043	7 715	8 003	7 556	7 307	7 451	8 355	6 717	6 596	6 167	
Biogas	1 795	1 675	1 830	1 963	2 280	2 123	2 118	2 361	2 700	2 502	2 568	2 797	2 742	2 546	2 941	2 952	3 261	
Industrial wastes		92	21	11	9	388	79	145	116	119	123	137	171	155	143	583	821	
Municipal waste - non-biogenic fract.	37	31	5	35	28	33	152	50	239	131	96	58	418	576	75	424	634	
Municipal waste – biogenic fraction	8								131	40	19	2	11	10	11	186	297	
Other petroleum products	44	86	103	43	43	86	43			29		5	10	20	11	6	83	
Petroleum coke																		
Coke	2 027	2 072	2 068	1 758	725	1 062	563	795	891	704	644	457	412	1 452	279	168	140	
Liquid petroleum gas (LPG)	4 588	3 772	3 404	3 312	4 048	2 852	2 990	2 990	3 220	3 287	3 059	3 454	2 300	2 162	1 748	1 626	1 380	
Motor gasoline																		
Jet kerosene																		
Aviation gasoline																		
Diesel oil	22 919	21 910	27 409	25 634	18 403	15 155	14 722	14 577	14 534	15 088	15 677	13 646	13 871	15 480	13 561	9 460	15 480	
Fuel oil			80	40														
Refinery feedstocks																		
Refinery gas																		
Petroleum coke oven gas	1	2	1	1	1		1						583	385	436			
Blast furnace gas																		
Gas works gas	18	17	17	18	14	10	2											

Table A5. 25. Fuel consumption [TJ] in 1A4bi. *Residential: Stationary plants*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Hard coal	272 689	358 521	351 542	372 347	309 920	305 701	326 681	271 980	213 584	223 330	166 013	184 731	209 771	207 214	219 654	249 994	284 628	257 388
Lignite	526	42		2 956	4 403	4 279	3 420	2 626	1 772	1 286	1 169	1 373	1 482	1 605	1 919	2 006	2 168	1 972
Hard coal briquettes																		
Brown coal briquettes	1 106																	
Crude oil																		
Natural gas	122 204	133 674	141 212	141 590	151 671	159 559	143 057	150 022	138 268	135 995	127 611	133 737	127 093	127 629	126 376	135 111	138 686	132 622
Fuel wood and wood waste	38 875	30 944	34 552	106 000	104 715	105 000	101 000	100 000	100 700	95 000	95 000	104 500	104 500	103 075	103 360	100 700	104 500	102 000
Biogas																		
Industrial wastes																		
Municipal waste - non-biogenic fract.																		
Municipal waste – biogenic fraction																		
Other petroleum products																		
Petroleum coke																		
Coke	14 444	11 979	26 448	30 280	27 328	26 808	27 409	32 446	18 677	18 528	11 671	11 912	8 525	8 569	6 964	2 932	3 216	1 393
Liquid petroleum gas (LPG)	1 750	1 041	1 892	6 244	9 224	13 197	16 555	18 920	18 920	19 866	20 812	21 285	21 995	26 015	24 596	23 650	23 650	24 596
Motor gasoline																		
Jet kerosene																		
Aviation gasoline																		
Diesel oil							2 150	6 450	8 600	9 804	17 200	21 500	23 005	23 005	21 500	19 350	19 350	15 480
Fuel oil																		
Refinery feedstocks																		
Refinery gas																		
Petroleum coke oven gas	15 155	13 706	11 334	6 779	3 560	1 723	226											
Blast furnace gas																		
Gas works gas	3 088	1 307	739	431	418	258	222	181	164	163	158	151	134	128	113	95	99	81
Fuel	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Hard coal	276 073	279 808	319 753	275 817	291 964	280 095	257 420	252 837	268 841	267 709	251 533	205 184	216 037	201 600	168 840	169 000	148 980	
Lignite	2 565	2 219	4 035	3 593	3 619	4 023	3 214	3 105	2 989	2 502	2 501	1 874	721	640	1 280	1 440	1 312	
Hard coal briquettes															700			
Brown coal briquettes																		
Crude oil																		
Natural gas	131 450	134 857	148 431	135 464	141 401	143 186	131 595	132 207	145 144	151 979	149 111	152 348	160 833	191 171	181 655	176 065	177 272	
Fuel wood and wood waste	102 500	102 500	112 746	115 000	116 850	116 850	105 450	108 395	111 435	109 725	237 671	219 724	203 228	207 136	196 917	183 250	184 775	
Biogas																		
Industrial wastes																		
Municipal waste - non-biogenic fract.																		
Municipal waste – biogenic fraction																		
Other petroleum products																		
Petroleum coke																		
Coke	1 111	5 747	6 401	5 495	5 297	5 591	4 786	4 112	3 900	4 194	3 637	1 393	961	1 128	1 644	1 232	1 134	
Liquid petroleum gas (LPG)	25 069	25 254	24 840	23 000	23 000	21 620	21 390	21 390	21 620	22 080	23 000	24 380	23 000	21 850	21 298	19 807	17 940	
Motor gasoline																		
Jet kerosene																		
Aviation gasoline																		
Diesel oil	11 610	8 011	4 547	4 763	3 767	3 464	3 031	3 182	3 010	3 010	3 440	2 795	2 838	4 214	3 655	3 440	4 214	
Fuel oil																		
Refinery feedstocks																		
Refinery gas																		
Petroleum coke oven gas																		
Blast furnace gas																		
Gas works gas	71	69	67	59	40	47	36	3										



Table A5. 26. Fuel consumption [TJ] in 1A4ci. *Agriculture/Forestry/Fishing – stationary*

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Hard coal	36 365	57 356	62 959	62 501	60 542	58 583	62 611	52 483	46 050	49 162	33 232	36 976	30 820	29 693	31 728	35 673	42 074	37 748
Lignite	844	1 018	911	814	1 642	1 698	1 299	1 292	1 419	1 097	939	1 236	1 395	1 528	2 086	2 188	2 489	2 125
Hard coal briquettes	506	114	65	47	45										23			
Brown coal briquettes	36	17	18														35	
Crude oil																		
Natural gas	448	275	55	132	212	243	428	571	869	476	536	777	914	1 197	1 182	1 084	1 492	1 841
Fuel wood and wood waste				20 057	18 367	18 500	17 567	17 000	17 100	17 100	17 100	19 043	19 010	19 017	19 878	19 047	19 978	19 062
Biogas																		
Industrial wastes																		
Municipal waste - non-biogenic fract.										6	12	11						
Municipal waste – biogenic fraction										6	13	10						
Other petroleum products																		
Petroleum coke																		
Coke	1 532	1 158	677	561	3 952	3 917	4 011	5 079	5 336	5 131	3 416	3 687	2 842	2 856	1 950	1 117	1 398	836
Liquid petroleum gas (LPG)					473	710	1 183	1 419	1 419	1 656	1 892	2 365	2 838	3 311	3 311	3 311	2 365	2 365
Motor gasoline				665	1 108	1 108	1 108	1 196	1 108	1 329	1 373	930	266	310	222	266	310	222
Jet kerosene																		
Aviation gasoline																		
Diesel oil																		
Fuel oil	3 596	2 747	1 454	13 534	16 887	8 807	4 040	6 626	5 737	5 535	5 656	5 292	3 919	5 898	6 020	7 272	1 737	1 212
Refinery feedstocks																		
Refinery gas																		
Petroleum coke oven gas	2	2																
Blast furnace gas																		
Gas works gas	1			2					1									
Fuel	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Hard coal	41 640	41 538	47 291	41 488	43 715	41 611	39 003	36 305	38 963	38 844	36 541	29 571	31 148	25 200	20 160	18 200	13 000	
Lignite	2 770	2 485	1 667	1 337	1 327	1 609	1 286	1 144	981	807	670	543	207	160	161	248	205	
Hard coal briquettes	46	23	24	46	163	233	209	118	301	273	302	211	2	5	70	1	213	
Brown coal briquettes	35	35			18	461	1 195	618	350	407	350	340	59	62				
Crude oil																		
Natural gas	1 900	1 577	1 486	1 531	1 796	1 501	1 438	1 144	1 305	1 519	1 267	1 558	1 806	2 176	1 528	1 668	1 845	
Fuel wood and wood waste	19 024	19 030	21 088	23 931	20 948	20 937	19 310	20 256	21 458	21 276	20 735	19 618	20 068	23 889	19 215	17 835	16 384	
Biogas	94	97	39	223	252	286	328	385	373	395	359	360	370	349	588	467	544	
Industrial wastes															0	0		
Municipal waste - non-biogenic fract.																		
Municipal waste – biogenic fraction																		
Other petroleum products																		
Petroleum coke																		
Coke	805	829	922	962	279	559	619	247	279	252	224	111	163	474	12	1	1	
Liquid petroleum gas (LPG)	2 412	2 070	2 300	2 346	2 300	2 300	2 438	2 622	2 760	2 852	2 852	2 990	2 852	2 667	856	2 069	1 839	
Motor gasoline	222	225	45	45	45	45	44	43	43	38	44	49	46	64	59	81	84	
Jet kerosene																		
Aviation gasoline																		
Diesel oil																		
Fuel oil	1 374	1 200	920	1 280	1 360	560	480	400	560	600	408	409	409	242	34	21	20	
Refinery feedstocks																		
Refinery gas																		
Petroleum coke oven gas																		
Blast furnace gas																		
Gas works gas																		

Table A5. 27. Fuel consumption [kt] in 1A4cii/ciii. Agriculture/Forestry/Fishing – mobile

Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1.A.4.c ii Agriculture																		
Diesel oil - Off-road transport	1 060	1 021	1 200	1 514	1 639	1 726	1 926	2 241	2 038	2 088	2 313	2 156	2 150	2 175	2 215	2 266	1 683	1 547
Diesel oil - Machinery	118	113	133	168	182	192	214	249	226	232	257	240	239	242	246	252	187	172
1.A.4.c iii Fishing																		
Diesel oil	80	77	81	66	75	74	60	62	45	45	40	42	41	33	37	32	30	31
Fuel oil	140	135	141	115	132	130	105	109	79	79	70	74	72	58	65	56	53	54
Fuel	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
1.A.4.c ii Agriculture																		
Diesel oil - Off-road transport	1 548	1 490	1 495	1 507	1 518	1 484	1 433	1 426	1 510	1 806	1 905	1 981	2 001	2 011	1 828	2 115	1 828	
Diesel oil - Machinery	172	166	166	167	169	165	159	158	168	201	212	220	222	223	203	235	203	
1.A.4.c iii Fishing																		
Diesel oil	30	44	36	38	38	41	37	39	42	44	43	44	43	41	36	35	30	
Fuel oil	52	78	63	66	67	72	65	69	73	76	75	77	75	72	64	61	53	

Note: ON - diesel oil; OP - fuel oil

I.5 Fugitive emission (NFR sector 1B)

Table A5. 28. Activity data used in 1B1. Fugitive emission from solid fuels [kt]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Hard coal extraction	147 493	140 027	131 313	130 047	133 127	136 190	137 048	137 129	115 145	109 322	102 219	103 280	102 723	101 659	100 517	97 110	94 407	87 406
Lignite extraction	67 584	69 406	66 852	68 105	66 770	63 547	63 845	63 169	62 820	60 839	59 484	59 552	58 210	60 920	61 198	61 636	60 844	57 538
Coke production	13 516	11 356	11 066	10 275	11 455	11 578	10 339	10 535	9 746	8 368	8 972	8 946	8 723	10 112	10 097	8 404	9 613	10 168
Imported hard coal	560	54	126	129	1 044	1 497	1 976	3 244	4 198	2 361	1 452	1 878	2 737	2 517	2 328	3 372	5 271	5 924
Imported brown coal	0	0	18	1	1	13	39	10	0	0	0	0	0	0	0	0	5	8
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Hard coal extraction	83 661	77 478	76 172	75 668	79 234	76 466	72 540	72 176	70 385	65 480	63 384	61 623	54 386	55 006	52 829	48 353	43 945	
Lignite extraction	59 668	57 108	56 510	62 841	64 280	65 849	63 877	63 128	60 246	61 161	58 571	50 329	45 983	52 356	54 621	40 101	40 975	
Coke production	10 075	7 091	9 844	9 377	8 893	9 360	9 568	9 792	9 718	9 418	9 473	8 916	7 783	9 284	8 483	8 003	7 607	
Imported hard coal	10 331	10 793	13 603	14 955	10 165	10 515	10 417	8 289	8 279	12 803	19 195	16 623	12 771	12 382	20 025	16 904	8 137	
Imported brown coal	20	30	24	76	147	195	176	281	289	328	276	290	151	130	270	254	157	

Table A5. 29. Activity data used in 1B2a. Fugitive emission from oil [kt]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Extraction of crude oil	160	158	200	235	284	292	317	289	360	434	653	767	728	765	886	848	796	721
Extraction of crude oil (off shore)	0	0	0	0	0	0	0	0	0	0	0	0	0	272	260	242	270	197
Extraction of crude oil (on shore)	160	158	200	235	284	292	317	289	360	434	653	767	728	493	626	606	526	524
Liquid fuel distribution (except gasoline)																		
Marine terminals	13 126	11 454	13 052	13 674	12 721	12 957	14 026	14 713	15 367	16 022	18 002	17 558	17 942	17 448	17 316	17 912	19 813	20 885
Refineries throughput	12 846	11 726	13 146	13 366	13 448	13 443	14 597	14 884	16 023	16 719	18 274	17 962	17 785	17 457	18 118	18 165	20 045	20 113
Handling and storage - diesel oil	5 297	4 922	5 135	5 572	5 781	6 306	6 545	6 559	6 411	6 707	6 004	5 739	5 070	5 908	6 831	7 484	8 595	9 605
Gasoline distribution																		
Gasoline distribution	3 773	4 100	4 763	4 536	4 761	5 466	4 696	5 091	5 036	5 908	5 176	4 749	4 317	4 215	4 212	4 067	4 162	4 143
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Extraction of crude oil	755	687	687	617	681	962	951	928	1 001	996	1 010	973	937	888	854	826	803	
Extraction of crude oil (off shore)	263	183	192	153	193	151	166	168	248	222	207	204	234	253	259	270	289	
Extraction of crude oil (on shore)	492	504	495	464	488	811	785	760	753	774	803	769	703	636	595	556	514	
Liquid fuel distribution (except gasoline)																		
Marine terminals	20 787	20 098	22 688	23 792	24 633	23 347	23 713	26 492	24 573	24 648	26 847	26 622	24 906	23 620	26 291	24 493	25 523	
Refineries throughput	20 804	20 304	22 843	24 001	25 153	24 302	24 196	26 140	25 790	25 139	26 899	27 181	25 757	24 755	26 645	24 979	26 000	
Handling and storage - diesel oil	10 509	10 896	12 006	12 295	12 093	11 252	11 080	12 084	13 791	16 436	17 317	17 625	17 306	18 624	18 588	19 299	18 562	
Gasoline distribution																		
Gasoline distribution	4 170	4 246	4 145	3 951	3 872	3 669	3 583	3 781	4 034	4 387	4 545	4 714	4 376	4 844	5 192	5 411	5 781	



Table A5. 30. Activity data used in 1B2b. Fugitive emission from gas [mln m3]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Extraction of natural gas	3 218	3 608	3 484	4 469	4 213	4 297	4 237	4 324	4 369	4 190	4 434	4 657	4 779	4 800	5 164	5 150	5 129	5 163
Extraction of natural (off shore)														22	31	25	42	21
Extraction of natural (on shore)	3 218	3 608	3 484	4 469	4 213	4 297	4 237	4 324	4 369	4 190	4 434	4 657	4 779	4 777	5 133	5 125	5 087	5 142
Gas distribution networks																		
natural gas (high - methane)	9 534	8 837	8 193	8 561	8 640	9 515	9 999	9 937	10 089	9 859	10 509	10 855	10 500	11 922	12 536	12 927	13 029	12 988
natural gas (nitrogenous)	2 829	2 716	2 684	2 927	2 719	2 937	2 956	2 982	2 935	2 956	3 114	3 278	3 357	3 335	3 390	3 570	3 492	3 561
Coke oven gas- consumption	1 589	1 412	1 203	1 169	1 065	1 177	986	1 074	886	1 016	1 098	1 127	1 091	1 346	987	804	1 098	1 133
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Extraction of natural gas	4 876	4 906	4 967	5 150	5 208	5 077	4 966	4 898	4 647	4 580	4 505	4 453	4 394	4 313	4 250	4 047	3 922	
Extraction of natural (off shore)	28	16	15	15	19	15	17	17	25	24	21	21	24	26	26	27	28	
Extraction of natural (on shore)	4 848	4 889	4 952	5 135	5 189	5 062	4 950	4 881	4 623	4 556	4 484	4 432	4 370	4 287	4 224	4 020	3 894	
Gas distribution networks																		
natural gas (high - methane)	13 269	13 020	14 010	13 970	14 819	14 774	14 484	14 608	15 617	16 491	17 209	18 170	18 367	19 710	16 056	16 726	18 070	
natural gas (nitrogenous)	3 408	3 569	3 771	3 853	3 987	3 942	3 864	3 828	3 753	3 812	3 820	3 830	3 767	3 768	3 588	3 522	3 472	
Coke oven gas- consumption	1 131	913	1 229	1 164	1 081	1 177	1 196	1 367	1 489	1 390	1 397	1 344	1 158	1 365	1 191	1 068	1 074	

Table A5. 31. Activity data used in 1B2c. Venting and flaring [kt]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Throughput	12 846	11 726	13 146	13 366	13 448	13 443	14 597	14 884	16 023	16 719	18 274	17 962	17 785	17 457	18 118	18 165	20 045	20 113
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Throughput	20 804	20 304	22 843	24 001	25 153	24 302	24 196	26 140	25 790	25 139	26 899	27 181	25 757	24 755	26 645	24 979	26 000	

II. NFR SECTOR 2 – INDUSTRIAL PROCESSES AND PRODUCT USE

Table A5. 32. Activity data used in NFR 2A. *Mineral products*

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Cement clinker and portland cement [kt]	22 827	22 247	22 377	21 930	26 392	26 516	25 715	27 742	26 944	27 233	26 604	21 409
Calx [kt]	3 200	2 413	2 526	2 584	2 516	2 526	2 461	2 516	2 406	2 299	2 376	2 074
Gypsum [kt]	192	247	222	290	357	407	450	504	511	459	445	1 035
Flat glass [kt]	348	328	315	305	274	331	325	331	517	480	493	481
Container glass [kt]	702	686	642	697	794	800	849	1 010	984	993	1 038	1 016
Glass fiber [kt]	0	0	3	4	5	8	6	5	13	2	57	68
Lead glass [kt]	9	9	9	8	10	11	10	15	14	16	16	15
Quarrying of minerals (other than coal) [kt]	74 656	61 228	67 613	82 231	70 020	70 743	80 277	89 092	95 334	110 412	112 523	94 465
Quarrying of copper ore [kt]	24 359	25 702	24 115	27 113	26 136	26 463	27 427	26 165	27 594	28 395	28 503	30 227
Quarrying of zinc-lead ores [kt]	4 875	4 849	5 017	4 819	4 871	5 040	5 030	4 939	5 052	5 068	4 857	4 666
Apartments construction [pcs]	134 215	136 790	132 969	94 449	76 080	67 072	62 130	73 706	80 594	81 979	87 789	105 967
Non-residential construction [pcs]	19 167	19 167	19 167	19 167	19 167	19 167	19 877	21 892	20 030	19 388	22 244	21 901
Road constructions [km]	15	15	15	15	15	15	15	40	40	40	40	41
Activity	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Cement clinker and portland cement [kt]	20 018	20 301	22 458	22 115	25 908	30 288	29 650	26 081	27 580	32 623	27 726	25 687
Calx [kt]	1 960	2 053	2 168	1 749	1 936	2 143	1 952	1 704	1 799	2 036	1 799	1 710
Gypsum [kt]	1 244	1 443	557	771	1 190	1 422	1 579	1 317	1 347	1 349	1 220	1 264
Flat glass [kt]	474	596	585	633	651	616	769	660	1 002	1 092	1 110	1 025
Container glass [kt]	1 113	1 078	1 297	1 189	1 330	1 465	1 421	1 426	1 280	1 289	1 453	1 519
Glass fiber [kt]	72	77	80	79	77	86	83	67	88	91	83	108
Lead glass [kt]	14	14	15	10	5	4	3	6	7	6	6	5
Quarrying of minerals (other than coal) [kt]	88 572	104 381	109 189	130 873	152 978	182 721	198 135	194 471	222 676	324 231	246 763	228 422
Quarrying of copper ore [kt]	29 705	29 992	31 880	32 019	32 875	31 809	30 920	31 253	30 805	31 241	31 725	32 215
Quarrying of zinc-lead ores [kt]	4 805	4 754	4 669	4 445	4 089	4 003	3 891	3 198	2 450	2 345	2 329	2 328
Apartments construction [pcs]	97 595	162 686	108 117	114 066	115 353	133 698	165 189	160 002	135 835	130 954	152 904	145 136
Non-residential construction [pcs]	24 314	28 783	28 700	30 452	32 832	38 350	37 221	28 565	29 556	29 792	32 615	29 635
Road constructions [km]	41	41	72	120	257	178	221	222	177	338	624	389
Activity	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Cement clinker and portland cement [kt]	27 680	26 544	27 858	30 251	33 178	33 124	33 410	33 621	33 657	29 440	30 544	
Calx [kt]	1 817	1 942	1 869	1 904	1 820	1 777	1 677	1 833	1 670	1 283	1 308	
Gypsum [kt]	1 073	1 099	1 119	1 182	1 120	1 150	1 132	1 510	1 382	1 400	1 420	
Flat glass [kt]	1 117	554	1 191	1 169	1 316	1 426	1 438	1 893	1 837	1 450	1 727	
Container glass [kt]	1 500	2 032	1 623	1 770	1 606	1 959	2 146	1 697	1 687	2 075	1 872	
Glass fiber [kt]	111	124	127	147	115	105	113	105	100	32	39	
Lead glass [kt]	5	4	4	3	2	1	3	4	4	4	3	
Quarrying of minerals (other than coal) [kt]	209 724	228 238	231 368	256 662	276 816	260 726	256 086	263 375	247 573	245 505	264 264	
Quarrying of copper ore [kt]	32 613	33 187	33 620	32 781	31 805	31 438	31 190	31 635	32 112	32 076	32 246	
Quarrying of zinc-lead ores [kt]	2 297	2 241	2 172	1 870	1 743	1 699	1 608	89	87	75	81	
Apartments construction [pcs]	143 166	147 711	163 325	178 342	185 063	207 425	220 831	231 057	234 876	218 174	197 685	
Non-residential construction [pcs]	31 237	31 831	28 506	29 088	28 508	28 647	26 936	26 460	26 251	25 432	24 004	
Road constructions [km]	332	84	140	356	321	460	138	426	322	267	156	



Table A5. 33. Activity data used in 2B. *Chemical Industry* [kt]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Ammonia	1 532	1 561	1 481	1 631	1 945	2 248	2 185	2 252	2 048	1 785	2 243	2 104	1 595	2 247	2 452	2 524	2 327	2 418
Nitric acid	1 577	1 438	1 388	1 608	1 701	1 931	1 929	1 808	1 671	1 635	2 007	2 060	1 689	2 030	2 085	2 219	2 201	2 270
Adipic acid	4	3	3	3	1													
Calcium carbide	297	283	221	180	174	178	145	121	70	53	39	38	28	29	28	25	21	16
Titanium white (TiO ₂)	30	27	28	24	34	35	35	32	35	37	35	38	38	42	41	41	41	39
Soda ash	1 335	1 125	1 103	1 007	1 369	1 019	909	950	1 000	926	902	926	906	917	975	996	1 026	1 192
Sulphuric acid	1 721	1 088	1 244	1 145	1 452	1 861	1 761	1 791	1 707	1 505	1 763	1 690	1 648	1 764	1 811	1 807	1 907	2 010
NPK fertilizers	5 423	4 288	4 547	4 707	5 540	6 491	6 625	6 558	5 983	5 634	6 869	6 441	5 924	6 975	7 385	7 464	7 347	7 896
Phosphate fertilizers	1 232	564	474	289	364	411	411	361	337	294	323	349	357	401	453	410	359	466
Ammonium sulphate	525	527	523	510	527	590	747	571	540	593	621	617	629	643	635	652	666	652
Ammonium nitrate	1 520	1 100	990	1 152	1 300	1 474	1 375	1 315	1 286	1 286	814	1 387	1 092	1 049	1 164	1 235	1 259	1 292
Urea	1 132	970	890	832	1 025	1 209	1 090	864	728	752	830	688	486	628	618	701	705	735
Carbon black	23	17	26	26	26	23	25	25	23	19	13	15	16	18	35	29	32	38
Chlorine - mercury cell	204	162	90	87	85	94	91	87	79	59	58	42	50	58	62	62	44	30
Ethylene	501	448	473	477	399	436	493	510	519	494	508	431	523	492	489	447	878	924
Propylene	193	177	190	188	164	176	194	202	189	198	249	228	256	257	246	249	413	409
Polyethylene	159	150	163	162	142	155	163	160	173	134	147	155	170	161	153	162	374	397
Polyvinylchloride (PVC)	203	195	220	212	202	225	254	285	266	259	274	226	249	256	268	217	278	303
Polypropylene	86	89	86	75	76	76	45	35	38	104	123	123	144	145	143	157	215	271
Polystyrene	19	21	26	32	34	46	47	49	51	71	94	93	87	82	97	93	101	108
Polystyrene EPS	12	13	16	20	21	29	29	30	32	44	56	50	53	60	58	59	70	64
Polystyrene GPPS/HIPS	4	5	6	7	7	10	10	11	11	15	17	20	16	10	20	17	13	21
Formaldehyde	65	70	75	80	85	90	95	100	105	110	101	94	211	221	232	221	233	224
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Ammonia	2 485	2 011	2 059	2 322	2 526	2 482	2 651	2 718	2 623	2 779	2 535	2 450	2 646	2 597	2 106	1 800	2 103	
Nitric acid	2 267	2 139	2 209	2 168	2 323	2 280	2 366	2 396	2 340	2 404	2 310	2 331	2 413	2 460	2 033	1 988	2 359	
Adipic acid																		
Calcium carbide																		
Titanium white (TiO ₂)	40	36	40	38	37	36	36	32	38	40	37	35	35	35	29	22	26	
Soda ash	1 425	890	1 051	1 083	1 162	1 183	1 187	1 203	1 384	1 421	1 363	1 321	1 241	1 290	1 309	1 053	975	
Sulphuric acid	1 813	1 243	1 686	1 889	1 693	1 462	1 550	1 701	1 637	1 713	1 633	1 655	1 586	1 635	1 486	1 241	1 195	
NPK fertilizers	7 290	5 759	6 967	7 389	7 719	7 341	7 744	8 171	8 164	8 385	8 230	8 334	8 390	8 530	7 115	5 871	6 828	
Phosphate fertilizers	458	146	310	392	376	311	366	377	403	363	390	423	397	386	348	273	325	
Ammonium sulphate	622	583	612	622	617	609	634	624	618	609	623	620	590	626	528	404	485	
Ammonium nitrate	1 260	1 348	1 323	1 324	1 389	1 272	1 341	1 364	1 300	1 328	1 293	1 285	1 312	1 332	1 053	1 133	1 347	
Urea	781	867	724	980	1 079	1 037	1 123	1 158	1 107	1 077	1 267	1 152	1 216	1 193	1 036	729	731	
Carbon black	33	26	33	42	20	28	35	42	54	53	55	57	48	53	50	42	50	
Chlorine - mercury cell	21																	
Ethylene	798	759	738	813	753	487	472	545	447	482	468	475	487	349	459	300	343	
Propylene	365	358	337	359	326	352	340	391	336	341	312	442	428	349	417	295	387	
Polyethylene	360	340	365	371	338	347	348	395	346	371	346	383	348	266	348	290	331	
Polyvinylchloride (PVC)	251	258	196	283	261	306	275	321	259	289	255	243	295	231	284	165	219	
Polypropylene	281	267	243	255	248	257	231	298	264	292	287	351	351	313	334	301	330	
Polystyrene	120	127	142	145	143	136	128	133	148	153	146	175	168	183	170	161	150	
Polystyrene EPS	79	83	82	85	86	78	75	83	91	96	88	111	103	110	101	92	87	
Polystyrene GPPS/HIPS	26	32	42	45	46	48	44	42	47	47	53	55	53	56	55	60	53	
Formaldehyde	116	96	98	219	221	219	258	243	273	242	248	464	448	532	423	401	426	

Table A5. 34. Activity data used in 2C. *Metal Production* [kt]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Blast furnace charging	8 657	6 502	6 462	6 293	7 081	7 420	6 600	7 343	6 179	5 233	6 492	5 440	5 296	5 632	6 400	4 477	5 543	5 804
Blast furnaces - smelting	8 657	6 502	6 462	6 293	7 081	7 420	6 600	7 343	6 179	5 233	6 492	5 440	5 296	5 632	6 400	4 477	5 543	5 804
Open hearth furnaces	3 965	2 638	1 820	1 660	1 631	1 545	1 063	1 034	496	378	376	178	7					
Basic oxygen furnaces (BOFs)	7 210	5 746	6 248	6 162	7 034	7 685	6 757	7 531	6 223	5 453	6 800	5 823	5 799	6 070	6 858	4 893	5 766	6 188
Electric arc furnaces (EAFs)	2 447	2 048	1 797	2 115	2 447	2 582	2 648	2 906	3 117	2 825	3 290	2 809	2 561	3 037	3 721	3 443	4 225	4 433
Rolling mills - hot	9 836	8 036	7 550	7 632	8 595	9 542	9 064	9 834	11 710	9 849	11 478	10 161	8 011	8 088	10 369	7 877	9 465	9 640
Rolling mills - cold	1 201	796	793	857	964	1 116	1 383	1 450	1 279	1 188	1 356	1 168	1 363	1 433	1 612	1 159	1 326	1 398
Sinter	11 779	8 613	8 622	7 628	8 787	8 647	8 319	8 981	6 882	6 476	8 079	7 353	7 617	7 732	8 591	6 168	6 908	6 954
Ferrosilicon	89	60	36	43	54	70	72	77	75	63	56	49	42	93	84	65	13	59
Primary aluminium	46	46	44	47	50	56	52	54	54	51	52	55	59	57	59	54	56	63
Secondary aluminium	23	23	31	18	34	92	117	117	117	117	117	117	119	123	252	247	250	294
Batteries	39	34	32	33	35	39	36	40	41	45	50	53	74	84	92	110	125	124
Primary lead	65	51	54	62	61	66	66	65	64	64	45	29	34	56	57	62	67	80
Secondary lead	11	11	15	10	12	14	38	31	39	17	37	32	67	67	39	45	46	50
Primary zinc	132	126	135	149	158	166	165	173	178	178	162	160	146	132	131	114	110	127
Secondary zinc	3	3	6	3	3	8	12	16	14	16	15	8	13	27	31	31	31	33
Primary and secondary copper	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Other metal production												C	C	C	C	C	C	C
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Blast furnace charging	4 934	2 984	3 638	3 975	3 941	4 012	4 637	5 621	4 674	5 199	4 788	4 242	3 502	3 595	3 089	2 791	3 462	
Blast furnaces - smelting	4 934	2 984	3 638	3 975	3 941	4 012	4 637	5 359	5 145	5 728	5 418	4 938	3 951	4 083	3 468	3 141	3 853	
Open hearth furnaces																		
Basic oxygen furnaces (BOFs)	5 225	3 236	3 995	4 424	4 333	4 520	5 182	5 359	5 145	5 728	5 418	4 938	3 951	4 083	3 468	3 141	3 853	
Electric arc furnaces (EAFs)	4 502	3 893	4 001	4 353	4 209	3 679	3 617	3 977	4 016	4 812	4 914	4 184	4 007	4 469	4 053	3 381	3 314	
Rolling mills - hot	8 589	6 455	7 182	8 261	7 949	8 382	8 733	8 913	8 881	10 284	10 322	8 737	7 158	7 866	7 166	6 353	6 405	
Rolling mills - cold	1 323	1 107	1 540	1 666	1 261	1 623	1 706	1 783	1 975	2 168	2 445	2 264	2 014	2 356	1 899	2 052	2 030	
Sinter	6 306	4 363	5 837	6 513	6 672	6 854	7 389	7 430	6 850	6 992	6 738	6 468	4 890	5 021	4 111	3 420	3 936	
Ferrosilicon	56	10	53	73	78	74	63	78	78	66	64	66	62	73	51	41	73	
Primary aluminium	47																	
Secondary aluminium	214	199	239	295	302	416	390	527	508	512	560	476	457	614	628	623	700	
Batteries	122	118	148	151	178	179	177	193	207	212	198	197	155	175	151	156	160	
Primary lead	86	79	91	84	96	92	86	69	66	62	65	61	65	74	71	65	69	
Secondary lead	51	54	62	70	81	86	112	114	104	119	141	104	85	92	84	83	81	
Primary zinc	129	110	98	109	134	134	123	115	107	100	98	108	102	101	96	95	93	
Secondary zinc	33	34	39	43	49	51	77	77	60	75	71	71	62	33	33	29	30	
Primary and secondary copper	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
Other metal production	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	

Table A5. 35. Activity data used in 2D3a. *Domestic solvent use* [thous. inhab]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Domestic solvent use including fungicides	38 073	38 144	38 203	38 239	38 265	38 284	38 294	38 290	38 277	38 263	38 254	38 242	38 219	38 191	38 174	38 157	38 125	38 116
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Domestic solvent use including fungicides	38 136	38 167	38 530	38 538	38 533	38 496	38 479	38 437	38 433	38 434	38 411	38 383	38 089	37 908	37 766	37 637	37 489	



Table A5. 36. Activity data used in 2D3b. *Road paving with asphalt* and 2D3c. *Asphalt roofing* [t]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Asphalt production	609 000	524 000	552 000	523 000	435 000	285 000	624 000	648 000	590 000	686 000	831 000	678 000	812 000	873 000
Amount of shingle	425 720	502 900	515 985	541 960	641 615	570 000	510 000	545 000	467 000	490 000	464 785	369 225	383 105	400 775
Activity	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Asphalt production	997 000	1 139 000	1 549 000	1 667 000	1 544 000	1 568 000	1 567 000	1 788 000	1 550 000	1 314 000	1 229 000	1 480 000	1 427 000	1 452 281
Amount of shingle	453 180	446 695	462 540	491 895	443 670	423 005	458 440	456 860	435 985	372 645	377 980	350 155	363 815	395 215
Activity	2018	2019	2020	2021	2022	2023	2024							
Asphalt production	1 493 853	1 484 868	1 529 176	1 400 658	1 351 438	1 285 148	1 290 718							
Amount of shingle	378 470	362 050	369 295	373 940	387 315	361 240	400 300							

Table A5. 37. Activity data used in 2D3d. *Coating applications* [t]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Decorative coating application	10 000	20 000	30 000	38 000	51 000	66 180	86 948	105 500	158 041	181 361	176 183	198 034	228 430	254 430	294 429	359 985	308 582	405 080
Industrial coating application	45 000	80 000	100 000	128 000	155 000	120 400	123 249	126 000	116 394	101 569	138 300	145 141	160 563	136 656	183 705	161 206	227 416	214 189
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Decorative coating application	381 510	363 626	374 136	373 144	355 641	340 359	359 010	379 660	372 960	381 523	386 021	408 011	406 367	393 999	324 422	330 991	319 892	
Industrial coating application	360 837	208 341	130 967	134 545	114 456	67 529	89 458	123 277	142 331	143 298	101 152	47 251	95 493	81 042	49 041	55 299	107 680	

Table A5. 38. Activity data used in 2D3e. *Degreasing* [t]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Degreasing	4 000	5 500	7 000	8 500	9 500	11 348	9 790	7 191	9 746	12 128	14 564	11 710	12 566	18 388	24 236	22 580	24 236	23 227
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Degreasing	29 613	20 519	16 963	16 343	11 903	10 310	10 441	16 304	15 028	8 518	7 814	15 202	10 025	13 661	14 516	13 418	11897	

Table A5. 39. Activity data used in 2D3f. *Dry cleaning* [thous. inhab]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Dry cleaning	38 073	38 144	38 203	38 239	38 265	38 284	38 294	38 290	38 277	38 263	38 254	38 242	38 219	38 191	38 174	38 157	38 125	38 116
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
Dry cleaning	38 136	38 167	38 530	38 538	38 533	38 496	38 479	38 437	38 433	38 434	38 411	38 383	38 089	37 908	37 766	37 637		

Table A5. 40. Activity data used in 2D3g. *Chemical products* [t]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Polyvinylchloride processing	203 405	211 684	219 963	212 143	202 273	225 267	254 000	285 000	266 000	259 000	273 930	225 608	248 541	255 762
Polystyrene foam processing	19 096	22 423	25 750	31 509	33 822	46 243	46 500	48 900	51 200	70 600	94 335	92 540	87 228	82 369
Rubber processing	203 989	161 488	171 362	184 317	210 085	249 000	266 000	271 000	288 000	290 000	353 773	383 251	399 487	449 821
Pharmaceutical products manufacturing [thous. inhab]	38 073	38 144	38 203	38 239	38 265	38 284	38 294	38 290	38 277	38 263	38 254	38 242	38 219	38 191
Paints manufacturing	310 000	320 000	330 000	350 000	377 000	453 167	539 208	247 000	367 391	334 266	280 231	295 981	330 989	361 884
Leather tanning	26 400	26 000	25 600	25 200	24 800	24 400	24 000	23 600	23 200	22 800	23 314	20 343	19 118	17 760
Tyres	NO	NO	NO	NO	NO	152 000	160 000	162 000	185 000	176 000	202 101	220 908	236 444	260 013
Shoes [thous. pairs]	NO	NO	NO	NO	NO	24 600	26 990	27 700	24 400	22 600	19 617	18 658	19 176	18 115
Asphalt blowing	352 131	302 983	319 173	302 405	251 522	164 791	360 805	374 682	341 145	396 654	480 495	392 028	469 508	504 779
Activity	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Polyvinylchloride processing	268 454	216 775	277 798	302 716	251 380	258 086	195 836	282 952	261 339	306 129	275 159	320 964	258 888	288 547
Polystyrene foam processing	87 228	92 667	101 179	107 815	119 973	127 281	142 051	145 099	143 160	135 731	128 352	132 908	148 249	152 500
Rubber processing	519 118	556 990	625 632	679 590	714 446	621 829	790 196	897 851	857 201	915 888	975 473	1 030 971	1 162 909	1 135 901
Pharmaceutical products manufacturing [thous. inhab]	38 174	38 157	38 125	38 116	38 136	38 167	38 530	38 538	38 533	38 496	38 479	38 437	38 433	38 434
Paints manufacturing	375 160	429 262	388 989	485 847	456 322	418 262	449 559	458 440	458 423	456 940	509 664	529 715	543 992	547 482
Leather tanning	19 038	16 148	12 382	11 253	13 652	14 721	14 952	16 197	14 438	13 898	16 416	17 249	21 272	22 589
Tyres	308 428	319 264	345 361	382 141	352 007	318 080	415 087	460 231	425 953	458 847	478 465	506 142	517 233	541 391
Shoes [thous. pairs]	16 825	14 904	14 642	15 154	13 377	11 433	11 784	12 049	11 489	11 860	14 907	12 430	14 164	14 847
Asphalt blowing	576 478	665 229	853 202	974 528	872 579	899 110	931 535	1 232 518	1 018 073	593 932	653 205	712 476	739 217	901 161

Activity	2018	2019	2020	2021	2022	2023	2024							
Polyvinylchloride processing	254 634	243 152	295 334	231 456	284 325	160 750	218 555							
Polystyrene foam processing	146 217	175 178	168 007	182 974	170 233	160 909	150 043							
Rubber processing	1 128 764	1 120 711	989 944	1 142 567	1 128 374	1 080 670	923 703							
Pharmaceutical products manufacturing [thous. inhab]	38 411	38 383	38 089	37 908	37 766	37 637	37 489							
Paints manufacturing	548 116	562 224	586 622	591 712	507 439	518 643	526 980							
Leather tanning	20 310	12 578	10 456	13 715	12 437	10 500	12 741							
Tyres	531 619	535 776	471 485	551 688	539 109	466 049	419 163							
Shoes [thous. pairs]	11 456	9 843	6 714	5 832	4 568	3 970	3 275							
Asphalt blowing	843 606	861 592	825 914	765 800	523 148	476 441	387 070							

Table A5. 41. Activity data used in 2D3h. *Printing [t]*

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Printing inks	763	1 306	2 235	3 824	4 865	5 398	7 704	11 989	14 423	17 565	20 703	21 051	25 323	27 186	30 594	36 432	44 671	41 933
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Printing inks	42 054	57 486	49 540	47 032	47 855	45 093	53 751	48 710	52 251	54 961	44 761	46 817	49 017	48 252	41 766	38 450	40 177	

Table A5. 42. Activity data used in 2D3i. *Other solvent use [t]*

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Fat. edible and non-edible oil extraction	260 363	221 645	200 383	227 069	227 452	298 538	303 700	317 375	319 674	367 700	464 800	461 700	432 500	396 100
Preservation of wood	2 511	2 511	2 511	3 207	2 898	3 531	2 049	2 689	2 720	3 530	4 145	1 454	1 654	1 876
Glues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	76 189	64 417
Adhesives	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	20 668	23 629
Activity	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Fat. edible and non-edible oil extraction	395 300	427 400	452 100	502 600	567 100	565 800	488 700	509 523	470 154	519 058	543 425	522 987	506 023	487 544
Preservation of wood	1 905	1 849	2 683	2 816	3 495	2 983	3 115	3 703	4 257	4 237	4 380	3 493	3 480	3 156
Glues	37 729	80 667	93 690	91 945	113 031	113 788	122 714	121 520	125 996	122 612	132 459	150 791	171 270	172 808
Adhesives	33 714	39 389	39 062	41 933	127 218	96 868	416 732	59 036	63 437	80 288	73 509	64 155	55 778	62 169
Activity	2018	2019	2020	2021	2022	2023	2024							
Fat. edible and non-edible oil extraction	565 430	535 976	538 484	545 880	583 202	607 558	668 265							
Preservation of wood	3 251	3 417	3 601	4 785	2 723	3 446	2 271							
Glues	186 802	178 888	176 329	206 092	184 374	187 285	226 171							
Adhesives	61 893	51 609	40 535	42 956	58 691	60 246	65 532							

Table A5. 43. Activity data used in 2G – 2L. *Other Products Use*

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Tobacco combustion [t]	100 817	99 289	95 508	100 951	96 007	99 194	89 646	91 054	92 056	88 388	74 748	74 802
Fireworks [t]	883	883	883	998	1 989	2 745	2 245	2 076	3 024	3 832	4 088	3 091
Chipboards [m ³]	1 380 000	1 562 000	1 612 000	1 726 000	1 975 000	2 398 000	2 614 000	3 125 000	3 764 000	3 988 000	4 612 200	4 569 000
Paper pulp (Kraft process) [kt]	523	509	567	597	644	671	644	664	722	798	751	753
Bread [kt]	3 129	2 775	2 634	2 707	2 750	2 750	2 915	3 194	3 449	3 674	1 620	1 653
Wine [hl]	2 113 921	2 970 381	2 285 079	2 468 887	2 498 055	2 470 000	3 480 000	4 280 000	4 500 000	4 490 000	3 855 586	3 315 476
Beer [hl]	11 294 200	13 633 300	14 138 800	12 584 900	14 098 600	15 200 000	16 700 000	19 300 000	21 000 000	23 400 000	25 231 000	25 162 900
Spirits [hl 100%]	151 005	143 331	135 656	149 518	156 621	153 947	665 041	665 041	665 041	665 041	665 041	574 023
Sugar [kt]	1 971	1 636	1 468	1 982	1 383	1 595	2 220	2 145	2 102	1 821	2 009	1 543
Slaughter products - cattle and calves [kt]	446	338	221	181	181	137	161	203	214	180	156	133
Slaughter products – pigs [kt]	963	844	823	718	654	728	727	720	785	824	704	701
Slaughter products – poultry [kt]	201	197	199	187	247	276	342	418	478	539	619	715
Slaughter products – fish [kt]	23	30	35	31	49	43	43	50	51	55	67	81
Margarine and fat spreads, excluding liquid margarine [kt]	179	194	234	276	320	374	368	395	363	367	384	380
Coffee [kt]	5	5	5	6	24	66	79	82	89	91	95	93
Prepared feeds for farm animals [kt]	4 968	4 372	4 164	2 941	3 121	4 453	4 453	4 453	4 453	4 453	4 453	4 598
Prepared pet foods [kt]	92	82	90	137	139	141	141	141	141	141	141	184
Smoke houses (excl. afterburning) [kt]	188	181	181	182	187	196	218	244	230	227	244	233
Smoke houses (incl. afterburning) [kt]	375	361	361	363	375	391	435	488	459	453	487	465
Grains and soya [kt]	28 014	27 811	19 962	23 417	21 763	25 905	25 298	25 399	27 159	25 750	22 341	26 960



Sawn wood [kt]	2 477	1 923	2 449	2 556	3 180	2 305	2 248	2 528	2 592	4 065	4 356	3 690
Activity	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Tobacco combustion [t]	76 819	73 326	73 561	75 322	76 137	71 924	79 742	66 755	69 546	69 177	66 586	59 784
Fireworks [t]	3 067	2 908	5 733	5 469	4 842	6 904	8 377	5 499	6 477	4 821	6 227	5 661
Chipboards [m ³]	4 822 000	5 754 000	6 384 000	6 627 000	7 284 100	8 445 335	8 031 235	7 729 987	8 063 580	8 346 805	8 439 036	8 953 962
Paper pulp (Kraft process) [kt]	783	811	791	802	825	814	820	826	881	894	848	881
Bread [kt]	1 547	1 556	1 532	1 549	1 552	1 523	1 684	1 663	1 675	1 601	1 675	1 689
Wine [hl]	3 549 022	3 558 239	3 236 412	2 764 698	2 679 669	2 456 338	2 230 163	1 881 311	1 816 152	1 666 663	1 483 883	1 531 133
Beer [hl]	26 874 900	28 621 700	31 850 600	31 572 200	33 953 300	36 895 500	37 107 500	36 235 800	36 800 400	38 066 600	39 605 100	40 001 200
Spirits [hl 100%]	607 484	795 615	868 605	790 175	833 375	927 524	1 081 306	1 043 402	1 070 126	1 035 802	1 032 199	1 156 615
Sugar [kt]	2 030	1 906	1 999	2 033	1 574	1 857	1 397	1 515	1 579	1 943	1 996	1 952
Slaughter products - cattle and calves [kt]	135	172	163	186	222	229	194	191	219	234	231	214
Slaughter products – pigs [kt]	835	1 033	1 017	1 031	1 186	1 221	1 020	909	929	913	1 103	1 186
Slaughter products – poultry [kt]	823	965	1 035	1 237	1 305	1 354	1 413	1 425	1 586	1 706	1 931	2 042
Slaughter products – fish [kt]	74	54	66	78	50	49	45	45	44	44	79	101
Margarine and fat spreads, excluding liquid margarine [kt]	371	351	355	348	345	345	341	363	391	402	426	432
Coffee [kt]	87	86	86	83	81	75	72	82	82	84	85	85
Prepared feeds for farm animals [kt]	4 741	5 596	5 464	5 278	6 337	6 993	7 070	7 287	7 906	7 738	8 413	8 574
Prepared pet foods [kt]	162	181	208	225	254	265	269	320	354	362	393	403
Smoke houses (excl. afterburning) [kt]	240	237	258	326	342	354	339	333	328	361	365	366
Smoke houses (incl. afterburning) [kt]	480	473	516	653	684	708	678	667	656	722	730	732
Grains and soya [kt]	26 649	22 595	29 635	26 928	21 774	27 136	27 664	29 819	27 228	26 757	28 538	28 437
Sawn wood [kt]	3 690	3 990	5 190	4 302	4 707	5 550	4 968	4 896	4 974	5 124	4 944	4 950
Activity	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Tobacco combustion [t]	50 599	56 349	54 421	39 471	44 403	48 899	33 480	38 097	38 220	43 847	45 249	
Fireworks [t]	9 250	7 122	6 104	9 108	11 928	8 187	4 180	3 855	11 999	7 842	6 246	
Chipboards [m ³]	9 147 159	9 685 690	10 401 133	11 017 110	11 368 622	11 974 387	11 807 066	13 452 971	11 379 527	10 386 551	10 386 551	
Paper pulp (Kraft process) [kt]	881	873	877	936	961	938	982	995	984	885	980	
Bread [kt]	1 570	1 588	1 591	1 546	1 514	1 466	1 381	1 342	1 441	1 480	1 461	
Wine [hl]	1 526 271	1 402 824	1 255 548	1 204 782	1 127 639	1 091 354	1 063 485	1 243 395	1 126 929	929 136	875 831	
Beer [hl]	40 075 300	40 890 000	41 369 200	40 382 000	41 482 000	40 411 000	39 066 000	38 832 155	37 963 577	35 337 837	35 011 355	
Spirits [hl 100%]	881 248	960 727	977 017	950 054	970 778	1 056 755	983 974	1 080 221	1 017 713	877 267	871 734	
Sugar [kt]	2 070	1 670	2 170	2 215	2 211	2 200.00	1 992.00	2 151	2 146	2 278	2 552	
Slaughter products - cattle and calves [kt]	204	215	204	224	216	211	228	230	217	201	188	
Slaughter products – pigs [kt]	1 216	1 222	1 282	1 321	1 413	1 328.00	1 140.00	1 359	1 342	1 264	1 414	
Slaughter products – poultry [kt]	2 199	2 383	2 797	3 038	3 056	3 079.00	3 187.00	3 158	3 360	3 462	3 669	
Slaughter products – fish [kt]	86	78	71	66	81	93	81	96	86	128	131	
Margarine and fat spreads, excluding liquid margarine [kt]	421	348	359	335	320	319	328	308	339	313	307	
Coffee [kt]	81	80	83	93	106	98	97	96	91	95	101	
Prepared feeds for farm animals [kt]	8 869	9 308	10 093	10 995	11 228	11 296.00	11 580.00	10 725	11 639	11 475	11 141	
Prepared pet foods [kt]	448	496	588	644	821	868	872	930	962	1 006	1 221	
Smoke houses (excl. afterburning) [kt]	362	361	392	387	374	369	362	319	391	351	331	
Smoke houses (incl. afterburning) [kt]	725	722	784	774	749	739	724	638	781	703	662	
Grains and soya [kt]	31 928	27 996	29 861	31 942	26 783	29 000	35 517	34 654	35 687	35 892	35 077	
Sawn wood [kt]	5 172	5 154	5 322	5 496	5 640	5 244	5 340	5 778	5 550	5 616	5 826	

Emissions from lubricant use in vehicles has been estimated with the use of COPERT 5 activity data.

III. NFR SECTOR 3 - AGRICULTURE

Activity data used in this sector are included in the Chapter 5.

IV. NFR SECTOR 5 – WASTE

Table A5.44. Activity data used in 5A. Biological treatment of waste - Solid waste disposal on land [kt]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
MSW landfilled	11 087	10 627	10 610	10 552	10 900	10 784	11 402	11 964	11 988	12 035	11 888	10 638	10 162	9 609	9 194	8 623	8 987	9 098
ISW landfilled	25 454	20 313	19 289	17 045	15 507	13 503	12 695	12 134	11 573	9 018	9 001	9 365	7 768	8 844	7 919	7 072	7 628	8 924
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
MSW landfilled	7 882	7 275	7 155	5 743	5 207	3 833	3 622	2 057	2 002	2 009	2 057	2 783	2 549	2 648	2 285	2 088	2 021	
ISW landfilled	9 665	9 467	11 161	12 475	12 980	13 732	14 713	15 649	15 470	12 142	10 618	12 127	12 144	12 068	9 612	8 742		

Table A5.45. Activity data used in 5B1. Biological treatment of waste - Composting [kt d.m.]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Composted waste	205.1	178.2	172.0	264.9	150.1	160.5	171.5	182.6	193.2	193.2	237.1	178.6	146.5	235.3	322.5	247.7	205.1	263.4
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Composted waste	269.0	272.8	306.7	336.2	741.2	739.0	895.5	986.3	848.6	855.4	867.2	1 142.1	1 265.5	1 231.9	1 334.8	1 431.1	1 589.1	

Table A5.46. Activity data used in 5B2. Biological treatment of waste – Anaerobic digestion [kt w.m.]

Activity	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
agricultural facilities	NO	NO	NO	1.2	2.2	1.6	6.2	21.9	55.3	191.8	552.2	1 079.9
municipal facilities	NO	NO	NO	NO	NO	NO	NO	NO	NO	12.8	55.2	73.6
WWTP facilities	11.9	19.4	22.9	22.6	40.0	22.3	19.3	46.1	75.5	104.6	130.1	93.4
Activity	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
agricultural facilities	1 518.3	1 840.2	2 370.6	2 601.8	3 134.7	3 119.6	3 530.1	3 984.8	4 617.8	5 561.3	6 164.9	
municipal facilities	93.8	133.1	198.7	250.0	315.2	358.2	309.9	357.2	343.7	357.2	344.2	
WWTP facilities	83.0	115.7	165.8	168.0	164.7	156.8	163.3	159.3	178.1	172.1	191.8	

Table A5.47. N content in substrates

Activity	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
municipal facilities [kt]										0.08	0.37	0.49
WWTP facilities [kt]	0.32	0.52	0.61	0.60	1.06	0.59	0.51	1.23	2.01	2.78	3.46	2.48
agricultural biogas facilities [t]:												
corn silage				1.20	2.19	1.58	6.30	22.12	55.83	473.61	1 071.07	1 195.98
grass silage				0.17	0.31	0.23	0.90	3.17	8.01	67.95	-	-
mixture of lecithin and soaps				0.17	0.30	0.22	0.87	3.05	7.71	65.40	-	-
waste from the dairy industry				-	-	-	-	-	-	-	27.48	27.49
technological sludge from the agri-food industry				-	-	-	-	-	-	-	-	-
fat sludge				-	-	-	-	-	-	-	-	-
other				0.16	0.30	0.21	0.86	3.01	7.60	64.44	-	276.15
other (including bird droppings)				-	-	-	-	-	-	-	74.50	-
fruit and vegetable residues				0.17	0.31	0.22	0.89	3.11	7.86	66.67	534.15	1 655.72
potato pulp				0.04	0.08	0.06	0.24	0.83	2.08	17.67	11.85	-
beet pulp				0.10	0.19	0.13	0.53	1.87	4.72	40.00	213.36	587.50
distillery stock				0.71	1.30	0.94	3.75	13.14	33.18	281.46	1 355.89	3 273.91
green fodder				-	-	-	-	-	-	-	17.90	74.61

Table A5.48. N content in substrates (cont.)

Activity	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
municipal facilities [kt]	0.62	0.88	1.32	1.66	2.09	2.38	2.06	2.37	2.28	2.37	2.29
WWTP facilities [kt]	2.21	3.08	4.41	4.47	4.38	4.17	4.35	4.24	4.74	4.58	5.10
agricultural biogas facilities [t]:											
corn silage	1 819.63	1 806.65	1 910.28	2 053.86	2 098.56	1 830.10	2 139.63	2 394.94	2 666.42	2 818.32	2508.84
grass silage	-	-	-	-	239.32	210.28	251.46	290.12	321.72	490.79	245.30
mixture of lecithin and soaps	-	-	-	-	0.29	10.91	1.33	2.41	0.36	12.84	5.12
waste from the dairy industry	45.19	102.22	190.56	162.41	230.80	267.50	284.11	288.39	371.31	588.38	720.24



Activity	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
technological sludge from the agri-food industry	148.04	390.95	850.26	1 012.68	1 151.14	1 202.43	1 454.27	2 649.05	1 976.28	2 103.07	2373.94
fat sludge	-	101.75	-	-	23.98	20.38	16.05	22.60	8.65	0.11	22.34
other	-	-	-	-	-	-	-	-	-	-	-
other (including bird droppings)	761.16	987.55	1 658.23	-	-	-	-	-	-	-	-
fruit and vegetable residues	2 151.67	2 998.55	4 038.05	4 594.09	4 679.20	4 666.68	4 290.71	4 457.08	4 694.10	5 633.27	7390.74
potato pulp	54.17	-	-	-	-	-	-	-	-	-	-
beet pulp	1 096.82	1 092.23	1 283.74	1 619.19	1 685.29	1 453.33	1 212.42	1 190.16	1 328.34	1 448.79	1636.20
distillery stock	3 298.54	4 061.14	4 411.68	7 042.59	7 760.32	7 549.83	8 508.77	8 615.05	9 873.86	13 040.55	14072.68
green fodder	-	-	275.73	467.19	197.96	160.74	212.43	158.44	91.16	99.63	160.04
glycerine					6.49	6.34	7.55	9.74	1.69	22.58	209.29
coffee					16.33	0.07	0.02	-	5.90	6.56	1.74
waste plant mass					398.02	306.67	307.65	529.76	551.14	724.09	726.14
protein and fat waste					27.23	31.24	23.02	42.66	39.95	47.94	97.16
catering waste					36.12	45.50	11.22	7.17	4.84	-	-
slaughterhouse waste					1 103.38	1 723.86	1 415.84	1 427.76	2 065.88	2 638.95	1965.20
waste from vegetable oil production					3.28	53.88	65.06	38.63	50.79	38.93	44.56
waste from food processing					552.99	1 005.06	2 869.53	3 352.71	6 513.82	8 062.06	8420.45
fusel oils					1.03	1.20	1.82	0.19	-	-	-
vegetable oils					1.08	32.28	20.49	26.35	32.11	12.20	49.87
yeast sludge					6.35	-	-	0.74	-	1.73	-
sludge from plant product processing					87.54	112.28	141.52	294.29	247.28	189.67	204.49
fruit and vegetables					121.35	95.92	145.15	193.67	153.43	152.41	335.03
feed					56.87	36.28	88.61	54.86	39.57	26.79	36.76
liquid wheat residues					3.31	2.77	2.53	2.18	2.64	2.78	2.92
digestate					-	0.06	0.14	0.15	0.27	0.40	0.72
rinsings					1.11	3.08	8.94	11.07	117.28	93.86	140.44
out-of-date food					474.05	633.73	754.67	941.16	1 037.49	1 066.38	1113.94
straw					34.75	21.27	39.34	47.05	40.62	30.56	15.64
protein and fat sludge					-	0.32	5.89	15.15	0.18	6.42	10.22
fats					55.23	67.72	118.63	126.61	182.40	225.88	306.29
content stomach					56.99	32.87	35.17	26.46	43.40	41.47	129.49
extraction cakes from the production of herbal pharmaceuticals					0.29	0.26	-	-	52.27	90.93	4.97
grain, grain waste					29.79	16.66	43.02	108.89	105.47	117.53	137.98

Table A5.49. Activity data used in 5C1bv. *Cremations* [thous.]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Cremations	0	0	0	2.0	3.9	5.8	7.7	9.5	11.3	13.3	14.7	16.3	18.0	20.1	21.8	23.9	25.9	25.8
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Cremations	25.4	25.8	34.1	33.8	48.1	62.0	79.1	86.9	93.1	112.4	131.8	132.5	161.9	187.0	170.8	162.2	168.4	

Table A5.50. Activity data used in 5C2. *Open burning of agricultural wastes* [kt]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Open burning of agricultural wastes	266.1	257.7	224.8	269.2	224.9	262.7	255.9	245.9	272.1	248.6	234.0	273.5	248.6	237.5	292.3	251.9	245.1	241.1
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Open burning of agricultural wastes	299.9	322.4	278.1	275.3	289.6	317.9	346.7	311.4	324.9	304.8	322.4	299.7	360.9	371.0	390.8	386.0	346.1	

Table A5.51. Activity data used in 5D. *Wastewater handling*

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Wastewater treatment [mln m ³]	2 772	2 621	2 466	2 308	2 374	2 319	2 303	2 329	2 378	2 288	2 200	2 160	2 074	1 965	1 943	1 929	1 960	2 000
Latrines [mln inhabitants]	6.53	6.31	6.10	5.88	5.67	5.46	5.24	5.03	4.81	4.60	4.38	4.17	3.95	3.74	3.52	3.31	3.09	2.88
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Wastewater treatment [mln m ³]	2 077	2 062	2 134	2 098	2 055	2 039	2 011	2 015	2 061	2 091	2 085	2 070	2 071	2 130	2 010	1 989	2 033	
Latrines [mln inhabitants]	2.66	2.45	2.24	2.02	2.00	1.99	1.97	1.95	1.93	1.91	1.90	1.88	1.86	1.84	1.82	1.81	1.79	

Table A5.52. Activity data used in 5E. *Unintentional fires*

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Landfill fires - surface	353	353	353	353	354	480	465	450	435	420	405	389	375	360	344	329	315	299
Landfill fires - deep	40	40	40	40	39	53	51	49	48	46	44	43	41	39	38	36	34	33
Automobile fires	3 500	4 000	4 600	5 091	5 237	5 277	5 540	6 135	6 701	7 243	7 100	6 851	7 212	6 916	6 700	7 307	7 835	7 463
Detached house fires	10 140	10 140	10 140	10 140	10 871	11 149	11 824	12 560	12 718	12 115	12 118	11 672	12 427	12 966	12 624	13 200	13 349	13 156
Undetached house fires	1 267	1 267	1 267	1 267	1 359	1 394	1 478	1 570	1 590	1 514	1 515	1 459	1 553	1 621	1 578	1 650	1 669	1 645
Apartment building fires	8 365	8 365	8 365	8 365	8 969	9 198	9 755	10 362	10 492	9 995	9 997	9 629	10 252	10 697	10 415	10 890	11 013	10 854
Industrial building fires	5 577	5 577	5 577	5 577	5 979	6 132	6 503	6 908	6 995	6 663	6 665	6 420	6 835	7 132	6 943	7 260	7 342	7 236
Activity	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Landfill fires - surface	284	269	254	239	224	208	194	179	163	148	195	175	113	74	118	75	46	
Landfill fires - deep	31	29	28	26	24	23	21	19	18	16	45	41	22	14	8	15	0	
Automobile fires	7 552	8 131	8 667	8 436	8 126	7 815	8 201	8 395	8 996	9 408	10 168	9 910	9 216	9 654	8 730	8 606	8 891	
Detached house fires	13 458	13 373	13 727	13 454	14 018	13 141	13 117	14 219	14 777	15 224	15 872	15 117	14 730	15 745	15 245	13 992	12 609	
Undetached house fires	1 682	1 672	1 716	1 682	1 752	1 643	1 640	1 777	1 847	1 903	1 984	1 890	1 841	1 968	1 906	1 749	1 576	
Apartment building fires	11 103	11 033	11 325	11 100	11 565	10 841	10 822	11 731	12 191	12 560	13 095	12 471	12 153	12 989	12 577	11 543	10 403	
Industrial building fires	7 402	7 355	7 550	7 400	7 710	7 228	7 214	7 821	8 127	8 373	8 730	8 314	8 102	8 660	8 385	7 696	6 935	

V. NFR SECTOR 11

Table A5.53. Activity data used in NFR 11B. *Forest fires* [t]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Forest fires	360 647	129 788	2 183 762	385 773	410 365	240 545	647 437	299 263	183 731	366 904	312 566	150 973	230 452	945 450
Activity	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Forest fires	169 048	256 833	261 023	155 237	134 027	195 567	99 603	131 331	339 472	69 801	135 410	274 252	73 965	53 185
Activity	2018	2019	2020	2021	2022	2023	2024							
Forest fires	139 370	189 635	439 980	48 574	195 288	63 120	64 199							

Table A5. 54. Activity data used in NFR 11C. *Managed forests* [thous. ha]

Activity	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Managed broadleaf forests	1 766	1 776	1 779	1 791	1 798	1 816	1 829	1 861	1 893	1 908	1 948	1 981	2 019	2 050
Managed coniferous forests	6 739	6 743	6 751	6 736	6 738	6 735	6 757	6 755	6 771	6 772	6 761	6 740	6 754	6 784
Activity	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Managed broadleaf forests	2 079	2 104	2 112	2 122	2 641	2 648	2 665	2 673	2 753	2 786	2 836	2 876	2 891	2 914
Managed coniferous forests	6 829	6 849	6 849	6 896	6 404	6 421	6 432	6 449	6 394	6 378	6 342	6 314	6 286	6 307
Activity	2018	2019	2020	2021	2022	2023	2024							
Managed broadleaf forests	2 917	2 935	2 936	2 909	2 904	2 908	2 909							
Managed coniferous forests	6 313	6 294	6 325	6 356	6 374	6 383	6 386							



Appendix 6. EMISSION FACTORS

VI. NFR SECTOR 1 - ENERGY

Emission factors with their source used for estimation of 2024 emissions of the particular pollutants are presented in the tables below according to NFR categories. These factors are used when the information on emission volume is not available directly.

VI.1 Public electricity and heat production (NFR sector 1A1a)

For category 1A1a. *Public electricity and heat production - Public power* aggregate emission data of SO₂, NO_x, CO, TSP and Hg was included directly from the National Emission Database.

Table A6. 1. SO₂ emission factors applied for NFR 1A1a

Emission source	EF	EF unit	EF reference
Heating plants			
Hard coal, Coke	0.238	t/TJ	Lewandowski, 2022
Brown coal	0.284	t/TJ	Lewandowski, 2022
Natural gas	0.002	t/TJ	Lewandowski, 2022
Biomass	0.004	t/TJ	Lewandowski, 2022
Fuel oils	0.006	t/t	S content
Industrial waste**	0.047	kg/t	EMEP/EEA EIG 2023
Municipal waste**	0.087	kg/t	EMEP/EEA EIG 2023
Industrial power			
Hard coal	0.051	t/TJ	PL (ARE)*
Gaseous fuels	0.010	t/TJ	PL (ARE)*
Biomass	0.030	t/TJ	Lewandowski, 2021
Fuel oils	0.006	t/t	S content
Diesel oil	0.006	t/t	S content
Industrial waste**	0.047	kg/t	EMEP/EEA EIG 2023
Municipal waste**	0.087	kg/t	EMEP/EEA EIG 2023

Note: emission factors based on sulphur content are country specific;

* PL(ARE) emission factors come from ARE surveys; ** EFs from the sector NFR 5 Waste;

Table A6. 2. NO_x emission factors applied for NFR 1A1a

Emission source	EF	EF unit	EF reference
Heating plants			
Hard coal and coke	0.116	t/TJ	Lewandowski, 2022
Brown coal	0.193	t/TJ	Lewandowski, 2022
Diesel oil	0.065	t/TJ	EMEP/EEA EIG 2023
Fuel oil	0.142	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.041	t/TJ	Lewandowski, 2022
Biomass	0.118	t/TJ	Lewandowski, 2022
Industrial wastes	0.870	kg/t	EMEP/EEA EIG 2023
Municipal waste	1.071	kg/t	EMEP/EEA EIG 2023
Other gaseous fuels	0.025	t/TJ	EMEP/EEA EIG 2023
Industrial power			
Hard coal	0.060	t/TJ	PL (ARE)*
Coke	0.209	t/TJ	EMEP/EEA EIG 2023
Diesel oil	0.065	t/TJ	EMEP/EEA EIG 2023
Fuel oil	0.142	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.038	t/TJ	PL (ARE)*
Biomass	0.075	t/TJ	Lewandowski, 2021
Industrial wastes**	0.870	kg/t	EMEP/EEA EIG 2023
Municipal waste**	1.071	kg/t	EMEP/EEA EIG 2023
Other gaseous fuels	0.025	t/TJ	EMEP/EEA EIG 2023

* PL(ARE) emission factors come from ARE; ** EFs from the sector NFR 5 Waste;

Table A6. 3. CO emission factors applied for NFR 1A1a

Emission source	EF	EF unit	EF reference
Heating plants			
Hard coal and coke	0.097	t/TJ	Lewandowski, 2022
Brown coal	0.003	t/TJ	Lewandowski, 2022
Diesel oil	0.016	t/TJ	EMEP/EEA EIG 2023
Fuel oil	0.015	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.006	t/TJ	Lewandowski, 2022
Biomass	0.021	t/TJ	Lewandowski, 2022
Other gaseous fuels	0.005	t/TJ	EMEP/EEA EIG 2023
Industrial wastes**	0.070	kg/t	EMEP/EEA EIG 2023
Municipal waste**	0.041	kg/t	EMEP/EEA EIG 2023
Industrial power			
Hard coal and coke	0.021	t/TJ	PL (ARE)*
Gaseous fuels	0.022	t/TJ	PL (ARE)*
Biomass	0.019	t/TJ	PL (ARE)*
Diesel oil	0.0162	t/TJ	EMEP/EEA EIG 2023
Fuel oil	0.0151	t/TJ	EMEP/EEA EIG 2023
Industrial wastes**	0.070	kg/t	EMEP/EEA EIG 2023
Municipal waste**	0.041	kg/t	EMEP/EEA EIG 2023

* PL(ARE) emission factors come from ARE; ** EFs from the sector NFR 5 Waste;

Table A6. 4. PM emission factors applied for NFR 1A1a

Emission source	EF			EF unit	EF reference	BC**
	TSP	PM10	PM2.5			% of PM2.5
Public power						
Hard coal	0.0025	0.0020	0.0011	t/TJ	PL (ARE)*; Lewandowski, 2022	2.2
Brown coal	0.0024	0.0017	0.0008	t/TJ	PL (ARE)*; Lewandowski, 2022	1.0
Diesel oil	0.0065	0.0032	0.0008	t/TJ	EMEP/EEA EIG 2023	33.5
Fuel oils	0.0354	0.0252	0.0193	t/TJ	EMEP/EEA EIG 2023	5.6
Natural gas	0.00014	0.00014	0.00014	t/TJ	EMEP/EEA EIG 2023	2.5
Other gaseous fuels	0.0015	0.0015	0.0015	t/TJ	EMEP/EEA EIG 2023	2.5
Biomass	0.0036	0.0023	0.0011	t/TJ	Lewandowski, 2021	3.3
Industrial wastes**	0.010	0.007	0.004	kg/t	EMEP/EEA EIG 2023	3.5
Municipal waste**	0.003	0.003	0.003	kg/t	EMEP/EEA EIG 2023	3.5
Heating plants						
Hard coal and coke	0.024	0.016	0.006	t/TJ	Lewandowski, 2022	2.2
Brawn coal	0.009	0.007	0.003	t/TJ	Lewandowski, 2022	1.0
Diesel oil	0.065	0.0032	0.0008	t/TJ	EMEP/EEA EIG 2023	33.5
Fuel oils	0.0354	0.0252	0.0193	t/TJ	EMEP/EEA EIG 2023	5.6
Natural gas	0.00014	0.00014	0.00014	t/TJ	EMEP/EEA EIG 2023	2.5
Other gaseous fuels	0.0015	0.0015	0.0015	t/TJ	EMEP/EEA EIG 2023	2.5
Biomass	0.012	0.009	0.003	t/TJ	Lewandowski, 2021	3.3
Industrial wastes**	0.010	0.007	0.004	kg/t	EMEP/EEA EIG 2023	3.5
Municipal waste**	0.003	0.003	0.003	kg/t	EMEP/EEA EIG 2023	3.5
Industrial power						
Hard coal	0.0025	0.0020	0.0011	t/TJ	PL (ARE)*; Lewandowski, 2022	2.2
Diesel oil	0.0065	0.0032	0.0008	t/TJ	EMEP/EEA EIG 2023	33.5
Fuel oils	0.0354	0.0252	0.0193	t/TJ	EMEP/EEA EIG 2023	5.6
Natural gas	0.00014	0.00014	0.00014	t/TJ	EMEP/EEA EIG 2023	2.5
Other gaseous fuels	0.0015	0.0015	0.0015	t/TJ	EMEP/EEA EIG 2023	2.5
Biomass	0.00558	0.0032	0.00125	t/TJ	Lewandowski, 2021	3.3
Industrial wastes**	0.010	0.007	0.004	kg/t	EMEP/EEA EIG 2023	3.5
Municipal waste **	0.003	0.003	0.003	kg/t	EMEP/EEA EIG 2023	3.5

* PL(ARE) emission factors from ARE; ** EFs from the sector NFR 5 Waste; ***EFs from EMEP/EEA EIG 2023;

Table A6. 5. NMVOC emission factors applied for NFR 1A1a

Emission source	EF	EF unit	EF reference
Hard coal, coal briquettes and coke	0.0010	t/TJ	EMEP/EEA EIG 2023
Brown coal and brown coal briquettes	0.0014	t/TJ	EMEP/EEA EIG 2023
Diesel oil	0.0008	t/TJ	EMEP/EEA EIG 2023
Fuel oils	0.0023	t/TJ	EMEP/EEA EIG 2023
Biomass	0.0073	t/TJ	EMEP/EEA EIG 2023
Gaseous fuels	0.0026	t/TJ	EMEP/EEA EIG 2023
LPG	0.0026	t/TJ	EMEP/EEA EIG 2023
Industrial wastes*	7.4000	kg/t	EMEP/EEA EIG 2023
Municipal waste*	0.0059	kg/t	EMEP/EEA EIG 2023

* EFs from the sector NFR 5 Waste;

Table A6. 6. NH3 emission factors applied for NFR 1A1a

Emission source	EF	EF unit	EF reference
Biogas	0.00023	t/TJ	EMEP/EEA EIG 2023
Municipal waste*	0.003	kg/t	EMEP/EEA EIG 2023

* EFs from the sector NFR 5 Waste;

Table A6. 7. Main Heavy Metals emission factors applied for NFR 1A1a

Emission source	EF			EF unit	EF reference
	Cd	Hg ^b	Pb		
Public power					
Hard coal	0.00024 ^a	-	0.00896	kg/TJ	PL (IETU)
Brown coal	0.00023 ^a	-	0.00384	kg/TJ	PL (IETU)
Coke	0.0009	-	0.0073	kg/TJ	EMEP/EEA EIG 2023
Biomass	0.00176	-	0.0206	kg/TJ	EMEP/EEA EIG 2023
Fuel oil	0.0024	-	0.00456	kg/TJ	PL (IETU); EMEP/EEA EIG 2023
Diesel oil	0.00136	-	0.00407	kg/TJ	EMEP/EEA EIG 2023
Gaseous fuels	0.00025	-	0.0015	mg/GJ	EMEP/EEA EIG 2023
Biogas	0.000002	-	0.000005	kg/TJ	EMEP/EEA EIG 2023
Industrial wastes*	0.1	-	1.3	kg/t	EMEP/EEA EIG 2023
Municipal waste*	0.0046	-	0.058	kg/t	EMEP/EEA EIG 2023
Heating plants					
Hard coal	0.00137 ^a	0.0064	0.1024	kg/TJ	PL (IETU)
Brown coal	0.00013	0.004	0.00384	kg/TJ	PL (IETU)
Hard coal briquettes	0.01638	0.0064	0.1024	kg/TJ	PL (IETU)
Brown coal briquettes	0.00013	0.004	0.00384	kg/TJ	PL (IETU)
Coke	0.0009	0.0014	0.0073	kg/TJ	EMEP/EEA EIG 2023
Biomass	0.00176	0.00151	0.0206	kg/TJ	EMEP/EEA EIG 2023
Fuel oil	0.024	-	0.03	kg/TJ	PL (IETU)
Diesel oil	0.00136	-	0.00407	kg/TJ	EMEP/EEA EIG 2023
Gaseous fuels	0.00025	0.1	0.0015	mg/GJ	EMEP/EEA EIG 2023
Biogas	0.000002	-	0.000005	kg/TJ	EMEP/EEA EIG 2023
Industrial wastes*	0.1	0.056	1.3	kg/t	EMEP/EEA EIG 2023
Municipal waste*	0.0046	0.0188	0.058	kg/t	EMEP/EEA EIG 2023
Industrial power					
Hard coal	0.0052 ^a	0.008	0.17	kg/TJ	PL (IETU)
Brown coal	0.0004 ^a	0.005	0.022	kg/TJ	PL (IETU)
Coke	0.023	0.0006	0.13	kg/TJ	PL (IETU)
Biomass	0.013	0.00056	0.027	kg/TJ	EMEP/EEA EIG 2023
Fuel oil	0.024	-	0.00456	kg/TJ	PL (IETU); EMEP/EEA EIG 2023
Diesel oil	0.00136	-	0.00407	kg/TJ	EMEP/EEA EIG 2023
Gaseous fuels	0.0009	0.54	0.011	mg/GJ	EMEP/EEA EIG 2023
Industrial wastes*	0.1	0.056	1.3	kg/t	EMEP/EEA EIG 2023
Municipal waste*	0.0046	0.0188	0.058	kg/t	EMEP/EEA EIG 2023

a) Country specific (IOS-PIB); b) For *Public power* aggregate emission data of Hg were included from the National Database

* EFs from the sector NFR 5 Waste;

Table A6. 8. Additional Heavy Metals emission factors applied for NFR 1A1a

Emission source	As	Cr	EF Cu	Ni	Zn	EF unit	EF reference
Public power							
Hard coal	0.00134	0.0025	0.00704	0.00576	0.01792	kg/TJ	PL (IETU)
Brown coal	0.00282	0.00192	0.00384	0.0009	0.01664	kg/TJ	PL (IETU)
Coke	0.0071	0.0045	0.0078	0.0049	0.019	kg/TJ	EMEP/EEA EIG 2023
Biomass	0.00946	0.00903	0.0211	0.0142	0.181	kg/TJ	EMEP/EEA EIG 2023
Fuel oil	0.0024	0.0029	0.0068	0.0654	0.0024	kg/TJ	PL (IETU)
Diesel oil	0.00181	0.00136	0.00272	0.00136	0.00181	kg/TJ	EMEP/EEA EIG 2023
Gaseous fuels	0.12	0.00076	0.000076	0.00051	0.0015	mg/GJ	EMEP/EEA EIG 2023
Biogas	0.000042	0.00018	0.00031	0.00023	0.004	kg/TJ	EMEP/EEA EIG 2023
Industrial wastes*	0.016	-	-	0.14	-	kg/t	EMEP/EEA EIG 2023
Municipal waste*	0.0062	0.0164	0.0137	0.0216	0.0245	kg/t	EMEP/EEA EIG 2023
Heating plants							
Hard coal	0.01024	0.01408	0.0576	0.0512	0.416	kg/TJ	PL (IETU)
Brown coal	0.00282	0.00192	0.00384	0.0009	0.01664	kg/TJ	PL (IETU)
Coke	0.0071	0.0045	0.0078	0.0057	0.019	kg/TJ	EMEP/EEA EIG 2023
Biomass	0.00946	0.00903	0.0211	0.014	0.181	kg/TJ	EMEP/EEA EIG 2023
Fuel oil	0.024	0.029	0.068	0.654	0.024	kg/TJ	PL (IETU)
Gaseous fuels	0.12	0.00076	0.000076	0.00051	0.0015	mg/GJ	EMEP/EEA EIG 2023
Biogas	0.000042	0.00018	0.00031	0.00023	0.004	kg/TJ	EMEP/EEA EIG 2023
Industrial wastes*	0.016	-	-	0.14	-	kg/t	EMEP/EEA EIG 2023
Municipal waste*	0.0062	0.0164	0.0137	0.0216	0.0245	kg/t	EMEP/EEA EIG 2023
Industrial power							
Hard coal	0.017	0.022	0.095	0.085	0.69	kg/TJ	PL (IETU)
Brown coal	0.018	0.011	0.024	0.005	0.11	kg/TJ	PL (IETU)
Coke	0.002	0.017	0.086	0.076	0.53	kg/TJ	PL (IETU)
Biomass	0.00019	0.0065	0.0046	0.002	0.114	kg/TJ	EMEP/EEA EIG 2023
Fuel oil	0.024	0.029	0.068	0.654	0.024	kg/TJ	PL (IETU)
Gaseous fuels	0.1	0.0007	0.0004	0.001	0.014	mg/GJ	EMEP/EEA EIG 2023
Industrial wastes*	0.016	-	-	0.14	-	kg/t	EMEP/EEA EIG 2023
Municipal waste*	0.0062	0.0164	0.0137	0.0216	0.0245	kg/t	EMEP/EEA EIG 2023

* EFs from the sector NFR 5 Waste;

Table A6. 9. PCDD/F, PCB and HCB emission factors applied for NFR 1A1a

Activity	Pollutant	EF	EF unit	EF reference
Hard coal	PCDD/F	0.06	mg TEQ/kt	Grochowalski A., 2002
Lignite	PCDD/F	0.06	mg TEQ/kt	EF for hard coal was applied
Biomass	PCDD/F	1	mg TEQ/kt	Berdowski et al., 1995
Fuel oil and diesel oil	PCDD/F	1	mg TEQ/kt	NILU, 1999
Municipal waste*	PCDD/F	0.0525	mg TEQ/kt	EMEP/EEA EIG 2023
Hard coal	PCB	0.31	g/kt	Parma at al., 1995
Lignite - Public power	PCB	1.8	g/kt	Parma at al., 1995
Lignite – Heating plants	PCB	0.6	g/kt	Parma at al., 1995
Biomass	PCB	0.9	g/kt	Parma at al., 1995
Fuel oil and diesel oil	PCB	0.6	g/kt	Parma at al., 1995
Municipal waste*	PCB	0.0034	g/kt	EMEP/EEA EIG 2023
Hard coal	HCB	0.013	g/kt	Bailey, 2001
Biomass	HCB	0.06	g/kt	Bailey, 2001
Municipal waste*	HCB	0.0452	g/kt	EMEP/EEA EIG 2023

* EFs from the sector NFR 5 Waste;

Table A6. 10. PAHs emission factors applied for NFR 1A1a

Activity	EF				EF unit	EF reference
	B(a)p	B(b)f	B(k)f	IP		
Hard coal	0.00352	0.00732	0.00732	0.00703	g/kt	Berdowski et al., 1995
Lignite	0.00352	0.00732	0.00732	0.00703	g/kt	Berdowski et al., 1995
Biomass	0.095	19	19	0.17	g/kt	Berdowski et al., 1995
Fuel oil and diesel oil	4.68	3.98	3.98	7.57	g/kt	Berdowski et al., 1995
Municipal waste*	0.0084	0.0179	0.0095	0.0116	g/kt	EMEP/EEA EIG 2023

* EFs from the sector NFR 5 Waste;

Table A6. 11. Abatement efficiencies for industrial waste incineration (including medical waste and sewage sludge)

Abatement shares	PCDD/F	reference
High technology combustion; sophisticated APC system	100%	EMEP/EEA EIG 2019
Controlled combustion; good APC system	100%	EMEP/EEA EIG 2019
Controlled combustion; minimal APC system	99%	EMEP/EEA EIG 2019
No APC system	0%	EMEP/EEA EIG 2019
Abatement shares	HCB	reference
A – high technology incineration and APC system	99.99%	CS
B – high technology incineration	99.9%	CS
C – active carbon	87%	CS
D – other APC system	99.27%	CS
E – no APC system	0%	CS

VI.2 Petroleum refining (NFR sector 1A1b)

SO₂, NO_x, CO and TSP aggregated emission data from the air pollutant emission reports (OS-1) submitted by entities to the Statistics Poland were used. The PM₁₀ and PM_{2.5} emission were calculated as a share of the TSP emission in proportion to the share of emission factors of these pollutants for fuel oil from the EMEP/EEA inventory guidebook.

Table A6. 12. NMVOC and NH₃ emission factors applied for NFR 1A1b

Emission source	Pollutant	EF	EF unit	EF Reference
Hard coal	NMVOC	0.001	t/TJ	EMEP/EEA EIG 2023
Crude oil	NH ₃	0.0008	kg/t crude oil input	EMEP/EEA EIG 2023

Most of the NMVOC emissions are fugitive and they were allocated to category 1B2aiv in order to avoid double-counting.

Table A6. 13. Main Heavy Metals emission factors applied for NFR 1A1b

Emission source	EF			EF unit	EF reference
	Cd	Hg	Pb		
Hard coal	0.027	0.008	0.17	kg/TJ	PL (IETU)
Coke	0.023	0.0006	0.13	kg/TJ	PL (IETU)
Fuel oil	0.024	-	0.03	kg/TJ	PL (IETU)
Diesel oil	0.00136	0.00136	0.0047	kg/TJ	EMEP/EEA EIG 2023
Natural gas	0.00025	0.1	0.0015	mg/GJ	EMEP/EEA EIG 2023
Refinery gas	2.19	0.372	1.61	mg/GJ	EMEP/EEA EIG 2023

Table A6. 14. Additional Heavy Metals emission factors applied for NFR 1A1b

Emission source	EF					EF unit	EF reference
	As	Cr	Cu	Ni	Zn		
Hard coal	0.017	0.022	0.095	0.085	0.69	kg/TJ	PL (IETU)
Brown coal	0.018	0.011	0.024	0.005	0.11	kg/TJ	PL (IETU)
Coke	0.002	0.017	0.086	0.076	0.53	kg/TJ	PL (IETU)
Fuel oil	0.024	0.029	0.068	0.654	0.024	kg/TJ	PL (IETU)
Diesel oil	0.00181	0.00136	0.00227	0.00136	0.00181	kg/TJ	EMEP/EEA EIG 2023
Natural gas	0.12	0.00076	0.000076	0.00051	0.0015	mg/GJ	EMEP/EEA EIG 2023
Refinery gas	0.352	6.69	3.29	7.37	17	mg/GJ	EMEP/EEA EIG 2023

Table A6. 15. Emission factors of PCDD/F, PCBs and HCB applied for NFR 1A1b

Activity	Pollutant	EF	EF unit	EF Reference
Hard coal	PCDD/F	0.06	mg TEQ/kt	Grochowalski A., 2002
Lignite	PCDD/F	0.06	mg TEQ/kt	EF for hard coal was applied
Biomass	PCDD/F	1	mg TEQ/kt	Berdowski et al., 1995
Fuel oil	PCDD/F	1	mg TEQ/kt	NILU, 1999
Hard coal	PCB	0.31	g/kt	Parma at al., 1995
Fuel and diesel oil	PCB	0.6	g/kt	Parma at al., 1995
Hard coal	HCB	0.013	g/kt	Bailey R., 2001

Table A6. 16. PAHs emission factors applied for NFR 1A1b

Activity	EF				EF unit	EF reference
	B(a)p	B(b)f	B(k)f	IP		
Hard coal	0.586	23.4	23.4	17.6	g/kt	Berdowski et al., 1995
Fuel oil and diesel oil	3.43	1.81	2.83	6.84	g/kt	Berdowski et al., 1995
Refinery gas	0.669	1.14	0.631	0.631	µg/GJ	EMEP/EEA EIG 2023

VI.3 Manufacture of solid fuels and other energy industries (NFR sector 1A1c)

SO₂, NO_x, CO and TSP aggregated emission data from the air pollutant emission reports (OS-1) submitted by entities to the Statistics Poland were used. The PM₁₀ and PM_{2.5} emission were calculated as a share of the TSP emission in proportion to the share of emission factors of these pollutants for hard coal from the EMEP/EEA inventory guidebook.

Table A6. 17. NMVOC emission factors applied for NFR 1A1c

Activity	EF	EF unit	EF Reference
Hard coal, lignite and coke	0.0008	t/TJ	EMEP/EEA EIG 2023
Gaseous fuels	0.0026	t/TJ	EMEP/EEA EIG 2023
LPG	0.0026	t/TJ	EMEP/EEA EIG 2023
Fuel oil	0.0023	t/TJ	EMEP/EEA EIG 2023
Diesel oil	0.0008	t/TJ	EMEP/EEA EIG 2023
Biomass	0.0073	t/TJ	EMEP/EEA EIG 2023

Table A6. 18. Main Heavy Metals emission factors applied for NFR 1A1c

Activity	EF			EF unit	EF reference
	Cd	Hg	Pb		
Hard coal	0.027	0.008	0.17	kg/TJ	PL (IETU)
Brown coal	0.0007	0.005	0.022	kg/TJ	PL (IETU)
Coke	0.023	0.0006	0.13	kg/TJ	PL (IETU)
Fuel oil	0.024	-	0.03	kg/TJ	PL (IETU)
Gaseous fuels	0.00025	0.1	0.0015	mg/GJ	EMEP/EEA EIG 2023

Table A6. 19. Additional Heavy Metals emission factors applied for NFR 1A1c

Activity	EF					EF unit	EF reference
	As	Cr	Cu	Ni	Zn		
Hard coal	0.017	0.022	0.095	0.085	0.69	kg/TJ	PL (IETU)
Brown coal	0.018	0.011	0.024	0.005	0.11	kg/TJ	PL (IETU)
Coke	0.002	0.017	0.086	0.076	0.53	kg/TJ	PL (IETU)
Fuel oil	0.024	0.029	0.068	0.654	0.024	kg/TJ	PL (IETU)
Gaseous fuels	0.12	0.00076	0.000076	0.00051	0.0015	mg/GJ	EMEP/EEA EIG 2023

Table A6. 20. PCDD/F, PCBs and HCB emission factors applied for NFR 1A1c

Activity	Pollutant	EF	EF unit	EF Reference
Hard coal and lignite	PCDD/F	0.06	mg TEQ/kt	Grochowalski A., 2002
Biomass	PCDD/F	1	mg TEQ/kt	Berdowski et al., 1995
Fuel and diesel oil	PCDD/F	1	mg TEQ/kt	NILU, 1999
Hard coal	PCB	0.31	g/kt	Parma at al., 1995
Lignite	PCB	1.8	g/kt	Parma at al., 1995
Biomass	PCB	0.9	g/kt	Parma at al., 1995
Fuel and diesel oil	PCB	0.6	g/kt	Parma at al., 1995
Hard coal	HCB	0.013	g/kt	Bailey R., 2001
Biomass	HCB	0.06	g/kt	Bailey R., 2001

Table A6. 21. PAHs emission factors applied for NFR 1A1c

Activity	EF				EF unit	EF reference
	B(a)p	B(b)f	B(k)f	IP		
Hard coal	0.586	23.4	23.4	17.6	g/kt	Berdowski et al., 1995
Lignite	0.586	23.4	23.4	17.6	g/kt	Berdowski et al., 1995
Biomass	0.095	19	19	0.17	g/kt	Berdowski et al., 1995
Fuel and diesel oil	3.43	1.81	1.81	6.84	g/kt	Berdowski et al., 1995

VI.4 Stationary combustion in manufacturing industries (NFR sector 1A2)

Table A6. 22. SO₂ emission factors applied for NFR 1A2

Emission source	EF	EF unit	EF Reference
Hard coal	0.017	t/t	S content
Brown coal	0.006	t/t	S content
Coke	0.016	t/t	S content
Fuel and diesel oil	0.006	t/t	S content
Gaseous fuels	0.00067	t/TJ	EMEP/EEA EIG 2023
Biomass	0.011	t/TJ	EMEP/EEA EIG 2023
Industrial waste*	0.047	kg/t	EMEP/EEA EIG 2023
Municipal waste*	0.087	kg/t	EMEP/EEA EIG 2023
Country specific EFs based on emission data reported by entities to the National Emission Database (NED)			
1A2c – Hard coal	0.054	t/TJ	CS (NED)
1A2d – Hard coal	0.120	t/TJ	CS (NED)
1A2e – Hard coal	0.272	t/TJ	CS (NED)

Note: emission factors based on sulphur content are country specific; *EFs from the sector NFR 5 Waste

Table A6. 23. NO_x emission factors applied for NFR 1A2

Emission source	EF	EF unit	EF reference
Hard coal, lignite and coke	0.173	t/TJ	EMEP/EEA EIG 2023
Biomass	0.091	t/TJ	EMEP/EEA EIG 2023
Fuel and diesel oil	0.513	t/TJ	EMEP/EEA EIG 2023
Gaseous fuel	0.074	t/TJ	EMEP/EEA EIG 2023
Industrial waste*	0.087	kg/t	EMEP/EEA EIG 2023
Municipal waste*	1.071	kg/t	EMEP/EEA EIG 2023
Country specific EFs based on emission data reported by entities to the National Emission Database (NED)			
1A2c – Hard coal	0.059	t/TJ	CS (NED)
1A2d – Hard coal	0.074	t/TJ	CS (NED)
1A2d – Biomass	0.051	t/TJ	CS (NED)
1A2e – Hard coal	0.129	t/TJ	CS (NED)
1A2gviii – Diesel oil	0.070	t/TJ	CS (KOBIZE)

*EFs from the sector NFR 5 Waste

Table A6. 24. CO emission factors applied for NFR 1A2

Emission source	EF	EF unit	EF reference
Hard coal, lignite and coke	0.931	t/TJ	EMEP/EEA EIG 2023
Biomass	0.57	t/TJ	EMEP/EEA EIG 2023
Fuel and diesel oil	0.066	t/TJ	EMEP/EEA EIG 2023
Gaseous fuel	0.029	t/TJ	EMEP/EEA EIG 2023
Industrial waste*	0.07	kg/t	EMEP/EEA EIG 2023
Municipal waste*	0.041	kg/t	EMEP/EEA EIG 2023

*EFs from the sector NFR 5 Waste

Table A6. 25. PM emission factors applied for NFR 1A2

Emission source	EF			EF unit	BC % of PM2.5	EF reference
	TSP	PM10	PM2.5			
Hard coal, brown coal and coke	0.124	0.117	0.108	t/TJ	2.2	EMEP/EEA EIG 2023
Biomass	0.150	0.143	0.140	t/TJ	3.3	EMEP/EEA EIG 2023
Fuel oil	0.020	0.020	0.020	t/TJ	5.6	EMEP/EEA EIG 2023
Diesel oil	0.020	0.020	0.020	t/TJ	33.5	EMEP/EEA EIG 2023
Gaseous fuel	0.00078	0.00078	0.00078	t/TJ	2.5	EMEP/EEA EIG 2023
Industrial waste*	0.010	0.007	0.004	kg/t	3.5	EMEP/EEA EIG 2023
Municipal waste*	0.003	0.003	0.003	kg/t	3.5	EMEP/EEA EIG 2023
Country specific EFs based on emission data reported by entities to the National Emission Database (NED)						
1A2c – Hard coal	0.0044	0.0041	0.0038	t/TJ	-	CS (NED)
1A2d – Hard coal	0.0059	0.0056	0.0051	t/TJ	-	CS (NED)
1A2d - Biomass	0.00149	0.00142	0.00139	t/TJ	-	CS (NED)
1A2e – Hard coal	0.0281	0.0265	0.0245	t/TJ	-	CS (NED)
1A2gviii - Biomass	0.0150	0.0143	0.0140	t/TJ	-	CS (NED)

*EFs from the sector NFR 5 Waste

Table A6. 26. NMVOC emission factors applied for NFR 1A2

Emission source	EF	EF unit	EF reference
Hard coal, brown coal and coke	0.0888	t/TJ	EMEP/EEA EIG 2023
Biomass	0.3	t/TJ	EMEP/EEA EIG 2023
Other petroleum products	0.025	t/TJ	EMEP/EEA EIG 2023
Coke	0.0888	t/TJ	EMEP/EEA EIG 2023
LPG	0.023	t/TJ	EMEP/EEA EIG 2023
Gasoline and oils	0.025	t/TJ	EMEP/EEA EIG 2023
Gaseous fuels	0.023	t/TJ	EMEP/EEA EIG 2023
Industrial waste*	7.4	kg/t	EMEP/EEA EIG 2023
Municipal waste*	0.0059	kg/t	EMEP/EEA EIG 2023
1A2d - Biomass	0.00731	t/TJ	EMEP/EEA EIG 2023
1A2f – Cement production	18	g/t clinker	EMEP/EEA EIG 2023
Country specific EFs based on emission data reported by entities to the National Emission Database (NED)			
1A2gviii – Biomass	0.022	t/TJ	CS (NED)

*EFs from the sector NFR 5 Waste

Table A6. 27. Main Heavy Metals emission factors applied for NFR 1A2

Emission source	EF			EF unit	EF reference
	Cd*	Hg	Pb		
Hard coal	0.0018	0.0029**	0.17	kg/TJ	PL (IETU)
Brown coal	0.0018	0.005	0.022	kg/TJ	PL (IETU)
Coke	0.0018	0.0006	0.13	kg/TJ	PL (IETU)
Fuel oil	0.6*10 ⁻⁶	-	0.03	kg/TJ	PL (IETU)
Biomass	0.013	0.00056	0.027	kg/TJ	EMEP/EEA EIG 2023
Gaseous fuels	0.0009	0.54	0.011	mg/GJ	EMEP/EEA EIG 2023

* EMEP/EEA EIG 2019 **National publication PGE

Table A6. 28. Additional Heavy Metals emission factors applied for NFR 1A2

Emission source	EF					EF unit	EF reference
	As	Cr	Cu	Ni	Zn		
Hard coal	0.017	0.022	0.095	0.085	0.69	kg/TJ	PL (IETU)
Brown coal	0.018	0.011	0.024	0.005	0.11	kg/TJ	PL (IETU)
Coke	0.002	0.017	0.086	0.076	0.53	kg/TJ	PL (IETU)
Fuel oil	0.024	0.029	0.068	0.654	0.024	kg/TJ	PL (IETU)
Biomass	0.00019	0.023	0.006	0.002	0.512	kg/TJ	EMEP/EEA EIG 2023
Gaseous fuels	0.1	0.013	0.0026	0.013	0.73	mg/GJ	EMEP/EEA EIG 2023

Table A6. 29. PCDD/F, PCBs and HCB emission factors applied for NFR 1A2

Activity	Pollutant	EF	EF unit	EF reference
Hard coal and lignite	PCDD/F	0.06	mg TEQ/ kt	Grochowalski A., 2002
Biomass	PCDD/F	1	mg TEQ/ kt	Berdowski et al., 1995
Fuel and diesel oil	PCDD/F	1	mg TEQ/ kt	NILU, 1999
Hard coal	PCB	0.31	g/kt	Parma at al., 1995
Lignite	PCB	1.8	g/kt	Parma at al., 1995
Biomass	PCB	0.9	g/kt	Parma at al., 1995
Coke	PCB	3.6	g/kt	NILU, 1999
Fuel and diesel oil	PCB	0.6	g/kt	Parma at al., 1995
Hard coal	HCB	0.013	g/kt	Bailey R., 2001
Biomass	HCB	0.06	g/kt	Bailey R., 2001

Table A6. 30. PAHs emission factors applied for NFR 1A2

Activity	EF				EF unit	EF reference
	B(a)p	B(b)f	B(k)f	IP		
Hard coal and lignite	0.586	23.4	23.4	17.6	g/kt	Berdowski et al., 1995
Biomass	0.095	19	19	0.17	g/kt	Berdowski et al., 1995
Fuel and diesel oil	3.43	1.81	1.81	6.84	g/kt	Berdowski et al., 1995

VI.5 Transport (NFR sector 1A3)

VI.5.1 Civil Domestic and International Aviation (NFR sector 1A3a)

Table A6. 31. SO₂ emission factors applied for 1A3a

SO ₂ emission source	EF	EF unit	EF reference
Aviation (LTO & Cruise)	1.0	kg/t	EMEP/EEA EIG 2009

Table A6. 32. NO_x emission factors applied for 1A3a

NO _x emission source	EF	EF unit	EF reference
Aviation (LTO)			
Jet fuel - Civil Aviation	8.3	kg/t	EMEP/EEA EIG 2009
Jet fuel - International Aviation	26	kg/t	EMEP/EEA EIG 2009
Aviation gasoline - Civil Aviation	4.0	kg/t	EMEP/EEA EIG 2023
Aviation (Cruise)			
Jet fuel - Civil Aviation	10.3	kg/t	EMEP/EEA EIG 2009
Jet fuel - International Aviation	12.8	kg/t	EMEP/EEA EIG 2009
Aviation gasoline - Civil Aviation	4.0	kg/t	EMEP/EEA EIG 2023

Table A6. 33. CO emission factors applied for 1A3a

CO emission source	EF	EF unit	EF Reference
Aviation (LTO)			
Jet fuel - Civil Aviation	11.80	kg/t	EMEP/EEA EIG 2016
Jet fuel - International Aviation	6.10	kg/t	EMEP/EEA EIG 2016
Aviation gasoline - Civil Aviation	1200.0	kg/t	EMEP/EEA EIG 2023
Aviation (Cruise)			
Jet fuel - Civil Aviation	2.0	kg/t	EMEP/EEA EIG 2016
Jet fuel - International Aviation	1.1	kg/t	EMEP/EEA EIG 2016
Aviation gasoline - Civil Aviation	1200.0	kg/t	EMEP/EEA EIG 2023

Table A6. 34. PM emission factors applied for 1A3a

PM emission source	EF				EF unit	EF reference
	TSP	PM10	PM2.5	BC		
Aviation (LTO & Cruise)						
Jet fuel - Civil Aviation	0.2	0.2	0.2	15% of PM2.5	t/kt	EMEP/EEA EIG 2009
Jet fuel - International Aviation	0.2	0.2	0.2	15% of PM2.5	t/kt	EMEP/EEA EIG 2009
Aviation gasoline - Civil Aviation	4	4	4	15% of PM2.5	t/kt	EMEP/EEA EIG 2009

Table A6. 35. NMVOC emission factors applied for 1A3a

Emission source	EF	EF unit	EF reference
Aviation (LTO)			
Jet fuel - Civil Aviation	0.5	kg/t	EMEP/EEA EIG 2009
Jet fuel - International Aviation	0.2	kg/t	EMEP/EEA EIG 2009
Aviation gasoline - Civil Aviation	19.0	kg/t	EMEP/EEA EIG 2016
Aviation (Cruise)			
Jet fuel - Civil Aviation	0.1	kg/t	EMEP/EEA EIG 2009
Jet fuel - International Aviation	0.5	kg/t	EMEP/EEA EIG 2009
Aviation gasoline - Civil Aviation	19.0	kg/t	EMEP/EEA EIG 2016

VI.5.2 Road Transportation (NFR sector 1A3b)

Emission has been estimated with the use of COPERT 5 emission factors.

VI.5.3 Railways (NFR sector 1A3c)

Table A6. 36. Emission factors applied for 1A3c for Diesel oil

Pollutant	EF	EF unit	EF reference
SO ₂	0.02*	kg/t	EMEP/EEA EIG 2023
NO _x	52.4	kg/t	EMEP/EEA EIG 2023
CO	10.7	kg/t	EMEP/EEA EIG 2023
NMVOC	4.65	kg/t	EMEP/EEA EIG 2023
NH ₃	0.007	kg/t	EMEP/EEA EIG 2023

Pollutant	EF	EF unit	EF reference
TSP	1.52	kg/t	EMEP/EEA EIG 2023
PM10	1.44	kg/t	EMEP/EEA EIG 2023
PM2.5	1.37	kg/t	EMEP/EEA EIG 2023
BC	65	% of PM2.5	EMEP/EEA EIG 2023
Cd	0.01	g/t	EMEP/EEA EIG 2023
Cr	0.05	g/t	EMEP/EEA EIG 2023
Cu	1.7	g/t	EMEP/EEA EIG 2023
Ni	0.07	g/t	EMEP/EEA EIG 2023
Zn	1	g/t	EMEP/EEA EIG 2023
B(a)p	0.03	g/t	EMEP/EEA EIG 2023
B(b)f	0.05	g/t	EMEP/EEA EIG 2023

* emission factor was calculated based on sulphur content in Diesel fuel (in Polish regulations – currently 10 mg/kg) based on guidelines included in EMEP/EEA Emission Inventory Guidebook 2023 assuming that all sulphur in the fuel is transformed completely into SO₂, then $EF = 2 \times S$, where S is the maximal allowed sulphur content in fuel

VI.5.4 Navigation (NFR sector 1A3d)

Table A6. 37. Emission factors applied for 1A3d – National navigation

Pollutant	EF	Unit	EF reference
SO ₂	2*	kg/t	EMEP/EEA EIG 2023
NO _x – Inland Navigation	52.4	kg/t	EMEP/EEA EIG 2023
NO _x – Maritime Navigation	72.2	kg/t	EMEP/EEA EIG 2023
CO	3.84	kg/t	EMEP/EEA EIG 2023
NM VOC	1.75	kg/t	EMEP/EEA EIG 2023
TSP	1.5	kg/t	EMEP/EEA EIG 2023
PM10	1.07	kg/t	EMEP/EEA EIG 2023
PM2.5	1.07	kg/t	EMEP/EEA EIG 2023
Cd	0.01	g/t	EMEP/EEA EIG 2023
Hg	0.03	g/t	EMEP/EEA EIG 2023
Pb	0.13	g/t	EMEP/EEA EIG 2023
As	0.04	g/t	EMEP/EEA EIG 2023
Cr	0.05	g/t	EMEP/EEA EIG 2023
Cu	0.88	g/t	EMEP/EEA EIG 2023
Ni	1.00	g/t	EMEP/EEA EIG 2023
Zn	1.20	g/t	EMEP/EEA EIG 2023
PCDD/F	0.13	ug I-TEQ/t	EMEP/EEA EIG 2023
PCB	0.038	mg/t	EMEP/EEA EIG 2023
HCB	0.08	mg/t	EMEP/EEA EIG 2023

*emission factor was calculated based on sulphur content in Diesel fuel (in Polish regulations – currently 10 mg/kg) based on guidelines included in EMEP/EEA Emission Inventory Guidebook 2023 assuming that all sulphur in the fuel is transformed completely into SO₂, then $EF = 2 \times S$, where S is the maximal allowed sulphur content in fuel

VI.5.5 Other transportation (NFR sector 1A3ei)

Table A6. 38. Emission factors applied for 1A3ei

Pollutant	EF	Unit	EF reference
SO ₂	0.67	kg/t	EMEP/EEA EIG 2019
NO _x	74.0	kg/t	EMEP/EEA EIG 2019
CO	29.0	kg/t	EMEP/EEA EIG 2019
NM VOC	23.0	kg/t	EMEP/EEA EIG 2019
TSP	0.78	kg/t	EMEP/EEA EIG 2019
PM10	0.78	kg/t	EMEP/EEA EIG 2019
PM2.5	0.78	kg/t	EMEP/EEA EIG 2019

VI.6 Other sectors – stationary sources (NFR sector 1A4)

VI.6.1 Commercial/Institutional (NFR sector 1A4ai), Residential (NFR sector 1A4bi), Agriculture/Forestry/Fishing (NFR sector 1A4ci)

Table A6. 39. SO₂ emission factors applied for NFR 1A4

Emission source	EF	EF unit	EF reference
1A4ai. Commercial and institutional plants			
Hard coal and hard coal briquettes	517	kg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	343	kg/TJ	
Wood and waste wood	28	kg/TJ	
Coke	138	kg/TJ	
Fuel oils	94	kg/TJ	EMEP/EEA EIG 2023
Natural gas	0.67	kg/TJ	
Other gases (industrial, biogas, LPG)	0.67	kg/TJ	
1A4bi. Residential plants			
Hard coal and hard coal briquettes	535	kg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	303	kg/TJ	
Wood and waste wood	78	kg/TJ	
Coke	122	kg/TJ	
Fuel oils	70	kg/TJ	EMEP/EEA EIG 2023
Natural gas	0.3	kg/TJ	
Other gases (industrial, biogas, LPG)	0.3	kg/TJ	
1A4ci. Agriculture/Forestry/Fishing			
Hard coal and hard coal briquettes	513	kg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	345	kg/TJ	
Wood and waste wood	49	kg/TJ	
Coke	164	kg/TJ	
Fuel oils	94	kg/TJ	EMEP/EEA EIG 2023
Natural gas	0.67	kg/TJ	
Other gases (industrial, biogas, LPG)	0.67	kg/TJ	

Table A6. 40. NO_x emission factors applied for NFR 1A4

Emission source	EF	EF unit	EF reference
1A4ai. Commercial and institutional plants			
Hard coal and hard coal briquettes	0.171	t/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.098	t/TJ	
Wood and wood waste	0.103	t/TJ	
Coke	0.097	t/TJ	
Fuel oils	0.306	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.074	t/TJ	
Other gases (industrial, biogas, LPG)	0.074	t/TJ	
1A4bi. Residential plants			
Hard coal and hard coal briquettes	0.176	t/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.084	t/TJ	
Wood and wood waste	0.076	t/TJ	
Coke	0.100	t/TJ	
Fuel oils	0.051	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.051	t/TJ	
Other gases (industrial, biogas, LPG)	0.051	t/TJ	
1A4ci. Agriculture/Forestry/Fishing			
Hard coal and hard coal briquettes	0.172	t/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.100	t/TJ	
Wood and wood waste	0.092	t/TJ	
Coke	0.090	t/TJ	
Fuel oils	0.306	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.074	t/TJ	
Other gases (industrial, biogas, LPG)	0.074	t/TJ	

Table A6. 41. CO emission factors applied for NFR 1A4

Emission source	EF	EF unit	EF reference
1A4ai. Commercial and institutional plants			
Hard coal and hard coal briquettes	4.054	t/TJ	IChPW, 2021
Brown coal and brown coal briquettes	7.194	t/TJ	
Wood and wood waste	1.012	t/TJ	
Coke	4.032	t/TJ	
Fuel oils	0.093	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.029	t/TJ	
Other gases (industrial, biogas, LPG)	0.029	t/TJ	
1A4bi. Residential plants			
Hard coal and hard coal briquettes	4.179	t/TJ	IChPW, 2021
Brown coal and brown coal briquettes	8.006	t/TJ	
Wood and wood waste	3.037	t/TJ	
Coke	4.160	t/TJ	
Fuel oils	0.057	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.026	t/TJ	
Other gases (industrial, biogas, LPG)	0.026	t/TJ	
1A4ci. Agriculture/Forestry/Fishing			
Hard coal and hard coal briquettes	3.948	t/TJ	IChPW, 2021
Brown coal and brown coal briquettes	7.066	t/TJ	
Wood and wood waste	1.864	t/TJ	
Coke	3.698	t/TJ	
Fuel oils	0.093	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.029	t/TJ	
Other gases (industrial, biogas, LPG)	0.029	t/TJ	

Table A6. 42. NH₃ emission factors applied for NFR 1A4

Emission source	EF	EF unit	EF reference
1A4ai. Commercial and institutional plants			
Hard coal and hard coal briquettes	0.254	kg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.270	kg/TJ	
Wood and wood waste	0.364	kg/TJ	
Coke	0.300	kg/TJ	
1A4bi. Residential plants			
Hard coal and hard coal briquettes	0.252	kg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.300	kg/TJ	
Wood and wood waste	1.399	kg/TJ	
Coke	0.300	kg/TJ	
1A4ci. Agriculture/Forestry/Fishing			
Hard coal and hard coal briquettes	0.245	kg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.264	kg/TJ	
Wood and wood waste	0.844	kg/TJ	
Coke	0.300	kg/TJ	

Table A6. 43. PM emission factors applied for NFR 1A4

Emission source	EF				EF unit	EF reference
	TSP	PM10	PM2.5	BC*		
1A4ai. Commercial and institutional plants						
Hard coal and hard coal briquettes	0.522	0.458	0.391	0.019	t/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.750	0.686	0.577	0.025	t/TJ	
Wood and wood waste	0.161	0.157	0.153	0.009	t/TJ	
Coke	0.090	0.082	0.071	0.003	t/TJ	
Fuel oils	0.021	0.021	0.018	56.0*	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.00078	0.00078	0.00078	4.0*	t/TJ	
Other gases (industrial, biogas, LPG)	0.00078	0.00078	0.00078	4.0*	t/TJ	
1A4bi. Residential plants						
Hard coal and hard coal briquettes	0.532	0.487	0.406	0.018	t/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.989	0.919	0.773	0.027	t/TJ	
Wood and wood waste	0.560	0.552	0.549	0.021	t/TJ	

Emission source	EF				EF unit	EF reference
	TSP	PM10	PM2.5	BC*		
Coke	0.092	0.085	0.074	0.003	t/TJ	EMEP/EEA EIG 2023
Fuel oils	0.0019	0.0019	0.0019	8.50*	t/TJ	
Natural gas	0.0012	0.0012	0.0012	5.40*	t/TJ	
Other gases (industrial, biogas, LPG)	0.0012	0.0012	0.0012	5.40*	t/TJ	
1A4ci. Agriculture/Forestry/Fishing						
Hard coal and hard coal briquettes	0.5106	0.445	0.380	0.019	t/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.737	0.673	0.566	0.024	t/TJ	
Wood and wood waste	0.345	0.340	0.337	0.017	t/TJ	
Coke	0.088	0.075	0.065	0.004	t/TJ	
Fuel oils	0.021	0.021	0.018	56.0*	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.00078	0.00078	0.00078	4.0*	t/TJ	
Other gases (industrial, biogas, LPG)	0.00078	0.00078	0.00078	4.0*	t/TJ	

* BC emission factors for liquid and gaseous fuels are defined in % of PM2.5

Table A6. 44. NMVOC emission factors applied for NFR 1A4

Emission source	EF	EF unit	EF reference
1A4ai. Commercial and institutional plants			
Hard coal and hard coal briquettes	0.215	t/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.452	t/TJ	
Wood and wood waste	0.097	t/TJ	
Coke	0.083	t/TJ	
Diesel / fuel oil	0.020	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.023	t/TJ	
Other gases (industrial, biogas, LPG)	0.023	t/TJ	
1A4bi. Residential plants			
Hard coal and hard coal briquettes	0.225	t/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.500	t/TJ	
Wood and wood waste	0.390	t/TJ	
Coke	0.087	t/TJ	
Diesel oil	0.00069	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.0019	t/TJ	
Other gases (industrial, biogas, LPG)	0.0019	t/TJ	
1A4ci. Agriculture/Forestry/Fishing			
Hard coal and hard coal briquettes	0.208	t/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.442	t/TJ	
Wood and wood waste	0.227	t/TJ	
Coke	0.072	t/TJ	
Diesel oil	0.020	t/TJ	EMEP/EEA EIG 2023
Natural gas	0.023	t/TJ	
Other gases (industrial, biogas, LPG)	0.023	t/TJ	

Table A6. 45. Main Heavy Metals emission factors applied for NFR 1A4

Emission source	Cd	EF Hg	Pb	EF unit	EF reference
1A4ai. Commercial and institutional plants					
Hard coal and hard coal briquettes	0.0020	0.0031	0.148	kg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.0010	0.0043	0.071	kg/TJ	
Wood and wood waste	0.0130	0.0006	0.027	kg/TJ	
Coke	0.0040	0.0017	0.172	kg/TJ	
Fuel oil	0.00015	0.00010	0.008	kg/TJ	EMEP/EEA EIG 2023
Natural gas	0.0000009	0.00010	0.000011	kg/TJ	
Other gases (industrial, biogas, LPG)	0.0000009	0.00010	0.000011	kg/TJ	
1A4bi. Residential plants					
Hard coal and hard coal briquettes	0.0017	0.0020	0.135	kg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.0010	0.0040	0.070	kg/TJ	
Wood and wood waste	0.0130	0.0006	0.027	kg/TJ	
Coke	0.0040	0.0012	0.170	kg/TJ	
Fuel oil	0.0000010	0.00012	0.000012	kg/TJ	EMEP/EEA EIG 2023
Natural gas	0.00000025	0.00010	0.0000015	kg/TJ	

Emission source	Cd	EF Hg	Pb	EF unit	EF reference
Other gases (industrial, biogas, LPG)	0.00000025	0.00010	0.0000015	kg/TJ	
1A4ci. Agriculture/Forestry/Fishing					
Hard coal and hard coal briquettes	0.0020	0.0031	0.149	kg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.0011	0.0043	0.072	kg/TJ	
Wood and wood waste	0.0130	0.0006	0.027	kg/TJ	
Coke	0.0040	0.0026	0.178	kg/TJ	
Fuel oil	0.00015	0.00010	0.008	kg/TJ	EMEP/EEA EIG 2023
Natural gas	0.0000009	0.00010	0.000011	kg/TJ	
Other gases (industrial, biogas, LPG)	0.0000009	0.00010	0.000011	kg/TJ	

Table A6. 46. Additional Heavy Metals emission factors applied for NFR 1A4

Emission source	EF					EF	EF
	As	Cr	Cu	Ni	Zn	unit	reference
1A4ai. Commercial and institutional plants							
Hard coal and hard coal briquettes	0.0058	0.0166	0.0877	0.0362	0.2273	kg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.0150	0.0258	0.0148	0.0075	0.1030	kg/TJ	
Wood and wood waste	0.0002	0.0230	0.0060	0.0020	0.5120	kg/TJ	
Coke	0.0050	0.0144	0.0300	0.0194	0.2958	kg/TJ	
Fuel oil	0.0005	0.0100	0.0030	0.1250	0.0180	kg/TJ	EMEP/EEA EIG 2023
Natural gas	0.00010	0.000013	0.000003	0.000013	0.00073	kg/TJ	
Other gases (industrial, biogas, LPG)	0.00010	0.000013	0.000003	0.000013	0.00073	kg/TJ	
1A4bi. Residential plants							
Hard coal and hard coal briquettes	0.0060	0.0176	0.1030	0.0413	0.2314	kg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.0140	0.0300	0.0120	0.0070	0.1000	kg/TJ	
Wood and wood waste	0.0002	0.0230	0.0060	0.0020	0.5120	kg/TJ	
Coke	0.0050	0.0150	0.0300	0.0200	0.3000	kg/TJ	
Fuel oil	0.000002	0.0002	0.00013	0.000005	0.00042	kg/TJ	EMEP/EEA EIG 2023
Natural gas	0.00003	0.0000008	0.00000008	0.0000005	0.0000015	kg/TJ	
Other gases (industrial, biogas, LPG)	0.00003	0.0000008	0.00000008	0.0000005	0.0000015	kg/TJ	
1A4ci. Agriculture/Forestry/Fishing							
Hard coal and hard coal briquettes	0.0059	0.0165	0.0884	0.0367	0.2249	kg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	0.0152	0.0256	0.0154	0.0076	0.1036	kg/TJ	
Wood and wood waste	0.0002	0.0230	0.0060	0.0020	0.5120	kg/TJ	
Coke	0.0050	0.0135	0.0300	0.0185	0.2959	kg/TJ	
Fuel oil	0.0005	0.0100	0.0030	0.1250	0.0180	kg/TJ	EMEP/EEA EIG 2023
Natural gas	0.00010	0.000013	0.000003	0.000013	0.00073	kg/TJ	
Other gases (industrial, biogas, LPG)	0.00010	0.000013	0.000003	0.000013	0.00073	kg/TJ	

Table A6. 47. PCDD/F emission factors applied for NFR 1A4

Activity	EF	EF unit	EF reference
1A4ai. Commercial and institutional plants			
Hard coal and hard coal briquettes	458.05	µg TEQ/TJ	IChPW, 2021
Brown coal and brown coal briquettes	281.86	µg TEQ/TJ	
Fuel wood and wood waste	173.95	µg TEQ/TJ	
Coke	194.30	µg TEQ/TJ	
Fuel oil	6.00	µg TEQ/TJ	EMEP/EEA EIG 2023
1A4bi. Residential plants			
Hard coal and hard coal briquettes	473.36	µg TEQ/TJ	IChPW, 2021
Brown coal and brown coal briquettes	300.00	µg TEQ/TJ	
Fuel wood and wood waste	418.38	µg TEQ/TJ	
Coke	200.00	µg TEQ/TJ	

Activity	EF	EF unit	EF reference
Fuel oil	5.90	µg TEQ/TJ	EMEP/EEA EIG 2023
1A4ci. Agriculture/Forestry/Fishing			
Hard coal and hard coal briquettes	449.54	µg TEQ/TJ	IChPW, 2021
Brown coal and brown coal briquettes	277.87	µg TEQ/TJ	
Fuel wood and wood waste	381.17	µg TEQ/TJ	
Coke	179.04	µg TEQ/TJ	
Fuel oil	6.00	µg TEQ/TJ	EMEP/EEA EIG 2023

Table A6. 48. Emission factors of PCB applied for NFR 1A4

Activity	EF	EF unit	EF reference
1A4ai. Commercial and institutional plants			
Hard coal and hard coal briquettes	9.30	mg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	9.55	mg/TJ	
Fuel wood and wood waste	2.06	mg/TJ	
Coke	1.43	mg/TJ	
Fuel oils	0.00013	mg/TJ	EMEP/EEA EIG 2023
1A4bi. Residential plants			
Hard coal and hard coal briquettes	9.34	mg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	10.00	mg/TJ	
Fuel wood and wood waste	3.68	mg/TJ	
Coke	1.50	mg/TJ	
Fuel oil	NE		EMEP/EEA EIG 2023
1A4ci. Agriculture/Forestry/Fishing			
Hard coal and hard coal briquettes	9.16	mg/TJ	IChPW, 2021
Brown coal and brown coal briquettes	9.45	mg/TJ	
Fuel wood and wood waste	2.74	mg/TJ	
Coke	1.24	mg/TJ	
Fuel oils	0.00013	mg/TJ	EMEP/EEA EIG 2023

Table A6. 49. HCB emission factors applied for NFR 1A4

Activity	EF	EF unit	EF reference
1A4ai. Commercial and institutional plants			
Hard coal and hard coal briquettes	0.62	mg/TJ	EMEP/EEA EIG 2023
Brown coal and brown coal briquettes	0.62	mg/TJ	
Fuel wood and wood waste	5.0	mg/TJ	
Coke	0.62	mg/TJ	
Fuel oils	0.22	mg/TJ	
1A4bi. Residential plants			
Hard coal and hard coal briquettes	0.62	mg/TJ	EMEP/EEA EIG 2023
Brown coal and brown coal briquettes	0.62	mg/TJ	
Fuel wood and wood waste	5.0	mg/TJ	
Coke	0.62	mg/TJ	
Fuel oils	NE		
1A4ci. Agriculture/Forestry/Fishing			
Hard coal and hard coal briquettes	0.62	mg/TJ	EMEP/EEA EIG 2023
Brown coal and brown coal briquettes	0.62	mg/TJ	
Fuel wood and wood waste	5.0	mg/TJ	
Coke	0.62	mg/TJ	
Fuel oils	0.22	mg/TJ	

Table A6. 50. Benzo(a)pyrene emission factors applied for NFR 1A4

Activity	EF	EF unit	EF reference
1A4ai. Commercial and institutional plants			
Hard coal and hard coal briquettes	232.82	g/TJ	IChPW, 2021
Brown coal and brown coal briquettes	193.53	g/TJ	
Wood and wood waste	25.77	g/TJ	
Coke	22.86	g/TJ	
Fuel oils	0.0019	g/TJ	EMEP/EEA EIG 2023
1A4bi. Residential plants			
Hard coal and hard coal briquettes	233.57	g/TJ	IChPW, 2021
Brown coal and brown coal briquettes	220.00	g/TJ	
Wood and wood waste	88.85	g/TJ	
Coke	24.00	g/TJ	
Fuel oils	0.08	g/TJ	EMEP/EEA EIG 2023
1A4ci. Agriculture/Forestry/Fishing			
Hard coal and hard coal briquettes	224.69	g/TJ	IChPW, 2021
Brown coal and brown coal briquettes	189.68	g/TJ	
Wood and wood waste	51.79	g/TJ	
Coke	19.10	g/TJ	
Fuel oils	0.0019	g/TJ	EMEP/EEA EIG 2023

Table A6. 51. Benzo(b)fluoranthene emission factors applied for NFR 1A4

Activity	EF	EF unit	EF reference
1A4ai. Commercial and institutional plants			
Hard coal and hard coal briquettes	197.57	g/TJ	IChPW, 2021
Brown coal and brown coal briquettes	208.69	g/TJ	
Fuel wood and wood waste	35.99	g/TJ	
Coke	84.73	g/TJ	
Fuel oils	0.015	g/TJ	EMEP/EEA EIG 2023
1A4bi. Residential plants			
Hard coal and hard coal briquettes	211.06	g/TJ	IChPW, 2021
Brown coal and brown coal briquettes	250.00	g/TJ	
Fuel wood and wood waste	114.53	g/TJ	
Coke	90.00	g/TJ	
Fuel oils	0.040	g/TJ	EMEP/EEA EIG 2023
1A4ci. Agriculture/Forestry/Fishing			
Hard coal and hard coal briquettes	191.05	g/TJ	IChPW, 2021
Brown coal and brown coal briquettes	204.55	g/TJ	
Fuel wood and wood waste	70.07	g/TJ	
Coke	68.31	g/TJ	
Fuel oils	0.015	g/TJ	EMEP/EEA EIG 2023

Table A6. 52. Benzo(k)fluoranthene emission factors applied for NFR 1A4

Activity	EF	EF unit	EF reference
1A4ai. Commercial and institutional plants			
Hard coal and hard coal briquettes	80.54	g/TJ	IChPW, 2021
Brown coal and brown coal briquettes	74.38	g/TJ	
Fuel wood and wood waste	16.57	g/TJ	
Coke	33.62	g/TJ	
Fuel oils	0.0017	g/TJ	EMEP/EEA EIG 2023
1A4bi. Residential plants			
Hard coal and hard coal briquettes	84.55	g/TJ	IChPW, 2021
Brown coal and brown coal briquettes	90.00	g/TJ	
Fuel wood and wood waste	64.36	g/TJ	
Coke	36.00	g/TJ	
Fuel oils	0.070	g/TJ	EMEP/EEA EIG 2023
1A4ci. Agriculture/Forestry/Fishing			
Hard coal and hard coal briquettes	77.97	g/TJ	IChPW, 2021
Brown coal and brown coal briquettes	72.93	g/TJ	
Fuel wood and wood waste	36.02	g/TJ	
Coke	27.38	g/TJ	
Fuel oils	0.0017	g/TJ	EMEP/EEA EIG 2023

Table A6. 53. Indeno(1.2.3-cd)pyrene emission factors applied for NFR 1A4

Activity	EF	EF unit	EF reference
1A4ai. Commercial and institutional plants			
Hard coal and hard coal briquettes	71.66	g/TJ	IChPW, 2021
Brown coal and brown coal briquettes	66.17	g/TJ	
Fuel wood and wood waste	13.54	g/TJ	
Coke	28.15	g/TJ	
Fuel oils	0.0015	g/TJ	EMEP/EEA EIG 2023
1A4bi. Residential plants			
Hard coal and hard coal briquettes	75.20	g/TJ	IChPW, 2021
Brown coal and brown coal briquettes	80.00	g/TJ	
Fuel wood and wood waste	53.26	g/TJ	
Coke	18.00	g/TJ	
Fuel oils	0.160	g/TJ	EMEP/EEA EIG 2023
1A4ci. Agriculture/Forestry/Fishing			
Hard coal and hard coal briquettes	69.31	g/TJ	IChPW, 2021
Brown coal and brown coal briquettes	63.89	g/TJ	
Fuel wood and wood waste	29.34	g/TJ	
Coke	23.20	g/TJ	
Fuel oils	0.0015	g/TJ	EMEP/EEA EIG 2023

VI.6.2 Agriculture/Forestry/Fishing – mobile sources (NFR sector 1A4cii & 1A4ciii)

Table A6. 54. Emission factors applied for 1A4cii *Off-road vehicles and other machinery*

Pollutant	Units	< 1981	1981-1990	1991-Stage	Stage I	Stage II	Stage IIIA	Stage IIIB	Stage IV	Stage V
BC	g/t	3221	2221	1074	727	483	416	74	73	9
CO	g/t	19804	17566	14147	6463	6104	6035	6087	6024	6077
NH ₃	g/t	7	7	8	8	8	8	8	8	8
NM VOC	g/t	7760	6439	4493	1544	1181	1173	544	530	526
NO _x	g/t	29901	37383	49002	30799	20612	12921	9318	1587	1861
PM ₁₀	g/t	5861	4047	1974	947	624	550	99	99	59
PM _{2.5}	g/t	5861	4047	1974	947	624	550	99	99	59
TSP	g/t	5861	4047	1974	947	624	550	99	99	59

Table A6. 55. Emission factors applied for 1A4cii *Off-road vehicles and other machinery*

Pollutant	EF	EF unit	EF Reference
SO ₂	0.02 ¹⁾	kg/t	EMEP/EEA EIG 2023
Cd	0.01	kg/kt	
Cr	0.05	kg/kt	
Cu	1.7	kg/kt	
Ni	0.07	kg/kt	
Zn	1.0	kg/kt	
PCDD/F	NE	-	
PCB	NA	-	
HCB	NA	-	
Benzo(a)pyrene	0.03	kg/kt	
Benzo(b)fluorantene	0.05	kg/kt	
Benzo(k)fluorantene	NE	-	
Indeno(1.2.3-cd)pyrene	NE	-	

¹⁾ emission factor was calculated based on sulphur content in Diesel fuel (in Polish regulations – currently 10 mg/kg) based on guidelines included in EMEP/EEA Emission Inventory Guidebook 2019 assuming that all sulphur in the fuel is transformed completely into SO₂, then EF = 2 x S, where S is the maximal allowed sulphur content in fuel

Table A6. 56. Emission factors applied for 1A4cii *National fishing*

Pollutant	EF (Diesel oil)	EF (Fuel oil)	EF unit	EF Reference
SO ₂	2 ¹⁾	0.04 ²⁾	kg/t	EMEP/EEA EIG 2023
NO _x	72.20		kg/t	
CO	3.84		kg/t	
NH ₃	NE		-	
TSP	1.07		kg/t	
PM ₁₀	1.07		kg/t	
PM _{2.5}	1.07		kg/t	
BC	0.0483		kg/t	
NMVOC	1.75		kg/t	
Cd	0.01		kg/kt	
Hg	0.03		kg/kt	
Pb	0.13		kg/kt	
As	0.04		kg/kt	
Cr	0.05		kg/kt	
Cu	0.88		kg/kt	
Ni	1.0		kg/kt	
Zn	1.2		kg/kt	
PCDD/F	0.13		mg TEQ/kt	
PCB	38		mg/kt	
HCB	80		mg/kt	
Benzo(a)pyrene emission	NE		-	
Benzo(b)fluorantene	NE		-	
Benzo(k)fluorantene	NE		-	
Indeno(1.2.3-cd)pyrene	NE		-	

¹⁾ emission factor was assumed as described under the table no. 3-2 referring to emission factors from marine diesel (0.5% pre 2000, 0.2% from 1 July 2000 and 0.1% from 1 January 2010)

²⁾ emission factor was calculated based on sulphur content in Diesel fuel (in Polish regulations – currently 20 mg/kg) based on guidelines included in EMEP/EEA Emission Inventory Guidebook 2023 assuming that all sulphur in the fuel is transformed completely into SO₂, then $EF = 2 \times S$, where S is the maximal allowed sulphur content in fuel

VI.7 Fugitive emission (NFR sector 1B)

VI.7.1 Fugitive emission from solid fuels (NFR sector 1B1)

Table A6. 57. Emission factors applied for NFR 1B1a

Emission source	EF				EF unit	EF reference
	NMVOC	TSP	PM10	PM2.5		
Extraction of hard coal	0.8	0.089	0.042	0.005	kg/t coal	EMEP/EEA EIG 2023
Extraction of brown coal	0.2	0.082	0.039	0.006	kg/t coal	EMEP/EEA EIG 2023
Handling and storage of coal	-	0.150	0.060	0.006	kg/t coal	CEPMEIP
Handling of imported coal	-	7.5	3.0	0.3	g/t coal	EMEP/EEA EIG 2023

Table A6. 58. Emission factors applied for NFR 1B1b – Coke oven plants

Pollutant	EF	EF unit	EF reference
NO _x	0.9	g/t coke	EMEP/EEA EIG 2023
NMVOC	7.7	g/t coke	
CO	460	g/t coke	
SO ₂	0.8	g/t coke	
NH ₃	3.7	g/t coke	
TSP	347	g/t coke	
PM10	146	g/t coke	
PM2.5	61	g/t coke	
BC	49	% of PM2.5	
Pb	0.38	g/t coke	
Cd	0.007	g/t coke	
Hg	0.012	g/t coke	
As	0.013	g/t coke	
Cr	0.170	g/t coke	
Cu	0.048	g/t coke	
Ni	0.120	g/t coke	
Zn	0.220	g/t coke	
PCDD/F	0.3	µg I-TEQ/t coke	
Benzo(a)pyrene	0.16	g/t coke	
Benzo(b)fluoranthene	0.2	g/t coke	
Benzo(k)fluoranthene	0.1	g/t coke	
Indeno(1.2.3-cd)pyrene	0.07	g/t coke	

Table A6. 59. PM emission factors applied for NFR 1B1c

Emission source	EF			EF unit	EF reference
	TSP	PM10	PM2.5		
Coke handling and storage	0.110	0.044	0.0044	kg/t coke	CEPMEIP

VI.7.2 Fugitive emissions from oil and natural gas (NFR sector 1B2)

Table A6. 60. NMVOC emission factors applied for NFR 1B2ai, 1B2av

Emission source	EF	EF unit	EF reference
1B2ai. Exploration, production, loading (oil)			
Petroleum products processing	0.2	kg/t oil	EMEP/EEA EIG 2023
Off shore extraction	0.4	kg/t oil	
On shore extraction	0.1	kg/t oil	
Marine terminals	0.3	kg/t	
Other handling and storage	0.02	kg/t	
1B2av. Gasoline distribution			
Distribution of oil products	0.7	kg/t	EMEP/EEA EIG 2023

Table A6. 61. Emission factors applied for NFR 1B2aiv

Pollutant	EF	EF unit	EF reference
NO _x	0.035	kg/t crude oil input	EMEP/EEA EIG 2023
CO	0.041	kg/t crude oil input	
NMVOC	0.11	kg/t crude oil input	
SO ₂	0.245	kg/t crude oil input	
NH ₃	IE	-	
TSP	0.006	kg/t crude oil input	
PM ₁₀	0.005	kg/t crude oil input	
PM _{2.5}	0.002	kg/t crude oil input	
Pb	0.003	g/t crude oil input	
Cd	0.0005	g/t crude oil input	
Hg	0.0005	g/t crude oil input	
As	0.0001	g/t crude oil input	
Cr	0.0001	g/t crude oil input	
Cu	0.0012	g/t crude oil input	
Ni	0.0053	g/t crude oil input	
Zn	0.001	g/t crude oil input	
PCDD/F	0.0012	µg I-TEQ/t crude oil input	

Table A6. 62. NMVOC emission factors applied for NFR 1B2b

Emission source	EF	EF unit	EF reference
<i>Extraction of gaseous fuels</i>			
Off-shore extraction	0.1	g/m ³ gas	EMEP/EEA EIG 2023
On-shore extraction	0.1	g/m ³ gas	EMEP/EEA EIG 2023
<i>Gas distribution networks</i>			
Natural gas (high - methane)	0.338	t/hm ³	PL (IETU)
Natural gas (nitrogenous)	0.784	t/hm ³	PL (IETU)
Coke oven gas	0.727	t/hm ³	PL (IETU)

Note: PL (IETU) emission factor comes from IETU surveys

Table A6. 63. NMVOC emission factors applied for NFR 1B2c

Pollutant	EF	EF unit	EF reference
NMVOC	2	g/m ³	EMEP/EEA EIG 2023
SO ₂	77	g/m ³	EMEP/EEA EIG 2023
NO _x	54	g/m ³	EMEP/EEA EIG 2023
CO	12	g/m ³	EMEP/EEA EIG 2023

VII. NFR SECTOR 2 – INDUSTRIAL PROCESSES AND PRODUCT USE

VII.1 Mineral Products (NFR sector 2A)

For category 2A1. Cement production aggregate emission data of TSP was included directly from the National Emission Database. The PM10 and PM2.5 emission factors have been calculated based on the ratio to the TSP emission factor included in EMEP/EEA.

For category 2A5a, a Tier 2 approach (model) has been used in accordance with EMEP/EEA assumptions. The model calculates the emission factors for each year independently from the input data. The emission factors shown in the table below are for the year 2024.

Table A6. 64. Emission factors applied for 2A – TSP, PM10, PM2.5 and BC

Pollutant	NFR	Emission source	EF unit	EF	EF reference
TSP	2A1	Portland cement (storage, handling and transport)	t/kt	0.01	CEPMEIP
	2A2	Calx	t/kt	0.4	EMEP/EEA EIG 2023
		Gypsum	t/kt	0.4	
	2A3	Flat glass	t/kt	0.13	
		Container glass	t/kt	0.28	
		Glass fiber	t/kt	0.1	
		Lead glass	t/kt	0.01	
	2A5a	Quarrying of minerals (other than coal)	t/kt	0.0825	
		Quarrying of copper ore	t/kt	0.102	
		Quarrying of zinc-lead ores	t/kt	0.102	
	2A5b	Apartment buildings	Mg/[m ² *year]	0.001	
		Non-residential construction	Mg/[m ² *year]	0.0033	
		Roads construction	Mg/[m ² *year]	0.0077	
PM10	2A1	Cement	t/kt	0.9 * TSP	EMEP/EEA EIG 2023
		Cement (storage, handling and transport)	t/kt	0.005	CEPMEIP
	2A2	Calx	t/kt	0.2	EMEP/EEA EIG 2023
		Gypsum	t/kt	0.2	
	2A3	Flat glass	t/kt	0.12	
		Container glass	t/kt	0.25	
		Glass fiber	t/kt	0.09	
		Lead glass	t/kt	0.009	
	2A5a	Quarrying of minerals (other than coal)	t/kt	0.0249	
		Quarrying of copper ore	t/kt	0.05	
		Quarrying of zinc-lead ores	t/kt	0.05	
	2A5b	Apartment buildings	Mg/[m ² *year]	0.0003	
		Non-residential construction	Mg/[m ² *year]	0.001	
		Roads construction	Mg/[m ² *year]	0.0023	
PM2.5	2A1	Cement	t/kt	0.5 * TSP	EMEP/EEA EIG 2023
		Cement (storage, handling and transport)	t/kt	0.0005	CEPMEIP
	2A2	Calx	t/kt	0.03	EMEP/EEA EIG 2023
		Gypsum	t/kt	0.03	
	2A3	Flat glass	t/kt	0.10	
		Container glass	t/kt	0.22	
		Glass fiber	t/kt	0.07	
		Lead glass		0.008	
	2A5a	Quarrying of minerals (other than coal)	t/kt	0.003	
		Quarrying of copper ore	t/kt	0.005	
		Quarrying of zinc-lead ores	t/kt	0.005	
	2A5b	Apartment buildings	Mg/[m ² *year]	0.00003	
		Non-residential construction	Mg/[m ² *year]	0.00010	
		Roads construction	Mg/[m ² *year]	0.00023	
BC	2A1	Cement	% of PM2.5	3.0	EMEP/EEA EIG 2023
	2A2	Calx	% of PM2.5	0.46	
		Gypsum	% of PM2.5	0.46	
	2A3	Flat glass	% of PM2.5	0.062	
		Container glass	% of PM2.5	0.062	

Pollutant	NFR	Emission source	EF unit	EF	EF reference
		Glass fiber	% of PM2.5	2.0	
		Lead glass	% of PM2.5	0.0062	

Table A6. 65. Emission factors applied for 2A – heavy metals

Pollutant	NFR	Emission source	EF unit	EF	EF reference
Pb	2A3	Flat glass	kg/kt	0.4	EMEP/EEA EIG 2023
		Container glass	kg/kt	2.9	
		Lead glass	kg/kt	10	
Cd	2A3	Flat glass	kg/kt	0.07	
		Container glass	kg/kt	0.12	
Hg	2A3	Flat glass	kg/kt	0.003	
		Container glass	kg/kt	0.003	
As	2A3	Flat glass	kg/kt	0.08	
		Container glass	kg/kt	0.29	
Cr	2A3	Flat glass	kg/kt	0.08	
		Container glass	kg/kt	0.37	
Cu	2A3	Flat glass	kg/kt	0.007	
		Container glass	kg/kt	0.007	
Ni	2A3	Flat glass	kg/kt	0.74	
		Container glass	kg/kt	0.24	
Zn	2A3	Flat glass	kg/kt	0.37	
		Container glass	kg/kt	0.37	

Table A6. 66. Emission factors applied for 2A – PCDD/F

NFR	Emission source	EF unit	EF	EF reference
2A3	Flat glass	mg I-TEQ/kt	0.20	UNEP Toolkit, 2013
	Container glass	mg I-TEQ/kt	0.20	

VII.2 Chemical Industry (NFR sector 2B)

Table A6. 67. Emission factors applied for 2B – NO_x, SO₂, NH₃, NMVOC, CO

Pollutant	NFR	Emission source	EF unit	EF	EF reference
NO _x	2B1	Ammonia	t/kt	1.00	EMEP/EEA EIG 2023
	2B2	Nitric acid	t/kt	3.80	PL *
	2B6	Titanium white (TiO ₂)	t/kt	0.108	EMEP/EEA EIG 2023
	2B10a	Carbon black	t/kt	15.00	
SO ₂	2B6	Titanium white (TiO ₂)	t/kt	3.97	EMEP/EEA EIG 2023
	2B10a	Sulfuric acid	t/kt	2.00	PL *
		Carbon black	t/kt	22.00	EMEP/EEA EIG 2023
NMVOC	2B10a	Carbon black	t/kt	0.70	EMEP/EEA EIG 2023
		Ethylene	t/kt	0.60	
		Propylene	t/kt	0.005	CORINAIR
		Polyethylene	t/kt	2.33	EMEP/EEA EIG 2023***
		Polyvinylchloride (PVC)	t/kt	0.008	PL (IETU)
		Polypropylene	t/kt	4.00	EMEP/EEA EIG 2023
		Polystyrene	t/kt	0.00126	PL (IETU)
		Formaldehyde	t/kt	7.00	EMEP/EEA EIG 2023
NH ₃	2B1	Ammonia	t/kt	0.01	EMEP/EEA EIG 2023
	2B7	Soda ash	t/kt	0.90	
	2B10a	Ammonium nitrate	t/kt	0.03	
		Urea	t/kt	2.5	
CO	2B1	Ammonia	t/kt	0.10	EMEP/EEA EIG 2023
	2B7	Soda ash	t/kt	9.00	
	2B10a	Carbon black	t/kt	3.00	
		Formaldehyde	t/kt	12.00	

* Emission factor derived from initial country studies (the methodology is still developing – the emission factor could be changed).

** No production since 1996.

*** Weighted average from LDPE and HDPE produced in 1:2.7 ratio. According to data provided by the Polish Chamber of Chemical Industry (PIPC).

Table A6. 68. Emission factors applied for 2B – TSP, PM10, PM2.5, BC, Cd

Pollutant	NFR	Emission source	EF unit	EF	EF reference
TSP	2B5	Calcium carbide	t/kt	0.1*	EMEP/EEA EIG 2023
	2B6	Titanium white (TiO ₂)	t/kt	0.30	EMEP/EEA EIG 2023
	2B7	Soda ash	t/kt	0.10	EMEP/EEA EIG 2023
	2B10a	NPK fertilizers	t/kt	0.30	EMEP/EEA EIG 2023
		Ammonium sulphate	t/kt	0.06	
		Ammonium nitrate	t/kt	2.00	
		Urea	t/kt	1.50	
		Carbon black	t/kt	0.30	
		Polyethylene	t/kt	0.079	EMEP/EEA EIG 2023**
		Polyvinylchloride (PVC)	t/kt	0.263	EMEP/EEA EIG 2023
		Polypropylene	t/kt	1.50	
		Polystyrene EPS	t/kt	0.03	
		Polystyrene GPPS/HIPS	t/kt	0.004	
PM10	2B10a	NPK fertilizers	t/kt	0.24	EMEP/EEA EIG 2023
		Urea	t/kt	1.20	
		Carbon black	t/kt	0.27	
		Polyvinylchloride (PVC)	t/kt	0.10	
PM2.5	2B10a	NPK fertilizers	t/kt	0.18	EMEP/EEA EIG 2023
		Urea	t/kt	0.90	
		Carbon black	t/kt	0.24	
		Polyvinylchloride (PVC)	t/kt	0.005	
BC	2B10a	Urea	% of PM _{2.5}	2.0	EMEP/EEA EIG 2023
		Carbon black	% of PM _{2.5}	10.0	EMEP/EEA EIG 2023
Cd	2B10a	Phosphate fertilizers	kg/kt	0.60	S. Hławiczka and J. Fudała (2003)

* No production since 2008.

** Weighted average from LDPE and HDPE produced in 1:2.7 ratio. According to data provided by the Polish Chamber of Chemical Industry.

VII.3 Metal production (NFR sector 2C)

For category 2C7a. Copper production and 2C7c. Other metal products, aggregated emissions data were used directly from copper, silver and gold smelters, and from the National Emission Database.

For category 2C7a, depending on the pollutant, emissions were calculated for the interval 1990-2000 or 1990-2013 using the EMEP/EEA EIG 2023 emission factors. For the other years, the emissions are taken from the copper smelter or the National Emission Database. The PM10 and PM2.5 emission factors for category 2C7a have been calculated based on the ratio to the TSP emission factor included in EMEP/EEA.

Table A6. 69. Emission factors applied for 2C – NO_x, SO₂, NMVOC, CO

Pollutant	NFR	Emission source	EF unit	EF	EF reference
NO _x	2C1	Open hearth furnaces	t/kt	0.7*	EMEP/EEA EIG 2023
		Basic oxygen furnaces (BOFs)	t/kt	0.01	EMEP/EEA EIG 2023
		Electric arc furnaces (EAFs)	t/kt	0.13	
		Rolling mills - hot	t/kt	0.10	Int. pub.
		Rolling mills - cold	t/kt	0.07	
		Primary aluminium	t/kt	1.0**	EMEP/EEA EIG 2023
SO ₂	2C1	Electric arc furnaces (EAFs)	t/kt	0.06	EMEP/EEA EIG 2023
	2C3	Primary aluminium	t/kt	4.5**	
	2C5	Primary lead	t/kt	2.05	
		Secondary lead	t/kt	2.05	
	2C6	Primary zinc	t/kt	1.35	
		Secondary zinc	t/kt	1.35	
	2C7a	Primary and secondary copper (1990-2000)	t/kt	3.0	
NMVOC	2C1	Blast furnace charging	t/kt	0.000237	PL (IETU)
		Open hearth furnaces	t/kt	0.02*	EMEP/EEA EIG 2023
		Basic oxygen furnaces (BOFs)	t/kt	0.000038	PL (IETU)

Pollutant	NFR	Emission source	EF unit	EF	EF reference
CO		Electric arc furnaces (EAFs)	t/kt	0.046	EMEP/EEA EIG 2023
		Rolling mills - hot	t/kt	0.007	
		Rolling mills - cold	t/kt	0.000126	PL (IETU)
		Sinter	t/kt	0.138	EMEP/EEA EIG 2023
	2C1	Basic oxygen furnaces (BOFs)	t/kt	3.50	EMEP/EEA EIG 2023
		Electric arc furnaces (EAFs)	t/kt	1.70	
	2C3	Primary aluminium	t/kt	120**	

* No production since 2003.

** No production since 2009.

Table A6. 70. Emission factors applied for 2C – TSP, PM10, PM2.5, BC

Pollutant	NFR	Emission source	EF unit	EF	EF reference
TSP	2C1	Blast furnace charging	t/kt	0.05	EMEP/EEA EIG 2023
		Open hearth furnaces	t/kt	1.0*	
		Basic oxygen furnaces (BOFs)	t/kt	0.035	
		Electric arc furnaces (EAFs)	t/kt	0.03	
		Rolling mills – hot	t/kt	0.009	
		Rolling mills – cold	t/kt	0.096	
		Sinter	t/kt	0.20	
	2C2	Ferrosilicon	t/kt	1.00	EMEP/EEA EIG 2023
	2C3	Primary aluminium	t/kt	1.8**	EMEP/EEA EIG 2023
		Secondary aluminium	t/kt	2.00	
	2C5	Primary lead	t/kt	0.006	EMEP/EEA EIG 2023
		Secondary lead	t/kt	0.073	PL (domestic studies)
	2C6	Primary zinc	t/kt	0.015	EMEP/EEA EIG 2023
		Secondary zinc	t/kt	0.015	
	2C7a	Primary and secondary copper (1990-2000)	t/kt	0.32	
PM10	2C1	Blast furnace charging	t/kt	0.04	EMEP/EEA EIG 2023
		Open hearth furnaces	t/kt	0.80*	
		Basic oxygen furnaces (BOFs)	t/kt	0.032	
		Electric arc furnaces (EAFs)	t/kt	0.024	
		Sinter	t/kt	0.10	
	2C2	Ferrosilicon	t/kt	0.85	
	2C3	Primary aluminium	t/kt	1.50**	
		Secondary aluminium	t/kt	1.40	
	2C5	Primary lead	t/kt	0.005	
		Secondary lead	t/kt	0.005	
	2C6	Primary zinc	t/kt	0.013	
		Secondary zinc	t/kt	0.013	
	2C7a	Primary and secondary copper (1990-2000)	t/kt	0.25	
		Primary and secondary copper (2001-2023)	t/kt	0.25/0.32 * TSP	
PM2.5	2C1	Blast furnace charging	t/kt	0.025	EMEP/EEA EIG 2023
		Open hearth furnaces	t/kt	0.60*	
		Basic oxygen furnaces (BOFs)	t/kt	0.028	
		Electric arc furnaces (EAFs)	t/kt	0.021	
		Sinter	t/kt	0.08	
	2C2	Ferrosilicon	t/kt	0.60	
	2C3	Primary aluminium	t/kt	1.10**	
		Secondary aluminium	t/kt	0.55	
	2C5	Primary lead	t/kt	0.0025	
		Secondary lead	t/kt	0.0025	
	2C6	Primary zinc	t/kt	0.012	
		Secondary zinc	t/kt	0.012	
	2C7a	Primary and secondary copper (1990-2000)	t/kt	0.19	
		Primary and secondary copper (2001-2023)	t/kt	0.19/0.32 * TSP	
BC	2C1	Blast furnace charging	% of PM2.5	2.4	EMEP/EEA EIG 2023
		Open hearth furnaces	% of PM2.5	2.4*	
		Basic oxygen furnaces (BOFs)	% of PM2.5	0.36	
		Electric arc furnaces (EAFs)	% of PM2.5	0.36	

Pollutant	NFR	Emission source	EF unit	EF	EF reference
		Sinter	% of PM2.5	0.17	
	2C2	Ferrosilicon	% of PM2.5	10.0	
	2C3	Primary aluminium	% of PM2.5	2.3**	
		Secondary aluminium	% of PM2.5	2.3	
	2C7a	Primary and secondary copper	% of PM2.5	0.1	

* No production since 2003.

** No production since 2009.

Table A6. 71. Emission factors applied for 2C – heavy metals

Pollutant	NFR	Emission source	EF unit	EF	EF reference
Pb	2C1	Blast furnace charging	kg/kt	0.29	S. Hławiczka and J. Fudała (2003)
		Blast furnaces - smelting	kg/kt	4.50	
		Open hearth furnaces	kg/kt	1.40*	
		Basic oxygen furnaces (BOFs)	kg/kt	0.10	
		Electric arc furnaces (EAFs)	kg/kt	5.50	
		Sinter	kg/kt	5.40	
	2C2	Ferrosilicon	kg/kt	0.24	
	2C5	Batteries	kg/kt	5.00	
		Primary lead	kg/kt	560.00	
	2C6	Secondary lead	kg/kt	40.00	
		Primary zinc	kg/kt	113.00	
Cd	2C1	Secondary zinc	kg/kt	85.00	S. Hławiczka and J. Fudała (2003)
		Primary and secondary copper (1990-2000)	kg/kt	19.00	
		Open hearth furnaces	kg/kt	0.2*	
		Basic oxygen furnaces (BOFs)	kg/kt	0.025	
		Electric arc furnaces (EAFs)	kg/kt	0.25	
		Sinter	kg/kt	0.10	
	2C3	Primary aluminium	kg/kt	0.10**	
	2C5	Primary lead	kg/kt	9.80	
		Secondary lead	kg/kt	0.30	
	2C6	Primary zinc	kg/kt	2.50	
		Secondary zinc	kg/kt	14.00	
Hg	2C1	Primary and secondary copper (1990-2000)	kg/kt	0.06	PL (IChPW)***
		Blast furnaces - smelting	kg/kt	0.0000001	EMEP/EEA EIG, 2016
		Basic oxygen furnaces (BOFs)	kg/kt	0.0014	EMEP/EEA EIG 2023
		Electric arc furnaces (EAFs)	kg/kt	0.005	
		Sinter	kg/kt	0.049	S. Hławiczka and J. Fudała (2003)
		Primary lead	kg/kt	3.00	
	2C5	Secondary lead	kg/kt	0.10	EMEP/EEA EIG 2023
		Primary zinc	kg/kt	5.00	
	2C6	Secondary zinc	kg/kt	0.02	S. Hławiczka and J. Fudała (2003)
		Primary and secondary copper (1990-2013)	kg/kt	0.023	
As	2C1	Open hearth furnaces	kg/kt	30*	EMEP/EEA EIG 2023
		Basic oxygen furnaces (BOFs)	kg/kt	0.4	
		Electric arc furnaces (EAFs)	kg/kt	0.015	
		Sinter	kg/kt	0.018	
	2C5	Primary lead	kg/kt	0.10	
		Secondary lead	kg/kt	0.10	
	2C6	Secondary zinc	kg/kt	5.90	
	2C7a	Primary and secondary copper (1990-2000)	kg/kt	4.00	
Cr	2C1	Open hearth furnaces	kg/kt	2.30*	EMEP/EEA EIG 2023
		Basic oxygen furnaces (BOFs)	kg/kt	0.0013	
		Electric arc furnaces (EAFs)	kg/kt	0.10	
		Sinter	kg/kt	0.016	
	2C7a	Primary and secondary copper (1990-2013)	kg/kt	16.00	EMEP/EEA EIG 2023
Cu	2C1	Blast furnaces - smelting	kg/kt	0.003	PL (IETU)
	2C1	Open hearth furnaces	kg/kt	3.0*	EMEP/EEA EIG 2023
	2C1	Basic oxygen furnaces (BOFs)	kg/kt	0.02	
	2C1	Electric arc furnaces (EAFs)	kg/kt	0.02	

Pollutant	NFR	Emission source	EF unit	EF	EF reference
Ni	2C1	Sinter	kg/kt	0.033	
	2C7a	Primary and secondary copper (1990-2000)	kg/kt	32.00	
	2C1	Open hearth furnaces	kg/kt	10*	EMEP/EEA EIG 2023
		Basic oxygen furnaces (BOFs)	kg/kt	0.13	
		Electric arc furnaces (EAFs)	kg/kt	0.70	
		Sinter	kg/kt	0.09	
	2C3	Primary aluminium	kg/kt	0.10**	PL (IETU)
	2C7a	Primary and secondary copper (1990-2013)	kg/kt	14.00	EMEP/EEA EIG 2023
Zn	2C1	Blast furnace charging	kg/kt	0.58	PL (IETU)
		Blast furnaces - smelting	kg/kt	0.021	
		Open hearth furnaces	kg/kt	8.10*	EMEP/EEA EIG 2023
		Basic oxygen furnaces (BOFs)	kg/kt	4.00	
		Electric arc furnaces (EAFs)	kg/kt	3.60	
		Sinter	kg/kt	0.06	
	2C3	Primary aluminium	kg/kt	0.15**	PL (IETU)
	2C5	Primary lead	kg/kt	75.00	EMEP/EEA EIG 2023
		Secondary lead	kg/kt	0.60	
	2C6	Primary zinc	kg/kt	80.00	
		Secondary zinc	kg/kt	150.00	

*No production since 2003; ** No production since 2009; *** EF obtained from the Institute for Chemical Processing of Coal.

Table A6. 72. Emission factors applied for 2C – POPs

Pollutant	NFR	Emission source	EF unit	EF	EF reference
PCDD/F	2C1	Blast furnaces - smelting	mg I-TEQ/kt	0.01	UNEP Toolkit, 2013
		Open hearth furnaces	mg I-TEQ/kt	2.00*	DK EPA, PL (2005)
		Basic oxygen furnaces (BOFs)	mg I-TEQ/kt	0.02	
		Electric arc furnaces (EAFs)	mg I-TEQ/kt	0.003	EMEP/EEA EIG 2023
		Sinter	mg I-TEQ/kt	0.008	
	2C3	Primary aluminium	mg I-TEQ/kt	2.00**	DK EPA, PL (2005)
		Secondary aluminium	mg I-TEQ/kt	35.00***	EMEP/EEA EIG 2023
	2C5	Primary lead	mg I-TEQ/kt	5.00	EMEP/EEA EIG 2023
		Secondary lead	mg I-TEQ/kt	8.00	EMEP/EEA EIG 2023
	2C6	Primary zinc	mg I-TEQ/kt	5.00	EMEP/EEA EIG 2023
		Secondary zinc	mg I-TEQ/kt	100.00	UNEP Toolkit, 2013
	2C7a	Primary and secondary copper	mg I-TEQ/kt	5.00	EMEP/EEA EIG 2023
PCB	2C1	Blast furnace charging	g/kt	0.0064	DK EPA, PL (2005)
		Open hearth furnaces	g/kt	2.60*	NILU (1999)
		Basic oxygen furnaces (BOFs)	g/kt	0.0048	DK EPA, PL (2005)
		Electric arc furnaces (EAFs)	g/kt	2.60	
		Rolling mills - hot	g/kt	2.60	NILU (1999)
		Sinter	g/kt	0.09	EMEP/EEA EIG 2023
	2C5	Primary lead	g/kt	1.90	EMEP/EEA EIG 2023
		Secondary lead	g/kt	3.20	
	2C6	Primary zinc	g/kt	0.90	EMEP/EEA EIG 2023
		Secondary zinc	g/kt	0.0031	
	2C7a	Primary and secondary copper	g/kt	2.60	NILU (1999)
HCB	2C1	Blast furnace charging	g/kt	0.00146	DK EPA, PL (2005)
		Basic oxygen furnaces (BOFs)	g/kt	0.001761	DK EPA, PL (2005)
		Sinter	g/kt	0.03	EMEP/EEA EIG 2023
	2C3	Secondary aluminium	g/kt	***	-
	2C7a	Primary and secondary copper	g/kt	0.06	PL (KGHM)****
Sum of 4 PAHs	2C1	Open hearth furnaces	kg/kt	0.01*	EMEP/EEA EIG 2023
	2C1	Basic oxygen furnaces (BOFs)	kg/kt	0.01	
	2C1	Electric arc furnaces (EAFs)	kg/kt	0.48	
	2C1	Sinter	kg/kt	0.30	

* No production since 2003; ** No production since 2009.

*** From 1998 onwards PARCOM DECISION 96/1 on the phasing-out of the use of hexachloroethane in the non-ferrous metal industry ([https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:21998A0328\(02\)&from=PL](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:21998A0328(02)&from=PL))

**** Trend of EF (weighted using changes in production technologies) obtained from producer (KGHM, Polska Miedź S.A.).

VII.4 Solvent use (NFR sector 2D)

Table A6. 73. Emission factors applied for NFR 2D3a,b,c,d,e,f

NFR	Emission source	EF	EF unit	EF reference
2D3a	NMVOC	1.15	kg/capita	ESIG
	Hg	5.6	mg/person	EMEP/EEA EIG 2016
2D3b	NMVOC	16	g/t asphalt	EMEP/EEA EIG 2023
	TSP	14 000	g/t asphalt	
	PM10	3 000	g/t asphalt	
	PM2.5	400	g/t asphalt	
	BC	5.7	% of PM2.5	
2D3c	CO	9.5	g/t shingle	EMEP/EEA EIG 2023
	NMVOC	130	g/t shingle	
	TSP	1 600	g/t shingle	
	PM10	400	g/t shingle	
	PM2.5	80	g/t shingle	
	BC	0.013	% of PM2.5	
2D3d	NMVOC (waterborne paints)	0.03	t/t paints	PL (IETU)
	NMVOC (conventional solvent paints)	0.5	t/t paints	
2D3e	NMVOC	0.699*	t/t solvent	PL (IETU)
2D3f	NMVOC	0.15	t/1000 people	

* EF for 2021 interpolated based on EFS for 2020 (0.744 t/t solvent) and 2025 (0.669 t/t solvent) obtained from ESIG

Table A6. 74. Emission factors applied for NFR 2D3g

Pollutant	Emission source	EF	EF unit	EF reference
NMVOC	Polyvinylchloride processing	0.0078	t/t	PL (IETU)
	Polystyrene foam processing	0.0600	t/t	EMEP/EEA EIG 2023
	Rubber processing	0.008	t/t	
	Pharmaceutical products manufacturing	0.014	t/1000 people	PL (IETU)
	Paints manufacturing	0.005	t/t	
	Tyres	10	kg/t	EMEP/EEA EIG 2023
	Asphalt blowing	27.2	kg/t	
	Shoes	0.045	kg/pair of shoes	
NH ₃	Leather tanning	0.68	t/kt	EMEP/EEA EIG 2023
TSP	Asphalt blowing	400	g/t asphalt	EMEP/EEA EIG 2023
Cd	Asphalt blowing	0.0001	g/t asphalt	EMEP/EEA EIG 2023
As	Asphalt blowing	0.0005	g/t asphalt	EMEP/EEA EIG 2023
Cr	Asphalt blowing	0.006	g/t asphalt	EMEP/EEA EIG 2023
Ni	Asphalt blowing	0.05	g/t asphalt	EMEP/EEA EIG 2023
PAH	Asphalt blowing	2.55	g/t asphalt	EMEP/EEA EIG 2023

Table A6. 75. NMVOC emission factors applied for NFR 2D3h

Emission source	EF	EF unit	EF reference
Heat set offset	558*	g/kg ink	EMEP/EEA EIG 2023
Publication gravure	210*	g/kg ink not diluted	
Packaging, small flexography	281*	g/kg ink ready to use	
Packaging, large flexography	250*	g/kg ink ready to use	
Packaging, rotogravure	366*	g/kg ink ready to use	

* EF with abatement efficiencies

Table A6. 76. Emission factors applied for NFR 2D3i (other solvent and product use)

Pollutant	Emission source	EF	EF unit	EF reference
NMVOC	Fat, edible oil extraction	0.018	t/t	PL (IETU)
	Glues	562	kg/t	EMEP/EEA EIG 2023
	Adhesives	562	kg/t	
	Preservation of wood (creosote)	105	g/kg creosote	
	Preservation of wood (organic solvent-borne)	945	g/kg preservative	
	Preservation of wood (waterborne)	5	g/kg preservative	
Benzo(a)pyrene	Wood preservation (creosote)	1.05	g/kg creosote	EMEP/EEA EIG 2023
Benzo(b)fluoranthene	Wood preservation (creosote)	0.53	mg/kg creosote	
Benzo(k)fluoranthene	Wood preservation (creosote)	0.53	mg/kg creosote	
Indeno(1.2.3-cd)pyrene	Wood preservation (creosote)	0.53	mg/kg creosote	

VII.5 Other solvent and product use (NFR sector 2G)

Emissions from lubricant use in vehicles has been estimated with the use of COPERT 5 emission factors.

Table A6. 77. Emission factors applied for NFR 2G

Source and pollutant	EF	EF unit	EF reference
Tobacco combustion			
NO _x	1.8	t/kt tobacco	EMEP/EEA EIG 2023
NM VOC	4.84	t/kt tobacco	EMEP/EEA EIG 2023
CO	55.1	t/kt tobacco	EMEP/EEA EIG 2023
NH ₃	4.15	t/kt tobacco	EMEP/EEA EIG 2023
TSP	27	mg/cigarette	EMEP/EEA EIG 2023
PM ₁₀	27	mg/cigarette	EMEP/EEA EIG 2023
PM _{2.5}	27	mg/cigarette	EMEP/EEA EIG 2023
BC	45	% of PM _{2.5} emission	EMEP/EEA EIG 2023
Pb	0.00005	g/t tobacco	IIR Norway 2019
Cd	5.4	µg/cigarette	EMEP/EEA EIG 2023
Ni	2.7	µg/cigarette	EMEP/EEA EIG 2023
Zn	2.7	µg/cigarette	EMEP/EEA EIG 2023
Cu	5.4	µg/cigarette	EMEP/EEA EIG 2023
Hg	0.0001	g/t tobacco	IIR Norway 2019
As	0.000159	g/t tobacco	IIR Norway 2019
Cr	0.000354	g/t tobacco	IIR Norway 2019
PCDD/F	0.1	µg I-TEQ/t tobacco	EMEP/EEA EIG 2023
BaP	0.111	g/t tobacco	EMEP/EEA EIG 2023
BbF	0.045	g/t tobacco	EMEP/EEA EIG 2023
BkF	0.045	g/t tobacco	EMEP/EEA EIG 2023
IDP	0.045	g/t tobacco	EMEP/EEA EIG 2023
Fireworks			
NO _x	260	g/t	EMEP/EEA EIG 2023
SO ₂	3020	g/t	EMEP/EEA EIG 2023
CO	7150	g/t	EMEP/EEA EIG 2023
TSP	109.83	g/t	EMEP/EEA EIG 2023
PM ₁₀	99.92	g/t	EMEP/EEA EIG 2023
PM _{2.5}	51.94	g/t	EMEP/EEA EIG 2023
Ni	30	g/t	EMEP/EEA EIG 2023
Pb	784	g/t	EMEP/EEA EIG 2023
Cd	1.48	g/t	EMEP/EEA EIG 2023
Hg	0.057	g/t	EMEP/EEA EIG 2023
As	1.33	g/t	EMEP/EEA EIG 2023
Cr	15.6	g/t	EMEP/EEA EIG 2023
Cu	444	g/t	EMEP/EEA EIG 2023
Zn	260	g/t	EMEP/EEA EIG 2023

VII.6 Other industry production (NFR sector 2H)

According to the EMEP/EEA Emission Inventory Guidebook 2023, for the activities in the food industry, it is assumed that abatement equipment reduces the NMVOC emissions by 90%, and therefore the default emission factors have been corrected accordingly. The table below shows the adjusted NMVOCs.

Table A6. 78. Emission factors applied for 2H

Pollutant	NFR	Emission source	EF unit	EF	EF reference
NO _x	2H1	Paper pulp (Kraft process)	t/kt	0.92	*
SO ₂	2H1	Paper pulp (Kraft process)	t/kt	0.19	
NMVOC	2H1	Chipboards	t/m ³	0.0002	PL (IETU)
		Paper pulp (Kraft process)	t/kt	2.00	EMEP/EEA EIG 2023
	2H2	Bread	t/kt	0.45	EMEP/EEA EIG 2023
		Wine	t/hl	0.000008	
		Beer	t/hl	0.0000035	
		Spirits	t/hl	0.00004	
		Sugar	t/kt	1.00	
		Slaughter products - cattle and calves	t/kt	0.03	
		Slaughter products - pigs	t/kt	0.03	
		Slaughter products - poultry	t/kt	0.03	
		Slaughter products - fish	t/kt	0.03	
		Margarine and fat spreads, excluding liquid margarine	t/kt	1.00	
		Coffee	t/kt	0.055	
		Prepared feeds for farm animals	t/kt	0.10	
		Prepared pet foods	t/kt	0.10	
CO	2H1	Paper pulp (Kraft process)	t/kt	0.33	*
TSP	2H1	Paper pulp (Kraft process)	t/kt	0.25	*
PM ₁₀	2H1	Paper pulp (Kraft process)	t/kt	0.20	**
	2H2	Handling of agricultural products (grains, soya)	t/kt	0.02	EMEP/EEA EIG 2023
PM _{2.5}	2H1	Paper pulp (Kraft process)	t/kt	0.15	**
BC	2H1	Paper pulp (Kraft process)	% of PM _{2.5}	2.60	EMEP/EEA EIG 2023
PCDD/F	2H2	Smoke houses (excl. afterburning)	mg I-TEQ/kt	6.00	UNEP Toolkit, 2013
	2H2	Smoke houses (incl. afterburning)	mg I-TEQ/kt	0.60	

*EF calculated based on data from the national emissions database. The presented EF applies only to 2024.

**The emissions of PM₁₀ and PM_{2.5} have been calculated as a proportion of the total suspended particulate (TSP) emission. This calculation has been derived from the EMEP/EEA inventory guidebook (EF PM₁₀/EF TSP and EF PM_{2.5}/EF TSP), which provides the share of the emission factors for these pollutants.

VII.7 Wood processing and Other production, consumption, storage, transportation or handling of bulk products (NFR sector 2I)

Table A6. 79. TSP emission factors applied for 2I

NFR	Emission source	EF unit	EF	EF reference
2I	Sawn wood	t/kt	1.00	EMEP/EEA EIG 2023

VIII. NFR SECTOR 3 - AGRICULTURE

Table A6. 80. NH₃ emission factors related to livestock breeding: both NFR 3B and 3D

Livestock slurry	Total NH ₃ EF [kg NH ₃ /animal/yr]	
	EMEP/EEA EIG 2023	CS (IEF)
Dairy cattle slurry	41.8	27.6 (1990) – 40.5 (2024)
Dairy cattle solid	26.4	
Other cattle slurry	15.0	12.7 (1990) – 11.0 (2024)
Other cattle solid	10.0	
Fattening pigs slurry	6.5	4.4 (1990) – 4.4 (2024)
Fattening pigs solid	5.6	
Sows slurry	17.7	8.2 (1990) – 8.6 (2024)
Sows solid	15.1	
Sheep solid	1.4	1.9
Goats solid	1.4	1.4
Horses solid	15.8	21.4
Laying hens solid/slurry	0.31/0.48	0.30
Broilers litter	0.17	0.15
Turkeys litter	0.90	0.77
Other poultry (ducks) litter	0.65	0.62
Other poultry (geese) litter	0.35	0.91
Fur animals	0.03	-

Table A6. 81. PM emission factors applied in source category NFR 3B Manure management

Emission source	EF			EF unit	EF reference
	TSP	PM10	PM2.5		
3B1a Dairy cows	1.380	0.630	0.410	kg/animal	EMEP/EEA EIG 2023 Chapter 3.B Manure Management Table 3.5
3B1b Other cattle (except calves)	0.590	0.270	0.180	kg/animal	
3B1b Other cattle (calves)	0.340	0.160	0.100	kg/animal	
3B2 Sheep	0.140	0.060	0.020	kg/animal	
3B3 Fattening pigs	1.050	0.140	0.006	kg/animal	
3B3 Sows	0.620	0.170	0.010	kg/animal	
3B4d Goats	0.140	0.060	0.020	kg/animal	
3B4e Horses	0.480	0.220	0.140	kg/animal	
3B4gi Laying hens	0.190	0.040	0.003	kg/animal	
3B4gii Broilers	0.040	0.020	0.002	kg/animal	
3B4giii Turkeys	0.110	0.110	0.020	kg/animal	
3B4giv Other poultry (ducks)	0.140	0.140	0.020	kg/animal	
3B4giv Other poultry (geese)	0.240	0.240	0.030	kg/animal	
3B4h Fur animals	0.018	0.008	0.004	kg/animal	

Table A6. 82. NH₃, NO_x and PM emission factors applied in NFR 3D selected subcategories

Emission source	Pollutant	EF	EF unit	EF reference
3Da2a Animal manure applied to soils	NO ₂	0.040	kg NO ₂ / kg manure N applied	EMEP/EEA EIG 2023 Chapter 3.D Table 3.1
3Da3 Animal manure left on pastures				
3Da2b. Sewage sludge applied to soils	NH ₃	0.130	kg NH ₃ /kg N	
	NO ₂	0.040	kg NO ₂ /kg N	T2 based on CS information on operations and D EFs from EMEP/EEA EIG 2023 Chapter 3.D Tables: 3.4 and 3.7
3Dc Agricultural operations	TSP, PM10	2.17 (2024)	kg/ha	
	PM2.5	0.12 (2024)	kg/ha	

Table A6. 83. Emission factors for source category NFR 3F

Pollutant	EF	EF unit	EF reference
BC	500	mg/kg DM	EMEP/EEA EIG 2023 Chapter 3.F Field burning of agricultural residues Table 3-1
TSP	0.0058	kg/kg DM	
PM10	0.0057	kg/kg DM	
PM2.5	0.0054	kg/kg DM	
NMVOC	0.0005	kg/kg DM	
CO	0.0667	kg/kg DM	
NOx	0.0023	kg/kg DM	
SO2	0.0005	kg/kg DM	
NH ₃	0.0024	kg/kg DM	
Cr	0.08	mg/kg DM	
Cu	0.073	mg/kg DM	
Zn	0.56	mg/kg DM	
As	0.0064	mg/kg DM	
Pb	0.11	mg/kg DM	
Cd	0.88	mg/kg DM	
Hg	0.14	mg/kg DM	
Ni	0.052	mg/kg DM	
PCDD/F	0.500	µg TEQ/t	
Benzo(b)fluoranthene	1.097	mg/kg DM	
Benzo(k)fluoranthene	0.468	mg/kg DM	
Benzo(a)pyrene	0.393	mg/kg DM	
Indeno(1,2,3-cd)pyrene	0.336	mg/kg DM	

IX. NFR SECTOR 5 – WASTE

IX.1 Solid waste disposal on land (NFR sector 5A)

Table A6. 84. PM emission factors applied for NFR 5A in 2023

Pollutant	EF	EF unit	EF reference
TSP	0.463	g/t	EMEP/EEA EIG 2023
PM10	0.219	g/t	EMEP/EEA EIG 2023
PM2.5	0.033	g/t	EMEP/EEA EIG 2023
NMVOC	0.194	t/kt CH4	CS

CS – see chapter 6.2.2

IX.2 Biological treatment of waste (NFR sector 5B)

Table A6. 85. Emission factors applied for NFR 5B1

Pollutant	EF	EF unit	EF reference
CO	0.56	kg/t	EMEP/EEA EIG 2023
NH ₃	0.66	kg/t	EMEP/EEA EIG 2023

Table A6. 86. Emission factors applied for NFR 5B2

Pollutant	EF	EF unit	EF reference
NH ₃	0.0275	kg NH3-N/kg N	EMEP/EEA EIG 2023

IX.3 Waste incineration (NFR sector 5C)

IX.3.1 Cremations (NFR sector 5C1bv)

Table A6. 87. Emission factors applied for NFR 5C1bv

Pollutant	EF	EF unit	EF reference
NO _x	0.825	kg/body	EMEP/EEA EIG 2023
NMVOC	0.013	kg/body	EMEP/EEA EIG 2023
SO ₂	0.113	kg/body	EMEP/EEA EIG 2023
CO	0.14	kg/body	EMEP/EEA EIG 2023
TSP	38.56	g/body	EMEP/EEA EIG 2023
PM10	34.7	g/body	EMEP/EEA EIG 2023
PM2.5	34.7	g/body	EMEP/EEA EIG 2023
Pb	30.03	mg/body	EMEP/EEA EIG 2023
Cd	5.03	mg/body	EMEP/EEA EIG 2023
Hg	1.49	g/body	EMEP/EEA EIG 2023
As	13.61	mg/body	EMEP/EEA EIG 2023
Cr	13.56	mg/body	EMEP/EEA EIG 2023
Cu	12.43	mg/body	EMEP/EEA EIG 2023
Ni	17.33	mg/body	EMEP/EEA EIG 2023
Zn	160.12	mg/body	EMEP/EEA EIG 2023
PCDD/F	0.027	µg/body	EMEP/EEA EIG 2023
PCB	0.41	mg/body	EMEP/EEA EIG 2023
HCB	0.15	mg/body	EMEP/EEA EIG 2023
Benzo(a)pyrene	13.2	µg/body	EMEP/EEA EIG 2023
Benzo(b)fluoranthene	7.21	µg/body	EMEP/EEA EIG 2023
Benzo(k)fluoranthene	6.44	µg/body	EMEP/EEA EIG 2023
Indeno(1,2,3-cd)pyrene	6.99	µg/body	EMEP/EEA EIG 2023

IX.3.2 Open burning of agricultural wastes (NFR SECTOR 5C2)

Table A6. 88. Emission factors applied for NFR 5C2

Pollutant	EF	EF unit	EF reference
CO	0.064	t/t	CS
NO _x	0.004	t/t	CS
SO ₂	0.00011	t/t	EMEP/EEA EIG 2023
NMVOC	0.00123	t/t	EMEP/EEA EIG 2023
TSP	0.00464	t/t	EMEP/EEA EIG 2023
PM ₁₀	0.00451	t/t	EMEP/EEA EIG 2023
PM _{2.5}	0.00419	t/t	EMEP/EEA EIG 2023
BC	0.00176	t/t	EMEP/EEA EIG 2023
Cr	0.00001	kg/t	EMEP/EEA EIG 2023
Cu	0.0002	kg/t	EMEP/EEA EIG 2023
Zn	0.01753	kg/t	EMEP/EEA EIG 2023
As	0.00041	kg/t	EMEP/EEA EIG 2023
Se	0.00007	kg/t	EMEP/EEA EIG 2023
Pb	0.00049	kg/t	EMEP/EEA EIG 2023
Cd	0.0001	kg/t	EMEP/EEA EIG 2023
Benzo(b)fluoranthene	0.00463	kg/t	EMEP/EEA EIG 2023
Benzo(k)fluoranthene	0.00568	kg/t	EMEP/EEA EIG 2023
Benzo(a)pyrene	0.00233	kg/t	EMEP/EEA EIG 2023
PCDD/F	0.01	g TEQ/kt	EMEP/EEA EIG 2023

CS – see chapter 6.4.2.2

IX.4 Wastewater handling (NFR sector 5D)

Table A6. 89. Emission factors applied for NFR 5D1 and NFR 5D2

Pollutant	EF	EF unit	EF reference
NH ₃	1.6	kg/person/year	EMEP/EEA EIG 2023
NMVOC	15	mg/m ³	EMEP/EEA EIG 2023

IX.5 Other waste (NFR sector 5E)

Table A6. 90. Emission factors applied for NFR 5E

Pollutant	EF	EF unit	EF reference
PCDD/F (Landfill fires - surface)	0.07	g TEQ/fire	Costner P. 2006
PCDD/F (Landfill fires - deep)	0.35	g TEQ/fire	
PCDD/F (Automobile fires)	0.048	mg/fire	EMEP/EEA EIG 2023
PCDD/F (Detached house fire)	1.44	mg/fire	EMEP/EEA EIG 2023
PCDD/F (Undetached house fire)	0.62	mg/fire	EMEP/EEA EIG 2023
PCDD/F (Apartment building fire)	0.44	mg/fire	EMEP/EEA EIG 2023
PCDD/F (Industrial building fire)	0.27	mg/fire	EMEP/EEA EIG 2023
TSP=PM ₁₀ =PM _{2.5} (Automobile fires)	2.3	kg/fire	EMEP/EEA EIG 2023
TSP=PM ₁₀ =PM _{2.5} (Detached house fires)	143.82	kg/fire	EMEP/EEA EIG 2023
TSP=PM ₁₀ =PM _{2.5} (Undetached house fires)	61.62	kg/fire	EMEP/EEA EIG 2023
TSP=PM ₁₀ =PM _{2.5} (Apartment building fires)	43.78	kg/fire	EMEP/EEA EIG 2023
TSP=PM ₁₀ =PM _{2.5} (Industrial building fires)	27.23	kg/fire	EMEP/EEA EIG 2023

X. MEMO ITEMS

X.1 Aviation (NFR sector 1A3ai)

It was assumed that emission factors for cruise traffic per fuel use are the same as used for LTO cycle.

X.2 Maritime navigation (NFR sector 1A3di)

Table A6. 91. Emission factors applied for 1A3di – International maritime navigation

Pollutant	EF	Unit	EF reference
SO ₂	2*	kg/t	EMEP/EEA EIG 2023
NO _x	69	kg/t	EMEP/EEA EIG 2023
CO	3.67	kg/t	EMEP/EEA EIG 2019
NMVOC	1.67	kg/t	EMEP/EEA EIG 2019
TSP	6.20	kg/t	EMEP/EEA EIG 2019
PM ₁₀	6.20	kg/t	EMEP/EEA EIG 2019
PM _{2.5}	5.60	kg/t	EMEP/EEA EIG 2023
Cd	0.02	g/t	EMEP/EEA EIG 2023
Hg	0.02	g/t	EMEP/EEA EIG 2023
Pb	0.18	g/t	EMEP/EEA EIG 2023
As	0.68	g/t	EMEP/EEA EIG 2023
Cr	0.72	g/t	EMEP/EEA EIG 2023
Cu	1.25	g/t	EMEP/EEA EIG 2023
Ni	32	g/t	EMEP/EEA EIG 2023
Se	0.21	g/t	EMEP/EEA EIG 2023
PCDD/F	0.47	ug I-TEQ/t	EMEP/EEA EIG 2023
PCB	0.57	mg/t	EMEP/EEA EIG 2023
HCB	0.14	mg/t	EMEP/EEA EIG 2019

*emission factor was calculated based on sulphur content in Diesel fuel (in Polish regulations – currently 10 mg/kg) based on guidelines included in EMEP/EEA Emission Inventory Guidebook 2023 assuming that all sulphur in the fuel is transformed completely into SO₂, then $EF = 2 \times S$, where S is the maximal allowed sulphur content in fuel

X.3 Forests fires (NFR sector 11B)

Table A6. 92. Emission factors applied for 11B

Pollutant	EF	EF unit	EF Reference
NO _x	0.0003	t/t dry mass	IPCC 2006
NMVOC	0.021	kg NMVOC/t C emitted as CO ₂	EEA/EMEP EIG 2023
CO	0.107	t/t dry mass	IPCC 2006
TSP	17.00	g/kg	EEA/EMEP EIG 2023
PM ₁₀	11.00	g/kg	EEA/EMEP EIG 2023
PM _{2.5}	9.00	g/kg	EEA/EMEP EIG 2023
BC	0.09	% of PM _{2.5}	EEA/EMEP EIG 2023
PCDD	1.00	mg TEQ/kt	UNEP Toolkit, 2013

X.4 Other natural emissions (NFR sector 11C)

Table A6. 93. NMVOC emission factors applied for 11C

Emission source	EF	EF unit	EF Reference
Managed coniferous forests	25.137	kg/ha	IOS-PIB*
Managed mixed forests	29.742	kg/ha	IOS-PIB*
Managed broadleaves forests	39.849	kg/ha	IOS-PIB*

*Methodology and data used for estimating above mentioned EF is provided in Appendix 2.

Appendix 7. 2025 TECHNICAL REVIEW OF NATIONAL EMISSION INVENTORIES

I. Review under Directive (EU) 2016/2284 (National Emission reduction Commitments Directive)

Changes recommended during 2025 review are presented below in the format of tables from the report “Final Review Report 2025. Review of National Air Pollutant Emission Inventory Data 2025 under Directive(UE) 2016/2284 (National Emission reduction Commitments Directive) Service Contract No. 09.0202/2023/903481/SER/ENV.C.3. Poland”. These changes are described in more detail in IIR 2026 chapters, concerning sectoral methodologies and recalculations. The column IIR chapter lists reference to the relevant chapter of the IIR report.

Table A7. 1. All findings for NO_x, NMVOC, SO₂, NH₃, PM_{2.5} and PM₁₀, including those made during the 2025 NECD inventory review and those not implemented from the 2024 NECD inventory review

	Observations	NFR, Pollutant(s), Year(s)	Recommendation	Action undertaken	IIR chapter
1	PL-1A2d-2025-0001	1A2d Stationary Combustion In Manufacturing Industries And Construction: Pulp, Paper And Print, NMVOC, 1990-2023	For category 1A2d Stationary Combustion In Manufacturing Industries And Construction: Pulp, Paper And Print, pollutant NMVOC, all years the TERT notes that a Tier 1 method is used for a key category. This over-estimate may have an impact on total emissions that is above the threshold of significance. The TERT is of the view that the use of a Tier 2 or Tier 3 method could be possible for Poland if more fuel-, technology- and country-specific information are available. In response to a question raised during the review, Poland explained that NMVOC emissions in this category come mainly from biomass combustion (biomass accounts for 89% of all fuels in this category) in power plants and provided a revised estimate using the Tier 2 NMVOC emission factor from the 2023 EMEP/EEA Guidebook, Chapter 1A1, Table 3-15. The TERT agreed with the revised estimate provided by Poland. The TERT recommends that Poland include the revised estimate in the next submission, to make effort to implement Tier 2 methodology for other fuels and pollutants as well, and to include a description in the IIR.	Poland has implemented the corrections in accordance with the TERT recommendation.	3.3.6
2	PL-1A2gviii-2025-0002	1A2gviii Stationary Combustion In Manufacturing Industries And Construction: Other, NO _x , 1990-2023	For category 1A2gviii Stationary Combustion In Manufacturing Industries And Construction: Other, pollutant NO _x , all years the TERT notes that a Tier 1 method is used for a key category. This over-estimate may have an impact on total emissions that is above the threshold of significance. The TERT is of the view that the use of a Tier 2 or Tier 3 method could be possible for Poland if more fuel-, technology- and country-specific information are available. In response to a question raised during the review, Poland explained that they consider using Tier 2 emission factors from the 2023 EMEP/EEA Guidebook Table 3-29 for category 1A4a Commercial/Institutional for diesel, which is mainly used in power generators in this category. For biomass, which is the second main source of NO _x emissions, Poland use a Tier 1 EF from the 2023	Poland has implemented the corrections in accordance with the TERT recommendation. As TERT suggested that use of diesel in gas turbines might not be the most typical, but rather the diesel might be used in diesel engines, Poland verified used NO _x emission factors. Ultimately, it was decided to use the country specific NO _x emission factors from the study prepared by KOBiZE for the purposes of reporting pollutant emissions to the National Emission Database.	3.3.6

	Observations	NFR, Pollutant(s), Year(s)	Recommendation	Action undertaken	IIR chapter
			EMEP/EEA Guidebook for 1A2 Stationary Combustion In Manufacturing Industries And Construction, which is equivalent to Tier 2 EF for 1A4ai Commercial/Institutional: Stationary (91 g/GJ). Poland provided revised estimates for years 2005, 2020-2023. The TERT agreed with the revised estimate provided by Poland. The TERT notes that use of diesel in gas turbines might not be the most typical, but rather the diesel might be used in diesel engines, and the TERT recommends that Poland review the technologies used for gas oil and revise the choice of emission factors if appropriate. The TERT recommends that Poland include the revised estimate in the next submission. The TERT commends Poland for providing provisional estimates for other fuels and recommends Poland to make effort to implement Tier 2 methodology for other fuels and pollutants as well and include a description in the IIR.		
3	PL-2D3i-2024-0002	2D3i Other Solvent Use, NMVOC, 1990-2023	For 2D3i Other Solvent Use, NMVOC, all years, the TERT notes that Poland use the Tier 1 emission factor from the 2023 EMEP/EEA Guidebook for the calculations of emissions of glues and adhesives whilst the information exists to estimate using a Tier 2 method. Other components of sector 2D3i are already estimated using a Tier 2 method. In response to a question raised during the review, Poland calculated the solvent content of glues and adhesives used within the country, in order to apply appropriate Tier 2 emission factors from the 2023 EMEP/EEA Guidebook. Poland provided revised estimates for years 2005, 2020-2023 and stated that it will be included in the next submission. The TERT agreed with the revised estimate provided by Poland. The TERT recommends that Poland include the revised estimate in the next submission.	Poland has implemented the corrections in accordance with the TERT recommendation.	4.5.6
4	PL-3Da4-2025-0001	3Da4 Crop Residues Applied To Soils, NH ₃ , 1990-2023	For 3Da4 Crop Residues Applied To Soils, the TERT noted that NH₃ emissions are reported using the notation key 'NE' (Not estimated) for all years of the time series when a Tier 1 and default EF method are available in the 2023 EMEP/EEA Guidebook. This resulted in an under-estimate of emissions above the threshold of significance. In response to a question raised during the review, Poland provided the initial estimates for the years 2005 and 2020–2023 and confirmed that the efforts to improve the results will be continued. The TERT agreed with the revised estimate provided by Poland. The TERT recommends that Poland report emissions from 3Da4 Crop Residues Applied To Soils in the next submission and document all underlying parameters utilised along with reference sources and encourages Poland to continue the work to refine the data and the assumptions required for this category.	Poland has reported this new source of NH ₃ emissions following method as presented during the review	5.4.2.5

	Observations	NFR, Pollutant(s), Year(s)	Recommendation	Action undertaken	IIR chapter
5	PL-0A-2025-0001	0A National Total - National Total For The Entire Territory - Based On Fuel Sold/Fuel Used, SO ₂ , NO _x , NH ₃ , NMVOC, PM _{2.5} , PAHs, PCBs, HCB, Cd, Hg, Pb, PCDD/F, 1990-2023	The TERT notes that there is a lack of transparency regarding the NFR tables and the value 'zero' reported in several instances. This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Poland explained that correct Notation Keys will be used for the relevant pollutant, sector and year combinations. The TERT recommends that Poland use the correct Notation Keys in the NFR tables where no emissions are reported to aid transparency.	Poland has implemented the corrections in accordance with the TERT recommendation.	Annex I
6	PL-1A3dii-2025-0001	1A3dii National Navigation (Shipping), PM ₁₀ , 1990-2023	For category 1A3dii National Navigation (Shipping), pollutant PM₁₀, all years, an observation has been created related to recalculations being applied only to PM₁₀, but not to PM_{2.5}. Studying the 2025 IIR, the TERT could not find a relevant explanation. In response to a question raised during the review, Poland answered that recalculation has been applied based on new emission factors from the 2023 EMEP/EEA Guidebook, which include EFs only for PM₁₀ from combustion of fuel oil and marine diesel oil; for this reason, the EFs for PM_{2.5} remain unchanged. To resolve the issue of PM₁₀ being less than PM_{2.5} (see observation PL-1A3dii-2025-0002), Poland suggested to apply the same emission factor for PM_{2.5} as for PM₁₀ in the next submission. The TERT agreed with this suggestion and confirms that this change is below the threshold of significance. The TERT recommends that Poland recalculate the PM_{2.5} values to be at least equal to (and not higher than) PM₁₀.	Poland has recalculate the PM _{2.5} by updating of its emission factor, which is now equal to the emission factor of PM ₁₀ .	IIR 3.4.6. Appendix 6 VI.5 Transport (NFR sector 1A3) VI.5.4 Navigation (NFR sector 1A3d)
7	PL-1A3dii-2025-0002	1A3dii National Navigation (Shipping), PM _{2.5} , 1990-2023	For category 1A3dii National Navigation (Shipping), pollutant PM_{2.5}, all years, an observation has been created related to PM₁₀ being less than PM_{2.5}, which is not expected. Studying the 2025 IIR, the TERT could not find a relevant explanation. In response to a question raised during the review, Poland answered that recalculation has been applied based on new emission factors from the latest version (2023) of the EMEP/EEA Guidebook, which include EFs only for PM₁₀ from combustion of fuel oil and marine diesel oil, for this reason the EFs for PM_{2.5} remain unchanged. To resolve the issue of PM₁₀ being less than PM_{2.5}, Poland suggested to apply the same emission factor for PM_{2.5} as for PM₁₀ in the next submission. The TERT agreed with this suggestion and confirms that this change is below the threshold of significance. The TERT recommends that Poland recalculate the PM_{2.5} values to be at least equal to (and not higher than) PM₁₀.	Poland has recalculate the PM _{2.5} by updating of its emission factor, which is now equal to the emission factor of PM ₁₀ .	IIR 3.4.6. Appendix 6 VI.5 Transport (NFR sector 1A3) VI.5.4 Navigation (NFR sector 1A3d)

	Observations	NFR, Pollutant(s), Year(s)	Recommendation	Action undertaken	IIR chapter
8	PL-2D3e-2025-0001	2D3e Degreasing, NMVOC, 2005-2023	For category 2D3e Degreasing, NMVOCs, and 2005-2023, the TERT notes that there is a lack of transparency regarding the assumptions taken into account in the emission factor, particularly as the emission factor decreases over time. In the IIR, Poland currently state that the emission factor has been obtained from IIASA. This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Poland explained that the emission factor considers the share of control technology applications, and the removal efficiency for each sector/technology combination. The TERT recommends that Poland engage further with IIASA to understand the assumptions used in the calculation of the emission factor for NMVOC from 2D3e Degreasing to determine its applicability over time. The TERT further recommends Poland include a more detailed description of the assumptions taken into account in the emission factor within the IIR.	The assumptions will be discussed with IIASA during the meeting(s) scheduled for March-May 2026.	
9	PL-2D3i-2024-0001	2D3i Other Solvent Use, PM2.5, PM10, 1990-2023	For 2D3i Other Solvent Use, PM2.5 and PM10, all years, the TERT notes that there may be an under-estimate of emissions. The TERT notes that this under-estimate may be due to the fact that no PM2.5 emissions are reported for Fat, edible and non-edible oil extraction, while a method exists in the 2023 EMEP/EEA Guidebook (chapter 2D3i, 2G Other Solvent And Product Use, table 3.4). In response to a question raised during the review, Poland explained that due to lack of activity data (quantities of seed used of tonnes per year), Poland is not presently able to estimate emissions from PM2.5, and Poland takes efforts to improve emission estimates from this category. Poland has engaged with IIASA and the Polish Association of Oil Producers (PAOP) in this respect. The TERT notes that the issue is below the threshold of significance for a technical correction. The TERT recommends that Poland further engage with IIASA to understand the methodology implemented further, and to continue to work with the PAOP to gather information on seed-oil processes. The TERT recommends Poland to include PM2.5 and PM10 emissions from Fat, edible and non-edible oil extraction at the earliest available opportunity.	Poland took effort to develop a Tier2 methodology for calculating emissions from this category. This methodology is now under scrutiny. It is planned to be implemented in the inventory for the next submission.	4.5.7
12	PL-2H1-2022-0001	2H1 Pulp And Paper Industry, SO2, 1990-2023	For 2H1 Pulp And Paper Industry, SO2, all years, the TERT notes that emissions from pulp production are estimated using the Tier 2 emission factor from the 2023 EMEP/EEA Guidebook Chapter 2H1 Table 3.2, which may over-estimate emissions at modern kraft pulp plants in Poland. This was raised during the 2022, 2023, and 2024 NECD inventory reviews. The TERT notes that the issue is below the threshold of significance for a technical correction. The TERT notes that the IIR section 4.7.7 (page 139) states that Poland is looking into the possibility of estimating emissions based on a Tier 3 methodology, using data from the National Emission Database and checking	Poland has revised the methodology used to calculate the emissions of pollutants produced during the kraft process of paper production. Poland contacted paper manufacturers and requested relevant data. Following an analysis of the availability of production and emission data (including data in National Emission Database), Poland adopted the new approach to calculate TSP, CO, NOx, and SO2 emissions.	4.7.2.1.

	Observations	NFR, Pollutant(s), Year(s)	Recommendation	Action undertaken	IIR chapter
			other sources for category 2H1 Pulp and Paper Industry. The results of this analysis will be included in the estimates as soon as possible. The TERT reiterates the recommendation that Poland carry out the analysis of the emission data from the National Emission Database and report the revised emissions using a Tier 3 methodology in the next submission.		
13	PL-2H2-2022-0001	2H2 Food And Beverages Industry, TSP, 1990-2023	For category 2H2 Food And Beverages Industry, for TSP, for all years, the TERT notes that Poland have estimated emissions of PM10, however have reported TSP as 'NE' (Not Estimated) whereas the TERT expects that emissions of TSP would be at least as great as PM10. In response to a question raised during the review, Poland said that they agree with the TERT and will implement the PM10 emission factor to estimate emissions of TSP in lieu of more appropriate data being available in the latest EMEP/EEA Guidebook in relation to emissions from the handling of agricultural products. The TERT notes that the issue is below the threshold of significance for a technical correction. The TERT recommends that Poland follow up on their intention and report TSP emissions for the handling of agricultural products in 2H2 Food And Beverages Industry by utilising the PM10 emission factor.	Poland has implemented the corrections in accordance with the TERT recommendation.	4.7.2.2.
14	PL-2H3-2025-0001	2H3 Other Industrial Processes, SO ₂ , NO _x , NMVOC, PM _{2.5} , 1990-2023	For category 2H3 Other Industrial Processes, for all pollutants and for all years, the TERT notes that Poland report emissions to be Not Occurring 'NO'. The TERT believes that it is likely that there are processes and/or uses of products that are not captured under the current reporting structure. In response to a question raised during the review, Poland stated that they have conducted research in 2022 where it was found that no activities taking place in Poland would fall into category 2H3. In the 2025 submission, Poland carried out further research which has resulted in investigating moving lead emissions reported under NFR 2C5 to NFR 2H3; the TERT believes that emissions from lead battery manufacture should be reported in 2C5 Lead Production. The TERT notes that the issue is below the threshold of significance for a technical correction. The TERT recommends that Poland retain emissions from lead battery manufacture within 2C5 Lead Production in the 2026 submission.	Poland retained emissions from lead battery manufacture within 2C5 Lead Production.	Appendix 5. Activity Data, II. NFR SECTOR 2 – INDUSTRIAL PROCESSES AND PRODUCT USE
15	PL-3B-2025-0002	3B Manure Management, NH ₃ , 1990-2023	For category 3B Manure Management for pollutant NH ₃ emissions, for the period between 2005 - 2023, the TERT notes that there is lack of transparency regarding how the data on abatement techniques for manure storage systems were obtained, reference sources consulted and what assumptions were made. This does not relate to an over- or under-estimate of emissions. In response to a question raised during the review, Poland listed the information sources that were consulted and explained how the penetration rates of various abatement techniques were developed.	Poland has completed description related to NH ₃ abatement techniques applied	5.3.2 <i>Ammonia abatement techniques</i>

	Observations	NFR, Pollutant(s), Year(s)	Recommendation	Action undertaken	IIR chapter
			The TERT recommends that Poland improve transparency by including reference sources consulted and assumptions made to collect the data on abatement techniques and develop relevant penetration rates.		
16	PL-3B1b-2025-0002	3B1b Manure Management - Non-Dairy Cattle, NH ₃ , 2005, 2020-2022	For category 3B1b Manure Management – Non-Dairy Cattle, pollutant NH ₃ , and the years 2005, 2020, 2021, and 2022, the TERT notes a lack of transparency regarding significant recalculations that have taken place. These recalculations do not relate to an over- or under-estimation of emissions. In response to a question raised during the review, Poland explained that the recalculations were made due to updated data on manure management systems, which were collected as part of the Agricultural Census 2020. The TERT recommends that Poland improve transparency by providing clear explanations for the significant recalculations in category 3B1b Manure Management – Non-Dairy cattle for pollutant NH₃ and the years 2005, 2020, 2021, and 2022.	Poland has expanded description of recalculations made	5.8
17	PL-3B4gii-2025-0001	3B4gii Manure Management - Broilers, NH ₃ , 2005, 2020-2022	For category 3B4gii Manure Management - Broilers, pollutant NH ₃ , and the years 2005, 2020, 2021, and 2022, the TERT notes a lack of transparency regarding significant recalculations that have taken place. These recalculations do not relate to an over- or underestimation of emissions. In response to a question raised during the review, Poland explained that the recalculations were made due to updated data on manure management systems, which were collected as part of the Agricultural Census 2020. The TERT recommends that Poland improve transparency by providing clear explanations for the significant recalculations in category 3B4gii Manure Management – Broiler for pollutant NH₃ and the years 2005, 2020, 2021, and 2022.	Poland has expanded description of recalculations made	5.8
18	PL-3Da2a-2025-0001	3Da2a Application Of Manure On The Fields, NH ₃ , 2005, 2020-2022	For category 3Da2a Application Of Manure On The Fields, pollutant NH ₃ , and the years 2005, 2020, 2021, and 2022, the TERT notes a lack of transparency regarding significant recalculations that have taken place. These recalculations do not relate to an over- or under-estimation of emissions. In response to a question raised during the review, Poland explained that the recalculations were made due to updated data on manure management systems, which were collected as part of the Agricultural Census 2020. The updated data affected the information on the amounts of manure available for application to soils. The TERT recommends that Poland improve transparency by providing clear explanations for the significant recalculations in category 3Da2a Application Of Manure On The Fields for pollutant NH₃ and the years 2005, 2020, 2021, and 2022.	Poland has expanded description of recalculations made	5.8

	Observations	NFR, Pollutant(s), Year(s)	Recommendation	Action undertaken	IIR chapter
19	PL-3De-2025-0001	3De Cultivated Crops, NMVOC, 1990-2023	For category 3De Cultivated Crops, pollutant NMVOC, and all reporting years, the TERT notes that Poland did not consider part of the data on cultivation area and yields for certain crop categories. This relates to an under-estimate of emissions. In response to a question raised during the review week, Poland provided revised estimates that included all crop categories cultivated in the country. The TERT notes that the issue is below the threshold of significance for a technical correction. The TERT recommends that Poland improve the accuracy of reporting by considering all crop categories and relevant underlying parameters in the estimates of NMVOC emissions for the entire reporting period, and by clearly documenting the underlying parameters.	Poland has implemented NMVOC estimations in this subcategory based on data provided during review	5.4.2.7
20	PL-5A-2025-0001	5A Biological Treatment Of Waste - Solid Waste Disposal On Land, NMVOC, 1990-2023	For 5A Biological Treatment Of Waste - Solid Waste Disposal On Land, for NMVOC and years 1990-2023, the TERT notes that in the IIR, page 354, Table A6.83 there is a lack of transparency regarding the used emission factor for NMVOC of 0.194 t/kt CH₄ as there is no reference on how this emission factor is derived. In response to a question raised during the review, Poland refers to the recommendation on issue PL-5A-2019-0001 where the TERT recommended to use the amount of produced methane coming from landfills reported to the UNFCCC (as mentioned in the footnote under the Tier 1 table of the 2019 EMEP/EEA Guidebook). The TERT notes with regards to this answers that the methodology of using the methane production from landfills in the 2023 EMEP/EEA Guidebook is in fact the new Tier 1 methodology. The TERT notes that the issue is below the threshold of significance for a technical correction. The TERT recommends that Poland use the methodology from the 2023 EMEP/EEA Guidebook.	Poland has implemented the recommendation.	6.2.2.
21	PL-5A-2025-0002	5A Biological Treatment Of Waste - Solid Waste Disposal On Land, PM2.5, PM10, TSP, 1990-2023	For 5A Biological Treatment Of Waste - Solid Waste Disposal On Land, for TSP, PM10, PM2.5 and years 1990-2023, the TERT notes that there may be an over-estimate of emissions that does not have an impact on total emissions that is above the threshold of significance. The TERT notes that this over-estimate may be due to calculating the PM emissions using the default emission factors for mineral waste handled with the total amount of deposited waste instead of just with the mineral waste handled as explained in the 2023 EMEP/EEA Guidebook. In response to a question raised during the review, Poland explained that this was recommended in the 2-19 EMEP/EEA Guidebook and that the new methodology in the 2023 EMEP/EEA Guidebook requires additional analysis and that the Eurostat data and national databases for estimating the amount of mineral waste handled and that new estimates will be prepared for the 2026 submission. The TERT notes that the issue is below the threshold of significance for a technical correction.	Analysis on amounts of landfilled mineral waste is planned.	6.2.7.

	Observations	NFR, Pollutant(s), Year(s)	Recommendation	Action undertaken	IIR chapter
			The TERT recommends in general that Poland aim to annually implement the latest version of the EMEP/EEA Guidebook and specifically that Poland estimate and explain the emissions from handling of mineral waste in the 2026 submission.		
22	PL-5B2-2025-0001	5B2 Biological Treatment Of Waste - Anaerobic Digestion At Biogas Facilities, NH3, 1990-2023	For 5B2 Biological Treatment Of Waste – Anaerobic Digestion At Biogas Facilities and NH3 and years 1990-2023, the TERT notes that there is a lack of transparency as the annual N content in the feedstock of the anaerobic digesters is not reported in the IIR and/or NFR table. The TERT is unable to determine whether there is an over- or under-estimate that may be above the threshold of significance. In response to a question raised during the review, Poland produced a detailed table with the annual N-feedstock of all waste streams that are anaerobic digested. The TERT recommends that Poland report the total N-feedstock as activity data in the NFR table and explain in the IIR what waste streams are included in the feedstock in the 2026 submission.	Poland has implemented the recommendation.	Appendix 5.
23	PL-5C-2025-0001	5C Waste Incineration, SO2, NOx, NH3, NMVOC, PM2.5, BaP, PAHs, PCBs, HCB, Cd, Hg, Pb, PCDD/F, PM10, CO, BC, TSP, 1990-2023	For 5C1bi Industrial Waste Incineration, 5C1bii Hazardous Waste Incineration, 5C1biii Clinical Waste Incineration and all relevant pollutants and years 1990-2023, the TERT notes that there is a lack of transparency regarding the reconstruction/refit of the incinerators with energy recovery technology. In response to a question raised during the review, Poland explained that energy recovery was installed in over several years. The TERT notes that under 5C for all sub-categories of waste incineration the notation key 'IE' is used. However, during the time period 1990-2023 waste incineration without energy recovery is also taking place and thus a split between with and without energy recovery is expected. The TERT recommends the use of notation key 'NO' (not occurring) in the case where all incineration is with energy recovery (so also for 5C1a Municipal Waste Incineration). The TERT recommends that Poland evaluate a split between with and without energy recovery between 1A Fuel Combustion Activities and 5C Waste Incineration and give a clear explanation in the IIR on when energy recovery (partly and full) was installed for the different NFR categories and for years that all incineration is with energy recovery use the notation key 'NO'.	Evaluation of split between with and without energy recovery between 1A Fuel Combustion Activities and 5C Waste Incineration is planned	6.4.7.

Table A7. 2. All findings for heavy metals and POPs, including those made during the 2025 NECD inventory review and those not implemented from the 2021 NECD inventory review

	Observations	NFR, Pollutant(s), Year(s)	Recommendation	Action undertaken	IIR chapter
1	PL-1A3bvi-2025-0001	1A3bvi Road Transport: Automobile Tyre And Brake Wear, PAHs, 1990-2023	For category 1A3bvi Road Transport: Automobile Tyre And Brake Wear, pollutant PAHs, all years, the TERT noted that the emissions are reported as 'NE' (not estimated) in the NFR tables, while the 2023 EMEP/EEA Guidebook provides the speciation of tyre and brake wear for PAHs in Table 3-10 (p. 22). In response to a question raised during the review, Poland answered that the latest version of COPERT does not calculate PAHs values in the 1A3bvi category. The TERT notes that the issue is below the threshold of significance for a technical correction. The TERT recommends that Poland calculate these emissions using a methodology based on the 2023 EMEP/EEA Guidebook in the next submission, until COPERT is updated to include these calculations.	Poland has implement the recommendation by calculating PAHs emissions using the methodology based on the 2023 EMEP/EEA Guidebook.	3.4.6.
2	PL-2C3-2025-0001	2C3 Aluminium Production, PCDD/F, 2008-2023	For 2C3 Aluminium Production, pollutants PCDD/F from 2008 onwards, the TERT notes Poland report 'NE' whilst secondary aluminium production continues to occur. In response to a question raised during the review, Poland stated that Poland is investigating the use of a PCDD/F emission factor for secondary aluminium production which is representative of the abatement techniques used in the country. The TERT recommends that Poland investigate a suitable PCDD/F emission factor to use for estimating emissions of secondary aluminium production for the 2026 submission. If no suitable emission factor is found, the TERT recommends Poland implement the Tier 2 emission factor presented in the 2023 EMEP/EEA Guidebook for secondary aluminium production. The TERT further recommends Poland consider the note below Table 3-4 in the 2023 EMEP/EEA Guidebook, where it suggests that emissions of PCDD/F are not applicable in secondary aluminium production if hexachloroethane is prohibited for degassing.	Poland has implemented the recommendations.	4.4.3.
3	PL-5-2020-0005	5C1biii Clinical Waste Incineration, Cd, Hg, 1990-2023	For 5C1biii Clinical Waste Incineration, for Cd and Hg, for all years, the TERT notes that Poland made recalculations following the recommendation made during the 2020 review. The TERT notes that the issue is that based on the information contained in the 2020 IIR, it was not possible for the TERT to check the underlying calculations. In response to a question raised during the 2021 review, Poland provided the TERT with information on the split between technologies as well as the abatement efficiencies used for the different technologies and that the issue is below the threshold of significance for a technical correction. In response to a question in the 2025 review, Poland explained that the spilt was made and is implemented in the NFR tables, and emissions from	Poland has implemented the recommendations.	Appendix 5. and Appendix 6.

	Observations	NFR, Pollutant(s), Year(s)	Recommendation	Action undertaken	IIR chapter
			5C1biii were reallocated to 1A but that explaining this in the IIR was overlooked and that this will be added to the IIR in the 2026 submission. The TERT reiterates the recommendation that Poland include an explanation on the split in technology as well as the abatement efficiencies used for the different technologies in the 2026 submission of the IIR.		
4	PL-5-2020-0006	5C1biv Sewage sludge incineration, HCB, 1990-2023	For 5C1biv Sewage Sludge Incineration, for HCB and all years, the TERT notes that there is a lack of transparency in the IIR regarding the split of activity data between technologies and applied abatement efficiencies. This does not relate to an over- or under-estimate of emissions. This was raised during the 2020 and 2021 NECD inventory review. In response to a question raised during the 2025 review, Poland explained that further analysis concluded that all incineration of sewage sludge is with energy recovery and as such the emissions are now reported under 1A1a Public Electricity And Heat Production and that the explanation on the methodology used was changed and mistakenly the information on the split between technologies for activity data as well as the abatement efficiencies used for the different technologies was omitted. The TERT reiterates the recommendation that Poland include the information on the split between technologies for activity data as well as the abatement efficiencies used for the different technologies in the 2026 submission of the IIR.	Poland has implemented the recommendations.	Appendix 5. and Appendix 6.
5	PL-5C1bi-2019-0001	5C1bi Industrial Waste Incineration, HCB, PCDD/F, 1990-2023	For 5C1bi Industrial Waste Incineration, for HCB and PCDD/F, the TERT notes that Poland made recalculations following the recommendation made during the 2020 review. However, based on the information contained in the IIR, it was not possible for the TERT to check the underlying calculations. This was raised during the 2019, 2020, and 2021 NECD inventory review. In response to a question raised during the 2021 review, Poland provided the TERT with information on the split between technologies for activity data as well as the abatement efficiencies used and the emission factors used for the different technologies. The TERT notes in the 2025 review that this split between technologies for activity data as well as the abatement efficiencies used and the emission factors used for the different technologies is not included in the IIR. In response to a question, Poland explained that the split is implemented in the 2025 inventory and emissions from 5C1bi were reallocated to 1A Fuel Combustion Activities but that an explaining on the split in technologies in the IIR was overlooked and that this will be added to the IIR in the 2026 submission. The TERT reiterates the recommendation that Poland include an explanation on the split in technology as well as the abatement	Poland has implemented the recommendations.	Appendix 5. and Appendix 6.

	Observations	NFR, Pollutant(s), Year(s)	Recommendation	Action undertaken	IIR chapter
			efficiencies used for the different technologies in the 2026 submission of the IIR.		
6	PL-5E-2025-0001	5E Other Waste, Cd, Hg, Pb, 1990-2023	For 5E Other Waste and Cd, Hg, Pb and years 1990-2023 the TERT notes that there may be an under-estimate of emissions as no emissions from these priority heavy metals are reported while emission factors are available in the 2023 EMEP/EEA Guidebook. In response to a question raised during the review, Poland calculated the emissions from these pollutants. The TERT notes that the issue is below the threshold of significance for a technical correction. The TERT recommends that Poland include the emissions from Cd, Hg and Pb for all years in the 2025 submission of the IIR and NFR tables.	Poland has implemented the recommendation.	6.6.2.

Appendix 8. UNCERTAINTY ANALYSIS OF EMISSIONS OF SELECTED AIR POLLUTANTS

The general information concerning uncertainty analysis is presented in Chapter 1.7. Detail results are presented in Appendix 8 in Excel format.

Appendix 9. SUMMARY INFORMATION ON CONDENSABLES IN PM

Table A9.1. Inclusion/exclusion of the condensable component in/from PM₁₀ and PM_{2.5} emission factors

NFR	Source / sector name	Condensable component		EF reference and/or comments
		Included	Excluded	
NFR 1 - Energy				
1A1a	Public electricity and heat production		x	CS EFs for coal and biomass, for other fuels EMEP/EEA EIG 2023 EFs - represent filterable PM emissions
1A1b	Petroleum refining		x	EMEP/EEA EIG 2023 EFs, PM factors represent filterable PM emissions only
1A1c	Manufacture of solid fuels and other energy industries	Unable to confirm		EMEP/EEA EIG 2023 EFs: for coal there is no identification; for gaseous and oil EFs represent filterable PM emissions
1A2	Stationary combustion in manufacturing industries and construction	Unable to confirm		EMEP/EEA EIG 2023 EFs: unclear whether they represent filterable PM or total PM emissions
1A3ai(i)	International aviation LTO (civil)	Unable to confirm		EFs are taken from the EMEP/EEA EIG 2009 without indication, probably filterable only
1A3aii(i)	Domestic aviation LTO (civil)	Unable to confirm		EFs are taken from the EMEP/EEA EIG 2009 without indication, probably filterable only
1A3bi	Road transport: Passenger cars	x		EMEP/EEA EIG 2023 (COPERT 5.8.1.)
1A3bii	Road transport: Light duty vehicles	x		EMEP/EEA EIG 2023 (COPERT 5.8.1.)
1A3biii	Road transport: Heavy duty vehicles and buses	x		EMEP/EEA EIG 2023 (COPERT 5.8.1.)
1A3biv	Road transport: Mopeds & motorcycles	x		EMEP/EEA EIG 2023 (COPERT 5.8.1.)
1A3bvi	Road transport: Automobile tyre and brake wear	x		EMEP/EEA EIG 2023 (COPERT 5.8.1.)
1A3bvii	Road transport: Automobile road abrasion	x		EMEP/EEA EIG 2023 (COPERT 5.8.1.)
1A3c	Railways	Unable to confirm		EFs are taken from the EMEP/EEA EIG 2023 without indication, probably filterable only
1A3di(ii)	International inland waterways	IE		included in 1A3dii
1A3dii	National navigation (shipping)	Unable to confirm		EFs are taken from the EMEP/EEA EIG 2023 without indication, probably filterable only
1A3ei	Pipeline transport		x	EMEP/EEA EIG 2019
1A4ai	Commercial/Institutional: Stationary	x (for solid fuels)		ITPE, 2021: EFs for solid fuels represent total PM (filterable and condensable) EMEP/EEA EIG 2023 EFs: unclear whether the EFs for liquid and gaseous fuels represent filterable PM or total PM emissions
1A4aii	Commercial/Institutional: Mobile	IE		Included in 1A3b
1A4bi	Residential: Household and gardening (mobile)	x (for solid fuels)		ITPE, 2021: EFs for solid fuels represent total PM (filterable and condensable) EMEP/EEA EIG 2023 EFs: unclear whether the EFs for liquid and gaseous fuels represent filterable PM or total PM emissions
1A4bii	Residential: Household and gardening (mobile)	IE		Included in 1A3b
1A4ci	Agriculture/Forestry/Fishing: Stationary	x (for solid fuels)		ITPE, 2021: EFs for solid fuels represent total PM (filterable and condensable) EMEP/EEA EIG 2023 EFs: unclear whether the EFs for liquid and gaseous fuels

NFR	Source / sector name	Condensable component		EF reference and/or comments
		Included	Excluded	
				represent filterable PM or total PM emissions
1A4cii	Agriculture/Forestry/Fishing: Off-road vehicles and other machinery	x		EMEP/EEA EIG 2023 EFs: PM factors represent total PM emissions (filterable and condensable fractions)
1A4ciii	Agriculture/Forestry/Fishing: National fishing	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
1B1a	Fugitive emission from solid fuels: Coal mining and handling	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
1B1b	Fugitive emission from solid fuels: Solid fuel transformation	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
1B1c	Venting and flaring (oil, gas, combined oil and gas)	Unable to confirm		CEPMEIP: no indication
NFR 2 - IPPU				
2A1	Cement production	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2A2	Lime production	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2A3	Glass production	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2A5a	Quarrying and mining of minerals other than coal	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2A5b	Construction and demolition	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2B1	Ammonia production	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2B2	Nitric acid production	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2B3	Adipic acid production	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2B5	Carbide production	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2B6	Titanium dioxide production	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2B7	Soda ash production	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2B10a	Chemical industry: Other	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2B10a	Chemical industry: Other	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2C1	Iron and steel production		x	EFs are taken from the EMEP/EEA EIG 2023, PM factors represent filterable PM emissions only
2C2	Ferroalloys production		x	EFs are taken from the EMEP/EEA EIG 2023, PM factors represent filterable PM emissions only
2C3	Aluminium production		x	EFs are taken from the EMEP/EEA EIG 2023, PM factors represent filterable PM emissions only
2C5	Lead production		x	EFs are taken from the EMEP/EEA EIG 2023, PM factors represent filterable PM emissions only
2C6	Zinc production		x	EFs are taken from the EMEP/EEA EIG 2023, PM factors represent filterable PM emissions only
2C7a	Copper production	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication Emissions from copper smelters and the National Emission Database.
2C7c	Other metal production	Unable to confirm		Emissions from copper smelters and the National Emission Database.
2D3b	Road paving with asphalt		x	EFs are taken from the EMEP/EEA EIG 2023 represents filterable PM emissions
2D3c	Asphalt roofing	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2G	Other product use (please specify in the IIR)	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2H1	Pulp and paper industry	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
2H2	Handling of agricultural products	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
NFR 3 - Agriculture				
3B1a	Manure management - Dairy cattle	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication

NFR	Source / sector name	Condensable component		EF reference and/or comments
		Included	Excluded	
3B1b	Manure management - Non-dairy cattle	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
3B2	Manure management - Sheep	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
3B3	Manure management - Swine	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
3B4d	Manure management - Goats	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
3B4e	Manure management - Horses	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
3B4gi	Manure management - Laying hens	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
3B4gii	Manure management - Broilers	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
3B4giv	Manure management - Other poultry	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
3B4h	Manure management - Other animals (please specify in the IIR)	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
3Dc	Farm-level agricultural operations including storage, handling and transport of agricultural products	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
3F	Field burning of agricultural residues	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
NFR 5 - Waste				
5A	Biological treatment of waste - Solid waste disposal on land	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
5C1a	Municipal waste incineration	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
5C1bi	Industrial waste incineration	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
5C1biv	Sewage sludge incineration	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
5C1bv	Cremation	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
5C2	Open burning of waste	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
5E	Other waste (please specify in IIR)	Unable to confirm		EMEP/EEA EIG 2023 EFs: no indication
MEMO ITEMS - NOT TO BE INCLUDED IN NATIONAL TOTALS				
1A3ai(ii)	International aviation cruise (civil)	Unable to confirm		EFs are taken from the EMEP/EEA EIG 2009 without indication, probably filterable only
1A3aii(ii)	Domestic aviation cruise (civil)	Unable to confirm		EFs are taken from the EMEP/EEA EIG 2009 without indication, probably filterable only
1A3di(i)	International maritime navigation	Unable to confirm		EFs are taken from the EMEP/EEA EIG 2019 without indication, probably filterable only
11B	Forest fires	Unable to confirm		EMEP/EEA EIG 2019 EFs: no indication

Appendix 10. THE STRUCTURE OF HEATING DEVICES OPERATED IN THE SMALL COMBUSTION SECTOR (NFR 1A4)

The structure of heating devices operated in the small combustion sector (NFR 1A4) estimated for the purpose of determining aggregated emission factors.

Table A10. 1. The statistics regarding solid fuel boilers operated in the residential sector (1A4bi) in 1990 – 2019

YEAR	Manual	Manual 5 class/ Ecodesign	Gasifying/ new construction	Gasifying 5 class/ Ecodesign	Automatic	Automatic 5 class/ Ecodesign	Automatic	Automatic 5 class/ Ecodesign
	hard coal/ brown coal/ coke/wood	hard coal	wood	wood	hard coal	hard coal	wood	wood
1990	99.00%	0.00%	1.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1991	99.00%	0.00%	1.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1992	99.00%	0.00%	1.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1993	98.99%	0.00%	1.01%	0.00%	0.00%	0.00%	0.00%	0.00%
1994	98.99%	0.00%	1.01%	0.00%	0.00%	0.00%	0.00%	0.00%
1995	98.98%	0.00%	1.02%	0.00%	0.00%	0.00%	0.00%	0.00%
1996	98.98%	0.00%	1.02%	0.00%	0.00%	0.00%	0.00%	0.00%
1997	98.95%	0.00%	1.02%	0.00%	0.02%	0.00%	0.01%	0.00%
1998	98.93%	0.00%	1.03%	0.00%	0.03%	0.00%	0.01%	0.00%
1999	98.91%	0.00%	1.03%	0.00%	0.05%	0.00%	0.01%	0.00%
2000	99.00%	0.00%	1.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2001	98.89%	0.00%	1.04%	0.00%	0.06%	0.00%	0.02%	0.00%
2002	98.70%	0.00%	1.18%	0.00%	0.09%	0.00%	0.03%	0.00%
2003	98.59%	0.00%	1.20%	0.00%	0.14%	0.00%	0.06%	0.00%
2004	98.42%	0.00%	1.23%	0.00%	0.25%	0.00%	0.10%	0.00%
2005	98.14%	0.00%	1.25%	0.00%	0.47%	0.00%	0.14%	0.00%
2006	97.66%	0.00%	1.29%	0.00%	0.87%	0.00%	0.18%	0.00%
2007	96.95%	0.00%	1.34%	0.00%	1.49%	0.00%	0.22%	0.00%
2008	95.97%	0.00%	1.39%	0.00%	2.38%	0.00%	0.26%	0.00%
2009	94.88%	0.00%	1.44%	0.00%	3.38%	0.00%	0.30%	0.00%
2010	93.85%	0.00%	1.48%	0.00%	4.33%	0.00%	0.35%	0.00%
2011	92.83%	0.00%	1.43%	0.00%	5.35%	0.00%	0.39%	0.00%
2012	91.82%	0.00%	1.39%	0.00%	6.35%	0.00%	0.44%	0.00%
2013	90.56%	0.00%	1.43%	0.00%	7.46%	0.00%	0.55%	0.00%
2014	89.52%	0.00%	1.45%	0.00%	8.39%	0.00%	0.64%	0.00%
2015	88.62%	0.00%	1.47%	0.00%	9.16%	0.00%	0.76%	0.00%
2016	87.93%	0.00%	1.47%	0.00%	9.71%	0.00%	0.88%	0.00%
2017	87.49%	0.00%	1.47%	0.00%	10.00%	0.00%	1.04%	0.00%
2018	83.41%	0.84%	1.38%	0.13%	10.19%	1.02%	1.00%	2.03%
2019	80.68%	1.51%	1.28%	0.26%	9.21%	2.07%	0.95%	4.05%
2019	78.17%	1.99%	1.19%	0.39%	8.22%	3.11%	0.90%	6.03%

Table A10. 2. The statistics regarding solid fuel boilers operated in the residential sector (1A4bi) in 2020 – 2050 – WEM scenario

YEAR	Manual	Manual 5 class/ Ecodesign	Gasifying/new construction	Gasifying 5 class/Ecodesign	Automatic	Automatic 5 class/Ecodesign	Automatic	Automatic 5 class/Ecodesign
	hard coal/ brown coal/ coke/wood	hard coal	wood	wood	hard coal	hard coal	wood	wood
2020	72.46%	1.96%	1.10%	0.52%	7.18%	7.35%	0.85%	8.58%
2021	67.84%	1.97%	1.03%	0.52%	6.26%	10.79%	0.80%	10.78%
2022	63.19%	1.97%	0.96%	0.53%	5.19%	14.39%	0.70%	13.06%
2023	58.51%	1.98%	0.89%	0.53%	4.13%	18.01%	0.59%	15.36%
2024	53.80%	1.98%	0.82%	0.53%	3.09%	21.62%	0.45%	17.70%
2025	49.07%	1.99%	0.75%	0.53%	2.05%	25.24%	0.30%	20.07%
2026	44.23%	1.99%	0.67%	0.53%	1.04%	28.81%	0.12%	22.60%
2027	39.38%	2.00%	0.60%	0.53%	0.00%	32.41%	0.00%	25.08%
2028	34.51%	2.00%	0.53%	0.53%	0.00%	34.98%	0.00%	27.45%
2029	29.63%	2.00%	0.45%	0.53%	0.00%	37.56%	0.00%	29.82%
2030	24.73%	2.01%	0.38%	0.54%	0.00%	40.15%	0.00%	32.21%
2031	19.82%	2.01%	0.30%	0.54%	0.00%	42.85%	0.00%	34.49%
2032	14.89%	2.01%	0.23%	0.54%	0.00%	45.56%	0.00%	36.78%
2033	9.94%	2.02%	0.15%	0.54%	0.00%	48.28%	0.00%	39.08%
2034	4.98%	2.02%	0.08%	0.54%	0.00%	51.00%	0.00%	41.38%
2035	0.00%	2.02%	0.00%	0.54%	0.00%	53.74%	0.00%	43.70%
2036	0.00%	2.03%	0.00%	0.54%	0.00%	53.13%	0.00%	44.30%
2037	0.00%	2.03%	0.00%	0.54%	0.00%	52.52%	0.00%	44.90%
2038	0.00%	2.04%	0.00%	0.54%	0.00%	51.91%	0.00%	45.51%
2039	0.00%	2.05%	0.00%	0.55%	0.00%	51.29%	0.00%	46.12%
2040	0.00%	2.05%	0.00%	0.55%	0.00%	50.67%	0.00%	46.74%
2045	0.00%	2.05%	0.00%	0.55%	0.00%	50.67%	0.00%	46.74%
2050	0.00%	2.05%	0.00%	0.55%	0.00%	50.67%	0.00%	46.74%

Table A10. 3. The statistics regarding solid fuel boilers operated in the residential sector (1A4bi) in 2020 – 2050 – WAM scenario

YEAR	Manual	Manual 5 class/ Ecodesign	Gasifying/ new construction	Gasifying 5 class/ Ecodesign	Automatic	Automatic 5 class/ Ecodesign	Automatic	Automatic 5 class/ Ecodesign
	hard coal/ brown coal/ coke/ wood	hard coal	wood	wood	hard coal	hard coal	wood	wood
2020	76.30%	2.07%	1.17%	0.55%	7.57%	3.10%	0.90%	8.36%
2021	73.34%	2.13%	1.12%	0.57%	6.77%	3.73%	0.87%	11.46%
2022	70.20%	2.19%	1.07%	0.59%	5.78%	4.56%	0.78%	14.83%
2023	66.86%	2.26%	1.02%	0.60%	4.73%	5.43%	0.67%	18.42%
2024	63.30%	2.34%	0.97%	0.62%	3.64%	6.33%	0.53%	22.27%
2025	59.50%	2.42%	0.91%	0.64%	2.49%	7.26%	0.37%	26.40%
2026	54.85%	2.48%	0.84%	0.66%	1.29%	9.06%	0.15%	30.67%
2027	49.97%	2.54%	0.76%	0.68%	0.00%	10.98%	0.00%	35.06%
2028	44.84%	2.60%	0.68%	0.69%	0.00%	11.64%	0.00%	39.53%
2029	39.44%	2.67%	0.60%	0.71%	0.00%	12.34%	0.00%	44.23%
2030	33.76%	2.74%	0.52%	0.73%	0.00%	13.07%	0.00%	49.18%
2031	27.18%	2.76%	0.42%	0.74%	0.00%	15.83%	0.00%	53.07%
2032	20.52%	2.78%	0.31%	0.74%	0.00%	18.63%	0.00%	57.02%
2033	13.77%	2.80%	0.21%	0.75%	0.00%	21.46%	0.00%	61.01%
2034	6.93%	2.82%	0.11%	0.75%	0.00%	24.33%	0.00%	65.06%
2035	0.00%	2.84%	0.00%	0.76%	0.00%	27.24%	0.00%	69.17%
2036	0.00%	2.84%	0.00%	0.76%	0.00%	25.57%	0.00%	70.83%
2037	0.00%	2.85%	0.00%	0.76%	0.00%	23.89%	0.00%	72.50%

2038	0.00%	2.86%	0.00%	0.76%	0.00%	22.20%	0.00%	74.18%
2039	0.00%	2.86%	0.00%	0.76%	0.00%	20.51%	0.00%	75.87%
2040	0.00%	2.87%	0.00%	0.76%	0.00%	18.80%	0.00%	77.56%
2045	0.00%	2.87%	0.00%	0.76%	0.00%	18.80%	0.00%	77.56%
2050	0.00%	2.87%	0.00%	0.76%	0.00%	18.80%	0.00%	77.56%

Table A10. 4. The statistics regarding space heaters operated in the residential sector (1A4bi) – not meeting and meeting Ecodesign requirements

Year	Not meeting Ecodesign requirements	Meeting Ecodesign requirements
2017	100%	0%
2018	93%	7%
2019	87%	13%
2020	80%	20%
2021	73%	27%
2022	67%	33%
2023	60%	40%
2024	53%	47%
2025	47%	53%
2026	40%	60%
2027	33%	67%
2028	27%	73%
2029	20%	80%
2030	13%	87%
2031	7%	93%
2032	0%	100%



Table A10. 5. The statistics regarding solid fuel boilers operated in the commercial/institutional sector (1A4ai) in 1990 – 2019

YEAR	Traditional manual boilers	Manual boilers 5 class / Ecodesign	Automatic boilers	Automatic boilers 5 class / Ecodesign	Traditional manual boilers > 50kW	Manual boilers 5 class/new construction > 50kW	Automatic boilers > 50kW	Traditional manual boilers for	Gasifying manual boilers	Gasifying boilers 5 class	Automatic boilers	Automatic boilers 5 class	Traditional manual boilers > 50kW	Manual boilers 5 class > 50kW	Automatic boilers > 50kW
	hard coal/brown coal/coke/wood	hard coal/brown coal/coke	hard coal/brown coal	hard coal/brown coal	hard coal/brown coal/coke/wood	hard coal/brown coal/coke	hard coal/brown coal	wood	wood	wood	wood	wood	wood	wood	wood
1990	87.63%	0.00%	0.00%	0.00%	4.82%	0.00%	0.00%	6.56%	0.63%	0.00%	0.00%	0.00%	0.36%	0.00%	0.00%
1991	87.62%	0.00%	0.00%	0.00%	4.81%	0.00%	0.00%	6.55%	0.67%	0.00%	0.00%	0.00%	0.35%	0.00%	0.00%
1992	87.60%	0.00%	0.00%	0.00%	4.80%	0.00%	0.00%	6.54%	0.70%	0.00%	0.00%	0.00%	0.35%	0.00%	0.00%
1993	87.59%	0.00%	0.00%	0.00%	4.79%	0.00%	0.00%	6.53%	0.74%	0.00%	0.00%	0.00%	0.35%	0.00%	0.00%
1994	87.58%	0.00%	0.00%	0.00%	4.78%	0.00%	0.00%	6.51%	0.77%	0.00%	0.00%	0.00%	0.35%	0.00%	0.00%
1995	87.56%	0.00%	0.00%	0.00%	4.77%	0.00%	0.00%	6.50%	0.81%	0.00%	0.00%	0.00%	0.35%	0.00%	0.00%
1996	87.55%	0.00%	0.00%	0.00%	4.77%	0.00%	0.00%	6.49%	0.84%	0.00%	0.00%	0.00%	0.35%	0.00%	0.00%
1997	87.48%	0.00%	0.01%	0.00%	4.76%	0.00%	0.00%	6.48%	0.88%	0.00%	0.00%	0.00%	0.35%	0.05%	0.00%
1998	87.45%	0.00%	0.03%	0.00%	4.75%	0.00%	0.00%	6.46%	0.91%	0.00%	0.00%	0.00%	0.35%	0.05%	0.00%
1999	87.44%	0.00%	0.03%	0.00%	4.74%	0.00%	0.00%	6.45%	0.95%	0.00%	0.00%	0.00%	0.35%	0.05%	0.00%
2000	87.37%	0.00%	0.06%	0.00%	4.73%	0.00%	0.00%	6.44%	0.98%	0.00%	0.02%	0.00%	0.35%	0.05%	0.00%
2001	87.20%	0.00%	0.08%	0.00%	4.72%	0.00%	0.00%	6.43%	1.12%	0.00%	0.03%	0.00%	0.35%	0.06%	0.00%
2002	87.11%	0.00%	0.14%	0.00%	4.71%	0.00%	0.01%	6.42%	1.14%	0.00%	0.06%	0.00%	0.35%	0.06%	0.00%
2003	86.96%	0.00%	0.24%	0.00%	4.71%	0.00%	0.01%	6.41%	1.16%	0.00%	0.10%	0.00%	0.35%	0.06%	0.01%
2004	86.71%	0.00%	0.45%	0.00%	4.69%	0.00%	0.02%	6.39%	1.18%	0.00%	0.13%	0.00%	0.35%	0.06%	0.01%
2005	86.29%	0.00%	0.82%	0.00%	4.67%	0.00%	0.04%	6.36%	1.23%	0.00%	0.17%	0.00%	0.34%	0.07%	0.01%
2006	85.66%	0.00%	1.41%	0.00%	4.64%	0.00%	0.08%	6.31%	1.27%	0.00%	0.21%	0.00%	0.34%	0.07%	0.01%
2007	84.80%	0.00%	2.26%	0.00%	4.59%	0.00%	0.12%	6.25%	1.32%	0.00%	0.25%	0.00%	0.34%	0.07%	0.01%
2008	83.83%	0.00%	3.21%	0.00%	4.54%	0.00%	0.17%	6.18%	1.36%	0.00%	0.29%	0.00%	0.33%	0.07%	0.02%
2009	82.92%	0.00%	4.10%	0.00%	4.49%	0.00%	0.22%	6.11%	1.40%	0.00%	0.33%	0.00%	0.33%	0.08%	0.02%
2010	82.02%	0.00%	5.08%	0.00%	4.44%	0.00%	0.27%	6.04%	1.36%	0.00%	0.37%	0.00%	0.33%	0.07%	0.02%
2011	81.13%	0.00%	6.02%	0.00%	4.39%	0.00%	0.33%	5.98%	1.32%	0.00%	0.42%	0.00%	0.32%	0.07%	0.02%
2012	80.01%	0.00%	7.08%	0.00%	4.33%	0.00%	0.38%	5.90%	1.36%	0.00%	0.52%	0.00%	0.32%	0.07%	0.03%
2013	79.02%	0.00%	7.95%	0.00%	4.35%	0.00%	0.44%	5.82%	1.37%	0.00%	0.61%	0.00%	0.32%	0.08%	0.03%
2014	78.03%	0.00%	8.66%	0.00%	4.51%	0.00%	0.50%	5.75%	1.39%	0.00%	0.71%	0.00%	0.33%	0.08%	0.04%
2015	77.36%	0.00%	9.17%	0.00%	4.54%	0.00%	0.54%	5.70%	1.39%	0.00%	0.84%	0.00%	0.33%	0.08%	0.05%
2016	76.90%	0.00%	9.44%	0.00%	4.59%	0.00%	0.56%	5.67%	1.39%	0.00%	0.98%	0.00%	0.34%	0.08%	0.06%
2017	73.34%	0.79%	9.62%	0.96%	4.35%	0.05%	0.63%	5.40%	1.30%	0.12%	0.94%	1.92%	0.32%	0.08%	0.17%
2018	70.74%	1.42%	8.67%	1.95%	4.40%	0.09%	0.66%	5.21%	1.21%	0.24%	0.90%	3.81%	0.32%	0.09%	0.29%
2019	68.17%	1.86%	7.70%	2.91%	4.63%	0.13%	0.72%	5.02%	1.12%	0.37%	0.85%	5.65%	0.34%	0.10%	0.44%

Table A10. 6. The statistics regarding solid fuel boilers operated in the commercial/institutional sector (1A4ai) in 2020 – 2050 – WEM scenario

YEAR	Traditional manual boilers	Manual boilers 5 class /Ecodesign	Automatic boilers	Automatic boilers 5 class /Ecodesign	Traditional manual boilers > 50kW	Manual boilers 5 class/new construction >50kW	Automatic boilers > 50kW	Traditional manual boilers for	Gasifying manual boilers	Gasifying boilers 5 class	Automatic boilers	Automatic boilers 5 class	Traditional manual boilers > 50kW	Manual boilers 5 class > 50kW	Automatic boilers > 50kW
	hard coal/brown coal/coke/wood	hard coal/brown coal/coke	hard coal/brown coal	hard coal/brown coal	hard coal/brown coal/coke/wood	hard coal/brown coal/coke	hard coal/brown coal	wood	wood	wood	wood	wood	wood	wood	wood
2020	61.81%	1.80%	6.57%	6.74%	5.67%	0.16%	1.22%	4.55%	1.01%	0.48%	0.78%	7.86%	0.42%	0.14%	0.79%
2021	59.16%	1.84%	5.86%	10.11%	4.02%	0.13%	1.08%	4.36%	0.97%	0.49%	0.75%	10.10%	0.30%	0.10%	0.74%
2022	55.11%	1.85%	4.86%	13.48%	3.74%	0.13%	1.25%	4.06%	0.90%	0.49%	0.66%	12.23%	0.28%	0.09%	0.88%
2023	51.03%	1.85%	3.87%	16.87%	3.47%	0.13%	1.41%	3.76%	0.84%	0.49%	0.55%	14.39%	0.26%	0.09%	1.01%
2024	46.92%	1.86%	2.89%	20.25%	3.19%	0.13%	1.57%	3.46%	0.77%	0.50%	0.42%	16.57%	0.23%	0.09%	1.15%
2025	42.79%	1.86%	1.92%	23.64%	2.91%	0.13%	1.74%	3.15%	0.70%	0.50%	0.28%	18.79%	0.21%	0.08%	1.30%
2026	38.58%	1.87%	0.97%	26.97%	2.62%	0.13%	1.90%	2.84%	0.63%	0.50%	0.11%	21.16%	0.19%	0.08%	1.45%
2027	34.34%	1.87%	0.00%	30.35%	2.33%	0.13%	2.06%	2.53%	0.56%	0.50%	0.00%	23.49%	0.17%	0.07%	1.60%
2028	30.10%	1.87%	0.00%	32.76%	2.04%	0.13%	2.23%	2.22%	0.49%	0.50%	0.00%	25.70%	0.15%	0.07%	1.75%
2029	25.84%	1.88%	0.00%	35.17%	1.76%	0.13%	2.39%	1.90%	0.42%	0.50%	0.00%	27.93%	0.13%	0.06%	1.90%
2030	21.57%	1.88%	0.00%	37.59%	1.47%	0.13%	2.55%	1.59%	0.35%	0.50%	0.00%	30.16%	0.11%	0.06%	2.05%
2031	17.28%	1.88%	0.00%	40.12%	1.17%	0.13%	2.73%	1.27%	0.28%	0.50%	0.00%	32.29%	0.09%	0.05%	2.19%
2032	12.98%	1.89%	0.00%	42.66%	0.88%	0.13%	2.90%	0.96%	0.21%	0.50%	0.00%	34.44%	0.06%	0.05%	2.34%
2033	8.67%	1.89%	0.00%	45.21%	0.59%	0.13%	3.07%	0.64%	0.14%	0.50%	0.00%	36.59%	0.04%	0.04%	2.49%
2034	4.34%	1.89%	0.00%	47.76%	0.29%	0.13%	3.24%	0.32%	0.07%	0.50%	0.00%	38.75%	0.02%	0.04%	2.63%
2035	0.00%	1.89%	0.00%	50.32%	0.00%	0.13%	3.42%	0.00%	0.00%	0.51%	0.00%	40.92%	0.00%	0.03%	2.78%
2036	0.00%	1.90%	0.00%	49.75%	0.00%	0.13%	3.38%	0.00%	0.00%	0.51%	0.00%	41.48%	0.00%	0.03%	2.82%
2037	0.00%	1.90%	0.00%	49.18%	0.00%	0.13%	3.34%	0.00%	0.00%	0.51%	0.00%	42.05%	0.00%	0.03%	2.86%
2038	0.00%	1.91%	0.00%	48.60%	0.00%	0.13%	3.30%	0.00%	0.00%	0.51%	0.00%	42.62%	0.00%	0.03%	2.90%
2039	0.00%	1.91%	0.00%	48.03%	0.00%	0.13%	3.26%	0.00%	0.00%	0.51%	0.00%	43.19%	0.00%	0.03%	2.93%
2040	0.00%	1.92%	0.00%	47.44%	0.00%	0.13%	3.22%	0.00%	0.00%	0.51%	0.00%	43.76%	0.00%	0.03%	2.97%
2045	0.00%	1.92%	0.00%	47.44%	0.00%	0.13%	3.22%	0.00%	0.00%	0.51%	0.00%	43.76%	0.00%	0.03%	2.97%
2050	0.00%	1.92%	0.00%	47.44%	0.00%	0.13%	3.22%	0.00%	0.00%	0.51%	0.00%	43.76%	0.00%	0.03%	2.97%

Table A10. 7. The statistics regarding solid fuel boilers operated in the commercial/institutional sector (1A4ai) in 2020 – 2050 – WAM scenario

YEAR	Traditional manual boilers	Manual boilers 5 class /Ecodesign	Automatic boilers	Automatic boilers 5 class /Ecodesign	Traditional manual boilers > 50kW	Manual boilers 5 class/new construction >50kW	Automatic boilers > 50kW	Traditional manual boilers for	Gasifying manual boilers	Gasifying boilers 5 class	Automatic boilers	Automatic boilers 5 class	Traditional manual boilers > 50kW	Manual boilers 5 class > 50kW	Automatic boilers > 50kW
	hard coal/brown coal/coke/wood	hard coal/brown coal/coke	Hard coal/Brown coal	hard coal/brown coal	hard coal/brown coal/coke/wood	hard coal/brown coal/coke	hard coal/brown coal	wood	wood	wood	wood	wood	wood	wood	wood
2020	65.09%	1.89%	6.93%	2.84%	5.97%	0.17%	0.90%	4.80%	1.07%	0.50%	0.82%	7.65%	0.44%	0.14%	0.78%
2021	63.96%	1.99%	6.34%	3.49%	4.35%	0.14%	0.67%	4.71%	1.05%	0.53%	0.82%	10.74%	0.32%	0.11%	0.78%
2022	61.22%	2.06%	5.41%	4.27%	4.16%	0.14%	0.66%	4.51%	1.00%	0.55%	0.73%	13.89%	0.31%	0.11%	0.99%
2023	58.31%	2.12%	4.42%	5.09%	3.96%	0.14%	0.65%	4.30%	0.96%	0.57%	0.63%	17.25%	0.29%	0.10%	1.21%
2024	55.21%	2.19%	3.41%	5.92%	3.75%	0.15%	0.63%	4.07%	0.91%	0.58%	0.50%	20.85%	0.28%	0.10%	1.45%
2025	51.90%	2.26%	2.33%	6.80%	3.53%	0.15%	0.62%	3.82%	0.85%	0.60%	0.34%	24.72%	0.26%	0.10%	1.70%
2026	47.84%	2.32%	1.21%	8.49%	3.25%	0.16%	0.66%	3.53%	0.78%	0.62%	0.14%	28.71%	0.24%	0.10%	1.96%
2027	43.58%	2.38%	0.00%	10.29%	2.96%	0.16%	0.70%	3.21%	0.71%	0.63%	0.00%	32.83%	0.22%	0.09%	2.23%
2028	39.11%	2.44%	0.00%	10.90%	2.66%	0.17%	0.74%	2.88%	0.64%	0.65%	0.00%	37.01%	0.20%	0.09%	2.51%
2029	34.40%	2.50%	0.00%	11.55%	2.34%	0.17%	0.78%	2.53%	0.56%	0.67%	0.00%	41.42%	0.17%	0.08%	2.81%
2030	29.44%	2.57%	0.00%	12.24%	2.00%	0.17%	0.83%	2.17%	0.48%	0.69%	0.00%	46.05%	0.15%	0.08%	3.13%
2031	23.71%	2.59%	0.00%	14.82%	1.61%	0.18%	1.01%	1.75%	0.39%	0.69%	0.00%	49.70%	0.12%	0.07%	3.38%
2032	17.90%	2.60%	0.00%	17.44%	1.22%	0.18%	1.18%	1.32%	0.29%	0.69%	0.00%	53.39%	0.09%	0.07%	3.63%
2033	12.01%	2.62%	0.00%	20.09%	0.82%	0.18%	1.37%	0.89%	0.20%	0.70%	0.00%	57.13%	0.06%	0.06%	3.88%
2034	6.05%	2.64%	0.00%	22.78%	0.41%	0.18%	1.55%	0.45%	0.10%	0.70%	0.00%	60.92%	0.03%	0.05%	4.14%
2035	0.00%	2.66%	0.00%	25.51%	0.00%	0.18%	1.73%	0.00%	0.00%	0.71%	0.00%	64.77%	0.00%	0.05%	4.40%
2036	0.00%	2.66%	0.00%	23.94%	0.00%	0.18%	1.63%	0.00%	0.00%	0.71%	0.00%	66.33%	0.00%	0.05%	4.51%
2037	0.00%	2.67%	0.00%	22.37%	0.00%	0.18%	1.52%	0.00%	0.00%	0.71%	0.00%	67.89%	0.00%	0.05%	4.61%
2038	0.00%	2.67%	0.00%	20.79%	0.00%	0.18%	1.41%	0.00%	0.00%	0.71%	0.00%	69.46%	0.00%	0.05%	4.72%
2039	0.00%	2.68%	0.00%	19.20%	0.00%	0.18%	1.30%	0.00%	0.00%	0.71%	0.00%	71.04%	0.00%	0.05%	4.83%
2040	0.00%	2.69%	0.00%	17.61%	0.00%	0.18%	1.20%	0.00%	0.00%	0.72%	0.00%	72.63%	0.00%	0.05%	4.93%
2045	0.00%	2.69%	0.00%	17.61%	0.00%	0.18%	1.20%	0.00%	0.00%	0.72%	0.00%	72.63%	0.00%	0.05%	4.93%
2050	0.00%	2.69%	0.00%	17.61%	0.00%	0.18%	1.20%	0.00%	0.00%	0.72%	0.00%	72.63%	0.00%	0.05%	4.93%

Table A10. 8. The statistics regarding solid fuel boilers operated in the agricultural/forestry/fishing sector (1A4ci) in 1990 – 2019

YEAR	Traditional manual boilers	Manual boilers 5 class /Ecodesign	Automatic boilers	Automatic boilers 5 class /Ecodesign	Traditional manual boilers >5 0kW	Manual boilers 5 class/new construction > 50kW	Automatic boilers > 50kW	Traditional manual boilers for	Gasifying manual boilers	Gasifying boilers 5 class	Automatic boilers	Automatic boilers 5 class	Traditional manual boilers > 50kW	Manual boilers 5 class > 50kW	Automatic boilers > 50kW
	hard coal/brown coal/coke/wood	hard coal/brown coal/coke	hard coal/brown coal	hard coal/brown coal	hard coal/brown coal/coke/wood	hard coal/brown coal/coke	hard coal/brown coal	wood	wood	wood	wood	wood	wood	wood	wood
1990	69.70%	0.00%	0.00%	0.00%	3.85%	0.00%	0.00%	24.49%	0.63%	0.00%	0.00%	0.00%	1.33%	0.00%	0.00%
1991	69.73%	0.00%	0.00%	0.00%	3.84%	0.00%	0.00%	24.44%	0.67%	0.00%	0.00%	0.00%	1.32%	0.00%	0.00%
1992	69.75%	0.00%	0.00%	0.00%	3.84%	0.00%	0.00%	24.39%	0.70%	0.00%	0.00%	0.00%	1.32%	0.00%	0.00%
1993	69.77%	0.00%	0.00%	0.00%	3.83%	0.00%	0.00%	24.35%	0.74%	0.00%	0.00%	0.00%	1.32%	0.00%	0.00%
1994	69.79%	0.00%	0.00%	0.00%	3.82%	0.00%	0.00%	24.30%	0.77%	0.00%	0.00%	0.00%	1.32%	0.00%	0.00%
1995	69.81%	0.00%	0.00%	0.00%	3.81%	0.00%	0.00%	24.25%	0.81%	0.00%	0.00%	0.00%	1.31%	0.00%	0.00%
1996	69.83%	0.00%	0.00%	0.00%	3.81%	0.00%	0.00%	24.21%	0.84%	0.00%	0.00%	0.00%	1.31%	0.00%	0.00%
1997	69.84%	0.00%	0.01%	0.00%	3.80%	0.00%	0.00%	24.16%	0.88%	0.00%	0.00%	0.00%	1.31%	0.00%	0.00%
1998	69.84%	0.00%	0.03%	0.00%	3.79%	0.00%	0.00%	24.12%	0.91%	0.00%	0.00%	0.00%	1.31%	0.00%	0.00%
1999	69.87%	0.00%	0.03%	0.00%	3.78%	0.00%	0.00%	24.07%	0.95%	0.00%	0.00%	0.00%	1.30%	0.00%	0.00%
2000	69.79%	0.00%	0.06%	0.00%	3.78%	0.00%	0.00%	24.02%	0.98%	0.00%	0.02%	0.00%	1.30%	0.05%	0.00%
2001	69.65%	0.00%	0.08%	0.00%	3.77%	0.00%	0.00%	23.98%	1.12%	0.00%	0.03%	0.00%	1.30%	0.06%	0.00%
2002	69.58%	0.00%	0.14%	0.00%	3.77%	0.00%	0.01%	23.95%	1.14%	0.00%	0.06%	0.00%	1.30%	0.06%	0.00%
2003	69.46%	0.00%	0.24%	0.00%	3.76%	0.00%	0.01%	23.91%	1.16%	0.00%	0.10%	0.00%	1.29%	0.06%	0.01%
2004	69.26%	0.00%	0.45%	0.00%	3.75%	0.00%	0.02%	23.84%	1.18%	0.00%	0.13%	0.00%	1.29%	0.06%	0.01%
2005	68.92%	0.00%	0.82%	0.00%	3.73%	0.00%	0.04%	23.72%	1.23%	0.00%	0.17%	0.00%	1.28%	0.07%	0.01%
2006	68.42%	0.00%	1.41%	0.00%	3.70%	0.00%	0.08%	23.55%	1.27%	0.00%	0.21%	0.00%	1.27%	0.07%	0.01%
2007	67.73%	0.00%	2.26%	0.00%	3.67%	0.00%	0.12%	23.31%	1.32%	0.00%	0.25%	0.00%	1.26%	0.07%	0.01%
2008	66.96%	0.00%	3.21%	0.00%	3.62%	0.00%	0.17%	23.05%	1.36%	0.00%	0.29%	0.00%	1.25%	0.07%	0.02%
2009	66.23%	0.00%	4.10%	0.00%	3.58%	0.00%	0.22%	22.80%	1.40%	0.00%	0.33%	0.00%	1.23%	0.08%	0.02%
2010	65.51%	0.00%	5.08%	0.00%	3.55%	0.00%	0.27%	22.55%	1.36%	0.00%	0.37%	0.00%	1.22%	0.07%	0.02%
2011	64.80%	0.00%	6.02%	0.00%	3.51%	0.00%	0.33%	22.31%	1.32%	0.00%	0.42%	0.00%	1.21%	0.07%	0.02%
2012	63.91%	0.00%	7.08%	0.00%	3.46%	0.00%	0.38%	22.00%	1.36%	0.00%	0.52%	0.00%	1.19%	0.07%	0.03%
2013	63.12%	0.00%	7.95%	0.00%	3.48%	0.00%	0.44%	21.73%	1.37%	0.00%	0.61%	0.00%	1.20%	0.08%	0.03%
2014	62.33%	0.00%	8.66%	0.00%	3.60%	0.00%	0.50%	21.45%	1.39%	0.00%	0.71%	0.00%	1.24%	0.08%	0.04%
2015	61.79%	0.00%	9.17%	0.00%	3.63%	0.00%	0.54%	21.27%	1.39%	0.00%	0.84%	0.00%	1.25%	0.08%	0.05%
2016	61.42%	0.00%	9.44%	0.00%	3.66%	0.00%	0.56%	21.14%	1.39%	0.00%	0.98%	0.00%	1.26%	0.08%	0.06%
2017	58.58%	0.79%	9.62%	0.96%	3.47%	0.05%	0.63%	20.16%	1.30%	0.12%	0.94%	1.92%	1.20%	0.08%	0.17%
2018	56.50%	1.42%	8.67%	1.95%	3.52%	0.09%	0.66%	19.45%	1.21%	0.24%	0.90%	3.81%	1.21%	0.09%	0.29%
2019	54.45%	1.86%	7.70%	2.91%	3.70%	0.13%	0.72%	18.74%	1.12%	0.37%	0.85%	5.65%	1.27%	0.10%	0.44%



Table A10. 9. The statistics regarding solid fuel boilers operated in the agricultural/forestry/fishing sector (1A4ci) in 2020 – 2050 - WEM scenario

YEAR	Traditional manual boilers	Manual boilers 5 class /Ecodesign	Automatic boilers	Automatic boilers 5 class /Ecodesign	Traditional manual boilers > 50kW	Manual boilers 5 class/new construction >50kW	Automatic boilers > 50kW	Traditional manual boilers for	Gasifying manual boilers	Gasifying boilers 5 class	Automatic boilers	Automatic boilers 5 class	Traditional manual boilers >50kW	Manual boilers 5 class > 50kW	Automatic boilers > 50kW
	hard coal/brown coal/coke/wood	hard coal/brown coal/coke	hard coal/brown coal	hard coal/brown coal	Hard coal/brown coal coke/wood	hard coal/brown coal/coke	hard coal/brown coal	wood	wood	wood	wood	wood	wood	wood	wood
2020	49.37%	1.80%	6.57%	6.74%	4.53%	0.16%	1.22%	16.99%	1.01%	0.48%	0.78%	7.86%	1.56%	0.14%	0.79%
2021	47.26%	1.84%	5.86%	10.11%	3.21%	0.13%	1.08%	16.27%	0.97%	0.49%	0.75%	10.10%	1.11%	0.10%	0.74%
2022	44.02%	1.85%	4.86%	13.48%	2.99%	0.13%	1.25%	15.15%	0.90%	0.49%	0.66%	12.23%	1.03%	0.09%	0.88%
2023	40.76%	1.85%	3.87%	16.87%	2.77%	0.13%	1.41%	14.03%	0.84%	0.49%	0.55%	14.39%	0.95%	0.09%	1.01%
2024	37.48%	1.86%	2.89%	20.25%	2.55%	0.13%	1.57%	12.90%	0.77%	0.50%	0.42%	16.57%	0.88%	0.09%	1.15%
2025	34.18%	1.86%	1.92%	23.64%	2.32%	0.13%	1.74%	11.77%	0.70%	0.50%	0.28%	18.79%	0.80%	0.08%	1.30%
2026	30.81%	1.87%	0.97%	26.97%	2.09%	0.13%	1.90%	10.61%	0.63%	0.50%	0.11%	21.16%	0.72%	0.08%	1.45%
2027	27.43%	1.87%	0.00%	30.35%	1.86%	0.13%	2.06%	9.44%	0.56%	0.50%	0.00%	23.49%	0.64%	0.07%	1.60%
2028	24.04%	1.87%	0.00%	32.76%	1.63%	0.13%	2.23%	8.28%	0.49%	0.50%	0.00%	25.70%	0.56%	0.07%	1.75%
2029	20.64%	1.88%	0.00%	35.17%	1.40%	0.13%	2.39%	7.10%	0.42%	0.50%	0.00%	27.93%	0.48%	0.06%	1.90%
2030	17.23%	1.88%	0.00%	37.59%	1.17%	0.13%	2.55%	5.93%	0.35%	0.50%	0.00%	30.16%	0.40%	0.06%	2.05%
2031	13.80%	1.88%	0.00%	40.12%	0.94%	0.13%	2.73%	4.75%	0.28%	0.50%	0.00%	32.29%	0.32%	0.05%	2.19%
2032	10.37%	1.89%	0.00%	42.66%	0.70%	0.13%	2.90%	3.57%	0.21%	0.50%	0.00%	34.44%	0.24%	0.05%	2.34%
2033	6.92%	1.89%	0.00%	45.21%	0.47%	0.13%	3.07%	2.38%	0.14%	0.50%	0.00%	36.59%	0.16%	0.04%	2.49%
2034	3.47%	1.89%	0.00%	47.76%	0.24%	0.13%	3.24%	1.19%	0.07%	0.50%	0.00%	38.75%	0.08%	0.04%	2.63%
2035	0.00%	1.89%	0.00%	50.32%	0.00%	0.13%	3.42%	0.00%	0.00%	0.51%	0.00%	40.92%	0.00%	0.03%	2.78%
2036	0.00%	1.90%	0.00%	49.75%	0.00%	0.13%	3.38%	0.00%	0.00%	0.51%	0.00%	41.48%	0.00%	0.03%	2.82%
2037	0.00%	1.90%	0.00%	49.18%	0.00%	0.13%	3.34%	0.00%	0.00%	0.51%	0.00%	42.05%	0.00%	0.03%	2.86%
2038	0.00%	1.91%	0.00%	48.60%	0.00%	0.13%	3.30%	0.00%	0.00%	0.51%	0.00%	42.62%	0.00%	0.03%	2.90%
2039	0.00%	1.91%	0.00%	48.03%	0.00%	0.13%	3.26%	0.00%	0.00%	0.51%	0.00%	43.19%	0.00%	0.03%	2.93%
2040	0.00%	1.92%	0.00%	47.44%	0.00%	0.13%	3.22%	0.00%	0.00%	0.51%	0.00%	43.76%	0.00%	0.03%	2.97%
2045	0.00%	1.92%	0.00%	47.44%	0.00%	0.13%	3.22%	0.00%	0.00%	0.51%	0.00%	43.76%	0.00%	0.03%	2.97%
2050	0.00%	1.92%	0.00%	47.44%	0.00%	0.13%	3.22%	0.00%	0.00%	0.51%	0.00%	43.76%	0.00%	0.03%	2.97%

Table A10. 10. The statistics regarding solid fuel boilers operated in the agricultural/forestry/fishing sector (1A4ci) in 2020 – 2050 - WAM scenario

YEAR	Traditional manual boilers	Manual boilers 5 class / Ecodesign	Automatic boilers	Automatic boilers 5 class / Ecodesign	Traditional manual boilers > 50kW	Manual boilers 5 class / new construction > 50kW	Automatic boilers > 50kW	Traditional manual boilers for	Gasifying manual boilers	Gasifying boilers 5 class	Automatic boilers	Automatic boilers 5 class	Traditional manual boilers > 50kW	Manual boilers 5 class > 50kW	Automatic boilers > 50kW
	hard coal/brown coal/coke/wood	hard coal/brown coal/coke	hard coal/brown coal	hard coal/brown coal	Hard coal/brown coal coke/wood	hard coal/brown coal/coke	hard coal/brown coal	wood	wood	wood	wood	wood	wood	wood	wood
2020	54.45%	1.86%	7.70%	2.91%	3.70%	0.13%	0.72%	18.74%	1.12%	0.37%	0.85%	5.65%	1.27%	0.10%	0.44%
2021	51.99%	1.89%	6.93%	2.84%	4.77%	0.17%	0.90%	17.90%	1.07%	0.50%	0.82%	7.65%	1.64%	0.14%	0.78%
2022	51.09%	1.99%	6.34%	3.49%	3.47%	0.14%	0.67%	17.59%	1.05%	0.53%	0.82%	10.74%	1.19%	0.11%	0.78%
2023	48.90%	2.06%	5.41%	4.27%	3.32%	0.14%	0.66%	16.83%	1.00%	0.55%	0.73%	13.89%	1.14%	0.11%	0.99%
2024	46.58%	2.12%	4.42%	5.09%	3.16%	0.14%	0.65%	16.03%	0.96%	0.57%	0.63%	17.25%	1.09%	0.10%	1.21%
2025	44.10%	2.19%	3.41%	5.92%	3.00%	0.15%	0.63%	15.18%	0.91%	0.58%	0.50%	20.85%	1.03%	0.10%	1.45%
2026	41.45%	2.26%	2.33%	6.80%	2.82%	0.15%	0.62%	14.27%	0.85%	0.60%	0.34%	24.72%	0.97%	0.10%	1.70%
2027	38.21%	2.32%	1.21%	8.49%	2.60%	0.16%	0.66%	13.15%	0.78%	0.62%	0.14%	28.71%	0.89%	0.10%	1.96%
2028	34.81%	2.38%	0.00%	10.29%	2.36%	0.16%	0.70%	11.98%	0.71%	0.63%	0.00%	32.83%	0.81%	0.09%	2.23%
2029	31.24%	2.44%	0.00%	10.90%	2.12%	0.17%	0.74%	10.75%	0.64%	0.65%	0.00%	37.01%	0.73%	0.09%	2.51%
2030	27.48%	2.50%	0.00%	11.55%	1.87%	0.17%	0.78%	9.46%	0.56%	0.67%	0.00%	41.42%	0.64%	0.08%	2.81%
2031	23.51%	2.57%	0.00%	12.24%	1.60%	0.17%	0.83%	8.09%	0.48%	0.69%	0.00%	46.05%	0.55%	0.08%	3.13%
2032	18.94%	2.59%	0.00%	14.82%	1.29%	0.18%	1.01%	6.52%	0.39%	0.69%	0.00%	49.70%	0.44%	0.07%	3.38%
2033	14.30%	2.60%	0.00%	17.44%	0.97%	0.18%	1.18%	4.92%	0.29%	0.69%	0.00%	53.39%	0.33%	0.07%	3.63%
2034	9.59%	2.62%	0.00%	20.09%	0.65%	0.18%	1.37%	3.30%	0.20%	0.70%	0.00%	57.13%	0.22%	0.06%	3.88%
2035	4.83%	2.64%	0.00%	22.78%	0.33%	0.18%	1.55%	1.66%	0.10%	0.70%	0.00%	60.92%	0.11%	0.05%	4.14%
2036	0.00%	2.66%	0.00%	25.51%	0.00%	0.18%	1.73%	0.00%	0.00%	0.71%	0.00%	64.77%	0.00%	0.05%	4.40%
2037	0.00%	2.66%	0.00%	23.94%	0.00%	0.18%	1.63%	0.00%	0.00%	0.71%	0.00%	66.33%	0.00%	0.05%	4.51%
2038	0.00%	2.67%	0.00%	22.37%	0.00%	0.18%	1.52%	0.00%	0.00%	0.71%	0.00%	67.89%	0.00%	0.05%	4.61%
2039	0.00%	2.67%	0.00%	20.79%	0.00%	0.18%	1.41%	0.00%	0.00%	0.71%	0.00%	69.46%	0.00%	0.05%	4.72%
2040	0.00%	2.68%	0.00%	19.20%	0.00%	0.18%	1.30%	0.00%	0.00%	0.71%	0.00%	71.04%	0.00%	0.05%	4.83%
2045	0.00%	2.68%	0.00%	19.20%	0.00%	0.18%	1.30%	0.00%	0.00%	0.71%	0.00%	71.04%	0.00%	0.05%	4.83%
2050	0.00%	2.68%	0.00%	19.20%	0.00%	0.18%	1.30%	0.00%	0.00%	0.71%	0.00%	71.04%	0.00%	0.05%	4.83%