2019

INFORMATIVE INVENTORY REPORT OF GEORGIA

2007-2017

Ministry of Environmental Protection and Agriculture of Georgia

Ambient Air Division

Submitted under the Convention on Long-Range Transboundary Air Pollution

Ambien Air Division

LIST OF ABBREVIATIONS

MEPA – Ministry of Environmental Protection and Agriculture of Georgia

EMEP – The European Monitoring and Evaluation Programme

EEA – European Economic Area

GEOSTAT – National Statistics Office of Georgia

IPCC – Intergovernmental Panel on Climate Change

CLRTAP – Convention on Long-Range Transboundary Air Pollution

COPERT 4 – Road transport database

CNG – Compressed natural gas

IIR – Informative Inventory Report (UNECE)

LPS – Large point sources, equals to the definition of E-PRTR installations

NFR – Nomenclature for reporting (IPCC code of categories)

QA/QC – Quality assurance/quality control:

UNECE – United Nations Economic Commission for Europe

Pollutants

As – Arsenic

Cd – Cadmium Cr

– Chromium Cu –

Copper

CO – Carbon monoxide

HCB – Hexachlorobenzene

Hg – Mercury

HM – Heavy metals

NH3 – Ammonia

Ni – Nickel

NMVOC – Non-methane volatile organic compounds

NO2 – Nitrogen dioxide

NOx – Nitrogen oxides, nitric oxide and nitrogen dioxide, expressed as nitrogen dioxide

PAH – Polyaromatic hydrocarbons expressed as the sum of benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3,-cd)pyrene

Pb – Lead

PCDD/PCDF – Dioxins and furans: 1,2,3,7,8-PeCDD; 2,3,4,7,8-PeCDF; 1,2,3,4,7,8-HxCDF; 1,2,3,6,7,8-HxCDF

PCB – Polychlorinated biphenyls

PCP – Pentachlorophenol

PFCs – Perfluorocarbons

PM2.5 – Particulate matter; particles on the order of ~ 2.5 micrometers or less

PM10 – Particulate matter; particles on the order of ~10 micrometers or less POP

– Persistent organic pollutants

Se – Selenium

SO_2 – Sulphur dioxide

SOx – Sulphur oxides, all sulphur compounds expressed as sulphur dioxide

TSP – Total suspended particulates

Zn – Zinc

Contents

Executive Summary

Georgia is a party to the 1979 Geneva Convention on Long-range Transboundary Air Pollution since 1999. The present report is the fourth Informative Inventory Report submitted by Georgia under the Convention on Long-Range Transboundary Air Pollution. The first IIR was submitted in 2015. The report provides background information on Georgia's emission inventory data.

Georgia reports emissions of NOx, NMVOC, SO2, NH3, PM2.5, PM10, TSP, CO, Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, PCDD/ PCDF, benzo(a) pyrene, benzo(b) fluoranthene, benzo(k) fluoranthene, Indeno (1,2,3-cd) pyrene, HCB, PCBs, in the following sectors: Energy, Industrial Processes and Product Use, Agriculture and Waste. Georgia also reports emission data from large point sources.

The main pollutants reported by Georgia show the following trends:

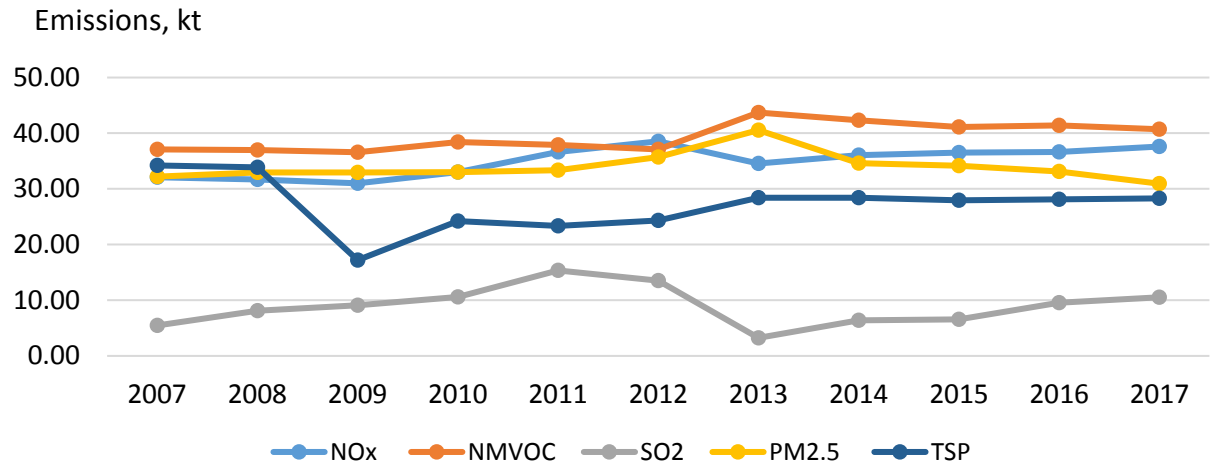

Figure 1.1 Trends of main pollutants, 2007-2017

1. Introduction

1.1. National Inventory Background

Georgia joined the Convention on Long-Range Transboundary Pollution in 1999. Georgia annually provides a national inventory of air pollutants. The following pollutants are covered:

Table 1.1 List of pollutants by sector

Sector	Pollutant / 2007-2017					
Energy	Main Pollutants	PM	CO	Priority Heavy Metals	Additional Heavy Metals	POPs
Industrial Processes and Product Use	Main Pollutants	PM	CO	Priority Heavy Metals	Additional Heavy Metals	POPs
Agriculture	Main Pollutants[1]	PM[2]				
Waste	Main Pollutants	PM	CO			POPs[3]

[1] Except SOx
[2] Except BC
[3] Only benzo(a)pyrene

1.2. Institutional Arrangements

In Georgia, the Ministry of Environmental Protection and Agriculture (MEPA) is responsible for preparation of the inventory. This task is located within the Ambient Air Division, which collects activity data from GEOSTAT (the Statistical Office) Ministry of Internal Affairs of Georgia (car fleet) and from various companies.

MEPA carries out the emission calculation based on the collected data. Quality checking/control is also carried out by MEPA.

MEPA is responsible for reporting emission data to the UNECE.

The responsibilities for preparing the inventory are shown in the following figure.

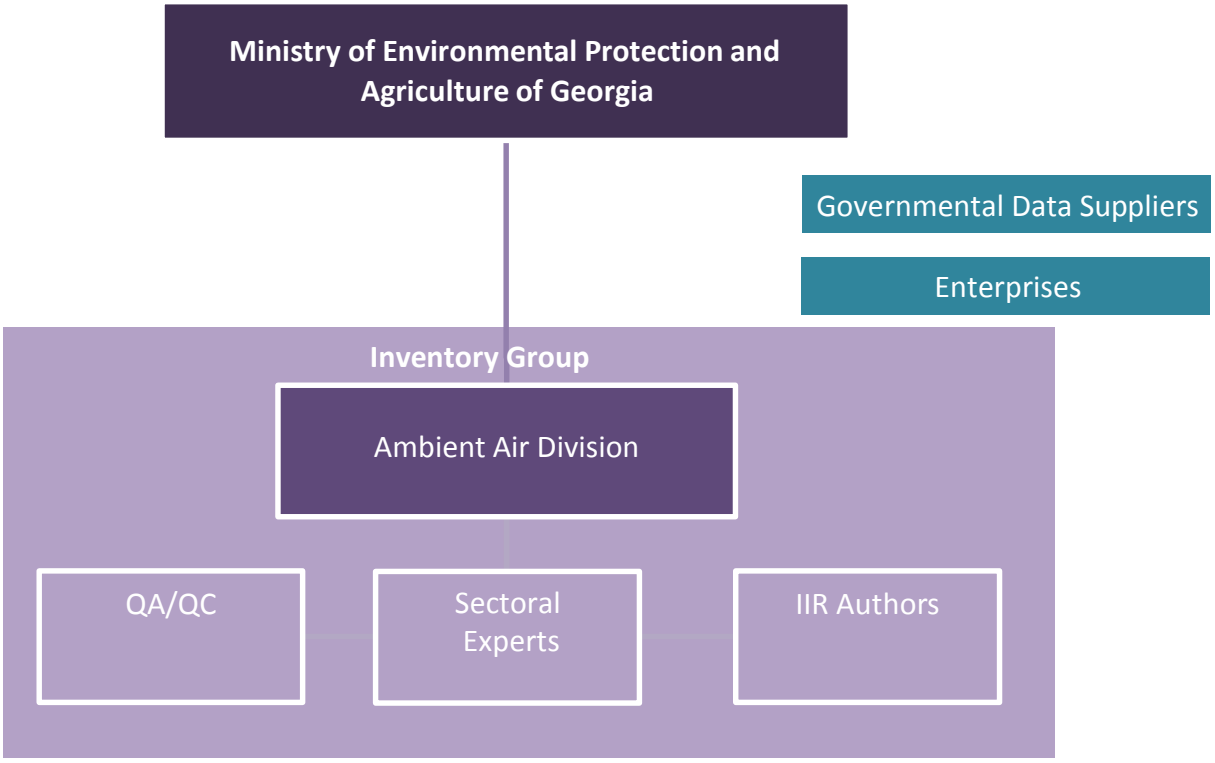

Figure 1.2 Responsibilities for preparing of emission inventory

1.3. Inventory preparation process

In the first step of inventory preparation, MEPA receives data from the Statistical office and other data suppliers. Information on county's car fleet are received from the Ministry of Internal Affairs of Georgia. Data on wastewater handling are provided by the Water Resources Management Division of MEPA.

Emissions are calculated on the base of the standard methods and procedures, such as: EMEP/EEA Guidebook, National Methodology, Country-specific EF, COPERT.

Activity data and emission factors are stored in Excel files. Data is backed-up and archived at MEPA (Ambient Air Division) in different computers and virtual server.

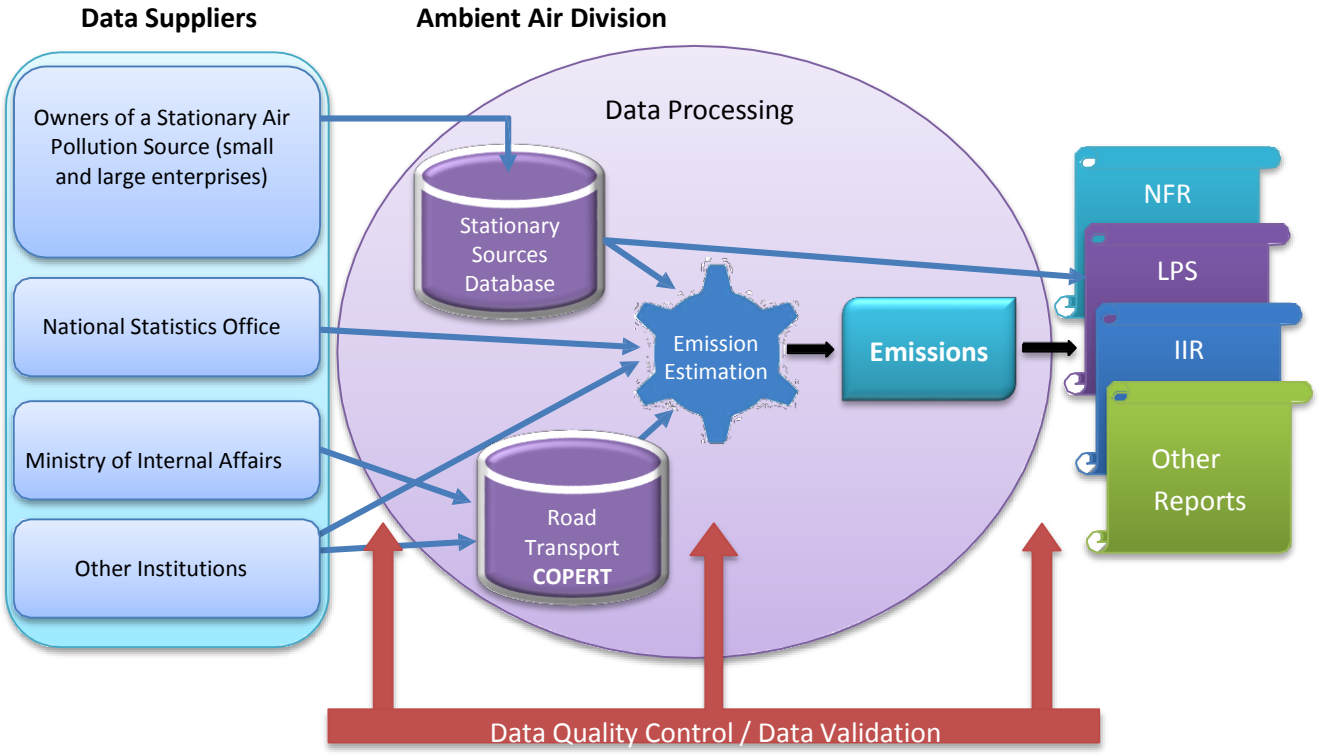

Figure 1.3 Emission inventory structure

1.4. Methods and data sources

Emissions from the Agriculture sector are calculated based on Tier 1 EMEP/EEA methodology, along with the recommended Tier 1 emission factors from GB2016. Road transport emissions are calculated by software tool COPERT 4 (Tier 2/3 method). Emissions from Solid waste disposal on land are calculated based on Tier 1 EMEP/EEA methodology and activity data were obtained from GHG inventory under UNFCCC (CH_4 emissions). From 2007-2012 for other sectors, a national methodology[5] is applied.

Since 2013, GEOSTAT prepares yearly National Energy Balance. From the same year was improved state reporting system from stationary sources (which covers all stationary sources, their type of activity, emissions, consumed material and fuel, manufactured products). Based on this improvements more detailed calculation of emissions from energy and industry sectors were made for the years 2013-2017. Consequently, inventory for these years covers more categories and pollutants. The methods used for the NFR sectors for the years 2013-2017 are as follows:

1. ENERGY

1A1a, 1A2d, 1A2e, 1A3dii: Tier 2 method, EMEP/EEA Guidebook - 2016.
1A2f: Tier 2/3 method, EMEP/EEA Guidebook – 2016; National Methodology.
1A3b (i-vi) Road transport: COPERT 4 model (v.11.2), Tier 2/3 method.
1A3c, 1A4ai, 1A4bi, 1A4ci, 1A4cii, 1B2b: Tier 1 method, EMEP/EEA Guidebook - 2016.

[5] # 435 Order of the Government on instrumental method for determination of actual amounts of emissions into ambient air from stationary pollution source, standard list of emission measuring equipment, and methodology for calculation of actual amounts of emissions into ambient air from stationary pollution source according to technological processes (31/12/13)

1B1a, 1B1b: Plant specific (emissions from state reporting system).

1B2ai: National Methodology.

2. INDUSTRIAL PROCESSES AND PRODUCT USE

2A1, 2A2, 2A5a, 2C2, 2H1, 2H2, 2I: National Methodology.

2A3, 2B10a, 2D3b: Plant specific (emissions from state reporting system).

2A6: National Methodology for emission calculation from concrete production and Plant specific (emissions from state reporting system) from brick production.

2C1, 2C5: Tier 1 method, EMEP/EEA Guidebook - 2016.

2C3: Tier 2 method, EMEP/EEA Guidebook - 2016.

3. AGRICULTURE

3B1a, 3B1b, 3B2, 3B3, 3B4a, 3B4d, 3B4gi, 3B4gii, 3Da1: Tier 1 method, EMEP/EEA Guidebook-2016.

5. WASTE

5A, 5D1, 5D2: Tier 1 method, EMEP/EEA Guidebook - 2016.

5C1bi, 5C1biii: Plant specific (emissions from state reporting system).

Data sources for the inventory comprise the National Statistical Office, the Ministry of Internal Affairs and the Water Resources Management Division. In addition, information for point sources is provided in reports by companies, verified by Department for Environmental Assessment of MEPA. Data on CH_4 emissions from solid waste disposal on land were obtained from Georgia's Biennial Update Reports to the UNFCCC.

1.5. Key categories

This chapter presents the results of key sources analyses.

It is good practice for each country to identify its national key categories in a systematic and objective way. This can be achieved by a quantitative analysis of the relationship between the magnitude of emissions in any one year (level) and the change in the emissions year to year (trend) of each category's emissions compared to the total national emissions.

Key sources analysis is prepared based on methodology described in Chapter 2 of the EMEP/EEA air pollutant emission inventory Guidebook 2016. The methodology covers Approaches 1 and 2 for level assessment. Both approaches identify key categories in terms of their contribution to the absolute level of the national emissions.

In Approach 1: the key categories are identified using a predetermined cumulative emissions threshold. Key categories are those which, when summed together in descending order of magnitude, cumulatively add up to 80% of the total level.

In Approach 2: the key categories can be derived by inventory compilers if category uncertainties or parameter uncertainties are available. Under Approach 2 the categories are sorted according to their contribution to uncertainty.

For identification of the key categories for level assessment, approach 1 has been selected.

Level assessment

The contribution of each source category to the total national inventory level is calculated according to equation (1) (level assessment (Approach 1)):

Key category level assessment = source category estimate / total contribution

$L_{x,t} = E_{x,t} / \sum E_t$

Where:

$L_{x,t}$ = level assessment for source x in latest inventory year (year Gg)

$E_{x,t}$ = value of emission estimate of source category x in year Gg

$\sum E_t$ = total contribution, which is the sum of the emissions in year Gg, calculated using the aggregation level chosen by the country for key category analysis.

Key categories according to equation (1) are those that, when summed together in descending order of magnitude, add up to 80 % of the sum of all $L_{x,t}$. Tables 1.2 - 1.26 present the source category, sorted by largest contribution to national total.

Table 1.2 Key categories Level assessment for NOx in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A3biii	Road transport: Heavy duty vehicles and buses	NOx	13.782	36.6%	36.6%
1A3bi	Road transport: Passenger cars	NOx	9.46	25.1%	61.8%
1A4bi	Residential: Stationary	NOx	2.36	6.3%	68.0%
1A3bii	Road transport: Light duty vehicles	NOx	2.36	6.3%	74.3%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	NOx	2.03	5.4%	79.7%
2C2	Ferroalloys production	NOx	1.70	4.5%	84.2%

Table 1.3 Key categories Level assessment for NMVOC in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A3bi	Road transport: Passenger cars	NMVOC	9.244	22.7%	22.7%
1A4bi	Residential: Stationary	NMVOC	9.08	22.3%	45.0%
2D3a	Domestic solvent use including fungicides	NMVOC	4.47	11.0%	56.0%
1A3bv	Road transport: Gasoline evaporation	NMVOC	4.10	10.1%	66.0%
3B1a	Manure management - Dairy cattle	NMVOC	3.84	9.4%	75.5%
2H2	Food and beverages industry	NMVOC	1.82	4.5%	79.9%
1A3biii	Road transport: Heavy duty vehicles and buses	NMVOC	1.76	4.3%	84.3%

Table 1.4 Key categories Level assessment for SOx in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	SOx	4.351	41.7%	41.7%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	SOx	3.72	35.7%	77.4%
1A1a	Public electricity and heat production	SOx	0.74	7.0%	84.5%

Table 1.5 Key categories Level assessment for NH_3 in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
3B1a	Manure management - Dairy cattle	NH3	16.232	52.3%	52.3%
3B1b	Manure management - Non-dairy cattle	NH3	4.88	15.8%	68.1%
3Da1	Inorganic N-fertilizers (includes also urea application)	NH3	3.22	10.4%	78.5%
3B4gii	Manure mangement - Broilers	NH3	2.88	9.3%	87.7%

Table 1.6 Key categories Level assessment for PM2.5 in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A4bi	Residential: Stationary	PM2.5	11.152	64.6%	64.6%
2C2	Ferroalloys production	PM2.5	1.67	9.7%	74.2%
2A1	Cement production	PM2.5	1.08	6.2%	80.5%

Table 1.7 Key categories Level assessment for PM10 in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A4bi	Residential: Stationary	PM10	11.453	52.4%	52.4%
2C2	Ferroalloys production	PM10	2.36	10.8%	63.2%
2A1	Cement production	PM10	1.94	8.8%	72.0%
2H1	Pulp and paper industry	PM10	1.17	5.4%	77.4%
3B4gii	Manure mangement - Broilers	PM10	0.77	3.5%	80.9%

Table 1.8 Key categories Level assessment for TSP in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A4bi	Residential: Stationary	TSP	12.054	42.6%	42.6%
2A6	Other mineral products (please specify in the IIR)	TSP	2.79	9.9%	52.5%
2C2	Ferroalloys production	TSP	2.78	9.8%	62.3%
2A1	Cement production	TSP	2.15	7.6%	69.9%
2A5a	Quarrying and mining of minerals other than coal	TSP	1.53	5.4%	75.3%
2H1	Pulp and paper industry	TSP	1.46	5.2%	80.5%

Table 1.9 Key categories Level assessment for BC in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A4bi	Residential: Stationary	BC	1.113	78.6%	78.6%
2C2	Ferroalloys production	BC	0.17	11.8%	90.4%

Table 1.10 Key categories Level assessment for CO in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A3bi	Road transport: Passenger cars	CO	99.372	56.3%	56.3%
1A4bi	Residential: Stationary	CO	60.95	34.5%	90.8%

Table 1.11 Key categories Level assessment for Pb in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
2C1	Iron and steel production	Pb	0.795	28.2%	28.2%
1A3bvi	Road transport: Automobile tyre and brake wear	Pb	0.62	22.0%	50.2%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	Pb	0.55	19.6%	69.8%
1A4bi	Residential: Stationary	Pb	0.41	14.5%	84.3%

Table 1.12 Key categories Level assessment for Cd in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A4bi	Residential: Stationary	Cd	0.195	79.6%	79.6%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	Cd	0.01	4.1%	83.8%

Table 1.13 Key categories Level assessment for Hg in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	Hg	0.062	29.9%	29.9%
2K	"Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)"	Hg	0.04	18.0%	47.9%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	Hg	0.03	15.9%	63.8%
1A4bi	Residential: Stationary	Hg	0.03	14.5%	78.3%
2D3a	Domestic solvent use including fungicides	Hg	0.02	10.1%	88.4%

Table 1.14 Key categories Level assessment for As in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
2C1	Iron and steel production	As	0.069	43.6%	43.6%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	As	0.03	21.2%	64.8%
2A3	Glass production	As	0.02	11.4%	76.2%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	As	0.02	10.5%	86.7%

Table 1.15 Key categories Level assessment for Cr in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
2C1	Iron and steel production	Cr	0.778	50.8%	50.8%
1A4bi	Residential: Stationary	Cr	0.35	22.5%	73.3%
1A3bvi	Road transport: Automobile tyre and brake wear	Cr	0.23	15.1%	88.4%

Table 1.16 Key categories Level assessment for Cu in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A3bvi	Road transport: Automobile tyre and brake wear	Cu	5.069	93.9%	93.9%

Table 1.17 Key categories Level assessment for Ni in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	Ni	0.062	20.3%	20.3%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	Ni	0.05	17.6%	38.0%
1A4ai	Commercial/institutional: Stationary	Ni	0.05	17.0%	55.0%
1A3bvi	Road transport: Automobile tyre and brake wear	Ni	0.04	11.7%	66.6%
1A4bi	Residential: Stationary	Ni	0.03	9.9%	76.6%
2C1	Iron and steel production	Ni	0.02	7.9%	84.5%

Table 1.18 Key categories Level assessment for Se in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
2A3	Glass production	Se	0.093	52.3%	52.3%
1A2f	Stationary combustion in manufacturing industries and construction: Non-metallic minerals	Se	0.03	18.0%	70.3%
1A1a	Public electricity and heat production	Se	0.03	16.1%	86.4%

Table 1.19 Key categories Level assessment for Zn in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A4bi	Residential: Stationary	Zn	7.689	54.2%	54.2%
1A3bi	Road transport: Passenger cars	Zn	1.71	12.1%	66.2%
1A3bvi	Road transport: Automobile tyre and brake wear	Zn	1.68	11.8%	78.1%
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	Zn	0.83	5.8%	83.9%

Table 1.20 Key categories Level assessment for PCDD/ PCDF in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A4bi	Residential: Stationary	PCDD	12.071	84.9%	84.9%

Table 1.21 Key categories Level assessment for benzo(a)pyrene in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A4bi	Residential: Stationary	benzoa	1.821	89.3%	89.3%

Table 1.22 Key categories Level assessment for benzo(b)fluoranthene in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A4bi	Residential: Stationary	benzob	1.673	85.2%	85.2%

Table 1.23 Key categories Level assessment for benzo(k)fluoranthene in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A4bi	Residential: Stationary	benzok	0.633	83.5%	83.5%

Table 1.24 Key categories Level assessment for Indeno(1,2,3-cd)pyrene in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A4bi	Residential: Stationary	Indeno	1.068	91.7%	91.7%

Table 1.25 Key categories Level assessment for HCB in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
1A4bi	Residential: Stationary	HCB	0.075	67.7%	67.7%
2C3	Aluminium production	HCB	0.02	18.9%	86.6%

Table 1.26 Key categories Level assessment for PCB in 2017

NFR category code	NFR category	Pollutant	Last year estimate Ex t	Level Assessment Lx t	Cumulative total of column E
2K	Consumption of POPs and heavy metals (e.g. electrical and scientific equipment)	PCBs	372.637	98.1%	98.1%

Trend assessment

Introduction of national energy balance and improvement of state emission reporting system (from stationary sources) from 2013 enabled use more detailed methodological approaches and calculate emissions for more categories and pollutants. Therefore, inventory data before 2013 and after 2013 are not consistent and comparable. Thus, until re-estimation of activity data and recalculation of emissions for the previous years, assessment of trends is not reasonable.

1.6. QA/QC and verification methods

The following quality control measures are carried out:

Check for transcription errors and data comparison

For point sources, the first check is made during the approval of the submitted annual reports, and then in process of the data analysis. Statistical data is compared to data available from previous years. In case of discrepancies, data from other sources (e.g. from companies) are used. If the data available to the Ministry shows higher levels than the statistical data, the levels available to the Ministry are used.

Check of calculated emissions

A staff member who did not make a specific calculation checks the colleague's approach and results. All results are compared to the values of previous years.

In addition, the following measure is carried out:

Review of methods and emission factors

Emission factors are updated when new EMEP/EEA-Guidebooks are published. Other guidebooks are monitored. The national methodology is also updated continuously.

1.7. General assessment of completeness

List of notation keys

In the following table, notation keys are listed (as defined in the UNFCCC reporting guidelines (ECE/EB.AIR/125):

(a) "NE" (not estimated), for activity data and/or emissions by sources of pollutants which have not been estimated but for which a corresponding activity may occur within a Party. Where NE is used in an inventory to report emissions of pollutants, the Party should indicate why such emissions have not been estimated;

(b) "IE" (included elsewhere), for emissions by sources of pollutants estimated but included elsewhere in the inventory instead of under the expected source category. Where IE is used in an inventory, the Party should indicate where in the inventory the emissions for the displaced source category have been included, and the Party should explain such a deviation from the inclusion under the expected category;

(c) "C" (confidential information), for emissions by sources of pollutants of which the reporting could lead to the disclosure of confidential information. The source category where these emissions are included should be indicated;

(d) "NA" (not applicable), for activities under a given source category that do occur within the Party but do not result in emissions of a specific pollutant;

(e) "NO" (not occurring), for categories or processes within a particular source category that do not occur within a Party;

(f) "NR" (not relevant). According to paragraph 37 in the Guidelines, emission inventory reporting for the main pollutants should cover all years from 1990 onwards if data are available. However, NR is introduced to ease the reporting where reporting of emissions is not strictly required by the different protocols, e.g., emissions for some Parties prior to agreed base years.

Sources not estimated

The following categories have not been estimated:
List of important sectors with "NE" and short justification why these sectors have not been estimated.

Table 1.14 Sources not estimated (NE)

NFR14 code	Substance(s)	Reason for not estimated
1A1a	NH_3, PCDD/ PCDF, HCB, PCBs	Emission occur, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2016)
1A2a	NH_3	
1A2b	NH_3	
1A2c	NMVOC, $PM_{2.5}$, PM_{10}, BC, HMs, POPs	Emission occur, but have not been estimated due to lack of emission factors in national methodology
1A2d	NH_3, HCB, PCB	Emission occur, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2016)
1A3ai(i)	All	Emission occur, but have not been estimated due to lack of statistic data
1A3aii(i)	All	
1A3bi	BC, Hg, As, HCB, PCBs	Emissions occur, but have not been estimated due to lack of emission factors in methodology (COPERT 4 version v11.2 fills NFR table (including notation keys NE)).
1A3bii	BC, Hg, As, HCB, PCBs	
1A3biii	BC, Hg, As, HCB, PCBs	
1A3biv	BC, Hg, As, HCB, PCBs	
1A3bv	PAHs, HCB, PCBs	
1A3bvi	TSP, Hg, As, PAHs, HCB, PCBs	
1A3bvii	$PM_{2.5}$, PM_{10}, TSP, CO, HMs, POPs	
1A3c	BC, Pb, Hg, As, PCDD/PCDF, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene	Emission occur, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2016)
1A3dii	SOx, BC, HMs, POPs	
1A3ei	All	Emission occur, but have not been estimated due to lack of statistic data
1A4aii	All	
1A4bii	All	
1A4cii	BC, Hg, As, PCDD/PCDF, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, HCB, PCBs	Emission occur, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2016)
1A4ciii	All	Emission occur, but have not been estimated due to lack of statistic data
1B1a	NMVOC, $PM_{2.5}$, PM_{10}, BC, HMs,	Emission occur, but have not been estimated due to lack of emission factors in national methodology
1B1b	NMVOC, NH_3, BC, HMs, POPs except **benzo(a) pyrene**	
1B2ai	$PM_{2.5}$, PM_{10}, BC, PCDD/PCDF	
1B2b	SOx, PCDD/PCDF	Emission occur, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2016)
1B2c	All	Emission occur, but have not been estimated due to lack of statistic data
2A5b	TSP, $PM_{2.5}$, PM_{10}	Emission occur, but have not been estimated due to lack of statistic data
2A6	$PM_{2.5}$, PM_{10}	Emission occur, but have not been estimated due to lack of emission factors in national methodology
2B10a	NMVOC, $PM_{2.5}$, PM_{10}	
2C3	Main Pollutants, CO, HMs, PAHs	Emission occur, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2016)
2C5	NMVOC, NH_3, BC, CO, Cr, Cu, Ni, Se, PAHs, HCB	

2D3c	All	Emission occur, but have not been estimated due to lack of statistic data
2D3d	NMVOC	
2D3e	NMVOC	
2D3f	NMVOC	
2D3g	NMVOC	
2D3h	NMVOC	
2H2	$PM_{2.5}$, PM_{10}	Emission occur, but have not been estimated due to lack of emission factors in national methodology
2I	$PM_{2.5}$, PM_{10}	
3B4e	NOx, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	Emission occur, but have not been estimated due to lack of statistic data
3B4f	NOx, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	
3B4giii	NOx, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	
3Da1	TSP	Emission occur, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2016)
3De	NMVOC, NH_3	Emission occur, but have not been estimated due to lack of statistic data
3F	All	
5A	NH_3, $PM_{2.5}$, PM_{10}, TSP, CO, Hg	
5B1	NOx, NMVOC, SOx, NH_3, $PM_{2.5}$, PM_{10}, TSP, BC, CO	
5C1a	All	
5C1bi	NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP, HMs except **Hg**, POPs	Emission occur, but have not been estimated due to lack of emission factors in national methodology
5C1bii	All	Emission occur, but have not been estimated due to lack of statistic data
5C1biii	NH_3, $PM_{2.5}$, PM_{10}, Se, Zn, POPs except **benzo(a) pyrene**	Emission occur, but have not been estimated due to lack of emission factors in national methodology
5C2	All	Emission occur, but have not been estimated due to lack of statistic data
5D1	TSP, PM_{10}, $PM_{2.5}$, HMs	Emission occur, but have not been estimated due to lack of emission factors in methodology (EMEP-EEA guidebook – 2013)
5D2	TSP, PM_{10}, $PM_{2.5}$, HMs	
5E	All	Emission occur, but have not been estimated due to lack of statistic data

Sources included elsewhere

List of important categories with "IE" and short explanation in which category they are included.

Table 1.15 Sources included elsewhere (IE)

NFR14 code	Substance(s)	Included in NFR code
1A2b	All	1A2a
1A2c	NOx, SOx, NH_3, TSP, CO	2B10a
1A2f	$PM_{2.5}$, PM_{10}, TSP, BC	2A1, 2A2, 2A3 and 2A6
1B1b	$PM_{2.5}$, PM_{10}, TSP	1B1a
2C1	NOx, SOx, CO, PAHs	1A2a
2C5	NOx, SOx	1A2a
3B4a	NOx, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	3B1b
3B4gi	NOx, NMVOC, NH_3, $PM_{2.5}$, PM_{10}, TSP	3B4gii

2. Explanation of key trends

In Georgia, ambient air pollution is mainly caused by emissions from motor vehicles, the energy, industrial and agriculture sectors. Trends of emissions of main pollutants from these sectors are presented in figure 2.1.

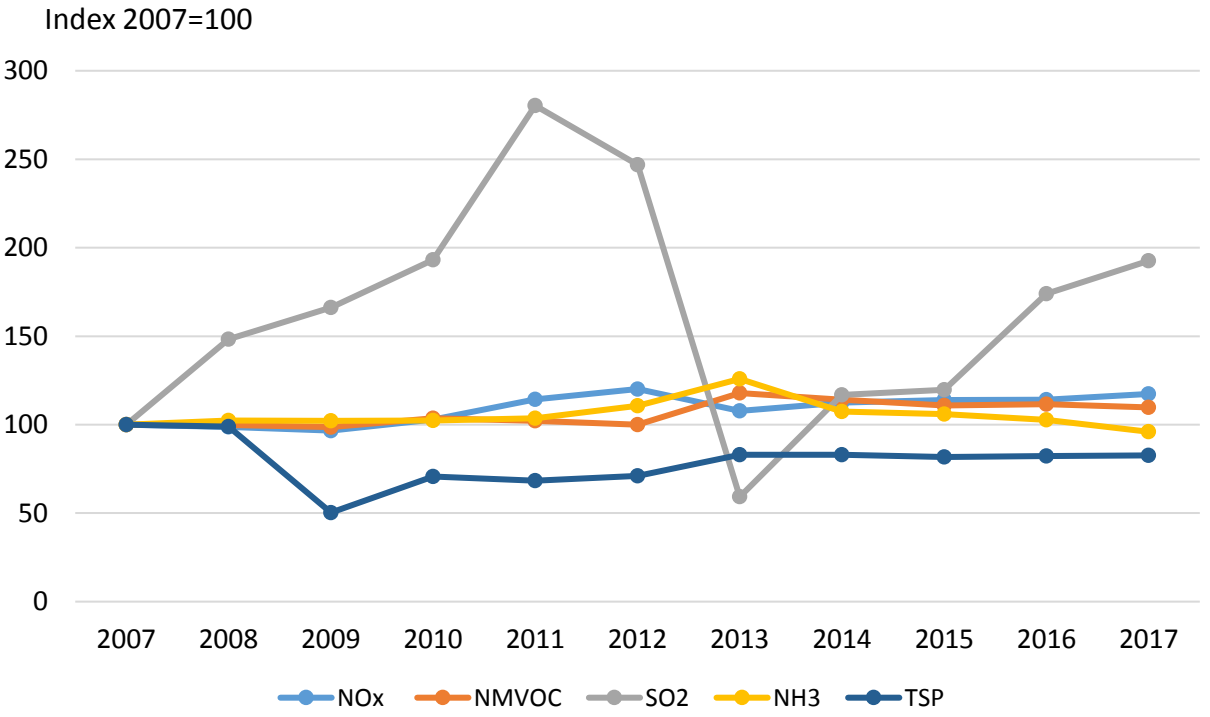

Figure 2.1 Main pollutants, trends over time, 2007 is 100 %.

- The general economic activity increased over the past decade. In consequence, emissions of most pollutants increase.
- Significant decrease of particulate matter's emissions in 2009, mainly, is a result of introduction of new emission abatement systems in country's largest cement plants. Another important reason is a global economic crisis.
- Dramatic drop of SOx emissions in 2013 was caused, on one hand, by desulphurisation of automotive fuel and decreased consumption of coal and, on the other hand, by launching of national energy balance and switching on the more detailed methodological approaches. Significant growth of the same pollutant's emissions in 2014 and 2017 related to increased consumption of coal with high sulphur content in manufacturing industries.

Nitrogen Oxides

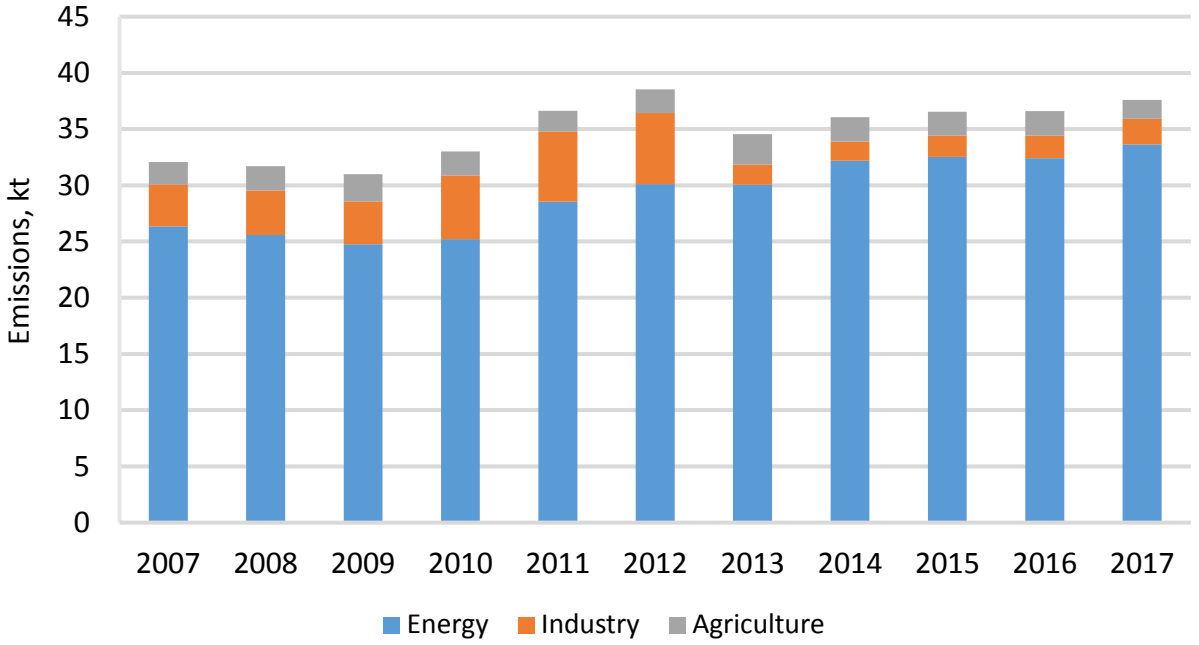

Figure 2.2 Trend of NOx emissions 2007-2017

Energy sector has the biggest share in total NOx emissions (about 89%).

Approximately 70% of total NOx emissions comes from road transport.

Significant decrease of NOx emissions since 2013 from industry sector caused by introduction of more robust methodology (Tier 3 approach – facility-specific data) in chemical industry subsector.

Non-methane volatile compounds

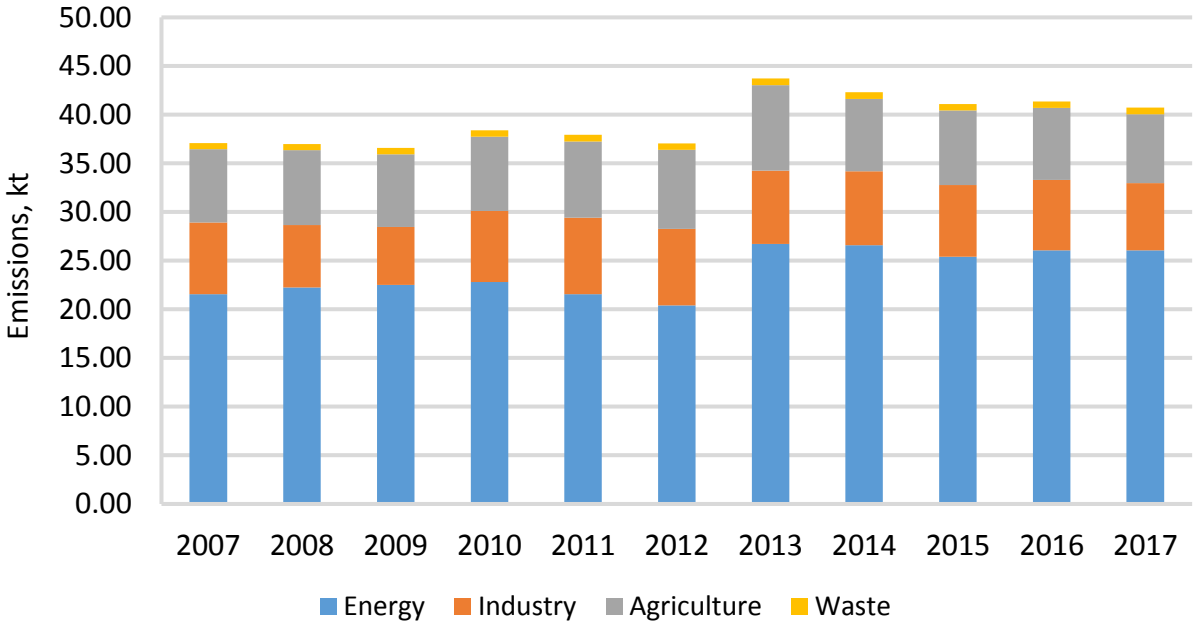

Figure 2.3 Trend of NMVOC emissions 2007-2017

In 2017 NMVOC emissions increased by 9% compared with 2007 due to increased emissions in Energy sector.

Energy sector is the main sources of pollution regarding NMVOC (about 60%).

Sulphur Dioxide

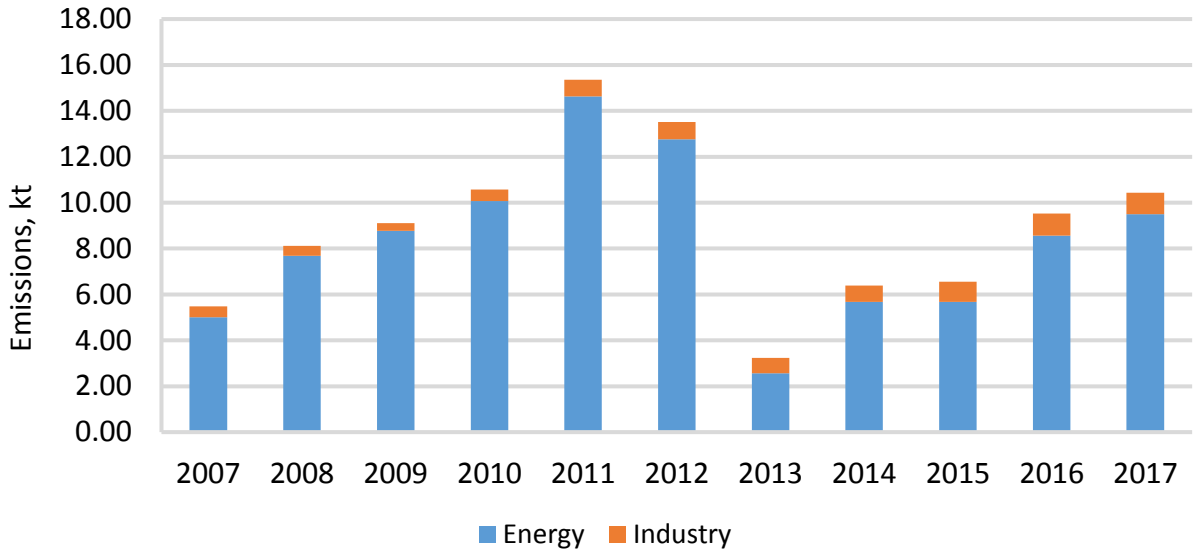

Figure 2.4 Trend of SO_2 emissions 2007-2017

Increased SO_2 emissions during the period of 2011-2012, mainly caused by introduction of coal fuel in industry sector (mostly in cement plants). Dramatic reduction in 2013 resulted by launching of national energy balance and switching on the more detailed methodological approaches. Significant increase in 2014 and 2017, caused by growth consumption of coal in subsector of iron and steel production and increased consumption of coal with high sulphur content in production of non-metallic minerals (in cement production).

About 80% of SO_2 emissions comes from combustion in manufacturing industries.

Ammonia

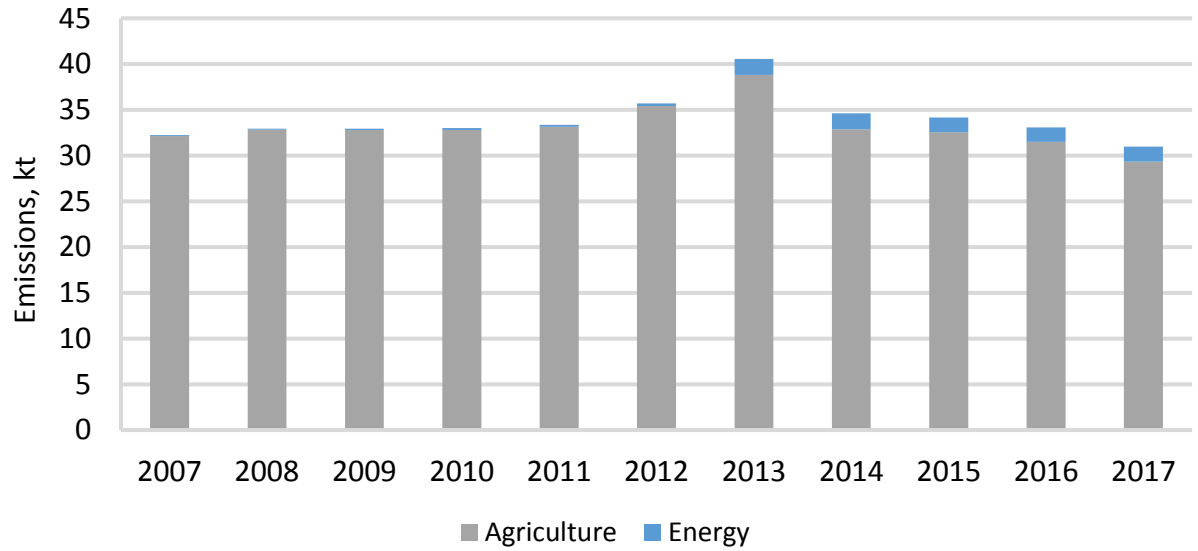

Figure 2.5 Trend of NH_3 emissions 2007-2017

Ammonia emissions during 2007-2011 remain stable. Drop of trend during last four years is related with recalculations of activity data in agriculture sector for these years by GEOSTAT. Substantial increase of emissions from energy sector since 2013 related to introduction of national energy balance. 95% of NH_3 emissions comes from agriculture sector.

Particulates

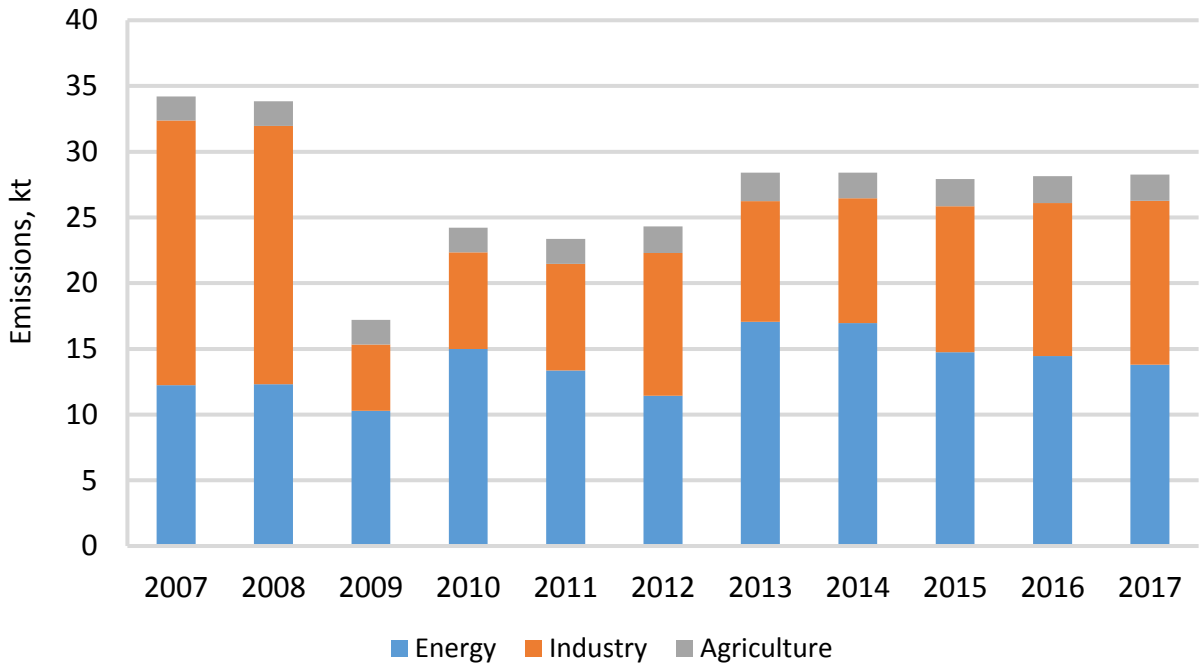

Figure 2.6 Trend of TSP emissions 2007-2017

Total emissions of particulates decreased by 17% from 2007 to 2016. The sharp reduction of particulate matter's emissions since 2009 mostly achieved by installation of new particulate filters in the biggest cement plants in Rustavi and Kaspi. As a result PM emissions from industry sector have been reduced by approximately 60%. From 2010 coal mining has been restored in Georgia. After that, this activity, together with residential stationary combustion and industry sectors became main PM polluters.

3. Energy (NFR sector 1)

Since 2013 GEOSTAT prepares yearly National Energy Balance. Energy balance gave an opportunity to improve significantly quality of inventory by estimating emissions in energy sector from much more activities than before using better methodologies and more detailed emission calculation approaches. Consequently, since 2013 emissions from activities 1A2a, 1A2d, 1A2e, 1A2f, 1A3c, 1A3dii, 1A4ai, 1A4bi, 1A4ci, 1A4cii were calculated. Additionally, for the same period emissions of heavy metals and POPs were calculated from almost all activities in energy sector.

Emissions in energy sector commonly come from fuel combustion. Minor fugitive emissions from fuel exploration generated as well. This sector covers five key activities: public electricity and heat production, combustion in manufacturing industries and construction, transport, small combustion and fugitive emissions. The energy sector is the main source of NOx, SO_2, NMVOC and TSP emissions in Georgia. In 2017, this sector contributed 89.4% of total NOx emissions and 91.1% of total SO_2 emissions, 64% of total NMVOC emissions and 48.8% of total TSP emissions.

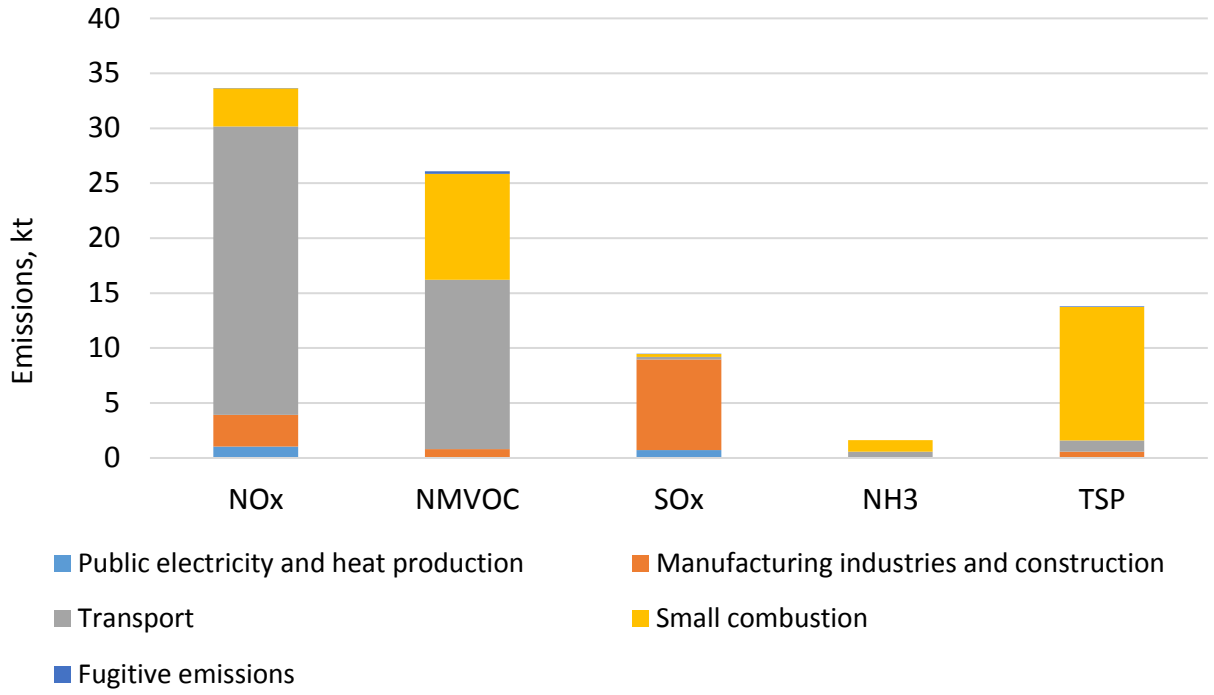

Figure 3.1 Emissions from energy sector in 2017

Transport is the major contributor of NOx (78%) and NMVOC (59.1%) emissions in the energy sector. Share of industrial combustion in total SO_2 emissions in energy sector is 85.6%. Small combustion is responsible for the 87.9% of PM and 68.4% of NH_3 emissions in this sector.

Energy industries (1A1)

Source category description

Emissions in this category come from natural gas consumption.

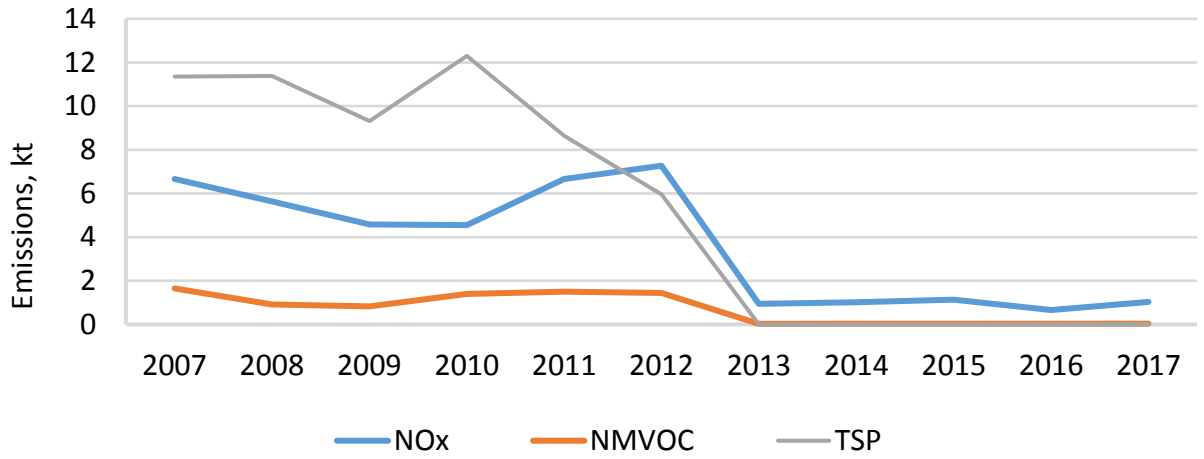

Figure 3.2 Emissions from public electricity and heat production 2007-2017

Dramatic reduction of emissions from this category since 2013 is related to introduction of national energy balance and switching on the more detailed methodological approaches.

Methodology

Emissions from 2007 to 2012 are estimated using national methodology and from 2013 (introduction of national energy balance) by EMEP/EEA Guidebook – 2016, Tier 2 approach and plant specific emissions (from state reporting system for stationary sources).

Manufacturing industries and construction (1A2)

Source category description

This category covers emissions occurred by combustion processes in industrial sector. The main emission sources in this category are metallurgy and production of mineral materials.

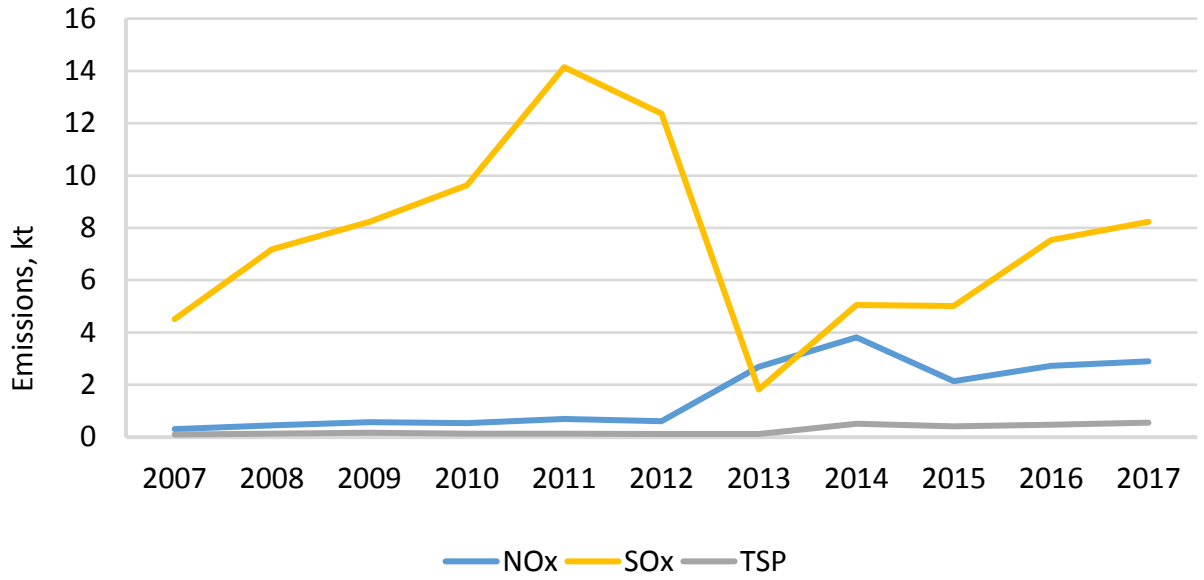

Figure 3.3 Emissions from combustion in manufacturing industries 2007-2017

Increasing trend of SO_2 emissions from 2008 to 2011 is resulted by introduction of coal fuel in industry sector (mostly in cement production). Decreasing emissions of same pollutant in 2012 related to reduced consumption of coal and heavy oil within those years, mainly caused by shifting back from coal to natural gas in cement industry. Further reduction of SO_2 emissions in 2013 is related to introduction of national energy balance, which provides detailed information on fuel consumption in categories that was not available before. It gave an opportunity to use more detailed emission estimation methodological approach (mostly EMEP/EEA Guidebook – 2016, Tier 2 approach). Raised emissions in 2014 in case of SO_2 and TSP caused by increased consumption of coal in iron and steel production, in case of NOx doubled production of cement clinker. Switching from coal with low sulphur content to high sulphur coal in production of non-metallic minerals (mostly in cement production) is a main reason of further increase of SO_2 emissions in 2016 and 2017.

Methodology

Emissions from 2007 to 2012 are estimated using national methodology and from 2013 (introduction of national energy balance) by EMEP/EEA Guidebook – 2016, Tier 2 approach and plant specific emissions (from state reporting system for stationary sources).

Transport (1A3)

Source category description

This category includes railways, national navigation (shipping) and all types of vehicles (passenger cars, light duty vehicles, heavy-duty trucks, buses, motorcycles) except off-road transport (agricultural and industrial machinery, etc.). Road transport is the main source of air pollution in Georgia. The number of transport vehicles has doubled within the last decade.

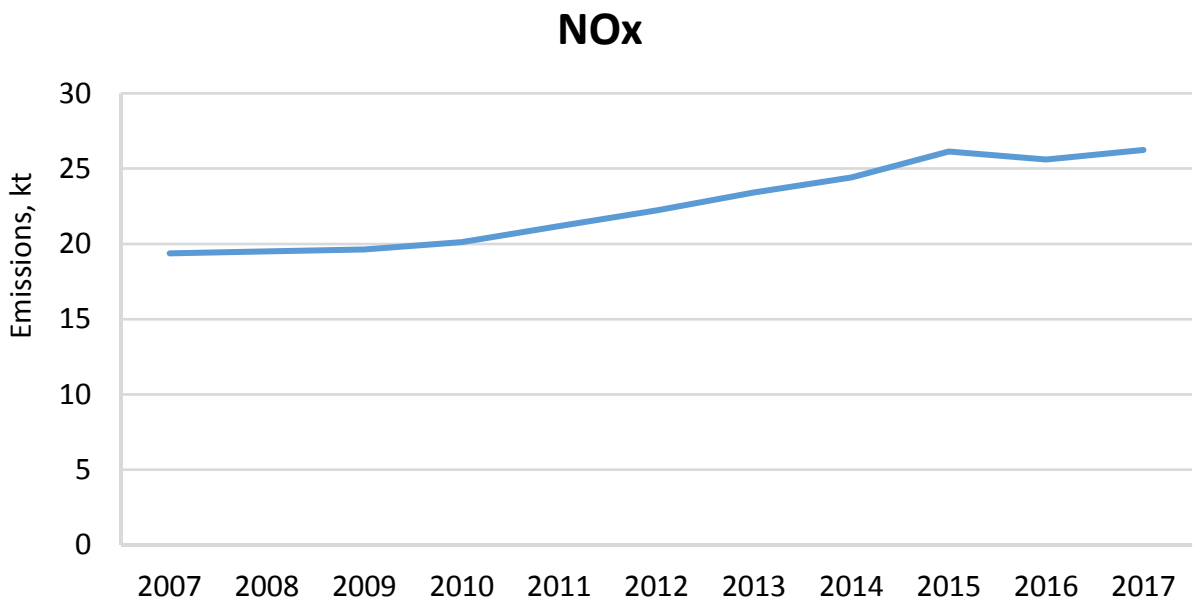

Figure 3.4 Emissions of NOx from transport 2007-2017

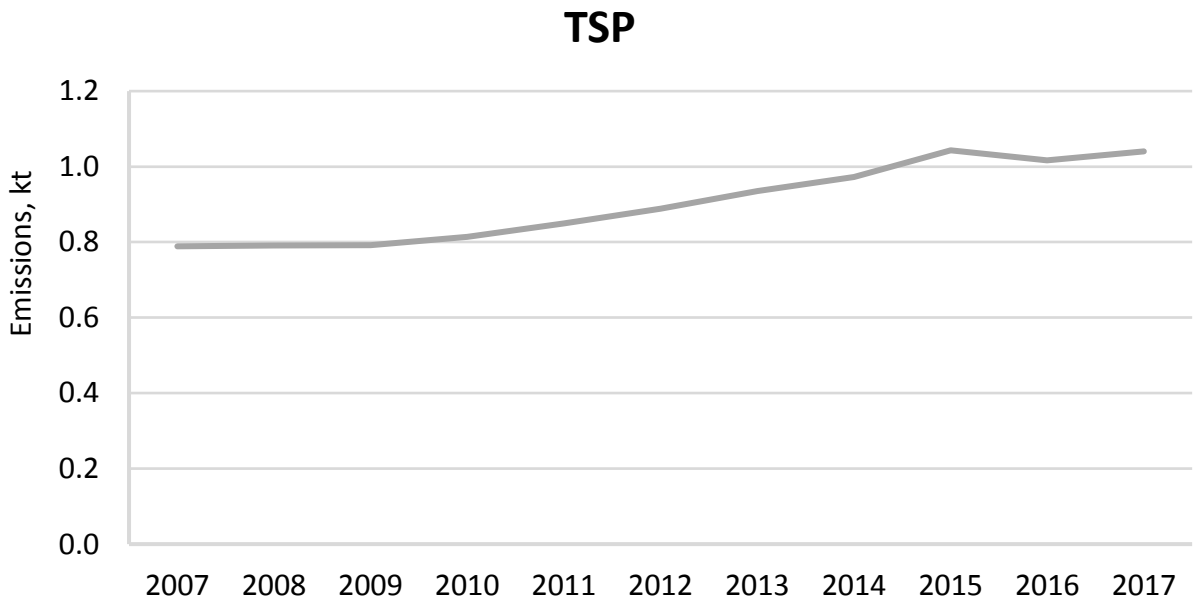

Figure 3.5 Emissions of TSP from transport 2007-2017

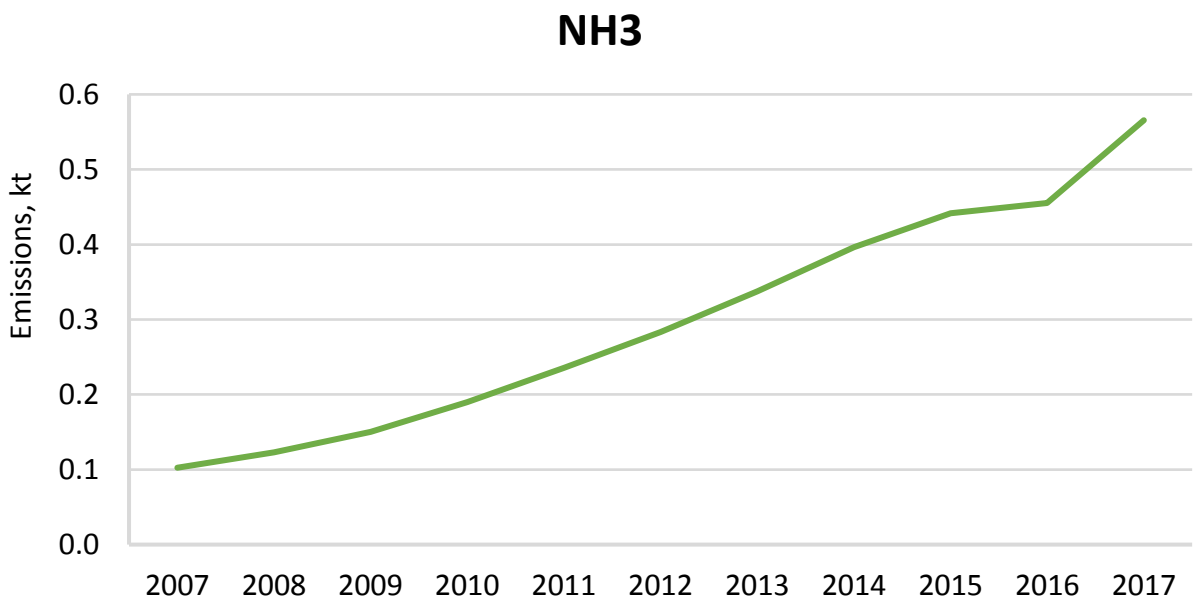

Figure 3.6 Emissions of NH_3 from transport 2007-2017

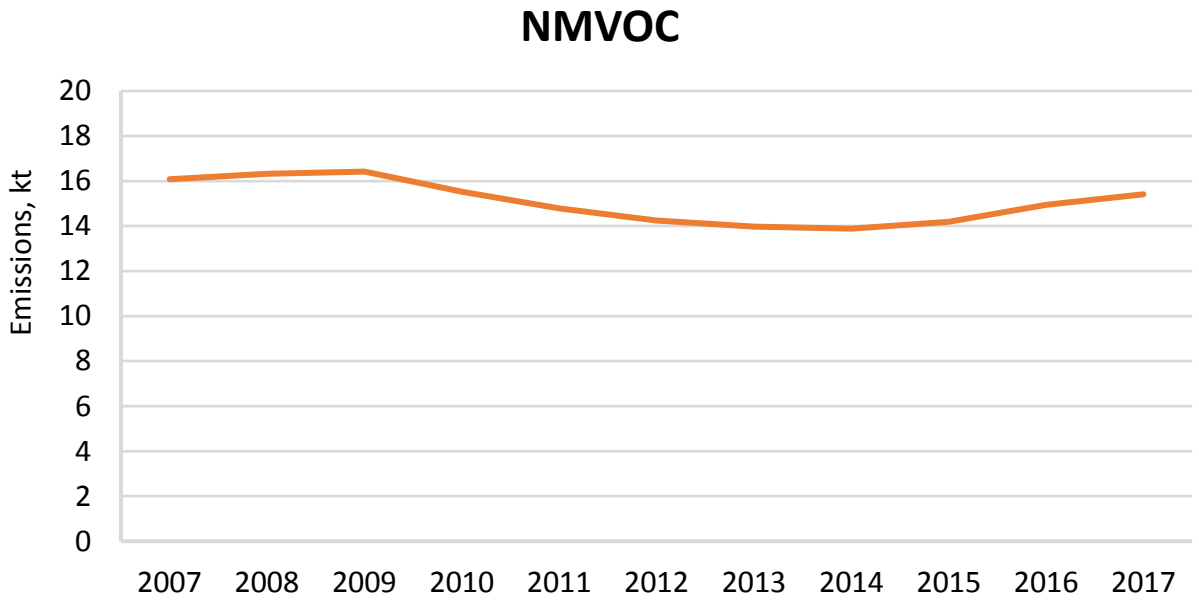

Figure 3.7 Emissions of NMVOC from transport 2007-2017

Emission trends of NOx, TSP and NH_3 from this sector is gradually increasing alongside growing number of vehicle in the country. From 2007 to 2017 emissions of NOx was increased by 35.5%, PM by 31.8 % and emissions of NH_3 by 451.9 %.

Decreasing NMVOC emissions from 2009 to 2015 caused by reduction of petrol consumption due to switching of passenger cars from petrol fuel to compressed natural gas (CNG). Increasing emissions since 2015 is related to growing petrol consumption in these years, mostly caused by switching back to petrol from CNG of passenger cars due to increased price of CNG.

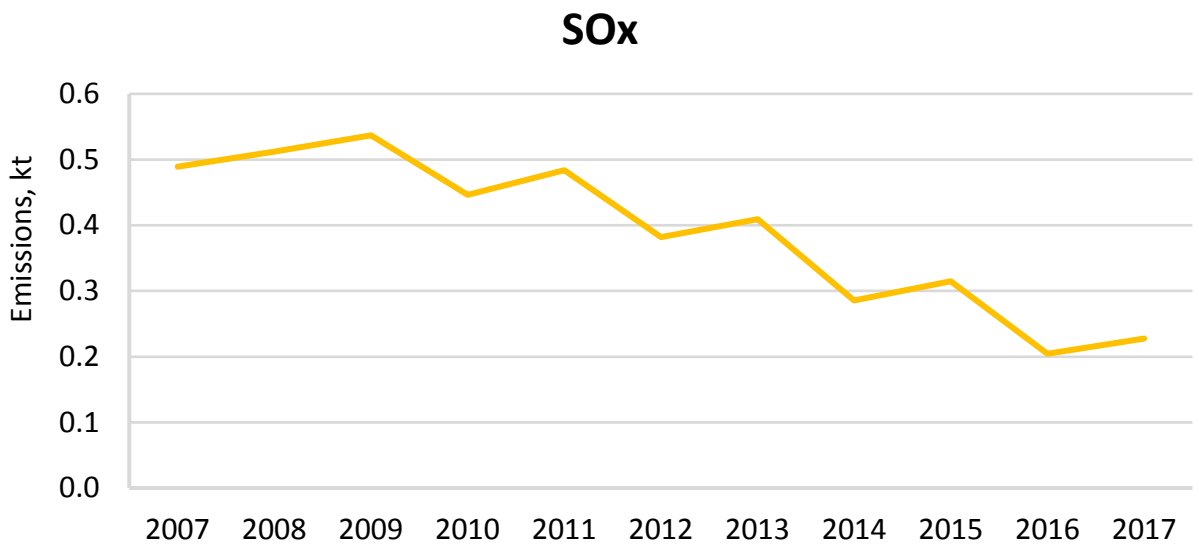

Figure 3.8 Emissions of SOx from transport 2007-2017

Emissions of SOx are gradually decreasing in parallel with reduction of sulphur content limits in national standards for petrol and diesel (for petrol: from 500 ppm to 10 ppm and for diesel: from 500 ppm to 100 ppm).

Methodology

Road transport emissions are calculated by software tool COPERT 4 (Tier 2/3 method of the EMEP/EEA Guidebook). Emissions from railways and national navigation (shipping) are estimated using EMEP/EEA Guidebook – 2016, Tier 1 and Tier 2 approaches respectively.

Small combustion (1A4)

Source category description

Emissions in this category come from stationary combustion in commercial/institutional, residential and agriculture/forestry/fishing, plus from off-road vehicles and other machinery of agriculture/forestry/fishing. Calculation of emissions from this category became available since 2013, after introduction of national energy balance.

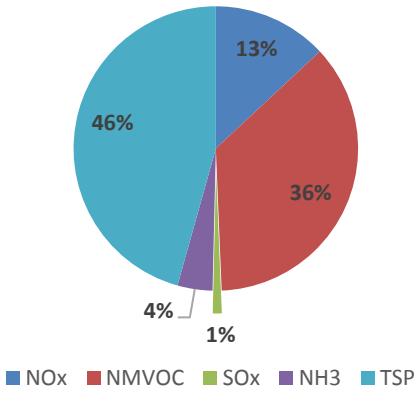

Figure 3.9 Share of emissions of main pollutants from small combustion in 2017

TSP and NMVOC have the biggest share in total emissions of the main pollutants from this category.

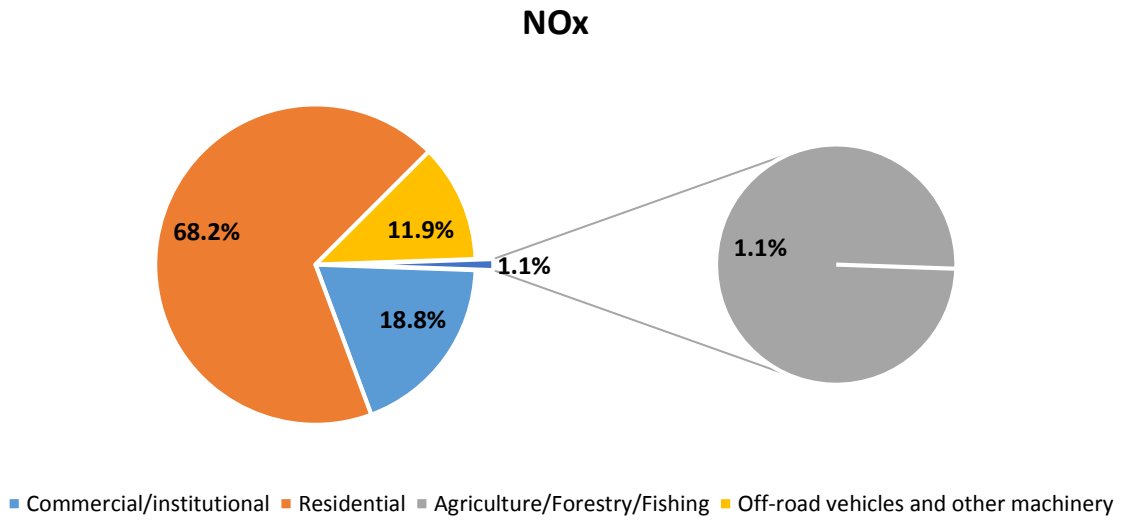

Figure 3.10 NOx emissions by sources of pollution in 2017

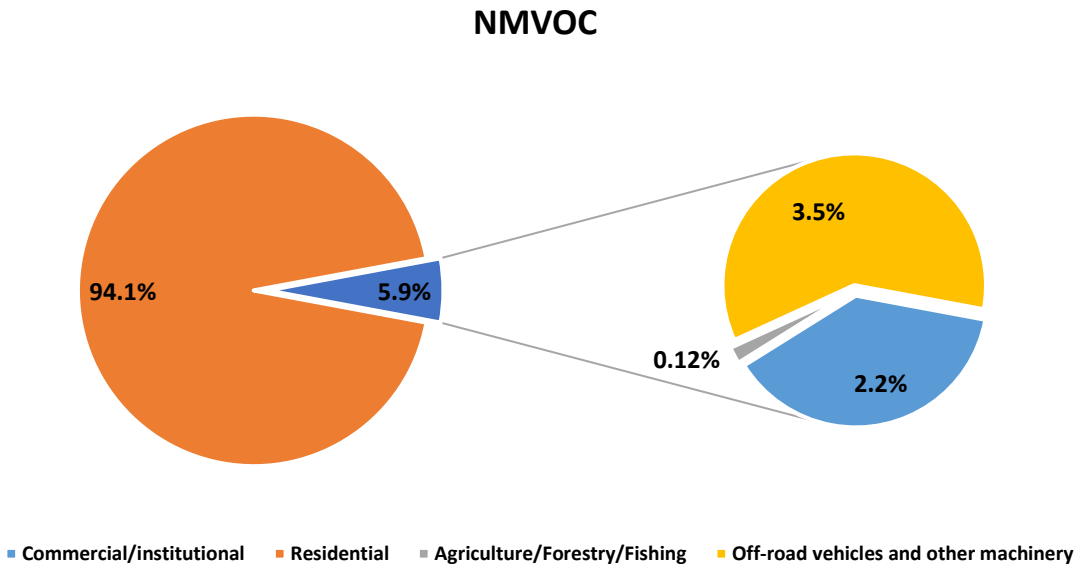

Figure 3.11 NMVOC emissions by sources of pollution in 2017

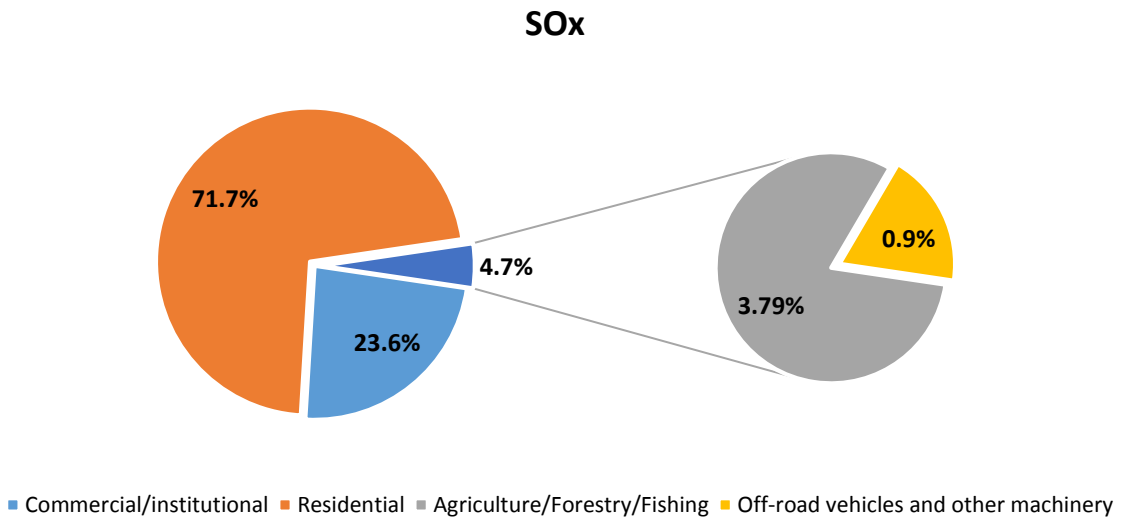

Figure 3.12 SOx emissions by sources of pollution in 2017

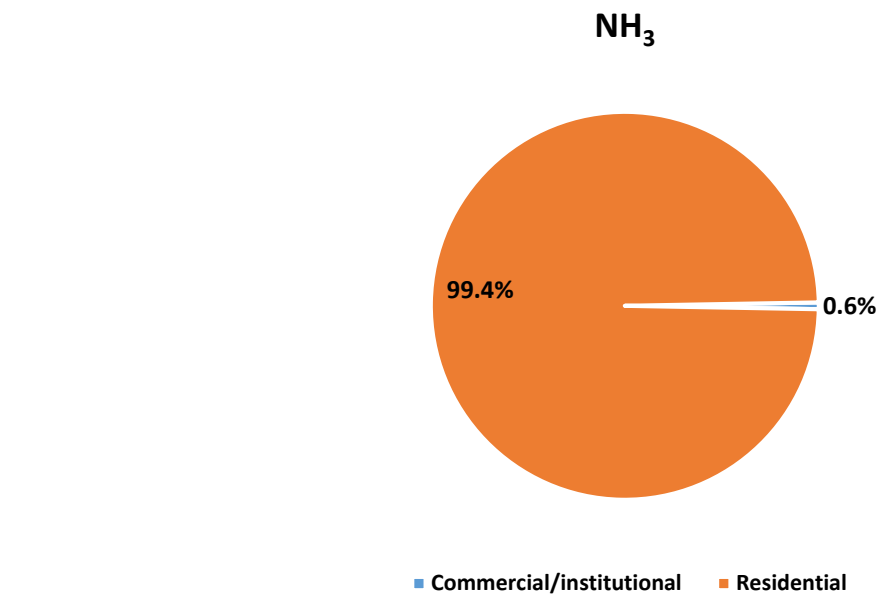

Figure 3.13 NH_3 emissions by sources of pollution in 2017

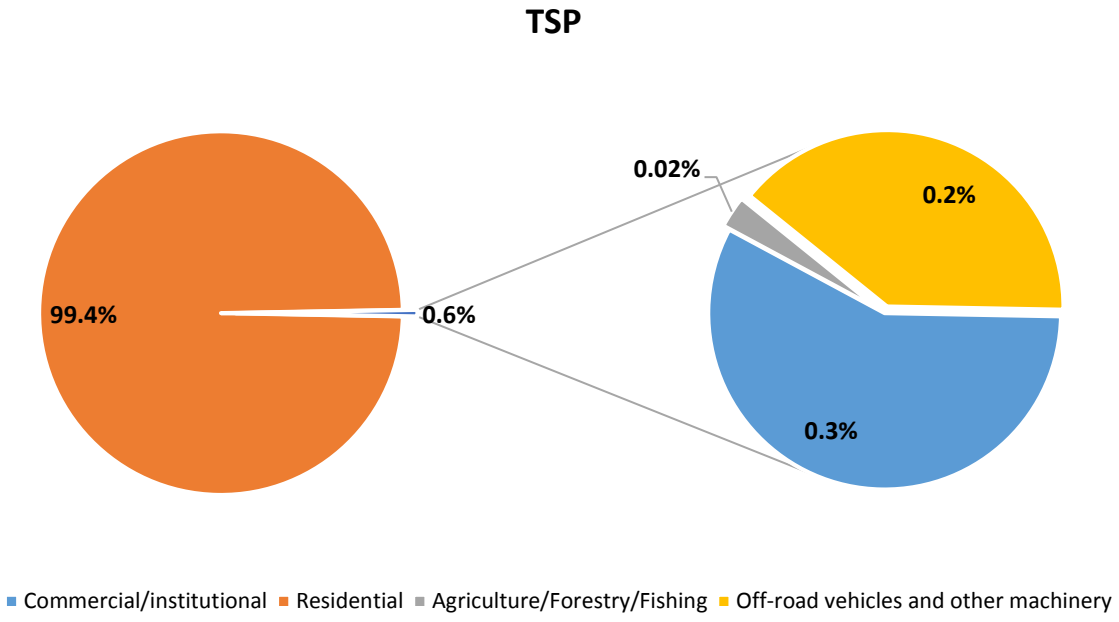

Figure 3.14 TSP emissions by sources of pollution in 2017

Residential stationary combustion is a main emission source for all pollutants as it is shown in figures 3.10-3.14.

Methodology

Emissions are estimated by EMEP/EEA Guidebook – 2016, Tier 1 approach.

Fugitive emissions from fuels (1B)

This category covers fugitive emissions from coal mining and handling, solid fuel transformation, oil and natural gas exploration.

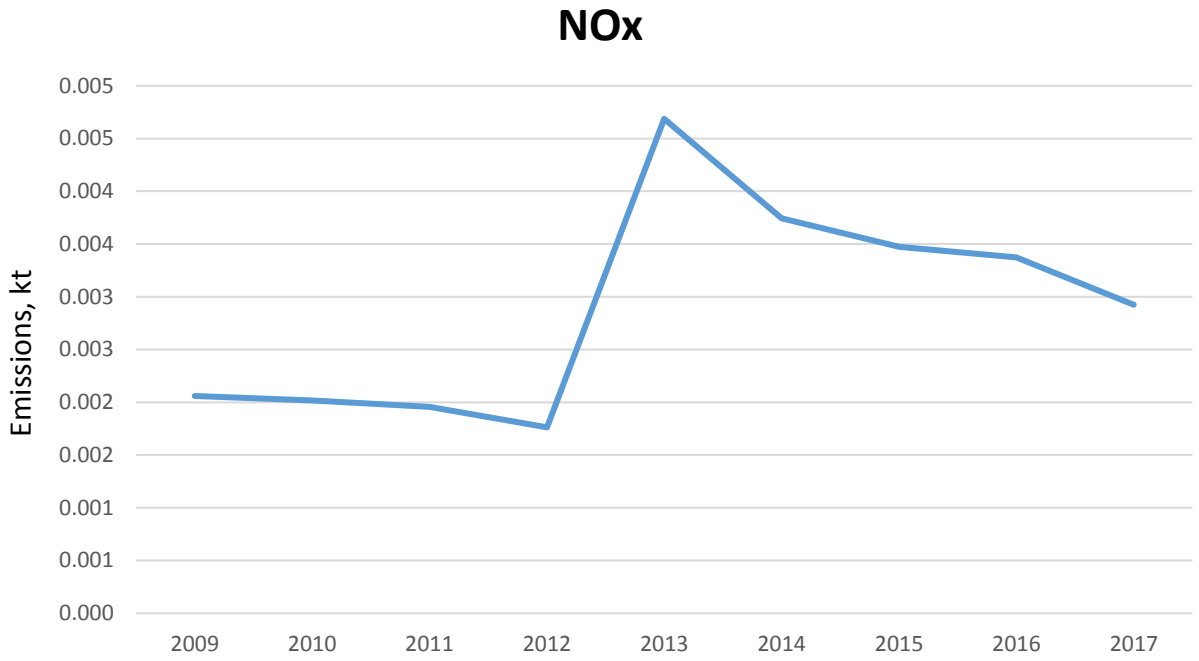

Figure 3.15 Fugitive emissions of NOx from fuels 2007-2017

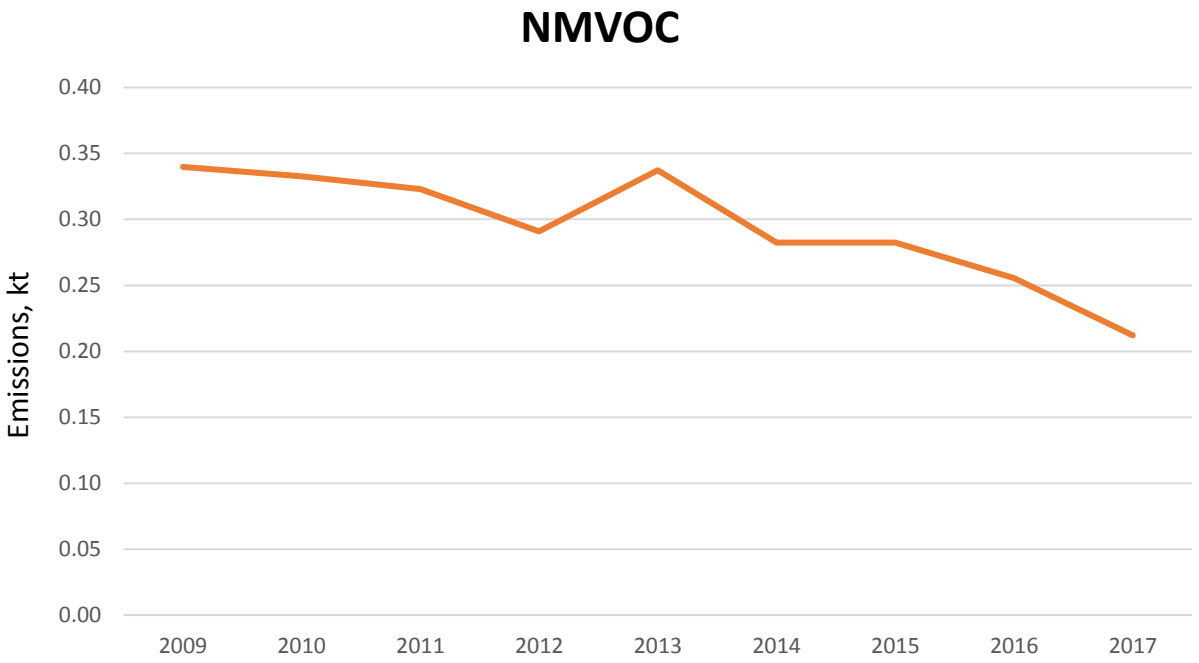

Figure 3.16 Fugitive emissions of NMVOC from fuels 2007-2017

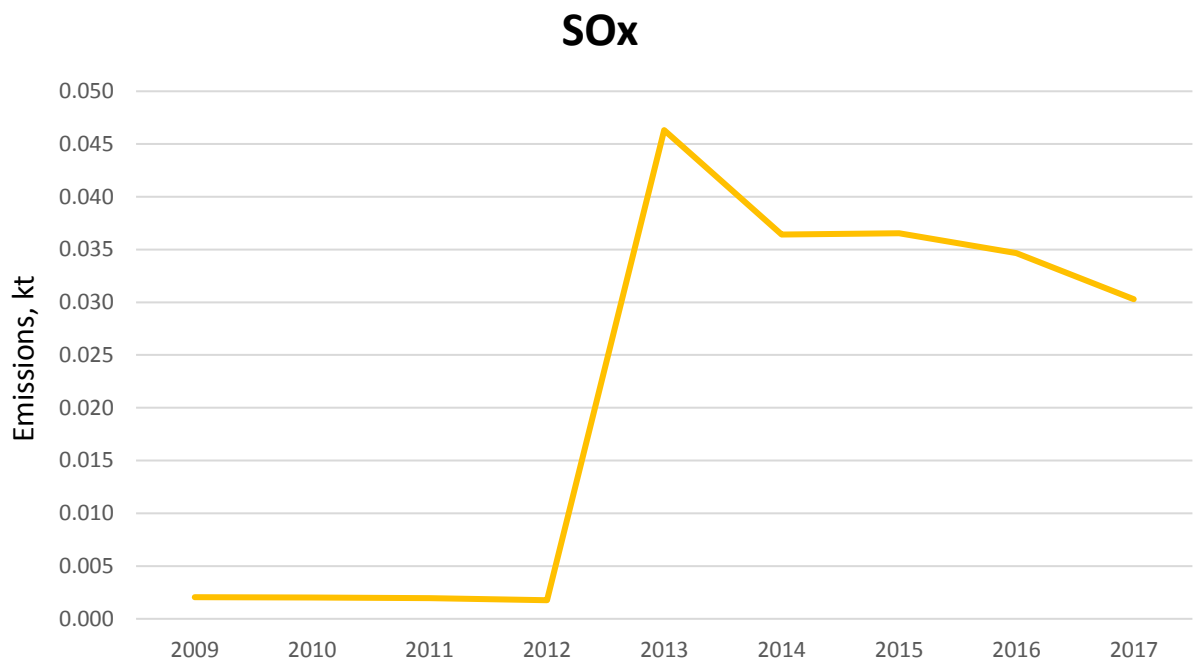

Figure 3.17 Fugitive emissions of SOx from fuels 2007-2017

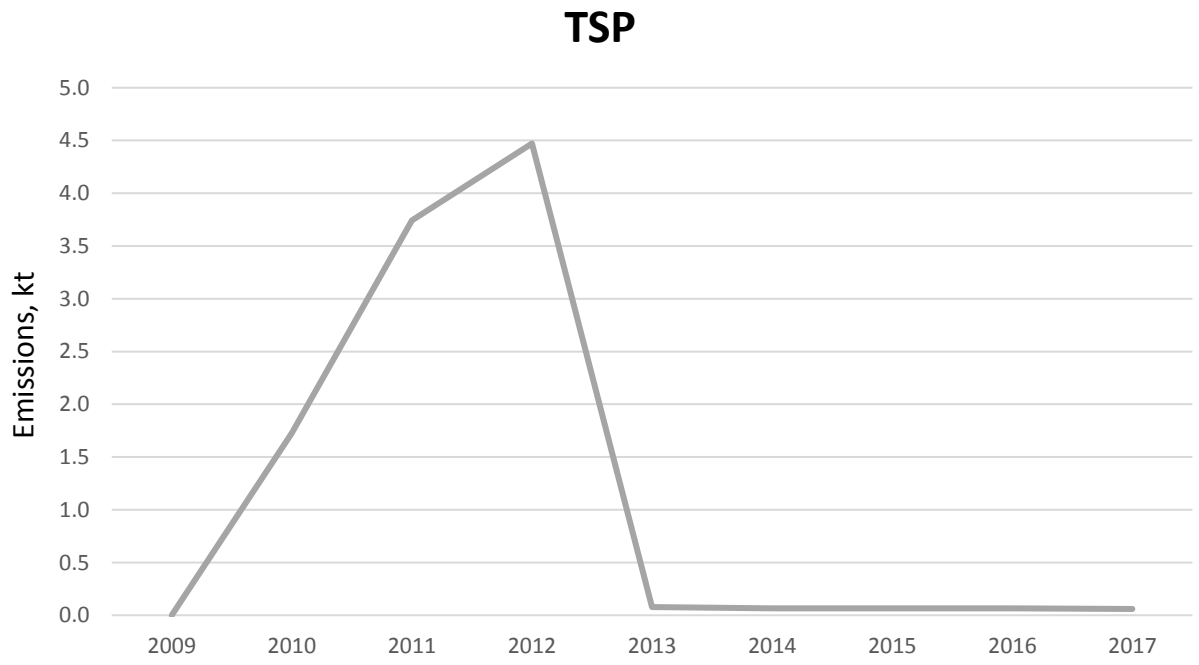

Figure 3.18 Fugitive emissions of TSP from fuels 2007-2017

Significant changes from 2013 related to using more reliable plant specific emissions (from state reporting system for stationary sources) instead of national methodology.

Methodology

Emissions are estimated using plant specific emissions (from state reporting system) and EMEP/EEA Guidebook – 2016, Tier 1 approach.

4. Industrial processes and product use (NFR sector 2)

Dissolution of the Soviet Union accompanied with the collapse of the economy in the 1990s resulted in a significant decrease of industrial activities in Georgia. There has been some growth in this sector in more recent years. The main activities in this sector are manufacturing of mineral products, chemical industry, metal production as well as paper, wood and food industries.

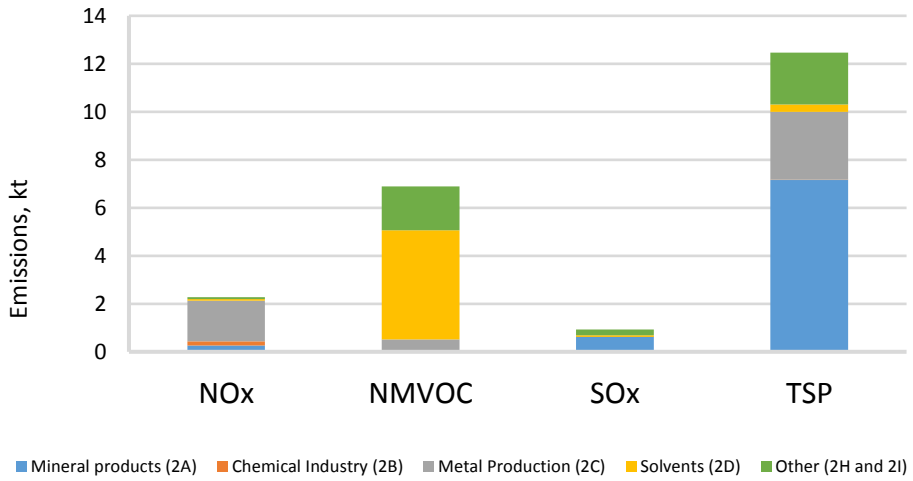

Figure 4.1 Emissions from industry sector in 2017

Share of metal production in total NOx emissions in industry sector is 74.8%. Solvent subsector is responsible for 66% of NMVOC emissions. Manufacturing of mineral products is the major contributor of SOx (66%) and TSP (57.5%) emissions from this sector.

Mineral Products (2A)

Source category description

In this category, cement production, lime production, limestone and dolomite use, gypsum plaster, bricks, concrete, gravel and glass production are reported.

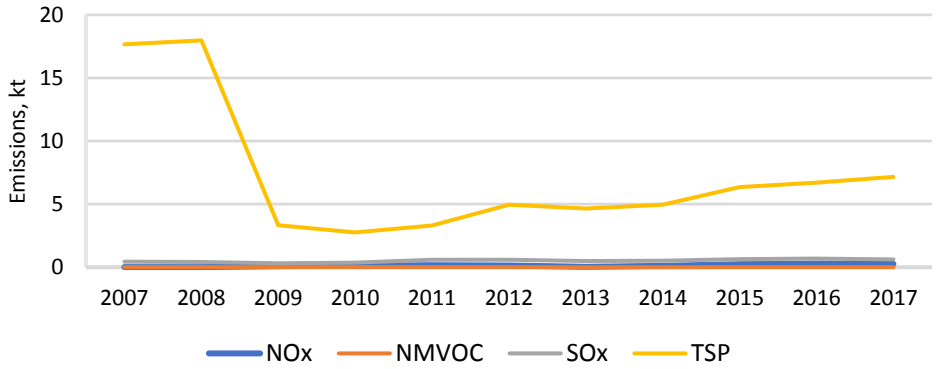

Figure 4.2 Emissions from mineral products 2007-2017

The most important pollutant emitted from this category is particulate matters. Dramatic drop of this pollutant's emissions since 2009 caused by introduction of new high efficient emission abatement systems in the country's largest cement plants.

Methodology

Emissions are calculated using national methodology and plant specific emissions (from state reporting system for stationary sources).

Chemical Industry (2B)

Source category description

This category covers emissions from fertilizer production.

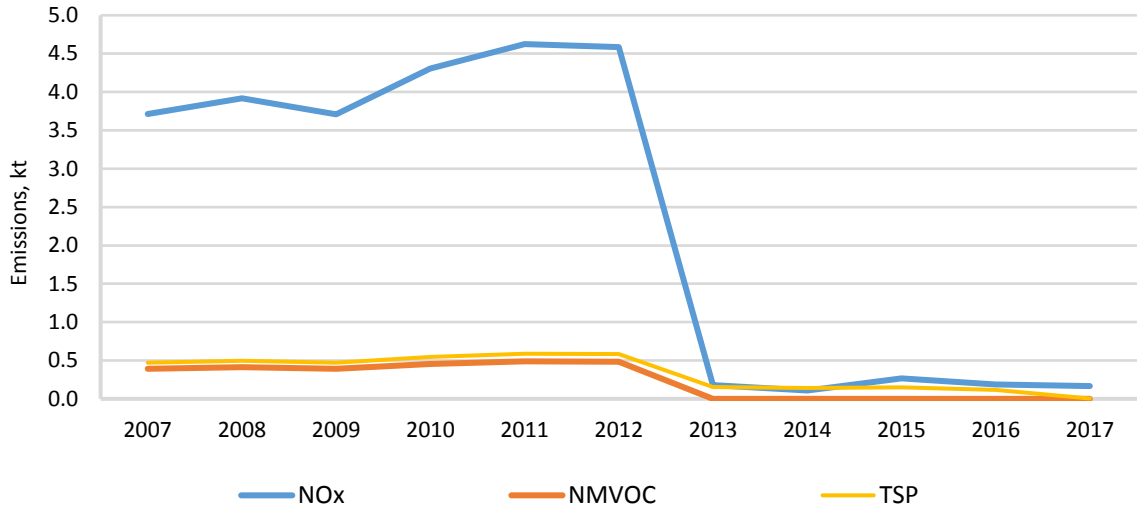

Figure 4.3 Emissions from chemical industry 2007-2017

Significant decrease of emissions since 2013 caused by introduction of more robust methodology (Tier 3 approach – facility-specific data) from this year.

Methodology

Emissions are estimated using plant specific emissions (from state reporting system for stationary sources).

Metal Production (2C)

Source category description

In Georgia, there is ferroalloys and secondary iron/steel, lead and aluminium production.

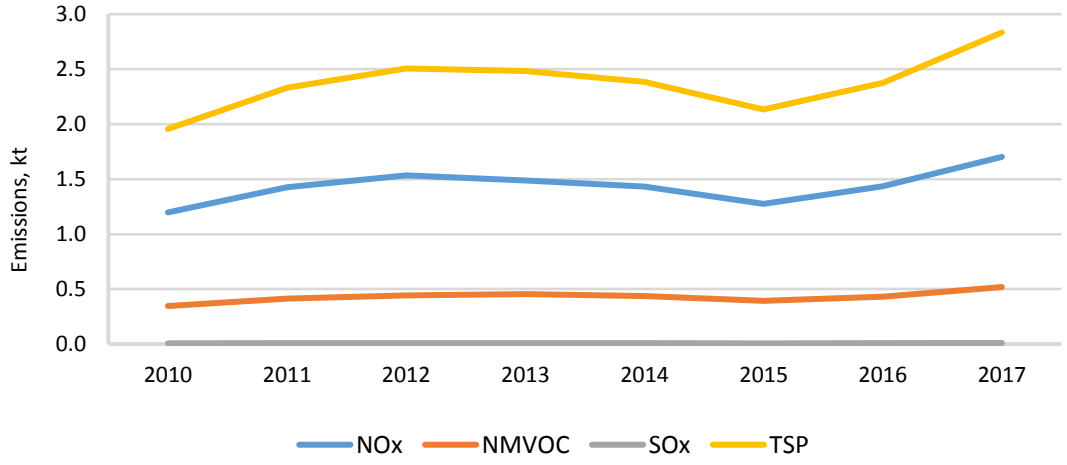

Figure 4.4 Emissions from metal production 2007-2017

Ferroalloys production is main source of emissions in this category.

Methodology

For ferroalloys, emissions are calculated using country-specific emission factors. These factors are given in national methodology that is approved by national legislation.

Emissions from secondary iron/steel, lead and aluminium production are estimated using EMEP/EEA Guidebook – 2016, Tier 1 approach.

Solvents (2D)

Source category description

This category covers only two activities - road paving with asphalt and domestic solvent use including fungicides.

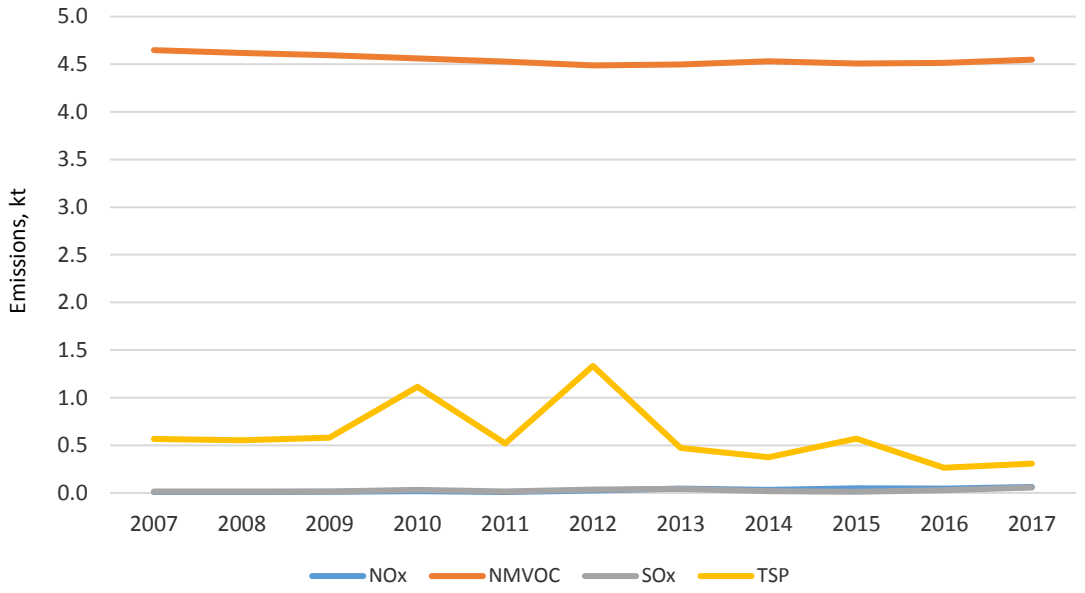

Figure 4.5 Emissions from solvents 2007-2017

NMVOC is the most important pollutant from this category that mostly comes from domestic solvent use.

Source of emissions of another important pollutant TSP is asphalt production. Trend of emissions of this substance is fluctuating parallel with asphalt consumption.

Methodology

For asphalt production, emissions from 2007 to 2012 calculated based on national methodology. From 2013 emissions are estimated using plant specific emissions (from state reporting system for stationary sources).

Emissions from domestic solvent use estimated EMEP/EEA Guidebook – 2016, Tier 1 approach, where number of population is activity data.

Other (2H and 2I)

Source category description

This category covers pulp and paper, food and drink and wood processing.

In Georgia, there is secondary paper processing only. Food comprises bread production, sugar production, flour production, tea production, coffee processing, canned food, fish processing, meat processing. Under drink production, beer, wine, spirits, soft drinks, mineral water and dairy products are included.

In the past large wood processing companies existed in Georgia. Nowadays small plants remain which process logs and produce wooden boards etc.

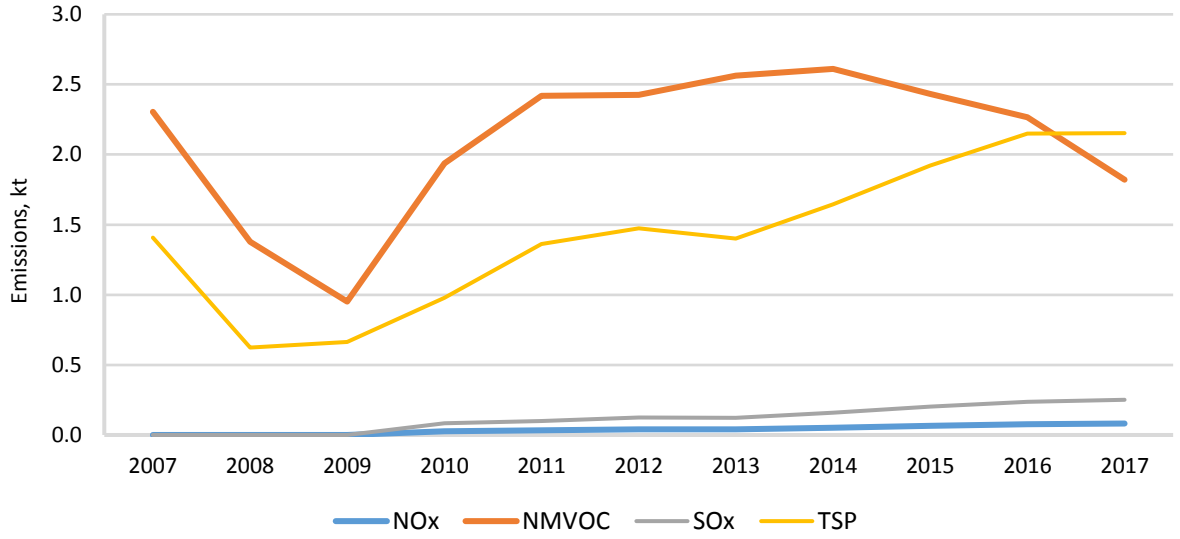

Figure 4.6 Emissions from other industrial processes 2007-2017

Reductions of emissions from this sector in 2008-2009 related to the global economic crisis. Further reduction of NMVOC emissions since 2015 is caused by a sharp decline in sugar production , which was reduced to zero in 2017.

Methodology

Emissions are calculated country-specific emission factors. These factors are given in national methodology that is approved by national legislation. Where new factors are provided in the EMEP/EEA Guidebook, they are taken from the guidebook directly (e.g. wine production).

The methodology is regularly updated based on the Guidebook. The methods referenced in the national legislation are also updated based on the Guidebook.

5. Agriculture (NFR sector 3)

Emission inventory from agriculture sector includes animal husbandry and the application of inorganic fertilizers.

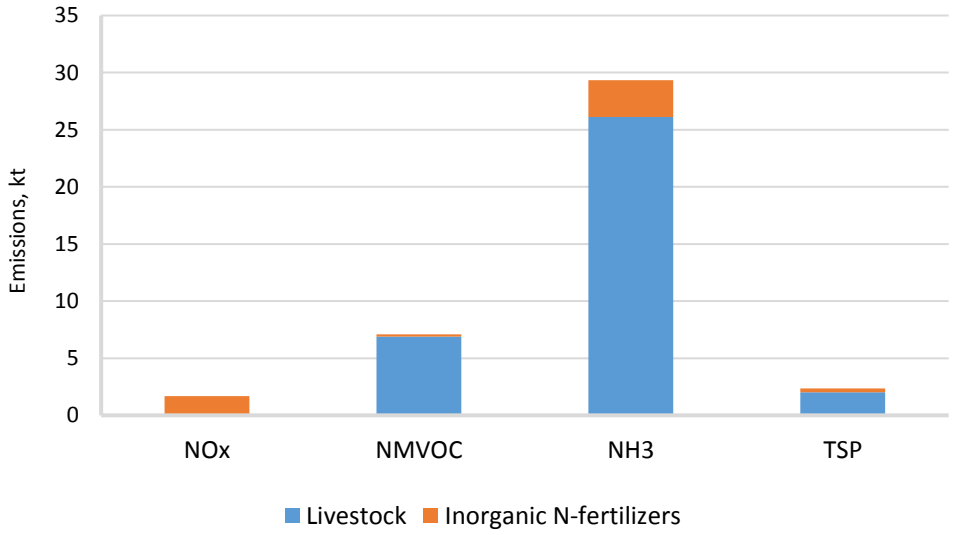

Figure 5.1 Emissions from agriculture sector in 2017

Agriculture sector is the main emitter of ammonia in the country.

Manure Management (3B)

Source category description

Manure management is the most significant source of ammonia emissions.

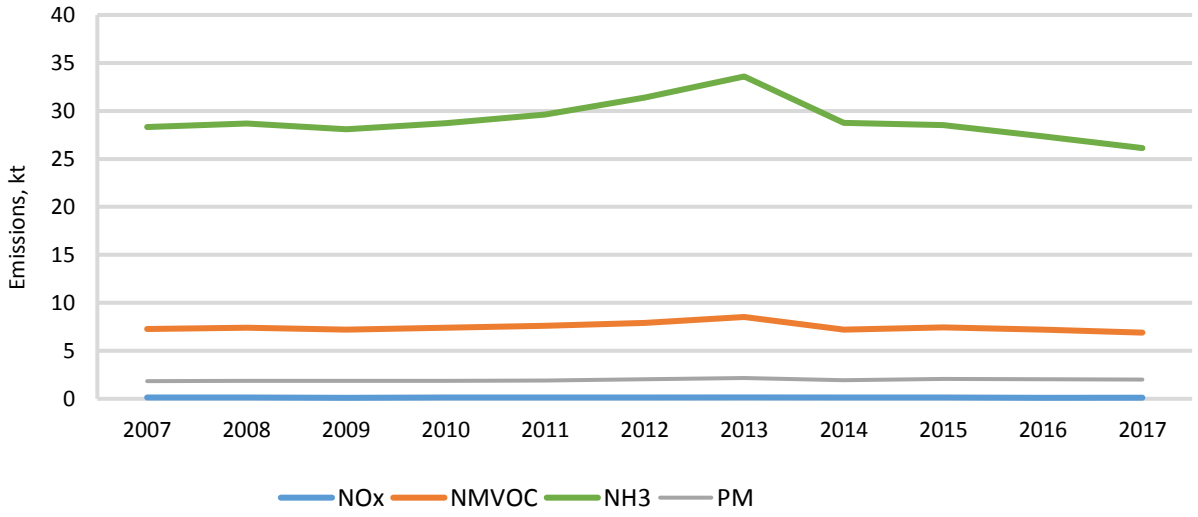

Figure 5.2 Emissions from livestock manure management 2007-2017

Drop of trend in 2014 is related with recalculations of activity data in agriculture sector by GEOSTAT.

Methodology

Emissions are calculated using the EMEP/EEA Guidebook – 2016, tier 1 approach.

Agricultural Soils (3D)

Source category description

Under this category, NH_3 emissions from fertilizers and particulate matters emissions from grain fields are provided. Additionally, emissions of NOx, NMVOC and $PM_{2.5}$ have occurred.

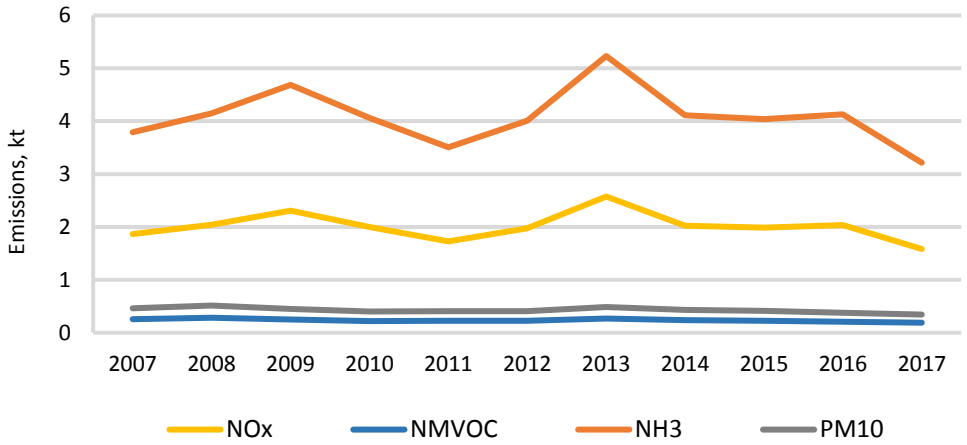

Figure 5.3 Emissions from agriculture soils 2007-2017

Drop of emissions in 2014 is related with recalculations of activity data in agriculture sector by GEOSTAT. Further decrease of ammonia and NOx emissions in 2017 are resulted by sharp reduction of use of fertilizers.

Methodology

Emissions are calculated using the EMEP/EEA Guidebook – 2016, tier 1 approach.

6. Waste (NFR sector 5)

This sector covers solid waste disposal on land, waste incineration and wastewater handling categories. The biggest polluting category in this sector is solid waste disposal on land from where comes about 99.5% of NMVOC emissions.

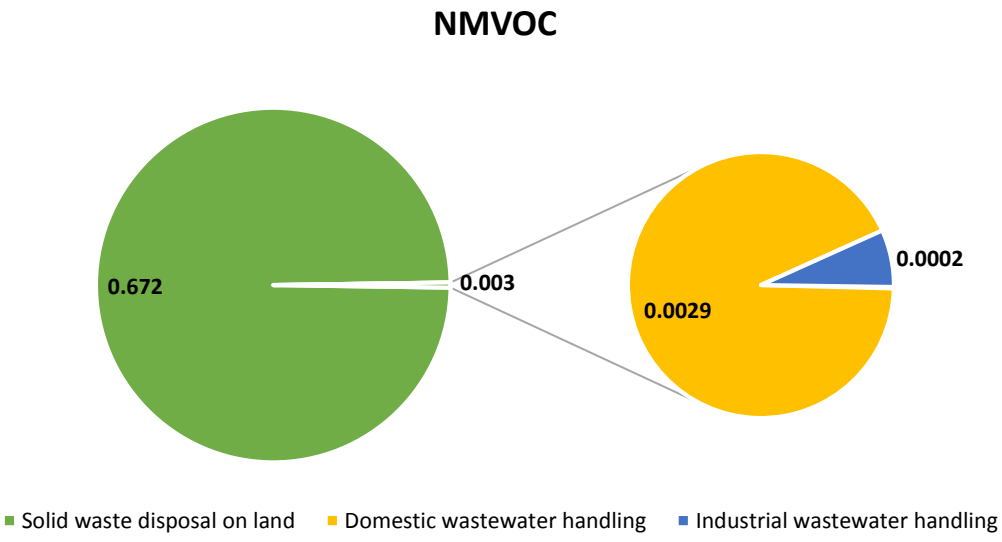

Figure 6.1 Emissions of NMVOC from waste sector in 2017 (kt)

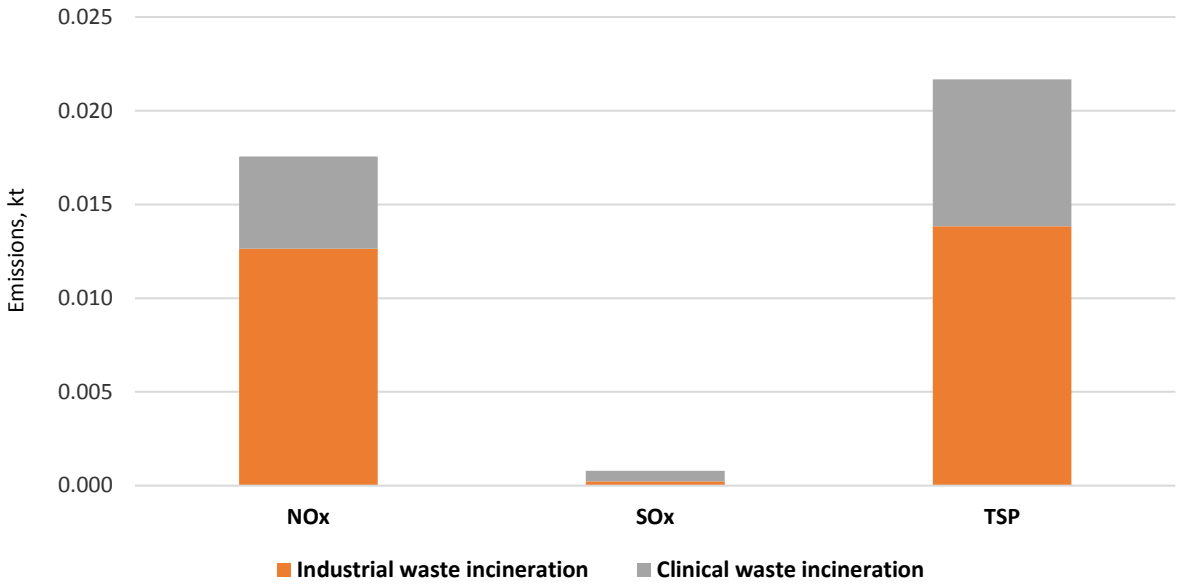

Figure 6.2 Emissions of NOx, SOx and TSP from waste sector in 2017

Solid waste disposal on land (5A)

Source category description

For the year 2014 emissions from this category were not calculated due to lack of activity data.

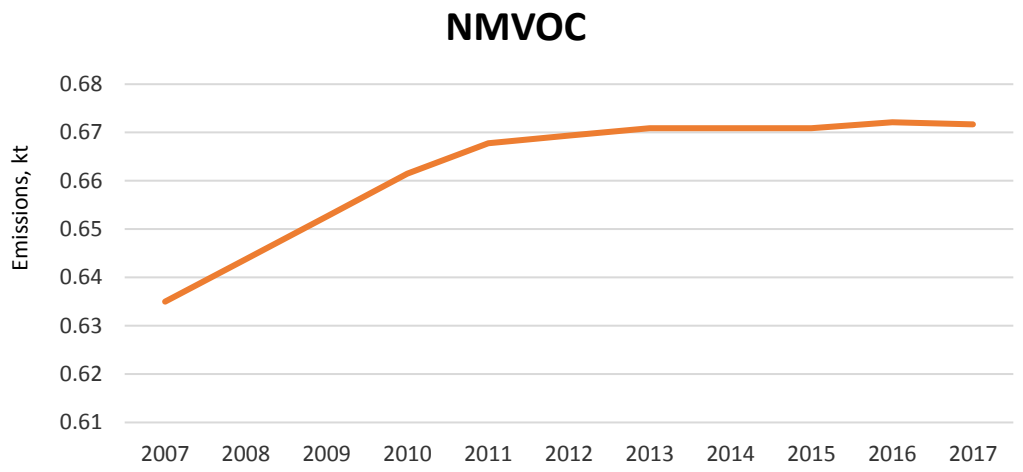

Figure 6.3 Emissions from solid waste disposal on land 2007-2017

Methodology

Emissions are calculated using EMEP/EEA Guidebook – 2016, Tier 1 approach. Data on CH_4 emissions from solid waste disposal on land were obtained from Georgia's Biennial Update Reports (BUR) to the UNFCCC. Emissions for 2007-2009 were extrapolated, since data on CH_4 emissions BUR is provided for 2005, then 2010 and onward.

Waste incineration (5C)

Source category description

This category includes industrial waste incineration and clinical waste incineration. Due to lack of activity data emissions from this category were estimated only from 2013.

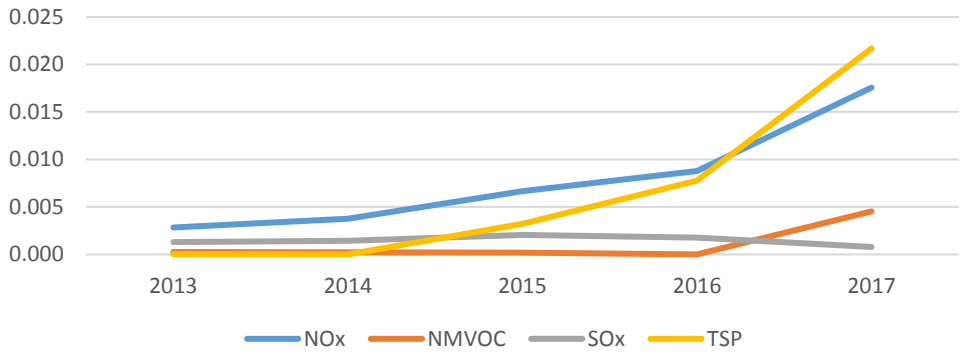

Figure 6.4 Emissions from waste incineration 2013-2017

Increased emissions from 2015 is resulted by installing of new incinerators and consequently, increased amount of waste incinerated. Sharp increase of emissions in 2017 caused by fast growing activities in industrial waste incineration.

Methodology

Emissions are estimated based on plant specific emissions (from state reporting system for stationary sources).

Wastewater handling (5D)

Source category description

This category covers industrial domestic wastewater handling and industrial wastewater handling.

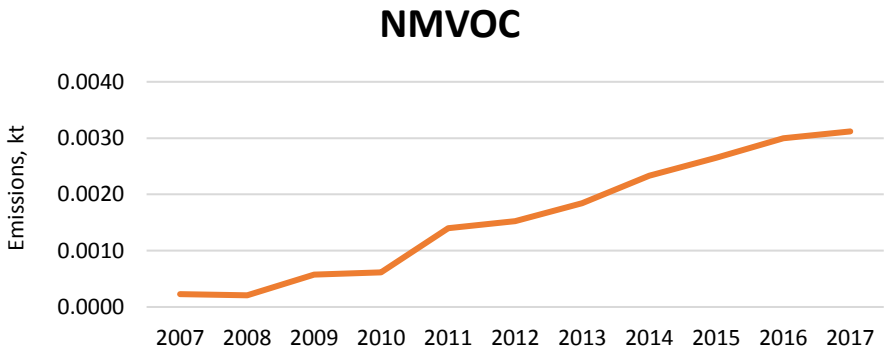

Figure 6.5 Emissions from wastewater handling 2007-2017

In parallel with growing amount of treated wastewater, emissions of MNVOC from this category were increased 14 times from 2007 to 2017.

Methodology

Emissions are calculated using EMEP/EEA Guidebook – 2016, Tier 1 approach. Activity data were gained from the Water Resources Management Division of MEPA.

7. Recalculations and improvements

Recalculations

Emissions from category road transport (1A3b) for 2016 have been recalculated taking into account more realistic fuel consumption data. Since 1 January 2017, the excise tax on petrol has doubled, and on diesel fuel almost tripled. Therefore, at the end of 2016, importers imported much more motor fuel than in any previous years and created some stock. Mistakenly, in National Energy Balance 2016 all imported amount of petrol and diesel fuel was reported as a consumption. Consequently, emissions calculated for road transport by COPERT were corrected based on inaccurate fuel consumption data. Taking into consideration all above mentioned, emissions from category road transport (1A3b) for 2016 have been recalculated based on realistic fuel consumption data.

In the updated EMEP/EEA Guidebook for categories 1A4ai, 1A4bi, 1A4ci and 1A4cii, emission factors for several pollutants were updated. Thus, emissions for the previous years (2013-2016) from these categories were recalculated.

Based on the census of the population provided by in 2014 recalculated In 2017 GEOSTAT recalculated population for previous years. Consequently, for the next categories 2D3a and 2K emissions for all years were recalculated accordingly.

In the updated EMEP/EEA Guidebook for manure management (3B), emission factors for NO were updated. Therefore, emissions from these categories were recalculated not only for this pollutant but for others as well, because approach to estimate manure management was changed.

Updated data on CH_4 emissions from solid waste disposal on land made available from Georgia's Biennial Update Report to the UNFCCC. Therefore, emissions from this category for all year were recalculated.

Planned improvements

It is planned to recalculate emissions in energy sector, since national energy balance (introduced in 2013) will give trend of five years. That will enable to reconsider energy consumption in previous years. This will improve consistency and comparability of data and allow to provide trend assessment.

For the next year, it is planned to calculate emissions from aviation and recalculate emissions from road transport using more modern software tool COPERT 5.

8. IIR References

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3. Annexes to UNECE reporting guidelines (ECE/EB.AIR/125) http://www.ceip.at/fileadmin/inhalte/emep/2014_Guidelines/Annexes_revised_140417.zip

4. UNECE, 2013. Decision 2013/4 reporting of emissions and projections data under the Convention and its protocols in force (ECE/EB.AIR/122/Add.1.);

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6. EMEP/EEA air pollutant emission inventory guidebook – 2016: http://www.eea.europa.eu/publications/emep-eea-guidebook-2016;

7. Energy Balance of Georgia, 2013;

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10. Energy Balance of Georgia, 2016;

11. Energy Balance of Georgia, 2017;

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