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KRAJOWY OŚRODEK BILANSOWANIA I ZARZĄDZANIA EMISJAMI
THE NATIONAL CENTRE FOR EMISSIONS MANAGEMENT

POLAND'S NATIONAL INVENTORY REPORT 2016

Greenhouse Gas Inventory
for 1988-2014

Submission under
the UN Framework Convention on Climate Change
and its Kyoto Protocol

Warszawa, May 2016

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Reporting entity:

National Centre for Emission Management (KOBiZE)
at the Institute of Environmental Protection – National Research Institute

Warszawa
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NOTE:

According to Decision 13/CP.20 of the Conference of the Parties to the UNFCCC, the CRF Reporter version 5.0.0 was not functioning in order to enable Annex I Parties to submit their CRF tables. In the same Decision, the Conference of the Parties reiterated that Annex I Parties may submit their CRF tables after 15 April 2015, but no longer than the corresponding delay in the CRF Reporter availability. Decisions 20/CP.21 and 10/CMP.11 further noted that the CRF reporter was still not functioning.

Functioning software means that the data on the greenhouse emissions/removals are reported accurately both in terms of reporting tables format and XML format. The CRF reporter version 5.14.0, released on 3rd May 2016, as well as its subsequent hotfix (5.14.1), still contain issues in the reporting format tables and XML formats, in particular in relation to Kyoto Protocol requirements. General assessment of the CRF Reporter software shows that it could be considered as sufficiently functioning to allow to submit information under UNFCCC and KP obligations. However GHG Inventory users should be aware that some of the potential issues or findings still occur in CRF Tables as a result of the data misplacement or miscalculation in the CRF Reporter.

Recalling the invitation of the Conference of Parties for Parties to submit as soon as practically possible, and considering that CRF reporter 5.14.0 allows sufficiently accurate reporting under the UNFCCC Convention, the present report is the official submission of Poland for the year 2016 under the UNFCCC. The present report is also an official submission under the Kyoto Protocol despite certain deficiencies indicated above in CRF Reporter and underlining CRF tables.

EXECUTIVE SUMMARY

ES.1. Background information on greenhouse gas inventories, climate change and supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

ES.1.1. Background information on greenhouse gas inventories and climate change

Poland has been the signatory to the United Nations Framework Convention on Climate Change (UNFCCC) since 1994 and to its Kyoto Protocol since 2002 thus joining the international efforts aiming at combating climate change. One of the main obligations resulting from ratification of the Kyoto Protocol by Poland is to reduce the greenhouse gas emissions by 6% in 2008-2012 in relation to the base year and by 20% in 2013−2020 jointly with the European Union.

According to the provisions of Article 4.6 of the UNFCCC and decision 9/CP.2 Poland uses 1988 as the base year for the estimation and reporting of GHG inventories. For groups of gases: HFCs, PFCs and for sulphur hexafluoride (SF_6) 1995 has been established as the base year and for the nitrogen trifluoride (NF_3) – 2000 has been adopted as the base year.

The underlying report, presenting the results of national greenhouse gas inventory for 2014, in line with the trend since 1988, has been prepared according to the *Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention* contained in the decision 24/CP.19.

The national inventory covers the emission of the following GHGs and groups of gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), nitrogen trifluoride (NF_3) which are reported in five categories: 1. Energy, 2. Industrial Processes and Product Use (IPPU), 3. Agriculture, 4. Land Use, Land Use Change and Forestry (LULUCF) and 5. Waste. This report contains also information on emissions of sulphur dioxide (SO_2) and the following GHG precursors: carbon monoxide (CO), nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOC).

Methodologies used to calculate emissions and sinks of GHGs are those published by the Intergovernmental Panel on Climate Change (IPCC) in 2006, namely *Revised 2006 Guidelines for National Greenhouse Gas Inventories* what is in accordance with the provisions of the decision 24/CP.19. According to these guidelines country specific methods have been used where appropriate giving more accurate emission data.

At the same time the underlying report has been elaborated for the purpose of Poland's obligations resulting from Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC as well as Commission Implementing Regulation (EU) No 749/2014 of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council.

The unit responsible for compiling the GHG inventory for the purpose of the European Union and the UNFCCC, according to the provisions of the Act of 17 July 2009 on the system to manage the emissions of greenhouse gases and other substances *(Journal of laws Nr 130, position 1070 with further changes)*, is the National Centre for Emissions Management (KOBiZE) in the Institute of Environmental Protection - National Research Institute, supervised by the Minister of the Environment.

ES.1.2. Background information on supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

The European Union (EU) and its Member States, and Iceland have agreed (agreement under Article 4 of the Kyoto Protocol) to fulfil jointly their quantified emission limitation and reduction commitment (QELRC) for the second commitment period of the Kyoto Protocol. The joint QELRC for the EU is 80% (Annex I to the Doha Amendment) what relates to 20% reduction in the total emissions comparing to the base year or period during the period 2013 – 2020. The joint assigned amount of the Parties of the agreement (EU, its Member States and Iceland) will be calculated based on the sum of the base or period year emissions for the EU Member States and Iceland in accordance with Article 3, paragraphs 7bis, 8 and 8bis. According to this Poland's input to the EU assigned amount for the second commitment period (CP2) of the Kyoto Protocol is as follows:

580,020,010 tonnes CO_2 eq. * 80% * 8 = 3,712,128,064 tonnes CO_2 eq.
(base year emissions)* (QELRLC) * (CP2 years) = (assigned amount)

As Poland is going to fulfil its emission reduction target jointly with the EU, the emission levels allocated to the Member States will be based on their annual emission allocations under the EU Effort Sharing Decision (406/2009/EC) as determined in the Commission decisions 2013/162/EU and 2013/634/EU. For Poland the annual emission allocations under ESD in 2013-2020 amount to **1,583,938,824 tonnes CO_2eq**.

By analogy commitment period reserve will be established jointly for the EU. Poland's CPR has been calculated for **1,425,544,942 tonnes CO_2eq.** as 90% of annual emission allocations given above.

Detail additional information required by the Kyoto Protocol is presented in Part II of the NIR.

ES.2. Summary of national emission and removal related trends. Emission and removals from KP–LULUCF activities

ES.2.1. Summary of national emission and removal related trends

The GHG emissions for the base year (see chapter S.1) and for 2014, expressed as CO_2 equivalent, are presented in table S.1. In 2014 the total national emission of GHG amounted to 380.04 million tonnes of CO_2 eq., excluding GHG emissions and removals from category 4 (*Land use, land use change and forestry* – LULUCF). Compared to the base year, the 2014 emissions have decreased by 34.5%.

Table S.1. National emissions of greenhouse gases for the base year and 2014

Pollutant	Emission in CO_2 eq. [kt]		(2014-base)/base [%]
	Base year	2014	
CO_2 (with LULUCF)	457 906.75	277 703.81	-39.35
CO_2 (without LULUCF)	473 954.84	310 307.30	-34.53
CH_4 (with LULUCF)	76 778.53	41 365.49	-46.12
CH_4 (without LULUCF)	76 734.40	41 330.22	-46.14
N_2O (with LULUCF)	29 043.68	19 811.27	-31.79
N_2O (without LULUCF)	29 032.34	19 746.42	-31.98
HFCs	97.34	8 586.93	8 721.26
PFCs	171.97	13.90	-91.92
Unspecified mix of HFCs and PFCs	NA,NO	NA,NO	NA
SF_6	29.12	52.79	81.26
NF_3	NA,NO	NA,NO	NA,NO
TOTAL net emission (with LULUCF)	564 027.39	347 534.19	-38.38
TOTAL without LULUCF	580 020.01	380 037.57	-34.48

Carbon dioxide is the main GHG in Poland with the share of 81.65% in national emissions in 2014, the share of methane and nitrous oxide contributes respectively with: 10.9% and 5.2%. All F-gases contribute to 2.3% of total GHG emissions. Percentage share of GHG in national total emissions (excluding category 4. LULUCF) in 2014 is presented at figure S.1.

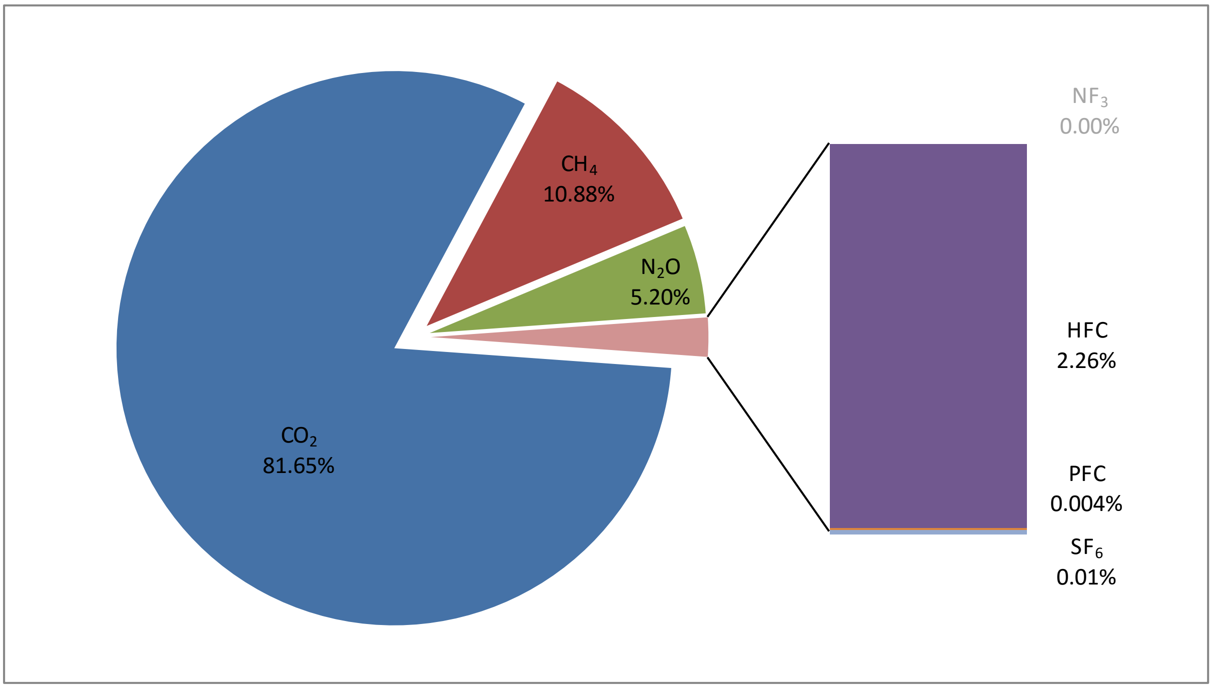

Figure S.1. Percentage share of greenhouse gases in national total emission in 2014 (excluding category 4. LULUCF)

The trend of aggregated greenhouse gases emissions follows the trend of emissions CO_2 alone, which is the primary greenhouse gas emitted in Poland. The GHGs trend for period between 1988 and 1990 indicates dramatic decrease triggered by significant economic changes, especially in heavy industry, related to political transformation from centralized to market economy. This drop in emissions continued up to 1993 and then emissions started to rise with a peak in 1996 as a result of development in heavy industry and other sectors and dynamic economic growth. Slow decline in emissions (up to

2002) characterized the succeeding years, when still energy efficiency policies and measures were implemented, and then slight increase up to 2007 caused by animated economic development. Since 2008 stabilisation in emissions has been noted with distinct decrease in 2009 related to world economic slow-down (see Table S.2 and Figure S.2). Since 2010 GHG emissions in Poland have gradually decreased.

Since 2005 Poland has taken part in the European Union's Emission Trading System, being one of the flexible mechanisms supporting measures for limiting the greenhouse gas emissions. The share of emissions related to installations covered by EU ETS in the national emissions in 2005−2014 amounted to about 51% on average (from 49% in 2010 up to 52% in 2014). One should notice, that since 2013 the scope of the EU ETS has expanded with new industries (like production of selected chemicals) and greenhouse gases (nitrous oxide) (Fig. S.2).

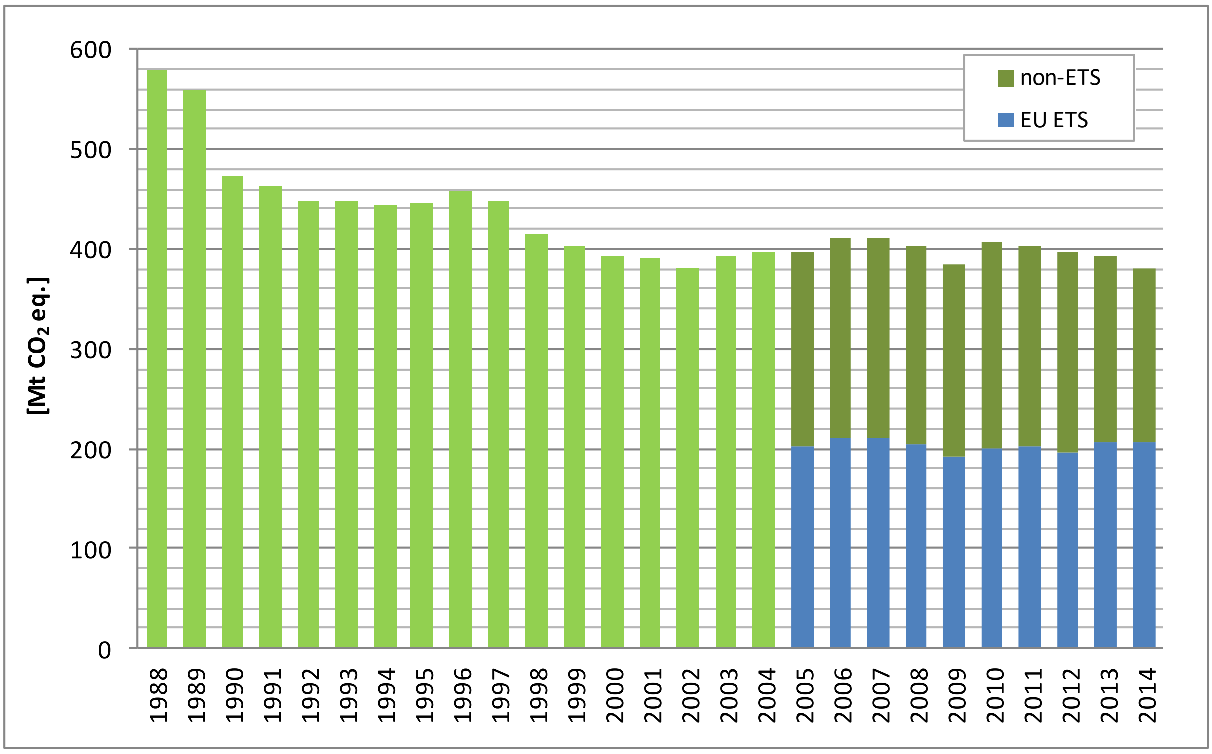

Figure S.2. Trend of aggregated GHGs emissions excluding category 4 for 1988–2014

Table S.2. National emissions of greenhouse gases for 1988–2014 by gases [kt CO_2 eq.]

GHG	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CO_2 (with LULUCF)	457 906.75	433 134.27	352 994.60	358 143.40	370 132.04	363 351.58	358 103.65	348 478.85	342 663.50	332 918.74	297 404.57	281 436.80	285 649.46
CO_2 (without LULUCF)	473 954.84	454 130.60	378 782.54	375 684.16	365 865.16	366 427.66	362 012.96	363 885.78	377 308.60	368 415.85	339 145.83	329 380.90	319 120.41
CH_4 (with LULUCF)	76 778.53	74 553.73	67 108.10	64 107.60	60 763.76	59 840.77	59 225.75	58 301.14	57 817.28	57 035.43	53 230.54	51 920.22	49 435.49
CH_4 (without LULUCF)	76 734.40	74 509.69	67 064.04	64 062.61	60 719.25	59 798.56	59 184.82	58 255.23	57 780.89	56 997.50	53 196.21	51 883.11	49 402.95
N_2O (with LULUCF)	29 043.68	30 271.20	27 021.23	22 553.62	21 048.58	21 996.41	21 872.27	22 850.74	23 006.22	22 893.17	22 641.51	21 924.17	22 295.40
N_2O (without LULUCF)	29 032.34	30 258.94	27 007.52	22 544.71	20 994.46	21 979.84	21 854.74	22 833.31	22 977.67	22 871.92	22 618.26	21 901.58	22 271.83
HFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	97.34	228.41	373.93	462.23	673.38	1 280.83
PFCs	147.26	147.51	141.87	141.31	134.63	144.86	152.78	171.97	161.07	173.36	174.86	168.71	176.68
Unspecified mix of HFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
SF_6	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	13.27	29.12	23.80	22.91	23.94	23.50	23.07
NF_3	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
TOTAL (with LULUCF)	**563 876.21**	**538 106.71**	**447 265.79**	**444 945.94**	**452 079.01**	**445 333.61**	**439 367.72**	**429 929.16**	**423 900.28**	**413 417.53**	**373 937.65**	**356 146.78**	**358 860.93**
TOTAL (without LULUCF)	**579 868.83**	**559 046.74**	**472 995.97**	**462 432.79**	**447 713.50**	**448 350.91**	**443 218.56**	**445 272.75**	**458 480.44**	**448 855.48**	**415 621.32**	**404 031.19**	**392 275.76**

Table S.2. (cont.) National emissions of greenhouse gases for 1988–2014 by gases [kt CO_2 eq.]

GHG	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CO_2 (with LULUCF)	290 793.48	273 913.81	284 032.38	275 450.24	274 789.43	293 208.71	297 454.15	291 226.05	281 834.45	301 345.32	294 349.88	287 734.25	281 496.55	277 703.81
CO_2 (without LULUCF)	315 274.09	307 535.64	320 230.17	324 279.45	323 372.58	336 500.58	336 268.11	329 338.17	315 937.97	334 026.15	333 713.65	326 597.79	322 440.49	310 307.30
CH_4 (with LULUCF)	50 199.28	48 175.41	48 115.04	47 422.23	47 161.10	46 960.54	45 493.39	44 557.17	43 009.79	43 198.02	42 159.10	42 619.80	42 394.09	41 365.49
CH_4 (without LULUCF)	50 166.70	48 140.69	48 078.13	47 387.97	47 127.61	46 921.47	45 463.69	44 522.53	42 979.95	43 166.37	42 128.02	42 588.03	42 357.11	41 330.22
N_2O (with LULUCF)	22 450.16	21 348.23	21 590.87	22 095.45	22 262.80	22 777.11	23 589.32	23 044.36	19 920.84	19 612.18	19 967.76	20 071.41	20 187.70	19 811.27
N_2O (without LULUCF)	22 430.68	21 318.71	21 543.16	22 060.36	22 228.47	22 746.17	23 550.46	23 001.01	19 874.64	19 571.19	19 924.84	20 019.95	20 140.19	19 746.42
HFCs	1 839.67	2 420.26	2 992.33	3 647.55	4 471.06	5 140.55	5 742.30	6 088.81	6 098.20	6 782.77	7 449.61	7 720.45	8 091.92	8 586.93
PFCs	197.34	207.33	201.08	205.07	187.41	193.58	184.63	163.12	17.97	17.07	16.22	15.41	14.64	13.90
Unspecified mix of HFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
SF_6	22.86	23.29	20.72	22.36	26.80	33.20	31.16	32.87	37.60	35.37	39.02	41.92	47.54	52.79
NF_3	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
TOTAL (with LULUCF)	**365 502.79**	**346 088.32**	**356 952.41**	**348 842.91**	**348 898.60**	**368 313.69**	**372 494.94**	**365 112.37**	**350 918.86**	**370 990.74**	**363 981.59**	**358 203.24**	**352 232.42**	**347 534.19**
TOTAL (without LULUCF)	**389 931.34**	**379 645.91**	**393 065.57**	**397 602.77**	**397 413.93**	**411 535.54**	**411 240.34**	**403 146.51**	**384 946.33**	**403 598.93**	**403 271.36**	**396 983.55**	**393 091.87**	**380 037.57**

ES.2.2. KP-LULUCF activities

The emissions and removals balance of greenhouse gases for the period 2008-2014, to related activities of land use, land use change and forestry (LULUCF) under Article 3.3 and 3.4 of the Kyoto Protocol is presented in Table ES.4. For activities related to afforestation/reforestation and forest management estimated balance is negative, what means the activity is considered as a net CO_2 sink.

Table S.3. The emissions and removals balance of greenhouse gases for the period 2008-2013 for selected activities of land use, land use change and forestry (LULUCF) [Mt CO_2 eq.]

Activity	2008	2009	2010	2011	2012	2013	2014
4.KP. A.1. Afforestation/Reforestation	-2.36	-2.45	-2.58	-2.66	-2.76	-2.82	-2.86
4.KP. A.2. Deforestation	0.23	0.26	0.26	0.26	0.27	0.25	0.26
4.KP. B.1. Forest Management	-41.55	-37.36	-35.75	-42.19	-41.65	-43.60	-36.14
4.KP. B.2 Cropland management	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
4.KP. B.3 Grazing land management	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
4.KP. B.4 Revegetation	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*

ES.3. Overview of source and sink category emission estimates and trends, including KP-LULUCF activities

ES.3.1. GHG inventory

Total GHG emissions presented in CO_2 equivalent for the base year and for 2014 together with change between 2014 and 1988 by main categories are given in table S.3. In all categories emission reduction has been observed while in LULUCF sector increase in carbon sink has been noted. The highest drop in emissions has occurred in *3. Agriculture* (by 36.0%) what was caused by significant structural and economic changes after 1989 in this sector, including diminishing animal and crop production (i.e. cattle population drop from 10.3 million to 5.9 or sheep population from 4.4 million to 201 thousand in 1988-2014). Next category with high emission reduction in 1988-2014 is *1. Energy* (by about 36.1%) what was caused by transformation of heavy industry in Poland as well as by decreasing coal use and mining and energy efficiency measures implemented.

Table S.4. GHG emissions according to main sectors in base year and in 2014

	Total [kt eq. CO_2]		(2014-base)/base [%]
	Base year	2014	
TOTAL with LULUCF	564 027.39	347 534.19	-38.4
TOTAL without LULUCF	580 020.01	380 037.57	-34.5
1. Energy	483 409.87	308 848.16	-36.1
2. Industrial Processes and Product Use	34 113.47	30 015.11	-12.0
3. Agriculture	47 528.62	30 409.64	-36.0
4. Land-Use, Land-Use Change and Forestry	-15 992.62	-32 503.37	103.2
5. Waste	14 968.05	10 764.66	-28.1

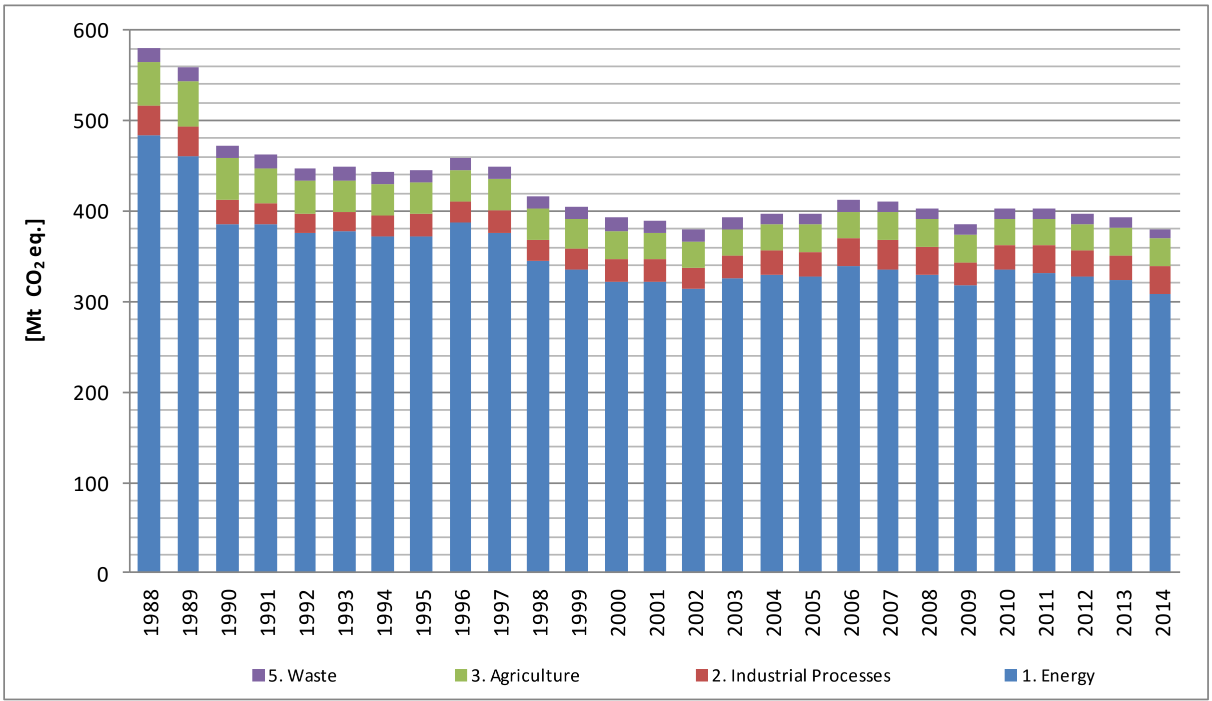

Figure S.3. Trend of aggregated GHGs emissions (excluding category 4) for 1988–2014 according to source categories

Table S.5. National emissions of greenhouse gases for 1988–2014 by source categories [kt CO_2 eq.]

IPCC sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1. Energy	483 409.87	461 081.49	386 321.00	386 034.45	375 703.83	378 128.55	371 799.45	372 528.10	387 366.41	376 419.09	344 981.72	336 097.53	322 219.07
2. Industrial Processes	33 962.29	32 798.28	25 114.87	22 033.69	21 367.37	21 054.30	23 015.06	24 560.80	23 795.49	24 570.32	22 953.21	22 001.73	25 499.26
3. Agriculture	47 528.62	50 210.29	46 848.19	39 825.90	36 244.49	34 952.79	34 525.88	34 482.09	33 767.23	34 349.36	34 092.07	32 364.94	30 792.17
4. Land-Use, Land-Use Change and Forestry	-15 992.62	-20 940.03	-25 730.18	-17 486.85	4 365.50	-3 017.30	-3 850.84	-15 343.59	-34 580.16	-35 437.94	-41 683.67	-47 884.41	-33 414.83
5. Waste	14 968.05	14 956.68	14 711.92	14 538.75	14 397.82	14 215.26	13 878.17	13 701.77	13 551.31	13 516.71	13 594.32	13 566.99	13 765.26
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
TOTAL (with LULUCF)	**563 876.21**	**538 106.71**	**447 265.79**	**444 945.94**	**452 079.01**	**445 333.61**	**439 367.72**	**429 929.16**	**423 900.28**	**413 417.53**	**373 937.65**	**356 146.78**	**358 860.93**
TOTAL (without LULUCF)	**579 868.83**	**559 046.74**	**472 995.97**	**462 432.79**	**447 713.50**	**448 350.91**	**443 218.56**	**445 272.75**	**458 480.44**	**448 855.48**	**415 621.32**	**404 031.19**	**392 275.76**

Table S.5. (cont.) National emissions of greenhouse gases for 1988–2014 by source categories [kt CO_2 eq.]

IPCC sector	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1. Energy	322 139.50	314 097.35	325 266.75	328 616.21	328 462.21	339 609.28	336 122.28	329 658.55	318 233.43	335 488.42	332 354.30	327 420.19	323 062.86	308 848.16
2. Industrial Processes	23 887.35	22 325.93	25 239.74	26 953.01	26 945.04	29 495.74	32 109.71	30 694.08	24 574.16	26 599.60	29 500.65	28 465.19	28 399.27	30 015.11
3. Agriculture	30 405.37	29 724.34	29 165.34	29 165.72	29 322.12	30 031.70	30 671.78	30 750.45	30 064.06	29 550.59	29 930.44	29 807.24	30 401.02	30 409.64
4. Land-Use, Land-Use Change and Forestry	-24 428.55	-33 557.59	-36 113.17	-48 759.86	-48 515.33	-43 221.85	-38 745.40	-38 034.13	-34 027.47	-32 608.19	-39 289.77	-38 780.31	-40 859.45	-32 503.37
5. Waste	13 499.12	13 498.29	13 393.74	12 867.83	12 684.56	12 398.81	12 336.57	12 043.43	12 074.68	11 960.32	11 485.97	11 290.93	11 228.72	10 764.66
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
TOTAL (with LULUCF)	**365 502.79**	**346 088.32**	**356 952.41**	**348 842.91**	**348 898.60**	**368 313.69**	**372 494.94**	**365 112.37**	**350 918.86**	**370 990.74**	**363 981.59**	**358 203.24**	**352 232.42**	**347 534.19**
TOTAL (without LULUCF)	**389 931.34**	**379 645.91**	**393 065.57**	**397 602.77**	**397 413.93**	**411 535.54**	**411 240.34**	**403 146.51**	**384 946.33**	**403 598.93**	**403 271.36**	**396 983.55**	**393 091.87**	**380 037.57**

Carbon dioxide emissions

The CO_2 emissions (excluding category 4) in 2014 were estimated as 310.31 million tonnes. This is 34.5% lower than in the base year. CO_2 emission (excluding category 4) accounted for 81.65% of total GHG emissions in Poland in 2014. The main CO_2 emission source is *Fuel Combustion* (1.A) subcategory. This sector contributed to the total CO_2 emission with 91.8% share in 2014. The shares of the main subcategories were as follows: *Energy industries* – 51.5%, *Manufacture Industries and Construction* – 9.6%, *Transport* – 14.1% and *Other Sectors* – 16.6%. *Industrial Processes* contributed to the total CO_2 emission with 6.6% share in 2014. *Mineral industry* (especially *Cement Production*) is the main emission source in this sector. The CO_2 removal in LULUCF sector in 2014, was calculated to be approximately 32.6 million tonnes. It means that app. 10.5% of the total CO_2 emissions are offset by CO_2 uptake by forests.

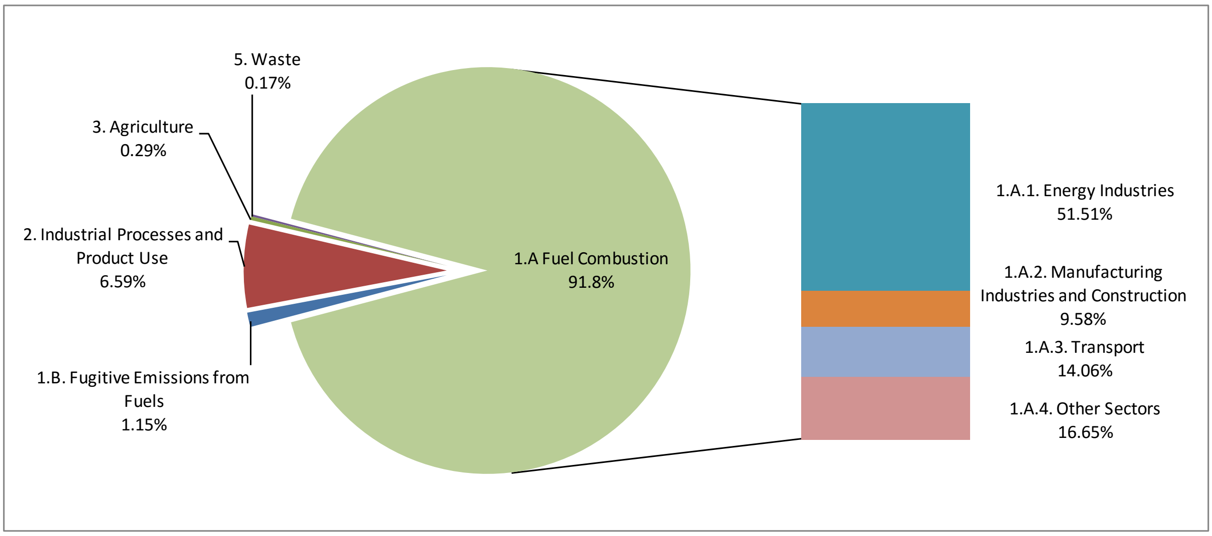

Figure S.4. Carbon dioxide emission (excluding category 4) in 2014 by sector

Methane emissions

The CH_4 emission (excluding category 4) amounted to 1 653.21 kt in 2014 i.e. 41.33 million tonnes of CO_2 equivalents. Compared to the base year, the emission in 2014 was lower by 46.1%. The contribution of CH_4 to the national total GHG emission amounted to 10.9% in 2014. Three of main CH_4 emission sources include the following categories: *Fugitive Emissions from Fuels, Agriculture* and *Waste*. They contributed 34.6%, 33.7% and 22.6% to the national methane emission in 2014, respectively. The emission from the first mentioned sector came from underground mines (28.8% of total CH_4 emission) and Oil and Natural Gas system (5.8% of total CH_4 emission). The emission from *Enteric Fermentation* (3.A) dominated in *Agriculture* and amounted to app. 29.7% of total CH_4 emission in 2014. Waste disposal sites were responsible for 20.7% of the total methane emission and Wastewater Handling for 1.6% of total CH_4 emission.

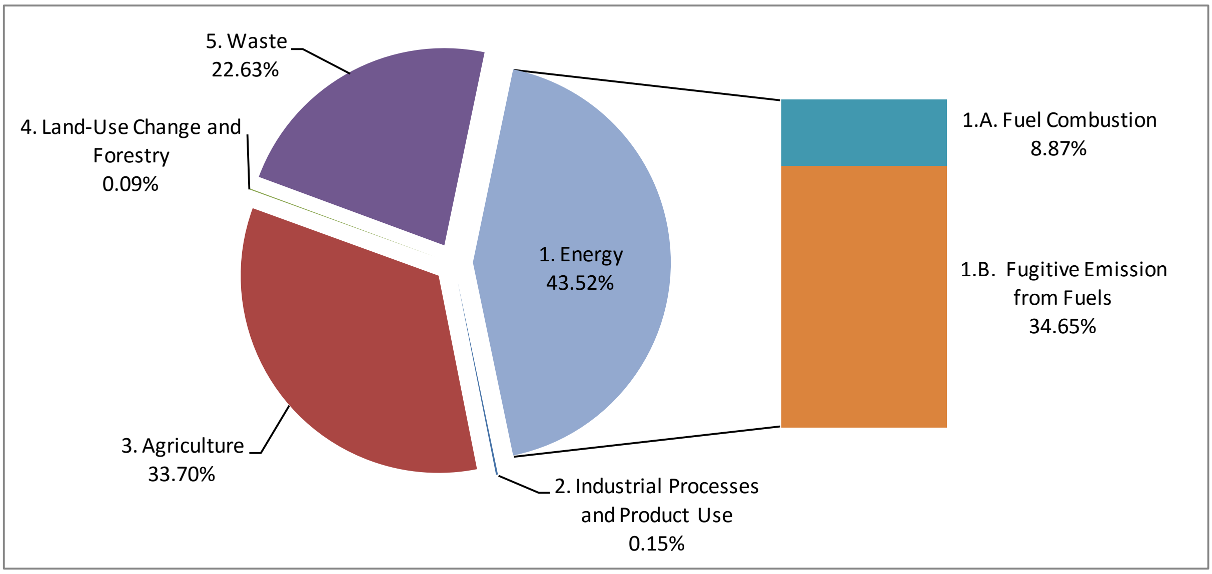

Figure S.5. Methane emission (excluding category 4) in 2014 by sector

Nitrous oxide emissions

The nitrous oxide emissions (excluding category 4) in 2014 amounted to 66.26 kt i.e. 19.75 million tonnes of CO_2 equivalent. The emission was app. 32.0% lower than the respective figure for the base year. N_2O emission constituted 5.2% of the national total GHG emission in 2014. The main N_2O emission sources and their shares in total N_2O emission in 2014 were as follows: *Agricultural Soils* – 68.2%, *Manure Management* – 10.7%, *Chemical Industry* – 3.7% and *Fuel Combustion* – 12.3%.

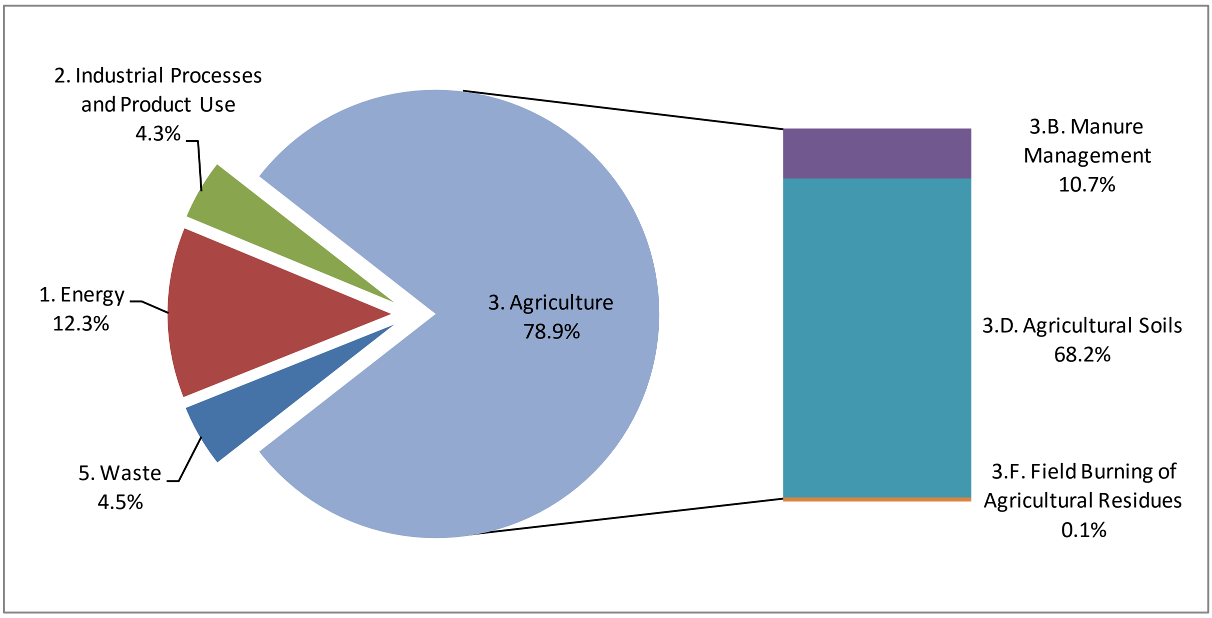

Figure S.6. Nitrous oxide emission (excluding category 4) in 2014 by sector

Emissions of Fluorinated gases

The total emission of industrial gases (HFCs, PFCs and SF_6) in 2014 was estimated at 8 653.62 kt CO_2 eq., and accounted for 2.3% of total GHG emissions in 2014. Industrial gases emissions were by 2799.7% higher comparing to the base year (table S.2). This significant growth in HFCs emission is mainly due to the increase in emission from refrigeration and air conditioning equipment. Shares of

HFCs, PFCs and SF_6 emissions in total 2014 emission were respectively as follows: 2.26%, 0.004% and 0.014%. NF_3 emissions did not occur.

ETS and ESD (non-ETS) emissions

EU member states, being the Parties to the Kyoto Protocol, have reached the agreement to fulfil their commitments jointly in the second KP period. To meet the obligations, the EU legislation divided all the emission sources into two main sectors: EU ETS and so-called non-ETS. The emissions from sources included in EU ETS (electricity and heat production, heavy industry) are reported directly by installations by the end of March every year. The sum of all the reported emissions by installations in Poland constitutes the emission of the Polish part of EU ETS. Those reports show the emission of CO_2 mainly (a small part of N_2O emission is also included). Total emission in this sector amounted to 205.7 Mt of CO_2 eq. in 2013 and to 197.1 Mt of CO_2 eq. in 2014 (table S.7)

Poland (nor any other EU member state) does not have any specific reduction target for 2013-2020 imposed on emissions coming from sources included in EU ETS, as such a limit has only been imposed on the whole EU ETS on the EU level (*cap*). The installations directly are responsible for their emissions within the overall limit.

The emissions from other sources than those included in EU ETS (including other GHG from EU ETS sources) constitute the non-ETS emissions. As already mentioned, Poland will fulfil its obligations jointly with other EU member states. Considering what was said above about EU ETS, this joint fulfilment has been operationalized by effort sharing decisions (ESD) adopted on the EU level, according to which Poland and other member states have specific emission targets imposed only on the non-ETS emissions. This has been regulated by *Decision No 406/2009/EC of the European Parliament and of the Council on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020* (ESD decision). Pursuant to the ESD decision, the European Commission adopted yearly emission limits for the EU member states in its decision 2013/162/EU of 26 March 2013 (Annex II). The limits have been corrected in the Commission implementing decision 2013/634/EU of 31 October 2013 (Annex II).

The emissions in ESD sector have been compared to ESD limits for 2013-2014 in the table below. The table shows that Poland overachieved in 2013 and 2014 its non-ETS emission targets by 6 and almost 12 Mt of CO_2 eq. respectively. . The non-ETS emission has been calculated by deducting both: the emissions reported by installations (total EU ETS) and CO_2 from domestic aviation from the total GHG emission excluding LULUCF sector.

Table S.6. Non-ETS (ESD) sector emission estimation for 2013-2014

Emission/emission limit [kt CO_2 eq.]	2013	2014
1. Total emission (excluding category 4. LULUCF)	393 091.872	380 037.566
2. EU ETS	205 736.590	197 129.387
3. CO_2 from domestic aviation (1.A.3.a)	113.562	136.568
4. Non-ETS (ESD) (1-2-3)	**187 241.720**	**182 771.611**
5. ESD limit	193 642.822	194 885.546
6. Overachievement (5-4)	6 401.102	12 113.935

ES.3.2. KP-LULUCF activities

Estimated emissions and removals of greenhouse gases for the period 2008-2014, associated with the LULUCF activities under Article 3.3 and 3.4 of the Kyoto Protocol are presented in Table ES.4. in Section ES.2.2.

Estimated sink associated with the afforestation activity, increased by 21% as compared to 2008. The emissions associated with deforestation as compared to 2008, increased by 13%. Net emissions increase was caused by the higher area of forest land exclusions for non-forestry and non agricultural purposes. The size of net absorption for forest management activity for the year 2014 is approximately 13% lower than in 2008.

PART I:
ANNUAL INVENTORY SUBMISSION

1. INTRODUCTION

1.1. Background information on greenhouse gas inventories, climate change and supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

1.1.1. Background information on greenhouse gas inventories and climate change

Poland has been the signatory to the United Nations Framework Convention on Climate Change (UNFCCC) since 1994 and to its Kyoto Protocol since 2002 thus joining the international efforts aiming at combating climate change. One of the main obligations resulting from ratification of the Kyoto Protocol by Poland is to reduce the greenhouse gas emissions by 6% in 2008-2012 in relation to the base year and by 20% in 2013−2020 jointly with the European Union.

According to the provisions of Article 4.6 of the UNFCCC and decisions 9/CP.2, Poland uses 1988 as the base year for the estimation and reporting of GHG inventories. For groups of gases: HFCs, PFCs and for sulphur hexafluoride (SF_6) 1995 has been established as the base year and for the nitrogen trifluoride (NF_3) – 2000 has been adopted as the base year.

The underlying report presenting the results of national greenhouse gas inventory for 2013, in line with the trend since 1988, is prepared according to the *Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention* contained in the decision 24/CP.19.

The national inventory covers the following GHGs and groups of gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), nitrogen trifluoride (NF_3) and are reported in five categories: 1. Energy, 2. Industrial Processes and Product Use (IPPU), 3. Agriculture, 4. Land Use, Land Use Change and Forestry (LULUCF) and 5. Waste. Information on emissions of sulphur dioxide (SO_2) and the following GHG precursors is also reported: carbon monoxide (CO), nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOC).

Methodologies used to calculate emissions and sinks of GHGs are those published by the Intergovernmental Panel on Climate Change (IPCC) in 2006, namely *Revised 2006 Guidelines for National Greenhouse Gas Inventories* what is in accordance with the provisions of the decision 24/CP.19. According to these guidelines country specific methods have been used where appropriate giving more accurate emission data

At the same time the underlying report has been elaborated for the for the purpose of Poland's obligations resulting from Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC as well Commission Implementing Regulation (EU) No 749/2014 of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council.

The unit responsible for compiling the GHG inventory for the purpose of the European Union and the UNFCCC, according to the provisions of the Act of 17 July 2009 on the system to manage the emissions of greenhouse gases and other substances *(Journal of laws Nr 130, position 1070 as amended)*, is the

National Centre for Emissions Management (KOBiZE) in the Institute of Environmental Protection - National Research Institute, supervised by the Minister of the Environment.

1.1.2. Background information on supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

The European Union (EU) and its Member States, and Iceland have agreed (agreement under Article 4 of the Kyoto Protocol) to fulfil jointly their quantified emission limitation and reduction commitment (QELRC) for the second commitment period of the Kyoto Protocol. The joint QELRC for the EU is 80% (Annex I to the Doha Amendment) what relates to 20% reduction in the total emissions comparing to the base year or period during the period 2013 – 2020. The joint assigned amount of the Parties of the agreement (EU, its Member States and Iceland) will be calculated based on the sum of the base or period year emissions for the EU Member States and Iceland in accordance with Article 3, paragraphs 7bis, 8 and 8bis. According to this Poland's input to the EU assigned amount for the second commitment period (CP2) of the Kyoto Protocol is as follows:

580,020,010 tonnes CO_2 eq. * 80% * 8 = 3,712,128,064 tonnes CO_2 eq.
(base year emissions)* (QELRLC) * (CP2 years) = (assigned amount)

As Poland is going to fulfil its emission reduction target jointly with the EU the emission levels allocated to the Member States will be based on their annual emission allocations under the EU Effort Sharing Decision (406/2009/EC) as determined in the Commission decisions 2013/162/EU and 2013/634/EU. For Poland the annual emission allocations under ESD in 2013-2020 amount to 1,583,938,824 tonnes CO_2 eq.

By analogy commitment period reserve will be established jointly for the EU. Poland's CPR has been calculated for 1,425,544,942 tonnes CO_2e as 90% of annual emission allocations given above.

Detail additional information required by the Kyoto Protocol is presented in Part II of the NIR.

1.2. Description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

The ***Act of 17 July 2009 on the system to manage the emissions of greenhouse gases and other substances*** (*Journal of Laws No 130 item 1070 as amended)* established a legal base to manage the national emissions cap for greenhouse gases or other substances in a way that should ensure that Poland complies with EU and international commitments and will allow for cost-effective reductions of pollutant emission. Pursuant to the above mentioned law, the National Centre for Emissions Management (Krajowy Ośrodek Bilansowania i Zarządzania Emisjami – KOBiZE) established in the Institute of Environmental Protection – National Research Institute in Warsaw:

- carries out tasks associated with functioning of the national system to balance and forecast emissions, including managing a national database on greenhouse gas emissions and other substances,
- elaborates methodologies to estimate emissions for individual types of installations or activities and methodologies to estimate emission factors per unit of produced good, fuel used or raw material applied,
- elaborates emission reports and projections for GHG and air pollutants,
- manages the national registry for Kyoto Protocol units,
- acts as the national EU Emission Trading Scheme administrator.

The Minister responsible for issues related to the environment supervises performance of the National Centre for Emissions Management.

According to Article 11 of above mentioned Act the National Centre prepares and submits to the Minister of the Environment, 30 days before the deadlines established in the European Union law or international environmental agreements, annual greenhouse gas inventories carried out in accordance with the UNFCCC guidelines and annual inventories of the substances listed in the Convention on Long-range Transboundary Air Pollution (UNECE CLRTAP). Prior to the submission the elaborated inventories undergo internal process of the official consideration and approval implemented by the Ministry of Environment.

The emission calculation, choices of activity data, emission factors and methodology are performed by the Emission Inventory Unit in the National Centre for Emissions Management. The National Centre collaborates with a number of individual experts as well as institutions when compiling inventories. Among the latter are: Central Statistical Office (GUS), Agency of Energy Market (ARE), Institute of Ecology of Industrial Areas in Katowice (IETU), Motor Transport Institute (ITS), Polish Geological Institute - National Research Institute (PIG PIB), State Mining Authority (WUG) as well as Office for Forest Planning and Management (BULGiL). These institutions are mainly involved in providing activity data for inventory estimates. The experts of the National Centre have access to the individual data of entities participating in the European Union Emission Trading Scheme (EU-ETS). This verified data is included in GHG inventory for some IPCC subcategories (e.g. in some subsectors in industrial processes).

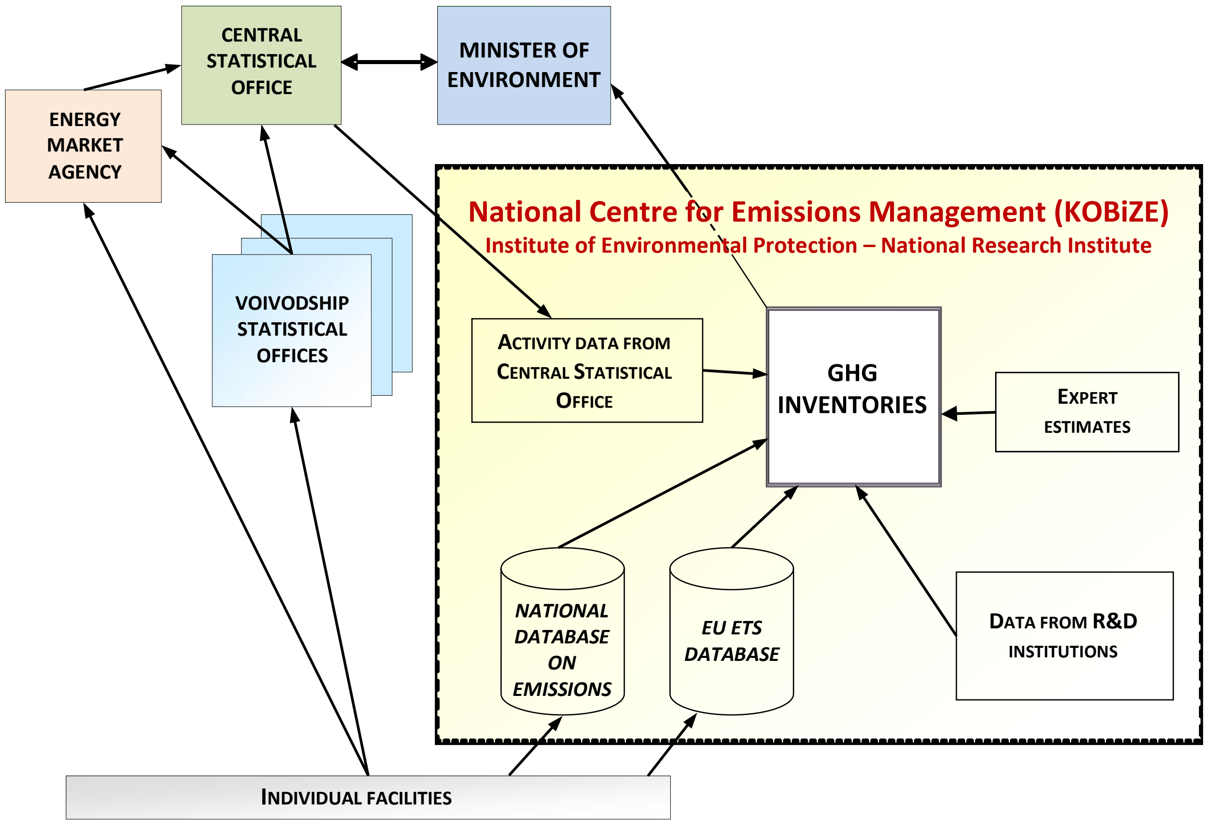

Figure 1.1. National GHG emissions inventory system scheme

The National Centre for Emissions Management, as the unit directly responsible for GHG inventory preparation, is also in charge of co-ordination and implementation of QA/QC procedures within inventory. The QA/QC programme has been elaborated in line with the *2006 IPCC Guidelines* to assure high quality of the Polish annual greenhouse gas inventory. The QA/QC programme contains tasks, responsibilities as well as time schedule for performance of the QA/QC procedures. The following elements of the Quality Assurance and Quality Control system have been addressed:

- Inventory agency responsible for coordinating QA/QC activities,
- QA/QC plan,
- General QC procedures (*Tier 1* method),
- Source category-specific QC procedures (*Tier 2*),
- QA review procedures,
- Reporting, documentation and archiving procedures.

For more detailed information see Annex 5.

1.3. Inventory preparation and data collection, processing and storage

The GHG emission estimates are based on methodologies elaborated by the Intergovernmental Panel on Climate Change (IPCC) and recommended by the UNFCCC, while emissions of indirect gases according to methodology elaborated by UNECE/EMEP. 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 can be briefly summarized in the following way:

- activity data are mostly taken from official public statistics (GUS, EUROSTAT) or, when required data are not directly available, (commissioned) research reports or expert estimates are used instead,
- emission factors for the main emission categories are mostly taken from reports on domestic research; IPCC default data are used in cases where the emission factors are highly uncertain (e.g. CH_4 and N_2O emission from stationary combustion), or when particular source category contribution to national total is insignificant,
- all activity data, emission factors and resulting emission data are stored in a database in KOBIZE, which is constantly updated and extended to meet the ever changing requirements for emission reporting, with respect to UNFCCC and LTRAP as well as their protocols.

1.4. Brief general description of methodologies and data sources used

The GHG emissions and removals inventory presented in this report follow the recommended by decision 24/CP.19 the *2006 IPCC Guidelines for national inventories* [IPCC 2006]. According to these guidelines country specific methods have been used where appropriate giving more accurate emission data especially in case of key categories. For categories where emissions do not occur or are not estimated the abbreviations NO and NE were used in tables. More detail description of methodologies used in Polish GHG inventory is given in sections 3–7.

The non-CO_2 GHG emissions from fuel combustion (1.A. category) were estimated based on fuel consumption estimates and respective emission factors. Data on fuel consumption for stationary sources with disaggregation into fuel type and source category come from fuel balances elaborated by Central Statistical Office and reported to Eurostat.

One of the steps of emission inventorying from the 1.A. *Energy* category is preparation of energy budgets for main fuels (energy carriers). These budgets are prepared based on the national energy balances published by Central Statistical Office and Agency of Energy Market. 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 are also assessed.

The example of evaluation of hard coal consumption is given in table 1.1. The examples of the fuel budgets for: lignite, natural gas, coke-oven gas and blast furnace gas are presented in Annex 4.

The data on quantity of coal combusted in whole country in a given year (tab. 1.1) is used for calculation of the average net calorific value of this fuel. This calculated net calorific value provides then the basis for the estimation of country specific CO_2 emission factor based on empirical formula that applies the relationship between net calorific value and elemental carbon content in fuel (see chapter 3.1.1). This factor can be used for estimation of the potential CO_2 emission from coal combustion. The amount of fuel combusted in a given year, calculated in fuel budget, can be compared with total consumption of this fuel in all sectors. It is one of the ways of verifying of sectoral approach.

Basic information on activity data regarding IPCC categories comes from Eurostat and Central Statistical Office (GUS) databases. The activity data that are not available in the GUS have been worked out in experts studies commissioned specifically for the GHG emission inventory purposes.

Table 1.1. Hard coal consumption in 2014

National fuel balance	Hard coal - Eurostat	
	10^3 Mg	TJ
In	83 688	2 002 112
From national sources	73 271	1 741 695
1) Indigenous production	72 540	1 725 174
2) Transformation output or return	731	16 521
3) Stock decrease	0	0
Import	10 417	260 417
Out	83 688	2 002 112
National consumption	73 125	1 745 744
1) Transformation input	55 189	1 296 110
a) input for secondary fuel production	12 722	375 973
b) fuel combustion	42 467	920 137
2) Direct consumption	17 936	449 634
Non-energy use	152	3 601
Combusted directly	17 784	446 033
Combusted in Poland	60 251	1 366 170
Stock increase	1 173	26 517
Export	8 956	242 497
Losses and statistical differences	434	-12 646

Net calorific value	MJ/kg	22.67

Eurostat database containing domestic data provided by GUS is the main source of activities for *Energy* sector (Annex 4). The data on fuel consumption in *Road Transportation* subcategory were also taken from the Eurostat database and next disaggregated on individual vehicle types based on methodology developed in the Motor Transport Institute.

1.5. Brief description of key categories

The source/sink categories in all sectors are identified to be *key categories* on the basis of their contribution to the total level and/or trend assessment established in accordance with 2006 IPCC GLs following quantitative Approach 1 and qualitative criteria. In 2014, 25 sources were identified as Poland's key categories excluding LULUCF and 29 including LULUCF while in 1988 22 and 25 respectively with the application of quantitative approach. Analysis with use of qualitative criteria identified no additional categories as key sources.

About 75.6% of GHG emissions in 2014 were generated in the sector 1.A *Energy,* of which four the biggest source categories: 1.A.1 *Energy Industries (Solid fuels)*, 1.A.3.b *Road Transportation (Fossil fuels)*, 1.A.4 *Other Sectors (Solid fuels)* and 1.A.2 *Manufacturing Industries and Construction (Solid fuels)* generate 63.5% of Poland's GHG emissions. This category is of significant influence on a country's total GHG emissions in terms of both: level and trend of emissions.

Table 1.2 presents the general information on identified key categories in the national inventory for 2014. Those categories contribute to 96.5% of the GHG emission (without LULUCF).

The complete tables with level and trend assessments for 1988 and 2014 are given in Annex 1.

Table 1.2. Key category analysis results in 2014 (without LULUCF)

	IPCC Source Category Code	IPCC Source Categories	Classification	Greenhouse Gas	Identification criteria (Level, Trend, Qualitative)			Comments
1	1.A.1	Energy Industries	Solid Fuels	CO2	L	T		
2	1.A.3.b	Road Transportation	Fossil fuels	CO2	L	T		
3	1.A.4	Other Sectors	Solid Fuels	CO2	L	T		
4	1.A.2	Manufacturing Industries and Construction	Solid Fuels	CO2	L	T		
5	3.A	Enteric Fermentation	Farming	CH4	L	T		
6	1.B.1	Solid Fuels	Operation	CH4	L	T		
7	1.A.4	Other Sectors	Gaseous Fuels	CO2	L	T		
8	3.D	Agricultural Soils	Direct N2O Emissions From Managed Soils	N2O	L	T		
9	1.A.4	Other Sectors	Liquid Fuels	CO2	L	T		
10	5.A	Solid Waste Disposal	Waste	CH4	L	T		
11	2.F.1	Refrigeration and Air conditioning	no classification	Aggregate F-gases	L	T		
12	1.A.2	Manufacturing Industries and Construction	Gaseous Fuels	CO2	L	T		
13	2.A.1	Cement Production	no classification	CO2	L	T		
14	1.A.1	Energy Industries	Gaseous Fuels	CO2	L	T		
15	2.B.1	Ammonia Production	no classification	CO2	L	T		
16	1.A.1	Energy Industries	Liquid Fuels	CO2	L	T		
17	1.A.2	Manufacturing Industries and Construction	Other Fossil Fuels	CO2	L	T		
18	3.D	Agricultural Soils	Farming	N2O	L			
19	1.B.1	Solid Fuels	Operation	CO2	L			
20	1.A.2	Manufacturing Industries and Construction	Liquid Fuels	CO2	L			
21	1.A.4	Other Sectors	Solid Fuels	CH4	L	T		
22	3.B	Manure Management	Farming	N2O	L			
23	2.D	Non-energy Products from Fuels and Solvent Use	no classification	CO2	L			
24	1.A.2.a	Iron and Steel Production	no classification	CO2	L	T		
25	2.A.4	Other Process Uses of Carbonates	no classification	CO2	L	T		
26	2.B.2	Nitric Acid Production	no classification	N2O		T		
27	1.B.2	Other emissions from energy production	Operation	CO2		T		
28	5.D	Wastewater Treatment and Discharge	Wastewater	CH4		T		
29	1.A.3.c	Railways	Fossil fuels	CO2		T		
30	2.A.2	Lime Production	no classification	CO2		T		
31	1.B.2.c	Venting and Flaring	Operation	CH4		T		

1.6. General uncertainty evaluation, including data on the overall uncertainty for the inventory totals

Uncertainty evaluation made for 2014 is based on calculations and national expert's judgments/ estimations as well as opinions expressed by international experts during the review led by UNFCCC Secretariat in the years 2007-2012. Calculations include simplified method for sector 4 and for fluorinated industrial gases.

The estimate of emission uncertainty for the year 2014 was made using *Tier 1* approach. The uncertainty ranges varied significantly among various source categories and are presented within sectoral chapters 3-7. More details, including sectoral information on uncertainty ranges, are given in Annex 8.

1.7. General assessment of the completeness

The Polish GHG emission inventory includes calculation of emissions from all relevant sources recommended by the mandatory guidelines. Only CO_2 from *Coal Mining and Handling* (1.B.1.a) is not considered due to the lack of data at this level of aggregation.

2. Trends in greenhouse gas emissions

2.1. Description and interpretation of emission trends for aggregated greenhouse gas emissions

For carbon dioxide, net emission is calculated by subtracting from the total CO_2 emission – the emissions and removals from category 4. *Land Use, Land Use Change and Forestry* (LULUCF). According to the IPCC methodology, CO_2 emissions are given with and without contributions from category 4. Also following IPCC, emission of CO_2 from biomass, is not included in the national total.

For non-CO_2 gases, the inventory results can also be presented (table 2.1) in units of CO_2 equivalents by applying values of the so called Global Warming Potentials - GWP. GWP for methane is 25, and for nitrous oxide 298. Carbon dioxide is the main GHG in Poland with the 81.65% (excluding category 4) share in 2014, while the methane contributes with 10.9% (excluding category 4) to the national total. Nitrous oxide contribution is 5.2% (excluding category 4) and all industrial GHG together contribute 2.3%. Percentage share of GHG in national total emissions in 2014 is presented in figure 2.1.

Table 2.1. Greenhouse gas emissions in 2014 in CO_2 eq.

Pollutant	2014	
	Emission in CO_2 eq. [kt]	Share [%]
CO_2 (with LULUCF)	277 703.81	79.91
CO_2 (without LULUCF)	310 307.30	81.65
CH_4 (with LULUCF)	41 365.49	11.90
CH_4 (without LULUCF)	41 330.22	10.88
N_2O (with LULUCF)	19 811.27	5.70
N_2O (without LULUCF)	19 746.42	5.20
HFCs	8 586.93	2.26
PFCs	13.90	0.00
Mix HFC i PFC	NA,NO	NA,NO
SF_6	52.79	0.01
NF_3	NA,NO	NA,NO
TOTAL net emission (with LULUCF)	347 534.19	100.00
TOTAL without LULUCF	380 037.57	100.00

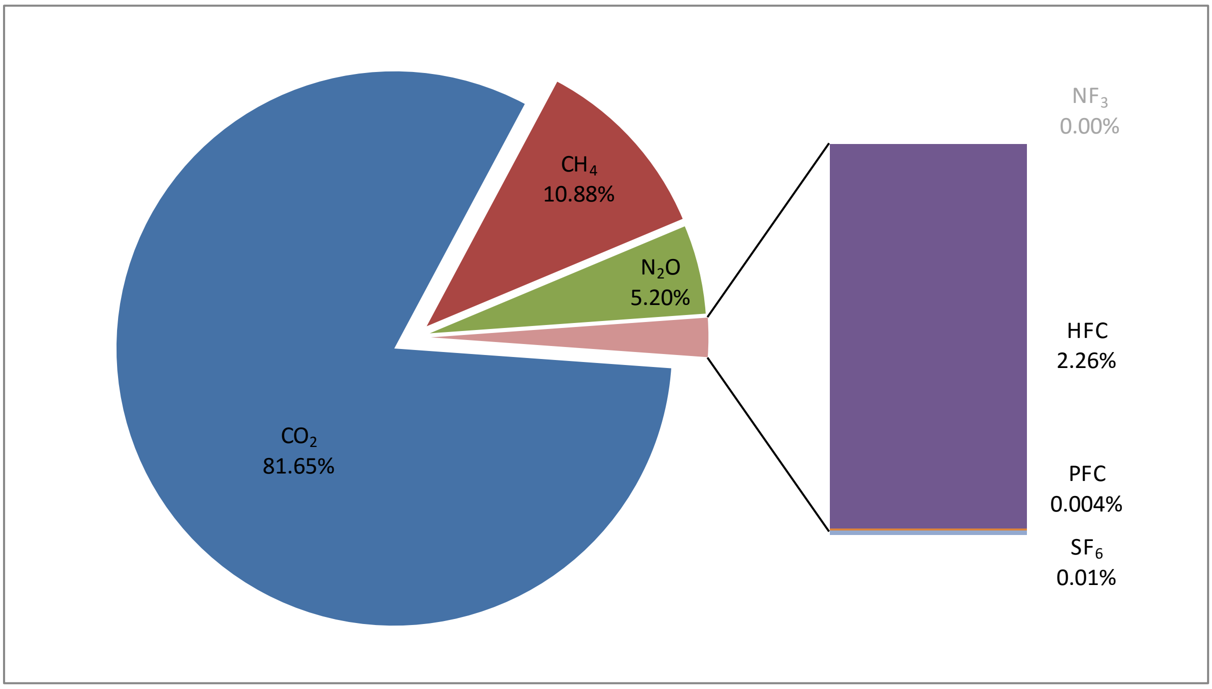

Figure 2.1. Percentage share of GHGs in national total emission in 2014 (excluding category 4)

Emissions of main GHGs in 2014, disaggregated into main source sub-sectors, are given in table 2.2. Respective values for the fluorinated industrial gases are presented in table 2.3. Discussion of these results is given in the following sections.

Table 2.2. Emissions of CO_2, CH_4 and N_2O in 2014 [kt]

GHG	CO_2	CH_4	N_2O
TOTAL without LULUCF	310 307.30	1 653.21	66.26
TOTAL with LULUCF	277 703.81	1 654.62	66.48
1. Energy	288 426.63	719.43	8.17
A. Fuel Combustion	284 863.92	146.62	8.17
1. Energy Industries	159 840.96	4.66	2.58
2. Manufacturing Industries and Construction	29 742.22	4.26	0.59
3. Transport	43 615.18	3.89	1.95
4. Other Sectors	51 665.56	133.81	3.05
5. Other	IE, NO	IE, NO	IE, NO
B. Fugitive Emissions from Fuels	3 562.71	572.81	0.002
1. Solid Fuels	1 705.16	476.31	NA
2. Oil and Natural Gas	1 857.54	96.50	0.00
2. Industrial Processes and Product Use	20 450.86	2.52	2.84
A. Mineral Industry	9 936.94	NA	NA
B. Chemical Industry	5 663.42	1.94	2.44
C. Metal Industry	2 586.03	0.58	NA
D. Other Production	2 264.47	NE	NE
G. Other	NO	NO	0.4
3. Agriculture	905.41	557.10	52.27
A. Enteric Fermentation	NE	491.78	NE
B. Manure Management	NE	64.26	7.06
D. Agricultural Soils	NE	NA	45.17
F. Field Burning of Agricultural Residues	NE	1.06	0.04
G. Liming	467.55	NA	NA
H. Urea application	437.86	NA	NA
4. Land Use, Land-Use Change and Forestry	-32 603.48	1.41	0.06
A. Forest Land	-34 593.61	1.29	0.0176
B. Cropland	429.07	IE, NO	0.0437
C. Grassland	-399.15	0.12	0.00184
D. Wetlands	4 678.41	0.00	0.0000
E. Settlements	1 835.73	NA, NO	NA, NO
F. Other Land	NA, NO	NA, NO	NA, NO
G. HWP	-4 553.93	NA, NO	NA, NO
5. Waste	524.40	374.16	2.97
A. Solid Waste Disposal	NO,NA	342.32	NO,NA
B. Biological Treatment of Solid Waste	NO,NA	5.17	0.31
C. Incineration and Open Burning of Waste	524.40	0.00	0.19
D. Wastewater Treatment and Discharge	NO,NA	26.67	2.48

Table 2.3. Emissions of industrial gases: HFCs, PFCs and SF_6 in 2014 [kt eq. CO_2]

2014	HFCs	PFCs	SF_6	Total in eq. CO_2
Total Industrial gases [kt eq. CO_2]	8 586.93	13.90	52.79	8 653.62
C. Metal Industry	NE	NO	4.15	4.15
4. Magnesium production	NE	NO	4.15	4.15
F. Consumption of Halocarbons and SF_6	8 586.93	13.90	NO	8 600.83
1. Refrigeration and Air Conditioning Equipment	8 046.11	NO	NO	8 046.11
2. Foam Blowing	343.83	NO	NO	343.83
3. Fire Extinguishers	71.13	13.90	NA	85.03
4. Aerosols	125.45	NA	NA	125.45
G. Other product manufacture and use	NO	NO	48.64	48.64
1. Electrical equipment	NO	NO	48.64	48.64

As a supplement to the tables 2.2 and 2.3, table 2.4 includes percentage contributions of main source sectors to the national totals in 2014 for CO_2, CH_4 and N_2O.

Trend of aggregated greenhouse gases emissions follows the trend of emissions CO_2 alone which is the primary greenhouse gas emitted in Poland. The GHGs trend for period between 1988 and 1990 indicate dramatic decrease triggered by significant economic changes, especially in heavy industry, related to political transformation from centralized to market economy. This drop in emissions continued up to 1993 and then emissions started to rise with peak in 1996 as a result of development in heavy industry and other sectors and dynamic economic growth. Slow decline in emissions (up to 2002) characterized the succeeding years, when still energy efficiency policies and measures were implemented, and then slight increase up to 2007 caused by animated economic development. Since 2008 stabilisation in emissions has been noted with distinct decrease in 2009 related to world economic slow-down (figure 2.2 and tables 2.5 and 2.6). Since 2010 GHG emissions in Poland have gradually decreased.

Since 2005 Poland has taken part in the European Union's Emission Trading System, being one of the flexible mechanism supporting measures for limiting the greenhouse gas emissions. The share of emissions related to installations covered by EU ETS in the national emissions in 2005−2014 amounted about 51% on average (from 49% in 2010 up to 52% in 2014). One should notice that since 2013 the scope of the EU ETS has expanded with new industries (like production of selected chemicals) and greenhouse gases (nitrous oxide) (Fig. 2.2).

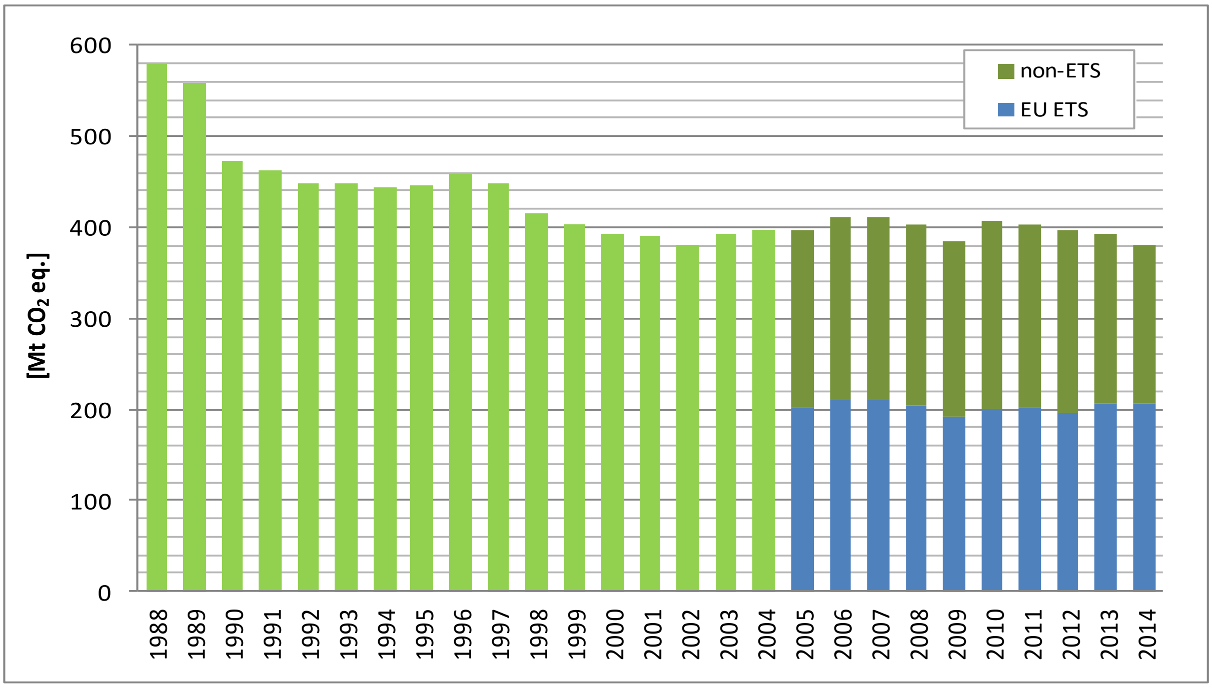

Figure 2.2. Trend of aggregated GHGs emissions (excluding category 4) for 1988–2014

Table 2.4. Percentage shares of individual source sectors in 2014 emissions

Percentage share of emissions of source sectors in current year without LULUCF	Share [%]		
	CO_2	CH_4	N_2O
TOTAL	100.00	100.00	100.00
1. Energy	92.95	43.52	12.34
A. Fuel Combustion	91.80	8.87	12.33
1. Energy Industries	51.51	0.28	3.90
2. Manufacturing Industries and Construction	9.58	0.26	0.90
3. Transport	14.06	0.24	2.94
4. Other Sectors	16.65	8.09	4.60
5. Other	IE, NO	IE, NO	IE, NO
B. Fugitive Emissions from Fuels	1.15	34.65	0.003
1. Solid Fuels	0.55	28.81	NA
2. Oil and Natural Gas	0.60	5.84	0.003
2. Industrial Processes and Product Use	6.59	0.15	4.29
A. Mineral Industry	3.20	NA	NA
B. Chemical Industry	1.83	0.12	3.69
C. Metal Industry	0.83	0.04	NA
D. Other Production	0.73	NE	NE
G. Other	NO	NO	0.60
3. Agriculture	0.29	33.70	78.88
A. Enteric Fermentation	NE	29.75	NE
B. Manure Management	NE	3.89	10.65
D. Agricultural Soils	NE	NA	68.17
F. Field Burning of Agricultural Residues	NE	0.06	0.06
G. Liming	0.15	NA	NA
H. Urea application	0.14	NA	NA
4. Land Use, Land-Use Change and Forestry	-	-	-
A. Forest Land	-	-	-
B. Cropland	-	-	-
C. Grassland	-	-	-
D. Wetlands	-	-	-
E. Settlements	-	-	-
F. Other Land	-	-	-
G. HWP	-	-	-
5. Waste	0.17	22.63	4.49
A. Solid Waste Disposal	NO,NA	20.71	NO,NA
B. Biological Treatment of Solid Waste	NO,NA	0.31	0.47
C. Incineration and Open Burning of Waste	0.17	0.00	0.28
D. Wastewater Treatment and Discharge	NO,NA	1.61	3.74

Table 2.5. National emissions of greenhouse gases for 1988–2014 by gases [kt CO_2 eq.]

GHG	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CO_2 (with LULUCF)	457 906.75	433 134.27	352 994.60	358 143.40	370 132.04	363 351.58	358 103.65	348 478.85	342 663.50	332 918.74	297 404.57	281 436.80	285 649.46
CO_2 (without LULUCF)	473 954.84	454 130.60	378 782.54	375 684.16	365 865.16	366 427.66	362 012.96	363 885.78	377 308.60	368 415.85	339 145.83	329 380.90	319 120.41
CH_4 (with LULUCF)	76 778.53	74 553.73	67 108.10	64 107.60	60 763.76	59 840.77	59 225.75	58 301.14	57 817.28	57 035.43	53 230.54	51 920.22	49 435.49
CH_4 (without LULUCF)	76 734.40	74 509.69	67 064.04	64 062.61	60 719.25	59 798.56	59 184.82	58 255.23	57 780.89	56 997.50	53 196.21	51 883.11	49 402.95
N_2O (with LULUCF)	29 043.68	30 271.20	27 021.23	22 553.62	21 048.58	21 996.41	21 872.27	22 850.74	23 006.22	22 893.17	22 641.51	21 924.17	22 295.40
N_2O (without LULUCF)	29 032.34	30 258.94	27 007.52	22 544.71	20 994.46	21 979.84	21 854.74	22 833.31	22 977.67	22 871.92	22 618.26	21 901.58	22 271.83
HFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	97.34	228.41	373.93	462.23	673.38	1 280.83
PFCs	147.26	147.51	141.87	141.31	134.63	144.86	152.78	171.97	161.07	173.36	174.86	168.71	176.68
Unspecified mix of HFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
SF_6	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	13.27	29.12	23.80	22.91	23.94	23.50	23.07
NF_3	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
TOTAL (with LULUCF)	**563 876.21**	**538 106.71**	**447 265.79**	**444 945.94**	**452 079.01**	**445 333.61**	**439 367.72**	**429 929.16**	**423 900.28**	**413 417.53**	**373 937.65**	**356 146.78**	**358 860.93**
TOTAL (without LULUCF)	**579 868.83**	**559 046.74**	**472 995.97**	**462 432.79**	**447 713.50**	**448 350.91**	**443 218.56**	**445 272.75**	**458 480.44**	**448 855.48**	**415 621.32**	**404 031.19**	**392 275.76**

Table 2.5. (cont.) National emissions of greenhouse gases for 1988–2014 by gases [kt CO_2 eq.]

GHG	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CO_2 (with LULUCF)	290 793.48	273 913.81	284 032.38	275 450.24	274 789.43	293 208.71	297 454.15	291 226.05	281 834.45	301 345.32	294 349.88	287 734.25	281 496.55	277 703.81
CO_2 (without LULUCF)	315 274.09	307 535.64	320 230.17	324 279.45	323 372.58	336 500.58	336 268.11	329 338.17	315 937.97	334 026.15	333 713.65	326 597.79	322 440.49	310 307.30
CH_4 (with LULUCF)	50 199.28	48 175.41	48 115.04	47 422.23	47 161.10	46 960.54	45 493.39	44 557.17	43 009.79	43 198.02	42 159.10	42 619.80	42 394.09	41 365.49
CH_4 (without LULUCF)	50 166.70	48 140.69	48 078.13	47 387.97	47 127.61	46 921.47	45 463.69	44 522.53	42 979.95	43 166.37	42 128.02	42 588.03	42 357.11	41 330.22
N_2O (with LULUCF)	22 450.16	21 348.23	21 590.87	22 095.45	22 262.80	22 777.11	23 589.32	23 044.36	19 920.84	19 612.18	19 967.76	20 071.41	20 187.70	19 811.27
N_2O (without LULUCF)	22 430.68	21 318.71	21 543.16	22 060.36	22 228.47	22 746.17	23 550.46	23 001.01	19 874.64	19 571.19	19 924.84	20 019.95	20 140.19	19 746.42
HFCs	1 839.67	2 420.26	2 992.33	3 647.55	4 471.06	5 140.55	5 742.30	6 088.81	6 098.20	6 782.77	7 449.61	7 720.45	8 091.92	8 586.93
PFCs	197.34	207.33	201.08	205.07	187.41	193.58	184.63	163.12	17.97	17.07	16.22	15.41	14.64	13.90
Unspecified mix of HFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
SF_6	22.86	23.29	20.72	22.36	26.80	33.20	31.16	32.87	37.60	35.37	39.02	41.92	47.54	52.79
NF_3	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
TOTAL (with LULUCF)	**365 502.79**	**346 088.32**	**356 952.41**	**348 842.91**	**348 898.60**	**368 313.69**	**372 494.94**	**365 112.37**	**350 918.86**	**370 990.74**	**363 981.59**	**358 203.24**	**352 232.42**	**347 534.19**
TOTAL (without LULUCF)	**389 931.34**	**379 645.91**	**393 065.57**	**397 602.77**	**397 413.93**	**411 535.54**	**411 240.34**	**403 146.51**	**384 946.33**	**403 598.93**	**403 271.36**	**396 983.55**	**393 091.87**	**380 037.57**

Table 2.6. National emissions of greenhouse gases for 1988–2014 by source categories [kt CO_2 eq.]

IPCC sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1. Energy	483 409.87	461 081.49	386 321.00	386 034.45	375 703.83	378 128.55	371 799.45	372 528.10	387 366.41	376 419.09	344 981.72	336 097.53	322 219.07
2. Industrial Processes	33 962.29	32 798.28	25 114.87	22 033.69	21 367.37	21 054.30	23 015.06	24 560.80	23 795.49	24 570.32	22 953.21	22 001.73	25 499.26
3. Agriculture	47 528.62	50 210.29	46 848.19	39 825.90	36 244.49	34 952.79	34 525.88	34 482.09	33 767.23	34 349.36	34 092.07	32 364.94	30 792.17
4. Land-Use, Land-Use Change and Forestry	-15 992.62	-20 940.03	-25 730.18	-17 486.85	4 365.50	-3 017.30	-3 850.84	-15 343.59	-34 580.16	-35 437.94	-41 683.67	-47 884.41	-33 414.83
5. Waste	14 968.05	14 956.68	14 711.92	14 538.75	14 397.82	14 215.26	13 878.17	13 701.77	13 551.31	13 516.71	13 594.32	13 566.99	13 765.26
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
TOTAL (with LULUCF)	**563 876.21**	**538 106.71**	**447 265.79**	**444 945.94**	**452 079.01**	**445 333.61**	**439 367.72**	**429 929.16**	**423 900.28**	**413 417.53**	**373 937.65**	**356 146.78**	**358 860.93**
TOTAL (without LULUCF)	**579 868.83**	**559 046.74**	**472 995.97**	**462 432.79**	**447 713.50**	**448 350.91**	**443 218.56**	**445 272.75**	**458 480.44**	**448 855.48**	**415 621.32**	**404 031.19**	**392 275.76**

Table 2.6. (cont.) National emissions of greenhouse gases for 1988–2014 by source categories [kt CO_2 eq.]

IPCC sector	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1. Energy	322 139.50	314 097.35	325 266.75	328 616.21	328 462.21	339 609.28	336 122.28	329 658.55	318 233.43	335 488.42	332 354.30	327 420.19	323 062.86	308 848.16
2. Industrial Processes	23 887.35	22 325.93	25 239.74	26 953.01	26 945.04	29 495.74	32 109.71	30 694.08	24 574.16	26 599.60	29 500.65	28 465.19	28 399.27	30 015.11
3. Agriculture	30 405.37	29 724.34	29 165.34	29 165.72	29 322.12	30 031.70	30 671.78	30 750.45	30 064.06	29 550.59	29 930.44	29 807.24	30 401.02	30 409.64
4. Land-Use, Land-Use Change and Forestry	-24 428.55	-33 557.59	-36 113.17	-48 759.86	-48 515.33	-43 221.85	-38 745.40	-38 034.13	-34 027.47	-32 608.19	-39 289.77	-38 780.31	-40 859.45	-32 503.37
5. Waste	13 499.12	13 498.29	13 393.74	12 867.83	12 684.56	12 398.81	12 336.57	12 043.43	12 074.68	11 960.32	11 485.97	11 290.93	11 228.72	10 764.66
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
TOTAL (with LULUCF)	**365 502.79**	**346 088.32**	**356 952.41**	**348 842.91**	**348 898.60**	**368 313.69**	**372 494.94**	**365 112.37**	**350 918.86**	**370 990.74**	**363 981.59**	**358 203.24**	**352 232.42**	**347 534.19**
TOTAL (without LULUCF)	**389 931.34**	**379 645.91**	**393 065.57**	**397 602.77**	**397 413.93**	**411 535.54**	**411 240.34**	**403 146.51**	**384 946.33**	**403 598.93**	**403 271.36**	**396 983.55**	**393 091.87**	**380 037.57**

2.2. Description and interpretation of emission trends by gas

Carbon dioxide (CO_2)

In 2014, the CO_2 emissions (without LULUCF) were estimated to be 310.31 million tonnes, while - when sector 4. LULUCF is included - the figure reaches 277.70 million tonnes (table 2.1). CO_2 share in total GHG emissions in 2014 amounted to 81.65%. The main CO_2 emission source is *Fuel Combustion* (1.A) subcategory. This sector contributed to the total CO_2 emission (without LULUCF) with 91.8% share in 2014 (fig. 2.3). The shares of the main subcategories in 1.A were as follows: *Energy industries* - 51.5%, *Manufacture Industries and Construction* – 9.6%, *Transport* – 14.1% and *Other Sectors* – 16.6%. Sector 2. *Industrial Processes* contributed to the total CO_2 emission with 6.6% share in 2014. *Mineral industry* (especially *Cement Production*) is the main emission source in this sector. The CO_2 emission/removal in LULUCF sector in 2014, was calculated to be approximately 32.6 million tonnes. It means that app. 10.5% of the total CO_2 emissions are offset by CO_2 uptake by forests.

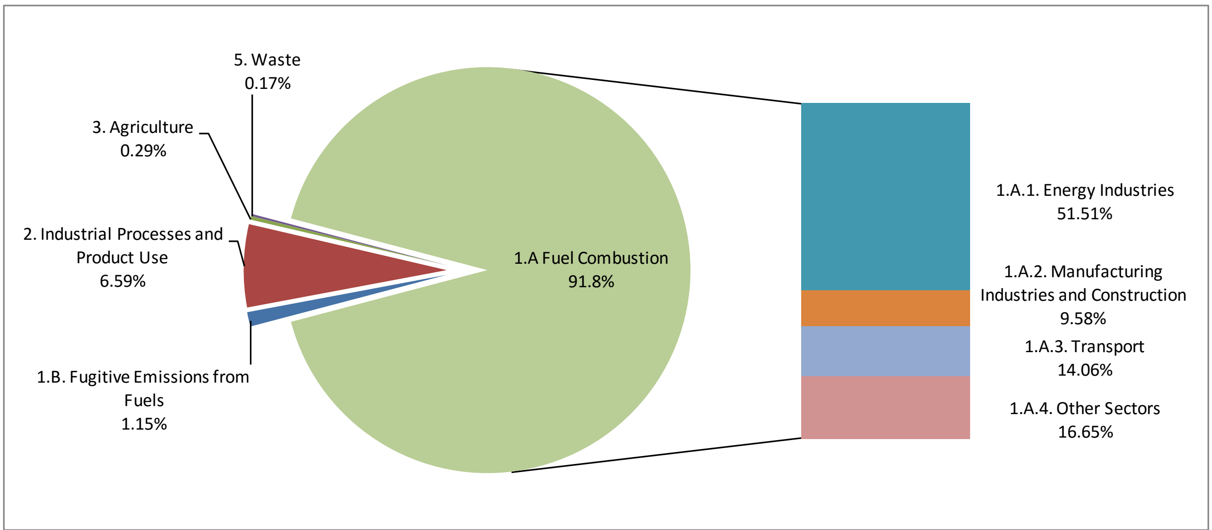

Figure 2.3. Carbon dioxide emission (excluding category 4) in 2014 by sector

Methane (CH_4)

The CH_4 emission (excluding category 4) amounted to 1 653.21 kt in 2014 i.e. 41.33 million tonnes of CO_2 equivalents (table 2.1). CH_4 share in total GHG emissions in 2014 amounted to 10.9%. Three of main CH_4 emission sources include the following categories: *Fugitive Emissions from Fuels, Agriculture* and *Waste*. They contributed with 34.6%, 33.7% and 0.0% shares to the national methane emission in 2014, respectively (fig. 2.4). The emission from the first mentioned sector was covered by emission from *Underground Mines* (app. 28.8% of total CH_4 emission) and *Oil and Natural Gas* system (about 5.8% of total emission). The emission from *Enteric Fermentation* dominated in *Agriculture* and amounted to app. 29.7% of total methane emission in 2014. *Disposal sites* contributed to 22.6% of the methane emission.

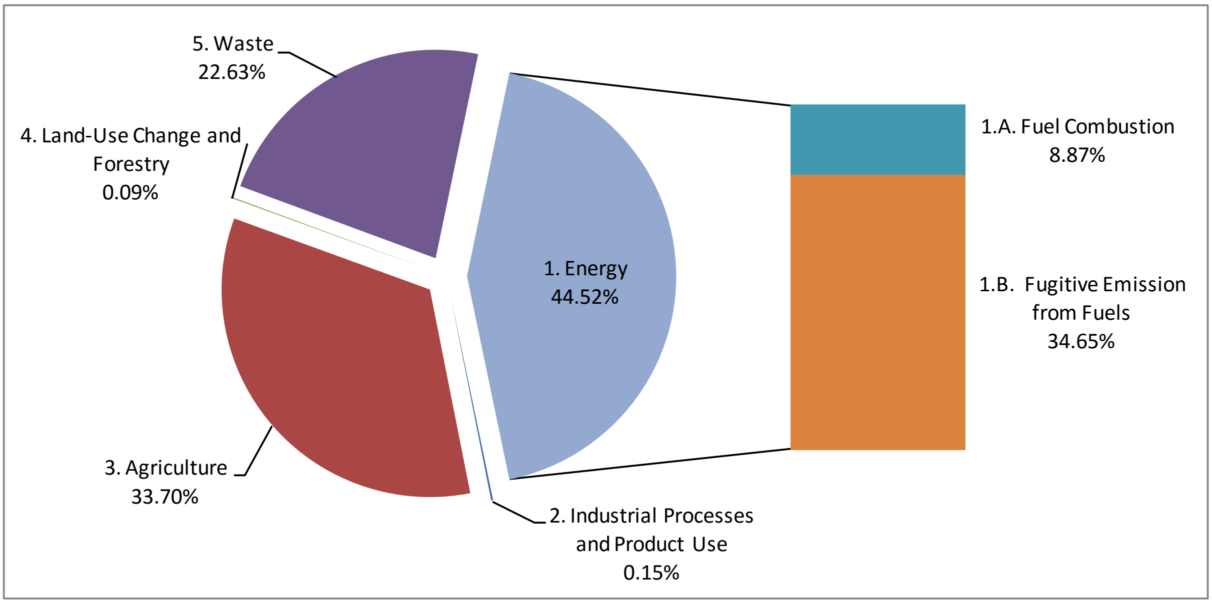

Figure 2.4. Methane emission (excluding category 4) in 2014 by sector

Nitrous oxide (N_2O)

The nitrous oxide emissions (excluding category 4) in 2014 were 66.26 kt i.e. 19.75 million tonnes of CO_2 equivalents (table 2.2). N_2O share in total GHG emissions in 2014 amounted to 5.2%. The main N_2O emission sources and their shares in total N_2O emission in 2014 are: *Agricultural Soils* – 68.2%, *Manure Management* – 10.7%, *Chemical Industry* – 4.3% and *Fuel Combustion* – 12.3% (fig. 2.5).

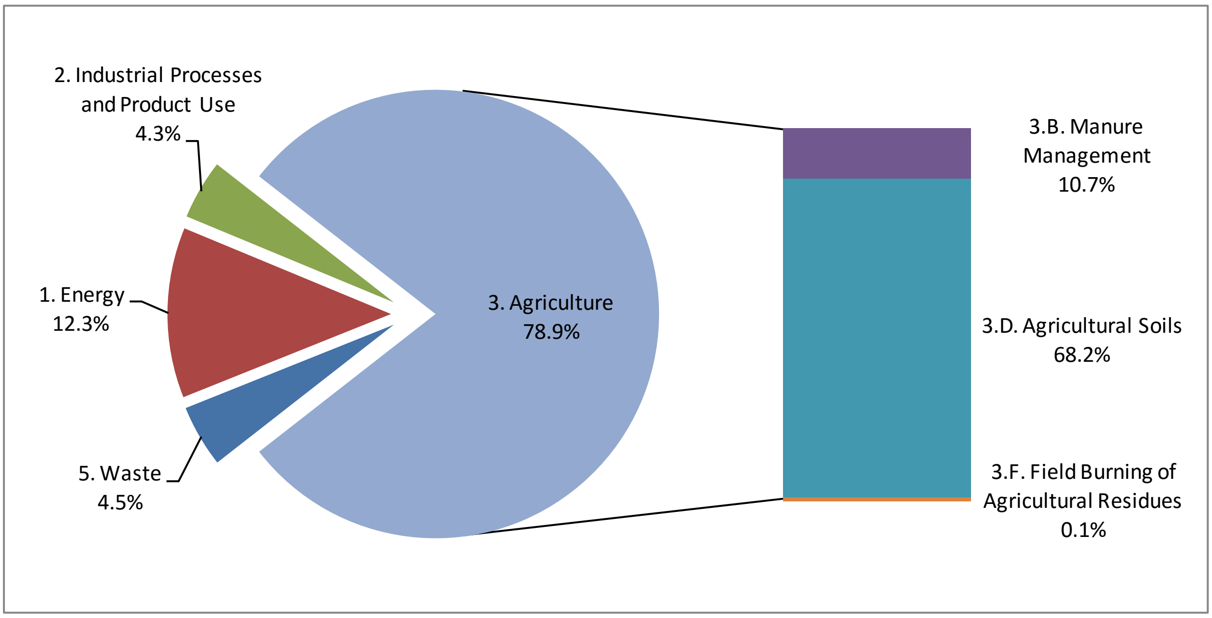

Figure 2.5. Nitrous oxide emission (excluding category 4) in 2014 by sector

Industrial gases

The total emission of industrial gases (HFCs, PFCs SF_6 and NF_3) in 2014 was 8 653.62 kt CO_2 equivalent what accounts for 2.3% of total GHG emissions share in 2014. This significant growth in HFCs emission is mainly due to the increase in emission from refrigeration and air conditioning equipment. Shares of HFCs, PFCs and SF_6 in total 2014 GHG emissions was respectively as follows: 2.26%, 0.004% and 0.014%. NF_3 emissions did not occur.

The total emissions in 2014 according to groups of industrial gases are as follows: HFCs – 8.59 million tonnes of CO_2 equivalents, PFCs – 0.01 million tonnes of CO_2 equivalents and SF_6 – million tonnes of CO_2 equivalents.

Comparison of GHG emissions to the base year

Percentage share of individual GHGs to national total in the base year (1988/1995) is presented in figure 2.6. Compared to the base year, the percentage share of CO_2 (excluding category 4) in 2014 decreased slightly from 81.71% to 81.65%.

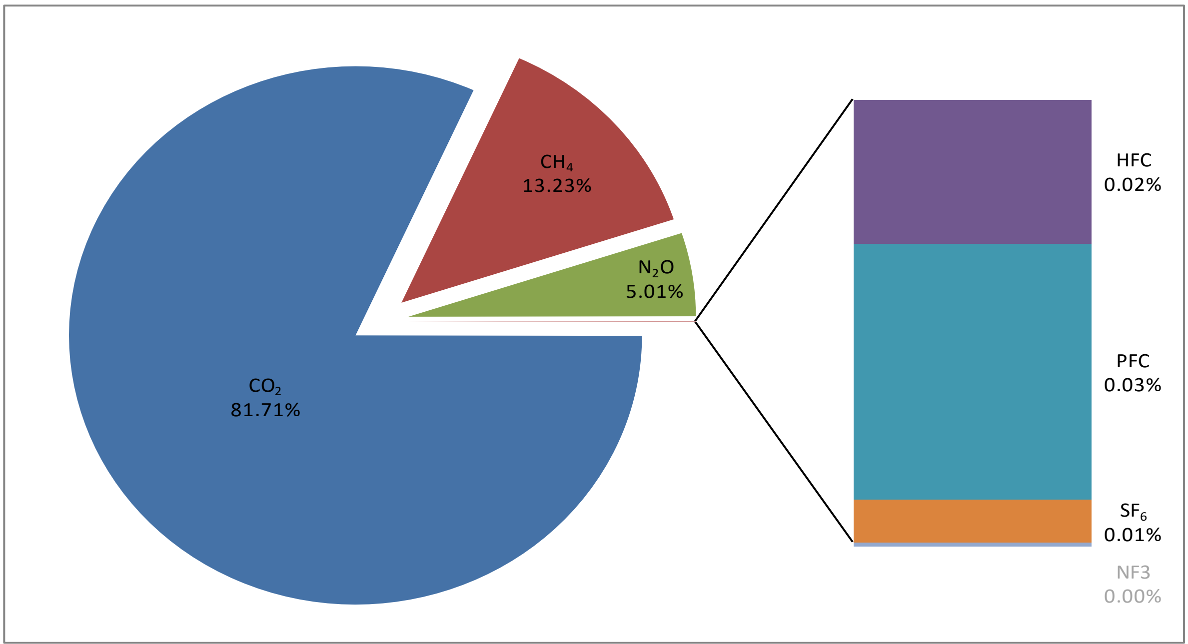

Figure 2.6. Percentage share of national greenhouse gas emissions in base year excluding emission from category 4

Table 2.7. Greenhouse gas emissions in 2014 with respect to base year (1988 and 1995 for F-gases)

Pollutant	Emission in CO_2 eq. [kt]		(2014-base)/base [%]
	Base year	2014	
CO_2 (with LULUCF)	457 906.75	277 703.81	-39.35
CO_2 (without LULUCF)	473 954.84	310 307.30	-34.53
CH_4 (with LULUCF)	76 778.53	41 365.49	-46.12
CH_4 (without LULUCF)	76 734.40	41 330.22	-46.14
N_2O (with LULUCF)	29 043.68	19 811.27	-31.79
N_2O (without LULUCF)	29 032.34	19 746.42	-31.98
HFCs	97.34	8 586.93	8 721.26
PFCs	171.97	13.90	-91.92
Unspecified mix of HFCs and PFCs	NA,NO	NA,NO	NA
SF_6	29.12	52.79	81.26
NF_3	NA,NO	NA,NO	NA,NO
TOTAL net emission (with LULUCF)	564 027.39	347 534.19	-38.38
TOTAL without LULUCF	580 020.01	380 037.57	-34.48

Comparison of GHG emissions in 2014 and the base year given in table 2.7 indicates significant drop in all gases, except HFCs and SF_6, especially in methane emissions where decrease reached 46% in 1988-2014. This was mainly caused by serious drop in coal mining as well as significant drop in livestock population.

Carbon dioxide

CO_2 emission (excluding category 4) decreased by app. 34.5% from the base year (1988) to 2014. The following changes took place in the structure of fuel use:

- share of solid fuels decreased from 80.1% in the base year to 55.8% in 2014,
- share of liquid fuels increased from 11.7% in the base year to 22.2% in 2014,
- share of gaseous fuels increased from 6.2% in the base year to 12.4% in 2014.

Methane

CH_4 emission (excluding category 4) decreased by app. 46.1% from the base year (1988) to 2014. The reasons for that are as follows:

- the decrease in emission from *Enteric Fermentation* by 44.0%,
- the decrease in *Fugitive Emission* by 56.8%,
- the decrease in emission from *Waste* by 32.0%.

Nitrous oxide

The nitrous oxide emissions (excluding category 4) in 2014 were app. 32.0% lower than the respective figure for the base year (1988) what was caused mostly by diminishing agricultural production. At the same time the share of *Manure Management* decreased from 11.0% in the base year 1988 to 10.7% in 2014, share of *Agricultural Soils* increased from 60.4% in the base year 1988 to 68.2% in 2014 and *Chemical Industry* decreased from 16.5% in the base year 1988 to 3.7% in 2014.

Industrial gases: HFCs, PFCs, NF_3 and SF_6

HFCs emissions in 2014 were 88.2 times higher than in base year (1995). This significant growth in HFCs emission is mainly due to the increase in emission from refrigeration and air conditioning equipment. PFCs emissions in 2014 were 92% lower than in base year (1995). The PFCs emission changes between 2014 and the preceding years depend on the aluminium production levels (main PFC source) and the use of C_4F_{10} in fire extinguishers.

SF_6 emissions in 2014 were about 81% higher than in base year (1995). Leakage from electrical equipment during its use and production is the main SF_6 emission. Large percentage increase of industrial gases emissions, compared to the base year (1995), does not influence significantly the national total GHG emission trend, because all the fluorinated industrial gases together contributed merely app. 34.5% to the national total in 2014. NF_3 emissions did not occur.

2.3. Description and interpretation of emission trends by category

Table 2.8 includes emissions of greenhouse gases from all categories for the base year and for year 2014 by main categories. In 2014 total GHG emissions accounted for 380.04 million tonnes CO_2 eq. excluding sector 4. LULUCF. Comparing to the base year emissions in 2014 decreased by 34.5%.

Table 2.8. GHG emissions by main sector in base year and 2014

	Total [kt eq. CO_2]		(2014-base)/base [%]
	Base year	2014	
TOTAL with LULUCF	564 027.39	347 534.19	-38.4
TOTAL without LULUCF	580 020.01	380 037.57	-34.5
1. Energy	483 409.87	308 848.16	-36.1
2. Industrial Processes and Product Use	34 113.47	30 015.11	-12.0
3. Agriculture	47 528.62	30 409.64	-36.0
4. Land-Use, Land-Use Change and Forestry	-15 992.62	-32 503.37	103.2
5. Waste	14 968.05	10 764.66	-28.1

2.3.1. Energy

The emission of GHGs from *Energy* sector in 2014 was 308.8 million tonnes of CO_2 equivalent. CO_2 emission share exceeded 93.4% of the total GHG emissions within 1. *Energy* category (table 2.9). The most emission intensive category was 1.A.1. *Fuel combustion activities* related mostly to heavy energy sector, highly energy consuming.

Table 2.9. GHG emissions from sub-sectors in category 1. *Energy* in 2014

GHG emission categories	GHG emission [kt CO_2 eq.]	% share in the total emission from sector 1. *Energy*	% share in total GHG emission		
			CO_2	CH_4	N_2O
1. TOTAL ENERGY	308 848.16	100.0	93.4	5.8	0.8
A. Fuel Combustion	290 964.79	94.2	92.2	1.2	0.8
1. Energy Industries	160 727.42	52.0	51.8	0.0	0.2
2. Manufacturing Industries and Construction	30 025.85	9.7	9.6	0.0	0.1
3. Transport	44 293.25	14.3	14.1	0.0	0.2
4. Other Sectors	55 918.26	18.1	16.7	1.1	0.3
5. Other	0.00	0.0	0.0	0.0	0.0
B. Fugitive Emissions from Fuels	17 883.37	5.8	1.2	4.6	0.0
1. Solid Fuels	13 612.86	4.4	0.6	3.9	0.0
2. Oil and Natural Gas and other emissions from energy production	4 270.51	1.4	0.6	0.8	0.0

2.3.2. Industrial Processes and Product Use

Table 2.10 shows detailed information on emissions of CO_2, CH_4, N_2O as well as HFCs, PFCs, SF_6 in 2. *Industrial Processes and Product Use* sector in 2014. CO_2 is dominating among GHGs – it's contribution exceeds 68.1%. The main GHG emission sources in this category were: production processes of cement, nitric acid and ammonia.

Table 2.10. The emissions of CO_2, CH_4 and N_2O from *Industrial Processes and Product Use* in 2014

GHG emission categories	GHG emission [kt CO_2 eq.]	% share in the total emission from sector 2. *IPPU*	% share in total GHG emission			
			CO_2	CH_4	N_2O	HFC, PFC and SF_6
2. TOTAL INDUSTRIAL PROCESSES AND PRODUCT USE	30 015.11	100.0	68.1	0.2	2.8	28.8
A. Mineral Industry	9 936.94	33.1	33.1	0.0	0.0	0.0
B. Chemical Industry	6 440.35	21.5	18.9	0.2	2.4	0.0
C. Metal Industry	2 604.67	8.7	8.6	0.0	0.0	0.0
D. Non-energy products from fuels and solvent use	2 264.47	7.5	7.5	0.0	0.0	0.0
F. Product uses as substitutes for ODS	8600.83	28.7	0.0	0.0	0.0	28.7
G. Other product manufacture and use	167.84	0.6	0.0	0.0	0.4	0.2

2.3.3. Agriculture

The main sources of GHG in category 3. *Agriculture* were: 3.D. *Agricultural Soils,* 3.A. *Enteric Fermentation* and 3.B. *Manure Management* (table 2.11). N_2O emission share was the largest in total GHG emission from 3. *Agriculture* in 2014 and came from both – direct (mineral and organic fertilization) and indirect (volatilization, leaching and runoff from applied synthetic fertilizer and animal manure) N_2O emissions from soils.

Table 2.11. GHG emissions from *Agriculture* in 2014

GHG emission categories	GHG emission [kt CO_2 eq.]	% share in the total emission from sector 3. *Agriculture*	% share in total GHG emission	
			CH_4	N_2O
3. TOTAL AGRICULTURE	30 409.64	100.0	45.8	51.2
A. Enteric Fermentation	12 294.52	40.4	40.4	0.0
B. Manure Management	3 709.95	12.2	5.3	6.9
D. Agricultural Soils	13 461.46	44.3	0.0	44.3
F. Field Burning of Agricultural Residues	38.30	0.1	0.1	0.0
G. Liming	467.55	1.5	0.0	0.0
H. Urea application	437.86	1.4	0.0	0.0

2.3.4. Waste

As it can be seen in table 2.12, the emission of CH_4 dominated in this sector in 2014 (with 86.9% share). The main part of GHG emissions came from 6.A. *Solid waste disposal*.

Table 2.12. GHG emissions from *Waste* in 2014

GHG emission categories	GHG emission [kt CO_2 eq.]	% share in the total emission from sector 5. *Waste*	% share in total GHG emission		
			CO_2	CH_4	N_2O
5. TOTAL WASTE	10 764.66	100	4.9	86.9	8.2
A. Solid Waste Disposal	8 557.95	79.5	0.0	79.5	0.0
B. Biological Treatment of Solid Waste	221.74	2.1	0.0	1.2	0.9
C. Incineration and Open Burning of Waste	579.97	5.4	4.9	0.0	0.5
D. Wastewater Treatment and Discharge	1 405.00	13.1	0.0	6.2	6.9

2.3.5. Emission from sources included in EU ETS system

The emissions from sources included in EU ETS (electricity and heat production, heavy industry) are reported directly by installations by the end of March every year. The sum of all the reported emissions by installations in Poland constitutes the emission of the Polish part of EU ETS. Those reports show the emission of CO_2 mainly (a small part of N_2O emission is also included). Total emission in this sector from stationary installations amounted to 205.7 Mt of CO_2 eq. in 2013 and to 197.1 Mt of CO_2 eq. in 2014 (table 2.13).

Poland (nor any other EU member state) does not have any specific reduction target for 2013-2020 imposed on emissions coming from sources included in EU ETS, as such a limit has only been imposed on the whole EU ETS on the EU level (cap). The installations directly are responsible for their emissions within the overall limit.

2.3.6. Emission from non-ETS (ESD) sources

The emissions from other sources than those included in EU ETS (including other GHG from EU ETS sources) constitute the non-ETS emissions. They amounted to 187,2 Mt of CO_2 eq. in 2013 and 182,7 Mt of CO_2 eq. in 2014.

Poland will fulfil its obligations jointly with other EU member states. Considering what was said above about EU ETS, this joint fulfilment has been operationalized by effort sharing decisions (ESD) adopted on the EU level, according to which Poland and other member states have specific emission targets imposed only on the non-ETS emissions. This has been regulated by *Decision No 406/2009/EC of the European Parliament and of the Council on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020* (ESD decision). Pursuant to the ESD decision, the European Commission adopted yearly emission limits for the EU member states in its decision 2013/162/EU of 26 March 2013 (Annex II). The limits have been corrected in the Commission implementing decision 2013/634/EU of 31 October 2013 (Annex II).

The emissions in ESD sector have been compared to ESD limits for 2013-2014 in the table below. The table shows that Poland overachieved in 2013 and 2014 its non-ETS emission targets by 6 and almost 12 Mt of CO_2 eq. respectively. The non-ETS emission has been calculated by deducting both: the emissions reported by installations (total EU ETS) and CO_2 from domestic aviation from the total GHG emission excluding LULUCF sector.

Table 2.13. Non-ETS (ESD) sector emission estimation for 2013-2014

Emission/emission limit [kt CO_2 eq.]	**2013**	**2014**
1. Total emission (excluding category 4. LULUCF)	393 091.872	380 037.566
2. EU ETS	205 736.590	197 129.387
3. CO_2 from domestic aviation (1.A.3.a)	113.562	136.568
4. Non-ETS (ESD) (1-2-3)	**187 241.720**	**182 771.611**
5. ESD limit	193 642.822	194 885.546
6. Overachievement (5-4)	6 401.102	12 113.935

2.4. Emission trends for SO_2 and indirect greenhouse gases

Emissions of all GHG precursors and SO_2 have significantly diminished since 1990.

CO emissions

From 1990 to 2014 the emissions of CO have decreased by over 8%. Compared to the year 2013, in 2014 emission of CO decreased by 6% which was a result of lower use of coal and wood in households (SNAP 0202).

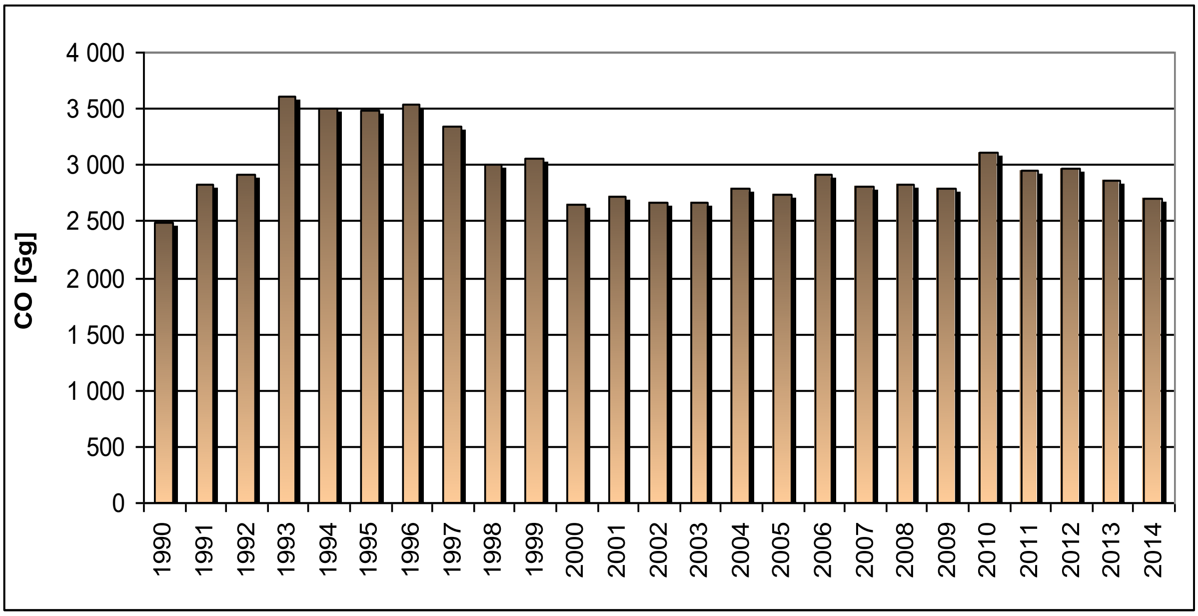

Figure 2.7. Emissions trend of CO

SO_2 emissions

Emissions of SO_2 decreased by over 70% between 1990 and 2014. Most of the reductions were caused by the decline of the heavy industry activities in the late 1980s and early 1990s. In late 1990s the emissions decreased because of the diminished share of coal (hard and brown) among fuels used for power and heat generation.

The trend of sulphur dioxide emissions is influenced mainly by the combustion processes in the sectors SNAP 01÷03. It should be noted that during the mentioned period more and more power plants are equipped with desulphurization installations.

In 2014 emissions of sulphur dioxide decreased by 6.3% compared to the respective figure for the year 2013. The most significant decreases were in combustion processes in the Power *Plants* and in industries, as a result of lower coal use.

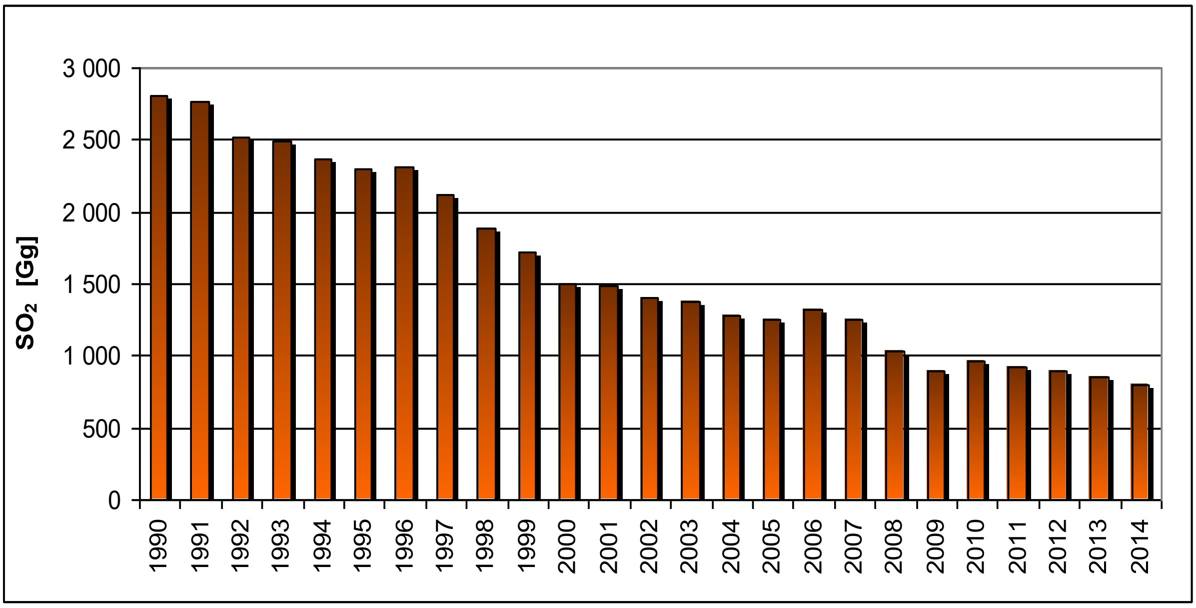

Figure 2.8. Emissions trend of SO_2

NO_x emissions

Emissions of NO_X decreased by over 32% between 1990 and 2014. Similarly to sulphur dioxide, most of the reductions were caused by the decline of the heavy industry activities and lower share of coal in the late 1980s and early 1990s. Substantial emissions from road traffic contribute to the national total and cause comparatively lower emission reductions than in case of SO_2.

Compared to the year 2013, in 2014 NO_2 emissions decreased by 6.5%. Decrease in emissions in *Road transport* was caused by lower use of liquid fuels.

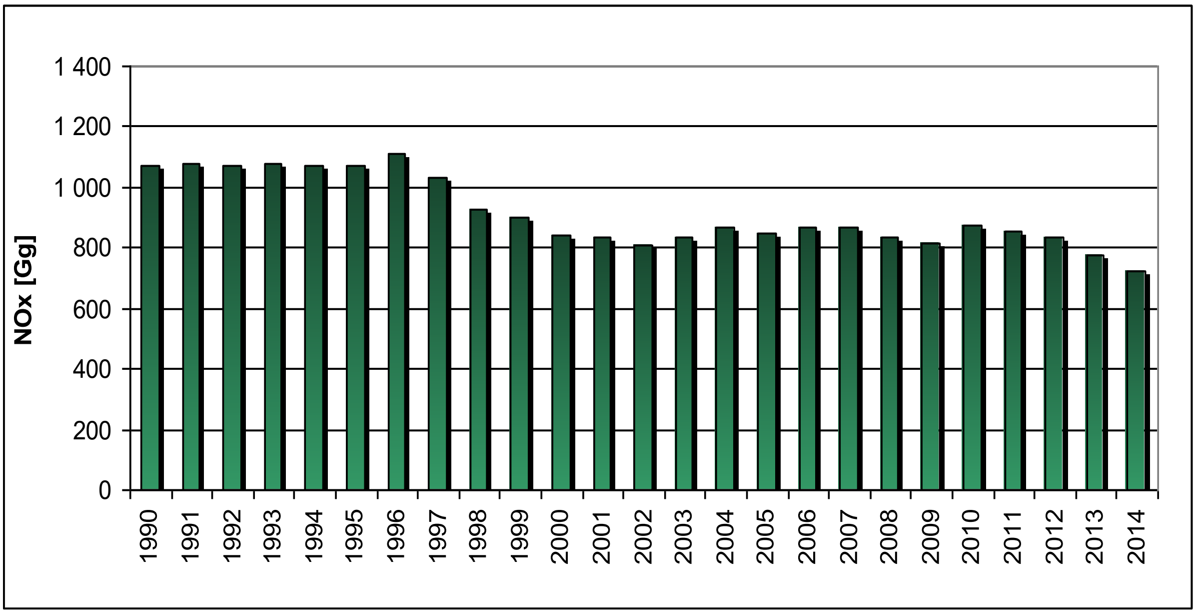

Figure 2.9. Emissions trend of NO_x

NMVOC emissions

Emissions of NMVOC decreased by over 11% between 1990 and 2014. According to calculations, the national total emission of NMVOCs in Poland in 2014 was 606 Gg. The assessed amount is lower by 1% compared to the respective figure for the year 2013. The biggest share in the decrease of the national total emission was due to lower volume of coal and wood used in households.

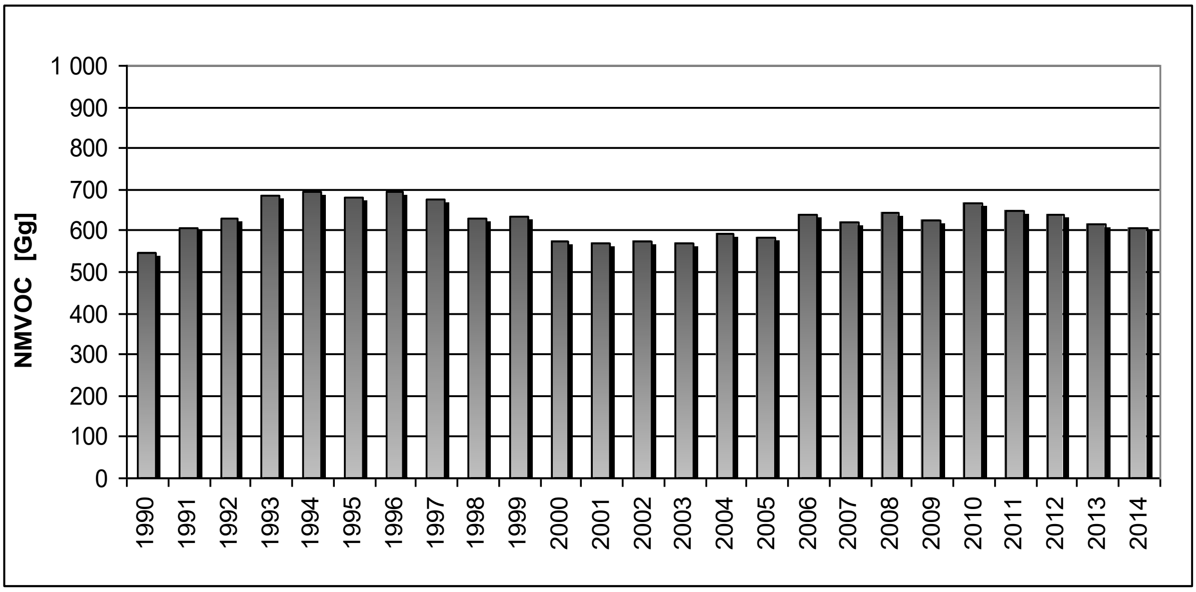

Figure 2.10. Emissions of NMVOC

2.5. Description and interpretation of emission trends for KP-LULUCF inventory in aggregate, by activity and by gas

The emissions and removals balance of greenhouse gases for the period 2008-2014, to related activities of land use, land use change and forestry (LULUCF) under Article 3.3 and 3.4 of the Kyoto Protocol is presented in Table 2.14. For activities related to afforestation/reforestation and forest management estimated balance is negative, what means the activity is considered as a net CO_2 sink.

Table 2.14. The emissions and removals balance of greenhouse gases for the period 2008-2013 for selected activities of land use, land use change and forestry (LULUCF) [Mt CO_2 eq.]

Activity	2008	2009	2010	2011	2012	2013	2014
4.KP. A.1. Afforestation/Reforestation	-2.36	-2.45	-2.58	-2.66	-2.76	-2.82	-2.86
4.KP. A.2. Deforestation	0.23	0.26	0.26	0.26	0.27	0.25	0.26
4.KP. B.1. Forest Management	-41.55	-37.36	-35.75	-42.19	-41.65	-43.60	-36.14
4.KP. B.2 Cropland management	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
4.KP. B.3 Grazing land management	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
4.KP. B.4 Revegetation	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*

3. ENERGY (CRF SECTOR 1)

3.1. Overview of sector

Following categories from sector 1 have been identified as key sources (excluding LULUCF):

IPCC Category Code	IPCC Source Categories	Greenhouse Gas	Level Assessment	Trend Assessment
1.A.1	Energy Industries	CO_2	+	+
1.A.2	Manufacturing Industries and Construction	CO_2	+	+
1.A.2.a	Iron and Steel Production	no classification	+	+
1.A.3.b	Road Transportation	Fossil fuels	+	+
1.A.3.c	Railways	Fossil fuels		+
1.A.4	Other Sectors	CO_2	+	+
1.B.1	Solid Fuels	CH_4	+	+
1.B.1	Solid Fuels	CO_2	+	
1.B.2	Other emissions from energy production	CO_2		+
1.B.2.c	Venting and Flaring	CH_4		+

Share of these categories in total Poland's GHG emissions is ca. 80.10%.

Figure 3.3.1 shows emission trend in *Energy* sector while figure 3.1.2 shows emission trend according to subcategories 1.A. *Fuel combustion* and 1.B. *Fugitive emission*. Emission from subcategory 1.A. *Fuel combustion* is the largest contributor to emissions from sector 1. *Energy* – in 2014 about 94%.

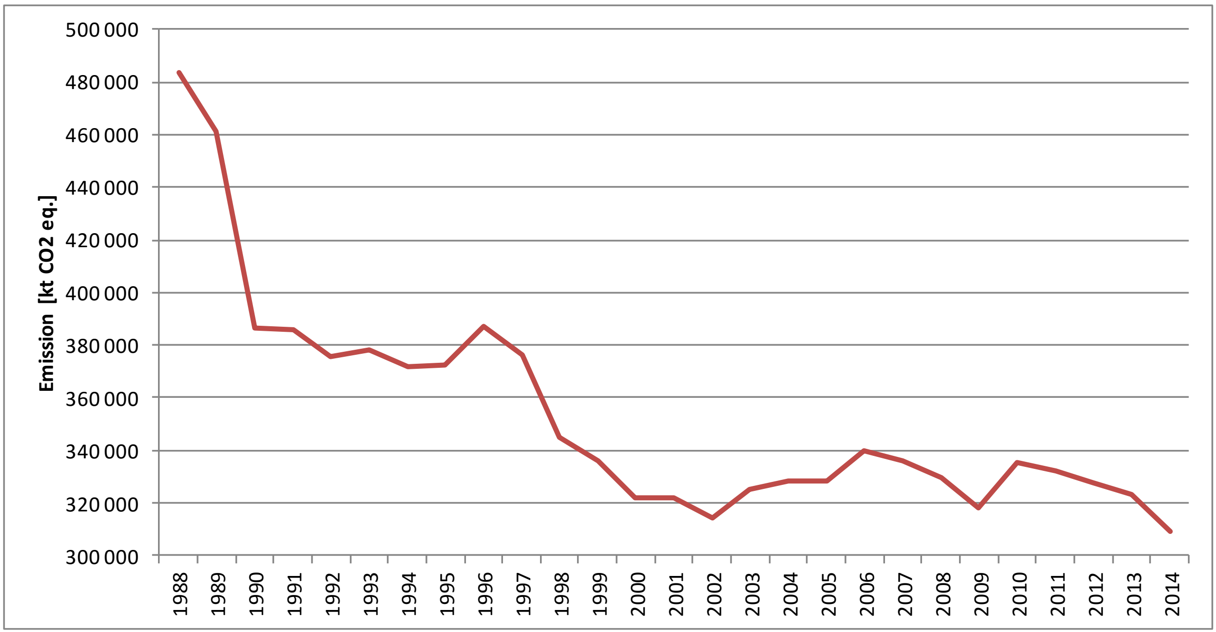

Figure 3.1.1. GHG emission trend in period 1988 – 2014 in sector *Energy*

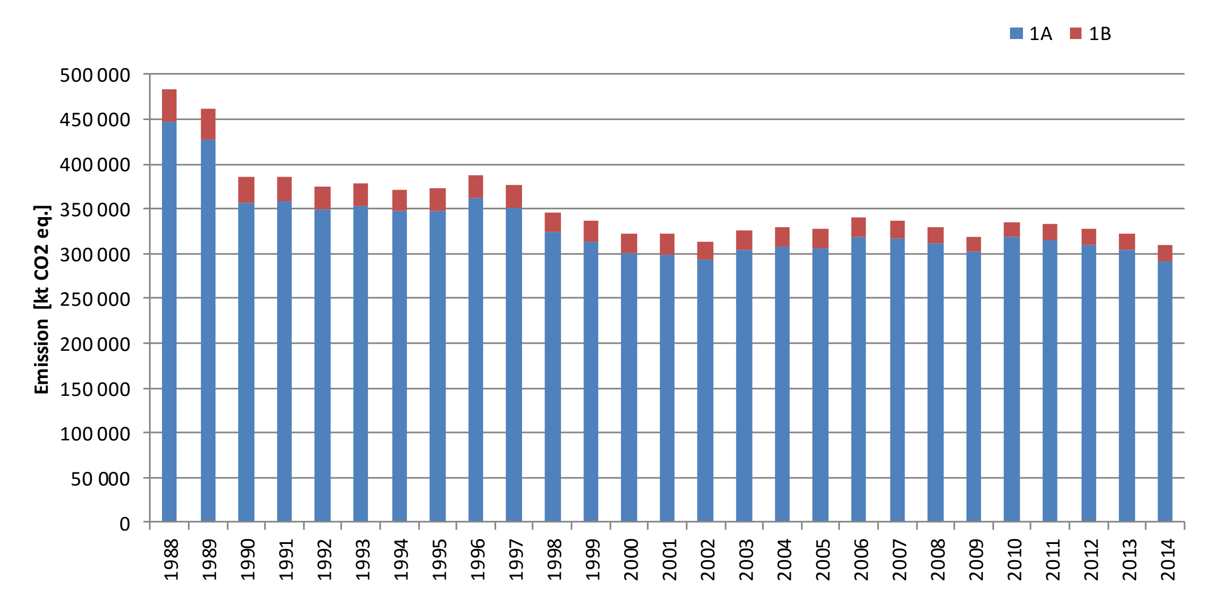

Figure 3.1.2. GHG emission trend in period 1988 - 2014 in subsectors 1.A and 1.B

3.1.1 Fuel combustion (CRF sector 1.A)

Combustion as a source of GHG emission occurs in the following category groups:
1.A.1. *Energy industries*
1.A.2. *Manufacturing industries and construction*
1.A.3. *Transport*
1.A.4. *Other sectors*:
- a. *Commercial/Institutional*
- b. *Residential*
- c. *Agriculture/Forestry/Fishing*

Share of that sector in total GHG emission in 2014 is over 76%. Subsector 1.A.1. *Energy Industries* is by far the largest contributor to emissions from fuel combustion (see figure 3.1.3).

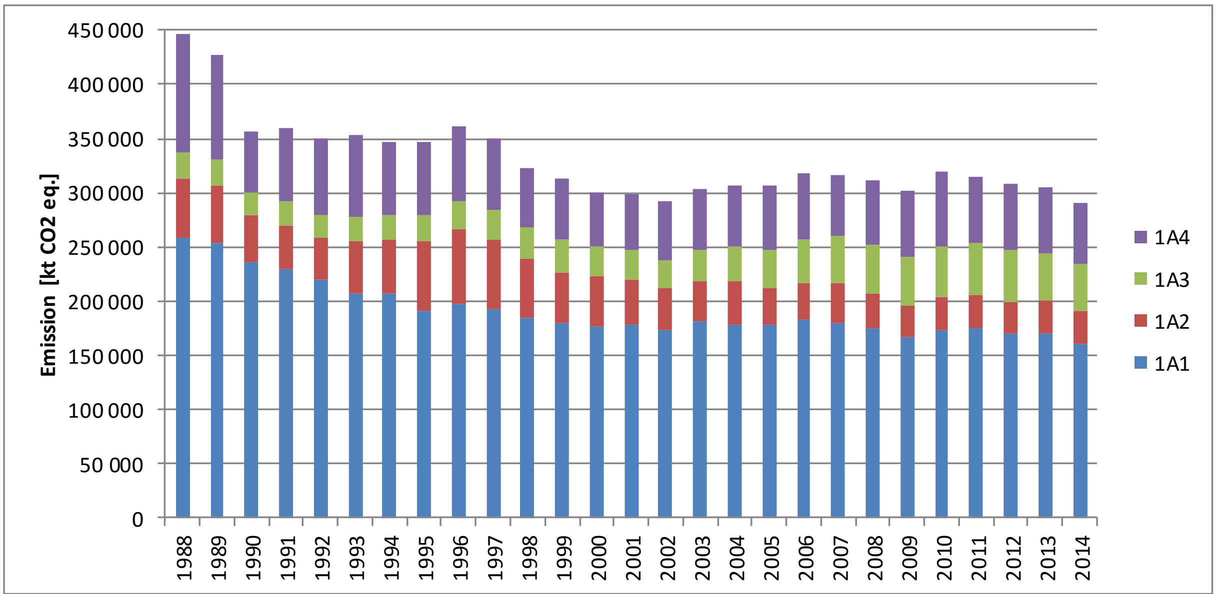

Figure 3.1.3. GHG emissions from fuel combustion in 1988-2014 according to subcategories

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

a) 1.A.1.a *Public Electricity and Heat Production*
- public thermal power plants
- autoproducing thermal power plants (CHP)
- heat plants

b) 1.A.1.b *Petroleum Refining*

c) 1.A.1.c *Manufacture of Solid Fuels and Other Energy Industries*
- *manufacture of solid fuels* (coke-oven plants, gas-works plants, mines, patent fuel/briquetting plants)
- *oil and gas extraction*
- *other energy industries* (own use in Electricity, CHP and heat plants)

Emissions in 1.A.2 *Manufacturing Industries and Construction* category are estimated for each fuel in detailed sub-categories as follows:

a) *Iron and Steel* - 1.A.2.a
b) *Non-Ferrous Metals* - 1.A.2.b
c) *Chemicals* - 1.A.2.c
d) *Pulp, Paper and Print* - 1.A.2.d
e) *Food Processing, Beverages and Tobacco* - 1.A.2.e
f) *Non-metallic minerals* - 1.A.2.f
g) *Other* - 1.A.2.g:
- *Manufacturing of machinery*
- *Manufacturing of transport equipment*
- *Mining (excluding fuels) and quarrying*
- *Wood and wood products*
- *Construction*
- *Textile and leather*
- *Off-road vehicles and other machinery*
- *Other* - other industry branches not included elsewhere

Estimation of emissions in 1.A.3 *Transport* are carried out for each fuel in sub-categories listed below:

a) *Civil Aviation* (1.A.3.a)
b) *Road Transportation* (1.A.3.b)
c) *Railways* (1.A.3.c)
d) *Navigation* (1.A.3.d)
e) *Other Transportation* (1.A.3.e)

Emissions in 1.A.4 *Other Sectors* are estimated for each fuel in detailed sub-categories given below:

a) *Commercial/Institutional* (1.A.4.a)
b) *Residential* (1.A.4.b)
c) *Agriculture/Forestry/Fishing* (1.A.4.c)
- agriculture – stationary sources,
- agriculture – mobile sources: off-road vehicles and other machinery
- fishing.

The amount of CO_2 emissions from fuel combustion in stationary sources were estimated on the level determined as IPCC *Tier 2 or Tier 1 depending on EF type (country specific or default).* In this case the calculation was 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

The amount of combusted fuel was accepted according to data included in the energy balance submitted by GUS to Eurostat [EUROSTAT].

List of combusted fuels for which GHG emissions were estimated based upon selected or calculated emission factors is as follows:

- liquid fuels: fuel oil, diesel oil, liquid petroleum gas (LPG), crude oil, motor gasoline, jet kerosene, refinery gas, feedstocks, other petroleum products and petroleum coke
- gaseous fuels: natural gas
- solid fuels: hard coal, lignite, coke, hard coal briquettes, lignite briquettes, coke oven gas, blast furnace gas, gas works gas,
- other fuels: industrial wastes, municipal waste (non-biogenic fraction)
- biomass: fuel wood and wood waste, biogas, municipal waste – biogenic fraction.

The emission factors for CO_2 emission estimation for fuel combustion in stationary sources are the following:

- country specific emission factors for hard coal and lignite;

  the EFs are based on empirical functions, that link the amount of carbon in fuel with the corresponding net calorific value, the empirical functions are the following:
  - for hard coal:

$$C_{hc} = 10(2.4898 * NCV + 3.3132)/NCV$$

  where:
  C_{hc} - emission factor/carbon content for hard coal [kg C/GJ],

  NCV - net calorific value of hard coal [MJ/kg] in the given sub-category calculated based upon hard coal combusted expressed in both physical and energy units,

  - for lignite:

$$C_{bc} = 10(1.9272 * NCV + 9.3856)/NCV$$

  where:
  C_{bc} - emission factor for lignite [kg C/GJ],

  NCV - net calorific value of lignite [MJ/kg] in the given sub-category calculated based upon lignite combusted expressed in both physical and energy units

- default emission factors [IPCC 2006] for all other fuels i.e.: natural gas, coke, hard coal briquettes, lignite briquettes, coke oven gas, blast furnace gas, fuel oil, diesel oil, LPG, crude oil, motor gasoline, jet kerosene, refinery gas, feedstocks, other petroleum products, petroleum coke, biomass (fuel wood and wood waste, biogas), waste (industrial and municipal waste) and gas works gas.

For coal and lignite, where the CS EFs were used, the oxidation factor was assumed as 0.980. In other cases oxidation factor assumed to be 1, because it is included in default emission factor value in accordance with 2006 IPCC GLs.

Emissions of CH_4 and N_2O from fuel combustion in stationary sources are based on fuel quantities submitted by GUS to Eurostat (Eurostat database) and the corresponding emission factors [IPCC 2006].

Trend of fuel use and methodology over the years 1988-2014

Estimation of CO_2 emission from fuel combustion in stationary sources for the years 1988-2013 is based on methodology corresponding to methodology applied for 2014 (that methodology is presented above). For the years: 1990-2013 fuel consumptions from the Eurostat database were applied. The Eurostat database does not cover fuel use data for Poland for the years before 1990. Therefore, fuel use data for the period: 1988-1989 were taken from IEA database [IEA]. Amounts of particular fuel consumptions in individual subsectors: 1.A.1, 1.A.2 and 1.A.4 were presented in the tables 1-13 (Annex 2). CO_2 emission factors from fuel combustion in stationary sources for hard coal and lignite are the country specific EFs. These EFs for the entire time series are based on the same empirical functions described above.

The values of CO_2 EFs changed over the years following the changes of the respective net calorific values for hard coal and lignite (Annex 2 -table 14-26). GHG emission factors for other fuels are the IPCC default EFs [IPCC 2006]. Values of applied emission factors were tabulated in annex 2 (emission factors of CO_2, CH_4 and N_2O for particular fuel are presented in tables 27-29 of this annex).

The time series of fuel use and GHG emissions for the main subsectors of 1.A *Fuel combustion* are presented below (in the following chapters). Detailed data on particular fuel consumption in the main subcategories of 1.A IPCC category for entire period 1988-2014 and GHG EFs for individual fuels are presented in Annex 2 .

3.1.2. Fugitive emissions (CRF sector 1.B)

The GHG emission sources in fugitive emissions sector cover: fugitive emission from solid fuels (CO_2 and CH_4) and fugitive emission from oil and gas (CO_2, CH_4 and N_2O).

Total emission of GHGs as carbon dioxide equivalent in 1.B. subcategory amounted to 17 873 kt in 2014 and decreased since 1988 by 51%. Table 3.1. shows emissions from 1.B.1 and 1.B.2 subcategories in period 1988-2014.

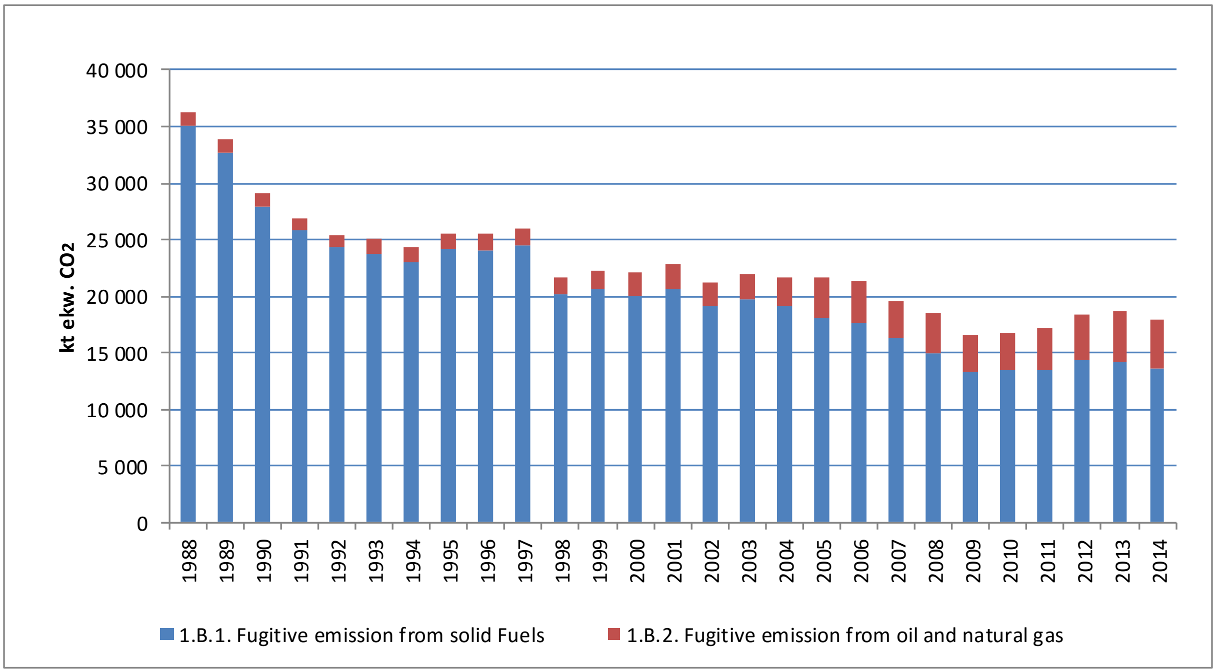

Figure 3.1. GHG emissions from 1.B.1 and 1.B.2 subcategories in 1988-2014.

3.2. Fuel combustion (CRF 1.A)

3.2.1. Comparison of the sectoral approach with the reference approach

The Reference Approach is a top-down approach, using a country's energy supply data to calculate the emissions of CO_2 from combustion of mainly fossil fuels. Comparability between the sectoral and reference approaches continues to allow a country to produce a second independent estimate of CO_2 emissions from fuel combustion. It allow to compare the results of these two independent estimates and indicate possible problems with the activity data, net calorific values, carbon content, carbon stored calculation, etc.

The Reference Approach is designed to calculate the emissions of CO_2 from fuel combustion, starting from high level energy supply data. The Reference Approach does not distinguish between different source categories within the energy sector and only estimates total CO_2 emissions from source category 1.A. *Fuel Combustion*. The IPCC Reference Approach is based on determining carbon dioxide emissions from domestic consumption of fuels and its secondary products.

CO_2 emissions from fuel combustion were estimated based on recommended IPCC methodology [IPCC 2006, equation 6.1]:

$$CO_{2\,Emissions} = \sum_i \left[\left((AP_i \times CF_i \times CC_i)10^{-3} - EC_i \right) COF_i \times 44/12 \right]$$

where:
i – fuel type
AP – apparent consumption of fuel, TJ or kt
CF – conversion factor for the fuel to energy unit, TJ/kt
CC – carbon content, t C/TJ
EC – excluded carbon, kt C
COF – carbon oxidation factor
44/12 - mass ratio of CO_2/C

CO_2 emissions were estimated based on adjusted fuel consumption data and default oxidation factors. National carbon emission factors were assumed for hard coal and lignite (based on empirical functions described in chapter 3.2.1). For fuels used in transport (gasoline, jet kerosene, diesel oil, LPG) average emission factors were applied from subcategories of 1A. For other fuels default carbon emission factors were applied.

Apparent consumption of fuels was calculated as below:

Apparent Consumption = Production + Imports – Exports – International Bunkers – Stock Change

Data about production, imports, exports, international bunkers and stock change are based on Eurostat database. For calculations only data in energy unit (TJ) were used, therefore conversion factors for all fuels is equal 1 TJ/kt (CRF table 1.A(b)).

Total apparent consumption was corrected by subtracting the amount of carbon (excluded carbon) which does not lead to fuel combustion emission (carbon which is emitted in another sector of the inventory or is stored in a product manufactured from the fuel). The main sources of such carbon are those used as non-energy products and feedstocks. The quantity of carbon to be excluded is calculated according to following equation:

Excluded carbon = activity data x CC x 10^{-3}

where:
activity data – non energy use of fuel and feedstock, TJ
CC – carbon content, t C/TJ

As the use of energy products for non-energy purposes can lead to emissions Poland has calculated these emission and report them under category 2D *Non-energy products from fuels and solvent use* (chapter 4.5).

The Reference Approach and the Sectoral Approach often have different results which may be caused by:
statistical differences - is the difference between energy available for final consumption covering the energy placed at the disposal of final users and final energy consumption covering energy supplied to the final consumer's door for all energy uses (see figure 3.2.1);
distribution loses - losses due to transport or distribution of natural gas;
differences in NCVs used in reference and sectoral approaches, especially for hard and brown coal, where NCV affects emission factors;
part of emission from solid fuel use was included in sector Industrial processes (2.C.1: production of sinter, pig iron and steel).

Correlation between difference in solid fuel apparent consumption in reference and sectoral approach and statistical differences for hard coal (which is predominant fuel among solid fuels) is shown on figure below.

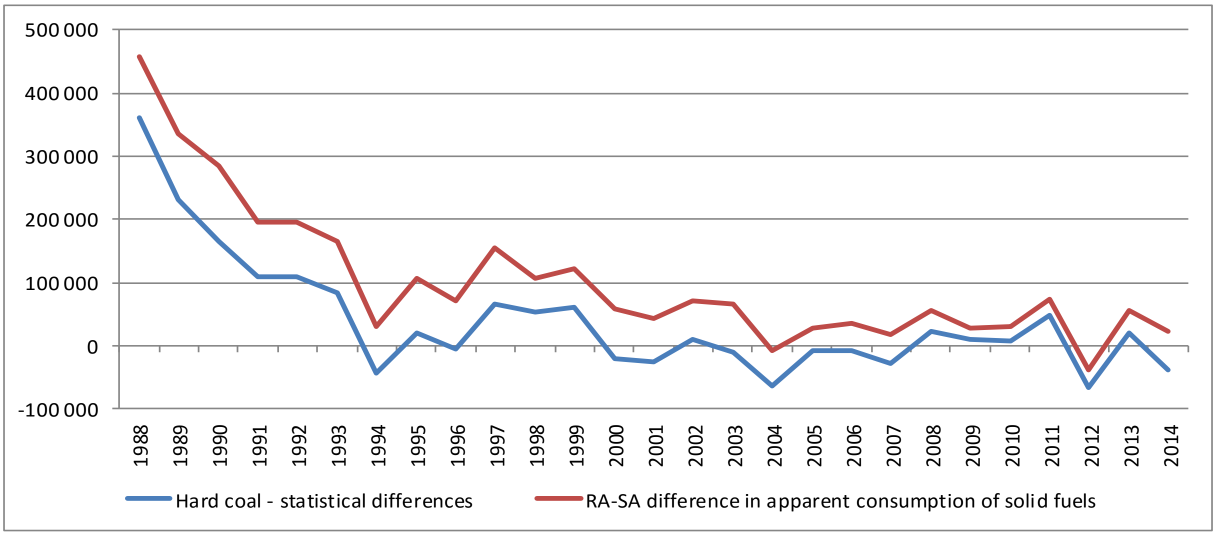

Figure 3.2.1. Correlation between statistical differences and differences between RA and SA for solid fuels [TJ] in period 1988 - 2014

In 2014 the difference between reference and sectoral approaches in CO_2 emissions is equal -1.04%. Comparison of both methods is given in table 3.2.1.

Table 3.2.1. Differences between CO_2 emissions in sectoral and reference approach

Year	Reference approach [kt]	Sectoral approach [kt]	Difference [%]
2014	281 914	284 864	-1.04
2013	299 444	297 880	0.53
2012	294 766	302 366	-2.51
2011	310 465	308 663	0.58
2010	310 543	311 905	-0.44
2009	292 513	295 420	-0.98
2008	305 354	305 041	0.10
2007	305 569	310 588	-1.62
2006	310 832	312 056	-0.39
2005	300 343	300 797	-0.15
2004	298 353	301 175	-0.94
2003	302 068	297 671	1.48
2002	293 217	287 270	2.07
2001	296 217	293 756	0.84
2000	293 970	294 756	-0.27
1999	313 131	307 862	1.71
1998	321 019	317 266	1.18
1997	349 508	343 594	1.72
1996	354 943	354 641	0.08
1995	341 235	340 045	0.35
1994	332 141	340 507	-2.46
1993	354 978	345 677	2.69
1992	356 756	344 163	3.66
1991	366 984	353 136	3.92
1990	370 442	351 940	5.26
1989	438 324	419 861	4.40
1988	470 800	439 016	7.24

3.2.2. International bunker fuels

3.2.2.1. International aviation

This category include emissions from flights that depart in one country and arrive in a different country.

For the years 1990-2014 data related to aviation gasoline and jet kerosene are those of the Eurostat database, while for the base year and 1989 – those of the IEA database. As there was no split on international and domestic jet kerosene use in those statistics, the amounts of domestic fuels use in years 2005 – 2014 were calculated based on Eurocontrol data on fuel share of jet kerosene used for international aviation in Poland. Due to the lack of Eurocontrol data for the years before 2005, the share for years 1988-2004 was assumed as a 5-years average from Eurocontrol data for years 2005-2009.

For the estimation of GHG emissions from aviation bunker fuels, the same IPCC 2006 default emission factors for jet fuel were assumed as those used for emission estimation for domestic aviation: for CO_2 – 71.50 kg/GJ, for CH_4 - 0.0005 kg/GJ and for N_2O - 0.002 kg/GJ.

The fuel use data and the corresponding emission estimates of CO_2, CH_4 and N_2O for international aviation bunker for the 1988-2014 period are presented in table 3.2.2.

Table 3.2.2. Fuel consumption and GHG emissions in international aviation in 1988-2014

		1988	1989	1990	1991	1992	1993	1994	1995	1996
Jet Kerosene	PJ	14.10	19.39	8.68	8.97	9.73	9.69	9.81	10.58	12.44
CO2 emission	kt	1007.87	1386.18	620.89	641.11	695.98	693.09	701.75	756.62	889.46
CH4 emission	kt	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01
N2O emission	kt	0.03	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.02
		1997	1998	1999	2000	2001	2002	2003	2004	2005
Jet Kerosene	PJ	11.15	11.35	10.14	10.78	10.62	10.42	11.27	11.07	12.40
CO2 emission	kt	797.05	811.49	724.86	771.06	759.51	745.07	805.72	791.28	886.92
CH4 emission	kt	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
N2O emission	kt	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
		2006	2007	2008	2009	2010	2011	2012	2013	2014
Jet Kerosene	PJ	16.70	17.46	21.15	19.11	20.00	19.48	21.05	21.12	23.68
CO2 emission	kt	1193.97	1248.74	1511.99	1366.10	1430.20	1393.06	1505.21	1509.80	1693.38
CH4 emission	kt	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
N2O emission	kt	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.05

3.2.2.2. International navigation

This category include emissions from journeys that depart in one country and arrive in a different country. Includes emissions from fuels used by vessels of all flags that engaged in international water-borne navigation. Exclude consumption by fishing vessels.

1990-2014 fuel use data for fuels classified to the international marine bunker were taken from the Eurostat database. For the years 1988-1989, the respective data were taken from the database of the International Energy Agency (IEA).

For the estimation of GHG emissions from bunker fuels, the same IPCC 2006 default emission factors were assumed as those used for maritime navigation: for CO_2 and diesel oil 74.10 kg/GJ, for fuel oil 77.40 kg/GJ. The emission factors for CH_4 and N_2O for the two fuels are: 0.007 kg/GJ and 0.002 kg/GJ, respectively. The fuel use data and the corresponding emission estimates of CO_2, CH_4 and N_2O for international marine bunker for the 1988-2014 period are presented in table 3.2.3.

Table 3.2.3. Fuel consumption and GHG emissions in international navigation in 1988-2014

		1988	1989	1990	1991	1992	1993	1994	1995	1996
Diesel oil	PJ	14.23	11.16	6.01	2.70	3.18	2.45	1.29	1.20	1.76
Fuel oil	PJ	9.00	9.37	10.48	3.76	6.76	3.16	4.24	4.60	5.08
CO2 emission	kt	1 751	1 552	1 256	491	758	426	424	445	524
CH4 emission	kt	0.163	0.144	0.115	0.045	0.070	0.039	0.039	0.041	0.048
N2O emission	kt	0.046	0.041	0.033	0.013	0.020	0.011	0.011	0.012	0.014
		1997	1998	1999	2000	2001	2002	2003	2004	2005
Diesel oil	PJ	2.53	2.87	4.42	1.89	0.94	1.85	1.97	1.67	4.98
Fuel oil	PJ	6.28	8.08	10.80	9.92	9.80	9.32	9.80	8.80	8.48
CO2 emission	kt	674	838	1 163	908	828	858	905	805	1 025
CH4 emission	kt	0.062	0.077	0.107	0.083	0.075	0.078	0.082	0.073	0.094
N2O emission	kt	0.018	0.022	0.030	0.024	0.021	0.022	0.024	0.021	0.027
		2006	2007	2008	2009	2010	2011	2012	2013	2014
Diesel oil	PJ	3.73	2.15	2.10	2.77	2.34	2.90	2.86	3.29	3.25
Fuel oil	PJ	8.56	8.16	9.32	7.60	6.68	4.24	3.20	2.60	2.92
CO2 emission	kt	939	791	877	794	690	543	459	445	467
CH4 emission	kt	0.086	0.072	0.080	0.073	0.063	0.050	0.042	0.041	0.043
N2O emission	kt	0.025	0.021	0.023	0.021	0.018	0.014	0.012	0.012	0.012

Figure 3.2.2 shows emissions of greenhouse gases from international navigation and aviation bunker in period 1988-2014.

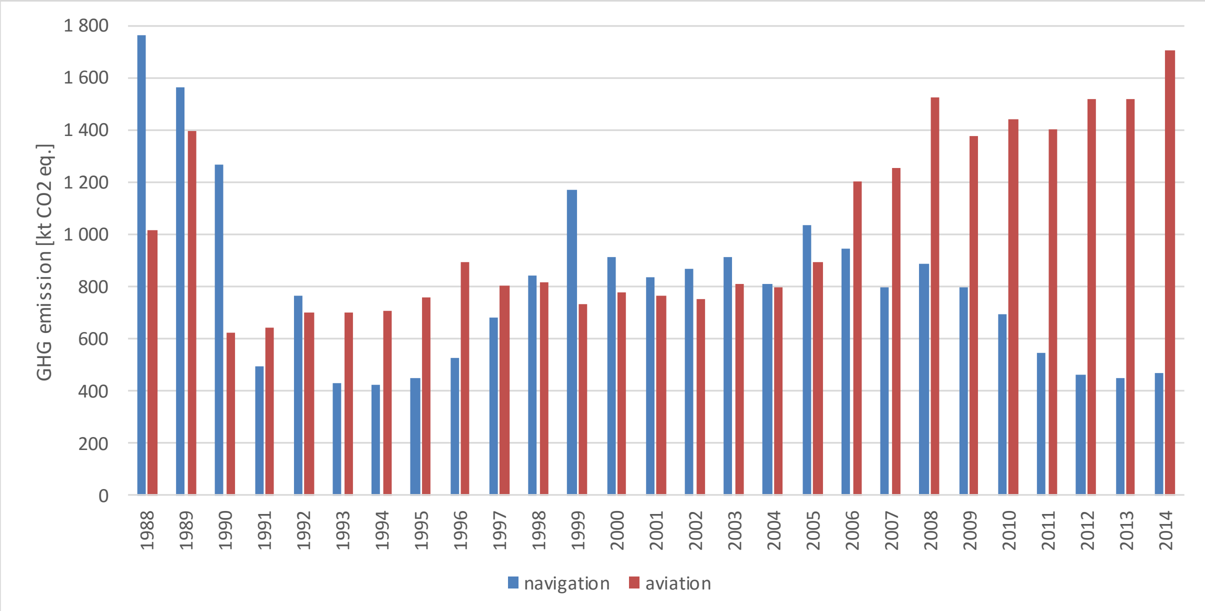

Figure 3.2.2. GHG emissions from international navigation and aviation bunker in period 1988-2014

3.2.3. Feedstocks and non-energy use of fuels

As the use of energy products for non-energy purposes can lead to emissions, Poland has calculated such emissions and report them under category 2D *Non-energy products from fuels and solvent use*. For more description see chapter 4.5.

3.2.4. CO_2 capture from flue gases and subsequent CO_2 storage

Not applicable in Poland.

3.2.5. Country-specific issues

Information on country specific fuel structure, important for national emission level and CO_2 emission factors for coal (main fuel in Polish economy), is presented in chapters 3.1.1, 3.2.6 - 3.2.9 and in annex 2.

3.2.6. Energy Industries (CRF sector 1.A.1.)

3.2.6.1. Source category description

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

a) 1.A.1.a *Public Electricity and Heat Production*
- public thermal power plants
- autoproducing thermal power plants (CHP)
- heat plants

b) 1.A.1.b *Petroleum Refining*

c) 1.A.1.c *Manufacture of Solid Fuels and Other Energy Industries*
- *manufacture of solid fuels* (coke-oven plants, gas-works plants, mines, patent fuel/briquetting plants)
- *oil and gas extraction*
- *other energy industries* (own use in Electricity, CHP and heat plants)

Subsector 1.A.1.a *Public Electricity and Heat Production* is by far the largest contributor to emissions from this category (see figure 3.2.6.1) – over 95% in 2014.

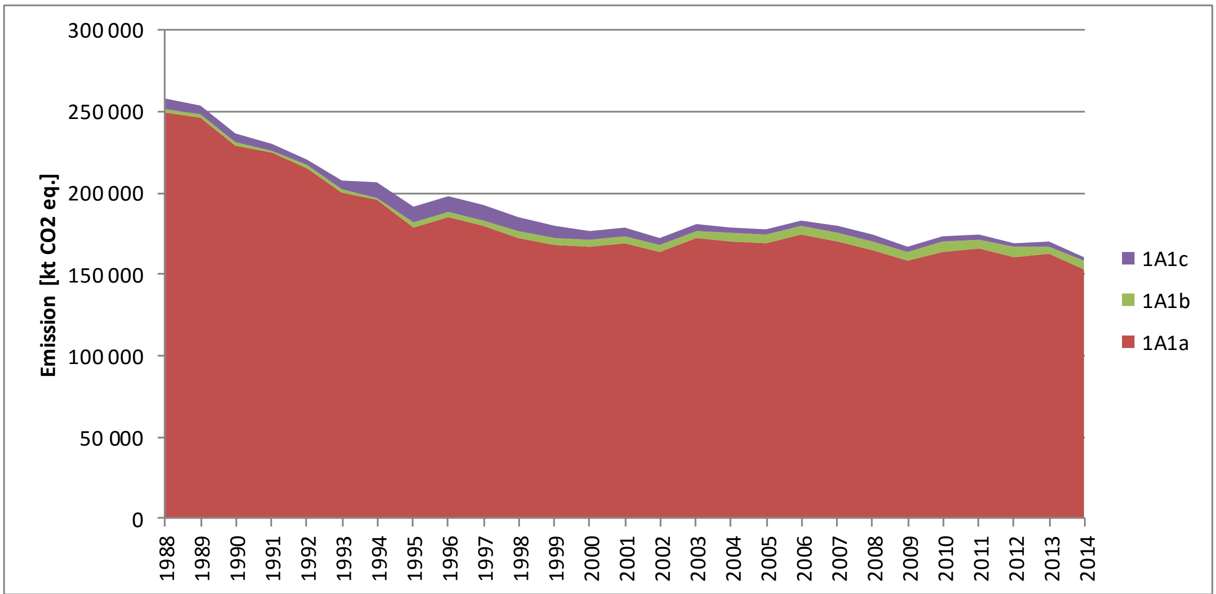

Figure 3.2.6.1. GHG emissions from *Energy Industries* in years 1988-2014 according to subcategories

3.2.6.2. Methodological issues

Methodology of emission estimation in 1.A.1 subcategory corresponds with methodology described for fuel combustion in stationary sources. Detailed information on fuel consumption and applied emission factors for subcategories mentioned below are presented in Annex 2.

3.2.6.2.1. Public electricity and heat production (CRF sector 1.A.1.a)

Table 3.2.6.1 presents the structure and amounts of fuel used in the sub-category 1.A.1.a *Public Electricity and Heat Production* for the years 1988-2014.

Table 3.2.6.1. Fuel consumption for the years 1988-2014 in 1.A.1.a subcategory [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	75.134	72.672	66.951	62.623	57.602	56.351	57.225	26.233
Gaseous Fuels	21.274	21.900	21.641	16.329	9.561	3.107	4.094	4.738
Solid Fuels	2374.674	2346.290	2197.782	2169.776	2086.989	1942.858	1890.625	1760.175
Biomass	3.741	3.873	5.265	8.914	7.354	6.658	6.876	3.878
Other Fuels	16.699	15.129	14.585	14.387	17.289	13.783	14.057	1.447
TOTAL	**2491.522**	**2459.864**	**2306.224**	**2272.029**	**2178.795**	**2022.757**	**1972.877**	**1796.471**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	28.878	29.000	19.329	18.538	15.837	16.923	15.701	14.154
Gaseous Fuels	7.156	7.949	10.768	16.210	21.627	28.242	38.700	45.496
Solid Fuels	1824.672	1776.913	1715.015	1671.753	1648.958	1665.608	1611.570	1690.270
Other Fuels	3.393	3.267	0.550	0.575	0.883	1.031	1.520	0.372
Biomass	2.793	3.381	3.877	3.747	3.904	5.449	5.424	6.642
TOTAL	**1866.892**	**1820.510**	**1749.539**	**1710.823**	**1691.209**	**1717.253**	**1672.915**	**1756.934**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	11.585	9.281	9.119	8.050	8.215	7.632	8.286	8.040
Gaseous Fuels	53.667	57.039	52.808	49.691	51.163	51.652	52.286	57.961
Solid Fuels	1664.247	1663.495	1717.390	1676.806	1613.352	1553.359	1607.106	1604.922
Other Fuels	0.407	0.483	0.427	0.440	0.593	0.682	0.809	0.861
Biomass	10.198	19.320	23.201	26.696	40.001	57.022	67.892	81.917
TOTAL	**1740.104**	**1749.618**	**1802.945**	**1761.683**	**1713.324**	**1670.347**	**1736.379**	**1753.701**
	2012	**2013**	**2014**					
Liquid Fuels	7.174	6.469	5.466					
Gaseous Fuels	61.963	53.395	52.017					
Solid Fuels	1550.077	1568.382	1470.390					
Other Fuels	0.791	0.718	0.813					
Biomass	109.804	92.581	102.737					
TOTAL	**1729.809**	**1721.545**	**1631.423**					

The data in table 3.2.6.1 shows that the use of solid fuels is dominant in 1.A.1.a – mainly hard coal and lignite. In 2014, the use of hard coal was app. 920 PJ i.e. about 56% of the entire energy of all fuels used in that sub-sector. Lignite made app. 31% of the energy, accordingly. Despite the significant share of solid fuels (app. 90%) in the total energy related fuel use in 1.A.1.a, a slow decreasing trend can be noticed since the late 1990s (from app. 98% in 1998 till 90% in 2014). At the same time in last decade increased the share of biomass as well as the share of natural gas. Detailed data concerning individual fuel consumptions in 1.A.1.a subcategory for the entire period 1988-2014 was presented in Annex 2 (tab. 1).

Figure 3.2.6.2 shows CO_2 emission changes over the period 1988-2014. A significant emission decrease took place over the years 1988-1995 followed by a period of emission stabilization.

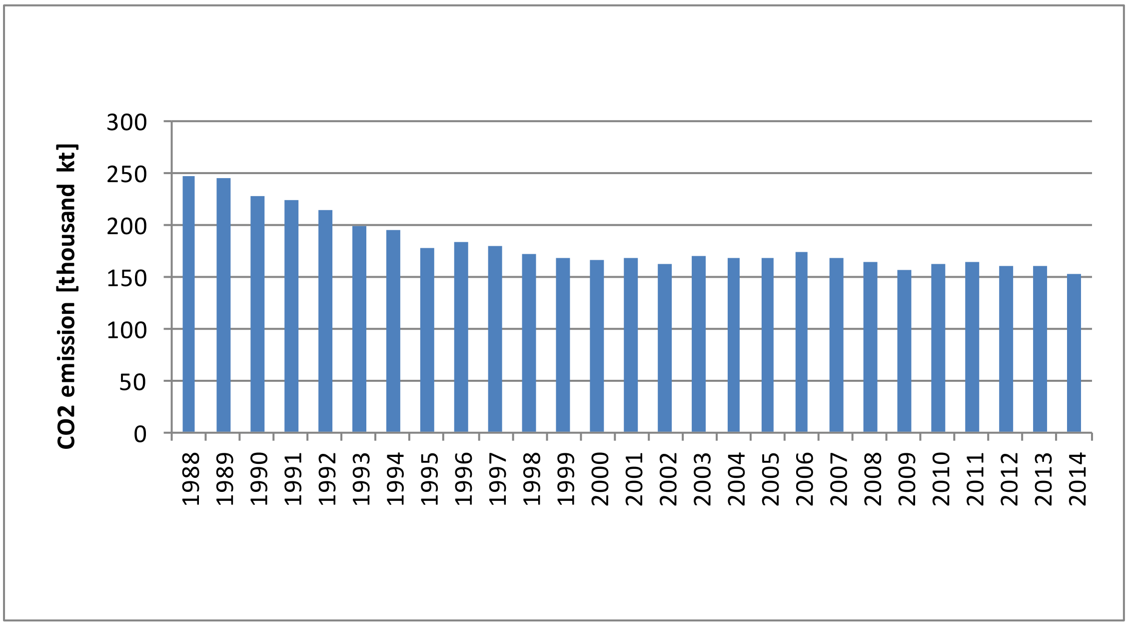

Figure 3.2.6.2. CO_2 emission for 1.A.1.a category in 1988-2014

Figure 3.2.6.3 shows emission trends for CH_4 and N_2O between the base year and 2014. Similarly to CO_2 a significant emission decrease for these gases happened in the period 1988-1995. Since 2002 is noticeable increase of CH_4 emission connected with a growth of biomass consumption. That emission increase is the result of relatively high value of CH_4 EF for solid biomass.

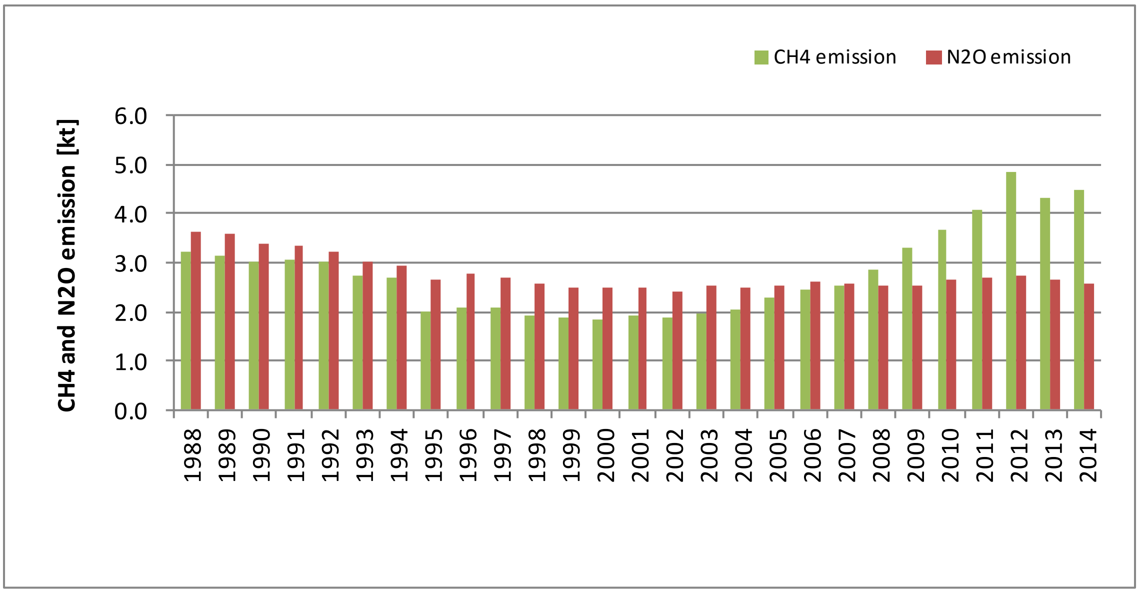

Figure 3.2.6.3. CH_4 and N_2O emissions for 1.A.1.a category in 1988-2014

3.2.6.2.2. Petroleum Refining (CRF sector 1.A.1.b)

Table 3.2.6.2 shows fuel consumption data in sub-category 1.A.1.b *Petroleum Refining* for the years 1988-2014. Detailed data on fuel consumptions in 1.A.1.b subcategory for the entire period 1988-2014 was presented in Annex 2 (table 2).

Table 3.2.6.2. Fuel consumption in 1988-2014 in 1.A.1.b subcategory [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	23.660	23.106	18.957	18.226	24.274	22.142	22.490	44.600
Gaseous Fuels	2.395	2.396	1.671	1.539	1.508	1.608	1.591	1.562
Solid Fuels	0.142	0.140	0.046	0.118	0.069	0.245	0.068	1.302
Other Fuels	7.724	7.487	5.222	0.272	0.682	0.002	0.259	1.919
Biomass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	**33.921**	**33.129**	**25.896**	**20.155**	**26.533**	**23.997**	**24.408**	**49.383**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	50.172	43.737	47.441	43.546	47.002	53.150	53.552	54.178
Gaseous Fuels	1.749	2.529	8.244	10.832	12.110	11.354	10.124	12.770
Solid Fuels	1.451	1.349	0.710	0.637	0.277	0.140	0.023	0.000
Other Fuels	0.350	0.163	0.000	0.310	0.219	0.095	0.253	0.176
Biomass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	**53.722**	**47.778**	**56.395**	**55.325**	**59.608**	**64.739**	**63.952**	**67.124**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	55.859	53.915	55.858	61.194	62.085	60.608	70.009	61.737
Gaseous Fuels	15.454	14.482	14.900	20.816	18.816	17.511	19.363	27.468
Solid Fuels	0.000	0.000	0.000	0.000	0.000	0.113	0.114	0.164
Other Fuels	0.221	0.285	0.224	0.000	0.000	0.000	0.000	0.000
Biomass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	**71.534**	**68.682**	**70.982**	**82.010**	**80.901**	**78.232**	**89.486**	**89.369**
	2012	**2013**	**2014**					
Liquid Fuels	61.108	44.315	38.269					
Gaseous Fuels	30.638	34.779	35.103					
Solid Fuels	0.113	0.176	0.181					
Other Fuels	0.000	0.000	0.000					
Biomass	0.000	0.000	0.000					
TOTAL	**91.859**	**79.270**	**73.553**					

Figure 3.2.6.4 shows CO_2 emission changes in 1988-2014 in sub-category 1.A.1.b.

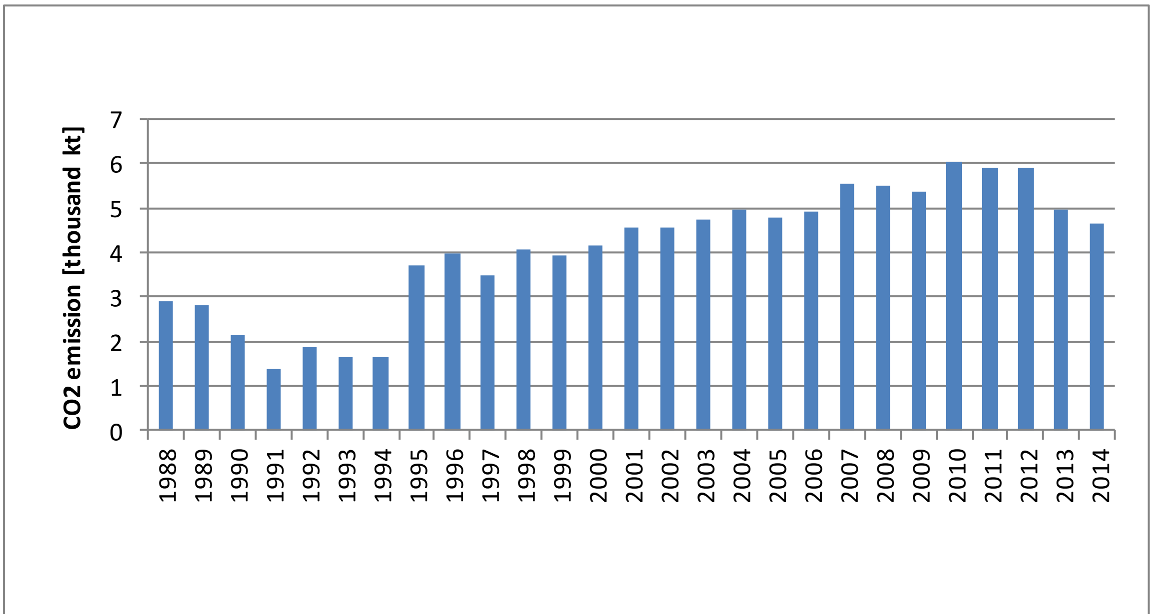

Figure 3.2.6.4. CO_2 emission for 1.A.1.b category in 1988-2014

Figure 3.2.6.5 shows the corresponding CH_4 and N_2O emission in that source sub-category between the base year and 2014.

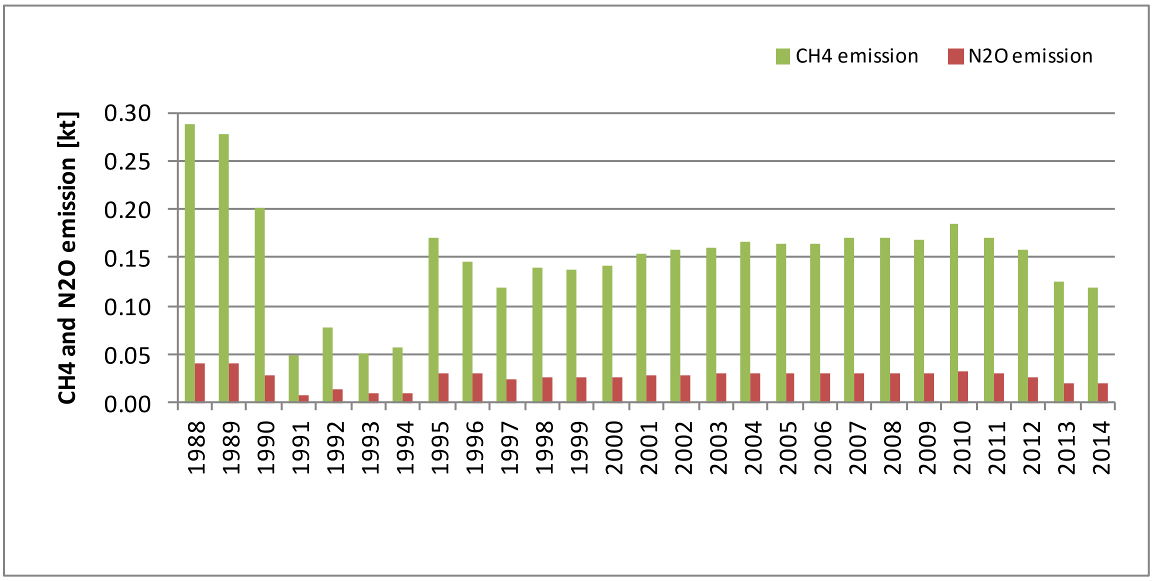

Figure 3.2.6.5. CH_4 and N_2O emissions for 1.A.1.b category in 1988-2014

3.2.6.2.3. Manufacture of Solid Fuels and Other Energy Industries (CRF sector 1.A.1.c)

Table 3.2.6.3 shows the fuel use data in the sub-category 1.A.1.c over the period: 1988-2014. Particular fuel consumptions in 1.A.1.c subcategory for the entire period 1988-2014 were tabulated in Annex 2 (table 3).

Table 3.2.6.3. Fuel consumption in 1988-2014 in 1.A.1.c subcategory [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	2.550	2.180	2.067	2.367	2.536	5.004	4.200	4.250
Gaseous Fuels	13.736	15.364	12.371	12.432	14.665	12.354	17.401	14.850
Solid Fuels	70.465	66.330	58.694	49.265	47.123	61.209	102.119	98.936
Other Fuels	0.046	0.001	0.000	0.000	0.000	0.311	0.235	0.184
Biomass	0.018	0.001	0.006	0.000	0.004	0.008	0.011	0.004
TOTAL	**86.815**	**83.875**	**73.138**	**64.064**	**64.328**	**78.886**	**123.966**	**118.224**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	3.716	3.164	2.965	2.216	2.208	1.712	1.730	1.652
Gaseous Fuels	23.269	21.155	17.779	19.458	19.491	12.986	12.515	9.741
Solid Fuels	97.647	95.586	89.237	76.215	68.737	66.257	49.936	56.476
Other Fuels	0.158	0.138	0.000	0.000	0.014	0.008	0.005	0.013
Biomass	0.014	0.031	0.026	0.027	0.037	0.052	0.047	0.026
TOTAL	**124.804**	**120.074**	**110.007**	**97.916**	**90.487**	**81.015**	**64.233**	**67.908**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	1.441	1.690	1.413	1.490	1.445	1.631	1.755	2.179
Gaseous Fuels	11.190	10.106	10.363	9.680	9.239	8.858	10.321	9.805
Solid Fuels	50.943	45.375	46.205	65.137	61.482	42.905	47.342	47.419
Other Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.010
Biomass	0.020	0.014	0.026	0.085	0.037	0.137	0.349	0.162
TOTAL	**63.594**	**57.185**	**58.007**	**76.392**	**72.203**	**53.531**	**59.769**	**59.575**
	2012	**2013**	**2014**					
Liquid Fuels	1.574	1.891	1.429					
Gaseous Fuels	11.205	12.013	12.788					
Solid Fuels	41.875	42.633	43.055					
Other Fuels	0.001	0.002	0.002					
Biomass	0.160	0.122	0.039					
TOTAL	**54.815**	**56.661**	**57.313**					

The emission trends of CO_2, CH_4 and N_2O in the 1988-2014 period are shown in figures 3.2.6.6 and 3.2.6.7.

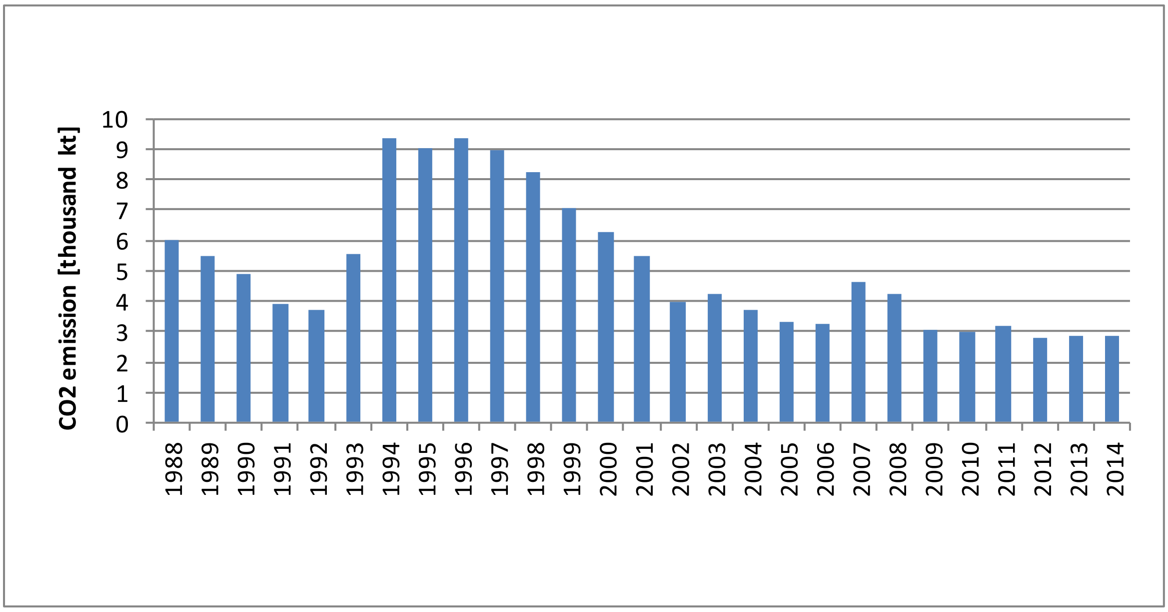

Figure 3.2.6.6. CO_2 emission for 1.A.1.c category in 1988-2014

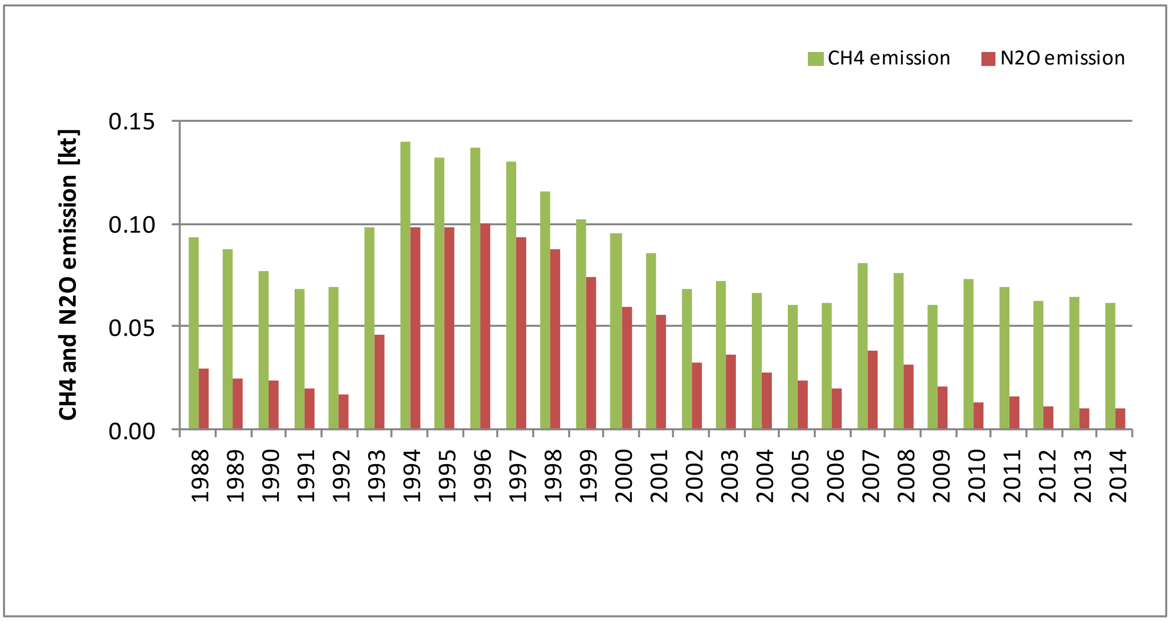

Figure 3.2.6.7. CH_4 and N_2O emissions for 1.A.1.c category in 1988-2014

3.2.6.3. Uncertainties and time-series consistency

Uncertainty analysis for the year 2014 for IPCC sector *1.Energy* was estimated with use of approach 1 described in 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Simplified approach was based on the assumptions that every value is independent and probability distribution is symmetric. Results of the sectoral uncertainty analysis are given below. More details on uncertainty assessment of whole inventory are given in annex 8.
Recalculation of data for years 1988-2013 ensured consistency for whole time-series.

2014	**CO_2 [kt]**	**CH_4 [kt]**	**N_2O [kt]**	**CO_2 Emission uncertainty [%]**	**CH_4 Emission uncertainty [%]**	**N_2O Emission uncertainty [%]**
1. Energy	**288 426.63**	**719.43**	**8.17**	1.9%	29.4%	12.3%
A. Fuel Combustion	**284 863.92**	**146.62**	**8.17**	1.9%	11.3%	12.3%
1. Energy Industries	159 840.96	4.66	2.58	2.7%	16.9%	29.9%
2. Manufacturing Industries and Construction	29 742.22	4.26	0.59	2.5%	11.2%	23.7%
3. Transport	43 615.18	3.89	1.95	5.7%	10.2%	20.0%
4. Other Sectors	51 665.56	133.81	3.05	4.3%	12.4%	16.0%
5. Other						
B. Fugitive Emissions from Fuels	**3 562.71**	**572.81**	**0.00**	8.5%	36.9%	71.7%
1. Solid Fuels	1 705.16	476.31		15.0%	44.2%	
2. Oil and Natural Gas	1 857.54	96.50	0.00	8.6%	15.7%	71.7%

3.2.6.4. Source-specific QA/QC and verification

Activity data used in the GHG inventory concerning energy sector come from Eurostat Database which is fed by the Central Statistical Office (GUS). GUS is responsible for QA/QC of collected and published data. Activity data applied in GHG inventory are regularly checked and updated if necessary according to adjustments made in Eurostat Database.

One of the elements of quality control of activity data correction is fuel balances prepared for the purpose of national GHG inventories (see Annex 4). For the main fuels (i.e. coal, lignite) calorific values are analysed for avoiding 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 are also validated based on Central Statistical Office's Energy Statistics published annually.
Natural verification of data in an energy sector is comparison of sectoral and reference approaches within the GHG inventory.

Calculations in energy sector were examined with focus on formulas, units and trends consistency. Generally QC procedures follow QA/QC plan presented in Annex 7.

3.2.6.5. Source-specific recalculations

fuel consumptions for the years 1990-2013 were updated according to current Eurostat database,

Table.3.2.6.4. Changes of GHG emission values in 1.A.1 subcategory as a result of recalculations

Changes	1988	1989	1990	1991	1992	1993	1994	1995
CO2								
kt	0.00	0.00	0.00	0.00	0.00	0.00	-0.07	0.00
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CH4								
kt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N2O								
kt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Changes	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
CO2								
kt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CH4								
kt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N2O								
kt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Changes	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
CO2								
kt	0.00	0.00	0.00	667.29	636.56	558.05	396.01	-5.17
%	0.0	0.0	0.0	0.4	0.4	0.3	0.2	0.0
CH4								
kt	0.000	0.000	0.000	0.000	-0.003	-0.002	-0.027	0.000
%	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.7	0.0
N2O								
kt	0.000	0.000	0.000	0.008	0.007	0.007	0.001	0.000
%	0.0	0.0	0.0	0.3	0.3	0.3	0.1	0.0
Changes	**2012**	**2013**						
CO2								
kt	-4.71	1.91						
%	0.0	0.0						
CH4								
kt	0.000	0.000						
%	0.0	0.0						
N2O								
kt	0.000	0.000						
%	0.0	0.0						

3.2.6.6. Source-specific planned improvements

analysis of the possibility of country specific EF elaboration for the gaseous fuels in Polish fuel structure

3.2.7. Manufacturing Industries and Construction (CRF sector 1.A.2)

3.2.7.1. Source category description

Emissions in 1.A.2 *Manufacturing Industries and Construction* category are estimated for each fuel in detailed sub-categories as follows:

a) *Iron and Steel* - 1.A.2.a
b) *Non-Ferrous Metals* - 1.A.2.b
c) *Chemicals* - 1.A.2.c
d) *Pulp, Paper and Print* - 1.A.2.d
e) *Food Processing, Beverages and Tobacco* - 1.A.2.e
f) *Non-metallic minerals* - 1.A.2.f
g) *Other* - 1.A.2.g:

- *Manufacturing of machinery*
- *Manufacturing of transport equipment*
- *Mining (excluding fuels) and quarrying*
- *Wood and wood products*
- *Construction*
- *Textile and leather*
- *Off-road vehicles and other machinery*
- *Other* - other industry branches not included elsewhere

Subsector 1.A.2.f *Non-metallic minerals, 1.A.2.c Chemicals and 1.A.2.a Iron and Steel are* the largest contributors to emissions from this category (see figure 3.2.7.1) – respectively 25.2%, 21.9% and 20.7% in 2014.

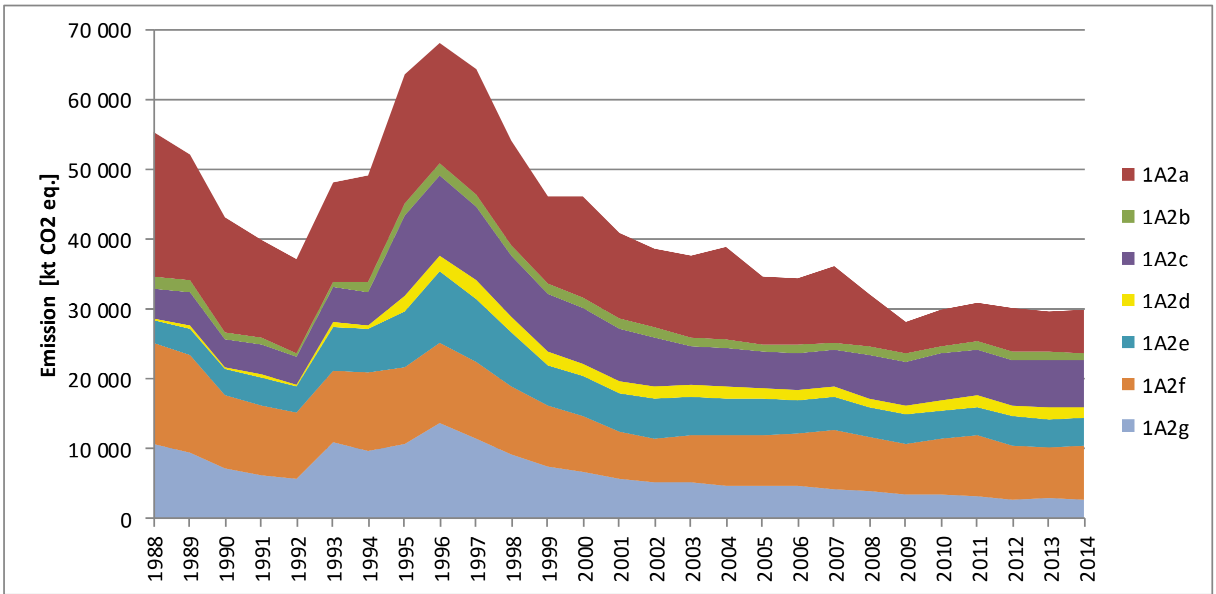

Figure 3.2.7.1. Emissions from *Manufacturing Industries and Construction* category in years 1988-2014 according to subcategories

3.2.7.2. Methodological issues

Methodology of emission estimation in 1.A.2 subcategory corresponds with methodology described for fuel combustion in stationary sources. Detailed information on fuel consumption and applied emission factors for subcategories listed below are presented in Annex 2.

3.2.7.2.1. Iron and Steel (CRF sector 1.A.2.a)

Table 3.3.7.1 shows the fuel use data in the sub-category 1.A.2.a *Iron and Steel* for the period: 1988-2014. As you can see in the table solid fuels is the dominant fuel type in that sub-category. Detailed data on fuel consumptions in 1.A.2.a subcategory for the entire period 1988-2014 was presented in Annex 2 (table 4).

Table 3.3.7.1. Fuel consumption in 1988-2014 in 1.A.2.a subcategory [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	18.248	15.528	11.172	7.929	5.452	4.623	3.518	2.812
Gaseous Fuels	73.507	63.332	52.851	33.974	26.568	25.562	25.487	24.239
Solid Fuels	95.323	82.955	74.910	72.626	73.599	85.080	96.976	118.715
Other Fuels	3.158	3.344	4.079	6.756	6.497	4.272	3.757	2.941
Biomass	0.000	0.000	0.000	0.000	0.000	0.016	0.014	0.005
TOTAL	**190.236**	**165.159**	**143.012**	**121.285**	**112.116**	**119.553**	**129.752**	**148.712**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	1.861	5.324	1.900	2.189	1.739	0.996	0.359	0.313
Gaseous Fuels	25.898	28.278	23.993	21.440	22.024	18.328	15.463	14.827
Solid Fuels	112.791	113.712	99.754	80.715	89.854	76.419	72.933	77.378
Other Fuels	0.498	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	0.006	0.004	0.006	0.004	0.003	0.006	0.003	0.004
TOTAL	**141.054**	**147.318**	**125.653**	**104.348**	**113.620**	**95.749**	**88.758**	**92.522**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	0.267	0.086	0.129	0.086	0.132	0.133	0.133	0.133
Gaseous Fuels	19.969	20.460	21.008	22.716	20.397	16.595	16.916	17.209
Solid Fuels	84.242	60.073	56.711	60.013	38.753	23.106	27.266	32.814
Other Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	0.004	0.002	0.001	0.001	0.001	0.001	0.000	0.000
TOTAL	**104.482**	**80.621**	**77.849**	**82.816**	**59.283**	**39.835**	**44.315**	**50.156**
	2012	**2013**	**2014**					
Liquid Fuels	0.135	0.089	0.133					
Gaseous Fuels	16.905	16.242	16.096					
Solid Fuels	37.570	36.121	38.576					
Other Fuels	0.000	0.000	0.000					
Biomass	0.000	0.001	0.001					
TOTAL	**54.610**	**52.453**	**54.806**					

Blast furnaces transformation efficiency in Eurostat energy balance is very high and it is the reason, that there is too little amount of coke use in „Transformation input in Blast Furnaces" compared with real technological demand. Because of that, some part of coke, classified in *Final energy consumption – Iron and Steel* in Eurostat database (1.A.2.a IPCC subcategory) was reallocated into blast furnace input and use in C mass balance prepared in 2 IPCC sector for pig iron production.

Amounts of coke [PJ] moved from 1.A2.a to 2.C.1 subcategory for individual years were as follow:

1988	12.050	1997	61.375	2006	36.903
1989	14.549	1998	45.291	2007	45.773
1990	97.056	1999	38.295	2008	36.584
1991	67.320	2000	54.904	2009	20.490
1992	66.873	2001	46.626	2010	23.828
1993	58.588	2002	37.455	2011	24.729
1994	65.168	2003	41.101	2012	23.291
1995	67.299	2004	44.292	2013	25.163
1996	58.137	2005	28.445	2014	31.228

CO_2 emission from reallocated coke was included in emission from 2.C.1 subcategory. Emissions of CH_4 and N_2O were included in 1.A.2.a category.

Figure 3.3.7.2 shows CO_2 emissions in the 1988-2014 period. Emissions of CH_4 and N_2O in the same time period are shown in figure 3.3.7.3. Emission trends for all three gases follow closely the trends in fuel use.

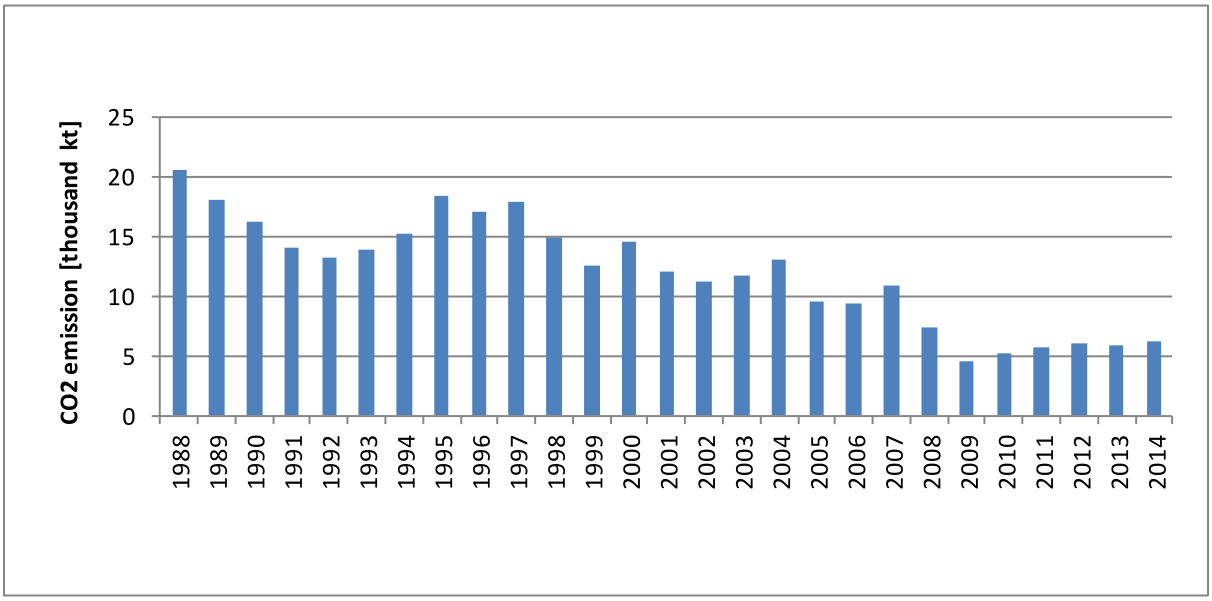

Figure 3.3.7.2. CO_2 emission for 1.A.2.a category in 1988-2014

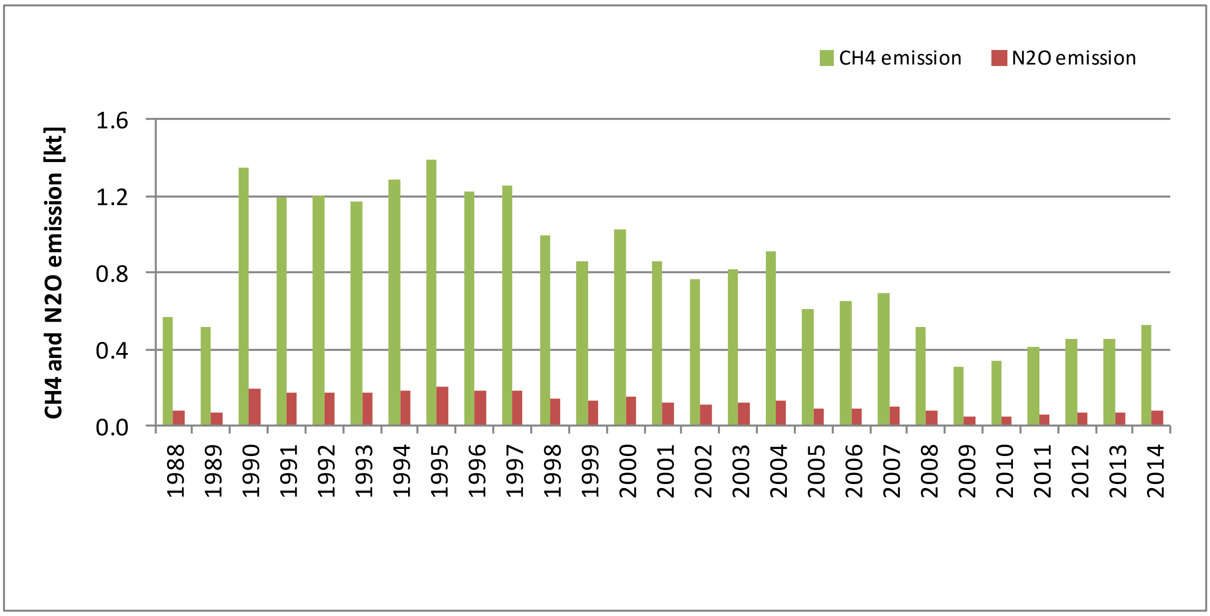

Figure 3.3.7.3. CH_4 and N_2O emissions for 1.A.2.a category in 1988-2014

3.2.7.2.2. Non-Ferrous Metals (CRF sector 1.A.2.b)

The data on fuel type use in the sub-category 1.A.2.b *Non-Ferrous Metals* over the 1988-2014 period are presented in table 3.3.7.2. More detailed data concerning fuel consumptions was tabulated in Annex 2 (table 5).

Table 3.3.7.2. Fuel consumption in 1988-2014 in 1.A.2.b subcategory [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	0.683	0.803	0.803	0.843	0.929	0.846	0.929	0.892
Gaseous Fuels	5.638	5.470	4.599	4.633	1.213	1.745	5.321	5.447
Solid Fuels	12.001	10.832	6.908	5.965	3.316	4.752	8.183	10.499
Other Fuels	0.870	0.719	0.439	0.483	0.514	0.729	0.823	2.150
Biomass	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000
TOTAL	**19.191**	**17.823**	**12.749**	**11.924**	**5.972**	**8.073**	**15.257**	**18.988**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	0.940	0.854	0.777	0.732	0.863	0.784	0.618	0.495
Gaseous Fuels	5.108	5.424	5.638	5.660	5.814	5.700	5.589	5.868
Solid Fuels	10.897	10.491	11.879	11.115	11.446	12.497	11.455	10.582
Other Fuels	2.411	2.361	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	0.149	0.042	0.026	0.010	0.011	0.005	0.001	0.000
TOTAL	**19.505**	**19.172**	**18.320**	**17.517**	**18.134**	**18.986**	**17.663**	**16.945**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	0.658	0.618	0.618	0.378	0.378	0.379	0.382	0.339
Gaseous Fuels	6.405	6.468	6.884	6.740	6.537	5.846	6.039	6.670
Solid Fuels	8.848	6.841	7.070	7.960	7.860	7.356	7.002	7.470
Other Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
Biomass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	**15.911**	**13.927**	**14.572**	**15.078**	**14.775**	**13.581**	**13.424**	**14.479**
	2012	**2013**	**2014**					
Liquid Fuels	0.293	0.293	0.253					
Gaseous Fuels	6.890	6.703	6.950					
Solid Fuels	7.469	7.488	7.886					
Other Fuels	0.000	0.000	0.000					
Biomass	0.000	0.000	0.000					
TOTAL	**14.652**	**14.484**	**15.089**					

Emissions of the main greenhouse gases in 1.A.2.b between the base year and 2014 are shown in figures 3.3.7.4 and 3.3.7.5.

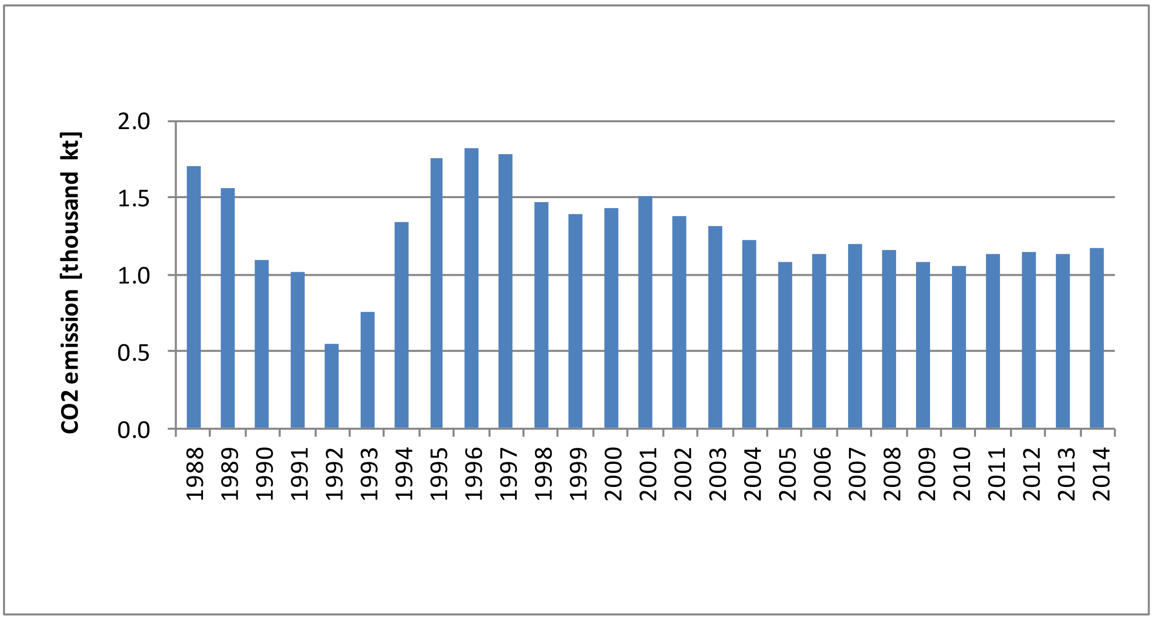

Figure 3.3.7.4. CO_2 emission for 1.A.2.b category in 1988-2014

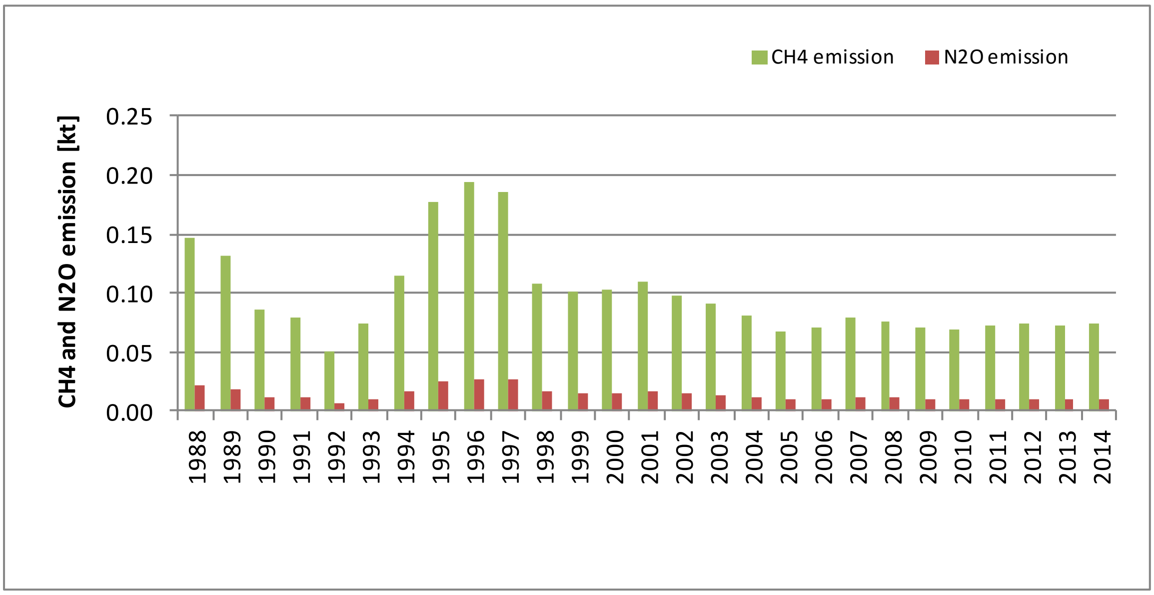

Figure 3.3.7.5. CH_4 and N_2O emissions for 1.A.2.b category in 1988-2014

3.2.7.2.3. Chemicals (CRF sector 1.A.2.c)

Detailed data on fuel consumptions in 1.A.2.c subcategory for the entire period 1988-2014 was presented in Annex 2 (table 6).
The data on fuel type use in the sub-category 1.A.2.c *Chemicals* over the 1988-2014 period are presented in table 3.3.7.3.

Table 3.3.7.3. Fuel consumption in 1988-2014 in 1.A.2.c subcategory [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	14.825	13.968	4.103	6.203	8.977	7.710	4.527	10.688
Gaseous Fuels	6.409	6.244	5.289	4.340	4.432	10.075	4.507	6.356
Solid Fuels	12.407	14.986	10.896	9.351	7.008	16.738	10.312	74.948
Other Fuels	12.255	14.915	16.712	18.586	17.039	18.003	22.591	21.546
Biomass	0.345	0.390	0.118	0.039	0.010	0.003	0.035	0.007
TOTAL	**46.241**	**50.503**	**37.118**	**38.519**	**37.466**	**52.529**	**41.972**	**113.545**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	19.576	22.964	40.929	39.132	38.344	33.144	32.907	33.483
Gaseous Fuels	6.191	11.024	9.408	9.041	9.464	8.481	7.199	6.457
Solid Fuels	75.455	65.909	57.138	52.421	51.772	50.353	47.485	30.174
Other Fuels	17.374	14.356	0.672	0.582	0.607	0.618	0.567	0.875
Biomass	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.153
TOTAL	**118.596**	**114.253**	**108.148**	**101.176**	**100.187**	**92.596**	**88.159**	**71.142**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	33.648	26.001	29.370	29.765	23.485	26.741	22.114	16.816
Gaseous Fuels	7.498	8.104	9.053	8.754	7.950	9.707	11.807	13.887
Solid Fuels	31.215	32.175	31.194	29.376	45.603	43.378	48.757	49.660
Other Fuels	1.122	0.628	0.721	0.707	0.509	0.584	0.770	0.732
Biomass	0.102	0.165	0.000	0.121	0.000	0.058	0.058	0.053
TOTAL	**73.585**	**67.073**	**70.338**	**68.723**	**77.547**	**80.468**	**83.506**	**81.148**
	2012	**2013**	**2014**					
Liquid Fuels	13.779	16.675	13.302					
Gaseous Fuels	13.568	14.696	14.500					
Solid Fuels	50.527	50.968	50.138					
Other Fuels	0.581	1.092	1.082					
Biomass	0.131	0.050	0.111					
TOTAL	**78.586**	**83.481**	**79.133**					

Figure 3.3.7.6 shows CO_2 emissions in the sub-category 1.A.2.c in the 1988-2014 period. Emissions of CH_4 and N_2O, in turn, are shown in figure 3.3.7.7.

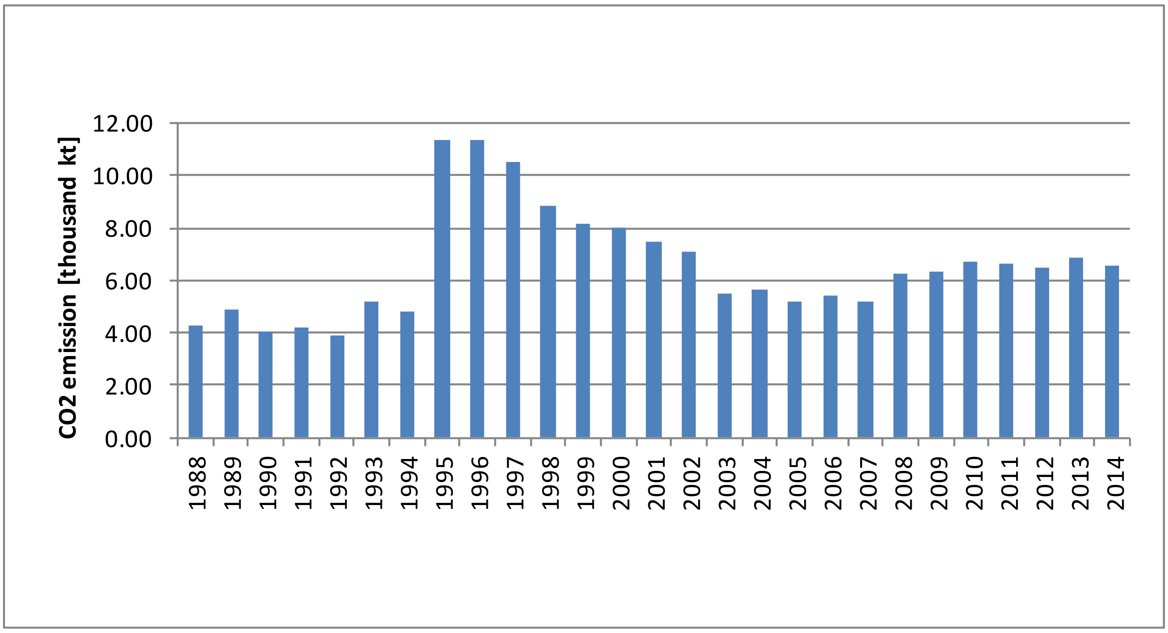

Figure 3.3.7.6. CO_2 emission for 1.A.2.c category in 1988-2014

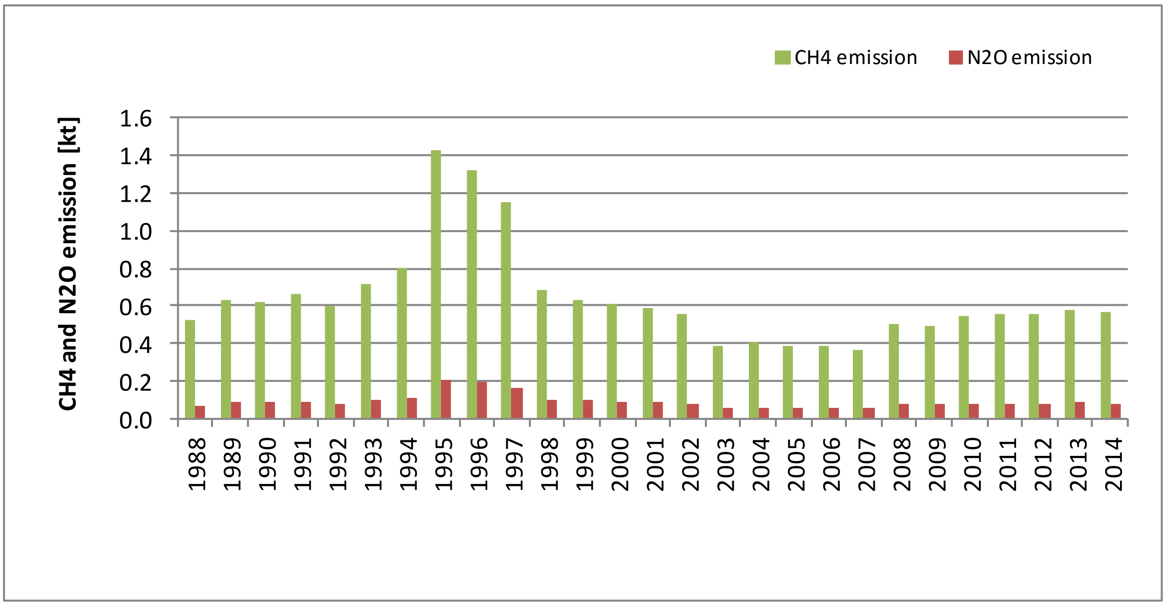

Figure 3.3.7.7. CH_4 and N_2O emissions for 1.A.2.c category in 1988-2014

3.2.7.2.4. Pulp, Paper and Print (CRF sector 1.A.2.d)

The data on fuel type use in the sub-category 1.A.2.d *Pulp, Paper and Print* over the 1988-2014 period are presented in table 3.3.7.4. Characteristic for that sub-sector is relatively large share of biomass in the total fuel use. Detailed data on fuel consumptions in 1.A.2.d subcategory was presented in Annex 2 (table 7).

Table 3.3.7.4. Fuel consumption in 1988-2014 in 1.A.2.d subcategory [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	1.371	1.291	1.369	1.332	1.409	1.649	1.532	2.535
Gaseous Fuels	0.103	0.162	0.101	0.061	0.026	0.061	0.250	0.232
Solid Fuels	1.976	2.192	1.810	2.043	1.639	4.841	4.123	22.605
Other Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	0.352	0.205	0.001	0.000	0.000	1.585	1.610	15.437
TOTAL	**3.803**	**3.850**	**3.281**	**3.436**	**3.074**	**8.136**	**7.515**	**40.809**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	1.687	2.119	2.619	2.227	2.099	2.044	2.035	2.208
Gaseous Fuels	0.455	1.096	0.563	1.007	1.210	1.445	1.461	2.094
Solid Fuels	22.494	24.121	19.022	17.528	15.724	15.592	14.345	14.107
Other Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	16.243	16.472	16.476	15.545	15.938	15.138	16.622	17.950
TOTAL	**40.879**	**43.808**	**38.680**	**36.307**	**34.971**	**34.219**	**34.463**	**36.359**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	2.244	2.029	2.118	2.333	1.986	1.995	1.992	1.988
Gaseous Fuels	2.657	2.288	2.976	4.087	4.822	4.972	5.134	4.587
Solid Fuels	13.825	13.458	11.620	9.480	7.878	8.515	10.114	11.301
Other Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	18.957	18.611	19.379	18.644	19.729	19.189	19.630	19.475
TOTAL	**37.683**	**36.386**	**36.093**	**34.544**	**34.415**	**34.671**	**36.870**	**37.351**
	2012	**2013**	**2014**					
Liquid Fuels	1.785	1.872	1.545					
Gaseous Fuels	5.535	6.271	6.994					
Solid Fuels	10.643	11.460	11.291					
Other Fuels	0.000	0.037	0.125					
Biomass	20.441	27.243	27.092					
TOTAL	**38.404**	**46.883**	**47.047**					

Figures 3.3.7.8 and 3.3.7.9 show emissions of CO_2, CH_4 and N_2O, respectively in the sub-category 1.A.2.d in the period: 1988-2014.

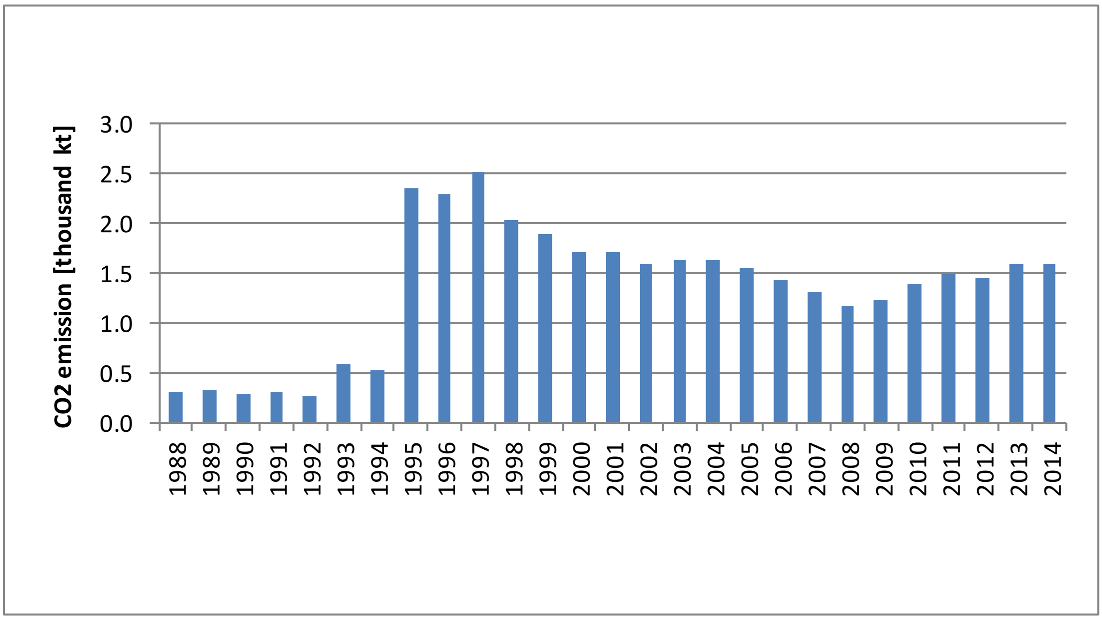

Figure 3.3.7.8. CO_2 emission for 1.A.2.d category in 1988-2014

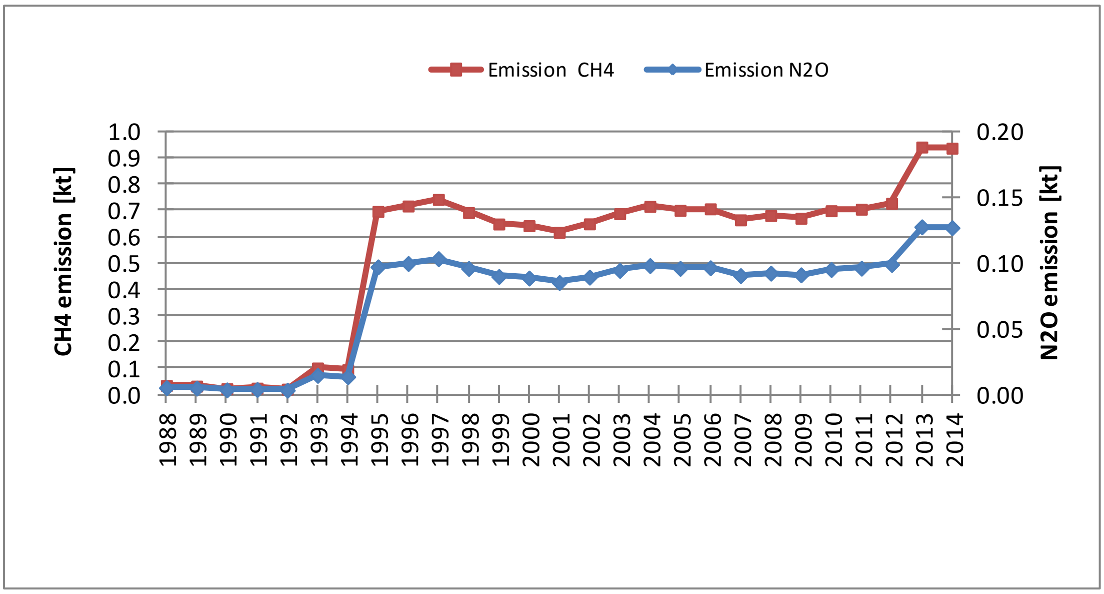

Figure 3.3.7.9. CH_4 and N_2O emissions for 1.A.2.d category in 1988-2014

3.2.7.2.5. Food Processing, Beverages and Tobacco (CRF sector 1.A.2.e)

The data on fuel type use in the sub-category 1.A.2.e *Food Processing, Beverages and Tobacco* over the 1988-2014 period are presented in table 3.3.7.5. Detailed data on fuel consumption was tabulated in Annex 2 (table 8).

Table 3.3.7.5. Fuel consumption in 1988-2014 in 1.A.2.e subcategory [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	4.413	3.484	3.065	2.646	2.402	4.707	5.219	7.339
Gaseous Fuels	1.965	1.910	1.970	1.984	2.339	3.171	7.180	3.839
Solid Fuels	29.280	35.542	35.468	39.034	35.517	59.569	56.912	75.938
Other Fuels	0.003	0.002	0.000	0.000	0.031	0.003	0.003	0.000
Biomass	0.114	0.105	0.091	0.094	0.072	0.151	0.056	0.082
TOTAL	**35.775**	**41.043**	**40.594**	**43.758**	**40.361**	**67.601**	**69.370**	**87.198**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	8.612	7.900	9.907	10.250	10.681	10.889	11.340	11.374
Gaseous Fuels	15.051	12.927	10.694	9.255	10.494	11.363	12.490	15.075
Solid Fuels	92.385	81.307	67.056	48.274	45.232	41.557	43.534	40.545
Other Fuels	0.000	0.000	0.000	0.000	0.001	0.014	0.000	0.000
Biomass	0.094	0.075	0.104	0.089	0.112	0.104	0.097	0.386
TOTAL	**116.142**	**102.209**	**87.761**	**67.868**	**66.520**	**63.927**	**67.461**	**67.380**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	11.022	10.036	8.665	7.801	7.561	5.612	5.014	4.524
Gaseous Fuels	16.164	17.456	18.623	20.614	20.725	20.950	21.610	22.128
Solid Fuels	37.450	36.955	31.793	32.077	27.434	26.470	26.530	26.156
Other Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	0.447	0.282	0.311	0.248	0.459	0.301	0.542	0.679
TOTAL	**65.083**	**64.729**	**59.392**	**60.740**	**56.179**	**53.333**	**53.696**	**53.487**
	2012	**2013**	**2014**					
Liquid Fuels	4.994	3.900	3.482					
Gaseous Fuels	23.704	24.475	25.094					
Solid Fuels	26.486	25.094	24.884					
Other Fuels	0.000	0.000	0.000					
Biomass	0.635	0.866	0.988					
TOTAL	**55.819**	**54.335**	**54.448**					

Figures 3.3.7.10 and 3.3.7.11 show emissions of CO_2, CH_4 and N_2O, respectively in the sub-category 1.A.2.e in the period: 1988-2014.

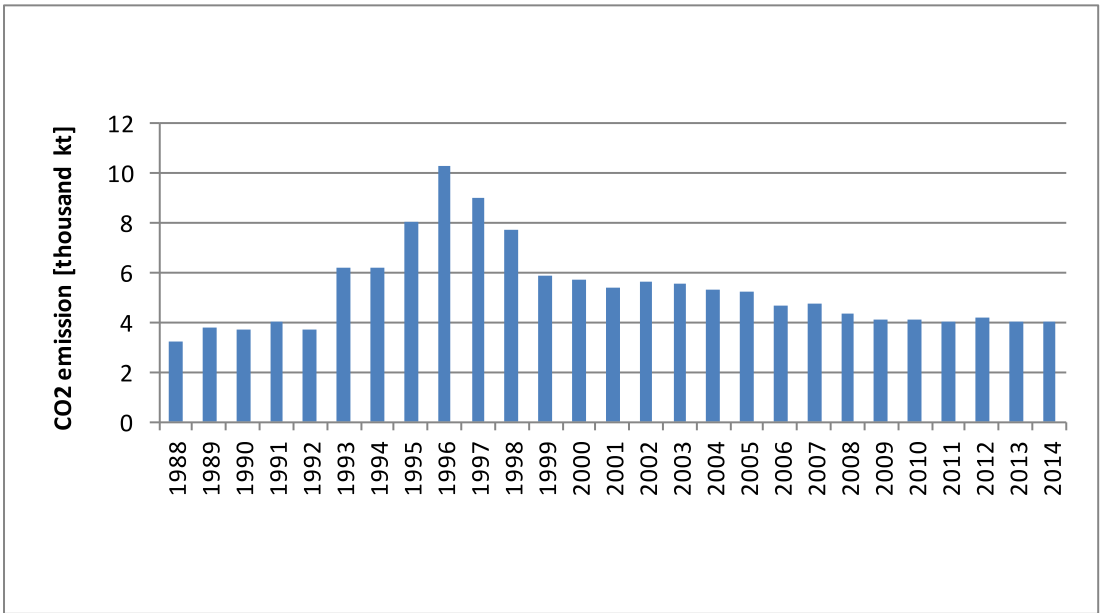

Figure 3.3.7.10. CO_2 emission for 1.A.2.e category in 1988-2014

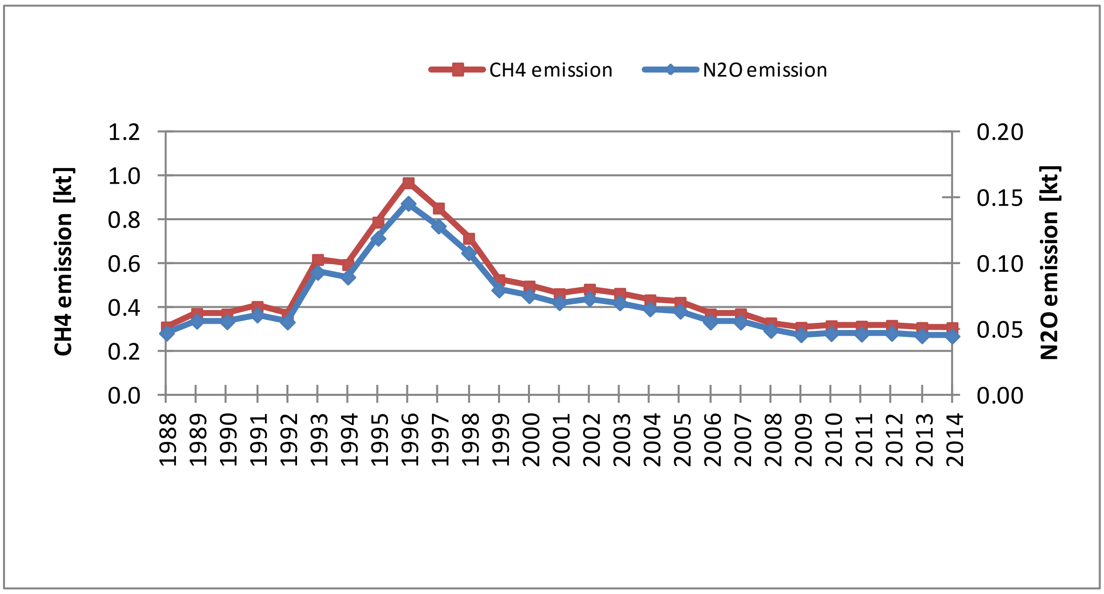

Figure 3.3.7.11. CH_4 and N_2O emissions for 1.A.2.e category in 1988-2014

3.2.7.2.6. Non-metallic minerals (CRF sector 1.A.2.f)

The data on fuel type use in the sub-category 1.A.2.f *Non-metallic minerals* in the 1988-2014 period are presented in table 3.3.7.6. Detailed data concerning total fuel consumption in 1.A.2.f subcategory was tabulated in Annex 2 (table 9).

Table 3.3.7.6. Fuel consumption in 1988-2014 in 1.A.2.f subcategory [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	7.321	7.828	5.104	3.615	4.332	4.732	5.356	7.548
Gaseous Fuels	28.729	28.108	24.574	22.704	22.246	21.986	21.506	25.518
Solid Fuels	128.357	123.387	92.221	89.061	84.226	91.535	98.135	92.655
Other Fuels	0.382	0.446	0.068	0.023	0.267	0.250	0.145	0.197
Biomass	1.778	1.924	1.155	0.455	0.042	0.033	0.004	0.010
TOTAL	**166.566**	**161.692**	**123.122**	**115.858**	**111.113**	**118.536**	**125.146**	**125.928**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	5.608	8.535	10.126	8.358	6.016	7.029	8.355	12.590
Gaseous Fuels	26.650	25.655	27.097	23.917	27.976	31.858	33.233	35.584
Solid Fuels	99.819	91.341	78.249	69.195	60.767	46.906	39.208	35.992
Other Fuels	0.144	0.047	0.207	0.529	0.472	0.524	0.508	1.474
Biomass	0.010	0.005	0.006	0.002	0.006	0.275	0.292	0.102
TOTAL	**132.231**	**125.583**	**115.685**	**102.001**	**95.237**	**86.592**	**81.596**	**85.742**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	12.156	14.214	8.720	5.855	6.108	7.209	6.038	4.410
Gaseous Fuels	38.233	38.963	41.283	42.465	39.696	41.394	42.872	44.492
Solid Fuels	38.551	35.210	36.102	50.003	41.280	29.982	32.419	39.231
Other Fuels	1.831	3.418	6.663	7.737	7.778	12.134	14.966	16.746
Biomass	0.261	0.110	0.139	0.117	0.224	0.314	0.422	1.686
TOTAL	**91.032**	**91.915**	**92.907**	**106.177**	**95.086**	**91.033**	**96.717**	**106.565**
	2012	**2013**	**2014**					
Liquid Fuels	3.556	3.274	2.425					
Gaseous Fuels	42.349	40.911	40.873					
Solid Fuels	31.510	27.253	27.959					
Other Fuels	16.083	16.515	19.231					
Biomass	1.767	1.889	2.252					
TOTAL	**95.265**	**89.842**	**92.740**					

Figures 3.3.7.12 and 3.3.7.13 show emissions of CO_2, CH_4 and N_2O, respectively in the sub-category 1.A.2.f in the period: 1988-2014.

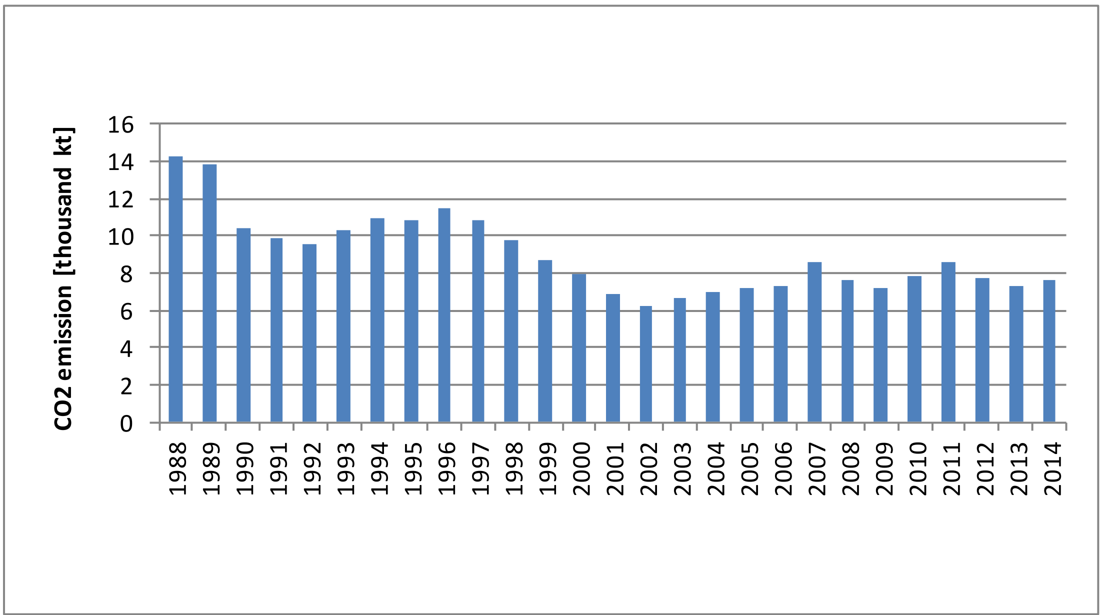

Figure 3.3.7.12. CO_2 emission from 1.A.2.f category in 1988-2014

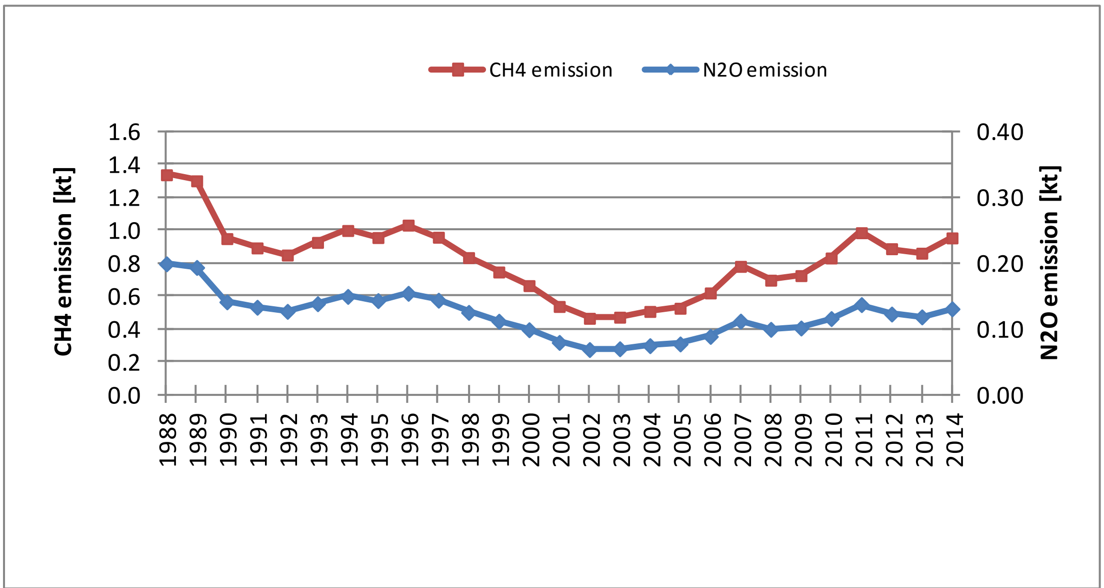

Figure 3.3.7.13. CH_4 and N_2O emissions from 1.A.2.f category in 1988-2014

3.2.7.2.7. Other (1.A.2.g)

The GHG emission was estimated for sub-categories as follows:

- *Manufacturing of machinery*
- *Manufacturing of transport equipment*
- *Mining (excluding fuels) and quarrying*
- *Wood and wood products*
- *Construction*
- *Textile and leather*
- *Off-road vehicles and other machinery*
- *Other* - other industry branches not included elsewhere

The data on fuel type use in stationary sources in the category 1.A.2.g *Other* over the 1988-2014 period are presented in table 3.3.7.7. Detailed data concerning total fuel consumption in 1.A.2.g subcategory was tabulated in Annex 2 (table 10).

Table 3.3.7.7. Fuel consumption in 1988-2014 in stationary sources of 1.A.2.g subcategory [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	19.848	18.040	13.846	12.029	10.684	12.077	11.560	14.398
Gaseous Fuels	24.039	22.347	15.645	11.755	13.811	17.922	17.336	15.176
Solid Fuels	82.038	72.062	54.022	48.748	41.858	92.328	80.329	87.356
Other Fuels	0.082	0.058	0.022	0.012	0.134	0.298	1.593	2.294
Biomass	8.335	7.545	5.826	5.518	5.035	4.995	3.410	4.970
TOTAL	**134.342**	**120.051**	**89.361**	**78.062**	**71.522**	**127.620**	**114.228**	**124.194**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	22.621	21.909	18.803	16.603	16.480	14.357	13.982	14.478
Gaseous Fuels	14.210	16.060	17.640	16.354	18.545	18.319	19.273	21.156
Solid Fuels	111.430	92.492	67.610	53.094	43.187	34.504	28.893	26.985
Other Fuels	2.675	1.133	2.080	1.482	2.075	1.802	2.078	2.503
Biomass	6.520	8.195	8.233	8.604	10.105	10.716	12.300	11.897
TOTAL	**157.456**	**139.789**	**114.366**	**96.137**	**90.392**	**79.698**	**76.526**	**77.019**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	14.166	15.025	15.380	12.883	11.811	11.545	11.694	11.647
Gaseous Fuels	22.595	23.325	23.290	23.541	26.265	22.861	24.964	23.876
Solid Fuels	23.495	20.805	18.958	17.446	14.889	11.734	11.916	10.953
Other Fuels	1.661	1.700	3.789	0.938	1.154	1.392	0.070	0.052
Biomass	12.184	11.918	11.030	13.171	14.044	14.007	17.901	20.051
TOTAL	**74.101**	**72.773**	**72.447**	**67.979**	**68.163**	**61.539**	**66.545**	**66.579**
	2012	**2013**	**2014**					
Liquid Fuels	9.210	8.445	8.877					
Gaseous Fuels	23.019	26.036	23.395					
Solid Fuels	8.173	7.973	7.022					
Other Fuels	0.069	0.098	0.064					
Biomass	20.854	24.842	25.929					
TOTAL	**61.325**	**67.394**	**65.287**					

Figures 3.3.7.14 and 3.3.7.15 show emissions of CO_2, CH_4 and N_2O, respectively in the 1.A.2.g category in the period: 1988-2014.

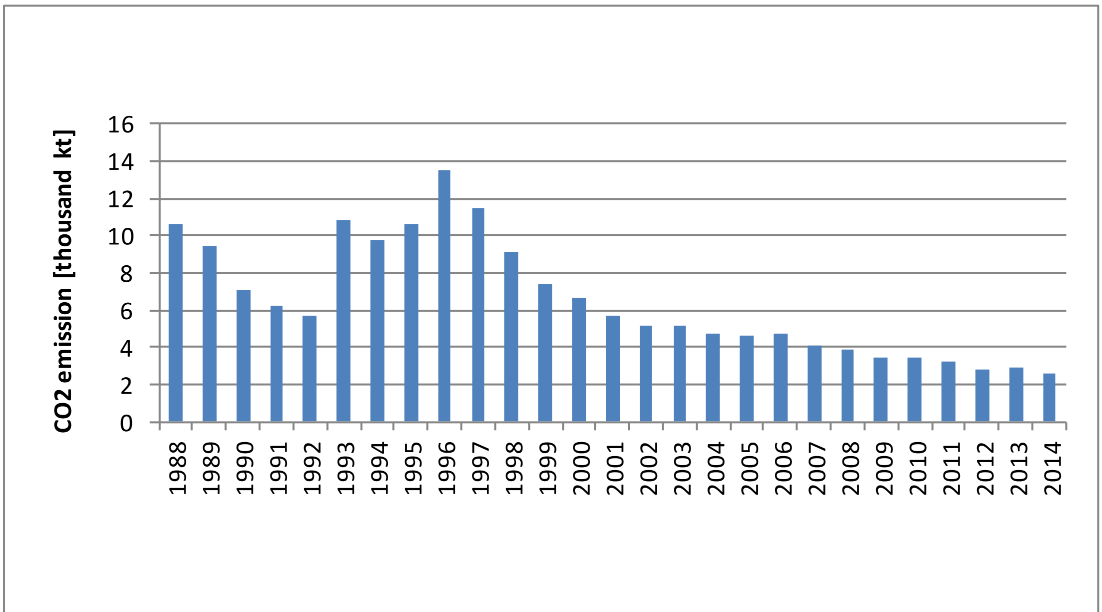

Figure 3.3.7.14. CO_2 emission from 1.A.2.g category in 1988-2014

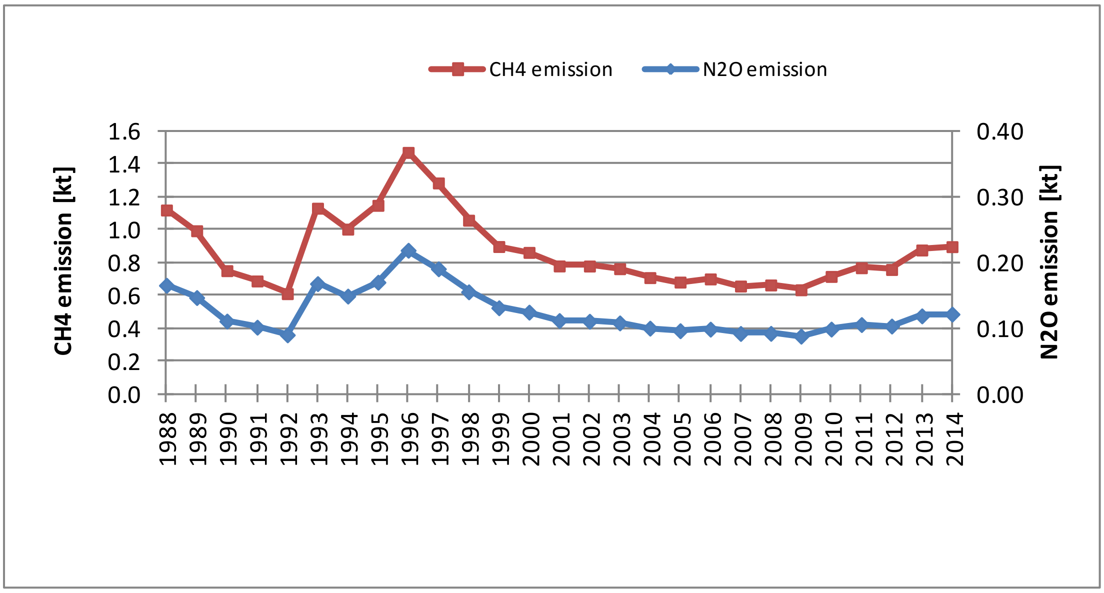

Figure 3.3.7.15. CH_4 and N_2O emissions from 1.A.2.g category in 1988-2014

3.2.7.3. Uncertainties and time-series consistency

See chapter 3.2.6.3.

3.2.7.4. Source-specific QA/QC and verification

See chapter 3.2.6.4.

3.2.7.5. Source-specific recalculations

- fuel consumptions for the years 1990-2013 were updated according to current Eurostat database;
- CO_2 emissions for the years 1990-2013 were recalculated due to adjustment of coke consumption in 1.A.2.a category resulting from changes introduced in C balance for blast furnaces (among others amounts of coke reallocated from 1.A2.a to 2.C.1 subcategory were changed; see chapter 3.2.7.2.1. Iron and Steel)

Table. 3.2.7.8. Changes in GHG emissions in 1.A.2 subsector as a result of recalculations

Changes	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
				CO2				
kt	0.00	0.00	-162.93	-256.22	-553.35	-97.39	161.67	154.29
%	0.0	0.0	-0.4	-0.6	-1.5	-0.2	0.3	0.2
				CH4				
kt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				N2O				
kt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Changes	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
				CO2				
kt	78.94	93.03	74.73	-73.46	-416.83	-418.24	-94.58	-95.79
%	0.1	0.1	0.1	-0.2	-0.9	-1.0	-0.2	-0.3
				CH4				
kt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				N2O				
kt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Changes	2004	2005	2006	2007	2008	2009	2010	2011
				CO2				
kt	-67.61	-0.51	-31.26	-431.84	-444.03	-441.52	-550.03	-309.52
%	-0.2	0.0	-0.1	-1.2	-1.4	-1.6	-1.8	-1.0
				CH4				
kt	0.00	0.00	0.00	-0.021	-0.020	-0.021	-0.001	0.000
%	0.0	0.0	0.0	-0.6	-0.6	-0.7	0.0	0.0
				N2O				
kt	0.00	0.00	0.00	-0.003	-0.003	-0.003	-0.001	0.000
%	0.0	0.0	0.0	-0.6	-0.6	-0.7	-0.1	0.0

Changes	2012	2013
CO2		
kt	-214.72	-293.93
%	-0.7	-1.0
CH4		
kt	-0.003	0.000
%	-0.1	0.0
N2O		
kt	0.000	0.000
%	0.0	0.0

3.2.7.6. Source-specific planned improvements

analysis of the possibility of country specific EF elaboration for the gaseous fuels in Polish fuel structure

3.2.8. Transport (CRF sector 1.A.3)

3.2.8.1. Source category description

Estimation of emissions in 1.A.3 *Transport* are carried out for each fuel in sub-categories listed below:

a) *Civil Aviation* (1.A.3.a)
b) *Road Transportation* (1.A.3.b)
c) *Railways* (1.A.3.c)
d) *Navigation* (1.A.3.d)
e) *Other Transportation* (1.A.3.e)

Share of that sector in total GHG emission in 2014 is about 11.7%. Road transport is by far the largest contributor to transport emissions (see figure 3.2.8.1) - in year 2014 about 97%.

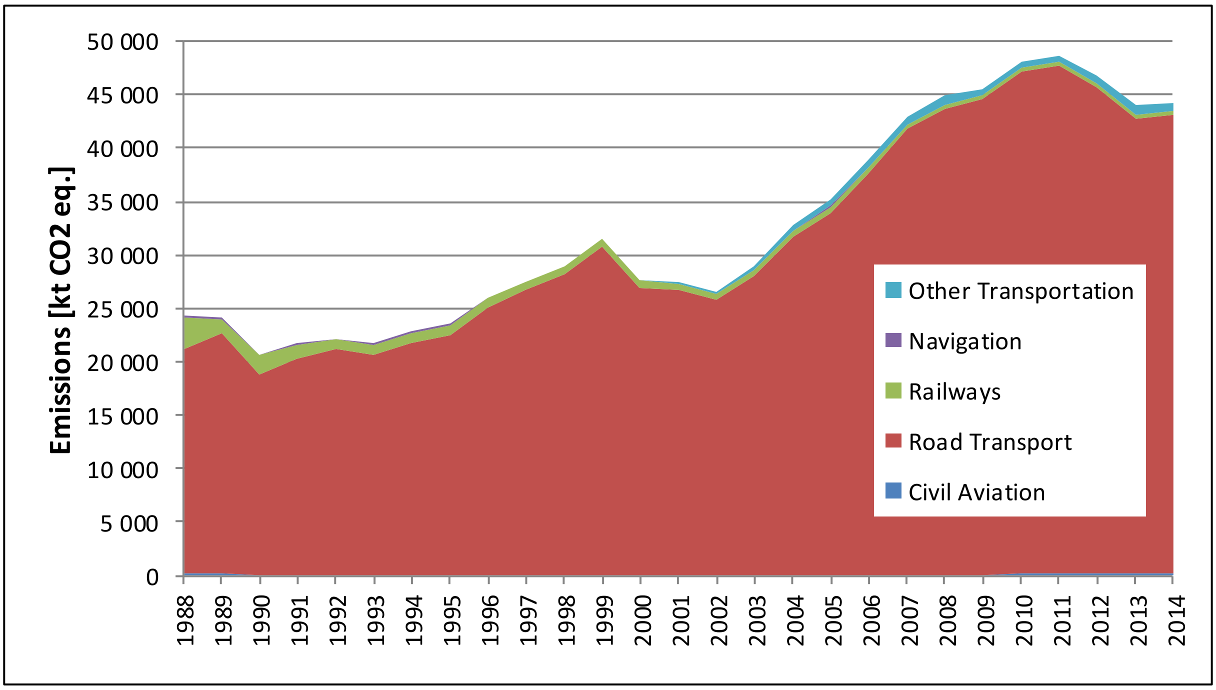

Figure 3.2.8.1. Emissions from transport in years 1988-2014

3.2.8.2. Methodological issues

The methodology used for estimation of GHG emissions in the national inventory for mobile sources for the entire time series 1988-2014 is factor based – data on fuel used are multiplied by the corresponding emission factors. Domestic emission factors for mobile sources include: CO_2 emission factors for road transport which are taken from annual reports of Motor Transport Institute and CO_2 emission factors for hard coal combustion in railway transport (concerns the period till 1998) – here the EF is calculated based upon an empirical function described above for stationary sources (chapter 3.1.1).

<u>Origin of CO_2 emission factors in Road transportation</u>

CO_2 emission factors for road transport have been elaborated by the Motor Transport Institute based on research, analysis and literature. The values of EFs may differ from year to year compared to values in table 3.2.8.1 which is caused by different issues explained below.

ITS published CO_2 EFs in g/kg units which must be converted into kg/GJ to be used in inventory calculation. To conversion NCVs are used, which may differ from year to year and that is why CO_2 EFs are not constant for period 1988-2014. Since 1996 NCV comes from "Energy Statistic" published by

Central Statistical Office (GUS) these are standard calorific values and are mostly constant (it fluctuate only ±0,01MJ/kg and from 2004 all NCV are constant). Before 1996 Poland use real calorific value based on statistical data of fuel consumption given in TJ and kt units.

Moreover, CO_2 EFs depend on carbon content in fuel. There is visible change between years 1995 and 1996 for CO_2 EF for gasoline. The change in IEF for gasoline in 1996 was caused by introducing the new EFs based on the newer country study applying, among others, analysis of gasoline content. EFs used before 1996 were based on study completed in early 1990-ties. The EFs were derived based on C content in different fuel types as well as on the data containing information on vehicle park and mobility. The specific car models were analyzed for elaboration of EFs.

To estimate amount of carbon in motor gasoline it was assumed by ITS that hydrogen carbon ratio is equal 1.85 [Directive 93/116]. It was taken into account that gasoline, except hydrocarbons, include:

- ethyl fluid,
- sulphur (average content in 1992 was about 0.06%),
- additives,
- oxygen (due to the addition of oxygenates).

Content of substances other than carbon and hydrogen was assumed as about 0.7% of mass. Due to this carbon content was about 88.0% of mass (99.3/13.85x12).

In 1993 and 1994 gasoline content significantly changed, e.g. the amount of oxygenates was higher. In some gasoline types oxygen content was almost 3% of mass. In this case new analyses were made. In one of Warsaw petrol stations there were taken 2 samples of each type of gasoline: E94, E98, E94EA (leaded petrol with ethyl alcohol) , B95 and B98. For each samples content of carbon and hydrogen was measured. Analyses were made in Institute of Organic Chemistry – Polish Academy of Sciences. Results of carbon content are presented below (average value from 2 samples):

- E94 – 86.8%
- E98 – 86.4%
- E94EA – 85.2%
- B95 – 85.9%
- B98 – 85.3%

Weighted average carbon content in motor gasoline in 1994 is then equal 86.45%. Total error of estimation of above analysis is assumed as 0.6%, therefore the value of carbon content which was assumed in previous estimation (equal 86.0%) is in the limit of error. For that reason for all calculation the amount of 86.0% was taken.

In case of diesel oil it was assumed that hydrogen carbon ratio is equal 1.86. Taken into account that diesel oil, except hydrogen and carbon, contain also sulphur, additives, oxygen and water, it was assumed that carbon content is similar to gasoline – 86.0%.

The LPG content is constantly changing, that is why literature value was taken at 81.4%.

IEF contain information on different EFs derived for various engine types, including two-stroke ones. In 1990-ties large change in vehicles number and structure was observed. The share of two-stroke engines extremely dropped in 1990-ties.

The other issue is that characteristics of gasoline used in Poland changed over time. The regular petrol (leaded) was used in 1980-ties and early 1990-ties like: regular petrol 86, 94, 98. Presently only lead-free petrol 95 and 98 is sold/used. For instance consumption of regular petrol 86 drop from 526.8 kt in 1991 to 88.1 ktin 1994 and was withdrawn from production in 1994 following decreasing demand.

Origin of other emission factors

All other emission factors for mobile sources were taken from IPCC 2006 guidelines and have constant values over the entire time series 1988-2014. Exception is N_2O emission factor from gasoline for passenger cars with catalyst, which is based on COPERT IV (following recommendation made by ERT). The values of the EFs in 2014 are those in table 3.2.8.1.

Table 3.2.8.1. Emission factors [kg/GJ] for transport types (means) in 2014

Type of transport	Fuel type	EF CO_2	EF CH_4	EF N_2O
1.A.3.a.ii International Aviation - bunker	Jet fuel	71.50	0.0005	0.002
1.A.3.a.ii Civil Aviation. Domestic	Jet fuel	71.50	0.0005	0.002
	Aviation gasoline	70.00	0.0600	0.0009
1.A.3.b.i Passenger Cars without catalysts	α.BS	70.04	0.03	0.002
	α.LG	62.48	0.02	0.0002
	α.ON	72.43	0.002	0.004
	β.BS	70.04	0.02	0.001
1.A.3.b.i Passenger Cars with catalysts	γ.BS	69.60	0.007	0.003
	γ.LG	62.48	0.02	0.0002
	γ.ON	72.43	0.002	0.004
1.A.3.b.ii Light Duty Vehicles < 3.5 t without catalysts	α.BS	70.04	0.02	0.001
	α.LG	62.48	0.03	0.0002
	α.ON	72.43	0.001	0.004
1.A.3.b.ii Light Duty Vehicles < 3.5 t with catalysts	γ.BS	69.60	0.02	0.001
	γ.LG	62.48	0.01	0.0002
	γ.ON	72.43	0.001	0.004
1.A.3.b.iii Heavy Duty Vehicles > 3.5 t. without catalysts	α.ON	72.43	0.006	0.003
1.A.3.b.iii Heavy Duty Vehicles > 3.5 t. with catalysts	γ.ON	72.43	0.006	0.003
1.A.3.b.iii Buses	α.ON	72.43	0.0039	0.0013
	γ.ON	72.43	0.0039	0.0013
1.A.3.b.iv Motorcycles	BS	70.04	0.1	0.001
1.A.3.b.iv Mopeds	BS	70.04	0.1	0.001
1.A.3.b.vi Tractors	ON	72.43	0.004	0.0039
1.A.3.b - different types of vehicles	biodiesel	70.80	0.003	0.0006
1.A.3.b - different types of vehicles	bioethanol	70.80	0.003	0.0006
1.A.3.c. Railways	ON	74.10	0.004	0.0286
1.A.3.d.ii Domestic Navigation - inland	ON	74.10	0.007	0.002
1.A.3.d.ii Domestic Navigation - marine	ON	74.10	0.007	0.002
	OP	77.40	0.007	0.002
1.A.3.d.i Domestic Navigation - bunker	ON	74.10	0.007	0.002
	OP	77.40	0.007	0.002
1.A.4.c.iii Fishery	ON	74.10	0.0070	0.0020
	OP	77.40	0.0070	0.0020
1.A.4.c.ii Agriculture – Mobile sources	ON	74.10	0.00415	0.0286
1.A.3.e.ii Pipeline transport	BS	69.30	0.003	0.0006
	ON	74.10	0.003	0.0006
	Natural gas	56.10	0.001	0.0001

Abbreviation explanations to table:
catalyst - catalytic converter; BS - motor gasoline; ON - diesel oil; LG – liquid gas; OP - fuel oil; α – 4-stroke, old generation; β - 2-stroke, old generation; γ – new generation (Euro).

3.2.8.2.1. Civil Domestic Aviation (CRF sector 1.A.3.a)

This category include emissions from passenger and freight traffic that departs and arrives in the same country (commercial, private, agriculture, etc.). Exclude use of fuel at airports for ground transport, fuel for stationary combustion at airports.

For the years 1990-2014 data related to aviation gasoline and jet kerosene are those of the Eurostat database, while for the base year and 1989 – those of the IEA database. As there was no split on international and domestic jet kerosene use in those statistics, the amounts of domestic fuels use in years 2005 – 2014 were calculated based on Eurocontrol data on fuel share of jet kerosene used for domestic aviation in Poland. Due to the lack of Eurocontrol data for the years before 2005, the share for years 1988-2004 was assumed as a 5-years average from Eurocontrol data for years 2005-2009.

Emissions from aviation come from the combustion of jet fuel and aviation gasoline. Data on fuel use in domestic aviation are shown in table 3.2.8.2 and figure 3.2.8.2. Figures 3.2.8.3 and 3.2.8.4 show emissions of CO_2, CH_4 and N_2O, respectively in the sub-category 1.A.3.a in the period 1988-2014.

Table 3.2.8.2. Fuel consumption and GHG emission in years 1988 - 2014

		1988	1989	1990	1991	1992	1993	1994	1995	1996
Aviation gasoline	TJ	879.98	836.02	352.00	220.00	88.00	176.00	440.00	308.00	176.00
Jet fuel	TJ	910.96	1252.90	561.19	579.46	629.06	626.45	634.28	683.87	803.94
CO2 emission	kt	126.73	148.10	64.77	56.83	51.14	57.11	76.15	70.46	69.80
CH4 emission	kt	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000
N2O emission	kt	0.004	0.004	0.002	0.002	0.001	0.002	0.002	0.002	0.002
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Aviation gasoline	TJ	264.00	176.00	132.00	132.00	132.00	176.00	176.00	132.00	132.00
Jet fuel	TJ	720.41	733.47	655.16	696.92	686.48	673.43	728.25	715.19	968.52
CO2 emission	kt	69.99	64.76	56.08	59.07	58.32	60.47	64.39	60.38	78.49
CH4 emission	kt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
N2O emission	kt	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Aviation gasoline	TJ	132.00	176.00	132.00	176.00	176.00	220.00	220.00	176.00	220.00
Jet fuel	TJ	1 146.15	1 111.09	1 170.25	1 103.65	1 282.14	1 371.63	2 039.05	1 415.98	1 694.66
CO2 emission	kt	91.19	91.76	92.91	91.23	103.99	113.47	161.19	113.56	136.57
CH4 emission	kt	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
N2O emission	kt	0.003	0.003	0.003	0.003	0.003	0.003	0.005	0.003	0.004

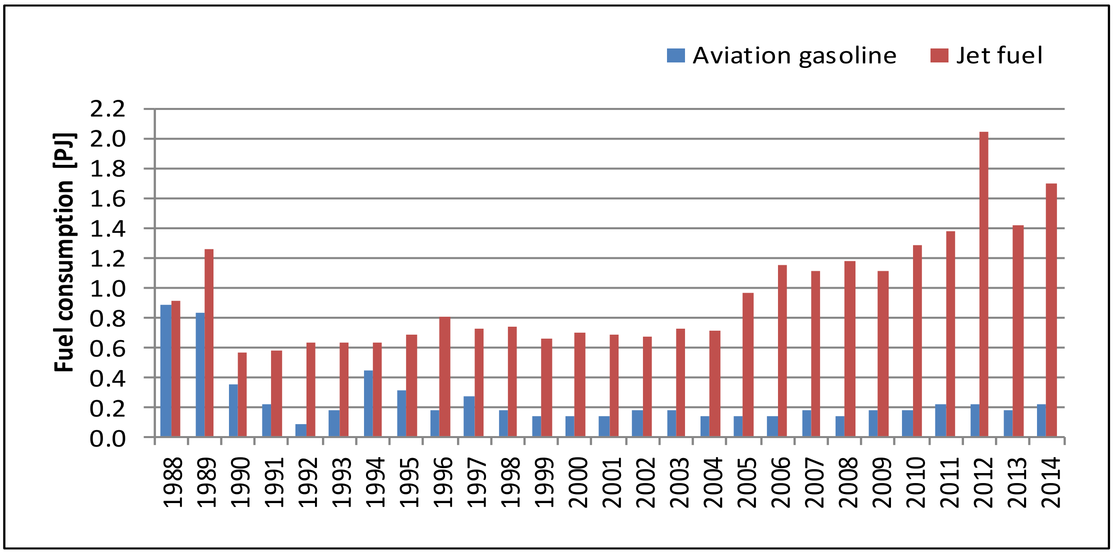

Figure 3.2.8.2. Fuel consumption in 1.A.3.a category for 1988-2014

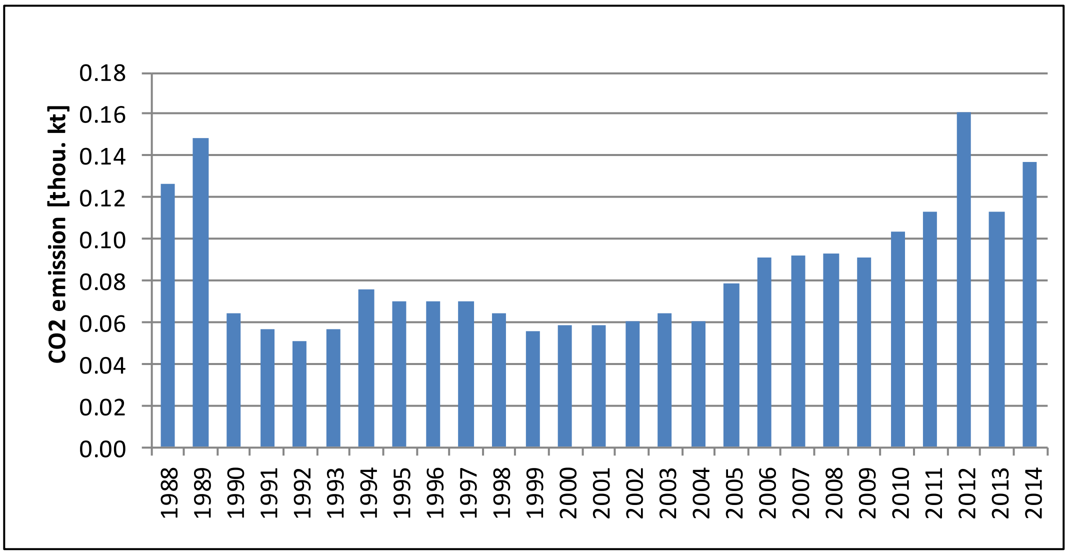

Figure 3.2.8.3. CO_2 emission for 1.A.3.a category in 1988-2014

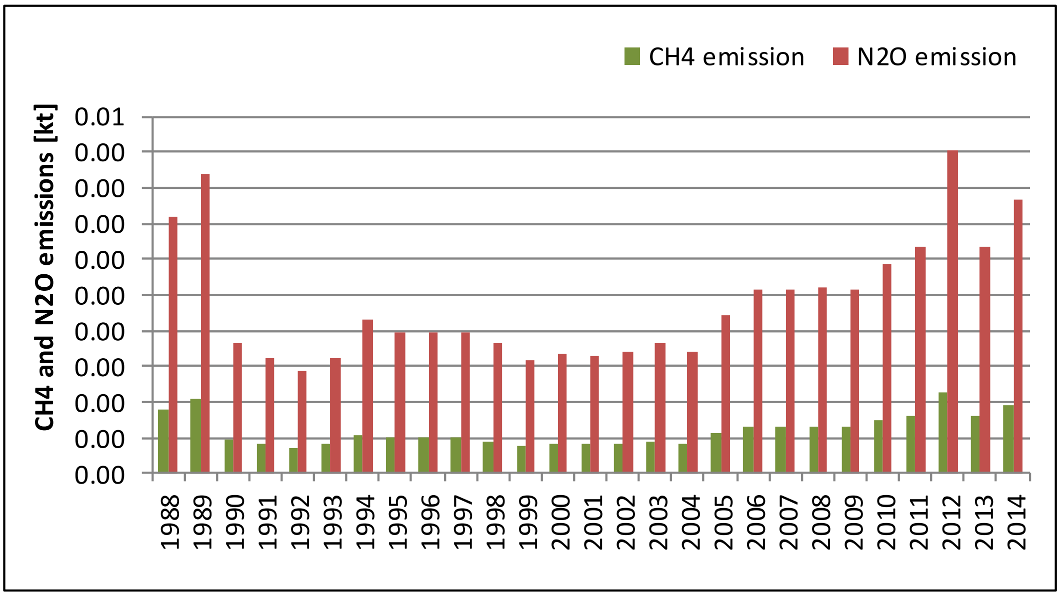

Figure 3.2.8.4. CH_4 and N_2O emissions for 1.A.3.a category in 1988-2014

3.2.8.2.2. Road Transportation (CRF sector 1.A.3.b)

Emission estimates from this category are based on fuel consumed by different vehicle types – including passenger cars, light and heavy duty vehicles, buses, tractors, motorcycles and mopeds. Data on fuel consumption for years 1990-2014 comes from Eurostat database, and for years 1988-1989 from IEA. Consumption of each type of fuel (used in road transport) in statistics is given without distinguishing on individual vehicle type. Therefore, for the purpose of this report fuel consumption was disaggregated based on ITS report [ITS 2014]. Table 3.2.8.3 shows fuel consumption and GHG emissions in 2014 by vehicle categories.

Table 3.2.8.3. Fuel consumption (exluding biofuels) and GHG emissions in 2014 by vehicle categories.

Vehicle category	Fuel type	Fuel consumption	CO_2 emission	CH_4 emission	N_2O emission
		[TJ]	[kt]	[kt]	[kt]
1.A.3.b.i Passenger Cars without catalysts	α.BS	4 894	342.78	0.147	0.010
	α.LPG	9 348	584.05	0.187	0.002
	α.ON	2 064	149.51	0.004	0.008
	β.BS	0	0.00	0.000	0.000
1.A.3.b.i Passenger Cars with catalysts	γ.BS	136 693	9514.19	0.957	0.410
	γ.LPG	52 215	3262.24	1.044	0.010
	γ.ON	175 494	12710.67	0.351	0.702
1.A.3.b.ii Light Duty Vehicles < 3.5 t without catalysts	α.BS	202	14.13	0.004	0.000
	α.LPG	1 190	74.36	0.036	0.000
	α.ON	1 479	107.14	0.001	0.006
	β.BS	0	0.00	0.000	0.000
1.A.3.b.ii Light Duty Vehicles < 3.5 t with catalysts	γ.BS	8 027	558.68	0.161	0.008
	γ.LPG	10 271	641.71	0.103	0.002
	γ.ON	92 931	6730.81	0.093	0.372
1.A.3.b.iii Heavy Duty Vehicles > 3.5 t. without catalysts	α.BS	0	0.00	0.000	0.000
	α.ON	18 174	1316.34	0.109	0.055
	β.ON	0	0.00	0.000	0.000
1.A.3.b.iii Heavy Duty Vehicles > 3.5 t. with catalysts	γ.ON	47 787	3461.14	0.287	0.143
1.A.3.b.iii Buses	α.ON	3 412	247.14	0.013	0.004
	γ.ON	21 586	1563.42	0.084	0.028
1.A.3.b.iv Motorcycles	BS	1 127	78.97	0.113	0.001
1.A.3.b.iv Mopeds	BS	522	36.54	0.052	0.001
1.A.3.b.vi Tractors	ON	11 526	834.82	0.046	0.045

catalyst - catalytic converter; BS - motor gasoline; ON - diesel oil; LG – liquid gas; α – 4-stroke, old generation; β - 2-stroke, old generation; γ – new generation (Euro).

The amount of vehicles according to categories in 2014 [GUS T 2015] is given in table below.

Table 3.2.8.4. Amount of vehicles according to categories in 2014

Category	Amount [thous. pcs.]
Passenger cars	20 004
Trucks	3 037
Buses	106
Motorcycles	1190
Mopeds	1 217
Tractors	1 668

Consumption of main fuels in road transport (gasoline, diesel oil and LPG) and GHG emissions in 1988-2014 period is shown in table 3.2.8.5.

Table 3.2.8.5. Fuel consumption and GHG emission in years 1988 - 2014

		1988	1989	1990	1991	1992	1993	1994	1995	1996
Motor gasoline	PJ	130.33	144.36	136.14	158.81	168.42	172.06	190.42	193.03	201.78
Diesel oil	PJ	155.40	161.03	117.85	116.77	118.15	107.85	101.42	104.89	136.47
LPG	PJ	0.00	0.00	0.00	0.00	0.00	1.10	3.27	8.10	11.64
Biodiesel	PJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bioethanol	PJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2 emission	kt	20 771	22 179	18 429	19 961	20 776	20 356	21 354	22 108	24 683
CH4 emission	kt	4.580	5.014	4.549	5.198	5.433	5.550	6.109	6.049	6.177
N2O emission	kt	0.713	0.755	0.603	0.637	0.662	0.646	0.676	0.712	0.855
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Motor gasoline	PJ	217.90	222.17	247.13	222.70	206.59	189.16	180.68	183.42	177.04
Diesel oil	PJ	139.25	155.34	162.08	134.79	140.58	134.84	164.18	200.99	229.82
LPG	PJ	15.46	16.10	21.48	19.55	26.96	38.13	49.22	61.69	71.25
Biodiesel	PJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65
Bioethanol	PJ	0.00	0.00	0.00	0.00	0.00	0.00	1.18	0.56	1.42
CO2 emission	kt	26 234	27 717	30 341	26 519	26 270	25 343	27 567	31 200	33 433
CH4 emission	kt	6.130	5.655	6.032	4.566	4.383	4.269	4.385	4.779	4.610
N2O emission	kt	0.922	1.014	1.108	0.967	0.948	0.894	0.975	1.111	1.206
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Motor gasoline	PJ	181.62	181.35	179.20	179.78	177.66	168.03	160.83	153.23	148.02
Diesel oil	PJ	268.77	323.21	352.55	365.97	402.82	421.92	401.95	369.44	379.22
LPG	PJ	78.20	80.50	79.07	76.04	76.36	73.97	73.88	73.28	73.00
Biodiesel	PJ	1.46	1.02	12.88	19.57	29.22	31.60	28.01	25.26	23.97
Bioethanol	PJ	2.30	3.00	5.31	7.05	7.10	6.73	5.79	6.03	5.56
CO2 emission	kt	37 008	41 073	42 957	43 780	46 322	46 883	44 928	42 005	42 333
CH4 emission	kt	4.956	5.036	5.043	5.003	5.090	4.811	4.455	4.073	3.860
N2O emission	kt	1.351	1.548	1.666	1.743	1.881	1.953	1.893	1.784	1.833

The decrease in fuel consumption (especially petrol and LPG) for road transport in recent years may be due to the economic downturn, rising of fuel prices and rationalization of transportation by transport companies. There is a growing trend of consumption of biofuels in road transport – share in 2014 was about 5%. Amounts of biofuels used in years 1988 - 2014 are given in table 3.2.8.5. As the consumption of biofuels in 1.A.3.b is not significant compared to consumption of other fuels, it is not shown in the below figure.

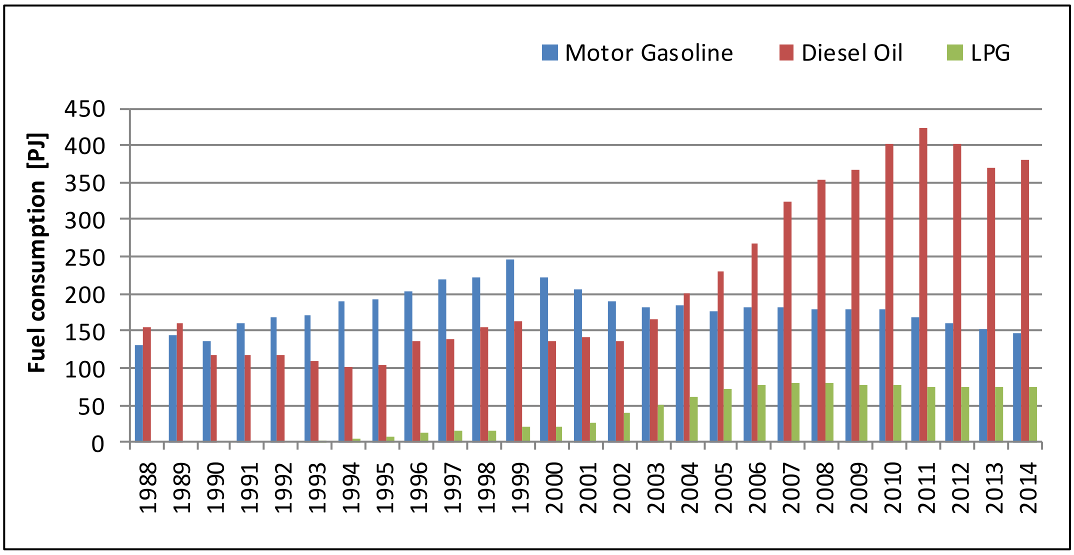

Figure 3.2.8.5. Fuel consumption in 1.A.3.b category for 1988-2014

Figure 3.2.8.6 shows CO_2 emissions in sub-category 1.A.3.b in period 1988-2014. Emissions of CH_4 and N_2O in the same sub-category are shown in figure 3.2.8.7.

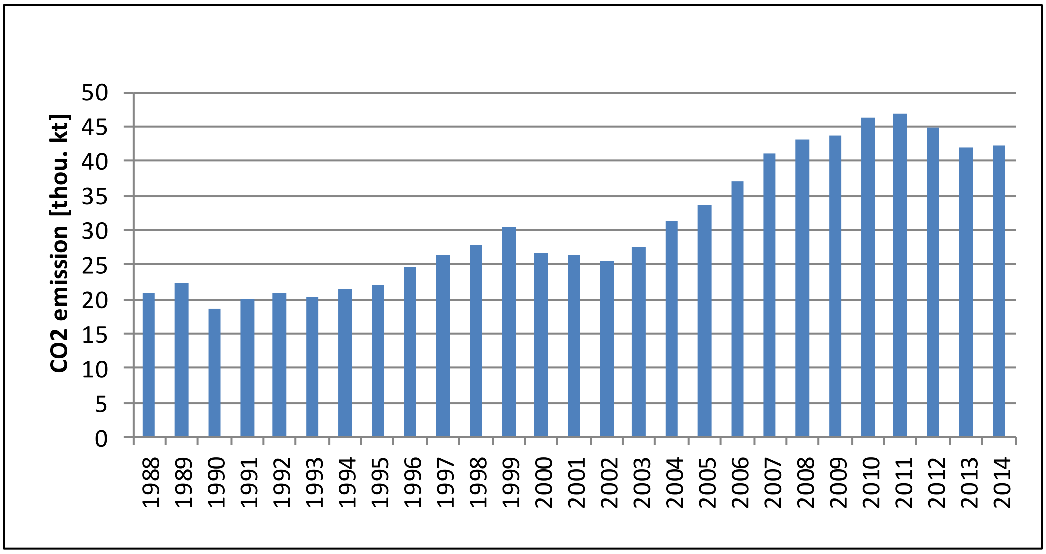

Figure 3.2.8.6. CO_2 emission for 1.A.3.b category in 1988-2014

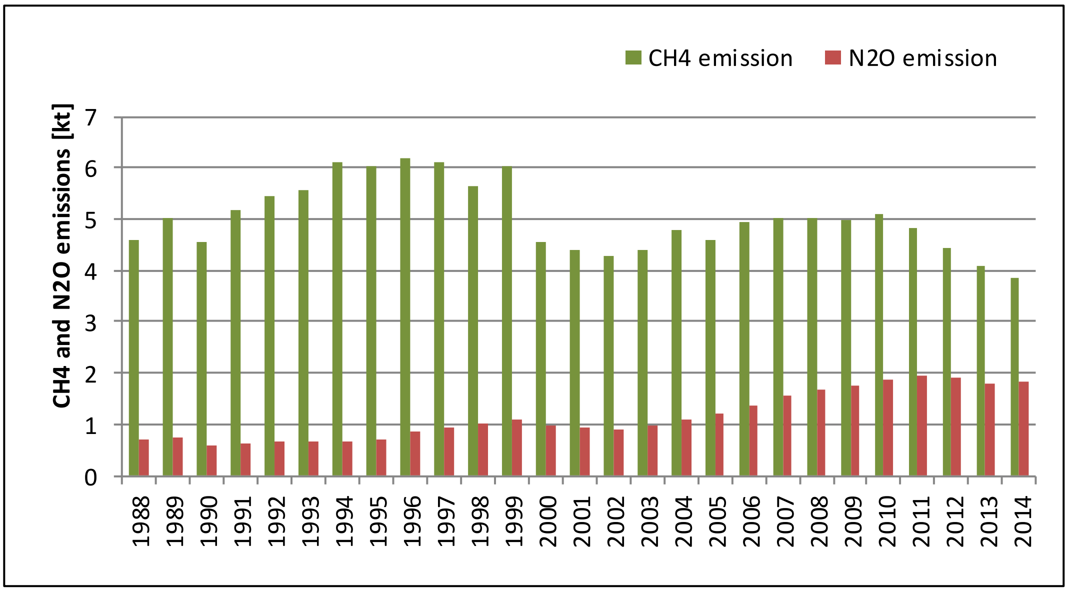

Figure 3.2.8.7. CH_4 and N_2O emissions for 1.A.3.b category in 1988-2014

3.2.8.2.3. Railways (CRF sector1.A.3.c)

Category include emissions from railway transport for both freight and passenger traffic routes. Railway locomotives used in Poland are diesel and electric. Up to year 1998 coal was used in steam locomotives. 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. The amounts of fuels used in railway transport in the 1988-2014 period are shown table 3.2.8.6 and in figure 3.2.8.8.

Table 3.2.8.6. Fuel consumption and GHG emission in years 1988 - 2014

		1988	1989	1990	1991	1992	1993	1994	1995	1996
Hard coal	TJ	10 972	5 785	3 169	1 686	350	293	156	132	192
Diesel oil	TJ	23 600	9 585	17 761	13 556	10 596	10 425	11 798	11 497	9 652
CO2 emission	kt	2 803	1 266	1 621	1 167	819	801	889	865	734
CH4 emission	kt	0.120	0.051	0.080	0.060	0.045	0.044	0.049	0.048	0.040
N2O emission	kt	0.691	0.283	0.513	0.390	0.304	0.299	0.338	0.329	0.276
		1997	1998	1999	2000	2001	2002	2003	2004	2005
Hard coal	TJ	181	138	0	0	0	0	0	0	0
Diesel oil	TJ	8 666	8 151	7 722	7 078	6 907	6 564	6 907	6 907	6 778
CO2 emission	kt	660	617	572	524	512	486	512	512	502
CH4 emission	kt	0.036	0.034	0.032	0.029	0.029	0.027	0.029	0.029	0.028
N2O emission	kt	0.248	0.233	0.221	0.202	0.198	0.188	0.198	0.198	0.194
		2006	2007	2008	2009	2010	2011	2012	2013	2014
Hard coal	TJ	0	0	0	0	0	0	0	0	0
Diesel oil	TJ	6 220	6 135	5 362	5 196	4 806	4 980	4 633	4 287	3 854
CO2 emission	kt	461	455	397	385	356	369	343	318	286
CH4 emission	kt	0.026	0.025	0.022	0.022	0.020	0.021	0.019	0.018	0.016
N2O emission	kt	0.178	0.175	0.153	0.149	0.137	0.142	0.133	0.123	0.110

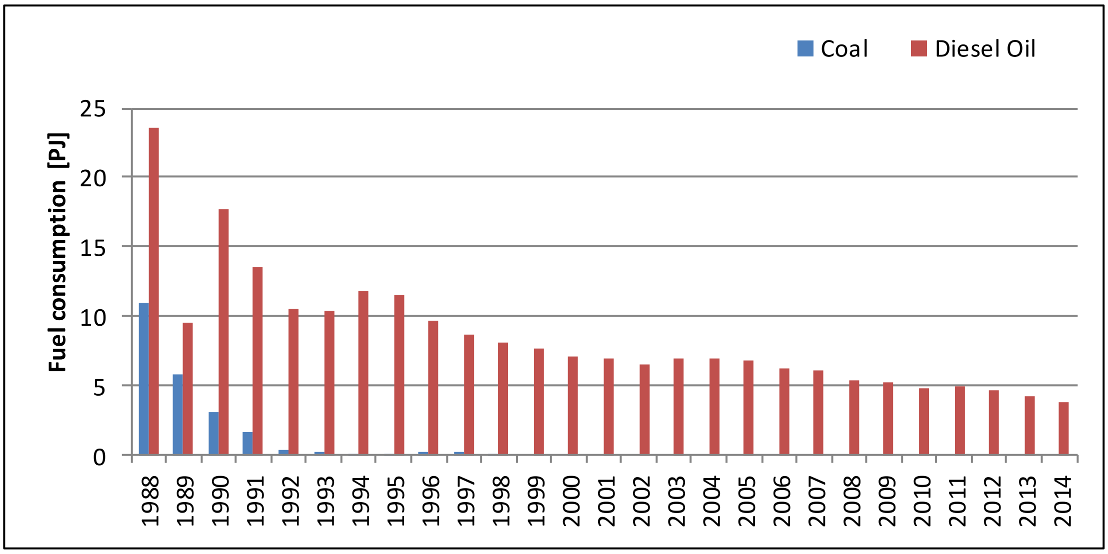

Figure 3.2.8.8. Fuel consumption in 1.A.3.c category for 1988-2014

Figures 3.2.8.9 and 3.2.8.10 show emissions of CO_2, CH_4 and N_2O, respectively in the sub-category 1.A.3.c for the entire time series beginning in the base year.

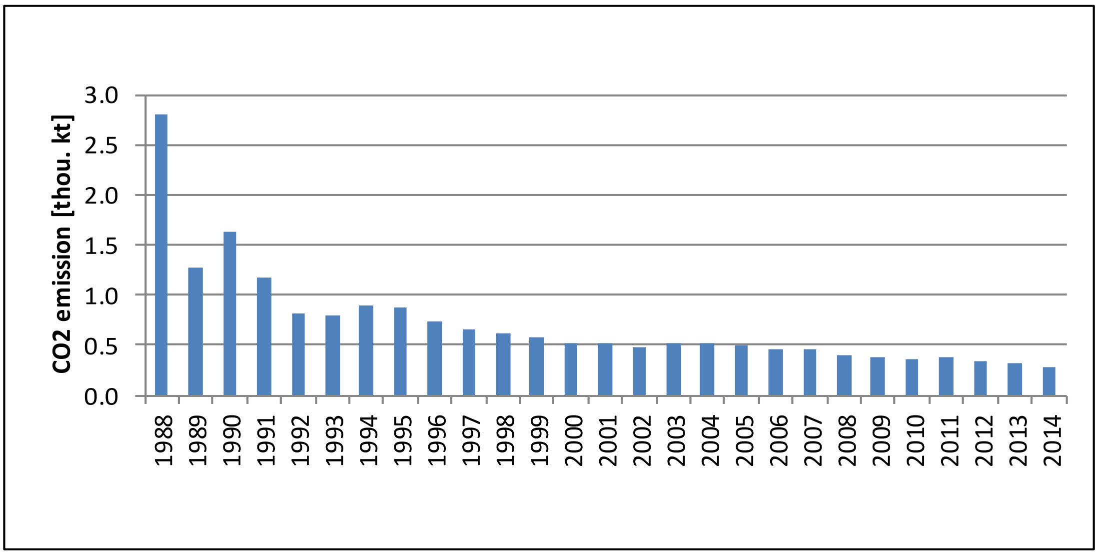

Figure 3.2.8.9. CO_2 emission for 1.A.3.c category in 1988-2014

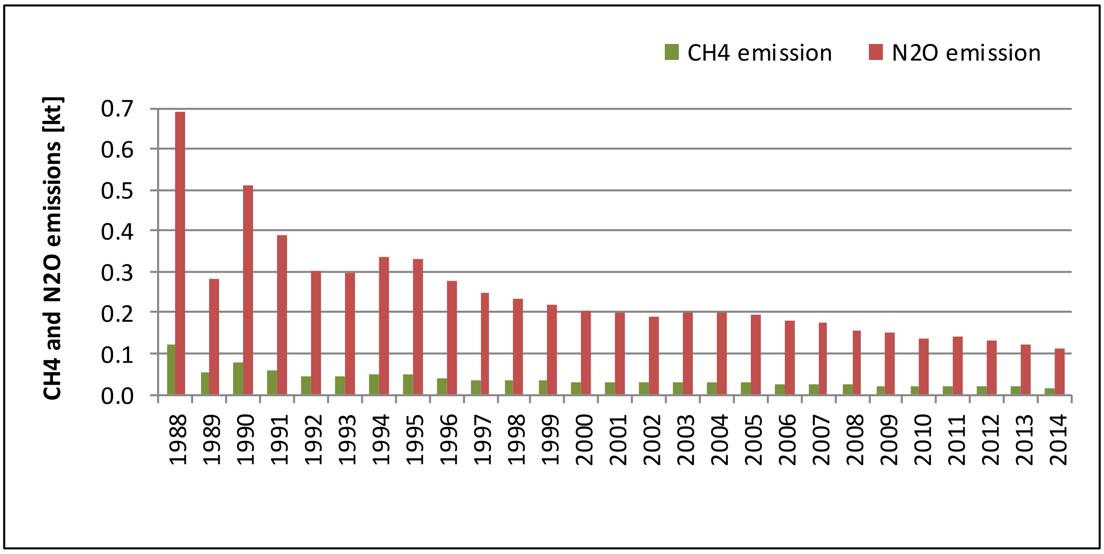

Figure 3.2.8.10. CH_4 and N_2O emissions for 1.A.3.c category in 1988-2014

3.2.8.2.4. Domestic Navigation (CRF sector 1.A.3.d)

Category relates to inland and marine domestic navigation and include emissions from fuels used by vessels of all flags that depart and arrive in the same country. Exclude fishing, which should be reported under 1 A 4 c iii.

The structure of fuels used in Navigation has been recalculated based on G-03 questionnaires and statistical data on levels of international vs. domestic shipping activity (see table 3.2.8.7). The amounts of fuels (diesel and fuel oil) used in both inland water and maritime navigation in the 1988-2014 period are shown in table 3.2.8.8 and figure 3.2.8.11.

The amount of diesel oil used in inland navigation in 2010 is reported in national statistic as zero (see table 3.2.8.7) which results from the unsuitable allocation - the fuel attributed to inland navigation has been moved to the Fishing sector. This data in the energy balance will be corrected in national statistic and related emissions in the nearest future.

Table 3.2.8.7. Cargo traffic at Polish seaports.

Cargo traffic	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998
International	kt	45 901	40 671	43 558	49 814	51 148	48 179	47 925	50 630	50 564
Domestic	kt	1 138	1 009	744	711	1 327	1 142	1 068	355	432
Share of domestic	%	2.4	2.4	1.7	1.4	2.5	2.3	2.2	0.7	0.8
		1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
International	kt	49 227	47 334	47 220	48 404	51 020	56 011	58 489	59 137	51 604
Domestic	kt	453	537	534	562	866	907	990	1 182	830
Share of domestic	%	0.9	1.1	1.1	1.1	1.7	1.6	1.7	2.0	1.6
		2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**		
International	kt	47 806	44 250	58 613	56 609	57 728	62 898	67 776		
Domestic	kt	1 027	829	893	1 129	1 098	1 206	1 159		
Share of domestic	%	2.1	1.8	1.5	2.0	1.9	1.9	1.7		

Table 3.2.8.8. Fuel consumption and GHG emission in years 1988 - 2014

		1988	1989	1990	1991	1992	1993	1994	1995	1996
Diesel oil-inland navigation	TJ	968.83	681.61	858.00	686.00	815.00	686.00	300.00	686.00	686.00
Diesel oil - maritime	TJ	239.59	236.54	232.96	183.59	119.30	82.08	97.98	93.40	72.68
Fuel oil - maritime	TJ	894.34	878.75	900.55	825.50	546.35	340.58	425.53	428.31	399.10
CO2 emission	kt	158.77	136.05	150.54	128.33	111.52	83.28	62.43	90.90	87.11
CH4 emission	kt	0.015	0.013	0.014	0.012	0.010	0.008	0.006	0.008	0.008
N2O emission	kt	0.004	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Diesel oil-inland navigation	TJ	644.00	386.00	300.00	257.00	257.00	214.00	300.00	257.00	214.00
Diesel oil - maritime	TJ	27.93	27.25	25.20	24.52	19.76	19.60	31.67	22.84	30.42
Fuel oil - maritime	TJ	127.94	156.91	142.74	138.76	133.80	133.37	182.04	85.41	60.55
CO2 emission	kt	59.69	42.77	35.15	31.60	30.86	27.63	38.67	27.35	22.80
CH4 emission	kt	0.006	0.004	0.003	0.003	0.003	0.003	0.004	0.003	0.002
N2O emission	kt	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Diesel oil-inland navigation	TJ	257.00	214.00	214.00	130.00	0.00	130.00	130.00	130.00	130.00
Diesel oil - maritime	TJ	31.48	24.15	26.70	16.49	9.22	10.46	10.14	13.39	11.43
Fuel oil - maritime	TJ	80.26	65.28	63.97	38.21	12.78	14.79	11.06	23.32	19.41
CO2 emission	kt	27.59	22.70	22.79	13.81	1.67	11.55	11.24	12.43	11.98
CH4 emission	kt	0.003	0.002	0.002	0.001	0.000	0.001	0.001	0.001	0.001
N2O emission	kt	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000

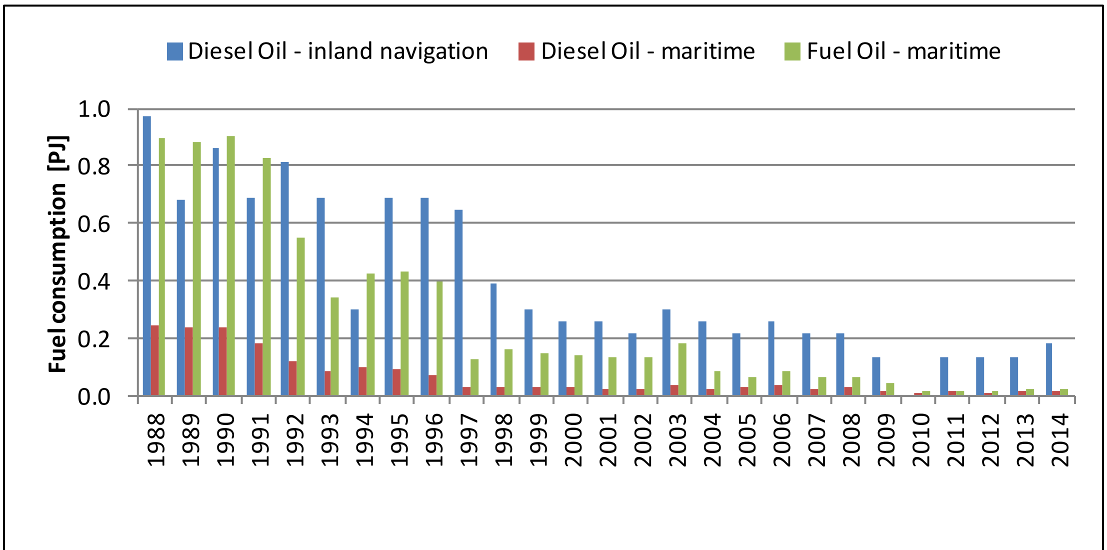

Figure 3.2.8.11. Fuel consumption in 1.A.3.d category for 1988-2014

Figures 3.2.8.12 and 3.2.8.13 show emissions of CO_2, CH_4 and N_2O, respectively in the sub-category 1.A.3.d for the entire time series 1988-2014.

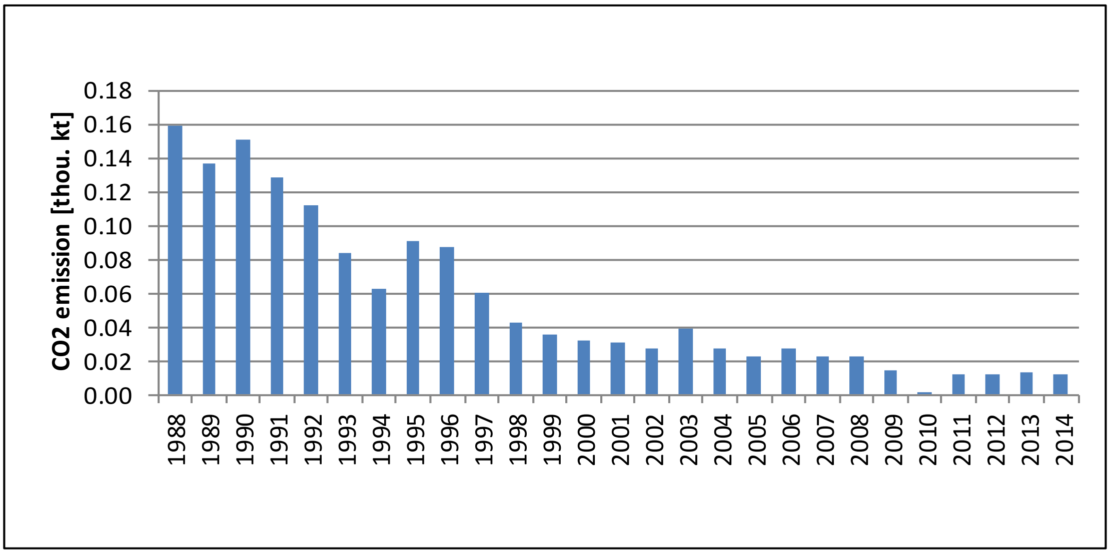

Figure 3.2.8.12. CO_2 emission for 1.A.3.d category in 1988-2014

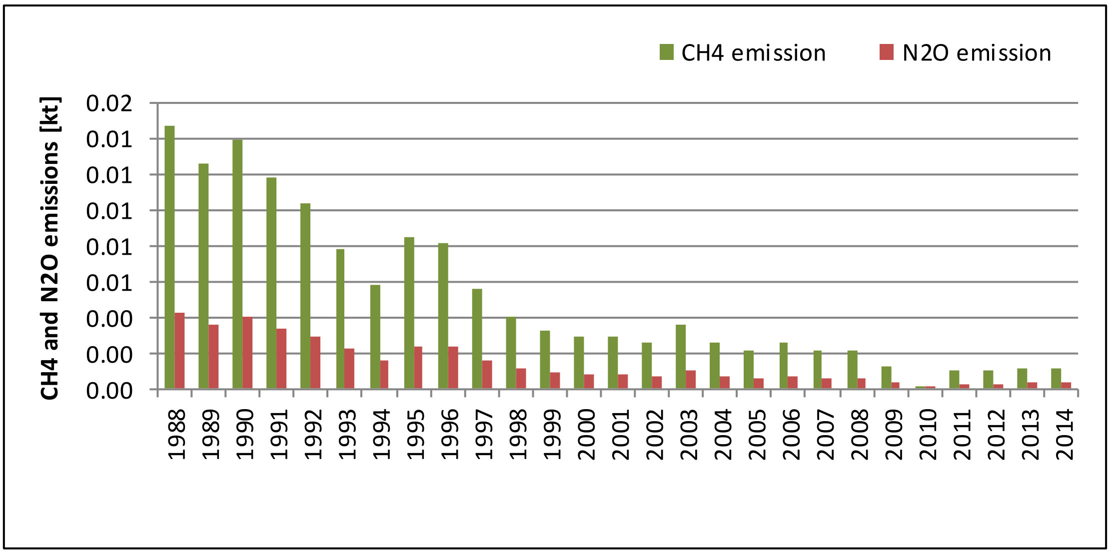

Figure 3.2.8.13. CH_4 and N_2O emissions for 1.A.3.d category in 1988-2014

3.2.8.2.5. Other transportation (CRF sector 1.A.3.e)

Pipeline transport contains combustion related emissions from the operation of pump stations and maintenance of pipelines. From year 2000, when gas pipeline Jamal was completed, the amount of this fuel increased sharply from 21 TJ in 1999 to 2498 TJ in 2000.

The amounts of fuels consumption in the sub-category 1.A.3.e.i. *Pipelines transport* in the 1988-2014 period are shown in table 3.2.8.9 Natural gas consumption is shown on figure 3.2.8.14.

Table 3.2.8.9. Fuel consumption and GHG emission in years 1988 - 2014

		1988	1989	1990	1991	1992	1993	1994	1995	1996
Gasoline	TJ	0	0	0	0	0	0	0	0	0
Diesel oil	TJ	0	0	0	0	0	0	0	0	0
Natural gas	TJ	0	0	0	0	0	0	1	7	24
CO2 emission	kt	0	0	0	0	0	0	0.06	0.39	1.34
CH4 emission	kt	0	0	0	0	0	0	0.000001	0.000007	0.000024
N2O emission	kt	0	0	0	0	0	0	0.000000	0.000001	0.000002
		1997	1998	1999	2000	2001	2002	2003	2004	2005
Gasoline	TJ	0	0	0	0	45	45	45	45	45
Diesel oil	TJ	0	0	0	43	43	0	43	43	43
Natural gas	TJ	26	23	21	2 498	3 262	3 502	5 257	7 381	9 866
CO2 emission	kt	1.45	1.28	1.17	142.59	188.32	198.57	299.68	418.25	556.96
CH4 emission	kt	0.000026	0.000023	0.000021	0.002627	0.003526	0.003637	0.005521	0.007645	0.010130
N2O emission	kt	0.000003	0.000002	0.000002	0.000276	0.000379	0.000377	0.000579	0.000791	0.001039
		2006	2007	2008	2009	2010	2011	2012	2013	2014
Gasoline	TJ	0	45	0	45	0	0	0	0	0
Diesel oil	TJ	43	43	43	43	43	43	43	43	43
Natural gas	TJ	12 912	11 828	13 442	11 084	9 269	9 299	10 806	15 422	15 143
CO2 emission	kt	723.90	666.47	742.79	619.04	513.43	522.22	606.34	864.00	848.43
CH4 emission	kt	0.013041	0.012092	0.013571	0.011348	0.009398	0.009428	0.010935	0.015551	0.015272
N2O emission	kt	0.001317	0.001236	0.001370	0.001161	0.000953	0.000956	0.001106	0.001568	0.001540

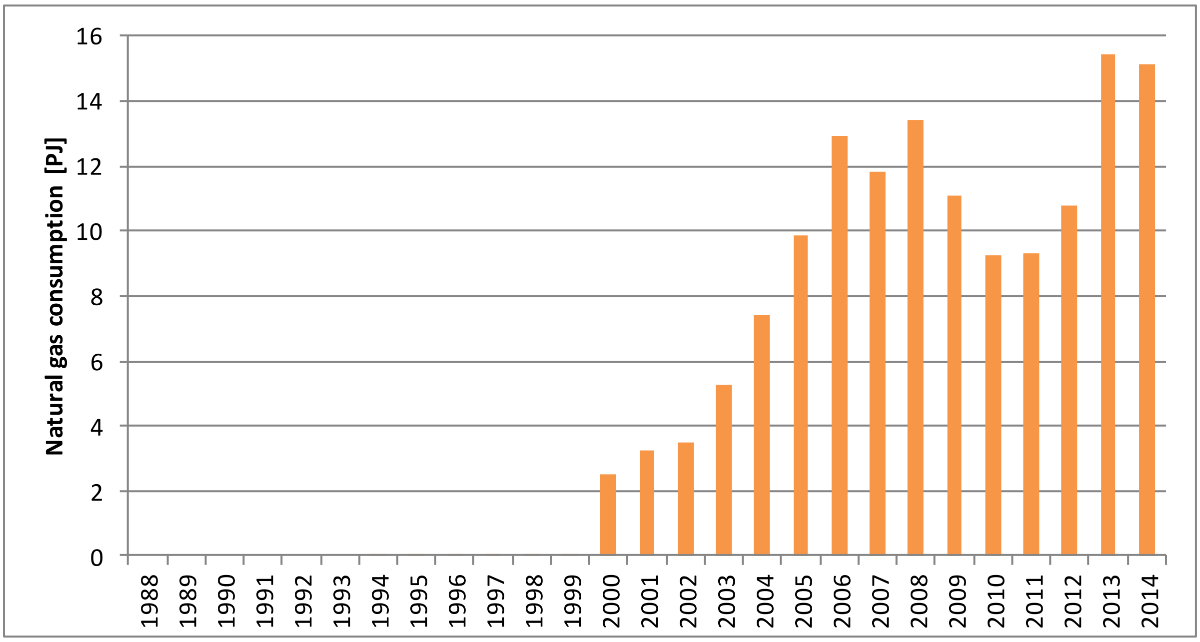

Figure 3.1.8.14. Natural gas consumption in *Pipelines transport* category for 1988-2014

Figures 3.2.8.15 and 3.2.8.16 show respectively emissions of CO_2, CH_4 and N_2O, in the sub-category 1.A.3.e from Pipelines for the entire time series 1988-2014.

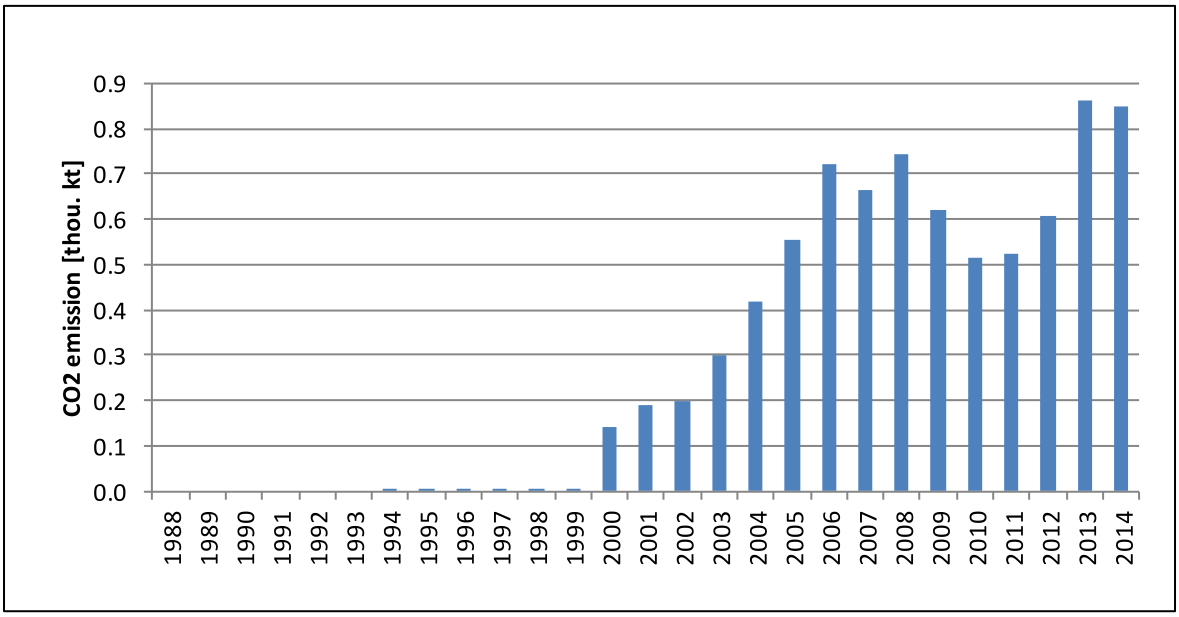

Figure 3.2.8.16. CO_2 emission from Pipelines category in 1988-2014

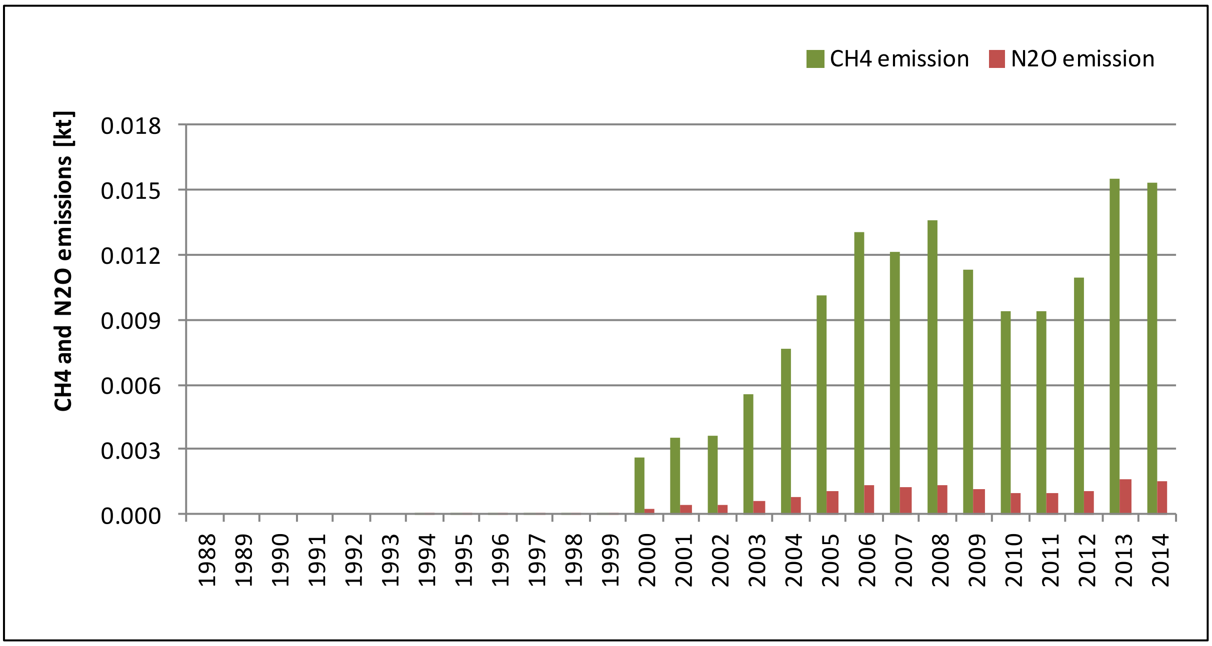

Figure 3.2.17. CH_4 and N_2O emissions from Pipelines category in 1988-2014

3.2.8.2.6. Other mobile sources outside of the source category 1.A.3

Other mobile sources included in the national inventory in sub-categories other than 1.A.3 include:

- machinery and off-road transport in agriculture (sub-category 1.A.4.c.ii) – classified in source category 1.A.4
- fishery (sub-category 1.A.4.c.iii) - classified in source category 1.A.4

The amounts of fuels used in the above listed sub-categories in the 1988-2014 period are presented in table 3.2.8.4 and figure 3.2.8.17. The amounts of corresponding emissions of CO_2, CH_4 and N_2O are shown in tables 3.2.8.10–3.2.8.12 and figures 3.2.8.18 and 3.2.8.19.

Table 3.2.8.10. Fuel consumption in 1988-2014 in mobile sources in subcategories other than 1.A.3

		1988	1989	1990	1991	1992	1993	1994	1995	1996
ON-1.A.4.c.ii	PJ	49.42	47.82	50.53	48.68	57.21	72.16	78.15	82.28	91.81
ON-1.A.4.c.iii	PJ	4.55	4.15	3.44	3.31	3.45	2.83	3.24	3.18	2.57
OP-1.A.4.c.iii	PJ	7.54	6.87	5.62	5.41	5.64	4.62	5.28	5.18	4.20
		1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
ON-1.A.4.c.ii	PJ	106.80	97.17	99.52	110.25	102.78	102.47	103.68	105.60	108.03
ON-1.A.4.c.iii	PJ	2.68	1.93	1.94	1.72	1.81	1.77	1.43	1.61	1.37
OP-1.A.4.c.iii	PJ	4.37	3.15	3.16	2.80	2.95	2.90	2.33	2.62	2.23
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
ON-1.A.4.c.ii	PJ	80.22	73.74	73.79	71.69	71.91	72.49	73.03	71.40	68.96
ON-1.A.4.c.iii	PJ	1.29	1.33	1.28	1.92	1.57	1.64	1.66	1.78	1.62
OP-1.A.4.c.iii	PJ	2.10	2.18	2.09	3.11	2.53	2.65	2.68	2.88	2.62

Table 3.2.8.11. GHG emission in 1988-2014 in subcategory 1.A.4.c.ii.

1.A.4.c.ii		1988	1989	1990	1991	1992	1993	1994	1995	1996
CO2 emission	kt	3 662	3 544	3 744	3 607	4 239	5 347	5 791	6 097	6 803
CH4 emission	kt	0.205	0.198	0.210	0.202	0.237	0.299	0.324	0.341	0.381
N2O emission	kt	1.413	1.368	1.445	1.392	1.636	2.064	2.235	2.353	2.626
1.A.4.c.ii		**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
CO2 emission	kt	7 914	7 200	7 374	8 170	7 616	7 593	7 682	7 825	8 005
CH4 emission	kt	0.443	0.403	0.413	0.458	0.427	0.425	0.430	0.438	0.448
N2O emission	kt	3.055	2.779	2.846	3.153	2.940	2.931	2.965	3.020	3.090
1.A.4.c.ii		**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
CO2 emission	kt	5 944	5 464	5 468	5 312	5 329	5 372	5 412	5 291	5 110
CH4 emission	kt	0.333	0.306	0.306	0.297	0.298	0.301	0.303	0.296	0.286
N2O emission	kt	2.294	2.109	2.110	2.050	2.057	2.073	2.089	2.042	1.972

Table 3.2.8.12. GHG emission in 1988-2014 in subcategory 1.A.4.c.iii.

1.A.4.c.iii		1988	1989	1990	1991	1992	1993	1994	1995	1996
CO2 emission	kt	921	839	690	664	692	567	648	637	516
CH4 emission	kt	0.085	0.077	0.063	0.061	0.064	0.052	0.060	0.059	0.047
N2O emission	kt	0.024	0.022	0.018	0.017	0.018	0.015	0.017	0.017	0.014
1.A.4.c.iii		**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
CO2 emission	kt	537	387	388	344	362	356	286	322	274
CH4 emission	kt	0.049	0.036	0.036	0.032	0.033	0.033	0.026	0.030	0.025
N2O emission	kt	0.014	0.010	0.010	0.009	0.010	0.009	0.008	0.008	0.007
1.A.4.c.iii		**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
CO2 emission	kt	258	267	257	383	312	326	330	354	322
CH4 emission	kt	0.024	0.025	0.024	0.035	0.029	0.030	0.030	0.033	0.030
N2O emission	kt	0.007	0.007	0.007	0.010	0.008	0.009	0.009	0.009	0.008

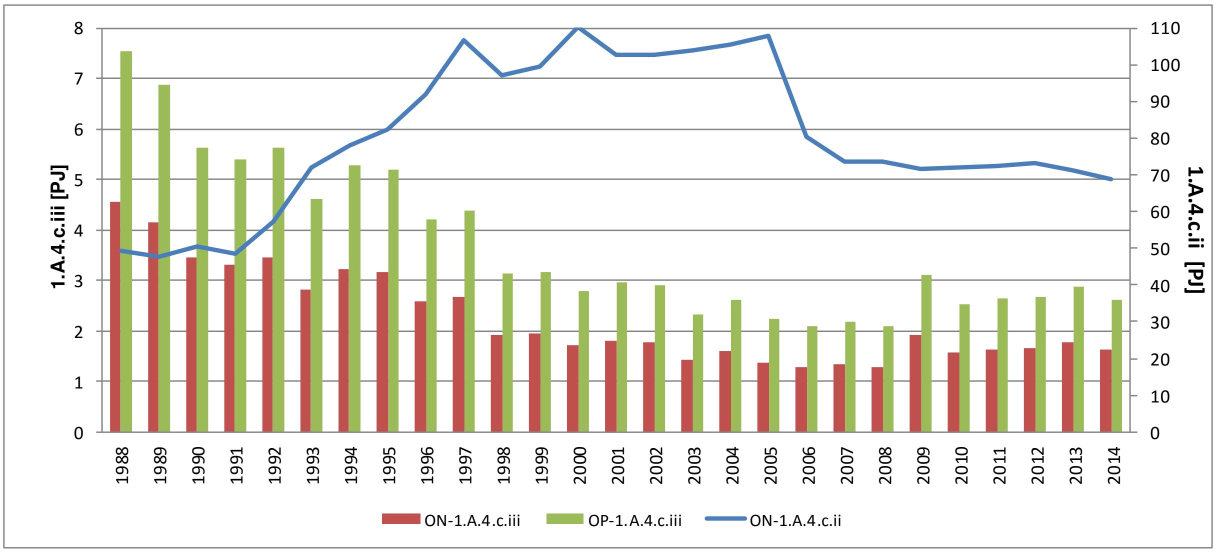

Figure 3.2.8.17. Fuel consumption in 1988-2014 in mobile sources in subcategories other than 1.A.3

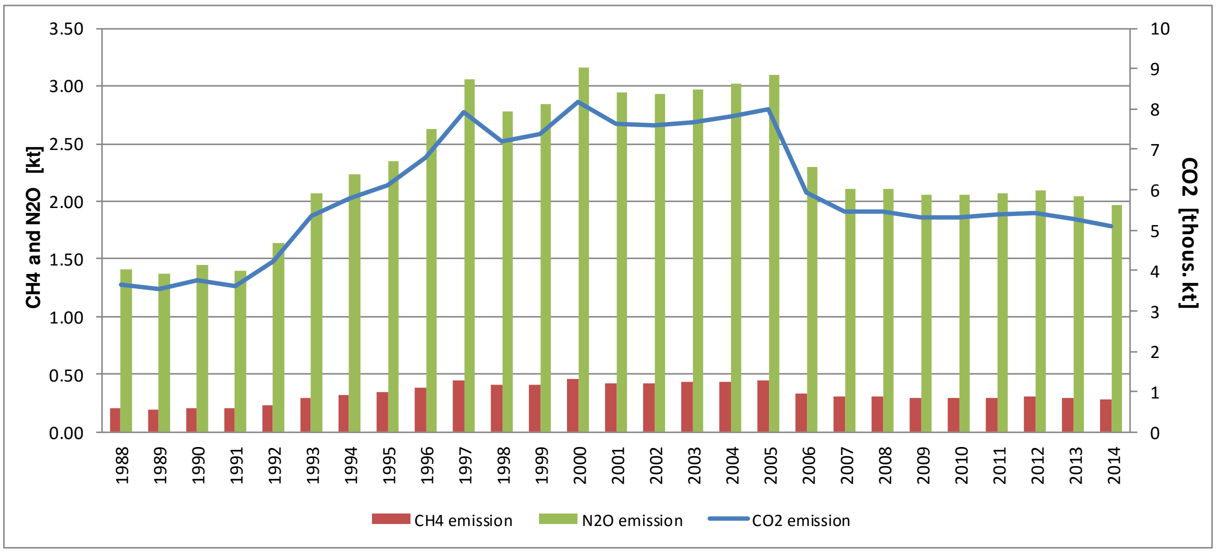

Figure 3.2.8.18. GHG emission in 1988-2014 in subcategory 1.A.4.c.ii.

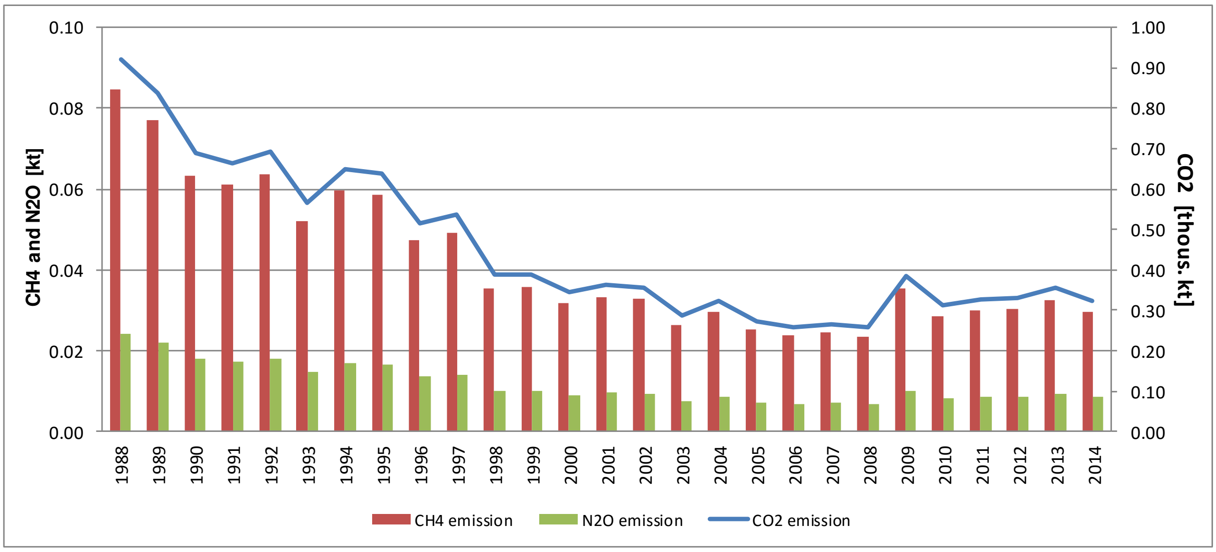

Figure 3.2.8.19. GHG emission in 1988-2014 in subcategory 1.A.4.c.iii.

3.2.8.3. Uncertainties and time-series consistency

See chapter 3.2.6.3

3.2.8.4. Source-specific QA/QC and verification

See chapter 3.2.6.4

3.2.8.5. Source-specific recalculations

- fuel consumption in all 1.A.3. subsectors was updated based on actual Eurostat data;
- in sector 1.A.3.a *Domestic aviation* share of domestic use of jet kerosene was updated based on actual Eurocontrol data;
- in sectors 1.A.3.a,c,d emission factors were updated based on IPCC 2006 guidelines.

Table 3.2.8.13. Changes in GHG emission in subsector 1.A.3.a. *Domestic aviation* resulting from recalculations.

Difference	1988	1989	1990	1991	1992	1993	1994	1995	1996
kt CO_2 eq.	-5.64	-6.53	-2.85	-2.48	-2.20	-2.48	-3.36	-3.08	-3.02
%	-4.22	-4.19	-4.19	-4.15	-4.09	-4.12	-4.19	-4.16	-4.11
Difference	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
kt CO_2 eq.	-3.05	-2.80	-2.42	-2.55	-2.52	-2.62	-2.79	-2.60	-2.62
%	-4.14	-4.12	-4.11	-4.10	-4.10	-4.12	-4.12	-4.10	-3.20
Difference	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	
kt CO_2 eq.	-4.60	-3.94	-4.25	-4.07	-3.11	-3.89	-13.49	-36.13	
%	-4.76	-4.09	-4.34	-4.23	-2.88	-3.29	-7.66	-23.98	

Table 3.2.8.14. Changes in GHG emission in subsector 1.A.3.b. *Road transport* resulting from recalculations.

Difference	1988	1989	1990	1991	1992	1993	1994	1995	1996
kt CO_2 eq.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Difference	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
kt CO_2 eq.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Difference	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	
kt CO_2 eq.	0.00	0.00	0.00	-0.28	-0.20	-0.19	-0.17	0.00	
%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Table 3.2.8.15. Changes in GHG emission in subsector 1.A.3.c. *Railways* resulting from recalculations.

Difference	1988	1989	1990	1991	1992	1993	1994	1995	1996
kt CO_2 eq.	168.36	67.56	129.87	99.58	78.50	77.20	87.47	85.24	71.59
%	5.92	5.26	7.89	8.41	9.44	9.49	9.68	9.70	9.60
Difference	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
kt CO_2 eq.	64.22	60.43	57.32	52.54	51.27	48.72	51.27	51.27	50.31
%	9.58	9.64	9.86	9.86	9.86	9.86	9.86	9.86	9.86
Difference	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	
kt CO_2 eq.	46.17	45.54	39.80	38.57	35.67	36.97	34.39	31.82	
%	9.86	9.86	9.86	9.86	9.86	9.86	9.86	9.86	

Table 3.2.8.16. Changes in GHG emission in subsector 1.A.3.d. *Navigation* resulting from recalculations.

Difference	1988	1989	1990	1991	1992	1993	1994	1995	1996
kt CO_2 eq.	-7.12	-5.06	-6.33	-5.08	-5.95	-4.99	-2.24	-5.00	-5.00
%	-4.25	-3.55	-4.00	-3.77	-5.02	-5.59	-3.42	-5.17	-5.37
Difference	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
kt CO_2 eq.	-4.64	-2.80	-2.18	-1.87	-1.87	-1.56	-2.19	-1.86	-1.55
%	-7.15	-6.08	-5.78	-5.53	-5.66	-5.30	-5.30	-6.31	-6.29
Difference	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	
kt CO_2 eq.	-1.86	-1.55	-1.55	-0.94	0.00	-0.93	-0.93	-0.94	
%	-6.25	-6.32	-6.30	-6.31	-0.15	-7.42	-7.60	-6.94	

3.2.8.6. Source-specific planned improvements

developing a methodology to split domestic and international aviation bunker fuels and estimating emissions from aviation;

improving the methodology of estimating emissions from road transport.

3.2.9. Other sectors (CRF sector 1.A.4)

3.2.9.1. Source category description

Emissions in 1.A.4 *Other Sectors* are estimated for each fuel in detailed sub-categories given below:

a) *Commercial/Institutional* (1.A.4.a)
b) *Residential* (1.A.4.b)
c) *Agriculture/Forestry/Fishing* (1.A.4.c)
  - agriculture – stationary sources,
  - agriculture – mobile sources: off-road vehicles and other machinery,
  - fishing.

Subsector 1.A.4.b *Residential* is by far the largest contributor to emissions from this category (see figure 3.2.9.1) – about 66.5 % in 2014.

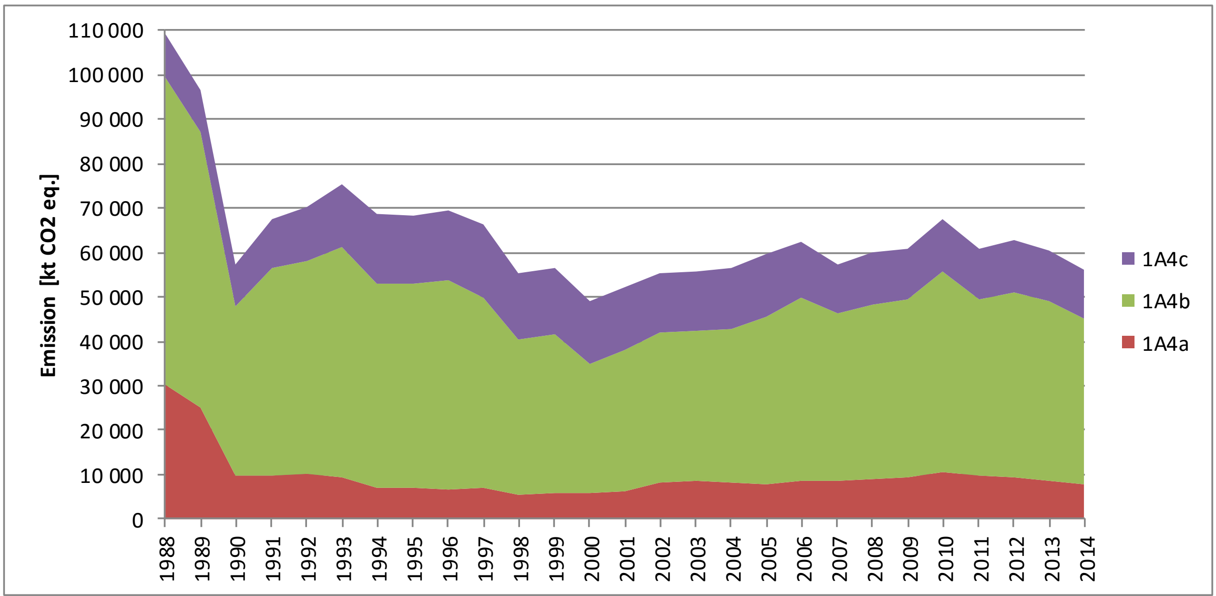

Figure 3.2.9.1. GHG emissions from 1.A.4. *Other sectors* in years 1988-2014 according to subcategories

3.2.9.2. Methodological issues

Methodology of emission estimation in 1.A.4 subcategory corresponds with methodology described for fuel combustion in stationary sources. Detailed information on fuel consumption and applied emission factors for subsectors included in 1.A.4 subcategory are presented in Annex 2.

3.2.9.2.1. Other Sectors – Commercial/Institutional (1.A.4.a)

The data on fuel type use in the sub-category 1.A.4.a *Other Sectors – Commercial/Institutional* over the 1988-2014 period are presented in table 3.5.9.1. Detailed data concerning fuel consumption in 1.A.4.a subcategory was tabulated in Annex 2 (table 11).

Table 3.5.9.1. Fuel consumption in 1988-2014 in 1.A.4.a subcategory [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	0.000	0.000	0.000	0.000	0.000	0.000	1.334	0.782
Gaseous Fuels	13.079	12.601	13.787	10.977	11.190	11.548	9.573	13.260
Solid Fuels	297.025	244.614	91.215	92.072	95.735	86.052	64.046	62.499
Other Fuels	2.135	0.144	0.504	0.081	0.011	0.352	0.089	0.000
Biomass	0.084	0.123	4.880	3.132	0.206	12.374	11.968	11.983
TOTAL	**312.322**	**257.481**	**110.386**	**106.262**	**107.142**	**110.326**	**87.010**	**88.524**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	1.769	6.118	7.784	10.346	16.522	21.281	22.808	24.014
Gaseous Fuels	18.771	24.256	32.769	37.696	38.567	49.971	61.001	67.057
Solid Fuels	52.142	48.086	29.849	27.864	22.004	17.283	29.822	29.723
Other Fuels	0.124	0.000	0.003	0.004	0.024	0.091	0.101	0.071
Biomass	10.625	9.627	9.085	9.216	9.192	6.596	6.430	6.452
TOTAL	**83.431**	**88.087**	**79.490**	**85.126**	**86.309**	**95.222**	**120.162**	**127.317**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	21.300	17.813	28.496	27.788	27.328	25.682	30.953	28.986
Gaseous Fuels	69.570	68.410	63.517	65.488	71.250	75.746	83.433	78.278
Solid Fuels	28.433	28.087	32.202	27.900	30.862	33.550	38.105	33.664
Other Fuels	0.002	0.022	0.000	0.000	0.037	0.123	0.026	0.046
Biomass	6.586	6.514	5.085	6.563	6.815	8.779	9.859	9.781
TOTAL	**125.891**	**120.846**	**129.300**	**127.739**	**136.292**	**143.880**	**162.376**	**150.755**
	2012	**2013**	**2014**					
Liquid Fuels	22.450	18.007	18.448					
Gaseous Fuels	80.888	76.501	67.429					
Solid Fuels	34.142	31.724	28.043					
Other Fuels	0.037	0.421	0.231					
Biomass	9.113	9.560	8.814					
TOTAL	**146.630**	**136.213**	**122.965**					

Figures 3.5.9.2 and 3.5.9.3 show emissions of CO_2, CH_4 and N_2O, respectively in the sub-category 1.A.4.a in the period 1988-2014.

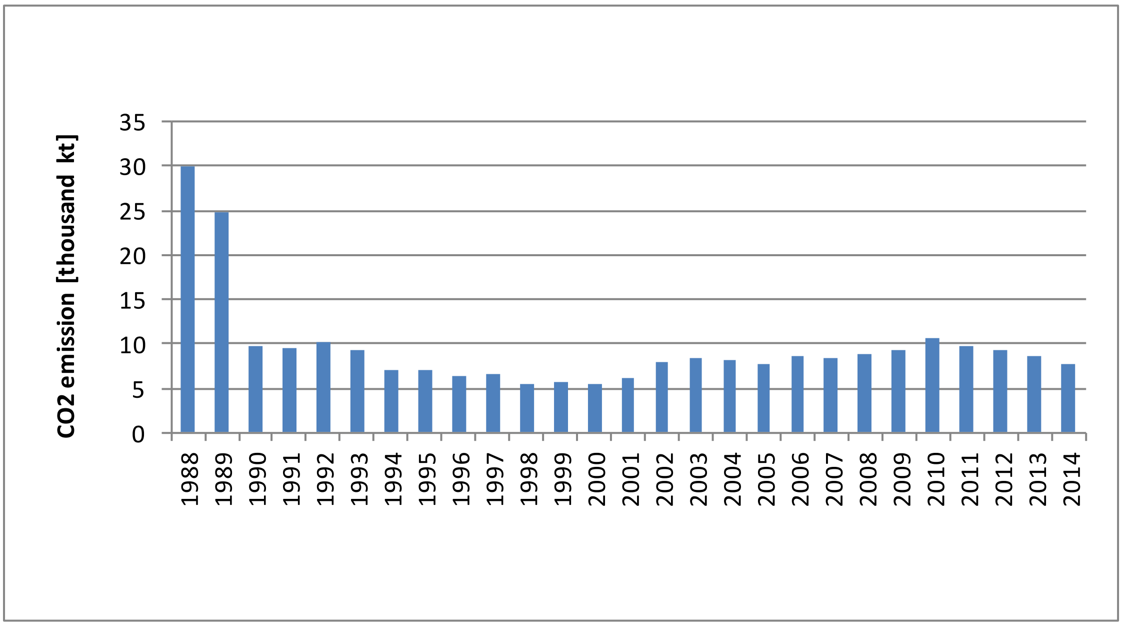

Figure 3.5.9.2. CO_2 emission for 1.A.4.a category in 1988-2014

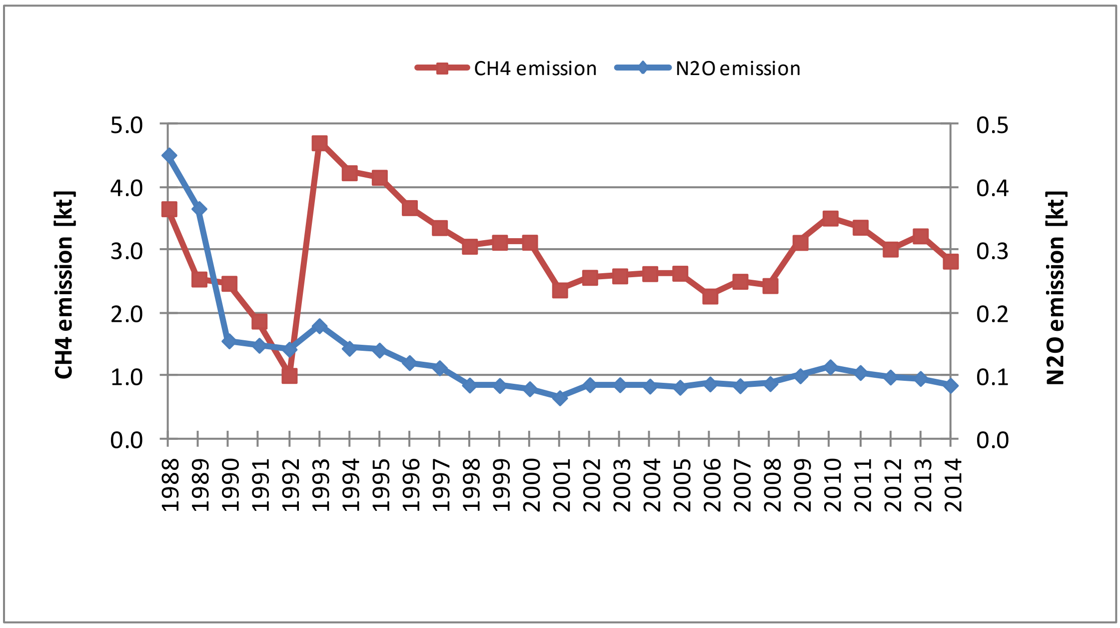

Figure 3.5.9.3. CH_4 and N_2O emissions for 1.A.4.a category in 1988-2014

3.2.9.2.2. Residential (CRF sector 1.A.4.b)

The data on fuel type use in stationary sources in the sub-category 1.A.4.b *Residential* over the 1988-2014 period are presented in table 3.5.2. Detailed information on fuel consumption for 1.A.4.b subcategory are presented in Annex 2 (table 12).

Table 3.5.2. Fuel consumption in 1988-2014 in 1.A.4.b subcategory [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	6.762	7.452	1.702	1.012	1.840	6.072	8.970	12.834
Gaseous Fuels	102.581	107.619	122.204	133.674	141.212	141.590	151.671	159.559
Solid Fuels	617.874	546.675	307.564	385.686	390.347	413.265	346.089	339.463
Other Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	33.615	32.351	34.335	27.721	33.969	106.000	104.715	105.000
TOTAL	**760.831**	**694.097**	**465.805**	**548.093**	**567.368**	**666.927**	**611.445**	**616.856**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	18.245	24.835	26.980	29.101	37.400	42.150	44.342	48.252
Gaseous Fuels	143.057	150.022	138.268	135.995	127.611	133.737	127.093	127.629
Solid Fuels	358.593	307.562	235.470	243.304	179.024	198.224	219.937	217.497
Other Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	101.000	100.000	100.700	95.000	95.000	104.500	104.500	103.075
TOTAL	**620.895**	**582.419**	**501.418**	**503.400**	**439.035**	**478.611**	**495.872**	**496.453**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	45.370	42.305	42.305	39.364	35.963	33.264	29.386	27.763
Gaseous Fuels	126.376	135.111	138.686	132.622	131.450	134.857	148.427	135.471
Solid Fuels	228.811	255.087	290.173	260.866	279.849	288.024	330.381	285.169
Other Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	103.360	100.700	104.500	102.000	102.500	102.500	112.746	115.000
TOTAL	**503.917**	**533.203**	**575.664**	**534.852**	**549.762**	**558.645**	**620.940**	**563.403**
	2012	**2013**	**2014**					
Liquid Fuels	26.767	25.084	25.571					
Gaseous Fuels	141.397	143.187	131.598					
Solid Fuels	301.038	289.864	265.515					
Other Fuels	0.000	0.000	0.000					
Biomass	116.850	116.850	105.450					
TOTAL	**586.052**	**574.985**	**528.134**					

Figure 3.5.9.4 show emissions of CO_2 in 1.A.4.b in the 1988-2014 period while CH_4 and N_2O, emissions in the same sub-category are shown in figure 3.5.9.5.

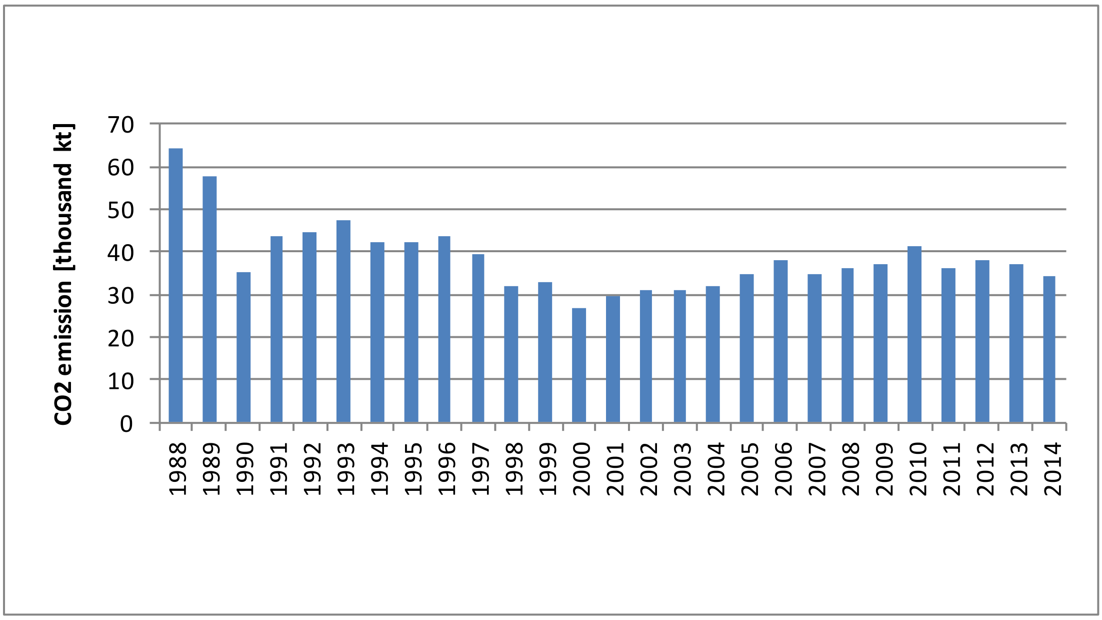

Figure 3.5.9.4. CO_2 emission for 1.A.4.b category in 1988-2014

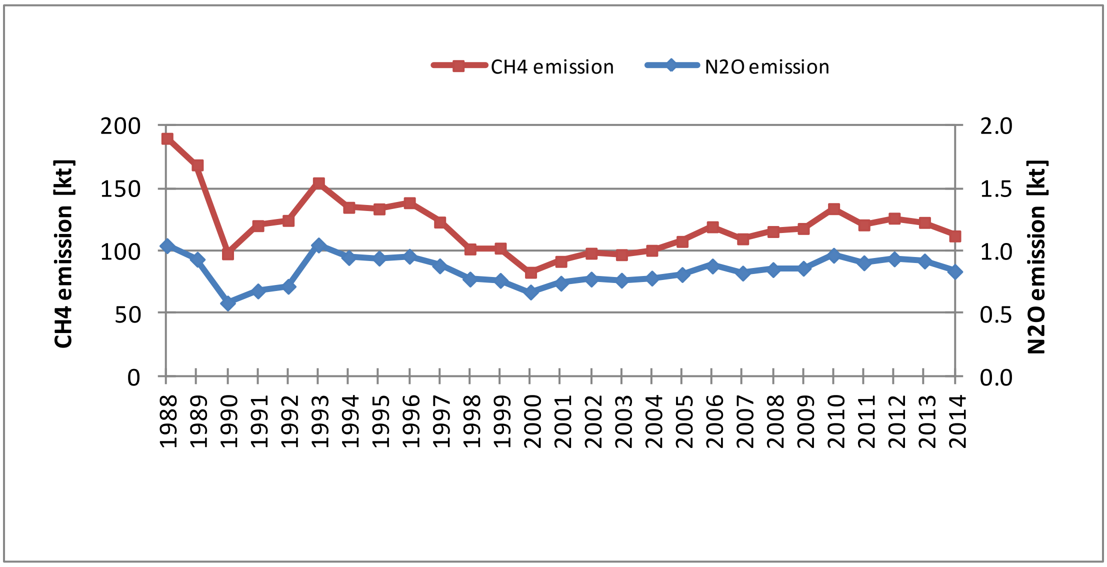

Figure 3.5.9.5. CH_4 and N_2O emissions for 1.A.4.b category in 1988-2014

3.2.9.2.3. Agriculture/Forestry/Fishing – stationary sources (CRF sector 1.A.4.c)

The data on fuel type use in stationary sources in the sub-category 1.A.4.c Agriculture/Forestry/ Fishing over the 1988-2014 period are presented in table 3.5.9.3. Detailed data concerning total fuel consumption in 1.A.4.c subcategory (including fuel consumption related to off-road vehicles and other machinery in agriculture and fuel use in fishing) was tabulated in Annex 2 (table 13).

Table 3.5.9.3. Fuel consumption in stationary sources in 1.A.4.c subcategory for years 1988-2014 [PJ]

	1988	1989	1990	1991	1992	1993	1994	1995
Liquid Fuels	2.720	2.600	3.560	2.720	1.440	14.074	18.302	10.532
Gaseous Fuels	0.507	0.445	0.448	0.275	0.055	0.132	0.212	0.243
Solid Fuels	42.691	42.026	39.465	59.710	64.662	63.946	66.261	64.299
Other Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	0.039	0.113	0.039	0.278	0.583	20.057	18.367	18.500
TOTAL	**45.956**	**45.185**	**43.512**	**62.983**	**66.740**	**98.209**	**103.142**	**93.574**
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Liquid Fuels	6.272	9.152	8.182	8.437	8.832	8.483	6.909	9.374
Gaseous Fuels	0.428	0.571	0.868	0.476	0.536	0.777	0.914	1.197
Solid Fuels	68.014	58.905	53.170	55.389	37.590	41.916	35.065	34.071
Other Fuels	0.000	0.000	0.000	0.006	0.012	0.011	0.000	0.000
Biomass	17.567	17.000	17.100	17.100	17.100	19.043	19.010	19.017
TOTAL	**92.281**	**85.628**	**79.320**	**81.408**	**64.070**	**70.230**	**61.898**	**63.659**
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Liquid Fuels	9.404	10.689	4.334	3.724	3.930	3.495	3.265	3.671
Gaseous Fuels	1.182	1.084	1.492	1.840	1.900	1.577	1.486	1.531
Solid Fuels	35.838	39.001	46.028	40.728	45.335	44.947	49.927	43.882
Other Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	19.878	19.038	19.977	19.061	19.118	19.127	21.127	24.154
TOTAL	**66.302**	**69.812**	**71.831**	**65.353**	**70.283**	**69.146**	**75.805**	**73.238**
	2012	**2013**	**2014**					
Liquid Fuels	3.705	2.905	3.284					
Gaseous Fuels	1.796	1.501	1.438					
Solid Fuels	45.552	44.603	42.540					
Other Fuels	0.000	0.000	0.000					
Biomass	21.200	21.223	19.638					
TOTAL	**72.253**	**70.232**	**66.900**					

Figures 3.5.9.6 and 3.5.9.7 show emissions of CO_2, and CH_4 and N_2O, respectively in the sub-category 1.A.4.c.i in the period: 1988-2014.

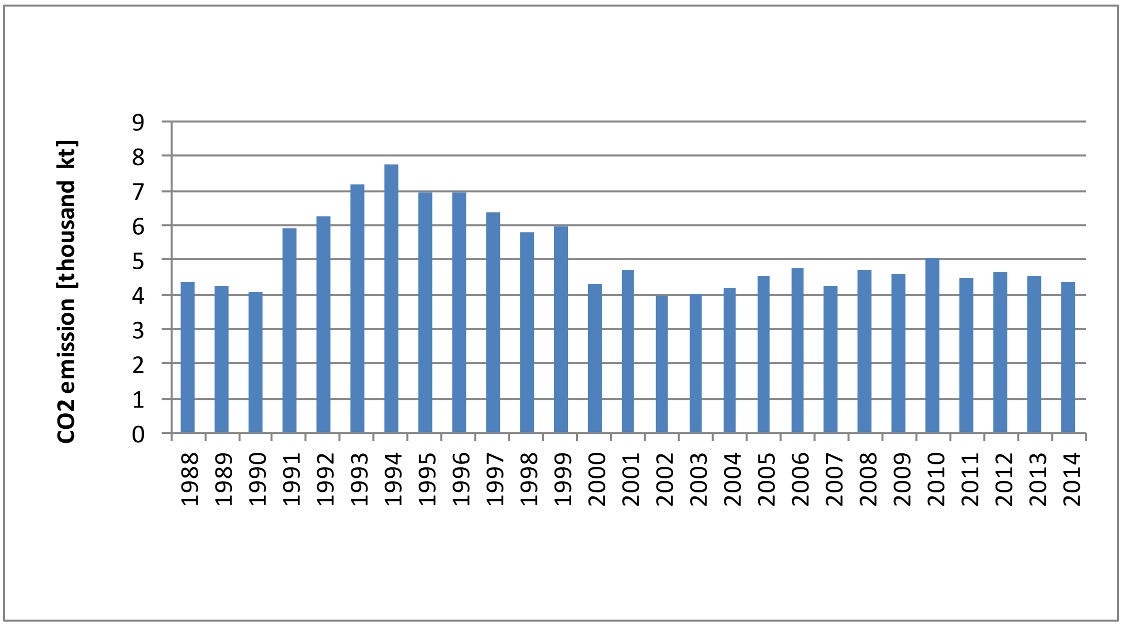

Figure 3.5.9.6. CO_2 emission for stationary sources in 1.A.4.c category in 1988-2014

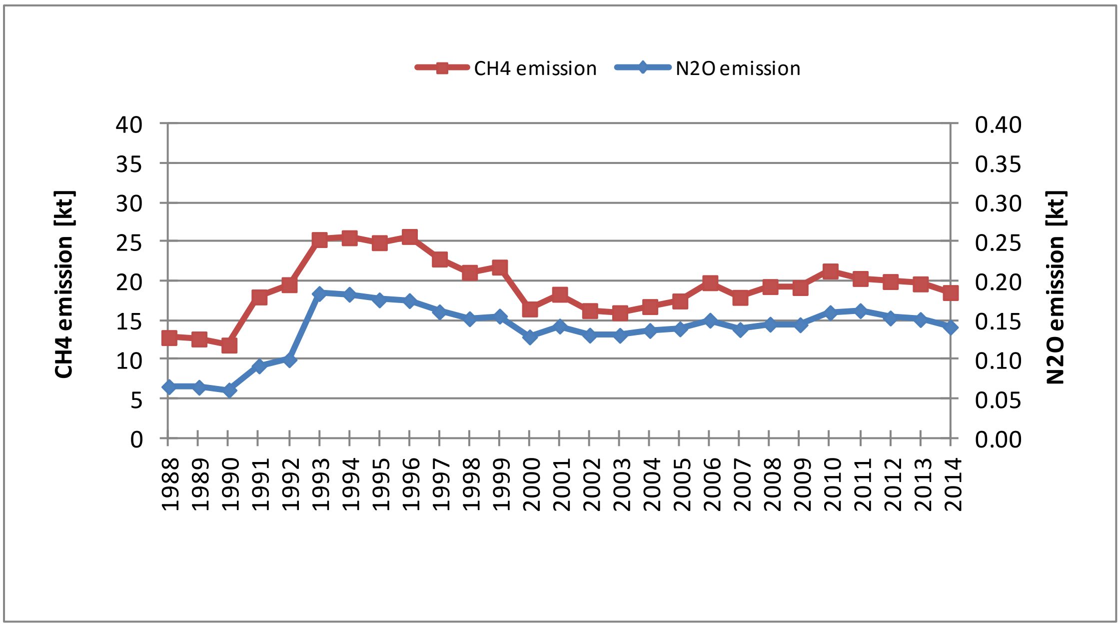

Figure 3.5.9.7. CH_4 and N_2O emissions for stationary sources in 1.A.4.c category in 1988-2014

The mobile sources classified in the sub-category 1.A.4.c (i.e. off-road vehicles and other machinery in agriculture and fishing) are described in chapter 3.2.8.2.6.

3.2.9.3. Uncertainties and time-series consistency

See chapter 3.2.6.3

3.2.9.4. Source-specific QA/QC and verification

See chapter 3.2.6.4

3.2.9.5. Source-specific recalculations

fuel consumptions for the years 1990-2013 were updated according to current Eurostat database, insignificant corrections were introduced in AD relating to NCV fuel use in mobile sources (1.A.4.c).

Table. 3.2.9.4. Changes in GHG emissions in 1.A.4 subsector as a result of recalculations

Changes	1988	1989	1990	1991	1992	1993	1994	1995
				CO2				
kt	0.00	0.00	-4.35	-4.18	-4.36	-3.58	-4.09	-4.01
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				CH4				
kt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				N2O				
kt	0.000	0.000	-0.001	-0.001	-0.001	0.000	-0.001	0.000
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Changes	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
				CO2				
kt	-3.25	-3.38	-2.44	-2.45	-2.17	-2.28	-2.24	-1.81
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				CH4				
kt	0.000	0.000	0.000	-0.002	-0.010	-0.003	-0.003	-0.004
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				N2O				
kt	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Changes	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
				CO2				
kt	-2.03	-1.73	-1.63	-1.68	-1.62	-2.41	-2484.48	0.40
%	0.0	0.0	0.0	0.0	0.0	0.0	-3.8	0.0
				CH4				
kt	-0.004	-0.009	-0.009	-0.005	0.005	0.006	-7.702	0.000
%	0.0	0.0	0.0	0.0	0.0	0.0	-4.6	0.0
				N2O				
kt	0.000	0.000	0.000	0.000	0.000	0.000	-0.041	0.000
%	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0

Changes	2012	2013
CO2		
kt	-2.07	2.21
%	0.0	0.0
CH4		
kt	0.000	0.015
%	0.0	0.0
N2O		
kt	0.000	0.000
%	0.0	0.0

3.2.9.6. Source-specific planned improvements

analysis of the possibility of country specific EF elaboration for the gaseous fuels in Polish fuel structure.

3.3. Fugitive emissions (CRF sector 1.B)

3.3.1. Fugitive emission from solid fuels (CRF sector 1.B.1)

3.3.1.1. Source category description

Fugitive emission from solid fuels involves emission from coal mining and handling (CH_4) and emission from coke oven gas subsystem (CO_2 and CH_4).

The biggest share of emission in 1.B category comes from coal mining and handling. The hard coal and lignite extraction are presented at the graph bellow (Figure 3.3.1). The main reason for the decreasing coal extraction since late 1980s was the declining demand for coal and lignite in economy.

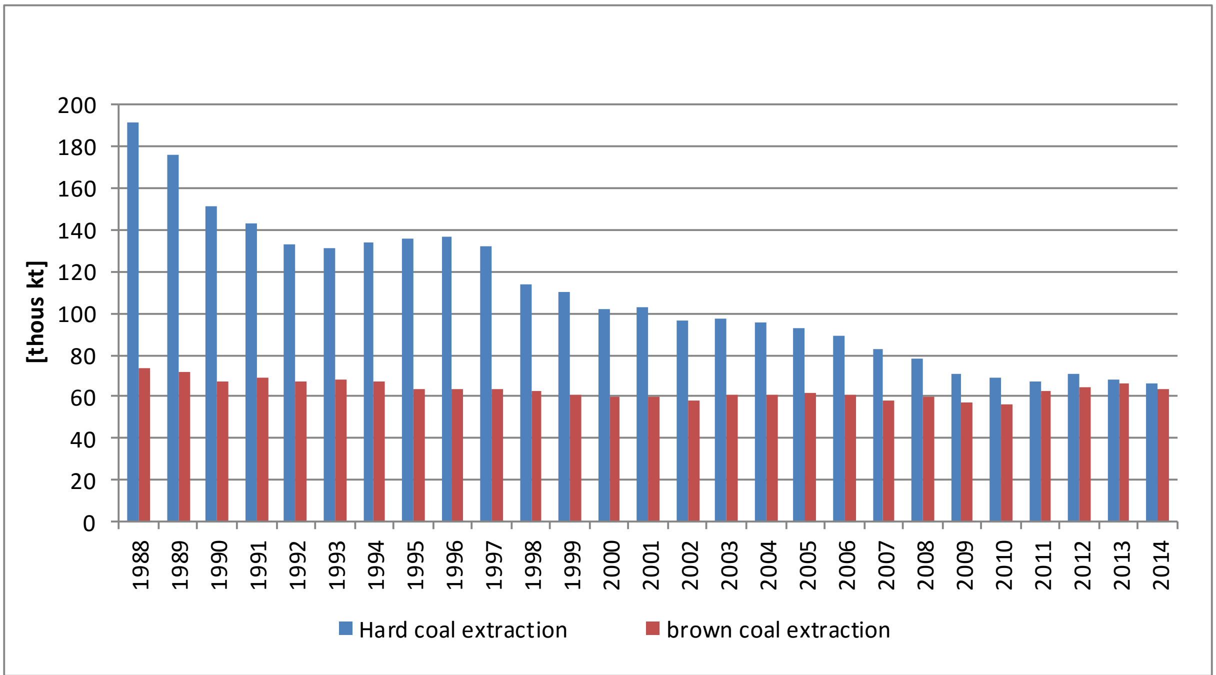

Figure 3.3.1. Hard coal and lignite extraction in 1988-2014.

3.3.1.2. Methodological issues

<u>3.3.1.2.1 Fugitive emissions from fuels – coal mining (CRF sector 1.B.1.a.)</u>

<u>Coal Mining and Handling – underground mines (1.B.1.a.i.)</u>

Coal production in 2014 was to 65 969 kt and compared to the previous year, was lower by 2 430 kt [Polish Geological Institute (PIG) 2015].
Tier 1 method has been used for calculation of fugitive emissions from coal mining and post-mining [IPCC 2006, page 4.11-4.12]

Fugitive emission of CH_4 from coal mining and post-mining was estimated based on the activity data concerning hard coal extraction amount from the study published by Polish Geological Institute [PIG. 2015] and emission factors presented in table 3.3.1. have been taken from IPCC 2006.

Table 3.3.1. CH_4 Emission factor for calculation mining and post-mining emission from coal mines

CH_4 emission factor	
Mining	6.80 [m^3CH_4/t; IPCC 1996, table I-54 str.1.105]
Post -Mining	2.50 [m^3CH_4/t; IPCC 2006, page 4.12]

Tier 1 method was used for calculation of fugitive emissions from abandoned underground mines, [IPCC 2006, page 4.21 equation 4.1.9.] Fugitive emission of CH_4 from coal mining and post-mining was estimated based on number of abandoned underground mines from the data provided by State Mining Authority [SMA- 2014] and emission factors from IPCC 2006 – table 4.1.5, 4.1.6, and 4.1.7.

Table 3.3.2 shows data on hard coal extraction, total methane emissions from coal mines and emission from abandoned underground mines, in 1988-2014 .

Table 3.3.2. Hard coal extraction, total methane emissions from coal mines and abandoned underground mines, in 1988-2014 .

Year	Hard coal extraction [kt]	CH_4 Emissions [kt]	Emission from abandoned underground mines [kt CH_4]
1988	191 624	1 194.01	10.46
1989	175 947	1 096.33	10.46
1990	151 321	942.88	10.46
1991	143 131	891.85	8.94
1992	132 730	827.04	12.26
1993	131 400	818.75	7.18
1994	134 078	835.44	6.62
1995	135 523	844.44	6.17
1996	136 272	849.11	5.80
1997	132 576	826.08	5.48
1998	113 859	709.46	5.21
1999	109 986	685.32	4.98
2000	102 081	636.07	4.78
2001	102 477	638.53	49.95
2002	96 160	599.17	20.88
2003	97 274	606.11	15.35
2004	95 623	595.83	12.66
2005	93 006	579.52	11.02
2006	89 342	556.69	9.87
2007	82 779	515.80	9.01
2008	77 989	485.95	8.35
2009	70 500	439.29	7.80
2010	69 186	431.12	7.36
2011	67 637	421.45	6.98
2012	71 339	444.51	6.65
2013	68 399	426.19	6.36
2014	65 969	411.05	6.11

Coal Mining and Handling – surface mines (1.B.1.a.ii.)

Tier 1 method was used for calculation of fugitive emissions from coal mining and post-mining [IPCC 2006, page 4.18-4.19]
Fugitive emission of CH_4 from coal mining and post-mining was estimated based on the activity data concerning lignite extraction amount from the study published by Polish Geological Institute [PIG. 2014] and emission factors from IPCC 2006. (table 3.3.3.).

Table 3.3.3. CH_4 Emission factor for calculation mining and post-mining emission from surface coal mining.

CH_4 emission factor	
Mining	1.20 [m^3CH_4/t; IPCC 2006, table I-54 str.4.18]
Post -Mining	0.1 [m^3CH_4/t; IPCC 2006, page 4.19]

The conversion factor applied for recalculation of emitted methane volume to mass of CH_4 is 0.67 kg/m^3.

In table 3.3.4 are shown data on lignite extraction and total related methane emissions in 1988-2014.

Table 3.3.4. Lignite extraction and total methane emissions from lignite mines in 1988-2014.

Year	Lignite extraction [kt]	CH_4 Emissions [kt]
1988	73 970 000	64.43
1989	72 000 000	62.71
1990	67 680 000	58.95
1991	68 720 000	59.86
1992	66 900 000	58.27
1993	68 200 000	59.40
1994	66 780 000	58.17
1995	63 550 000	55.35
1996	63 850 000	55.61
1997	63 200 000	55.05
1998	62 880 000	54.77
1999	60 860 000	53.01
2000	59 490 000	51.82
2001	59 550 000	51.87
2002	58 240 000	50.73
2003	60 920 000	53.06
2004	61 190 000	53.30
2005	61 610 000	53.66
2006	60 850 000	53.00
2007	57 700 000	50.26
2008	59 500 000	51.82
2009	57 060 000	49.70
2010	56 520 000	49.23
2011	62 890 000	54.78
2012	64 297 000	56.00
2013	66 139 000	57.61
2014	64 002 000	55.75

3.3.1.2.2. Fugitive emission from solid fuel transformation (1.B.1.b.)

Processing emission of CO_2 from coking plants in the period 1990-2014 was estimated based on carbon budgets in the coking plants (tab. 3.3.4). Data concerning input and output are based on [Eurostat] and [GUS 1991a-2013a]. Coke productions for 1990-2014 were applied according to data in Eurostat [Eurostat].

The Eurostat database does not cover energy balances for Poland for the years before 1990 so data on input and output in coking plants (i.e. coke output) applied for C balance in coke production process for the period: 1988-1989 were taken from IEA database [IEA].

The amounts of carbon in the input and output components used in C balances for entire period were calculated based on IPCC factors [IPCC 1997, IPCC 2006].

Fuels given as the input in C balance for coke production process (tab. 3.3.5) did not include the fuels for energy purpose of the process. Emission from coke production given in 1.A.1.c subcategory was related to the fuel consumption for energy purpose of the coke plants, so double counting should not be the case in GHG inventory.

CO_2 emission from coke production in Polish GHG inventory is split between two sub-categories and is reported under following sub-sectors:

1.A.1.c – includes the emission estimated based on fuel use. given in Eurostat database as *Consumption of the energy branch – Coke-oven and gas-works plants* (it means based on fuel consummated for own energy purpose)

2.C.1 – includes the emission calculated based on C balance (i.e. carbon emission = carbon content in transformation output – carbon content in transformation input)

CH_4 emission in the period 1990-2013 was estimated based on coke production volume from [Eurostat] while for 1988 and 1989 from [IEA]. For the entire period emission factor equal 0.1g CH_4/Mg coke produced [IPCC 2006; table 4.2., page 4.26] was applied.

Table 3.3.5. Carbon balance for coke production in years 1988-2014.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
INPUT [TJ]													
Coking coal	**656 592**	**637 742**	**535 538**	**448 105**	**437 665**	**405 168**	**436 596**	**451 761**	**403 902**	**423 800**	**377 787**	**338 208**	**366 814**
High Methane Natural Gas	0	1239	0	0	0	0	0	0	0	0	0	0	0
Coke			969	542	1767	1568	2394	2337	1824	1682	2109	1482	2024
Blast furnace gas	0	152	0	0	0	0	0	0	0	0	0	0	0
Tar	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial waste	7	0	0										
NCV [MJ/kg]													
Coking coal	29.41	29.41	29.41	29.41	29.41	29.41	28.49	29.36	29.36	29.45	29.54	29.48	29.62
INPUT – Material-specific carbon content [kg C/GJ]													
Coking coal	26.02	26.02	26.02	26.02	26.02	26.02	26.06	26.03	26.03	26.02	26.02	26.02	26.02
High Methane Natural Gas	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3
Coke	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5
Blast furnace gas	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0
Tar	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Industrial waste	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0
INPUT – Carbon contents in charge components [kt]													
Coking coal	17087.6	16597.0	13937.2	11661.8	11390.1	10544.3	11378.1	11757.8	10512.1	11028.5	9829.9	8800.9	9543.2
High Methane Natural Gas	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coke	0.0	0.0	28.6	16.0	52.1	46.3	70.6	68.9	53.8	49.6	62.2	43.7	59.7
Blast furnace gas	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial waste	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbon contents in charge – SUM [kt]	**17087.8**	**16626.0**	**13965.7**	**11677.7**	**11442.2**	**10590.6**	**11448.7**	**11826.7**	**10565.9**	**11078.2**	**9892.1**	**8844.6**	**9602.9**
OUTPUT [TJ]													
Coke	**471501.8**	**455831.8**	385206.0	323646.0	315381.0	292838.0	326468.0	329973.0	294662.0	300248.0	277761.0	238488.0	255702.0
Coke-Oven Gas	**118914.6**	**117040.4**	96832.0	84743.0	82307.0	75753.0	84002.0	84767.0	76036.0	79286.0	73457.0	62989.0	68849.0
Tar	27580.0	27429.3	22885.3	20268.2	20648.1	19071.4	21146.6	21265.0	19831.9	19600.4	17949.6	16264.8	17003.0
Benzol	7701.5	7230.9	6166.9	5150.7	5646.2	5159.1	6010.6	6056.5	5446.7	5428.6	4856.9	4524.7	2498.5
OUTPUT – Material-specific carbon content [kg C/GJ]													
Coke	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5
Coke-Oven Gas	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
Tar	22	22	22	22	22	22	22	22	22	22	22	22	22
Benzol	23	23	23	23	23	23	23	23	23	23	23	23	23
OUTPUT – Carbon content in products [kt]													
Coke	13909.3	13447.0	11363.6	9547.6	9303.7	8638.7	9630.8	9734.2	8692.5	8857.3	8193.9	7035.4	7543.2
Coke-Oven Gas	1545.9	1521.5	1258.8	1101.7	1070.0	984.8	1092.0	1102.0	988.5	1030.7	954.9	818.9	895.0
Tar	606.8	603.4	503.5	445.9	454.3	419.6	465.2	467.8	436.3	431.2	394.9	357.8	374.1
Benzol	177.1	166.3	141.8	118.5	129.9	118.7	138.2	139.3	125.3	124.9	111.7	104.1	57.5
Carbon content in products – SUM [kt]	**16239.1**	**15738.3**	**13267.7**	**11213.6**	**10957.9**	**10161.7**	**11326.3**	**11443.3**	**10242.6**	**10444.1**	**9655.5**	**8316.1**	**8869.8**
C process emission[kt]	**848.8**	**887.7**	**698.0**	**464.2**	**484.3**	**428.8**	**122.4**	**383.4**	**323.3**	**634.1**	**236.6**	**528.4**	**733.2**
CO_2 process emission[kt]	**3112.1**	**3254.8**	**2559.5**	**1701.9**	**1775.9**	**1572.4**	**448.8**	**1405.9**	**1185.5**	**2324.9**	**867.5**	**1937.6**	**2688.3**
Coke output [kt]	17007	16499	13516	11356	11066	10275	11455	11578	10339	10535	9746	8368	8972
EF [kg CO_2/Mg of coke]	**183**	**197**	**189**	**150**	**160**	**153**	**39**	**121**	**115**	**221**	**89**	**232**	**300**

Table 3.3.5. (cont.) Carbon balance for coke production in years 1988-2014.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
INPUT [TJ]														
Coking coal	362 343	353 752	410 854	405 806	335 694	383 094	402 391	389 792	274 662	381 938	364 348	350 150	371 333	375 885
High Methane Natural Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke	1 054	1 710	1 568	1 710	2 138	2 366	2 650	3 050	1 938	3 021	2 964	2 366	1 710	1 938
Blast furnace gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tar	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial waste	0	0	0	0	0	0	0	0	0	3.5	0	0	0	0
NCV [MJ/kg]														
Coking coal	29.53	29.53	29.56	29.55	29.51	29.59	29.50	29.57	29.56	29.49	29.52	29.60	29.59	29.55
INPUT – Material-specific carbon content [kg C/GJ]														
Coking coal	26.02	26.02	26.02	26.02	26.02	26.02	26.02	26.02	26.02	26.02	26.0	26.0	26.0	26.0
High Methane Natural Gas	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3
Coke	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5
Blast furnace gas	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0
Tar	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Industrial waste	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0	39.0
INPUT – Carbon contents in charge components [kt]														
Coking coal	9428.2	9204.6	10689.9	10558.7	8735.0	9967.2	10470.6	10141.8	7146.4	9938.6	9480.5	9110.0	9661.2	9779.6
High Methane Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coke	31.1	50.4	46.3	50.4	63.1	69.8	78.2	90.0	57.2	89.1	87.4	69.8	50.4	57.2
Blast furnace gas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial waste	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Carbon contents in charge – SUM [kt]	**9459.3**	**9255.1**	**10736.2**	**10609.1**	**8798.1**	**10037.0**	**10548.8**	**10231.8**	**7203.6**	**10027.8**	**9567.9**	**9179.8**	**9711.6**	**9836.8**
OUTPUT [TJ]														
Coke	254961.0	248606.0	288192.0	287764.0	239514.0	273970.0	289788.0	287138.0	202094.0	280554.0	267244.0	253450.0	266760.0	272688.0
Coke-Oven Gas	69008.0	65570.0	75091.0	72947.0	61947.0	71712.0	76950.0	73935.0	53376.0	73008.0	69440.0	65321.0	68844.0	69754.0
Tar	17232.6	16462.6	18188.1	17417.0	14590.0	16211.0	17342.0	15721.0	11838.0	16475.0	15268.0	14175.0	14854.0	14477.0
Benzol	4788.6	4474.8	5253.3	5358.3	4403.2	3803.7	5315.6	4711.9	3373.4	4892.6	4518.8	4125.1	4465.4	4455.9
OUTPUT – Material-specific carbon content [kg C/GJ]														
Coke	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5
Coke-Oven Gas	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
Tar	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Benzol	23	23	23	23	23	23	23	23	23	23	23	23	23	23
OUTPUT – Carbon content in products [kt]														
Coke	7521.3	7333.9	8501.7	8489.0	7065.7	8082.1	8548.7	8470.6	5961.8	8276.3	7883.7	7476.8	7869.4	8044.3
Coke-Oven Gas	897.1	852.4	976.2	948.3	805.3	932.3	1000.4	961.2	693.9	949.1	902.7	849.2	895.0	906.8
Tar	379.1	362.2	400.1	383.2	321.0	356.6	381.5	345.9	260.4	362.5	335.9	311.9	326.8	318.5
Benzol	110.1	102.9	120.8	123.2	101.3	87.5	122.3	108.4	77.6	112.5	103.9	94.9	102.7	102.5
Carbon content in products – SUM [kt]	**8907.7**	**8651.4**	**9998.8**	**9943.8**	**8293.2**	**9458.5**	**10052.9**	**9886.0**	**6993.7**	**9700.4**	**9226.2**	**8732.7**	**9193.9**	**9372.1**
C process emission[kt]	**551.6**	**603.7**	**737.4**	**665.4**	**504.9**	**578.5**	**495.9**	**345.8**	**209.9**	**327.4**	**341.6**	**447.1**	**517.8**	**464.7**
CO_2 process emission[kt]	**2022.5**	**2213.4**	**2703.8**	**2439.7**	**1851.2**	**2121.0**	**1818.4**	**1267.9**	**769.6**	**1200.5**	**1252.7**	**1639.3**	**1898.4**	**1704.0**
Coke output [kt]	8946	8723	10112	10 097	8 404	9 613	10 168	10 075	7 091	9 844	9 377	8 893	9 360	9 568
EF [kg CO_2/Mg of coke]	**226**	**254**	**267**	**242**	**220**	**221**	**179**	**126**	**109**	**122**	**134**	**184**	**203**	**178**

3.3.1.2.3. Fugitive emissions from fuels – coke oven gas (CRF sector 1.B.1.c)

Tier 1 method has been used for calculation of fugitive emissions from coke oven gas system [IPCC 2006] while emission factors presented in table 3.3.5. have been taken from domestic case study [Steczko 1994]. Activity data for 1990-2014 come from [EUROSTAT]. For years: 1988-1989 the activity data come from [IEA] database.

Table 3.3.6. Emission factors for CO_2 and CH_4 from coke oven gas system.

Gas system emission factor [kt/PJ]	**CO_2**	**CH_4**
gas processing	0.000194	0.000546
gas transmission	0.020629	0.057977
gas distribution	0.038056	0.106954

For coke-oven gas subsystem there is no possibility to add activity data in PJ in the CRF Reporter database, but only in kt. This conversion into kt was done only for CRF Reporter purposes (emission is estimated on the PJ activity data basis) the mentioned change has no impact on emissions.

3.3.1.3. Uncertainties and time-series consistency

See chapter 3.2.6.3

3.3.1.4. Source-specific QA/QC and verification

QA/QC and verification are integral parts of the inventory and has been elaborated in line with the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and *2006 IPCC Guidelines for National Greenhouse Gas Inventories(2006)*.
Activity data used in the GHG inventory concerning sector 1.B.1 come from Eurostat database which is fed by the Central Statistical Office (GUS) and from 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 GHG inventory are regularly checked and updated if necessary according to adjustments made in Eurostat database.
Generally QC procedures follow QA/QC plan presented in Annex 7.

3.3.1.5. Source-specific recalculations

Recalculations for the years 1988-2013 was made. Recalculations for this years was made as result of implementation the of 2006 IPCC guidelines (CH_4 emission factor for coke production) was changed and activity data was updated according to current Eurostat database.
Emission changes for subcategory 1.B.1. are presented in table below. Emission changes for subcategory 1.B.1 are presented in table below.

Tabele 3.3.7. Emission changes for subcategory 1.B.1. Fugitive emissions from fuels.

Difference	1988	1989	1990	1991	1992	1993
kt eq CO_2	-212.54	-206.20	-168.92	-141.92	-138.30	-128.41
%	-0.61	-0.63	-0.60	-0.55	-0.57	-0.54
	1994	**1995**	**1996**	**1997**	**1998**	**1999**
kt eq CO_2	-143.16	-144.70	-129.21	-131.66	-121.80	-104.58
%	-0.62	-0.60	-0.54	-0.54	-0.60	-0.51
	2000	**2001**	**2002**	**2003**	**2004**	**2005**
kt eq CO_2	-112.13	-111.80	-109.02	-126.37	-126.19	-105.03
%	-0.56	-0.54	-0.57	-0.64	-0.66	-0.58
	2006	**2007**	**2008**	**2009**	**2010**	**2011**
kt eq CO_2	-120.14	-455.84	-400.65	-335.47	-262.52	-117.19
%	-0.68	-2.80	-2.67	-2.53	-1.95	-0.87
	2012	**2013**				
kt eq CO_2	-111.14	-111.15				
%	-0.77	-0.78				

3.3.1.6. Source-specific planned improvements

Analysis for possibility of updating the emission factors for the systems of coke-oven gas.

3.3.2. Fugitive emissions from oil and natural gas (CRF sector 1.B.2)

3.3.2.1. Source category description

Fugitive emission from oil and natural gas include fugitive emissions from extraction, transport and refining of oil, from production, processing, transmission, distribution and underground storage of gas as well as from venting and flaring of gas and oil.

3.3.2.2. Methodological issues

3.3.2.2.1 Fugitive emissions from fuels – oil (CRF sector 1.B.2.a)

Tier 1 method has been used for calculation of fugitive emissions from oil system [IPCC 2006]. Activity data come from [EUROSTAT]. For years: 1988-1989 the activity data come from [IEA] database. Activity data for 1990-2014 come from Eurostat (table 3.3.8)

Table 3.3.8. Activity data for emission from oil system.

Year	Production [kJ]	Production [kt]	Import [kt]	Transport [kt]	Input to oil refineries [PJ]
1988	6.58	155.51	14 681.42	14 836.92	618.67
1989	6.48	153.19	14 422.39	14 575.59	628.44
1990	6.59	160.00	13 126.00	13 286.00	528.78
1991	6.45	158.00	11 454.00	11 612.00	478.33
1992	7.98	200.00	13 052.00	13 252.00	524.72
1993	9.49	235.00	13 674.00	13 909.00	539.96
1994	10.97	284.00	12 721.00	13 005.00	519.25
1995	11.28	292.00	12 957.00	13 249.00	519.06
1996	12.70	317.00	14 026.00	14 343.00	584.98
1997	11.92	289.00	14 713.00	15 002.00	613.70
1998	14.88	360.00	15 367.00	15 727.00	662.31
1999	18.03	434.00	16 022.00	16 456.00	694.72
2000	26.55	653.00	18 002.00	18 655.00	742.97
2001	31.64	767.00	17 558.00	18 325.00	740.95
2002	29.72	728.00	17 942.00	18 670.00	726.13
2003	32.60	765.00	17 448.00	18 213.00	743.88
2004	37.34	886.00	17 316.00	18 202.00	763.48
2005	35.18	848.00	17 912.00	18 760.00	753.68
2006	32.86	796.00	19 813.00	20 609.00	827.46
2007	30.30	721.00	20 885.00	21 606.00	845.22
2008	31.16	755.00	20 787.00	21 542.00	858.70
2009	28.79	687.00	20 098.00	20 785.00	850.95
2010	28.51	687.00	22 688.00	23 375.00	948.07
2011	25.26	617.00	23 792.00	24 409.00	982.70
2012	27.79	681.00	24 633.00	25 314.00	1 026.41
2013	39.74	962.00	23 347.00	24 309.00	1 003.96
2014	39.03	951.00	23 713.00	24 664.00	993.00

CO_2 and CH_4 factors used for estimation of emissions from oil production have been taken from country study [Żebrowski 1994] while for oil transmission and refining default factors were used from [IPCC 2006] (tab. 3.3.9).

Table 3.3.9. Emission factors for CO_2 and CH_4 from oil production and transmission.

Oil system	Emission factors	Source
	CO_2	
production [kt/PJ]	6.3150	country specific
transmission [kt/m^3]	0.00049	IPCC 2006
	CH_4	
production [kt/PJ]	0.0618	country specific
transmission [kt/m^3]	0.0054	IPCC 2006
refining [kt/PJ]	0.0007	IPCC 2006

3.3.2.2.2 Fugitive emissions from fuels – natural gas (CRF sector 1.B.2.b).

Estimation of CO_2 and CH_4 emissions from natural gas was carried out based on *Tier 1* method [IPCC 2006]. Activity data for 1990-2014 come from [EUROSTAT]. For years 1988-1989 activity data come from [IEA] database. Activity data are given in table 3.3.10.

Table 3.3.10. Activities for natural gas system [TJ]

Year	Production [TJ]	Total consumption [TJ]
1988	156.6	350.7
1989	145.0	343.0
1990	99.6	374.2
1991	111.3	348.9
1992	107.2	325.0
1993	136.9	341.4
1994	129.8	344.0
1995	132.7	376.6
1996	131.5	395.5
1997	134.2	394.3
1998	136.0	398.3
1999	129.9	387.8
2000	138.7	417.0
2001	146.2	434.4
2002	149.4	423.4
2003	151.2	471.5
2004	164.4	497.4
2005	162.6	512.2
2006	162.5	526.8
2007	163.1	523.1
2008	154.5	526.1
2009	154.0	505.0
2010	154.6	536.1
2011	161.2	537.4
2012	163.6	572.8
2013	160.1	575.1
2014	156.0	561.2

Emission factors gas system for production, processing, transmission, underground storage and distribution was taken from IPCC 2006. Emission factor listed in table 3.3.11.

Table 3.3.11. Emission factors for CO_2 and CH_4 from natural gas system.

Emission factors [kt/10^{6}m^3]	CO_2	CH_4
Gas production	0.000082	0.0023
Gas processing	0.00032	0.00103
Gas transmission	0.00000088	0.00048
Underground gas storage	0.00000011	0.000025
Gas distribution	0.000051	0.0011

3.3.2.2.3 Fugitive emissions from fuels – Venting and Flaring (CRF sector 1.B.2.c)

Venting and Flaring in oil subsystem

CO_2 and CH_4 emission from venting and CO_2, CH_4 and N_2O emission from flaring were calculated in oil subsystem. Emission factors for both emissions were taken default from [IPCC 2006].

CO_2 EF from venting:	0.000095	$kt/10^3m^3$
CH_4 EF from venting:	0.00072	$kt/10^3m^3$

CO_2 from flaring:	0.00002500	$kt/10^3m^3$
CH_4 from flaring:	0.04100000	$kt/10^3m^3$
N_2O from flaring:	0.00000064	$kt/10^3m^3$

Extraction of oil is used as activity data and is in accordance with whole oil subsystem. Other emissions from venting and flaring in oil subsystem are included in 1.B.2.a.

CO_2 process emission from refineries and flaring was included into sub-category 1.B.2.C.2. This emission were estimated based on the verified reports for refineries which participate in EU ETS [KOBiZE 2013]. These values amounted to: 1545.68kt for 2014, 1701.7kt for 2013, 1671.1 kt for 2012, 1553.6 kt for 2011, 991.9 kt for 2010, 1093.0 kt for 2009, 1091.6 kt for 2008, 956.5 kt for 2007, 1143.1 kt CO_2 in 2006 and 1082.3 kt CO_2 in 2005 respectively. CO_2 emission from refineries reported as process emission mainly resulted from the following processes: hydrogen production, regeneration of catalysts and after-burning gases from asphalt production.

Flaring in natural gas subsystem

CO_2, CH_4 and N_2O emissions from flaring in gas extraction and consumption were calculated in natural gas subsystem. Emission factors for those emissions were taken default from [IPCC 2006].

CO_2 EF from flaring in gas extraction:	0.000000760	$kt/10^6m^3$
CH_4 EF from flaring in gas extraction:	0.0012	$kt/10^6m^3$
N_2O EF from flaring in gas extraction:	0.000000021	$kt/10^6m^3$
CO_2 EF from flaring in gas consumption:	0.00360	$kt/10^6m^3$
CH_4 EF from flaring in gas consumption:	0.00000002	$kt/10^6m^3$
N_2O EF from flaring in gas consumption:	0.00000005	$kt/10^6m^3$

Extraction and consumption of natural gas are used as activity data and are in accordance with whole natural gas subsystem. Other emissions from venting and flaring in natural gas subsystem are included in 1.B.2.b.

3.3.2.3. Uncertainties and time-series consistency

See chapter 3.2.6.3

3.3.2.4. Source-specific QA/QC and verification

See chapter 3.3.1.4.

3.3.2.5. Source-specific recalculations

Recalculations for the years 1988-2014 was made. Emission changes for subcategory 1.B.2 are presented in table below. Recalculations for this years was related with updated to current Eurostat database.

Tabele 3.3.12. Emission changes for subcategory 1.B.2. Fugitive emissions from oil and natural gas.

Difference	1988	1989	1990	1991	1992	1993
kt eq CO_2	0.00	0.00	0.00	0.00	0.00	0.00
%	0.00	0.00	0.00	0.00	0.00	0.00
	1994	**1995**	**1996**	**1997**	**1998**	**1999**
kt eq CO_2	0.00	0.00	0.00	0.00	0.00	0.00
%	0.00	0.00	0.00	0.00	0.00	0.00
	2000	**2001**	**2002**	**2003**	**2004**	**2005**
kt eq CO_2	0.00	0.00	0.00	0.07	0.08	0.11
%	0.00	0.00	0.00	0.00	0.00	0.00
	2006	**2007**	**2008**	**2009**	**2010**	**2011**
kt eq CO_2	0.07	0.10	-0.28	-0.35	-0.27	-1.50
%	0.00	0.00	-0.01	-0.01	-0.01	-0.04
	2012	**2013**				
kt eq CO_2	-1.55	-2.17				
%	-0.04	-0.05				

3.3.2.6. Source-specific planned improvements

Any improvements are planned at the moment.

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

4.1. Source category description

Following categories from sector 2 have been identified as key sources (excluding LULUCF):

IPCC Category Code	IPCC Source Categories	Greenhouse Gas	Level Assessment	Trend Assessment
2.A.1	Cement Production	CO_2	+	+
2.A.2	Lime Production	CO_2		+
2.A.4	Other Process Uses of Carbonates	CO_2	+	+
2.B.1	Ammonia Production	CO_2	+	+
2.B.2	Nitric Acid Production	N_2O		+
2.D	Non-energy Products from Fuels and Solvent Use	CO_2	+	
2.F.1	Refrigeration and Air conditioning	Aggregate F-gases	+	+

Share of these categories in total Poland's GHG emissions is ca. 6.60%.

Figure bellow shows GHG emission trend in *Industrial processes* sector.

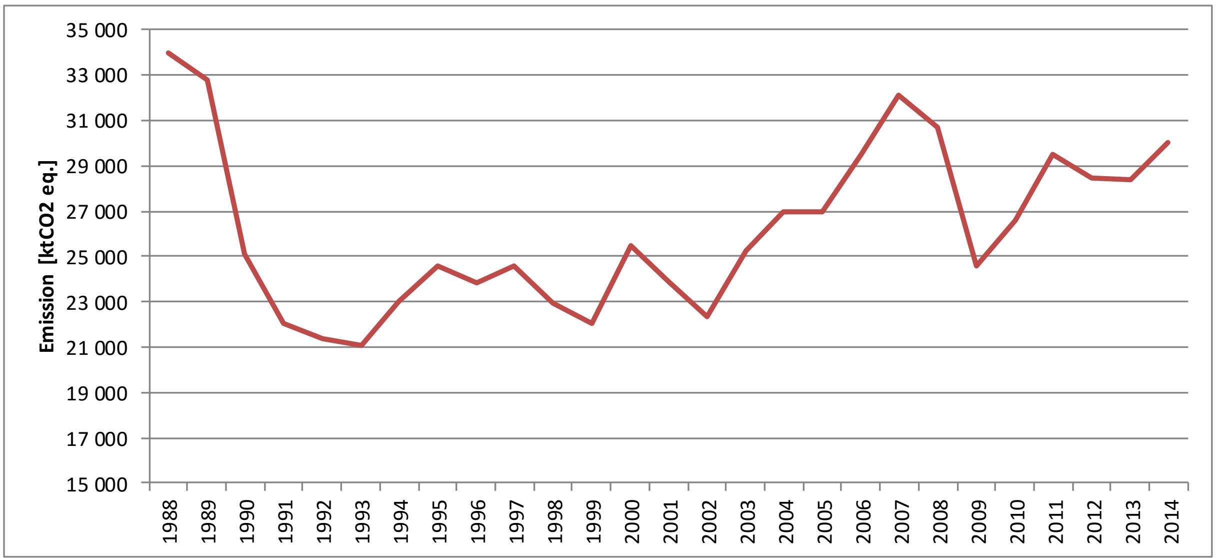

Figure 4.1.1. Emission trend in *Industrial processes* sector in period 1988 – 2014

Figure 4.1.2 shows GHG emissions according to subcategories of sector 2:

- 2.A. *Mineral industry*
- 2.B. *Chemical industry*
- 2.C. *Metal industry*
- 2.D. *Non-energy products from fuels and solvent use*
- 2.E. *Electronics industry*
- 2.F. *Product uses as substitutes for ODS*
- 2.G. *Other product manufacture and use*
- 2.H. *Other.*

For estimation of the 2014 emission in sector 2. *Industrial Processes and product use* some data from EU ETS installation reports was applied in the following subcategories:

- 2.A. *Mineral industry*: 2.A.1. *Cement Production*, 2.A.4.a. *Other process uses of carbonates - ceramics*
- 2.C. *Metal industry:* processes included into *Iron and Steel Production* (2.C.1) such as: sinter production, pig iron production, steel production in basic oxygen process, steel production in electric arc furnace process.

Emissions in individual subcategories in period 1988 – 2014 are shown in figure 4.1.2

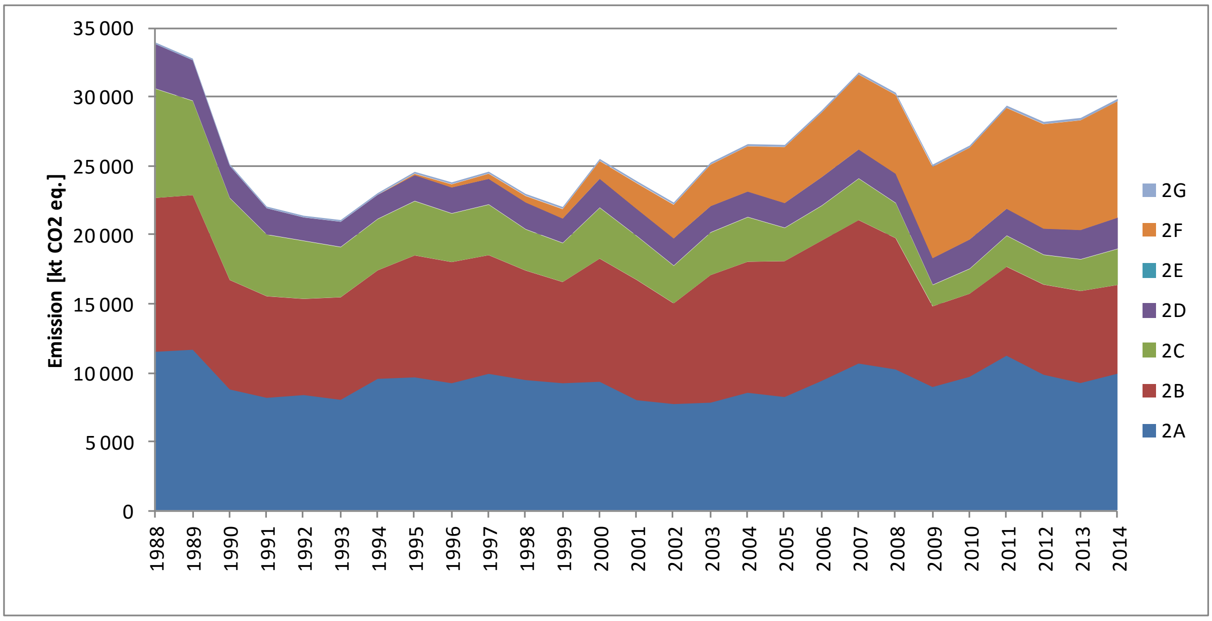

Figure 4.1.2. GHG emissions from *Industrial processes* in 1988-2014 according to subcategories

4.2. Mineral industry (CRF sector 2.A)

4.2.1. Source category description

Estimation of emissions in 2.A. *Mineral industry* is carried out in sub-categories listed below:

a) *Cement Production* (2.A.1)
b) *Lime Production* (2.A.2)
c) *Glass production* (2.A.3)
d) *Other process uses of carbonates* (2.A.4)

- *Ceramics*
- *Other uses of soda ash*
- *Non-metallurgical magnesium production*
- *Other*

Subsector 2.A.1. *Cement Production* is by far the largest contributor to emissions from this category (see figure 4.2.1) – almost 65% in 2014.

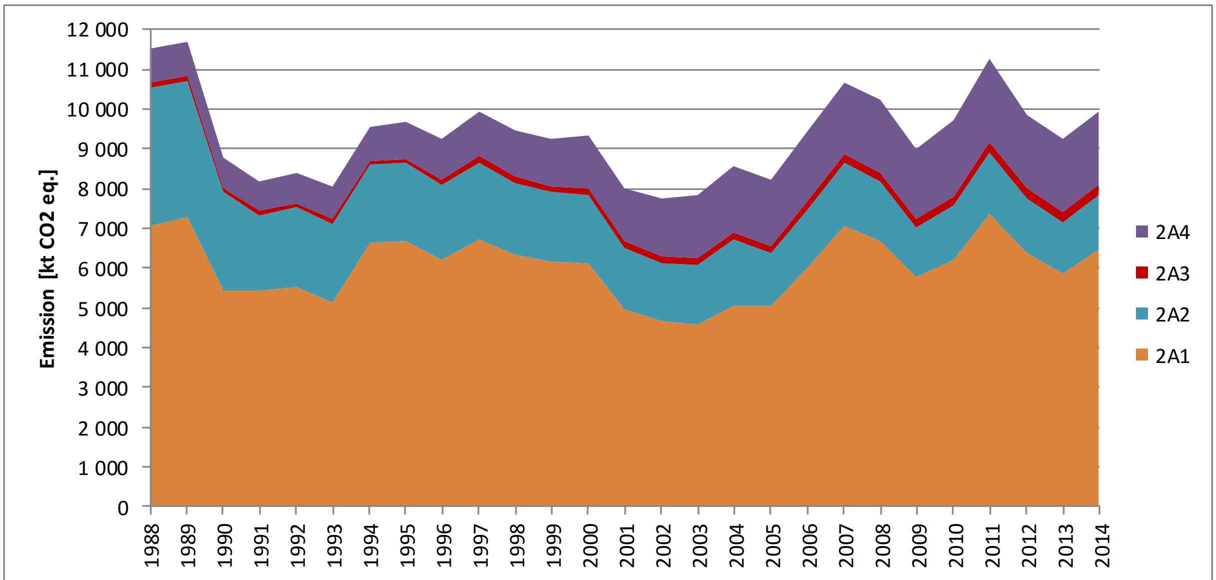

Figure 4.2.1. Emissions from *Mineral industry* sector in years 1988-2014 according to subcategories.

4.2.2. Methodological issues

4.2.2.1. Cement Production (CRF sector 2.A.1)

CO_2 emission from clinker production is the sum of the process emissions given in the verified reports for 2014 for installation of clinker production, which participate in the EU ETS [KOBiZE 2015]. This emission was estimated as 6456.4 kt CO_2. Data on clinker production was taken from [GUS 2015b].

The clinker production in period 1988-2014 is shown on figure 4.2.2. Data on clinker production for the entire inventoried period was taken from [GUS 1989b-2015b].

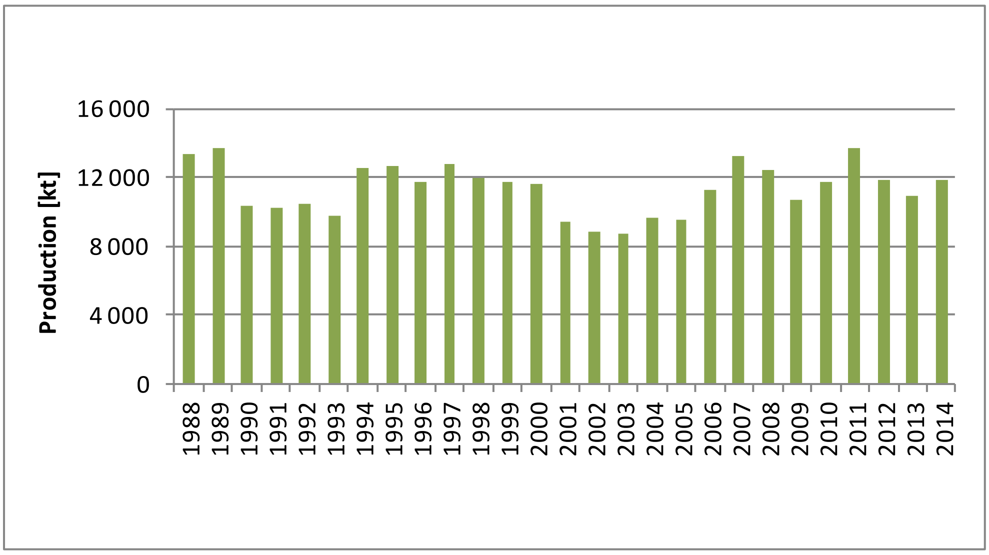

Figure 4.2.2. Clinker production in 1988-2014

CO_2 emission from clinker production was taken from the verified reports for the years: 2005-2014 for installations which participate in EU ETS. For other years emissions were estimated based on clinker production and emission factors. Emission factors which were used to estimate CO_2 process emissions from subcategory 2.A.1 are given bellow:

- for years: 1988-2000 – emission factor equal 529 kg CO_2/t of clinker – average from country specific factors for years: 2001-2004 (2001 – 531 kg CO_2/t, 2002 – 530 kg CO_2/t, 2003 – 528 kg CO_2/t, 2004 – 527 kg CO_2/t)
- for years: 2001-2004 - country specific factors (given above) from [IMMB 2006].

Since 2005 CO_2 process emissions from clinker production in GHG inventory corresponded to the sums of emissions provided in the EU-ETS verified reports, due to the fact that all installations for clinker production participate in EU-ETS. Emissions of CO_2 for installations covered by the EU ETS are estimated for 2013 and 2014 following the *Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council* (Annex IV section 9). For the earlier years the emission in ETS reports was estimated based on *Ordinance of the Minister of Environment of 12 September 2008 on the way of monitoring of emission amounts of substances covered by the Community Emission Trading Scheme* (Dz. U. Nr 183, poz. 1142). The ordinance transposes to the Polish law the UE Monitoring and Reporting Guidelines for ETS (Commission Decision 2007/589/EC). Methods applied for CO2 process emission estimation from clinker production in the EU-ETS are described in ANNEX VII of mentioned EC Decision: *Activity-specific guidelines for installations for the production of cement clinker as listed in Annex I to Directive 2003/87/EC.*

According to Commission Decision 2007/589/EC there was no obligation to provide information concerning production. Production amounts from installations covered by EU ETS were additionally collected in Poland in accordance with *Ordinance of the Minister of Environment of 12 September 2008 on the way of monitoring of emission amounts of substances covered by the Community Emission Trading Scheme* (Dz. U. Nr 183, poz. 1142).

Data on clinker production provided in ETS reports are comparable to data collected by GUS (differences in production values between GUS data and data based on ETS reports are range 0.2-1.6 % for the years 2005-2014).

CO_2 emissions from clinker production in period 1988-2014 are shown in figure 4.2.3.

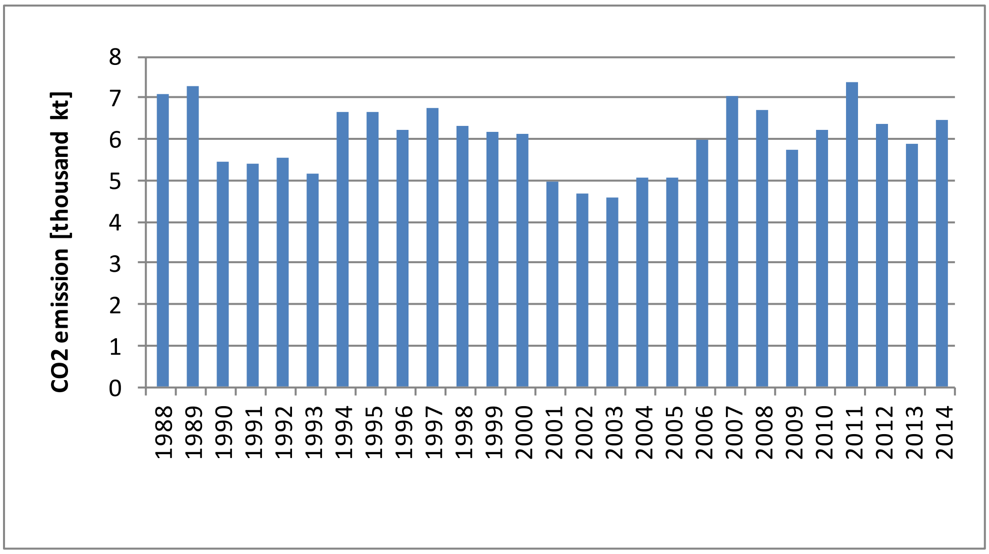

Figure 4.2.3. CO_2 process emission for clinker production in 1988-2014

4.2.2.2. Lime Production (CRF sector 2.A.2)

Emission of CO_2 from lime production was calculated based on lime production data from Central Statistical Office. Since 2000 activity data divided into quicklime, hydrated lime and hydraulic lime has been applied and emission has been estimated for each type of lime separately using default emission factors for high calcium lime and hydraulic lime from IPCC 2006 GLs (tab. 2.4. p. 2.22). For hydrated lime appropriate correction was considered. Due to the lack of the disaggregated lime production data for the years before 2000, the IEFs (average emission factor from the years 2000-2014) and total lime production was used for CO_2 emission estimation.
Dolomite lime production is given separately in the Polish statistical yearbook, as calcined and sintered dolomite. Emission from production of this type of lime was estimated based on dolomite consumption in production process according to the study [Galos 2013]. Emission from dolomite lime production was added to the emission from production of other lime types.

The figure 4.2.4 presents data concerning lime production (including dolomite lime) for the entire period. CO_2 emissions in period 1988-2014 are shown in the figure 4.2.5.

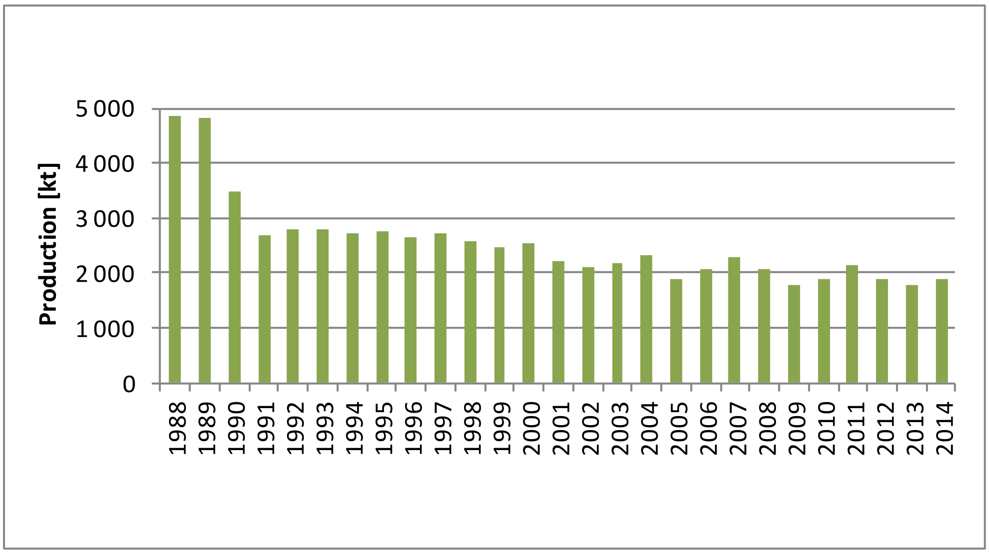

Figure 4.2.4. Lime (including dolomite lime) production in 1988-2014

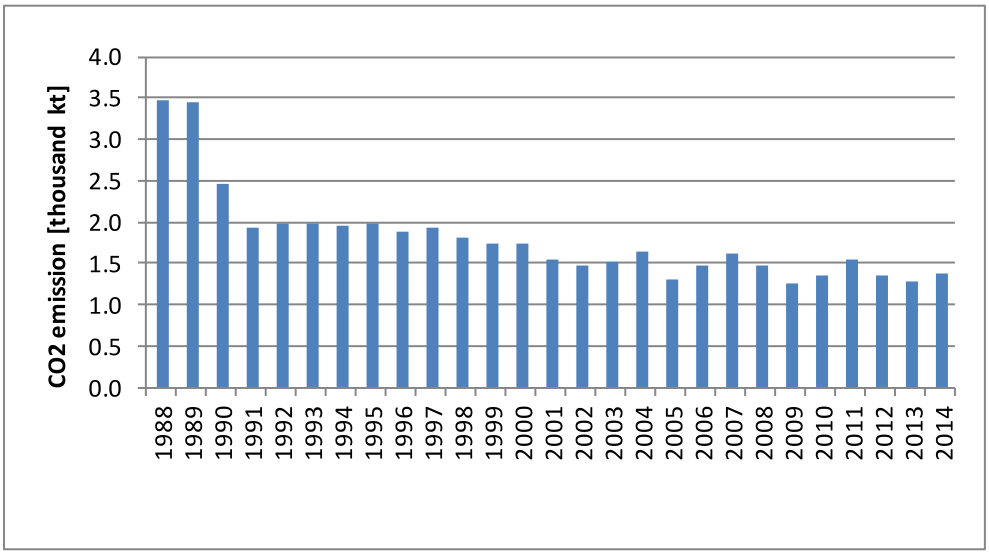

Figure 4.2.5. CO_2 process emission for lime production in 1988-2014

4.2.2.3. Glass production (CRF sector 2.A.3)

Emission of CO_2 from lime production was calculated based on glass production data from Central Statistical Office. Default CO_2 emission factor amounted to 0.1 tonnes CO_2/tonne glass was applied for emission estimation in entire period, according to IPCC 2006 GLs – equation 2.13 p. 2.29 and assumption on default cullet ratio of 50% (recommendation from p.2.30, IPCC 2006 GLs).

Glass production and CO_2 emission values from that process in period 1988-2014 are shown in the figures 4.2.6 and 4.2.7 respectively.

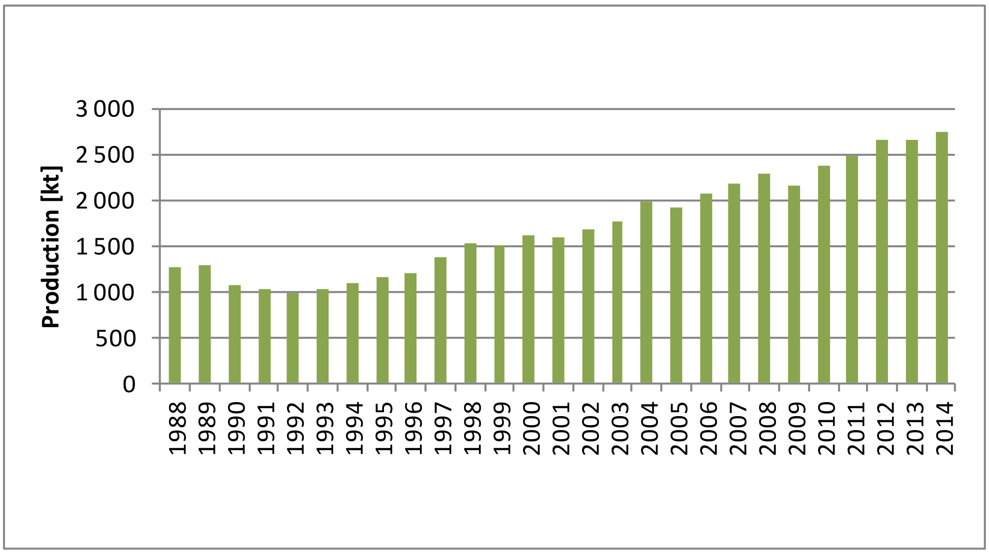

Figure 4.2.6. Glass production in 1988-2014

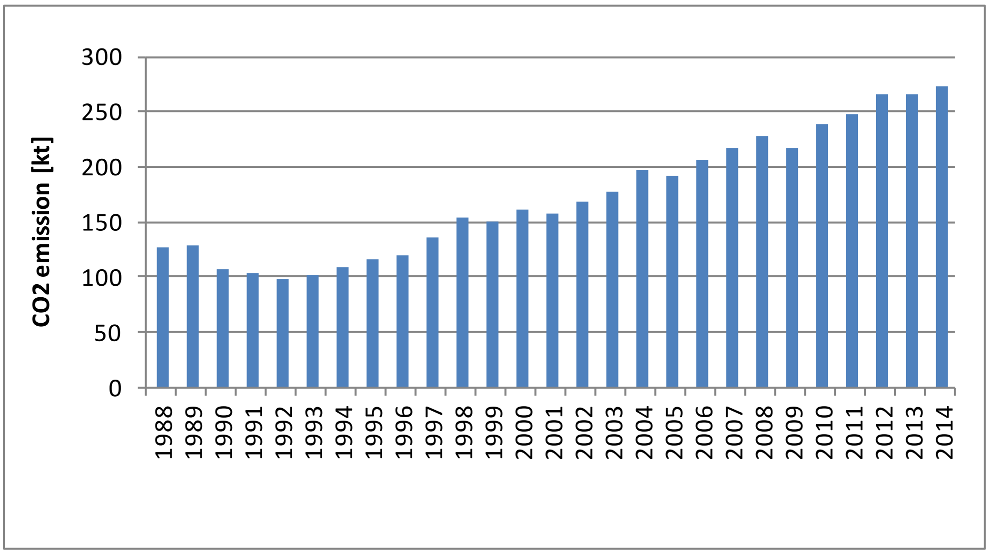

Figure 4.2.7. CO_2 process emission for glass production in 1988-2014

4.2.2.4. Other processes uses of carbonates (CRF sector 2.A.4)

This category includes CO_2 emission from sources as follows:

- ceramics
- other uses of soda ash
- non-metallurgical magnesium production
- other

2.A.4.a. Ceramics

Estimation of CO_2 emission from ceramics was based on ceramics production data from Central Statistical Office (Fig. 4.2.8). CO_2 emission factors for the years 2005-2014 was grounded on the verified reports for ceramic installation covered by EU ETS [KOBiZE 2015].

EFs values, expressed in kg CO_2/t of ceramics, were following:

2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
56.69	48.20	54.30	53.88	48.52	51.44	48.77	49.41	49.86	43.47

For the years before 2005 average value of EFs from 2005-2014, amounted to 51.23 kg CO_2/t of ceramics, was applied.

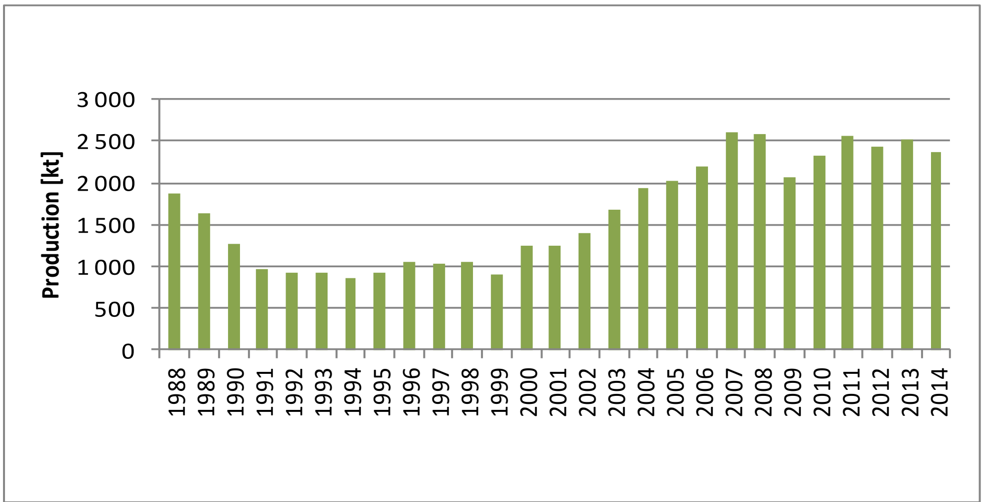

Figure 4.2.8. Ceramic production in 1988-2014

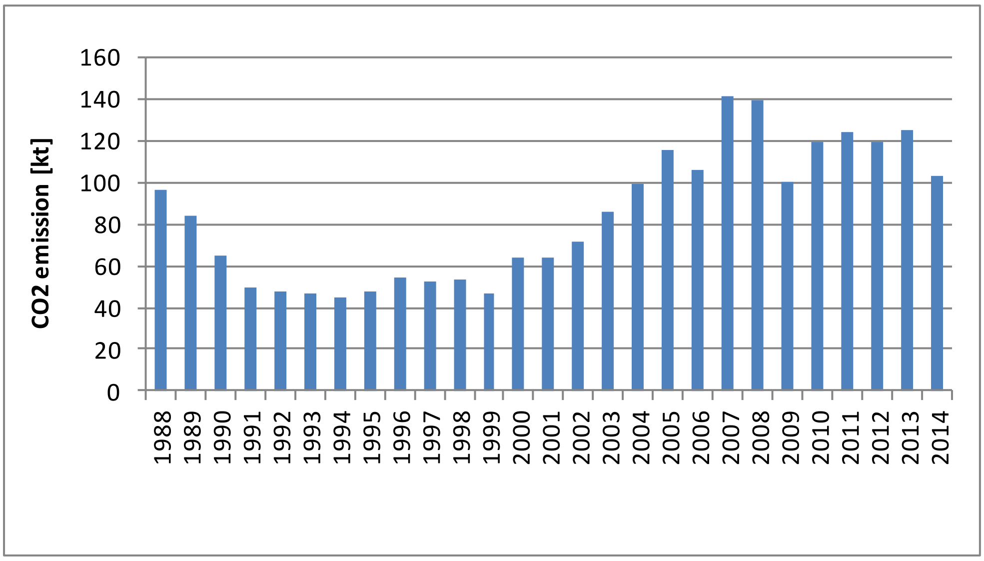

Figure 4.2.9. CO_2 process emission from ceramics in 1988-2014

2.A.4.b. Other uses of soda ash

CO_2 emission from soda ash use was estimated based on annually consumption of soda ash, which was published in GUS yearbook: *Materials Management in 2014* [GUS 2015f]. Additionally to assumed that half of soda ash use was consumed in glass and ceramics production and that amount was subtracted from AD because it was included in 2.A.3 and 2.A.4.a subcategories respectively.

EF amounting to 414.92 kg CO_2/t of soda ash used was applied for inventory calculation for the entire period (EF was taken from IPCC 2006 GLs, tab. 2.1. p. 2.7).

CO_2 emission for the years 1992-2014 was estimated based on data concerning soda ash consumption taken from *Materials Management* [GUS 1994f-2015f]. For years before 1992, due to lack of the published statistical data, the assumption was made, that total soda ash consumption amounts to 50% of soda ash production. That assumption was based on the analysis, which considered production [GUS 1998e-2000e] and use of soda ash in the period 1992-1999.

CO_2 emission values from soda ash use in 2.A.4.b subcategories, for entire period 1988-2014, were presented in the figure 4.2.10.

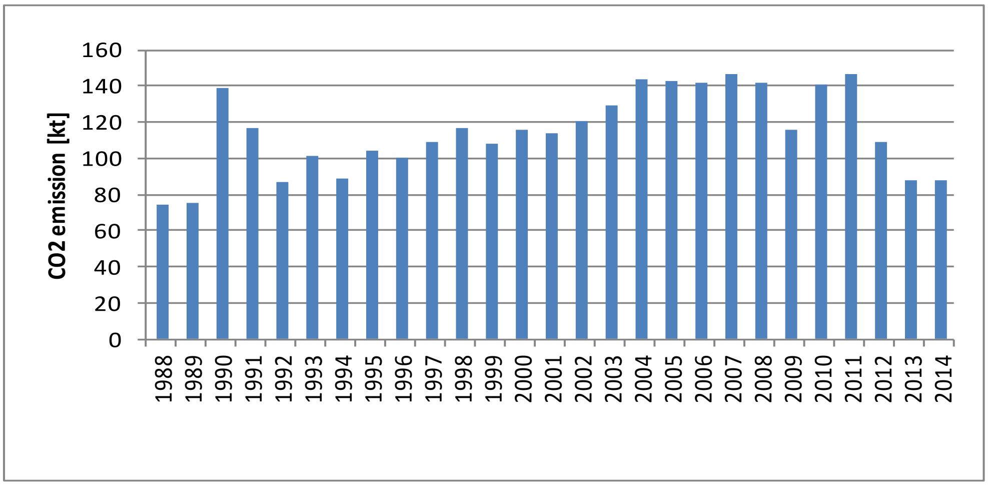

Figure 4.2.10. CO_2 emission values from soda ash use in 2.A.4.b subcategory in the years 1988-2014

2.A.4.c. Non-metallurgical magnesium production

Magnesium has not been produced in Poland [PIG-PIB 2014].

2.A.4.d. Other

CO_2 emission from limestone use as a sorbent in lime wet flue-gas desulfurization, FGD in FBB (fluid bad boiler) and other method of flue gas desulfurization was considered under this subcategory. Estimation of emission was based on study [Galos 2013]. The results were presented in figure 4.2.11. Details concerning calculations of CO_2 emission for 2.A.4.d category were provided in the Annex 3.1.

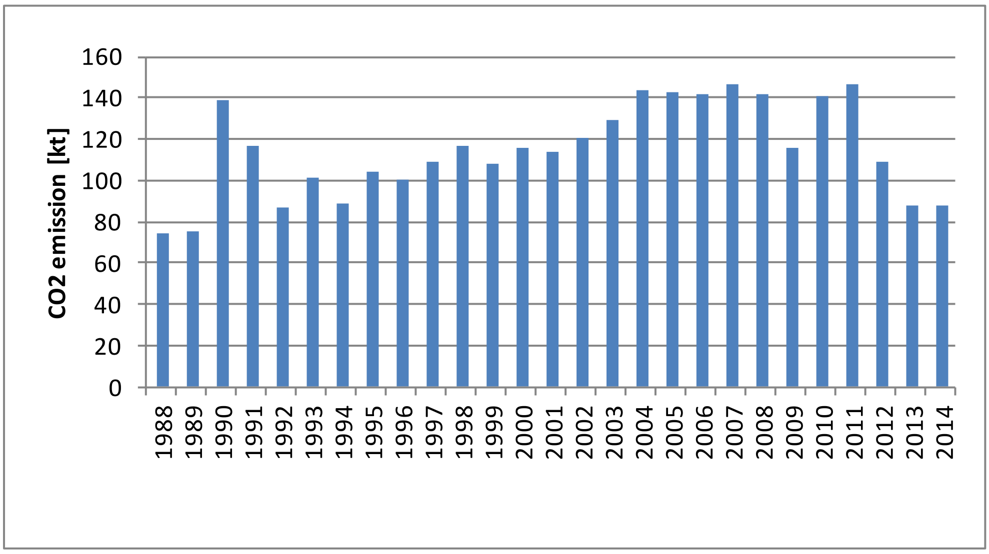

Figure 4.2.11. CO_2 emission from carbonate use in 2.A.4.d subcategory for 1988-2014

4.2.3. Uncertainties and time-series consistency

Uncertainty analysis for the year 2014 for IPCC sector *2.Industrial processes and product use* was estimated with use of approach 1 described in 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Simplified approach was based on the assumptions that every value is independent and probability distribution is symmetric. Results of the sectoral uncertainty analysis are given below. More details on uncertainty assessment of whole inventory are given in annex 8.
Recalculation of data for years 1988-2013 ensured consistency for whole time-series.

2014	**CO_2 [kt]**	**CH_4 [kt]**	**N_2O [kt]**	**CO_2 Emission uncertainty [%]**	**CH_4 Emission uncertainty [%]**	**N_2O Emission uncertaint y [%]**
2. Industrial processes and product use	**20 450.86**	**2.52**	**2.84**	3.4%	28.7%	39.1%
A. Mineral industry	9 936.94			5.8%		
B. Chemical industry	5 663.42	1.94	2.44	4.4%	36.9%	45.0%
C. Metal industry	2 586.03	0.58	0.00	5.1%	18.5%	0.0%
D. Non-energy Products from Fuels and Solvent Use	2 264.47			12.3%		
G. Other			0.40			40.3%

4.2.4. Source-specific QA/QC and verification

Activity data used in the GHG inventory concerning industry sector come from yearbooks published by the Central Statistical Office (GUS). GUS is responsible for QA/QC of collected and published data. Data on selected production is compared to data collected from installations/entities covered by the EUETS. Depending on type of emission factor and *Tier* method applied in the GHG inventory, EF is compared with plant specific emission factor or the default one, respectively.

Data relating to EUETS installations are verified by independent reviewers and by verification unit established in the National Centre for Emissions Management (KOBiZE). Additionally data on industrial production is compared with public statistics in case where entire sector is covered by EUETS.
Calculations in industry sector were examined with focus on formulas, units and trends consistency. Generally QC procedures follow QA/QC plan presented in Annex 7.

4.2.5. Source-specific recalculations

- more accurate value of CO_2 emission factor for soda ash use was applied for entire period (414.92 kg CO_2/tonne carbonate instead of 415 kg CO_2/t)
- AD for *Other uses of soda ash* was slightly corrected for 2013.

Table. 4.2.2. Changes of GHG emission values in 2.A. subcategory as a result of recalculations

Change	1988	1989	1990	1991	1992	1993	1994	1995
CO2								
kt	-0.014	-0.014	-0.027	-0.022	-0.017	-0.020	-0.017	-0.020
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change	1996	1997	1998	1999	2000	2001	2002	2003
CO2								
kt	-0.019	-0.021	-0.022	-0.021	-0.022	-0.022	-0.023	-0.025
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change	2004	2005	2006	2007	2008	2009	2010	2011
CO2								
kt	-0.028	-0.027	-0.027	-0.028	-0.027	-0.022	-0.027	-0.028
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change	2012	2013						
CO2								
kt	-0.021	1.974						
%	0.0	0.0						

4.2.6. Source-specific planned improvements

No improvements are planned at the moment.

4.3. Chemical industry (CRF sector 2.B)

4.3.1. Source category description

Estimation of emissions in 2.B. *Chemical industry* are carried out in sub-categories listed below:

a) *Ammonia production* (2.B.1)
b) *Nitric acid production* (2.B.2)
c) *Adipic acid production* (2.B.3)
d) Caprolactam, glyoxal and glyoxylic acid production (2.B.4)
e) *Carbide production* (2.B.5)
f) *Titanium dioxide production* (2.B.6)
g) *Soda ash production* (2.B.7)
h) *Petrochemical and carbon black production* (2.B.8)

Subsectors 2.B.1. *Ammonia production* is the largest contributors to emissions from this category (see figure 4.3.1) – almost 71% in 2014. Adipic acid was produced up to 1994.

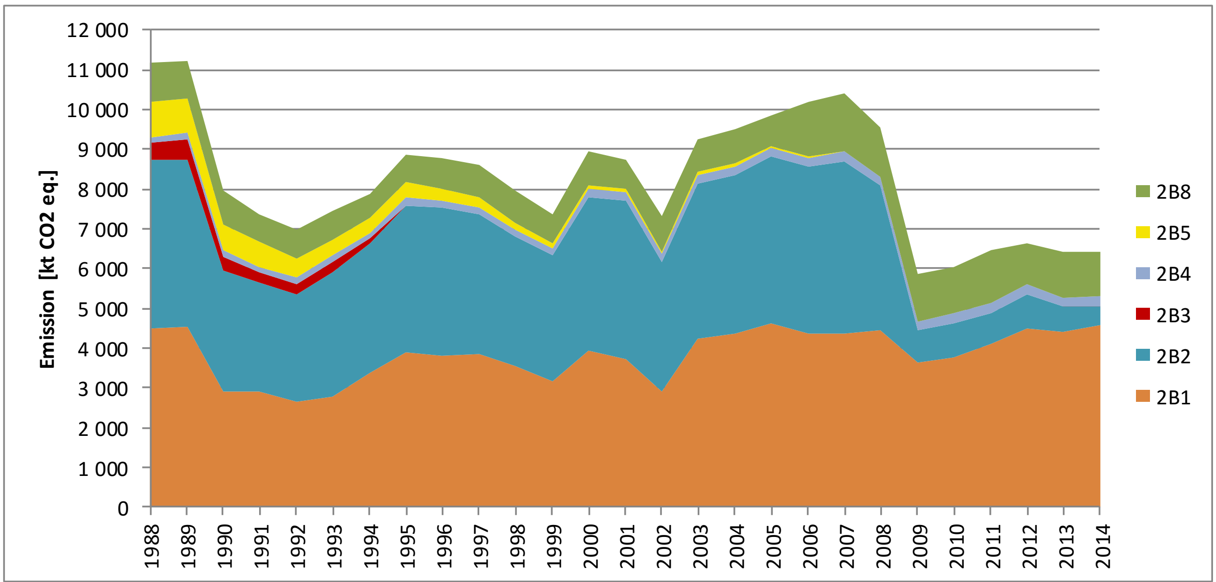

Figure 4.3.1. Emissions from *Chemical industry* category in years 1988-2014 according to subcategories

4.3.2. Methodological issues

4.3.2.1. Ammonia production (CRF sector 2.B.1)

CO_2 emissions for ammonia production are estimated based on the data on natural gas use in this process (natural gas consumption for the years 1988-2014 was presented in Annex 3.2). The amount of natural gas consumption expressed in volume units was taken from [GUS 2015e]. In order to calculate CO_2 emission, country specific carbon content in natural gas was estimated, based on the data from verified EU ETS reports provided by ammonia production installations [KOBiZE 2015]. The value of C content was estimated as 0.542 kg C/m^3 for 2014. For 2013 it amounted to 0.544 kg C/m^3 and the same value was applied for previous years back to 1988. Accounting above-mentioned information, the CO_2 process emission from ammonia production was calculated using the following formula:

$$E_{CO2} = Z_{natural\ gas} * C_{content} * 44/12$$

where:
E_{CO2} – CO_2 process emission from ammonia production [t]
$Z_{natural\ gas}$ – natural gas use [thousands m^3]
$C_{content}$ – carbon content in natural gas [kg C/m^3]

This method was used for entire period: 1988-2014. In years 1989-1990, also coke-oven gas was used for ammonia production and this fact was reflected in the inventory calculations (Annex 3.2). The coke-oven gas consumption was taken in energy units – also based on G-03 reports – and the carbon content factor is taken from IPCC [IPCC 2006].

CO_2 process emissions in the period: 1988-2014 are shown in figure 4.3.2 while the ammonia production values [GUS 1989e-2015e] are presented in figure 4.3.3.

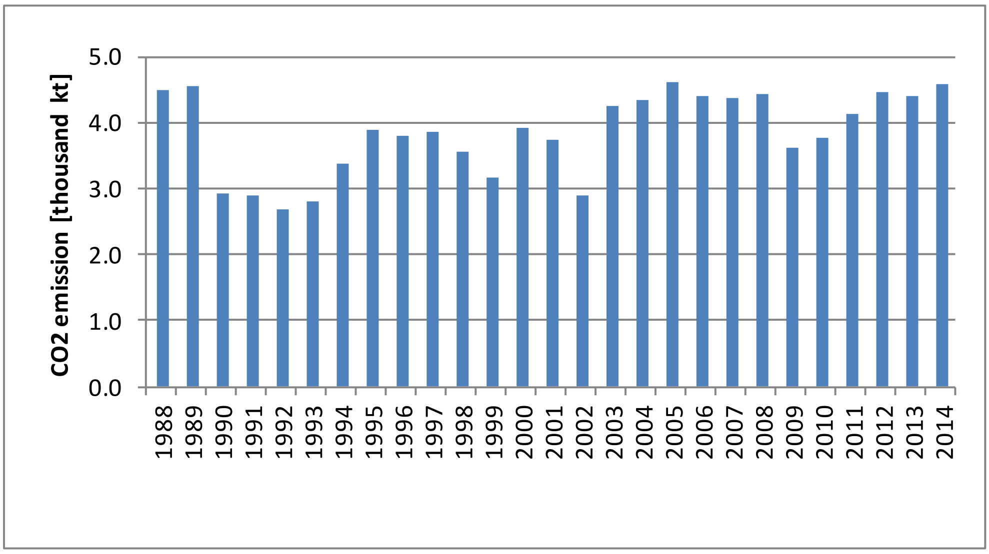

Figure 4.3.2. CO_2 process emission for ammonia production in 1988-2014

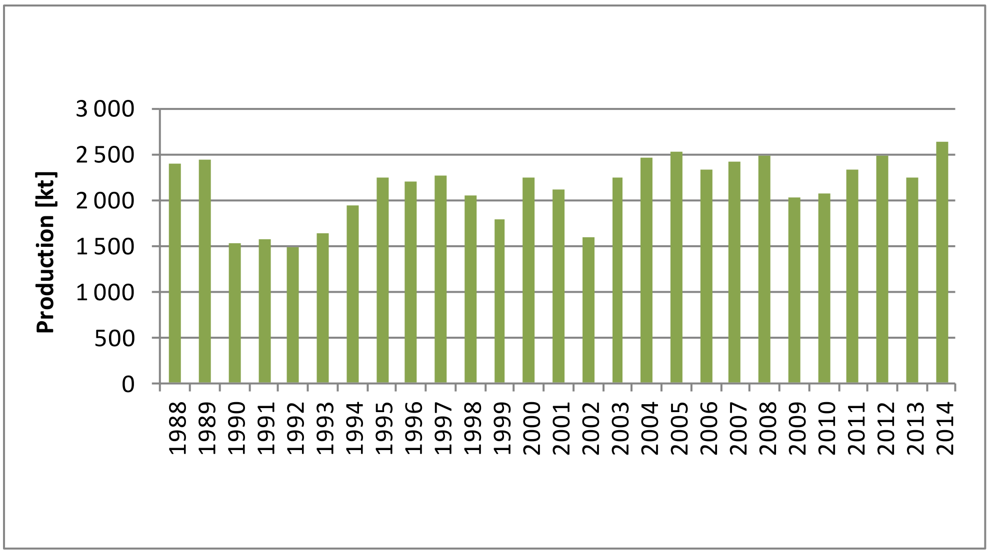

Figure 4.3.3. Production of ammonia in 1988-2014

4.3.2.2. Nitric acid production (CRF sector 2.B.2)

Estimation of N_2O emission from nitric acid production for 2014 was based on annual HNO_3 production data from [GUS 2015b]. The country specific emission factor of 0.70 kg/t nitric acid for 2014 was estimated based on the reports from all producers of HNO_3 [KOBiZE 2015]. The N_2O emission factors for years 2005-2013 were calculated also based on the reports provided by installations of nitric acid production.

The values of N_2O EFs applied for the years 2005-2014, expressed in kg CO_2/t HNO_3, were as follows:

2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
6.36	6.37	6.43	5.40	1.31	1.34	1.21	1.28	0.92	0.70

Emission factors mentioned above were estimated as weighted average of plant specific emission factors obtained from all nitric acid producers (from 5 installations located in 4 enterprises).

Decrease of the N_2O EF value from nitric acid production in 2008 and its significant drop in 2009 -2011 are the result of the implementation of the JI projects. N_2O catalytic decompose inside the oxidation ammonia reactor is the abatement technology applied in these installations.

Decline of emission factor value between 2013 and 2014 is mainly the result of change the catalyst for more effective one in the largest HNO_3 production installation.
Individual data obtained from nitric acid producers is confidential, so was not published in the NIR (it could be available for ERT review purpose only).

For the period 1988-2004, N_2O EF amounted to 6.47 kg/t nitric acid was applied. This country specific emission factor was taken from [Kozłowski 2001].

Activity data (i.e. HNO_3 production) for estimation of nitrous oxide emissions in 2.B.2 subcategory were taken from [GUS 1989b-2015b] for the entire period 1988-2014. The amount of production and N_2O emissions from nitric acid production are shown in figures 4.3.4 and 4.3.5, respectively.

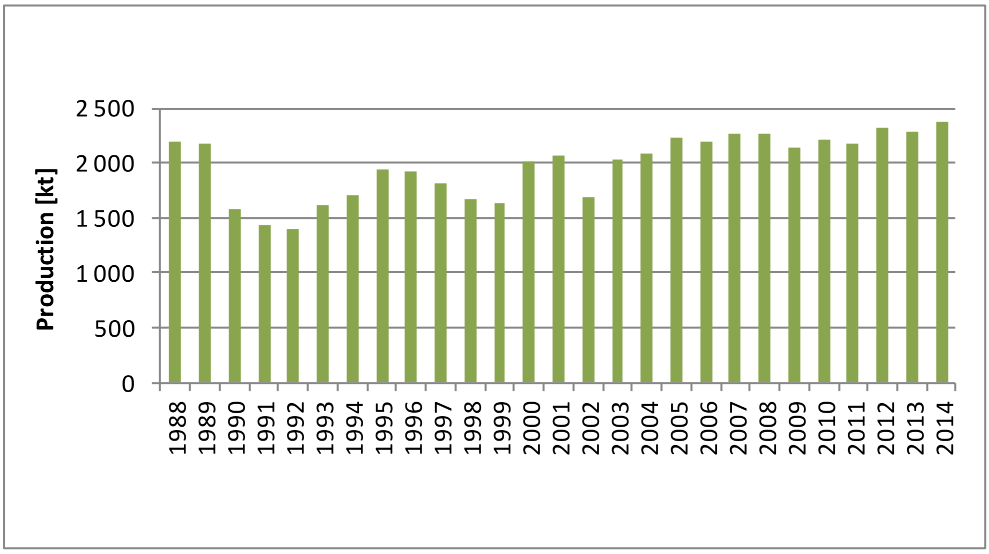

Figure 4.3.4. Production of nitric acid in 1988-2014

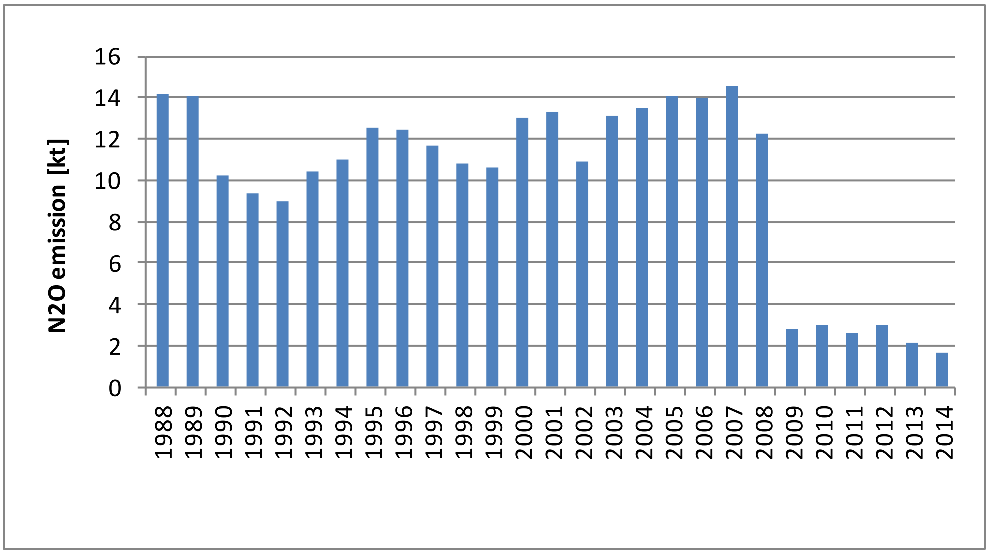

Figure 4.3.5. N_2O process emission for nitric acid production in 1988-2014

4.3.2.3. Adipic acid production (CRF sector 2.B.3)

Production of adipic acid was continued up to 1994. Activity data concerning adipic acid production was taken from the only adipic production plant.
CO_2 emission factor for this category, which is equal 300 kg CO2/ t, was taken from table 3.4, p. 3.30, 2006 IPCC GLs [IPCC 2006].

4.3.2.4. Caprolactam, glyoxal and glyoxylic acid production (CRF sector 2.B.4)

Caprolactam Production

Data on annual caprolactam production for inventory calculation purpose was taken from [GUS 2014b]. Applied country specific emission factor of N_2O, which value is 4.74 kg N_2O/t caprolactam produced, was assessed based on the Polish study [Kozłowski 2001].
For the entire time series the same activity data source – GUS publications [GUS 1989b-2014b] and the same emission factor were applied.

Glyoxal and glyoxylic acid production

Glyoxal and glyoxylic acid have not been produced in Poland.

4.3.2.5. Carbide production (CRF sector 2.B.5)

CO_2 emission from calcium carbide category was estimated for years 1988-2007 based on annual production amounts taken from [GUS 1989b-2008b]. Starting from 2008 carbide is no longer produced in Poland.
EF equal 2190 kg CO2/t of carbide (i.e.: 1090 kg CO_2/t carbide from production + 1100 kg CO_2/t carbide from use) was applied for CO_2 emission estimation in entire period 1988-2007. The factors given above were taken from tab. 3.8, 2006 IPCC GLs [IPCC 2006].

Silicon carbide has not been produced in Poland.

4.3.2.6. Titanium dioxide production (CRF sector 2.B.6)

Titanium dioxide is produced in Poland in sulphate route process, so it was assumed, that the GHG emission is insignificant from TiO_2 production (in accordance with 2006 IPCC GLs (Chapter 3.7, p. 3.47)

4.3.2.7. Soda ash production (CRF sector 2.B.7)

In Poland, soda ash is produced in the Solvay process. Emission of CO_2 from this process was assumed as 0 as coke consumption in soda ash production process is included in fuel use in *Final Energy Consumption - Chemical and Petrochemical* category in Polish energy balance and CO_2 emission is accounted in 1.A.2.c IPCC sector.

4.3.2.8. Petrochemical and carbon black production (CRF sector 2.B.8)

a. Methanol production

Process emissions of CO_2 and CH_4 from methanol production for the entire period 1988-2014 were estimated based on data on annual production from [GUS 1989b-2015b]. CO_2 EF equal 670 kg CO_2/t from tab. 3.12 of 2006 IPCC GLs [IPCC 2006] was applied. CH_4 emission values were calculated based on CH_4 EF equal 2.3 kg CH_4/t [IPCC 2006].

b. Ethylene production

CO_2 and CH_4 process emissions related to ethylene production were estimated for the entire period 1988-2014 based on the data on annual production amounts taken from [GUS 1989b-2015b]. CO_2 EF equal 1903 kg CO_2/t was applied. It is value of CO_2 EF (for default feedstock) given in tab. 3.14 of 2006 IPCC GLs adjusted by recommended regional factor (110% in case of Eastern Europe; tab. 3.15) [IPCC 2006]. CH_4 emission values were calculated based on CH_4 EF equal 3.0 kg CH_4/t according to the table 3.16 [IPCC 2006].

c. Ethylene dichloride and vinyl chloride monomer production

CO_2 and CH_4 emission in this IPCC category was estimated based on vinyl chloride monomer production. Activity data for the years 2002-2014 was taken from Central Statistical Office. Data for the years 1988-2001 come directly from VCM producer. CO_2 EF amounted to 294.3 kg CO2/t VCM produced, recommended for balanced process (default process) in the table 3.17 of 2006 IPCC GLs [IPCC 2006], was applied for emission estimation in entire period. CH_4 emission was calculated using EF=0.0226 kg/t VCM produced (tab. 3.19, 2006 IPCC GLs).

d. Ethylene oxide production

Ethylene oxide production amounts from Central Statistical Office were used for estimation of CO_2 and CH_4 emissions. Default EFs for both CO_2 and CH_4 were applied in order to calculation of emissions. Utilized EF values were as follow: CO_2 EF = 863 kg CO_2/tonne ethylene oxide (tab. 3.20, 2006 GLs), CH_4 EF = 1.79 kg CH_4/tonne ethylene oxide (tab. 3.21, 2006 GLs).

e. Acrylonitrile production

According to data from Central Statistical Office production of acrylonitrile in Poland was in the years: 1988-1990 and 1996-2003. Emission of CO_2 and CH_4 from this production was estimated according to 2006 IPCC GLs. CO_2 EF = 1000 kg CO_2/tonne acrylonitrile produced (tab. 3.22, 2006 GLs) and CH_4 EF = 0.18 kg CH_4/tonne acrylonitrile produced (p. 3.79, 2006 GLs) were applied for GHG inventory purpose.

f. Carbon black production

CO_2 and CH_4 emissions from production of carbon black was estimated based on annual carbon black production taken from [GUS 1989b-2000b] and [GUS 2001e-2015e] respectively. CO_2 EF equal to 2620 kg CO_2/tonne carbon black produced (tab. 3.23, 2006 GLs) and CH_4 EF = 0.06 kg CH_4/tonne carbon black produced (tab. 3.24, 2006 GLs) were used.

g. Other

- Styrene Production

Data on styrene production applied for emission estimation was obtained from [GUS 1996e-2015e] for the years 1995-2014 and directly from the only styrene producer for previous years (1988-1994). Methane emissions values for the entire period 1988-2014 were estimated by applying the same emission factor of 4 kg CH_4/t styrene produced [IPCC 1997].

4.3.3. Uncertainties and time-series consistency

See chapter 4.2.3

4.3.4. Source-specific QA/QC and verification

See chapter 4.2.4

4.3.5. Source-specific recalculations

-adjustment of EFs and emission values for N_2O from nitric acid production for the years 2010-2013 was introduced based on corrected data from HNO_3 production installations.

Table. 4.3.1. Changes of GHG emission values in 2.B. subcategory as a result of recalculations

Change	2010	2011	2012	2013
		N_2O		
kt	-0.031	-0.041	0.365	-0.869
%	0.0	0.0	0.0	-0.1

4.3.6. Source-specific planned improvements

No improvements are planned at the moment.

4.4. Metal industry (CRF sector 2.C)

4.4.1. Source category description

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

1. *Iron and steel production* (2.C.1)
    a. *Steel* (2.C.1.a)
    b. *Pig iron* (2.C.1.b)
    c. *Direct reduced iron* (2.C.1.c)
    d. *Sinter* (2.C.1.d)
    e. *Pellet* (2.C.1.e)
    f. *Other* (2.C.1.f)
2. *Ferroalloys production* (2.C.2)
3. *Aluminium production* (2.C.3)
4. *Magnesium production* (2.C.4)
5. *Lead production* (2.C.5)
6. *Zinc production* (2.C.6)
7. *Other* (2.C.7)

Subsector 2.C.1. *Iron and Steel Production* is by far the largest contributor to emissions from this category (see figure 4.4.1) – over 80% in 2014.

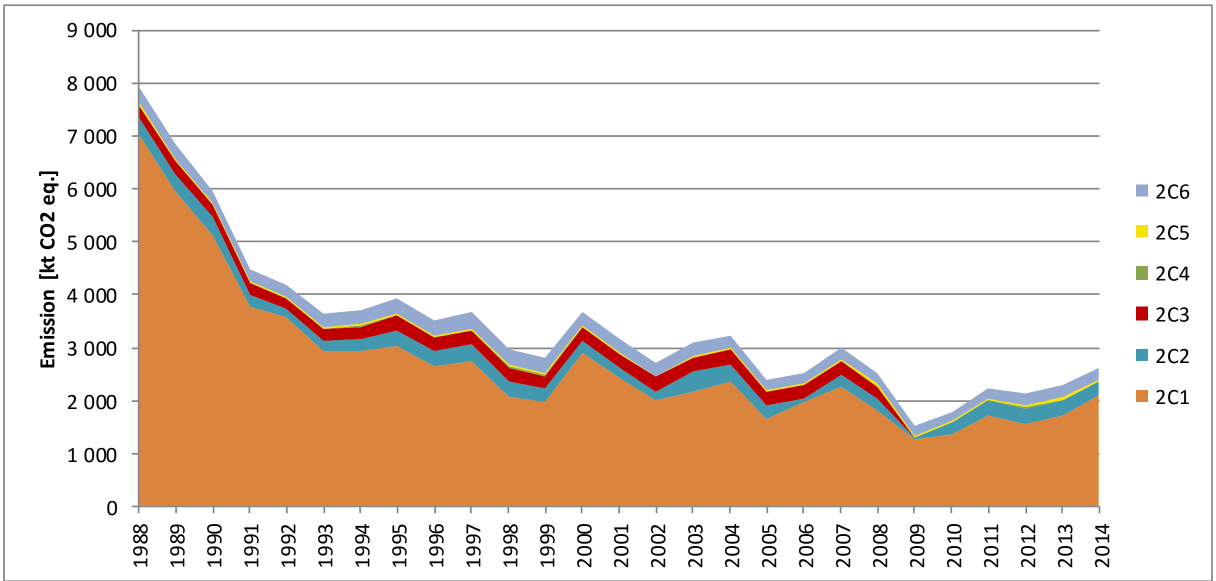

Figure 4.4.1. Emissions from *Metal industry* sector in years 1988-2014 according to subcategories

4.4.2. Methodological issues

4.4.2.1. Iron and steel production (CRF sector 2.C.1)

4.4.2.1.a. Steel (CRF sector 2.C.1.a)

Basic oxygen furnace steel production

Amount of CO_2 process emission from steel production in basic oxygen furnace was estimated based on the carbon balance in converter process (table 4.4.1). For the years 1988-2006 the Polish Steel Association (HIPH) study [HIPH 2007] was the main source of data for C balance purpose. The HIPH data was supplemented for the years 1988-2004 with the information from questionnaires collected by the National Centre for Emissions Management (KOBiZE) for installations covered by EU ETS and starting from 2005 with the data from verified reports concerning CO_2 emission, prepared as part of EU ETS. Based on mentioned verified reports, C balances for basic oxygen steel plants were prepared for the years not included in the HIPH study, it means for the period 2007-2015. Steel production amounts applied in the C balance were in accordance with data published in GUS yearbook [2005b-2015b].

Table 4.4.1. Carbon balance for steel production in basic oxygen process in years 1988-2014

	1988	1989	1990	1991	1992	1993	1994	1995	1996
CHARGE									
Pig iron [t]	6 437 194	6 274 714	6 212 430	4 835 755	5 279 309	5 205 226	5 873 001	6 440 439	5 669 525
Scrap [t]	1 895 954	1 841 725	1 840 367	1 468 313	1 595 404	1 573 016	1 796 072	1 962 554	1 725 579
Carbon pick-up agent [t]	0	0	0	0	0	0	0	0	0
Ferroalloys [t]	61 135	58 311	57 193	45 416	48 066	46 278	53 217	57 027	51 883
Dolomite [t]	187 960	182 054	189 020	144 459	155 741	144 853	163 776	177 073	156 867
Technological indicator [t/t of steel]									
Pig iron	0.867	0.870	0.862	0.841	0.845	0.845	0.835	0.838	0.839
Scrap	0.2554	0.2554	0.2554	0.2554	0.2554	0.2554	0.2554	0.2554	0.2554
Carbon pick-up agent	0	0	0	0	0	0	0	0	0
Ferroalloys	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.007	0.008
Dolomite	0.025	0.025	0.026	0.025	0.025	0.024	0.023	0.023	0.023
Material-specific carbon content									
Pig iron [t C/t]	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Scrap [t C/t]	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Carbon pick-up agent [t C/TJ]	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5
Ferroalloys [t C/t]	0.033	0.033	0.033	0.033	0.032	0.033	0.033	0.033	0.032
Dolomite [t C/t]	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130
Carbon contents in charge components [t C]									
Pig iron	257 488	250 989	248 497	193 430	211 172	208 209	234 920	257 618	226 781
Steel scrap	7 584	7 367	7 361	5 873	6 382	6 292	7 184	7 850	6 902
Carbon pick-up agent	0	0	0	0	0	0	0	0	0
Ferroalloys	2 019	1 936	1 868	1 481	1 557	1 518	1 741	1 862	1 686
Dolomite	24 435	23 667	24 573	18 780	20 246	18 831	21 291	23 019	20 393
Carbon contents in charge – SUM [t]	**291 526**	**283 959**	**282 299**	**219 564**	**239 357**	**234 850**	**265 136**	**290 349**	**255 762**
OUTPUT									
Steel [t]	**7 424 676**	**7 212 315**	**7 206 995**	**5 750 006**	**6 247 703**	**6 160 031**	**7 033 534**	**7 685 488**	**6 757 479**
Material-specific carbon content									
Steel [t C/t]	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Carbon content in products [t C]									
Steel	29 699	28 849	28 828	23 000	24 991	24 640	28 134	30 742	27 030
Carbon content in products – SUM [t]	**29 699**	**28 849**	**28 828**	**23 000**	**24 991**	**24 640**	**28 134**	**30 742**	**27 030**
C emission from steel production [t]	261 827	255 109	253 471	196 564	214 366	210 210	237 002	259 607	228 732
CO_2 process emission from steel production [kt]	**960.033**	**935.401**	**929.394**	**720.734**	**786.009**	**770.769**	**869.006**	**951.893**	**838.684**
CO_2 EMISSION FACTOR [kg CO_2/t of steel]	**129.30**	**129.69**	**128.96**	**125.34**	**125.81**	**125.12**	**123.55**	**123.86**	**124.11**

Table 4.4.1. Carbon balance (cont.) for steel production in basic oxygen process in years 1988-2014

	1997	1998	1999	2000	2001	2002	2003	2004	2005
CHARGE									
Pig iron [t]	6 311 208	5 233 149	4 640 291	6 491 867	5 440 047	5 296 410	5 629 786	6 304 253	4 538 670
Scrap [t]	1 923 174	1 588 976	1 303 910	1 657 053	1366064.9	1 360 557	1 424 125	1 608 909	1 147 906
Carbon pick-up agent [t]	0	0	0	0	1 201	2 645	4 286	1 689	1 205
Ferroalloys [t]	59 896	50 915	45 285	57 840	50 035	49 610	48 197	57 157	56 566
Dolomite [t]	188 810	157 145	141 317	174 301	156 426	161 404	127 127	162 673	191 374
Technological indicator [t/t of steel]									
Pig iron	0.838	0.841	0.851	1.047	1.070	1.095	1.078	1.088	1.078
Scrap	0.2554	0.2554	0.2391	0.2437	0.2346	0.2346	0.2346	0.2346	0.2346
Carbon pick-up agent	0	0	0	0	0.0002	0.0005	0.0007	0.0002	0.0002
Ferroalloys	0.008	0.008	0.008	0.009	0.009	0.009	0.008	0.008	0.012
Dolomite	0.025	0.025	0.026	0.026	0.027	0.028	0.021	0.024	0.039
Material-specific carbon content									
Pig iron [t C/t]	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Scrap [t C/t]	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Carbon pick-up agent [t C/TJ]	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.5
Ferroalloys [t C/t]	0.033	0.033	0.032	0.033	0.032	0.032	0.032	0.033	0.031
Dolomite [t C/t]	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130	0.130
Carbon contents in charge components [t C]									
Pig iron	252 448	209 326	185 612	259 675	217 602	211 856	225 191	252 170	181 547
Steel scrap	7 693	6 356	5 216	6 628	5 464	5 442	5 696	6 436	4 592
Carbon pick-up agent	0	0	0	0	992	2 184	3 539	1 395	995
Ferroalloys	1 951	1 659	1 466	1 905	1 623	1 598	1 560	1 860	1 779
Dolomite	24 545	20 429	18 371	22 659	20 335	20 983	16 527	21 147	24 879
Carbon contents in charge – SUM [t]	**286 637**	**237 769**	**210 665**	**290 867**	**246 016**	**242 063**	**252 514**	**283 008**	**213 791**
OUTPUT									
Steel [t]	**7 531 274**	**6 222 532**	**5 452 751**	**6 799 681**	**5 822 518**	**5 799 042**	**6 069 985**	**6 857 583**	**4 892 671**
Material-specific carbon content									
Steel [t C/t]	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Carbon content in products [t C]									
Steel	30 125	24 890	21 811	27 199	23 290	23 196	24 280	27 430	19 571
Carbon content in products – SUM [t]	**30 125**	**24 890**	**21 811**	**27 199**	**23 290**	**23 196**	**24 280**	**27 430**	**19 571**
C emission from steel production [t]	256 512	212 879	188 854	263 668	222 726	218 867	228 234	255 578	194 220
CO_2 process emission from steel production [kt]	**940.545**	**780.557**	**692.464**	**966.782**	**816.662**	**802.513**	**836.857**	**937.119**	**712.141**
CO_2 EMISSION FACTOR [kg CO_2/t of steel]	**124.89**	**125.44**	**126.99**	**142.18**	**140.26**	**138.39**	**137.87**	**136.65**	**145.55**

Table 4.4.1. (cont.) Carbon balance for steel production in basic oxygen process in years 1988-2014

	2006	2007	2008	2009	2010	2011	2012	2013	2014
CHARGE									
Pig iron [t]	5 338 401	5 723 961	4 892 172	2 988 979	3 599 854	3 942 754	3 934 606	3 951 192	4 620 431
Scrap [t]	1 352 895	1 414 926	1 105 439	727 586	965 296	1 106 613	912 706	925 533	1 046 608
Carbon pick-up agent [t]	1 036	753	8 270	12 826	16 033	24 905	8 845	9 044	7 874
Ferroalloys [t]	68 765	71 480	65 149	40 273	53 926	59 738	53 477	57 253	66 718
Dolomite [t]	35 776	37 149	18 930	10 786	16 375	14 220	15 560	20 627	15 305
Technological indicator [t/t of steel]									
Pig iron	1.080	0.924	0.936	0.924	0.901	0.891	0.908	0.874	0.892
Scrap	0.2346	0.228	0.212	0.225	0.242	0.250	0.211	0.205	0.202
Carbon pick-up agent	0.0002	0.000	0.002	0.004	0.004	0.006	0.002	0.002	0.002
Ferroalloys	0.012	0.012	0.012	0.012	0.013	0.014	0.012	0.013	0.013
Dolomite	0.006	0.006	0.004	0.003	0.004	0.003	0.004	0.005	0.003
Material-specific carbon content									
Pig iron [t C/t]	0.04	0.042	0.042	0.043	0.042	0.042	0.043	0.043	0.043
Scrap [t C/t]	0.004	0.003	0.008	0.008	0.009	0.009	0.008	0.008	0.008
Carbon pick-up agent [t C/t]	0.826	0.899	0.820	0.845	0.823	0.806	0.823	0.833	0.853
Ferroalloys [t C/t]	0.029	0.032	0.035	0.035	0.033	0.028	0.031	0.031	0.033
Dolomite [t C/t]	0.130	0.130	0.124	0.125	0.125	0.125	0.126	0.125	0.126
Carbon contents in charge components [t C]									
Pig iron	213 536	239 730	207 333	127 337	150 438	165 971	167 334	168 816	197 002
Steel scrap	5 412	4 297	8 457	5 785	9 109	9 865	7 292	6 999	8 255
Carbon pick-up agent	855	677	6 783	10 839	13 198	20 075	7 277	7 538	6 714
Ferroalloys	2 021	2 288	2 249	1 427	1 761	1 673	1 681	1 769	2 222
Dolomite	4 649	4 829	2 341	1 345	2 047	1 780	1 960	2 586	1 924
Carbon contents in charge – SUM [t]	**226 474**	**251 821**	**227 163**	**146 733**	**176 553**	**199 365**	**185 544**	**187 708**	**216 117**
OUTPUT									
Steel [t]	**5 766 375**	**6 197 910**	**5 225 075**	**3 235 666**	**3 994 650**	**4 423 604**	**4 333 168**	**4 520 358**	**5 182 371**
Material-specific carbon content									
Steel [t C/t]	0.004	0.003	0.008	0.008	0.010	0.009	0.008	0.003	0.002
Carbon content in products [t C]									
Steel	23 066	18 304	41 662	25 760	38 441	40 780	34 990	11 919	8 579
Carbon content in products – SUM [t]	**23 066**	**18 304**	**41 662**	**25 760**	**38 441**	**40 780**	**34 990**	**11 919**	**8 579**
C emission from steel production [t]	203 408	233 516	185 501	120 974	138 111	158 585	150 554	175 789	207 538
CO_2 process emission from steel production [kt]	**745.831**	**856.227**	**680.171**	**443.570**	**506.409**	**581.478**	**552.032**	**644 561**	**760 973**
CO_2 EMISSION FACTOR [kg CO_2/t of steel]	**129.34**	**138.15**	**130.17**	**137.09**	**126.77**	**131.45**	**127.40**	**142.59**	**146.84**

Electric furnace steel production

Process emissions of CO_2 from steel production in electric furnaces for particular years in the period 1988-2006 were estimated based on the data from Polish Steel Association study [HIPH 2007]. For the last years information from verified reports, prepared as part of EU ETS, was applied for emission calculation. Steel production amounts was taken from Central Statistical Office yearbook [GUS 2008b-2015b]. Results of CO_2 emission estimation, AD and emission factors applied for calculation are presented in the table 4.4.2.

Table 4.4.2. Values of steel production in electric furnace [kt] as well as CO_2 emission factors [kg/t of steel] and CO_2 emission [kt] connected with that process for the years 1988-2014.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Production	2572.4	2264.3	2308.6	1950.9	1727.3	2044.2	2368.1	2581.9	2648.4	2906.3
CO_2 emission factor	34.75	36.94	36.94	36.11	33.21	37.82	36.44	33.05	33.05	33.05
CO_2 emission	89.38	83.63	85.27	70.45	57.36	77.32	86.29	85.34	87.54	96.07
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Production	3116.9	2825.1	3283.9	2809.1	2561.2	2916.6	3720.9	3443.2	4225.3	4432.8
CO_2 emission factor	35.83	29.15	44.13	44.10	45.64	41.90	55.10	46.97	48.88	44.76
CO_2 emission	111.66	82.35	144.91	123.89	116.90	122.20	205.00	161.74	206.53	198.41
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**			
Production	4502.3	3892.8	4001.4	4352.9	4209.3	3679.0	3617.1			
CO_2 emission factor	53.44	52.84	50.70	54.98	52.70	61.26	58.44			
CO_2 emission	240.58	205.68	202.88	239.30	221.84	225.38	211.40			

Open-hearth furnace steel production

Steel production in open-hearth furnaces was continued up to 2002. CO_2 process emissions from this source was estimated according to case study prepared by the Polish Steel Association (HIPH) [HIPH 2007]. CO_2 emission was calculated based on carbon balance developed for steel production process in mentioned furnaces.

4.4.2.1.b. Pig iron (CRF sector 2.C.1.b)

CO_2 process emission from pig iron production for the years 1988-2014 was estimated based on carbon balance in blast furnace process. Balances for individual years were founded on the statistical data for main components of input and output. Pig iron production values for entire period were accepted according to G-03 questioners [GUS 1989e-2015e]. Output of blast furnace gas was taken from Eurostat database for the period 1990-2014. For the years 1988-1989 that data came from IEA database [IEA] due to data for mentioned years is not available in Eurostat database. In case of coke input its amounts were derived from IEA. Data from Eurostat database was not applied to C balance for process of pig iron production, because of blast furnaces transformation efficiency in Eurostat energy balance is very high and it is the reason, that there is too little amount of coke use in „Transformation input in Blast Furnaces" compared with real technological demand. This problem was also mentioned in chapter 3.2.7.2.1. *Iron and steel* (1.A.2.a). Amounts of other components were estimated according to technological factors taken from literature [Szargut J. 1978]. These coefficients enabled to estimate amounts i.a.: dolomite (0,0885 kg/kg pig iron), limetone (0,0974 kg/kg pig iron) and iron ore (0,188 kg roasted ore/kg pig iron 0,0716 manganese ore/kg pig iron). In case of iron ore sinter was assumed (in accordance with data from steel plants), that total annual sinter production is consumed in given year for pig iron production. Carbon contents in components of charge and output were calculated base on C EFs from 2006 IPCC guidelines (for coke, pig iron, limestone and dolomites) or based on country specific values (data for iron ore comes from [Szargut J. 1978] while for sinter and BF gas − from plants). Carbon balance for blast furnace process for the years 1988-2014 and estimated emissions for entire period were presented in the table 4.4.3.

Table 4.4.3. Carbon balance for blast furnace process in years: 1988-2014

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
CHARGE – amount used in process in given year										
Sinter [kt]	14 107.3	12 992.5	11 779.4	8 612.7	8 621.7	7 628.2	8 787.4	8 646.6	8 318.6	8 980.8
Roasted ore [kt]	1 929.3	1 783.7	1 627.5	1 222.3	1 214.9	1 183.1	1 331.3	1 399.4	1 233.6	1 394.6
Dolomite [kt]	907.7	839.2	765.7	575.1	571.6	556.6	626.4	658.4	580.4	656.2
Limestone [kt]	999.6	924.1	843.2	633.3	629.4	612.9	689.7	725.0	639.1	722.5
Manganese ore [kt]	734.8	679.3	619.8	465.5	462.7	450.6	507.0	533.0	469.8	531.1
Coke [kt]	6 607.5	6 365.7	5 576.0	3 838.0	3 760.0	3 378.0	3 820.0	3 944.0	3 400.0	3 593.0
Coking coal [TJ]										
CHARGE – C content										
Sinter [kg/kg]	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011
Roasted ore [kg/kg]	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113
Dolomite [kg/kg]	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300
Limestone [kg/kg]	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200
Manganese ore [kg/kg]	0.0262	0.0262	0.0262	0.0262	0.0262	0.0262	0.0262	0.0262	0.0262	0.0262
Coke [kg/kg]	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Coking coal [kg/GJ]										
CHARGE – total C content [kt]										
Sinter	15.5	14.3	13.0	9.5	9.5	8.4	9.7	9.5	9.2	9.9
Roasted ore	21.7	20.1	18.3	13.8	13.7	13.3	15.0	15.8	13.9	15.7
Dolomite	118.0	109.1	99.5	74.8	74.3	72.4	81.4	85.6	75.5	85.3
Limestone	119.9	110.9	101.2	76.0	75.5	73.6	82.8	87.0	76.7	86.7
Manganese ore	19.2	17.8	16.2	12.2	12.1	11.8	13.3	13.9	12.3	13.9
Coke	5 484.2	5 283.5	4 628.1	3 185.5	3 120.8	2 803.7	3 170.6	3 273.5	2 822.0	2 982.2
Coking coal										
C IN CHARGE – SUM	5 778.6	5 555.7	4 876.3	3 371.7	3 305.9	2 983.2	3 372.7	3 485.3	3 009.5	3 193.7
OUTPUT IN GIVEN YEAR										
Pig iron [kt]	**10 262.4**	**9 487.6**	**8 656.7**	**6 501.5**	**6 462.0**	**6 292.9**	**7 081.2**	**7 443.5**	**6 561.9**	**7 418.0**
Blast furnace gas [TJ]	74 521	71 771	62 970	42 811	40 802	38 157	44 162	45 545	39 062	41 319
OUTPUT – C content										
Pig iron [kg/kg]	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Blast furnace gas [kg/GJ]	66.88	66.88	66.88	66.88	66.88	66.88	66.88	66.88	66.88	66.88
OUTPUT – total C content [kt]										
Pig iron	410.5	379.5	346.3	260.1	258.5	251.7	283.2	297.7	262.5	296.7
Blast furnace gas	4 983.7	4 799.8	4 211.2	2 863.0	2 728.7	2 551.8	2 953.4	3 045.9	2 612.3	2 763.3
C IN OUTPUT – SUM	5 394.2	5 179.3	4 557.5	3 123.1	2 987.2	2 803.5	3 236.6	3 343.6	2 874.8	3 060.0
DIFFERENCE BETWEEN C IN INPUT and C IN OUTPUT [kt]	384.5	376.4	318.8	248.6	318.7	179.6	136.1	141.7	134.7	133.7
CO_2 EMISSION [kt]	**1 410**	**1 380**	**1 169**	**912**	**1 169**	**659**	**499**	**520**	**494**	**490**
CO_2 EMISSION FACTOR [kg/t]	**137**	**145**	**135**	**140**	**181**	**105**	**70**	**70**	**75**	**66**

Table 4.4.3. (cont.) Carbon balance for blast furnace process in years: 1988-2014

	1998	1999	2000	2001	2002	2003	2004	2005	2006
CHARGE – amount used in process in given year									
Sinter [kt]	6 882.1	6 475.9	8 078.7	7 352.8	7 616.9	7 732.2	8 590.6	6 168.4	6 907.8
Roasted ore [kt]	1 180.5	993.1	1 223.0	1 023.3	995.7	1 061.4	1 208.3	842.5	1 042.1
Dolomite [kt]	555.4	467.2	575.4	481.4	468.5	499.4	568.5	396.4	490.3
Limestone [kt]	611.6	514.5	633.6	530.1	515.9	549.9	626.0	436.5	539.9
Manganese ore [kt]	449.6	378.2	465.8	389.7	379.2	404.2	460.2	320.9	396.9
Coke [kt]	2 983	2 495	3 386	2 935	2 553	2 753	2 990	2 056	2 549
Coking coal [TJ]									
CHARGE – C content									
Sinter [kg/kg]	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011
Roasted ore [kg/kg]	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113
Dolomite [kg/kg]	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300
Limestone [kg/kg]	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200
Manganese ore [kg/kg]	0.0262	0.0262	0.0262	0.0262	0.0262	0.0262	0.0262	0.0262	0.0262
Coke [kg/kg]	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Coking coal [kg/GJ]									
CHARGE – total C content [kt]									
Sinter	7.6	7.1	8.9	8.1	8.4	8.5	9.4	6.8	7.6
Roasted ore	13.3	11.2	13.8	11.5	11.2	12.0	13.6	9.5	11.7
Dolomite	72.2	60.7	74.8	62.6	60.9	64.9	73.9	51.5	63.7
Limestone	73.4	61.7	76.0	63.6	61.9	66.0	75.1	52.4	64.8
Manganese ore	11.8	9.9	12.2	10.2	9.9	10.6	12.0	8.4	10.4
Coke	2 475.9	2 070.9	2 810.4	2 436.1	2 119.0	2 285.0	2 481.7	1 706.5	2 115.7
Coking coal									
C IN CHARGE – SUM	2 654.1	2 221.5	2 996.1	2 592.1	2 271.3	2 446.9	2 665.8	1 835.1	2 273.9
OUTPUT IN GIVEN YEAR									
Pig iron [kt]	**6 279.4**	**5 282.3**	**6 505.3**	**5 442.8**	**5 296.4**	**5 645.9**	**6 426.9**	**4 481.2**	**5 543.4**
Blast furnace gas [TJ]	34 289	28 179	37 053	31 904	28 752	31 031	33 836	23 446	28 948
OUTPUT – C content									
Pig iron [kg/kg]	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Blast furnace gas [kg/GJ]	66.88	66.88	66.88	66.88	66.88	66.88	66.88	66.88	66.88
OUTPUT – total C content [kt]									
Pig iron	251.2	211.3	260.2	217.7	211.9	225.8	257.1	179.2	221.7
Blast furnace gas	2 293.1	1 884.5	2 478.0	2 133.6	1 922.8	2 075.2	2 262.8	1 568.0	1 935.9
C IN OUTPUT – SUM	2 544.3	2 095.8	2 738.2	2 351.3	2 134.7	2 301.1	2 519.9	1 747.2	2 157.7
DIFFERENCE BETWEEN C IN INPUT and C IN OUTPUT [kt]	109.8	125.7	257.9	240.7	136.6	145.9	145.9	87.8	116.3
CO_2 EMISSION [kt]	**403**	**461**	**946**	**883**	**501**	**535**	**535**	**322**	**426**
CO_2 EMISSION FACTOR [kg/t]	**64**	**87**	**145**	**162**	**95**	**95**	**83**	**72**	**77**

Table 4.4.3. (cont.) Carbon balance for blast furnace process in years: 1988-2014

	2007	2008	2009	2010	2011	2012	2013	2014
CHARGE – amount used in process in given year								
Sinter [kt]	6 954.0	6 306.4	4 362.6	5 837.3	6 512.8	6 672.5	6 854.2	7 389.4
Roasted ore [kt]	1 091.2	927.6	560.9	683.9	747.3	741.0	754.2	871.8
Dolomite [kt]	513.4	436.4	263.9	321.8	351.6	348.6	354.9	410.2
Limestone [kt]	565.4	480.6	290.6	354.3	387.2	383.9	390.8	451.7
Manganese ore [kt]	415.6	353.3	213.6	260.5	284.6	282.2	287.3	332.0
Coke [kt]	3 057	2 521	1 561	1 827	1 878	1 830	1 898	2 227
Coking coal [TJ]				948	2 338	5 977	4 205	5 465
CHARGE – C content								
Sinter [kg/kg]	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011
Roasted ore [kg/kg]	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113
Dolomite [kg/kg]	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300	0.1300
Limestone [kg/kg]	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200	0.1200
Manganese ore [kg/kg]	0.0262	0.0262	0.0262	0.0262	0.0262	0.0262	0.0262	0.0262
Coke [kg/kg]	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Coking coal [kg/GJ]				26.02	26.03	25.97	26.01	26.02
CHARGE – total C content [kt]								
Sinter	7.6	6.9	4.8	6.4	7.2	7.3	7.5	8.1
Roasted ore	12.3	10.4	6.3	7.7	8.4	8.3	8.5	9.8
Dolomite	66.7	56.7	34.3	41.8	45.7	45.3	46.1	53.3
Limestone	67.8	57.7	34.9	42.5	46.5	46.1	46.9	54.2
Manganese ore	10.9	9.2	5.6	6.8	7.4	7.4	7.5	8.7
Coke	2 537.3	2 092.4	1 295.6	1 516.4	1 558.7	1 518.9	1 575.3	1 848.4
Coking coal				24.7	60.9	155.2	109.4	142.2
C IN CHARGE – SUM	2 702.7	2 233.5	1 381.5	1 646.4	1 734.8	1 788.6	1 801.3	2 124.7
OUTPUT IN GIVEN YEAR								
Pig iron [kt]	**5 804.4**	**4 933.8**	**2 983.5**	**3 638.0**	**3 974.9**	**3 941.4**	**4 012.0**	**4 637.5**
Blast furnace gas [TJ]	34 626	28 551	17 610	22 022	22 271	22 684	22 530	25 802
OUTPUT – C content								
Pig iron [kg/kg]	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Blast furnace gas [kg/GJ]	66.88	68.37	67.85	65.7	65.51	66.97	67.12	67.31
OUTPUT – total C content [kt]								
Pig iron	232.2	197.4	119.3	145.5	159.0	157.7	160.5	185.5
Blast furnace gas	2 315.7	1 952.2	1 194.8	1 446.3	1 459.1	1 519.2	1 512.2	1 736.7
C IN OUTPUT – SUM	2 547.8	2 149.5	1 314.1	1 591.8	1 618.1	1 676.8	1 672.7	1 922.2
DIFFERENCE BETWEEN C IN INPUT and C IN OUTPUT [kt]	154.9	83.9	67.4	54.6	116.7	111.8	128.6	202.6
CO_2 EMISSION [kt]	**568**	**308**	**247**	**200**	**428**	**410**	**472**	**743**
CO_2 EMISSION FACTOR [kg/t]	**98**	**62**	**83**	**55**	**108**	**104**	**118**	**160**

4.4.2.1.c. Direct reduced iron (CRF sector 2.C.1.c)

Direct reduced iron has not been produced in Poland (information confirmed by Polish Steel Association (HIPH)).

4.4.2.1.d Sinter (2.C.1.d)

Estimation of carbon dioxide process emissions from iron ore sinter production for 2014 was based on the data from the EU ETS verified reports on annual emissions of CO_2 from iron ore sinter installations [KOBiZE 2015]. Sinter production (not published from 2000 in statistical materials) and data needed for estimation of country specific CO_2 EFs (i.a. amounts of components in input and output of the sintering process) were accepted according to mentioned EU ETS reports as well. Emissions for 2005-2013 were also estimated in accordance with EU ETS reports while for the years 1988-2004 according to data from questionnaires obtained by the National Centre for Emissions Management from installations entering the EU ETS [KOBiZE 2015]. The values of iron ore sinter production (AD), CO_2 EFs and CO_2 emissions were presented in the table 4.4.1. AD sources were as follows: G-03 reports for 1988-2000 [GUS 1989e-2001e], questionnaires from EU ETS installations collected by National Centre for Emissions Management for 2001-2004 and EU ETS verified reports for the years starting from 2005 [KOBiZE 2015].

For the entire period 1988-2014 emissions of CH_4 were also estimated from iron ore sinter production. The default emission factor for CH_4 (0.07 kg/t), was taken from tab. 4.2., 2006 GLs [IPCC 2006].

Table 4.4.4. Iron ore sinter production [kt], CO_2 emission factors [kg/t of sinter] and CO_2 emission values from sinter production in the years 1988-2014 [kt]

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Production	14107.3	12992.5	11779.4	8612.7	8621.7	7628.2	8787.4	8646.6	8318.6	8980.8
CO_2 emission factor	78.05	56.72	71.41	79.08	72.97	75.70	73.10	79.77	79.81	74.89
CO_2 emission	1101.14	736.98	841.16	681.13	629.08	577.45	642.35	689.76	663.94	672.58
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Production	6882.1	6475.9	8078.7	7352.8	7616.9	7732.2	8590.6	6168.4	6907.8	6954.0
CO_2 emission factor	73.55	83.21	79.00	72.36	73.92	85.08	76.79	72.59	84.59	88.28
CO_2 emission	506.20	538.89	638.21	532.01	563.07	657.86	659.70	447.73	584.31	613.91
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**			
Production	6306.4	4362.6	5837.3	6512.8	6672.5	6854.2	7389.4			
CO_2 emission factor	91.11	82.25	75.77	69.29	52.63	51.86	49.10			
CO_2 emission	574.59	358.80	442.32	451.29	351.14	355.48	362.79			

4.4.2.1.e Pellet (2.C.1.e)

Direct reduced iron has not been produced in Poland.

4.4.2.2. Ferroalloys production (CRF sector 2.C.2)

Emission of CO_2 concerning ferroalloys production was estimated based on annual ferrosilicon production taken from [GUS 2015b]. Applied emission factor of 4000 kg CO_2/t ferrosilicon, was taken from [IPCC 2006] – tab. 4.5 for ferrosilicon – 75% Si.

CH_4 emission was estimated based on emission factors from [IPCC 2006] – tab. 4.7 which is equal 1 kg CH_4/t ferrosilicon – 75% Si.

In the period 1988-2013 CO_2 and CH_4 process emission from ferroalloys production was estimated also based on annual ferrosilicon production taken from [GUS 1989b-2014b] (figure 4.4.2) and emission factors as in 2014.

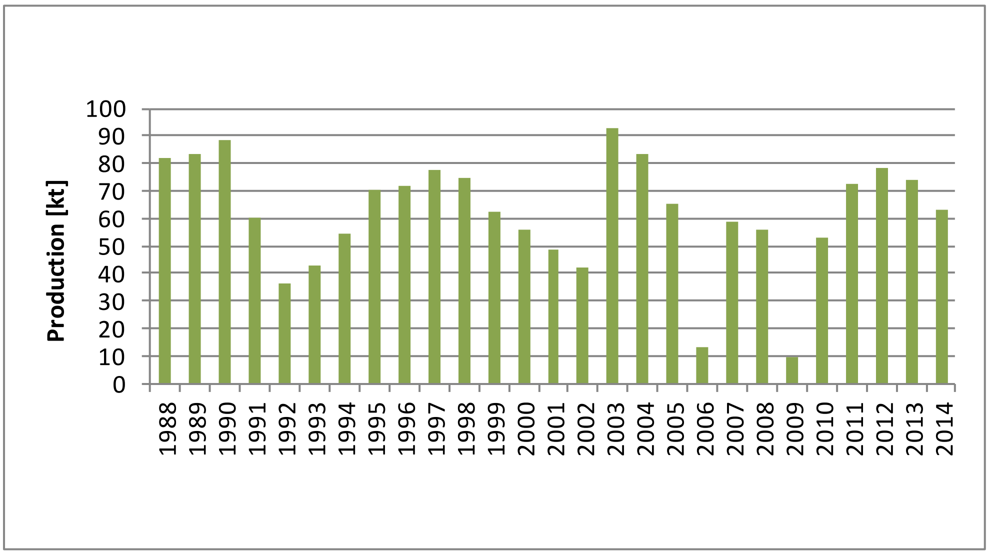

Figure 4.4.2. Production of ferrosilicon in 1988-2014

Coal consumption in ferroalloys production is submitted in national energy statistics as non-energy use of fuel. This means that coal consumed as reducer in mentioned process is not included in energy consumption of coal in 1.A.2 subsector, so double counting is avoided.

4.4.2.3. Aluminium production (CRF sector 2.C.3)

CO_2 emission from aluminium production was estimated for years 1988-2008 based on annual production amounts taken from [GUS 1989b-2009b]. Starting from 2009 primary aluminium is no longer produced in Poland.
The emission factor amounting to 1.7 t CO_2/t primary aluminium was applied in order to estimate CO_2 emission for entire period 1988-2008. Mentioned CO_2 EF is given in tab. 4.10. of 2006 IPCC GLs [IPCC 2006] as the value recommended for Soderberg process.

Emission of PFC gases from aluminium production is described in chapter 4.7.2.

4.4.2.4. Magnesium production (CRF sector 2.C.4)

Emission from use of SF_6 in magnesium foundries is described in chapter 4.7.2.

4.4.2.5. Lead production (CRF sector 2.C.5)

Process emissions of CO_2 from lead production for the years 1988-2014 were estimated based on annual lead productions taken from GUS yearbooks [GUS 1989b-2015b]. The default emission factor of 0.52 t CO_2/t lead produced, taken from the table 4.21 of 2006 GLs [IPCC 2006], was applied for the entire period.

The trend of process emissions from lead production is given in figure 4.4.3.

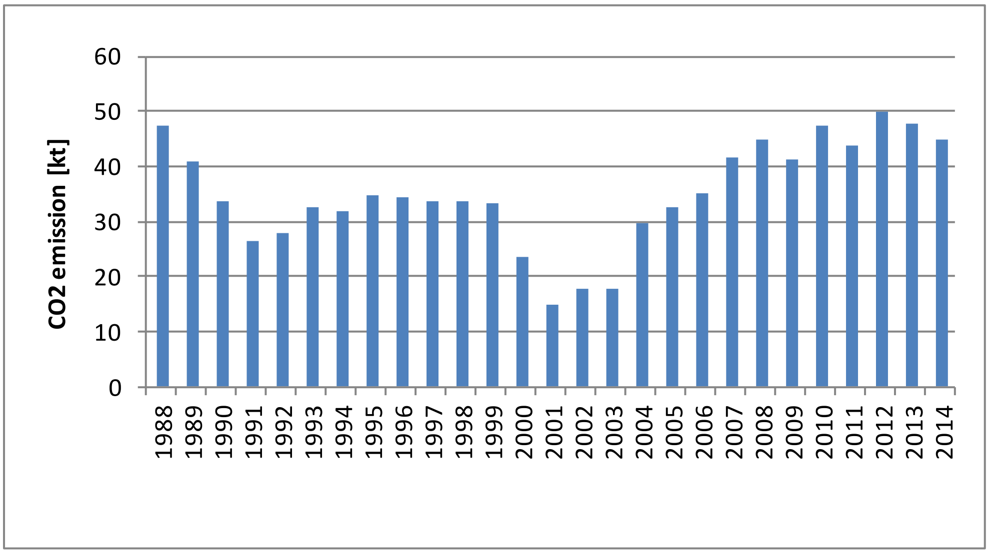

Figure 4.4.3. CO_2 process emission for lead production in 1988-2014

4.4.2.6. Zinc production (CRF sector 2.C.6)

CO_2 process emission from zinc production for the years 1988-2014 was estimated based on annual zinc production taken from GUS yearbooks [GUS 1989b-2015b]. The default emission factor amounting to 1.72 t CO_2/t zinc was used for entire reporting period. The factor comes from table 4.24 of 2006 GLs [IPCC 2006].

Process emission trend of CO_2 from zinc production is presented in figure 4.4.4.

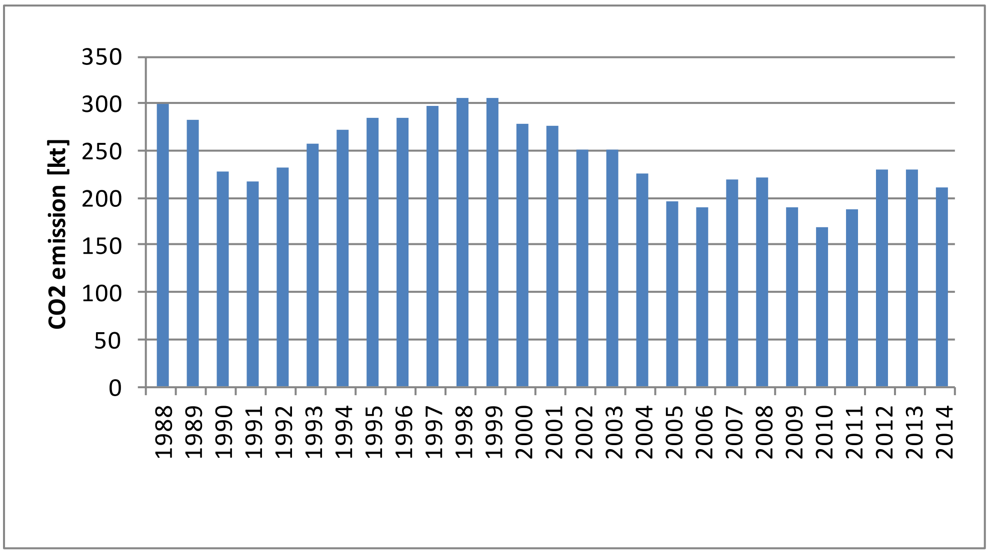

Figure 4.4.4. CO_2 process emission for zinc production in 1988-2014

4.4.3. Uncertainties and time-series consistency

See chapter 4.2.3

4.4.4. Source-specific QA/QC and verification

See chapter 4.2.4

4.4.5. Source-specific recalculations

changes in C balance for blast furnace process in the period 1988-2013 were introduced (i.a. application of country specific value for C content in blast furnace gas)

Table. 4.4.7. Changes of GHG emission values in 2.C. subcategory as a result of recalculations.

Change	1988	1989	1990	1991	1992	1993	1994	1995
CO2								
kt	-286.2	-269.5	-258.0	-30.9	279.5	-158.1	-456.3	-458.6
%	-3.6	-3.9	-4.3	-0.7	7.4	-4.4	-11.4	-11.0
CH4								
kt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
CO2								
kt	-339.5	-368.8	-303.2	-114.8	169.1	204.8	-97.2	-111.1
%	-9.3	-9.6	-9.8	-4.2	5.1	7.4	-3.7	-3.7
CH4								
kt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
CO2								
kt	-158.0	-155.7	-162.0	-168.8	-294.2	-130.2	91.4	89.5
%	-5.0	-6.5	-6.5	-5.6	-11.0	-7.9	5.4	4.2
CH4								
kt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Change	2012	2014
CO2		
kt	-147.9	-164.8
%	-6.5	-6.8
CH4		
kt	0.0	0.0
%	0.0	0.0

4.4.6. Source-specific planned improvements

No improvements are planned at the moment.

4.5. Non-energy Product from Fuels and Solvent Use (CRF sector 2.D)

4.5.1. Source category description

Estimation of emissions in 2.D *Non Energy Product from Fuels and Solvent Use* are carried out in sub-categories listed below:

a) *Lubricant use* (2.D.1)
b) *Paraffin wax use* (2.D.2)
c) *Other (2.D.3)*

Subsector 2.D.3. *Other* is by far the largest contributor to emissions from this category (see figure 4.4.1) – almost 81% in 2014.

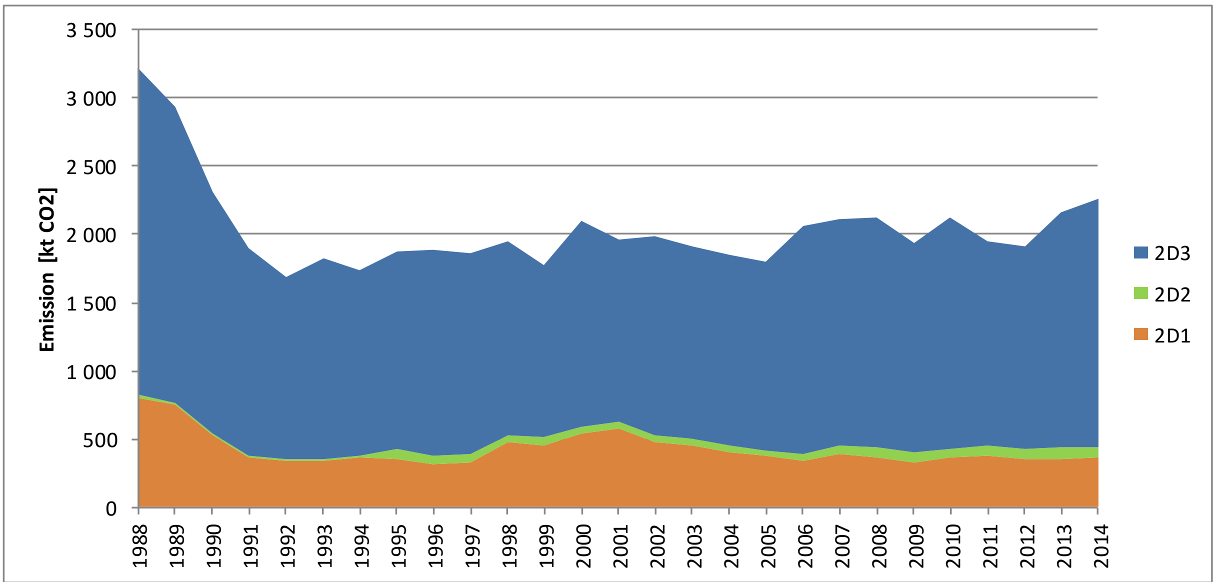

Figure 4.5.1. Emissions from *Non Energy Product from Fuels and Solvent Use* sector in years 1988-2014 according to subcategories

4.5.2. Methodological issues

4.5.2.1. Lubricant use (CRF sector 2.D.1)

Associated CO_2 emissions concerning non-energy use of lubricants were estimated based on Tier 1 method according to IPCC 2006 guidelines. Calculations were made in accordance with the following formula:

$$CO_{2\,emissions} = LC \times CC \times ODU \times 44/12$$

where:
LC – non-energy use of lubricants, TJ
CC – carbon content of lubricants (carbon emission factor), t C/TJ
ODU – oxidised during use factor
44/12 – mass ratio of CO_2/C

Carbon content of lubricants is default value equal 20 t C/TJ. ODU factor for lubricant is country specific and is equal 0.5.

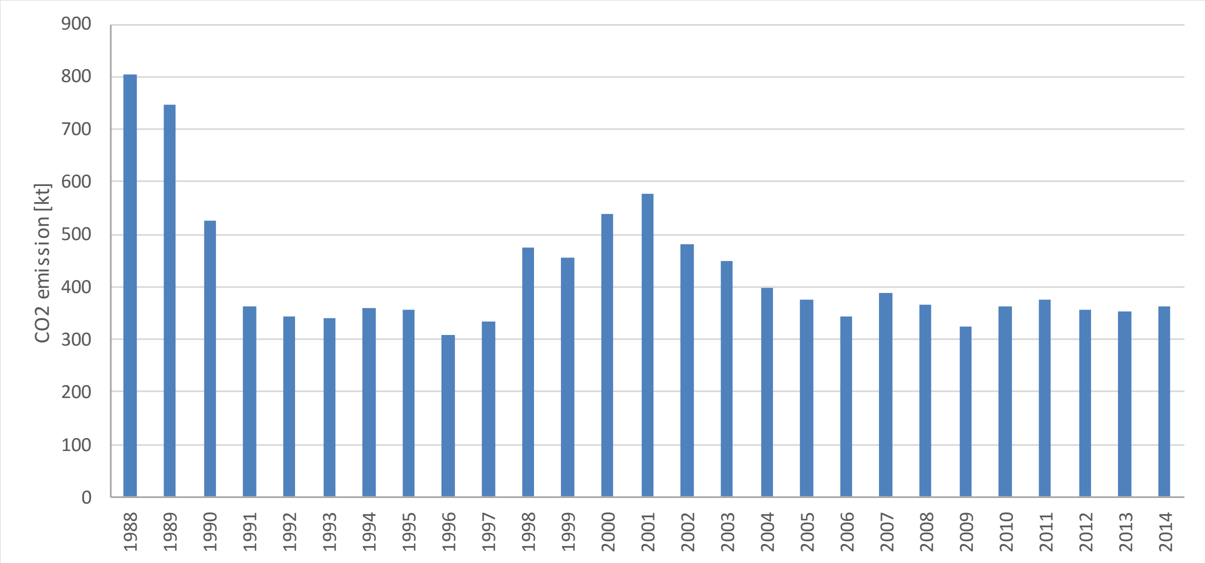

Figure 4.5.2. Associated CO_2 emissions from non-energy use of lubricants in years 1988 - 2014

4.5.2.2. Paraffin wax use (CRF sector 2.D.2)

Associated CO_2 emissions concerning non-energy use of paraffin wax were estimated based on Tier 1 method according to IPCC 2006 guidelines. Calculations were made in accordance with the following formula:

$$CO_{2\ emissions} = PW \times CC \times ODU \times 44/12$$

where:
PW – non-energy use of paraffin wax, TJ
CC – carbon content of paraffin wax (carbon emission factor), t C/TJ
ODU – oxidised during use factor
44/12 – mass ratio of CO_2/C

Carbon content of paraffin wax is default value equal 20 t C/TJ. ODU factor for paraffin wax is default value equal 0.2.

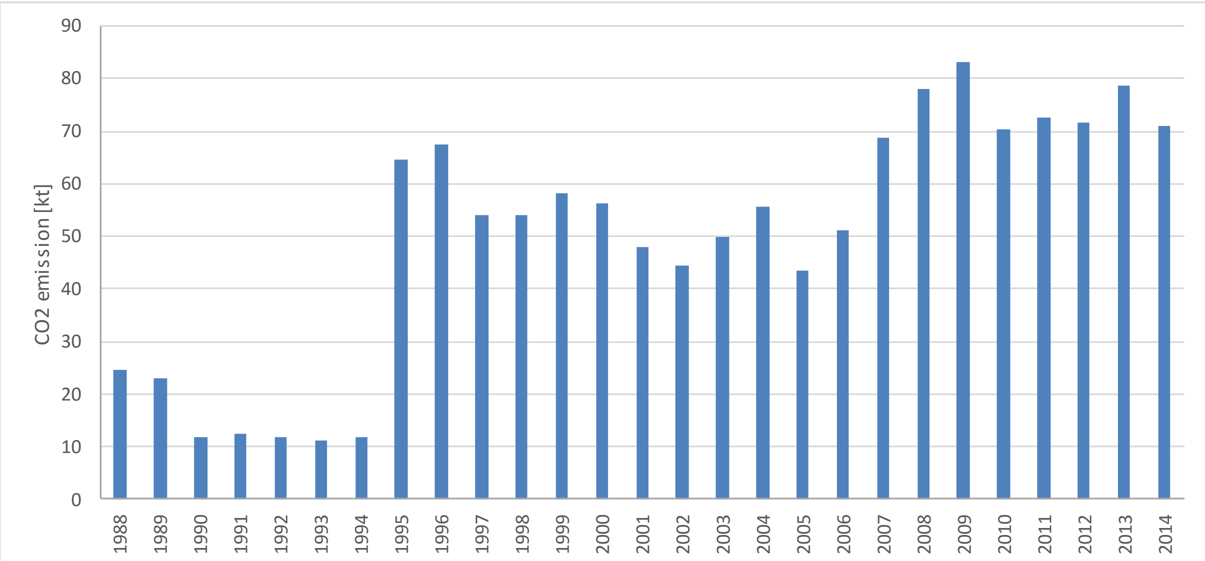

Figure 4.5.3. Associated CO_2 emissions from non-energy use of paraffin waxes in years 1988 - 2014

4.5.2.3. Other (CRF sector 2.D.3)

Category contain emission from solvent use and associated CO_2 emissions concerning non-energy use of fuels.

4.5.2.3.1. Solvent use

There are no sources from sub-category Solvent Use , which are identified as key sources.

The use of solvents is one of the main sources of NMVOC emissions and is associated with following processes:

- Paint application(SNAP 0601),
- Degreasing and dry cleaning (SNAP 0602),
- Chemical Products, Manufacture and Processing(SNAP 0603),
- Other solvents use(SNAP 0604).

The GHG emission sources in Solvent and Other Product Use sector involve:

CO_2 emission from the following activities: Paint application, Degreasing and dry cleaning, Chemical Products, Manufacture and Processing and Other solvents use (Fat edible and non-edible oil extraction, Other non-specified),

Emission trend is consistent with the submission to:
the European Union in the framework of reporting to the Directive 2001/81/EC of European Parliament and the Council of 23 October 2001 on national emission ceilings for certain pollutants
the Convention on Long-range Transboundary Air Pollution (LRTAP).

According to the new 2006 IPCC guidelines N2O emissions from the use of N_2O for anesthesia is reported sub-category 2.G.3.

Total emission of GHG in this sector in 2014 was estimated to 678 kt CO_2. This emission decreased by 23% from year 1988 to 2014 (Figure 4.5.4). This is mostly due to decrease of using solvents in paint applications (by 33%) (Figure 4.5.5).

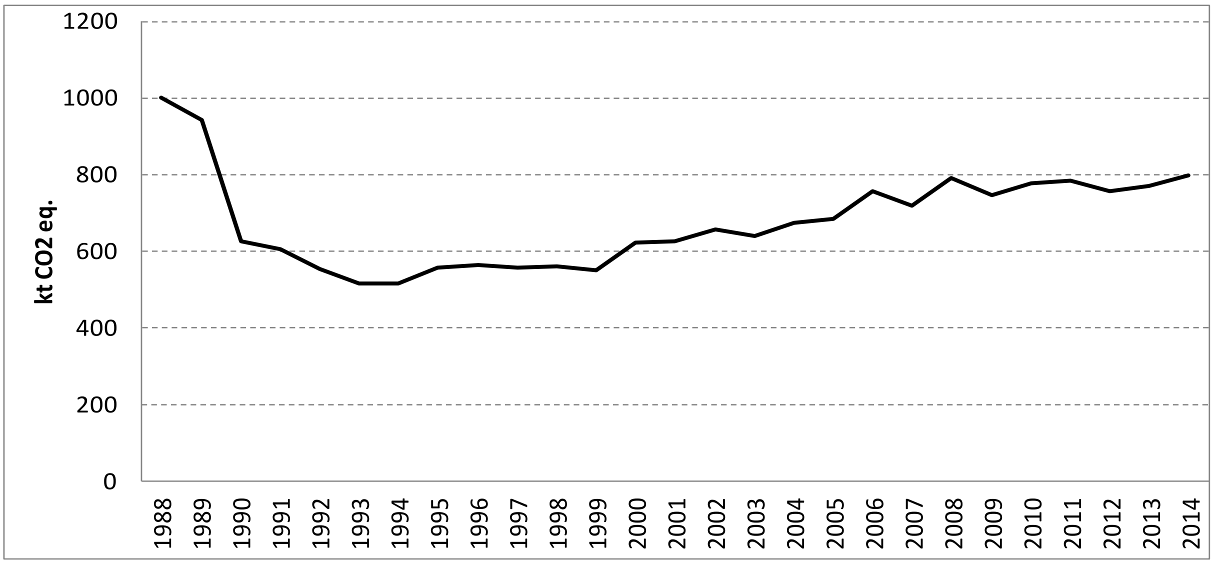

Figure 4.5.4. GHG emission from Solvent and Other Product Use sector in 1988-2014.

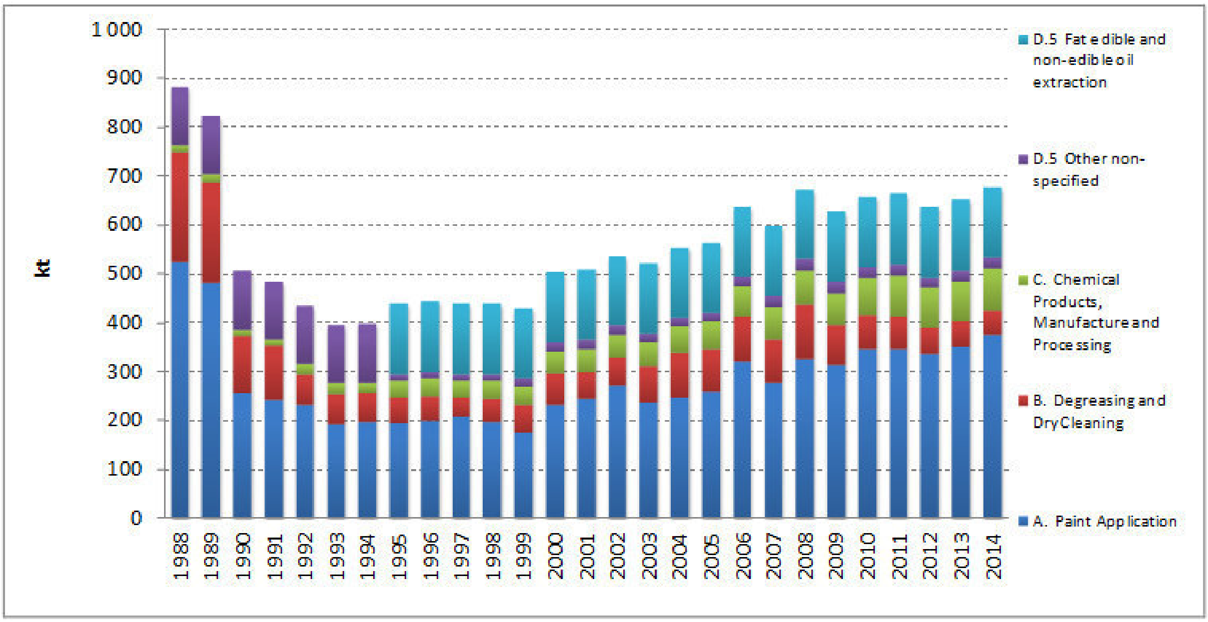

Figure 4.5.5. CO_2 emission from Solvent and Other Product Use sector in 1988-2014.

Paint application

Paint application includes the following processes:

- cars production,
- car repair,
- use in households,
- coil coating,
- ship building,
- wood painting,
- other applications in industry,
- other non-manufacturing applications.

In the national inventory all of these processes are considered jointly with the division on the use of paints based on organic solvents and water-based paints.

Calculations of CO_2 emissions within Sector 3, using the common methodology, were carried out on the basis of results of NMVOC emissions [EMEP 2013]. CO_2 emission factor was determined assuming, that carbon content in NMVOC is 85%. Then carbon content has been calculated in a stoichiometric way to CO_2. Calculations were made in accordance with the following formula:

$$\mathbf{CO_2 = 0.85 * 44/12 * NMVOC}$$

where:

CO_2 – carbon dioxide emission from particular subsectors,
NMVOC – NMVOC emission from particular subsectors.

Degreasing and dry Cleaning

Degreasing and dry cleaning include:

- degreasing metals,
- chemical cleaning,

- production of electronic components,
- other industrial cleaning processes.

In the Polish national inventory the first two processes were considered. It was assumed that "degreasing metals" include also solvents used for other purposes in industrial processes, which were not included separately in the inventory report for NMVOC (eg., electronic industry, textile, leather, etc.).

Chemical products, manufacture and processing

The national inventory includes emissions from the following processes:
- polyvinylchloride processing,
- polystyrene foam processing,
- rubber processing,
- pharmaceutical products manufacturing,
- paints manufacturing.

Other solvents use

The category "Other use of solvents" includes following processes:

- solvents in the household use (except paint)
- oil extraction (production of fats and oils)

4.5.2.3.2. Other non-energy use of fuels

Associated CO_2 emissions concerning non-energy use of fuels were estimated based on Tier 1 method according to IPCC 2006 guidelines. Calculations were made in accordance with the following formula:

$$CO_{2\ emissions} = \sum_i (NEU_i \times CC_i \times ODU_i) \times 44/12$$

where:
NEU_i – non-energy use of fuel *i*, TJ
CC_i – carbon content of fuel *i* (carbon emission factor), tC/TJ
ODU – oxidised during use factor of fuel *i*
44/12 – mass ratio of CO_2/C

List of fuels and CO_2 emission is presented on figure 4.5.6.

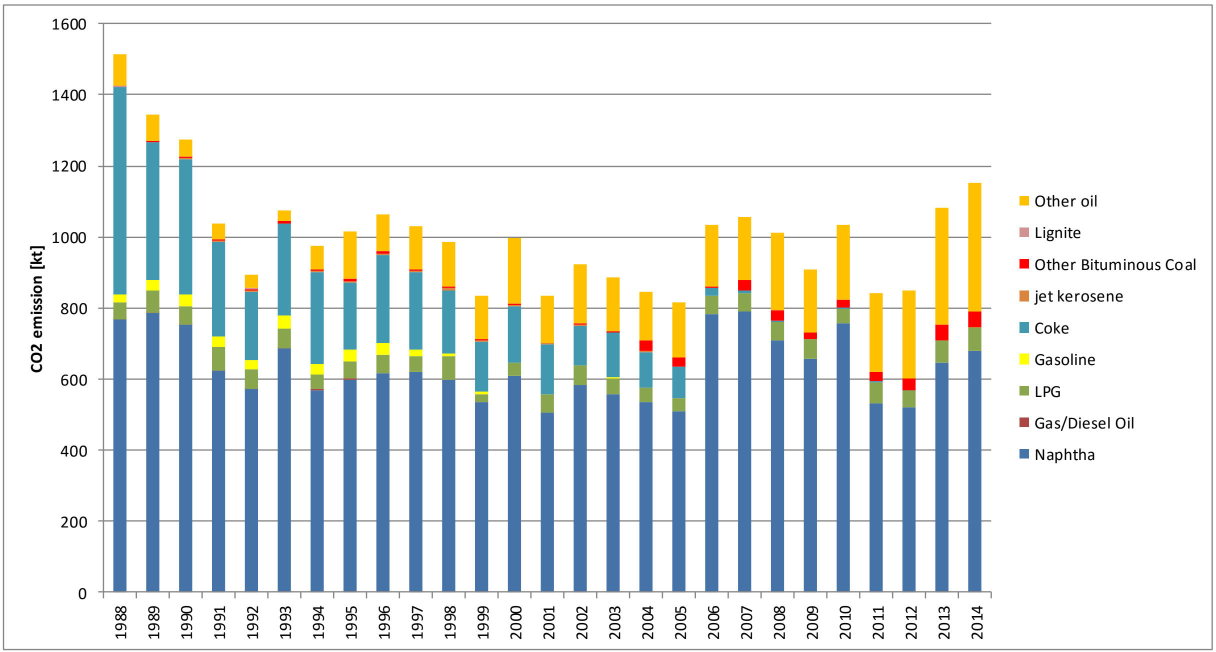

Figure 4.5.6. Associated CO_2 emission in 1988-2014

4.5.3. Uncertainties and time-series consistency

See chapter 4.2.3

4.5.4. Source-specific QA/QC and verification

See chapter 4.2.4

4.5.5. Source-specific recalculations

Recalculations for the year 2009-2013 was made as result of the correction of activity data. In table 4.5.1. are shown emission changes for subcategory - Chemical products, manufacture and processing (2.D.3) .

Table 4.5.1. Emission changes for subcategory Chemical products, manufacture and processing.

Difference	1988	1989	1990	1991	1992	1993	1994	1995
kt CO_2 eq.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1996	1997	1998	1999	2000	2001	2002	2003
kt CO_2 eq	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2004	2005	2006	2007	2008	2009	2010	2011
kt CO_2 eq	0.00	0.00	0.00	0.00	0.00	0.30	0.71	0.35
%	0.00	0.00	0.00	0.00	0.00	0.46	0.93	0.42
	2012	2013						
kt CO_2 eq	0.34	0.43						
%	0.43	0.52						

4.5.6. Source-specific planned improvements

Any possible improvements will be related to further development of NMVOCs emissions methodology.

4.6. Electronic industry (CRF sector 2.E)

Not occurring.

4.7. Product uses as substitutes for ODS (CRF sector 2.F)

4.7.1 Source category description

Data used to estimate emissions in preparation of the greenhouse gas inventories is based on aggregated data collected by operators under Article 3(6) of Regulation (EC) No 842/2006. Use of the same data source for both obligations results in full consistency between datasets. Data consistency checks are performed on yearly basis for the whole reported time series.

In case of refrigeration and air-conditioning equipment containing HFCs, some information concerning e.g. amounts of gas used, are collected by experts among main domestic producers and importers/exporters [Mąkosa 2012, Popławska-Jach 2016].

To assure transparency and completeness of the description in NIR it was decided to group description of all f-gases emission in this chapter. Methodologies described here were divided into 3 groups referring to the substance: HFCs, PFCs and SF_6.

Besides dominating category in terms of f-gases emission 2.F Product uses as substitutes for ODS – this chapter also includes description of **PFC emission** from IPCC category **2.C.3 Aluminium production** described under PFC section below.

This chapter also includes description of **SF_6 emissions** from IPCC categories **2.C.4 Magnesium production** and 2.G.1 **Electrical equipment.**

Implementation of IPCC 2006 Guidelines resulted in number of changes in methodology – most notable are:
- use of updated global warming potentials (GWPs) from the IPCC 4th Assessment Report
- the reporting of new greenhouse gases (GHGs) including NF_3 and the new species of hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

4.7.2 Methodological issues

NF_3

Since 2015 mandatory reporting was extended to include NF3, which is used in the manufacture of semiconductors, liquid crystal display (LCD) panels and photovoltaics. Other application of NF_3 are hydrogen fluoride and deuterium fluoride lasers.

During preparation of submission 2015 Polish market was investigated to identify potential sources of NF_3. During this process **no activity resulting in NF_3 emission was identified** and all potential sources are not occurring in Poland. During preparation of f-gases inventory for submission 2016 this information was verified and confirmed by information reported by producers and suppliers of f-gases in Poland. Therefore, NF_3 emission from all potential categories was reported as not occurring.

HFC

The national GHG inventory covers the following emission sources for HFCs:

- 2.F.1 Refrigeration and air-conditioning equipment (dominating category in terms of emission volume),
- 2.F.2 Foam blowing agents,
- 2.F.3 Fire protection,
- 2.F.4 Aerosols (technical and medical),
- 2.F.5 Solvents.

2.F.1 Refrigeration and air-conditioning equipment

For transparency reasons and due to importance of the emissions from the refrigeration and air-conditioning equipment (2.F.1) – the main assumptions for estimates were described with more details below. Activity data and assumptions made within the sector were revised in 2016 (described in recalculation chapter of this section). Amount of input in each equipment type was given in table 4.7.1.

Methodology used for estimates of f-gases is IPCC 2006 Guidelines, which is mandatory for submission 2016. Applying new guidelines didn't affect estimated emission values directly, because this methodology was used before, however some emissions were allocated differently than in submission 2014 to reflect new classification (electrical equipment, etc).

Table 4.7.1. Amount of input in each equipment type

Equipment type	**F-gas input per piece of equipment [kg]**
Domestic refrigerators	0.285
Domestic freezers	0.285
Commercial refrigeration (small hermetic MT)	0.24
Commercial refrigeration (small hermetic LT)	0.24
Commercial refrigeration (single condensing units MT)	3.60
Commercial refrigeration (single condensing units LT)	2.70
Commercial refrigeration (large multipack MT)	100.00
Commercial refrigeration (large multipack LT)	50.00
Stationary air-conditioning (small split)	0.90
Stationary air-conditioning (medium split)	2.25
Stationary air-conditioning (large split)	5.60
Stationary air-conditioning (packaged systems)	20.0
Stationary air-conditioning (VRF systems)	25.0
Stationary air-conditioning (small chillers)	30.0
Stationary air-conditioning (medium chillers)	150.0
Stationary air-conditioning (large chillers)	500.0
Passenger cars with air-conditioning	1.20
Public transport	1.50
Trucks	1.50
Trailers	5.50
Wagon, tank, cold rooms	5.50
Cargo railway cars	5.50
Tram cars	5.50
Equipment used for refrigeration	5.50

Estimates of the amount of each gas in selected equipment type assumption on shares of gases (or their mixes) were applied (see table 4.7.2. and 4.7.3 below).

Table 4.7.2. Share of gases and mixes for commercial refrigerators

Gas or mix	Percent of mix	HFC-125 amount	HFC-134a amount	HFC-143a amount	HFC-32 amount
407c	10	4	4	2	0
410a	70	35	0	0	35
HFC-134a	20	0	20	0	0
Amount of gas applied to estimates		38	25	2	35

Table 4.7.3. Share of gases and mixes for stationary air-conditioning

Gas or mix	Percent of mix	HFC-125 amount	HFC-134a amount	HFC-143a amount	HFC-32 amount
404a	30	12	1	17	0
507a	40	20	0	20	0
HFC-134a	30	0	30	0	0
Amount of gas applied to estimates		35	30	35	0

The final assumptions on percent of refrigeration equipment where HFC-32, 125, 134a and 143a were used was shown in tables 4.7.4-4.7.7 below.

Table 4.7.4. Percent of equipment in which HFC-32 was used

Type of equipment	Percent of equipment in which HFC-32 was used																			
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Stationary air-conditioning	0	0	0	0	0	25	30	35	35	35	35	35	35	35	35	35	35	35	35	32

Table 4.7.5. Percent of equipment in which HFC-125 was used

Type of equipment	**Percent of equipment in which HFC-125 was used**																			
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Commercial air-conditioning	0	0	5	10	15	20	20	25	30	25	30	30	30	30	29	28	27	27	27	25
Stationary air-conditioning	0	0	0	0	0	25	30	35	35	35	38	38	38	38	38	38	38	38	38	35
Transport refrigeration	0	0	0	0	0	11	11	11	11	11	11	22	22	22	22	33	33	41	41	41

Table 4.7.6. Percent of equipment in which HFC-134a was used

Type of equipment	**Percent of equipment in which HFC-134a was used**																			
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Domestic refrigerators	50	70	100	100	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0
Domestic freezers	50	70	100	100	100	100	100	100	0	0	0	0	0	0	0	0	0	0	0	0
Commercial air-conditioning	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Stationary air-conditioning	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Passenger cars with air-conditioning	15	20	25	30	40	50	60	60	70	70	80	80	90	90	100	100	100	100	100	100
Public transport	10	10	20	25	30	30	30	30	40	40	40	50	50	50	60	60	60	60	60	60
Trucks	0	0	15	20	25	25	25	30	30	30	40	40	40	50	50	50	50	50	50	50
Trailers	0	0	0	0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Wagon, tank, cold rooms	0	0	0	0	0	1	1	1	1	1	1	3	3	3	3	4	4	5	5	5
Cargo railway cars	0	0	0	0	0	1	1	1	1	1	1	3	3	3	3	4	4	5	5	5
Tram cars	0	0	0	0	0	1	1	1	1	1	1	3	3	3	3	4	4	5	5	5

Type of equipment	Percent of equipment in which HFC-134a was used																			
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Equipment used for refrigeration	0	0	0	0	0	1	1	1	1	1	1	3	3	3	3	4	4	5	5	5

Table 4.7.7. Percent of equipment in which HFC-143a was used

Type of equipment	Percent of equipment in which HFC-143a was used																			
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Commercial air-conditioning	0	0	7	15	20	25	25	35	35	35	40	40	40	40	39	39	38	38	38	38
Stationary air-conditioning	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2
Transport refrigeration	0	0	0	0	0	13	13	13	13	13	13	26	26	26	26	38	48	48	48	48

Table 4.7.8 shows aggregated national total HFCs emissions over 1995-2014 expressed in CO_2 equivalents and HFCs emission in sub-sector: 2.F.1 Refrigeration and Air Conditioning Equipment. Prior to 1995, HFCs were not used in Poland.

Table 4.7.8. HFCs emissions in 2.F.1 Refrigeration and Air Conditioning Equipment and in Total

Year	HFCs emissions in 2.F.1 Refrigeration and Air Conditioning Equipment [t CO_2 eq.]	Total HFCs emissions [t CO_2 eq.]
1995	79 826	97 344
1996	145 780	228 406
1997	248 325	373 929
1998	341 999	462 228
1999	552 814	673 377
2000	1 169 762	1 280 826
2001	1 665 993	1 839 666
2002	2 221 767	2 420 257
2003	2 891 714	2 992 326
2004	3 246 234	3 647 554
2005	3 759 618	4 471 061
2006	4 202 313	5 140 550
2007	4 840 080	5 742 295
2008	5 397 723	6 088 806
2009	5 551 857	6 098 201
2010	6 353 642	6 782 775
2011	6 996 576	7 449 613
2012	7 260 935	7 720 453
2013	7 568 831	8 091 919
2014	8 046 112	8 586 931

2.F.2 Foam blowing agents

Activity data for this application was collected during the questionnaire survey of importers, suppliers and end users of HFCs. Analysis of the Polish market allowed to identify use of HFC-134a, HFC-227ea, HFC-365mfc, HFC-245ca and HFC-152a as foam blowing agents. Following IPCC 2006 GLs it was assumed that HFCs applied to open cells foam are released in first year of use. Regarding release ratio from hard foam (closed pores) applications it was assumed as follows:

- EF for HFC-134a: new product = 95% first year; 2.5% next years
- EF for HFC-227ea: new product = 10% first year; 4.5% next years

- EF for HFC-365mfc: new product = 25% first year; 1.5% next years
- EF for HFC-245ca: new product = 25% first year; 1.5% next years
- EF for HFC-152a: new product = 95% first year; 2.5% next years

Results of the emission estimates for foam blowing agents were presented in table 4.6.9 below.

Table 4.7.9. HFCs emissions for categories: 2.F.2 Foam blowing agents, 2.F.3 Fire protection; 2.F.4 Aerosols and 2.F.5 Solvents [t CO2 eq.]

	HFCs emissions			
Year	2.F.2 Foam blowing agents [t CO_2 eq.]	2.F.3 Fire protection [t CO_2 eq.]	2.F.4 Aerosols [t CO_2 eq.]	2.F.5 Solvents [t CO_2 eq.]
1995	NO	NO	17 518	NO
1996	NO	43	82 583	NO
1997	NO	121	125 483	NO
1998	NO	234	119 995	NO
1999	11 440	1 408	107 715	NO
2000	11 440	1 580	98 044	NO
2001	11 440	3 517	158 716	NO
2002	42	3 008	195 441	NO
2003	1 561	9 097	89 954	NO
2004	9 707	7 959	383 655	NO
2005	318 273	11 930	380 716	524
2006	352 563	15 114	569 559	1 000
2007	395 357	21 341	484 877	640
2008	347 947	25 107	317 701	328
2009	245 586	30 143	269 631	984
2010	263 026	40 387	123 484	2 234
2011	277 983	47 156	125 112	2 786
2012	277 067	54 565	126 268	1 618
2013	336 316	61 407	124 955	410
2014	343 833	71 131	125 445	410

NO – emission not occurring

2.F.3 Fire protection

Activity data for this application was collected during the same questionnaire survey of importers, suppliers and end users of HFCs as for categories 2.F.1 and 2.F.2. Analysis of the Polish market allowed to identify use of HFC-227ea and HFC-236fa (since 1996). Regarding release ratio from fire protection equipment it was assumed as follows:

- EF for HFC-227ea: new product = 1% first year; 5% next years
- EF for HFC-236fa: new product = 1% first year; 5% next years

Results of the emission estimates for foam blowing agents were presented in table 4.6.9 above.

2.F.4 Aerosols

As mentioned in description of categories above activity data for this application of technical and medical aerosols was collected during the questionnaire survey of importers, suppliers and end users of HFCs. Analysis of the Polish market allowed to identify use of HFC-134a (since 1995). Release ratio for technical and medical aerosols was assumed as follows:

- EF for HFC-134a: import for production of technical aerosols = 50% first year; 50% next year
- EF for HFC-134a: import of technical aerosols = 50% first year; 50% next year
- EF for HFC-134a: import for production of medical aerosols = 100% first year
- EF for HFC-134a: import of medical aerosols = 100% first year

Results of the emission estimates for foam blowing agents were presented in table 4.6.9 above.

2.F.5 Solvents

As mentioned in description of categories above activity data for this application of technical and medical aerosols was collected during the questionnaire survey of importers, suppliers and end users of HFCs. Analysis of the Polish market allowed to identify use of HFC-365mfc and HFC-43-10mee (since 2005). Release ratio for solvents category was assumed as follows:

- EF for HFC-365mfc: 50% first year; 50% next year
- EF for HFC-43-10mee: 50% first year; 50% next year

Results of the emission estimates for foam blowing agents were presented in table 4.6.9 above.

PFC

The national GHG inventory covers the following emission sources for PFCs: fire extinguishers (C_4F_{10}) and primary aluminium production (CF_4, C_2F_6).

2.C.3 Aluminium production

The dominating source of emission of PFC gases in Poland is IPCC sector 2.C.3 Aluminium production. Activities on aluminium production were taken from [GUS 2010b]. *Tier 1* method and the country specific emission factors were used for estimation of PFC emissions:

- for CF_4 EF = 0.373 kg/Mg aluminium produced
- for C_2F_6 EF = 0.027 kg/Mg aluminium produced

Country specific emission factors given above are based on plant specific reporting of installations under EU ETS.

Table 4.7.10 shows aggregated national total PFCs emissions over 1988-2013 expressed in CO_2 equivalents and PFCs emission in sub-sector: 2.C.3 Aluminium Production. More details on activity in this category was provided in chapter describing CO_2 emission from aluminium production.

2.F.3 Fire protection

According to historical data obtained from producers and importers/exporters first use of PFCs (C_4F_{10}) in fire extinguishers began in 1996. Prior to 1996, the only known source of PFCs was primary aluminium production. On basis of IPCC 2006 GL applied emission factors for C_4F_{10} for import and use of equipment were 1% and 5% respectively. Formula used for estimating amount of substance in use in current year (n+1) is presented below:

in use n+1 = in use n - emission from in use n + (import n+1 - emission from import n+1)

where: n - year

Table 4.7.10. PFCs emissions in 2.C.3 Aluminium production and 2.F.3 Fire protection compared to national total PFCs emission

Year	PFCs emissions in 2.C.3 Aluminium Production [t CO_2 eq.]	PFCs emissions in 2.F.3 Fire protection [t CO_2 eq.]	Total PFCs emissions [t CO_2 eq.]
1988	147 258	NO	147 258
1989	147 508	NO	147 508
1990	141 870	NO	141 870
1991	141 311	NO	141 311
1992	134 630	NO	134 630
1993	144 857	NO	144 857
1994	152 778	NO	152 778
1995	171 969	NO	171 969
1996	160 231	843	161 074
1997	165 446	7 915	173 361
1998	167 155	7 703	174 858
1999	157 299	11 414	168 713
2000	161 499	15 181	176 680
2001	168 489	28 855	197 343
2002	181 449	25 881	207 330
2003	176 635	24 443	201 078
2004	181 853	23 221	205 074
2005	165 347	22 060	187 407
2006	172 620	20 957	193 577
2007	164 721	19 909	184 630
2008	144 203	18 914	163 116
2009	NO	17 968	17 968
2010	NO	17 070	17 070
2011	NO	16 216	16 216
2012	NO	15 405	15 405
2013	NO	14 635	14 635
2014	NO	13 903	13 903

NO – emission not occurring

SF_6

As concerns SF_6 the national GHG inventory covers the following emission sources: electrical equipment and magnesium foundries.

2.C.4 Magnesium casting

Data on Mg casting were obtained from yearbooks of *Modern Casting*. The first use of SF_6 in magnesium foundries was identified in 1994. Due to unavailability of the data on magnesium in national statistics and other external data sources for recent years it was decided to use last verified activity data available (2007). Emission factors referring to amount of cast per year was used for calculation of SF_6 emission:

$$\text{Mg casting EF} = 1\text{kg } SF_6 / \text{Mg of the amount of alloy used to produce casting}$$

Amount of alloy used to produce casting is based on amount of magnesium production per year taking into account yield factor 55%.

Table 4.7.11 includes the activity data used for estimation SF_6 emissions over the period: 1988-2014.

2.G.1 Electrical equipment

Applied emissions factors were based on methodology provided in IPCC 2006 GL. Amounts of equipment on the market was assessed on the basis of data provided by producers and importers/exporters.

Electrical equipment manufacturing EF = 0.06 Mg/Mg of SF_6 used
Electrical equipment use EF = 0.05 Mg/Mg SF6 in use (1995), EF = 0.02 Mg/Mg (since 1996)

Table 4.7.11 presented below includes the activity data used for estimation SF_6 emissions over the period: 1994-2013.

Table 4.7.11. Activity data used for estimation of SF_6 emissions in 2.C.4 Magnesium production and 2.G.1 Electrical equipment

Activity characteristic for the source sector	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
2.C. Metal industry										
4. Magnesium production – amount of alloy used to produce casting [Mg]	320	400	400	345	291	236	181	127	72	46
2.G Consumption of HFC, PFC and SF_6										
1. Electrical equipment – amount of SF_6 in use [Mg]		11.00	14.02	17.05	20.07	23.10	26.12	28.70	32.04	33.75
1 Electrical equipment – amount of imported SF_6 [Mg]	NO	NO	0.60	0.60	2.00	2.33	2.66	3.30	4.16	2.50

Activity characteristic for the source sector	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
2.C. Metal industry											
4. Magnesium production – amount of alloy used to produce casting [Mg]	20	30	65	100	100	100	100	100	100	100	100
2.G Consumption of HFC, PFC and SF_6											
1. Electrical equipment – amount of SF_6 in use [Mg]	36.45	40.57	46.23	48.63	51.32	55.80	57.97	61.50	65.66	71.70	78.95
1. Electrical equipment –amount of imported SF_6 [Mg]	3.59	5.16	6.89	3.54	3.89	5.86	3.50	4.99	5.73	7.82	9.24

Table 4.7.12 below shows aggregated national total SF_6 emissions over 1994-2014 in tones compared to SF_6 emission in most important sub-sector: 2.G.1 *Electrical Equipment*. There is no data available on SF_6 use prior to 1994.

Table 4.7.12. SF_6 emissions in 2.C.4 Magnesium foundries and 2.G.1 Electrical equipment compared to national total emission

Year	SF_6 emissions in 2.C.4 Magnesium [t]	SF_6 emissions in 2.G.1 Electrical Equipment [t]	Total SF_6 emissions [t]
1994	0.58	NO	0.58
1995	0.73	0.55	1.28
1996	0.73	0.32	1.04
1997	0.63	0.38	1.00
1998	0.53	0.52	1.05
1999	0.43	0.60	1.03
2000	0.33	0.68	1.01
2001	0.23	0.77	1.00
2002	0.13	0.89	1.02
2003	0.08	0.82	0.91
2004	0.04	0.94	0.98
2005	0.05	1.12	1.18
2006	0.12	1.34	1.46
2007	0.18	1.18	1.37
2008	0.18	1.26	1.44
2009	0.18	1.47	1.65
2010	0.18	1.37	1.55
2011	0.18	1.53	1.71
2012	0.18	1.66	1.84
2013	0.18	1.90	2.08
2014	0.18	2.13	2.32

NO – emission not occurring

4.7.3. Uncertainties and time-series consistency

Simplified analysis were made for industrial gases HFC, PFC and SF6, where uncertainty assumptions were applied directly to emission values of each pollutant. Due to lack of available information, simplified approach has to be used and country recognizes need of additional analysis in this sector as planned improvement for future inventories. More details on uncertainty assessment of whole inventory are given in annex 8.

	Emission HFC [kt of CO2 eq.]	Emission PFC [kt of CO2 eq.]	Emission SF6 [kt of CO2 eq.]	Uncertainty of emission HFC [%]	Uncertainty of emission PFC [%]	Uncertainty of emission SF6 [%]	Absolute emission uncertainty for HFC [kt of CO2 eq.]	Absolute emission uncertainty for PFC [kt of CO2 eq.]	Absolute emission uncertainty for SF6 [kt of CO2 eq.]
TOTAL	**8 586.93**	**13.90**	**52.79**	**46.9%**	**85.0%**	**92.5%**	**4 027.37**	**11.82**	**52.79**
2. Industrial processes and product use	8 586.93	13.90	52.79	46.9%	85.0%	92.5%	4 027.37	11.82	52.79
C. Metal industry		0.00	4.15		85.0%	100.0%		0.00	4.15
3. Aluminium production		NO			85.0%				
4. Magnesium production			4.15			100.0%			4.15
F. Product uses as substitutes for ODS	8 586.93	13.90		46.9%	85.0%		4027.37	11.82	0.00
1. Refrigeration and Air Conditioning Equipment	8 046.11			50.0%			4023.06		
2. Foam Blow ing	343.83			50.0%			171.92		
3. Fire Extinguishers	71.13	13.90		50.0%	85.0%		35.57	11.82	
4. Aerosols/ Metered Dose Inhalers	125.45			50.0%			62.72		
5. Solvents	0.41			50.0%			0.21		
G. Other Product Manufacture and Use			48.64			100.0%			48.64
1. Electrical Equipment			48.64			100.0%			48.64

4.7.4. Source-specific QA/QC and verification

See chapter 4.2.4

4.7.5. Source-specific recalculations

Assumptions for estimating HFCs emission from 2.F.1.d Transport refrigeration were revised to reflect new data obtained from the market. Especially assumptions applied to percent of equipment in which HFC-134a and HFC-143a were revised to provide more realistic values and reflect national circumstances. In current submission gradual increase of number of equipment used in transport refrigeration was assessed instead applying constants value for whole time series.

Regarding emissions from 2.F.1.e Mobile Air-Conditioning – there were applied corrections to assumptions regarding life emission factor for HFC-134a used in air conditioning systems. Instead of steady value since the beginning of the time series, decreasing trend was applied to better reflect national circumstances in evolving market. Assumptions on life emission factor took into account improvement of the equipment and in result gradual decrease of the life emission factor as presented below:

- Years: 1995-1999 – 0.30 for both „passenger cars with air-conditioning" and "Public transportation and trucks"
- Years: 2000-2003 – 0.25 for both subcategories „passenger cars with air-conditioning" and "Public transportation and trucks"
- Years: 2004-2006 – 0.20 both subcategories „passenger cars with air-conditioning" and "Public transportation and trucks"
- Years: 2007-2008 - 0.15 for „passenger cars with air-conditioning" and 0.20 for "Public transportation and trucks"
- Years: 2009-2014 – 0.1 for „passenger cars with air-conditioning" and 0.15 for "Public transportation and trucks"

Example results of the recalculations for 2013 were presented in table below:

kt of CO2 eq.	HFCs	PFCs	SF6
Previous sub.	9606.78	14.64	39.15
Latest sub.	8091.92	14.64	47.54
Difference	-1514.86	0.00	8.38
%	-15.77%	0.00%	21.41%

4.7.6. Source-specific planned improvements

Continuing ongoing project on revision and extending dataset for f-gases. Improving description of methodology and assumptions in NIR. Further analysis of filling amounts in equipment containing HFCs, PFCs and SF_6.

4.8. Other product manufacture and use (CRF sector 2.G)

SF_6 emissions from sector 2.G.1 *Electrical equipment* is described in chapter 4.7.2.

2.G.3. Other Product Manufacture and Use - N_2O emission from Use of N_2O for Anaesthesia.

N_2O emission from anaesthesiology was estimated based on: Strategy of reduction of GHG emission until 2020 in the division into separate gases (N_2O, HFCs, PFCs and SF_6) and sectors - Institute of Environmental Protection [IOŚ 2001].

Further analysis of possibilities to amend data covering N_2O used in anaesthesiology.

5. AGRICULTURE (CRF SECTOR 3)

5.1. Overview of sector

The GHG emission sources in agricultural sector involve: enteric fermentation from domestic livestock (CH_4), manure related to livestock management (CH_4 and N_2O), agricultural soils (N_2O), liming and urea application (CO_2) and agricultural residue burning (CH_4 and N_2O). Emission categories like: rice cultivation and prescribed burning of savannas do not occur in Poland and are therefore not reported.

Following categories from sector 4 have been identified as key sources (excluding LULUCF):

IPCC Category Code	IPCC Source Categories	Greenhouse Gas	Level Assessment	Trend Assessment
3.A	Enteric Fermentation	CH_4	+	+
3.B	Manure Management	N_2O	+	
3.D	Agricultural Soils	N_2O	+	+
3.D	Agricultural Soils	N_2O	+	

Share of these categories in total Poland's GHG emissions is ca. 7.30%.

Total emissions of GHG in Agriculture sector presented as carbon dioxide equivalent amounted to 30 410 kt in 2014 and decreased since 1988 by about 36%. Strong decrease in emissions in Poland occurred after 1989 when economic transformation began shifting from centrally planned economy to the market one (Fig. 5.1). The cost-effectiveness of agricultural production deeply changed then – up to 1989 agricultural production was generally subsidised on the state level. Since 1990 the prices for agricultural products as well as for agricultural means of production (like mineral fertilisers or machines) became the market ones and the subsidies were cut off. Deterioration of macroeconomic conditions for agricultural production in early 1990-ties during the restructuring of the state economy triggered changes in structure of agricultural farms since 1989. The big state agricultural farms became economically ineffective in a new market conditions so they were constantly eliminated. Also production of many small family farms became cost-ineffective so for instance the process of leaving the animal production by small farms started. On the other hand - gradual development of private and collective farms breeding large livestock herds begun. Still almost 70% of Polish farms are smaller than 5 hectares.

Dramatic decrease of livestock numbers was observed after 1989 – the cattle population decreased almost by half − from over 10 million in 1988 to less than 6 million since 2002. Since 2002, just before accessing Poland to the European Union (in 2004), population of dairy cattle stabilized when the limits of milk production were known in advance what stabilized the milk market. In the same time sheep population drop by 94% (from over 4 million in 1988 up to 0.2 million in 2014). Especially sheep breeding became unprofitable − the wool up to 1989 was highly subsidised so sheep farming was related mostly to wool production and over 70% of sheep farms' income was related to wool sale. Small domestic demand for sheep meat also caused retreat from sheep breeding.

Additional reasons for decreasing the agricultural production in 1990-ties were export limitation for Eastern markets, deterioration of relationship between prices for agricultural products and prices for means of production as well as increased competition of imported food from Western Europe. Since 2004, when Poland joined the European Union, the key factor influencing the Polish agriculture and rural areas is the EU Common Agricultural Policy aiming at improvement of productivity through introducing technical progress and stabilisation of agricultural market.

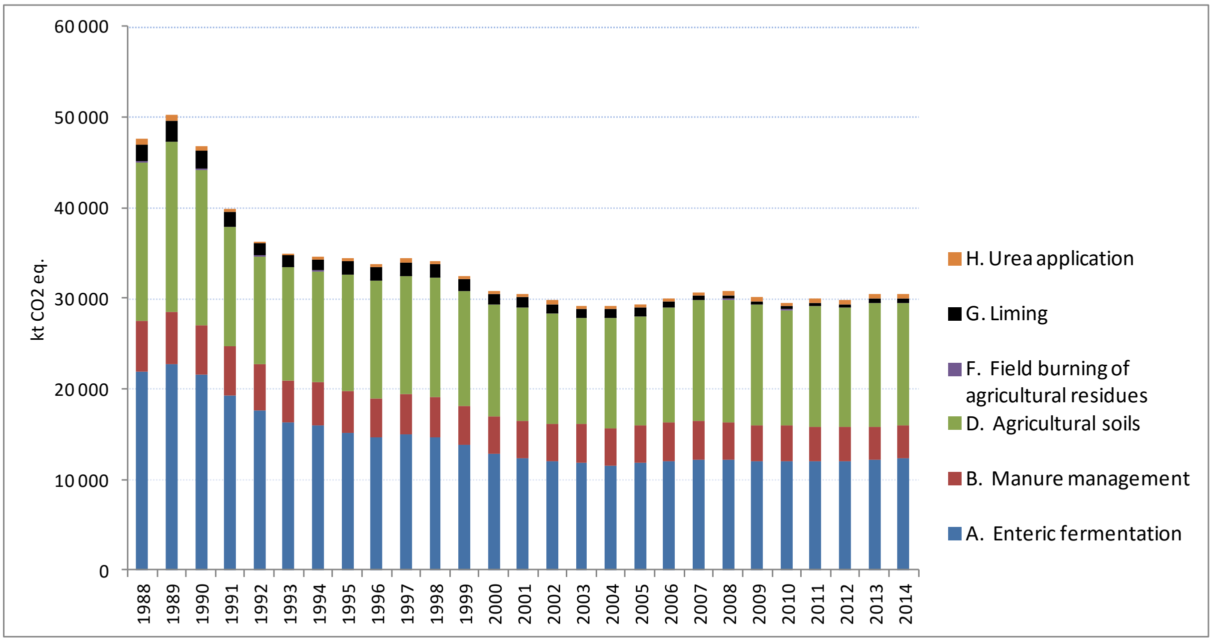

Figure 5.1. Total greenhouse gas emissions from the Polish agriculture in 1988-2014 presented in CO_2 equivalent

In 2014, in relation to the previous year, gross agricultural output increased by 6.1%. The growth in global production was the result of increased crop production (by 4.9%) as well as livestock production (by 7.3%). Primarily very good harvests of most agricultural crop that is cereals, consumer pulses, rape and turnip rape, potatoes, sugar beets, field vegetables as well as fruit trees influenced on the growth in crop production. The level of livestock production resulted from an increase in the production of all main species of livestock, chicken eggs and cow milk. Year 2014 was following year in which market conditions of agricultural production have worsened, which had a negative impact on profitability of agricultural production. The decrease rate of agricultural prices sold products by individual farmers (93.5) was higher than the decrease rate of the average prices of goods and services purchased for the current agricultural production and investment purposes (98.6).

Consumption of mineral fertilizers for crops in 2014 remained at a similar level as in the previous year. Consumption of lime fertilizers due to the state of acidification of Polish soil is still insufficient. Sale of plant protection products for agricultural needs (based on the active substance) increased by 6.1% in relation to the previous year. [GUS R4 2015].

Contribution of Agriculture in national emissions excluding LULUCF is about 8% in 2014. Among GHGs the highest contribution has N_2O – 51.2%, then CH_4 – 45.8% and CO_2 – 3.0%. The biggest share in GHG Agricultural emissions have 2 sectors: Agricultural soils – 44.3% and Enteric fermentation – 40.4%. Manure management is responsible for about 12.2% GHG emissions, liming and urea application respectively for: 1.5% and 1.4%. Share of CH_4 and N_2O emissions from Field burning of agricultural residues are minor – only about 0.1%.

The review of trends by gases and subsectors are given in Figures 5.2–5.4. Carbon dioxide emissions in Agriculture sector come from liming and urea application – share of both sources is close to 50% in 2014 (Fig. 5.2).

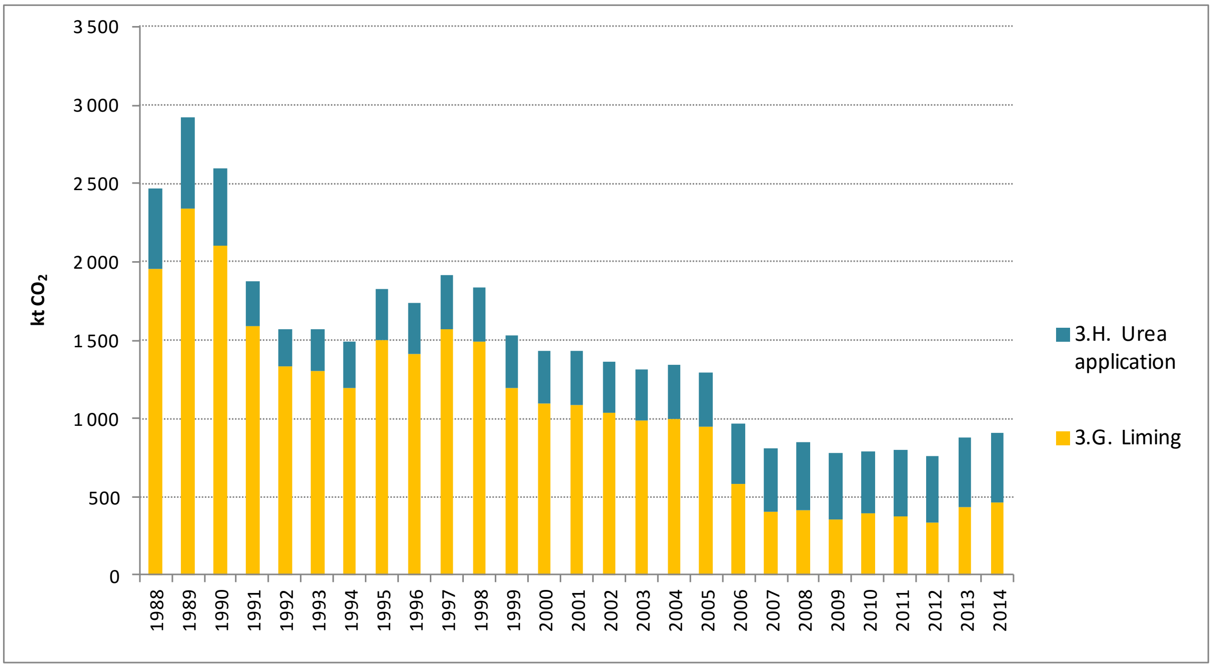

Figure 5.2. Carbon dioxide emissions from the Polish agriculture according to subcategories

As relates to methane emissions most of them originated from enteric fermentation (88.4%) and about 11.4% is related to manure management in 2014. Share of field burning of agricultural residues represent only 0.2% of emissions (Fig. 5.3).

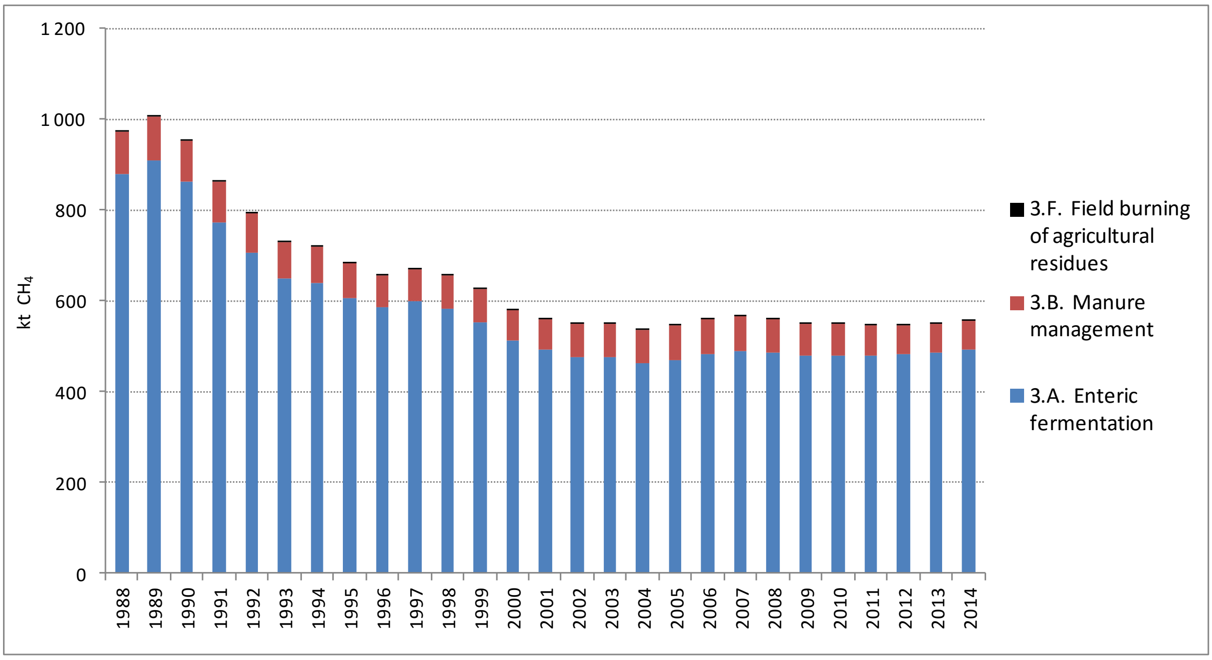

Figure 5.3. Methane emissions from the Polish agriculture according to subcategories

As concerns the nitrous oxide emissions, the main source of emissions in 2014 is agricultural soils responsible for 86.9% while manure management – for 13.0%. Emissions from field burning of agricultural residues are negligible (0.1%) (Fig. 5.4).

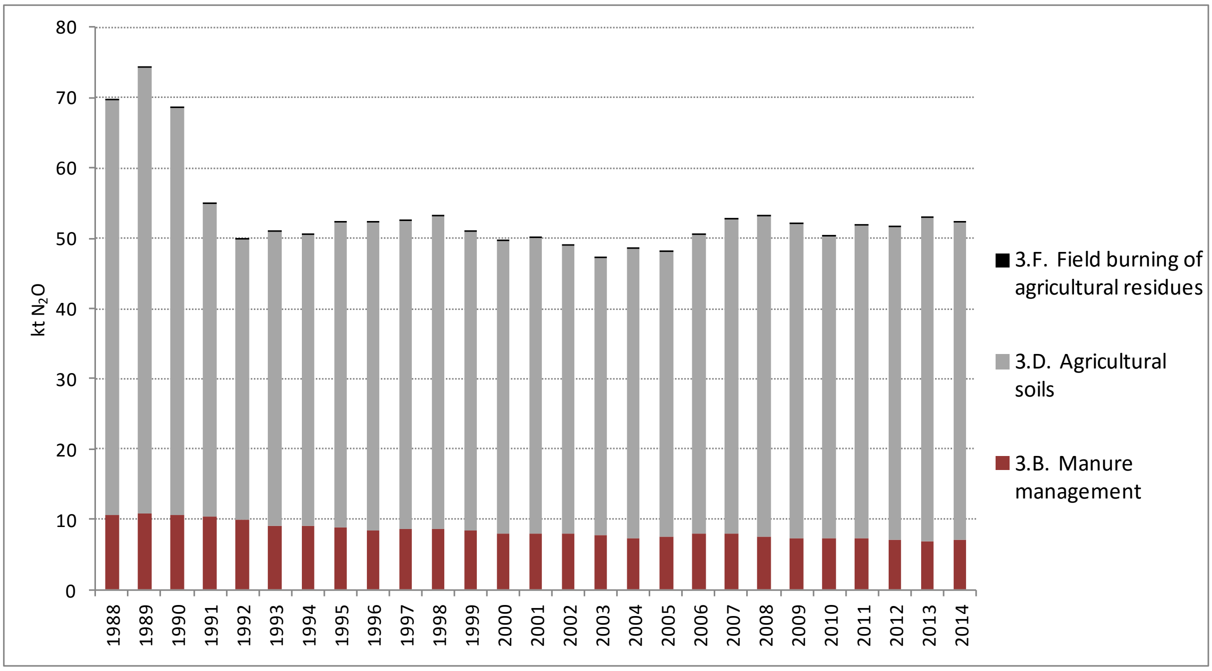

Figure 5.4. Nitrous oxide emissions from the Polish agriculture according to subcategories

5.2. Enteric Fermentation (CRF sector 3.A)

5.2.1. Source category description

CH_4 emissions from animals' enteric fermentation in 2014 amounted to 491.8 kt CH_4 and decreased since 1988 by 44%. Majority of CH_4 emissions in this subcategory, more than 95%, are related to cattle breeding. The main driver influencing CH_4 emissions decline from enteric fermentation is the decrease of livestock population since 1988. The biggest change over time relates to the sheep breeding where cut of emissions exceeds 95% in 1988-2014. At the same time CH_4 emission reduction for dairy cattle amounted for 44%.

Table 5.1. Trends in CH_4 emissions from enteric fermentation in 1988-2014 [kt CH_4]

Year	Dairy cattle	Non-dairy cattle	Sheep	Goats	Horses	Swine	Total
1988	525.2	268.7	35.0	0.9	18.9	29.4	878.1
1989	548.5	279.5	35.3	0.9	17.5	28.3	909.9
1990	532.1	249.8	33.3	0.9	16.9	29.2	862.2
1991	487.7	207.7	25.9	0.9	16.9	32.8	771.9
1992	447.5	192.9	15.0	0.9	16.2	33.1	705.6
1993	418.3	178.0	10.1	0.9	15.1	28.3	650.8
1994	406.6	186.3	7.0	0.9	11.2	29.2	641.2
1995	375.2	181.1	5.7	0.9	11.4	30.6	604.9
1996	365.5	178.5	4.4	0.9	10.2	26.9	586.5
1997	371.3	185.3	3.9	0.9	10.0	27.2	598.7
1998	375.9	164.2	3.6	0.9	10.1	28.8	583.4
1999	360.7	150.7	3.1	0.9	9.9	27.8	553.1
2000	329.8	143.7	2.9	0.9	9.9	25.7	512.9
2001	324.4	130.1	2.7	0.9	9.8	25.7	493.6
2002	310.4	129.6	2.8	1.0	5.9	27.9	477.6
2003	314.3	124.7	2.7	1.0	6.0	27.9	476.6
2004	304.6	123.4	2.5	0.9	5.8	25.5	462.8
2005	306.4	128.7	2.5	0.7	5.6	27.2	471.1
2006	310.5	134.9	2.4	0.7	5.5	28.3	482.4
2007	310.8	141.0	2.7	0.7	5.9	27.2	488.3
2008	312.9	142.6	2.6	0.7	5.9	23.1	487.8
2009	302.2	148.1	2.3	0.6	5.4	21.4	480.0
2010	298.6	151.3	2.1	0.5	4.8	22.3	479.6
2011	297.5	155.4	2.0	0.6	4.6	20.3	480.3
2012	298.6	160.3	2.1	0.4	4.0	17.4	482.9
2013	297.3	166.1	1.8	0.4	3.7	16.7	486.0
2014	297.1	171.3	1.6	0.4	3.7	17.6	491.8
share [%] in 2014	*60.4*	*34.8*	*0.3*	*0.1*	*0.8*	*3.6*	*100.0*
change [%] 1988-2014	*-43.4*	*-36.2*	*-95.4*	*-54.4*	*-80.3*	*-40.2*	*-44.0*

5.2.2. Methodological issues

Activity data for 2014, similarly to those for entire period since 1988, related to livestock population come from national statistics (Central Statistical Office) [GUS R1 2015]. Detail methodological information related to collecting data on livestock population is given in Annex 5.

Generally population of major livestock is available on an annual basis. As relates to goats population some lack of data is noticed for 1988-1995 and 1997, so data for 1996 was taken for the period 1988–1995 and for 1997 the average value for 1996 and 1998 was calculated. Since 1998 goats population is available on an annual basis. Trends of animal population (excluding cattle) in 1988–2014 is given in table 5.2.

Table 5.2. Trends of livestock population in 1988-2014

Years	Livestock population [thousands]				
	Sheep	Goats	Horses	Swine	Poultry
1988	4 377	179	1 051	19 605	234 605
1989	4 409	179	973	18 835	253 301
1990	4 159	179	941	19 464	216 341
1991	3 234	179	939	21 868	209 090
1992	1 870	179	900	22 086	192 880
1993	1 268	179	841	18 860	188 759
1994	870	179	622	19 466	194 661
1995	713	179	636	20 418	185 745
1996	552	179	569	17 964	203 873
1997	491	182	558	18 135	197 400
1998	453	186	561	19 168	197 193
1999	392	181	551	18 538	197 267
2000	362	177	550	17 122	194 126
2001	343	172	546	17 105	202 519
2002	345	193	330	18 629	193 996
2003	338	192	333	18 605	143 457
2004	318	176	321	16 988	128 835
2005	316	142	312	18 112	122 755
2006	301	130	307	18 881	122 068
2007	332	144	329	18 129	133 475
2008	324	136	325	15 425	141 615
2009	286	119	298	14 279	125 878
2010	258	108	264	14 865	140 997
2011	251	112	254	13 509	139 837
2012	267	90	222	11 581	127 130
2013	223	82	207	11162	134 584
2014	201	82	207	11724	142 342

Trends of cattle population presented for specific subcategories is given in Table 5.3. In 1998 Central Statistical Office introduced methodological changes in collecting statistical data on cattle population (apart from dairy cattle). This change triggered some inconsistency in population trend of other cattle. So in response to recommendations of the Expert Review Team (ERT 2013) the non-dairy cattle trend for 1988-1997 was unified based on average share in 1998-2007 of specific age groups in relation to all non-dairy cattle population (italics).

Table 5.3. Trends of cattle population in 1988-2014 [thousands]

Years	Dairy cattle	Non-dairy cattle			
		young cattle < 1 year	young cattle 1-2 years	heifers > 2 years	bulls >2 years
1988	4806	*2879*	*2025*	*401*	*211*
1989	4994	*2996*	*2107*	*417*	*219*
1990	4919	*2678*	*1883*	*373*	*196*
1991	4577	*2227*	*1567*	*310*	*163*
1992	4257	*2069*	*1456*	*288*	*151*
1993	3983	*1910*	*1344*	*266*	*140*
1994	3863	*2001*	*1407*	*279*	*146*
1995	3579	*1946*	*1368*	*271*	*142*
1996	3461	*1919*	*1349*	*267*	*140*
1997	3490	*1992*	*1401*	*278*	*146*
1998	3542	1799	1235	280	99
1999	3418	1647	1108	283	99
2000	3098	1572	1101	231	81
2001	3005	1472	973	210	74
2002	2873	1384	1084	142	50
2003	2897	1349	932	229	81
2004	2796	1309	916	246	86
2005	2795	1425	978	209	76
2006	2824	1428	1040	224	90
2007	2787	1473	1072	265	99
2008	2806	1502	1102	263	83
2009	2688	1472	1204	238	99
2010	2656	1457	1244	276	92
2011	2626	1481	1300	242	113
2012	2578	1469	1344	239	147
2013	2531	1586	1422	178	144
2014	2479	1609	1433	259	141

In the estimation of CH_4 emissions from enteric fermentation two types of approaches were applied – in case of horses, sheep, goats and swine, the IPCC *Tier 1* method was applied using default CH_4 Emission Factors [IPCC 2006, table 10.10] as given below:

Animal	Emission Factor [kg CH_4/head/year]
Horses	18.0
Sheep	8.0
Goats	5.0
Swine	1.5

Emissions from enteric fermentation of poultry and fur animals were not estimated as the IPCC do not provide the guidelines.

More detailed, IPCC *Tier 2* method, was applied in calculation of methane emissions from enteric fermentation from cattle responsible for over 95% of CH_4 emissions in this subsector. Here country specific emission factors were calculated based on specific gross energy intake (GE) values estimated for selected cattle sub-categories [IPCC 2006, equation 10.21]:

$$EF = \left(GE * \frac{Y_m}{100} * 365 \frac{days}{yr}\right) / \left(55.65 \frac{MJ}{kg\ CH_4}\right)$$

where:

EF – emission factor, kg CH_4/head/yr

GE – gross energy intake, MJ/head/day
Ym – methane conversion rate which is the fraction of gross energy in feed converted to methane, %.

Gross energy intake (GE) was calculated separately for dairy cattle and for and non-dairy cattle disaggregated for: calves under 1 year, young cattle 1-2 years and other mature cattle (divided for heifers and bulls over 2 years) using the equation 10.16 from [IPCC 2006]:

$$GE = \left[\frac{\left(NE_m + NE_a + NE_l + NE_{work} + NE_p\right)}{REM} + \frac{NE_g}{REG}\right] / \frac{DE\%}{100}$$

Where:
GE = gross energy, MJ/day
NE_m = net energy required by the animal for maintenance (Equation 10.3), MJ/day
NE_a = net energy for animal activity (Equation 10.4), MJ/day
NE_l = net energy for lactation (Equations 10.8), MJ/day
NEwork = net energy for work (Equation 10.11), MJ/day (assumed zero)
NEp = net energy required for pregnancy (Equation 10.13), MJ/day
REM = ratio of net energy available in a diet for maintenance to digestible energy consumed (Equation 10.14)
NEg = net energy needed for growth (Equation 10.6), MJ/day
REG = ratio of net energy available for growth in a diet to digestible energy consumed (Equation 10.15)
DE%= digestible energy expressed as a percentage of gross energy

Parameters required for estimation of GE factor for dairy cattle like pregnancy [GUS R1 2015], milk production [GUS M 2015], percent of fat in milk [GUS R 2015] come from national statistics. Digestible energy (DE – expressed as a percent of gross energy) for cattle was estimated by the National Research Institute of Animal Production [Walczak 2006, 2013] and relates to genetic as well as feeding improvements of cattle breading throughout inventoried period. For dairy cattle DE varies from 58.6% in 1988 through 60% in 1995 up to 63.3% in 2014. As concerns non-dairy cattle, DE parameters for 1988-2014 are as following: young cattle up to 1 year: 71.1−71.3%, bovines between 1–2 years: 66.1−66.5%, for matured heifers – 62.4−62.7% and for bulls constant value was taken – 59.1%. Other parameters used for calculation of GE were taken from IPCC 2006 GLs (C_{fi} − table 10.4, C_a − table 10.5, $C_{pregnacy}$ − table 10.7). Methane conversion rate (Y_m) for cattle was adopted as 6.5% from [IPCC 2006, table 10.12].

Methane emission factor for dairy cattle, established based on the above described methodology, vary from 109.3 CH_4/animal/year in 1988 up to 119.9 kg CH_4/animal/year in 2014, following GE changes, and is higher than IPCC default one (89 kg CH_4/animal/year for Eastern Europe with average milk production 2550 kg/head/yr) due to increasing intensification of dairy cattle production, characterised among others, with growing milk production (tab. 5.4). For non–dairy cattle GE factor was calculated for every subcategory based on country specific parameters like mean mass and daily weight gain [Walczak 2006]. Specific methane emission factors for entire trend for non-dairy cattle are presented in table 5.4. The values of EFs vary from 48.7 kg CH_4/animal/year in 1988 up to 49.9 kg CH_4/animal/year in 2014. Relatively low EF (IPCC default is 58 kg CH_4/animal/year for Eastern Europe) depends on high share of youngest cattle (< 1 year) among this category (53% in 1998 and 47% in 2014) (table 5.3).

Table 5.4. Average annual milk production, daily gross energy intake (GE) and CH_4 emissions factors for dairy cattle in 1988–2014

Years	Average milk production [litres/cow/yr]	GE gross energy intake [MJ/cow/day]	EF emission factor [kg CH_4/animal/year]
1988	3165	256.31	109.27
1989	3260	257.60	109.82
1990	3151	253.73	108.17
1991	3082	249.93	106.55
1992	3015	246.58	105.12
1993	3075	246.33	105.02
1994	3121	246.90	105.26
1995	3136	245.90	104.83
1996	3249	247.70	105.60
1997	3370	249.57	106.40
1998	3491	248.92	106.12
1999	3510	247.53	105.53
2000	3668	249.72	106.46
2001	3828	253.20	107.94
2002	3902	253.41	108.04
2003	3969	254.43	108.47
2004	4082	255.57	108.96
2005	4147	257.14	109.63
2006	4200	257.94	109.97
2007	4292	261.56	111.51
2008	4351	261.59	111.52
2009	4455	263.73	112.43
2010	4487	263.75	112.45
2011	4618	265.76	113.30
2012	4845	271.71	115.84
2013	4978	275.54	117.47
2014	5164	281.14	119.86

Table 5.5. Trends of emission factors for cattle with detail breakdown of non-dairy cattle population in 1988-2014 [kg CH_4/head/yr]

Years	Non-dairy cattle weighted mean EF	Non-dairy cattle EF			
		young cattle < 1 year	young cattle 1-2 years	heifers > 2 years	bulls >2 years
1988	48.71	32.71	68.41	49.65	76.29
1989	48.71	32.71	68.41	49.65	76.29
1990	48.69	32.70	68.38	49.61	76.24
1991	48.67	32.68	68.36	49.58	76.18
1992	48.65	32.67	68.33	49.55	76.13
1993	48.64	32.66	68.31	49.52	76.08
1994	48.61	32.65	68.28	49.48	76.03
1995	48.58	32.63	68.26	49.45	75.98
1996	48.56	32.62	68.23	49.42	75.93
1997	48.55	32.61	68.21	49.38	75.88
1998	48.10	32.60	68.19	49.35	75.83
1999	48.03	32.58	68.16	49.32	75.78
2000	48.15	32.57	68.14	49.29	75.73
2001	47.69	32.56	68.11	49.25	75.68
2002	48.73	32.55	68.09	49.22	75.63
2003	48.13	32.53	68.06	49.19	75.58
2004	48.27	32.54	67.98	48.98	75.59
2005	47.88	32.55	67.97	48.26	75.59
2006	48.51	32.55	67.97	48.95	75.59
2007	48.47	32.49	67.80	48.99	75.59
2008	48.34	32.47	67.80	48.87	75.59
2009	49.16	32.35	67.63	48.76	75.59
2010	49.31	32.27	67.46	48.76	75.40
2011	49.56	32.19	67.29	48.65	75.40
2012	50.13	32.11	67.29	48.65	75.59
2013	49.90	32.11	67.29	48.65	75.59
2014	49.78	32.11	67.29	48.65	75.59

5.2.3. Uncertainties and time-series consistency

Uncertainty analysis for the year 2014 for IPCC sector *3.Agriculture* was estimated with use of approach 1 described in 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Simplified approach was based on the assumptions that every value is independent and probability distribution is symmetric. Results of the sectoral uncertainty analysis are given below. More details on uncertainty assessment of whole inventory are given in annex 8.
Recalculation of data for years 1988-2013 ensured consistency for whole time-series.

2014	CO_2 [kt]	CH_4 [kt]	N_2O [kt]	CO_2 Emission uncertainty [%]	CH_4 Emission uncertainty [%]	N_2O Emission uncertainty [%]
3. Agriculture	905.41	**557.10**	**52.27**	18.8%	29.5%	61.9%
A. Enteric Fermentation		491.78			32.4%	
B. Manure Management		64.26	7.06		60.5%	40.0%
D. Agricultural Soils			45.17			71.4%
F. Field Burning of Agricultural Residues		1.06	0.04		18.7%	87.1%
G. Liming	467.55			22.8%		
H. Urea application	437.86			30.4%		

5.2.4. Source-specific QA/QC and verification

Activity data related to livestock population and any additional parameters like milk productivity or cattle pregnancy come from national statistics prepared by the Central Statistical Office. Data like livestock population, crop production, nitrogen fertilizers use and others are available in several publications 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. Generally QC procedures follow QA/QC plan presented in Annex 7.

5.2.5. Source-specific recalculations

- update of cattle, swine, poultry and fur animals population for 2013 based on national statistics

Table 5.6. Changes in CH_4 emissions from enteric fermentation due to recalculations made

Change	1988	1989	1990	1991	1992	
kt	0	0	0	0	0	
%	0	0	0	0	0	
Change	**1993**	**1994**	**1995**	**1996**	**1997**	
kt	0	0	0	0	0	
%	0	0	0	0	0	
Change	**1998**	**1999**	**2000**	**2001**	**2002**	
kt	0	0	0	0	0	
%	0	0	0	0	0	
Change	**2003**	**2004**	**2005**	**2006**	**2007**	
kt	0	0	0	0	0	
%	0	0	0	0	0	
Change	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
kt	0	0	0	0	0	17.5
%	0	0	0	0	0	3.7

5.2.6. Source-specific planned improvements

No further improvements are planned at the moment.

5.3. Manure Management (CRF sector 3.B)

5.3.1. Source category description

CH_4 emissions related to animal manure management in 2014 amounted to 58 kt and decreased since 1988 by about 38%. Most of CH_4 emissions come from manure generated by cattle (51%) and swine (41%).

Table 5.7. Trends in CH_4 emissions from manure management according to livestock categories in 1988-2014

Year	Dairy cattle	Non-dairy cattle	Sheep	Goats	Horses	Swine	Poultry	Fur animals	Total
1988	35.96	11.97	0.83	0.02	1.64	36.66	5.94	0.42	93.44
1989	37.49	13.81	0.84	0.02	1.52	35.27	6.66	0.39	95.99
1990	35.97	10.01	0.79	0.02	1.47	36.50	5.82	0.36	90.95
1991	32.99	9.37	0.61	0.02	1.46	41.07	5.57	0.33	91.43
1992	29.92	8.66	0.36	0.02	1.40	41.55	5.25	0.30	87.46
1993	27.50	7.74	0.24	0.02	1.31	35.53	5.20	0.27	77.82
1994	26.75	8.02	0.17	0.02	0.97	36.73	5.54	0.24	78.44
1995	24.69	7.61	0.14	0.02	0.99	38.58	5.17	0.21	77.42
1996	23.61	7.33	0.10	0.02	0.89	34.00	5.12	0.19	71.27
1997	24.37	7.44	0.09	0.02	0.87	34.37	5.00	0.20	72.37
1998	24.10	6.74	0.09	0.02	0.88	36.57	5.19	0.21	73.79
1999	24.96	6.35	0.07	0.02	0.86	35.33	5.23	0.22	73.05
2000	23.25	6.16	0.07	0.02	0.86	32.63	5.26	0.23	68.48
2001	22.79	5.66	0.07	0.02	0.85	32.74	5.43	0.23	67.80
2002	25.90	5.67	0.07	0.03	0.51	35.72	5.20	0.24	73.34
2003	28.56	5.54	0.06	0.03	0.52	35.65	3.62	0.26	74.24
2004	29.91	5.48	0.06	0.02	0.50	32.54	3.32	0.27	72.10
2005	30.24	5.71	0.06	0.02	0.49	35.53	3.26	0.29	75.59
2006	30.31	5.85	0.06	0.02	0.48	37.37	3.33	0.30	77.71
2007	30.83	6.18	0.06	0.02	0.51	36.39	3.60	0.31	77.92
2008	31.20	6.26	0.06	0.02	0.51	30.87	3.88	0.33	73.13
2009	29.91	6.44	0.05	0.02	0.46	29.40	3.59	0.34	70.21
2010	28.60	6.64	0.05	0.01	0.41	30.36	3.84	0.36	70.27
2011	29.01	6.81	0.05	0.01	0.40	26.95	3.86	0.33	67.42
2012	29.01	6.79	0.05	0.01	0.35	23.19	3.76	0.31	63.47
2013	28.88	7.11	0.04	0.01	0.32	22.30	3.75	0.29	62.71
2014	28.87	7.43	0.04	0.01	0.32	23.38	3.93	0.29	64.26
share [%] in 2014	*44.9*	*11.6*	*0.1*	*0.0*	*0.5*	*36.4*	*6.1*	*0.5*	*100.0*
change [%] 1988-2014	*19.7*	*38.0*	*95.4*	*54.4*	*80.3*	*36.2*	*33.9*	*30.2*	*31.2*

Generally decreasing trend is observed in CH_4 emissions from manure management for all livestock sub-categories, where the biggest drop over time occurred to sheep breeding where CH_4 emissions dropped by 95% in 1988-2014 (tab. 5.7). The main reason for decreasing emissions are diminishing livestock populations.

N_2O emissions from manure management amounted to 7 kt in 2014 and drop since 1988 by 34% what is associated mostly with the diminishing livestock population. Direct emissions are responsible for about 49% and indirect for 51% of N_2O emissions in this category (fig. 5.5).

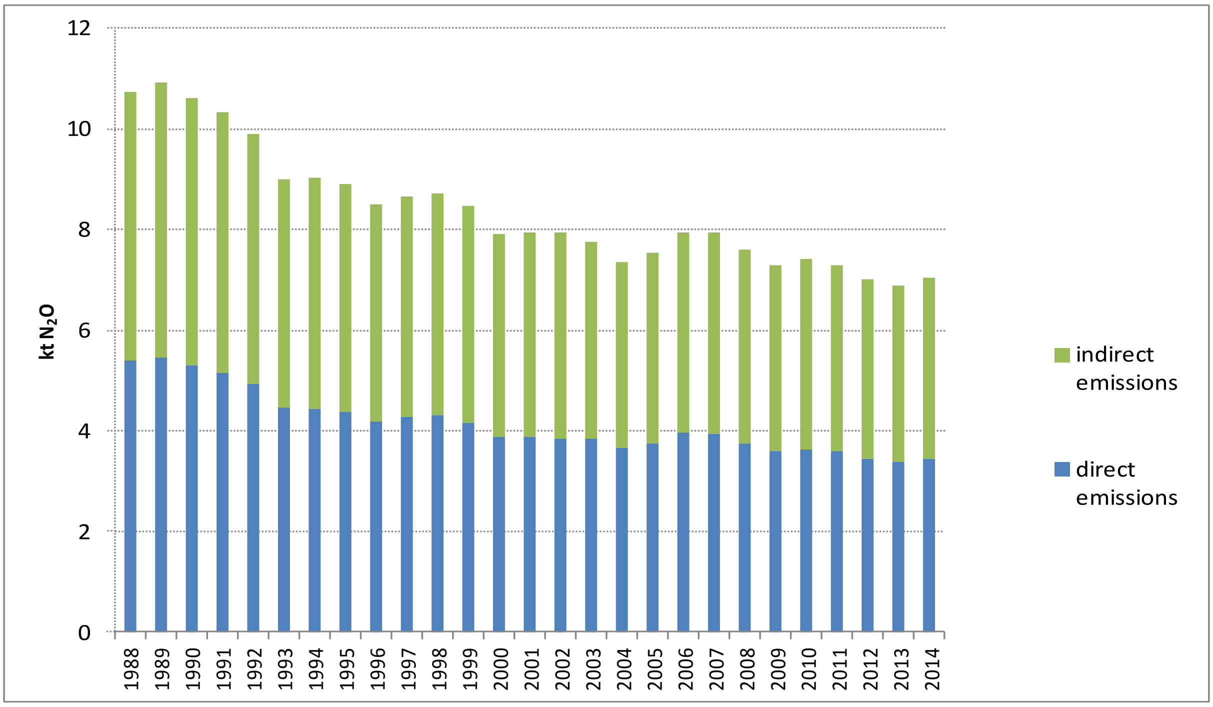

Figure 5.5. Trends of N_2O emissions (in division for direct and indirect) from manure management in 1988-2014

5.3.2. Methodological issues

The source of activity data i.e. animal population was taken from the public statistics as described in chapter 5.2.2 (tab. 5.2, 5.3). Additionally emissions from fur animals in this sub-category are estimated. Data on fur animals population is available in public statistics only for selected years like: 1983 [GUS R5 1987] and 1996 [GUS R6 1996], 2002 [GUS R7 2002], 2010 [GUS R8 2010] and 2013 [GUS R9 2014] when Agricultural Censuses were performed or other periodic studies were published containing required data. Interpolation was used for lacking years, for 2014 data from 2013 was used. No information on deer population is available.

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 (tab. 5.8). 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. Data for 2012 were used for 2013 and 2014.

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 liquid systems and 89% on solid storage [Walczak 2011, 2012, 2013].

Table 5.8. Fractions of manure managed in given AWMS for cattle and swine for selected years [%]

	Dairy cattle			Other cattle			swine		
	liquid	solid	pasture	liquid	solid	pasture	liquid	solid	pasture
1988	2.8	75.2	22.0	4.9	77.1	18.0	22.3	77.7	0.0
1990	2.7	76.1	21.2	3.2	79.2	17.6	22.4	77.6	0.0
1995	2.3	80.4	17.2	3.8	80.6	15.6	22.7	77.3	0.0
2000	3.7	83.1	13.2	4.0	82.4	13.6	23.0	77.0	0.0
2005	10.6	79.4	10.0	5.2	82.8	12.0	24.0	76.0	0.0
2010	10.1	79.6	10.3	5.1	82.9	12.1	25.5	74.5	0.0
2014	10.5	79.2	10.3	5.1	82.9	12.0	24.3	75.7	0.0

In Poland prevail small farms where solid systems for animal management are commonly used. Liquid systems are applied only at big farms, having more than 120 animals. Development of such big milk farms in early years of 2000 influenced significant increase of CH_4 emissions from manure management for dairy cattle since 2002.

5.3.2.1. Estimation of CH_4 emissions from manure management

The *Tier 1* methodology and the default emission factors were used for estimation of CH_4 emissions from manure management of horses, sheep, goats, poultry and fur animals [IPCC 2006] (tab. 5.9). The *Tier 2* methodology was used to establish domestic CH_4 emission factors for cattle and swine applying equation 10.23 from [IPCC 2006]:

$$EF = Vs * 365\frac{days}{year} * B_o * 0.67\frac{kg}{m^3} * \sum MCF * MS$$

where:

- EF – emission factor (kg CH_4/animal/year),
- Vs – average daily volatile excreted solids,
- B_o – maximum CH_4 production capacity for manure produced by animal
- MCF – methane conversion factors for each manure management system for cool climate [IPCC 2006, tab. 10.17],
- MS – fraction of livestock category manure in given AWMS (table 5.8).

For cattle volatile solids (Vs) were estimated based on equation 10.24 in 2006 IPCC GLs with the use of specific GE and DE parameters, urinary energy expressed as fraction of GE was assumed as 0.04 (IPCC 2006) while ASH content as 0.08 (IPCC 2006). Maximum CH_4 producing capacity (B_o) was taken from IPCC 2006 tables 10A.4 and 10A.5. For swine the default values for Vs and B_o were used (IPCC 2006). Examples of above mentioned parameters and emission factors used for calculation of CH_4 emissions from manure management for livestock are shown in table 5.9.

Methane conversion factors (MFCs) for all systems were taken from the table 10.17 of the 2006 IPCC Guidelines for cool climate ≤ 10°C: 1% for pasture/range/paddock, 2% for solid storage and for 17% liquid/slurry systems. As the information on share of liquid systems with and without crust are not presently recognised in detail the conservative approach was taken to use the higher value of MCF characterising slurry system without natural crust cover for cool climate conditions.

Table 5.9. Methane-producing potential (B_o), volatile solids excreted (Vs) and CH_4 emission factors for manure management in 2014

Livestock	EF Emission Factor [kg CH_4/animal/year]	Vs Volatile Solids Excreted [kg dm/animal/day]	B_o Methane-producing potential [m^3 CH_4/kg Vs]
Dairy cattle	8,98	5.71	0.24
Non-dairy cattle	2.16	1.90	0.17
Swine	1.99	Breeding swine: 0.50 Market swine: 0.30	0.45
Sheep	0.19		
Goats	0.13		
Horses	1.56		
Poultry:			
Layers (dry)	0.03		
Broilers	0.02		
Turkeys	0.09		
Ducks	0.02		
Rabbits	0.08		
Fur-bearing animals	0.68		

5.3.2.2. Estimation of direct N_2O emissions from manure management

Direct nitrous oxide emissions from manure management were estimated based on recommended IPCC methodology [IPCC 2006, equation 10.25] using the same AWMS data as for CH_4 emissions (chapter 5.3.2.1):

$$N_2O_{D(mm)} = \left[\sum_S \left[\sum_T \left(N_{(T)} * Nex_{(T)} * MS_{(T,S)}\right) * EF_{3(S)}\right] * \frac{44}{28}\right]$$

where:

$N_2O_{D(mm)}$ – direct N2O emissions from manure management in the country (kg N_2O/year),
$N_{(T)}$ – livestock population in given category *T* in the country,
$Nex_{(T)}$ – annual average N excretion per head of livestock category T in country (kg N/animal/year),
$MS_{(T,S)}$ – fraction of total annual nitrogen excretion for each livestock category *T* managed in manure management system *S,*
$EF_{3(S)}$ – emission factor for direct N_2O emissions from manure management system *S* (kg N_2O–N/kg N),
S – manure management system
T – livestock category
44/28 – conversion of $(N_2O–N)_{(mm)}$ emissions to $N_2O_{(mm)}$ emissions

Data on nitrogen excretion for livestock categories (kg N/head/year) is country specific and come from [IUNG, Kopiński 2014]. The basis for assessment of Nitrogen excretion rates (Nex) applied in calculations of N_2O emissions 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. Country specific Nex values (table 5.10) are generally in line with parameters published in [UNECE 2001] as well as with those published in [IPCC 2006, table 10.19] for most livestock categories. The Nex parameters for dairy cattle differ in time what is related mostly to increasing milk production. For rabbits and other fur-bearing animals the default Nex values were used from [IPCC 2006, table 10.19].

Table 5.10. Country specific Nitrogen excretion rates (Nex) in manure by livestock categories

Livestock	Nex [kg/head/year]
Dairy cattle:	
1988–1995	65.0
1996–2000	70.0
2001–2005	75.0
2006–2010	80.0
Since 2011	83.0
Non-dairy cattle:	
calves up to 1 year	19.0
Young cattle 1–2 years	46.0
Heifers above 2 years	53.0
Bulls above 2 years	65.0
Swine:	
piglets (< 20 kg)	2.6
piglets (20-50 kg)	9.0
fattening pigs (> 50 kg)	15.0
sows	20.0
butcher hogs	18.0
Sheep	9.5
Goats	8.0
Horses	55.0
Poultry (weighted):	0.5

Default values of N_2O emission factors for given management systems from [IPCC 2006, table 10.21] were applied (table 5.11). As the information on share of liquid systems with and without crust are not presently recognised in detail the conservative approach was taken to use the higher value of N_2O EF characterising slurry system with natural crust cover.

Table 5.11. Emission factors for calculating N_2O emissions from manure management [IPCC 2006]

Animal Waste Management Systems	Emission factor (EF_3) [kg N_2O-N/kg N]
Liquid / slurry with natural crust cover	0.005
Liquid / slurry without natural crust cover	0.000
Solid storage	0.005
Pit storage below animal confinements	0.002
Poultry manure with litter	0.001
Poultry manure without litter	0.001

5.3.2.3. Indirect N_2O emission from manure management

Following IPCC 2006 Guidelines the indirect N_2O emissions from manure management were estimated based on equations: 10.27 (N volatilisation) and 10.29 (N leaching) as well as nitrogen excretion rates (Nex) and manure management systems shares (MS) described in previous subchapters related to GHG emissions from manure management. Emission factor for calculation of N_2O emissions from atmospheric nitrogen deposition was assumed as 0.01 kg N_2O−N while emission factor for N_2O emissions from nitrogen leaching and runoff was adopted as 0.0075 kg N_2O−N (default EFs from IPCC 2006).

Nitrogen losses related to volatilisation from manure management were calculated based on equation 10.26 [IPCC 2006] where fractions of managed manure nitrogen for given livestock category that volatilises as NH_3 and NOx in given manure system ($Frac_{GAS}$) are taken from [IPCC 2006 table 10.22]. Nitrogen losses due to leaching from manure management were estimated based on equation 10.28

[IPCC 2006] applying fraction of managed manure nitrogen losses for livestock categories due to runoff and leaching during manure storage as 10% (mid value for range 1–20% in the IPCC 2006 Guidelines).

5.3.3. Uncertainties and time-series consistency

Description of uncertainties is given in Chapter 5.2.3.

5.3.4. Source-specific QA/QC and verification

Activity data related to livestock population come from national statistics prepared by the Central Statistical Office. Data on Animal Waste Management Systems are elaborated by the National Research Institute of Animal Production which develops activities aiming at obtaining representative data on the production of main livestock categories. Collection of this data is based on appointing a suitable monitoring for various institutions like statistical office, Farmers Chambers, Centres for Agricultural Advice and Veterinary Inspection. Partially monitoring is covered also by Institute's employees.
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. Generally QC procedures follow QA/QC plan presented in Annex 5.

5.3.5. Source-specific recalculations

- update of livestock population for 2012 and 2013 according to national statistics
- correction of Vs for market swine according to the IPCC 2006 GLs (table 10A-7)

Table 5.12. Changes in CH_4 emissions from manure management due to recalculations

Change	1988	1989	1990	1991	1992	
kt	-21.01	-20.21	-20.92	-23.54	-23.81	
%	-18.36	-17.39	-18.70	-20.47	-21.40	
Change	1993	1994	1995	1996	1997	
kt	-20.36	-21.05	-22.11	-19.48	-19.70	
%	-20.74	-21.16	-22.21	-21.47	-21.40	
Change	1998	1999	2000	2001	2002	
kt	-20.66	-20.10	-18.65	-18.56	-20.24	
%	-21.87	-21.58	-21.40	-21.49	-21.63	
Change	2003	2004	2005	2006	2007	
kt	-20.32	-18.67	-20.25	-21.53	-20.80	
%	-21.49	-20.57	-21.13	-21.69	-21.07	
Change	2008	2009	2010	2011	2012	2013
kt	-17.98	-16.94	-17.56	-15.90	-13.85	-11.32
%	-19.74	-19.44	-19.99	-19.09	-17.91	-15.29

Table 5.13. Changes in N_2O emissions from manure management due to recalculations

Change	1988	1989	1990	1991	1992	
kt	0	0	0	0	0	
%	0	0	0	0	0	
Change	1993	1994	1995	1996	1997	
kt	0	0	0	0	0	
%	0	0	0	0	0	
Change	1998	1999	2000	2001	2002	
kt	0	0	0	0	0	
%	0	0	0	0	0	
Change	2003	2004	2005	2006	2007	
kt	0	0	0	0	0	
%	0	0	0	0	0	
Change	2008	2009	2010	2011	2012	2013
kt	0	0	0	0.00	0.07	0.21
%	0	0	0	-0.03	0.99	3.17

5.3.6. Source-specific planned improvements

Update of country specific Nitrogen excretion rates (Nex) is planned as well as collection of data on liquid systems management with differentiation for with/without crust.

5.4. Agricultural Soils (CRF sector 3.D)

5.4.1. Source category description

Nitrous oxide emissions from agricultural soils amounted to 45.2 kt N_2O in 2014 and dramatically decreased after 1989 by about 37% up to 1992 (fig. 5.6). Since 1993 emissions stabilised with few percent changes between years. There are several main driving forces influencing emissions variability during entire inventoried period: nitrogen mineral and organic fertilizers use, livestock and crops production.

As a result of economic transformation of the Polish economy in 1989 significant changes were observed in relation to crop production and usage of agricultural land. For instance the decrease of agricultural land of which share in total country area changed from 59.2% in 1989 up to 54% in 1996, also significant increase of fallow land was noted - in 1989 the share of fallow land in agricultural land was 1.1% while in 2002 - 13.6%. Between 1990 and 2002 the decrease of sown area by 3.5 million hectares occurred, also the decrease of mineral fertilisers' use drop from 164 kg per 1 ha of agricultural land in 1989/90 to 93 kg in 2001/02. Since 1988 production of certain crops in Poland changed noteworthy – potatoes cultivation dropped by 78% up to 2014 while maize production increased more than 20-fold (table 5.14).

Table 5.14. Main crops production in 1988–2014 in Poland [kt]

	wheat	barley	maize	oats	rye	triticale	cereal mixed	millet & buckwheat	pulses edible	pulses feed	potatoes	rape & agrimony	All vegetables	All fruits
1988	7582	3804	204	2222	5501	1731	3387	73	108	457	34707	1199	5179	2168
1989	8462	3909	244	2185	6216	2404	3466	72	120	495	34390	1586	5067	2078
1990	9026	4217	290	2119	6044	2721	3554	43	116	493	36313	1206	5259	1416
1991	9270	4257	340	1873	5900	2449	3683	39	133	547	29038	1043	5637	1873
1992	7368	2819	206	1229	3981	1711	2612	36	98	282	23388	758	4518	2385
1993	8243	3255	290	1493	4992	1894	3200	50	107	304	36270	594	5823	2705
1994	7658	2686	189	1243	5300	1631	3026	30	66	149	23058	756	5198	2109
1995	8668	3278	239	1495	6288	2048	3844	45	101	167	24891	1377	5746	2115
1996	8576	3437	350	1581	5653	2130	3520	51	97	180	27217	449	5253	2781
1997	8193	3866	416	1630	5299	1841	4105	49	97	163	20776	595	5136	2887
1998	9537	3612	497	1460	5663	2058	4274	58	111	178	25949	1099	6096	2517
1999	9051	3401	599	1447	5181	2097	3914	60	99	218	19927	1132	5457	2387
2000	8503	2783	923	1070	4003	1901	3084	74	93	171	24232	958	5721	2247
2001	9283	3330	1362	1305	4864	2698	4060	58	88	123	19379	1064	5428	3413
2002	9304	3370	1962	1486	3831	3048	3608	40	95	134	15524	953	4537	3018
2003	7858	2831	1884	1182	3172	2812	2812	44	66	172	13731	793	4870	3309
2004	9892	3571	2344	1430	4281	3723	4322	72	77	193	13999	1633	5283	3521
2005	8771	3582	1945	1324	3404	3903	3916	83	66	187	10369	1450	5220	2923
2006	7060	3161	1261	1035	2622	3197	3379	59	60	146	8982	1652	4919	3212
2007	8317	4008	1722	1462	3126	4147	4257	96	75	210	11791	2130	5475	1694
2008	9275	3619	1844	1262	3449	4460	3673	82	56	179	10462	2106	5023	3843
2009	9790	3984	1706	1415	3713	5234	3884	93	60	212	9703	2497	5601	3749
2010	9408	3397	1994	1516	2852	4576	3339	146	88	268	8188	2229	4878	2826
2011	9339	3326	2392	1382	2601	4235	3373	109	84	251	9362	1862	5575	3414
2012	8608	4180	3996	1468	2888	3349	3920	128	85	395	9041	1866	5431	3286
2013	9485	2934	4040	1190	3359	4273	3021	135	84	291	7290	2678	4986	4128
2014	11629	3275	4468	1459	2793	5247	2922	135	115	352	7689	3276	5607	4189
change 1988-2014 [%]	53.4	-13.9	2090.4	-34.4	-49.2	203.1	-13.7	85.4	6.9	-23.0	-77.8	173.2	8.3	93.2

More than 80% of N_2O emissions here are related to direct soil cultivation, while about 20% are generated in indirect emission processes. The main sources of N_2O emissions estimated relate to direct soil cultivation covering:

- Inorganic N fertilizers use,
- Organic N fertilizers use (animal manure and sewage sludge),
- Urine and dung deposited by grazing animals,
- Crop residues,
- Mineralisation/immobilisation associated with loss/gain of soil organic matter,
- Cultivation of organic soils (i.e. histosols).

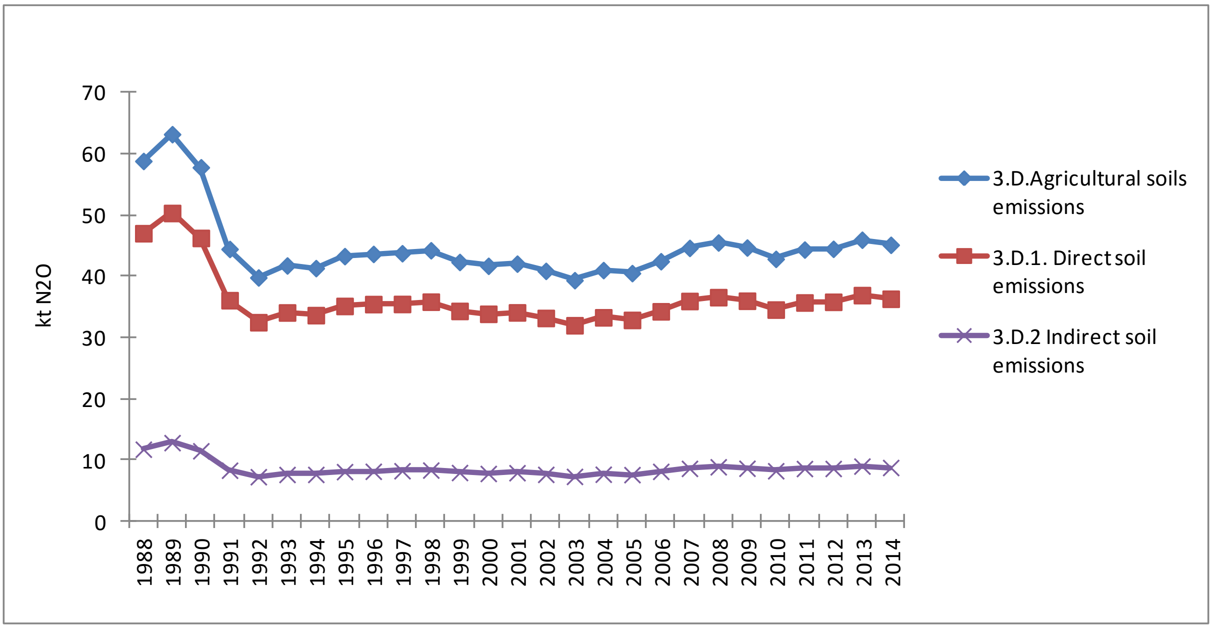

Figure 5.6. N_2O emissions from agricultural soils for 1988–2014

5.4.2. Methodological issues

5.4.2.1. Direct N_2O emissions from managed soils (CRF sector 3.D.a)

Direct N_2O emissions from managed soils has been estimated based on equation 11.1 from the IPCC 2006:

$$N_2O_{Direct} - N = (F_{SN} + F_{ON} + F_{CR} + F_{SOM})EF_1 + F_{OS} * EF_2 + F_{PRP} * EF_{3PRP}$$

where:

N_2O_{Direct}-N = annual direct N_2O–N emissions produced from managed soils (kg N_2O–N/year)
F_{SN} = annual amount of synthetic fertiliser N applied to soils (kg N/year)
F_{ON} = annual amount of animal manure, compost, sewage sludge and other organic N additions applied to soils (kg N/year)
F_{CR} = annual amount of N in crop residues (above and below ground), including N-fixing crops, and from forage/pasture renewal, returned to soils (kg N/year)
F_{SOM} = annual amount of N in mineral soils that is mineralised, in association with loss of soil C from soil organic matter as a result of changes of land use or management (kg N/year)
F_{OS} = annual area of managed/drained organic soils (ha)
F_{PRP} = annual amount of urine and dung N deposited by grazing animals on pasture, range and paddock (kg N/year)
EF_1 = emission factor for N_2O emissions from N inputs (kg N_2O–N/kg N input)
EF_2 = emission factor for N_2O emissions from drained/managed organic soils (kg N_2O–N/ha/year)

EF_{3PRP} = emission factor for N_2O emissions from urine and dung N deposited on pasture, range and paddock by grazing animals (kg N_2O–N/kg N input)

The following default values of **N_2O emission factors** to estimate direct emissions from managed soils were applied [IPCC 2006, table 11.1]:
EF_1 = 0.01 kg N_2O–N/kg N input
EF_2 = 8 kg N_2O–N/ha/year (for temperate organic crop and grassland soils)
EF_{3PRP} = 0.02 for cattle, swine and poultry, 0.01 for sheep, goats and horses

In 2014 about 48% of direct N_2O emissions comes from the use of synthetic nitrogen fertilizers, about 24% relates to management of organic soils, 13% − to crop residues and 12% − to animal manure applied to soils. Only 3% of direct N_2O emissions comes from urine and dung left by grazing animals on pastures and trace emissions (0.2%) relate to mineralisation of soils (fig. 5.7).

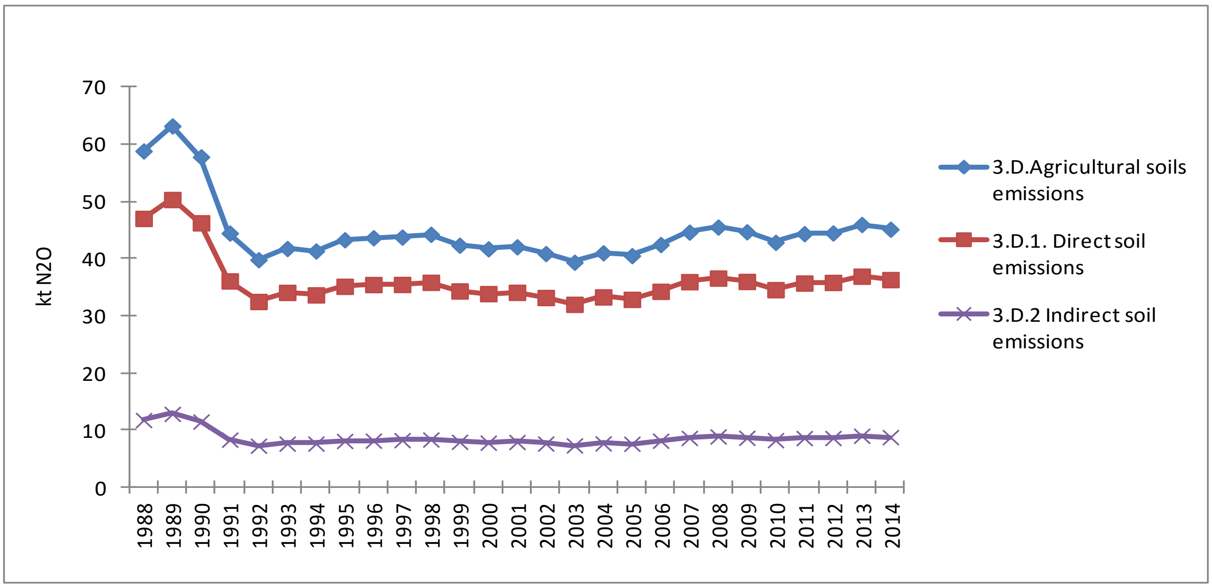

Fig. 5.7. Direct N_2O emissions from specific subcategories

Synthetic nitrogen fertilizers (F_{SN})

N_2O emission from synthetic fertilizers was estimated based on the amount of nitrogen synthetic fertilizer applied to soils published in [GUS R2 2015]. Data regarding consumption of mineral fertilizers is elaborated on the basis of reporting from production and trade units, statistical reports of agricultural farms: state-owned, co-operatives and companies with share of public and private sector, expert's estimates as well as Central Statistical Office estimates. Present level of fertilizing is still lower than it was in 1988−1989. The drop of nitrogen fertilizers use in 1989−1992 amounted to 41% and gradually increased up to 2007 when exceeded 1 million tons (table 5.15). As part of the Act on Fertilisers and Fertilisation, *inter alia*, the following measures are introduced: limitation of the natural fertiliser dose to 170 kg N/ha/year, a ban on the use of natural fertilisers from the end of November to the beginning of March and mandatory training courses for persons who provide services in application of fertilisers [BR2 POL 2015, chapter 3.5.2].

Table 5.15. Nitrogen fertilizers use (F_{SN}) in 1988–2014 in Poland [kt N]

1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1 335	1 520	1 274	735	619	683	758	836	852	890	891	862
2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
861	895	862	832	895	895	996	1 056	1 142	1095	1028	1091
2012	**2013**	**2014**									
1095	1179	1098									

Nitrous oxide emissions amounted in 2014 about 17.3 kt N_2O. Generally trend in N_2O emissions follow nitrogen fertilizers use and range from 23.9 kt N_2O in 1989 to 9.7 kt N in 1992.

Organic nitrogen fertilizers (F_{ON})

Organic nitrogen fertilisers cover both animal manure as well as sewage sludge applied to fields.

The amount of nitrogen in **animal manure applied to soils** is calculated according to the method described in chapter 5.3.2.2. Following guidelines given in chapter 10.5.4 and using equation 10.34 (2006 IPCC), all nitrogen excreted on pasture, range and paddock as well as all nitrogen volatilised prior to final application to managed soils is subtracted from the total excreted manure. The amount of managed manure nitrogen that is lost in the manure management system is taken from table 10.23 (IPCC 2006) for particular livestock categories. Nitrogen from bedding material was not accounted for animal manure applied to soils, it is covered by the nitrogen returned to soils as crop residues. The fractions of animal manure burned for fuel, used for feed and fuel were neglected because these activities do not occur in Poland. The nitrogen input from manure applied to soils are given in CRF-table 3.D under 3.D.a.2.a.

Nitrous oxide emissions from animal manure applied to soils in 2014 was about 4.3 kt N_2O. Trend of emissions is caused by trend of livestock population, mainly cattle and sheep after 1989 (see tables 5.2, 5.3).

Activity data on the amount of **sewage sludge applied on the fields** were taken from GUS [GUS 2015d] 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 2003–2012 (fig. 5.8). 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 27 million in 2014 where this number was more than doubled in 1988-2014. Also the number of municipal sewage treatment plants increased from 558 in 1988 up to 1923 in 1998 and 3288 in 2014 [GUS 2015].

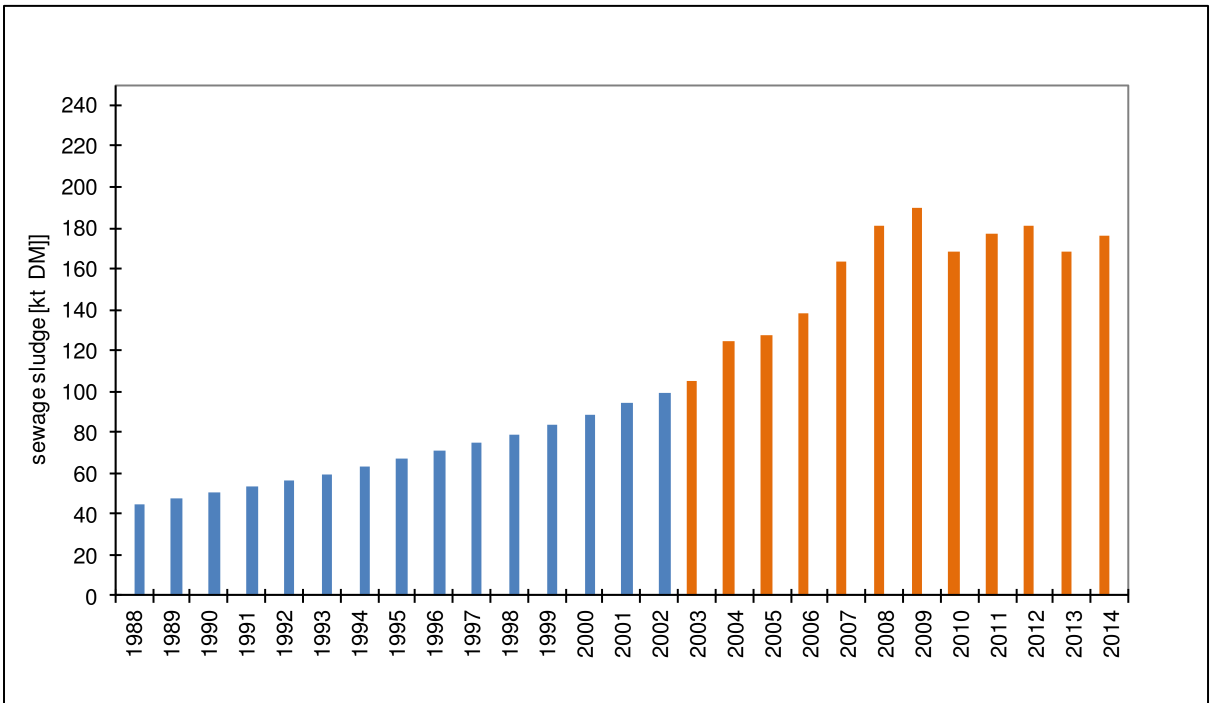

Fig. 5.8. Amounts of sewage sludge applied in agriculture [kt DM]

The mean content of nitrogen in sewage sludge was taken as 2.61% from publication [Siebielec, Stuczyński 2008] where analysis of nitrogen content in domestic sewage sludge applied in agriculture was made. The study covered a group of 60 biosolids collected in 2001-2004 from 43 municipal sewage treatment plants. The same N content was assumed for both – municipal and industrial sewage sludge because majority of it applied in agriculture (about 76%) come from municipal treatment plants.

In Poland application of sewage sludge as fertilizer is relatively small, after increasing trend 2003−2009, certain stabilisation is noticed. Emissions of N_2O for this subcategory amount to 0.07 kt N_2O in 2014.

Crop Residues (F_{CR})

N_2O emission from crop residue returned to soils was generally estimated based on modified equation 11.6 from [Corrigenda for the 2006 IPCC GLs]:

$$F_{CR} = \sum_{T} \{Crop_{(T)} * Area_{(T)} * Frac_{Renew(T)} * [R_{AG(T)} * N_{AG(T)} * (1 - Frac_{Burn(T)} - Frac_{Remove(T)}) + R_{BG(T)} * N_{BG(T)}]\}$$

where:

F_{CR} = annual amount of N in crop residues (above and below ground), including N-fixing crops, and from forage/pasture renewal, returned to soils annually, kg N / yr

$Crop_{(T)}$ = harvested annual dry matter yield for crop *T*, kg d.m. / ha

$Area_{(T)}$ = total annual area harvested of crop *T*, ha / yr

$Frac_{Renew(T)}$ = fraction of total area under crop *T* that is renewed annually.

$R_{AG(T)}$ = ratio of above-ground residues dry matter ($AG_{DM(T)}$) to harvested yield for crop *T* ($Crop_{(T)}$), kg d.m. / kg d.m.,

$N_{AG(T)}$ = N content of above-ground residues for crop *T*, kg N / kg d.m.,

$Frac_{Burn(T)}$ - fraction of crop residues burned as indicated in sector 3.F

$Frac_{Remove(T)}$ = fraction of above-ground residues of crop *T* removed annually for purposes such as feed, bedding and construction, kg N / kg crop-N

$R_{BG(T)}$ = ratio of below-ground residues to harvested yield for crop *T*, kg d.m. / kg d.m.

$N_{BG(T)}$ = N content of below-ground residues for crop *T*, kg N / kg d.m.

T = crop or forage type

$R_{BG(T)}$ is calculated by multiplying R_{BG-BIO} in Table 11.2 by the ratio of total above-ground biomass to crop yield (= [($AG_{DM(T)}$ ● 1000 + $Crop_{(T)}$) / $Crop_{(T)}$], calculating $AG_{DM(T)}$ from the information in Table 11.2. Values of nitrogen content in below-ground residues for specific crops $N_{BG(T)}$ were taken from table 11.2 [IPCC 2006]. For permanent pastures and meadows, which are renewed on average every 20 years, $Frac_{Renew}$ = 1/20. For annual crops $Frac_{Renew}$ was taken as 1.

Data on N content in the above-ground residues, ratio of above-ground residues in dry matter to harvested yield for crops, fraction of crops burned come from country studies [Łoboda 1994, IUNG 2012] where experimental and literature data as well as default emission factors were used and are given in table 5.23. Fraction of total above-ground crop biomass that is removed from the field as a crop product (FracR) were consulted with the Institute of Soil Science and Plant Cultivation – State Research Institute and is presented in table 5.16.

Table 5.16. Fraction of total above-ground crop biomass that is removed from the field as a crop product ($Frac_{Remove}$) according to crops/group of crops

crop	$Frac_{Remove}$	crop	$Frac_{Remove}$
wheat	0.70	sugar beet	0.25
rye	0.70	rape	0.10
barley	0.70	other oil-bearing	0.10
oats	0.70	flux straw	0.90
triticale	0.70	tobacco	0.65
`cereal mixed	0.70	hop	0.01
millet & buckwheat	0.70	hey from pastures and meadows	0.95
maize	0.10	hey from pulses	0.95
pulses edible	0.10	hey from legumes	0.95
pulses feed	0.10	vegetables	0.10
potatoes	0.01		

Activity data concerning crop production was taken from national statistics [GUS R3 2015] (table 5.12). The default emission factor of 0.01 kgN_2O-N/kg N [IPCC 2006, table 11.1] multiplied by 44/28 was used for estimating the N_2O emissions from N inputs from crop residues.

Emission from above- and belowground crop residues in 2014 was 4.9 kt N_2O and is lower by about 11% than in 1988 due to drop in area sawn and crop production.

Mineralised N resulting from loss of soil organic C stocks in mineral soils through land-use change or management practices (F_{SOM})

This category deals with direct N_2O emissions from N mineralization resulting from change of land use or management of mineral soils. Tier 3 method was not applied to the estimation in this subcategory in Poland. Therefore, according to the *2006 IPCC Guidelines*, N immobilization associated with gain of soil carbon on mineral soils is not considered. Consequently, only N_2O emissions from mineralization associated with loss of soil organic matter (SOM) were estimated.

For amount of N mineralized in mineral soil associated with land use change, annual loss of soil carbon in mineral soil for estimating carbon stock changes in mineral soils was used. The area of mineral soil in land use change, which are calculated by subtracting the area of organic soil from the total area of land converted to cropland, were considered for the estimation as the activity data.
Estimation of the N release by mineralization was made according to the following steps presented below:

Step 1: Calculations of the average annual loss of soil C ($\Delta C_{Mineral, LU}$) for the land use change, over the inventory period, using equation 2.25.

Step 2: Each land use change has been assessed by the single value of $\Delta C_{Mineral, LU}$ As a consequence of this loss of soil C (F_{SOM}), equation 11.8 was applied to estimate N potentially mineralized applying C/N-ratio of 15 [IPCC 2006].

Cultivation of organic soils (F_{OS})

The area of cultivated organic soils (i.e. histosols) in Poland was estimated as a case study for the purposes at national inventory [Oświecimska–Piasko 2008]. Based on information collected from Computer database on peatlands in Poland "TORF" as well as from system of Spatial Information on Wetlands in Poland the area of histosols was assessed for mid–1970s and mid–1990s. The area from which N_2O emissions were calculated covers histosols as agricultural lands cultivated and/or irrigated.

So the area of such area was 882.6 thousand ha in mid–1970–ties and 769 thousand ha in mid–1990–ties. The area of histosols was then interpolated for 1976−1994.

Additionally the area of cultivated histosols was assessed for 2015 for the purpose of GHG emission projections which amounts to 680 thousand ha [6RR 2013, chapter 5.1]. Similarly to the previous period interpolation of histosol areas was applied between 1995 and 2015.

Nitrous oxide emissions from cultivated histosols in Poland in 2014 was about 8.6 kt N_2O and is falling since 1988 because of continuous progress of mineralization of organic matter as well as increasing area of histosols occupied by forest and scrub communities following cultivation termination of these areas.

Urine and dung deposited by grazing animals (F_{PRP})

Emission of N_2O resulting from animal urine and dung deposited on pastures is calculated based on equation 11.5 [IPCC 2006] using animal population (tables 5.2, 5.3), total amount of nitrogen in animal excreta (Nex) estimated based on country specific parameters presented in table 5.10 and data on fraction of manure related to grazing animals was presented in chapter 5.3.2 and, table 5.8.

Emissions in 2014 from pasture, range and paddock manure were 1.2 kt N_2O and stabilized since 2002. This value is much lower than in 1988 by about 68% what was caused by decreasing livestock population as well as decreasing percentage of livestock grazed.

5.4.2.2. Indirect N_2O emissions from managed soils (CRF sector 3.D.b)

Atmospheric deposition (CRF sector 3.D.b.1)

Indirect emissions of N_2O from atmospheric deposition of N volatilised were assessed using equation 11.9 [IPCC 2006]:

$$N_2O_{(ATD)} - N = \left[(F_{SN} * Frac_{GASF}) + \left((F_{ON} + F_{PRP}) * Frac_{GASM}\right)\right] * EF_4$$

where:

$N_2O_{(ATD)}$-N – annual amount of N_2O-N produced from atmospheric deposition of N volatilised from managed soils (kg N_2O-N/year)
F_{SN} – annual amount of synthetic N fertilizer applied to soils (kg N/year)
F_{ON} – annual amount of organic N fertilizer applied to soils (animal manure and sewage sludge nitrogen) (kg N/year)
F_{PRP} = annual amount of urine and dung N deposited by grazing animals on pasture, range and paddock (kg N/year)
$Frac_{GASF}$ - fraction of synthetic fertilizer that volatilises as NH_3 and NO_x (kg of N applied)
$Frac_{GASM}$ - fraction of organic fertilizer materials that volatilises as NH_3 and NO_x (kg of N applied)
EF_4 – emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces (kg N−N_2O)

Nitrogen amounts from synthetic fertilizers as well as from organic additions to soils (livestock manure and sewage sludge) correspond to values presented in chapter 5.4.2.1. Parameters characterising $Frac_{GASF}$ and $Frac_{GASM}$ are taken from table 11.3 [IPCC 2006] and amount respectively: 0.1 kg NH_3-N+NO_x-N/kg N applied and 0.2 kg NH_3-N+NO_x-N/kg N applied. Also the default emission factor EF_4 [IPCC 2006, table 11.3] is used amounting to 0.01 kg N_2O-N (kg NH_3-N+NO_x-N volatilised).

Table 5.17. Volatized nitrogen from synthetic and organic fertilizers applied to soils

Year	Volatized N [kt N/yr]	Year	Volatized N [kt N/yr]
1988	245.59	2001	160.89
1989	266.51	2002	154.99
1990	237.14	2003	149.81
1991	177.05	2004	152.48
1992	158.23	2005	153.72
1993	155.87	2006	167.10
1994	160.87	2007	173.52
1995	165.96	2008	180.24
1996	164.27	2009	172.76
1997	168.55	2010	166.63
1998	168.66	2011	172.60
1999	162.89	2012	170.89
2000	157.57	2013	179.26
		2014	172.18

Nitrogen leaching and run-off (CRF sector 3.D.b.2)

Indirect emissions of N_2O from leaching and runoff of N from soils were assessed using equation 11.10 [IPCC 2006]:

$$N_2O_{(L)}\text{-}N = (F_{SN} + F_{ON} + F_{PRP} + F_{CR} + F_{SOM}) * Frac_{LEACH\text{-}(H)} * EF_5$$

where:

$N_2O_{(L)}$-N – annual amount of N_2O-N produced from leaching and runoff of N additions to managed soils (kg N_2O–N/year)

F_{SN} = annual amount of synthetic fertiliser N applied to soils (kg N/year)

F_{ON} = annual amount of animal manure, compost, sewage sludge and other organic N additions applied to soils (kg N/year)

F_{PRP} = annual amount of urine and dung N deposited by grazing animals on pasture, range and paddock (kg N/year)

F_{CR} = annual amount of N in crop residues (above and below ground), including N-fixing crops, and from forage/pasture renewal, returned to soils (kg N/year)

F_{SOM} = annual amount of N in mineral soils that is mineralised, in association with loss of soil C from soil organic matter as a result of changes of land use or management (kg N/year)

$Frac_{LEACH\text{-}(H)}$ - fraction of all N added to/mineralised in managed soils (kg N / kg of N additions)

EF_5 – emission factor for N_2O emissions from N leaching and runoff (kg N_2O–N)

Nitrogen additions to soils correspond to values presented in chapter 5.4.2.1. $Frac_{LEACH\text{-}(H)}$ equals 0.3 kg N/kg N added and is the default value taken from [IPCC 2006, table 11.3]. The default emission factor EF_5 equal 0.0075 kg N_2O-N/kg N leached and runoff was used for calculation of N_2O-N emissions produced from leaching and runoff of N [IPCC 2006, table 11.3].

Table 5.18. Nitrogen losses through leaching and runoff from nitrogen added to soils

Year	N losses [kt N/yr]	Year	N losses [kt N/yr]
1988	673.56	2001	460.87
1989	736.73	2002	445.66
1990	662.71	2003	424.52
1991	473.78	2004	451.09
1992	409.08	2005	443.86
1993	443.14	2006	471.12
1994	437.10	2007	503.97
1995	468.95	2008	516.82
1996	476.05	2009	506.73
1997	477.90	2010	480.27
1998	487.25	2011	503.12
1999	460.91	2012	506.23
2000	454.79	2013	528.34
		2014	517.90

Total indirect emission in 2014 was about 8.8 kt N_2O and the trend since 1992 is rather stable after significant drop in 1989−1992 accompanying serial decrease in mineral fertilisers use and animal population.

5.4.3. Uncertainties and time-series consistency

Description of uncertainties is given in Chapter 5.2.3.

5.4.4. Source-specific QA/QC and verification

Activity data related to mineral fertilisers use or crop production come from national statistics prepared by the Central Statistical Office. Overall final estimation of cereals and potatoes output was verified by means of simulative calculation of crops quantity according to the distribution of output between: sale, sowing/planting, fodder and self consumption. Final estimation of sugar beets, rape and turnip rape, and some species of industrial crops were verified with procurement data for these crops. Estimation of fodder crops output in private farms, conducted by local experts of CSO, was additionally verified by the calculation of fodder crops according to the directions of their use. Total area of fodder crops comprises the area of meadows, pastures and field crops for fodder. This area does not include the area of cereals, potatoes, and other agricultural crops, a part of which was directly or indirectly used for fodder.

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. Generally QC procedures follow QA/QC plan presented in Annex 5.

5.4.5. Source-specific recalculations

- update of activity data for entire trend for mineralisation of gains/losses of soil organic matter,
- update of livestock population for 2012 and 2013 according to national statistics influencing manure management data

Table 5.19. Changes in N_2O emissions from agricultural soils resulting from recalculations.

Change	1988	1989	1990	1991	1992	
kt	0.01	0.01	0.00	0.01	0.02	
%	0.01	0.02	0.00	0.02	0.04	
Change	**1993**	**1994**	**1995**	**1996**	**1997**	
kt	0.03	0.03	0.03	0.03	0.03	
%	0.06	0.07	0.07	0.07	0.07	
Change	**1998**	**1999**	**2000**	**2001**	**2002**	
kt	0.03	0.04	0.05	0.05	0.05	
%	0.08	0.10	0.12	0.12	0.12	
Change	**2003**	**2004**	**2005**	**2006**	**2007**	
kt	0.05	0.05	0.05	0.06	0.07	
%	0.13	0.12	0.12	0.14	0.16	
Change	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
kt	0.05	0.06	0.08	0.08	0.16	0.28
%	0.11	0.13	0.18	0.18	0.35	0.62

5.4.6. Source-specific planned improvements

Presently no improvements are planned.

5.5. Field Burning of Agricultural Residues (CRF sector 3.F)

5.5.1. Source category description

Greenhouse gas emissions in 2014 from field burning of agricultural residues amounted for 1.06 kt CH_4 and 0.04 kt. The share of GHG emissions from field burning of agricultural residues in total agricultural emissions is 0.1%. The trend of GHG emissions within this category is presented on figure 5.9 and fluctuates following the annual crop production.

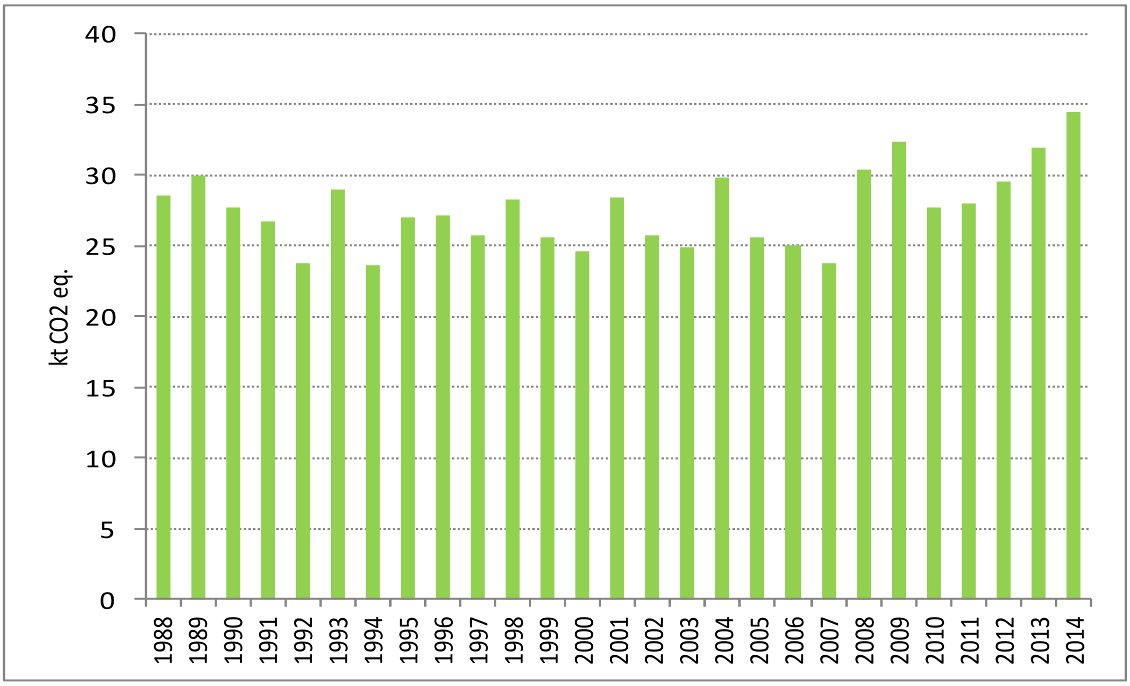

Figure 5.9 CH_4 and N_2O emissions from field burning of agricultural residues presented as CO_2 equivalent

5.5.2. Methodological issues

While estimating GHG emissions in this subcategory only methane and nitrous oxide are taken into account assuming that carbon dioxide released during burning of crop residues is reabsorbed during the next growing season.

Estimation of CH_4 and N_2O emissions from burning of agricultural residues in fields is based on the IPCC methodology [IPCC 1997]. For domestic purposes 43 crops were selected for which residues can potentially be burned [Łoboda *at al* 1994]. Within this group certain plants were excluded for which residues can be composted or used as forage. So finally there were selected 38 crops which were than aggregated into 32 groups containing cereals, pulses, tuber and root, oil-bearing plants, vegetables and fruits potentially could be burned on fields.

Activity data on crop production comes from public statistics [GUS R3, GUS R10, 2015]. Factors applied for emissions calculation were taken from country studies [Łoboda 1994, IUNG 2012] where experimental and literature data as well as default emission factors were used. These values for selected crops are presented in the table 5.20.

Table 5.20. Selected crop residue statistics employed in GHG estimation from field burning of agriculture residues (4.F) and direct soil emissions related to N fixing crops (3.D.1.3) and crop residues returned to soils (3.D.1.4)

Crops	Residue to crop ratio	Dry matter fraction	Fraction burned in fields	Fraction oxidized	Carbon fraction of residue	Nitrogen fraction of residue
winter wheat	0.90	0.85	0.005	0.90	0.4853	0.0068
spring wheat	0.85	0.85	0.005	0.90	0.4853	0.0068
rye	1.40	0.86	0.005	0.90	0.4800	0.0053
spring barley	0.80	0.86	0.005	0.90	0.4567	0.0069
oats	1.10	0.86	0.004	0.90	0.4700	0.0075
triticale	1.10	0.86	0.005	0.90	0.4853	0.0063
cereal mixed	0.90	0.86	0.004	0.90	0.4730	0.0071
buckwheat & millet	1.70	0.86	0.002	0.90	0.4500	0.0090
maize	1.30	0.52	0.002	0.90	0.4709	0.0094
edible pulses	0.90	0.86	0.001	0.90	0.4500	0.0180
feed pulses	1.30	0.85	0.001	0.90	0.4500	0.0203
potatoes	0.10	0.25	0.100	0.85	0.4226	0.0203
rape	1.20	0.87	0.030	0.90	0.4500	0.0068
other oil-bearing crops	3.50	0.87	0.030	0.90	0.4500	0.0068
flax straw	0.25	0.86	0.001	0.90	0.4500	0.0072
tobacco	1.25	0.50	0.002	0.85	0.4500	0.0180
hop	4.00	0.25	0.020	0.90	0.4500	0.0158
hay from greenland	0.05	0.23	0.001	0.90	0.4500	0.0198
hay from pulses	0.05	0.23	0.001	0.90	0.4500	0.0203
hay from clover and lucerne	0.05	0.23	0.001	0.90	0.4500	0.0275
tomatoes	0.60	0.15	0.050	0.85	0.4500	0.0225
other ground vegetables	0.35	0.15	0.010	0.90	0.4500	0.0248
vegetables under cover	0.40	0.35	0.010	0.90	0.4500	0.0270
apples	1.50	0.35	0.050	0.90	0.4500	0.0275
pears and other fruits	1.50	0.35	0.070	0.90	0.4500	0.0149
plums	1.50	0.35	0.100	0.90	0.4500	0.0149
cherries	1.50	0.35	0.100	0.90	0.4500	0.0149
sweet cherries	1.50	0.35	0.100	0.90	0.4500	0.0149
strawberries	0.50	0.18	0.010	0.90	0.4500	0.0149
raspberries	1.20	0.30	0.250	0.90	0.4500	0.0248
currants	1.20	0.30	0.250	0.90	0.4500	0.0149
gooseberries and other berries	1.20	0.30	0.250	0.90	0.4500	0.0149

5.5.3. Uncertainties and time-series consistency

Description of uncertainties is given in Chapter 5.2.3.

5.5.4. Source-specific QA/QC and verification

Activity data related to mineral fertilisers use or crop production come from national statistics prepared by the Central Statistical Office. Overall final estimation of cereals and potatoes output was verified by means of simulative calculation of crops quantity according to the distribution of output between: sale. sowing/planting. fodder and self consumption. Final estimation of sugar beets. rape and turnip rape. and some species of industrial crops were verified with procurement data for these crops. Estimation of fodder crops output in private farms. conducted by local experts of CSO. was additionally verified by the calculation of fodder crops according to the directions of their use. Total area of fodder crops comprises the area of meadows. pastures and field crops for fodder. This area does not include the area of cereals. potatoes. and other agricultural crops. a part of which was directly or indirectly used for fodder.

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. Generally QC procedures follow QA/QC plan presented in Annex 5.

5.5.5. Source-specific recalculations

No recalculations were made.

5.5.6. Source-specific planned improvements

No improvements are planned presently.

5.6. CO2 emissions from liming (CRF sector 3.G)

5.6.1. Source category description

Category moved from LULUCF sector (see NIR 2014, chapter. 7.3.4.5).
Emissions of CO_2 from lime ($CaCO_3$) and dolomite ($CaMg(CO_3)_2$) application to agricultural soils in 2014 amounted to 152 kt and 316 kt respectively. Trend in CO_2 emissions of both fertilizers drop since 1988 due to significant changes of agricultural farms after 1989 (see chapter 5.1) as well as current economic situation at rural market (prices of means of production vs. prices of agricultural goods).

5.6.2. Methodological issues

The reported annual carbon emission from agricultural lime application is calculated Tier 1 method using equation 11.12 [IPCC 2006]:

$$CO_2\text{-C } Emission = (M_{limestone} * EF_{limestone}) + (M_{dolomite} * EF_{dolomite})$$

where:

CO_2-C *Emission* = annual C emissions from lime application (t C/year)
$M_{limestone}$ – annual amount of calcic limestone ($CaCO_3$) [t / yr]
$M_{dolomite}$ – annual amount of dolomite ($CaCO_3$) [t / yr]
$EF_{limestone}$ – emission factor for limestone – 0.12 [t C / t limestone] [IPCC 2006]
$EF_{dolomite}$ – emission factor for dolomite – 0.13 [t C / t dolomite] [IPCC 2006]

Activity data on use of lime fertilizers is available in national statistics on an annual basis in pure nutrient (CaO) [GUS R2 2014]. So it was necessary to convert these data into actual use of fertilizers [Radwański 2006b]. It was assumed that lime – magnesium fertilizers ($CaMg(CO_3)_2$) contains 89.1% of $CaCO_3$ and 10.9% of $MgCO_3$. Carbon (C) is converted to carbon-dioxide (CO_2) by the conversion factor 44/12.

5.6.3. Uncertainties and time-series consistency

Description of uncertainties is given in Chapter 5.2.3.

5.6.4. Source-specific QA/QC and verification

Description is given in Chapter 5.2.4.

5.6.5. Source-specific recalculations

- update of activity data on lime application for selected years based on national statistics

Change	1988	1989	1990	1991	1992	
kt	-386.43	0.00	-237.92	-506.10	-258.85	
%	-16.53	0.00	-10.18	-24.11	-16.25	
Change	**1993**	**1994**	**1995**	**1996**	**1997**	
kt	-28.95	-107.50	305.61	-93.39	161.66	
%	-2.17	-8.23	25.51	-6.21	11.46	
Change	**1998**	**1999**	**2000**	**2001**	**2002**	
kt	-83.23	-289.73	-103.76	-10.68	-52.56	
%	-5.30	-19.46	-8.66	-0.97	-4.85	
Change	**2003**	**2004**	**2005**	**2006**	**2007**	
kt	-39.87	0.47	-47.59	-360.62	-182.92	
%	-3.86	0.05	-4.79	-38.16	-31.31	
Change	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
kt	0.00	0.00	3.40	0.01	0.00	-2.48
%	0.00	0.00	0.88	0.00	0.00	-0.56

5.6.6. Source-specific planned improvements

No improvements are planned at the moment.

5.7. CO_2 emissions from urea fertilization (CRF sector 3.H)

5.7.1. Source category description

Adding urea to soils during fertilisation leads to a loss of atmospheric CO_2 that was fixed in the industrial production process of the fertilizer. Emissions related to this process in Poland amount to 434 kt CO_2 and drop since 1988 by 15%.

5.7.2. Methodological issues

The annual carbon emission from urea application is calculated Tier 1 method using equation 11.13 [IPCC 2006]:

$$CO_2\text{-C } Emission = M * EF$$

where:

CO_2-C *Emission* = annual C emissions from urea application (t C / year)
M – annual amount of urea fertilization [t urea / yr]
EF – emission factor [t C/ t urea]

Annual amount of urea used for application to soils is derived from data on mineral nitrogen fertilizers used in Poland [GUS R2 2015] and share of urea in nitrogen fertilizers used (Central Statistical Office). Emission factor is the default one from the IPCC 2006 GLs: 0.20 t C/ t urea.

5.7.3. Uncertainties and time-series consistency

Description of uncertainties is given in Chapter 5.2.3.

5.7.4. Source-specific QA/QC and verification

Description is given in Chapter 5.2.4.

5.7.5. Source-specific recalculations

No recalculations were performed.

5.7.6. Source-specific planned improvements

No improvements are planned at the moment.

6. LAND USE, LAND USE CHANGE AND FORESTRY (CRF SECTOR 4)

6.1. Overview of sector

The greenhouse gas inventory of the Land Use, Land Use Change and Forestry (LULUCF) sector covers all CO_2 emissions and removals of due to gains and losses in the relevant carbon pools of the predefined six land-use categories, as well as non-CO_2 emissions from biomass burning and disturbance associated with land-use conversions. It should be noted that a number of factors used in the estimations of GHG's assumes default values (recommended by the IPCC). Those factors are considered to be modified on the basis of in-country analysis.

Data included in this inventory is based on statistical data presented in statistical journals published by the Central Statistical Office. The data relating to the land area by the type of usage (in accordance with the methodology recommended by IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry) is based on:

- generalized results of land use and sown area survey conducted on private farms, data on the condition and changes in the registered intended use of land were developed on the basis of annual reports on land, introduced in the following Regulations: of the Minister of Agriculture and Municipal Management of 20 February 1969 on land register (MP No. 11, item 98), from 1997 – of the Minister of Spatial Economy and Construction and of the Minister of Agriculture and Food Economy 17 December 1996 on register of land and buildings (O. J. No. 158, item 813), and from 2002 of the Minister of Regional Development and Construction of 29 March 2001 on register of land and buildings (O. J. No. 38, item 454).

Amendments to the regulations introduced changes in classifications of land. Subsequent changes were implemented inter alia due to adoption of the international standards. Beginning with data for 1997 on, the registers of land were prepared by the Head Office of Geodesy and Cartography as well as voivodship branches of geodesy and land management. The data are presented, taking into consideration geodesic area.

6.1.1. The greenhouse gas inventory overview of the Land Use, Land-Use Change and Forestry (LULUCF) sector

The greenhouse gas inventory of LULUCF sector comprises emissions and removals of CO_2 due to overall carbon gains or losses in the relevant carbon pools of the predefined six land-use categories. These activities in 2014 altogether resulted in net removals estimated to be equal to 28 174 kt of CO_2 equivalent.

Most removals are generated by biomass gains in the *Forest Land remaining Forest Land* and the *Land converted to Forest Land* categories. The net sink in these category is mainly due to the fact that the forest area has been increasing, and that the total increment of the growing stock in forest lands has always been higher than the annual harvest

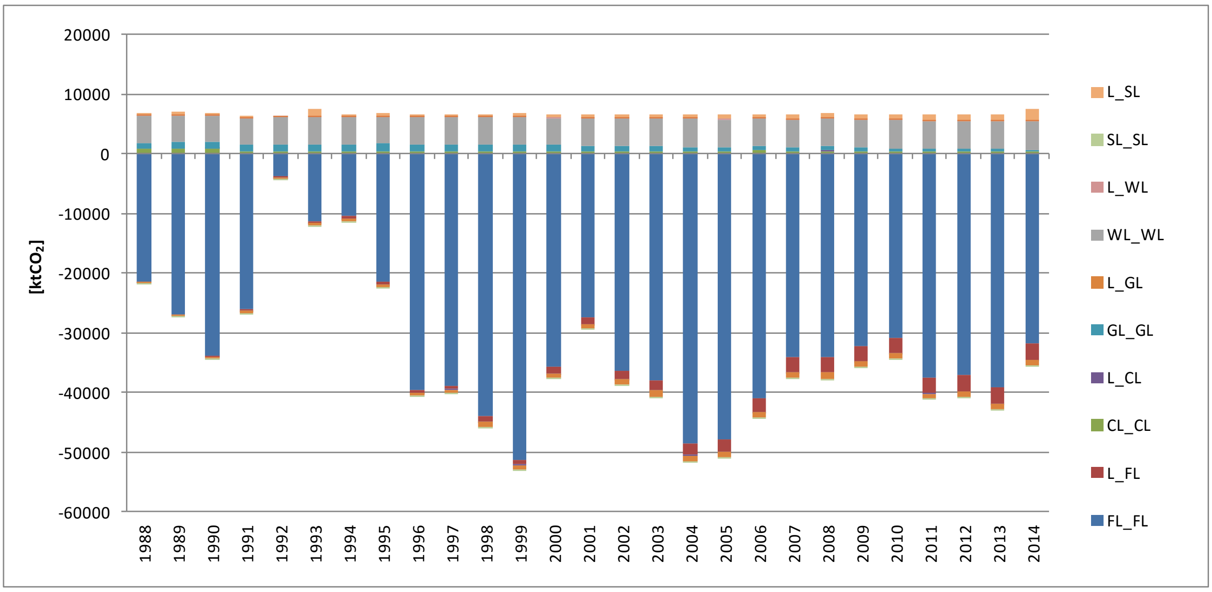

Figure 6.1. Trends in emissions/removals from the LULUCF sector by land-use and land-use change

The most important category recognised to be the main source of CO_2 removals is the subcategory 4.*A forest land*. This situation is, to some extent, related to the recorded growth of timber resources. It shall be noted that the recorded growth is the result of timber harvest carried out in accordance with the forest sustainability principle and furthermore persistent enlargement of the forest area.

6.1.2. Country area balance in 2014

Table 6.1 Country area balance in 2014

Year	2014
Greenhouse gas source and sink categories	Area [ha]
4. Total land-use categories	
4.A. forest land	9 382 578
4.A.1. forest land remaining forest land	8 712 904
4.A.2. land converted to forest land	669 674
total organic soils on forest land, of which	255 845
on forest land remaining forest land	237 561
on land converted to forest land	18,28
4.B. cropland	
total cropland area	14 011 289
4.B.1. cropland remaining cropland	13 697 969
4.B.2. land converted to cropland	313 319
total organic soils on cropland, of which	536 573
on cropland remaining cropland	536 573
on land converted to cropland	NO
4.C. grassland	
total grassland area	4 153 197
4.C.1. grassland remaining grassland	3 971 987
4.C.2. land converted to grassland	181 209
total organic soils on grassland, of which	147 877
on grassland remaining grassland	147 877
on land converted to grassland	NO
4.D. wetlands	
total wetlands area	1 366 387
4.D.1. wetlands remaining wetlands	1 305 787
4.D.2. land converted to wetlands	60 599
total organic soils on wetland, of which	360 810

Year	2014
on wetlands remaining wetlands	360 810
on land converted to wetlands	NO
4.E. settlements	
total settlements area	2 249 939
4.E.1. settlements remaining settlements	1 950 574
4.E.2. land converted to settlements	299 365
4.F. other Land	104 576
Country area balance	31 267 967

6.1.3. Land uses classification for representing LULUCF areas

For the reporting purposes to the United Nations Framework Convention on Climate Change and Kyoto Protocol it is recommended to match national land-use categories (as specified in the Regulation of the Minister of Administration and Digitization of 29 November 2013 amending the regulation on the registration of land and buildings *(Journal of Laws 2013 pos. 1551))* to the appropriate categories of land use consistently to the IPCC guidelines (Chapter 3.3.1. of IPCC 2006 Guidelines of the Volume 4). To fulfil the above mentioned recommendations available data were summarized taking into account the assessment provided in the table 7.1.3.

Table 6.2 Land use assessment.

IPCC category	National Land Identification System
4.A forest land	forest land
4.B cropland	arable land, orchards,
4.C grassland	permanent meadows and pastures; woody and bushy land
4.D wetland	land under waters (marine internal, surface stands); land under ponds; land under ditches; ecological arable land; wasteland
4.E settlements	agricultural build-up areas; build-up and urbanized areas;
4.F other land	miscellaneous land

6.1.4. Key categories

Key category assessment for LULUCF category is included in annex 1.

6.2. Forest Land (CRF sector 4.A.)

6.2.1. Source category description

Estimations for this subcategory were based on IPCC methodology described in the chapter 4 of IPCC 2006 guidelines of the Volume 4. GHG balance in this category in 2014 is a net CO_2 sink, estimated to be equal to 34 593 kt CO_2.

6.2.1.1. Area of forest land in Poland in year 2014

Forest land reported under subcategory 4.A. is classified as a "forest" according to Art. 3 of *Act on Forests of 28 Sep 1991 (Journal of Law of 1991 No 101 item 444, as amended).* This assessment is in line with internationally adopted standard which takes into account the forest land associated with forest management. Forest land area in Poland, as of 1 January 2014, was equal to 9 382 578 ha *(GUS Environmental protection 2014)*.

Table 6.3 Forest land area by provinces as of the end of inventory year.

No	Voivodship	Unit	2008	2009	2010	2011	2012	2013	2014
	Total	[ha]	9 251 404	9 275 786	9 304 762	9 329 174	9353731	9369403	9382578
1.	**Dolnośląskie**	[ha]	606 104	607 327	608 387	609 279	610583	610968	611562
2.	**Kujawsko-pomorskie**	[ha]	425 207	426 170	427 147	427 843	428254	428491	428772
3.	**Lubelskie**	[ha]	568 601	572 620	576 420	579 237	581002	582307	583447
4.	**Lubuskie**	[ha]	706 788	707 583	708 201	709 002	709881	710350	710858
5.	**Łódzkie**	[ha]	386 172	387 711	388 597	389 350	390358	390950	391259
6.	**Małopolskie**	[ha]	439 126	438 280	439 765	440 114	440432	440664	440672
7.	**Mazowieckie**	[ha]	802 158	804 912	808 810	812 973	817869	824660	828607
8.	**Opolskie**	[ha]	257 858	258 170	258 246	258 399	258570	258846	258982
9.	**Podkarpackie**	[ha]	671 363	674 450	677 953	680 166	683371	683462	685002
10.	**Podlaskie**	[ha]	621 718	624 856	626 532	627 235	628678	629184	630047
11.	**Pomorskie**	[ha]	676 165	677 673	678 226	679 898	681014	681537	682244
12.	**Śląskie**	[ha]	400 709	399 592	399 954	401 747	402014	402307	402989
13.	**Świętokrzyskie**	[ha]	331 492	332 089	332 487	332 980	402364	334796	335083
14.	**Warmińsko-mazurskie**	[ha]	752 146	755 050	760 064	763 567	334385	769824	771463
15.	**Wielkopolskie**	[ha]	778 863	780 795	783 340	784 649	785648	785998	786497
16.	**Zachodniopomorskie**	[ha]	826 934	828 508	830 633	832 735	834009	834760	835094

Difference between the areas reported by Poland under FAO and UNFCCC

Data on the condition and changes in the registered intended use of land, developed on the basis of annual reports on land prepared by the Head Office of Geodesy and Cartography, was applied in the estimations and reported under the UNFCCC. National statistics prepared and published on the basis of those reports, describes areas of all land uses, including forest land, with the consideration of the geodesic area [e.g. "GUS; Environmental Protection 2014"].

In relation to the FAO reports, data collected and reported there was developed on the basis of information obtained from stand-alone statistical surveys in subsequent years. As a result of various methods, which were applied for data collection and processing some notable differences can occur. What needs to be emphasized, statistical approach used in stand-alone statistical surveys do not consider all land use types in the same survey at the same time. Therefore, with regard to the data comparability and accuracy reported under the UNFCCC and KP, information obtained from statistical surveys on land areas, which covers country territory partially, could not be applied.

6.2.1.2. Habitat structure

The diversity of growing conditions for forests in Poland is linked to the natural-forest habitats allocations and is presented on Fig. 6.3. Poland has mainly retained forests on the poorest soils, which is reflected in the structure of forest habitat types. Coniferous habitats prevail, accounting for 52,5% of the total forest area, while broadleaved habitats cover 52,5% . In both groups, a further distinction is made between upland habitats which occupy 6,3% of the forest area and mountain habitats which occupy 8.6%.

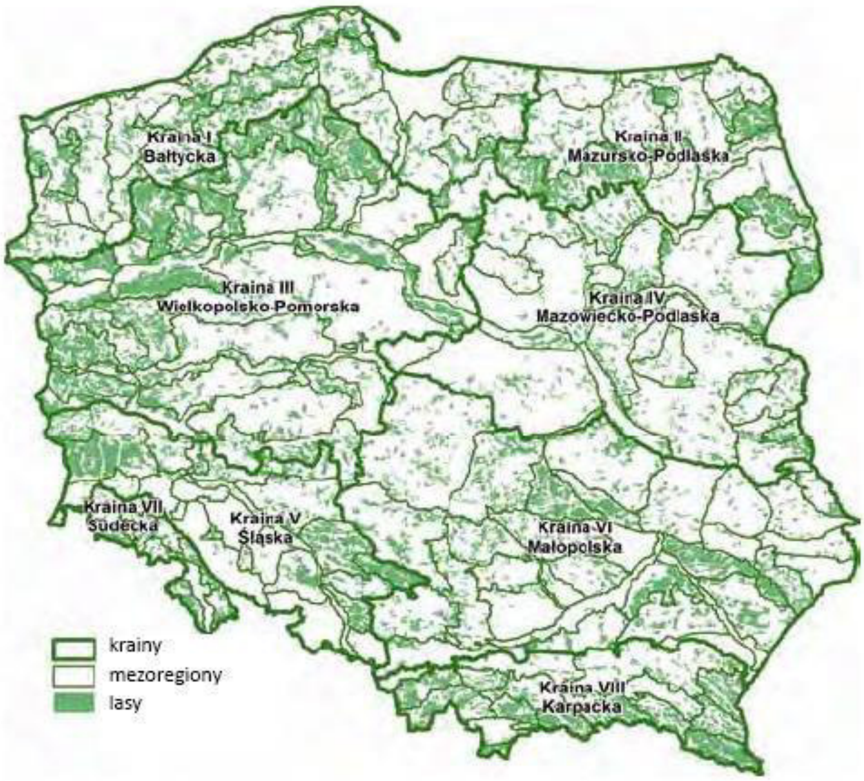

Figure 6.2 Natural-forest habitats diversification in Poland

6.2.1.3. Species composition

The geographical distribution of habitats is, to a great extent, reflected in the spatial structure of dominant tree species. Apart from the mountain regions where spruce (west) and spruce and beech (east) are the main species in stand composition, and a few other locations where stands have diversified species structure, in most of the country stands with pine prevail as the dominant species.

In terms of forest area, coniferous species dominate in Polish forests, accounting for 69,1 % of the total forest area. Poland offers optimal climatic and site conditions for pine within its Euro-Asiatic natural range, which resulted in development of a number of important ecotypes (e.g. the Taborska pine or the Augustowska pine). Pine accounts for 58,5 % of the area of forests in all ownership categories, for 62,0 % in the State Forests and for 57.0 % in the privately-owned forests.

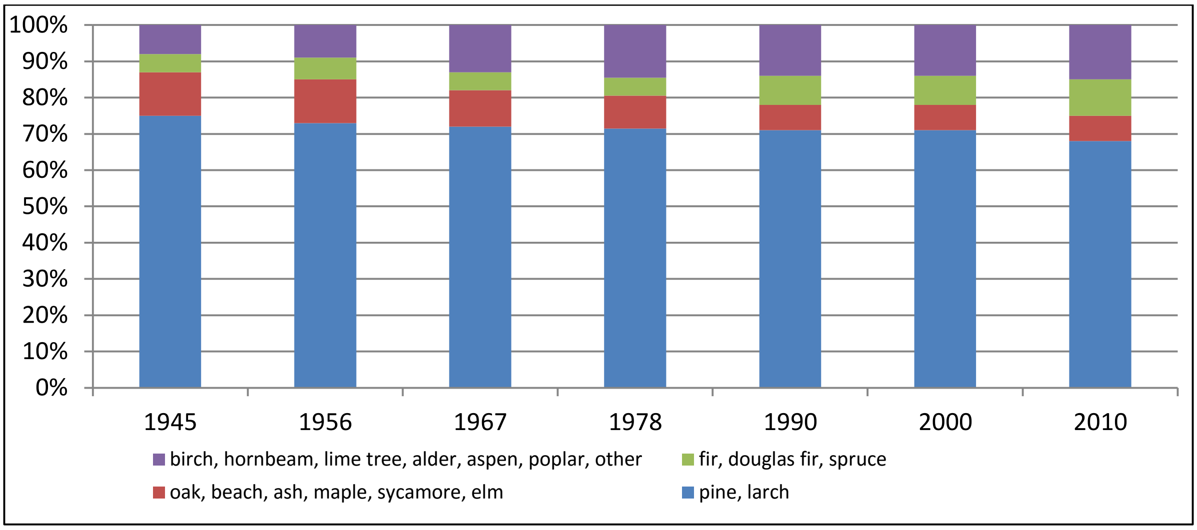

Figure 6.3. Spatial structure of dominant tree species

Since 1945 forest species structure has undergone significant changes, expressed, inter alia, by increased share of stands for deciduous trees. Considering state forests, where it is possible to trace this phenomenon on the basis of annual updates of forest land area and timber resources, total area of deciduous stands increased from 13 to 27.2%. Despite the increase in the surface of deciduous forests, their share is still below potential, arising from the structure of forest habitats.

6.2.1.4. Age structure

Stands aged 41–80 years, representing age classes III and IV prevail in the age structure of forests and cover 27,8% and 24,2% of the forest area respectively. Moreover, stands aged 41–80 years are dominating in total forests area, with their total share equal to nearly 52,0%. Stands over 80 years old, including stands in the restocking class, account for 36,5% of the total forest area.

6.2.1.5. Structure of timber resources by volume

According to the Statistical Yearbook "Forestry 2015", estimated timber resources as of the end of 2014 amounted to 2 469 212 m^3 of gross merchantable timber, including 2 039 000 m^3 in the public forests and 403 001m^3 in private forests.

6.2.2. Information on approaches used for representing land area and on land-use databases used for the inventory preparation

According to the description suggested in the chapter 3.3.1. of IPCC 2006 Guidelines of the Volume 4, managed forest land areas associated with the forestry activities in Poland is identified using Approach 3. Geographic boundaries encompassing units of land subject to multiple activities are indentified based on data *on the condition and changes in the registered intended use of land* developed on the basis of annual reports on land.

6.2.3. Land-use definitions and classification system used and their correspondence to the LULUCF categories

According to the regulations of art. 3 of the Act on Forests of September 28th 1991 *(Journal of Law of 1991 No 101 item 444, as amended)*, forest land is the area:

1) of contiguous area greater than or equal to 0.10 ha, covered with forest vegetation (or plantation forest) – trees and shrubs and ground cover, or else in part deprived thereof, that is:

   a. designated for forest production, or
   b. constituting a Nature Reserve or integral part of a National Park, or
   c. entered on the Register of Monuments;
2) of contiguous area greater than or equal to 0.10 ha, associated with forest management.

This subcategory includes entire land with woody vegetation consistent with thresholds used to define forest land in the national GHG inventory with :

- minimum area: 0.1 hectare,
- minimum width of forest land area: 10 m,
- minimum tree crown cover: 10% with trees having a potential to reach a minimum height of 2 metres at maturity in situ. Young stands and all plantations that have yet to reach a crown density of 10 percent or a tree height of 2 metres are included under forest. Areas normally forming part of the forest area that are temporarily un-stocked as a result of human intervention, such as harvesting or natural causes such as wind-throw, but which are expected to revert to forest are also included.

6.2.4. Forest Land remaining Forest Land (CRF sector 4.A.1)

GHG balance in this category is a net sink. In 2014 net CO_2 sink was about 31 815 kt CO_2. Methodological assumptions are provided in the following chapters.

6.2.4.1 Methodological issues

Due to the intensive forest monitoring as described above, all forest stands are continuously accounted for. This also means that all changes in the biomass carbon stocks of the forests due to any causes from growth through harvests, natural disturbances and deforestation are captured by the forestry statistics of each stand at least on a decade scale, and those of the whole forest area even on an annual basis.

6.2.4.2 Subcategory area

Land use change matrix is presented in the annex 6

According to the provisions of the decision 9/CP.2 *Communications from Parties included in Annex I to the Convention: guidelines, schedule and process for consideration* where it is decided that the four Parties that have invoked Article 4.6 of the Convention, which requested in their first communications for flexibility to use base years other than 1990, Poland has chosen the year 1988 to be set as a starting point for the reported transitions according to the IPCC 2006 guidelines.

6.2.4.3. Living biomass

<u>Carbon stock changes</u>

Annual change in carbon stocks in living biomass reservoir was estimated considering the changes in forest resources on forest land all forms of ownership, using the information contained in the statistical yearbooks "Forestry". Estimations were based on the equation 2.8 contained in the IPPC guidelines; as suggested in the Volume 4, Chapter 2.3.1.1. Data sources contains tables describing forest resources species cover and age classes.

As mentioned above, the general methodology to estimate emissions and removals in the forestry sector is based on the IPCC methodology (IPCC 2006). However, wherever it was possible, country specific data was used (Tier 2), and IPCC default values (Tier 1) were only used in a few cases. Changes in carbon stocks in the biomass pool are accounted annually on the basis of the Polish forestry statistics which provides relevant information, describing aboveground volume of all forests at the country level, available annually for the each inventory year. Moreover gross merchantable volume stock used in the above mentioned calculations is estimated on the basis of data obtained from the most recent 5-year cycle of large-scale inventory, which is published in the form of official statistics by the Central Statistical Office.

Fortunately, the State Forest Holding's data base also contains aggregate annual statistics on total growing stocks by species and age classes. These statistics are produced by a bottom-up approach, i.e. growing stocks of stands are aggregated by species and age classes. There are uncertainties around these statistics, however, they are regarded smaller than those associated with a gain-loss method and systematic errors. We noted that since growing stocks and their changes incorporate the effects of all processes mentioned above, no particular inferences on emissions and removals can be made separately for any of these processes.

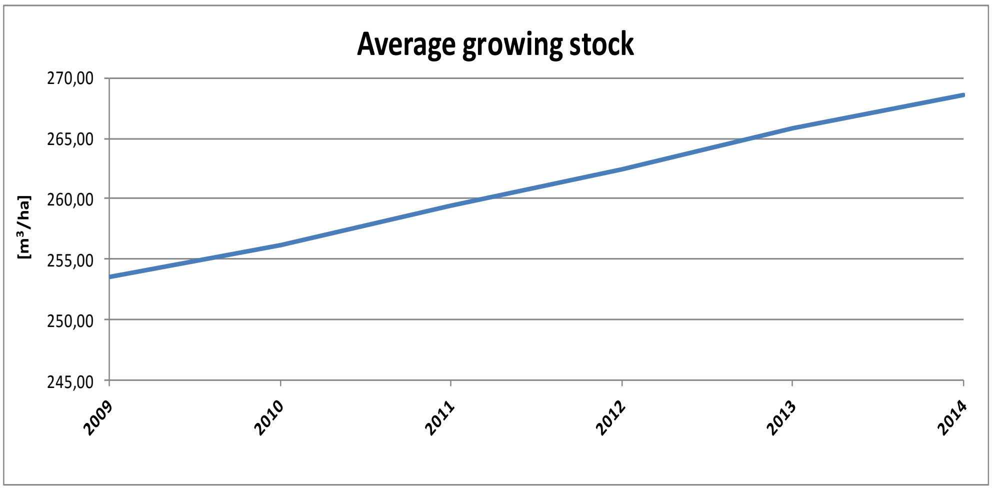

Figure 6.4 Average volume stock of merchantable timber in Polish forests

Data provided on the graph above was prepared on the basis of the large-scale forest inventory in the country conducted in 2010-2015 by the Forest Management and Geodesy Bureau. Recent result are not fully comparable with data published up to 2009. To eliminate potential overestimations of carbon sinks linear calibration was applied. It should be noted that forest inventory is conducted by the Forest Management and Geodesy Bureau and its branches. The inventory data is stored by stand in a computerized database, i.e. the National Forest Database During the continuous survey of the forest inventory, the main stand measures (such as height, diameter, basal area, and density) are estimated by various measurement methods. The survey also includes mapping of the forest area. The survey methods applied in individual stands depend on species, age and site. Since the recent forest inventory scheme is based on survey's considering measurements of individual sample plots, more accurate results were obtained from the year 2009.

For carbon stock changes in biomass, the system of calculations allows for the use of even simpler sensitivity analysis than before. This is especially true if only the major sources of CO_2 emissions and removals are considered, which represent the bulk of all emissions and removals. The reason for this is that the equation inherent in the calculation is simple: only volume stock changes, wood density, root-to-shoot ratio, and carbon fraction factors are involved. With respect to accuracy and precision, the reported estimated values are generally accurate and precise as far as practicable. Where uncertainty seems to be high, and for non-quantifiable factors, the principle of conservativeness is always applied. With regard to carbon stock change estimation, it can be concluded that many sources of error were removed by switching from the process-based method to the stock-change method.

Thus, it is expected that current estimates better reflect emissions and removals associated with forest land than previous estimates.

6.2.4.4. Basic wood density

Basic wood density was calculated based as the weighted mean of wood density by wood species. To calculate the basic air-dry wood density values, the specific gravity of dry wood and shrinkage of the total volume were used for each species. Scheme for weighted mean wood density calculation is presented in table below:

Table 6.4. Scheme for weighted mean wood density calculation by wood species.

Species	Air-dry wood density [t/m^3]	Volume of thick [thous. m^3]	Mean wood density [t dm.]
	A	B	C=A*B
Pine	0.43	1508689	647589
Spruce	0.38	158030	59798
Fir	0.36	96299	34863
Beech	0.57	165437	94061
Oak	0.57	158030	89777
Hornbeam	0.63	32100	20363
Birch	0.52	123461	64617
Alder	0.43	130868	56046
Poplar	0.35	14815	5206
Aspen	0.36	2469	879
Other	0,36	79015	28129
Total	-	2469212	1101328
Weighted mean wood density			**0.4460**

6.2.4.5. Biomass conversion and expansion factor

Biomass conversion and expansion factor was adjusted on the basis of default values proposed to be used by the IPCC in the framework of IPCC 2006 Guidelines; Volume 4, table 4.5.

Table 6.5. Scheme for calculation of BCEF .

BEF_2 – coniferous species	A	dimensionless	1.30
BEF_2 – deciduous species	B	dimensionless	1.40
Gross merchantable timber – coniferous species	C	[thous. m^3]	1763017
Gross merchantable timber – deciduous species	D	[thous. m^3]	706195
Gross merchantable timber – total	E	[thous. m^3]	2469212
BEF_2 – weighted mean	F=((A*C)+(B*D))/E	dimensionless	**1.3286**
BCEF – weighted mean		dimensionless	**0.5926**

6.2.4.6. Root-to-shoot ratio

Root-to-shoot ratio was adjusted based on weighted average default values proposed to be used by the IPCC in IPCC 2006 Guidelines of the Volume 4, table 4.4.

Table 6.6. Scheme of R factor calculation

R – coniferous species	A	R (default)	0.23
R– deciduous species	B	R (default)	0.24
Gross merchantable timber – coniferous species	C	m^3	1763017
Gross merchantable timber – deciduous species	D	m^3	706195
Gross merchantable timber – total	E	m^3	2469212
R- weighted mean	F=((A*C)+(B*D))/E		**0.2329**

6.2.4.7. Carbon fraction

Estimations are based on the following default factor:

- fraction of carbon in the dry matter: 0.47 [IPCC 2006].

6.2.4.8. Dead organic matter

It is assumed that this reservoir is not the net source of CO_2 emissions, relevant reporting tables related to dead organic matter, were filled up with the notation" NO".

What should be highlighted, the potential carbon gains might have a positive impact on final carbon balance related to the category *4.A.1 forest land remaining forest land*, therefore recent approach may lead to the potential overestimation of net emissions.

Current demonstration that this reservoir in not a source depends on the data availability, generally following justifications were considered:

1. direct implementation of Tier 1 description suggested in the chapter 4.2.2.1 of IPCC 2006 Guidelines of the Volume 4, assuming that the average transfer rate into the dead organic matter reservoir is equal to the transfer rate out of this pool so the net change is in equilibrium;
2. expert judgments based on a combination of qualitative and quantitative arguments, like international references to the neighbouring country's GHG's inventories;
3. conservative assumptions based on in-country forestry practices, as described below.

In the last decades, the close-to-nature forest management has been promoted in Poland and clear cuts were limited, especially after the adoption of the most recent Forest Act of 1991. This Act requests that semi natural forests must be managed in an increasingly natural way, which includes leaving more deadwood in the forest after harvests than before, as well as creating and maintaining gaps, and enhancing species mixture. It should be noted that the recent increasing share of broadleaved species in the species structure drives important positive role in the final changes of CS in dead organic matter pool. As a result of the implementation of these requirements, we can assume the accumulation of dead wood in the Polish forests is stable.

The other reason of the increase of dead organic matter stock in all forests is that about one-third of all forests are afforestations since 1945 (post World War II afforestations) and most of these forests are still in their intensive growing phase, which means that carbon stocks of the dead organic matter pool have not saturated yet. Finally, no major disturbances or other processes have occurred that could have resulted in substantial emissions from the dead organic matter pool.

6.2.4.9. Mineral soils

Annual change in carbon stocks in the litter reservoir was estimated using equation 2.25 contained in IPCC 2006 Guidelines of the Volume 4, section 2.3.3. For the needs of equation application, default reference values of SOC_{ref} were considered to be used linked with the dominant tree habitats.

Table 6.7 Forest habitant types in Poland with the SOC_{ref} assignment

SOC_{ref}	Forest habitat types
high active SOC ref (50 [MgC/ha])	Fresh mixed forest, moist mixed forest, mixed upland forest, mountain mixed forest, fresh broadleaved forest, moist broadleaved forest upland forest, mountain forest
low active SOC ref (33[MgC/ha])	Moist coniferous forest, mountain coniferous forest, high- mountain coniferous forest, 0,5*fresh mixed coniferous forest, moist mixed coniferous forest, upland mixed coniferous forest, mountain mixed coniferous forest
sandy SOC ref (34 [MgC/ha])	Dry coniferous forest, fresh coniferous forest 0,5* fresh mixed coniferous forest
wetland SOC ref (87 [MgC/ha])	Marshy coniferous forest, boggy mountain coniferous forest, boggy mixed coniferous forest, boggy mixed forest, alder forest, ash- alder swamp forest, mountain alder forest, floodplain forest, mountain floodplain forest

Table 6.8. Percentage share of soil types by land use system (for time t and t–20)

Habitats	**2014 (t)**	**1994 (t-20)**
high activity	45.5	34.0
low activity	17.9	19.6
sandy	32.1	42.6
wetland	4.6	3.8
Total	100.0	100.0

Carbon stock changes in mineral soils were estimated based ion following references contained in the IPCC 2006 Guidelines of the Volume 4, section 2.3:

- transitional period - 20 years
- $f_{man\ intensity}$ - 1.0
- $f_{dist\ regime}$ - 1.0
- $f_{forest\ type}$ - 1.0

6.2.4.10. Organic soils

The area of cultivated histosols in Poland was estimated as a case study for the purposes at national inventory [Oświecimska–Piasko 2008]. Based on information collected from Computer database on peatlands in Poland "TORF" as well as from system of Spatial Information on Wetlands in Poland the area of histosols was assessed for mid–1970s and mid–1990s. The area from which N_2O emissions were calculated covers histosols as agricultural lands cultivated and/or irrigated. So the area of such area was 882.6 thousand ha in mid–1970–ties and 769 thousand ha in mid–1990–ties. The area of histosols was then interpolated for 1976–1994.

Additionally the area of cultivated histosols was assessed for 2015 for the purpose of GHG emission projections which amounts to 680 thousand ha [PLNC6 2013]. Similarly to the previous period interpolation of histosols areas was applied between 1995 and 2015. Since 1970-ties area of histosols occupied by forest and scrub communities is increasing. In 1970-ties it was equal 170 800 ha. in 1990-ties – 214 400 ha. Also proportion of and scrub communities at organic soils are increasing from 12% at the beginning of 1970-ties to 16.5 % in 1990-ties.

Total organic soils area in 2014 was estimated for ha with the following split for subcategories: forest land remaining forest land – 234 076 ha land converted to forest land – 17 383 ha. Emissions from organic soils on forest land were estimated with the default EF contained in the table 4.6 of IPCC 2006 Guidelines of the Volume 4.

Table 6.9 CO_2 emission factor for drained organic soils

Name	Volume	Unit
$EF_{drainag}$	0.68	[tC/ha/rok]

6.2.4.11. Biomass burning

According to the article 30 of *Act on forests of 28th September, 1991 (Journal of Law of 1991 No 101 item 444, as amended)* the burning of surface soil layers or remnants of vegetation is forbidden. In relation to this record it is considered that controlled biomass burning does not occur on forests. CH_4, N_2O, CO and NO_x emissions from uncontrolled forest fires were calculated using following equation 2.27 (IPCC 2006, page 2.42.):

Table 6.10. Emissions ratios for calculation CH_4, N_2O, CO and NO_x emissions from forests fires [table 2.5 p. 2.47 of IPCC 2006 Guidelines, Volume 4]

Compound	Ratio [g/kg d.m]		
CH_4	6.1	default	[IPCC 2003]
CO	78.0	default	[IPCC 2003]
N_2O	0.06	default	[IPCC 2003]
NO_x	1.1	default	[IPCC 2003]

6.2.5. Land converted to Forest Land (CRF sector 4.A.2)

GHG balance in this category is a net sink. In 2014 net CO_2 sink was approximately 2777 kt CO_2. For the methodologies used, see following chapters.

6.2.5.1 Methodological issues

Due to the intensive forest monitoring as described above, all forest stands are continuously accounted for. This also means that all changes in the biomass carbon stocks of the forests due to any causes from growth through harvests, natural disturbances and deforestation are captured by the forestry statistics of each stand at least on a decade scale, and those of the whole forest area even on an annual basis.

6.2.5.2. Subcategory area

Land use change matrix is presented in the annex 6.

6.2.5.3. Living biomass

Annual change in carbon stocks in living biomass reservoir was estimated considering the annual gains and losses with the equation 2.16 (section 2.3.1 of IPCC 2006 guidelines of the Volume 4). For the needs of equation application, default reference values of biomass increment were considered to be used.

Table 6.11. Default biomass increment.

Name	Value	Unit
G_{ext}	4	[m^3/ha/year]

6.2.5.4. Dead organic matter

Carbon stock changes in dead wood on afforested and reforested areas is assumed to be equal to zero, therefore reported as 'NO'. The accumulation of dead wood was assumed to be marginal on afforested and reforested sites, during 1993-2014, and also dead wood pool cannot decrease on those sites, because there is actually no dead wood there before the conversion. The dead wood starts to accumulate when natural mortality or thinnings occur that is nearly at the age of over 20 years. To keep correctness in CRF tables notation keys NO (not occurring) were used in the relevant table. Additionally, when an area is afforested, first it is cleared of all above-ground biomass in case there was any, however, no DW and LI are usually present on these lands prior to afforestations. After afforestations, dead woody debris, litter as well as dead trees start to accumulate. In lack of representative measurements, the rate and timing of accumulation is not known, however, standard forestry experience suggests that they depend on species, site and silvicultural regime, and quickly accumulate over time. Fast growing species are usually planted so that no large amount of deadwood is produced, or thinned so that self-thinning does not ensue, but litter is continuously produced even in these stands. On the other hand, slow-growing species tend to produce dead wood and litter even at an early stage.. The above demonstration is based upon well-established principles of forest science, the every-day experiences of forestry practice, the experience and data of forest surveys, as well as sound reasoning. Because of this, although no representative measurements have been made as mentioned, the level of confidence of the demonstration is suggested to be very high. To keep correctness in CRF tables notation keys NO (not occurring) were used in the relevant table.

6.2.6. Uncertainties and time-series consistency

Detailed information contain chapter 6.6.5.

6.2.7. Category-specific QA/QC and verification

Detailed information contain chapter 6.6.6.

6.2.8. Recalculations

Detailed information contain chapter 6.6.7.

6.2.9. Planned improvements

Detailed information contain chapter 6.6.8.

6.3. Cropland (CRF sector 4.B.)

6.3.1. Source category description

Estimations for category 4.B. were based on IPCC methodology described in the chapter 5. of IPCC 2006 guidelines of the Volume 4.

6.3.1.1. Cropland remaining Cropland (CRF sector 4.B.1.)

GHG balance in this category was identified as a net CO_2 source. Net CO_2 balance was equal to 366 kt CO_2.

Activity data (i.e. area) for the lands divisions included in this category is provided by the land use change matrix, for both 4.B.1 Cropland remaining Cropland and 4.B.2 Land converted to Cropland subcategories. Estimation of carbon stock changes corresponds to Tier 1, estimating annual rates of growth and loss for national level data on the major type of crops.

6.3.1.2. Land converted to Cropland (CRF sector 4.B.2.)

GHG balance in this category was identified as a net CO_2 source. Net CO_2 balance was equal to 62 kt CO_2.

6.3.2. Information on approaches used for representing land areas and on land-use databases used for the inventory preparation

According to the description suggested in the chapter 3.3.1. of IPCC 2006 Guidelines of the Volume 4, Poland has selected Approach 2, considering the set of information's available in the register of land and buildings.

6.3.3. Land-use definitions and classification system used and their correspondence to the LULUCF categories

According to the Regulation of the Minister of Administration and Digitization of 29 November 2013 amending the regulation on the registration of land and buildings. (Journal of Laws 2013 pos. 1551),agricultural land considered as cropland consists of:

- arable land includes land which is cultivated, i.e. sowed and fallow land. Arable land should be maintained in good agricultural condition. Cultivated arable land is understood as land sowed or planted with agricultural or horticultural products, willow and hops plantations, area of greenhouses, area under cover and area of less than 10 a, planted with fruit trees and bushes, as well as green manure,
- fallow land includes arable land which are not used for production purposes but are maintained in good agricultural condition;
- orchards include land with the area of at least 10 a, planted with fruit trees and bushes.

6.3.4. Methodological issues

6.3.4.1. Subcategory area

Land use matrix is provided in the annex 6.

6.3.4.2. 4.C.1. Living organic matter on cropland remaining cropland

Annual carbon stock change in living biomass was calculated based **o**n cropland area covered by perennial woody biomass (orchards). Annual growth rate for perennial woody biomass was calculated using equation 2.7 of IPCC 2006 guidelines of the Volume 4. For calculations there were used default factors as below:

- biomass accumulation rate – 2.1 [tC/ha] table 5.1 p. 5.9,
- harvest/maturity cycle – 30 [year] table 5.1 p. 5.9,biomass carbon loss – 63 [t/ha*yr] table 5.1 p. 5.9.

Estimation of C stocks changes was made individually on each of the two different types of land included in the Cropland category and their subcategories: perennial crops (orchards) and non-woody agricultural land (arable).

6.3.4.3. 4.C.2. Living organic matter on land converted to croplands

Agricultural land here is represented mainly by arable land or management cycles which include arable land. Current data shows there are conversions from all land use categories to cropland, largest area being the conversions from grasslands. Conversion also occur from Settlements and Other land (i.e. industrial dumps and ecologization, reclamation of river deposits and islands along Danube and other rivers).

Estimates are calculated using equation 2.15 from 2006 Guidelines. Initial C stock changes in biomass are calculated under Tier 1 (ΔCconversions), assuming a biomass C stock of 6.1 t dm/ha for grasslands the default value for the warm temperate dry eco-region (Table 6.4 of 2006 Guidelines) and 4.7t C/ha for annual crops (Table 5.9 of 2006 Guidelines). Entire amount of C stock in biomass in land use category before conversion is assumed to be lost in the moment of conversion to cropland (e.g. usually the technology implies deep soil preparation and removals of any pre-existing vegetation).

6.3.4.4. Mineral soil

Agricultural land valuation classes with the assignment to IPCC soils types.

- high activity soils - soils having appreciable contents of high activity clays (eg. 2:1 expandable clays such as montmorillonite) which promote long-term stabilization of organic matter, particularly in many carbon-rich temperate soils.
- low activity soils - soils with low-activity clays (eg., 1:1 non-expandable clays such as kaolinite and hydropus oxide clays of iron and aluminum) which have a much lower ability to stabilize organic matter and consequently respond more rapidly to changes in the soil's carbon balance; among these are highly-weathered acid soils of subtropical and tropical regions.
- sandy soil - soils with less than 8% clay and more than 70% sand, which generally have low structural stability and low capacity to stabilize carbon.
- wetland - mineral soils which have developed in poorly-drained, wet environments; they have reduced decomposition rates and high organic matter contents; if drained for agriculture they are subject to large losses of carbon.

Estimation of area of different soil types (high activity soils, low activity soils, sandy and wetland) were based on area of soil valuation classes. The percentage fraction of all soil types in croplands was calculated based on available data sets.

Table 6.12. Area of soil valuation classes

Valuation classes	1976	1979	1985	1990	2000
	thous. ha				
agriculture land					
Total	**19349.4**	**19200.5**	**18945**	**18804.8**	**18536.9**
I	71	70.7	70	68.7	67.8
II	547.6	551.1	550.3	544.1	536.4
III	4153.2	4152.1	4199.1	4201.6	4201.9
IV	7627.5	7611.8	7545.6	7493.4	7402.9
V	4522	4441	4310.3	4267.2	4197.2
VI	2428.1	2373.8	2269.7	2229.8	2114.9
land not classified	0	0	0	0	15,8
arable land and orchard					
Total	**15173.7**	**15073.4**	**14818**	**14682.8**	**14451.1**
I	69	68.5	67.4	66.5	65
II	480	483.8	485	482.2	479.6
III	3621.5	3618.9	3643.7	3650.7	3664.6
IV	5961	5924.2	5807.6	5743.4	5640.2
V	3151.8	3114.5	3018.3	2976.2	2908.3
VI	1890.4	1863.5	1796.1	1763.8	1682.6
Land not classified					10.8

Due to limited data availability, linear interpolation was applied between the subsequent years. Since 2000, estimations are based on the latest available data sets from the year 2000.

Table 6.13 Valuation classes of agricultural land with the SOC_{ref} assignment.

Soil type	Soil valuation classes
high activity	I, II, III
low activity	IV
sandy	V
wetland	other

Valuation classes of agricultural land describe the quality of land in terms of value to agricultural production. Class I corresponds to the highest agricultural value and class VI to the lowest. Valuation classes of agricultural land are presented in table 7.3.1.

Table. 6.14. Soil organic carbon by land use system and soil types

Land-use/ management system	Soil by IPCC	Carbon in soils [Mg C/ha]
		default IPCC
agricultural crops	high activity soils	50
	low activity soils	33
	sandy	34
	wetland	87

For calculations there were used default factors as below:

- stock change factor for land use or land-use change type in the beginning of inventory year - $F_{LU}(0\text{-}T)$ = 0.80 [IPCC 2006 tab. Tab. 5.5 page 5.17].
- stock change factor for management regime in the beginning of inventory year – $F_{MG}(0\text{-}T)$=1.00 [IPCC 2006 tab. Tab. 5.5 page 5.17].
- Stock change factor for input of organic matter in the beginning of inventory year – $F_I(0\text{-}T)$=0.95 [IPCC 2006 tab. Tab. 5.5 page 5.17].
- Stock change factor for land use or land-use change type in current inventory year – $F_{LU}(0)$= 0.80 [IPCC 2006 tab. Tab. 5.5 page 5.17].

- Stock change factor for management regime in current inventory year –$F_{MG}(0)$=1.00 [IPCC 2006 tab. Tab. 5.5 page 5.17].
- Stock change factor for input of organic matter in current inventory year – $F_I(0)$ = 0.95 [IPCC 2006 tab. Tab. 5.5 page 5.17].

6.3.4.5. Organic soils

The area of cultivated histosols in Poland was estimated as a case study for the purposes at national inventory [Oświecimska–Piasko 2008]. Based on information collected from Computer database on peatlands in Poland "TORF" as well as from system of Spatial Information on Wetlands in Poland the area of histosols was assessed for mid–1970s and mid–1990s. The area from which N_2O emissions were calculated covers histosols as agricultural lands cultivated and/or irrigated. So the area of such area was 882.6 thousand ha in mid–1970–ties and 769 thousand ha in mid–1990–ties. The area of histosols was then interpolated for 1976−1994. Additionally the area of cultivated histosols was assessed for 2015 for the purpose of GHG emission projections which amounts to 680 thousand ha [PL NC6 2013]. Similarly to the previous period interpolation of histosols areas was applied between 1995 and 2015.

N_2O emission from cultivation of histosols was estimated based on default emission factor for Mid-Latitude Organic Soils from [IPCC 2006]: 8 kg N_2O-N /ha. N_2O emission is reported in sector 4. Agriculture in subcategory 3.D.a.6.

To estimate CO_2 emission from cultivated organic soils were used default emission factor for cold temperate climate – 5 tC/ha*year [tab. page 5.19 IPCC 2006].

6.3.4.6. CH_4, N_2O, CO and NO_x emissions from fires

CH_4, N_2O, CO and NO_x emissions from wildfires fires on croplands are reported in subcategory 4.C.1.

6.3.4.7. Mineralised N resulting from loss of soil organic C stocks in mineral soils through land-use change or management practices

This category deals with direct N_2O emissions from N mineralization resulting from change of land use or management of mineral soils. Tier 3 method was not applied to the estimation in this subcategory in Poland. Therefore, according to the 2006 IPCC Guidelines, N immobilization associated with gain of soil carbon on mineral soils is not considered. Consequently, only N_2O emissions from mineralization associated with loss of soil organic matter (SOM) were estimated.

For amount of N mineralized in mineral soil associated with land use change, annual loss of soil carbon in mineral soil for estimating carbon stock changes in mineral soils was used. The area of mineral soil in land use change, which are calculated by subtracting the area of organic soil from the total area of land converted to cropland, were considered for the estimation as the activity data.

Estimation of the N release by mineralization was made according to the following steps:

- Step 1: Calculations of the average annual loss of soil C (ΔCMineral, LU) for the land use change, over the inventory period, using equation 2.25.
- Step 2: Each land use change has been assessed by the single value of ΔCMineral, LU As a consequence of this loss of soil C (FSOM), equation 11.8 was applied to estimate N potentially mineralized .

Losses of soil organic matter were accounted for land-use change activity occurring when grassland is converted to cropland. Additionally, nitrogen mineralisation was estimated by dividing the carbon loss on grasslands converted to croplands with a C/N-ratio of 15 (default value from IPCC 2006).

6.3.5. Uncertainties and time-series consistency

With ongoing project to derive new activity data for all land categories the uncertainty is not yet estimated. Estimates for the uncertainty of the activity data would be derived as soon as data processing will be finalized. The advantage of the new land classification and area estimation method is that it provides sampling error for the area estimates for each land category and subcategory.

6.3.6. Category-specific QA/QC and verification

For the estimation of C stock changes in soils of land "remaining croplands" there is an improvement plan available, related to the development of national system to respond accounting requirements set in decision 529/2013UE. According to this decision a reporting to European Commission on the national estimating system for cropland management and grazing land management is due annually for 2016-2018 while provide preliminary estimates before 2022 and final estimates in the final deadline in 2022.

6.3.7. Recalculations

Detailed information contain chapter 6.6.7.

6.3.8. Planned improvements

Detailed information contain chapter 6.2.8.

6.4. Grassland (CRF sector 4.C.)

6.4.1. Source category description

Calculation for category 4.C. based on IPCC methodology described in the chapter 6 of IPCC 2006 guidelines of the Volume 4.

Activity data used to calculate GHG emissions for the land included in the Grassland category is provided by the land use change matrix, both for the 4.C.1 – Grassland remaining Grassland and 4.C.2 Land converted to Grassland category. Estimation of carbon stock change in the Grassland category corresponds to Tier 1, with country specific data on reference C stock in soils.

6.4.1.1. Grassland remaining Grassland (CRF sector 4.C.1.)

GHG balance in this was identified as a net CO_2 source. Net CO_2 balance was equal to 379 kt of CO_2 emissions .

6.4.1.2. Land converted to Grassland (CRF sector 4.C.2.)

GHG balance in this was identified as a net CO_2 sink. Net CO_2 balance was equal to 778 kt of CO_2 removals.

6.4.2. Information on approaches used for representing land areas and on land-use databases used for the inventory preparation

According to the description suggested in the chapter 3.3.1. of IPCC 2006 Guidelines of the Volume 4, Poland has selected Approach 2, considering the set of information's available in the register of land and buildings.

6.4.3. Land-use definitions and classification system used and their correspondence to the LULUCF categories

According to the Regulation of the Minister of Administration and Digitization of 29 November 2013 amending the regulation on the registration of land and buildings. (Journal of Laws 2013 pos. 1551), agricultural land considered as grassland consists of:

- permanent meadows and pastures include land permanently covered with grass, but it does not include arable land sown with grass as part of crop rotation; permanent meadows are understood as the land permanently covered with grass and mown in principle and in mountain area also the area of mown mountain pastures and meadows.
- permanent pastures are understood as the land permanently covered with grass not mown but grazed in principle and in mountain area – also the area of grazed pastures and meadows;

Permanent meadows and pastures classified to this category must be maintained in good agricultural condition.

6.4.4. Methodological issues

6.4.4.1. Subcategory area

Land use change matrix is provided in the annex 6.

6.4.4.2. Living organic matter

Estimates of the change of C stocks vary by type of land included in this land category:

- *Land remaining under the same use.* In the case of grasslands where there are no changes in usage it was considered that there are no changes in the C stocks of any pool (aboveground, belowground).
- *Land in conversion to grassland*. A default biomass value for the warm temperate dry eco-region (Table 6.4 of 2006 Guidelines) of 6.1tC/ha was used in calculations. Estimates are calculated using equation 2.15 from 2006 Guidelines. Initial C stock changes in biomass are calculated under Tier 1 (ΔCconversions), assuming a biomass C stock of 4.7t C/ha for annual crops (Table 5.9 of 2006 Guidelines).

6.4.4.3. Change of C stock in dead organic matter and soil

For the estimation of C stock changes in dead organic matter of land "remaining grasslands" there is an improvement plan available, related to the development of national system to respond accounting requirements set in decision 529/2013UE. Current approach is that there no change in dead organic matter C pool since there is no management change (reference soil C stock and values of C stock change factors would practically no change in time).

For the estimation of C stock changes in soil organic matter in land remaining the same category following assumptions were applied. Estimation of area of different soil types (high activity soils, low activity soils, sandy and wetland) is based on area of soil valuation classes. The percentage fraction of all soil types in grassland was calculated based on available data sets.

Table 6.15. Area of soil valuation classes

Valuation classes	1976	1979	1985	1990	2000
	thous. ha				
grassland					
Total	**4175.7**	**4127.1**	**4126.9**	**4122**	**4085.8**
I	2.0	2.2	2.6	2.2	2.8
II	67.6	67.3	65.3	61.9	56.8
III	531.7	533.2	555.4	550.9	537.3
IV	1666.5	1687.6	1738	1750	1762.7
V	1370.2	1326.5	1292	1291	1288.9
VI	537.7	510.3	473.6	466	432.3
land not classified					5.0

Due to limited data availability, linear interpolation was applied between the subsequent years. Since 2000, estimations are based on the latest available data sets.

Table 6.16 Valuation classes of agricultural land with the SOC_{ref} assignment.

soil type	soil valuation classes
high activity	I, II, III
low activity	IV
sandy	V
wetland	other

Valuation classes of agricultural land describe the quality of land in terms of value to agricultural production. Class I corresponds to the highest agricultural value and class VI to the lowest.

Table 6.4.3. Soil organic carbon by land use system and soil types

Land-use/ management system	Soil types by IPCC	Carbon in soils [Mg C/ha]
		Default IPCC
Permanent meadows and pastures	sigh activity	50
	low activity	33
	sandy	34
	wetland	87

For calculations there were used default factors as below:

- stock change factor for land use or land-use change type in the beginning of inventory year - $F_{LU}(0\text{-}T)$ = 1.00 [IPCC 2006 tab. Tab. 6.2 page 6.16]
- stock change factor for management regime in the beginning of inventory year – $F_{MG}(0\text{-}T)$=1.14 [IPCC 2006 tab. Tab. 6.2 page 6.16]
- Stock change factor for input of organic matter in the beginning of inventory year – $F_I(0\text{-}T)$=1.11 [IPCC 2006 tab. Tab. 6.2 page 6.16]
- Stock change factor for land use or land-use change type in current inventory year – $F_{LU}(0)$= 1.00 [IPCC 2006 tab. Tab. 6.2 page 6.16]
- Stock change factor for management regime in current inventory year –$F_{MG}(0)$=1.14 [IPCC 2006 tab. Tab. 6.2 page 6.16]
- Stock change factor for input of organic matter in current inventory year – $F_I(0)$ = 1.11 [IPCC 2006 tab. Tab. 6.2 page 6.16]

6.4.4.4. Organic soils

The area of cultivated histosols in Poland was estimated as a case study for the purposes if national inventory [Oświecimska–Piasko 2008]. To estimate CO_2 emission from cultivated organic soils the default emission factor was used for cold temperate – 0.25 tC/ha*year [IPCC 2006 tab. Tab. 6.3 page 6.17].

6.4.4.5. Biomass burning

CH_4, N_2O, CO and NO_x emissions from fires were calculated using following equation (IPCC 2006, page 2.429. equation 2.27). This subcategory is covering the non-CO_2 emission from crop area, meadows and stubbles fires.

6.4.5. Uncertainties and time-series consistency

Detailed information contain chapter 6.6.5.

6.4.6. Category-specific QA/QC and verification

Detailed information contain chapter 6.6.6.

6.4.7. Recalculations

Detailed information contain chapter 6.6.7.

6.4.8. Planned improvements

For the estimation of C stock changes in soils of land "remaining grasslands" there is an improvement plan available, related to the development of national system to respond accounting requirements set in decision 529/2013UE. According to this decision a reporting to European Commission on the national estimating system for cropland management and grazing land management is due annually for 2016-2018 while provide preliminary estimates before 2022 and final estimates in the final deadline in 2022.

6.5. Wetlands (CRF sector 4.D.)

6.5.1. Source category description

Calculation for category 4.D. is based on IPCC methodology described in the chapter 7. of IPCC 2006 guidelines of the Volume 4.

6.5.1.1. Wetlands remaining wetlands

GHG balance in this was identified as a net CO_2 source. Net CO_2 balance was equal to 4678 kt of CO_2 emissions.

6.5.1.2. Lands converted to Wetlands

GHG balance in this was identified as a net CO_2 source. Net CO_2 balance was equal to 9 kt of CO_2 emissions.

6.5.2. Information on approaches used for representing land areas and on land-use databases used for the inventory preparation

According to the description suggested in the chapter 3.3.1. of IPCC 2006 Guidelines of the Volume 4, Poland has selected Approach 2, considering the set of information's available in the register of land and buildings.

6.5.3. Land-use definitions and classification system used and their correspondence to the LULUCF categories

According to the Regulation of the Minister of Administration and Digitization of 29 November 2013 amending the regulation on the registration of land and buildings. (Journal of Laws 2013 pos. 1551), agricultural land considered as wetland consists of:

1. land under waters
    - marine internal;
    - surface flowing waters, which covers land under waters flowing in rivers, mountain streams, channels, and other water courses, permanently or seasonally and their sources as well as land under lakes and artificial water reservoirs. from or to which the water course flow;
    - land under surface lentic water which covers land under water in lakes and reservoirs other than those described above;
2. land under ponds including water reservoirs (excluding lakes and dam reservoirs for water level adjustment) including ditches and areas adjacent and related to ponds;
3. land under ditches including open ditches acting as land improvement facilities for land used.

According to IPCC 2006 wetlands are divided into organic soils managed for peat extraction and flooded lands. Area of organic soils managed for peat extraction in 2014 was 3 341 ha and area of flooded land was 852 992 ha.

CO_2 and N_2O emissions are estimated from organic soils managed for peat extraction. This area was 78 341 ha in 1960-ties and 1 200 ha at the end of 1990-ties. Area of organic soils managed for peat extraction between years 1960-1999 was calculated using interpolation, and due to the data relevant data gaps, for years 2000-2008 value from year 1999 was taken. Since 1999 national statistics contain data on area of organic soils managed for peat extraction It need to be highlighted that data from national statistics are consistent with the previously estimated values of organic soils managed for peat extraction.

Table 6.17. Area of organic soils managed for peat extraction in period 1999-2014

Year		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Area of organic soils managed for peat extraction:, in this:	[ha]	4680.0	5178.0	2912.0	5138.0	5141.0	5508.0	5107.0	3429.0	3433.0	3410.0	3311.0	3314.0	3312.0	3312.0	3312.0	1960
Rich organic soli	[ha]	4009.7	4436.4	2494.9	4402.1	4404.7	4719.1	4375.6	2937.9	2941.3	2921.6	2836.8	2839.4	2838.0	2838.0	2838.0	1679
Poor organic soli	[ha]	670.3	741.6	417.1	735.9	736.3	788.9	731.4	491.1	491.7	488.4	474.2	474.6	474.6	474.6	474.6	280

Source: Central Statistical Office - Environmental Protection 2000-2015

6.5.4. Methodological issues

6.5.4.1. Wetlands remaining wetlands

Emission calculations are based on equation 7.6 of IPCC 2006 guidelines of the Volume 4. page 7.9.

Table 6.18. Emission factors for CO_2-C

Symbol	Unit	Emission factor	Source
$EF_{peatNrich}$	[t C/ha*year]	1.1	table 7.4. page 7.13 IPCC 2006
$EF_{peatNpoor}$	[t C/ha*year]]	0.2	

N_2O emission calculations are based on equation 7.7 of IPCC 2006 guidelines of the Volume 4.

Table 6.19. Emission factors for N2O emissions from managed peatlands

Symbol	Unit	Emission factor	Source
$EF_{peatNrich}$	[kgN_2O/ha*year]	1.8	table 7.6. page 7.16 IPCC 2006
$EF_{peatNpoor}$	[kgN_2O/ha*year]	negligible	

CO_2 emission calculations are based on equation 7.5 of IPCC 2006 guidelines of the Volume 4For calculations default emission factors for cold climate were used as presented below:

Table 6.20 Emission factors for the subcategory wetland remaining wetland

Symbol	Unit	Emission factor	Source
CO_2-C	[t C/t air-dry peat]$^{-1}$]	0.45	table 7.5. page 7.13 IPCC 2006
CO_2-C	[t C/t air-dry peat]$^{-1}$]	0.40	

6.5.4.2. Land converted to Wetlands (CRF sector 4.D.2.)

For calculations default emission factors were used as presented below:

- carbon fraction of dry matter CF = 0.5 [IPCC 2006],
- living biomass in land immediately before conversion to flooded land B_{Before} = 2.8 t dm/ha [IPCC 2006, page 6.8],living biomass immediately following conversion to flooded land B_{After} = 0 t dm/ha [IPCC 2006. page 7.20].

Table 6.21 Emission factors

Emission factor	unit	value	Source
$EF_{peatNrich}$	[t C/ha*yr]	1.1	table 7.4. page 7.13 IPCC 2006

6.5.5. Uncertainties and time-series consistency

Detailed information contain chapter 6.6.5.

6.5.6. Category-specific QA/QC and verification

Detailed information contain chapter 6.5.6.

6.5.7. Recalculations

Detailed information contain chapter 6.6.7.

6.5.8. Planned improvements

Detailed information contain chapter 6.6.8.

6.6. Settlements (CRF sector 4.E.)

6.6.1. Source category description

Calculation for category 4.E. is based on IPCC methodology described in the chapter 8. of IPCC 2006 guidelines of the Volume 4. GHG balance for this subcategory was identified as a net CO_2 Source. Net CO_2 balance was equal to 1835 kt of CO_2.

6.6.2. Information on approaches used for representing land areas and on land-use databases used for the inventory preparation

According to the description suggested in the chapter 3.3.1. of IPCC 2006 Guidelines of the Volume 4, Poland has selected Approach 2, considering the set of information's available in the register of land and buildings.

6.6.3. Land-use definitions and classification system used and their correspondence to the LULUCF categories

According to the Regulation of the Minister of Administration and Digitization of 29 November 2013 amending the regulation on the registration of land and buildings (Journal of Laws 2013 pos. 1551), agricultural land considered as settlements consists of:

- residential areas include land not used for agricultural and forest production, put under dwelling buildings, devices functionally related to dwelling buildings (yards, drives, passages, playgrounds adjacent to houses), as well as gardens adjacent to houses;
- industrial areas include land put under buildings and devices serving the purpose of industrial production;
- other built-up areas include land put under buildings and devices related to administration. not listed under residential and industrial areas;
- undeveloped urbanised areas include land that is not built over, allocated in spatial management plans to building development and excluded from agricultural and forest production;
- recreational and resting areas comprise the following types of land not put under buildings;
- areas of recreational centres,. children playgrounds, beaches, arranged parks, squares, lawns (outside street lanes);
- areas of historical significance: ruins of castles, strongholds, etc.;
- sport grounds: stadiums, football fields, ski-jumping take-offs, toboggan-run, sports rifle-ranges, public baths etc.;
- area for entertainment purposes: amusement, grounds, funfairs etc.;
- zoological and botanical gardens;
- areas of non-arranged greenery, not listed under woodlands or land planted with trees or shrubbery;
- transport areas including land put under:
  1. roads: national roads; voivodship roads; poviat roads; communal roads; roads within housing estates; access roads to agricultural land and woodlands and to facilities of public utility; stopping and manoeuvring yards next to railway stations, bus stations and airports, maritime and river ports and other ports, as well as universal accesses to unloading platforms and storage yards;
  2. railway grounds;
  3. other transport grounds.

6.6.4. Methodological issues

6.6.4.1. Settlements remaining Settlements

Living biomass

Calculations for carbon stock changes in living biomass were based on crown cower area method (urban green area – GUS 2014 Environmental Protection). Carbon stock changes in living biomass were calculated based on equation 8.2. page 8.7 [IPCC 2006]. Default accumulation rate C_{RF}=2.9 t C/ha was used for calculations [IPCC 2006, page 8.9].

6.6.4.2. Land converted to Settlements (CRF sector 4.E.2.)

Net emissions in this subcategory are equal to 1994 kt of CO_2 emissions. The fundamental equation for estimating change in carbon stocks associated with land-use conversions has been explained in other sections covering conversions of land converted to to forest land, cropland and grassland, respectively. The same decision tree and the same basic method were applied to estimate change in carbon stocks in forest land converted to settlements.

Living biomass

Annual change in carbon stocks in living biomass reservoir was estimated considering the changes in carbon stocks between biomass in the forest prior to conversion (B_{Before}) and that in the settlements after conversion (B_{After}). Estimations are based on the equation 2.16 contained in IPCC 2006 guidelines of the Volume 4.

Average gross merchantable volume used in the above mentioned equation is estimated on the basis of data from the most recent 5-year cycle of large-scale inventory and is published in the form of official statistics by the Central Statistical Office. This method follows the approach in the IPCC Guidelines where the amount of living aboveground biomass that is cleared for expanding settlements is estimated by multiplying the forest area converted annually to settlements by the difference in carbon stocks between biomass in the forest prior to conversion (B_{Before}) and that in the settlements after conversion (B_{After}) which is equal to zero.

To estimate LB carbon stock change in Forest Land converted to Settlements, we have considered instant oxidation of carbon stock in living biomass and litter and dead wood.

Dead organic matter

Annual change in carbon stocks in dead wood reservoir was estimated considering the changes in dead wood resources on forest land all forms of ownership, using the information contained in the statistical yearbooks "Forestry". Estimations are based on the equation 2.19 contained in IPCC 2006 guidelines of the Volume 4.
Dead wood thickness used in the above mentioned equation is estimated on the basis of data from the most recent 5-year cycle of large-scale inventory and is published in the form of official statistics by the Central Statistical Office.

This method follows the approach in the IPCC guidelines where the amount of living aboveground biomass dead organic matter that is cleared for expanding settlements is estimated by multiplying the forest area converted annually to settlements by the difference in carbon stocks between biomass in the forest prior to conversion (DOM_{t1}) and that in the settlements after conversion (DOM_{t2}) which is assumed to be equal to zero.

Soils

Annual change in carbon stocks in the litter reservoir was estimated using equation 3.2.14 contained in the Good Practice Guidance for Land Use, Land Use Change and Forestry ", section 3.2.1.3.1. For the needs of equation application, default reference values of SOC_{ref} were considered to be used linked with the dominant tree habitats.

Table 6.22. Forest habitant types in Poland with the SOC_{ref} assignment

SOC_{ref}	Forest habitat types
high active SOC ref (50 [MgC/ha])	Fresh mixed forest, moist mixed forest, mixed upland forest, mountain mixed forest, fresh broadleaved forest, moist broadleaved forest upland forest, mountain forest
low active SOC ref (33[MgC/ha])	Moist coniferous forest, mountain coniferous forest, high- mountain coniferous forest, 0,5*fresh mixed coniferous forest, moist mixed coniferous forest, upland mixed coniferous forest, mountain mixed coniferous forest
sandy SOC ref (34 [MgC/ha])	Dry coniferous forest, fresh coniferous forest 0,5* fresh mixed coniferous forest
wetland SOC ref (87 [MgC/ha])	Marshy coniferous forest, boggy mountain coniferous forest, boggy mixed coniferous forest, boggy mixed forest, alder forest, ash- alder swamp forest, mountain alder forest, floodplain forest, mountain floodplain forest

Carbon stock changes in mineral soils were estimated based ion following references contained in of IPCC 2006 Guidelines of the Volume 4 [IPCC, 2006]:

- transition period – 1 year
- $f_{man\ intensity}$ – 1.0
- $f_{dist\ regime}$ – 1.0
- $f_{forest\ type}$ – 1.0

6.6.5. Uncertainties and time-series consistency

Uncertainty analysis for the revised year 2014 for IPCC sector *4.Land-Use Change and Forestry* was estimated with use of approach 1 described in 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Simplified approach was based on the assumptions that every value is independent and probability distribution is symmetric. This year uncertainty assumptions were applied directly to on activities and emission factors, instead of emission as in previous years. Results of the sectoral uncertainty analysis are given below. More details on uncertainty assessment of whole inventory are given in annex 8.
Recalculation of data for years 1988-2013 ensured consistency for whole time-series.

Table 6.23. Results of the sectoral uncertainty analysis in 2014

2014	CO_2 [kt]	CH_4 [kt]	N_2O [kt]	CO_2 Emission uncertainty [%]	CH_4 Emission uncertainty [%]	N_2O Emission uncertainty [%]
4. Land-Use Change and Forestry	**-32603.48**	**1.41**	**0.22**	25.9%	73.7%	74.3%
A. Forest Land	-34593.61	1.29	0.02	20.6%	80.2%	100.1%
B. Cropland	429.07			20.6%		
C. Grassland	-399.15	0.12	0.00	20.6%	80.2%	100.1%
D. Wetlands	4678.41	0.00	0.00	20.6%	0.0%	0.0%
E. Settlements	1835.73			20.6%		
F. Other Land						
G. Other	-4553.93			20.6%		

6.6.6. Category-specific QA/QC and verification

Basing on the current recommendations from the IPCC Good Practice Guidance and Uncertainty Management in National GHG Inventories, following elements of quality assurance and control were defined for the inventory of national activities in this area:

- performing an inventory of institutions. is responsible for coordinating QA / QC,
- general procedures for quality control inventory QA / QC (using Tier 1),
- a detailed set for the category of sources. quality control procedures (using Tier 2).

Most of the input data used in the inventory process comes from official national statistics in the statistical studies of Central Statistical Office, reports of Forest Management and Geodesy Bureau. In case of deviations from the trend, more detailed checks are carried out concerning data input. This situation has occurred in the year 2009 for the studies presented in the official statistical volume of forest resources as a result of changes in methodology for their estimation. Presented data as a result of using National of State Forest Inventory of all forms of ownership become an official source of national statistics. In addition, for the annually calculated emissions are compared with the corresponding values from the previous years (trend of emissions), and in the event of any unexpected changes they are examined in more detail. For the detailed information see chapter QA/QC.

6.6.7. Recalculations

Main reasons leading to recalculations in the LULUCF sector for the whole time-series are as follows:

- comprehensive implementation of methods and factors provided in IPCC 2006 guidelines.
- factors related adjustment of carbon stocks calculation in category 4A;
- activity data assessment for entire time series due to change of land use assessment system;
- new estimates of nitrous oxide (N2O) emissions from drained organic soils;,
- new direct nitrous oxide (N2O) emissions from nitrogen (N) mineralization/immobilization associated with loss/gain of soil organic matter.

Net effect of recalculations on CO2 emissions/removals is provided in the Table 7.6.1.

Table 6.24 Recalculations overview.

CRF	Unit	1988	1989	1990	1991	1992	1993	1994	1995
4A	[%]	1.51	1.20	0.95	0.44	98.57	3.00	3.45	0.95
	[kt]	-320.70	-318.70	-319.39	-114.39	-1 929.39	-335.67	-359.45	-205.42
4B	[%]	0.22	0.26	0.19	-0.49	-0.37	-0.25	-0.25	-0.49
	[kt]	186.98	257.87	223.23	-304.33	-231.21	-157.53	-159.72	-316.24
4C	[%]	0.00	0.00	0.00	0.05	0.09	0.15	0.15	0.06
	[kt]	0.00	0.00	0.00	36.96	60.10	85.65	85.65	48.69
4D	[%]	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.02
	[kt]	7.59	23.60	45.09	58.78	73.36	84.88	97.35	107.65
4E	[%]	-0.33	-0.27	-0.18	0.07	0.52	-0.22	0.43	0.29
	[kt]	-220.51	-176.14	-71.35	27.08	132.52	-358.37	153.19	116.28

CRF	Unit	1996	1997	1998	1999	2000	2001	2002	2003
4A	[%]	1.41	0.64	0.34	0.58	0.72	0.43	0.53	2.10
	[kt]	-556.23	-251.20	-152.92	-299.49	-263.11	-123.28	-198.37	-811.56
4B	[%]	-0.37	-0.34	0.39	0.13	0.28	0.29	0.66	1.15
	[kt]	-239.05	-217.74	251.89	85.53	183.47	187.05	423.99	717.68

CRF	Unit	1996	1997	1998	1999	2000	2001	2002	2003
4C	[%]	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	[kt]	25.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4D	[%]	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05
	[kt]	124.13	136.53	141.44	154.52	174.21	189.57	193.08	219.04
4E	[%]	0.67	0.69	0.75	1.17	1.38	0.60	0.90	1.18
	[kt]	168.39	173.09	233.62	318.66	334.97	218.43	259.98	286.63

CRF	Unit	2004	2005	2006	2007	2008	2009	2010	2011
4A	[%]	0.30	0.43	-33.88	0.39	0.31	0.48	0.27	0.28
	[kt]	-150.94	-215.13	22 187.58	-142.41	-112.52	-164.95	-88.48	-111.20
4B	[%]	0.95	0.94	0.96	1.07	0.85	0.78	1.01	1.05
	[kt]	591.07	687.67	696.61	757.83	932.40	661.85	679.35	663.33
4C	[%]	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.26
	[kt]	0.00	0.00	0.00	0.00	0.00	0.00	-85.65	-85.65
4D	[%]	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08
	[kt]	263.25	281.03	291.48	299.90	317.05	330.50	331.09	348.23
4E	[%]	0.72	0.95	1.57	1.68	1.47	1.64	1.54	1.96
	[kt]	253.52	321.00	462.83	548.71	473.26	581.37	602.01	616.36

CRF	Unit	2012	2013
4A	[%]	0.72	1.30
	[kt]	-283.01	-537.57
4B	[%]	1.08	-1.55
	[kt]	665.10	673.80
4C	[%]	0.25	0.21
	[kt]	-85.65	-73.48
4D	[%]	0.08	0.08
	[kt]	358.61	359.12
4E	[%]	1.45	2.66
	[kt]	617.27	696.77

6.6.8. Planned improvements

With the connection to the first cycle of National Forest Inventory of all ownership forms, executed in a 5-year cycles but updated annually, a continuous analysis of the conventional statistics and indicators is being performed on the basis of the collected material and the use of the collected data to estimate emissions and removals from the forestry sector with regard to actions under Article. 3.3 and 3.4 of the Kyoto Protocol. It should be added that the results of NFI are a valuable source of reliable information on forest resources (i.e. dead wood on forest land, which are used in the National Inventory of greenhouse gases). In addition, research projects will be able to allow a precise determination of changes in carbon content in forest litter. and also allows verification of the conventional factors used to determine changes in carbon content in forest soils. Moreover Party is considering the revision of in-country specific SOC factors. Such an eventuality is dictated by many factors and processes that are determining the direction and rate of change in SOC content when vegetation and soil management practices are changed. Ones that may be important for increasing SOC storage include: (1) increasing the input rates of organic matter, (2) changing the decomposition of organic matter inputs that increase LF-OC in particular, (3) placing organic matter deeper in the soil either directly by increasing belowground inputs or indirectly by enhancing surface mixing by soil organisms, and (4) enhancing physical protection through either intra-aggregate or organo-mineral complexes. Subsequent analysis will be possible at the end of the ongoing studies related SOC at national level. Poland is considering described factor as important for further improvements.

6.7. Other land (CRF sector 4.F)

Emissions/removals from this subcategory were not estimated. It is included to match overall consistency of country land area.

6.8 Harvested wood products (CRF sector 4G)

Following coefficients from Table 12.4 of 2006 Guidelines (default factors to convert from product units to carbon) were adapted to the conditions of our country, resulting the following factors for conversion to carbon:

Table 6.25 Factors for conversion to carbon

Item	Value
Solid wood	0.285
Sawn wood	0.268
Wood panel	0.294
Paper ansd paper board	0.45
Wood charcoal	0.765
Bark	1.120

The half-live time parameters

According to the 2006 Guidelines, the half-live time parameters are: 30 years - solid wood (decay rate k=0,023) and 2 years- paper products (decay rate k=0,347).

Data sources (FAO database)

When determining CO_2 emission balance, we resorted to consulting the FAO database (available at the following address: http://faostat.fao.org). Based on FAO classification, we retrieved data regarding the production and export of the following wood products: roundwood, sawnwood, wood-based panels, paper and paperboard, wood pulp and recovered paper, industrial roundwood, chips and particles, wood charcoal and wood residues.

Estimating data for the period between 1900 and 1960.

Due to the fact that FAO only supplies data beginning with 1961, we resorted to estimate production and export of wood products between 1900 and 1960 by equation 12.6, which takes into account the production and exports values for 1961 and U (the exchange rate in Europe, which amounts to 0.0151).

The variables (1.A, 1.B, 2.A, 2.B,3,4,5) were determined in conformity with the provisions of the *IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Agriculture, Forestry and Other Land Use, chapter 12 Harvested Wood Products 2006*. Calculation runs through all of the mentioned stages, and also by using the I*nventory Software ver 2.12*, available at http://www.ipcc-nggip.iges.or.jp/software/index.html.

Calculation

Step 1: Calculating variable 1.A (i.e. Annual change in carbon stock in "products in use"). It was calculated using formulas 12.1 and 12.2, for each product category (solid wood or paper products), inflow, k (decay rate), and the carbon stock at the beginning of the year (C(i)).

Step 2: Calculating variable 2.A (Annual change in carbon stock in "products in use" where wood came from harvest in the reporting country (includes exports)). It was calculated using formulas 12.1 and 12.3, accounting for the product category (solid wood or paper products), inflow, k (decay rate) and the stock of carbon at the beginning of the year (C(i)).

Step 3: Calculating variable 1.B (Annual Change in stock of HWP in SWDS from consumption) and 2.B (annual Change in stock of HWP in SWDS produced from domestic harvest). When calculating the 1.B and 2.B variables, we took into account the Waste Sector Tier 1 estimates, as laid out in the IPCC Guidelines (2006).

6.8.1 Uncertainties and time series consistency

Estimation of C stock change in HWP is under further refining. Estimate of uncertainty is going to be done with future submissions.

6.8.2 Category-specific QA/QC and verification, if applicable

Comparable order of magnitude of currently submitted estimates with those submitted by Poland in the past (TAR for forest management reference level).

6.8.3 Category-specific recalculations, if applicable, including changes made in response to the review process and impact on emission trend

No recalculations were performed in relation to the HWP estimates.

6.8.4 Category-specific planned improvements, if applicable (e.g. methodologies, activity data, emission factors, etc.), including those in response to the review process

Current approach is to build capacity to cover HWP, to better understand the estimation methodologies and requirements, as well as available data.

7. WASTE

7.1. Overview of sector

The GHG emission sources in waste sector involve: methane emission from 5.A *Solid Waste Disposal*, CH_4 and N_2O emissions from 5.B *Biological Treatment of Solid Waste*; CO_2, CH_4 and N_2O emissions from 5.C *Incineration and Open Burning of Waste* and CH_4 and N_2O emissions from 5.D *Wastewater Treatment and Discharge*.

Following subcategories from sector 6 have been identified as key source (excluding LULUCF):

IPCC Category Code	IPCC Source Categories	Greenhouse Gas	Level Assessment	Trend Assessment
5.A	Solid Waste Disposal	CH_4	+	+
5.D	Wastewater Treatment and Discharge	CH_4		+

Share of these categories in total Poland's GHG emissions is 2.50%.

Total emission of GHG as carbon dioxide equivalent amounted to 10 764.66 kt in 2014 and decreased since 1988 by 28.08% (Figure 7.1).

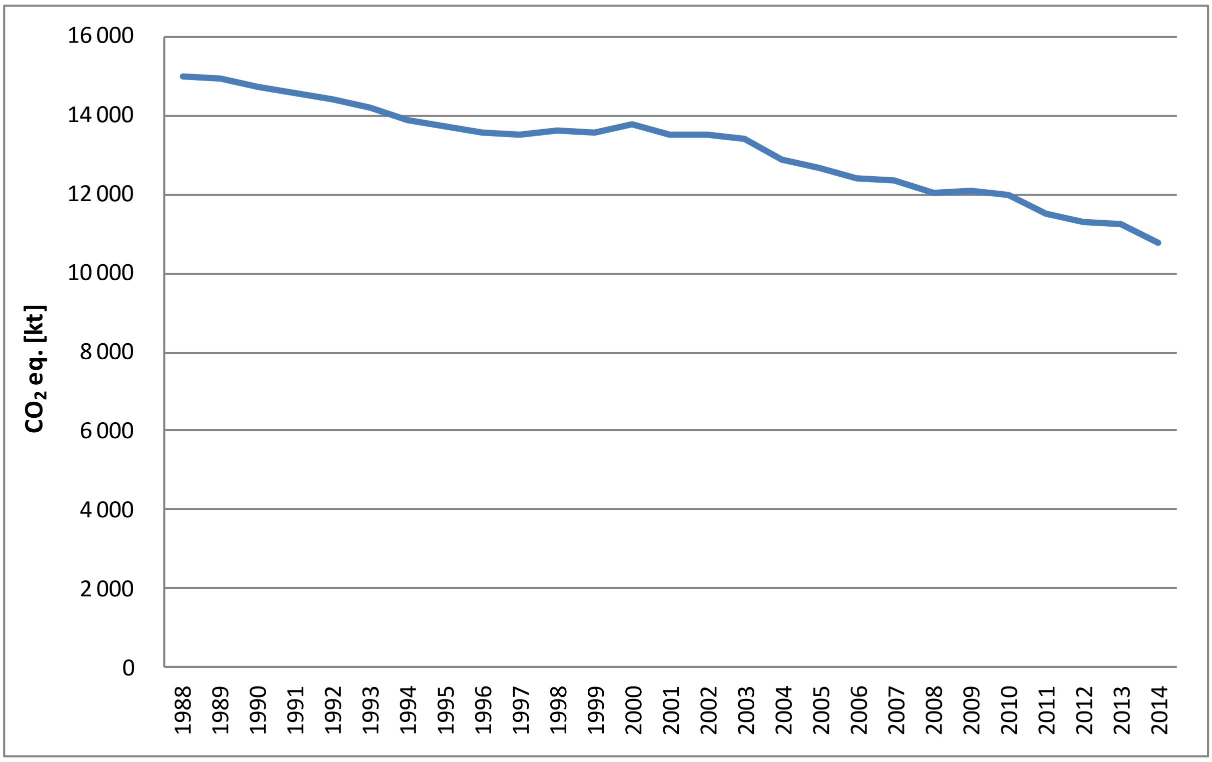

Figure 7.1. GHG emissions from waste sector in 1988-2014

Between years 1988 and 2014 decrease of GHG emissions appeared in subcategory 5.A (by 18.3 %) and 5.D (by 65.1 %) while emissions from sources gathered in subcategories 5.B and 5.C increased since 1988 by 3 939.4 % (5.B) and 26.7 % (5.C). The main reason of decrease of emissions from sector 5 is 79.5 of GHG emissions in subsector 5.A *Solid Waste Disposal on Land* and subsector 5.D *Wastewater Treatment and Discharge* (Figure 7.2), the biggest contributors to emission from *Waste* sector.

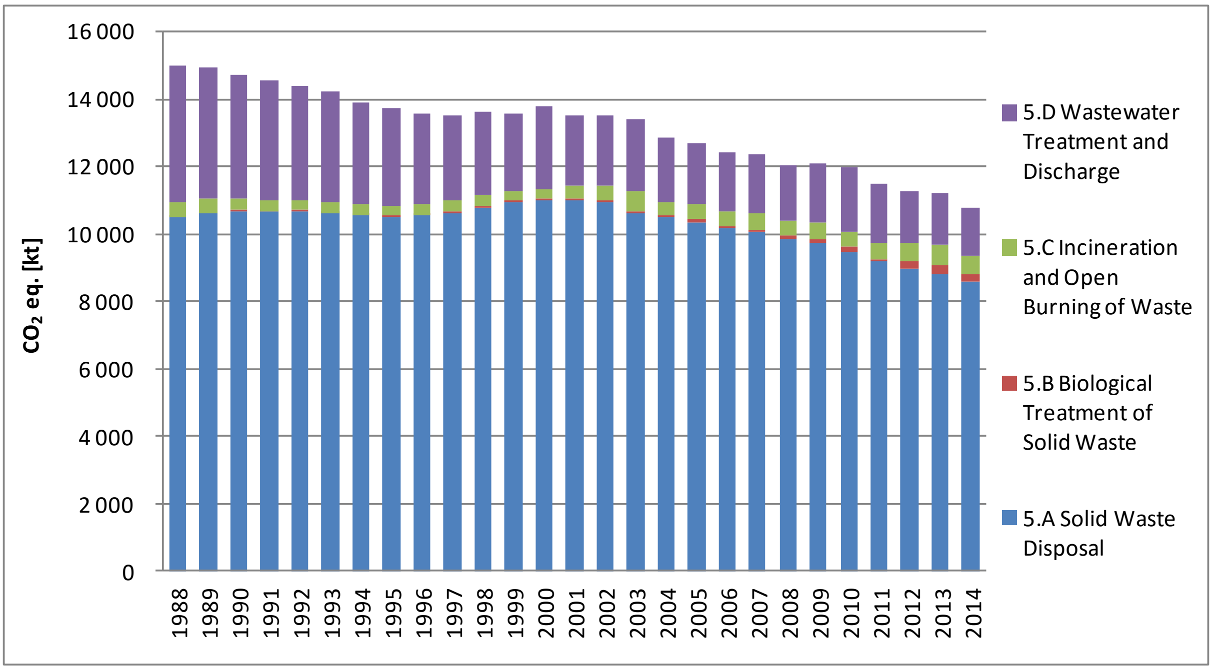

Figure 7.2. GHG emissions from waste sector divided to subsectors

According to statistical data [GUS 2015d] in 2014 collected municipal solid wastes go to four different pathways: incineration (0.3%), biological treatment (11.2%), recycling (35.9%) and landfilling (52.6%).

The changes in shares of municipal solid waste treatment pathways since 2007 are presented below (figure 7.3).

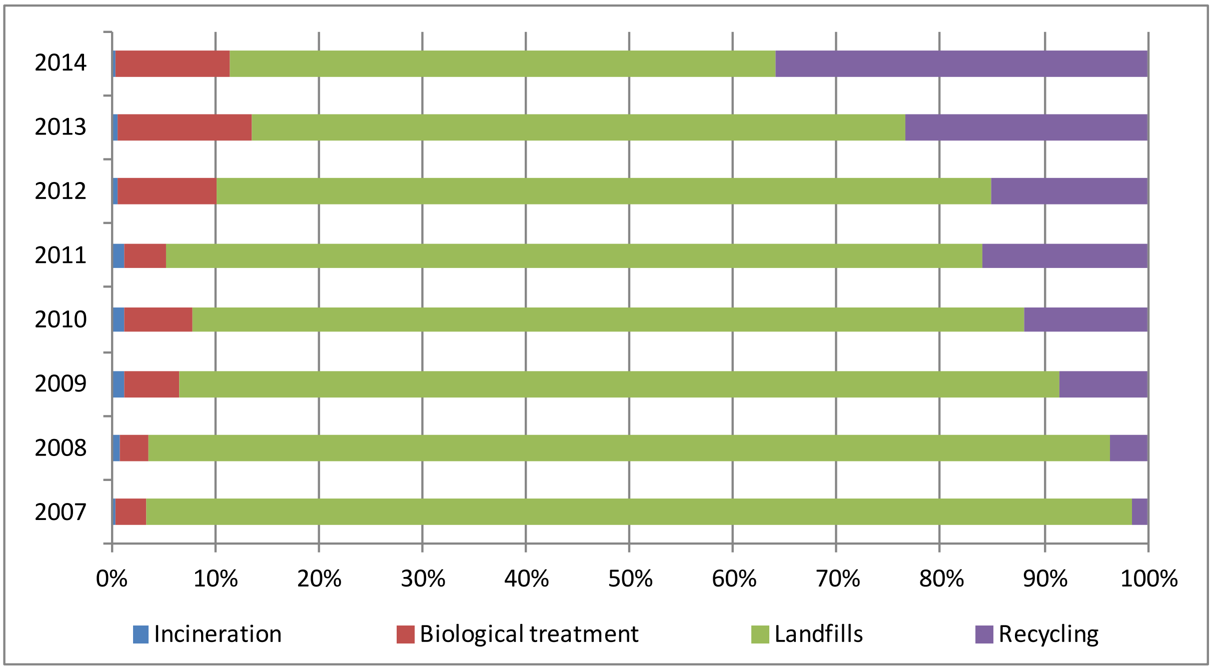

Figure 7.3. Municipal solid waste treatment pathways

7.2. Solid Waste Disposal (CRF sector 5.A)

7.2.1. Source category description

The 5.A *Solid Waste Disposal on Land* subcategory share in total waste sector is 79.5% and it involves methane emissions from Managed Waste Disposal on Land (41.9% share of 5.A), Unmanaged Waste Disposal on Land deep (26.9% share of 5.A) and Uncategorized MSW Disposal on Land (10.8% share of 5.A). This sector includes emission from disposal of sewage sludge on land which is mentioned in chapter 7.2.2.1.

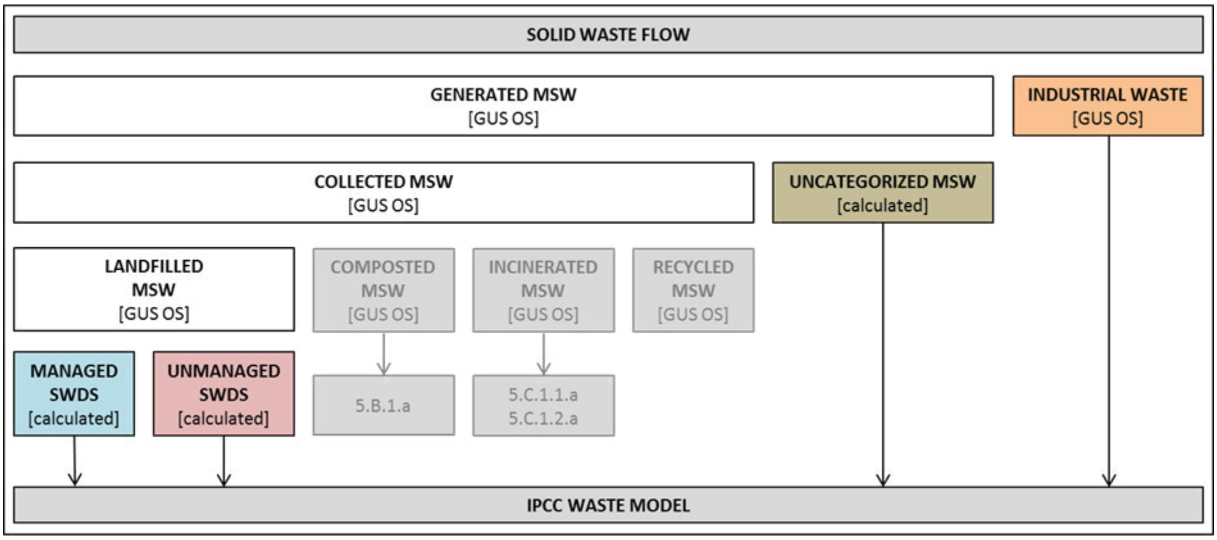

Figure 7.4. Solid waste flow scheme

The trend of emissions from sector 5.A is mostly conditioned by activity data – amounts of waste generated and collected – which reached highest values around the year 1990 and the year 1999. The first peak in the trend (Fig. 7.4) is a result of high waste generation and poorly developed waste collection and recycling system in the early '90. The post-communist economy was generating big amounts of municipal and industrial waste and the most of it was being landfilled, and the significant amount of disposal sites was unmanaged. Increase of emission resulting in second peak, which appeared around the year 1999, is related to highest share of utilization in unmanaged waste disposal sites.

Since 1999 the trend of methane emission is decreasing, mostly due to development of collection, segregation and landfilling system (what is the result of implementing recommendations of Landfill Directive 1999/31/EC, among others). During this period waste recycling was popularized and the recycling system was developed, what resulted in decrease of landfilled municipal waste. Moreover, new technologies were introduced on disposal sites what caused the decrease in amount of waste landfilled in unmanaged disposal sites.

The basic legal regulatory for waste management in Poland is the Act on waste (Dz.U. 2013/0/21 with later changes) describing the ways of waste treatment leading to human and environmental protection.

Poland is importing solid waste but according to information from Chief Inspectorate of Environmental Protection those are mostly hazardous waste (no municipal waste is imported) for incineration and it's amount is included in data on incinerated waste used by Party for estimates from subsector 5.C.

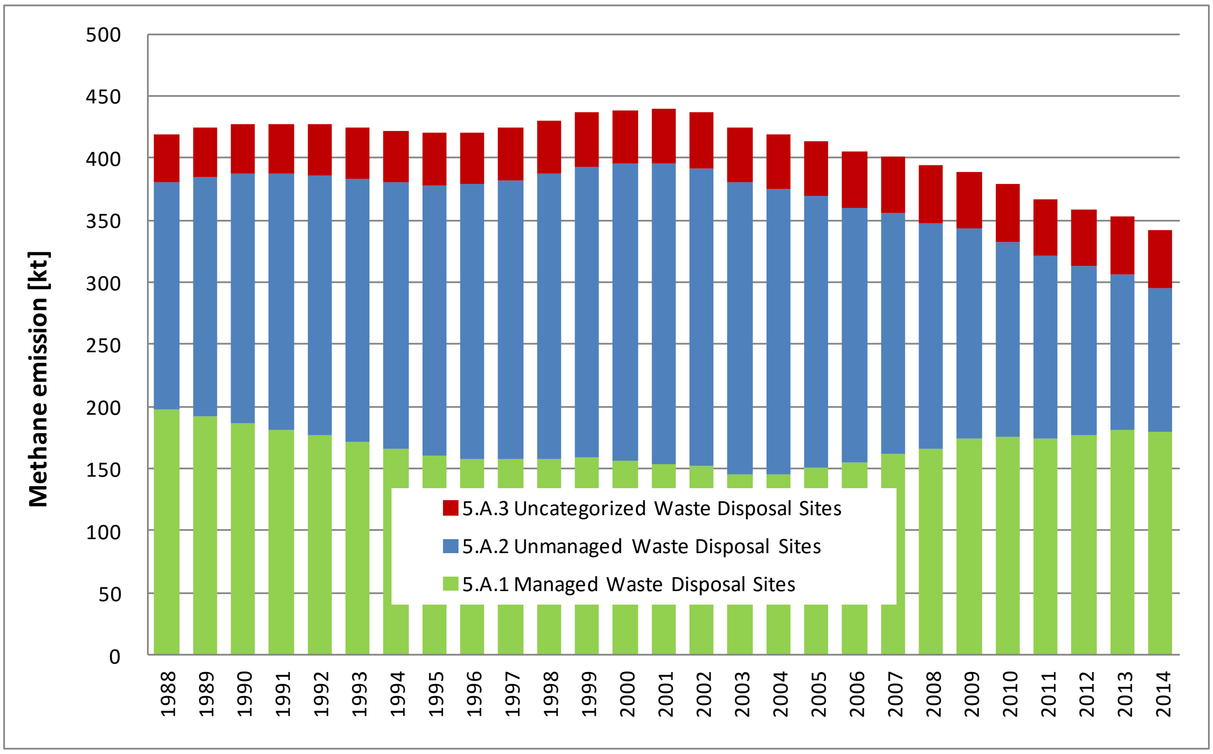

Figure 7.5. Methane emission from 5.A subsector divided to subcategories

7.2.2. Methodological issues

The methane emission estimates from waste disposal sites were calculated using IPCC 2006 *Tier 2* method. The choice of the method was supported by good quality country-specific historical and current activity data on waste disposal at SWDSs from Central Statistical Office and the Ministry of Environment.

The methane emissions estimates were calculated with application the IPCC Waste Model published in [IPCC 2006]. The model establishes multiyear series when methane is generated from organic matter decomposition in anaerobic conditions. The emission of CH_4 is diminished by recapturing of this gas for energy purposes. The data on recovered methane are based on responses to questionnaires of Central Statistical Office on energy combustion.

The following factors were used for estimation of CH_4 emissions:
- DOC – degradable organic carbon in the year of deposition (table 7.1, default value [IPCC 2006])
- DOC_f – fraction of DOC that can decompose (fraction) (table 7.1, default value [IPCC 2006])
- MCF – CH_4 correction factor for aerobic decomposition in the year of deposition (table 7.2, default value [IPCC 2006])
- OX – Oxidation Factor reflecting the amount of CH_4 from solid waste disposal sites that is oxidized in the soil or other material covering the waste (table 7.3, default value [IPCC 2006])
- k – reaction constant [IPCC 2006] (table 7.3)
- F – fraction of CH_4 by volume, in generated landfill gas (fraction) [IPCC 2006] (table 7.3)

The values of abovementioned factors are presented in tables 7.1 – 7.5.

Table 7.1. DOC and DOC_f indicators, municipal waste

DOC (Degradable Organic Carbon)	Range	Default	Adopted Value
Food waste	0.08-0.20	0.15	0.15
Garden	0.18-0.22	0.2	0.2
Paper	0.36-0.45	0.4	0.4
Wood and straw	0.39-0.46	0.43	0.43
Textiles	0.20-0.40	0.24	0.24
DOC_f		0.5	0.5

Table 7.2. MCF indicators of organic carbon in disposed municipal and industrial waste

Unmanaged, shallow	Unmanaged, deep	Managed	Managed, semiaerobic	Uncategorised
0.4	0.8	1	0.5	0.6

Table 7.3. Factors k, F and OX assumed for calculations, municipal waste

Methane generation rate constant (k)	Range	Default	Value
Food waste	0.1–0.2	0.185	0.185
Garden	0.06–0.1	0.1	0.1
Paper	0.05–0.07	0.06	0.06
Wood and straw	0.02–0.04	0.03	0.03
Textiles	0.05–0.07	0.06	0.06
Delay time (months)		6	6
Fraction of methane (F) in developed gas		0.5	0.5
Oxidation factor (OX)		0	0-0.1*

* since 2001 managed SWDSs fulfill requirements of [IPCC 2006] to be treated as "well-managed" SWDSs for which the 0.1 value of oxidation factor is default

Table 7.4. DOC and DOC_f indicators, industrial waste

DOC (Degradable Organic Carbon)	Range	Default	Adopted Value
Food waste	0.08-0.20	0.15	0.15
Paper	0.36-0.45	0.4	0.4
Wood and straw	0.39-0.46	0.43	0.43
Textiles	0.20-0.40	0.24	0.24
Rubber		0.39	0.39
DOC_f		0.5	0.5

Table 7.5. Factors k, F and OX assumed for calculations, industrial waste

Methane generation rate constant (k)	Range	Default	Value
Food waste	0.1–0.2	0.185	0.185
Paper	0.05–0.07	0.06	0.06
Wood and straw	0.02–0.04	0.03	0.03
Textiles	0.05–0.07	0.06	0.06
Rubber	0.02–0.04	0.03	0.03
Delay time (months)		6	6
Fraction of methane (F) in developed gas		0.5	0.5
Oxidation factor (OX)		0	0

Emission from sewage sludge was estimated on the basis of [IPCC 2006] methodology, using IPCC Waste Model. Party assumed that sewage sludge is being landfilled only since 1995 (earlier data are not available and extrapolation is not possible due to lack of distinct trend) and only in managed municipal waste disposal sites. Emission factors used are default [IPCC 2006] (table 7.6).

Other parameters were assumed as for municipal solid waste landfilled in managed waste disposal sites.

Table 7.6. Sewage sludge emission factors

DOC	Reaction constant (k)
0.05	0.185

7.2.2.1 Managed Waste Disposal Sites – Municipal Waste

Activities used for estimation of CH_4 emissions from solid waste disposals contain:

- generated municipal solid waste – for the years 1970 – 2004 data was extrapolated according to amount of collected MSW [Central Statistical Office],
- collected Municipal Solid Wastes (MSW) was taken from National Statistics. Because of lack of data for years 1971-1973 data were interpolated on a basis of data from 1970 and 1974. The same method was used for 1976. In domestic statistics data were given in dam^3 - to recalculate it into kilotonnes a conversion factor 0.26 Mg/m^3 was used, given by Central Statistical Office,
- Municipal Solid Waste deposited on landfills fulfilling requirements of Landfill Directive 1999/31/EC – data from Waste Management Department of Ministry of Environment,
- amount of Industrial Waste deposited on landfills,
- amount of Sewage Sludge deposited on landfills,
- composition of municipal and industrial waste,
- R – methane recovery [GUS OZE 2015],
- population of Poland.

Table 7.7. Data sources for amount of municipal waste

Years	Generated MSW [kt]	Data source	Collected MSW [kt]	Data source
1970	6 365.93	extrapolation	4 113.98	[GUS 1987]
1971	6 876.60	extrapolation	4 624.65	interpolation
1972	7 387.26	extrapolation	5 135.31	interpolation
1973	7 897.93	extrapolation	5 645.98	interpolation
1974	8 408.60	extrapolation	6 156.64	[GUS 1974d]
1975	9 040.92	extrapolation	6 788.96	[GUS 1986d]
1976	9 649.95	extrapolation	7 397.99	interpolation
1977	10 258.98	extrapolation	8 007.03	[GUS 1981d]
1978	10 954.78	extrapolation	8 702.83	[GUS 1981d]
1979	11 304.58	extrapolation	9 052.63	[GUS 1981d]
1980	12 120.67	extrapolation	9 868.72	[GUS 1986d]
1981	12 266.37	extrapolation	10 014.42	[GUS 1986d]
1982	12 581.02	extrapolation	10 329.07	[GUS 1986d]
1983	12 793.86	extrapolation	10 541.91	[GUS 1986d]
1984	13 116.49	extrapolation	10 864.54	[GUS 1986d]
1985	13 338.90	extrapolation	11 086.95	[GUS 1986d]
1986	13 798.81	extrapolation	11 546.86	[GUS 1987]
1987	14 129.40	extrapolation	11 877.45	[GUS 1989d]
1988	14 336.13	extrapolation	12 084.18	[GUS 1989d]
1989	14 252.90	extrapolation	12 000.95	[GUS 1990d]
1990	13 350.23	extrapolation	11 098.28	[GUS 1996]
1991	12 889.93	extrapolation	10 637.98	[GUS 1996]
1992	12 872.95	extrapolation	10 621.00	[GUS 1996]
1993	12 896.61	extrapolation	10 644.66	[GUS 1996]
1994	13 266.59	extrapolation	11 014.64	[GUS 1996]
1995	13 236.95	extrapolation	10 985.00	[GUS 2005d]
1996	13 873.17	extrapolation	11 621.22	[GUS 1997d]
1997	14 435.40	extrapolation	12 183.44	[GUS 1998d]
1998	14 527.72	extrapolation	12 275.77	[GUS 1999d]

Years	Generated MSW [kt]	Data source	Collected MSW [kt]	Data source
1999	14 568.85	extrapolation	12 316.90	[GUS 2000d]
2000	14 477.95	extrapolation	12 226.00	[GUS 2005d]
2001	13 360.95	extrapolation	11 109.00	[GUS 2005d]
2002	12 760.65	extrapolation	10 508.70	[GUS 2005d]
2003	12 176.56	extrapolation	9 924.61	[GUS 2005d]
2004	12 011.26	extrapolation	9 759.31	[GUS 2005d]
2005	12 169.00	[GUS 2012d]	9 352.12	[GUS 2006d]
2006	12 235.00	[GUS 2009d]	9 876.59	[GUS 2007d]
2007	12 264.00	[GUS 2010d]	10 082.58	[GUS 2011d]
2008	12 194.00	[GUS 2011d]	10 036.41	[GUS 2011d]
2009	12 053.00	[GUS 2012d]	10 053.50	[GUS 2012d]
2010	12 038.00	[GUS 2012d]	10 040.11	[GUS 2012d]
2011	12 128.80	[GUS 2012d]	9 827.64	[GUS 2012d]
2012	12 085.00	[GUS 2013d]	9 580.87	[GUS 2013d]
2013	11 295.00	[GUS 2014d]	9 473.83	[GUS 2014d]
2014	10330.40	[GUS 2015d]	10330.40	[GUS 2015d]

Distribution of solid waste disposal sites for managed and unmanaged SWDSs was made in accordance to elaboration [Gworek 2003] until year 2001. According to this publication 14% of disposal sites are managed, 86% are unmanaged.

Since 2001 Poland was implementing the Landfill Directive (1999/31/EC) and, as a result, the share of unmanaged SWDSs started to decrease (landfills fulfilling requirements of the Directive are considered to be managed). In accordance to data from Waste Management Department of Ministry of Environment about amount of MSW landfilled on landfills fulfilling requirements of the Directive the share of MSW on managed and unmanaged SWDSs was updated. According to data from abovementioned Waste Management Department since 2012 all SWDSs in Poland fulfill the Directive and can be considered as managed.

Tabela 7.8. Amount of waste collected and landfilled on managed SWDSs

Year	Collected MSW [kt]	MSW landfilled on managed SWDS [kt]	Share
2001	data unavailable	data unavailable	20%*
2002	data unavailable	data unavailable	26%*
2003	10753.0	3414.0	32%
2004	9029.3	5207.5	58%
2005	8623.1	5210.0	60%
2006	7824.4	5903.3	75%
2007	9227.8	7411.4	80%
2008	8947.2	7584.8	85%
2009	8543.6	7379.9	86%
2010	8577.6	7885.3	92%
2011	7649.8	6979.1	91%
2012	7158.2	7158.2	100%
2013	5978.7	5978.7	100%
2014	5437.0	5437.0	100%

* extrapolated data

Composition of municipal waste was calculated on the basis of publication [Rosik-Dulewska Cz. 2000] and on the basis of publication by [Rzeczyński B. 1996]. From the first publication composition of waste in 1985 was taken. From the second publication, information on change in composition of metals and plastics during 20 years was taken (11.8% decrease from 1992 to 1972), and interpolation for the years until 2000 was made (table 7.6). Data for 2001-2003 are based on National Waste Management Plan 2003 [KPGO 2003], for 2004-2008 on [KPGO 2010], for 2008-2013 on [KPGO 2014] and for the year 2014 [KPGO 2015].

Table 7.9. Composition of municipal solid waste

Year	Food	Garden	Paper	Wood	Textile	Plastics, and other inert
1970	31.5%	4.7%	15.5%	6.3%	3.5%	38.5%
1971	31.2%	4.7%	15.6%	6.2%	3.4%	38.9%
1972	31.0%	4.7%	15.6%	6.0%	3.4%	39.2%
1973	30.7%	4.7%	15.7%	5.9%	3.3%	39.6%
1974	30.5%	4.7%	15.8%	5.7%	3.2%	40.0%
1975	30.2%	4.7%	15.9%	5.6%	3.2%	40.4%
1976	30.0%	4.7%	15.9%	5.5%	3.1%	40.8%
1977	29.7%	4.7%	16.0%	5.3%	3.0%	41.2%
1978	29.5%	4.7%	16.1%	5.2%	3.0%	41.5%
1979	29.2%	4.8%	16.2%	5.0%	2.9%	41.9%
1980	29.0%	4.8%	16.2%	4.9%	2.9%	42.3%
1981	28.7%	4.8%	16.3%	4.7%	2.8%	42.7%
1982	28.5%	4.8%	16.4%	4.6%	2.7%	43.1%
1983	28.2%	4.8%	16.5%	4.5%	2.7%	43.5%
1984	27.9%	4.8%	16.5%	4.3%	2.6%	43.8%
1985	27.7%	4.8%	16.6%	4.2%	2.5%	44.2%
1986	27.4%	4.8%	16.7%	4.0%	2.5%	44.6%
1987	27.2%	4.8%	16.7%	3.9%	2.4%	45.0%
1988	26.9%	4.8%	16.8%	3.8%	2.3%	45.4%
1989	26.7%	4.8%	16.9%	3.6%	2.3%	45.7%
1990	26.4%	4.8%	17.0%	3.5%	2.2%	46.1%
1991	26.2%	4.8%	17.0%	3.3%	2.1%	46.5%
1992	26.0%	4.8%	17.1%	3.2%	2.1%	46.8%
1993	25.7%	4.8%	17.2%	3.1%	2.0%	47.2%
1994	25.5%	4.8%	17.2%	2.9%	2.0%	47.5%
1995	25.3%	4.8%	17.3%	2.8%	1.9%	47.9%
1996	25.0%	4.8%	17.4%	2.7%	1.8%	48.3%
1997	24.8%	4.8%	17.4%	2.5%	1.8%	48.6%
1998	24.5%	4.9%	17.5%	2.4%	1.7%	49.0%
1999	24.3%	4.9%	17.6%	2.3%	1.7%	49.3%
2000	24.1%	4.9%	17.6%	2.1%	1.6%	49.7%
2001	23.8%	4.9%	17.7%	2.0%	1.5%	50.0%
2002	23.6%	4.9%	17.8%	1.9%	1.5%	50.4%
2003	23.3%	4.9%	17.8%	1.8%	1.4%	50.8%
2004	23.1%	4.9%	17.9%	1.6%	1.4%	51.1%
2005	26.0%	4.8%	16.6%	1.3%	1.7%	49.6%
2006	28.9%	4.7%	15.2%	1.0%	2.0%	48.1%
2007	31.8%	4.6%	13.9%	0.7%	2.4%	46.6%
2008	34.7%	4.5%	12.6%	0.4%	2.7%	45.1%
2009	34.9%	3.8%	12.9%	0.4%	2.9%	45.1%
2010	35.0%	3.1%	13.2%	0.4%	3.1%	45.1%
2011	35.2%	2.4%	13.6%	0.5%	3.3%	45.0%
2012	35.3%	1.7%	13.9%	0.5%	3.5%	45.0%
2013	35.5%	1.0%	14.3%	0.6%	3.7%	45.0%
2014	35.7%	0.3%	14.6%	0.6%	3.9%	44.9%

Abovementioned composition of municipal solid waste is used in IPCC Waste Model to calculate weight of each fraction of waste deposited at SWDSs, and finally - amounts of CH_4 generated by each fraction.

The data on amounts of landfilled sewage sludge was taken from Central Statistical Office annuals – Environment Protection. For years 1998, 1999 and 2001 there was a lack of activity data and interpolation method was used for its achievement.

Table 7.11. Sewage sludge activity data

Year	Amount of sewage sludge disposed on landfills [kt]
1995	1 471
1996	1 419
1997	2 184
1998	1 983
1999	1 783
2000	1 582
2001	1 573
2002	1 565
2003	1 510
2004	1 511
2005	1 330
2006	1 271
2007	991
2008	696
2009	605
2010	553
2011	534
2012	559
2013	458
2014	451

7.2.2.2 Managed Waste Disposal – Industrial Waste

Methodology of estimation of methane emissions from industrial solid waste disposal is based on 2006 IPCC Guidelines [IPCC 2006] and performed with application of IPCC Waste Model. The model does not support estimating the emissions for each type of industrial waste – there is only possibility to use the total amount. Therefore, the emission from industrial waste was calculated with the application of forms for municipal waste, which approach, according to IPCC Guidelines, is correct. For this reason the Waste Model was used separately to calculate emissions from municipal and industrial waste. The choice of the method was supported by good quality country-specific historical and current activity data on industrial waste disposal at SWDSs.

According to IPCC Guidelines there is CH_4 emission only from few types of industrial waste:

- paper and cardboard,
- textiles,
- food,
- wood,
- tobacco,
- rubber and leather (only synthetic).

In national inventory activity data were taken from Central Statistical Office annuals – Environment Protection. Time series are 1975-2014. Before year 1975 there were no data on industrial waste.

Waste from manufacturing of furniture is not included in the inventory due to lack of information on content of wood, plastic, metal and other materials in disposed furniture.

Table 7.12. Composition of industrial waste [kt]

Year	Food	Paper	Wood	Textile	Rubber	Plastics, other inert	Total	Source of activity data
1975	2 671.2	226.1	78.0	67.2	0.0	0.0	3 042.5	[GUS 1975d]
1976	3 390.7	173.6	79.5	51.5	0.0	0.0	3 695.3	[GUS 1976d]
1977	4 226.3	216.6	107.3	110.3	0.0	0.0	4 660.5	[GUS 1977d]
1978	4 841.5	163.1	87.2	201.0	0.0	0.0	5 292.8	[GUS 1978d]
1979	4 551.0	164.9	94.9	87.6	0.0	0.0	4 898.4	[GUS 1979d]
1980	3 727.0	198.4	88.1	93.2	0.0	0.0	4 106.7	[GUS 1981d]
1981	4 337.8	161.4	47.9	79.2	0.0	0.0	4 626.3	[GUS 1982d]
1982	3 741.9	273.5	47.7	82.4	0.0	0.0	4 145.5	[GUS 1983d]
1983	3 519.6	380.0	60.7	66.4	0.0	0.0	4 026.7	[GUS 1984d]
1984	3 373.1	319.2	50.7	78.8	0.0	0.0	3 821.8	[GUS 1985d]
1985	3 483.9	295.9	61.5	81.5	0.0	0.0	3 922.8	[GUS 1986d]
1986	1 273.3	347.2	102.2	144.9	0.0	0.0	1 867.6	[GUS 1987d]
1987	1 258.9	381.4	123.6	87.5	0.0	0.0	1 851.4	[GUS 1988d]
1988	1 498.3	409.2	106.0	137.8	0.0	0.0	2 151.3	[GUS 1989d]
1989	1 235.3	492.9	108.5	70.2	0.0	0.0	1 906.9	[GUS 1990d]
1990	1 211.5	408.2	90.9	42.2	0.0	0.0	1 752.8	[GUS 1991d]
1991	1 385.1	407.0	65.6	40.1	0.0	0.0	1 897.8	[GUS 1992d]
1992	938.9	363.2	23.9	53.4	81.4	11.5	1 472.3	[GUS 1993d]
1993	1 058.9	339.0	17.6	34.0	36.1	13.1	1 498.7	[GUS 1994d]
1994	855.3	277.1	19.1	21.6	21.2	10.4	1 204.7	[GUS 1995d]
1995	705.3	240.3	35.2	25.9	19.2	17.5	1 043.4	[GUS 1996d]
1996	791.0	266.9	30.9	29.2	19.5	12.1	1 149.6	[GUS 1997d]
1997	624.3	258.2	23.0	24.7	17.5	13.3	961.0	[GUS 1998d]
1998	612.3	464.5	20.9	21.3	8.2	27.9	1 155.1	[GUS 1999d]
1999	467.5	729.1	24.5	12.5	5.2	30.1	1 268.9	[GUS 2000d]
2000	430.6	446.3	21.7	6.9	3.3	31.7	940.5	[GUS 2001d]
2001	330.9	363.0	13.5	2.8	2.8	23.4	736.4	[GUS 2002d]
2002	295.7	356.5	15.3	1.7	0.9	16.3	686.4	[GUS 2003d]
2003	275.6	275.2	13.6	1.2	0.6	18.2	584.4	[GUS 2004d]
2004	294.3	186.2	10.1	1.9	0.7	0.7	493.9	[GUS 2005d]
2005	314.4	144.5	7.6	4.5	0.7	0.6	472.3	[GUS 2006d]
2006	244.1	119.4	3.9	2.0	0.3	1.9	371.6	[GUS 2007d]
2007	219.6	105.5	3.5	0.3	0.1	1.8	330.8	[GUS 2008d]
2008	151.6	72.1	3.1	0.3	0.0	1.5	228.6	[GUS 2009d]
2009	88.3	100.3	2.0	0.0	0.0	1.6	192.2	[GUS 2010d]
2010	85.2	175.0	1.4	0.0	0.0	2.2	263.8	[GUS 2011d]
2011	61.1	125.9	1.5	0.0	0.1	2.4	191.0	[GUS 2012d]
2012	53.1	111.5	1.4	0.0	0.0	1.8	167.8	[GUS 2013d]
2013	36.6	99.1	1.3	0.0	0.0	3.9	140.9	[GUS 2014d]
2014	18.1	86.6	1.6	0.0	0.0	5.4	111.7	[GUS 2015d]

For years 1977 and 1978 no data on amount of industrial waste from separate industries are available, for this reason data on waste amount from resorts are used. But the data were aggregated – in textile resort there were data for textiles and leather products, in forests and wood resort there were data on wood and on pulp and paper. Disaggregating of these data was made on the basis of adequate data from years 1976 and 1979. Also the percentages of food waste in a food resort were taken from 1976 and 1979.

On the basis of waste amount from each industry sector the composition of waste was calculated.

Table 7.13. Composition of industrial waste

Year	Food	Paper	Wood	Textile	Rubber	Plastics, other inert
1975	87.8%	7.4%	2.6%	2.2%	0.0%	0.0%
1976	91.8%	4.7%	2.2%	1.4%	0.0%	0.0%
1977	90.7%	4.6%	2.3%	2.4%	0.0%	0.0%
1978	91.5%	3.1%	1.6%	3.8%	0.0%	0.0%
1979	92.9%	3.4%	1.9%	1.8%	0.0%	0.0%
1980	90.8%	4.8%	2.1%	2.3%	0.0%	0.0%
1981	93.8%	3.5%	1.0%	1.7%	0.0%	0.0%
1982	90.3%	6.6%	1.2%	2.0%	0.0%	0.0%
1983	87.4%	9.4%	1.5%	1.6%	0.0%	0.0%
1984	88.3%	8.4%	1.3%	2.1%	0.0%	0.0%
1985	88.8%	7.5%	1.6%	2.1%	0.0%	0.0%
1986	68.2%	18.6%	5.5%	7.8%	0.0%	0.0%
1987	68.0%	20.6%	6.7%	4.7%	0.0%	0.0%
1988	69.6%	19.0%	4.9%	6.4%	0.0%	0.0%
1989	64.8%	25.8%	5.7%	3.7%	0.0%	0.0%
1990	69.1%	23.3%	5.2%	2.4%	0.0%	0.0%
1991	73.0%	21.4%	3.5%	2.1%	0.0%	0.0%
1992	63.8%	24.7%	1.6%	3.6%	5.5%	0.8%
1993	70.7%	22.6%	1.2%	2.3%	2.4%	0.9%
1994	71.0%	23.0%	1.6%	1.8%	1.8%	0.9%
1995	67.6%	23.0%	3.4%	2.5%	1.8%	1.7%
1996	68.8%	23.2%	2.7%	2.5%	1.7%	1.1%
1997	65.0%	26.9%	2.4%	2.6%	1.8%	1.4%
1998	53.0%	40.2%	1.8%	1.8%	0.7%	2.4%
1999	36.8%	57.5%	1.9%	1.0%	0.4%	2.4%
2000	45.8%	47.5%	2.3%	0.7%	0.4%	3.4%
2001	44.9%	49.3%	1.8%	0.4%	0.4%	3.2%
2002	43.1%	51.9%	2.2%	0.2%	0.1%	2.4%
2003	47.2%	47.1%	2.3%	0.2%	0.1%	3.1%
2004	59.6%	37.7%	2.0%	0.4%	0.1%	0.1%
2005	66.6%	30.6%	1.6%	1.0%	0.1%	0.1%
2006	65.7%	32.1%	1.0%	0.5%	0.1%	0.5%
2007	66.4%	31.9%	1.1%	0.1%	0.0%	0.5%
2008	66.4%	31.5%	1.4%	0.1%	0.0%	0.7%
2009	45.9%	52.2%	1.0%	0.0%	0.0%	0.8%
2010	32.3%	66.3%	0.5%	0.0%	0.0%	0.8%
2011	32.0%	65.9%	0.8%	0.0%	0.1%	1.3%
2012	31.6%	66.4%	0.8%	0.0%	0.0%	1.1%
2013	26.0%	70.3%	0.9%	0.0%	0.0%	2.8%
2014	16.2%	77.5%	1.4%	0.0%	0.0%	4.8%

7.2.3. Uncertainties and time-series consistency

Uncertainty analysis for the revised year 2014 for IPCC sector 5.*Waste* was estimated with use of approach 1 described in 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Simplified approach was based on the assumptions that every value is independent and probability distribution is symmetric. Results of the sectoral uncertainty analysis are given below. More details on uncertainty assessment of whole inventory are given in annex 8.

Recalculation of data for years 1988-2013 ensured consistency for whole time-series.

2014	CO_2 [kt]	CH_4 [kt]	N_2O [kt]	CO_2 Emission uncertainty [%]	CH_4 Emission uncertainty [%]	N_2O Emission uncertainty [%]
5. Waste	**524.40**	**374.16**	**2.97**	33.5%	60.4%	126.6%
A. Solid Waste Disposal on Land		342.32			65.7%	
B. Biological treatment of solid waste		5.17	0.31		104.4%	153.0%
C. Waste Incineration	524.40	0.00	0.19	33.5%	101.1%	0.0%
D. Wastewater treatment and discharge		26.67	2.48		72.8%	150.3%

7.2.4. Source-specific QA/QC and verification

Activity data concerning solid waste disposals and sewage sludge come from Central Statistical Office (GUS). GUS is responsible for QA/QC of collected and published data. In some cases of solid waste comparison is made between national statistical data and National Waste Management Plan. Activity data on waste incineration is based on external expert's research involving questionnaires from individual entities. Country specific emission factors involved in estimation of GHG emissions from waste water treatment are based on external expert's analysis of questionnaires from individual entities.

The attempt has been undertaken to ensure internal consistency between different treatment pathways of waste and sewage sludge. Calculations in waste sector were examined with focus on formulas, units and trends consistency. Generally QC procedures follow QA/QC plan presented in Annex 7.

7.2.5. Source-specific recalculations

Table 7.15. Change in methane emissions in result of recalculations

Change	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
kt CH_4	9.0	10.9	12.9	14.7	16.5	18.3	20.1	22.0	23.9	25.9	28.1	30.3	32.4
%	2%	3%	3%	4%	4%	5%	5%	6%	6%	6%	7%	7%	8%

Change	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
kt CH_4	34.4	35.7	35.8	35.8	30.3	26.5	24.1	22.7	19.8	17.1	14.8	12.8	11.1
%	8%	9%	9%	9%	8%	7%	6%	6%	5%	5%	4%	4%	3%

- recalculation of composition of municipal waste was performed

7.2.6. Source-specific planned improvements

No further improvements are currently planned for sector 5.A.

7.3. Biological Treatment of Solid Waste (CRF sector 5.B)

7.3.1. Source category description

In the following section estimation of emissions of methane and N_2O from sector 5.B is provided. Because of lack of sufficient data on amounts of waste digested anaerobically only emissions from composting of waste were estimated. The 5.B subcategory share in total waste sector is 2.1%.

7.3.2. Methodological issues

Calculations are based on IPCC 2006 Guidelines [IPCC 2006] methodology, *Tier 1*, choice of which justifies lack of country-specific method of estimation GHG emission.

Default emission factors applied by Party are: 4 g CH_4/kg treated waste and 0.24 g N_2O/kg treated waste (composting, wet weight basis).

Activity data and its sources are presented in table 7.16. Data on amounts of municipal waste composted in years 1993 – 2014 were taken from statistical yearbooks, apart from the year 1997 where, due to lack of data, interpolation was applied. For the years 1988 – 1992 activity data were achieved by extrapolation.

Data on amounts of waste other than municipal composted in years 1998 – 2014 were taken from statistical yearbooks. For the years prior to 1998 no activity data are available and extrapolation was not possible due to lack of distinct trend.

Table 7.16. Amounts of composted waste and data sources

Year	Municipal waste [kt]	Data source	Other waste [kt]	Data source
1988	32.0	extrapolation	NA	-
1989	39.6	extrapolation	NA	-
1990	48.9	extrapolation	NA	-
1991	60.5	extrapolation	NA	-
1992	74.7	extrapolation	NA	-
1993	92.4	[GUS 1994d]	NA	-
1994	114.2	[GUS 1997d]	NA	-
1995	200.6	[GUS 1997d]	NA	-
1996	218.6	[GUS 1998d]	NA	-
1997	220.2	interpolation	NA	-
1998	221.7	[GUS 2002d]	82.6	[GUS 2002d]
1999	225.2	[GUS 2003d]	96.8	[GUS 2003d]
2000	248.3	[GUS 2003d]	73.7	[GUS 2003d]
2001	309.0	[GUS 2004d]	86.1	[GUS 2004d]
2002	214.8	[GUS 2004d]	82.8	[GUS 2004d]
2003	128.9	[GUS 2004d]	115.3	[GUS 2004d]
2004	234.1	[GUS 2007d]	158.1	[GUS 2007d]
2005	317.9	[GUS 2007d]	219.6	[GUS 2007d]
2006	297.1	[GUS 2009d]	181.6	[GUS 2009d]
2007	277.7	[GUS 2010d]	224.3	[GUS 2010d]
2008	262.4	[GUS 2011d]	225.9	[GUS 2011d]
2009	508.3	[GUS 2012d]	175.4	[GUS 2012d]
2010	608.5	[GUS 2012d]	173.5	[GUS 2012d]
2011	365.6	[GUS 2012d]	118.9	[GUS 2012d]
2012	926.5	[GUS 2013d]	137.8	[GUS 2013d]
2013	1230.5	[GUS 2014d]	142.3	[GUS 2014d]
2014	1154.0	[GUS 2015d]	138.8	[GUS 2015d]

7.3.3. Uncertainties and time-series consistency

See chapter 7.2.3.

7.3.4. Source-specific QA/QC and verification

See chapter 7.2.4.

7.3.5. Source-specific recalculations

Change	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
kt CO_2 eq.	-0.6	-0.7	-0.9	-1.1	-1.3	-1.7	-2.0	-3.6	-3.9	-3.9	-5.4	-5.8	-5.8
%	-9%	-9%	-9%	-9%	-9%	-9%	-9%	-9%	-9%	-9%	-9%	-9%	-9%

Change	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
kt CO_2 eq.	-7.1	-5.3	-4.4	-7.0	-9.6	-8.6	-9.0	-8.7	-12.2	-14.0	-8.7	-19.0	-24.5
%	-9%	-9%	-9%	-9%	-9%	-9%	-9%	-9%	-9%	-9%	-9%	-9%	-9%

- the new value of N_2O emission factor provided in IPCC 2006 Guidelines corrigenda was applied.

7.3.6. Source-specific planned improvements

Investigation on possibility of estimation of GHG from anaerobic digestion of organic waste is planned.

7.4. Incineration and Open Burning of Waste (CRF sector 5.C)

7.4.1. Source category description

The 5.C subcategory share in total waste sector is 5.4% and it involves CO_2 and N_2O emissions from incineration of municipal, industrial (including hazardous) and medical waste and sewage sludge. According to IPCC Guidelines biogenic emission of CO_2 (147.54 kt in 2014) is not included in total emission. Estimates of emissions from open burning of waste were not calculated because of lack sufficient activity data.

7.4.2. Methodological issues

Estimates of emissions of GHG from waste incineration are based on IPCC 2006 Guidelines [IPCC 2006] and domestic case study [Wielgosiński G. 2003]. For estimation of carbon dioxide from incineration of municipal waste *Tier 2a* approach was taken due to availability of country specific data on amount and fractions of incinerated waste. Estimation of emissions of N_2O from incineration of municipal waste, and emissions of GHG from incineration of industrial and medical waste as well as sewage sludge was performed using *Tier 1*.

Table 7.17. Emission factors

Incinerated waste	**Factor**	**Source**
municipal	composition of waste	CS - see table 7.21
	dry matter	default IPCC 2006
	fraction of carbon (CF)	default IPCC 2006
	fraction of fossil carbon (FCF)	default IPCC 2006
	oxidation factor	default IPCC 2006
	N_2O emission factor	default IPCC 2006
Industrial	dry matter	default IPCC 2006
	fraction fo carbon in the dry matter	default IPCC 2006
	fraction of fossil carbon	default IPCC 2006
	oxidation factor	default IPCC 2006
	N_2O emission factor	default IPCC 2006
medical	dry matter	default IPCC 2006
	fraction fo carbon in the dry matter	default IPCC 2006
	fraction of fossil carbon	default IPCC 2006
	oxidation factor	default IPCC 2006
sewage sludge	dry matter	default IPCC 2006
	fraction fo carbon in the dry matter	default IPCC 2006
	fraction of fossil carbon	default IPCC 2006
	oxidation factor	default IPCC 2006
	N_2O emission factor	default IPCC 2006

Biogenic and non-biogenic content of waste for municipal waste was assumed on a basis of national case study [Wielgosiński G. 2003]. For industrial, medical waste and sewage sludge this content was taken from [IPCC 2000].

Table 7.18. Biogenic and non-biogenic content of waste

Type of waste	Biogenic waste (1-nonbiogenic)	Non-biogenic waste
municipal	0.3	0.7
industrial	0.1	0.9
medical	0.6	0.4
sewage sludge	1	0

The amounts of incinerated municipal, industrial waste and sewage sludge are taken from Central Statistical Office Environmental Protection Yearbooks [GUS 2015d]. Data on incinerated medical waste is taken from Central Waste System database

Table 7.19. Activity data in 2014 [kt]

Type of waste	Amount of waste incinerated
municipal	31.61
industrial	382.8
medical	41.73
sewage sludge	164.40

Table 7.20. Composition of incinerated waste [kt]

Year	Municipal		Medical		Industrial (incl. hazardous)		Sewage sludge
	nonbiogenic	biogenic	nonbiogenic	biogenic	nonbiogenic	biogenic	biogenic
1988	NO	NO	22.6	33.9	291.7	32.4	NA
1989	NO	NO	22.1	33.1	268.2	29.8	NA
1990	NO	NO	22.4	33.6	225.8	25.1	NA
1991	NO	NO	22.0	33.1	201.4	22.4	NA
1992	NO	NO	21.4	32.1	191.2	21.2	NA
1993	NO	NO	21.7	32.5	189.1	21.0	NA
1994	NO	NO	21.8	32.7	189.7	21.1	NA
1995	NO	NO	21.4	32.2	192.5	21.4	NA
1996	NO	NO	21.3	32.0	195.5	21.7	NA
1997	NO	NO	20.9	31.3	195.3	21.7	NA
1998	NO	NO	20.7	31.1	208.9	23.2	41.4
1999	NO	NO	19.9	29.9	172.6	19.2	31.9
2000	1.2	1.7	20.4	30.6	168.2	18.7	34.1
2001	10.5	15.5	10.8	16.1	220.8	24.5	46.6
2002	14.5	21.5	7.3	10.9	278.7	31.0	31.5
2003	16.7	24.9	8.2	12.3	370.5	41.2	47.0
2004	21.0	22.0	10.7	16.1	236.7	26.3	39.9
2005	21.7	22.7	11.8	17.7	267.6	29.7	37.4
2006	20.2	21.1	8.8	13.3	268.6	29.8	39.3
2007	21.4	22.4	10.1	15.2	300.1	33.3	33.7
2008	20.8	20.0	9.8	14.7	301.9	33.5	44.5
2009	20.6	19.7	11.4	17.2	290.8	32.3	50.4
2010	20.9	20.0	11.1	16.6	277.7	30.9	66.4
2011	20.1	19.3	13.3	20.0	280.9	31.2	85.2
2012	25.9	24.8	13.7	20.5	349.9	38.9	101.1
2013	25.5	24.5	14.0	20.9	364.4	40.5	148.8
2014	15.4	16.2	16.7	25.0	344.5	38.3	164.4

Table 7.21. Composition of incinerated municipal solid waste

Year	Food	Garden	Paper	Wood	Textile	Plastics, and other inert
2000	24.1%	4.9%	17.6%	2.1%	1.6%	49.7%
2001	23.8%	4.9%	17.7%	2.0%	1.5%	50.0%
2002	23.6%	4.9%	17.8%	1.9%	1.5%	50.4%
2003	23.3%	4.9%	17.8%	1.8%	1.4%	50.8%
2004	23.1%	4.9%	17.9%	1.6%	1.4%	51.1%
2005	26.0%	4.8%	16.6%	1.3%	1.7%	49.6%
2006	28.9%	4.7%	15.2%	1.0%	2.0%	48.1%
2007	31.8%	4.6%	13.9%	0.7%	2.4%	46.6%
2008	34.7%	4.5%	12.6%	0.4%	2.7%	45.1%
2009	34.9%	3.8%	12.9%	0.4%	2.9%	45.1%
2010	35.0%	3.1%	13.2%	0.4%	3.1%	45.1%
2011	35.2%	2.4%	13.6%	0.5%	3.3%	45.0%
2012	35.3%	1.7%	13.9%	0.5%	3.5%	45.0%
2013	35.5%	1.0%	14.3%	0.6%	3.7%	45.0%
2014	35.7%	0.3%	14.6%	0.6%	3.9%	44.9%

The table 7.21 presents composition of incinerated municipal waste. Before the year 2000 no municipal waste was incinerated in Poland. Data on incineration of sewage sludge before 1998 are not available and lack of distinguishable trend indisposes extrapolation.

Waste combusted for energy purposes is included in Energy sector and treated as a fuel. Information on used EFs is included in NIR report under the Annex 2.

7.4.3. Uncertainties and time-series consistency

See chapter 7.2.3.

7.4.4. Source-specific QA/QC and verification

See chapter 7.2.4.

7.4.5. Source-specific recalculations

Table 7.22. Change in GHG emissions in result of recalculations

Change	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
kt CO_2 eq.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Change	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
kt CO_2 eq.	-0.3	-0.4	-0.4	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	7.7
%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%

- update of activity data on amount of incinerated industrial waste for the year 2013

7.4.6. Source-specific planned improvements

Continuation of research on usage of activity data from Central Waste System for emissions estimation.

7.5. Waste Water Handling (CRF sector 5.D)

7.5.1. Source category description

The 5.D category share in emission of GHG from waste sector is 13.1% and it involves methane emission from industrial wastewater (18.4% share of 5.D), methane emission from Domestic wastewater (29.0% share of 5.D) and N_2O emission from human sewage (52.5% share of 5.D).

The emission from sector 5.D decreased ca. 65.1 since the base year, mostly because of significant development of national wastewater collection and treatment system. The main contributor and driver of emission change in 5.D is the *Domestic Wastewater* subsector (5.D.1) – responsible of ca. 81.6% of emission of GHG from sector 5.D in 2014.

Emission of methane from subsector *5.D.2 Industrial Wastewater* is ca. 18.4% of emission of GHG from sector 5.D in 2014 and it is constantly decreasing due to reduction of wastewater production by industries.

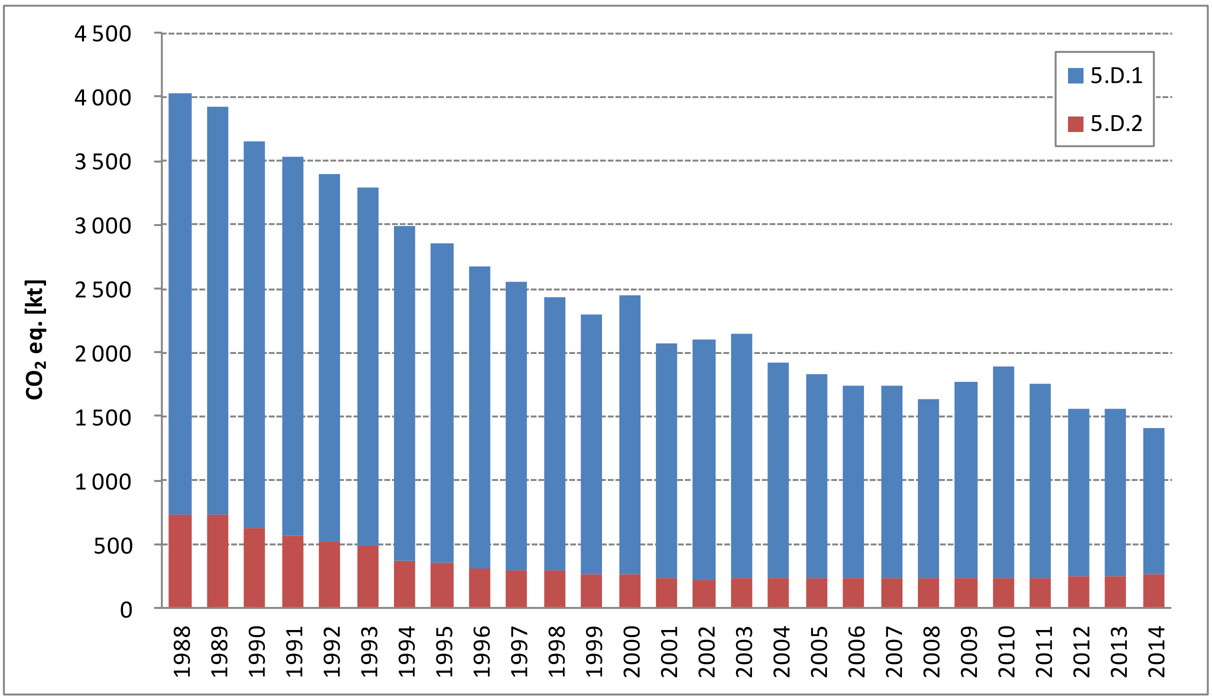

Figure 7.6. GHG emission from 5.D subsector

7.5.2. Methodological issues

7.5.2.1. Domestic Wastewater (CRF sector 5.D.1)

Methane emission

Estimation of CH_4 emissions from sector 5.B.1 *Domestic Wastewater* was based on methodology IPCC 2006 Guidelines [2006 IPCC], *Tier 2* – which choice is justified by availability of country specific activity data. Amounts of degradable organic components were estimated basing on the data on population of Poland, and rural and urban population using different sewage treatment pathways. These data were taken from [GUS 2015d]. Activity data are presented in table 7.23.

Table 7.23. Rural and urban population using given sewage treatment pathways [%]

Year	Rural population shares in treatment pathway					Urban population shares in treatment pathway				
	mechanical treatment plant	biological treatment plant	high nutrient removal	not connected	latrine	mechanical treatment plant	biological treatment plant	high nutrient removal	not connected	latrine
1988	0.04	2.06	0.00	0.89	97.02	13.43	31.46	0.00	35.77	19.35
1989	0.06	2.04	0.00	1.20	96.69	11.05	34.01	0.00	35.81	19.13
1990	0.09	2.02	0.00	1.56	96.34	8.55	36.58	0.00	36.21	18.66
1991	0.12	1.99	0.00	1.93	95.96	16.51	39.21	0.00	26.01	18.27
1992	0.14	1.97	0.00	2.30	95.59	15.12	42.14	0.00	24.80	17.94
1993	0.17	1.95	0.00	2.75	95.13	17.47	42.64	0.00	22.08	17.80
1994	0.19	1.93	0.00	3.25	94.64	15.23	47.53	0.00	19.64	17.60
1995	0.27	2.51	0.31	2.82	94.10	14.24	46.77	4.69	16.86	17.44
1996	0.35	3.31	0.50	2.33	93.50	13.47	46.14	7.42	15.75	17.23
1997	0.38	4.85	0.63	1.44	92.70	11.64	47.78	13.07	10.54	16.97
1998	0.38	5.54	1.16	1.41	91.50	9.26	46.27	20.42	7.28	16.77
1999	0.33	6.72	1.61	1.24	90.10	7.31	47.47	23.90	4.78	16.54
2000	0.37	8.09	2.36	0.69	88.50	5.53	43.47	30.96	3.79	16.25
2001	0.45	8.76	3.82	0.00	86.96	5.09	41.57	35.01	2.48	15.84
2002	0.48	9.15	5.56	0.00	84.81	4.22	38.03	40.90	0.00	16.85
2003	0.43	10.44	5.97	0.00	83.16	3.92	33.48	46.23	0.00	16.37
2004	0.43	11.16	7.53	0.00	80.87	3.21	30.53	50.41	0.00	15.85
2005	0.35	11.97	8.88	0.00	78.79	3.16	25.75	55.80	0.00	15.29
2006	0.26	12.85	9.93	0.00	76.96	0.87	26.29	58.07	0.00	14.77
2007	0.17	13.63	11.19	0.00	75.01	0.65	23.94	60.91	0.00	14.50
2008	0.19	13.94	13.05	0.00	72.82	0.26	16.76	68.86	0.00	14.12
2009	0.20	14.42	13.80	0.00	71.59	0.10	14.90	71.41	0.00	13.58
2010	0.22	14.94	14.85	0.00	70.00	0.08	13.64	72.84	0.00	13.45
2011	0.22	15.73	15.63	0.00	68.42	0.07	10.85	76.22	0.00	12.85
2012	0.29	16.55	17.41	0.00	65.75	0.06	10.35	77.75	0.00	11.84
2013	0.21	17.43	18.84	0.00	63.52	0.03	9.91	78.81	0.00	11.24
2014	0.06	19.70	17.62	0.00	62.62	0.04	9.06	81.11	0.00	9.80

Default value of organic load in biochemical oxygen demand per person, which is equal to 60 g BOD/person/day [IPCC 2006], was taken for the calculations.

Amounts of recovered methane are taken from national statistics [GUS OZE 2015]. Amounts of organic component removed as sludge are calculated on basis of statistical data on amounts sewage sludge applied in agriculture, composting, incinerated and landfilled [GUS 2015d] and factor supplied by ATV Germany which equals to 0.8 kg dry matter/kg BOD.

Methane Correction Factors (MCF) for various treatment pathways are taken from [2006 IPCC] and domestic study [Bernacka 2005]. Their values are listed in table 7.24.

Table 7.24. MCF values

Treatment pathway	mechanical treatment plant	biological treatment plant	high nutrient removal plant	not connected	latrine
MCF	0.05	0.05	0.05	0.1	0.5
source	Bernacka 2005	Bernacka 2005	Bernacka 2005	default IPCC 2006	default IPCC 2006

N_2O emission

N_2O emission from human sewage was calculated according to default method [2006 IPCC]. Population of Poland was provided by Central Statistical Office [GUS 2015]. Amounts of animal and vegetal protein consumption per capita per year was taken from FAO database. For years 2012-2014 protein consumption was assumed on the level of 2011 data, what is a result of lack of up-to-date data in FAO database. Values and sources of emission factors are provided in table 7.25.

Table 7.25. Emission factors

Emission factor	F_{npr}	$EF_{effluent}$	$F_{non-con}$	$F_{ind-com}$
value	0.16	0.005	1.1	1.25
source	default IPCC 2006	default IPCC 2006	default IPCC 2006	default IPCC 2006

7.5.2.2. Industrial Wastewater (CRF sector 5.D.2)

Estimates of emissions of methane from industrial wastewater treatment subsector are based on IPCC 2006 Guidelines [IPCC 2006] *Tier 1* and domestic case study [Przewłocki, 2007], and based on COD default emission factors. For some branches, were the COD EF was not available country specific data were used [Rueffer, 1998].

Data on share of aerobic and anaerobic wastewater treatment method and recovery of methane in industrial wastewater treatment was taken from expert opinion [Przewłocki, 2007].

Data on amount of industrial wastewater from separate branches and on biological treatment of organic wastewater were taken from national statistics [GUS 2015d]. Data on employment and production from some branches were taken from national statistics [GUS 1989-2015].

Total organic product is derived from amount of wastewater from each industry, COD concentration in organic wastewater and wastewater produced per unit product by industry.

Table 7.26. Emission factors on wastewater and sludge

Industry sector	**COD concentration in organic wastewater**	**Methane correction factor from wastewater**	**Maximum CH_4 producing capacity form wastewater**	**Methane emission factor for wastewater**	**Methane correction factor from sludge**	**Maximum CH_4 producing capacity form sludge**	**Methane emission factor for sludge**
	kg/m³		**kg CH_4/kg ChZT**	**kg CH_4/kg ChZT**		**kg CH_4/kg ChZT**	**kg CH_4 kg ChZT**
Mining and quarrying	0.60	0.10	0.25	0.030	0.32	0.25	0.080
Iron and steel	0.75	0.10	0.25	0.030	0.32	0.25	0.080
Non-iron metals	0.67	0.10	0.25	0.030	0.32	0.25	0.080
Synthetic fertilizers	0.82	0.10	0.25	0.030	0.32	0.25	0.080
Food products: Meat & Poultry	3.00	0.20	0.25	0.050	0.36	0.34	0.120
Food products: Fish Processing	2.50	0.15	0.25	0.040	0.68	0.34	0.231
Food products: Vegetables & Fruits	2.82	0.20	0.25	0.050	0.35	0.29	0.102
Food products: Vegetable Oils	0.79	0.34	0.25	0.090	0.65	0.34	0.221
Food products: Dairy Products	2.88	0.16	0.25	0.040	0.32	0.34	0.109
Food products: Sugar	2.51	0.52	0.25	0.130	0.38	0.34	0.129
Food products: Soft Drinks	1.49	0.10	0.25	0.030	0.2	0.34	0.068
Food products: Beer & Malt	3.81	0.10	0.25	0.030	0.20	0.34	0.068
Food products: Other	2.77	0.22	0.25	0.060	0.39	0.34	0.133
Textiles	0.90	0.12	0.25	0.030	0.24	0.25	0.060
Leathers	3.31	0.29	0.25	0.070	0.24	0.25	0.060
Wood and Paper	2.71	0.11	0.25	0.030	0.12	0.25	0.030
Petroleum Refineries	0.37	0.15	0.25	0.040	0.08	0.25	0.020
Organic Chemicals	3.00	0.15	0.25	0.040	0.08	0.25	0.020
Plastics & Resins	3.70	0.15	0.25	0.040	0.08	0.25	0.020
Other non-metallic	2.50	0.10	0.25	0.030	0.32	0.25	0.080
Manufacturing of Machinery and Transport Equipment	4.97	0.10	0.25	0.030	0.32	0.25	0.080
Other	0.77	0.10	0.25	0.030	0.32	0.25	0.080

Table 7.27. Amount of industrial wastewater by industry [million m^3]

Rok	Mining and quarrying	Iron and steel	Non-iron metals	Synthetic fertilizers	Food products: Meat & Poultry	Food products: Fish Processing	Food products: Vegetables & Fruits	Food products: Vegetable Oils	Food products: Dairy Products	Food products: Sugar	Food products: Soft Drinks	Food products: Beer & Malt	Food products: Other	Textiles	Leathers	Wood and Paper	Petroleum Refineries	Organic Chemicals	Plastics & Resins	Other non-metallic	Manufacturing of Machinery and Transport Equipment	Other
1988	548.0	94.2	48.7	123.0	3.3	1.6	14.2	3.7	19.5	23.7	4.1	4.0	2.7	14.2	6.3	195.0	43.2	126.0	17.4	58.2	53.6	90.9
1989	426.5	119.6	86.1	118.3	3.0	1.5	12.0	2.5	20.6	21.0	4.2	4.0	5.7	13.9	5.7	199.1	43.4	224.1	0.0	59.6	54.6	91.3
1990	519.0	99.8	39.7	92.5	2.7	1.3	10.0	1.5	19.7	20.4	4.3	4.3	3.7	11.1	4.7	184.0	38.7	107.0	17.6	53.3	50.3	95.2
1991	470.0	73.1	67.8	58.4	3.2	1.2	8.5	1.0	17.7	13.9	5.0	4.0	2.6	8.2	4.2	168.0	40.0	120.0	15.8	43.9	42.1	89.8
1992	453.0	51.4	66.2	53.5	5.4	1.1	7.4	0.5	16.2	10.0	5.8	4.0	0.6	9.0	3.0	146.0	36.6	108.0	15.7	31.0	32.6	79.8
1993	392.0	47.0	59.7	48.5	4.6	0.9	8.0	2.1	15.3	11.0	2.3	3.6	1.5	7.8	2.6	132.0	33.6	97.7	15.1	28.0	30.7	82.7
1994	382.0	45.8	128.0	51.3	3.9	0.8	7.4	1.2	14.2	7.9	2.6	2.7	1.6	7.3	1.7	129.0	32.6	101.0	14.6	29.6	29.5	104.0
1995	378.0	44.4	134.0	41.5	4.0	0.3	8.3	1.0	13.2	7.7	2.4	2.1	1.5	6.4	1.6	121.0	33.2	98.6	12.6	29.3	27.0	94.5
1996	362.0	43.0	142.0	48.5	4.2	0.4	7.8	3.6	12.5	6.5	2.6	1.7	0.9	5.7	1.3	117.0	28.1	94.3	6.7	28.8	25.9	115.0
1997	340.0	43.9	172.0	51.9	4.2	0.2	7.7	4.8	12.2	5.7	2.9	1.7	1.1	5.2	1.1	114.0	25.1	81.5	9.2	32.9	26.5	110.0
1998	336.0	25.3	188.0	52.3	3.9	0.1	9.4	2.5	12.3	6.1	2.7	1.6	2.5	4.7	0.7	106.0	24.3	63.1	10.3	27.9	25.1	161.0
1999	362.3	13.2	184.8	52.6	4.0	0.1	7.5	3.2	11.4	4.9	2.6	1.4	0.5	3.1	0.7	90.3	20.3	55.9	8.4	29.8	22.0	116.7
2000	350.0	14.2	184.0	51.7	3.6	0.1	7.5	2.4	11.3	4.0	2.5	1.3	0.8	2.6	1.1	81.7	17.8	47.7	7.8	32.3	12.0	121.0
2001	332.0	14.8	187.0	49.7	3.4	0.1	7.2	0.7	11.7	2.9	2.1	1.3	0.7	2.1	1.2	76.9	18.1	42.4	4.7	34.2	10.4	130.0
2002	293.0	13.3	184.0	50.3	3.4	0.1	6.4	0.3	11.3	2.7	2.2	1.4	0.7	1.7	0.9	77.1	16.8	42.0	2.7	38.0	9.1	126.0
2003	272.0	9.6	155.0	46.0	3.5	0.1	7.8	0.2	11.5	2.7	3.1	1.2	0.8	1.6	0.8	71.5	17.4	38.3	2.5	31.9	8.1	120.0
2004	261.0	8.2	135.0	49.4	4.1	0.1	6.8	0.3	13.0	2.2	2.0	1.2	3.3	1.5	0.6	70.9	19.6	36.0	2.5	37.4	6.8	129.0
2005	267.0	6.5	132.0	48.6	4.3	0.0	6.6	0.3	13.5	1.8	2.1	1.3	2.8	1.6	0.7	68.9	19.3	38.4	2.4	36.3	7.0	128.0
2006	272.0	7.4	132.0	50.7	4.6	0.0	7.0	0.4	13.8	1.4	2.1	1.7	2.3	1.3	0.6	69.7	20.7	38.6	2.2	43.2	4.4	128.0
2007	271.0	10.8	133.0	52.6	4.8	0.0	6.8	0.4	14.4	1.9	1.9	1.4	2.4	0.7	0.6	67.6	23.0	39.1	2.3	39.4	4.2	148.0
2008	242.6	8.3	130.8	176.3	5.0	0.0	6.0	0.6	14.2	2.7	1.6	1.4	2.6	0.6	0.4	64.7	20.9	35.5	1.9	46.1	3.7	141.7
2009	252.9	12.8	128.4	121.3	5.8	0.0	6.1	0.8	14.2	3.2	1.8	1.1	2.1	0.4	0.5	66.8	21.3	29.4	1.8	39.9	2.1	168.4
2010	283.2	16.5	147.3	49.8	6.6	0.0	5.8	0.7	14.5	2.6	1.6	2.4	36.1	0.3	0.4	64.2	23.1	35.6	2.1	46.8	2.8	183.2
2011	286.2	13.2	166.4	48.1	6.5	0.0	5.8	0.6	13.8	3.1	2.2	10.3	35.3	0.0	0.3	66.3	23.1	38.0	2.4	48.0	2.7	164.9
2012	286.0	12.4	133.5	53.8	6.6	0.0	7.1	0.7	13.9	3.6	3.1	1.3	39.2	0.0	0.2	69.4	23.8	35.4	2.2	40.2	2.2	136.1
2013	320.9	13.4	134.6	51.1	6.9	0.0	6.8	0.8	14.7	3.5	3.0	1.3	39.2	0.0	0.2	71.4	24.0	37.2	1.8	19.9	1.7	79.3
2014	312.1	12.2	128.6	52.0	7.6	0.0	7.3	0.8	14.8	3.5	3.3	1.3	42.5	0.0	0.3	71.1	22.5	38.8	2.5	40.4	2.1	160.8

7.5.3. Uncertainties and time-series consistency

See chapter 7.2.3.

7.5.4. Source-specific QA/QC and verification

See chapter 7.2.4.

7.5.5. Source-specific recalculations

Table 7.28. Change in emissions in result of recalculations

Change	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
kt eq. CO_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Change	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
kt eq. CO_2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-61.0
%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-4%

- update of data on amount of methane recovered during domestic wastewater treatment process

7.5.6. Source-specific planned improvements

No further improvements are currently planned for sector 5.D.

8. OTHER (CRF SECTOR 6)

No other emissions were identified in the Polish GHG inventory apart from those given in CRF categories 1-5.

9. INDIRECT CO_2 AND NITROUS OXIDE EMISSIONS

Addressing paragraph 29 of decision 24/CP.19, Poland has not elected to report indirect CO_2 and N_2O emissions. Information on indirect N_2O emissions in the Agriculture sector can be found in Chapter 5.

10. RECALCULATIONS AND IMPROVEMENTS

10.1. Explanations and justifications for recalculations

10.1.1. GHG inventory

Recalculations made in 2016 consists mostly in improvements in calculation methods based on the 2006 IPCC Guidelines and country specific ones. Detail sectoral information on recalculations made are given in Chapters 3-7 dedicated to source/sink categories. Also information on planned improvements is included in sectoral Chapters 3-7. Due to implementation of new IPCC GLs some ERT recommendations obtained in 2014 are not yet relevant.

The percentage change caused by recalculation with respect to the previous submission, has been calculated as follows:

$$Change = 100\% \times [(LS-PS)/PS]$$

where:

LS = Latest Submission (for 1988−2013 inventory submitted in NIR 2016)
PS = Previous Submission (for 1988−2013 inventory submitted in NIR 2015)

Specific information on recalculation within CRF sectors are given in sectoral chapters 3-8 and in CRF table 8.

10.1.2. KP-LULUCF inventory

Main reasons leading to recalculations in the LULUCF sector for the whole time-series are as follows:

- biomass conversion and expansion factor was adjusted on the basis of default values proposed to be used by the IPCC in the framework of IPCC 2006 Guidelines; Volume 4, table 4.5 and available NFI data.
- in terms of data consistency, linear calibration of activity data was applied to eliminate potential overestimations of carbon sinks in subcategory 4.A.1. This assessment allowed to eliminate outlining value previously reported for the year 2006.

Net effect of recalculations on CO_2 emissions/removals is provided in Table 7.6.1.

10.2. Implications for emission levels and trends

10.2.1. GHG inventory

Recalculations of CO_2 emissions are generally insignificant except 2006 (Fig. 10.1). The main cause for specific increase in CO_2 total emissions and removals in 2006 was further improvements of country specific methodology aiming at correction of activity data in sector 4.A Forest land in entire trend. Recent assessment was implemented to keep the highest level of data consistency and comparability. In terms of data consistency, linear calibration of activity data was applied to eliminate potential overestimations of carbon sinks in subcategory 4.A.1. This assessment allowed to eliminate outlining value previously reported for the year 2006.

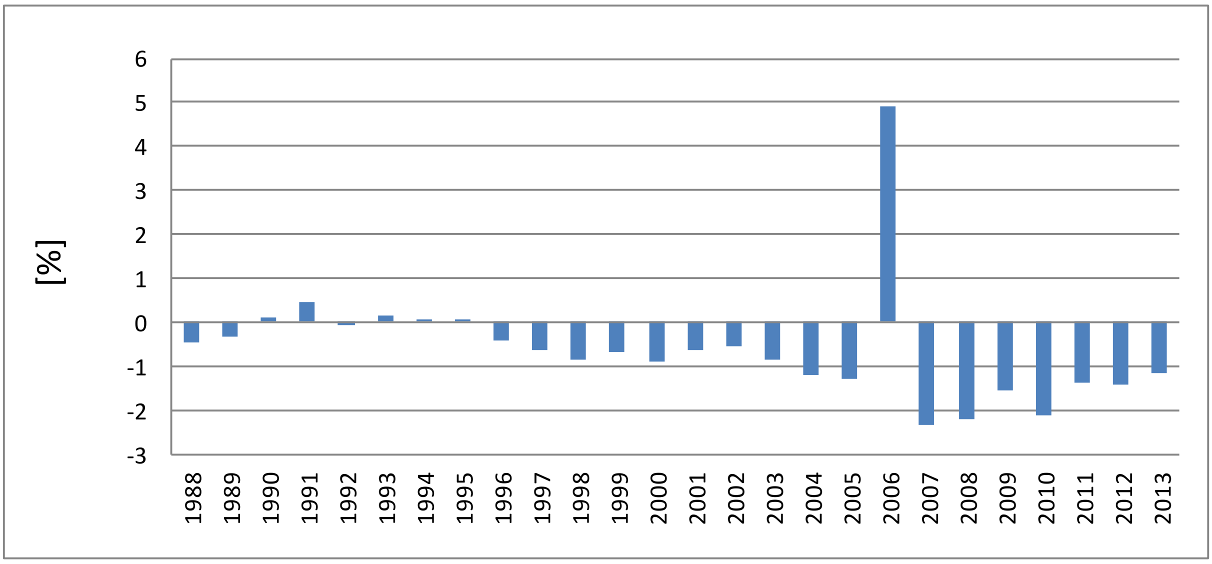

Figure 10.1. Recalculation of CO_2 for entire time series made in CRF 2016 comparing to CRF 2015

In the case of CH_4 the most significant recalculations were made in Agriculture and Waste sectors following further improvements in implementation of the 2006 IPCC GLs (Fig. 10.2).

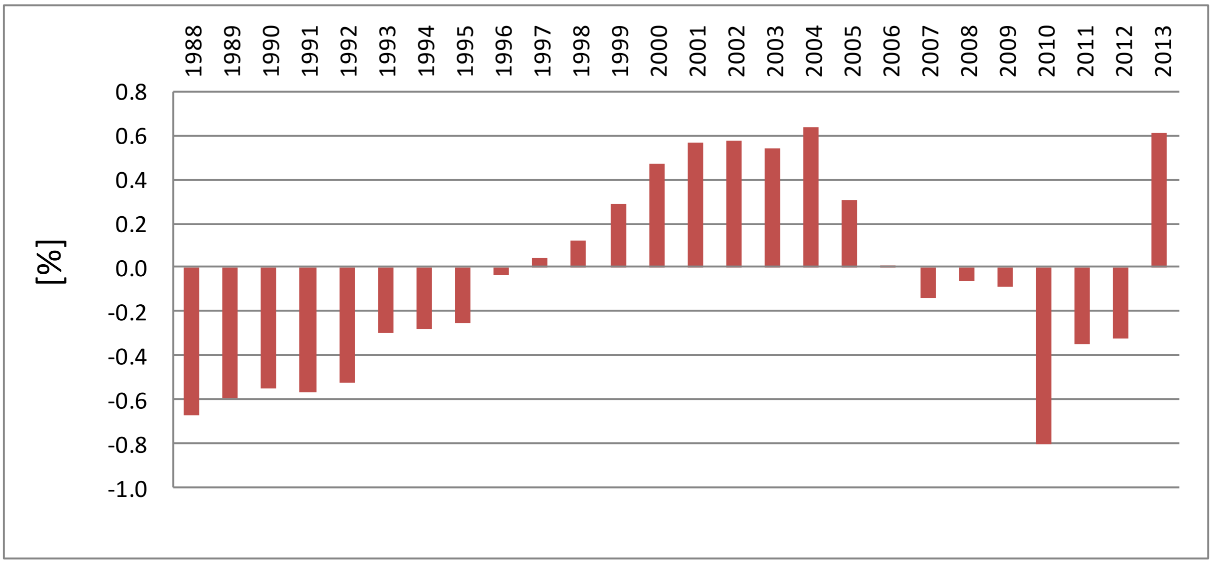

Figure 10.2. Recalculation of CH_4 for entire time series made in CRF 2016 comparing to CRF 2015

Changes in N_2O emissions in entire period (Fig. 10.3) were mostly triggered in Agriculture and LULUCF sectors related to methodological improvements in response to implementing the 2006 IPCC GLs, as well as amending activity data based on national statistics.

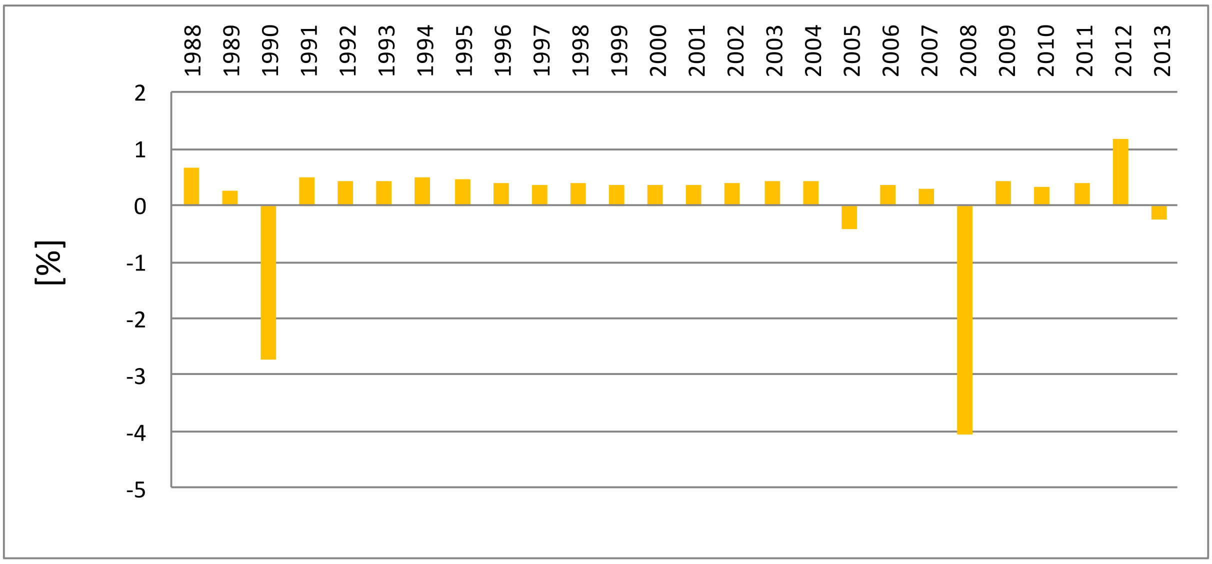

Figure 10.3. Recalculation of N_2O for entire time series made in CRF 2016 comparing to CRF 2015

10.2.2. KP-LULUCF inventory

Main reasons leading to recalculations in the LULUCF sector for the whole time-series are as follows:

- biomass conversion and expansion factor was adjusted on the basis of default values proposed to be used by the IPCC in the framework of IPCC 2006 Guidelines; Volume 4, table 4.5 and available NFI data.

As a result of recalculations for KP−LULUCF sector decrease in net emissions for 2008−2012 was observed. The main reason for recalculations was the application of carbon stock change method related to the calculation of carbon stocks in forest lands. Net emissions of CO_2 related to more detailed estimations resulted in emissions decrease by 9,54% comparing to Submission 2013. Data on emissions of non-CO_2 gases did not change.

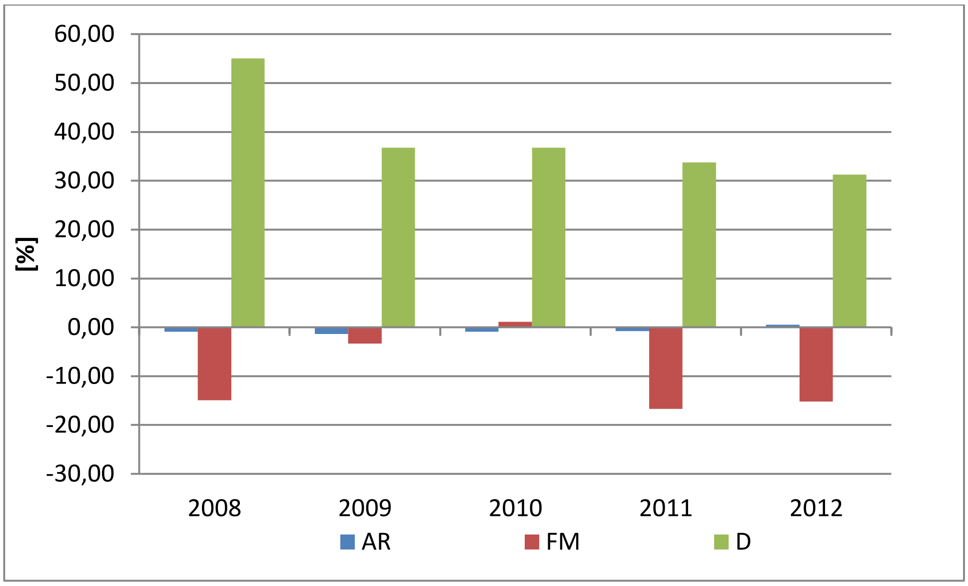

Fig. 10.4. Recalculation of CO_2 for 2008−2012 for KP-LULUCF activities made in CRF 2016 comparing to CRF 2014

10.3. Implications for emission trends

10.3.1. GHG inventory

Recalculations made in 2016 in relation to previous Submission 2015 did not influenced the change in GHG emission trend in 1988−2013 as they are made in consistent manner as relates to activity data and methods used ensuring comparability of results in entire series. Changes for particular years fluctuate from −0.02 up to −0.65% (Fig. 10.4).

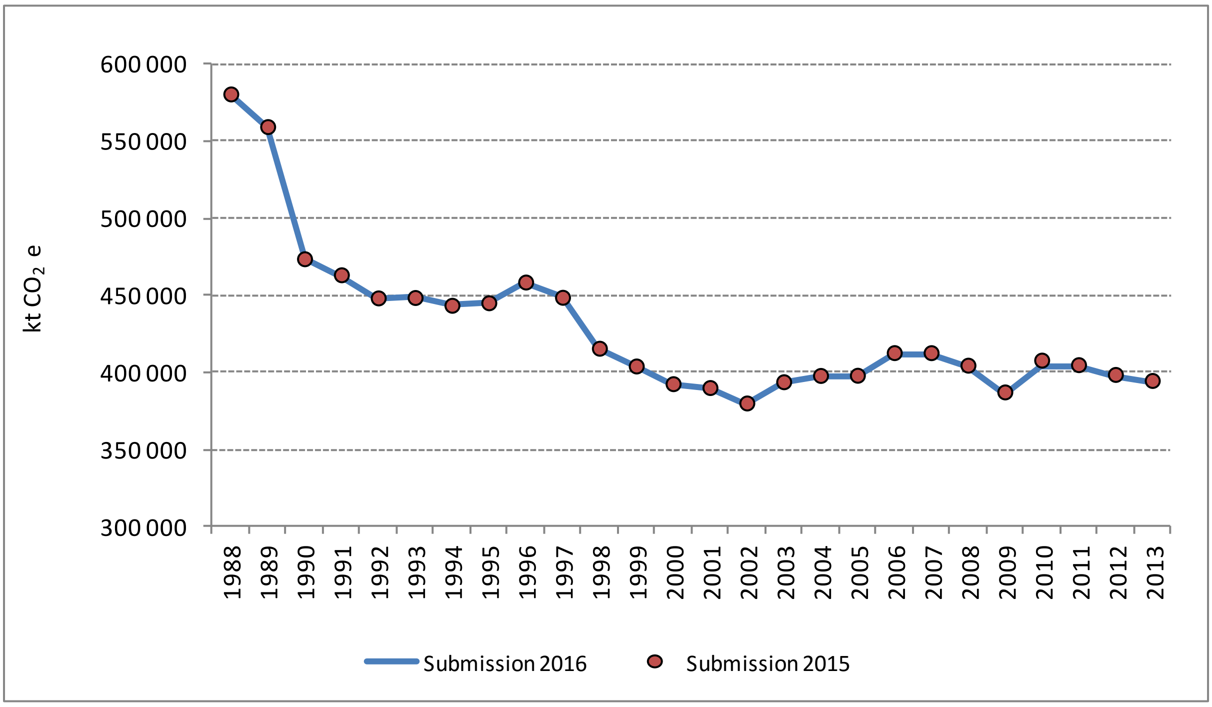

Figure 10.4. GHG emission trends according to Submissions made in 2016 and 2015

10.3.2. KP-LULUCF inventory

Net CO_2 emissions/removals related to elaborating the calculations in more detail, decreased overall by 9,5 comparing to Submission 2014. Net emissions of other gases did not change.

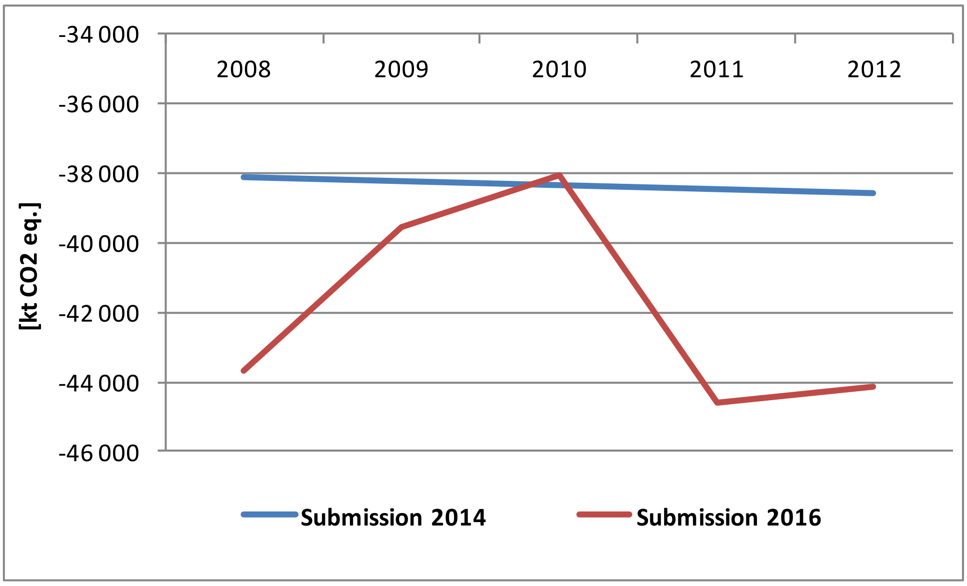

Figure 10.5. KP LULUCF GHG emission trends according to Submissions made in 2016 and 2014

10.4. Recalculations, including in response to the review process, and planned improvements to the inventory

10.4.1. GHG inventory

Table 10.1. The list of recommendations resulting from the *Report on the individual review of the annual submission of Poland submitted in 2014* (FCCC/ARR/2014/POL) and its implementation status

CRF category / issue	Review recommendation	Paragraph	MS response / status of implementation	Chapter/section in the NIR
Energy				
Reference approach and sectoral approach	Include the explanation in the documentation box of CRF table 1.A(c) and in the NIR when the difference between both approaches is larger than 2 per cent	28	The explanation is already given in the NIR	chapter 3.2.1
International bunker fuels	Document any recalculations of the emissions from international aviation for the years 1988–2011 undertaken to ensure time-series consistency in accordance with the IPCC good practice guidance	29	All recalculations are described in the NIR	chapter 3.2.8.5

CRF category / issue	Review recommendation	Paragraph	MS response / status of implementation	Chapter/section in the NIR
International bunker fuels	Include information on the split between domestic and international navigation in the NIR and provide details of the trend in international and domestic bunker fuel use across the time series	30	Mentioned information will be supplemented in next submissions	
Feedstocks and non-energy use of fuels	Further clarify the reporting of feedstocks and non-energy use of fuels in CRF table 1.A(d) and in the NIR and provide detailed information on the allocation of the associated emissions in the inventory	31	Mentioned information will be supplemented in next submissions	
Stationary combustion: all fuels – CO2	Complete and report on the planned development of country-specific CO2 EFs for the significant fuels in the energy sector and consider applying the country-specific CO2 EF for gasoline used in road transportation also for stationary combustion	32	Work on the analysis of the possibility of country specific EF elaboration for the significant fuels in Poland is ongoing.	
Stationary combustion: all fuels – CO2	Include information on the trend for the CO2 IEF for the subcategory public electricity and heat production (other fuels)	33	CO2 IEF for *Other fuels* is weighted average of CO2 EFs of Municipal waste - non-biogenic fraction (default CO2 EF = 91.70 kg/GJ) and Industrial wastes *(default CO2 EF = 143.0 kg/GJ). CO2 IEF for* Other fuels *was equal to 143.0 kg/GJ in the period 1988-2008 because of Industrial wastes was only fuel in Others fuel. Starting from 2009* Municipal waste - non-biogenic fraction was consumed, so IEF depend on share consumption of both mentioned fuels in particular year.	NIR - Annex 2 *Fuel consumption and GHG emission factors from selected categories of CRF sector 1.A* (Tab.1 and Tab. 27)
Stationary combustion: all fuels – CH4	Apply tier 2 methods to estimate CH4 emissions from stationary combustion (solid fuels and biomass)	34	Work on the analysis of the possibility of country specific EF elaboration for the significant fuels in Poland is ongoing.	

CRF category / issue	Review recommendation	Paragraph	MS response / status of implementation	Chapter/section in the NIR
Oil and natural gas – CO_2, CH_4 and N_2O	Use the correct notation key for other leakages and provide adequate explanations in the NIR and in the documentation box of CRF table 1.B.2	36	1.B.2. Other Leakage- this is underground storage of gas. Emissions associated with the exploitation of the gas storage. Polish gas system (high-methane gas system) has four underground gas storage tanks gas with a total capacity of 0.6 billion m3. The emission includes: - Emissions from leaks from heads exploiting operating holes - Emissions from pneumatic devices - Emissions from gas compressor station - Emissions from repair and maintenance - Emissions from breakdown. [Steczko 2003] The activity data is total consumption for gas system .The emission factor was taken from IPCC 2006.	
Oil and natural gas – CO_2, CH_4 and N_2O	Reconsider the reporting of the CO_2 and CH_4 emissions from distribution of oil products	37	according to IPCC 2006 page 4.53 table 4.2.4 the CO_2 and CH_4 emission factor for fugitive emission from refined product distribution is not applicable	
Other transportation: liquid and gaseous fuels – CO_2, CH_4 and N_2O	Ensure the consistency of the time series for CO_2, CH_4 and N_2O emissions from pipeline transport	39	Mentioned information will be supplemented in next submissions	
Industrial processes and solvent and other product use				
Recalculations	Further enhance the explanations of the recalculations, including by: specifying the impact of each change on the estimates; providing information on the impact of the recalculations over the entire time series and across the inventory in case of cross-sectoral reallocations; clearly documenting the recalculations made in response to the review process; and ensuring consistency between the information provided in different sections of the NIR	41-43	recalculations are given in specific subchapters for sectoral changes as well as in chapter on recalculations	

CRF category / issue	Review recommendation	Paragraph	MS response / status of implementation	Chapter/section in the NIR
Transparency	Improve the transparency of the NIR for cement production, nitric acid production, consumption of F-gases, adipic acid production and primary aluminium production and include the information provided during the review	45	New text describing assumptions made during f-gases estimation was introduced. Description relating to adipic acid, aluminium and nitric acid productions was supplemented as well.	chapters: 4.2 -4.7
Cement production – CO2	Provide detailed information on the estimation method used under the EU ETS and the comparison of the GUS data and EU ETS data on clinker production as provided during the review	46	Mentioned information will be supplemented in next submissions	
Lime production – CO2	Collect the necessary data and consistently implement a tier 2 method for the years before 2005	47	resolved	chapter 4.2.2.2
Nitric acid production – N2O	Clarify in the NIR that for the years 2005–2011 plant-specific production data are also available and include the supplementary information provided during the review	48	resolved	chapter 4.3.2.2
Consumption of halocarbons and SF6 – HFCs	Further improve the transparency of the estimates	49	New text describing assumptions made during f-gases estimation was introduced.	
Consumption of halocarbons and SF6 – HFCs	Change the notation key for HFC-23 and HFC-152a under the subcategory refrigeration and air-conditioning equipment used in CRF table 2(II); and include the relevant analysis of the national F-gas market in the NIR and an explanation for the lack of HFC-23 and HFC-152a emissions from refrigeration and air-conditioning equipment	50	issue under development, new text will be introduced in next NIR	
Consumption of halocarbons and SF6 – HFCs	Include the information provided to the ERT during the review on the data quality checks undertaken for the category transport refrigeration	52	issue under development, new text will be introduced in next NIR	
Consumption of halocarbons and SF6 – HFCs	Justify the lifetime used by the Party for transport refrigeration	53	issue under development, new text will be introduced in next NIR	
Adipic acid production – N2O	Provide a description of the method and data source used for the calculation of the N2O emissions from adipic acid production in a category-specific subchapter in the NIR	56	resolved	chapter 4.3.2.3.
Aluminium	Improve the transparency of the NIR by including a trend description for primary aluminium production	57	issue under development, new text will be introduced in next NIR	

CRF category / issue	Review recommendation	Paragraph	MS response / status of implementation	Chapter/section in the NIR
SF6 used in aluminium and magnesium foundries – SF6	Implement the new data from the Polish Geological Institute and ensure the consistent reporting of the category across the time series	58	issue under development, new text will be introduced in next NIR	
Agriculture				
QA/QC	Document the main findings of the sector-specific QA/QC activities and report the results, particularly the reasons for any discrepancies, in the category-specific subchapters of the NIR	63	issue under development	
Uncertainty	Revise the uncertainty of the N2O emissions from agricultural soils	64	resolved	chapter 5.2.3
Transparency	Provide a transparent explanation for the use of specific livestock census statistics, including the additional information provided during the review	65	resolved	chapter 5.2.2
Enteric fermentation – CH4	Include additional information on the methods and assumptions used to derive the gross energy intake values by livestock subcategory	66	resolved	chapter 5.2.2
Enteric fermentation – CH4	Provide data justifying the lower body weight of dairy cattle used in the inventory	67	resolved	chapter 5.2.2
Enteric fermentation – CH4	Report a weighted Ym for sheep in the CRF tables and provide a respective explanation in the NIR	68	issue not valid any more, default EF from the 2006 IPCC GLs is applied	chapter 5.3.2.1
Manure management – CH4 and N2O	Provide additional information that justifies the distribution of animal waste management systems used (including, for example, information on general agricultural structures and policies)	69	issue under development	
Manure management – CH4 and N2O	Report the correct values for the allocation of animal waste management systems in CRF table 4.B(a)s2	70	CRF issue, still not corrected by the Secretariat	
Manure management – CH4 and N2O	Separately report CH4 emissions from anaerobic digesters	71	issue under development	
Manure management – CH4 and N2O	Include additional information on the Nex rate of swine in the NIR	72	updated swine Nex vales applied following weight aggregation as in national statistics	chapter 5.3.2.2, table 5.10
Direct soil emissions – N2O	Consistently report crop production across all emission categories and between the CRF tables and the NIR	73	resolved	chapter 5.4.1

CRF category / issue	Review recommendation	Paragraph	MS response / status of implementation	Chapter/section in the NIR
Direct soil emissions – N2O	Explain in the NIR the trend interpolation applied for the application of sewage sludge in agriculture	74	resolved	chapter 5.4.2.1
Field burning of agricultural residues – N2O	Include more information about the assumptions used to estimate emissions from this category	76	resolved	chapter 5.5.2
LULUCF				
Recalculations	Provide detailed information on the rationale and impact of the recalculations	78	Issue resolved	NIR - chapter 6.6.7
Completeness	Estimate and report the carbon stock changes from all mandatory categories	79	Issue resolved	
Activity data	Include the land-use transition matrices (approach 2) in the NIR and revise the time series of the land-use change data to ensure that the total territorial area is consistent for the entire inventory period since 1988	80	Issue resolved	NIR - annex 6
Transparency	Include the information on the data discrepancy with the FAO data in the NIR	81	Issue resolved	NIR -chapter 6.1.3
Transparency	Provide estimates for the net carbon stock changes in organic soils for cropland converted to grassland (reported as "IE") or clearly indicate the subcategory to which these emissions/removals have been allocated	83	Issue resolved. Relevant CRF table were amended.	CRF- table 4.C Grassland
Transparency	Clearly explain the allocation of the emissions and removals from all carbon pools in the category cropland converted to settlements	84	Issue resolved	NIR- chapter 6.6.4.2
Transparency	Provide evidence that no orchards have been converted to forest land	86	Issue resolved	NIR- chapter 6.2.5.1
Forest land remaining forest land – CO2	Provide more detailed information on how the NFI data were factored into the calculation to estimate the growing stock volume since 2009	87	Issue resolved	NIR- chapter 6.2.4.3
Forest land remaining forest land – CO2	Seek to resolve the issue regarding the time-series consistency between 2008 and 2009 for the gross timber resources using the IPCC approaches	87	Issue under development, new approach will be introduced in the upcoming version of the NIR	

CRF category / issue	Review recommendation	Paragraph	MS response / status of implementation	Chapter/section in the NIR
Forest land remaining forest land – CO_2	Explore the possibility of using country-specific values for the BEF and the root-to-shoot ratio and indicate the results of such attempt and the limitations encountered	88	Issue under development, new approach will be introduced in the upcoming version of the NIR	
Forest land remaining forest land – CO_2	Ensure the time-series consistency of the reported estimates for both litter and dead wood using the appropriate IPCC approaches	89	Issue resolved	NIR- chapter 6.2.4.8
Forest land remaining forest land – CO_2	Use consistent regions when selecting the default values among the categories or derive a country-specific adjustment factor reflecting the effect of the change from the previous forest type to the new one	90	Issue resolved. Nevertheless, MS is exploring the possibility of using country-specific adjustment factors reflecting the effect of the carbon stock change on forest soils	
Land converted to forest land – CO_2	Revise the default biomass increment value for living biomass	92	Issue resolved	NIR- chapter 6.2.5.1
Land converted to forest land – CO_2	Further analyse the NFI data and use data exclusively from age class I (1–20 years old) for the estimation of the carbon stock changes in living biomass and dead wood for land converted to forest land	93	Issue under development, new approach will be introduced in the upcoming version of the NIR	
Land converted to forest land – CO_2	Apply the gain-loss method (tier 2), which follows a more disaggregated approach and allows for more precise estimates of the changes in carbon stocks in biomass	94	Issue under development, new approach will be introduced in the upcoming version of the NIR	NIR- chapter 6.2.5.1
Land converted to forest land – CO_2	Disaggregate the area converted by species and clarify in the NIR why the conversion occurs only for extensively managed forests and not intensively managed forests, as would be the case for plantations	94	Issue under development, new approach will be introduced in the upcoming version of the NIR	
Land converted to forest land – CO_2	Provide more detailed information on the estimation methods used for the carbon stock changes in the dead organic matter and soil pools in the NIR	95	Issue resolved	NIR- chapter 6.2.5.5
Cropland remaining cropland – CO_2	Provide the interpolated and extrapolated results for the area of cropland under different soil types	96	Issue resolved	NIR- chapter 6.3.4.3

CRF category / issue	Review recommendation	Paragraph	MS response / status of implementation	Chapter/section in the NIR
	Include justification for the use of the management factor of 1.09 (for temperate wet climates)	96	Issue resolved, Relative stock change factors as suggested in the Volume 4 of the IPCC 2006 Guidelines were applied.	NIR- chapter 6.3.4.3
Land converted to cropland – CO2	Explain why the gain in carbon stock in living biomass occurred only in 2003 and clarify why the loss of living biomass occurred in 2004 (one year after the conversion)	98	Relevant information will be provided in the upcoming version of the NIR.	
Grassland remaining grassland – CO2	Provide details regarding the calculation of changes in carbon stock in soils	99	Issue resolved	NIR- chapter 6.4.4.3
Land converted to grassland – CO2	Include information on the extrapolated results for the area of grassland under different soil types	100	Issue resolved	NIR- chapter 6.4.4.3
	Use the relative stock change factors from table 3.4.5. (on grassland) of the IPCC good practice guidance for LULUCF	100	Issue resolved. Relative stock change factors as suggested in the Volume 4 of the IPCC 2006 Guidelines were applied.	NIR- chapter 6.4.4.3
Biomass burning – CO2, CH4 and N2O	Provide more information on the values used as input to equation 3.2.20 (e.g. mass of available fuel, fraction of biomass combusted, EFs) to estimate the non-CO2 emissions from wildfires	101	Issue resolved	NIR- chapter 6.4.4.5
Waste				
Solid waste disposal on land – CH4	Include information on the method used to estimate the DOC value for solid waste disposal on land	107	issue under development	
Solid waste disposal on land – CH4	Correct the information in CRF table summary 3 on the applied method and improve the QA/QC procedures	108	resolved	
Wastewater handling – CH4 and N2O	Report the practices related to CH4 recovery	110	transparency of reporting CH4 recovery will be improved in upcoming NIR	
Wastewater handling – CH4 and N2O	Report revised emission estimates for the CH4 emissions from domestic and commercial wastewater (sludge) as planned	111	resolved	
Wastewater handling – CH4 and N2O	Update the values of protein consumption with the latest available data in the FAO database	112	resolved	

10.5. Changes in methodological description

The major changes in methodological descriptions that have been made since the last Polish submission in 2015 are presented below in aggregated form.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	DESCRIPTION OF METHODS	RECALCULATIONS	REFERENCE
	Please mark the relevant cell where the latest NIR includes major changes in methodological descriptions compared to the NIR of the previous year	Please mark the relevant cell where this is also reflected in recalculations compared to the previous years' CRF	If the cell is marked please provide a reference to the relevant section or pages in the NIR and if applicable some more detailed information such as the sub-category or gas concerned for which the description was changed.
1. Energy			
A. Fuel Combustion (sectoral approach)			
1. Energy industries			
2. Manufacturing industries and construction		X	correction in coke consumption in 1.A.2.a category connected with C balance changes in blast furnace process (2.C.1); NIR - Chapter 3.2.7.2.1
3. Transport		x	subcategory 1.A.3.b. *Road transportation* oxidation factor equal 0.99 was implemented subcategory 1.A.3.d. Domestic navigation, fuel consumption share in domestic maritime were recalculated
4. Other sector			
5. Other			
B. Fugitive emissions from fuels			
1. Solid fuels			
2. Oil and natural gas and other emissions from energy production			
C. CO2 transport and storage			
2. Industrial processes and product use			
A. Mineral industry			
B. Chemical industry			
C. Metal industry	X	X	blast furnace process -changes in C balance (i.a. application of country specific value for C content in blast furnace gas); NIR - Chapter 4.4.2.1.b.
D. Non-energy products from fuels and solvent use			
E. Electronic industry			
F. Product uses as substitutes for ODS			
G. Other product manufacture and use			
H. Other			
3. Agriculture			
A. Enteric fermentation	X		wider description of methodology for cattle in Chapter 5.2.2
B. Manure management	X	X	CH4 EF for swine (corrected Vs for market swine according to table 10A-7) in Chapter 5.3.2.1
C. Rice cultivation			

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	DESCRIPTION OF METHODS	RECALCULATIONS	REFERENCE
	Please mark the relevant cell where the latest NIR includes major changes in methodological descriptions compared to the NIR of the previous year	Please mark the relevant cell where this is also reflected in recalculations compared to the previous years' CRF	If the cell is marked please provide a reference to the relevant section or pages in the NIR and if applicable some more detailed information such as the sub-category or gas concerned for which the description was changed.
D. Agricultural soils			
E. Prescribed burning of savannahs			
F. Field burning of agricultural residues			
G. Liming			
H. Urea application			
I. Other carbon containing fertilisers			
J. Other			
4. Land use, land-use change and forestry			
A. Forest land	X	X	Estimation of CSC in biomass on forest land remaining forest land was updated on the basis of suggestions provided in the chapter 2.3.1.1 in the Volume 4 of the IPCC 2006 Guidelines.
B. Cropland	X		Broader information on the calculations of changes in carbon stock in mineral soils on grassland converted to cropland will be provided in NIR 2016
C. Grassland			Broader information on the calculations of changes in carbon stock in mineral soils on grassland remaining grassland will be provided in NIR 2016
D. Wetlands			
E. Settlements	X		Broader information on the calculations of changes in carbon stock in mineral soils on cropland converted to settlements will be provided in NIR 2016
F. Other land			
G. Harvested wood products	X		CSC in HWP pool assigned to the category FL remaining FL were estimated and relevant description is to be provided in the NIR 2016
H. Other			
5. Waste			
A. Solid waste disposal	X	X	interpolation of composition of municipal solid waste
B. Biological treatment of solid waste	X	X	update of N2O emission factor
C. Incineration and open burning of waste			
D. Wastewater treatment and discharge			

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	DESCRIPTION OF METHODS	RECALCULATIONS	REFERENCE
	Please mark the relevant cell where the latest NIR includes major changes in methodological descriptions compared to the NIR of the previous year	Please mark the relevant cell where this is also reflected in recalculations compared to the previous years' CRF	If the cell is marked please provide a reference to the relevant section or pages in the NIR and if applicable some more detailed information such as the sub-category or gas concerned for which the description was changed.
E. Other			
6. Other			
KP LULUCF			
Article 3.3 activities			
Afforestation/reforestation			
Deforestation			
Article 3.4 activities			
Forest management	X	X	Estimation of CSC in biomass on land subject to the forest management activity was updated on the basis of suggestions provided in the chapter 2.3.1.1 in the Volume 4 of the IPCC 2006 Guidelines.
Cropland management (if elected)			
Grazing land management (if elected)			
Revegetation (if elected)			
Wetland drainage and rewetting (if elected)			

PART II:
SUPPLEMENTARY INFORMATION
REQUIRED UNDER ARTICLE 7, PARAGRAPH 1

11. KP-LULUCF

11.1 General information

According to relevant provisions, Parties to the Kyoto Protocol (KP) must submit information on land use, land use change and forestry (LULUCF) that is supplementary to what is contained in the report under the UNFCCC (i.e., Section 6). These provisions set principles to govern the treatment of LULUCF activities; require a consistent definition for terms such as "forest", as well as definitions for activities under Article 3.3 and agreed activities under Article 3.4; and describe how modalities, rules and guidelines are implemented relating to the accounting of activities under Articles 3.3 and 3.4. Good practice guidance concerning the methodology for estimating GHG emissions and removals are given in IPCC guidelines (2013).

As Poland only elected Forest Management (FM) under Art. 3.4 for the first commitment period (it is obligatory to report on FM in the second commitment period), and no other activity has been elected for the second commitment period, this part of the NIR mainly covers issues related to the forestry sector. Information on other land use related activities (e.g. cropland management) is limited to relevant information about land use conversions.

11.1.1 Definition of forest and any other criteria

For the needs of reporting to Articles 3.3 and 3.4 of the Kyoto Protocol, Poland selected the following minimum values for the forest definition[1]:

1. minimum forest land area: 0,1 hectare
2. minimum width of forests land area[2]: 10 m
3. minimum tree crown cover: 10% with trees having a potential to reach a minimum height of 2 meters at maturity in situ. Young stands and all plantations that have yet to reach a crown density of 10 percent of tree height of 2 meters are included under forest. Areas normally forming part of the forest area that are temporarily un-stocked as result of human intervention, such as harvesting or natural causes such as wind-throw, but which are expected to revert to forest are also included.

According to the regulations of art. 3 of the Act on Forests of September 28th, 1991 [Journal of Law of 1991 NO 101 item 444, as amended], a forest is a land:

1. of contiguous area greater than or equal to 0.10 ha, covered with forest vegetation (or plantation forest) – trees and shrubs and ground cover, or else in part deprived thereof, that is:
   - designated for forest production, or
   - constituting a Nature Reserve or integral part of a National Park, or
   - entered on the Register of Monuments;

[1] These values are not in contradiction to forest definition in the Polish law (A*ct on forests of 28 Sep 1991* [Journal of Law of 1991 No 101 item 444, as amended]).

[2] Excluding small private properties, private land given to State Forest [Państwowe Gospodarstwo Leśne Lasy Państwowe] or land belonging to Agriculture Real Estate Agency [Agencja Nieruchomości Rolnych Skarbu Państwa].

2. associated with forest management, but occupied in the name thereof by buildings or building sites, melioration installations and systems, forest division lines, forest roads, land beneath power lines, forest nurseries and timber stores; or else put to use as forest car parks or tourist infrastructure.

11.1.2 Elected activities under Article 3, paragraph 4, of the Kyoto Protocol

Poland reports GHG emissions and CO2 removals on afforestation/reforestation and deforestation (ARD), forest management (FM). Forest management activity accounted in the first commitment period under the Kyoto Protocol continues to be accounted during the second commitment period. The land area reported and changes in land area subject to the various activities in the inventory year are reported in the CRF in NIR-2 table.

11.1.3 Description of how the definitions of each activity under Article 3.3 and each mandatory and elected activity under Article 3.4 have been implemented and applied consistently over time

The definitions given below refer to those caused by human activities that increase or reduce the total area of forest land.

a) *Afforestation*

Afforestation refers to the conversion of land not fulfilling the forest definition to forest land according to the following assumptions:

1. area of the transformed land is at least equal to 0.1 ha;
2. transformed land remained without cover of forest vegetation for at least 50 years, until 31.12.1989;
3. transformation is directly caused by intended human activity.

Land subject to the afforestation activity, was assigned to the area of forest land, established on the basis of legal land use conversion since 1990. This approach was applied due to the fact that from the moment of conversion afforested land is at least subject of the protective measures listed respectively in the Act on forests of September 28th, 1991 (Journal of Laws of 1991 No. 101, item. 444, as amended) as well as in the Act on the protection of agricultural and forest land of February 3rd, 1995 (Journal of Laws of 1995 No. 16, item. 78, as amended) considered as direct human-induced activities, intended for the forest land including newly established.

b) *Reforestation*

Reforestation refers to the conversion of land not fulfilling the forest definition to forest land according to the following assumptions:

1. area of the transformed land is at least equal to 0.1 ha;
2. transformed land remained without cover of forest vegetation for less than 50 years, until 31.12.1989;
3. transformation is directly caused by intended human activity

Forestry legislation in Poland does not distinguish between afforestation (A) and reforestation activities (R) in the sense of the Marrakesh Accord, so they were treated similarly in the national GHG inventory and supplementary reporting. This lands are included under 4.A.2 conversions to forest lands. Artificial plantations of forest trees on lands which are expected to meet forest definitions thresholds are reported as AR. Currently, data provided by National Statistics is used.

c) *Deforestation*

Deforestation refers to the conversion of forest land to other categories of land use. Within the national statistical surveys that category of land use change is considered as the exclusion of forest land for non –forestry purposes. The assumptions used to determine the size of deforestation are as follows:

1. the area of transformed land was covered with forest vegetation on 1 January 1990;
2. transformation is directly caused by intended human activity.

Deforestation is strictly limited by the national law. The main document in this regard is the Act on the protection of agricultural and forest land of February 3rd, 1995 (Journal of Laws of 1995 No. 16, item. 78, as amended). Any exclusion of forest land for non –forestry and non agricultural purposes requires:

1) for the agricultural land consisting valuation land classes I-III – the consent of the minister responsible for rural development;
2) for the forest land owned by the State – the consent of the minister responsible for the environment or the person having the minister's authorization;
3) for the remaining forest land - the consent of the province marshal, issued considering the opinion expressed by the local Chamber of Agriculture.

d) *Forest Management*

Forest management has been defined in paragraph 1 (f) of the Annex to Decision 16/CMP.1 as a system of practices aimed as management of forests, including their ecological (including protection of biodiversity), economic and social functions conducted in a sustainable manner. Sustainable forest management as described in the *Act on Forest Forests of 28 Sep 1991*... sets out principles for the retention, protection and augmentation of forest resources, as well as for the management of forests and other elements of the environment in reference to the national economy.

Sustainable forest management practices, consistent to the provisions of this *Act on Forests*..., apply to all forests irrespectively of their form of ownership. Such activities carried out mainly by the State Forest National Forests Holding result in biomass increase leading to growth of carbon sequestration. Increasing forest area as well as activities aiming at saving forest resources in Poland support this process. The following main activities are performed within forest management by the General Direction of The State Forests:

- increasing of the area undergrowth plants,
- change of species structure from monoculture to multi-species-stands rebuilding,
- introducing second storey into one storey stands,
- using the maximum age for cutting main species of trees,
- if it is advisable not to harvesting some parts of stands above their normal cutting age,
- if it advisable using selective cutting instead of clear cutting method,
- leaving residues on cutting area,
- enhancing natural regeneration,
- enhancing forest fire prevention.

"Forest management" in general includes all kinds of activities in the forest from protecting forests through their economic utilization (of all kinds) to making use of a wide variety of social and ecological functions and services of the forests. All these activities often require rather intensive management of all forests, although this intensity is quite different in the various stands depending on site, species, and the local objective of managing the stand. Managing forests involves preparing forest management plans, afforesting, regenerating, intensive thinning, harvesting, forest protection, maintenance of roads and road building, inspecting of forestry operations and others. The intensity of management is characterized by the length of the operational cycle of returning to each forest compartment, which varies from about a few weeks (in afforested or regenerated areas where tending in necessary) to a year (in young poplar stands for tending) to five years (between pre-commercial thinnings in young stands of fast growing species) to maximum 15-20 years (between thinnings in older stands of slow growing species). Forest management planning covers all forests, and forest management plans are made for 10(-12) years. That all forests (in the sense of the above "forest" definition) are managed in one way or another in Poland is partly an economic and practical necessity because the country uses more wood a year than what it produces, and because the density of the population, which requires all kinds of products and services from the forests, is quite high according to official statistics.

Land under the "FM since 1990" activity is identified by establishing FM in 31 December 1989 (which equaled the total FL at that point) and then subtracting D areas in subsequent years. It thus excludes D areas.

11.1.4 Description of precedence conditions and/or hierarchy among Article 3.4 activities, and how they have been consistently applied in determining how land was classified.

Since only one activity of the listed Article 3.4 Activities was elected by Poland, no precedence conditions among Article 3.4 activities are applicable. The ranking of priority is given in the following order: Deforestation – Afforestation – Forest management.

11.2 Land-related information

11.2.1 Information on geographical location and identification of land.

National boundaries were applied for all activities.

11.2.2 Spatial assessment unit used for determining the area of the units of land under Article 3.3

Artificial plantations of forest trees on lands which are expected to meet forest definitions thresholds are reported as AR. Currently, data provided by National Statistics is used, but the system improves to provide better data by statistical sampling associated to NFI combined with spatial information from register of land and buildings.

With regard to the regulations of art. 3 of the act on forests, forest land considered a subject to the forest management is the area:

3) of contiguous area greater than or equal to 0.10 ha, covered with forest vegetation (or plantation forest) – trees and shrubs and ground cover, or else in part deprived thereof, that is:
    a. designated for forest production, or
    b. constituting a Nature Reserve or integral part of a National Park, or
    c. entered on the Register of Monuments;
4) of contiguous area greater than or equal to 0.10 ha, associated with forest management.

Provisions of this act allow to standardize the definition of forest land as a part of land use scheme. Party has established a system of regulations allowing to indentify, collect, process, report and publish data of land use in the annual statistics. Annual summary reports on land use areas submitted by the Head Office of Geodesy and Cartography are prepared on the basis of regulations of *Act on geodesy and cartography* (Journal of Laws of 1989 No. 30, item. 163, as amended) constituting the basis for the statistical publications fulfilling requirements of National Land Identification System.

11.2.3 Methodology used to develop the land transition matrix

The land transition matrix is developed the following way:

1. Areas under annual AR activities are identified on a per stand basis each year, and the area of these stands are summed up.
2. Areas under D activity are identified since 1 Jan 1990 on a per stand basis each year, and the area of these stands is summed up.
3. The total (known) forest area at the end of each year (since 1990) is identified on the basis of the NFD that includes appropriate records for each known stand in the country.
4. By identifying the total forest area, as well as all additions to, and reductions from, the forest area of the previous year, the constant elements (i.e. FM) can be identified. Land under FM was first identified at 31 December 1989. FM area has subsequently been reduced by the area of the deforested stand.

The above procedure ensures the consistency of land identification under all KP activities, as well as FL under the UNFCCC. We identified all changes in the land use statistics and classified them so that, eventually, all land can be accounted for in the respective categories since 1990 (see also section 6.) Land statistics based on annually updated data obtained from National Record of land and buildings directly refers to changes in land use caused by intended human intervention at the level of single cadastral unit.

Any changes in land use categories are recorded with the attribute of the area being a subject of any type of conversion and are aggregated in a form of annual reports on land prepared by the Head Office of Geodesy and Cartography. Data on the condition and changes in the registered intended use of land were developed on the basis of annual reports on land are published as the official statistical information by the Central Statistical Office. Publications of the different categories of land use are subsequently used to determine the direction of changes in land use.

Considering the area of the country and its specific conditions, there is no applicable stratification that would justify reporting on smaller scale than at the national level. This is also supported by the attributes of the available activity data. However, the land-use representation and land-use change identification system developed for the KP and UNFCCC reporting purposes permit a truly detailed spatial assessment and identification of AR and D activities at the level of the individual cadastral units.

Methodology for the preparation of the land use change matrix is described in the LULUCF section 6.2. There were two matrices developed: one that starts in 1988, developed for the inventory purpose (which covers GHG inventory 1988-2014) and another one that starts in 1990 developed for the Kyoto Protocol reporting and accounting purpose. The two are fully consistent, the difference is that Convention's one implements 20 years transition period,

Since 1988 is the base year for Poland, pre-1990 data was only needed to provide a net GHG emission/removals estimate for the Convention categories activity in 1988 and 1989. The complete matrix used for estimation of emission/removals on KP eligible lands is available in NIR-2 table in CRF.

11.2.4 Maps and/or database to identify the geographical locations, and the system of identification codes for the geographical locations

Afforestation and reforestation (AR) - mapping and identification

The identification of land area eligible as AR activities could be done based on forest management plans and their forest maps, in which these areas are included after the conversion to the forest land. Thus, the explicit location and plantation/stand description is available for each such area. Further on, such land can be tracked in time through the numbering systems of the forest parcels (compartments), as far as the number (code) remains unchanged over the planning cycles. A piece of land covered by afforestation is subject of plantation and, if necessary, repeated gap filling according technical norms for afforestation.

Deforestation (D) - mapping and identification

Deforested lands are identified by statistical sampling method.

Forest management (FM)- mapping and identification

For each year, all FM area (i.e. each stand) is allocated to one of the geographical locations, thus, aggregate data (e.g. volume stocks, volume stock changes etc.) for these locations can be developed for each year. The identification system of sub-compartments is made up of three elements which are registered for every sub-compartment. These elements are: the municipality (village, or town), the compartment (a larger piece of forest, e.g. a hillside or a valley) and sub-compartment (which is part of a compartment). Measurements and observations are made on permanent sample plots. System of permanent observation plots (ICP Forest) was applied as a basis for damage assessment in forests, according to the European Union regulations (ie. the network 16x16 km).

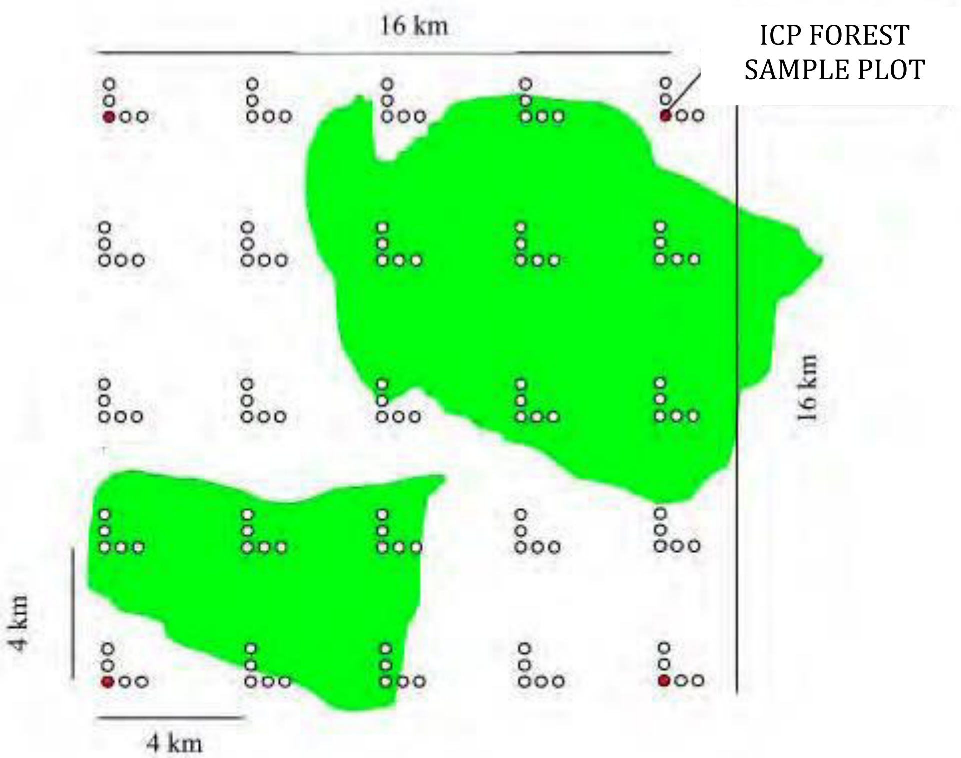

Figure 11.1. The general layout of sample plots.

The network of sample plots for large-scale inventory system was concentrated to 4x4 km, with the individual specification of single plots coordinates in WGS 84 and PUWG 1992 systems. The individual sample plot was located schematically in line with the system schemes deployed in the 4x4 km network, while within each line 200 meters long (shaped L with equal arms) five sample plots is located.

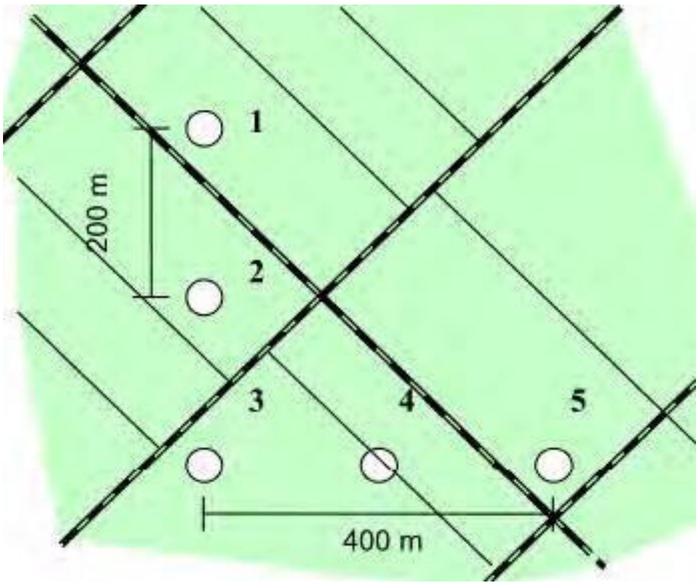

Figure 11.2. Routes system with the background of the sample plots distribution

Over 28 thous. of sample plots have been established in Polish forests during the current inventory process. Location of every single sample plots in the area was marked up on the map with its marker points designation and identification (determined by the location of individual sample plots). Since the long term stabilization was completed and single points were marked (by punching a metal tube about 1 inch in diameter around 30 cm into the ground and punching the nails in his neck the next three root trees), offsets to the centre of each sample plot were measured (using the azimuth and distance). Locations of sample plots were recorded mostly by GPS receivers, starting from the point of marker and by navigation to the ground of the next trial area where it was possible to read the GPS coordinates with appropriate measurement parameters. This point was also marked as an intermediate point, stabilized in the same manner as marker point.

11.3 Activity-specific information

11.3.1 Methods for carbon stock change and GHG emission and removal estimates

Implementation of 2006 Guidelines has affected insignificantly the estimates for KP activities. All emissions are estimated, none is considered as insignificant in the sense of para 37 of the Annex to decision 24/CP19.

11.3.1.1 Description of the methodologies and the underlying assumptions used

Similar methodological approaches were implemented under the convention and KP reporting. Estimation of GHG emissions from sources is consistent with data and methods used in the convention estimation and are described under section 6 of the NIR.

Afforestation/reforestation

Net changes in C stocks in aboveground and belowground biomass, and soil organic matter pools during each year of the annual commitment period are estimated and reported for accounting purposes under Tier 2.

Deforestation

Emissions are calculated using Tier 2 methods and input data as described under the chapter 6. All carbon pools are reported and D is not a key activity under KP.

Forest management

Emissions/removals from FM activity have been calculated, using the same assumptions, formulas and parameters as used for the estimation of the GHG inventory (see section 6 of the NIR). The FM is a key category under KP.

11.3.1.2 Justification when omitting any carbon pool or GHG emissions/removals from activities under Article 3.3 and elected and mandatory activities under Article 3.4

For the litter and dead wood pools on AR land, the option of paragraph 2e of decision 2/CMP.8 is selected, and it is demonstrated (see below) that these pools are not a source, thus, no accounting is made for these pools.

Carbon stock changes in dead wood on afforested and reforested areas is assumed to be equal to zero, therefore reported as 'NO'. The accumulation of dead wood was assumed to be marginal on afforested and reforested sites, during 1990-2012, and also dead wood pool cannot decrease on those sites, because there is actually no dead wood there before the conversion. The dead wood starts to accumulate when natural mortality or thinnings occur that is nearly at the age of over 20 years. To keep correctness in CRF tables notation keys NO (not occurring) were used in the relevant table.

Carbon stock changes in litter on afforested and reforested areas is assumed to be equal to zero, therefore reported as 'NO'. The accumulation of litter was assumed to be marginal on afforested and reforested sites, during 1990-2012, When an area is afforested, first it is cleared of all above-ground biomass in case there was any, however, no DW and LI are usually present on these lands prior to afforestation. After afforestation, dead woody debris, litter as well as dead trees start to accumulate. In lack of representative measurements, the rate and timing of accumulation is not known, however, standard forestry experience suggests that they depend on species, site and silvicultural regime, and quickly accumulate over time. Fast growing species are usually planted so that no large amount of deadwood is produced, or thinned so that self-thinning does not ensue, but litter is continuously produced even in these stands. On the other hand, slow-growing species tend to produce dead wood and litter even at an early stage. Overall for all AR land, also considering that AR activity has been continuous since 1990 and stands on AR land are usually younger for deadwood and litter accumulation to saturate, it can safely be concluded that the carbon in the deadwood and litter pools in AR lands was increasing between 2008-2010, i.e. these pools are not a source. The above demonstration is based upon well-established principles of forest science, the every-day experiences of forestry practice, the experience and data of forest surveys, as well as sound reasoning. Because of this, although no representative measurements have been made as mentioned, the level of confidence of the demonstration is suggested to be very high. To keep correctness in CRF tables notation keys NO (not occurring) were used in the relevant table.

According to the article 30 of *Act on forests of 28th September, 1991 (Journal of Law of 1991 No 101 item 444, as amended)* burning of surface soil layers or remnants of vegetation is forbidden. In relation to this record it is considered that controlled biomass burning does not occur on forests. To keep correctness in CRF tables notation keys NO (not occurring) were used in the table NIR 1 and connected tables for all indicated activities for wildfires on forest land.

The size of forest land with the relation to legitimacy of fertilization on forest land in a large scale causing that fertilization is limited only to the forest nurseries where use of fertilizers is a part of intensive production technology. In this situation, to prevent the possibility of double emission estimation in conjunction with the sector "Agriculture", it is assumed that fertilization on forest land is not affected. To keep correctness in CRF tables notation keys NO (not occurring) were used in the table NIR 1 and connected tables for all indicated activities for fertilization on forest land.

11.3.1.3 Information on whether or not indirect and natural GHG emissions and removals have been factored out

Available activity data and methodologies did not allow the exclusions of indirect and natural GHG emissions from the present estimation of anthropogenic GHG emissions for the relevant activities.

11.3.1.4 Changes in data and methods since the previous submission (recalculations)

All changes are caused by the change in activity data, for forest and forest management activity. Emission and C stock change factors are not changed at all.

11.3.1.5 Information on other methodological issues

11.3.1.2.1 Information that demonstrates methodological consistency between the reference level and reporting for forest management

In order to avoid expectance of net debits and credits, during the second commitment period, the consistency of parameters used for FMRL and estimates over the CP2 has to be ensured for, i.e. area accounted for, the treatment of harvested wood products, and the accounting of any emissions from natural disturbances.

11.3.2.3.2 Technical corrections

A technical correction is planned in the light of new data available from NFI at the later stage.

11.3.1.6 The year of the onset of an activity, if after 2013

Data on the year of onset of activity is reflected in the time series used to derive the activity data. Under current method, which determines the land use change periodically, interpolation is used between successive moments in time.

11.4 Article 3.3

11.4.1 Information that demonstrates that activities under Article 3.3 began on or after 1 January 1990 and before 31 December 2012 and are direct human-induced

The annually updated cadastral information from the National Record of Lands and Buildings refers exclusively to intentional, i.e. human-induced interventions into land use. These interventions are thereby reflected in the corresponding records, including the time attribute, collected and summarized at the level of cadastral units. Summarised area of land use changes at the level of cadastral units are annually reported as a official statistical data by the Central Statistical Office

11.4.2 Information on how harvesting or forest disturbance that is followed by the re-establishment of forest is distinguished from deforestation

Since no remote sensing technology is directly involved in the KP LULUCF emission inventory, there is no issue related to distinguishing harvesting or forest disturbance from deforestation. Harvesting and forest disturbance always occur on forest land, while deforestation is a cadastral change of land use from forest land to other land use categories

The forest disturbance alone cannot trigger land conversions from forestland, i.e. land is subject to further forest management. Thus distinction between harvested and disturbance affected areas, on the one hand, and deforestation, on the other, is made as follows: for the former, there is legal obligation for the forest owner/administrator to maintain the land under forests category and forestry regime (including tree harvest based on permit), to apply the forest management plans specifications and regenerate it within a given timeframe (maximum 5 years); for the latter, following legal procedure with the issuance of the approval, a new land use category is assigned to that land, and the forestry regime is no longer applicable.

Any deforestation in terms of land use change in the in-country land use scheme requires an official decision. Hence, no permanent loss of forest cover may occur prior to this approval, which is reflected in cadastral land use. A temporary loss of forest cover up to an area of 2 [ha] ha may occur as part of forest management operations on Forest land (units of land subject to FM), which is not qualified as deforestation in terms of Art. 3.3. KP LULUCF activity. Nevertheless, forest owners (art. 13.1 of the the *Act on forests* of September 28th, 1991 *(Journal of Laws of 1991 No. 101, item. 444, as amended)* shall be obliged to ensure the permanent maintenance of forest cover, as well as continuity of utilization, and in particular:

1) to preserve forest vegetation (plantations) in forests, as well as natural marshlands and peatlands;
2) to reintroduce forest vegetation (plantations) in forest areas within five years of a stand being cleared;
3) to tend and protect forest, including against fire;
4) to convert and rebuild stands, where these are not in a condition to ensure achievement of the objectives of forest management set out in the Forest Management Plan, Simplified Forest Management Plan or Decision;
5) to make rational use of forests in a manner permanently ensuring optimal discharge of all the functions thereof, by means of:
   a) the harvesting of wood within limits not exceeding a forest's productive capabilities,
   b) the harvesting of raw materials and by-products of forest use, in a manner providing for biological renewal, and also ensuring protection of forest-floor vegetation.

A basic requirement of the forest regime is that an area has to be restocked in maximum 5 years, without reference to a minim area. In practice, such lands can regenerate either by plantations (usually followed by state forests) or by assisted natural regeneration (, or by mixed ways. Its implementation is observed by public authority responsible for forestry. These areas cannot be confounded with deforested areas as far as they are subject to continuous planning and management (i.e. planting/ gap filling, maintenance, etc).

11.4.3 Information on the size and geographical location of forest areas that have lost forest cover but which are not yet classified as deforested

The actions referred to the deforestation under Article 3.3 of the Kyoto Protocol and the provisions of Article 5 of the *Act on Agricultural and Forest Land Protection (Journal of Laws of 1995, No 16, item78 as amended*) require a formal decision to exclude individual forest plots as administrative units of forestry production. National legal considerations indicate deforestation as a process of administrative changes in land use category, while the temporary deprivation of the forest land of forest cover cannot be equated with deforestation process and should be treated as part of sustainable forest management. Size of final felling sites at the country level that have lost forest cover but which is not yet classified as deforested is presented in the table below.

Table 11.1. Size of final felling sites.

Year	Land area [thos. ha]
2008	72.7
2009	76.9
2010	78.0
2011	77.9
2012	79.6
2013	79.0
2014	77.9

11.4.4 Information related to the natural disturbances provision under article 3.3

Not applicable

11.4.5 Information on Harvested Wood Products under article 3.3

As requested by para 26 of Annex to 2/CMP.7, carbon stock changes in the HWP pool are reported and accounted for in the Polish inventory. The methodology of estimation is described in Section 11.5.2.5 because, due to lack of data, we are unable to separate harvest from AR and FM. Therefore, according to page 2.118 of the IPCC 2013 KP Supplement, "in case it is not possible to differentiate between the harvest from AR and FM, it is conservative and in line with good practice to assume that all HWP entering the accounting framework originate from FM", thus we report carbon stock changes together for the two categories. In contrast, harvest from D is separated and excluded, and treated as instantaneous oxidation.

11.5 Article 3.4

11.5.1 Information that demonstrates that activities under Article 3.4 have occurred since 1 January 1990 and are human-induced

Confirmation that the FM activity is human induced and occurred since 1990 is given by the fact that associated lands were reported as part of the national economic system by continuous planning and implementation of the management measures or subject to forest regime in any case.

11.5.2 Information relating to Forest Management

Forest management activity refers to forest for which a management plan has been set up (some 90% of forests) while the rest are subject to wood harvesting permission. First category are managed according to management plans, they are continuously surveyed for disturbances; forest operations and harvesting are subject to 10 years cycle planning; forest regeneration is closely and intensively assisted. Such lands are mapped, landmarked and annually up-dated in statistics. The forestry regime relies primarily on the forest law, then in subsequent legislation and technical norms, in order to ensure sustainable forests management at national scale.

11.5.2.1 Information that the definition of forest for this category conforms with the definition in item 11.1 above

FM land only includes managed forest areas that are included in the FL category, for which the definition of "forest" is applied as required by the the *Act on forests* of September 28th, 1991 *(Journal of Laws of 1991 No. 101, item. 444, as amended)*, as it is demonstrated above in section 11.1.

11.5.2.2 Conversion of natural forest to planted forest

It is assumed that this type of conversion does not occur in Poland.

11.5.2.3 Forest Management Reference Level (FMRL)

In order to avoid expectance of net debits and credits, during the second commitment period, the consistency of parameters used for FMRL and estimates over the CP2 has to be ensured for, i.e. area accounted for, the treatment of harvested wood products, and the accounting of any emissions from natural disturbances.

Emissions from harvested wood products originating from forests prior to the start of the second commitment period have been calculated in the FMRL using the stock change approach defined in IPCC 2006 (data used were associated with years starting with 1900).

11.5.2.3 Technical Corrections of FMRL

A technical correction is planned in the light of new data available from NFI.

11.5.2.4 Information related to the natural disturbances provision under article 3.4

Not applicable. Poland does not intend to use the provision to exclude emissions caused by natural disturbances during the second commitment period of the Kyoto-Protocol.

11.5.2.5 Information on Harvested Wood Products under article 3.4

From a methodological point of view, emissions and removals HWP under FM are treated similarly than that under the UNFCCC, see Section 6.5.4.2.4. However, there are a number of elements where, due to KP-specific provisions, accounting has to follow specific rules and involves reporting different amounts of emissions and removals than those under the UNFCCC.
First, HWP from FM under the KP is treated together with HWP from AR, see Section 11.4.5. Second, an important specific methodological element of the estimation of carbon stock changes in the HWP pool under the KP is that, complying with Paragraph 16 of the Annex to Decision 2/CMP.7 and the methodological guidance of the IPCC 2013 KP Supplement (page 2.121), which is applicable in case the FMRL is based on a projection representing a 'business as usual scenario' (see Section 11.5.2.2), inherited emissions from before the start of the second commitment period are excluded from accounting.
As a consequence of the above, whereas losses from the HWP pool accounted for under the UNFCCC are partly from wood products that were produced prior to the second CP, losses from the HWP pool accounted for under the KP are only from wood products produced during the second CP. Recent estimates of carbon stock changes in the HWP pool under the KP using statistical data for inventory year 2014.

11.5.3. Information relating to Cropland Management, Grazing Land Management and Revegetation, if elected, for the base year

As Poland did not elect either Cropland Management, nor Grazing Land Management, nor Wetland drainage and Rewetting, nor Revegetation, this is a non-issue.

11.6 Other information

11.6.1 Key category analysis for Article 3.3 activities, forest management and any elected activities under Article 3.4

In the national GHG inventory, the Tier 1 analysis (Level Assessment, including LULUCF), showed that the CO2 removals from the category 4.A.1 Forest Land remaining Forest Land is a key category. Country specific data is used for this category, noting that reporting some C pools are still achieved according to Tier 1.

Significant change regarding the two related estimates ("Forest Land remaining Forest Land" under the Convention tables and "Forest Management" activity under the KP) are not expected for the following years.

11.7 Information relating to Article 6

There are no Article 6 activities concerning the LULUCF sector in Poland.

12. INFORMATION ON ACCOUNTING OF KYOTO UNITS

12.1. Background information

The information on accounting of Kyoto units is provided as a part of greenhouse gas inventories of Poland. The following paragraphs present relevant data on holdings and transactions with Kyoto Protocol Units within the Polish registry.

Information related to transactions, CDM notifications and accounting of Kyoto units are based on data derived from the consolidated Union Registry.

12.2. Summary of information reported in the SEF tables

In accordance with paragraph 11 of the annex I.E to Decision 15/ CMP.1 the Standard Electronic Format report for 2015 (hereafter: SEF) has been submitted in conjunction with this report (please refer to the files: RREG1_PL_2015.xlsx and ITL_PL_2015_2_1.xml).

The SEF includes information regarding: total quantities of Kyoto Protocol units held on national accounts at the beginning and at the end of reported year, annual internal transactions and transaction between PPSR accounts, share of proceeds transactions under decision 1/CMP.8, paragraph 21 - Adaptation Fund, expiry, cancellation and replacement of CER units and summary information for the commitment period.

12.3. Discrepancies and notifications

In accordance with respective paragraphs of the annex I.E to Decision 15/CMP.1 relevant information is provided:

a) *paragraph 12: List of discrepant transactions*
   No discrepant transactions occurred in 2015.
b) *paragraph 13 & 14: List of CDM notifications*
   No CDM notifications occurred in 2015.
c) *paragraph 15: List of non-replacements*
   No non-replacements occurred in 2015.
d) *paragraph 16: List of invalid units*
   No invalid units exist as at 31 December 2015.
e) *paragraph 17: Actions and changes to address discrepancies*
   No actions were taken or changes made to address discrepancies for the period under review.

12.4. Publicly accessible information

The information that was made available to the public in accordance with section E in Part II of Annex to Decision 13 / CMP.1 is provided at http://www.kobize.pl/pl/article/rejestr-uprawnien/id/661/publicly-available-reports . It contains data regarding accounts, transactions and holdings, article 6 projects, transactions with Kyoto units and authorized legal entities information:

a) paragraph 45: Account information
   In this report following information were provided:

- *paragraph 45 (a): Account name: the holder of the account*
- *paragraph 45 (b): Account type: the type of account (holding, cancellation or retirement)*
- *paragraph 45(c): Commitment period: the commitment period with which a cancellation or retirement account is associated*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART45.pdf)

In line with the data protection requirements of Regulation (EC) No 45/2001 and Directive 95/46/EC and in accordance with Article 110 and Annex XIV of Commission Regulation (EU) No 389/2013, the information on account identifier and account representatives held in the EUTL, the Union Registry and any other KP registry (required by paragraph 45) is considered confidential.

b) *paragraph 46: Article 6 project information*
- *paragraph 46 (a): Project name*
- *paragraph 46 (b): Project location - the Party and town or region in which the project is located*
- *paragraph 46 (c): Years of ERUs issuance as a result of the Article 6 project*
- *paragraph 46 (d): Reports - downloadable electronic version of all publicly available documentation relating to the project*

These information is available in the report - *Joint Implementation (JI) project information*
(reference: https://dokumenty.kobize.pl/projekty_ji/index.htm)

c) *paragraph 47: Holding and transaction information*
- *paragraph 47 (a): The total quantity of ERUs, CERs, AAUs and RMUs at the beginning of the year*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART47_a.pdf)

Information on the total quantity of ERUs, CERs, AAUs and RMUs held in each account is considered to be confidential (in accordance with article 110 (1) of Commission Regulation (EU) No 389/2013 of 2 May 2013). Therefore, the report details were limited to information related to subtotals per account type only.

- *paragraph 47 (b): The total quantity of AAUs issued on the basis of the assigned amount pursuant to Article 3*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART47_b_h_k.pdf)

- *paragraph 47 (c): The total quantity of ERUs issued on the basis of Article 6 projects*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART47_c_e_g_i_j.pdf)

- *paragraph 47 (d): The total quantity of ERUs, CERs, AAUs and RMUs acquired from other registries and the identity of the transferring registries*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART47_d_f.pdf)

Information on details of transactions carried out is considered to be confidential (in accordance with article 110 (1) of Commission Regulation (EU) No 389/2013 of 2 May 2013). Therefore, the transaction details were limited to transferring and/or acquiring registry ID only.

- *paragraph 47 (e): The total quantity of RMUs issued on the basis of each activity under Article 3*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART47_c_e_g_i_j.pdf)

- *paragraph 47 (f): The total quantity of ERUs, CERs, AAUs and RMUs transferred to other registries and the identity of the acquiring registries*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART47_d_f.pdf)

Information on details of transactions carried out is considered to be confidential (in accordance with article 110 (1) of Commission Regulation (EU) No 389/2013 of 2 May 2013). Therefore, the transaction details were limited to transferring and / or acquiring registry ID only.

- *paragraph 47 (g): The total quantity of ERUs, CERs, AAUs and RMUs cancelled on the basis of activities under Article 3*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART47_c_e_g_i_j.pdf)

- *paragraph 47 (h): The total quantity of ERUs, CERs, AAUs and RMUs cancelled following determination by the Compliance Committee that the Party is not in compliance with its commitment under Article 3*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART47_b_h_k.pdf)

- *paragraph 47 (i): The total quantity of other ERUs, CERs, AAUs and RMUs cancelled*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART47_c_e_g_i_j.pdf)

- *paragraph 47 (j): The total quantity of ERUs, CERs, AAUs and RMUs retired*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART47_c_e_g_i_j.pdf)

- *paragraph 47 (k): The total quantity of ERUs, CERs and AAUs carried over from the previous commitment period*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART47_b_h_k.pdf)

- *paragraph 47 (l): Current holdings of ERUs, CERs, AAUs and RMUs in each account*

(reference: https://dokumenty.kobize.pl/raporty/Public_ART47_l.pdf)

Information on the total quantity of ERUs, CERs, AAUs and RMUs held in each account is considered to be confidential (in accordance with article 110 (1) of Commission Regulation (EU) No 389/2013 of 2 May 2013). Therefore, the report details were limited to information related to subtotals per account type only.

d) paragraph 48: Authorized Legal Entities Information

(reference: https://dokumenty.kobize.pl/raporty/Public_ART48.pdf)

In line with the data protection requirements of Regulation (EC) No 45/2001 and Directive 95/46/EC and in accordance with Article 110 and Annex III of the Commission Regulation (EU) no 389/2013, the legal entity contact information (required by paragraph 48) is considered confidential.

12.5. Calculation of the commitment period reserve (CPR)

The recent value of commitment period reserve of Poland is **1 996 339 848 tCO_2 eq.** The calculation of Poland's CPR is contained in chapter G.2 of the "Report on the individual review of the annual submission of Poland submitted in 2014" (ref.: FCCC/ARR/2014/POL, paragraph 135., http://unfccc.int/resource/docs/2015/arr/pol.pdf).

13. Information on changes in national system

There were no changes in the national system for GHG inventories in Poland since the last NIR was issued.

14. Information on changes in national registry

The following changes to the national registry of Poland have occurred in 2015.

a) *15/CMP.1 annex II, paragraph 32.(a): Change of name or contact*

No change in the name or contact information of the registry administrator occurred during the reported period.

b) *15/CMP.1 annex II, paragraph 32.(b): Change of cooperation arrangement*

No change of cooperation arrangement occurred during the reported period.

c) *15/CMP.1 annex II, paragraph 32.(c): Change to the database or the capacity of national registry*

There was no change to the database structure as it pertains to KP functionality in 2015.

Versions of the CSEUR released after 6.3.3.2 (the production version at the time of the last Chapter 14 submission) introduced minor changes in the structure of the database.

These changes were limited and only affected EU ETS functionality. No change was required to the database and application backup plan or to the disaster recovery plan. The database model is provided in Annex A (please refer to the file: Annex A_CSEUR_DB_MODEL_20150113.pdf).

No change to the capacity of the national registry occurred during the reported period.

d) *15/CMP.1 annex II, paragraph 32.(d): Change of conformance to technical standards*

Changes introduced since version 6.3.3.2 of the national registry are listed in Annex B (please refer to the file: Annex B – Changes From 6.3.3.2.to 6.7.3.xlsx).

Each release of the registry is subject to both regression testing and tests related to new functionality. These tests also include thorough testing against the DES and were successfully carried out prior to the relevant major release of the version to Production (please refer to the file: Annex B – Changes From 6.3.3.2.to 6.7.3.xlsx). Annex H testing was carried out in February 2016 and the test report is attached.

No other change in the registry's conformance to the technical standards occurred for the reported period.

e) *15/CMP.1 annex II, paragraph 32.(e): Change of discrepancies procedures*

No change of discrepancies procedures occurred during the reported period.

f) *15/CMP.1 annex II, paragraph 32.(f): Change of Security*

No change of security measures occurred during the reporting period.

g) *15/CMP.1 annex II, paragraph 32.(g): Change of list of publicly available information*

No change to the list of publicly available information occurred during the reporting period.

h) 15/CMP.1 annex II, paragraph 32.(h): Change of Internet address

No change of the registry internet address occurred during the reporting period.

i) 15/CMP.1 annex II, paragraph 32.(i): Change of data integrity measure

No change of data integrity measures occurred during the reporting period.

j) 15/CMP.1 annex II, paragraph 32.(j): Change of test results

Changes introduced since version 6.3.3.2 of the national registry are listed in Annex B. Both regression testing and tests on the new functionality were successfully carried out prior to release of the version to Production. The site acceptance test was carried out by quality assurance consultants on behalf of and assisted by the European Commission (please refer to the file: Annex B – Changes From 6.3.3.2.to 6.7.3.xlsx).

Annex H testing was carried out in February 2016 and the test report is attached.

15. Changes in information on minimization of adverse impacts in accordance with Article 3.14

According to chapter I.H of the annex to the decision 15/CMP.1 below Poland provides new information on how it is implementing its commitment under Article 3.14 of the Kyoto Protocol related to striving to implement its commitment under Article 3.1 of the Kyoto Protocol in such a way as to minimize potential adverse social, environmental and economic impacts on developing countries.

In 2014 the climate related activities, supported by the Ministry of Foreign Affairs in frames of bilateral co-operation, were realised covering 1.3 million EUR. About 51% of those funds was assigned to infrastructure projects, the remaining part supported activities aimed at capacity building. These projects were realised among others in the following countries: Armenia, Azerbaijan, Georgia, Kirgizstan, Tajikistan, Moldova, Ethiopia, Nigeria, Kenya, Uganda, Somalia. The projects cover climate change adaptation actions as well as mitigation ones in the areas of: irrigation and sewage treatment systems, energy efficiency and renewable energy sources or waste selection and treatment. The capacity building projects cover among others: education on environmental protection and limitation of deforestation, sustainable development at the local scale, flood warning systems.

ABBREVIATIONS

AR	Afforestation/ Reforestation
AWMS	Animal waste management system
BEF	Biomass expansion factor (LULUCF)
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
CRF	Common reporting format
DOC	Degradable organic component
D	Deforestation
ERT	Expert Review Team
FM	Forest management
FMRL	Forest Management Reference Level
GHG	Greenhouse Gases
HWP	Harvested wood products
IE	Included elsewhere
KOBiZE	National Centre for Emissions Management
LULUCF	Land use, land-use change and forestry
MCF	Methane correction factor (Waste)
MCF	Methane Conversion Factor (Agriculture)
MSW	Municipal solid waste
NA	Not applicable
NE	Not estimated
NO	Not occurring
NMVOC	Non-methane volatile organic compounds
SWDS	Solid waste disposal site

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EUROSTAT, EUROSTAT database

FAOSTAT, FAOSTAT database

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Annex 1. Key categories in 2014

The source/sink categories in all sectors, are identified to be key sources on the basis of their contribution to the total level and/or trend assessment. The methodology of reporting key categories is based on 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Approach 1.

Poland's key category analysis guides the inventory preparation and is used to set priorities for the development of more advanced methodologies.

From source categories which have been identified as key sources in level assessment, the biggest contributors of the GHG emissions are categories:
Energy Industries - Solid Fuels,
Road Transportation - Fossil Fuels,
Other Sectors - Solid Fuels.

Emission from abovementioned sources made up ca. 60% of the total GHG emissions in Poland expressed in units of CO_2 equivalents.

The biggest contributors of the GHG emissions in trend assessment are categories:
Road Transportation - Fossil Fuels,
Other Sectors - Solid Fuels,
Energy Industries - Solid Fuels.

Share of these sources made up 46% of the total GHG emissions in Poland (CO_2 equivalent).

As a result of analysis with use of qualitative criteria no additional categories were identified as key sources.

Summary of key category analysis with sector LULUCF in 2014

	IPCC Source Category Code	IPCC Source Categories	Classification	Greenhouse Gas	Identification criteria (Level, Trend, Qualitative)			Comments
1	1.A.1	Energy Industries	Solid Fuels	CO2	L	T		
2	1.A.3.b	Road Transportation	Fossil Fuels	CO2	L	T		
3	4.A	Forest Land	Carbon stock change	CO2	L	T		
4	1.A.4	Other Sectors	Solid Fuels	CO2	L	T		
5	1.A.2	Manufacturing Industries and Construction	Solid Fuels	CO2	L	T		
6	3.A	Enteric Fermentation	Farming	CH4	L	T		
7	1.B.1	Solid Fuels	Operation	CH4	L	T		
8	1.A.4	Other Sectors	Gaseous Fuels	CO2	L	T		
9	3.D	Agricultural Soils	Direct N2O Emissions From Managed Soils	N2O	L	T		
10	1.A.4	Other Sectors	Liquid Fuels	CO2	L	T		
11	5.A	Solid Waste Disposal	Waste	CH4	L	T		
12	2.F.1	Refrigeration and Air conditioning	no classification	Aggregate F-gases	L	T		
13	1.A.2	Manufacturing Industries and Construction	Gaseous Fuels	CO2	L	T		
14	2.A.1	Cement Production	no classification	CO2	L	T		
15	1.A.1	Energy Industries	Gaseous Fuels	CO2	L	T		
16	2.B.1	Ammonia Production	no classification	CO2	L	T		
17	4.D	Wetlands	Carbon stock change	CO2	L	T		
18	1.A.1	Energy Industries	Liquid Fuels	CO2	L	T		
19	4.A	Forest Land	Carbon stock change	CO2	L	T		
20	3.D	Agricultural Soils	Farming	N2O	L	T		
21	1.A.2	Manufacturing Industries and Construction	Other Fossil Fuels	CO2	L	T		
22	1.A.2	Manufacturing Industries and Construction	Liquid Fuels	CO2	L	T		
23	1.B.1	Solid Fuels	Operation	CO2	L	T		
24	1.A.2.a	Iron and Steel Production	no classification	CO2	L	T		
25	3.B	Manure Management	Farming	N2O	L			
26	2.D	Non-energy Products from Fuels and Solvent Use	no classification	CO2	L			
27	1.A.4	Other Sectors	Solid Fuels	CH4	L			
28	4.E	Settlements	Carbon stock change	CO2	L	T		
29	1.B.2	Other emissions from energy production	Operation	CO2	L	T		
30	2.B.2	Nitric Acid Production	no classification	N2O		T		
31	2.A.4	Other Process Uses of Carbonates	no classification	CO2		T		
32	1.B.2.c	Venting and Flaring	Operation	CH4		T		
33	5.D	Wastewater Treatment and Discharge	Wastewater	CH4		T		
34	1.A.3.c	Railways	Fossil Fuels	CO2		T		
35	1.A.1	Energy Industries	Other Fossil Fuels	CO2		T		

Summary of key category analysis without sector LULUCF in 2014

	IPCC Category Code	IPCC Source Categories	Classification	Greenhouse Gas	Identification criteria			Comments
1	1.A.1	Energy Industries	Solid Fuels	CO2	L	T		
2	1.A.3.b	Road Transportation	Fossil Fuels	CO2	L	T		
3	1.A.4	Other Sectors	Solid Fuels	CO2	L	T		
4	1.A.2	Manufacturing Industries and Construction	Solid Fuels	CO2	L	T		
5	3.A	Enteric Fermentation	Farming	CH4	L	T		
6	1.B.1	Solid Fuels	Operation	CH4	L	T		
7	1.A.4	Other Sectors	Gaseous Fuels	CO2	L	T		
8	3.D	Agricultural Soils	Direct N2O Emissions From Managed Soils	N2O	L	T		
9	1.A.4	Other Sectors	Liquid Fuels	CO2	L	T		
10	5.A	Solid Waste Disposal	Waste	CH4	L	T		
11	2.F.1	Refrigeration and Air conditioning	no classification	Aggregate F-gases	L	T		
12	1.A.2	Manufacturing Industries and Construction	Gaseous Fuels	CO2	L	T		
13	2.A.1	Cement Production	no classification	CO2	L	T		
14	1.A.1	Energy Industries	Gaseous Fuels	CO2	L	T		
15	2.B.1	Ammonia Production	no classification	CO2	L	T		
16	1.A.1	Energy Industries	Liquid Fuels	CO2	L	T		
17	1.A.2	Manufacturing Industries and Construction	Other Fossil Fuels	CO2	L	T		
18	3.D	Agricultural Soils	Farming	N2O	L			
19	1.B.1	Solid Fuels	Operation	CO2	L			
20	1.A.2	Manufacturing Industries and Construction	Liquid Fuels	CO2	L			
21	1.A.4	Other Sectors	Solid Fuels	CH4	L	T		
22	3.B	Manure Management	Farming	N2O	L			
23	2.D	Non-energy Products from Fuels and Solvent Use	no classification	CO2	L			
24	1.A.2.a	Iron and Steel Production	no classification	CO2	L	T		
25	2.A.4	Other Process Uses of Carbonates	no classification	CO2	L	T		
26	2.B.2	Nitric Acid Production	no classification	N2O		T		
27	1.B.2	Other emissions from energy production	Operation	CO2		T		
28	5.D	Wastewater Treatment and Discharge	Wastewater	CH4		T		
29	1.A.3.c	Railways	Fossil Fuels	CO2		T		
30	2.A.2	Lime Production	no classification	CO2		T		
31	1.B.2.c	Venting and Flaring	Operation	CH4		T		

Summary of key category analysis with sector LULUCF in 1988

	IPCC Category Code	IPCC Source Categories	Classification	Greenhouse Gas	Identification criteria (L - level, T - trend, Q - qualitative)			Comments
1	1.A.1	Energy Industries	Solid Fuels	CO2	L			
2	1.A.4	Other Sectors	Solid Fuels	CO2	L			
3	1.A.2	Manufacturing Industries and Construction	Solid Fuels	CO2	L			
4	1.B.1	Solid Fuels	Operation	CH4	L			
5	3.A	Enteric Fermentation	Farming	CH4	L			
6	4.A	Forest Land	Carbon stock change	CO2	L			
7	1.A.3.b	Road Transportation	Fossil Fuels	CO2	L			
8	3.D	Agricultural Soils	Direct N2O Emissions From Managed Soils	N2O	L			
9	5.A	Solid Waste Disposal	Waste	CH4	L			
10	1.A.1	Energy Industries	Liquid Fuels	CO2	L			
11	1.A.2	Manufacturing Industries and Construction	Gaseous Fuels	CO2	L			
12	2.A.1	Cement Production	no classification	CO2	L			
13	1.A.2.a	Iron and Steel Production	no classification	CO2	L			
14	1.A.4	Other Sectors	Gaseous Fuels	CO2	L			
15	1.A.4	Other Sectors	Liquid Fuels	CO2	L			
16	1.A.2	Manufacturing Industries and Construction	Liquid Fuels	CO2	L			
17	1.A.4	Other Sectors	Solid Fuels	CH4	L			
18	2.B.1	Ammonia Production	no classification	CO2	L			
19	2.B.2	Nitric Acid Production	no classification	N2O	L			
20	4.D	Wetlands	Carbon stock change	CO2	L			
21	3.D	Agricultural Soils	Farming	N2O	L			
22	2.A.2	Lime Production	no classification	CO2	L			
23	3.B	Manure Management	Farming	N2O	L			
24	2.D	Non-energy Products from Fuels and Solvent Use	no classification	CO2	L			
25	1.A.3.c	Railways	Fossil Fuels	CO2	L			

Summary of key category analysis without sector LULUCF in 1988

	IPCC Category Code	IPCC Source Categories	Classification	Greenhouse Gas	Identification criteria (L - level, T - trend, Q - qualitative)			Comments
1	1.A.1	Energy Industries	Solid Fuels	CO2	L			
2	1.A.4	Other Sectors	Solid Fuels	CO2	L			
3	1.A.2	Manufacturing Industries and Construction	Solid Fuels	CO2	L			
4	1.B.1	Solid Fuels	Operation	CH4	L			
5	3.A	Enteric Fermentation	Farming	CH4	L			
6	1.A.3.b	Road Transportation	Fossil Fuels	CO2	L			
7	3.D	Agricultural Soils	Direct N2O Emissions From Managed Soils	N2O	L			
8	5.A	Solid Waste Disposal	Waste	CH4	L			
9	1.A.2	Manufacturing Industries and Construction	Gaseous Fuels	CO2	L			
10	1.A.1	Energy Industries	Liquid Fuels	CO2	L			
11	2.A.1	Cement Production	no classification	CO2	L			
12	1.A.2.a	Iron and Steel Production	no classification	CO2	L			
13	1.A.4	Other Sectors	Gaseous Fuels	CO2	L			
14	1.A.4	Other Sectors	Liquid Fuels	CO2	L			
15	1.A.2	Manufacturing Industries and Construction	Liquid Fuels	CO2	L			
16	1.A.4	Other Sectors	Solid Fuels	CH4	L			
17	2.B.1	Ammonia Production	no classification	CO2	L			
18	2.B.2	Nitric Acid Production	no classification	N2O	L			
19	3.D	Agricultural Soils	Farming	N2O	L			
20	2.A.2	Lime Production	no classification	CO2	L			
21	3.B	Manure Management	Farming	N2O	L			
22	2.D	Non-energy Products from Fuels and Solvent Use	no classification	CO2	L			

Level Assessment without category 4 in year 2014

	IPCC Source Category Code	IPCC Source Categories	Classification	Direct GHG	Level Assessment	Cumulative Total
1	1.A.1	Energy Industries	Solid Fuels	CO2	0.396	0.40
2	1.A.3.b	Road Transportation	Fossil Fuels	CO2	0.111	0.51
3	1.A.4	Other Sectors	Solid Fuels	CO2	0.083	0.59
4	1.A.2	Manufacturing Industries and Construction	Solid Fuels	CO2	0.045	0.64
5	3.A	Enteric Fermentation	Farming	CH4	0.032	0.67
6	1.B.1	Solid Fuels	Operation	CH4	0.031	0.70
7	1.A.4	Other Sectors	Gaseous Fuels	CO2	0.03	0.73
8	3.D	Agricultural Soils	Direct N2O Emissions From Managed Soils	N2O	0.028	0.76
9	1.A.4	Other Sectors	Liquid Fuels	CO2	0.023	0.78
10	5.A	Solid Waste Disposal	Waste	CH4	0.023	0.80
11	2.F.1	Refrigeration and Air conditioning	no classification	Aggregate F-gases	0.021	0.82
12	1.A.2	Manufacturing Industries and Construction	Gaseous Fuels	CO2	0.02	0.84
13	2.A.1	Cement Production	no classification	CO2	0.017	0.86
14	1.A.1	Energy Industries	Gaseous Fuels	CO2	0.015	0.88
15	2.B.1	Ammonia Production	no classification	CO2	0.012	0.89
16	1.A.1	Energy Industries	Liquid Fuels	CO2	0.008	0.90
17	1.A.2	Manufacturing Industries and Construction	Other Fossil Fuels	CO2	0.007	0.90
18	3.D	Agricultural Soils	Farming	N2O	0.007	0.91
19	1.B.1	Solid Fuels	Operation	CO2	0.007	0.92
20	1.A.2	Manufacturing Industries and Construction	Liquid Fuels	CO2	0.006	0.92
21	1.A.4	Other Sectors	Solid Fuels	CH4	0.006	0.93
22	3.B	Manure Management	Farming	N2O	0.006	0.93
23	2.D	Non-energy Products from Fuels and Solvent Use	no classification	CO2	0.006	0.94
24	1.A.2.a	Iron and Steel Production	no classification	CO2	0.005	0.95
25	2.A.4	Other Process Uses of Carbonates	no classification	CO2	0.005	0.95

Level Assessment without category 4 in year 1988

	IPCC Source Category Code	IPCC Source Categories	Classification	Direct GHG	Level Assessment	Cumulative Total
1	1.A.1	Energy Industries	Solid Fuels	CO2	0.424	0.42
2	1.A.4	Other Sectors	Solid Fuels	CO2	0.157	0.58
3	1.A.2	Manufacturing Industries and Construction	Solid Fuels	CO2	0.069	0.65
4	1.B.1	Solid Fuels	Operation	CH4	0.055	0.71
5	3.A	Enteric Fermentation	Farming	CH4	0.038	0.74
6	1.A.3.b	Road Transportation	Fossil Fuels	CO2	0.036	0.78
7	3.D	Agricultural Soils	Direct N2O Emissions From Managed Soils	N2O	0.024	0.80
8	5.A	Solid Waste Disposal	Waste	CH4	0.018	0.82
9	1.A.2	Manufacturing Industries and Construction	Gaseous Fuels	CO2	0.014	0.84
10	1.A.1	Energy Industries	Liquid Fuels	CO2	0.013	0.85
11	2.A.1	Cement Production	no classification	CO2	0.012	0.86
12	1.A.2.a	Iron and Steel Production	no classification	CO2	0.012	0.87
13	1.A.4	Other Sectors	Gaseous Fuels	CO2	0.011	0.88
14	1.A.4	Other Sectors	Liquid Fuels	CO2	0.009	0.89
15	1.A.2	Manufacturing Industries and Construction	Liquid Fuels	CO2	0.009	0.90
16	1.A.4	Other Sectors	Solid Fuels	CH4	0.008	0.91
17	2.B.1	Ammonia Production	no classification	CO2	0.008	0.92
18	2.B.2	Nitric Acid Production	no classification	N2O	0.007	0.92
19	3.D	Agricultural Soils	Farming	N2O	0.006	0.93
20	2.A.2	Lime Production	no classification	CO2	0.006	0.94
21	3.B	Manure Management	Farming	N2O	0.006	0.94
22	2.D	Non-energy Products from Fuels and Solvent Use	no classification	CO2	0.006	0.95

Level Assessment with category 4 in year 2014

	IPCC Source Category Code	IPCC Source Categories	Classification	Direct GHG	Level Assessment	Cumulative Total
1	1.A.1	Energy Industries	Solid Fuels	CO2	0.356	0.36
2	1.A.3.b	Road Transportation	Fossil Fuels	CO2	0.1	0.46
3	4.A	Forest Land	Carbon stock change	CO2	0.075	0.53
4	1.A.4	Other Sectors	Solid Fuels	CO2	0.075	0.61
5	1.A.2	Manufacturing Industries and Construction	Solid Fuels	CO2	0.04	0.65
6	3.A	Enteric Fermentation	Farming	CH4	0.029	0.68
7	1.B.1	Solid Fuels	Operation	CH4	0.028	0.70
8	1.A.4	Other Sectors	Gaseous Fuels	CO2	0.027	0.73
9	3.D	Agricultural Soils	Direct N2O Emissions From Managed Soils	N2O	0.026	0.76
10	1.A.4	Other Sectors	Liquid Fuels	CO2	0.02	0.78
11	5.A	Solid Waste Disposal	Waste	CH4	0.02	0.80
12	2.F.1	Refrigeration and Air conditioning	no classification	Aggregate F-gases	0.019	0.82
13	1.A.2	Manufacturing Industries and Construction	Gaseous Fuels	CO2	0.018	0.83
14	2.A.1	Cement Production	no classification	CO2	0.015	0.85
15	1.A.1	Energy Industries	Gaseous Fuels	CO2	0.013	0.86
16	2.B.1	Ammonia Production	no classification	CO2	0.011	0.87
17	4.D	Wetlands	Carbon stock change	CO2	0.011	0.88
18	1.A.1	Energy Industries	Liquid Fuels	CO2	0.008	0.89
19	4.A	Forest Land	Carbon stock change	CO2	0.007	0.90
20	3.D	Agricultural Soils	Farming	N2O	0.006	0.90
21	1.A.2	Manufacturing Industries and Construction	Other Fossil Fuels	CO2	0.006	0.91
22	1.A.2	Manufacturing Industries and Construction	Liquid Fuels	CO2	0.006	0.92
23	1.B.1	Solid Fuels	Operation	CO2	0.006	0.92
24	1.A.2.a	Iron and Steel Production	no classification	CO2	0.005	0.93
25	3.B	Manure Management	Farming	N2O	0.005	0.93
26	2.D	Non-energy Products from Fuels and Solvent Use	no classification	CO2	0.005	0.94
27	1.A.4	Other Sectors	Solid Fuels	CH4	0.005	0.94
28	4.E	Settlements	Carbon stock change	CO2	0.005	0.95
29	1.B.2	Other emissions from energy production	Operation	CO2	0.004	0.95

Level Assessment with category 4 in year 1988

	IPCC Source Category Code	IPCC Source Categories	Classification	Direct GHG	Level Assessment	Cumulative Total
1	1.A.1	Energy Industries	Solid Fuels	CO2	0.403	0.40
2	1.A.4	Other Sectors	Solid Fuels	CO2	0.15	0.55
3	1.A.2	Manufacturing Industries and Construction	Solid Fuels	CO2	0.065	0.62
4	1.B.1	Solid Fuels	Operation	CH4	0.053	0.67
5	3.A	Enteric Fermentation	Farming	CH4	0.036	0.71
6	4.A	Forest Land	Carbon stock change	CO2	0.035	0.74
7	1.A.3.b	Road Transportation	Fossil Fuels	CO2	0.034	0.78
8	3.D	Agricultural Soils	Direct N2O Emissions From Managed Soils	N2O	0.023	0.80
9	5.A	Solid Waste Disposal	Waste	CH4	0.017	0.82
10	1.A.1	Energy Industries	Liquid Fuels	CO2	0.013	0.83
11	1.A.2	Manufacturing Industries and Construction	Gaseous Fuels	CO2	0.013	0.84
12	2.A.1	Cement Production	no classification	CO2	0.012	0.85
13	1.A.2.a	Iron and Steel Production	no classification	CO2	0.011	0.87
14	1.A.4	Other Sectors	Gaseous Fuels	CO2	0.011	0.88
15	1.A.4	Other Sectors	Liquid Fuels	CO2	0.009	0.89
16	1.A.2	Manufacturing Industries and Construction	Liquid Fuels	CO2	0.008	0.89
17	1.A.4	Other Sectors	Solid Fuels	CH4	0.008	0.90
18	2.B.1	Ammonia Production	no classification	CO2	0.007	0.91
19	2.B.2	Nitric Acid Production	no classification	N2O	0.007	0.92
20	4.D	Wetlands	Carbon stock change	CO2	0.007	0.92
21	3.D	Agricultural Soils	Farming	N2O	0.006	0.93
22	2.A.2	Lime Production	no classification	CO2	0.006	0.93
23	3.B	Manure Management	Farming	N2O	0.005	0.94
24	2.D	Non-energy Products from Fuels and Solvent Use	no classification	CO2	0.005	0.94
25	1.A.3.c	Railways	Fossil Fuels	CO2	0.005	0.95

Trend Assessment without category 4 in 2014

	IPCC Source Category Code	IPCC Source Categories	Classification	Direct GHG	Trend Assessment	Cumulative Total
1	1.A.3.b	Road Transportation	Fossil Fuels	CO2	0.049	0.19
2	1.A.4	Other Sectors	Solid Fuels	CO2	0.048	0.38
3	1.A.1	Energy Industries	Solid Fuels	CO2	0.018	0.46
4	1.A.2	Manufacturing Industries and Construction	Solid Fuels	CO2	0.016	0.52
5	1.B.1	Solid Fuels	Operation	CH4	0.016	0.58
6	2.F.1	Refrigeration and Air conditioning	no classification	Aggregate F-gases	0.014	0.64
7	1.A.4	Other Sectors	Gaseous Fuels	CO2	0.012	0.69
8	1.A.4	Other Sectors	Liquid Fuels	CO2	0.009	0.72
9	1.A.1	Energy Industries	Gaseous Fuels	CO2	0.007	0.75
10	3.A	Enteric Fermentation	Farming	CH4	0.004	0.77
11	1.A.2	Manufacturing Industries and Construction	Gaseous Fuels	CO2	0.004	0.78
12	1.A.2.a	Iron and Steel Production	no classification	CO2	0.004	0.80
13	2.B.2	Nitric Acid Production	no classification	N2O	0.004	0.81
14	3.D	Agricultural Soils	Direct N2O Emissions From Managed Soils	N2O	0.003	0.83
15	5.A	Solid Waste Disposal	Waste	CH4	0.003	0.84
16	2.A.1	Cement Production	no classification	CO2	0.003	0.85
17	2.B.1	Ammonia Production	no classification	CO2	0.003	0.86
18	1.A.1	Energy Industries	Liquid Fuels	CO2	0.003	0.87
19	1.B.2	Other emissions from energy production	Operation	CO2	0.003	0.88
20	5.D	Wastewater Treatment and Discharge	Wastewater	CH4	0.003	0.90
21	1.A.3.c	Railways	Fossil Fuels	CO2	0.003	0.91
22	1.A.2	Manufacturing Industries and Construction	Other Fossil Fuels	CO2	0.002	0.92
23	1.A.4	Other Sectors	Solid Fuels	CH4	0.002	0.92
24	2.A.4	Other Process Uses of Carbonates	no classification	CO2	0.002	0.93
25	2.A.2	Lime Production	no classification	CO2	0.002	0.94
26	1.B.2.c	Venting and Flaring	Operation	CH4	0.002	0.95

Trend Assessment with category 4 in 2014

	IPCC Source Category Code	IPCC Source Categories	Classification	Direct GHG	Trend Assessment	Cumulative Total
1	1.A.3.b	Road Transportation	Fossil Fuels	CO2	0.048	0.21
2	1.A.4	Other Sectors	Solid Fuels	CO2	0.041	0.38
3	1.A.2	Manufacturing Industries and Construction	Solid Fuels	CO2	0.013	0.44
4	1.B.1	Solid Fuels	Operation	CH4	0.013	0.50
5	2.F.1	Refrigeration and Air conditioning	no classification	Aggregate F-gases	0.013	0.55
6	1.A.4	Other Sectors	Gaseous Fuels	CO2	0.012	0.60
7	1.A.4	Other Sectors	Liquid Fuels	CO2	0.009	0.64
8	1.A.1	Energy Industries	Gaseous Fuels	CO2	0.007	0.67
9	1.A.1	Energy Industries	Solid Fuels	CO2	0.004	0.69
10	4.A	Forest Land	Carbon stock change	CO2	0.004	0.71
11	1.A.2	Manufacturing Industries and Construction	Gaseous Fuels	CO2	0.004	0.72
12	4.A	Forest Land	Carbon stock change	CO2	0.004	0.74
13	1.A.2.a	Iron and Steel Production	no classification	CO2	0.004	0.76
14	2.B.2	Nitric Acid Production	no classification	N2O	0.004	0.78
15	3.D	Agricultural Soils	Direct N2O Emissions From Managed Soils	N2O	0.003	0.79
16	5.A	Solid Waste Disposal	Waste	CH4	0.003	0.80
17	2.A.1	Cement Production	no classification	CO2	0.003	0.81
18	2.B.1	Ammonia Production	no classification	CO2	0.003	0.83
19	4.D	Wetlands	Carbon stock change	CO2	0.003	0.84
20	1.A.1	Energy Industries	Liquid Fuels	CO2	0.003	0.85
21	4.E	Settlements	Carbon stock change	CO2	0.003	0.87
22	1.B.2	Other emissions from energy production	Operation	CO2	0.003	0.88
23	3.A	Enteric Fermentation	Farming	CH4	0.002	0.89
24	1.A.2	Manufacturing Industries and Construction	Other Fossil Fuels	CO2	0.002	0.90
25	2.A.4	Other Process Uses of Carbonates	no classification	CO2	0.002	0.91
26	1.B.2.c	Venting and Flaring	Operation	CH4	0.002	0.91
27	5.D	Wastewater Treatment and Discharge	Wastewater	CH4	0.002	0.92
28	1.A.3.c	Railways	Fossil Fuels	CO2	0.002	0.93
29	1.A.1	Energy Industries	Other Fossil Fuels	CO2	0.002	0.94
30	3.D	Agricultural Soils	Farming	N2O	0.001	0.94
31	1.A.2	Manufacturing Industries and Construction	Liquid Fuels	CO2	0.001	0.95
32	1.B.1	Solid Fuels	Operation	CO2	0.001	0.95

Annex 2. Fuel consumption and GHG emission factors from selected categories of CRF sector 1.A

Table 1. Fuel consumption [PJ] in 1.A.1.a category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	1752.496	1719.899	1597.240	1574.444	1504.529	1364.716	1317.391	1205.058	1267.444	1221.134	1155.693
Lignite	568.786	575.819	555.587	561.502	548.623	550.751	539.277	529.124	533.077	530.661	535.230
Hard coal briquettes (patent fuels)	5.001	3.888	2.520	0.322	0.117	0.059	0.059	0.000	0.000	0.059	0.000
Brown coal briquettes	0.354	0.247	0.140	0.060	0.200	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	21.274	21.900	21.641	16.329	9.561	3.107	4.094	4.738	7.156	7.949	10.768
Fuel wood and wood waste	16.695	15.123	14.571	14.384	17.265	13.783	14.051	1.322	2.656	3.293	3.673
Biogas	0.004	0.006	0.014	0.003	0.024	0.000	0.006	0.125	0.137	0.088	0.204
Industrial wastes	3.741	3.873	5.265	8.914	7.354	6.658	6.876	3.878	3.393	3.267	0.550
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	13.591	12.561	12.626	12.967	10.944	8.864	7.524	7.239	6.954	5.301	4.076
Liquid petroleum gas (LPG)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.046	0.184
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.767	0.724	0.601	0.601	0.558	0.429	0.387	0.343	1.158	1.674	1.545
Fuel oil	73.080	70.760	65.360	61.280	56.400	55.080	55.600	25.840	27.720	27.280	17.600
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	1.287	1.188	0.990	0.742	0.644	0.842	1.238	0.050	0.000	0.000	0.000
Coke oven gas	5.568	6.565	7.125	7.555	8.863	8.144	13.147	12.828	13.975	16.450	13.697
Blast furnace gas	28.221	26.733	22.377	12.797	13.378	10.239	13.190	5.905	3.218	3.306	3.060
Gas works gas	0.659	0.579	0.167	0.129	0.335	0.085	0.037	0.021	0.004	0.002	3.259
Fuels											
Liquid fuels	75.134	72.672	66.951	62.623	57.602	56.351	57.225	26.233	28.878	29.000	19.329
Gaseous fuels	21.274	21.900	21.641	16.329	9.561	3.107	4.094	4.738	7.156	7.949	10.768
Solid fuels	2374.674	2346.290	2197.782	2169.776	2086.989	1942.858	1890.625	1760.175	1824.672	1776.913	1715.015
Other fuels	3.741	3.873	5.265	8.914	7.354	6.658	6.876	3.878	3.393	3.267	0.550
Biomass	16.699	15.129	14.585	14.387	17.289	13.783	14.057	1.447	2.793	3.381	3.877
Total	**2491.522**	**2459.864**	**2306.224**	**2272.029**	**2178.795**	**2022.757**	**1972.877**	**1796.471**	**1866.892**	**1820.510**	**1749.539**

Table 1. (cont.) Fuel consumption [PJ] in 1.A.1.a category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	1125.965	1118.163	1127.286	1091.937	1144.769	1122.123	1105.919	1159.978	1148.642	1060.617	1033.585
Lignite	521.068	504.999	512.219	494.038	518.250	514.275	533.979	525.818	501.140	521.178	494.048
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	16.210	21.627	28.242	38.700	45.496	53.667	57.039	52.808	49.691	51.163	51.652
Fuel wood and wood waste	3.398	3.461	4.886	4.809	5.799	8.905	17.500	21.180	25.181	37.976	54.823
Biogas	0.349	0.443	0.563	0.615	0.843	1.293	1.820	2.021	1.515	2.025	2.199
Industrial wastes	0.575	0.883	1.031	1.520	0.372	0.407	0.483	0.427	0.440	0.209	0.314
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.384	0.368
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	2.850	1.995	1.710	1.254	0.912	0.598	0.342	0.171	0.142	0.086	0.056
Liquid petroleum gas (LPG)	0.230	0.184	0.184	0.184	0.046	0.000	0.000	0.000	0.000	0.000	0.000
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	1.588	1.973	2.059	2.317	2.188	1.545	1.201	1.159	0.730	0.815	0.952
Fuel oil	16.720	13.680	14.680	13.200	11.920	10.040	8.080	7.960	7.320	7.400	6.680
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	16.077	17.094	17.079	16.420	18.032	16.955	14.373	18.322	16.024	16.765	13.112
Blast furnace gas	3.286	4.317	4.976	4.783	5.715	6.665	4.146	8.323	6.395	10.204	7.730
Gas works gas	2.507	2.390	2.338	3.109	2.592	3.631	4.736	4.778	4.463	4.502	4.828
Fuels											
Liquid fuels	18.538	15.837	16.923	15.701	14.154	11.585	9.281	9.119	8.050	8.215	7.632
Gaseous fuels	16.210	21.627	28.242	38.700	45.496	53.667	57.039	52.808	49.691	51.163	51.652
Solid fuels	1671.753	1648.958	1665.608	1611.570	1690.270	1664.247	1663.495	1717.390	1676.806	1613.352	1553.359
Other fuels	0.575	0.883	1.031	1.520	0.372	0.407	0.483	0.427	0.440	0.593	0.682
Biomass	3.747	3.904	5.449	5.424	6.642	10.198	19.320	23.201	26.696	40.001	57.022
Total	**1710.823**	**1691.209**	**1717.253**	**1672.915**	**1756.934**	**1740.104**	**1749.618**	**1802.945**	**1761.683**	**1713.324**	**1670.347**

Table 1. (cont.) Fuel consumption [PJ] in 1.A.1.a category

Fuels	2010	2011	2012	2013	2014
Hard coal	1095.945	1054.878	990.212	993.766	920.138
Lignite	477.467	517.018	527.314	539.685	513.429
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	52.286	57.961	61.963	53.395	52.017
Fuel wood and wood waste	65.114	78.589	105.585	87.694	96.989
Biogas	2.778	3.328	4.219	4.887	5.732
Industrial wastes	0.442	0.458	0.420	0.381	0.470
Municipal waste - non-biogenic fraction	0.367	0.403	0.371	0.337	0.343
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.016
Other petroleum products	0.060	0.000	0.031	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000
Coke	0.057	0.028	0.028	0.028	0.028
Liquid petroleum gas (LPG)	0.000	0.000	0.000	0.000	0.000
Motor gasoline	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.866	1.040	0.823	0.909	0.866
Fuel oil	7.360	7.000	6.320	5.560	4.600
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000
Coke oven gas	18.611	16.640	15.993	17.867	17.789
Blast furnace gas	9.954	11.001	11.328	11.729	13.937
Gas works gas	5.072	5.357	5.202	5.307	5.069
Fuels					
Liquid fuels	8.286	8.040	7.174	6.469	5.466
Gaseous fuels	52.286	57.961	61.963	53.395	52.017
Solid fuels	1607.106	1604.922	1550.077	1568.382	1470.390
Other fuels	0.809	0.861	0.791	0.718	0.813
Biomass	67.892	81.917	109.804	92.581	102.737
Total	**1736.379**	**1753.701**	**1729.809**	**1721.545**	**1631.423**

Table 2. Fuel consumption [PJ] in 1.A.1.b category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	0.114	0.113	0.046	0.090	0.069	0.245	0.068	1.302	1.451	1.349	0.629
Lignite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	2.395	2.396	1.671	1.539	1.508	1.608	1.591	1.562	1.749	2.529	8.244
Fuel wood and wood waste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	7.724	7.487	5.222	0.272	0.682	0.002	0.259	1.919	0.350	0.163	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.520	1.080	0.880
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	0.028	0.028	0.000	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Liquid petroleum gas (LPG)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.046	0.092
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.000	0.000	0.043	0.043	0.000	0.086	0.086	0.172	0.172	0.214	0.343
Fuel oil	14.800	13.800	11.440	10.560	15.760	12.800	11.960	32.400	40.520	32.200	39.840
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	8.860	9.306	7.474	7.623	8.514	9.256	10.444	12.028	8.960	10.197	6.286
Coke oven gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.081
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fuels											
Liquid fuels	23.660	23.106	18.957	18.226	24.274	22.142	22.490	44.600	50.172	43.737	47.441
Gaseous fuels	2.395	2.396	1.671	1.539	1.508	1.608	1.591	1.562	1.749	2.529	8.244
Solid fuels	0.142	0.140	0.046	0.118	0.069	0.245	0.068	1.302	1.451	1.349	0.710
Other fuels	7.724	7.487	5.222	0.272	0.682	0.002	0.259	1.919	0.350	0.163	0.000
Biomass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	**33.921**	**33.129**	**25.896**	**20.155**	**26.533**	**23.997**	**24.408**	**49.383**	**53.722**	**47.778**	**56.395**

Table 2. (cont.) Fuel consumption [PJ] in 1.A.1.b category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	0.586	0.208	0.070	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.113
Lignite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	10.832	12.110	11.354	10.124	12.770	15.454	14.482	14.900	20.816	18.816	17.511
Fuel wood and wood waste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.310	0.219	0.095	0.253	0.176	0.221	0.285	0.224	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	1.720	0.000	0.040	0.040	0.040	0.360	0.320	0.440	0.360	0.672	0.986
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Liquid petroleum gas (LPG)	0.184	0.276	0.000	0.046	0.092	0.000	0.000	0.000	0.000	0.000	0.000
Motor gasoline	0.090	0.135	0.000	0.000	0.135	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.043	0.000	0.000	0.000	0.000
Diesel oil	0.086	1.373	0.386	0.858	0.343	0.987	0.300	0.729	0.172	0.429	0.216
Fuel oil	35.080	36.160	42.280	42.560	43.520	42.880	42.560	41.720	44.080	43.560	44.160
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	6.386	9.058	10.444	10.048	10.048	11.632	10.692	12.969	16.582	17.424	15.246
Coke oven gas	0.051	0.069	0.070	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fuels											
Liquid fuels	43.546	47.002	53.150	53.552	54.178	55.859	53.915	55.858	61.194	62.085	60.608
Gaseous fuels	10.832	12.110	11.354	10.124	12.770	15.454	14.482	14.900	20.816	18.816	17.511
Solid fuels	0.637	0.277	0.140	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.113
Other fuels	0.310	0.219	0.095	0.253	0.176	0.221	0.285	0.224	0.000	0.000	0.000
Biomass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	**55.325**	**59.608**	**64.739**	**63.952**	**67.124**	**71.534**	**68.682**	**70.982**	**82.010**	**80.901**	**78.232**

Table 2. (cont.) Fuel consumption [PJ] in 1.A.1.b category

Fuels	2010	2011	2012	2013	2014
Hard coal	0.114	0.114	0.091	0.113	0.158
Lignite	0.000	0.050	0.022	0.063	0.023
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	19.363	27.468	30.638	34.779	35.103
Fuel wood and wood waste	0.000	0.000	0.000	0.000	0.000
Biogas	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.450	0.660	1.271	0.992	0.960
Petroleum coke	0.000	0.000	0.000	0.000	0.000
Coke	0.000	0.000	0.000	0.000	0.000
Liquid petroleum gas (LPG)	0.000	0.092	0.092	0.092	0.138
Motor gasoline	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.130	0.173	0.130	0.043	0.087
Fuel oil	46.560	39.280	31.400	22.200	21.640
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	22.869	21.532	28.215	20.988	15.444
Coke oven gas	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.000	0.000	0.000	0.000	0.000
Fuels					
Liquid fuels	70.009	61.737	61.108	44.315	38.269
Gaseous fuels	19.363	27.468	30.638	34.779	35.103
Solid fuels	0.114	0.164	0.113	0.176	0.181
Other fuels	0.000	0.000	0.000	0.000	0.000
Biomass	0.000	0.000	0.000	0.000	0.000
Total	**89.486**	**89.369**	**91.859**	**79.270**	**73.553**

Table 3. Fuel consumption [PJ] in 1.A.1.c category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	12.314	10.347	10.425	7.912	6.205	23.487	57.593	58.698	59.891	56.159	53.263
Lignite	0.416	0.057	0.078	0.132	0.073	0.322	0.303	0.336	0.370	0.333	0.296
Hard coal briquettes (patent fuels)	0.023	0.000	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.035	0.018	0.020	0.020	0.000	0.040	0.020	0.020	0.040	0.040	0.020
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080	0.082	0.083
Natural gas	13.736	15.364	12.371	12.432	14.665	12.354	17.401	14.850	23.269	21.155	17.779
Fuel wood and wood waste	0.018	0.001	0.006	0.000	0.004	0.008	0.011	0.003	0.003	0.003	0.003
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.011	0.028	0.023
Industrial wastes	0.046	0.001	0.000	0.000	0.000	0.311	0.235	0.184	0.158	0.138	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080	0.080	0.040
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	1.173	0.522	0.619	0.538	0.284	0.513	1.226	0.884	0.598	0.142	0.086
Liquid petroleum gas (LPG)	0.092	0.092	0.092	0.092	0.092	0.046	0.046	0.046	0.046	0.000	0.046
Motor gasoline	0.088	0.088	0.090	0.090	0.090	0.180	0.314	0.269	0.090	0.090	0.045
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	2.130	1.960	1.845	2.145	2.274	4.418	3.560	3.775	3.260	2.832	2.231
Fuel oil	0.240	0.040	0.040	0.040	0.080	0.360	0.280	0.160	0.160	0.080	0.520
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	50.866	50.938	43.557	38.488	39.121	34.604	40.489	37.038	35.105	37.000	33.709
Blast furnace gas	5.632	4.440	3.961	1.995	1.430	2.123	2.488	1.954	1.582	1.893	1.695
Gas works gas	0.005	0.008	0.005	0.180	0.010	0.120	0.000	0.006	0.061	0.019	0.168
Fuels											
Liquid fuels	2.550	2.180	2.067	2.367	2.536	5.004	4.200	4.250	3.716	3.164	2.965
Gaseous fuels	13.736	15.364	12.371	12.432	14.665	12.354	17.401	14.850	23.269	21.155	17.779
Solid fuels	70.465	66.330	58.694	49.265	47.123	61.209	102.119	98.936	97.647	95.586	89.237
Other fuels	0.046	0.001	0.000	0.000	0.000	0.311	0.235	0.184	0.158	0.138	0.000
Biomass	0.018	0.001	0.006	0.000	0.004	0.008	0.011	0.004	0.014	0.031	0.026
Total	**86.815**	**83.875**	**73.138**	**64.064**	**64.328**	**78.886**	**123.966**	**118.224**	**124.804**	**120.074**	**110.007**

Table 3. (cont.) Fuel consumption [PJ] in 1.A.1.c category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	44.994	34.648	32.658	16.819	19.618	13.900	12.331	9.542	19.965	14.265	9.458
Lignite	0.286	0.420	0.307	1.000	0.625	0.542	0.175	0.204	1.380	1.766	0.908
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.020	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.083	0.041	0.000	0.041	0.128	0.126	0.000	0.000	0.000	0.000	0.000
Natural gas	19.458	19.491	12.986	12.515	9.741	11.190	10.106	10.363	9.680	9.239	8.858
Fuel wood and wood waste	0.005	0.006	0.039	0.029	0.008	0.004	0.002	0.011	0.057	0.020	0.134
Biogas	0.022	0.027	0.012	0.018	0.018	0.016	0.012	0.015	0.028	0.017	0.003
Industrial wastes	0.000	0.010	0.008	0.005	0.013	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.004	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.080	0.080	0.000	0.040	0.040	0.040	0.080	0.040	0.040	0.032	0.029
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	0.028	0.171	0.028	0.000	0.114	0.057	0.028	0.000	0.028	0.656	0.000
Liquid petroleum gas (LPG)	0.046	0.000	0.000	0.000	0.000	0.000	0.000	0.046	0.046	0.000	0.046
Motor gasoline	0.045	0.045	0.045	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	1.802	1.802	1.587	1.244	1.244	1.115	1.330	1.287	1.244	1.373	1.516
Fuel oil	0.160	0.240	0.080	0.360	0.240	0.160	0.280	0.040	0.160	0.040	0.040
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	29.872	32.634	33.111	32.027	36.094	36.410	32.796	36.410	43.722	44.789	32.527
Blast furnace gas	0.847	0.840	0.149	0.086	0.021	0.030	0.042	0.045	0.037	0.000	0.000
Gas works gas	0.168	0.004	0.004	0.004	0.004	0.004	0.003	0.004	0.005	0.006	0.012
Fuels											
Liquid fuels	2.216	2.208	1.712	1.730	1.652	1.441	1.690	1.413	1.490	1.445	1.631
Gaseous fuels	19.458	19.491	12.986	12.515	9.741	11.190	10.106	10.363	9.680	9.239	8.858
Solid fuels	76.215	68.737	66.257	49.936	56.476	50.943	45.375	46.205	65.137	61.482	42.905
Other fuels	0.000	0.014	0.008	0.005	0.013	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	0.027	0.037	0.052	0.047	0.026	0.020	0.014	0.026	0.085	0.037	0.137
Total	**97.916**	**90.487**	**81.015**	**64.233**	**67.908**	**63.594**	**57.185**	**58.007**	**76.392**	**72.203**	**53.531**

Table 3. (cont.) Fuel consumption [PJ] in 1.A.1.c category

Fuels	2010	2011	2012	2013	2014
Hard coal	2.221	4.534	2.482	2.184	2.473
Lignite	1.442	1.666	0.728	0.221	0.283
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	10.321	9.805	11.205	12.013	12.788
Fuel wood and wood waste	0.349	0.162	0.160	0.122	0.039
Biogas	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.002	0.010	0.001	0.002	0.002
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.030	0.060	0.062	0.032	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000
Coke	0.000	0.057	0.000	0.000	0.000
Liquid petroleum gas (LPG)	0.000	0.000	0.000	0.000	0.000
Motor gasoline	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000
Diesel oil	1.645	2.079	1.472	1.819	1.429
Fuel oil	0.080	0.040	0.040	0.040	0.000
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000
Coke oven gas	43.667	41.153	38.653	40.220	40.298
Blast furnace gas	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.012	0.009	0.012	0.008	0.001
Fuels					
Liquid fuels	1.755	2.179	1.574	1.891	1.429
Gaseous fuels	10.321	9.805	11.205	12.013	12.788
Solid fuels	47.342	47.419	41.875	42.633	43.055
Other fuels	0.002	0.010	0.001	0.002	0.002
Biomass	0.349	0.162	0.160	0.122	0.039
Total	**59.769**	**59.575**	**54.815**	**56.661**	**57.313**

Table 4. Fuel consumption [PJ] in 1.A.2.a category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	2.367	1.278	1.138	1.243	1.494	9.159	8.513	25.320	28.922	23.636	21.085
Lignite	0.000	0.000	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.009	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	73.507	63.332	52.851	33.974	26.568	25.562	25.487	24.239	25.898	28.278	23.993
Fuel wood and wood waste	0.000	0.000	0.000	0.000	0.000	0.016	0.014	0.005	0.006	0.004	0.006
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	3.158	3.344	4.079	6.756	6.497	4.272	3.757	2.941	0.498	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	12.258	7.268	9.076	19.909	22.910	28.028	34.566	28.031	25.180	29.632	24.400
Liquid petroleum gas (LPG)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.046	0.000
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.128	0.128	0.172	0.129	0.172	0.343	0.558	0.772	0.901	0.558	0.300
Fuel oil	18.120	15.400	11.000	7.800	5.280	4.280	2.960	2.040	0.960	4.720	1.600
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	32.570	30.997	26.038	22.090	22.568	21.604	25.480	27.686	24.404	24.257	24.742
Blast furnace gas	43.812	40.192	36.484	27.903	25.909	25.676	28.350	37.610	34.205	36.120	29.520
Gas works gas	4.316	3.219	2.174	1.462	0.718	0.613	0.067	0.068	0.080	0.058	0.007
Fuels											
Liquid fuels	18.248	15.528	11.172	7.929	5.452	4.623	3.518	2.812	1.861	5.324	1.900
Gaseous fuels	73.507	63.332	52.851	33.974	26.568	25.562	25.487	24.239	25.898	28.278	23.993
Solid fuels	95.323	82.955	74.910	72.626	73.599	85.080	96.976	118.715	112.791	113.712	99.754
Other fuels	3.158	3.344	4.079	6.756	6.497	4.272	3.757	2.941	0.498	0.000	0.000
Biomass	0.000	0.000	0.000	0.000	0.000	0.016	0.014	0.005	0.006	0.004	0.006
Total	**190.236**	**165.159**	**143.012**	**121.285**	**112.116**	**119.553**	**129.752**	**148.712**	**141.054**	**147.318**	**125.653**

Table 4. (cont.) Fuel consumption [PJ] in 1.A.2.a category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	19.074	18.262	14.701	12.424	12.593	17.281	11.379	9.636	11.747	3.950	4.784
Lignite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.029	0.029	0.029	0.000	0.000	0.029	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	21.440	22.024	18.328	15.463	14.827	19.969	20.460	21.008	22.716	20.397	16.595
Fuel wood and wood waste	0.004	0.003	0.006	0.003	0.004	0.004	0.002	0.001	0.001	0.001	0.001
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	21.724	22.144	17.650	20.776	22.147	22.830	15.847	12.681	4.874	5.613	2.679
Liquid petroleum gas (LPG)	0.046	0.184	0.184	0.230	0.184	0.138	0.000	0.000	0.000	0.046	0.046
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.343	0.515	0.172	0.129	0.129	0.129	0.086	0.129	0.086	0.086	0.087
Fuel oil	1.800	1.040	0.640	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	15.875	17.574	16.994	15.122	16.132	15.368	12.643	12.770	13.885	9.850	5.296
Blast furnace gas	24.034	31.874	26.768	23.876	25.282	27.109	19.239	20.580	28.194	18.347	9.873
Gas works gas	0.008	0.000	0.277	0.706	1.195	1.654	0.965	1.015	1.313	0.993	0.474
Fuels											
Liquid fuels	2.189	1.739	0.996	0.359	0.313	0.267	0.086	0.129	0.086	0.132	0.133
Gaseous fuels	21.440	22.024	18.328	15.463	14.827	19.969	20.460	21.008	22.716	20.397	16.595
Solid fuels	80.715	89.854	76.419	72.933	77.378	84.242	60.073	56.711	60.013	38.753	23.106
Other fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	0.004	0.003	0.006	0.003	0.004	0.004	0.002	0.001	0.001	0.001	0.001
Total	**104.348**	**113.620**	**95.749**	**88.758**	**92.522**	**104.482**	**80.621**	**77.849**	**82.816**	**59.283**	**39.835**

Table 4. (cont.) Fuel consumption [PJ] in 1.A.2.a category

Fuels	2010	2011	2012	2013	2014
Hard coal	3.592	4.871	8.276	6.177	7.913
Lignite	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.029	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	16.916	17.209	16.905	16.242	16.096
Fuel wood and wood waste	0.000	0.000	0.000	0.001	0.001
Biogas	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000
Coke	3.050	8.062	9.636	10.601	9.687
Liquid petroleum gas (LPG)	0.046	0.046	0.092	0.046	0.046
Motor gasoline	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.087	0.087	0.043	0.043	0.087
Fuel oil	0.000	0.000	0.000	0.000	0.000
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000
Coke oven gas	8.378	8.420	8.230	8.518	9.014
Blast furnace gas	12.059	11.258	11.352	10.797	11.863
Gas works gas	0.187	0.203	0.047	0.028	0.099
Fuels					
Liquid fuels	0.133	0.133	0.135	0.089	0.133
Gaseous fuels	16.916	17.209	16.905	16.242	16.096
Solid fuels	27.266	32.814	37.570	36.121	38.576
Other fuels	0.000	0.000	0.000	0.000	0.000
Biomass	0.000	0.000	0.000	0.001	0.001
Total	**44.315**	**50.156**	**54.610**	**52.453**	**54.806**

Table 5. Fuel consumption [PJ] in 1.A.2.b category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	1.411	1.323	0.455	0.565	0.850	1.916	1.771	4.172	4.285	3.907	3.331
Lignite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	5.638	5.470	4.599	4.633	1.213	1.745	5.321	5.447	5.108	5.424	5.638
Fuel wood and wood waste	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.149	0.042	0.026
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.870	0.719	0.439	0.483	0.514	0.729	0.823	2.150	2.411	2.361	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	9.754	8.730	6.014	5.216	2.280	2.793	6.412	6.327	6.612	6.584	6.384
Liquid petroleum gas (LPG)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.046	0.000	0.000
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.043	0.043	0.043	0.043	0.129	0.086	0.129	0.172	0.214	0.214	0.257
Fuel oil	0.640	0.760	0.760	0.800	0.800	0.760	0.800	0.720	0.680	0.640	0.520
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.461	0.437	0.397	0.178	0.186	0.043	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.375	0.341	0.042	0.006	0.000	0.000	0.000	0.000	0.000	0.000	2.164
Fuels											
Liquid fuels	0.683	0.803	0.803	0.843	0.929	0.846	0.929	0.892	0.940	0.854	0.777
Gaseous fuels	5.638	5.470	4.599	4.633	1.213	1.745	5.321	5.447	5.108	5.424	5.638
Solid fuels	12.001	10.832	6.908	5.965	3.316	4.752	8.183	10.499	10.897	10.491	11.879
Other fuels	0.870	0.719	0.439	0.483	0.514	0.729	0.823	2.150	2.411	2.361	0.000
Biomass	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.149	0.042	0.026
Total	**19.191**	**17.823**	**12.749**	**11.924**	**5.972**	**8.073**	**15.257**	**18.988**	**19.505**	**19.172**	**18.320**

Table 5. (cont.) Fuel consumption [PJ] in 1.A.2.b category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	3.117	3.108	3.790	2.560	2.115	1.092	0.024	0.024	0.570	0.000	0.000
Lignite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	5.660	5.814	5.700	5.589	5.868	6.405	6.468	6.884	6.740	6.537	5.846
Fuel wood and wood waste	0.010	0.011	0.005	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.040	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	5.928	6.070	6.156	6.156	5.928	5.956	5.814	6.042	6.441	6.640	6.270
Liquid petroleum gas (LPG)	0.000	0.046	0.092	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.172	0.257	0.172	0.172	0.129	0.172	0.172	0.172	0.172	0.172	0.173
Fuel oil	0.560	0.560	0.520	0.400	0.320	0.400	0.400	0.400	0.160	0.160	0.160
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	2.070	2.268	2.551	2.739	2.539	1.800	1.003	1.004	0.949	1.220	1.086
Fuels											
Liquid fuels	0.732	0.863	0.784	0.618	0.495	0.658	0.618	0.618	0.378	0.378	0.379
Gaseous fuels	5.660	5.814	5.700	5.589	5.868	6.405	6.468	6.884	6.740	6.537	5.846
Solid fuels	11.115	11.446	12.497	11.455	10.582	8.848	6.841	7.070	7.960	7.860	7.356
Other fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	0.010	0.011	0.005	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	**17.517**	**18.134**	**18.986**	**17.663**	**16.945**	**15.911**	**13.927**	**14.572**	**15.078**	**14.775**	**13.581**

Table 5. (cont.) Fuel consumption [PJ] in 1.A.2.b category

Fuels	2010	2011	2012	2013	2014
Hard coal	0.000	0.250	0.114	0.113	0.091
Lignite	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	6.039	6.670	6.890	6.703	6.950
Fuel wood and wood waste	0.000	0.000	0.000	0.000	0.000
Biogas	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.001	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000
Coke	6.042	6.214	6.384	6.270	6.469
Liquid petroleum gas (LPG)	0.046	0.046	0.000	0.000	0.000
Motor gasoline	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.216	0.173	0.173	0.173	0.173
Fuel oil	0.120	0.120	0.120	0.120	0.080
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.000	0.039	0.043	0.039	0.051
Blast furnace gas	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.960	0.967	0.928	1.066	1.275
Fuels					
Liquid fuels	0.382	0.339	0.293	0.293	0.253
Gaseous fuels	6.039	6.670	6.890	6.703	6.950
Solid fuels	7.002	7.470	7.469	7.488	7.886
Other fuels	0.001	0.000	0.000	0.000	0.000
Biomass	0.000	0.000	0.000	0.000	0.000
Total	**13.424**	**14.479**	**14.652**	**14.484**	**15.089**

Table 6. Fuel consumption [PJ] in 1.A.2.c category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	9.197	9.059	7.216	6.623	4.550	13.125	7.945	70.221	71.191	63.913	54.992
Lignite	0.056	0.038	0.039	0.038	0.027	0.047	0.029	0.428	0.460	0.389	0.429
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	6.409	6.244	5.289	4.340	4.432	10.075	4.507	6.356	6.191	11.024	9.408
Fuel wood and wood waste	0.345	0.390	0.118	0.039	0.010	0.003	0.035	0.007	0.000	0.000	0.000
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Industrial wastes	12.255	14.915	16.712	18.586	17.039	18.003	22.591	21.546	17.374	14.356	0.672
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.600	2.880	3.440
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	1.763	4.530	2.679	1.966	1.852	1.881	1.938	3.477	2.964	1.454	1.539
Liquid petroleum gas (LPG)	3.726	4.554	0.000	0.000	0.000	0.046	0.000	0.000	0.000	0.000	0.000
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	1.406	1.363	0.987	0.858	0.772	0.729	0.729	0.944	1.072	1.072	1.416
Fuel oil	6.080	6.120	2.720	1.880	2.760	2.480	3.600	8.160	9.320	9.360	17.560
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	3.614	1.930	0.396	3.465	5.445	4.455	0.198	1.584	6.584	9.652	18.513
Coke oven gas	1.053	0.993	0.701	0.522	0.440	1.548	0.276	0.729	0.784	0.140	0.174
Blast furnace gas	0.148	0.136	0.047	0.010	0.006	0.011	0.014	0.023	0.004	0.013	0.004
Gas works gas	0.190	0.230	0.214	0.192	0.133	0.126	0.110	0.070	0.052	0.000	0.000
Fuels											
Liquid fuels	14.825	13.968	4.103	6.203	8.977	7.710	4.527	10.688	19.576	22.964	40.929
Gaseous fuels	6.409	6.244	5.289	4.340	4.432	10.075	4.507	6.356	6.191	11.024	9.408
Solid fuels	12.407	14.986	10.896	9.351	7.008	16.738	10.312	74.948	75.455	65.909	57.138
Other fuels	12.255	14.915	16.712	18.586	17.039	18.003	22.591	21.546	17.374	14.356	0.672
Biomass	0.345	0.390	0.118	0.039	0.010	0.003	0.035	0.007	0.000	0.000	0.001
Total	**46.241**	**50.503**	**37.118**	**38.519**	**37.466**	**52.529**	**41.972**	**113.545**	**118.596**	**114.253**	**108.148**

Table 6. (cont.) Fuel consumption [PJ] in 1.A.2.c category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	50.522	50.115	48.485	45.458	27.959	28.709	30.107	27.683	26.780	43.781	42.011
Lignite	0.138	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	9.041	9.464	8.481	7.199	6.457	7.498	8.104	9.053	8.754	7.950	9.707
Fuel wood and wood waste	0.000	0.000	0.000	0.001	0.153	0.102	0.165	0.000	0.121	0.000	0.058
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.582	0.607	0.618	0.567	0.875	1.122	0.628	0.721	0.707	0.509	0.584
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	2.520	0.480	0.480	0.280	0.240	0.000	0.040	0.040	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	1.624	1.596	1.710	1.738	1.568	1.881	1.454	2.964	1.938	1.168	0.884
Liquid petroleum gas (LPG)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.092
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.090
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	1.330	1.030	4.762	4.247	4.333	3.904	3.775	4.076	3.732	3.689	4.590
Fuel oil	15.680	13.520	7.360	7.640	7.080	7.320	3.920	3.920	3.560	0.640	1.080
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	19.602	23.314	20.542	20.740	21.830	22.424	18.266	21.334	22.473	19.156	20.889
Coke oven gas	0.130	0.050	0.150	0.285	0.634	0.606	0.608	0.547	0.658	0.654	0.483
Blast furnace gas	0.007	0.011	0.008	0.004	0.013	0.019	0.006	0.000	0.000	0.000	0.000
Gas works gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fuels											
Liquid fuels	39.132	38.344	33.144	32.907	33.483	33.648	26.001	29.370	29.765	23.485	26.741
Gaseous fuels	9.041	9.464	8.481	7.199	6.457	7.498	8.104	9.053	8.754	7.950	9.707
Solid fuels	52.421	51.772	50.353	47.485	30.174	31.215	32.175	31.194	29.376	45.603	43.378
Other fuels	0.582	0.607	0.618	0.567	0.875	1.122	0.628	0.721	0.707	0.509	0.584
Biomass	0.000	0.000	0.000	0.001	0.153	0.102	0.165	0.000	0.121	0.000	0.058
Total	**101.176**	**100.187**	**92.596**	**88.159**	**71.142**	**73.585**	**67.073**	**70.338**	**68.723**	**77.547**	**80.468**

Table 6. (cont.) Fuel consumption [PJ] in 1.A.2.c category

Fuels	2010	2011	2012	2013	2014
Hard coal	47.304	47.704	46.768	47.308	46.501
Lignite	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	11.807	13.887	13.568	14.696	14.500
Fuel wood and wood waste	0.058	0.053	0.131	0.050	0.103
Biogas	0.000	0.000	0.000	0.000	0.008
Industrial wastes	0.770	0.732	0.581	1.092	1.082
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000
Coke	0.826	1.340	3.164	3.021	2.992
Liquid petroleum gas (LPG)	0.138	0.138	0.138	0.184	0.138
Motor gasoline	0.000	0.045	0.045	0.045	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000
Diesel oil	4.200	3.637	3.334	4.027	2.468
Fuel oil	0.600	0.720	0.560	0.440	0.400
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	17.176	12.276	9.702	11.979	10.296
Coke oven gas	0.627	0.616	0.595	0.639	0.645
Blast furnace gas	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.000	0.000	0.000	0.000	0.000
Fuels					
Liquid fuels	22.114	16.816	13.779	16.675	13.302
Gaseous fuels	11.807	13.887	13.568	14.696	14.500
Solid fuels	48.757	49.660	50.527	50.968	50.138
Other fuels	0.770	0.732	0.581	1.092	1.082
Biomass	0.058	0.053	0.131	0.050	0.111
Total	**83.506**	**81.148**	**78.586**	**83.481**	**79.133**

Table 7. Fuel consumption [PJ] in 1.A.2.d category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	1.639	1.940	1.548	1.741	1.379	4.524	3.836	22.318	22.233	23.979	18.936
Lignite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	0.103	0.162	0.101	0.061	0.026	0.061	0.250	0.232	0.455	1.096	0.563
Fuel wood and wood waste	0.352	0.205	0.001	0.000	0.000	1.585	1.610	15.437	16.243	16.472	16.476
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	0.331	0.247	0.256	0.285	0.256	0.314	0.285	0.285	0.256	0.142	0.086
Liquid petroleum gas (LPG)	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.092	0.184
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.085	0.085	0.043	0.086	0.043	0.043	0.086	0.129	0.601	0.987	1.115
Fuel oil	1.240	1.160	1.280	1.200	1.320	1.560	1.400	2.360	1.040	1.040	1.320
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.004	0.003	0.003	0.003	0.002	0.003	0.002	0.002	0.001	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.003	0.003	0.003	0.014	0.002	0.000	0.000	0.000	0.004	0.000	0.000
Fuels											
Liquid fuels	1.371	1.291	1.369	1.332	1.409	1.649	1.532	2.535	1.687	2.119	2.619
Gaseous fuels	0.103	0.162	0.101	0.061	0.026	0.061	0.250	0.232	0.455	1.096	0.563
Solid fuels	1.976	2.192	1.810	2.043	1.639	4.841	4.123	22.605	22.494	24.121	19.022
Other fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	0.352	0.205	0.001	0.000	0.000	1.585	1.610	15.437	16.243	16.472	16.476
Total	**3.803**	**3.850**	**3.281**	**3.436**	**3.074**	**8.136**	**7.515**	**40.809**	**40.879**	**43.808**	**38.680**

Table 7. (cont.) Fuel consumption [PJ] in 1.A.2.d category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	17.528	15.696	15.564	14.317	14.050	13.797	13.430	11.592	9.452	7.850	8.515
Lignite	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	1.007	1.210	1.445	1.461	2.094	2.657	2.288	2.976	4.087	4.822	4.972
Fuel wood and wood waste	15.545	15.938	15.138	16.622	17.950	18.957	18.611	19.379	18.644	19.729	19.171
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018
Industrial wastes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.040	0.040	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	0.000	0.028	0.028	0.028	0.057	0.028	0.028	0.028	0.028	0.028	0.000
Liquid petroleum gas (LPG)	0.092	0.138	0.092	0.046	0.046	0.092	0.046	0.092	0.184	0.046	0.092
Motor gasoline	0.000	0.000	0.000	0.000	0.090	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.815	0.601	0.472	0.429	0.472	0.472	0.343	0.386	0.429	0.300	0.303
Fuel oil	1.320	1.360	1.480	1.560	1.600	1.680	1.600	1.600	1.720	1.640	1.600
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fuels											
Liquid fuels	2.227	2.099	2.044	2.035	2.208	2.244	2.029	2.118	2.333	1.986	1.995
Gaseous fuels	1.007	1.210	1.445	1.461	2.094	2.657	2.288	2.976	4.087	4.822	4.972
Solid fuels	17.528	15.724	15.592	14.345	14.107	13.825	13.458	11.620	9.480	7.878	8.515
Other fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	15.545	15.938	15.138	16.622	17.950	18.957	18.611	19.379	18.644	19.729	19.189
Total	**36.307**	**34.971**	**34.219**	**34.463**	**36.359**	**37.683**	**36.386**	**36.093**	**34.544**	**34.415**	**34.671**

Table 7. (cont.) Fuel consumption [PJ] in 1.A.2.d category

Fuels	2010	2011	2012	2013	2014
Hard coal	10.086	11.301	10.643	11.460	11.291
Lignite	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	5.134	4.587	5.535	6.271	6.994
Fuel wood and wood waste	19.581	19.402	20.358	27.152	26.987
Biogas	0.049	0.073	0.083	0.091	0.105
Industrial wastes	0.000	0.000	0.000	0.037	0.125
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000
Coke	0.028	0.000	0.000	0.000	0.000
Liquid petroleum gas (LPG)	0.092	0.092	0.092	0.092	0.092
Motor gasoline	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.260	0.216	0.173	0.260	0.173
Fuel oil	1.640	1.680	1.520	1.520	1.280
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.000	0.000	0.000	0.000	0.000
Fuels					
Liquid fuels	1.992	1.988	1.785	1.872	1.545
Gaseous fuels	5.134	4.587	5.535	6.271	6.994
Solid fuels	10.114	11.301	10.643	11.460	11.291
Other fuels	0.000	0.000	0.000	0.037	0.125
Biomass	19.630	19.475	20.441	27.243	27.092
Total	**36.870**	**37.351**	**38.404**	**46.883**	**47.047**

Table 8. Fuel consumption [PJ] in 1.A.2.e category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	25.200	31.694	31.914	35.940	32.724	55.643	53.801	73.024	88.777	78.207	64.659
Lignite	0.085	0.104	0.058	0.019	0.018	0.369	0.195	0.265	0.380	0.250	0.317
Hard coal briquettes (patent fuels)	0.023	0.023	0.000	0.000	0.000	0.205	0.205	0.059	0.029	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	1.965	1.910	1.970	1.984	2.339	3.171	7.180	3.839	15.051	12.927	10.694
Fuel wood and wood waste	0.114	0.105	0.091	0.094	0.072	0.151	0.056	0.082	0.094	0.075	0.101
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003
Industrial wastes	0.003	0.002	0.000	0.000	0.031	0.003	0.003	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080	0.080	0.040
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	3.609	3.569	3.334	2.936	2.650	3.249	2.708	2.565	3.192	2.850	2.080
Liquid petroleum gas (LPG)	0.046	0.046	0.046	0.046	0.046	0.046	0.092	0.138	0.184	0.184	0.276
Motor gasoline	0.440	0.264	0.135	0.090	0.135	0.180	0.135	0.180	0.180	0.045	0.090
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	2.087	1.534	1.244	1.030	0.901	1.201	1.072	0.901	5.448	5.191	6.821
Fuel oil	1.840	1.640	1.640	1.480	1.320	3.280	3.920	6.120	2.720	2.400	2.680
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.336	0.120	0.111	0.125	0.124	0.102	0.003	0.025	0.004	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.027	0.032	0.051	0.014	0.001	0.001	0.000	0.000	0.003	0.000	0.000
Fuels											
Liquid fuels	4.413	3.484	3.065	2.646	2.402	4.707	5.219	7.339	8.612	7.900	9.907
Gaseous fuels	1.965	1.910	1.970	1.984	2.339	3.171	7.180	3.839	15.051	12.927	10.694
Solid fuels	29.280	35.542	35.468	39.034	35.517	59.569	56.912	75.938	92.385	81.307	67.056
Other fuels	0.003	0.002	0.000	0.000	0.031	0.003	0.003	0.000	0.000	0.000	0.000
Biomass	0.114	0.105	0.091	0.094	0.072	0.151	0.056	0.082	0.094	0.075	0.104
Total	**35.775**	**41.043**	**40.594**	**43.758**	**40.361**	**67.601**	**69.370**	**87.198**	**116.142**	**102.209**	**87.761**

Table 8. (cont.) Fuel consumption [PJ] in 1.A.2.e category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	46.327	43.417	40.020	41.803	39.030	36.095	35.894	30.864	31.165	26.778	25.814
Lignite	0.237	0.191	0.149	0.192	0.175	0.129	0.092	0.074	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	9.255	10.494	11.363	12.490	15.075	16.164	17.456	18.623	20.614	20.725	20.950
Fuel wood and wood waste	0.069	0.049	0.062	0.060	0.323	0.373	0.214	0.239	0.164	0.365	0.192
Biogas	0.020	0.063	0.042	0.037	0.063	0.074	0.068	0.072	0.084	0.094	0.109
Industrial wastes	0.000	0.001	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	1.710	1.624	1.368	1.539	1.340	1.226	0.969	0.855	0.912	0.656	0.656
Liquid petroleum gas (LPG)	0.460	0.690	0.874	1.426	1.380	1.564	1.426	1.196	0.920	1.012	0.966
Motor gasoline	0.045	0.135	0.045	0.090	0.090	0.000	0.045	0.045	0.045	0.045	0.045
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	7.465	7.336	7.250	6.864	6.864	6.178	5.405	4.504	4.076	4.504	3.161
Fuel oil	2.280	2.520	2.720	2.960	3.040	3.280	3.160	2.920	2.760	2.000	1.440
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fuels											
Liquid fuels	10.250	10.681	10.889	11.340	11.374	11.022	10.036	8.665	7.801	7.561	5.612
Gaseous fuels	9.255	10.494	11.363	12.490	15.075	16.164	17.456	18.623	20.614	20.725	20.950
Solid fuels	48.274	45.232	41.557	43.534	40.545	37.450	36.955	31.793	32.077	27.434	26.470
Other fuels	0.000	0.001	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	0.089	0.112	0.104	0.097	0.386	0.447	0.282	0.311	0.248	0.459	0.301
Total	**67.868**	**66.520**	**63.927**	**67.461**	**67.380**	**65.083**	**64.729**	**59.392**	**60.740**	**56.179**	**53.333**

Table 8. (cont.) Fuel consumption [PJ] in 1.A.2.e category

Fuels	2010	2011	2012	2013	2014
Hard coal	25.903	25.614	26.172	24.724	24.428
Lignite	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	21.610	22.128	23.704	24.475	25.094
Fuel wood and wood waste	0.441	0.534	0.436	0.664	0.747
Biogas	0.101	0.145	0.199	0.202	0.241
Industrial wastes	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000
Coke	0.627	0.542	0.314	0.370	0.456
Liquid petroleum gas (LPG)	0.828	0.782	0.690	0.828	0.966
Motor gasoline	0.045	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000
Diesel oil	2.901	2.382	2.944	1.992	1.516
Fuel oil	1.240	1.360	1.360	1.080	1.000
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.000	0.000	0.000	0.000	0.000
Fuels					
Liquid fuels	5.014	4.524	4.994	3.900	3.482
Gaseous fuels	21.610	22.128	23.704	24.475	25.094
Solid fuels	26.530	26.156	26.486	25.094	24.884
Other fuels	0.000	0.000	0.000	0.000	0.000
Biomass	0.542	0.679	0.635	0.866	0.988
Total	**53.696**	**53.487**	**55.819**	**54.335**	**54.448**

Table 9. Fuel consumption [PJ] in 1.A.2.f category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	102.301	98.072	72.637	72.514	68.894	76.924	83.926	79.647	86.930	81.562	66.639
Lignite	0.263	0.180	0.156	0.150	0.091	0.161	0.117	0.163	0.150	0.185	0.153
Hard coal briquettes (patent fuels)	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.035	0.018	0.020	0.020	0.000	0.000	0.000	0.000	0.000	0.040	0.040
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	28.729	28.108	24.574	22.704	22.246	21.986	21.506	25.518	26.650	25.655	27.097
Fuel wood and wood waste	1.778	1.924	1.155	0.455	0.042	0.033	0.004	0.010	0.010	0.005	0.006
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.382	0.446	0.068	0.023	0.267	0.250	0.145	0.197	0.144	0.047	0.207
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.400	1.200
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	18.984	18.997	13.936	11.314	11.115	10.716	11.400	10.118	11.144	8.664	10.089
Liquid petroleum gas (LPG)	0.000	0.000	0.000	0.000	0.000	0.000	0.092	0.138	0.046	0.092	0.230
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.135	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	1.321	1.108	0.944	0.815	0.772	0.772	0.944	1.330	1.802	2.788	2.016
Fuel oil	6.000	6.720	4.160	2.800	3.560	3.960	4.320	6.080	3.760	4.120	6.680
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	2.685	2.241	2.101	1.821	1.341	1.234	0.482	0.886	0.509	0.353	0.988
Blast furnace gas	0.140	0.118	0.101	0.106	0.079	0.108	0.120	0.053	0.053	0.036	0.010
Gas works gas	3.926	3.761	3.270	3.136	2.706	2.392	2.090	1.788	1.033	0.501	0.330
Fuels											
Liquid fuels	7.321	7.828	5.104	3.615	4.332	4.732	5.356	7.548	5.608	8.535	10.126
Gaseous fuels	28.729	28.108	24.574	22.704	22.246	21.986	21.506	25.518	26.650	25.655	27.097
Solid fuels	128.357	123.387	92.221	89.061	84.226	91.535	98.135	92.655	99.819	91.341	78.249
Other fuels	0.382	0.446	0.068	0.023	0.267	0.250	0.145	0.197	0.144	0.047	0.207
Biomass	1.778	1.924	1.155	0.455	0.042	0.033	0.004	0.010	0.010	0.005	0.006
Total	**166.566**	**161.692**	**123.122**	**115.858**	**111.113**	**118.536**	**125.146**	**125.928**	**132.231**	**125.583**	**115.685**

Table 9. (cont.) Fuel consumption [PJ] in 1.A.2.f category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	59.965	53.349	41.103	33.981	30.332	32.332	31.206	31.547	43.846	36.975	26.468
Lignite	0.069	0.057	0.009	0.019	0.000	0.000	0.000	0.000	0.000	0.063	0.000
Hard coal briquettes (patent fuels)	0.000	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.040	0.040	0.020	0.020	0.040	0.040	0.040	0.040	0.040	0.040	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	23.917	27.976	31.858	33.233	35.584	38.233	38.963	41.283	42.465	39.696	41.394
Fuel wood and wood waste	0.002	0.006	0.275	0.292	0.102	0.261	0.110	0.139	0.116	0.223	0.285
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.529	0.472	0.524	0.508	1.471	1.818	2.701	5.043	5.961	7.400	7.715
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.003	0.013	0.717	1.620	1.776	0.378	4.419
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.029
Other petroleum products	0.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	4.416	3.232	7.072	3.584	1.568	1.152	2.752
Coke	8.008	6.868	4.874	4.418	4.874	4.674	2.594	3.050	4.503	2.679	2.280
Liquid petroleum gas (LPG)	0.322	0.506	0.736	1.610	1.380	1.656	0.874	0.368	0.322	0.368	0.460
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.045
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	1.716	1.630	1.973	2.145	2.274	2.788	2.188	1.888	1.845	2.188	1.992
Fuel oil	5.920	3.880	4.320	4.600	4.520	4.480	4.080	2.880	2.120	2.400	1.960
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.804	0.413	0.897	0.767	0.746	1.505	1.370	1.465	1.614	1.523	1.233
Blast furnace gas	0.005	0.011	0.003	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Gas works gas	0.304	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fuels											
Liquid fuels	8.358	6.016	7.029	8.355	12.590	12.156	14.214	8.720	5.855	6.108	7.209
Gaseous fuels	23.917	27.976	31.858	33.233	35.584	38.233	38.963	41.283	42.465	39.696	41.394
Solid fuels	69.195	60.767	46.906	39.208	35.992	38.551	35.210	36.102	50.003	41.280	29.982
Other fuels	0.529	0.472	0.524	0.508	1.474	1.831	3.418	6.663	7.737	7.778	12.134
Biomass	0.002	0.006	0.275	0.292	0.102	0.261	0.110	0.139	0.117	0.224	0.314
Total	**102.001**	**95.237**	**86.592**	**81.596**	**85.742**	**91.032**	**91.915**	**92.907**	**106.177**	**95.086**	**91.033**

Table 9. (cont.) Fuel consumption [PJ] in 1.A.2.f category

Fuels	2010	2011	2012	2013	2014
Hard coal	28.045	34.403	26.766	22.808	23.013
Lignite	0.224	0.283	0.549	0.347	0.487
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.180	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	42.872	44.492	42.349	40.911	40.873
Fuel wood and wood waste	0.299	0.348	0.407	0.498	0.724
Biogas	0.000	0.000	0.000	0.000	0.000
Industrial wastes	10.454	11.729	12.170	12.763	15.171
Municipal waste - non-biogenic fraction	4.512	5.017	3.913	3.752	4.060
Municipal waste – biogenic fraction	0.123	1.338	1.360	1.391	1.528
Other petroleum products	0.000	0.000	0.000	0.000	0.000
Petroleum coke	1.792	0.064	0.064	0.160	0.032
Coke	2.536	2.679	2.508	2.366	2.508
Liquid petroleum gas (LPG)	0.414	0.368	0.230	0.322	0.414
Motor gasoline	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000
Diesel oil	1.992	2.338	1.862	1.472	1.299
Fuel oil	1.840	1.640	1.400	1.320	0.680
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000
Coke oven gas	1.614	1.866	1.687	1.552	1.951
Blast furnace gas	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.000	0.000	0.000	0.000	0.000
Fuels					
Liquid fuels	6.038	4.410	3.556	3.274	2.425
Gaseous fuels	42.872	44.492	42.349	40.911	40.873
Solid fuels	32.419	39.231	31.510	27.253	27.959
Other fuels	14.966	16.746	16.083	16.515	19.231
Biomass	0.422	1.686	1.767	1.889	2.252
Total	**96.717**	**106.565**	**95.265**	**89.842**	**92.740**

Table 10. Fuel consumption [PJ] in 1.A.2.g category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	56.386	49.492	38.514	36.640	29.689	80.735	73.256	81.016	105.124	88.131	65.259
Lignite	0.789	0.662	0.176	0.564	0.182	0.654	0.274	0.621	0.600	0.389	0.317
Hard coal briquettes (patent fuels)	0.210	0.139	0.088	0.029	0.000	0.000	0.000	0.000	0.029	0.000	0.000
Brown coal briquettes	0.088	0.071	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	24.039	22.347	15.645	11.755	13.811	17.922	17.336	15.176	14.210	16.060	17.640
Fuel wood and wood waste	8.335	7.545	5.826	5.518	5.035	4.995	3.410	4.968	6.519	8.194	8.231
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.001	0.001	0.002
Industrial wastes	0.082	0.058	0.022	0.012	0.134	0.298	1.593	2.294	2.675	1.133	2.080
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.120	0.440	0.520
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	20.610	18.284	12.797	10.032	11.001	10.402	6.640	5.614	5.614	3.961	2.023
Liquid petroleum gas (LPG)	0.184	0.138	0.138	0.092	0.092	0.092	0.138	0.046	0.138	0.414	0.460
Motor gasoline	1.716	1.584	1.123	1.302	0.898	0.943	0.539	1.032	0.630	2.201	0.763
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.086
Diesel oil	14.228	13.078	10.425	8.795	7.294	7.722	7.163	8.280	18.533	15.574	13.214
Fuel oil	3.720	3.240	2.160	1.840	2.400	3.320	3.720	5.040	3.200	3.280	3.760
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	2.499	2.357	1.675	0.984	0.734	0.475	0.056	0.049	0.022	0.010	0.011
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	1.457	1.056	0.732	0.459	0.212	0.022	0.063	0.016	0.001	0.001	0.000
Fuels											
Liquid fuels	19.848	18.040	13.846	12.029	10.684	12.077	11.560	14.398	22.621	21.909	18.803
Gaseous fuels	24.039	22.347	15.645	11.755	13.811	17.922	17.336	15.176	14.210	16.060	17.640
Solid fuels	82.038	72.062	54.022	48.748	41.858	92.328	80.329	87.356	111.430	92.492	67.610
Other fuels	0.082	0.058	0.022	0.012	0.134	0.298	1.593	2.294	2.675	1.133	2.080
Biomass	8.335	7.545	5.826	5.518	5.035	4.995	3.410	4.970	6.520	8.195	8.233
Total	**134.342**	**120.051**	**89.361**	**78.062**	**71.522**	**127.620**	**114.228**	**124.194**	**157.456**	**139.789**	**114.366**

Table 10. (cont.) Fuel consumption [PJ] in 1.A.2.g category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	49.964	40.662	31.997	26.862	25.045	21.927	20.047	18.024	16.542	14.069	10.978
Lignite	0.247	0.210	0.149	0.106	0.055	0.009	0.009	0.018	0.000	0.009	0.163
Hard coal briquettes (patent fuels)	0.000	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.080	0.100
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	16.354	18.545	18.319	19.273	21.156	22.595	23.325	23.290	23.541	26.265	22.861
Fuel wood and wood waste	8.604	10.105	10.716	12.300	11.897	12.184	11.918	11.028	13.166	14.043	14.004
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003
Industrial wastes	1.482	2.075	1.802	2.078	2.503	1.661	1.700	3.789	0.937	1.154	1.392
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.005	0.000	0.000
Other petroleum products	0.360	0.240	0.040	0.080	0.080	0.120	0.080	0.120	0.080	0.064	0.029
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	2.877	2.282	2.338	1.909	1.768	1.110	0.626	0.854	0.825	0.684	0.454
Liquid petroleum gas (LPG)	0.782	1.472	1.104	1.104	1.242	1.334	1.334	1.242	1.150	1.196	0.966
Motor gasoline	0.360	0.315	0.180	0.135	0.225	0.180	0.180	0.225	0.135	0.090	0.135
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.086	0.086	0.086	0.043	0.043	0.043	0.043	0.086	0.086	0.043	0.043
Diesel oil	11.455	10.767	9.867	9.780	10.168	9.609	10.468	11.067	9.952	9.138	9.092
Fuel oil	3.560	3.600	3.080	2.840	2.720	2.880	2.920	2.640	1.480	1.280	1.280
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.006	0.004	0.020	0.016	0.117	0.436	0.110	0.062	0.059	0.047	0.033
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.013	0.013	0.000	0.000	0.000	0.006
Gas works gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fuels											
Liquid fuels	16.603	16.480	14.357	13.982	14.478	14.166	15.025	15.380	12.883	11.811	11.545
Gaseous fuels	16.354	18.545	18.319	19.273	21.156	22.595	23.325	23.290	23.541	26.265	22.861
Solid fuels	53.094	43.187	34.504	28.893	26.985	23.495	20.805	18.958	17.446	14.889	11.734
Other fuels	1.482	2.075	1.802	2.078	2.503	1.661	1.700	3.789	0.938	1.154	1.392
Biomass	8.604	10.105	10.716	12.300	11.897	12.184	11.918	11.030	13.171	14.044	14.007
Total	**96.137**	**90.392**	**79.698**	**76.526**	**77.019**	**74.101**	**72.773**	**72.447**	**67.979**	**68.163**	**61.539**

Table 10. (cont.) Fuel consumption [PJ] in 1.A.2.g category

Fuels	2010	2011	2012	2013	2014
Hard coal	11.348	10.096	7.619	7.288	6.676
Lignite	0.089	0.363	0.269	0.432	0.158
Hard coal briquettes (patent fuels)	0.000	0.029	0.000	0.000	0.000
Brown coal briquettes	0.080	0.200	0.100	0.040	0.040
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	24.964	23.876	23.019	26.036	23.395
Fuel wood and wood waste	17.901	20.051	20.854	24.842	25.929
Biogas	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.070	0.052	0.069	0.098	0.064
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.090	0.090	0.093	0.064	0.096
Petroleum coke	0.000	0.000	0.000	0.000	0.000
Coke	0.370	0.228	0.171	0.199	0.142
Liquid petroleum gas (LPG)	1.150	1.196	0.966	1.150	1.334
Motor gasoline	0.270	0.135	0.090	0.090	0.176
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.043	0.043	0.000	0.043	0.043
Diesel oil	8.661	8.703	7.101	6.538	6.668
Fuel oil	1.480	1.480	0.960	0.560	0.560
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.020	0.025	0.010	0.010	0.004
Blast furnace gas	0.009	0.012	0.004	0.004	0.002
Gas works gas	0.000	0.000	0.000	0.000	0.000
Fuels					
Liquid fuels	11.694	11.647	9.210	8.445	8.877
Gaseous fuels	24.964	23.876	23.019	26.036	23.395
Solid fuels	11.916	10.953	8.173	7.973	7.022
Other fuels	0.070	0.052	0.069	0.098	0.064
Biomass	17.901	20.051	20.854	24.842	25.929
Total	**66.545**	**66.579**	**61.325**	**67.394**	**65.287**

Table 11. Fuel consumption [PJ] in 1.A.4.a category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	207.335	163.251	54.547	62.166	54.214	50.334	34.666	34.267	25.608	18.696	16.200
Lignite	0.540	0.390	0.000	0.000	0.000	0.017	0.091	0.025	0.026	0.009	0.009
Hard coal briquettes (patent fuels)	5.749	1.581	0.000	0.000	0.000	0.000	0.000	0.322	0.000	0.000	0.000
Brown coal briquettes	0.548	0.476	0.420	0.000	0.000	1.780	1.820	1.940	0.240	0.540	0.120
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	13.079	12.601	13.787	10.977	11.190	11.548	9.573	13.260	18.771	24.256	32.769
Fuel wood and wood waste	0.000	0.000	4.501	2.945	0.000	12.312	11.719	11.560	10.046	9.028	8.437
Biogas	0.084	0.123	0.379	0.187	0.206	0.062	0.249	0.423	0.579	0.599	0.648
Industrial wastes	2.135	0.144	0.504	0.081	0.011	0.352	0.089	0.000	0.124	0.000	0.003
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	80.500	77.450	34.712	28.264	40.068	33.402	27.332	25.878	26.220	28.642	13.480
Liquid petroleum gas (LPG)	0.000	0.000	0.000	0.000	0.000	0.000	1.334	0.782	0.782	1.748	1.564
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.987	4.290	6.220
Fuel oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080	0.000
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	1.417	1.135	1.224	1.088	0.877	0.428	0.123	0.053	0.034	0.127	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.937	0.330	0.312	0.554	0.576	0.091	0.014	0.014	0.014	0.072	0.040
Fuels											
Liquid fuels	0.000	0.000	0.000	0.000	0.000	0.000	1.334	0.782	1.769	6.118	7.784
Gaseous fuels	13.079	12.601	13.787	10.977	11.190	11.548	9.573	13.260	18.771	24.256	32.769
Solid fuels	297.025	244.614	91.215	92.072	95.735	86.052	64.046	62.499	52.142	48.086	29.849
Other fuels	2.135	0.144	0.504	0.081	0.011	0.352	0.089	0.000	0.124	0.000	0.003
Biomass	0.084	0.123	4.880	3.132	0.206	12.374	11.968	11.983	10.625	9.627	9.085
Total	**312.322**	**257.481**	**110.386**	**106.262**	**107.142**	**110.326**	**87.010**	**88.524**	**83.431**	**88.087**	**79.490**

Table 11. (cont.) Fuel consumption [PJ] in 1.A.4.a category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	15.104	13.354	13.460	21.677	21.539	22.502	25.405	29.320	25.291	28.763	31.393
Lignite	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.520	0.380	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	37.696	38.567	49.971	61.001	67.057	69.570	68.410	63.517	65.488	71.250	75.746
Fuel wood and wood waste	8.553	8.514	5.736	5.747	5.752	6.028	6.171	4.580	5.482	5.020	7.104
Biogas	0.663	0.678	0.860	0.683	0.700	0.558	0.343	0.505	1.081	1.795	1.675
Industrial wastes	0.004	0.004	0.091	0.092	0.060	0.002	0.022	0.000	0.000	0.000	0.092
Municipal waste - non-biogenic fraction	0.000	0.020	0.000	0.009	0.011	0.000	0.000	0.000	0.000	0.037	0.031
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.640	0.880	3.000	0.360	1.720	2.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	12.226	8.265	3.819	8.122	8.180	5.928	2.679	2.878	2.594	2.080	2.138
Liquid petroleum gas (LPG)	2.070	2.300	3.266	3.358	5.520	5.014	4.600	5.244	4.922	4.462	3.772
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	7.636	13.342	15.015	19.090	16.774	14.286	13.213	23.252	22.866	22.866	21.910
Fuel oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.002
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.005	0.005	0.004	0.003	0.004	0.003	0.003	0.003	0.014	0.018	0.017
Fuels											
Liquid fuels	10.346	16.522	21.281	22.808	24.014	21.300	17.813	28.496	27.788	27.328	25.682
Gaseous fuels	37.696	38.567	49.971	61.001	67.057	69.570	68.410	63.517	65.488	71.250	75.746
Solid fuels	27.864	22.004	17.283	29.822	29.723	28.433	28.087	32.202	27.900	30.862	33.550
Other fuels	0.004	0.024	0.091	0.101	0.071	0.002	0.022	0.000	0.000	0.037	0.123
Biomass	9.216	9.192	6.596	6.430	6.452	6.586	6.514	5.085	6.563	6.815	8.779
Total	**85.126**	**86.309**	**95.222**	**120.162**	**127.317**	**125.891**	**120.846**	**129.300**	**127.739**	**136.292**	**143.880**

Table 11. (cont.) Fuel consumption [PJ] in 1.A.4.a category

Fuels	2010	2011	2012	2013	2014
Hard coal	34.503	31.119	32.855	30.116	27.068
Lignite	1.475	0.702	0.531	0.515	0.402
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	83.433	78.278	80.888	76.501	67.429
Fuel wood and wood waste	8.029	7.818	6.833	7.433	6.556
Biogas	1.830	1.963	2.280	2.127	2.258
Industrial wastes	0.021	0.011	0.009	0.388	0.079
Municipal waste - non-biogenic fraction	0.005	0.035	0.028	0.033	0.152
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.060	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000
Coke	2.109	1.824	0.741	1.083	0.570
Liquid petroleum gas (LPG)	3.404	3.312	4.048	2.852	3.726
Motor gasoline	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000
Diesel oil	27.409	25.634	18.402	15.155	14.722
Fuel oil	0.080	0.040	0.000	0.000	0.000
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.001	0.001	0.001	0.000	0.001
Blast furnace gas	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.017	0.018	0.014	0.010	0.002
Fuels					
Liquid fuels	30.953	28.986	22.450	18.007	18.448
Gaseous fuels	83.433	78.278	80.888	76.501	67.429
Solid fuels	38.105	33.664	34.142	31.724	28.043
Other fuels	0.026	0.046	0.037	0.421	0.231
Biomass	9.859	9.781	9.113	9.560	8.814
Total	**162.376**	**150.755**	**146.630**	**136.213**	**122.965**

Table 12. Fuel consumption [PJ] in 1.A.4.b category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	543.559	489.774	272.689	358.521	351.542	372.347	309.920	305.701	326.681	271.980	213.584
Lignite	2.911	1.180	0.526	0.042	0.000	2.956	4.403	4.279	3.420	2.626	1.772
Hard coal briquettes (patent fuels)	17.200	4.742	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	1.627	1.427	1.240	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	102.581	107.619	122.204	133.674	141.212	141.590	151.671	159.559	143.057	150.022	138.268
Fuel wood and wood waste	33.615	32.351	34.335	27.721	33.969	106.000	104.715	105.000	101.000	100.000	100.700
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	31.927	30.721	14.866	12.110	26.732	30.752	27.788	27.502	28.044	32.775	19.950
Liquid petroleum gas (LPG)	6.762	7.452	1.702	1.012	1.840	6.072	8.970	12.834	16.100	18.400	18.400
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.145	6.435	8.580
Fuel oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	15.996	15.134	15.155	13.706	11.334	6.779	3.560	1.723	0.226	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	4.655	3.697	3.088	1.307	0.739	0.431	0.418	0.258	0.222	0.181	0.164
Fuels											
Liquid fuels	6.762	7.452	1.702	1.012	1.840	6.072	8.970	12.834	18.245	24.835	26.980
Gaseous fuels	102.581	107.619	122.204	133.674	141.212	141.590	151.671	159.559	143.057	150.022	138.268
Solid fuels	617.874	546.675	307.564	385.686	390.347	413.265	346.089	339.463	358.593	307.562	235.470
Other fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	33.615	32.351	34.335	27.721	33.969	106.000	104.715	105.000	101.000	100.000	100.700
Total	**760.831**	**694.097**	**465.805**	**548.093**	**567.368**	**666.927**	**611.445**	**616.856**	**620.895**	**582.419**	**501.418**

Table 12. (cont.) Fuel consumption [PJ] in 1.A.4.b category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	223.330	166.012	184.730	209.771	207.214	219.654	249.994	284.628	257.388	276.073	279.808
Lignite	1.286	1.169	1.373	1.482	1.605	1.919	2.006	2.168	1.972	2.565	2.219
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	135.995	127.611	133.737	127.093	127.629	126.376	135.111	138.686	132.622	131.450	134.857
Fuel wood and wood waste	95.000	95.000	104.500	104.500	103.075	103.360	100.700	104.500	102.000	102.500	102.500
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	18.525	11.685	11.970	8.550	8.550	7.125	2.992	3.278	1.425	1.140	5.928
Liquid petroleum gas (LPG)	19.320	20.240	20.700	21.390	25.300	23.920	23.000	23.000	23.920	24.380	25.254
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	9.781	17.160	21.450	22.952	22.952	21.450	19.305	19.305	15.444	11.583	8.010
Fuel oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.163	0.158	0.151	0.134	0.128	0.113	0.095	0.099	0.081	0.071	0.069
Fuels											
Liquid fuels	29.101	37.400	42.150	44.342	48.252	45.370	42.305	42.305	39.364	35.963	33.264
Gaseous fuels	135.995	127.611	133.737	127.093	127.629	126.376	135.111	138.686	132.622	131.450	134.857
Solid fuels	243.304	179.024	198.224	219.937	217.497	228.811	255.087	290.173	260.866	279.849	288.024
Other fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	95.000	95.000	104.500	104.500	103.075	103.360	100.700	104.500	102.000	102.500	102.500
Total	**503.400**	**439.035**	**478.611**	**495.872**	**496.453**	**503.917**	**533.203**	**575.664**	**534.852**	**549.762**	**558.645**

Table 12. (cont.) Fuel consumption [PJ] in 1.A.4.b category

Fuels	2010	2011	2012	2013	2014
Hard coal	319.753	275.817	291.964	280.095	257.420
Lignite	4.035	3.593	3.619	4.022	3.214
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	148.427	135.471	141.397	143.187	131.598
Fuel wood and wood waste	112.746	115.000	116.850	116.850	105.450
Biogas	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000
Coke	6.526	5.700	5.415	5.700	4.845
Liquid petroleum gas (LPG)	24.840	23.000	23.000	21.620	22.540
Motor gasoline	0.000	0.000	0.000	0.000	0.000
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000
Diesel oil	4.546	4.763	3.767	3.464	3.031
Fuel oil	0.000	0.000	0.000	0.000	0.000
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.067	0.059	0.040	0.047	0.036
Fuels					
Liquid fuels	29.386	27.763	26.767	25.084	25.571
Gaseous fuels	148.427	135.471	141.397	143.187	131.598
Solid fuels	330.381	285.169	301.038	289.864	265.515
Other fuels	0.000	0.000	0.000	0.000	0.000
Biomass	112.746	115.000	116.850	116.850	105.450
Total	**620.940**	**563.403**	**586.052**	**574.985**	**528.134**

Table 13. Fuel consumption [PJ] in 1.A.4.c category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Hard coal	38.608	38.489	36.365	57.356	62.959	62.501	60.542	58.583	62.611	52.483	46.050
Lignite	1.581	1.139	0.844	1.018	0.911	0.814	1.642	1.698	1.299	1.292	1.419
Hard coal briquettes (patent fuels)	0.598	0.527	0.645	0.146	0.088	0.059	0.059	0.000	0.000	0.000	0.000
Brown coal briquettes	0.106	0.106	0.040	0.020	0.020	0.000	0.000	0.000	0.000	0.000	0.000
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	0.507	0.445	0.448	0.275	0.055	0.132	0.212	0.243	0.428	0.571	0.868
Fuel wood and wood waste	0.039	0.113	0.039	0.278	0.583	20.057	18.367	18.500	17.567	17.000	17.100
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Industrial wastes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	1.786	1.754	1.568	1.168	0.684	0.570	4.018	4.018	4.104	5.130	5.700
Liquid petroleum gas (LPG)	0.000	0.000	0.000	0.000	0.000	0.000	0.460	0.690	1.150	1.380	1.380
Motor gasoline	0.000	0.000	0.000	0.000	0.000	0.674	1.122	1.122	1.122	1.212	1.122
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	53.967	51.972	53.968	51.995	60.661	74.989	81.381	85.457	94.380	109.481	99.099
Fuel oil	10.264	9.469	9.175	8.125	7.076	18.020	21.999	13.905	8.200	10.930	8.831
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.012	0.010	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.001	0.002	0.001	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.001
Fuels											
Liquid fuels	64.230	61.441	63.143	60.120	67.737	93.683	104.962	101.174	104.852	123.003	110.432
Gaseous fuels	0.507	0.445	0.448	0.275	0.055	0.132	0.212	0.243	0.428	0.571	0.868
Solid fuels	42.691	42.026	39.465	59.710	64.662	63.946	66.261	64.299	68.014	58.905	53.170
Other fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	0.039	0.113	0.039	0.278	0.583	20.057	18.367	18.500	17.567	17.000	17.100
Total	**107.467**	**104.025**	**103.095**	**120.383**	**133.037**	**177.818**	**189.802**	**184.216**	**190.861**	**199.479**	**181.570**

Table 13. (cont.) Fuel consumption [PJ] in 1.A.4.c category

Fuels	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hard coal	49.162	33.231	36.975	30.820	29.693	31.728	35.673	42.074	37.748	41.640	41.538
Lignite	1.097	0.939	1.236	1.395	1.528	2.086	2.188	2.489	2.125	2.770	2.485
Hard coal briquettes (patent fuels)	0.000	0.000	0.000	0.000	0.000	0.029	0.000	0.000	0.000	0.059	0.029
Brown coal briquettes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.040	0.000	0.040	0.040
Crude oil	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Natural gas	0.476	0.536	0.777	0.914	1.197	1.182	1.084	1.492	1.840	1.900	1.577
Fuel wood and wood waste	17.100	17.100	19.043	19.010	19.017	19.878	19.038	19.977	19.061	19.024	19.030
Biogas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.094	0.097
Industrial wastes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.006	0.012	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke	5.130	3.420	3.705	2.850	2.850	1.995	1.140	1.425	0.855	0.826	0.855
Liquid petroleum gas (LPG)	1.610	1.840	2.300	2.760	3.220	3.220	3.220	2.300	2.300	2.346	2.070
Motor gasoline	1.347	1.392	0.943	0.269	0.314	0.224	0.269	0.314	0.224	0.224	0.225
Aviation gasoline	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diesel oil	101.458	111.969	104.590	104.247	105.105	107.207	109.395	81.510	75.075	75.075	73.610
Fuel oil	8.642	8.400	8.191	6.776	8.172	8.579	9.432	3.825	3.375	3.453	4.311
Feedstocks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fuels											
Liquid fuels	113.057	123.601	116.024	114.052	116.811	119.230	122.316	87.949	80.974	81.098	80.216
Gaseous fuels	0.476	0.536	0.777	0.914	1.197	1.182	1.084	1.492	1.840	1.900	1.577
Solid fuels	55.389	37.590	41.916	35.065	34.071	35.838	39.001	46.028	40.728	45.335	44.947
Other fuels	0.006	0.012	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biomass	17.100	17.100	19.043	19.010	19.017	19.878	19.038	19.977	19.061	19.118	19.127
Total	**186.028**	**178.839**	**177.771**	**169.041**	**171.096**	**176.128**	**181.439**	**155.446**	**142.603**	**147.451**	**145.867**

Table 13. (cont.) Fuel consumption [PJ] in 1.A.4.c category

Fuels	2010	2011	2012	2013	2014
Hard coal	47.291	41.488	43.715	41.611	39.003
Lignite	1.667	1.337	1.327	1.609	1.286
Hard coal briquettes (patent fuels)	0.029	0.059	0.205	0.293	0.264
Brown coal briquettes	0.000	0.000	0.020	0.520	1.360
Crude oil	0.000	0.000	0.000	0.000	0.000
Natural gas	1.486	1.531	1.796	1.501	1.438
Fuel wood and wood waste	21.088	23.931	20.948	20.937	19.310
Biogas	0.039	0.223	0.252	0.286	0.328
Industrial wastes	0.000	0.000	0.000	0.000	0.000
Municipal waste - non-biogenic fraction	0.000	0.000	0.000	0.000	0.000
Municipal waste – biogenic fraction	0.000	0.000	0.000	0.000	0.000
Other petroleum products	0.000	0.000	0.000	0.000	0.000
Petroleum coke	0.000	0.000	0.000	0.000	0.000
Coke	0.940	0.998	0.285	0.570	0.627
Liquid petroleum gas (LPG)	2.300	2.346	2.300	2.300	2.760
Motor gasoline	0.045	0.045	0.045	0.045	0.044
Aviation gasoline	0.000	0.000	0.000	0.000	0.000
Jet kerosene	0.000	0.000	0.000	0.000	0.000
Diesel oil	73.480	74.130	74.692	73.177	70.579
Fuel oil	3.451	3.926	4.039	3.436	3.096
Feedstocks	0.000	0.000	0.000	0.000	0.000
Refinery gas	0.000	0.000	0.000	0.000	0.000
Coke oven gas	0.000	0.000	0.000	0.000	0.000
Blast furnace gas	0.000	0.000	0.000	0.000	0.000
Gas works gas	0.000	0.000	0.000	0.000	0.000
Fuels					
Liquid fuels	79.276	80.447	81.076	78.958	76.479
Gaseous fuels	1.486	1.531	1.796	1.501	1.438
Solid fuels	49.927	43.882	45.552	44.603	42.540
Other fuels	0.000	0.000	0.000	0.000	0.000
Biomass	21.127	24.154	21.200	21.223	19.638
Total	**151.816**	**150.014**	**149.624**	**146.285**	**140.095**

Table 14. CO2 EFs [kg/GJ] for coal and lignite in 1.A.1.a category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	95.58	95.57	95.25	95.11	94.97	94.97	94.95	94.98	94.96	94.95	94.91	94.92
Lignite	111.47	110.88	109.87	109.76	109.28	109.90	110.03	108.95	109.04	108.90	108.41	108.31
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.97	94.97	94.94	94.93	94.98	94.95	94.92	94.97	94.98	94.90	94.96	95.01
Lignite	108.72	108.21	108.64	108.56	108.84	107.83	107.88	107.54	107.20	107.52	108.62	109.56
	2012	**2013**	**2014**									
Hard coal	94.99	94.98	94.96									
Lignite	109.76	109.91	110.77									

Table 15. CO2 EFs [kg/GJ] for coal and lignite in 1.A.1.b category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	94.70	94.76	94.64	94.76	94.64	94.81	94.72	94.86	94.64	94.59	94.58	94.55
Lignite												
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.62	94.57	94.64							94.73	94.69	94.69
Lignite												109.53
	2012	**2013**	**2014**									
Hard coal	94.70	94.73	94.74									
Lignite	109.74	109.91	109.74									

Table 16. CO2 EFs [kg/GJ] for coal and lignite in 1.A.1.c category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	95.30	95.37	94.70	94.73	94.65	94.81	94.71	94.86	94.60	94.55	94.55	94.51
Lignite	111.39	110.71	103.84	105.02	106.21	104.86	103.76	108.93	109.01	105.71	108.39	103.45
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.59	94.54	94.51	94.53	94.59	94.34	94.52	94.36	94.55	94.54	94.67	94.22
Lignite	104.58	105.50	104.33	105.94	105.96	105.87	105.62	106.15	106.87	106.39	108.60	109.53
	2012	**2013**	**2014**									
Hard coal	93.88	93.88	93.85									
Lignite	109.74	109.91	109.74									

Table 17. CO2 EFs [kg/GJ] for coal and lignite in 1.A.2.a category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	94.70	94.68	94.70	94.73	94.65	94.81	94.71	94.86	94.63	94.58	94.58	94.54
Lignite				104.75						106.72		
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.62	94.57	94.55	94.53	94.59	94.34	94.52	94.45	94.68	94.52	94.34	94.11
Lignite												
	2012	**2013**	**2014**									
Hard coal	93.90	93.92	93.92									
Lignite												

Table 18. CO2 EFs [kg/GJ] for coal and lignite in 1.A.2.b category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	94.70	94.68	94.70	94.73	94.65	94.81	94.71	94.86	94.63	94.59	94.58	94.55
Lignite												
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.52	94.37	94.49	94.53	94.59	94.43	94.43	93.64	0.00	0.00	0.00	94.71
Lignite												
	2012	**2013**	**2014**									
Hard coal	94.69	94.73	94.70									
Lignite												

Table 19. CO2 EFs [kg/GJ] for coal and lignite in 1.A.2.c category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	94.70	94.68	94.70	94.73	94.65	94.81	94.71	94.86	94.63	94.59	94.58	94.55
Lignite	105.16	104.93	103.84	104.75	106.72	105.13	104.14	108.93	109.01	105.66	108.39	103.47
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.62	94.56	94.55	94.53	94.59	94.34	94.52	94.45	94.70	94.75	94.68	94.70
Lignite												
	2012	**2013**	**2014**									
Hard coal	94.70	94.74	94.73									
Lignite												

Table 20. CO2 EFs [kg/GJ] for coal and lignite in 1.A.2.d category .

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	94.70	94.68	94.70	94.73	94.65	94.81	94.71	94.86	94.63	94.59	94.58	94.55
Lignite												
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.62	94.57	94.55	94.53	94.59	94.34	94.52	94.45	94.70	94.75	94.68	94.70
Lignite												
	2012	**2013**	**2014**									
Hard coal	94.70	94.74	94.73									
Lignite												

Table 21. CO2 EFs [kg/GJ] for coal and lignite in 1.A.2.e category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	94.70	94.68	94.70	94.73	94.65	94.81	94.71	94.86	94.63	94.58	94.58	94.55
Lignite	105.14	104.92	104.14	104.75	106.72	104.90	103.84	108.93	109.01	105.67	108.39	103.40
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.62	94.57	94.55	94.53	94.59	94.34	94.52	94.44	94.69	94.75	94.67	94.70
Lignite	104.57	105.47	104.38	105.87	105.85	105.91	105.71					
	2012	**2013**	**2014**									
Hard coal	94.70	94.74	94.73									
Lignite												

Table 22. CO2 EFs [kg/GJ] for coal and lignite in 1.A.2.f category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	94.70	94.68	94.70	94.73	94.65	94.81	94.71	94.86	94.63	94.58	94.58	94.55
Lignite	105.15	104.93	103.84	105.22	106.31	104.86	103.84	108.93	109.01	105.71	108.39	103.47
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.62	94.57	94.55	94.53	94.59	94.34	94.52	94.45	94.69	94.75	94.68	94.70
Lignite	104.75	106.72	104.75						106.72		108.60	109.53
	2012	**2013**	**2014**									
Hard coal	94.70	94.74	94.73									
Lignite	109.74	109.91	109.74									

Table 23. CO2 EFs [kg/GJ] for coal and lignite in 1.A.2.g category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	94.70	94.68	94.70	94.73	94.65	94.81	94.71	94.86	94.63	94.58	94.58	94.55
Lignite	105.15	104.92	104.53	105.13	106.31	104.83	103.97	108.93	109.01	105.66	108.39	103.60
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.62	94.57	94.55	94.53	94.59	94.34	94.52	94.45	94.70	94.75	94.68	94.70
Lignite	104.86	105.47	104.78	106.04	106.72	106.72	106.72		106.72	106.49	108.60	109.53
	2012	**2013**	**2014**									
Hard coal	94.70	94.74	94.73									
Lignite	109.74	109.91	109.74									

Table 24. CO2 EFs [kg/GJ] for coal and lignite in 1.A.4.a category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	94.70	94.76	94.76	94.76	94.57	94.75	94.82	94.89	94.44	94.71	94.64	94.80
Lignite	111.07	110.71				108.93	110.02	109.72	108.16	106.72	106.72	106.72
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.84	94.94	94.87	94.68	94.34	94.14	93.99	94.20	94.04	94.05	93.90	94.06
Lignite											109.72	109.61
	2012	**2013**	**2014**									
Hard coal	93.96	94.04	94.05									
Lignite	111.17	111.16	111.20									

Table 25. CO2 EFs [kg/GJ] for coal and lignite in 1.A.4.b category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	94.70	94.76	94.76	94.76	94.57	94.75	94.82	94.89	94.44	94.72	94.65	94.80
Lignite	111.07	110.71	109.64	109.40		108.61	109.92	108.97	108.20	108.42	108.46	108.59
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.85	94.94	94.87	94.68	94.34	94.14	93.99	94.20	94.04	94.05	93.90	94.06
Lignite	108.78	108.55	107.94	108.96	109.67	108.09	108.14	108.93	107.15	107.25	109.70	109.61
	2012	**2013**	**2014**									
Hard coal	93.96	94.04	94.05									
Lignite	111.19	111.18	111.22									

Table 26. CO2 EFs [kg/GJ] for coal and lignite in 1.A.4.c category

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hard coal	94.70	94.76	94.76	94.76	94.57	94.75	94.82	94.89	94.44	94.71	94.65	94.80
Lignite	111.07	110.71	109.61	109.01	108.12	108.61	109.92	108.97	108.19	108.41	108.47	108.60
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Hard coal	94.84	94.94	94.87	94.68	94.34	94.14	93.99	94.20	94.04	94.05	93.90	94.06
Lignite	108.76	108.54	107.93	108.98	109.67	108.09	108.14	108.93	107.15	107.25	109.71	109.61
	2012	**2013**	**2014**									
Hard coal	93.96	94.04	94.05									
Lignite	111.19	111.17	111.21									

Table 27. CO_2 EFs [kg/GJ] applied for other fuels in the years 1988-2014 for stationary sources in 1.A.1, 1.A.2 and 1.A.4 categories [IPCC 2006]

Fuels	EF
Hard coal briquettes (patent fuels)	97.50
Brown coal briquettes	97.50
Crude oil	73.30
Natural gasl	56.10
Fuel wood and wood waste	112.00
Biogas	54.60
Industrial wastes	143.00
Municipal waste - non-biogenic fraction	91.70
Municipal waste – biogenic fraction	100.00
Other petroleum products	73.30
Petroleum coke	97.50
Coke	107.00
Liquid petroleum gas (LPG)	63.10
Motor gasoline	69.30
Aviation gasoline	70.00
Jet kerosene	71.50
Diesel oil	74.10
Fuel oil	77.40
Feedstocks	73.30
Refinery gas	57.60
Coke oven gas	44.40
Blast furnace gas	260.00
Gas works gas	44.40

Table 28. CH_4 EFs [kg/GJ] applied for the years 1988-2014 for stationary sources [IPCC 2006]

Fuels	1.A.1	1.A.2	1.A.4.a	1.A.4.b-c
Hard coal	0.0010	0.0100	0.0100	0.3000
Lignite	0.0010	0.0100	0.0100	0.3000
Hard coal briquettes (patent fuels)	0.0010	0.0100	0.0100	0.3000
Brown coal briquettes	0.0010	0.0100	0.0100	0.3000
Crude oil	0.0030	0.0030	0.0100	0.0100
Natural gasl	0.0010	0.0010	0.0050	0.0050
Fuel wood and wood waste	0.0300	0.0300	0.3000	0.3000
Biogas	0.0010	0.0010	0.0050	0.0050
Industrial wastes	0.0300	0.0300	0.3000	0.3000
Municipal waste - non-biogenic fraction	0.0300	0.0300	0.3000	0.3000
Municipal waste – biogenic fraction	0.0300	0.0300	0.3000	0.3000
Other petroleum products	0.0030	0.0030	0.0100	0.0100
Petroleum coke	0.0030	0.0030	0.0100	0.0100
Coke	0.0010	0.0100	0.0100	0.3000
Liquid petroleum gas (LPG)	0.0010	0.0010	0.0050	0.0050
Motor gasoline	0.0030	0.0030	0.0100	0.0100
Aviation gasoline	0.0030	0.0030	0.0100	0.0100
Jet kerosene	0.0030	0.0030	0.0100	0.0100
Diesel oil	0.0030	0.0030	0.0100	0.0100
Fuel oil	0.0030	0.0030	0.0100	0.0100
Feedstocks	0.0030	0.0030	0.0100	0.0100
Refinery gas	0.0010	0.0010	0.0050	0.0050
Coke oven gas	0.0010	0.0010	0.0050	0.0050
Blast furnace gas	0.0010	0.0010	0.0050	0.0050
Gas works gas	0.0010	0.0010	0.0050	0.0050

Table 29. N_2O EFs [kg/GJ] applied for the years 1988-2014 for stationary sources in 1.A.1, 1.A.2 and 1.A.4 categories [IPCC 2006]

Fuels	EF
Hard coal	0.0015
Lignite	0.0015
Hard coal briquettes (patent fuels)	0.0015
Brown coal briquettes	0.0015
Crude oil	0.0006
Natural gasl	0.0001
Fuel wood and wood waste	0.0040
Biogas	0.0001
Industrial wastes	0.0040
Municipal waste - non-biogenic fraction	0.0040
Municipal waste – biogenic fraction	0.0040
Other petroleum products	0.0006
Petroleum coke	0.0006
Coke	0.0015
Liquid petroleum gas (LPG)	0.0001
Motor gasoline	0.0006
Aviation gasoline	0.0006
Jet kerosene	0.0006
Diesel oil	0.0006
Fuel oil	0.0006
Feedstocks	0.0006
Refinery gas	0.0001
Coke oven gas	0.0001
Blast furnace gas	0.0001
Gas works gas	0.0001

Annex 3.1. Calculation of CO_2 emission from 2.A.4.d subcategory: Other processes uses of carbonates - other

Table 1. Estimation of CO_2 emission from calcite use as limestone sorbents to desulfurize the off-gases by wet method (lime WFGD) in the years 1988-2014 (all values in the table are expressed in kilotons [kt])

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Desulphurization plaster production in lime wet FGD	0	0	0	0	0	0	0	175	474	583	674	860	1140	1134	1038	1109	1250
Consumption of limestone sorbents to desulfurize the off-gases by wet method (lime WFGD)	0	0	0	0	0	0	0	104	282	346	400	511	677	673	617	659	742
Limestone consumption in lime WFGD	0	0	0	0	0	0	0	99	268	329	380	485	643	640	586	626	705
CO2 emission from decomposition of calcium carbonate in WFGD	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**43**	**118**	**145**	**167**	**214**	**283**	**281**	**258**	**275**	**310**

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Desulphurization plaster production in lime wet FGD	1177	1240	1338	1596	2076	2389	2505	2572	2768	2768
Consumption of limestone sorbents to desulfurize the off-gases by wet method (lime WFGD)	699	736	795	948	1233	1418	1487	1527	1644	1644
Limestone consumption in lime WFGD	664	700	755	900	1171	1347	1413	1451	1561	1561
CO2 emission from decomposition of calcium carbonate in WFGD	**292**	**308**	**332**	**396**	**515**	**593**	**622**	**638**	**687**	**687**

Table 2. Estimation of CO_2 emission from decomposition of calcite use to desulfurize the off-gases in fluid bad boilers (FGD in FBB) and in other method of flue gas desulfurization (FGD other than lime WFGD) in the years 1988-2014 (all values in the table are expressed in kilotons [kt])

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
SO2 emission captured by FGD in power plants and autoproducers CHP	916	924	766	786	857	900	990	1048	1178	1321	1379	1426	1620	1630	1699	1881	1939
SO2 captured with use of lime wet FGD method	0	0	0	0	0	0	0	65	176	217	251	320	424	422	386	413	465
SO2 captured with use of other FGD method	916	924	766	786	857	900	990	983	1002	1104	1128	1106	1196	1208	1313	1468	1474
Consumption of limestone sorbents to desulfurize the off-gases in FBB and in FGD other than lime wet FGD	1574	1588	1317	1351	1473	1547	1702	1689	1721	1898	1939	1901	2055	2076	2256	2524	2533
Limestone consumption in FGD in FBB and in FGD other than lime wet FGD	1543	1556	1290	1324	1444	1516	1668	1656	1687	1860	1900	1863	2014	2035	2211	2473	2482
CO2 emission from calcium carbonate in FGD in FBB and in FGD other than lime WFGD	**679**	**685**	**568**	**583**	**635**	**667**	**734**	**728**	**742**	**818**	**836**	**820**	**886**	**895**	**973**	**1088**	**1092**

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SO2 emission captured by FGD in power plants and autoproducers CHP	1967	2075	2091	2178	2136	2299	2524	2297	2302	2322
SO2 captured with use of lime wet FGD method	438	461	498	594	773	889	932	957	1030	1030
SO2 captured with use of other FGD method	1529	1614	1593	1584	1363	1410	1592	1340	1272	1292
Consumption of limestone sorbents to desulfurize the off-gases in FBB and in FGD other than lime wet FGD	2628	2773	2738	2723	2343	2424	2736	2303	2186	2220
Limestone consumption in FGD in FBB and in FGD other than lime wet FGD	2575	2718	2683	2668	2297	2375	2681	2257	2142	2176
CO2 emission from calcium carbonate in FGD in FBB and in FGD other than lime WFGD	**1133**	**1196**	**1181**	**1174**	**1010**	**1045**	**1180**	**993**	**943**	**957**

Table 3. CO_2 emission values from carbonate use in 2.A.4.d subcategory for the years 1988-2014 (all values in the table are expressed in kilotons [kt])

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of limestone use presented in the tables 1-2	1543	1556	1290	1324	1444	1516	1668	1754	1954	2189	2281	2348	2657	2674	2797	3099	3188
CO2 emission from carbonate use in 2.A.4.d subcategory	**679**	**685**	**568**	**583**	**635**	**667**	**734**	**772**	**860**	**963**	**1003**	**1033**	**1169**	**1177**	**1231**	**1363**	**1403**

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Sum of limestone use presented in the tables 1-2	3239	3417	3438	3569	3468	3723	4094	3708	3704	3737
CO2 emission from carbonate use in 2.A.4.d subcategory	**1425**	**1504**	**1513**	**1570**	**1526**	**1638**	**1802**	**1631**	**1630**	**1644**

Annex 3.2. Calculation of CO_2 process emission from ammonia production (2.B.1)

Table 1. Calculation of CO_2 process emission from ammonia production

		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Activity data	**Unit**												
natural gas	[10^3 m3]	2 184 552	2 230 523	1 447 064	1 447 326	1 337 619	1 401 804	1 688 887	1 942 704	1 907 689	1 937 127	1 789 006	1 587 228
natural gas	TJ	76 413	77 862	50 625	50 911	47 044	49 522	60 161	69 070	67 919	69 049	64 163	56 105
coke oven gas	[10^3 m3]	183 960	113 672	30 560									
coke oven gas	TJ	3 204	1 970	537									
CO_2 emission from natural gas use	kt	4 357	4 449	2 886	2 887	2 668	2 796	3 369	3 875	3 805	3 864	3 568	3 166
CO_2 emission from coke oven gas use	kt	142	87	24									
Total CO2 emission	kt	4 500	4 537	2 910	2 887	2 668	2 796	3 369	3 875	3 805	3 864	3 568	3 166
Ammonia production	kt	2389.353	2433.726	1531.552	1560.883	1480.798	1630.946	1945.470	2248.317	2185.188	2251.616	2047.948	1784.726
Implied EF of CO_2 process emission	[t CO2/ t NH3]	1.88	1.86	1.90	1.85	1.80	1.71	1.73	1.72	1.74	1.72	1.74	1.77

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Activity data	**Unit**												
natural gas	[10^3 m3]	1 965 162	1 873 685	1 455 329	2 122 465	2 177 127	2 310 818	2 197 622	2 186 299	2 221 406	1 814 589	1 881 957	2 061 524
natural gas	TJ	70 483	68 096	52 144	76 053	77 817	82 219	78 591	78 072	79 351	63 478	67 234	73 798
coke oven gas	[10^3 m3]												
coke oven gas	TJ												
CO_2 emission from natural gas use	kt	3 920	3 737	2 903	4 234	4 343	4 609	4 384	4 361	4 431	3 620	3 754	4 112
CO_2 emission from coke oven gas use	kt												
Total CO2 emission	kt	3 920	3 737	2 903	4 234	4 343	4 609	4 384	4 361	4 431	3 620	3 754	4 112
Ammonia production	kt	2243.108	2103.805	1594.797	2246.505	2451.557	2523.790	2326.621	2417.543	2485.148	2010.891	2059.437	2321.849
Implied EF of CO_2 process emission	[t CO2/ t NH3]	1.75	1.78	1.82	1.88	1.77	1.83	1.88	1.80	1.78	1.80	1.82	1.77

		2012	2013	2014
Activity data	**Unit**			
natural gas	[10^3 m3]	2 242 281	2 207 620	2 295 270
natural gas	TJ	81 150	79 269	83 391
coke oven gas	[10^3 m3]			
coke oven gas	TJ			
CO_2 emission from natural gas use	kt	4 473	4 403	4 565
CO_2 emission from coke oven gas use	kt			
Total CO2 emission	kt	4 473	4 403	4 565
Ammonia production	kt	2467.458	2228.303	2634.506
Implied EF of CO_2 process emission	[t CO2/ t NH3]	1.81	1.98	1.73

Annex 4. Energy balance data for main fuels in 2014

Energy balances for several main fuels: lignite, natural gas, coke oven gas and blast furnace gas are given below. Similar balance data for hard coal are presented in Chapter 1.4.

Lignite consumption

National fuel balance	Lignite - Eurostat	
	10^3 Mg	TJ
In	64 053	522 032
From national sources	63 877	520 598
1) Indigenous production	63 877	520 598
2) Transformation output or return	0	0
3) Stock decrease	0	0
Import	176	1 434
Out	64 053	522 033
National consumption	63 900	519 282
1) Transformation input	63 206	513 429
a) input for secondary fuel production	0	0
b) fuel combustion	63 206	513 429
2) Direct consumption	694	5 853
Non-energy use	0	0
Combusted directly	694	5 853
Combusted in Poland	63 900	519 282
Stock increase	-95	-774
Export	303	2 469
Losses and statistical differences	-55	1 056

Net calorific value	MJ/kg	8.13

Natural gas consumption

National fuel balance	Natural gas - Eurostat
	TJ
In	562 520
From national sources	156 014
1) Indigenous production	156 014
2) Transformation output or return	0
3) Stock decrease	0
Import	406 506
Out	562 520
National consumption	558 768
1) Transformation input	75 068
a) input for secondary fuel production	0
b) fuel combustion	75 068
2) Direct consumption	483 700
Non-energy use	86 299
Combusted directly	397 401
Combusted in Poland	472 469
Stock increase	-1 289
Export	2 592
Losses and statistical differences	2 449

Coke oven gas consumption

National fuel balance	Coke Oven Gas - Eurostat
	TJ
In	69 754
From national sources	69 754
1) Indigenous production	0
2) Transformation output or return	69 754
3) Stock decrease	0
Import	0
Out	69 754
National consumption	69 754
1) Transformation input	17 789
a) input for secondary fuel production	0
b) fuel combustion	17 789
2) Direct consumption	51 965
Non-energy use	0
Combusted directly	51 965
Combusted in Poland	69 754
Stock increase	0
Export	0
Losses and statistical differences	0

Blast furnace gas consumption

National fuel balance	Blast furnace gas - Eurostat
	TJ
In	25 802
From national sources	25 802
1) Indigenous production	0
2) Transformation output or return	25 802
3) Stock decrease	0
Import	0
Out	25 802
National consumption	25 802
1) Transformation input	13 937
a) input for secondary fuel production	0
b) fuel combustion	13 937
2) Direct consumption	11 865
Non-energy use	0
Combusted directly	11 865
Combusted in Poland	25 802
Stock increase	0
Export	0
Losses and statistical differences	0

Annex 5.
Methodological notes related to elaboration of representative research on livestock animals performed by Central Statistical office [GUS R1 (2015)]

METHODICAL NOTES

I. SOURCES OF DATA

The data in this publication were compiled on the basis of:

- generalized results of sample surveys[a/] on cattle, sheep, poultry and pigs, as well as, the animal output in private farms,
- statistical reports in the scope of livestock in state and cooperative farms and companies with public and private property share,
- statistical reports from slaughter houses of farm animals,
- statistical reports from poultry hatcheries,
- information on the livestock of poultry from voivodship experts,
- own estimates.

Surveys on cattle, sheep, poultry and animal output were conducted in approx. of the sample of private farms breeding the above-listed species of animals; this sample amounted to 30 thousand farms.

Surveys on pigs and production of pigs for slaughter were carried out in a sample of private farms breeding pigs; this sample amounted to 30 thousand farms.

The results of the survey of farm animal stocks and animal output were compiled by voivodship according to the residence of the land user, i.e. for private farms – according to the official residence (place of residence) of the land user, while for state owned farms, cooperative farms and companies – according to the official residence of the enterprise (farm).

II. MAJOR DEFINITIONS, TERMS AND ENUMERATION RULES

An agricultural farm is understood as an organised economic and technical unit with separate management (a user or a manager), conducting agricultural activity.

An agricultural activity shall include activity related to cultivation of plants and rearing and breeding of animals, which covers: all field crops (including mushrooms), vegetable gardening and horticulture, nurseries, cultivation and seed production of agricultural and horticultural crops as well as activity related to rearing and breeding of animals (cattle, sheep, goats, horses, pigs, poultry, rabbits, fur-covered animals, game kept

a/ The surveys on cattle, sheep and poultry stock are conducted twice a year, i.e. in June and in December, while the survey on pigs – three times a year, i.e. in April, August and December.

for slaughter), bees as well as activity consisting in maintaining the land no longer used for production purposes in accordance with cultivation principles with respect for environment protection requirements (according to the norms).

A natural person is holding (private farm) is understood as a farm owned or used by a natural person of the area of at least 1.0 ha and more of agricultural land or a farm of the area of less than 1.0 ha, excluding agricultural land, which meets at least one of the thresholds mentioned below:

- 0,5 ha of fruit-bearing trees plantation,
- 0,5 ha of fruit-bearing shrubs plantation,
- 0,3 ha of fruit and ornamental nurseries,
- 0,5 ha of soil-grown vegetables,
- 0,5 ha of soil-grown strawberries,
- 0,1 ha of vegetables under cover,
- 0,1 ha of strawberries under cover,
- 0,1 ha of flowers and ornamental plants under cover,
- 0,5 ha of hop,
- 0,1 ha of tobacco,
- 25 m^2 of edible mushrooms,
- 10 head of cattle in total,
- 5 head of cows in total,
- 50 head of pigs in total,
- 10 head of sows,
- 20 head of sheep in total,
- 20 head of goats in total,
- 100 head of poultry for slaughter in total,
- 80 head of poultry for laying in total,
- 5 head of horses in total,
- 50 head of female rabbits,
- 80 beehives.

A legal person's or organizational unit without legal status is understood as farm run by a legal person or an organization unit without legal personality, the basic activity of which is rated, according to the Polish Classification of Activities, to Section A, division 01, group:

- growing of non perennial,

- 01.2 – growing of perennial plants,
- 01.3 – plant propagation,
- 01.4 – livestock production and breeding,
- 01.5 – cultivation of plants combined with rearing and breeding of animals (mixed agricultural activity),
- 01.6, class 01.61 – service activities supporting plant production (maintaining the lands in accordance with cultivation principles with respect for environment protection requirements), and also, irrespective of the basic activity classification, when the area of agricultural land per the lands used by an individual is 1 ha and more or when livestock is reared and bred.

A holder is understood as a natural person or a legal person or an organisational unit without legal personality, actually using the land, regardless of whether as owners or leaseholders, or using the land in any other respect, regardless of whether this land is situated in one or in several gminas.

Livestock

The survey covered the livestock staying in the farm during the survey period, as well as animals sent to herding, grazing and shepherd's huts. All animals were registered, i.e. the ones owned by an agriculture holding user or members of his household, as well as animals temporarily or permanently kept in the farm, i.e. taken for raising, fattening, etc., irrespective of the fact whether they were taken from private farms, state-owned farms, cooperative entities, or companies.

Dairy cows are understood as cows which, due to their breed, species or particular qualities, are kept in a farm exclusively or mainly for production of milk to be consumed or to be processed into dairy products. Dairy cows rejected from breeding, kept in a farm for the period regarded as pre-slaughter pasturing, after which they are sent to slaughter, are also included in this group.

Suckling cows are understood as cows which, due to their breed (beef breed cows and cows born from a cross-breed with beef breeds) or particular qualities, are kept in a farm exclusively or mainly for calves for slaughter, and whose milk is used to feed calves or other animals. Suckling cows rejected from breeding, kept in a farm for the period regarded as pre-slaughter pasturing, after which they are sent to slaughter, are also included in this group.

In the case of farms engaged in production of poultry on a large scale (such as a large-scale farm producing broilers or hen eggs), in which no poultry has been recorded on the survey day due to the current technological break in production, whenever such break does not exceed 8 weeks, the poultry stocks from the period before emptying the rooms (poultry houses) have been adopted.

Information on the number of cattle, sheep and poultry contained in this publication referes to the stocs in June and December 20112, while the data of pigs to the stocs in March, July and November 2012.

III. MAJOR GROUPS AND THE SCOPE OF PUBLISHED DATA

The data regarding the farm animals stocks as well as the elements of cattle and pigs turnover were classified according to ownership forms, i.e. for the private sector, as well as the public one.

The **private sector** includes: entities of state domestic ownership (private farms, cooperative farms and private domestic companies), foreign ownership and mixed ownership.

The **public sector** includes state owned farms (of the State Treasury and state legal persons), farms owned by self-governments (gminas) and entities of mixed ownership (companies with a predominance of public property).

As regards the private sector the data in this publication are presented for the following farms:

- of state domestic ownership, including:
    - private farms,
    - agricultural production cooperatives,
- of foreign ownership,
- of mixed ownership.

As regards the public sector the data were compiled for farms:

- of state ownership (state owned farms), including farms of the State Treasury ownership,
- farms owned by self-governments.

The percentages are presented with one decimal point and due to the electronic technique of rounding may not sum up into 100%. These figures are substantially correct.

IV. SAMPLING SCHEME

Survey on cattle, sheep and poultry stock

1. Introductory notes

The purpose of the surveys conducted by the Central Statistical Office twice a year (i.e. in June and in December) is to obtain detailed information on the number of cattle and poultry, both by voivodships and for Poland, and on the number of sheep for Poland only. The surveyed population consists of private agricultural farms which, according to the results of the Agricultural Census 2010, were keeping cattle, or poultry, or sheep, and farms with the area of agricultural land of 15 ha or more, which did not keep the above mentioned species of animals. The surveyed population in 2012 consisted of 909, 523 farms, of which approx. 854 thousand farms keeping cattle, poultry, or sheep. It was decided that the sample for the survey would consist of approx. 30 thousand private farms.

2. Sampling frame

The results of the Agricultural Census 2010 were used for establishing the sampling frame. An individual agricultural farm constituted a sampling unit. The following information was recorded for each farm:

- voivodship code,
- farm number (Nr_gos),
- total farm area,
- agricultural land in the farm ,
- number of cattle,
- number of poultry,
- number of sheep.

3. Sampling scheme

Before sampling, the population of farms was divided into three parts. **The first part** included farms fulfilling at least one of the following criteria, i.e. farms with at least one head of cattle or farms with more than 50 head of poultry and without any sheep. This part of population included 574, 901 farms. **The second part** consisted of farms with no cattle or sheep, and with no more than 50 head of poultry. Furthermore, the farms which did not keep the above mentioned animals at all, but having the area of agricultural land of 15 ha or more were also included in this group. The second part amounted to 323, 335 farms. Finally, **the third part** included farms keeping sheep, and It amounted to 11, 287 farms.

Sample drawing was done with a stratified and optimal sampling scheme. The number of cattle and poultry was used in the first part of the population as the criteria for stratification and allocation of the sample between the strata. In the second part, the strata were established on the basis of the agricultural land, whereas in the third part – on the basis of the number of head of sheep. There were created 12 strata in each voivodship, of which 7 related to farms from the first part, and 5 related to farms from the second part. In the third part, 6 national strata were established, i.e. strata that covered farms from all voivodships.

It was decided that a sample consisting of approx. 21 thousand farms be drawn from **the first part** farms.

The following assumptions were made while drawing the sample from this category of farms:

(1) the size of **n** sample is established for the population of farms in Poland, and not for individual voivodships, where n consists of approx. 21,000 farms,

(2) the sample is drawn in individual voivodships according to the stratified and optimal sampling scheme, with the use of the Neyman method,

(3) the population in each voivodship is first divided into 7 strata (h = 1, 2, …., 7), and the sample is then allocated between these strata,

(4) stratum no. 7 (i.e. h = 7) in each voivodship consists of such sampling units for which the value of variables adopted as the stratification basis is above the specified threshold. The stratum created in this way, so called the upper stratum, includes the units which are not drawn, but which are all included in the sample,

(5) it has been assumed that the expected accuracy of the survey results, measured with the variation coefficient of the livestock of cattle or poultry, will be identical for each voivodship and will be approximately equal to 1.0%.

The above problem was solved with the use of the numerical optimization method[1]. The population was divided into strata whose (upper) boundaries expressed in the number of cattle and poultry were presented in Table 1.

Table 1. Boundaries of strata by voivodship in the survey on cattle, sheep, and poultry stocks in 2012.

WOJ.	B – cattle D - poultry	b_1	b_2	b_3	b_4	b_5	b_6
02	B	5	12	23	40	65	111
	D	413	452	527	942	1,598	17,998
04	B	9	19	32	50	76	133
	D	213	264	279	407	513	7,393
06	B	4	10	20	34	55	93
	D	101	122	127	170	217	3,029
08	B	8	18	30	48	75	116
	D	1,185	1,445	2,165	4,995	16,525	41,995
10	B	5	12	22	35	55	122
	D	164	211	357	429	519	9,919
12	B	2	5	10	17	30	53
	D	101	123	123	173	174	3,049
14	B	9	18	32	58	92	144
	D	187	217	233	386	530	10,199
16	B	8	17	29	46	72	116
	D	350	373	660	807	1,532	29,998
18	B	1	2	4	9	20	27
	D	42	82	101	102	135	453
20	B	9	21	29	32	52	144
	D	66	78	79	104	109	1,002
22	B	7	15	27	42	64	102
	D	413	427	507	673	892	16,998
24	B	5	11	21	37	60	101
	D	455	510	572	1,032	3,198	19,998
26	B	2	3	5	6	14	48
	D	39	64	73	119	163	316
28	B	13	27	43	69	107	175
	D	430	567	795	992	5,998	18,998
30	B	10	21	36	58	91	153
	D	417	525	594	1,084	1,699	21,099
32	B	7	16	29	45	69	115
	D	322	432	437	747	773	13,998

[1] The description of the solution to this problem was published in the article written by B. Lednicki and R. Wieczorkowski “Optimal Stratification and Sample Allocation Between Subpopulation and Strata”, Statistics in Transition”, book 10, 2003, Warsaw

The boundaries of stratum 6, i.e. b_6, presented in Table 1, constitute also a **threshold** above which the farms are included in stratum 7, which means that they are not subject to sampling, but are all included in the sample. For other strata, i.e. h = 1, 2, … , 6, the Neyman optimal allocation method was applied for establishing the values of n_{wh}, i.e. size of the samples drawn from the h-stratum in w-voivodship.

After that, 20, 807 farms were drawn to the sample, based on the assumed allocation, including 3,861 farms from stratum no. 7.

Before sampling, 5 strata were established in each voivodship in **the second part** (h = 8, 9,…., 12). These strata were created in respect of agricultural land, i.e.: h = 8: farms of less than 1 ha, h = 9: farms of 1 ha to 4.99, h = 10: farms of 5 ha to 14.99 ha, h = 11: farms of 15 ha to 49.99 ha, h = 12: farms of 50 ha or more. Identical accuracy of the number of poultry in this part of the population was adopted as the criterion for allocation of the sample between voivodships, while within voivodships the sample was allocated by means of the Neyman optimal method. From this part of the population 6,938 farms were drawn.

In **the third part**, in which 6 national strata were established (h = 13, 14, ..., 18), 2,255 farms were drawn for the sample. **All farms from stratum 18 were included in the sample.** These were farms keeping sheep and simultaneously 50 or more head of cattle, or at least 400 head of poultry. The boundaries of other strata, and the assumed number of the sample allocated between these strata, were established with the above mentioned numerical optimisation method. The upper stratum (h = 17) was also established, from which no farms were drawn. This stratum included farms which had not been previously included in stratum 18, and which kept more than 75 head of sheep. The upper boundaries of the remaining strata were the following: $b_{13} = 2$, $b_{14} = 6$, $b_{15} = 13$, $b_{16} = 24$. The aim of establishing this category of farms as a separate one, as well as optimising the division into strata, was to accurately estimate the data on the livestock of sheep in country terms, with no regional breakdown.

Eventually, the entire sample for the survey on cattle, poultry, and sheep consisted of 30000 farms.

4. Results generalization and the accuracy assessment method

The sum of X variable value, such as cattle stock in total, is the basic parameter estimated in the survey of livestock of cattle, sheep and poultry.

This parameter for w-voivodship is calculated according to the formula:

(1) $\hat{x}_w = \sum_h \sum_i W1_{whi} * x_{whi}$, (i = 1, 2, ... , n_{wh}; h = 1, 2, ... , 9)

where:

x_{whi} – the value of X variable in i-farm (sampling unit) drawn from h-stratum in w-voivodship,

$W1_{whi}$ – the weight assigned to i-farm drawn from h-stratum of w-voivodship,whereas this weight is calculated according to this formula:

(2) $W1_{whi} = \frac{N_{wh}}{n_{wh}}$,

N_{wh} – the number of sampling units in h-stratum of w-voivodship,

n_{wh} – the number of sampling units drawn for the sample from h-stratum of w-voivodship.

The $W1_{whi}$ weight might be used to estimate the survey results only if the survey is completed. This weight must be corrected if some of the sampled farms refuse to participate in the survey. For this purpose, the drawn sample is divided into 4 groups based on information on the survey performance:

(1) the surveyed farms,

(2) farms that refused to participate in the survey,

(3) closed down farms etc.,

(4) farms with which the contact was not established during the survey performance.

For each stratum separately in each voivodship, the size of the above groups, namely $n1_{wh}$, $n2_{wh}$, $n3_{wh}$ and $n4_{wh}$ is established, and then the likelihood function of surveyed and not surveyed among the farms with a determined status is established, that is:

(3) $c_{wh} = \frac{n1_{wh} + n2_{wh}}{n_{wh} - n4_{wh}}$,

Then the number of the n_{awh} active farms in h-stratum of w-voivodship is calculated for the drawn sample:

(4) $n_{awh} = n1_{wh} + n2_{wh} + c_{wh} * n4_{wh}$

On this basis, the R_{wh} correction factor is calculated for a given stratum:

(5) $R_{wh} = \frac{n_{awh}}{n1_{wh}}$,

The purpose of this factor is to correct the $W1_{whi:}$ weight in order to obtain final $W_{hi:}$ weight:

(6) $W_{whi} = R_{wh} * W1_{whi}$,

The sum of X variable value for Poland is the sum of values obtained for particular voivodships, i.e.:

(7) $\hat{x} = \sum_{w} \hat{x}_w,$ (w = 1, 2, ... , 16)

Original weights resulting from sampling are corrected not only due to incompleteness of the survey but also due to the occurrence of so called outliers, that is unusual farms. This pertains to farms with high assigned weight (drawn with a high likelihood function) and, at the same time, with relatively high values for some of the analysed variables. In this case, the weight correction is to prevent significant overestimation of the value of the surveyed variable.

For the selected major assessments of the parameters, their variation coefficients were calculated as the accuracy measures. For an estimator expressed by formula (1) i.e. for w-voivodship, its variation coefficient estimation is expressed in the following formula:

(8) $v\left(x_w\right) = \frac{\sqrt{d^2\left(\hat{x}_w\right)}}{\hat{x}_w} * 100,$

while:

(9) $d^2\left(\hat{x}_w\right) = \sum_{h} n_{awh}\left(1 - \frac{n_{wh}}{N_{wh}}\right) * s^2_{wh},$

where:

(10) $s^2_{wh} = \frac{1}{n_{awh} - 1} \sum_{i}\left(y_{whi} - \frac{1}{n_{awh}} * \hat{y}_{wh}\right)^2,$

while:

(11) $y_{whi} = W_{whi} * x_{whi},$

and:

(12) $\hat{y}_{wh} = \sum_{i} y_{whi},$

For Poland the variation coefficient of the sum X estimated with the formula (7) is expressed by the following formula:

(13) $v\left(\hat{x}\right) = \frac{\sqrt{d^2\left(\hat{x}\right)}}{\hat{x}},$

whereas:

$$(14)\quad d^2(\hat{x}) = \sum_w d^2(\hat{x}_w),$$

Survey on pigs

1. Introductory notes

The purpose of the surveys on pigs stocks, conducted by the Central Statistical Office three times a year (i.e. in April, in August and in December), is to obtain detailed information on the number of pigs by voivodships and for Poland. The surveyed population consists of individual farms which, according to the data of the Agricultural Census 2010, were keeping pigs, as well as farms with the area of agricultural land of 15 ha or more, but with no pigs. The surveyed population consisted of 499,284 farms, of which approx. 359.3 thousand of farms keeping pigs. It was decided that the sample for the survey would consist of approx. 30 thousand farms.

2. Sampling frame

Individual results of the Agricultural Census 2010 were employed in establishing the sampling frame. An individual agricultural farm constituted a sampling unit. The following information was recorded for each farm:

- voivodship code,
- farm number (Nr_gos),
- total farm area,
- agricultural land,
- number of pigs.

3. Sampling scheme

In order to draw sample, a stratified sampling and optimal scheme was used with respect to farms which, according to the sampling frame, reared pigs. In contrast, the stratified and proportional sampling was applied in each voivodship with respect to the population of farms which did not keep pigs. 2.0% of farms with the area of agricultural land of 15.00 – 49.99 ha, and 5.0% of farms with the area of agricultural land of 50.00 ha or more were drawn for the sample. In total, a sample consisting of 2,770 farms was drawn from this part of the population.

It was decided that a sample consisting of approx. 27 thousand farms be drawn from all farms breeding and rearing pigs.

The following assumptions were made while drawing the sample from this category of farms:

(1) the size of **n** sample is established for the population of farms in Poland, and not for individual voivodships, where n consists of approx. 27 thousand farms,

(2) the sample is drawn in individual voivodships according to the stratified and optimal sampling scheme, by means of the Neyman method,

(3) the population in each voivodship is first divided into 7 strata (h = 1, 2, …. , 7), and then the sample is allocated between these strata,

(4) stratum no. 7 (i.e. h = 7) in each voivodship consists of such sampling units, for which the value of at least one of the variables adopted as the stratification basis is above the specified threshold. The stratum created this way, regarded as the upper stratum, includes the units which are not drawn, but which are all included in the sample,

(5) it has been assumed that the expected accuracy of the survey results, measured with the variation coefficient of the livestock of pigs, will be identical for each voivodship and will be equal approximately to 0.3%.

The above problem was solved with the use of the numerical optimization method[2]. The population was divided into strata whose (upper) boundaries expressed in the number of pigs were presented in Table 2 below.

Table 2. Boundaries of strata by voivodship in the survey on pigs stock in 2012.

VOIV.	b_1	b_2	b_3	b_4	b_5	b_6
02	4	9	17	27	45	68
04	16	33	59	95	153	269
06	4	8	16	28	51	106
08	5	13	24	37	53	76
10	6	16	28	47	85	174
12	3	7	14	24	37	63
14	6	15	29	54	104	203
16	12	29	48	76	115	175
18	-	-	8	16	27	50
20	4	9	17	30	58	110
22	9	19	37	57	93	146
24	6	15	25	40	64	97
26	4	9	17	28	47	80
28	7	20	38	68	113	180
30	16	38	67	113	191	371
32	7	18	37	69	146	1,286

[2] The description of the solution to this problem was published in the article written by B. Lednicki and R. Wieczorkowski "Optimal Stratification and Sample Allocation Between Subpopulation and Strata", Statistics in Transition, book 10, 2003, Warsaw

The boundary of stratum 6, i.e. $\mathbf{b_6}$, presented in Table 2, also constitutes a **threshold, above which** the sampling units are included in stratum 7, which means they are not subject to sampling, but are all included in the sample. For other strata, i.e. h = 1, 2, … , 6, the Neyman optimal allocation method was employed for establishing the values of $n_{wh,}$ i.e. size of the samples drawn from the h-stratum in w-voivodship. In the case of one voivodship ("18"), as a result of applying numerical optimization procedures, the lower strata obtained were numerically too small, which caused strata 1 and 2 to be necessarily combined in one stratum no. 3. After that, 27, 230 farms were drawn to the sample, based on the assumed allocation, including 10,246 farms from stratum no. 7. Together with farms not keeping pigs (according to the sampling frame) fron stratum no. 8 (i.e. farms of the area of 15.00 ha to 49.99 ha of agricultural land) and stratum no. 9 farms (i.e. farms of 50 ha or more), the sample consisted of 30,000 farms.

4. Results generalization and the accuracy assessment method

The sum of X variable value, such as pigs stock in total, is the basic parameter estimated during the survey on the livestock of pigs.
This parameter for w-voivodship is calculated according to the formula:

$$(1)\quad \hat{x}_w = \sum_h \sum_i W1_{whi} * x_{whi}, \qquad (i = 1, 2, \dots, n_{wh};\ h = 1, 2, \dots, 9)$$

where:

x_{whi} – the value of X variable in i-farm (sampling unit) drawn from h-stratum in w-voivodship,

$W1_{whi}$ – weight assigned to i-farm drawn from h-stratum in w-voivodship, calculated on the basis of the following formula:

$$(2)\quad W1_{whi} = \frac{N_{wh}}{n_{wh}},$$

N_{wh} – the number of sampling units in h-stratum of w-voivodship,

n_{wh} – the number of sampling units drawn from h-stratum of w-voivodship.

Weight $W1_{whi}$ can be used for the estimation of survey results only when the survey is complete. The weight must be adjusted when a part of farms drawn for the survey refuse to participate in the survey. For this purpose, the drawn sample is divided into 4 groups on the basis of information on carrying out the survey:

(1) the surveyed farms,

(2) farms which refused to participate in the survey,

(3) closed down farms etc.

(4) farms with which there was no contact during carrying out the survey.

For each stratum, separately for each voivodship, the size of the above groups, i.e. $n1_{wh}$, $n2_{wh}$, $n3_{wh}$ and $n4_{wh}$ is established, then the likelihood function of surveyed and not surveyed among the farms with a determined status is established, i.e.:

(3) $$c_{wh} = \frac{n1_{wh} + n2_{wh}}{n_{wh} - n4_{wh}},$$

Next, the number of the n_{awh} active farms in h-stratum of w-voivodship is calculated for the drawn sample:

(4) $$n_{awh} = n1_{wh} + n2_{wh} + c_{wh} * n4_{wh}$$

On the basis of this, the R_{wh} correction factor is calculated for a given stratum:

(5) $$R_{wh} = \frac{n_{awh}}{n1_{wh}},$$

The function of this factor is the correction of the $W1_{whi}$ weight in order to achieve final weight $W_{hi:}$

(6) $$W_{whi} = R_{wh} * W1_{whi},$$

The evaluation of the sum of X variable value for Poland is the sum of values obtained for particular voivodships, i.e.:

(7) $$\hat{x} = \sum_{w} \hat{x}_w, \qquad (\text{ w} = 1, 2, \dots , 16)$$

Primary weights resulting from sample drawing are corrected not only due to the incompleteness of the survey but also due to the occurrence of the so called outlier farms. This pertains to farms with high assigned weight (drawn with a high likelihood function) and, at the same time, with relatively high values for some of the analysed variables. Weight correction is aimed at preventing substantial overestimation of the value of the analysed variable.

For the selected major assessments of the parameters, their variation coefficients were estimated as the accuracy measures. For an estimator expressed by formula (1), i.e. for w-voivodship, its variation coefficient is estimated with the following formula:

(8) $$v\left(x_w\right) = \frac{\sqrt{d^2\left(\hat{x}_w\right)}}{\hat{x}_w} * 100,$$

while:

$$(9)\quad d^2(\hat{x}_w) = \sum_h n_{awh}\left(1 - \frac{n_{wh}}{N_{wh}}\right) * s^2_{wh},$$

where:

$$(10)\quad s^2_{wh} = \frac{1}{n_{awh}-1}\sum_i\left(y_{whi} - \frac{1}{n_{awh}} * \hat{y}_{wh}\right)^2,$$

while:

$$(11)\quad y_{whi} = W_{whi} * x_{whi},$$

and:

$$(12)\quad \hat{y}_{wh} = \sum_i y_{whi},$$

For Poland the variation coefficient of the sum X estimated with the formula (7) is expressed by the following formula:

$$(13)\quad v(\hat{x}) = \frac{\sqrt{d^2(\hat{x})}}{\hat{x}},$$

whereas:

$$(14)\quad d^2(\hat{x}) = \sum_w d^2(\hat{x}_w),$$

The values of the relative standard error of selected attributes for Poland – based on the results of a sample survey of the livestock of cattle, sheep and poultry as well as the results of a survey of pigs – conducted in December 2012.

No. of the attribute	Name of the attribute	Relative standard error
1.	Cattle total	0.74
2.	Cows	0.83
3.	Pigs total	0.67
4.	Sows total	0.69
5.	Hens	0.41
6.	Laying hens	0.76

Annex 6.
Land transition matrixes

Poland

Land Use, Land-Use Change and Forestry Land Transition Matrix 2016

	Unit	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Forest land (managed)													
Remaining Forest land (managed)	kha	8659.18	8665.68	8677.82	8693.29	8705.94	8714.49	8714.45	8723.54	8741.13	8778.29	8808.85	8860.76
Converted to Forest land (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	kha	1.32	1.32	0.68	0.61	0.36	3.71	0.57	0.67	0.40	0.42	0.58	0.49
Converted to Other land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Total unmanaged land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	kha	8660.50	8667.00	8678.50	8693.90	8706.30	8718.20	8715.02	8724.22	8741.53	8778.71	8809.43	8861.25
Final area	kha	8667.00	8678.50	8693.90	8706.30	8718.20	8715.02	8724.22	8741.53	8778.71	8809.43	8861.25	8877.14
Forest land (unmanaged)													
Remaining Forest land (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Other land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Total unmanaged land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Final area	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Cropland													
Remaining Cropland	kha	14702.00	14678.50	14652.72	14644.85	14620.95	14607.09	14581.06	14567.42	14536.31	14518.16	14446.69	14467.34
Converted to Forest land (managed)	kha	6.04	9.90	12.42	10.05	9.47	0.41	7.54	13.90	29.03	24.06	40.48	12.66
Converted to Forest land (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (managed)	kha	23.30	5.94	5.94	3.29	9.42	13.32	11.76	1.12	1.38	0.75	34.92	8.74
Converted to Grassland (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Wetlands (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	kha	7.66	7.66	7.33	5.94	5.22	6.58	7.69	6.37	1.42	1.21	0.98	1.32
Converted to Other land	kha	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.98
Converted to Total unmanaged land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	kha	14739.00	14702.00	14679.00	14664.13	14645.06	14627.39	14608.05	14588.80	14568.14	14544.17	14523.07	14496.04
Final area	kha	14702.00	14679.00	14664.13	14645.06	14627.39	14608.05	14588.80	14568.14	14544.17	14523.07	14496.04	14467.34

Poland

Land Use, Land-Use Change and Forestry Land

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Forest land (managed)															
Remaining Forest land (managed)	8876.74	8902.84	8915.10	8967.74	9030.40	9105.71	9152.43	9163.49	9223.51	9250.78	9275.14	9304.21	9328.57	9353.24	9368.63
Converted to Forest land (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	0.40	0.72	0.53	0.42	0.69	0.65	0.47	0.60	0.60	0.62	0.64	0.55	0.60	0.49	0.78
Converted to Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Total unmanaged land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	8877.14	8903.56	8915.63	8968.16	9031.09	9106.37	9152.91	9164.08	9224.11	9251.40	9275.78	9304.76	9329.18	9353.73	9369.40
Final area	8903.56	8915.63	8968.16	9031.09	9106.37	9152.91	9164.08	9224.11	9251.40	9275.78	9304.76	9329.18	9353.73	9369.4030	9382.58
Forest land (unmanaged)															
Remaining Forest land (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Total unmanaged land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Final area	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Cropland															
Remaining Cropland	14438.73	14405.47	14345.13	14282.17	14331.94	14332.27	14329.35	14278.60	14281.33	14261.48	14216.30	14182.92	14138.13	14103.69	14011.29
Converted to Forest land (managed)	20.71	9.88	40.98	48.94	58.68	36.46	9.00	46.83	21.54	19.31	22.88	19.29	19.44	12.49	10.78
Converted to Forest land (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (managed)	6.19	0.00	17.48	35.91	5.14	0.00	3.92	0.00	9.77	7.65	11.52	7.89	6.77	5.76	0.00
Converted to Grassland (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Wetlands (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	1.72	1.50	1.88	1.77	1.88	2.24	6.72	3.92	3.92	6.61	10.79	6.21	18.59	11.56	81.63
Converted to Other land	0.00	25.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.63	0.00
Converted to Total unmanaged land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	14467.34	14442.66	14405.47	14368.79	14397.64	14370.97	14348.99	14329.35	14316.55	14295.06	14261.48	14216.30	14182.92	14138.13	14103.69
Final area	14442.66	14405.47	14368.79	14397.64	14370.97	14348.99	14329.35	14316.55	14295.06	14261.48	14216.30	14182.92	14138.13	14103.69	14011.29

	Unit	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Grassland (managed)													
Remaining Grassland (managed)	kha	4306.90	4317.26	4303.56	4298.62	4291.43	4293.56	4301.64	4306.59	4301.49	4298.73	4287.06	4308.00
Converted to Forest land (managed)	kha	1.78	2.92	3.66	2.96	2.79	0.12	2.22	4.09	8.55	7.09	11.92	3.73
Converted to Forest land (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	kha	0.00	0.00	11.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Grassland (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	kha	1.41	5.01	1.52	2.51	0.99	1.58	0.03	2.72	2.47	0.07	1.02	3.66
Converted to Wetlands (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	kha	5.61	5.01	2.58	5.41	6.70	5.59	2.99	0.00	0.00	0.00	4.18	6.59
Converted to Other land	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Total unmanaged land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	kha	4315.70	4330.20	4323.20	4309.50	4301.91	4300.86	4306.88	4313.41	4312.51	4305.88	4304.18	4321.98
Final area	kha	4330.20	4323.20	4309.50	4301.91	4300.86	4306.88	4313.41	4312.51	4305.88	4304.18	4321.98	4316.74
Grassland (unmanaged)													
Remaining Grassland (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Other land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Total unmanaged land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Final area	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Wetlands (managed)													
Remaining Wetlands (managed)	kha	1322.09	1323.49	1328.47	1329.91	1332.40	1333.38	1334.92	1334.91	1337.17	1338.19	1338.05	1338.98
Converted to Forest land (managed)	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Forest land (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Grassland (managed)	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39	0.00	0.00
Converted to Grassland (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	kha	0.01	0.01	0.03	0.08	0.02	0.01	0.04	0.04	0.47	0.07	0.20	0.10
Converted to Other land	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Total unmanaged land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	kha	1322.10	1323.50	1328.50	1329.99	1332.42	1333.39	1334.97	1334.95	1337.63	1339.64	1338.25	1339.08
Final area	kha	1323.50	1328.50	1329.99	1332.42	1333.39	1334.97	1334.95	1337.63	1339.64	1338.25	1339.08	1342.63
Wetlands (unmanaged)													
Remaining Wetlands (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Other land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Total unmanaged land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Final area	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Grassland (managed)															
Remaining Grassland (managed)	4302.05	4287.29	4272.30	4260.51	4274.39	4262.08	4235.22	4210.11	4182.86	4175.85	4167.46	4165.15	4162.81	4156.36	4153.20
Converted to Forest land (managed)	6.10	2.91	12.07	14.41	17.28	10.74	2.65	13.79	6.35	5.69	6.74	5.68	5.72	3.68	3.17
Converted to Forest land (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	0.00	0.00	0.00	0.00	0.00	2.43	0.00	0.39	13.73	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Grassland (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	3.64	0.68	2.91	14.87	4.74	1.69	1.27	5.39	3.42	1.96	4.78	2.21	1.05	2.08	0.00
Converted to Wetlands (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	4.96	0.00	0.00	0.00	0.00	2.59	6.69	10.06	3.76	9.13	7.35	5.94	3.46	5.76	5.75
Converted to Other land	0.00	17.36	0.00	0.00	0.00	0.00	16.26	0.00	0.00	0.00	0.00	0.00	0.00	1.69	0.00
Converted to Total unmanaged land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	4316.74	4308.24	4287.29	4289.79	4296.42	4279.53	4262.09	4239.75	4210.11	4192.62	4186.32	4178.98	4173.03	4169.58	4162.12
Final area	4308.24	4287.29	4289.79	4296.42	4279.53	4262.09	4239.75	4210.11	4192.62	4186.32	4178.98	4173.03	4169.58	4162.12	4153.20
Grassland (unmanaged)															
Remaining Grassland (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Total unmanaged land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Final area	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Wetlands (managed)															
Remaining Wetlands (managed)	1341.90	1341.62	1341.24	1343.06	1357.08	1360.61	1360.05	1359.72	1363.51	1362.18	1362.92	1366.59	1367.74	1368.78	1366.39
Converted to Forest land (managed)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Forest land (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Grassland (managed)	0.00	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00	2.80	0.00	0.00	0.00	0.00	0.00
Converted to Grassland (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	0.74	0.68	1.05	1.09	0.85	1.21	1.27	1.60	1.60	1.96	1.22	1.10	1.06	0.00	4.48
Converted to Other land	0.00	3.24	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
Converted to Total unmanaged land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	1342.63	1345.53	1342.30	1344.16	1357.93	1361.82	1362.30	1361.32	1365.11	1366.93	1364.14	1367.70	1368.80	1368.78	1370.86
Final area	1345.53	1342.30	1344.16	1357.93	1361.82	1362.30	1361.32	1365.11	1366.93	1364.14	1367.70	1368.80	1368.78	1370.86	1366.39
Wetlands (unmanaged)															
Remaining Wetlands (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Total unmanaged land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Final area	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

	Unit	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Settlements													
Remaining Settlements	kha	1944.90	1958.40	1972.40	1983.02	1995.06	2007.36	2023.24	2029.74	2033.81	2032.78	2034.47	2040.41
Converted to Forest land (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Grassland (managed)	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.80	3.01	3.32	0.00	0.00
Converted to Grassland (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Wetlands (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Other land	kha	3.20	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Total unmanaged land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	kha	1948.10	1959.50	1972.40	1983.02	1995.06	2007.36	2023.24	2034.54	2036.82	2036.10	2034.47	2040.41
Final area	kha	1959.50	1972.40	1983.02	1995.06	2007.36	2023.24	2034.54	2036.82	2036.10	2034.47	2040.41	2048.90
Other land													
Remaining Other land	kha	282.90	286.60	287.20	287.75	281.30	280.33	272.59	271.87	264.01	259.10	209.75	209.75
Converted to Forest land (managed)	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Forest land (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	kha	0.00	0.00	0.00	0.04	6.44	0.97	7.75	0.72	7.86	4.90	49.35	0.00
Converted to Grassland (managed)	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Grassland (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Wetlands (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	kha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Total unmanaged land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	kha	282.90	286.10	287.20	287.78	287.75	281.30	280.33	272.59	271.87	264.01	259.10	209.75
Final area	kha	286.10	287.20	287.78	287.75	281.30	280.33	272.59	271.87	264.01	259.10	209.75	215.74
Total unmanaged land													
Remaining Total unmanaged land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Other land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Final area (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Net change													
Forest land (managed)	kha	6.50	11.50	15.40	12.40	11.90	-3.18	9.19	17.31	37.18	30.72	51.82	15.90
Forest land (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Cropland	kha	-37.00	-23.00	-14.87	-19.07	-17.67	-19.34	-19.25	-20.66	-23.97	-21.11	-27.03	-28.70
Grassland (managed)	kha	14.50	-7.00	-13.70	-7.59	-1.05	6.02	6.52	-0.89	-6.63	-1.70	17.79	-5.23
Grassland (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Wetlands (managed)	kha	1.40	5.00	1.49	2.43	0.97	1.58	-0.01	2.68	2.00	-1.39	0.82	3.56
Wetlands (unmanaged)	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Settlements	kha	11.40	12.90	10.62	12.04	12.30	15.88	11.29	2.28	-0.72	-1.63	5.94	8.49
Other land	kha	3.20	1.10	0.58	-0.04	-6.44	-0.97	-7.75	-0.72	-7.86	-4.90	-49.35	5.98
Total unmanaged land	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Settlements															
Remaining Settlements	2048.90	2028.64	2019.00	2007.01	1999.60	2003.02	2009.71	2024.86	2041.03	2060.04	2080.44	2104.30	2120.23	2145.62	2157.31
Converted to Forest land (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	0.00	0.00	12.53	15.44	10.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Grassland (managed)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Grassland (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Wetlands (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Other land	0.00	28.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.13
Converted to Total unmanaged land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	2048.90	2056.72	2031.53	2022.45	2010.29	2003.02	2009.71	2024.86	2041.03	2060.04	2080.44	2104.30	2120.23	2145.62	2163.44
Final area	2056.72	2031.53	2022.45	2010.29	2003.02	2009.71	2024.86	2041.03	2060.04	2080.44	2104.30	2120.23	2145.62	2163.44	2249.94
Other land															
Remaining Other land	211.79	211.79	275.17	175.15	146.81	132.51	132.33	111.03	101.89	99.80	95.94	93.81	92.13	92.13	98.45
Converted to Forest land (managed)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Forest land (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	3.95	0.00	11.12	100.03	28.34	14.29	0.00	37.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Grassland (managed)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
Converted to Grassland (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Converted to Wetlands (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.14	2.06	3.87	2.13	1.68	0.00	0.00
Converted to Total unmanaged land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area	215.74	211.79	286.30	275.17	175.15	146.81	132.33	148.59	111.03	101.89	99.80	95.94	93.81	92.13	98.45
Final area	211.79	286.30	275.17	175.15	146.81	132.33	148.59	111.03	101.89	99.80	95.94	93.81	92.13	98.45	104.58
Total unmanaged land															
Remaining Total unmanaged land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Forest land (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Grassland (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (managed)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Wetlands (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Converted to Other land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Initial area (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Final area (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Net change															
Forest land (managed)	26.41	12.07	52.53	62.93	75.28	46.54	11.18	60.03	27.29	24.38	28.98	24.41	24.56	15.67	13.17
Forest land (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Cropland	-24.68	-37.19	-36.68	28.85	-26.67	-21.98	-19.64	-12.80	-21.50	-33.57	-45.18	-33.38	-44.79	-34.44	-92.40
Grassland (managed)	-8.51	-20.95	2.50	6.63	-16.88	-17.45	-22.34	-29.63	-17.49	-6.30	-7.35	-5.95	-3.45	-7.45	-8.93
Grassland (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Wetlands (managed)	2.90	-3.23	1.86	13.77	3.89	0.49	-0.99	3.79	1.83	-2.80	3.56	1.10	-0.01	2.08	-4.48
Wetlands (unmanaged)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Settlements	7.82	-25.19	-9.08	-12.16	-7.27	6.69	15.15	16.17	19.01	20.41	23.86	15.94	25.39	17.82	86.50
Other land	-3.95	74.50	-11.12	-100.03	-28.34	-14.48	16.26	-37.56	-9.14	-2.08	-3.86	-2.13	-1.68	6.32	6.13
Total unmanaged land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Poland

KP LULUCF Land Transition Matrix 2016

	Unit	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Afforestation and reforestation													
Remaining afforestation and reforestation	kha	NO	NO	NO	16.08	29.10	41.36	41.89	51.65	69.64	107.21	138.35	190.75
Changed to deforestation	kha	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total area at the end of the previous year	kha	NO	NO	NO	16.08	29.10	41.36	41.89	51.65	69.64	107.21	138.35	190.75
Total area at the end of the current year	kha	NO	NO	16.08	29.10	41.36	41.89	51.65	69.64	107.21	138.35	190.75	207.13
Deforestation													
Remaining deforestation	kha	NO	NO	NO	0.68	1.30	1.66	5.36	5.93	6.61	7.01	7.42	8.00
Total area at the end of the previous year	kha	NO	NO	NO	0.68	1.30	1.66	5.36	5.93	6.61	7.01	7.42	8.00
Total area at the end of the current year	kha	NO	NO	0.68	1.30	1.66	5.36	5.93	6.61	7.01	7.42	8.00	8.49
Forest management													
Changed to deforestation	kha	NO	NO	0.68	0.61	0.36	3.71	0.57	0.67	0.40	0.42	0.58	0.49
Remaining forest management	kha	8659.18	8691.32	8677.82	8677.20	8676.85	8673.14	8672.57	8671.89	8671.49	8671.08	8670.50	8670.01
Total area at the end of the previous year	kha	8660.50	8667.00	8678.50	8677.82	8677.20	8676.85	8673.14	8672.57	8671.89	8671.49	8671.08	8670.50
Total area at the end of the current year	kha	8667.00	8678.50	8677.82	8677.20	8676.85	8673.14	8672.57	8671.89	8671.49	8671.08	8670.50	8670.01
Cropland management													
Changed to afforestation and reforestation	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to forest management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remaining cropland management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to grazing land management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to revegetation	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to wetland drainage and rewetting	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the previous year	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the current year	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grazing land management													
Changed to afforestation and reforestation	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to forest management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to cropland management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remaining grazing land management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to revegetation	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to wetland drainage and rewetting	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the previous year	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the current year	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Poland

KP LULUCF Land Transition Matrix 2016

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Afforestation and reforestation															
Remaining afforestation and reforestation	207.13	233.95	246.74	299.79	363.14	439.11	486.30	497.95	558.57	586.46	611.46	641.08	666.05	691.21	707.37
Changed to deforestation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total area at the end of the previous year	207.13	233.95	246.74	299.79	363.14	439.11	486.30	497.95	558.57	586.46	611.46	641.08	666.05	691.21	707.37
Total area at the end of the current year	233.95	246.74	299.79	363.14	439.11	486.30	497.95	558.57	586.46	611.46	641.08	666.05	691.21	707.37	721.32
Deforestation															
Remaining deforestation	8.49	8.89	9.61	10.13	10.55	11.24	11.89	12.36	12.96	13.56	14.18	14.82	15.37	15.98	16.47
Total area at the end of the previous year	8.49	8.89	9.61	10.13	10.55	11.24	11.89	12.36	12.96	13.56	14.18	14.82	15.37	15.98	16.47
Total area at the end of the current year	8.89	9.61	10.13	10.55	11.24	11.89	12.36	12.96	13.56	14.18	14.82	15.37	15.98	16.47	17.24
Forest management															
Changed to deforestation	0.40	0.72	0.53	0.42	0.69	0.65	0.47	0.60	0.60	0.62	0.64	0.55	0.60	0.49	0.78
Remaining forest management	8669.61	8668.89	8668.37	8667.95	8667.26	8666.61	8666.14	8665.54	8664.94	8664.32	8663.68	8663.13	8662.52	8662.03	8661.26
Total area at the end of the previous year	8670.01	8669.61	8668.89	8668.37	8667.95	8667.26	8666.61	8666.14	8665.54	8664.94	8664.32	8663.68	8663.13	8662.52	8662.03
Total area at the end of the current year	8669.61	8668.89	8668.37	8667.95	8667.26	8666.61	8666.14	8665.54	8664.94	8664.32	8663.68	8663.13	8662.52	8662.03	8661.26
Cropland management															
Changed to afforestation and reforestation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to forest management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remaining cropland management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to grazing land management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to revegetation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to wetland drainage and rewetting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the previous year	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the current year	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grazing land management															
Changed to afforestation and reforestation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to forest management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to cropland management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remaining grazing land management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to revegetation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to wetland drainage and rewetting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the previous year	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the current year	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	Unit	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Revegetation													
Changed to afforestation and reforestation	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to forest management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to cropland management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to grazing land management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remaining revegetation	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to wetland drainage and rewetting	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the previous year	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the current year	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wetland drainage and rewetting													
Changed to afforestation and reforestation	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to forest management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to cropland management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to grazing land management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to revegetation	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remaining wetland drainage and rewetting	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the previous year	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the current year	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other													
Changed to afforestation and reforestation	kha	NA	NA	16.08	13.01	12.26	0.53	9.76	17.99	37.58	31.14	52.40	16.38
Changed to deforestation	kha	NA	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Changed to forest management	kha	7.82	12.82	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Changed to cropland management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to grazing land management	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to revegetation	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to wetland drainage and rewetting	kha	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remaining Other	kha	22607.80	22601.80	22573.75	22577.67	22548.65	22548.12	22538.35	22520.37	22482.79	22451.65	22399.25	22382.87
Total area at the end of the previous year	kha	22607.80	22601.80	22589.83	22590.69	22560.91	22548.65	22548.12	22538.35	22520.37	22482.79	22451.65	22399.25
Total area at the end of the current year	kha	22599.98	22590.30	22573.75	22560.91	22548.65	22548.12	22538.35	22520.37	22482.79	22451.65	22399.25	22382.87

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Revegetation															
Changed to afforestation and reforestation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to forest management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to cropland management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to grazing land management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remaining revegetation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to wetland drainage and rewetting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the previous year	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the current year	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wetland drainage and rewetting															
Changed to afforestation and reforestation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to forest management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to cropland management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to grazing land management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to revegetation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remaining wetland drainage and rewetting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the previous year	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total area at the end of the current year	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other															
Changed to afforestation and reforestation	26.81	12.79	53.05	63.35	75.97	47.19	11.65	60.62	27.89	25.00	29.62	24.97	25.16	16.17	13.95
Changed to deforestation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Changed to forest management	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Changed to cropland management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to grazing land management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to revegetation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Changed to wetland drainage and rewetting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remaining Other	22356.06	22343.25	22290.21	22226.86	22150.90	22103.71	22091.87	22030.87	22002.98	21977.97	21948.39	21923.42	21898.26	21882.09	21868.14
Total area at the end of the previous year	22382.87	22356.05	22343.27	22290.21	22226.86	22150.90	22103.52	22091.49	22030.87	22002.98	21978.01	21948.39	21923.42	21898.26	21882.09
Total area at the end of the current year	22356.05	22343.27	22290.21	22226.86	22150.90	22103.52	22091.49	22030.87	22002.98	21978.01	21948.39	21923.42	21898.26	21882.09	21868.14

Annex 7. Quality Assurance and Quality Control

Quality Assurance / Quality Control and Verification programme for the Polish annual greenhouse gas inventory has been elaborated and updated if needed. It has been elaborated in line with the 2006 ***IPCC Guidelines for National GHG Inventories***. The QA/QC programme aiming at improving and assuring the high quality of GHG inventories contains tasks, responsibilities as well as time schedule for performance of the QA/QC procedures. Detailed domestic QA/QC plan has been annexed to this programme.

Quality Control (QC) activities are carried out by the personnel directly responsible for the inventory and are aimed at keeping its high standards and quality.
Within the national inventory the main activities underlying Quality Control process are conducted using *Tier 1* method and relate to all source/sink categories. Tier 2 procedures are carried out for main key categories with special attention to the energy sector.

Following the Chapter 6 of the 2006 *IPCC Guidelines for National GHG Inventories*, Quality control (QC) covers routine technical activities carried out with the aim of quality control of national emissions and removals inventories allowing for:

- Maintaining the correctness and completeness of data,
- Elimination of errors and determination of potential deficiencies.

Quality Control activities contain: checks for accuracy of data and estimations acquiring as well as application of approved procedures for calculation of emissions, uncertainty, archiving of information and reporting.

Activities aiming at **quality assurance (QA)** cover procedural system for control carried out by experts not involved directly in elaborating GHG inventory in a given sector. QA activities are conducted over a completed inventory and allow to ensure that national inventory represents top level of emissions and removals assessment at the present knowledge and available data and effectively support quality control (QC).

Verification activities – where possible - include comparisons with external emission analyses estimates and databases conducted by independent bodies or teams. They allow to improve inventory methods and outcomes in both short and long terms.

The Polish inventory is directly based on sectoral activity data and carried out in two main steps. First, calculations are produced around 12 months after the end of the inventoried year (n-1) depending primarily on the availability of required activity data. Initial check of activity data and estimation procedures is then done. When the official statistics are available the revision of data is made and final inventory is produced up to 15 months after given year. Additionally the recalculations of the previous inventories for selected categories are performed because of methodological changes and improvements. The timetable for inventory preparation and QA/QC activities conducted at respective stages of the inventory preparation are presented in Table 1.

The basic elements of QA/QC plan which are to be implemented and co-ordinated by the National Centre for Emission Balancing and Management (KOBiZE), the unit responsible for Polish GHG inventory preparation. It follows the 2006 *IPCC Guidelines for National GHG Inventories* recommendations. The main procedures for QA/QC activities are described in the *National Quality Assurance / Quality Control and Verification Programme of the Polish Greenhouse Gas Inventory* and the detail check procedures are contained below as the examples of QC procedures performed by KOBiZE experts.

General timeframes of annual inventory preparation (including checking procedures), approval and submission are presented in the table 1. The dates for particular stages are established based on country specific availability of statistical data as well as national (legal) and international obligations.

Table 1. Timetable for inventory preparation and check (n – submission year)

Timing	Activity
June -15 December (year n–1)	→ Data and emission factors collection (estimation) → Check for consistency and correctness of the emission data, trends and factors, using all the relevant methods of both QC and verification outlined in the Programme (points 6-8 and 10) → Initial calculations and checks of GHG emissions considering ERT recommendations → Submission to the Ministry of Environment for acceptance
15 January (year n–2)	→ Submission of PL GHG inventory for the year n-2 and elements of NIR to the EIONET CDR (required by regulation (EU) No 525/2013 Article 7.1)
15 December – 15 February (year n–2)	→ Emission results and methodology verification based on remarks and comments made by ministerial emission experts (QA methods applied) → Elaboration of final inventory, additional checks and final corrections to the inventory, preparation of NIR and CRF tables (QC and verification methods applied) → Additional CRF and NIR quality upgrading on the basis of EEA control questions and remarks - corrections of any possible mistakes or deficiencies if found (QA methods applied) → Submission to the Ministry of the Environment for acceptance
15 March (year n–2)	→ Emission results and methodology verification based on remarks and comments made by external sectoral experts within inter-ministerial and inter-institutional check of the report (QA methods applied) → Submission of complete National Inventory Report and CRF tables to the EIONET CDR (required by regulation (EU) No 525/2013 Article 7.3)
15 April (year n–2)	→ Submission of GHG inventory for the year n-2 to the UNFCCC Secretariat (CRF and NIR) (required by decision 24/CP.19)

Each IPCC sector undergoes detail QC procedure which is carried out by expert responsible for given category/subcategory. Check for correctness of data, emission factors and calculation results are performed several times during the following stages of inventory elaboration: during its preparation, after completing the calculations, after CRF tables generation and after NIR report completing. Additionally part of the data, especially for Energy sector, are checked by other KOBiZE experts than those making inventory who are responsible for other sectors. As a part of QA activity the inventory team cooperates with specialists from different institutes, associations and individual experts who are involved in verification of data and assumptions to the inventory.

Procedures for quality assurance of the national inventories cover both actions performed by domestic agencies as well as by foreign (EU, UNFCCC). The National Inventory Report is delivered to the Ministry of Environment, where it is consulted in two stages: internally, among suitable departments, and externally - in inter-ministerial dialogue. In this second stage branch institutes supervised by ministers are engaged to review the inventory.

After including obtained comments and amendments into the NIR, according to recommendations delivered during the inter-ministerial compliance, the Ministry of the Environment initiates the procedure for governmental acceptance of the NIR by the Committee for the European Affairs after which both NIR and underlying CRF tables are conveyed to the UNFCCC. The same report and data are sent earlier to the European Commission pursuant to the timeline determined in the regulation (EU) No 525/2013.

The inventory results and methodology applied for emission estimation are also subject to wide discussions during domestic conferences and seminars. Additionally National Inventory Reports are available, in Polish, at the website of KOBIZE. Broader participation of academic circles in reviewing the overall inventory is planned under the QA procedures. For the time being such reviews were conducted occasionally.

The national inventory results are also verified by the European Union. Since 2012 this verification, being the element of inventory quality control, is performed in a wide range using the *EEA Emission Review Tool (EMRT)* available through the website. This verification is made in February and March after submission of emission results following Article 7.1 of the regulation (EU) No 525/2013. In the given time detail explanations are prepared what is accompanied by additional check of data and calculations. If the problem is acknowledged as solved, such information is set in the communication table (attachment, table 4). Potential corrections of data resulting from EU verification are introduced into emission inventory.

Two-stage procedures controlling the results of the national inventory submitted in the form of CRF files performed by the UNFCCC Secretariat also constitute important element for quality assurance of the Polish emission inventory (attachment, table 5 and 6). When analysis of questions sent is prepared under the stage 2 of the UNFCCC check, the inventory experts perform additional check of data and results and prepare the response for comments. This is the first step for international review performed by Expert Review Team. The international review of the Polish GHG inventory made on an annual basis under UNFCCC constitutes one of the key elements in the process of further improvement the quality of reported data.

There are also internal deliberations on the usefulness of an idea to engage systemically external reviewers from R&D Institutes, Branch Associations, Industrial Chambers, individual plants as well as independent experts in verification of the inventory assumptions and results. Such a scrutiny should help find cost-utility balance of this kind of an extensive review process.

Depending on methodology used for emission estimation within categories Tier 1 or Tier 2 check procedures are carried out. The extended QC procedure for checking the correctness of emissions estimations is used for these categories where country specific emission factors are established. This concerns the key categories especially for such sectors like: fuel combustion (1.A), transport (1.A.3), cement production (2.A.1), enteric fermentation (3.A), manure management (3.B), and others. For GHG emission sources for which Tier 1 method is used for emission calculation also Tier 1 method is applied for inventory checks. The categorisation of IPCC inventory sectors for Tier 1 and Tier 2 quality control procedures is shown in table 2.

Data Management Manual has been elaborated in KOBiZE-ZIE for the purpose of efficient governance with all important information containing databases, software, worksheets, final reports as well as QA/QC documentation regarding to inventory process. For the purposes of documentation of data and calculations QC the files are archived in electronic and hardcopy forms.

Table 2. Categorisation of IPCC sectors for Quality Control Tier 1 and Tier 2 procedures

Categories checked following the Tier 1 procedure	Categories checked following the Tier 2 procedure
1.A.1,2,4, stationary combustion (solid, liquid and gaseous fuels) (CH_4, N_2O) **1.A.3** transport (except 1.A.3.b) (CO_2, CH_4, N_2O) **1.A.3.b** road transport (CH_4, N_2O)	**1.A.1,2,4,** stationary combustion (solid, liquid and gaseous fuels) (CO_2) **1.A.3.b** road transport (CO_2)
1.B.1.c other **1.B.2** oil and natural gas (except of 1.B.2.b) (CO_2, CH_4)	**1.B.1.a** coal mining and handling (CH_4) **1.B.2.b** natural gas (CH_4)
2.B.4 caprolactam production (N_2O) **2.B.8** Petrochemical and carbon black production (CO_2, CH_4) **2.C** Metal production (except 2.C.1) (CO_2, CH_4) **2.D** Non-energy products from fuels and **s**olvent use **2.G** Other product manufacture and use (N_2O, SF_6) **2.E+2.F** electronic industry and product uses as ODS substitutes (HFC, PFC)	**2.A.1** cement production (CO_2) **2.A.2** lime production (CO_2) **2.A.3** glass production (CO_2) **2.A.4** Other process uses of carbonates (CO_2) **2.B.1** ammonia production (CO_2) **2.B.2** nitric acid production (N_2O) **2.C.1** iron and steel production (CO_2)
3.D.b indirect soil emissions (N_2O) **3.G** Liming (CO2) **3.H** Urea application (CO2)	**3.A** enteric fermentation (CH_4) **3.B** manure management (CH_4, N_2O) **3.D.a** direct soil emissions (N_2O) **3.F** field burning of agricultural residues (CH_4, N_2O)
4. LULUCF (except of 5.A) (CO_2, CH_4, N_2O)	**4.A** forest land (CO_2)
5.B Biological treatment of solid waste **5.D.** Wastewater treatment and discharge (CH_4, N_2O)	**5.A** solid waste disposal (CH_4) **5.C** Incineration and open burning of waste (CO_2, CH_4, N_2O)

Annex 8. Uncertainty assessment of the 2014 inventory

Uncertainty analysis for the year 2014 was performed with use of Approach 1 provided in *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Chosen methodology is based on the assumptions that every value is independent (there is no correlation between values) and probability of underestimation and overestimation is the same.
Conclusions from the previous centralized reviews and in-country review in 2013 were taken into account.
Latest major changes applied to uncertainties follow the changes in estimation methodology and new revised classification in CRF reporting tables. Uncertainty calculation model was extended to provide separate result for assessments including and excluding LULUCF sector. Another improvement triggered by ERT recommendation was calculation of overall uncertainty of inventory including information about uncertainties involved in estimation of Global Warming Potentials.

Additionally, since submission 2015 was provided uncertainty analysis of emission trend with use of 1998 emission inventory as a base year.

For industrial gases (HFC, PFC, SF6) due to lack of appropriate information, uncertainty estimates were applied directly to emission values on the basis of expert's opinion. No NF3 emission sources were identified in Poland thus, it was excluded from the analysis.

First stage of the estimates was to assign uncertainty to each activity data and emission factor. Next step was to estimate error propagation and its influence on national total emissions. To estimate error propagation from activity and emission factor to emission values, formula (1) was used.

$$U_{emission} = \text{square root } (U_{act}^2 + U_{EF}^2) \qquad (1)$$

where: $U_{emission}$ – uncertainty of emission value
U_{act} – uncertainty of activity value
U_{ef} – uncertainty of emission factor value

To estimate error propagation from sectoral emissions to national total, formula (2) was used

$$U_{emission} = \text{square root } (\Sigma\ (\text{Emission} * U_{emission})^2) / \Sigma\ \text{Emission} \qquad (2)$$

where: $U_{emission}$ – uncertainty of emission value in sector
Emission – emission from sector

As the base bottom level of analysis the following sectors were chosen:

- sector 1. Energy: categories on levels 1.A.1, 1.A.2, 1.A.3., 1.A.4, 1.A.5 with disaggregation by fuel type (liquid, solid, gaseous, biomass etc.)
- sector 2. IPPU: subcategories 2.A.1, 2.A.2 .... 2.C.3
- sector 3. Agriculture: subcategories 3.A.1, 3.A.2 .... 3.F.5 with further disaggregation
- sector 4. LULUCF: main subcategories 4.A, 4.B….4.E
- sector 5. Waste: 5.A.1, 5.A.2; 5.B with further disaggregation

Most of the estimates were based on default assumption described in methodology, but after investigation of socio-economic parameters literature data was applied to selected activities in sector *1. Energy* and for activities and emission factors in sector *2. Industrial processes and product use.* Selected uncertainties for activities and factors in 5.C Waste/Waste Incineration were estimated with help expert's opinion in Emission Balancing and Reporting Unit (former National Emission Centre).

Results of analysis of error propagation of uncertainty of national totals for 2014 were shown below:

	CO_2	CH_4	N_2O	HFC	PFC	SF_6	All GHG recalculated to CO_2 eq.
Total uncertainty Including IPCC 4. LULUCF	3.6%	21.2%	49.1%	46.9%	85.0%	92.5%	**4.9%**
Emission recalculated to CO2 eq [kt] Including IPCC 4. LULUCF	277 703.81	41 365.49	19 811.27	8 586.93	13.90	52.79	347 534.19
Total uncertainty Excluding IPCC 4. LULUCF	1.8%	21.2%	49.2%	46.9%	85.0%	92.5%	**3.9%**
Emission recalculated to CO2 eq [kt] Excluding IPCC 4. LULUCF	310 307.30	41 330.22	19 746.42	8 586.93	13.90	52.79	380 037.57

Activity data

Most uncertain values of activity were assigned in category 3.*F Agriculture/Field Burning of Agricultural Residues* and in *5.B Waste/Domestic and Commercial Wastewater* (30%). Lowest uncertainty values were assigned to *1.A.1 Energy/ Fuel Combustion,* especially in subsector 1.A.1 *Energy Industries* (2%,). In general Polish energy sector is responsible for 90 % of GHG emission and is covered with detailed national statistics, which allows to keep overall uncertainty of inventory at low level.

CO_2 emission factors

Most uncertain values for CO_2 emission factors were assigned in sector 5.*C Waste incineration* (50%), *2.A. Cement Production* (15%) and *2.C Metal Industry* (10%), the most precise values were reported in *1.A Fuel Combustion* (1-2%).

Low level of uncertainty of national total of CO_2 (3.6%) comes from the fact, that major part of emission comes from sector *1.A Fuel Combustion* where input data for activities and factors is the most precise (relatively 1-5% and 1-3%, excluding biomass).

CH_4 emission factors

Most uncertain values for CH_4 emission factors were assigned in sector 5.A Solid Waste Disposal (100%), and 5.C. Waste incineration (100%), *1.A Fuel Combustion* (75%), 1.B Fugitive Emission from fuels (75%), 3.*A. Enteric Fermentation* and 3.*B Manure Management (50%).* The most precise values were in *2. Industrial Processes and Product Use* (20%) and 3.*F Field Burning of Agricultural Residues* (20%). In 2009 new sources were included to analysis in *2.C. Metal Production (sinter, electric furnaces, pig iron and basic oxygen furnaces)* as a result of incorporating to national emission inventories data from reporting for EU Emission Trading Scheme.

Uncertainty of CH_4 emission is app. 21.2% which is result of share of agriculture and waste sectors in national totals – emission factors in those sectors have high relatively uncertainty.

N_2O emission factors

Most uncertain values for N_2O emission factors were assigned in sector 3.*B Manure management* (150%), *3.D Agricultural Soils* (150%) and in *3.F Agriculture/Field Burning of Agricultural Residues* (150%), most precise values were applied in sector *2.C Metal Industry (20%)*. Data available from polish part of EU Emission Trading Scheme reporting were taken into account during this analysis with relatively low uncertainty.

Highest value of uncertainty of national total occurred in N_2O (46.1%) and is a result of high uncertainty of the emission factors in sector of *Agriculture* (*3.*B *Liquid systems*, *3.*B *Solid Storage and Dry Lot, 3.D Agricultural Soils* and *3.Field Burning of Agricultural residues* – 150%).

Industrial Gases

Simplified analysis were made for industrial gases HFC, PFC and SF6, where uncertainty assumptions were applied directly to emission values of each pollutant. Final results of analysis where as follows: HFC – 46.9%, PFC – 85.0% and SF6 – 92.5%. Due to lack of information, simplified approach has to be used and country recognizes need of additional analysis in this sector as planned improvement for future inventories.

Uncertainty introduced into the trend in total national emissions

In submission 2016 uncertainty analysis is providing information on uncertainty introduced into the trend in total national emissions. First step of the analysis was assessing of level uncertainty introduced to national total in base year (1988). Methodology used to assess trend uncertainties is the same as mentioned for analysis for 2014. Results of level uncertainty analysis for base year with and without IPCCC 4.LULUCF are presented below.

	CO_2	CH_4	N_2O	HFC	PFC	SF_6	All GHG recalculated to CO_2 eq.
Total uncertainty Including IPCC 4. LULUCF	2.3%	25.0%	42.6%		85.0%		**4.5%**
Emission recalculated to CO2 eq [kt] Including IPCC 4. LULUCF	457 906.75	76 778.53	29 043.68		147.26		563 876.21
Total uncertainty Excluding IPCC 4. LULUCF	2.0%	25.0%	42.7%		85.0%		**4.3%**
Emission recalculated to CO2 eq [kt] Excluding IPCC 4. LULUCF	473 954.84	76 734.40	29 032.34		147.26		579 868.83

On the basis of results of analysis made for the base year and latest reported year analysis for trend was done and results are presented below:

	CO_2	CH_4	N_2O
Trend uncertainty with IPCC 4.LULUCF	1.26%	2.48%	2.48%
Trend uncertainty without IPCC 4.LULUCF	1.13%	2.48%	2.48%

Planned improvements for next years

- further investigation of data for industrial gases
- revising uncertainty model used for Approach 2 (Monte Carlo analysis)
- collection of data and setting up model for KP art 3.3 and 3.4 uncertainty estimates

GHG inventory 2014 – Uncertainty analysis, part 1, sector IPCC 1 Energy.

2014	Activity [TJ]	Activity uncertainty [%]	EF CO2 Uncertainty [%]	EF CH4 Uncertainty [%]	EF N2O Uncertainty [%]	CO2 [kt]	CH4 [kt]	N2O [kt]	CO2 Emission uncertainty [%]	CH4 Emission uncertainty [%]	N2O Emission uncertainty [%]	CO2 Emission absolute uncertainty [kt]	CH4 Emission absolute uncertainty [kt]	N2O Emission absolute uncertainty [kt]
TOTAL (without LULUCF)						**310 307.30**	**1 653.21**	**66.26**	**1.8%**	**21.2%**	**49.2%**	5 532.46	350.48	32.62
TOTAL (with LULUCF)						**277 703.81**	**1 654.62**	**66.48**	**3.6%**	**21.2%**	**49.1%**	10 098.75	350.48	32.62
1. Energy						**288 426.63**	**719.43**	**8.17**	**1.9%**	**29.4%**	**12.3%**	**5482.92**	**211.81**	**1.00**
A. Fuel Combustion						**284 863.92**	**146.62**	**8.17**	**1.9%**	**11.3%**	**12.3%**	5474.60	16.62	1.00
1. Energy Industries						159 840.96	4.66	2.58	2.7%	16.9%	29.9%	4272.26	0.79	0.77
Liquid Fuels	45 164	2.0%	1.0%	10.0%	20.0%	3 176.13	0.10	0.02	2.2%	10.2%	20.1%	71.02	0.01	0.00
Solid Fuels	1 513 626	2.0%	2.0%	13.5%	35.0%	150 961.04	1.51	2.16	2.8%	13.6%	35.1%	4269.82	0.21	0.76
Gaseous Fuels	99 908	2.0%	1.0%	17.0%	40.0%	5 604.84	0.10	0.01	2.2%	17.1%	40.0%	125.33	0.02	0.00
Other fossil fuels	815	5.0%	5.0%	25.0%	75.0%	98.95	0.02	0.00	7.1%	25.5%	75.2%	7.00	0.01	0.00
Peat	NO					NO	NO	NO						
Biomass	102 776	10.0%	5.0%	24.0%	37.0%	11 181.70	2.92	0.39	11.2%	26.0%	38.3%	1250.15	0.76	0.15
2. Manufacturing Industries and Construction						29 742.22	4.26	0.59	2.5%	11.2%	23.7%	730.77	0.48	0.14
Liquid Fuels	30 017	3.0%	1.0%	10.0%	20.0%	2 034.40	0.06	0.01	3.2%	10.4%	20.2%	64.33	0.01	0.00
Solid Fuels	167 756	3.0%	2.0%	13.5%	35.0%	17 472.41	1.77	0.26	3.6%	13.8%	35.1%	629.98	0.24	0.09
Gaseous Fuels	133 902	4.0%	1.0%	17.0%	40.0%	7 511.90	0.13	0.01	4.1%	17.5%	40.2%	309.72	0.02	0.01
Other fossil fuels	20 502	5.0%	5.0%	25.0%	75.0%	2 723.51	0.62	0.08	7.1%	25.5%	75.2%	192.58	0.16	0.06
Peat	NO					NO	NO	NO						
Biomass	56 373	10.0%	5.0%	20.0%	37.0%	6 275.12	1.68	0.22	11.2%	22.4%	38.3%	701.58	0.38	0.09
3. Transport						43 615.18	3.89	1.95	5.7%	10.2%	20.0%	2494.48	0.40	0.39
Liquid Fuels	606 215.50	3.0%	5.0%	10.0%	20.0%	42 769.91	3.79	1.93	5.8%	10.4%	20.2%	2493.89	0.40	0.39
Solid Fuels	NO	3.0%	5.0%	13.5%	35.0%				5.8%	13.8%	35.1%			
Gaseous Fuels	15 143.00	4.0%	5.0%	17.0%	40.0%	845.27	0.02	0.00	6.4%	17.5%	40.2%	54.12	0.00	0.00
Other fossil fuels	NA,NO		5.0%	25.0%	75.0%				5.0%	25.0%	75.0%			
Biomass	29 532.50	10.0%	5.0%	24.0%	37.0%	2 090.90	0.09	0.02	11.2%	26.0%	38.3%	233.77	0.02	0.01
4. Other Sectors						51 665.56	133.81	3.05	4.3%	12.4%	16.0%	2227.70	16.59	0.49
Liquid Fuels	120 497.91	4.0%	5.0%	10.0%	20.0%	8 619.61	0.64	1.99	6.4%	10.8%	20.4%	551.92	0.07	0.41
Solid Fuels	336 098.00	4.0%	5.0%	13.5%	35.0%	31 774.62	92.69	0.50	6.4%	14.1%	35.2%	2034.57	13.05	0.18
Gaseous Fuels	200 465.00	4.0%	5.0%	17.0%	40.0%	11 246.09	1.00	0.02	6.4%	17.5%	40.2%	720.10	0.18	0.01
Other fossil fuels	231.00	4.0%	5.0%	25.0%	75.0%	25.24	0.07	0.00	6.4%	25.3%	75.1%	1.62	0.02	0.00
Peat	NO					NO	NO	NO						
Biomass	133 902.00	10.0%	5.0%	24.0%	37.0%	14 848.59	39.41	0.53	11.2%	26.0%	38.3%	1660.12	10.25	0.20
5. Other						0.00	0.00	0.00	0.0%	0.0%	0.0%	0.00	0.00	0.00
Liquid Fuels	NO	5.0%	3.0%	100.0%	20.0%				5.8%	100.1%	20.6%	0.00	0.00	0.00
Solid Fuels	NO	5.0%	5.0%	80.0%	35.0%				7.1%	80.2%	35.4%	0.00	0.00	0.00
Gaseous Fuels	NO	5.0%	5.0%	90.0%	40.0%				7.1%	90.1%	40.3%	0.00	0.00	0.00
Biomass	NO	20.0%	5.0%	95.0%	37.0%				20.6%	97.1%	42.1%	0.00	0.00	0.00
B. Fugitive Emissions from Fuels						**3562.71**	**572.81**	**0.00**	**8.5%**	**36.9%**	**71.70%**	301.85	211.16	0.00
1. Solid Fuels						1705.16	476.31		15.0%	44.2%		255.59	210.61	0.00
1. B. 1. a. Coal Mining and Handling												0.00	0.00	0.00
i. Underground Mines [Activity in Mt, EF in kg/t]	65.97	2.0%		50.0%			417.16			50.0%		0.00	208.75	0.00
ii. Surface Mines [Activity in Mt, EF in kg/t]	64.00	2.0%		50.0%			55.75			50.0%		0.00	27.90	0.00
1. B. 1. b. Solid Fuel Transformation [Activity in Mt, EF in kg/t]	NA					1703.95	0.00		15.0%	25.0%		255.59	0.00	
1. B. 1. c. Other [CO2 Emisson from Coking Gas Subsystem]	552.26	2.0%	10.0%	50.0%		1.21	3.40		10.2%	50.0%		0.12	1.70	
2. Oil and Natural Gas						1857.54	96.50	0.00	8.6%	15.7%	71.70%	160.58	15.18	0.00
1. B. 2. a. Oil												0.00	0.00	
2. Production [Activity in PJ, EFs in kg/PJ]	39.03	2.0%	6.6%	50.0%		246.468	2.41		6.9%	50.0%		17.00	1.21	
3. Transport [Activity in kt]	24 664.00	2.0%	6.6%	50.0%		0.014	0.15		6.9%	50.0%		0.00	0.08	
4. Refining/storage [kt]	993.00	2.0%	6.6%	50.0%		NA	1.12		6.9%	50.0%			0.56	
1. B. 2. b. Natural Gas												0.00	0.00	
2. Production [Activity in PJ, EF in kg/PJ]	156.01	2.0%	6.6%	50.0%		0.372	10.43		6.9%	50.0%		0.03	5.22	
3. Processing [Activity in PJ, EF in kg/PJ]	156.01	2.0%	6.6%	50.0%		5.222	4.67		6.9%	50.0%		0.36	2.34	
4. Transmission and storage [Activity in PJ, EF in kg/PJ]	561.22	2.0%	6.6%	50.0%		0.014	7.83		6.9%	50.0%		0.00	3.92	
5. Distribution [Activity in PJ, EF in kg/PJ]	561.22	2.0%	6.6%	50.0%		0.832	17.95		6.9%	50.0%		0.06	8.98	
6. Other leakage [Activity in PJ, EF in kg/PJ]	561.22	2.0%	6.6%	50.0%		0.002	0.41		6.9%	50.0%		0.00	0.20	
1. B. 2. c. Venting - Oil	951.00	5.0%	6.6%	50.0%		0.156	0.78		8.3%	50.2%		0.01	0.39	
1. B. 2. c. Venting and flaring - oil [kt]	951.00	5.0%	6.6%	50.0%	100.0%	0.028	45.29	0.00	8.3%	50.2%	100.1%			0.00
1. B. 2. c. Venting and flaring - natural gas [10^6 m3]	4 536.61	5.0%	6.6%	50.0%	100.0%	58.753	5.44	0.00	8.3%	50.2%	100.1%			0.00
1. B. 2. d. Other (Process emission from refineries and flaring)	NA		NA			1545.682			10.0%					

GHG inventory 2014 – Uncertainty analysis, part 2, IPCC sector 2 Industrial processes and product use

2. Industrial processes and product use						**20 450.86**	**2.52**	**2.84**	**3.4%**	**28.7%**	**39.1%**	696.91	0.72	1.11
A. Mineral Industry						9 936.94			5.8%			572.77	0.00	0.00
1. Cement Production [Activity in kt, EF in t/t]	11 865.50	5.0%	5.0%			6 456.42			7.1%			456.54	0.00	0.00
2. Lime Production [Activity in kt, EF in t/t]	1 885.50	5.0%	10.0%			1 372.05			11.2%			153.40	0.00	0.00
3. Limestone and dolomite Use [activitz in kt, EFs in t/t]	2 732.19	8.0%	10.0%			273.22			12.8%					
4.a Ceramics [Activity in kt, Ef in t/t]	2 361.91	5.0%	10.0%			102.68			11.2%					
4.b Other soda use [Activity in kt, EF in t/t]	212.35	10.0%	15.0%			88.11			18.0%			15.88	0.00	0.00
4.c Other [Activity in kt, EF in t/t]	3 737.41	10.0%	15.0%			1 644.46			18.0%			296.46	0.00	0.00
B. Chemical Industry						5 663.42	1.94	2.44	4.4%	36.9%	45.0%	250.67	0.71	1.10
1. Ammonia Production [Activity in kt, EF in t/t]	2 634.51	2.0%	5.0%			4 564.96			5.4%			245.83	0.00	0.00
2. Nitric Acid Production [Activity in kt, EF in t/t]	2 365.88	2.0%	5.0%		60.0%			1.65			60.0%	0.00	0.00	0.99
3. Adipic Acid Production [Activity in kt, EF in t/t]	NO	2.0%						NO						
4. Caprolactam production [Activity in kt, EF in t/t]	167.60	2.0%	10.0%		60.0%			0.79			60.0%		0.00	0.48
5. Calcium carbide production [Activity in kt, EF in t/t]	NO					NO								
6. Titanium oxide production [Activity in kt, EF in t/t]	36.21	2.0%	10.0%			NO								
7. Soda ash production [Activity in kt, EF in t/t]	1 186.66	2.0%	10.0%			NO								
8.a Methanol production [Activity in kt, EF in t/t]	0.31	2.0%	5.0%	50.0%		0.21	0.00		5.4%	50.0%				
8.b Ethylene production [Activity in kt, EF in t/t]	471.83	2.0%	5.0%	50.0%		897.89	1.42		5.4%	50.0%				
8.c. Ethylene Dichloride and Vinyl Chloride Monomer [Activity in kt, EF in t/t]	272.10	2.0%	5.0%	30.0%		80.08	0.01		5.4%	30.1%				
8.d. Ethylene dioxide [Activity in kt, EF in t/t]	31.81	2.0%	5.0%	25.0%		27.45	0.06		5.4%	25.1%				
8.e Acrylonitrile [Activity in kt, EF in t/t]	NO													
8.f Carbon black production [Activity in kt, EF in t/t]	35.43	5.0%	5.0%	20.0%		92.83	0.00		7.1%	20.6%		6.56	0.00	0.00
8.g Styrene production [Activity in kt, EF in t/t]	114.28	2.0%		20.0%			0.46			20.1%		0.00	0.09	0.00
C. Metal Industry						2 586.03	0.58		5.1%	18.5%		133.10	0.11	0.00
1. Iron and Steel Production												0.00	0.00	0.00
1.b Pig iron [Aktywność w kt, WE w t/t]	4 637.48	5.0%	10.0%			742.82			11.2%			83.05	0.00	0.00
1.d Sinter [Aktywność w kt, WE w t/t]	7 389.44	5.0%	10.0%	20.0%		362.79	0.52		11.2%	20.6%		NA	NA	0.00
1.f Open-heart Steel [Activity in kt, EF in t/t]	0.00													
1.f. Basic Oxygen Furnace Steel [Activity in kt, EF in t/t]	0.00	5.0%	10.0%			760.97			11.2%			85.08	0.00	0.00
1.f. Electric Furnace Steel [Activity in kt, EF in t/t]	0.00	5.0%	10.0%			211.40			11.2%			23.63	0.00	0.00
2. Ferroalloys Production [Activity in kt, EF in t/t]	62.88	5.0%	10.0%	20.0%		251.51	0.06		11.2%	20.6%		28.12	0.01	0.00
3. Aluminium Production [Activity in kt, EF in t/t]	NO											0.00	0.00	0.00
4. Magnesium production [Activity in kt, EF in t/t]	0.10	5.0%	10.0%			NA							0.00	0.00
6. Other (Lead Production) [Activity in kt, EF w t/t]	86.29	5.0%	10.0%			44.87			11.2%			5.02		
7. Other (Zinc Production) [Activity in kt, EF w t/t]	123.06	5.0%	10.0%			211.66			11.2%			23.66		
D. Non-energy Products from Fuels and Solvent Use						2 264.473			12.3%			277.60	0.00	0.00
1. Lubricant use	NE					361.90			20.0%					
2. Paraffin Wax Use	NE					70.99			20.0%					
3.a Solvents use	NE					677.97			20.0%					
3.b Associated CO2 emissions	NE					1 153.62			20.0%					
G. Other Product Manufacture and Use								0.40			40.3%	0.00	0.00	0.16
3.a N2O from product uses	0.40	20.0%			35.0%			0.40			40.3%			

GHG inventory 2014 – Uncertainty analysis, part 3, IPCC sector 3. Agriculture

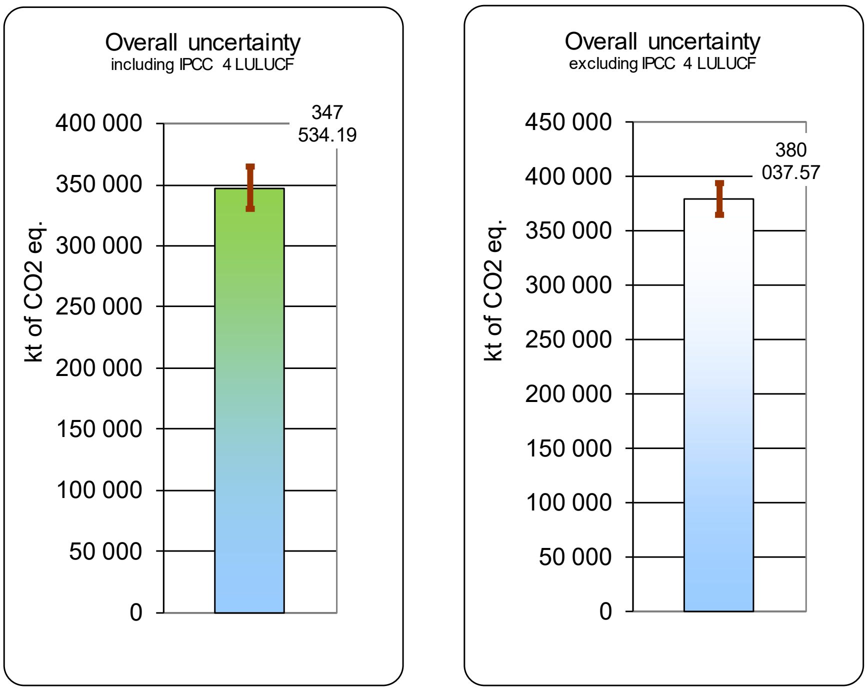
3. Agriculture						**905.41**	**557.10**	**52.27**	18.8%	29.5%	61.9%		164.24	32.37
A. Enteric Fermentation							491.78			32.4%			159.58	0.00
1. Cattle													0.00	0.00
Dairy Cattle [Activity in 1000 heads, EF in kg/head]	1 432.9	5.0%		50.0%			96.41			50.2%			48.45	0.00
Non-dairy young cattle (less than 1 year) [Activity in 1000 heads	2 479.1	5.0%		50.0%			297.14			50.2%			149.31	0.00
Non-dairy young cattle 1-2 years [Activity in 1000 heads, EF in k	1 608.6	5.0%		50.0%			51.65			50.2%				
Non-dairy heifers (older than 2 years) [Activity in 1000 heads, EF	259.1	5.0%		50.0%			12.60			50.2%				
Bulls (olther than 2 years)	140.8	5.0%		50.0%			10.64			50.2%				
2. Sheep [Activity in 1000 heads, EF in kg/head]	201.3	5.0%		50.0%			1.61			50.2%			0.81	0.00
3. Swine [Activity in 1000 heads, EF in kg/head]	11 724.1	5.0%		50.0%			17.59			50.2%			8.84	0.00
4.a Goats [Activity in 1000 heads, EF in kg/head]	81.7	5.0%		50.0%			0.41			50.2%			0.21	0.00
4.b Horses [Activity in 1000 heads, EF in kg/head]	207.1	5.0%		50.0%			3.73			50.2%			1.87	0.00
B. Manure Management							64.26	7.06		60.5%	40.0%		38.87	2.82
1. Cattle													0.00	0.00
Dairy Cattle [Activity in 1000 heads, EF in kg/head]	2 479	5.0%		50.0%	100.0%		28.87	0.83		50.2%			14.50	0.00
Non-Dairy Cattle [Activity in 1000 heads, EF in kg/head]	3 441	5.0%		50.0%	100.0%		7.43	1.45		50.2%			3.73	0.00
2. Sheep [Activity in 1000 heads, EF in kg/head]	201	5.0%		50.0%	100.0%		0.04	0.01		50.2%			0.02	0.00
3. Swine [Activity in 1000 heads, EF in kg/head]	11 724	5.0%		50.0%	100.0%		23.38	0.95		50.2%			11.75	0.00
kg/head]	768	5.0%		50.0%	100.0%		0.29	0.02		50.2%			0.15	0.00
4.b Goats [Activity in 1000 heads, EF in kg/head]	82	5.0%		50.0%	100.0%		0.01	0.00		50.2%			0.01	0.00
4.c Horses [Activity in 1000 heads, EF in kg/head]	207	5.0%		50.0%	100.0%		0.32	0.07		50.2%			0.16	0.00
4.d Poultry [Activity in 1000 heads, EF in kg/head]	142 342	5.0%		50.0%	100.0%		3.93	0.12						
5.a Indirect emission [emission in kt]	NA							3.61			40.0%		0.00	1.44
D. Agricultural Soils								45.17			71.4%			32.24
a. Direct Soil Emissions														0.00
1. Inorganic N fertilizers [Aktywność w kg N, WE w kg N2O-N/k	1 098 455 000	5.0%			150.0%			17.26			150.1%			25.91
2. Organic N fertilizers [Aktywność w kg N, WE w kg N2O-N/kg	277 111 846	5.0%			150.0%			4.35			150.1%			6.54
3. Urine and dung deposited by grazing animals [Aktywność w k	39 142 553	5.0%			150.0%			1.17			150.1%			1.76
4. Crop residues [Aktywność w kg N, WE w kg N2O-N/kg N]	310 779 889	5.0%			150.0%			4.88			150.1%			7.33
5. Mineralization/immobilization associated with loss/gain of so	5 455 050	5.0%			150.0%			0.09			150.1%			0.13
6. Cultivation of organic soils (i.e. histosols) [Aktywność w kg N	684 450	5.0%			150.0%			8.60			150.1%			12.91
b. Indirect N2O Emissions from managed soils														
1. Atmospheric deposition [Aktywność w kg N, WE w kg N2O-N	172 176 616	20.0%			150.0%			2.71			151.3%			4.09
2. Nitrogen leaching and run-off [Aktywność w kg N/yr, WE w k	517 903 655	20.0%			150.0%			6.10			151.3%			9.24
F. Field Burning of Agricultural Residues							1.06	0.04		18.7%	87.1%		0.20	0.03
1. Cereals													0.00	0.00
Wheat [Activity in t of crop production, EF in kg/t dm]	39.774	30.0%		20.0%	150.0%		0.13	0.00		36.1%	153.0%		0.05	0.00
Barley [Activity in t of crop production, EF in kg/t dm]	10.139	30.0%		20.0%	150.0%		0.03	0.00		36.1%	153.0%		0.01	0.00
Maize [Activity in t of crop production, EF in kg/t dm]	5.437	30.0%		20.0%	150.0%		0.02	0.00		36.1%	153.0%		0.01	0.00
Oats [Activity in t of crop production, EF in kg/t dm]	0.356	30.0%		20.0%	150.0%		0.00	0.00		36.1%	153.0%		0.00	0.00
Rye [Activity in t of crop production, EF in kg/t dm]	15.130	30.0%		20.0%	150.0%		0.05	0.00		36.1%	153.0%		0.02	0.00
Triticale [Activity in t of crop production, EF in kg/t dm]	4.967	30.0%		20.0%	150.0%		0.02	0.00		36.1%	153.0%			
Other Cereals [Activity in t of crop production, EF in kg/t dm]	22.335	30.0%		20.0%	150.0%		0.07	0.00		36.1%	153.0%		0.03	0.00
Millet and buckwheat [Activity in t of crop production, EF in kg/t	8.143	30.0%		20.0%	150.0%		0.03	0.00		36.1%	153.0%			
2 Pulses	0.430	30.0%		20.0%	150.0%		0.00	0.00		36.1%	153.0%		0.00	0.00
3 Tuber and Root													0.00	0.00
Potatoes [Activity in t of crop production, EF in kg/t dm]	16	30.0%		20.0%	150.0%		0.05	0.00		36.1%	153.0%		0.02	0.01
5 Other													0.00	0.00
Rape and other oil bearing [Activity in t of crop production, EF i	3	30.0%		20.0%	150.0%		0.01	0.00		36.1%	153.0%		0.00	0.00
Straw and hop [Activity in t of crop production, EF in kg/t dm]	124	30.0%		20.0%	150.0%		0.37	0.02		36.1%	153.0%		0.13	0.03
Vegetables [Activity in t of crop production, EF in kg/t dm]	96	30.0%		20.0%	150.0%		0.29	0.01		36.1%	153.0%		0.10	0.01
Fruits [Activity in t of crop production, EF in kg/t dm]	0.27	30.0%		20.0%	150.0%		0.00	0.00		36.1%	153.0%		0.00	0.00
G. Liming						467.55			22.8%					
Limestone CaCO3 [Activity in t, EF in t CO2-C/t]	345 385.10	30.0%	5.0%			151.97			30.4%					
Dolomite CaMg(CO3)2 [Activity in t, EF in t CO2-C/t]	662 066.87	30.0%	5.0%			315.59			30.4%					
H. Urea application	597 078.24	30.0%	5.0%			437.86			30.4%					

GHG inventory 2014 – Uncertainty analysis, part 4, IPCC sector 4 Land use, land-use change and forestry and IPCC sector 5.Waste

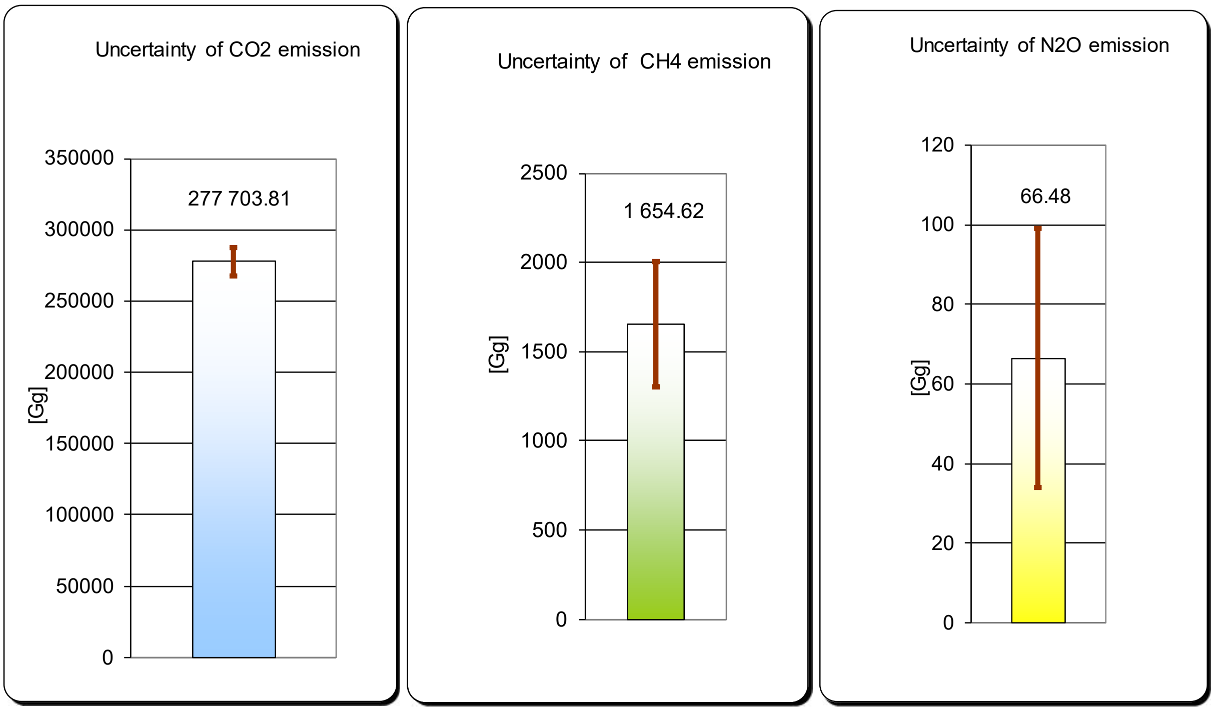
4. Land-Use, land-use change and forestry						**-32 603.48**	**1.41**	**0.22**	25.9%	73.7%	74.3%	-8448.47	1.04	0.162
A. Forest Land [Activity in kha, EF in kt/kha]	9 382.58	5.0%	20.0%	80.0%	100.0%	-34 593.61	1.29	0.02	20.6%	80.2%	100.1%	-7131.65	1.04	0.018
B. Cropland [Activity in kha, EF in kt/kha]	14 011.29	5.0%	20.0%		100.0%	429.07		0.04	20.6%		100.1%	88.46	0.00	0.044
C. Grassland [Activity in kha, EF in kt/kha]	4 153.20	5.0%	20.0%	80.0%	100.0%	-399.15	0.12	0.00	20.6%	80.2%	100.1%	0.00	0.10	0.002
D. Wetlands [Activity in kha, EF in kt/kha]	1 366.39	5.0%	20.0%			4 678.41			20.6%			964.48	0.00	0.000
E. Settlements [Activity in kha, EF in kt/kha]	2 249.94	5.0%	20.0%		100.0%	1 835.73		0.1545	20.6%		100.1%	378.45	0.00	0.155
F. Other Land [Activity in kha, EF in kt/kha]	104.58	5.0%											0.00	0.000
G. Other [Activity in kt C, EF in kt/kha]	1 241.98	5.0%	20.0%			-4 553.93			20.6%			-938.82		
5. Waste						**524.40**	**374.16**	**2.97**	33.5%	60.4%	126.6%	175.89	225.83	3.76
A. Solid Waste Disposal							342.32			65.7%		0.00	224.93	0.00
1 Managed waste disposal sites [Activity in kt, EF in t/t MSW]	5 548.70	23.0%		100.0%			180.38			102.6%		0.00	185.09	0.00
2 Unmanaged waste disposal sites [Activity in kt, EF in t/t MSW]	NO	23.0%		100.0%			115.62			102.6%		0.00	118.64	0.00
3 Uncategorized waste disposal sites [Activity in kt, EF in t/t MS	NO	23.0%		100.0%			46.32			102.6%		0.00	47.53	0.00
B. Biological treatment of solid waste							5.17	0.31		104.4%	153.0%	0.00	5.40	0.47
1. Composting [Activity in kt DC(1), EF in kg/kg DC]	1 292.80	30.0%		100.0%	150.0%		5.17	0.31		104.4%	153.0%	0.00	5.40	0.47
2. Anaerobic digestion in biogas installations [Activity in kt DC(1),	NA,NO	30.0%										0.00	0.00	0.00
C. Waste Incineration						524.40	0.00	0.19	33.5%	101.1%	150.7%			
1. Waste incineration [Activity in kt, EF in kg/t waste]	620.54	15.0%	30.0%	100.0%	150.0%	524.40	0.00	0.19	33.5%	101.1%	150.7%	175.89	0.00	0.28
2. Open burning of waste [Activity in kt, EF in kg/t waste]	NA													
D. Wastewater treatment and discharge							26.67	2.48		72.8%	150.3%	0.00	19.42	3.72
1. Domestic wastewater [Activity in kt DC(1), EF in kg/kg DC]	842.68	10.0%		100.0%	150.0%		16.31	2.48		100.5%	150.3%	0.00	16.39	3.72
2. Industrial wastewater [Activity in kt DC(1), EF in kg/kg DC]	404.43	10.0%		100.0%			10.37			100.5%		0.00	10.42	0.00

Industrial gases inventory 2014 – Uncertainty analysis for HFC, PFC and SF_6.

	Emission HFC [kt of CO2 eq.]	Emission PFC [kt of CO2 eq.]	Emission SF6 [kt of CO2 eq.]	Uncertainty of emission HFC [%]	Uncertainty of emission PFC [%]	Uncertainty of emission SF6 [%]	Absolute emission uncertainty for HFC [kt of CO2 eq.]	Absolute emission uncertainty for PFC [kt of CO2 eq.]	Absolute emission uncertainty for SF6 [kt of CO2 eq.]
TOTAL	**8 586.93**	**13.90**	**52.79**	**46.9%**	**85.0%**	**92.5%**	**4 027.37**	**11.82**	**52.79**
2. Industrial processes and product use	8 586.93	13.90	52.79	46.9%	85.0%	92.5%	4 027.37	11.82	52.79
C. Metal industry		0.00	4.15		85.0%	100.0%		0.00	4.15
3. Aluminium production		NO			85.0%				
4. Magnesium production			4.15			100.0%			4.15
F. Product uses as substitutes for ODS	8 586.93	13.90		46.9%	85.0%		4027.37	11.82	0.00
1. Refrigeration and Air Conditioning Equipment	8 046.11			50.0%			4023.06		
2. Foam Blowing	343.83			50.0%			171.92		
3. Fire Extinguishers	71.13	13.90		50.0%	85.0%		35.57	11.82	
4. Aerosols/ Metered Dose Inhalers	125.45			50.0%			62.72		
5. Solvents	0.41			50.0%			0.21		
G. Other Product Manufacture and Use			48.64			100.0%			48.64
1. Electrical Equipment			48.64			100.0%			48.64



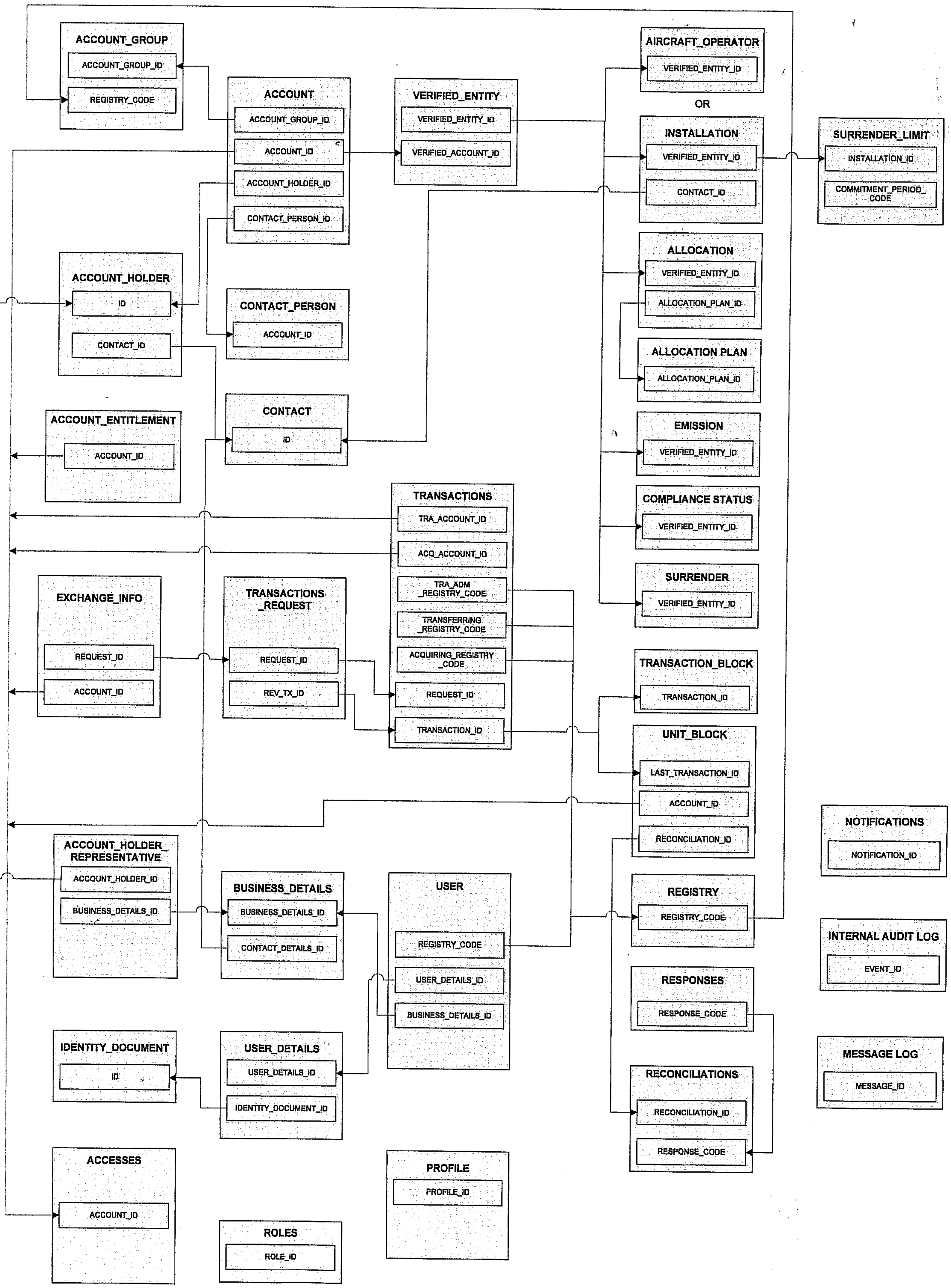
Overall emission results for 2014 including and excluding IPCC 4.LULUCF with uncertainties bars



Emission results for 2014 including IPCC 4.LULUCF with uncertainties bars

Annex 9.
Additional information on national registry

Annex A: CSEUR Database structure



Annex B

FEATURE	DESCRIPTION	TEST CASES	SAT Status
A series of technical test cases, ensuring YLE and PRD are handled and checked by EUTL correctly, even in the case when EUCR screen mechanisms are bypassed	***(EUTL) Edit YLE and Permit Revocation Date***		PASSED
	Modify Check 7028	1. Connect as NA and update the PRD of an installation to a past date; approve the update as another NA 2. Navigate to an account in the TAL of the account whose installation is the installation affected in step [1] 3. Propose a transfer to the account whose installation is the installation affected in step [1] 4. Approve the transfer 5. Ensure the transaction is COMPLETED	PASSED
	Create Check 7175	Scenario 1: Test YLE cannot get < VE year via EUCR 1. Locate an account with VE for 2011, 2012, 2013, 2014 2. Update installation and set YLE = 2013 3. Ensure the following message appears: "There are Verified Emissions introduced in years after to the proposed Last Year of Verification." 4. The update cannot be submitted. Scenario 2: Test YLE cannot get < VE year via EUCR 1. Locate an account with VE for 2011, 2012, 2013, 2014 2. Update in EUTL database the record in VERIFIED_EMISSION table to 2016 so that an artificial VE record exists in EUTL for 2016. 3. Update YLE for this installation via EUCR screen 4. Approve the request 5. Locate the state of the installation update request via: select * from installation_update_req where request_id = <<request_id>>; select * from request_state where request_state_id = <<request_state_id from previous query>>; select * from response where request_id = <<request_id>>; Ensure the request is REJECTED with response code 7175.	PASSED
	Add Check 7174	Scenario #1: Change YLE in EUTL 1. Create a request for change of YLE to 2014, and Permit Revocation Date to a date in 2014. Grab the RequestId. 2. Manually change the YLE of the request to 2016. update verified_entity set end_year = '2016' where verified_entity_id = (select NEW_INSTALLATION_ID from INSTALLATION_UPDATE_REQ where request_id = XXXXX); commit 3. In the Task List, verify that the data of the Request have changed. 4. Approve the Request 5. Verify that the Request gets Rejected from EUTL with code 7174. (select * from response where request_id = XXXXXXX) Scenario #2: Change PRD in EUTL Follow the steps of scenario #1 but set permit_revocation_date to a date before YLE. The closure request must be rejected with code 7174.	PASSED
	Set allocations to 0 for years > YLE	1. Login as NA of a registry 2. Select an OHA account without allocations. 3. At the "Installation" tab of the account check the YLE. 4. Go to EU ETS - Allocation Tables Phase 3 and upload a valid NAT xml up to the YLE of the account. 5. Check the Details table and ensure that the NAT xml has been uploaded successfully 5. Login to to EUTL. 6. Go to "Registry Mgt" and upload the same valid xml 7. Go to ETS - Installation Mgt and search for the account 8. Click on "Installation Number" link and ensure that the NAT xml has been uploaded successfully. 9. Go to EUCR to Accounts and search for the account 10. Go to "Installation" tab of the account and change the YLE to a previous value. Submit and approve the new update. 11. Go to to EU ETS - Allocation Tables Phase 3 and at the "Details' table search for the specific account 12. Ensure that NAT allocations set to zero (0) for year> YLE. 13. Login to EUTL and go to ETS - Installation Mgt and search for the account 14. Click on "Installation Number" link and ensure that the NAT allocations set to zero (0) for year> YLE. 15. Repeat the above test for AOHA and upload a NAAT xml file	PASSED
	Setting permit status after permit revocation date has passed	1. Set an installation in EUTL database to PRD = 2/2/1902 and permit active via the query: update installation set permit_revocation_date = '2/2/1902', installation_status_code = 1 where installation_id = <<installation_identifier>>; 2. Wait 10 minutes 3. Perform the query: select permit_revocation_date, installation_status_code from installation where installation_id = <<installation_identifier>>; and ensure the installation_status_code is now set to 2.	PASSED

	YLE, PRD should not be updated in RequestAccountClosure, RejectAccountClosure	1. Update an installation and set YLE=2016 and PRD=1/1/2016 2. Approve the update 3. Request closure of the account 4. Reject the closure request 5. Ensure the account in EUTL has unaffected YLE and PRD via the query: select * from installation where installation_identifier = <<installation_id>> and registry_code = <<registry_code>>;	PASSED
	modify Check 7168	1. Connect as NA and locate an OHA 2. Submit a close account request 3. In EUTL, via the database: 4. update yle to be less than yfe 5. Approve the account closure request 6. Ensure via the database that the request is terminated with error code 7168 (at least this code) 7. Restore the EUTL installation record to its former state Repeat the above steps but replace step 4 with the following alternatives: * delete PRD for installation * delete YLE	PASSED
	Modify UpdatedInstallation class	1. Connect as NA in ETS, Finnish registry 2. Locate an OHA and update YLE to 2013 and PRD to 1/1/2013 3. Query in EUTL database the following: select * from installation where installation_identifier = <<installation_identifier>> and registry_code = 'FI'; 4. Ensure YLE and PRD are as entered in step [2].	PASSED
	Modify compliance calculation query	1. Set the YLE to an installation to 2020 and approve the request 2. Delete record from COMPLIANCE_STATUS_BL for that installation for last period_year. Installation ID can be found via the query in EUTL: select * from installation where installation_identifier = <<verified_entity.identifier>> and registry_code = <<MS of the installation>>; The connected record must have been deleted from COMPLIANCE_STATUS_HISTORY. 3. Run Compliance Calculation Job - a record should be inserted for that installation in COMPLIANCE_STATUS_BL.	PASSED
Tests for EUCR screens, to handle YLE and PRD requirements	***Edit YLE and Permit Revocation Date***		PASSED
	Account closure request creation modifications	Scenario 1 1. Login as NA of a registry 2. Search for an OHA account with no values at the fields YLE and PRD 3. Click on "Close" link. 4. Ensure that the system displays the error message: "The Operator Holding Account cannot be closed as long as the Permit Revocation Date and the Last Year of Verification are not filled in; they can be entered by the National Administrator from the Installation tab of the Account Details". Below the error message you can see a table with Permit Revocation Date and Last Year of Verification with no data 5. Repeat the above test with an AR of the account Scenario 2 1. Login as NA of a registry 2. Search for an OHA account with no values only at the field YLE 3. Click on "Close" link. 4. Ensure that the system displays the error message: "The Operator Holding Account cannot be closed as long as the Permit Revocation Date and the Last Year of Verification are not filled in; they can be entered by the National Administrator from the Installation tab of the Account Details". Below the error message you can see a table. At the "Permit Revocation Date" field you can see the date and the "Last Year of Verification" field is without data 5. Repeat the above test with an AR of the account Scenario 3 1. Login as NA of a registry 2. Search for an OHA account with no values only at the field PRD 3. Click on "Close" link. 4. Ensure that the system displays the error message: "The Operator Holding Account cannot be closed as long as the Permit Revocation Date and the Last Year of	PASSED
	Allocation Screen - Allocation Job - modify for V1.40 doc	1. Login to ESD registry and select an OHA account with YLE & PRD = 2020 2. Upload a valid NAT xml for years 2013 - 2020 3. Go to "Allocation Phase 3" and search for the specify account 4. If current year is 2016 you can see Allocation data for the specific account up to 2016. (if Current year 2014, system displays Allocation data = 2014) 5. Go to the account at the "Installation" tab and change the YLE< of current year (for example 2013). Submit and approve the changes 6. Go to "Allocation Phase 3" and search for the specify account 7. Ensure that can see values up to 2013 for the specific account. 8. Go to the account at the "Installation" tab. Delete the value at YLE and change the PRD < of current year (for example 31/12/2013). Submit and approve the changes 6. Go to "Allocation Phase 3" and search for the specify account. 7. Ensure that can see values up to 2013 for the specific account. 9. Repeat the above test for AOHA only for YLE.	PASSED

	Installation/Aircraft Tab - If user NA, add "Edit YLE" functionality	Scenario 1 1. Login as NA of a registry 2. Select an OHA without LYV and PRD and FYV<= 2013 3. Go to "Installation" tab and click on "Update" button 4. Ensure that you can see the fields : "Permit Revocation Date", "First Year of Verification" and "Last Year of Verification" 5. Delete the data at FYV field and click on "Submit" button 6. System displays the error message : "First Year of Verification: Validation Error: Value is required." 7. Enter a value at LYV<FYV 8. System displays the error message: "The Last Year of Verification must be greater or equal to the First Year of Verification. 9. Enter a value at PRD and click on "Submit" button 10. System displays the information message: "Your request to update installation information has been submitted under identifier xxxxx" 11. Login as an other NA and approve the test. 12. Ensure that the account has been updated with the new data. 13. Enter a data at LYE and click on "Submit" button. 14. System displays the information message: "Your request to update installation information has been submitted under identifier xxxxx" 15. Login as an other NA and approve the test. 16. Ensure that the account has been updated with the new data. 17. Delete the values at PRD and LYE and click on "Submit" button. 18.System displays the information message: "Your request to update installation information has been submitted under identifier xxxxx" 19. Login as an other NA and approve the test. 20. Ensure that the account has been updated with the new data. 21. Enter LYE> PRD and click on "Submit" button 22. System displays the error message: "The Year of the Permit Revocation Date	PASSED
	NAT/NAVAT allocations set to zero (0) for year > YLE	1. Login as NA of a registry 2. Select an OHA account without allocations. 3. At the "Installation" tab of the account check the YLE. 4. Go to EU ETS - Allocation Tables Phase 3 and upload a valid NAT xml up to the YLE of the account. 5. Check the Details table and ensure that the NAT xml has been uploaded successfully 5. Login to EUTL. 6. Go to "Registry Mgt" and upload the same valid xml 7. Go to ETS - Installation Mgt and search for the account 8. Click on "Installation Number" link and ensure that the NAT xml has been uploaded successfully. 9. Go to EUCR to Accounts and search for the account 10. Go to "Installation" tab of the account and change the YLE to a previous value. Submit and approve the new update. 11. Go to EU ETS - Allocation Tables Phase 3 and at the "Details' table search for the specific account 12. Ensure that NAT allocations set to zero (0) for year> YLE. 13. Login to EUTL and go to ETS - Installation Mgt and search for the account 14. Click on "Installation Number" link and ensure that the NAT allocations set to zero (0) for year> YLE. 15. Repeat the above test for AOHA and upload a NAAT xml file	PASSED
	OHA Account - Compliance Tab - Enter/Edit emissions between YFE & YLE	1. Login as NA of a registry and select an OHA without emissions. 2. Go to "Installation" tab and check the dates at the YFE and YLE. 3. Go to "Compliance" tab and ensure that you are able to enter emissions between YFE & YLE. 4. Go to Installation" tab again and change the dates at YFE and YLE. 5. Go to "Compliance" tab and ensure that you are able to enter emissions between YFE & YLE. 6. Ensure that as NA you can see the "Save" button. 7. Login as another appropriate user of the account. 8. Ensure that you can enter appropriate user and that you cannot see the "Save" button. 9. Repeat the above test for AOHA 10. Repeat the above test for accounts with emissions and ensure that you are able to edit emissions. Edit emissions should be handled like the account was excluded (i.e. if a verified emissions exist, it is possible to change the value etc)	PASSED
	PRD Quartz Trigger	Scenario 1 1. Login as NA of a registry and select an OHA in Open or Blocked status. 2. Go to "Installation" tab and ensure that the Permit Status =ACTIVE 3. Enter/ Change the Permit Revocation Date to a date in the future (for example enter tomorrow's date) and approve the task 4. At the date of Permit Revocation Date check the account. 5. Ensure that the Permit Status = REVOKED. Scenario 2 1. Login as NA of a registry and select an OHA in Open or Blocked status. 2. Go to "Installation" tab and ensure that the Permit Status =ACTIVE 3. Enter/ Change the Permit Revocation Date to a date in the past and approve the task 4. Check the account. 5. Ensure that the Permit Status = REVOKED. Scenario 3 1. Select an OHA in Suspended or Closed status and go to "Installation" tab. 2. Ensure that the "Update" button is not available	PASSED

	Rejection of Account Closure Request	Scenario 1 1. Login as NA of a registry 2. Search for an OHA account with values at fields YLE & PRD 3. Click on "Close" or "Force Close" link of the account 4. Go to task list and reject the account closure task. 5. Go back to the account and ensure that the fields YLE & PRD have not changed values. 6. Repeat the above test with an AR of the account. As NA of the registry reject the task. 7. Go back to the account and ensure that the fields YLE & PRD have not changed values. Scenario 2 1. Login as NA of a registry 2. Search for an AOHA account with values at field "Expiry Date" 3. Click on "Close" link of the account 4. Go to task list and reject the account closure task. 5. Go back to the account and ensure that the field "Expiry Date" has the correct value 6. Repeat the above test with an AR of the account. As NA of the registry reject the task. 7. Go back to the account and ensure that the field "Expiry Date" has the correct value	PASSED
	Sum of Verified Emissions - Compliance Status/Entitlements	Scenario 1 1. Select an OHA and go to "Compliance" tab 2. Ensure that you have enter emissions for year 2013 3. At the "Compliance" table check the value at "Cumulative Verified Emissions" field. 4. Ensure that you can see correct data 5. Tick on the Exclude box for year 2013 and click on "Save" button 6. System displays the information message: "Compliance data are being recalculated" 7. When the process completed, check again at the "Compliance" table the value at "Cumulative Verified Emissions" field. 8. Ensure that you can see correct data 9. Repeat the above test for AOHA (year 2013 is excluded by default for AOHAs. To be able to perform the above test should not apply the parameters of "exclusion") Scenario 2 Run the following script to check if entitlements updated correctly: select ve_cp2 from account_entitlement_extras ae, account a where a.account_id = ae.account_id and a.identifier = :p_account_identifier;	PASSED
	Update YLE-PRD Screen - Show warning with js	1. Login as NA of a registry 2. Select an OHA account and go to "Installation" tab 3. Click on "Update" button 4. At the field "Permit Revocation Date" enter a date > than the year at the field "Last Year of Verification" 5. Ensure that the system displays the warning message: "Warning: Last year of verification is earlier than the year of Permit Revocation Date" next to the field of PRD 6. Click on "Submit" button 7. Ensure that the request to update installation information has been submitted	PASSED
Allocation delivery settings conformation has a useless checkbox	Allocation delivery settings conformation has a useless checkbox	1. Log in to MS as NA 2. Go to Allocation Phase 3, select Aircraft Operators tab and choose 2014 form the list. 3. Tick the allocation that you want and click on "Submit" button 4. At the "Approve Transaction Request" pop up, ensure that there isn't a checkbox next to the titles "Free" and "Special Reserve"	PASSED
Allocations to disabled aircraft operators sometimes appeared as allowed; this is now fixed.	Allocations for disabled Aircraft Operator	1. Log in to MS as NA 2. Go to Allocation Phase 3, select Aircraft Operators tab and choose 2014 form the list 3, Make sure that at check box for least one Aircraft Operator is disabled (grey with question mark icon) 4. Click "Free" checkbox 5. Ensure that all positions except disabled ones are checked	PASSED
Fix account block mechanism so that OHA are correctly blocked	Block Accounts Job - Count non excluded years for OHA ignore excluded 2013	1. Create a new account with YFE=YLE=2013 2. Approve the account creation 3. Exclude year 2013 for this account 4. Run BlockAccountsTrigger by modifying its next fire time, e.g. via the query: update qrtz_cron_triggers set cron_expression = '0 0/10 * 1/1 * ? *' where trigger_name = 'BlockAccountsTrigger'; 5. Wait ten minutes. 6. Ensure the account is still OPEN	PASSED
Issued amount for ESD appeared double for the first issuance only; this is now fixed.	CLONE - Double value for ESD Issuance - first issuance time	1. Remove the existing ESD TQA via the query in EUCR: (update account set status = 'REMOVED' where eu_account_type = 'AEA_TOTAL_QUANTITY_ACCOUNT' ; commit;) 2. Create a new ESD TQA via ESD account management screens 3. Perform an issuance of AEA units, and approve the issuance request. 4. Navigate to ESD accounts list; verify that the balance of the ESD TQA is the one that you issued during step [3].	PASSED
CP1 credits ineligible after 31 March 2015	CP1 credits ineligible after 31 March 2015	1. Set system date to a date after 31/3/2015 (OR SET PARAMETER ZZZZZ) 2. Locate an account with ICH eligible CER units with OP=AP=1 3. Transfer one of these units to JP-100-999 account; the transfer can be proposed 4. Transfer one of these units to an ETS account; the transfer cannot be submitted; error message: "80706: The acquiring account is not allowed to hold CP1 units after a specified date"	PASSED

Cannot search ESD entitlements transactions by account identifier	Cannot search ESD entitlements transactions by account identifier	1. Log in to ESD 2. Go to ESD Entitlements Transactions page 3. Enter account identifier either to "Transferring Account ID" or "Acquiring Account ID" and click search. 4. Ensure that you can see correct data	PASSED
Translation issue	Change of labels in EN	1. Propose a transaction reversal; ensure the approval task description is: "The following Reversal Transaction needs approval prior to launching the Transaction workflow" 2. Propose a transaction; ensure the approval task description is: "The following Transaction needs approval prior to launching the Transaction workflow."	PASSED
Correction in EUTL check	Check 7864 for Post Compliance Transfers should check Transferring Account	For each of the following transaction types: ESD Post Compliance Transfers ESD Delete after OverAllocation ESD AEA Transfer ESD Entitlement Transferred do the following: 1. Propose a new transaction 2. Update the end_of_validity of the transferring account of the transaction in EUTL to 1/1/1999 3. Approve the transaction request 4. Ensure the transaction is terminated with error code 7864 5. Update the value updated during step [2] to 1/1/9999 6. Repeat the same transaction 7. Ensure the transaction is completed	PASSED
Compliance Status figure C is not calculating	Compliance Status figure C is not calculating	1. Connect as ESD-CA and locate an ESD compliance account with zero emissions and zero balance for the active year 2. Execute balance job for the active year 3. Ensure an entry is entered in esd compliance as follows: select * from esd_compliance_history where account_id = (select account_id from account where identifier = <<acc_identifier>>); All values must be null except the balance, which is zero 4. Execute compliance status job for the active year 5. Perform the same query and ensure the compl. status of this account is C.	PASSED
Condition if an installation appears in the allocation list should not contain Expiry Date	Condition if an installation appears in the allocation list should not contain Expiry Date	1. Connect as NA and navigate to Allocation screen. 2. Ensure the rules for an installation/aircraft operator to appear in this screen are as follows: Account Status NOT CLOSED AND The state of the NAT/NAAT is ACTIVE (not deleted) AND Remaining quantity is greater than 0 AND For Installations: (Year of allocation <= year of Permit Revocation if this exists) AND (Year of allocation <= YLE if this exists) For Aircrafts operators: Year of allocation <= YLE	PASSED
ESD : AR and AAR addition	ESD : AR and AAR addition	Scenario 1 1. Login to ESD registry as an AR of an account 2. Go to "ESD ARs" tab and add a new AR to the account. Submit the task 3. Login as ESD CA and go to task list to approve the task 4. Repeat the above test for "ESD AARs" tab and add a new AAR to the account 5. Ensure that the new AR / AAR has been added to the account Scenario 2 1. Login to ESD registry as an AAR of an account 2. Go to "ESD ARs" tab 3. Ensure that you cannot see the "Add ESD AR" button Scenario 3 1. Login to ESD registry as an AR of an account 2. Go to "ESD ARs" tab and select an AR 3. Click on replace button and select a new AR. Submit the task 4. Login as ESD CA and go to task list to approve the task 5. Repeat the above test for "ESD AARs" tab and replace an AAR 5. Ensure that the new AR / AAR has been replaced to the account Scenario 4 1. Login to ESD registry as an AAR of an account 2. Go to "ESD ARs" tab 3. Ensure that you cannot see the "Replace" button	PASSED
ESD AR user can see details of suspended account as well as suspension reason	ESD AR user can see details of suspended account as well as suspension reason	1. Log in as ESD CA and suspend an account 2. As ESD CA ensure that you can see the links "View Details", "Restore" and "Suspension reason" 3. Log in as AR/AAR of suspended account and display Account list 4. Ensure that you cannot see the links "View Details", "Restore" and "Suspension reason"	PASSED
ESD Compliance Dashboard - Account Identifier should not be a link for SUSPENDED account and user is AR/AAR	ESD Compliance Dashboard - Account Identifier should not be a link for SUSPENDED account and user is AR/AAR	Scenario 1 1. Login as ESD CA to ESD registry and find a suspended account or select to suspend an account 2. Go to ESD Compliance dashboard 3. Ensure that at the suspended account's identifier there is a link 4. Click on the link of suspended account and ensure it is active Scenario 2 As AR/AAR of the suspended account: 1. Login to ESD registry as an ESD AR of the suspended account 2. Go to ESD Compliance dashboard 3. Ensure that at the suspended account's identifier there is NOT a link. 4. Repeat the above test as an AAR of the suspended account	PASSED

ESD Entitlements - Propose transaction from account with NO AAR, AAR is supposed to sign ??	ESD Entitlements - Propose transaction from account with NO AAR, AAR is supposed to sign ??	1. Login as ESD AR and go to ESD Entitlements screen 2. Ensure that you can Propose Transaction 3. Select an ESD account of the MS and Suspend all ESD AARs of the account 4. As ESD AR go again to ESD Entitlements screen 5. Ensure that the proposal link is not visible when the user is an AR of the account and the account does not have any enrolled AARs.	PASSED
ESD Entitlements - Transaction Proposal enabled for user who is not AR/CA of account + Red screen when transaction proposed	ESD Entitlements - Transaction Proposal enabled for user who is not AR/CA of account + Red screen when transaction proposed	1. Ensure that in a MS you have the same ESD AR in two accounts (for example BG 2013 and BG 2017) 2. Login as the ESD AR and go to ESD Entitlements Screen. 3. Ensure that you can see all accounts of the same MS but the "Propose Transaction" link only to the account that you are as ESD AR 4. As ESD CA suspend an account of the ESD AR 5. Login as the ESD AR and go to ESD Entitlements Screen. 6. Ensure that you can not see the "Propose Transaction" link of the suspended account 7. Restore the suspended account. 8. Ensure that the ESD AR is able to see the "Propose Transaction" link at ESD Entitlements Screen. 9. Select to suspend the ESD AR of an account 10. Login as the ESD AR and go to ESD Entitlements Screen. 11. Ensure that you can not see the "Propose Transaction" link of account that the ESD AR has been suspended 12. Restore the suspended ESD AR. 13. Ensure that the ESD AR is able to see the "Propose Transaction" link at ESD Entitlements Screen.	PASSED
Corrections in ESD Parameters page	ESD Parameters - there is no way to change EU_PARTY_ACC_IDENTIFIER_FOR_NON_KP_MS value via GUI	Regression incoming CER from KP PHA to ESD 1. I setup EU-296 as (incoming) PHA for MT 2. I give 100 limit1 to MT-2014 account for ESD 3. I set dates so that we are now between balance date and compliance status date 4. I connect as NA to EU and navigate to 296 PHA 5. The transaction type "Transfer to ESD" appears 6. I enter a KP transfer and approve as another CA 7. Transfer is completed and target account balance is increased; Limit1 is decreased. Please also refer to tab "ESD Parameters regression tests"	PASSED
		1. Connect as ESD-CA and navigate to ESD Parameters screen 2. Select MS=CY 3. Select KP PHA Registry = Bulgaria, identifier = 999 4. Click Save 5. Ensure it is saved via the query "select * from esd_parameter where esd_member_state = 'CY';" 6. Update KP PHA Registry = European Union, identifier = 111 7. Click Save 8. Ensure it is saved via the same query Repeat for MT. Repeat for FR.	PASSED
ESD Parameters - user cannot set European Union value as KP Party Holding Account Registry parameter	ESD Parameters - user cannot set European Union value as KP Party Holding Account Registry parameter	1. Connect as ESD-CA and navigate to "Modify ESD Parameters" 2. Select MS = 'CY' and provide KP PHA Registry = "European Union" and KP PHA identifier = 12 3. Click Save 4. Execute the query "select * from esd_parameter where esd_member_state = 'CY';" and ensure the provided values are persisted. Repeat the same steps for FR, MT, GR.	PASSED
ESD Task List for ESD-AR: shows submitted transfer AEA but not submitted transfer entitlement	ESD Task List for ESD-AR: shows submitted transfer AEA but not submitted transfer entitlement	1. Ensure that ESD-ARs have the permissions : "ERM_ESD_TR_ENT_APPROVE" & "PERM_ESD_AEA_TRANSFER_APPROVE" 2. Connect as ESD-AR of an ESD account. 3. Go to "Holdings" tab and submit one transfer AEA 4. Go to ESD- ESD Entitlements and submit one transfer entitlement 5. Go to task list -as the initiator AR- and ensure that you can see and reject the tasks "Approve Transaction Request" for transfer AEA & "Approve ESD Entitlements Transaction Request" for transfer entitlement 6. Login as an other ESD AR of the account and go to task list. Ensure that you can only see the tasks.	PASSED
ESD parameters page gets locked when empty Abatement Factor (and others) is saved	ESD parameters page gets locked when empty Abatement Factor (and others) is saved	Flow #1 1.1. Log in to ESD as NA 1.2. Go to ESD Parameters 1.3. Remove value from Abatement Factor field 1.4. Click [Save] 1.5 Ensure an error message appears forbidding saving with null abatement factor Flow #2 2.1. Log in to ESD as NA 2.2. Go to ESD Parameters 2.3. Choose member state which has "Carry-forward AEA limit" and "Transfer AEA limit" values set 2.4. Remove value from "Carry-forward AEA limit" field 2.5. Change value in "Transfer AEA limit" field 2.6. Click [Save] 2.7 Ensure saving is forbidden without a value in "Carry-forward AEA limit" and in "Transfer AEA limit".	PASSED

ETS account management: "View suspension reason" should only be visible to roles that have permission PERM_ACC_SUSP_REST	ETS account management: "View suspension reason" should only be visible to roles that have permission PERM_ACC_SUSP_REST	<<all permissions of account search screen should be regressed>> Scenario 1 1. Login as NA of a registry 2. Ensure that only NA and SD Agent have the role "Suspend or unsuspend account (PERM_ACC_SUSP_REST)' 3. Search for a suspended account or suspend an account and enter Suspension reason. 4. Ensure that NA is able to see and click on the "Suspension reason" link. 5. Repeat the above test for SD Agent. 6. Ensure that SD Agent is able to see and click on the "Suspension reason" link. Scenario 2 1. Log in as one of the ARs for that account (making sure you do not have any admin privileges) 2. Ensure that you cannot see the "Suspension reason" link. 3. Repeat the above test as AAR of the suspended account 4. Ensure that you cannot see the "Suspension reason" link.	PASSED
EUTL - CP1 credits ineligible after 31 March 2015	EUTL - CP1 credits ineligible after 31 March 2015	1. Set the parameter ets.last.allowed.date.cp1 to a future date; this is in eucr-configuration.properties 2. Set in EUTL database table EUTL_PARAMETERS, parameter name "cp1_inelligible_date" to a past date 3. Connect as NA in ETS and locate an account with CER or ERU in CP1 4. Propose a transfer of CP1 units towards ETS; approve it 5. Ensure that transaction is TERMINATED with response code "7657: CP1 units are no more eligible" 6. Propose a transfer of CP1 units towards Japan. Approve it. Ensure it remains in status PROPOSED (this is normal, expecting for an approval from Japan) 7. Propose a transfer of CP1 units towards another PHA. Approve it. Ensure the check 7657 is not generated.	PASSED
EUTL Public - If VE are missing for an unexcluded year and Compliance Status is C, Emissions should be shown as "Not Reported" and Cumulative Emissions should be "Not Calculated"	EUTL Public - If VE are missing for an unexcluded year and Compliance Status is C, Emissions should be shown as "Not Reported" and Cumulative Emissions should be "Not Calculated"	1. Select an OHA or AOHA without VE and Compliance Status = C. 2. Login to EUTL Public 3. Go to ETS - Operator Holding Accounts and search for the account 4. Click on "Details - Current Period " link. 5. Ensure that you can see at "Verified Emissions " column the value " Not Reported" at the "Total verified emissions*** " column the value "Not Calculated" 6. Press History. 7. Ensure that under the column "Cumulative Verified Emissions" the value "Not Calculated" is displayed 1. Link to EUTL public 2. From ETS - Operator Holding Accounts search for an OHA or AOHA with Compliance Status = C. 3. Go to ETS-Allocation Compliance. Select Registry of OHA/AOHA of step 2 and Second Commitment period. 4. Click on the proper year link 5. Enter the installation identifier of OHA/AOHA from step 2. 6. Ensure the value "Not Calculated " is shown under column "Total verified emissions"	PASSED
Enable retirement from an AAU deposit account	Enable retirement from an AAU deposit account	1. Select a registry with balance at the ETS AAU deposit account. 2. Click on "View Details" link and go to "Holdings" tab 3. Click on "Propose a transaction" button 4. Ensure that at the "Transaction selection" screen you can see the "Retirement" link. 5. Make sure that the Retirement link is active.	PASSED
Entitlement Transfer to Closed Account	Entitlement Transfer to Closed Account	Scenario 1 1. Login to ESD registry and search for an account in status "Closed" 2. Go to ESD Entitlements and select to Propose Transaction for a different account than the account with "Closed" status 3. At the "Credit Entitlement Transaction" screen select "Transfer" and search for the account in "Closed" status. 4. Ensure that the data of "Closed" account does not appear for selection 5. Repeat the above test for Transaction type: Carry-over Scenario 2. 1. Login to ESD registry and search for an account in status "Blocked" or "Open" (for ex. GR 2015) 2. Go to ESD Entitlements and select to Propose Transaction for a different account than the account with "Blocked" status (For ex. FR 2013) 3. At the "Credit Entitlement Transaction" screen, select "Transfer" to the previous account in "Blocked" or "Open"status. 4. Enter a quantity to transfer and click on "Next" button 5. System displays the information message: "Your ESD Entitlements transfer proposal has been recorded and assigned the identifier EDxxx. The transaction request with id xxxxx has been submitted for approval." 6. Do not approve the task. 7. Go to Accounts and search for the Blocked account (GR 2015) 8. Close the account and approve the account closure task 9. Ensure that the account (GR 2015) is in closed status. 10. Go to task list and approve the previous "Approve ESD Entitlements Transaction Request". 11. Go to ESD -ESD Entitlement Transaction and search for the request 12. Ensure that ESD Entitlements Transfer is in status "5-Terminated" . 13. Click on Transaction Id link and go to "Response Codes" tab.	PASSED

ITL does not reply back to the registries if the transactions sent are more than 3.000 unit blocks. For this one we should implement an EUCR check to prevent the initiation of such transaction.	ITL does not reply back to the registries if the transactions sent are more than 3.000 unit blocks. For this one we should implement an EUCR check to prevent the initiation of such transaction.	Scenario #1: More than ITL limit across one unit type 1. Set the configuration parameter itlIntegrationSettings.maxTransactionUnitBlocks = 10 2. Locate an account with more than 10 unit blocks via the query: select account_id, unit_type, count(*) , sum(end_ - start_ + 1) quantity from unit_block group by account_id, unit_type order by 3 desc, 1, 2; 2. Connect as NA and locate this account 3. Propose a transfer of units for a quantity spanning more than 10 unit blocks 4. Click on "Submit" 5. Sign in via ECAS 5. The system presents a message: "Check 80002: The amount requested exceeds the maximum number of blocks (10) accepted by ITL in a single transaction." 6. Ensure the message presents quantities whose total quantities sum up to the quantity entered in step [3]. Scenario #2: Equal to ITL limit across many unit types 1. Set the configuration parameter itlIntegrationSettings.maxTransactionUnitBlocks = 3 2. Locate an account with 3 unit types (e.g. CER, RMU, ICER) 3. Enter a transfer of 1+1+1 units across each of the types 4. Ensure the proposal is successfully submitted. 5. Ensure the proposal can be approved and completed normally Scenario #3: Less than ITL limit across many unit types 1. Repeat scenario #2 but enter 1+1 units across two unit types 2. Ensure the proposal is successfully proposed and completed	PASSED
Implement solution that links the KP account to which ESD accounts transfer KP units to MS, not to Year and MS	Implement solution that links the KP account to which ESD accounts transfer KP units to MS, not to Year and MS	1. Connect to ESD as ESD-CA 2. Navigate to Modify ESD parameters 3. Select MS='CZ' 4. Set values for KP Party Holding Account Registry and KP Party Holding Account Identifier 5. Save the values 6. Execute the query: select * from esd_parameter where esd_member_state = 'CZ'; 7. Ensure that for parameters: COMPL_PARTY_ACC_HOST_REG EU_PARTY_ACC_IDENTIFIER_FOR_NON_KP_MS COMPL_PARTY_ACC_IDENTIFIER the value of ESD_YEAR is 9999. 8. Ensure that for other parameters the value of ESD_YEAR is not 9999. Repeat for MT, CY, IT, FR.	PASSED
Incorrect tool tip for excluded Aircraft Operator in Allocation Phase 3 list	Incorrect tool tip for excluded Aircraft Operator in Allocation Phase 3 list	1. Login as NA of a registry 2. Go to EU ETS - Allocation Phase 3 3. Go to Aircraft Operators tab 4. Check the text in tool tip for excluded Aircraft Operator 5. Ensure that you can see the text "Allocation disabled because aircraft operator is excluded for year (YYYY)". Where YYYY is the allocation year	PASSED
Installation Details empty on Account Opening request	Installation Details empty on Account Opening request	1. Request Account Opening for OHA & AOHA 2. In the Task List verify that the Installation tab is not empty	PASSED
Lack of order with displaying "Transfer to year" drop-down list while Transferring AEA units	Lack of order with displaying "Transfer to year" drop-down list while Transferring AEA units	1. Login to ESD registry as ESD CA 2. Propose creating account for one MS, from 2013 up to 2020. 3. While approving, pick random order like: 2018, 2014, 2020, 2015, 2017, 2016.. etc.. 4. From other account with balance propose AEA transfer to MS, open drop-down list: "Transfer to year" 5. Make sure the years are ordered correctly	PASSED
Modify ESD Parameters - fix validation message for the various fields	Modify ESD Parameters - fix validation message for the various fields	1. Login as CA in ESD registry 2. Go to ESD- Modify ESD parameters 3. At the "Abatement Factor" field enter letters and symbols 4. System displays the error message: "the value provided must be numeric." 5. Enter more that two fractional digits 6. System displays the error message: "Only two fractional digits are allowed in abatement factor"	PASSED
New Check for Allocations against YLE/PRD	New Check for Allocations against YLE/PRD	Scenario #1: Submit allocation and change YLE from EUCR screen 1. Prepare and upload an allocation XML; upload in EUCR and EUTL 2. Tick allocation for an included installation; approve the allocation 3. Update via account=>installation screen the YLE to a value earlier than the allocation year of step [2]. 4. At next job execution: Ensure a transaction request is not generated because it is stopped by EUCR Scenario #2: Submit allocation and change YLE from EUTL database 1. Repeat step 1 of scenario #1 2. Repeat step 2 of scenario #1 3. Update the YLE in EUTL via the query: update installation set year_of_last_emissions = 2013 where installation_identifier = <<installation_identifier>> and registry_code = 'FI'; 4. Ensure that at the next job invocation, the allocation transaction towards the specific account is generated, by logging in EU Registry. 5. Ensure the transaction is TERMINATED with error code 7229.	PASSED

This is partial implementation of TST-619, which will be completed in the next EUCR release.	replace ESD eligibility icons with text	1. Ensure that in ESD registry the Current Phase within Compliance Cycle is "Between Balance Calculation and Compliance Status Calculation" 2. Login to a registry and search for a Party HA relates to ESD MS 3. Click on "View Details" link 4. Go to "Holdings" tab. 5. Ensure that at the table of the screen the iconic representation like "moon" has been removed and that at the "ESD Eligibility' column you can see the values "Limit 1"and / or "Limit 2" and /or "Limit 1 + "Limit 2". 6. Click on "Propose a transaction" button 7. At the Transaction selection screen "Transfer of ERU, CER, lCER and tCER to ESD Compliance Account" 8. At the Transfer credits to ESD compliance account screen ensure that at the column "Eligible for ESD" you can see the values "Limit 1"and / or "Limit 2" and /or "Limit 1 + "Limit 2". 9. Enter a quantity to transfer and click on "Next" button 10. Ensure that at the "Transfer Confirmation" pop up you can see the values "Limit 1"and / or "Limit 2" and /or "Limit 1 + "Limit 2".	PASSED
Problem with actions in Modify ESD Parameter page	Problem with actions in Modify ESD Parameter page	1. Connect to ESD as ESD-CA 2. Navigate to "Modify ESD Parameters" 3. Click "Save" without changing anything 4. Ensure the message "There is no change on your submit request" appears 5. Change abatement factor to "1.99" and click "Save" 6. Ensure the messages "There exists a pending request for modifying the ESD Parameters, page in view only mode" and "Updated values have been submitted to EUTL for approval" appears at the top of the screen 7. After 2 minutes re-visit the page and ensure the messages do not appear any more 8. Perform the following query in EUTL and ensure the value "1.99" appears: 'select * from esd_parameters where name like 'ABAT%'; 9. Set MS = "AT", KP PHA Registry = "Bulgaria", KP PHA Identifier = "999" and click Save. 10. Ensure the message "KP Party Holding Account Identifier values have been saved." appears 11. Select MS = "AT" and check the other values entered during step [9] appear on the screen. 12. Select MS = "AT" and year = 2020 and set Carry-forward limit = 2 and Transfer AEA limit = 2 and click 'Save'. 13. Ensure the messages "There exists a pending request for modifying the ESD Parameters, page in view only mode" and "Updated values have been submitted to EUTL for approval" appear. 14. After 2 minutes re-visit the page and ensure the messages do not appear any more 15. Perform the following query in EUTL and ensure the entered values during step [13] have been stored: select * from esd_parameters where esd_registry='AT'; 16. Select MS: CY, KP Party Holding Account Registry: European Union, KP Party Holding Account Identifier: 5000280. Click [Save] button. Ensure the messages "KP Party Holding Account Identifier values have been saved" appears	PASSED
Red Box error while clicking Save button in ESD Parameter Page with no data selected	Red Box error while clicking Save button in ESD Parameter Page with no data selected	1. Login as CA in ESD registry 2. Go to ESD- Modify ESD parameters 3. Click on "Save" button without selecting or entering a value 4. Ensure that system displays the message: "There is no change on your submit request." 5. If there is a value at "Abatement Factor" field delete it and click on "Save" button 6. Ensure that system displays the message: "Abatement Factor: Validation Error: Value is required."	PASSED
Refresh button in ESD Compliance Dates page is not working - for ESD SDAgent user	Refresh button in ESD Compliance Dates page is not working - for ESD SDAgent user	1. Login as user with ESD SD Agent role to ESD registry 2. Go to ESD Compliance Dates page 3. Ensure that Refresh button is available and works properly when clicking on it.	PASSED
Open/blocked status not-recalculated when excluding accounts.	Open/blocked status not-recalculated when excluding accounts.	1. Find an OHA with YFE 2013 but no 2013 emissions and check it is blocked 2. Go to the Compliance page 3. Tick the "Exclude" box for 2013 4.Go back to the Account Search and look for the account again. 5. Ensure that the status of the account is "Open" 6. Un-exclude 2013 and click on "Save" button 7. Ensure that the status of the account is "Blocked"	PASSED
Alignment between Dynamic Compliance Status and Account Status in EUCR	Alignment between Dynamic Compliance Status and Account Status in EUCR	Detailed excel of Test Cases is attached in SDB-2680 1. An account does not have emissions for a year it should => becomes C => becomes blocked 2. An account has all emissions but less surrenders => becomes B => becomes open 3.An account has all emissions but equal or more surrenders => becomes A => becomes open Test exclude-unexlude Test YFE, YLE	PASSED

Show Unit Block management screen for ESD and add details	Show Unit Block management screen for ESD and add details	Scenario #1: Test unit block management page in ESD 1. Connect as ESD-CA and navigate to administration=>unit blocks; ensure columns ESD used and ESD eligibility columns are added as rightmost columns. 2. Ensure the presented data correspond to the rows returned from the query: select * from unit_block where account_id in (select account_id from account where registry_code='ED'); 3. Test search functionality by searching for unit types, ranges and other screen fields. 4. Test export functionality via the same fields. 5. Test sorting functionality by clicking on all columns. 6. Click on a unit block record and edit/suspend/restore the record. Scenario #2: Test unit block management page in IT 1. Connect as NA in Italian registry 2. Repeat all steps of scenario #1 for Italian registry	PASSED
Suspended user can see account details and gets unrecoverable error on transaction proposal	Suspended user can see account details and gets unrecoverable error on transaction proposal	1. Login to ESD as AR of an account. Do not leave the page. 2. From an other browser login to ESD as CA and suspend the above AR user in his account 3. Go to the browser that you have login as ESD AR and search for the account for which this user was suspended (clicking on "Search" button) 4. Ensure that suspended ESD AR cannot see the account at the ESD Compliance Accounts list. After the AR/AAR gets suspended he'll loose access to the particular account almost instantly (which might lead to a 404 error on his next click)	PASSED
There is no displayed Transaction ID in ESD Task List for Entitlement Transactions	There is no displayed Transaction ID in ESD Task List for Entitlement Transactions	1. Login to ESD registry as ESD CA or ESD AR and Propose an Entitlement transaction 2. Go to task list and search for the "Approve ESD Entitlements Transaction Request" task 3. At the "Filter results" table ensure that at the column "Transaction Id" you can see the correct value.	PASSED
Task - user who approved/rejected a task disappears	Task - user who approved/rejected a task disappears	1. Log in as AR 2. Claim and approve a task; note the request Id 3. Submit an un-enrolment request as this user 4. Connect as NA 5. Navigate to Task History 6. Navigate to the request with Id as noted in step 2 7. Ensure the task claimant on this request remains the user from step 1	PASSED
Task List - Search & Export - Wrong description	Task List - Search & Export - Wrong description	1. Login as NA of a registry 2. Go to task list at "Exclusive Task List" and click on "Search & Export" button 3. Check the description. 4. Ensure that you can see correct data 5. Go to "General Task List" tab and click on "Search & Export" button 6. Check the description. 7. Ensure that you can see correct data 8. Go to "History" tab and click on "Search & Export" button 9. Check the description. 10. Ensure that you can see correct data 11. Login as AR or/and as AAR 12. Go to Task list and click on "Filter & Export" button 13.Check the description. 14. Ensure that you can see correct data 15. Go to "History" tab and click on "Search & Export" button 16. Check the description. 17. Ensure that you can see correct data	PASSED
The amendment table should not appear for the NAT Tab of allocation tables phase 3	The amendment table should not appear for the NAT Tab of allocation tables phase 3	1. Login as NA of a registry 2. Go to EU ETS - Allocation Tables Phase 3 3. Go to "National Allocation Table" 4. Ensure that you cannot see the table "Amendments". 5. Go to "National Aviation Allocation Table" 6. Ensure that you can see the table "Amendments" at the end of the screen.	PASSED
Unrecoverable error while trying to do KP transfer to non-existing account	Unrecoverable error while trying to do KP transfer to non-existing account	1. Log in to MS as NA 2. Display PHA account with eligible KP units 3. Propose KP transfer to non-existing account (but with valid account number; you can accomplish this by temporarily changing account identifier of another account to 9999 in EUCR and EUTL, and send the transaction to that account) 4. System displays an error message: 7020: The specified account identification does not exist in the acquiring registry 5. Restore back the change to the account identifier described in step [2]. 6. Propose a transfer to that account 7. Ensure the transfer is properly proposed, approved and respective transaction is completed.	PASSED
View Details link not working	View Details link not working	1. Login as NA to a registry 2. Search for AOHA accounts 3. Click the ">|" button to navigate to the last page of the results 4. Click on the "<<" button to go to the previous page 5. Click the "View Details" link of any account on that page 6. Ensure that you can see the details of the AOHA account 7. Repeat the above test for OHAs account	PASSED
Wrong number of "rows found" displayed in NAT an NAAT	Wrong number of "rows found" displayed in NAT an NAAT	1. Log in to a MS as NA 2. Go to Allocation Table Phase 3 3. At National Allocation Table tab check that you can see correct number at "rows found" field 4. Repeat the above test for National Aviation Allocation Table tab 5. Ensure that system displays correct number at "rows found" field	PASSED

NAs cannot complete "Send Enrolment Keys Task"	Three NAs were needed in order to approve/enrol a user and send enrolment keys; this is now fixed and two NAs are needed for such processes.	Scenario A: Add user as AR - NA1 sends keys A1. Connect as NA and locate the URID of a REGISTERED user A2. Navigate to an OPEN OHA and add the user of step [A1] A3. Connect as NA1 and approve the task A4. Ensure that after 1 minute NA1 has a "Send enrolment keys" task for the specific user. A5. Ensure NA1 can claim and approve the task A6. Ensure the registered user of step A1 is now VALIDATED A7. Ensure the user is indeed added on the specific account Scenario B: Add user as AR - NA sends keys B1. Repeat steps A1-A4. B2. Ensure that after 5 minutes NA1 has a "Send enrolment keys" task for the specific user. B3. Connect as another NA. Ensure NA can claim and approve the task B4. Ensure the registered user of step A1 is now VALIDATED. B5. Ensure the user is indeed added in the specific account Scenario C: Open account and appoint user C1. Create a new account and appoint as AR one REGISTERED user C2. Approve the account opening as NA C3. As the same NA ensure a task "Send enrolment keys' is created C4. Claim and approve the task C5. Ensure the account is created and the user is in VALIDATED status Repeat the above scenarios for adding AAR. Repeat the above scenarios for replacement of existing AR/AAR with another user who is REGISTERED. Ensure the user is finally VALIDATED and the user indeed	PASSED
Revision of the Czech translation	Translation issue		PASSED
Empty Error after adding closed account to TAL list	When attempting to add a CLOSED account to a TAL, an empty error box appeared; this is now fixed	A. Add CLOSED account to another account's TAL A1. Get Account number of holding account which is CLOSED A2. Go to another OPEN holding account A3. Add closed account into TAL list of holding account A4. Ensure the message "80207: The account EU-100-320-0-80 is closed." appears and the TAL addition cannot be submitted. Repeat for BLOCKED account in step A2. B. Attempt to add non existing account Repeat scenario A but enter a non-existing account Ensure the message "80206: The specified account number EU-100-655454545-0-89 does not exist in the registry." and the TAL addition cannot be submitted. C. Attempt the add account with wrong check digits Repeat scenario A but enter a existing account and wrong check digits Ensure the message "80203: The account number is invalid with respect to its check digits. Check digits cannot be provided for non-ETS accounts." D. Negative scenario - TAL addition works normally for adding OPEN account Repeat scenario A but choose an OPEN account to add. Ensure account is added normally to the TAL.	PASSED
ESD Entitlements Transactions: Transferring ESD Account Year and Acquiring ESD Account Year cleared after search is performed	Search presentation issue in ESD transactions	1. Log to ESD as CA 2. Go to ESD - ESD Entitlements Transactions 3. Select values for Transferring ESD Account Year and Acquiring ESD Account Year 4. Click "Search" button 5. Ensure that you can see correct data at the "ESD Entitlements Transactions" table. At filters "Transferring ESD Account Year" and "Acquiring ESD Account Year" , system displays the pre-selected values	PASSED
No user names in Representative drop down list when creating account for existing holder	Account opening presentation issue, enriching screen objects with account representative names.	1. Log in to MS as NA 2. Go to Accounts - Account request 3. Choose "Account Holder is already recorded in the registry" 4. Provide Account Holder ID (NA must NOT be related to this holder) 5. Click Next 6. At the "Account Opening - Authorised Representative Information" choose the option " Representative is already related to the Account Holder" 7. At the field "Representative" open the drop down list. 8. Ensure that you can see the URIDs and the names of the Representatives 9. Choose Authorised Representatives and go to "Account Opening - Additional Authorised Representative Information" 10. Choose the option " Representative is already related to the Account Holder" 11. At the field "Representative" open the drop down list. 12. Ensure that you can see the URIDs and the names of the Representatives	PASSED

Incorrect warnings when saving ESD parameters	Incorrect warnings when saving ESD parameters	Log in to ESD as CA and go to ESD/Modify ESD parameters Scenario 1 1.1 Select any MS and any Year. 1.2 Remove value from "Transfer AEA limit" field and click [Save] 1.3 System displays the error message: "Transfer AEA limit: Validation Error: Value is required." Scenario 2 2.1 Type value 3333.00 in "Abatement Factor" field and click [Save] 2.2 System displays the error message: "Abatement factor must be a decimal number with up to 3 digits as integer part and up to 2 digits as fractional part." Scenario 3 3.1 Select any MS and any "KP Party Holding Account Registry" 3.2 At the "KP Party Holding Account Identifier" try to type a value > of 15 digits. 3.3 Ensure that system doesn't allow you to type more than 15 digits. Scenario 4 4.1 Select any MS and any Year. 4.2 Type 0 in "Carry-forward AEA limit" field and click [Save] 4.3 System displays the error message: "Carry-forward AEA limit must be a positive integer up to 7 digits long. 4.4 Repeat steps for "Transfer AEA limit" 4.5 System displays the error message: "Transfer AEA limit must be a positive integer up to 7 digits long."	PASSED
Contents of Administration menu are not scaled properly under Chrome	Graphical issue, concerning Administration menu under Chrome browser	1. Clear browser cache 2. Log in as NA 3. Navigate to "Administration" menu 4. Try to move the browser window in various positions and sizes 5. Ensure the vertical scroll-bar does not appear in the "Administration" menu	PASSED
There is no "Approve ESD Entitlements Transaction Reversal Request" in Task name filter	There was no "Approve ESD Entitlements Transaction Reversal Request" in Task name filter; this is now fixed	1. Log in to ESD as CA 2. Make sure there is at lease one "Approve ESD Entitlements Transaction Reversal Request" task pending approval 3. Go to Task list / Exclusive Task List 4. At the field "Task name" open the drop down list and ensure that you can see the option "Approve ESD Entitlements Transaction Reversal Request". 5. Select the option "Approve ESD Entitlements Transaction Reversal Request" and click on "Search" button 6. Ensure that the system displays correct data	PASSED
No possibility to filter Unit Blocks in ESD by Holding Account Type	Searching of unit blocks is optimised under ESD to included holding account type.	1. Login to ESD as CA. 2. Go to Administration - Unit Blocks. 3. At the Search Criteria go to "Holding account Type" field and open the drop down list 4. Ensure that you can see the options: EU AEA Total Quantity Account ESD Deletion Account ESD Compliance Account 5. Try to filter Unit Blocks by Holding Account Type 6. Ensure that you can see correct data.	PASSED
Problem with filtering Unit blocks in ETS-EUCR by Holding Account Type	Searching of unit blocks is optimised under ETS to included holding account type.	1. Login as NA of a registry 2. Go to "Administration" -"Unit Blocks" 3. Click on Search button and check how many results are displayed 4. At the field "Holding account Type" open the drop-down list and select "None". Consult number of results displayed (ensure that the number of rows are < 500) 5. From the above drop down list select KP accounts. Consult number of results displayed for each KP account. 6. Ensure that the sum of rows of all KP accounts is equal to rows of "None"	PASSED
CP1 units are not marked red after "last allowed date"	All CP1 KP units are considered as ineligible after a specified date.	1. Connect as NA. 2. Set the parameter ets.last.allowed.date.cp1 equal to 31/5/2020 3. Locate an account with CP1 CERs. 4. Ensure that the projects of the CERs of step [3] are in no list. 5. Ensure the holdings of account of step [3] all show red in holdings screen; attempt a proposal of transfer of KP units and ensure these are summed in red colour (ineligible). 6. Add some projects of step 3 in Art58(1) Negative list 7. Ensure the holdings of account of step [3] all show red in holdings screen; attempt a proposal of transfer of KP units and ensure these are summed in red colour (ineligible). 8. Remove projects from Art581(1) Negative list and add them in a positive list 9. Ensure the units appear green/eligible in holdings and propose KP transfer screens. 10. Set the parameter ets.last.allowed.date.cp1 is equal to 31/5/2013 11. Ensure the units appear red/ineligible in holdings and propose KP transfer screens.	PASSED

red box when uploading auction tables	Under a specific sequence, when uploading auction tables a red screen error appeared; this is now fixed.	Scenario 1: Upload a valid Auction xml file in EUCR 1.1 Login as CA to EU registry 1.2 Go EU ETS - Auction Tables 1.3 Select a valid Auction xml file (General and / or Aviation Allowance) and click on "Import" button 1.4 At the "Auction table changes confirmation" pop up check the data and click on "Confirm" button. 1.5 System displays the information message: "The auction table has been imported." 1.6 Check the "Details" table and ensure that you can see correct data. 1.7 Repeat the above test for Update and Delete valid Auction xml Scenario 2 Negative: Click on “Import” button without selecting xml file 2.1 Login as CA to EU registry 2.2 Go EU ETS - Auction Tables 2.3 Click on "Import" button without selected a xml file 2.4 System displays the error message: "A file is required" Scenario 3 Negative: Cancel the import of an Auction Table 3.1 Login as CA to EU registry 3.2 Go EU ETS - Auction Tables 3.3 Select a valid Auction xml file (General and / or Aviation Allowance) and click on "Import" button 3.4 At the "Auction table changes confirmation" pop up check the data and click on "Cancel" button. 3.4 Ensure that the Auction xml file has not been imported 3.5 Repeat the above test for Update and Delete xml files Scenario 4 Negative: Attempt to upload an Auction xml file with Invalid content	PASSED
Filtering Auction Tables by Auction Platform Name is not entirely working	Optimisation of auction tables search	1. Login as CA in EU registry 2. Go to EU ETS - Auction Tables 3. At the "Auction Platform" field enter an existed Platform name and click on "Filter" button 4. Ensure that you can see correct data 5. At the "Auction Platform" field enter a wrong Platform name and click on "Filter" button 6. Ensure that the system does not display data 7. At the "Auction Platform" field enter a part of an existed Platform name with a * at the end and click on "Filter" button 8. Ensure that you can see correct data 9. Click on "Filter & Export" button 10. Ensure that you can see correct data	PASSED
Auction Delivery - Search is no clearing filter criteria	Optimisation of auction delivery search	1. Login as CA in EU registry 2. Go EU ETS - Auction Delivery 3. In Auction Delivery in results table there are displayed records with the years for 2013, 2014, 2015. (Filter by all years) 4. Click one of the records and ensure that the radio button is selected 5. Click on "Search" button and ensure that the radio button has been deselected. 6. Click on "Submit" button without selected a new record 7. System displays the error message: "No Entry SelectedPlease select an entry in the auction delivery list". 8. Repeat the above test by selecting values to filter "Year " for example select 2015 9. Click one of the records and ensure that the radio button is selected 10. Click on "Search" button and ensure that the radio button has been deselected, or select an other year and then click on "Search" button 11. Click on "Submit" button without selected a new record 12. System displays the error message: "No Entry SelectedPlease select an entry in the auction delivery list".	PASSED
Typo in Modify ESD Parameters page	Typo in Modify ESD Parameters page; this is now fixed	1. Visit "Modify ESD Parameters" page 2. Select CY 3. Verify that the text is corrected as "KP Party Holding Account Identifier (incoming)"	PASSED
Red Box error while searching records in JI Project page	Red Box error while searching records in JI Project page; this is now fixed	1. Navigate to JI Projects 2. Perform Search by Track and Unit Type 3. Verify that the search is performed without errors. 4. With the results verify that the data for Unit Type is shown as "ERU from AAU" instead of "ERU_FROM_AAU" and "ERU from RMU" instead of "ERU_FROM_RMU". 5. With the results verify that the data for Track are displayed properly, i.e. "Track 1" instead of "Track_1", and so on.	PASSED
Surrender of Allowances - Period to be changed to Phase	Screen change in surrender allowance screen	From any OHA or AOHA that has some available Allowances: 1. Go to Holdings tab 2. Click Propose Transaction 3. Select Surrender of allowances Expected result: In the surrender of allowances screen, in the compliance information section the 3rd figure on the left column should be labelled: "Carry-Over from previous phase"	PASSED

Allow Emissions for year Y when YLE = Y	Compliance issue, for allowing emissions submission for current year	TEST CASE 1 1. Update Installation, change PRD and YLE to a date in current year Y 2. Approve the Request 3. Verify that the link Propose (emissions) is available for current year. 4. Propose Emissions for current Y. 5. Verify that EUTL approved them TEST CASE 2 1. Update Installation, change PRD and YLE to a date in current year Y 2. Approve the Request 3. Submit a request for Account Closure for the account 4. Verify that the link Propose (emissions) is available for current year. 5. Propose Emissions for current Y. 6. Verify that EUTL approved them TEST CASE 3 1. Locate an installation without a YLE. 2. Verify that the link Propose (emissions) is not available for current year. TEST CASE 4 1. Locate an installation with YLE = any future year up to 2020. 2. Verify that the link Propose (emissions) is not available for current year. Repeat all scenarios for AOHA	PASSED
When there is a pending request for Account Closure, the system should not allow new requests of Installation Information update	When there is a pending request for Account Closure, the system should not allow new requests of Installation Information update; this is now enforced	1. Login as NA of a registry 2. Select an OHA in Open (without balance) or Blocked status 3. Click on "View Details" link and go to "Installation" tab 4. Ensure that the button "Update" is active 5. Click on "Close" or " Force Close' button. 6. Ensure that the "Account Closure" task has been created at the task list 7. Click on "View Details" link and go to "Installation" tab 8. Ensure that you cannot see the "Update" button 9. Repeat the above test for AOHA and "Aircraft Operator" tab	PASSED
CP1 Eligibility in transaction details page	CP1 Eligibility is added in transaction details page	Test Case 1. Change CP1 Eligibility parameter (eucr-configuration) to expire after current date 2. Perform a transaction of CP1 CERs units than belong to a White list 3. Transactions page > Locate the performed transaction and check on Summary tab that units are displayed as eligible. Test Case 2 1. Change CP1 Eligibility parameter (eucr-configuration) to expire BEFORE current date 2. Perform a transaction of CP1 CERs units than belong to a White list 3. Transactions page > Locate the performed transaction and check on Summary tab that units are displayed as ineligible.	PASSED
Account Claim > Cannot Approve task	Account claim request could not be approved under certain conditions; this is now fixed	Scenario A: Release and claim account A1. Connect as NA, locate an OHA and release it A2. Claim the account and assign another account holder and representatives A3. Submit the task A4. Connect as another NA and approve the task A5. Ensure the task appears in history list and in list of account requests mentioning the included account holder and representatives. Scenario B (regression test): Release and reject claim Repeat steps A1-A3 B2. Connect as another NA and reject the claim request B3. Ensure the account still belongs to the original account holder	PASSED
Approved "Allocation Delivery Settings" request displays all allocations not only approved one.	Column sorting on "Approve Allocation Settings Delivery" task is disabled to avoid presentation of wrong data.	Scenario A: Task details approval task hides sorting symbols A1. Navigate to NA's tasklist and locate a "Approve Allocation Settings Delivery" task A2. View the details of this task A3. Ensure the column heading do not show sorting symbols Ensure that both tasks pertaining to installations and to aircraft operators behave as described. Scenario B: Allocation screen uses sorting symbols B1. Navigate to EUETS=>Allocation Phase 3. B2. Ensure that sorting via clicking column headers works normally for both installations and aircrafts, by clicking on the respective tabs.	PASSED

Eligibility Flag does not reflect CP1 eligibility in all views	In some screens, units considered ineligible as per CP1 end date are erroneously displayed as eligible. This is now fixed.	**Scenario A: Test CP1 date affects eligibility (screens #067, #076, #077, #062)** A1. Set ets.last.allowed.date.cp1 to 1/1/2023 A2. Locate a PHA with CP1 CER units A3. Add these CER units in General Positive List A4. Ensure the units are shown as eligible in the account's holdings screen . A5. Propose a KP transfer and ensure the units are shown as eligible A6. Ensure these units can be transferred to an OHA and approve the transaction request as another NA. A7. Ensure the units are shown as eligible in Cancellation proposal screen and its confirmation; approve the transaction request as another NA. A8. Ensure the units are shown as eligible in Cancellation Against Deletion proposal screen and its confirmation; approve the transaction request as another NA. A9. Set ets.last.allowed.date.cp1 to 1/1/2013 A10. Repeat steps 4-8 but ensure units are shown as ineligible because they are past CP1 end date. A11. Lookup all completed transactions and ensure their transaction PDF show eligible/ineligible units as this is shown in the transaction details screen; ensure the eligible/ineligible flags in the transaction details screen are correct. **Scenario B: Test CP1 date affects eligibility in exchange screen (screen #522)** B1. Repeat the steps A1-A5 but choose an OHA with 100 entitlements. B2. Ensure 10 eligible units can be exchanged. B3. Ensure any ineligible unit cannot be exchanged. **Scenario C: Test unit block search screen (screen #110)** C1. Connect as NA and navigate to unit block search screen C2. Set ets.last.allowed.date.cp1 to 1/1/2023 C3. Locate a unit block of type CER which is in no list C4. Ensure it is shown as ineligible	PASSED
Change of error message	Addition of translation for all registries	Ensure the error message of error check 7175 is as proposed.	PASSED
[SI - SLOVENIA] Registry administrators could not view details of AO account	Addition of Slovenian translation	1. As NA login to SI registry 2. Change the UI Language to SLOVENIAN 3. Search for AOHA accounts 4. Open the details of any AOHA from the results 5. The page should be displayed normally	PASSED

System doesn't reject CO2 only emission upload when opt-ins are enabled	System should demand explicit values (zeros are acceptable) for CO2, N2O and PFC for all year of Phase 3.	Set up system configuration for all registries opt-in PFC and opt-in N2O starting with 2013, as follows:
		# GHG Gases Opt-in defaults
		registryConfig.ALL.OPT_IN_N2O = true
		registryConfig.ALL.OPT_IN_N2O_YEAR = 2013
		registryConfig.ALL.OPT_IN_PFC = true
		registryConfig.ALL.OPT_IN_PFC_YEAR = 2013
		
		Perform the following tests for any year of Phase 3.
		-- 	
		
		A1. Ensure XML containing all three gases uploads correctly via EUETS=> Emissions Upload (refer to XML 1)
		A2. Ensure emissions screen demands all gases
		
		B1. Ensure XML containing no gases does not upload via EUETS=> Emissions Upload (refer to XML 2)
		B2. Ensure emissions screen cannot accept empty gases fields
		
		C1. Ensure XML omitting values for any of the three gases does not upload via EUETS=> Emissions Upload (refer to XML 3)
		C2. Ensure emissions screen does not accept anything less than the three gases.
		
		D. Ensure an account with some null emissions value is updated correctly
		1. Locate an account with emissions CO2=5, PFC=null, N20=null
		2. Edit the emissions of the account
		3. Ensure that a positive or zero value is demanded for all three gases.
		4. Ensure the cumulative emissions quantity is calculated adding the values of CO2, PFC, N2O.
			PASSED

Entitlement values are not calculated correctly in EUCR	Entitlement values of accounts should be re-calculated at emission verification and at exclusion/unexclusion of account.	Preliminary step: Upload the following ICE XML for an installation: <?xml version="1.0" encoding="UTF-8" standalone="no"?> <entitlements registryCode="<<registry>>" xmlns="urn:eu:europa:ec:clima:ets:1.0"> <installation identifier="<<installation_id>>"> <action>A</action> <flag>2</flag> <ice>5</ice> </installation> </entitlements> A. Ensure ICE value is recalculated for all DCS by uploading emissions and excluding/unexcluding years A1. Exclude all years for an installation, so that DCS=BLANK A2. Upload a new ICE XML with a large ICE value and ensure this appears in the installation's entitlement value B1. Unexclude a year and enter emissions and equal surrenders. B2. Ensure DCS=A B3. Update emissions to 1 B4. Ensure entitlements are re-calculated to the max of 4.5% of VE and the value provided in the ICE XML C1. Update emissions to a larger value C2. Ensure DCS=B. C3. Ensure entitlement value is recalculated to 4,5% of the VE value D1. Via the database delete all emissions of this installation and update the	PASSED

Initially blocked AOHA account doesn't get unblocked when its DCS becomes A	AOHA account status should be updated when Dynamic Compliance Status gets to A, B, C or BLANK, according to a defined set of rules.	1. AOHA which is OPEN, has not been compliant and gets DCS=BLANK should become OPEN. 2. AOHA which is OPEN, has been compliant and gets DCS=BLANK should become OPEN. 3. AOHA which is BLOCKED, has not been compliant and gets DCS=BLANK should become BLOCKED. 4. AOHA which is BLOCKED, has been compliant and gets DCS=BLANK should become OPEN. 5. AOHA which is BLOCKED, has not been compliant and gets DCS=OPEN should become OPEN. 6. AOHA which is BLOCKED, has been compliant and gets DCS=A should become OPEN. 7. AOHA which is OPEN, has not been compliant and gets DCS=A should become OPEN. 8. AOHA which is OPEN, has been compliant and gets DCS=A should become OPEN. 9. AOHA which is OPEN, has not been compliant and gets DCS=B should become BLOCKED. 10. AOHA which is OPEN, has been compliant and gets DCS=B should become OPEN. 11. AOHA which is BLOCKED, has not been compliant and gets DCS=B should become BLOCKED. 12. AOHA which is BLOCKED, has been compliant and gets DCS=B should become OPEN. 13. AOHA which gets DCS = C should become BLOCKED.	PASSED
Task list: I un-claim one task -> many tasks get unclaimed	Due to a bug, unclaiming one task resulted in unclaiming multiple tasks; this is now fixed.	A. Unclaim only the checked tasks 1. Log in as NA 2. Go to Exclusive tasklist 3. Claim 10 tasks 4. Click one task and click "Unclaim" 5. Only the clicked task becomes unclaimed; the other 9 remain claimed. B. Regression - Unlaim between two users 1. Connect as a user (A) that has tasks visible in his task-list 2. Claim any number of tasks (more than 1) 3. Connect as another user (B) that also has tasks visible in his task-list 4. Claim any number of tasks (more than 1) 5. As NA user propose the un-enrolment of user (A) (no need to Approve it) 6. Ensure the tasks previously claimed by user (A) are now unclaimed 7. Ensure the tasks previously claimed by user (B) remain claimed C. Regression - Task history of un-enrolled user is unaffected 1. As an NA that has tasks visible in his task-list 2. Claim and approve a task 3. Verify that the approved task in the task-history shows the user as claimant 4. Connect as another NA user and propose the un-enrolment of the NA of step 1 (no need to Approve it) 5. Ensure that the tasklist history still presents the same information as shown in step 3.	PASSED
Transaction View - Request details wrong info for reversals	Reversals did not present correctly the corresponding actors; this is now fixed.	1. Login to EUCR as NA of a Registry 2. Go to "Transactions" and search for Allocation Allowances transaction (or create a new one) 3. Click on "Transaction Id" link 4. Click on "Reverse" button and ender your ECAS Signature 5. Login as an other NA of the registry and go to Task List 6. Approve the Transaction Request and ender your ECAS Signature 7. Login as CA and go to Task List 8. Approve the Transaction Request and ender your ECAS Signature 9. Login as NA and go to the "Transactions" 10. Search for the reversal transaction and Click on "Transaction Id" link 11. Click on "Request Details" tab 12. Ensure that you can see correct data.	PASSED
CLONE - SMS of credit entitlements transaction capitalization	The SMS of credit entitlements transaction is modified.	1. Propose an ESD Entitlement transaction 2. Ensure the SMS states "Confirm the ESD Credit Entitlements transaction proposal..." Note that this can be tested via technical means, by checking the ECAS log for the exact SMS message generated.	PASSED
Red error encountered when clicking on transaction	Certain old transactions which did not have some attributes produced an error screen when clicked; this is now fixed.	Scenario 1: Manually modify the transferring account of a transaction 1. Connect as NA and navigate to Accounts=>Transactions screen 2. Locate a transaction identifier 3. Update the transaction details in the database as follows: update transactions set tra_account_id = 9999, tra_acc_identifier_full = 'ZZZZZ' where transaction_identifier = <<located_transaction_identifier>>; 4. Log-out and re-connect to the same screen. 5. Locate the transaction and click on its identifier 6. Ensure the transaction details screen appears correctly. Note: Clicking on the imaginary transferring account hyperlink will lead to the 404-Invalid screen of EUETS.	PASSED

YFE should be able to override existing VE years, if VE=0	It should be able to set YFE to a year higher than those for provided emissions, if the provided emissions for the lower years are zero.	**Scenario A: YFE can be set to a larger year having zero emissions** 1. Login as NA1 2. Find OHA with YFE=2013 3. Make sure the VE for 2013=0 4. Go to "Installation" tab of the account and update First Year of Verification = 2014 5. As NA2 approve the "Update of Installation Information" task 6. Check that the account has been updated. Repeat for AOHA **Scenario B: YFE can be set to a larger year having zero emissions, with some excluded years** 1. Login as NA1 2. Find OHA with YFE=2013 3. From the Compliance tab mark year 2013 as excluded. 4. Set VE emissions for 2014=0 5. Login as NA2 and approve the emissions update 8. As NA1 go to "Installation" tab of the account and update First Year of Verification = 2015 9. As NA2 approve the "Update of Installation Information" task 6. Check that the account has been updated. Repeat for AOHA **Scenario C (regression): YFE cannot be set to a larger year when having non-zero emissions** 1. Login as NA1 2. Find OHA with YFE=2013 3. Make sure the VE for 2013>0 4. Go to "Installation" tab of the account and update First Year of Verification = 2014 5. The error “There are Verified Emissions introduced in years prior to the proposed	PASSED
User appears twice in the AR list	Under a series of actions, users attached on accounts appeared twice in the account screen. This is now fixed.	**Scenario A: Add AR to two accounts concurrently** 1. Locate an account (ACC1) and a user (USER1) who is not connected to the account. Ensure the corresponding account holder has at least one more account (ACC2). The accounts to which an account's holder is connected to are returned via the following query: select identifier from account where account_holder_id = (select account_holder_id from account where identifier = <<account_identifier>>); 2. Ensure the user is not connected to any account of this account holder; run this query and ensure it returns no results: select * from account_holder_representative where URID = '<<URID>>' and account_holder_id = (select account_holder_id from account where identifier = <<account_identifier>>) 3. Propose to add USER1 to ACC1 (user is not yet connected to the account holder). Do not approve it yet. 4. Propose to add USER1 to ACC2 (user is now connected to the account holder). Do not approve it yet. 5. Reject the request of step 3. 6. Repeat step 3 and approve request for USER1. 7. Approve the request of step 4.	PASSED
Emissions entered for year 2014 are rejected by EUTL	Submission of emissions to EUTL needed a certain configuration; this is no longer needed, as EUTL gets the current year automatically.	**Scenario A: Ensure EUTL accepts emissions even when database setting is equal to a year in the past** 1. Update in EUTL database the parameter param_value3 with a year in the past UPDATE system_parameter SET param_value3 = 2014 WHERE system_parameter_id = 1; 2. As NA1 go to OHA account with no YLE and no emissions for 2014 3. Go to "Compliance" tab and enter emissions for year 2014 (Approve Emissions task is generated) 4. As NA2 approve task "Approve Emissions" 5. Check the OHA in EUCR (account->compliance screen) and confirm that the emissions have been updated 6. Check the OHA in EUTL (account mgt->installation) and confirm that the emissions have been updated 7. Check EUTL log and confirm that there is no error “FINE: Check7119 [Correlation ID: xxxxx]: The verified emission year [2014] for installation [yyyyyy] must be before the current year [2014] since no year of last emissions has been provided for the installation.” Repeat for AOHA.	PASSED

Task claimed by NA can be claimed by AR/AAR	It was possible for an AR/AAR to claim a task already claimed by an NA; this is now fixed.	Create a task for testing: 1. Login as AAR 2. Go to an OHA account with configured ARs and AARs, in the holdings tab 3. Click propose a transaction 4. Choose deletion of allowances 5. Enter a quantity to delete and click next 6. Click confirm 7. Complete the signature procedure **Scenario 1. Claimant is AAR; NA and AR attempt to claim the task** 1. Login as AAR and claim the "Approve transaction request" task but do NOT proceed to approve it. 2. Login as AR and try to claim the task. You should get "Claim task item error: One or more task items cannot be claimed, because they are not in unclaimed status." 3. As AR try to unclaim the task. You should get "Unclaim task item error: One or more task items cannot be unclaimed, because the claimant is not the currently connected user." 4. Login as NA and try to claim the task. You should get "Claim task item error: One or more task items cannot be claimed, because they are not in unclaimed status." 5. As NA try to unclaim the task. You should get "Unclaim task item error: One or more task items cannot be unclaimed, because the claimant is not the currently connected user." **Scenario 2. Claimant is AR; NA and AAR attempt to claim the task** 1. Login as AAR and unclaim the task 2. Login as AR and claim the task but do not proceed to approve it	PASSED
Condition if an installation appears in the allocation list should not contain Expiry Date	Installations appearing in the "Allocation" screen should appear irrespectively of the value of Expiry Date.	A. Ensure setting PerExpDate to a past or future date does not affect appearance of the respective account in the allocation screen A1. Connect as NA and navigate to EUETS => Allocation Phase 3 screen. A2. Choose year = 2014 and locate an installation whose record appears on screen. A3. Update PerExpDdate = 1/1/2013 and approve the change A4. Ensure the installation appears in the allocation screen for year = 2014 A5. Update PerExpDdate = 1/1/2014 and approve the change A6. Ensure the installation appears in the allocation screen for year = 2014 A7. Update PerExpDdate = 1/1/2015 and approve the change A8. Ensure the installation appears in the allocation screen for year = 2014 B. Ensure closing an account hides it from the allocation screen B1. Repeat steps A1 and A2 B2. Update the account status to 'CLOSED' B3. Ensure the installation does not appear in the allocation screen B4. Update the account status to 'OPEN' B5. Ensure the installation appears in the allocation screen B6. Update the account status to 'BLOCKED' B7. Ensure the installation appears in the allocation screen Repeat scenario for aircraft operator C. Ensure allocated installations do not appear in the allocation screen C1. Repeat steps A1 and A2 C2. Allocate to this installation C3. Ensure after allocation the specific entry does not appear in the allocation screen Repeat scenario for aircraft operator	PASSED
Check 80211 - Upload NAT fails for some cases when Return of Excess allocation exist in another year	It was impossible to increase NAT if a "Return for Excess Allocation" existed for the installation for any year; this is now changed. NAT increases are now allowed for years later than the "Return of Excess Allocation"	REA = Return of Excess Allocation Scenario A: Allocation for future years after REA is allowed 1. Upload NAT 2. Allocate 2015 with values for 2015, 2016, 2017 3. Upload new NAT with less value for 2015 4. Return exc.alloc for 2015 5. Upload new NAT with higher values for 2016 and 2017 6. Ensure NAT upload succeeds 7. Allocate next years for this installation (2016 and 2017) 8. Ensure allocation for 2016 and 2017 succeeds Scenario B (negative): NAT upload fails for year of REA Execute steps 1 to 4 of scenario A. 2. Upload new NAT with higher values for 2015 3. Ensure NAT upload fails with error code: "80211: The installation 102 has returned allocation. It is not permitted to increase any of allocation, transitional allocation, reserve for year 2015" Scenario C (regression): Allocation succeeds for installation without REA 1. Upload NAT with values for 2015, 2016, 2017 for an installation without REA 2. Allocate for 2015, 2016, 2017 3. Ensure the allocation completes correctly. Repeat for aircraft operator (note: aircraft operators do not have REA).	PASSED

Auction Delivery -> Search -> Null Pointer Exception	Issues with auction delivery screen are now fixed.	Scenario A: Check search criteria 1. Login to EU Registry as CA 2. Go to EU ETS - Auction Delivery 3. Make a search 4. Ensure that you can see correct data 5. Click on "Search and Export" button 6. Ensure that you can see correct data Note1: The search criteria must contain any one and any combination of the filters below: * Auction delivery account ID - Numeric search returns a correct results - Non-numeric characters return an error (validation error appears) - Numeric characters plus non-numeric characters return an error (validation error appears) - Wildcards are not supported for this field (validation error appears) - Negative or decimal numeric values return an validation error * Year (2012-2020 years are possible entries) * Allowance (General/Aviation are possible entries) Scenario B: Check "Show past deliveries" B1. Repeat Scenario A without checking the checkbox "Show past deliveries" B2. Ensure the results do not contain records where Volume of Auction = Auctioned Volume B3. Repeat Scenario A after checking the checkbox "Show past deliveries" B2. Ensure the results contain records where Volume of Auction = Auctioned Volume	PASSED
Transaction delays are present where they should not be	Transfer from Trading account towards TAL which were approved on weekends are executed on next working day Start Of Business.	Set the parameter registryConfig.ALL.WORKING_HOURS_START = 08:00 Scenario A: Approve a transfer from TRADING->TAL on weekday 1. Locate an OPEN trading account with allowances 2. Propose a transfer towards a TAL account 3. Approve the transfer on weekday 4. Ensure the transaction execution date is immediate Scenario B: Approve a transfer from TRADING->TAL on weekend 1. Locate an OPEN trading account with allowances 2. Propose a transfer towards a TAL account 3. Approve the transfer on Sunday 4. Ensure the transaction execution date is on the next working day at 08:00	PASSED
Clean-up job for stuck returns of excess allocation	Returns of Excess Allocation which are not properly approved via ECAS are cleared-down automatically.	1. Propose a return for excess allocation and do not approve it 2. Wait at least 35 minutes 3. Ensure no pending returns of excess allocations exists. The following query should return no results: SELECT tr.request_id, tr.transaction_type FROM transaction_request tr JOIN request_state rs ON rs.request_state_id = tr.request_state_id WHERE transaction_type IN ('ReturnOfExcessAllocation') AND state = 'SUBMITTED_NOT_YET_APPROVED' AND tr.datetime < SYSDATE - 35 / (24 * 60)	PASSED
Account Statements - Wrong Information	Correction in the generation of account statements.	Scenario 1: Generate account statement 1. Login to a registry as NA 2. Click accounts then click search 3. Click "View Details" of account "A" 4. Go to "Account statement" tab 5. Enter start and end dates and hit Refresh. 6. Note the results 7. Click transactions, then search 8. Click on the hyperlink of a different account "B" 9. Go to "Account Statements" tab 10. Enter the same start and end dates as in step 5 and hit Refresh. 11. Confirm that the results are not the same. Scenario 2 (regression): Generate account statement with wrong dates 1. Login to a registry as NA 2. Click accounts then click search 3. Click "View Details" of account "A" 4. Go to "Account statement" tab 5. Enter start and end dates that are more than 30 days apart and click Refresh. 6. Confirm that there is error "The selected period should not be longer than a month." 7. Enter start and end dates more than 3 years in the past 8. Confirm that there is error "Cannot select a date more than 3 years back." Scenario 3: Generate account statement in PDF and CSV 1. Login to a registry as NA 2. Click accounts then click search 3. Click "View Details" of account "A" 4. Go to "Account statement" tab 5. Enter start and end dates and click Refresh.	PASSED

SEF XML exported from Union Registry has 'NA' instead of 'NO' for table 5a	SEF XML exported from Union Registry has 'NA' instead of 'NO' for table 5a; this is now fixed.	1. Export a SEF report for any registry/year. 2. Ensure the following five instances of UnitQty element have the value "NA". <Table5a numbering="5a" description="Summary information on additions and subtractions"> <SubTotal> <Additions> <UnitQty type="RMU">NA</UnitQty> <UnitQty type="tCER">NA</UnitQty> <UnitQty type="lCER">NA</UnitQty> </Additions> <Subtractions> <UnitQty type="tCER">NA</UnitQty> <UnitQty type="lCER">NA</UnitQty> </Subtractions> </SubTotal>	PASSED
Initially blocked AOHA account doesn't get unblocked when its DCS becomes A	AOHA attaining DCS equal to A are now automatically set to OPEN.	1. AOHA which is OPEN, has not been compliant and gets DCS=BLANK should become OPEN. 2. AOHA which is OPEN, has been compliant and gets DCS=BLANK should become OPEN. 3. AOHA which is BLOCKED, has not been compliant and gets DCS=BLANK should become BLOCKED. 4. AOHA which is BLOCKED, has been compliant and gets DCS=BLANK should become OPEN. 5. AOHA which is BLOCKED, has not been compliant and gets DCS=OPEN should become OPEN. 6. AOHA which is BLOCKED, has been compliant and gets DCS=A should become OPEN. 7. AOHA which is OPEN, has not been compliant and gets DCS=A should become OPEN. 8. AOHA which is OPEN, has been compliant and gets DCS=A should become OPEN. 9. AOHA which is OPEN, has not been compliant and gets DCS=B should become BLOCKED. 10. AOHA which is OPEN, has been compliant and gets DCS=B should become OPEN. 11. AOHA which is BLOCKED, has not been compliant and gets DCS=B should become BLOCKED. 12. AOHA which is BLOCKED, has been compliant and gets DCS=B should become OPEN. 13. AOHA which gets DCS = C should become BLOCKED.	PASSED
Entitlement values are not calculated correctly in EUCR	Available entitlement values are re-calculated at emission upload and at exclusion/unexclusion of years.	Preliminary step: Upload the following ICE XML for an installation: <?xml version="1.0" encoding="UTF-8" standalone="no"?> <entitlements registryCode="FI" xmlns="urn:eu:europa:ec:clima:ets:1.0"> <installation identifier="101"> <action>A</action> <flag>2</flag> <ice>5</ice> </installation> </entitlements> A. Ensure ICE value is recalculated for all DCS by uploading emissions and excluding/unexcluding years A1. Exclude all years for an installation, so that DCS=BLANK A2. Upload a new ICE XML with a large ICE value and ensure this appears in the installation's entitlement value B1. Unexclude a year and enter emissions and equal surrenders. B2. Ensure DCS=A B3. Update emissions to 1 B4. Ensure entitlements are re-calculated to the max of 4.5% of VE and the value provided in the ICE XML C1. Update emissions to a larger value C2. Ensure DCS=B. C3. Ensure entitlement value is recalculated to 4,5% of the VE value D1. Via the database delete all emissions of this installation and update the	PASSED

one parameter for ECAS signature	All authorisation mechanisms of EUCR are harmonised so as to use or bypass ECAS via a single parameter.	Before performing the following scenarios, set registryConfig.ALL.ECAS_SIGNATURE_ENABLED in eucr-configuration.properties to true Scenario No. 1 Signature during pre-allocation 1. Login as CA into registry EU 2. On the left side menu click “EU ETS” 3. Choose “Pre-Allocations” 4. Choose “Credit of Allocation Account prior to allocations” and fill in the “Quantity of Allowances to transfer” 5. Click on “Submit” 6. The ECAS signature page appears Scenario No. 2 Trusted Account Addition 1. Login as NA1 2. Go to Accounts 3. Choose an OHA 4. On the “Trusted Accounts” tab click “Add” 5. Enter an account and a description and click “Save’ 6. Click Confirm 7. The ECAS Signature Page appears. Repeat for AOHA Scenario No. 3 Trusted Account addition approval 1. Login as NA2 2. On the left side menu click “Task List” 3. Click on the tab “General Task List” 4. Select on field “Task Name:” the choice “Addition of account to Trusted Account List”	PASSED
ESD SDAgent have no access to Unit Blocks menu item	ESD SDAgent have no access to Unit Blocks menu item; this is now fixed.	1. Login as an ESD SD Agent 2. Go to "Administration" - " Unit Blocks" 3. Verify that you have access to Unit Blocks menu 4. Ensure that the buttons "Add", "Delete" and "Suspend/Restore" at the button of the "Unit Block Search Result" table are not visible	PASSED
Task list date range filter return zero results	When searching for tasks, date ranges did not filter correctly; this is now fixed.	1. Login to EUCR as NA of a Registry and go to Task List 2. Enter a date range for example 01/10/2014 and 31/12/2014 in the Start Date "From" and "To" fields to "Exclusive Task List", "General Task List" and "History" tabs 3. Click on Search Button 4. Ensure that you can see correct data 5. Click on "Search and Export" button and verify that you can see correct data 6. Repeat the above test as AR, AAR and CA	PASSED
Task list: I un-claim one task -> many tasks get unclaimed	Unclaiming one task triggered the unclaim of all tasks of the specific role; this is now fixed.	**A. Unclaim only the checked tasks** 1. Log in as NA 2. Go to Exclusive tasklist 3. Claim 10 tasks 4. Click one task and click "Unclaim" 5. Only the clicked task becomes unclaimed; the other 9 remain claimed. **B. Regression - Unclaim between two users** 1. Connect as a user (A) that has tasks visible in his task-list 2. Claim any number of tasks (more than 1) 3. Connect as another user (B) that also has tasks visible in his task-list 4. Claim any number of tasks (more than 1) 5. As NA user propose the un-enrolment of user (A) (no need to Approve it) 6. Ensure the tasks previously claimed by user (A) are now unclaimed 7. Ensure the tasks previously claimed by user (B) remain claimed **C. Regression - Task history of un-enrolled user is unaffected** 1. As an NA that has tasks visible in his task-list 2. Claim and approve a task 3. Verify that the approved task in the task-history shows the user as claimant 4. Connect as another NA user and propose the un-enrolment of the NA of step 1 (no need to Approve it) 5. Ensure that the tasklist history still presents the same information as shown in step 3.	PASSED
ESD - ENTITLEMENTS Transaction View - Request details wrong info for reversals	Reversals of ESD entitlement transactions did not present correctly the actors; this is now fixed.	1. Connect as ESD-CA 2. Navigate to ESD->ESD Entitlements Transactions 3. Search for entitlements reversals transactions and locate one which has been proposed by an ESD-AR (so that three users are involved for its approval in total) 4. Click on a COMPLETED reversal and navigate to the tab "Request Details" 5. Ensure three distinct users appear as actors of the reversal.	PASSED

Allocation process - wrong summary information	The summary at the top of the allocation approval screen is corrected and enriched.	**Scenario A. Check adding allocations** 1. Login as NA of a Registry 2. Go to "Allocation Phase 3" 3. Select a year and tick three tick boxes of allocations of type "FREE" 4. Submit the task 5. Login as an other NA and go to "Task list" 6. Search for the "Approve Allocation Settings Delivery" task, claim it and click on the "Request" link 7. Verify that at the confirmation page the three ticked boxes are green and their total appears at the top: Total of allocations to be delivered: <<total of free>> (<<total of free>> free, 0 transitional, 0 from the NER) Total of allocations to be removed: 0 (0 free, 0 transitional, 0 from the NER) Repeat adding Transitional and NER allocation types and ensure that their subtotal appears. Confirm the allocation job executes and creates the approved allocations. **Scenario B. Check removing allocations** Execute Scenario A and approve the allocation 2. Before execution of the job go to "Allocation Phase 3" and un-tick two checkboxes of type "FREE" 3. Submit the task 4. Login as an other NA and go to "Task list" 5. Search for the "Approve Allocation Settings Delivery" task, claim it and click on the "Request" link 6. Verify that at the confirmation page the two un-ticked boxes are red and their total appears at the top: Total of allocations to be delivered:	PASSED
Glitch in Holdings screen of Party Holding Account	The holdings "Total;" is not aligned to the "Balance" column; this is now fixed.	1. Connect as NA and navigate to a Party Holding Account, "Holdings" tab. 2. Ensure that the "Total" figure is aligned to the "Balance" column. Repeat with all other account types.	PASSED
Under a certain sequence of actions, an AR does appear correctly in an account	AR not displayed in OHA account	1. Locate USER1 and AccountHolder to which this user is NOT related 2. Submit AccountRequest_1 and use USER1 as AR (fill in the data manually) 3. Submit AccountRequest_2 and use USER1 as AR (choose the user from the list) 4. Reject AccountRequest_1 5. Approve AccountRequest_2 6. USER1 will not be displayed as AR for new account Description There is a user that is not related to account holder. For this account holder two account requests are submitted that will have this user as AR. When first request is rejected and second approved - this user will not be displayed as AR for new account (however the user will see it in his account list and will be able to act as AR). Attachments	PASSED
Change of message on NAT upload after return of excess allocation	Change in Documentation and message: Unable to modify NAT after REA	The error produced by the system: "80211: The installation 102 has returned allocation. It is not permitted to increase any of allocation, transitional allocation, reserve for year 2015" Is correct and refers to any returned allocation, pending or completed. The description of check 80211 in the documentation is wrong and will be corrected to the following text: "If there exists -pending- transaction of type "Return of Excess Allocation", it is not allowed to increase any values of allocation, transitional, reserve" Let us know if you prefer a different approach.	PASSED
An update of YFE should be allowed if emissions exist, and they are zero	YFE cannot override existing VE years, if VE=0	It should be able to set YFE to a year higher than those for provided emissions, if the provided emissions for the lower years are zero. Installation update requests are rejected by EUTL with "7173 Check if change of YFE of an Installation is valid (*new)"	PASSED
Label change	Not renamed label for Past Deliveries	Open EUCR with MS=EU Go to Auction Delivery menu and consult the label next to the checkbox. It should be "Show completed deliveries"	PASSED

Ineligible units of incoming transaction (either CP1 or Blacklisted) show as eligible in transaction details.	1. Request CP1 units form ITL 2. Verify if in incoming transaction details units are marked as ineligible If CP1 units are received from ITL CDM account in Summary tab of such Transaction details units are marked as eligible whereas. In subsequent transactions of these units, they are properly marked as ineligible so it seam to pertain only to the first transaction which transfers the units to registry.	Scenario 1: Test incoming transaction from Japan -> KP account in CP1 and in ICH General Negative list 1. Perform a transaction from Japan -> KP account, whose units are in CP1 and in ICH General Negative list 2. Ensure the transaction completes and the units appear as ineligible in Transaction Details tab 3. Ensure the units appear as "CP1 Expired Unit" in Administration->Unit Blocks screen, column Reason, when searching via acquiring account identifier 4. Ensure the units appear as "CP1 Expired Unit" when being exported via the Export CSV functionality of the Administration->Unit Blocks screen. Scenario 2: Test incoming transaction from Japan -> KP account in CP1 and in ICH General Positive list 1. Repeat scenario 1 but with units in ICH General Positive list. Scenario 3: Test incoming transaction from Japan -> KP account in CP2 and in ICH General Negative list 1. Repeat scenario 1 but with units in CP2 and in ICH General Negative list. 2. In this case the unit blocks should be marked in the screen and in the exported CSV as "Ineligible, General Negative List", columns Flag - Reason. Scenario 4: Test incoming transaction from Japan -> KP account in CP2 and in ICH General Positive list 1. Repeat scenario 1 but with units in CP2 and in ICH General Positive list. 2. Ensure the transaction completes and the units appear as eligible in Transaction Details and as "Eligible, General Positive List" in Unit Blocks screen, columns Flag - Reason and in the exported CSV.	PASSED
KP Public Reports Page - Last update is in 12h clock without am/pm	When updating the last modified date of the KP public reports to a time after pm (i.e. 18:30) the time is displayed using a 12h clock format without am/pm indication so 18:30 is displayed as 06:30. To fix this, we need to change the display format to 24h clock.	1) Update the "Last Update" of the KP public reports to any date and a time in "AM" 2) Visit the KP public Reports page and verify that the last update at the bottom of the page shows the correct date and time. 3) Update the "Last Update" of the KP public reports to any date and a time in "PM" 4) Visit the KP public Reports page and verify that the last update at the bottom of the page shows the correct date and time.	PASSED
CLONE - Problem with incoming transactions details	When clicking transaction details, for example CDM31006 or CH19830, the webpage with red error code appears and the details can't be seen. The error applies to all transactions (External Transfer Kyoto Unit) from other Kyoto registries.	A) Test Scenario: 1. Locate a transaction of type 03-00 (External Transfer Kyoto Unit) in the database. 2. Update ACQ_ACCOUNT_IDENTIFIER to null 3. Commit. 4. Navigate to “Transactions”. 2. Search for the same transaction you updated in (1) 3. Click on transaction ID. 4. No error should be thrown. B) Repeat (A) but this time update the column TR_ACCOUNT_IDENTIFIER to null in step (2) C) Repeat (A) but this time update both ACQ_ACCOUNT_IDENTIFIER & TR_ACCOUNT_IDENTIFIER to null in step (2) Regression Test: In ESD registry ensure that ESD transaction details include: - Transferring MS - Acquiring MS - Transferring Year - Acquiring Year	PASSED
Mistake in error message	The following error message should read: error.message.check.7119 = 7119: Verified emissions must be entered for a year equal to or after the year of first emissions, and either before the current year (if no year of last emissions has been set) or up to the year of last emissions. instead of error.message.check.7119 = 7119: Verified emissions must be equal or after the year of first emissions, and either before the current year (if no year of last emissions has been set) or up to the year of last emissions.	Ensure the message is corrected as specified.	PASSED

Mistake in error message	Error message 7662 should read: error.message.check.7662 = 7662: Return of Excess Allocation transaction is allowed only if Allocation amount is less than the already Allocated amount minus any Returned amount. instead of error.message.check.7662 = 7662: Return of Excess Allocation transaction is allowed only if Allocation amount is less that the already Allocated amount minus any Returned amount.	Ensure the message is corrected as specified.	PASSED
Transaction ID link in "Completed Transactions" points to wrong transaction; this is now fixed	Transaction ID link in "Completed Transactions" points to wrong transaction		PASSED
"Rejection details" link is not re-enabled after closing "Rejection Information" window; this is now fixed	"Rejection details" link is not re-enabled after closing "Rejection Information" window	1. Log in to registry 2. Go to the "List of Account requests" and search for rejected requests 3. Click on "Rejection details" 4. Close "Rejection Information" window 5. Ensure the "Rejection Details" hyperlink clicked in step [3] is still enabled.	PASSED
Confirmation buttons for Task assignment stay disabled; this is now fixed	Confirmation buttons for Task assignment stay disabled	1. Log in to registry as NA 2. Go to Task list and search for tasks 3. Select the task and click [Assign] button 4. Select the user and clock [Save] 5. Click [Confirm] or [Cancel] or [Close pop up window] 6. Ensure all buttons are enabled and repeat steps 3-5	PASSED
"Return to search" in Transaction details doesn't work under FF; this is now fixed	"Return to search" in Transaction details doesn't work under FF	1. Log in to registry using FF 2. Go to Transactions, search for transactions 3. Click on a transaction identifier and display transaction details 3. Click on "Return to search" 4. Ensure the screen presented is the screen of step [2]	PASSED
Unrecoverable error in Conversion of AAU screen when following a certain sequence of actions; this is now fixed	Unrecoverable error in Conversion of AAU screen	1. Log in to registry 2. Go to account that holds AAU (e.g. BG-100-5009554-0-88 in TEST environment) 3. Propose "Conversion of AAU or RMU to ERU" transaction 4. Change commitment period to First commitment period; ensure holdings appear normally and no runtime error occurs. 5. Change commitment period to Second commitment period; ensure holdings appear normally and no runtime error occurs.	PASSED
Error on creating account statement; this is now fixed	NullPointerException on creating account statement	*Scenario 1: Ensure missing dates do not crash the system* 1. Log in to any registry 2. Open account details and go to "Account Statements" tab 3. Without specifying start and end date click on [Account Statement PDF]; ensure the error message "Start date should be set" appears. 4. Repeat the same for button [Account Statement CSV]; ensure the error message "Start date should be set" appears. 5. Repeat steps 3-4 by providing start date; ensure the error message "End date should be set" appears. *Scenario 2 (regression): Ensure that by providing start and end dates the system operates normally* 1. Locate an account's latest transaction in CER units. 2. Repeat scenario 1 for the account of step [2]; provide start and end dates as before and after the transaction's execution date, respectively. 2. Ensure the system presents modified balances for CER units on screen, PDF and CSV account statement formats. Repeat for general and aviation allowances. Do not test AAU units because of issue ETS-8773 which is not fixed.	PASSED
Installation link in "Allocation Phase 3" page points to wrong installation; this is now fixed	Installation link in "Allocation Phase 3" page points to wrong installation	1. Log in EUCR 2. Go to "Allocation Phase 3" or "Allocation Tables Phase 3" 3. Click on the Installation ID link for any installation. 4. Ensure the next screen is the account pertaining to the clicked installation (click to Installation tab and ensure the shown Installation Id is the one clicked in step 3)	PASSED
Unrecoverable error in Task list; this is now fixed	Unrecoverable error in Task list	1. Log into any EUCR registry e.g. BG 2. Go to Task list 3. Enter 'aaa' into Account Identifier field and press Enter 4. Ensure an orange pop-up box appears at the top of the screen with the error message "ERROR CODE:10100 The account number must contain 1 to 15 digits."	PASSED
Wrong default action in Task list; this is now fixed	Wrong default action in Task list	1. Log into any EUCR registry e.g. BG 2. Go to Task list 3. Enter '123' into Account Identifier field and press Enter 4. Ensure a tasklist search is performed and not an export of data.	PASSED
Validation error is not displayed in ESD Compliance screen; this is now fixed	Validation error is not displayed in ESD Compliance screen	1. Log in to ESD 2. Go to "ESD Compliance Dashboard" search page 3. From HTML level modify "Member State" and "Year" fields to use invalid values e.g. X and 201 respectively 4. Click [Search] button 5. Ensure the error message "The value entered for Member State is not a valid Member State The value entered for Year is not a valid Year" appears at the top of the screen	PASSED

Message added for validation rule 7869	EUCR-2162 Add message for Check 7869	This is a technical issue. Ensure that in messages.properties the code 7869 corresponds to the message "Exchanged Units are not eligible for ESD".	PASSED
Correction in ESD Entitlements transaction type validation	ClassCastException when validating ESD Entitlements Transaction Type	1. Log in to ESD 2. Go to "ESD Entitlements Transaction" search page 3. From HTML level modify "ESD Entitlements Transaction Type" search field to use ESD_ENTTRANSFER value 4. Click [Search] button 5. Ensure the error message "The value entered for ESD Entitlements Transaction Type is not a valid" appears in an orange box.	PASSED
Return to Search (account details) link disappears after double click; this is now fixed	Return to Search (account details) link disappears after double click	1. Go to EUCR 2. Go to Accounts->Accounts screen and perform a search which returns some accounts 3. Click on an "account details" hyperlink and navigate to an account's details 4. Double click on "Return to Search" link 5. Ensure the next screen is the originating search screen of step [2].	PASSED
Validation error when creating new ESD account; this is now fixed	Validation error on using URID filter when creating new ESD account	1. Log in to ESD as ESDCA 2. Click on [Account request] 3. Select type, MS and year 4. Click [Add] button to add new AR 5. Enter valid URID in URID filter and click [Apply Filter(s)] button 6. Ensure the corresponding AR was located in the results list. 7. Select ARs and additional ARs for this account creation request and submit the request 8. Approve the request as another ESDCA 9. Navigate to ESD->Accounts and ensure the new ESD compliance accounts exists and has the ARs/AARs specified in steps 4 and 7. *Technical explanation:* After implementing TST-896 / EUCR-2072 URID filter cannot be used anymore when creating new ESD account. This is probably related to error in implemented validation pattern which is Validator.Urid=^[A-Z]{2}\d{12}$ (there should be double escape before d{12}). In this situation using proper URID for search such as ED818239191418 leads to an error: "The value entered for URID is not a valid URID"	PASSED
KP2 requirement: Ensure exchanged units retain exchanged property when split	Ensure exchanged units retain exchanged property when split	Scenario 1: When manually split, exchanged units retain exchanged property 1. Locate an exchanged unit by searching Administration->Unit Blocks screen by an IC account identifier. <<Normally all unit blocks held by this account should have value 'No (exchanged)' in ESD Eligibility column >> 2. Click "edit" and split the unit block. 3. Locate the split unit blocks by searching Administration->Unit Blocks screen by an IC account identifier. 4. Ensure the split unit blocks retain "No (exchanged)" value by checking the "ESD Eligibility" column. *Scenario 2: Split unit blocks by loading ICH list and ensure exchanged property is preserved* 1. Connect as CA in EU registry 2. Navigate to ICH Lists and upload an ICH Application Procedure Positive List, mentioning half a unit block which is exchanged (exchanged unit block details can be located as described in Scenario 1). 3. Use the Administration->Unit Blocks screen to locate the specific unit block and ensure its value "No (exchanged)" for "ESD Eligibility" column; also, the other half of the split unit block should also have as value "No (exchanged)". *Scenario 3: Transfer a part of an exchanged unit block* 1. Locate an exchanged unit block in an IC Account. 2. Transfer a sub-set of the unit block in another PHA. 3. Ensure that both part of the unit block are exchanged by visiting the first and the second PHA screen and checking the "ESD Eligibility" column of both accounts. *Note*: A method in order to prioritize larger unit blocks to be picked by a transaction is to set the smaller unit blocks to reconciliation mode, e.g. update unit_block set blocked_by_recon = 999 where ID in (IDs of smaller unit blocks);	PASSED
Implementation of KP2-DA67-REQ-12	[KP2-DA67-REQ-12] Allow external transfers from NaHA	Scenario 1: Ensure transfer from NaHA completes successfully 1. Repeat scenario EUCR-2161 but use NaHA as transferring account and KP account as acquiring account. 2. Ensure the transaction completes successfully and the units are transferred to acquiring account. Repeat with OHA as acquiring account, using CP2 units (because CP1 units cannot enter ETS accounts).	PASSED
Implementation of KP2-DA67-REQ-8	[KP2-DA67-REQ-8] Allow external transfers of AAUs from MS KP accounts to EU KP accounts	Scenario 1: Ensure external transfers of AAUs from MS KP accounts to EU KP accounts are allowed. 1. Repeat scenario EUCR-2161 but use as transferring account a KP account hosted by a member-state and as acquiring account KP account hosted by EU. 2. Ensure the transaction completes normally and the units are transferred to the acquiring account.	PASSED
Implementation of KP2-DA67-REQ-9	[KP2-DA67-REQ-9] Allow external transfers from AAU Deposit account -> EU KP account	Scenario 1: Ensure transfer from AAU Deposit account -> KP account completes successfully. 1. Repeat scenario of EUCR-2161 but use AAU Deposit account as transferring and a KP account hosted in EU Registry 2. Ensure the transaction completes and the units are transferred to the destination account.	PASSED

Implementation of KP2-DA67-REQ-4	[KP2-DA67-REQ-4] Exchanged units are ineligible for ETS	Scenario 1: Ensure exchanged units cannot enter ETS accounts 1. Locate a PHA account with exchanged units. 2. Choose to transfer the specific units and choose an OHA as destination account 3. Ensure the error core <<80706: The acquiring account is not allowed to hold CP1 units after a specified date>> appears and the transaction is not permitted. Repeat for CER, ERU units. Note: This issue is checked indirectly; CER/ERU units cannot enter ETS accounts not only because they are exchanged, but because they are CP1. Nevertheless, the business rule is enforced. CER or ERU units of CP2 are not envisaged to exist beyond IC accounts, so this scenario is not tested. Scenario 2 (regression): Ensure exchanged units can enter KP accounts Repeat scenario 1 but choose a KP account as destination account. Ensure the transaction completes normally.	PASSED
Implementation of KP2-DA67-REQ-7	[KP2-DA67-REQ-7]: Precedence of ESD eligibility	Scenario 1: Ensure "Exchanged" flag precedes ESD eligibility flagging 1. Navigate to a KP PHA holdings screen 2. Locate a 'No (exchanged)' unit block 3. Add this unit block to General Positive list by the following actions: 4. Connect as ESD-CA in ESD Registry and navigate to ESD->ESD Eligibility Lists 5. Add the Project, Country, Unit Type to General Positive List 6. Return to the KP PHA holdings screen of step 1 and ensure the unit block is still marked as "No (exchanged)" 7. Navigate to Administration -> Unit Blocks and locate this unit block and ensure it is marked as "No (exchanged)" Repeat for CER, ERU Repeat for General Positive List, General Negative List. *Scenario 2 (regression): Ensure non-exchanged units show correct ESD eligibility flags* 1. Navigate to a KP PHA holdings screen 2. Locate a unit block which has <<null>> value in ESD Eligibility column 3. Add the unit block in General Positive list as described in steps 1.4-1.5 4. Return to the KP PHA holdings screen of step 1 and ensure the unit block is marked as Limit1. 5. Navigate to Administration -> Unit Blocks and locate this unit block and ensure it is marked as Limit1. 6. Remove the unit block from General Positive list. 7. Repeat steps 4 and 5 and ensure the unit block is no longer marked as Limit1. Repeat for CER, ERU Repeat for General Positive List, General Negative List.	PASSED
Implementation of KP2-DA67-REQ-6	[KP2-DA67-REQ-6]: Exchanged units re-entering ETS remain exchanged	Scenario 1: Transfer exchanged units from IC account to KP account 1. Locate IC account(general) 2. Transfer exchanged units to a KP account 3. Ensure the transaction completes normally Repeat for a destination of PHA and person HA. Repeat for IC account (aviation) Repeat for CER, ERU units. Repeat only for CP1 units; CP2 units will not be transferred out of IC account (general/aviation) in the near future. *Scenario 2: Transfer exchanged units from PHA to Japan* 1. Locate exchanged units to a PHA 2. Transfer exchanged units to an account in Japan 3. Ensure the transaction ends in "Proposed" state (a Japanese registry is needed for further advance) *Scenario 3 (regression scenario of existing functionality): Ensure transfer exchanged units from Japan to ETS fails* 1. Transfer CP1 exchanged units from Japan to an ETS account; exchanged unit blocks can be found in EUTL by the query: select * from exchanged_unit_block; 2. Ensure the transaction is terminated with code 7657 *Scenario 4: Ensure transfer exchanged units from Japan to PHA completes* 1. Transfer exchanged units from Japan to a PHA 2. Ensure the transaction is completed 3. Navigate to the holdings of the PHA and ensure the transacted units are denoted with "NO (exchanged)" in the ESD Eligibility column. Repeat for CER, ERU units. Repeat for a subset of a transferred unit block: (e.g. if the unit block was 1-100.	PASSED

Implementation of KP2-DA67-REQ-5, REQ-11 and REQ-10	[KP2-DA67-REQ-5] [REQ-11] [REQ-10]: Exchanged units are ineligible for ESD	Scenario 1: Ensure exchanged units cannot be transferred to ESD 1. Locate a PHA with exchanged units and not any non-exchanged units 2. Navigate to its account holdings 3. Ensure the exchanged units are flagged with ESD eligibility-> "No (exchanged)" 4. Ensure the transaction type "Transfer to ESD" is not available OR this transaction type is available and when clicked, the exchanged units are not able to be chosen for ESD transfer Repeat for CER, ERU units. Scenario 2 (regression): Ensure non-exchanged units can be transferred to ESD 1. Locate a PHA with non-exchanged units. 2. Navigate to its account holdings 3. Ensure the transaction type "Transfer to ESD" is available. 4. Propose a "Transfer to ESD" and choose non-exchanged units. 5. Ensure the "Transfer to ESD" transaction completes normally. Repeat for CER, ERU units Scenario 3: Ensure exchanged units cannot be transferred to ESD even if chosen along with non-exchanged units 1. Locate a PHA with exchanged and non-exchanged units 2. Navigate to its account holdings; ensure the exchanged and non-exchanged units are in different lines in the account holdings screen and are denoted as follows. -- Non-exchanged have in column ESD Eligibility: "Limit1", "Limit2", "Limit1+Limit2" or null -- Exchanged units have in column ESD Eligibility: "No (Exchanged)" 3. Ensure the transaction type "Transfer to ESD" is available; initiate a "Transfer to ESD" transaction. Ensure that only the non-exchanged units appear in the unit selection screen; the exchanged units appearing in step [2] of this scenario do not appear in the unit selection screen.	PASSED
Implementation of KP2-DA67-REQ-1, REQ-2 and REQ-3	[KP2-DA67-REQ-1] & [REQ-2] & [REQ-3]: Allow transfers out of IC account (General/Aviation)	Scenario 1: Ensure external transfer from IC account (general/aviation) is possible 1. Connect as a user assigned as AR to an IC account (general) in Account Search screen. 2. Search for IC account (general) and navigate to account holdings and propose an external transfer towards a PHA. 3. Choose CP1 CER units. 4. Approve the transaction as AAR assigned on the account. 5. Ensure the transfer completes and the units are transferred to the destination account. 6. Navigate to the destination PHA and ensure the transferred units in column "ESD Eligibility" state "No (exchanged)". Repeat for ERU units. Repeat for IC account (aviation). Repeat with NA user assigned as AR on the account; the transaction must be approved by another NA assigned to the account. Note that it is not in the scope of ETS 6.7.1 to transfer CP2 units out of IC account (general/aviation). Therefore this is not tested.	PASSED
When proposing a transfer, only 10 unit types-commitment period combinations appeared; this is now fixed	Only 10 unit types displayed on transfer proposal screen	1. Locate a KP account with unit_types/original period/applicable period combinations counting more than 10. 2. Navigate to its account holdings and propose a KP transfer 3. Ensure all possible combinations of unittypes/original period/applicable period appear, and they are more than 10 4. Propose a transfer to another KP account 5. Submit and approve the transfer 6. Ensure the transfer completes successfully	PASSED
Uploading an ESD eligibility list now ignores exchanged units	ESD limit marking of exchanged KP units that returned to ETS	*Scenario 1: ESD Limit XML upload omits the exchanged units.* 1. Locate the IC Accounts and select in EUCR the corresponding units blocks. This is achieved via the following query: select ub.* from account acc, unit_block ub where acc.ACCOUNT_ID = ub.ACCOUNT_ID and identifier = 10000344 and registry_code = 'EU' order by 2; 2. Ensure column IS_EXCHANGED is set to 1, since all units in IC Accounts are exchanged. 3. Update manually these blocks so that they belong to no ESD list. This can be accomplished by setting ESD_ELIG1 and ESD_ELIG2 of the unit blocks of step 1 to null. 4. Delete from table EUCR.esd_sg_list and from EUTL.Esd_List_Project the record(s) pertaining to the specific project and country. Upload an ESD limits XML for LIMIT1 (ESD General List) referencing the project, unit type and country used in step 1. 5. Ensure that the units of step 1.1 were not marked as belonging to the limit of the XML, so their column ESD_ELIG1 is null. Repeat for ESD_ELIG2 and (ESD Special List). *Scenario 2: ESD Limit entry via EUCR screen omits exchanged units.* 1. Locate a project, country and unit type contained in the IC Account, for example: project=1, country=RO, unit_type=CER 2. Ensure this set of values does not exist in ESD General list. 3. Add it in ESD General list via ESD->View ESD Eligibility Lists-> Insert 4. Wait until the change is propagated to EUTL. 5. Ensure the exchanged units are not marked in Limit1 but non-exchanged units are	PASSED

There is no possibility to choose a project when sending KP units to ESD; this is now fixed	There is no possibility to choose a project when sending KP units to ESD	1. Connect as NA and locate a PHA with units in Limit1, for a member-state with enough entitlement in ESD account of current year. 2. Navigate to account holdings and propose a transaction of type "transfer to ESD compliance account" 3. Ensure the next screen "Transfer credits to ESD compliance account" contains a Project ID. 4. Choose one project from the drop-down list and submit the transaction request. 5. Approve the transaction request as another NA 6. Ensure the transaction completes and the transaction blocks of the completed transaction contain only units of the project chosen in step [4].	PASSED
Proposed transfer to ESD increases displayed balance for exchanged units; this is now fixed	Proposed transfer to ESD increases displayed balance for exchanged units	1. Connect as NA and navigate to a PHA which contains some exchanged units and which has limit 1 in ESD for the current year. 2. Propose a transfer to ESD and enter a quantity to transfer. 3. After proposal, return to account holdings 4. Ensure in account holdings screen only the "Reserved for Transaction" column has been increased for the rows pertaining to the quantities reserved in step [2]. 5. Cancel the transaction request and ensure the account holdings return to the same quantities as in step [2].	PASSED
The message pertaining to rule 80000 was wrong; this is now fixed	Wrong label substituted instead "Aviation Allowance"	Since the error check for rule 80000 is the same throughout the application and since auction deliveries may not exist in the test system, the following scenario can test this functionality: 1. Login ETS as NA 2. Search for AOHA and select one with aviation allowances 3. Navigate to account holdings and propose a transfer or allowances 4. Propose a transfer to an account in TAL 5. Enter more aviation allowances than available and click "submit" 6. Ensure the following error message appears: "80000: The amount <<qty entered>> of Aviation Allowance is not available in the account: <<account identifier>>"	PASSED
Uploading an ESD eligibility list now ignores exchanged units	ESD limit marking of exchanged KP units that returned to ETS	Scenario 1: ESD Limit XML upload omits the exchanged units. 1. Locate the IC Accounts and select in EUTL the corresponding units blocks, pertaining to a specific project, country and unit type. This is achieved via the following query: select ub.* from account acc, account_holding ah, unit_block ub, unit_type_code utc where acc.ACCOUNT_ID = ah.ACCOUNT_ID and ah.BLOCK_ID = ub.BLOCK_ID and account_identifier = <<acct_identifier>> and registry_code = 'EU' and ub.UNIT_TYPE_CODE = utc.UNIT_TYPE_CODE and ub.unit_type_code = <<unit_type>> and originating_country_code = <<country>> and project_id = <<project>> order by 2; 2. Ensure column IS_EXCHANGED is set to 1, since all units in IC Accounts are exchanged. 3. Update manually these blocks so that they belong to no ESD list. This can be accomplished by setting ESD_ELIG1 and ESD_ELIG2 of the unit blocks of step 1 to null. 4. Upload an ESD limits XML for LIMIT1 (ESD General List) referencing the project, unit type and country used in step 1. 5. Ensure that the units of step 1.1 were not marked as belonging to the limit of the XML, so their column ESD_ELIG1 is null. Repeat for ESD_ELIG2 and (ESD Special List). Scenario 2: ESD Limit entry via EUCR screen omits exchhanged units. 1. Locate a project, country and unit type contained in the IC Account, for example: project=1, country=RO, unit_type=CER 2. Ensure this set of values does not exist in ESD General list. 3. Add it in ESD General list via ESD->View ESD Eligibility Lists-> Insert	PASSED
Using Internet Explorer to access the site, for certain downloads an unrecoverable error is generated.	Unrecoverable error on downloads in Internet Explorer.	**Scenario A**: Functionality tests using Internet Explorer. 1. Log in to Registry using Internet Explorer (checked on IE 9.0.8112) . 2. Navigate to Accounts -> Transactions -> Search and locate a transaction -> Click on the transaction Identifier -> Click on "Transaction PDF". Ensure no error is generated and the PDF file appears correctly. 3. Navigate to Accounts -> Accounts -> Search and locate an account -> Click on "Account Statements" -> Enter Start Date and End Date and click on "Account Statement PDF" -> Ensure no error is generated and the PDF file appears correctly. 4. Click on Administration -> View ICH Lists -> Click on Export XML and Export CSV; ensure no error is generated and the XML/CSV files appear correctly. 5. Click on EU ETS-> Entitlements -> Click on Search -> Click on Export XML and Export CSV; ensure no error is generated and the XML/CSV files appear correctly. **Scenario B**: Regression tests using Firefox. Repeat the tests of Scenario A using Firefox. **Scenario C**: Regression tests using Chrome. Repeat the tests of Scenario A using Chrome.	PASSED

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Annex H TEST RESULTS EU

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Table of Contents

1 Introduction

The tests were conducted on 22nd to 23rd February 2016. The environments used were ITL REG, EUTL and CSEUR ACC.

1.1 Overview

This is the test report for the ‘EU custom Annex’. LV and LT are the registries used in this test.

This test is follows the test plan produced by the UNFCCC and distributed in advance to all test participants

To set up the ITL REGISTRY environment for this testing, CGI App Support uploaded the provided government accounts, set the registries test limits and created the projects

1.2 References

Reference	Identifier	Title
01	DES	Technical Specifications for Data Exchange, version 2.0.1 draft 5 17 August 2015
02	Test Plan	EC Custom Annex H - Feb 2016 - Detailed Test Plan - v0.1

2 Test Configuration

2.1 Registries

Following registries are used

ZZ	XX	YY	QQ	RR
LV	LT	--NA--	--NA--	--NA--

2.2 Additional Results

At the end of each scenario the relevant ITL logs were captured.

A WebEx session is used for communication during the testing. This will be captured at the end of each day.

3 TEST RESULTS

Ref	*Description*	*Pass/Fail Time*	*Notes*
1.1	***Successful AAU issuance in CP1***	***PASS***	
1.2	***Successful RMU issuance, LULUCF activity 1 in CP1***	***PASS***	
1.3	***Reconciliation***	***PASS***	
2.1	***Successful AAU conversion***	***PASS***	
2.2	***Successful RMU conversion***	***PASS***	
3.1	***Successful voluntary cancellation of CP1 AAUs***	***PASS***	
3.2	***Successful mandatory cancellation of CP1 AAUs***	***NA***	***Not performed because the EC indicated that this type of transaction and account are not enabled in their current software version***
3.3	***Cancellation to fulfil net source cancellation notification in CP1***	***PASS***	
3.4	***Cancellation to fulfil non-compliance cancellation notification in CP1***	***PASS***	
3.5	***Reconciliation***	***PASS***	
4.1	***External transfer attempt of CP1 units***	***PASS***	
4.2	***Receive CP1 and CP2 CERs, tCERs, lCERs and other units***	***PASS***	***We had an issue with the data set up in ITL; hence transactions were not successful initially. We have sorted out the issue and set the data correctly. Post this change transactions were successful***

4.3	***Reconciliation***	***NA***	***Skipped reconciliation, because the test 4.1 'External transfer' had to take one hour to complete.***

Ref	***Description***	***Pass/Fail***	***Notes***
5.1	***Retirement of AAUs, ERUs, CERs, and lCERs***	***PASS***	
5.2	***Reconciliation***	***PASS***	
1.1bis	***Successful AAU issuance in CP2***	***PASS***	
1.2bis	***Successful RMU issuance, LULUCF activity 1 in CP2***	***PASS***	
3.1bis	***Successful voluntary cancellation of CP2 AAUs***	***PASS***	
3.2bis	***Successful mandatory cancellation of CP2 AAUs***	***NA***	***Not Performed***
3.5bis	***Reconciliation***	***PASS***	
4.1bis	***External transfer of CP2 units***	***PASS***	
5.1bis	***Successful retirement of CP2 AAUs***	***PASS***	
5.3bis	***Unsuccessful attempt for Retirement of CP2 CERs***	***PASS***	***It took several attempts to get it to work as expected (unsuccessful transaction). The key was to re-enable the check in ITL REG and to restart the apps server***
5.3ter	***Successful Retirement of CP2 CERs***	***PASS***	
5.2bis	***Reconciliation***	***PASS***	