ANNEXES TO THE NATIONAL INVENTORY REPORT

2014

TABLE OF CONTENTS

Annex 1 Key Categories

A1.1. Description of methodology used for identifying key sources and reference to the key source tables in the CRF

This annex describes the key category analysis conducted for the 2011 Hungarian inventory.

The IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000) recommend as good practice the identification of key source categories of emissions. As a result of the adoption (Decision 13/CP.9) of the LULUCF Good Practice Guidance (IPCC, 2003) the concept of key sources has been expanded in order to cover LULUCF emissions by sources and removals by sinks. Therefore the term key category is used in order to include both sources and sinks.

Generally, inventory uncertainty is lower when emissions are estimated using the available most rigorous methods, but due to finite resources this may not be feasible for every category. Therefore it is good practice to identify those categories (key categories) that have the greatest contribution to overall inventory uncertainty in order to make the most efficient use of available resources. In that context, a "key category" is one that is prioritized within the national inventory system because its estimate has a significant influence on a country's total inventory of direct greenhouse gases in terms of the absolute level of emissions (level assessment) or/and to the trend of emissions (trend assessment).

IPCC GPG 2000 describes two TIER level for identification of key categories. The difference is that in TIER2 approach assessments are weighted with the uncertainty values of each source category.

Both in TIER1 and TIER2 Approaches key categories are identified from two perspectives.

The first analyzes the emission contribution that each category makes to the national total (with LULUCF). The second perspective analyzes the trend of emission contributions from each category to identify where the greatest absolute changes (either increases or reductions) have taken place over a given time (with LULUCF categories). The percent contributions to both levels and trends in emissions are calculated and sorted from greatest to least. A cumulative total is calculated for both approaches. IPCC has determined that a cumulative contribution threshold of 95% for both level and trend assessments is a reasonable approximation of 90% uncertainty for the Tier 1 method of determining key categories (IPCC, 2000). The 95% cumulative contribution threshold has been used in this analysis to define an upper boundary for key category identification. Therefore, when source and/or sink contributions are sorted in decreasing order of importance, those that contribute to 95% of the cumulative total are considered quantitatively to be key. Results for these analyses are shown in *Table A1-3* and *Table A1-4*.

The Equation 7.1 from GPG2000 was used for Level assessment and Equation 7.2 from GPG2000 was used for Trend assessment.

Good practice first requires that source categories should be disaggregated into categories from which key sources and sinks may be identified. Several recommendations exist for the list of categories (aggregation/disaggregation level):

- IPCC GPG2000 Table 7.1; (does not include LULUCF)
- IPCC GPG LULUCF 2003; (includes LULUCF)
- EU list (includes LULUCF) (more disaggregated)
- country specific list

TIER1 Level and Trend assessment was conducted on all list mentioned above, but it is important to note that in CRF Table 7 and in NIR chapter 1.6 the key category analysis performed on the disaggregation level presented in Table A1-1 is used in 2013 submission. This list and the summary of results of Tier1 analysis are shown in Table A1-1 below. This list is more disaggregated than in the case of earlier submissions, which makes possible the

more specific identification of the categories, where the available resources should be concentrated. The list was set up giving more detailed insight into the most emitting sectors and taking into account country specific properties. This list is used for compilation of CRF Table 7 as well, so the list of source categories presented in the NIR and in CRF tables are the same.
The full TIER1 key category analysis is presented in Table A1-6, using the format suggested in GPG2000 Table 7A1 and Table 7A2.

Table A1-1 *Category list used in Tier 1 analysis*

A		B	C	D
IPCC Source Categories		**Direct GHG**	**Key Source Category Flag**	**If C Yes. Criteria for Identification**
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ biomass	CH_4	No	
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ biomass	N_2O	No	
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ gas	CH_4	No	
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ gas	CO_2	Yes	L1 T1 L1exL T1exL
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ gas	N_2O	No	
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ liquid	CH_4	No	
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ liquid	CO_2	Yes	T1 T1exL
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ liquid	N_2O	No	
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ other	CH_4	No	
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ other	CO_2	Yes	L1 T1 L1exL T1exL
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ other	N_2O	No	
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ solid	CH_4	No	
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ solid	CO_2	Yes	L1 T1 L1exL T1exL
1A1a	Energy - Stationary Combustion - Public electricity and heat production/ solid	N_2O	No	
1A1b	Energy - Stationary Combustion - Petroleum refining/ biomass	CH_4	No	
1A1b	Energy - Stationary Combustion - Petroleum refining/ biomass	N_2O	No	
1A1b	Energy - Stationary Combustion - Petroleum refining/ gas	CH_4	No	
1A1b	Energy - Stationary Combustion - Petroleum refining/ gas	CO_2	Yes	L1 L1exL
1A1b	Energy - Stationary Combustion - Petroleum refining/ gas	N_2O	No	
1A1b	Energy - Stationary Combustion - Petroleum refining/ liquid	CH_4	No	
1A1b	Energy - Stationary Combustion - Petroleum refining/ liquid	CO_2	Yes	L1 T1 L1exL T1exL
1A1b	Energy - Stationary Combustion - Petroleum	N_2O	No	

	refining/ liquid			
1A1b	Energy - Stationary Combustion - Petroleum refining/ other	CH_4	No	
1A1b	Energy - Stationary Combustion - Petroleum refining/ other	CO_2	No	
1A1b	Energy - Stationary Combustion - Petroleum refining/ other	N_2O	No	
1A1c	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries/ biomass	CH_4	No	
1A1c	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries/ biomass	N_2O	No	
1A1c	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries/ gas	CH_4	No	
1A1c	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries/ gas	CO_2	No	
1A1c	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries/ gas	N_2O	No	
1A1c	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries/ liquid	CH_4	No	
1A1c	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries/ liquid	CO_2	No	
1A1c	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries/ liquid	N_2O	No	
1A1c	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries/ solid	CH_4	No	
1A1c	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries/ solid	CO_2	No	
1A1c	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries/ solid	N_2O	No	
1A2	Energy - Manufacturing Industries and Construction/ biomass	CH_4	No	
1A2	Energy - Manufacturing Industries and Construction/ biomass	N_2O	No	
1A2	Energy - Manufacturing Industries and Construction/ gas	CH_4	No	
1A2	Energy - Manufacturing Industries and Construction/ gas	CO_2	Yes	L1 T1 L1exL T1exL
1A2	Energy - Manufacturing Industries and Construction/ gas	N_2O	No	
1A2	Energy - Manufacturing Industries and Construction/ liquid	CH_4	No	
1A2	Energy - Manufacturing Industries and Construction/ liquid	CO_2	Yes	L1 T1 L1exL T1exL
1A2	Energy - Manufacturing Industries and Construction/ liquid	N_2O	No	
1A2	Energy - Manufacturing Industries and Construction/ other	CH_4	No	
1A2	Energy - Manufacturing Industries and Construction/ other	CO_2	No	
1A2	Energy - Manufacturing Industries and Construction/ other	N_2O	No	
1A2	Energy - Manufacturing Industries and Construction/ solid	CH_4	No	
1A2	Energy - Manufacturing Industries and Construction/ solid	CO_2	Yes	L1 T1 L1exL T1exL
1A2	Energy - Manufacturing Industries and Construction/ solid	N_2O	No	
1A3b	Energy - Mobile combustion - Road transportation/	CH_4	No	

	biomass			
1A3b	Energy - Mobile combustion - Road transportation/ biomass	N_2O	No	
1A3b	Energy - Mobile combustion - Road transportation/ gn	CH_4	No	
1A3b	Energy - Mobile combustion - Road transportation/ gn	CO_2	No	
1A3b	Energy - Mobile combustion - Road transportation/ gn	N_2O	No	
1A3b	Energy - Mobile combustion - Road transportation/ ld	CH_4	No	
1A3b	Energy - Mobile combustion - Road transportation/ ld	CO_2	Yes	L1 T1 L1exL T1exL
1A3b	Energy - Mobile combustion - Road transportation/ ld	N_2O	No	
1A3b	Energy - Mobile combustion - Road transportation/ lg	CH_4	No	
1A3b	Energy - Mobile combustion - Road transportation/ lg	CO_2	Yes	L1 T1 L1exL T1exL
1A3b	Energy - Mobile combustion - Road transportation/ lg	N_2O	No	
1A3b	Energy - Mobile combustion - Road transportation/ ll	CH_4	No	
1A3b	Energy - Mobile combustion - Road transportation/ ll	CO_2	No	
1A3b	Energy - Mobile combustion - Road transportation/ ll	N_2O	No	
1A3c	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation/ gas	CH_4	No	
1A3c	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation/ gas	CO_2	No	
1A3c	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation/ gas	N_2O	No	
1A3c	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation/ liquid	CH_4	No	
1A3c	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation/ liquid	CO_2	Yes	T1 T1exL
1A3c	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation/ liquid	N_2O	No	
1A3c	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation/ solid	CH_4	No	
1A3c	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation/ solid	CO_2	No	
1A3c	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation/ solid	N_2O	No	
1A4	Energy - Stationary Combustion - Other/ biomass	CH_4	Yes	T1
1A4	Energy - Stationary Combustion - Other/ biomass	N_2O	No	
1A4	Energy - Stationary Combustion - Other/ gas	CH_4	No	
1A4	Energy - Stationary Combustion - Other/ gas	CO_2	Yes	L1 T1 L1exL T1exL
1A4	Energy - Stationary Combustion - Other/ gas	N_2O	No	
1A4	Energy - Stationary Combustion - Other/ liquid	CH_4	No	
1A4	Energy - Stationary Combustion - Other/ liquid	CO_2	Yes	L1 T1 L1exL T1exL
1A4	Energy - Stationary Combustion - Other/ liquid	N_2O	No	
1A4	Energy - Stationary Combustion - Other/ solid	CH_4	Yes	T1 T1exL
1A4	Energy - Stationary Combustion - Other/ solid	CO_2	Yes	L1 T1 L1exL T1exL

1A4	Energy - Stationary Combustion - Other/ solid	N_2O	No	
1B1a	Energy - Fugitive Emissions from Fuels - Solid Fuels	CH_4	Yes	T1 T1exL
1B1a	Energy - Fugitive Emissions from Fuels - Solid Fuels	CO_2	No	
1B1a	Energy - Fugitive Emissions from Fuels - Solid Fuels	N_2O	No	
1B2a	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	No	
1B2a	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2	No	
1B2a	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O	No	
1B2b	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	Yes	L1 T1 L1exL T1exL
1B2b	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2	No	
1B2b	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O	No	
1B2c	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	No	
1B2c	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2	No	
1B2c	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O	No	
1B2d	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	Yes	L1 T1 L1exL T1exL
1B2d	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2	No	
1B2d	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O	No	
2A1	Industrial Processes - Mineral Products - Cement production	CO_2	Yes	L1 T1 L1exL T1exL
2A2	Industrial Processes - Mineral Products - Lime production	CO_2	Yes	T1 T1exL
2A3	Industrial Processes - Mineral Products - Limestone and dolomit use	CO_2	Yes	L1 L1exL T1exL
2A4	Industrial Processes - Mineral Products - Soda Ash Use	CO2		
2A5	Industrial Processes - Mineral Products - Asphalt roofing	CO_2	No	
2A6	Industrial Processes - Mineral Products - Road paving with asphalt	CO_2	No	
2A7	Industrial Processes - Mineral Products - Other	CH_4	No	
2A7	Industrial Processes - Mineral Products - Other	CO_2	Yes	T1 T1exL
2A7	Industrial Processes - Mineral Products - Other	N_2O	No	
2B1	Industrial Processes - Chemical Industry - Ammonia production	CH_4	No	
2B1	Industrial Processes - Chemical Industry - Ammonia production	CO_2	Yes	L1 T1 L1exL T1exL
2B1	Industrial Processes - Chemical Industry - Ammonia production	N_2O	No	
2B2	Industrial Processes - Chemical Industry - Nitric acid production	CO_2	No	
2B2	Industrial Processes - Chemical Industry - Nitric acid production	N_2O	Yes	T1 T1exL
2B5	Industrial Processes - Chemical Industry - Other	CH_4	No	
2B5	Industrial Processes - Chemical Industry - Other	CO_2	No	

2B5	Industrial Processes - Chemical Industry - Other	N_2O	No	
2C1	Industrial Processes - Metal Production - Iron and steel production	CH_4	No	
2C1	Industrial Processes - Metal Production - Iron and steel production	CO_2	Yes	L1 T1 L1exL T1exL
2C2	Industrial Processes - Metal Production - Ferroalloys production	CH_4	No	
2C2	Industrial Processes - Metal Production - Ferroalloys production	CO_2	No	
2C3	Industrial Processes - Metal Production - Aluminium production	CH_4	No	
2C3	Industrial Processes - Metal Production - Aluminium production	CO_2	No	
2C4	Industrial Processes - Metal Production - Aluminium production	PFCs	No	
2D	Industrial Processes - Other Production	CO_2	No	
2E	Industrial Processes - Production of Halocarbons and SF_6	HFCs	No	
2E	Industrial Processes - Production of Halocarbons and SF_6	PFCs	No	
2E	Industrial Processes - Production of Halocarbons and SF_6	SF_6	No	
2Fa1	Industrial Processes - Consumption of Halocarbons and SF_6 - Refrigeration and air conditioning equipment	HFCs	Yes	L1 T1 L1exL T1exL
2Fa1	Industrial Processes - Consumption of Halocarbons and SF_6 - Refrigeration and air conditioning equipment	PFCs	No	
2Fa2	Industrial Processes - Consumption of Halocarbons and SF_6 - Foam blowing	HFCs	No	
2Fa2	Industrial Processes - Consumption of Halocarbons and SF_6 - Foam blowing	PFCs	No	
2Fa3	Industrial Processes - Consumption of Halocarbons and SF_6 - Fire extinguishers	HFCs	No	
2Fa3	Industrial Processes - Consumption of Halocarbons and SF_6 - Fire extinguishers	PFCs	No	
2Fa4	Industrial Processes - Consumption of Halocarbons and SF_6 - Aerosols	HFCs	No	
2Fa4	Industrial Processes - Consumption of Halocarbons and SF_6 - Aerosols	PFCs	No	
2Fa8	Industrial Processes - Consumption of Halocarbons and SF_6 - Electrical equipment	SF_6	No	
2Fa9	Industrial Processes - Consumption of Halocarbons and SF_6 - Other	SF_6	No	
2G1	Industrial Processes - Feedstocks	CO_2	Yes	L1 T1 L1exL T1exL
3a	Solvent and Other Product Use - Paint Application	CO_2	No	
3b	Solvent and Other Product Use - Degreasing and Dry Cleaning	CO_2	No	
3c	Solvent and Other Product Use - Chemical Products	CO_2	No	
3d	Solvent and Other Product Use - Other	N_2O	Yes	L1 T1 L1exL T1exL
4A(2,4,7, 10,R)	Agriculture - Enteric Fermentation /Buffalo, goat,mule, rabbit, other	CH_4	No	
4A1	Agriculture - Enteric Fermentation /Cattle	CH_4	Yes	L1 T1 L1exL T1exL
4A3	Agriculture - Enteric Fermentation /Sheep	CH_4	No	

4A6	Agriculture - Enteric Fermentation /Horse	CH_4	No	
4A8	Agriculture - Enteric Fermentation /Swine	CH_4	No	
4A9	Agriculture - Enteric Fermentation /Poultry	CH_4	No	
4B(2,4,7, 10,R)	Agriculture - Manure Management /Buffalo, goat,mule, rabbit, other	CH_4	No	
4B12	Agriculture - Manure Management /Liquid	N_2O	No	
4B13	Agriculture - Manure Management /Solid	N_2O	Yes	L1 T1 L1exL
4B14	Agriculture - Manure Management /Other AWMS	N_2O	No	
4B1	Agriculture - Manure Management /Cattle	CH_4	Yes	L1 L1exL
4B3	Agriculture - Manure Management /Sheep	CH_4	No	
4B6	Agriculture - Manure Management /Horse	CH_4	No	
4B8	Agriculture - Manure Management /Swine	CH_4	Yes	L1 T1 L1exL T1exL
4B9	Agriculture - Manure Management /Poultry	CH_4	No	
4C	Agriculture - Rice Cultivation	CH_4	No	
4D1.1.	Agriculture - Agricultural Soils - Direct soil emissions /Syntetic Fertilizer	N_2O	Yes	L1 L1exL
4D1.2-4.	Agriculture - Agricultural Soils - Direct soil emissions /Animal Manure and other	N_2O	Yes	L1 T1 L1exL
4D2	Agriculture - Agricultural Soils - Pasture, range and paddock manure	N_2O	Yes	L1 L1exL
4D3	Agriculture - Agricultural Soils - Indirect emissions	N_2O	Yes	L1 T1 L1exL
4F	Agriculture - Field Burning of Agricultural Residues	CH_4	No	
4F	Agriculture - Field Burning of Agricultural Residues	N_2O	No	
5A1	LULUCF - Forest Land - remaining	CH_4	No	
5A1	LULUCF - Forest Land - remaining	CO_2	Yes	L1 T1
5A1	LULUCF - Forest Land - remaining	N_2O	No	
5A2	LULUCF - Forest Land - converted to	CH_4	No	
5A2	LULUCF - Forest Land - converted to	CO_2	Yes	L1 T1
5A2	LULUCF - Forest Land - converted to	N_2O	No	
5B1	LULUCF - Cropland - remaining	CH_4	No	
5B1	LULUCF - Cropland - remaining	CO_2	Yes	L1 T1
5B1	LULUCF - Cropland - remaining	N_2O	No	
5B2	LULUCF - Cropland - converted to	CH_4	No	
5B2	LULUCF - Cropland - converted to	CO_2	Yes	L1 T1
5B2	LULUCF - Cropland - converted to	N_2O	No	
5C1	LULUCF - Grassland remaining Grassland	CH4	No	
5C1	LULUCF - Grassland remaining Grassland	CO_2	Yes	L1 T1
5C1	LULUCF - Grassland remaining Grassland	N_2O	No	
5C2	LULUCF - Land converted to Grassland	CO_2	Yes	
5D2	LULUCF - Land converted to Wetlands	CO_2	No	
5D1	LULUCF - Wetlands remaining wetlands	CO_2	No	
5E2	LULUCF - Land converted to Settlements	CO_2	No	
5F2	LULUCF - Land converted to Other Land	CO_2	No	
6A	Waste - Solid Waste Disposal on Land	CH_4	Yes	L1 T1 L1exL T1exL
6A	Waste - Solid Waste Disposal on Land	CO_2	No	
6B1	Waste - Wastewater Handling - Industrial	CH_4	No	
6B1	Waste - Wastewater Handling - Industrial	N_2O	No	
6B2	Waste - Wastewater Handling - Domestic and Commercial	CH_4	Yes	L1 L1exL
6B2	Waste - Wastewater Handling - Domestic and Commercial	N_2O	Yes	L1 L1exL

6C	Waste - Waste Incineration	CH_4	No	
6C	Waste - Waste Incineration	CO_2	No	
6C	Waste - Waste Incineration	N_2O	No	
6D	Waste - Other	CH_4	No	
6D	Waste - Other	CO_2	No	
6D	Waste - Other	N2O	No	

TIER2 Level and Trend assessment was conducted on a less disaggregated list, suggested by the IPCC GPGs (with LULUCF) complemented by some HU specific points. Several additions were needed also in order to achieve the full coverage of emissions (for example sector 3 is added, however GPGs do not mention it). This list and the notes on the categories where further aggregation/disaggregation was performed are shown in Table A1-2 below. The required uncertainty values for source categories are listed in *Table A7-1.* The calculation was performed using the spreadsheet 6.1 described in the IPCC Good Practice Guidance (IPCC, 2000). The percent contributions to both levels and trends in emissions are calculated and sorted from greatest to least. A cumulative total is calculated for both approaches and the key source categories are identified by accounting for those that add up to 90 % of the cumulative total. Results from Tier 2 approach can be seen in *Table A1- 4, Table A1-5*

The results of Level and Trend assessments using both approaches are summarized in Table 1.1 in chapter 1.6 of the NIR.

Table A1-2 *List of source categories used for TIER2 assessment*

IPCC code	IPCC Source category	GHG	Note/Source
1. A.	Stationary Combustion - Gas	CO_2	GPG2000
1. A.	Stationary Combustion - Oil	CO_2	GPG2000
1. A.	Stationary Combustion - Coal	CO_2	GPG2000
1. A.	Stationary Combustion - Other Fuel	CO_2	GPG2000
1. A.	Stationary Combustion - all subcategories	N_2O	GPG2000
1. A.	Stationary Combustion - all subcategories	CH_4	GPG2000
1. A. 3. B.	Mobile Combustion - Road Vehicles	CO_2	GPG2000
1. A. 3.	Mobile Combustion - Other vehicles	CO_2	HU specific- aggregated from all subcategories in 1.A.3.
1. A. 3.	Mobile Combustion - all subcategories	CH_4	HU specific- aggregated from all subcategories in 1.A.3.
1. A. 3.	Mobile Combustion - all subcategories	N_2O	HU specific- aggregated from all subcategories in 1.A.3.
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CH_4	GPG2000
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	CO_2	GPG2000
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	N_2O	GPG2000
1. B. 2.	Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH_4	GPG2000
2.	Industry - all subcategories	CH_4	HU specific- aggregated from all subcategories in sector 2
2.	Industry - all subcategories	N_2O	HU specific- aggregated from all subcategories in

IPCC code	IPCC Source category	GHG	Note/Source
			sector 2 (including Nitric Acid production)
2. A. 1.	Cement Production	CO_2	GPG2000
2. A. 2.	Lime Production	CO_2	GPG2000
2. A. 3.	Limestone and Dolomite Use	CO_2	GPG2000
2. A. 7.	Other Mineral Products	CO_2	HU specific- addition to the list of suggested IPCC source categories
2. B. 1.	Ammonia Processes	CO_2	HU specific - addition to the list of suggested IPCC source categories
2. B. 2.	Nitric Acid Production	CO_2	GPG2000
2. C.	Metal Production	CO_2	GPG2000
2.-3.	All PCF emissions	PFCs	HU specific - aggregation
2.-3.	All HCF emissions	HFCs	HU specific - aggregation
2.-3.	All SF6 emissions	SF_6	HU specific - aggregation
2. G.	Feedstocks and non-energy use	CO2	HU specific - addition to the list of suggested IPCC source categories
3.	Solvent and Other Product Use	CO_2	HU specific- addition to the list of suggested IPCC source categories
3.	Solvent and Other Product Use	N_2O	HU specific- addition to the list of suggested IPCC source categories
4. A.	Enteric Fermentation in Domestic Livestock	CH_4	GPG2000
4. B.	Manure Management	CH_4	GPG2000
4. B.	Manure Management	N_2O	GPG2000
4. C.	Rice Cultivation	CH_4	GPG2000
4. D. 1.	Direct N_2O Emissions from Agricultural Soils	N_2O	GPG2000
4. D. 2.	Pasture, Range and Paddock Manure	N_2O	GPG2000
4. D. 3.	Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O	GPG2000
5. A. 1.	Forest Land Remaining Forest Land	CO_2	GPG LULUCF 2003
5. A. 1.	Forest Land remaining Forest Land/Controlled burning	N_2O	GPG LULUCF 2003 and HU specific disaggregation due to separate calculation of uncertainty
5. A. 1.	Forest Land remaining Forest Land/Wildfires	N_2O	
5. A. 1.	Forest Land remaining Forest Land/Controlled burning	CH_4	
5. A. 1.	Forest Land remaining Forest Land/Wildfires	CH_4	
5. A. 2.	Land converted Forest Land	CO_2	GPG LULUCF 2003
5. B. 1.	Cropland Remaining Cropland	CO_2	GPG LULUCF 2003
5. B. 1.	Cropland Remaining Cropland	CH4	GPG LULUCF 2003
5. B.	Cropland	N2O	GPG LULUCF 2003
5. B. 2.	Land converted Cropland	CO_2	GPG LULUCF 2003
5. C. 1.	Grassland Remaining Grassland	CO_2	GPG LULUCF 2003
5. C. 1.	Grassland Remaining Grassland	CH4	GPG LULUCF 2003
5. C. 1.	Grassland Remaining Grassland	N2O	GPG LULUCF 2003
5. C. 2.	Land converted Grassland	CO_2	GPG LULUCF 2003

IPCC code	IPCC Source category	GHG	Note/Source
5. D. 1	Wetlands remaining Wetlands	CO_2	GPG LULUCF 2003
5.D. 2	Land converted to Wetlands	CO_2	GPG LULUCF 2003
5. E. 2.	Land converted Settlements	CO_2	GPG LULUCF 2003
5. F. 2.	Land converted Other Land	CO_2	GPG LULUCF 2003
6. A.	Solid Waste Disposal Sites	CH_4	GPG2000
6. B.	Wastewater Handling	N_2O	GPG2000
6. B.	Wastewater Handling	CH_4	GPG2000
6. C.	Waste Incineration	CO_2	GPG2000
6. C.	Waste Incineration	CH_4	GPG2000
6. C.	Waste Incineration	N_2O	GPG2000

A1.2. Results of the key category analysis

Table A1-3 *TIER1 Level assessment*

CRF code + note	IPCC Categories	Direct Greenhouse Gas	Current Year (2012) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment %	Cumulative Total %
1A4gaCO2	**Energy - Stationary Combustion - Other**	**CO2**	**9,909.87**	**9909.87**	**14.4%**	**14.4%**
1A1asoCO2	**Energy - Stationary Combustion - Public electricity and heat production**	**CO2**	**8,732.26**	**8732.26**	**12.7%**	**27.2%**
1A3bIdCO2	**Energy - Mobile combustion - Road transportation**	**CO2**	**6,858.60**	**6858.60**	**10.0%**	**37.2%**
1A1agaCO2	**Energy - Stationary Combustion - Public electricity and heat production**	**CO2**	**5,656.89**	**5656.89**	**8.2%**	**45.4%**
1A3bIgCO2	**Energy - Mobile combustion - Road transportation**	**CO2**	**3,649.45**	**3649.45**	**5.3%**	**50.7%**
5A1CO2	**LULUCF - Forest Land - remaining**	**CO2**	**-2,720.78**	**2720.78**	**4.0%**	**54.7%**
6ACH4	**Waste - Solid Waste Disposal on Land**	**CH4**	**2,472.02**	**2472.02**	**3.6%**	**58.3%**
1A2gaCO2	**Energy - Manufacturing Industries and Construction**	**CO2**	**2,392.40**	**2392.40**	**3.5%**	**61.8%**
4D3N2O	**Agriculture - Agricultural Soils - Indirect emissions**	**N2O**	**1,929.42**	**1929.42**	**2.8%**	**64.6%**
4D1.1. N2O	**Agriculture - Agricultural Soils - Direct soil emissions /Synthetic Fertilizer**	**N2O**	**1,715.02**	**1715.02**	**2.5%**	**67.1%**
5B1CO2	**LULUCF - Cropland - remaining**	**CO2**	**-1,590.94**	**1590.94**	**2.3%**	**69.4%**

CRF code + note	IPCC Categories	Direct Greenhouse Gas	Current Year (2012) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment %	Cumulative Total %
1B2bCH4	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	1,484.95	1484.95	2.2%	71.6%
4D1.2-4. N2O	Agriculture - Agricultural Soils - Direct soil emissions / Animal Manure and other	N2O	1,215.57	1215.57	1.8%	73.3%
1A2soCO2	Energy - Manufacturing Industries and Construction	CO2	1,163.05	1163.05	1.7%	75.0%
4A1caCH4	Agriculture - Enteric Fermentation /Cattle	CH4	1,159.85	1159.85	1.7%	76.7%
5A2CO2	LULUCF - Forest Land - converted to	CO2	-1,097.14	1097.14	1.6%	78.3%
2G1CO2	Industrial Processes - Feedstocks	CO2	1,070.95	1070.95	1.6%	79.9%
1A4liCO2	Energy - Stationary Combustion - Other	CO2	985.65	985.65	1.4%	81.3%
1A1bliCO2	Energy - Stationary Combustion - Petroleum refining	CO2	976.98	976.98	1.4%	82.7%
2Fa1HFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Refrigeration and air conditioning equipment	HFCs	846.70	846.70	1.2%	84.0%
4B8swCH4	Agriculture - Manure Management /Swine	CH4	701.51	701.51	1.0%	85.0%
2A1CO2	Industrial Processes - Mineral Products - Cement production	CO2	678.42	678.42	1.0%	86.0%
1A4soCO2	Energy - Stationary Combustion - Other	CO2	645.65	645.65	0.9%	86.9%
4B13soN2O	Agriculture - Manure Management /Solid	N2O	630.52	630.52	0.9%	87.9%

CRF code + note	IPCC Categories	Direct Greenhouse Gas	Current Year (2012) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment %	Cumulative Total %
4B1caCH4	**Agriculture - Manure Management /Cattle**	**CH4**	**521.05**	**521.05**	**0.8%**	**88.6%**
2B1CO2	**Industrial Processes - Chemical Industry - Ammonia production**	**CO2**	**481.68**	**481.68**	**0.7%**	**89.3%**
1B2dCH4	**Energy - Fugitive Emissions from Fuels - Oil and Natural Gas**	**CH4**	**474.05**	**474.05**	**0.7%**	**90.0%**
5C1CO2	**LULUCF - Grassland remaining Grassland**	**CO2**	**462.79**	**462.79**	**0.7%**	**90.7%**
1A1bgaCO2	**Energy - Stationary Combustion - Petroleum refining**	**CO2**	**433.17**	**433.17**	**0.6%**	**91.3%**
5B2CO2	**LULUCF - Cropland - converted to**	**CO2**	**339.11**	**339.11**	**0.5%**	**91.8%**
1A2liCO2	**Energy - Manufacturing Industries and Construction**	**CO2**	**326.45**	**326.45**	**0.5%**	**92.3%**
2A3CO2	**Industrial Processes - Mineral Products - Limestone and dolomite use**	**CO2**	**324.40**	**324.40**	**0.5%**	**92.8%**
6B2CH4	**Waste - Waste-water Handling - Domestic and Commercial**	**CH4**	**282.85**	**282.85**	**0.4%**	**93.2%**
3dN2O	**Solvent and Other Product Use - Other**	**N2O**	**276.62**	**276.62**	**0.4%**	**93.6%**
1A1aotCO2	**Energy - Stationary Combustion - Public electricity and heat production**	**CO2**	**272.38**	**272.38**	**0.4%**	**94.0%**
6B2N2O	**Waste - Waste-water Handling - Domestic and Commercial**	**N2O**	**265.20**	**265.20**	**0.4%**	**94.4%**
5E2CO2	**LULUCF - Land converted to Settlements**	**CO2**	**228.61**	**228.61**	**0.3%**	**94.7%**
4D2N2O	**Agriculture - Agricultural Soils - Pasture, range and paddock manure**	**N2O**	**226.69**	**226.69**	**0.3%**	**95.0%**
1A4biCH4	Energy - Stationary Combustion - Other	CH4	226.18	226.18	0.3%	95.3%

CRF code + note	IPCC Categories	Direct Greenhouse Gas	Current Year (2012) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment %	Cumulative Total %
2C1CO2	Industrial Processes - Metal Production - Iron and steel production	CO2	217.66	217.66	0.3%	95.7%
4B14otN2O	Agriculture - Manure Management /Other AWMS	N2O	216.04	216.04	0.3%	96.0%
4A3shCH4	Agriculture - Enteric Fermentation /Sheep	CH4	191.69	191.69	0.3%	96.3%
1A1csoCO2	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CO2	178.04	178.04	0.3%	96.5%
1A1aliCO2	Energy - Stationary Combustion - Public electricity and heat production	CO2	177.71	177.71	0.3%	96.8%
1A3cliCO2	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	CO2	146.02	146.02	0.2%	97.0%
2A2CO2	Industrial Processes - Mineral Products - Lime production	CO2	140.07	140.07	0.2%	97.2%
2A7CO2	Industrial Processes - Mineral Products - Other	CO2	137.51	137.51	0.2%	97.4%
5C2CO2	LULUCF - Land converted to Grassland	CO2	-114.71	114.71	0.2%	97.6%
2Fa8SF6	Industrial Processes - Consumption of Halocarbons and SF6 - Electrical equipment	SF6	103.08	103.08	0.2%	97.7%
2Fa2HFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Foam blowing	HFCs	101.72	101.72	0.1%	97.9%
1B2bCO2	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO2	94.64	94.64	0.1%	98.0%
6CCO2	Waste - Waste Incineration	CO2	93.01	93.01	0.1%	98.1%
4A8swCH4	Agriculture - Enteric Fermentation	CH4	92.98	92.98	0.1%	98.3%
1A2otCO2	Energy - Manufacturing Industries and Construction	CO2	87.24	87.24	0.1%	98.4%
1B2cCO2	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO2	80.45	80.45	0.1%	98.5%
1A3bldN2O	Energy - Mobile combustion - Road transportation	N2O	71.82	71.82	0.1%	98.6%
1A3bllCO2	Energy - Mobile combustion - Road transportation	CO2	61.62	61.62	0.1%	98.7%
2Fa9SF6	Industrial Processes - Consumption of Halocarbons and SF6 - Other	SF6	50.29	50.29	0.1%	98.8%
2Fa4HFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Aerosols	HFCs	46.44	46.44	0.1%	98.8%
1A4biN2O	Energy - Stationary Combustion - Other	N2O	44.52	44.52	0.1%	98.9%
1B2cCH4	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	40.35	40.35	0.1%	99.0%
1A4soCH4	Energy - Stationary Combustion - Other	CH4	40.24	40.24	0.1%	99.0%
3cCO2	Solvent and Other Product Use - Chemical Products	CO2	38.87	38.87	0.1%	99.1%
5B2N2O	LULUCF - Cropland - converted to	N2O	38.10	38.10	0.1%	99.1%
1B2aCH4	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	36.97	36.97	0.1%	99.2%
2B5CH4	Industrial Processes - Chemical Industry - Other	CH4	35.01	35.01	0.1%	99.2%
1A3blgN2O	Energy - Mobile combustion - Road transportation	N2O	34.01	34.01	0.0%	99.3%
1A1asoN2O	Energy - Stationary Combustion - Public electricity and heat production	N2O	30.67	30.67	0.0%	99.3%

CRF code + note	IPCC Categories	Direct Greenhouse Gas	Current Year (2012) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment %	Cumulative Total %
5A1CH4	LULUCF - Forest Land - remaining	CH4	30.63	30.63	0.0%	99.4%
4A6horseCH4	Agriculture - Enteric Fermentation /Horse	CH4	28.76	28.76	0.0%	99.4%
3aCO2	Solvent and Other Product Use - Paint Application	CO2	28.22	28.22	0.0%	99.5%
6B1CH4	Waste - Waste-water Handling - Industrial	CH4	26.75	26.75	0.0%	99.5%
2B2N2O	Industrial Processes - Chemical Industry - Nitric acid production	N2O	22.80	22.80	0.0%	99.5%
1A1abiN2O	Energy - Stationary Combustion - Public electricity and heat production	N2O	21.43	21.43	0.0%	99.6%
4B9poCH4	Agriculture - Manure Management /Poultry	CH4	20.99	20.99	0.0%	99.6%
1A1botCO2	Energy - Stationary Combustion - Petroleum refining	CO2	20.30	20.30	0.0%	99.6%
1A4gaCH4	Energy - Stationary Combustion - Other	CH4	18.64	18.64	0.0%	99.7%
1A3blgCH4	Energy - Mobile combustion - Road transportation	CH4	18.17	18.17	0.0%	99.7%
6DN2O	Waste - Other	N2O	17.01	17.01	0.0%	99.7%
4A(2,4,7,10,R)buf,goat,mule,rabbit, otCH4	Agriculture - Enteric Fermentation	CH4	15.45	15.45	0.0%	99.7%
6DCH4	Waste - Other	CH4	15.36	15.36	0.0%	99.8%
4A9poCH4	Agriculture - Enteric Fermentation	CH4	13.52	13.52	0.0%	99.8%
4CCH4	Agriculture - Rice Cultivation	CH4	12.43	12.43	0.0%	99.8%
1B1aCH4	Energy - Fugitive Emissions from Fuels - Solid Fuels	CH4	10.98	10.98	0.0%	99.8%
2Fa3HFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Fire extinguishers	HFCs	10.96	10.96	0.0%	99.8%
1A1abiCH4	Energy - Stationary Combustion - Public electricity and heat production	CH4	10.89	10.89	0.0%	99.8%
3bCO2	Solvent and Other Product Use - Degreasing and Dry Cleaning	CO2	6.73	6.73	0.0%	99.8%
5D1CO2	LULUCF - Wetlands remaining wetlands	CO2	6.55	6.55	0.0%	99.9%
1A4gaN2O	Energy - Stationary Combustion - Other	N2O	5.50	5.50	0.0%	99.9%
4B12liN2O	Agriculture - Manure Management	N2O	5.20	5.20	0.0%	99.9%
1A1aotN2O	Energy - Stationary Combustion - Public electricity and heat production	N2O	4.84	4.84	0.0%	99.9%
1A3bldCH4	Energy - Mobile combustion - Road transportation	CH4	4.62	4.62	0.0%	99.9%
1A2gaCH4	Energy - Manufacturing Industries and Construction	CH4	4.50	4.50	0.0%	99.9%
4B3shCH4	Agriculture - Manure Management /Sheep	CH4	4.45	4.45	0.0%	99.9%
2C1CH4	Industrial Processes - Metal Production - Iron and steel production	CH4	4.11	4.11	0.0%	99.9%
1A2biN2O	Energy - Manufacturing Industries and Construction	N2O	3.21	3.21	0.0%	99.9%
1A1agaN2O	Energy - Stationary Combustion - Public electricity and heat production	N2O	3.15	3.15	0.0%	99.9%
5A1N2O	LULUCF - Forest Land - remaining	N2O	3.12	3.12	0.0%	99.9%

CRF code + note	IPCC Categories	Direct Greenhouse Gas	Current Year (2012) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment %	Cumulative Total %
5D2CO2	LULUCF - Land converted to Wetlands	CO2	3.02	3.02	0.0%	99.9%
1A4liCH4	Energy - Stationary Combustion - Other	CH4	2.97	2.97	0.0%	99.9%
6CN2O	Waste - Waste Incineration	N2O	2.89	2.89	0.0%	99.9%
1A4soN2O	Energy - Stationary Combustion - Other	N2O	2.79	2.79	0.0%	99.9%
1A1bliN2O	Energy - Stationary Combustion - Petroleum refining	N2O	2.71	2.71	0.0%	99.9%
1A4liN2O	Energy - Stationary Combustion - Other	N2O	2.63	2.63	0.0%	99.9%
1A3bgnCO2	Energy - Mobile combustion - Road transportation	CO2	2.61	2.61	0.0%	99.9%
1A1aotCH4	Energy - Stationary Combustion - Public electricity and heat production	CH4	2.46	2.46	0.0%	100.0%
1A1cgaCO2	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CO2	2.41	2.41	0.0%	100.0%
4B6horseCH4	Agriculture - Manure Management /Horse	CH4	2.22	2.22	0.0%	100.0%
1A1agaCH4	Energy - Stationary Combustion - Public electricity and heat production	CH4	2.14	2.14	0.0%	100.0%
4B(2,4,7,10,R)buf,goat,mule,rabbit,otCH4	Agriculture - Manure Management /Buffalo, goat, mule, rabbit, other	CH4	2.13	2.13	0.0%	100.0%
5C1CH4	LULUCF - Grassland remaining Grassland	CH4	1.91	1.91	0.0%	100.0%
1A2otN2O	Energy - Manufacturing Industries and Construction	N2O	1.64	1.64	0.0%	100.0%
1A2biCH4	Energy - Manufacturing Industries and Construction	CH4	1.64	1.64	0.0%	100.0%
1A1asoCH4	Energy - Stationary Combustion - Public electricity and heat production	CH4	1.61	1.61	0.0%	100.0%
1A2soN2O	Energy - Manufacturing Industries and Construction	N2O	1.60	1.60	0.0%	100.0%
2Fa1PFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Refrigeration and air conditioning equipment	PFCs	1.37	1.37	0.0%	100.0%
1A2gaN2O	Energy - Manufacturing Industries and Construction	N2O	1.33	1.33	0.0%	100.0%
1A3bllCH4	Energy - Mobile combustion - Road transportation	CH4	1.29	1.29	0.0%	100.0%
5B1CH4	LULUCF - Cropland - remaining	CH4	1.23	1.23	0.0%	100.0%
6CCH4	Waste - Waste Incineration	CH4	1.16	1.16	0.0%	100.0%
5C1N2O	LULUCF - Grassland remaining Grassland	N2O	1.04	1.04	0.0%	100.0%
1A1bliCH4	Energy - Stationary Combustion - Petroleum refining	CH4	0.92	0.92	0.0%	100.0%
1A2otCH4	Energy - Manufacturing Industries and Construction	CH4	0.83	0.83	0.0%	100.0%
1A2soCH4	Energy - Manufacturing Industries and Construction	CH4	0.81	0.81	0.0%	100.0%
2A4CO2	Industrial Processes - Mineral Products - Soda Ash Use	CO2	0.74	0.74	0.0%	100.0%
1A2liN2O	Energy - Manufacturing Industries and Construction	N2O	0.69	0.69	0.0%	100.0%
1A1aliN2O	Energy - Stationary Combustion - Public electricity and heat production	N2O	0.42	0.42	0.0%	100.0%

CRF code + note	IPCC Categories	Direct Greenhouse Gas	Current Year (2012) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment %	Cumulative Total %
1A3cliN2O	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	N2O	0.38	0.38	0.0%	100.0%
1A1botN2O	Energy - Stationary Combustion - Petroleum refining	N2O	0.34	0.34	0.0%	100.0%
5B1N2O	LULUCF - Cropland - remaining	N2O	0.33	0.33	0.0%	100.0%
1A1bgaN2O	Energy - Stationary Combustion - Petroleum refining	N2O	0.24	0.24	0.0%	100.0%
1A3cliCH4	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	CH4	0.21	0.21	0.0%	100.0%
1B2aCO2	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO2	0.21	0.21	0.0%	100.0%
1B2cN2O	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N2O	0.19	0.19	0.0%	100.0%
1A1botCH4	Energy - Stationary Combustion - Petroleum refining	CH4	0.17	0.17	0.0%	100.0%
1A1bgaCH4	Energy - Stationary Combustion - Petroleum refining	CH4	0.16	0.16	0.0%	100.0%
1A2liCH4	Energy - Manufacturing Industries and Construction	CH4	0.16	0.16	0.0%	100.0%
1A1aliCH4	Energy - Stationary Combustion - Public electricity and heat production	CH4	0.14	0.14	0.0%	100.0%
1A1csoN2O	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	N2O	0.12	0.12	0.0%	100.0%
1A1csoCH4	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CH4	0.08	0.08	0.0%	100.0%
1A3bllN2O	Energy - Mobile combustion - Road transportation	N2O	0.06	0.06	0.0%	100.0%
1A3bgnCH4	Energy - Mobile combustion - Road transportation	CH4	0.05	0.05	0.0%	100.0%
1A1cbiN2O	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	N2O	0.01	0.01	0.0%	100.0%
1A1cbiCH4	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CH4	0.01	0.01	0.0%	100.0%
1A3bgnN2O	Energy - Mobile combustion - Road transportation	N2O	0.00	0.00	0.0%	100.0%
1A1cgaN2O	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	N2O	0.00	0.00	0.0%	100.0%
1A1cgaCH4	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CH4	0.00	0.00	0.0%	100.0%
2B2CO2	Industrial Processes - Chemical Industry - Nitric acid production	CO2	0.00	0.00	0.0%	100.0%
1A1bbiCH4	Energy - Stationary Combustion - Petroleum refining	CH4	NO	0.00	0.0%	100.0%
1A1bbiN2O	Energy - Stationary Combustion - Petroleum refining	N2O	NO	0.00	0.0%	100.0%
1A1cliCH4	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CH4	NO	0.00	0.0%	100.0%
1A1cliCO2	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CO2	NO	0.00	0.0%	100.0%

CRF code + note	IPCC Categories	Direct Greenhouse Gas	Current Year (2012) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment %	Cumulative Total %
1A1cliN2O	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	N2O	NO	0.00	0.0%	100.0%
1A3bbiCH4	Energy - Mobile combustion - Road transportation	CH4	IE	0.00	0.0%	100.0%
1A3bbiN2O	Energy - Mobile combustion - Road transportation	N2O	IE	0.00	0.0%	100.0%
1A3cgaCH4	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	CH4	0.00	0.00	0.0%	100.0%
1A3cgaCO2	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	CO2	0.00	0.00	0.0%	100.0%
1A3cgaN2O	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	N2O	0.00	0.00	0.0%	100.0%
1A3csoCH4	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	CH4	NO	0.00	0.0%	100.0%
1A3csoCO2	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	CO2	NO	0.00	0.0%	100.0%
1A3csoN2O	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	N2O	NO	0.00	0.0%	100.0%
1B1aCO2	Energy - Fugitive Emissions from Fuels - Solid Fuels	CO2	IE,NA,NO	0.00	0.0%	100.0%
1B1aN2O	Energy - Fugitive Emissions from Fuels - Solid Fuels	N2O	NA,NO	0.00	0.0%	100.0%
1B2aN2O	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N2O	IE,NO	0.00	0.0%	100.0%
1B2bN2O	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N2O	0.00	0.00	0.0%	100.0%
1B2dCO2	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO2	NA	0.00	0.0%	100.0%
1B2dN2O	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N2O	NA	0.00	0.0%	100.0%
2A5CO2	Industrial Processes - Mineral Products - Asphalt roofing	CO2	NA	0.00	0.0%	100.0%
2A6CO2	Industrial Processes - Mineral Products - Road paving with asphalt	CO2	NA	0.00	0.0%	100.0%
2A7CH4	Industrial Processes - Mineral Products - Other	CH4	NA,NO	0.00	0.0%	100.0%
2A7N2O	Industrial Processes - Mineral Products - Other	N2O	NA,NO	0.00	0.0%	100.0%
2B1CH4	Industrial Processes - Chemical Industry - Ammonia production	CH4	NO	0.00	0.0%	100.0%
2B1N2O	Industrial Processes - Chemical Industry - Ammonia production	N2O	NO	0.00	0.0%	100.0%
2B5CO2	Industrial Processes - Chemical Industry - Other	CO2	IE,NO	0.00	0.0%	100.0%
2B5N2O	Industrial Processes - Chemical Industry - Other	N2O	NO	0.00	0.0%	100.0%
2C2CH4	Industrial Processes - Metal Production - Ferroalloys production	CH4	NO	0.00	0.0%	100.0%
2C2CO2	Industrial Processes - Metal Production - Ferroalloys production	CO2	NO	0.00	0.0%	100.0%
2C3CH4	Industrial Processes - Metal Production - Aluminium production	CH4	NO	0.00	0.0%	100.0%
2C3CO2	Industrial Processes - Metal Production - Aluminium production	CO2	NO	0.00	0.0%	100.0%
2C4PFCs	Industrial Processes - Metal Production - Aluminium production	PFCs	NO	0.00	0.0%	100.0%
2DCO2	Industrial Processes - Other Production	CO2	NO	0.00	0.0%	100.0%
2EHFCs	Industrial Processes - Production of Halocarbons and SF6	HFCs	NA,NO	0.00	0.0%	100.0%
2EPFCs	Industrial Processes - Production of Halocarbons and SF6	PFCs	NA	0.00	0.0%	100.0%
2ESF6	Industrial Processes - Production of Halocarbons and SF6	SF6	NA,NO	0.00	0.0%	100.0%

CRF code + note	IPCC Categories	Direct Greenhouse Gas	Current Year (2012) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment %	Cumulative Total %
2Fa2PFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Foam blowing	PFCs	NO	0.00	0.0%	100.0%
2Fa3PFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Fire extinguishers	PFCs	NO	0.00	0.0%	100.0%
2Fa4PFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Aerosols	PFCs	NO	0.00	0.0%	100.0%
4FCH4	Agriculture - Field Burning of Agricultural Residues	CH4	NA,NO	0.00	0.0%	100.0%
4FN2O	Agriculture - Field Burning of Agricultural Residues	N2O	NA,NO	0.00	0.0%	100.0%
5A2CH4	LULUCF - Forest Land - converted to	CH4	NO	0.00	0.0%	100.0%
5A2N2O	LULUCF - Forest Land - converted to	N2O	IE,NO	0.00	0.0%	100.0%
5B2CH4	LULUCF - Cropland - converted to	CH4	IE,NO	0.00	0.0%	100.0%
5F2CO2	LULUCF - Land converted to Other Land	CO2	NE,NO	0.00	0.0%	100.0%

Table A1-4 *TIER1 Trend Assessment*

CRF Code + note	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (abs. Gg CO_2-eq.)	Current Year (2012) Emission (abs. Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total %
1A4gaCO2	**Energy - Stationary Combustion - Other**	**CO2**	**4582.97**	**9909.87**	**0.18**	**13.0%**	**13.0%**
1A4soCO2	**Energy - Stationary Combustion - Other**	**CO2**	**12205.88**	**645.65**	**0.16**	**11.6%**	**24.7%**
1A3bldCO2	**Energy - Mobile combustion - Road transportation**	**CO2**	**2761.76**	**6858.60**	**0.13**	**9.4%**	**34.1%**
1A2gaCO2	**Energy - Manufacturing Industries and Construction**	**CO2**	**9429.39**	**2392.40**	**0.08**	**5.6%**	**39.7%**
1A4liCO2	**Energy - Stationary Combustion - Other**	**CO2**	**6735.10**	**985.65**	**0.07**	**5.3%**	**45.0%**
1A1agaCO2	**Energy - Stationary Combustion - Public electricity and heat production**	**CO2**	**4747.70**	**5656.89**	**0.07**	**5.2%**	**50.2%**
1A2soCO2	**Energy - Manufacturing Industries and Construction**	**CO2**	**6736.23**	**1163.05**	**0.07**	**5.0%**	**55.1%**
2B2N2O	**Industrial Processes - Chemical Industry - Nitric acid production**	**N2O**	**4541.51**	**22.80**	**0.07**	**4.7%**	**59.8%**
1A1aliCO2	**Energy - Stationary Combustion - Public electricity and heat production**	**CO2**	**4068.70**	**177.71**	**0.05**	**3.9%**	**63.8%**
1A2liCO2	**Energy - Manufacturing Industries and Construction**	**CO2**	**4190.03**	**326.45**	**0.05**	**3.8%**	**67.6%**

CRF Code + note	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (abs. Gg CO_2-eq.)	Current Year (2012) Emission (abs. Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total %
6ACH4	**Waste - Solid Waste Disposal on Land**	**CH4**	**1471.30**	**2472.02**	**0.04**	**2.9%**	**70.5%**
5B1CO2	**LULUCF - Cropland - remaining**	**CO2**	**181.82**	**1590.94**	**0.04**	**2.7%**	**73.2%**
1A3blgCO2	**Energy - Mobile combustion - Road transportation**	**CO2**	**4083.88**	**3649.45**	**0.03**	**2.3%**	**75.5%**
5A1CO2	**LULUCF - Forest Land - remaining**	**CO2**	**2776.67**	**2720.78**	**0.03**	**2.0%**	**77.4%**
5A2CO2	**LULUCF - Forest Land - converted to**	**CO2**	**128.22**	**1097.14**	**0.03**	**1.8%**	**79.3%**
1B2bCH4	**Energy - Fugitive Emissions from Fuels - Oil and Natural Gas**	**CH4**	**946.54**	**1484.95**	**0.02**	**1.7%**	**81.0%**
2Fa1HFCs	**Industrial Processes - Consumption of Halocarbons and SF6 - Refrigeration and air conditioning equipment**	**HFCs**	**0.00**	**846.70**	**0.02**	**1.5%**	**82.5%**
1A1asoCO2	**Energy - Stationary Combustion - Public electricity and heat production**	**CO2**	**13912.62**	**8732.26**	**0.02**	**1.1%**	**83.6%**
1B1aCH4	**Energy - Fugitive Emissions from Fuels - Solid Fuels**	**CH4**	**923.01**	**10.98**	**0.01**	**0.9%**	**84.5%**
4B8swCH4	**Agriculture - Manure Management /Swine**	**CH4**	**2047.40**	**701.51**	**0.01**	**0.9%**	**85.4%**
2G1CO2	**Industrial Processes - Feedstocks**	**CO2**	**1034.33**	**1070.95**	**0.01**	**0.8%**	**86.3%**
1A3cliCO2	**Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation**	**CO2**	**1042.55**	**146.02**	**0.01**	**0.8%**	**87.1%**
2B1CO2	**Industrial Processes - Chemical Industry - Ammonia production**	**CO2**	**1616.22**	**481.68**	**0.01**	**0.8%**	**87.9%**
5C1CO2	**LULUCF - Grassland remaining Grassland**	**CO2**	**13.12**	**462.79**	**0.01**	**0.8%**	**88.7%**
1A4soCH4	**Energy - Stationary Combustion - Other**	**CH4**	**713.78**	**40.24**	**0.01**	**0.7%**	**89.4%**
2A1CO2	**Industrial Processes - Mineral Products - Cement production**	**CO2**	**1778.28**	**678.42**	**0.01**	**0.6%**	**90.1%**
4A1caCH4	**Agriculture - Enteric Fermentation /Cattle**	**CH4**	**2596.32**	**1159.85**	**0.01**	**0.6%**	**90.7%**
5B2CO2	**LULUCF - Cropland - converted to**	**CO2**	**18.96**	**339.11**	**0.01**	**0.6%**	**91.3%**
4D3N2O	**Agriculture - Agricultural Soils - Indirect emissions**	**N2O**	**3845.10**	**1929.42**	**0.01**	**0.6%**	**91.8%**
1A1aotCO2	**Energy - Stationary Combustion - Public electricity and heat production**	**CO2**	**44.08**	**272.38**	**0.01**	**0.4%**	**92.3%**
2A7CO2	**Industrial Processes - Mineral Products - Other**	**CO2**	**642.13**	**137.51**	**0.01**	**0.4%**	**92.7%**
4B13soN2O	**Agriculture - Manure Management /Solid**	**N2O**	**1478.83**	**630.52**	**0.01**	**0.4%**	**93.1%**
1B2dCH4	**Energy - Fugitive Emissions from Fuels - Oil and Natural Gas**	**CH4**	**434.74**	**474.05**	**0.01**	**0.4%**	**93.5%**
2A2CO2	**Industrial Processes - Mineral Products - Lime production**	**CO2**	**606.79**	**140.07**	**0.01**	**0.4%**	**93.9%**
4D1.2-4. N2O	**Agriculture - Agricultural Soils - Direct soil emissions /Animal Manure and other**	**N2O**	**2443.42**	**1215.57**	**0.01**	**0.4%**	**94.3%**
5E2CO2	**LULUCF - Land converted to Settlements**	**CO2**	**70.72**	**228.61**	**0.00**	**0.3%**	**94.6%**
3dN2O	**Solvent and Other Product Use - Other**	**N2O**	**154.17**	**276.62**	**0.00**	**0.3%**	**95.0%**
2A3CO2	Industrial Processes - Mineral Products - Limestone and dolomit use	CO2	248.68	324.40	0.00	0.3%	95.3%

CRF Code + note	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (abs. Gg CO_2-eq.)	Current Year (2012) Emission (abs. Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total %
4D1.1. N2O	Agriculture - Agricultural Soils - Direct soil emissions /Syntetic Fertilizer	N2O	3225.36	1715.02	0.00	0.3%	95.6%
4B1caCH4	Agriculture - Manure Management /Cattle	CH4	1176.54	521.05	0.00	0%	96%
1A4biCH4	Energy - Stationary Combustion - Other	CH4	128.69	226.18	0.00	0%	96%
2C1CO2	Industrial Processes - Metal Production - Iron and steel production	CO2	616.08	217.66	0.00	0%	96%
6B2CH4	Waste - Waste-water Handling - Domestic and Commercial	CH4	722.85	282.85	0.00	0%	97%
1A1bgaCO2	Energy - Stationary Combustion - Petroleum refining	CO2	541.02	433.17	0.00	0%	97%
5C2CO2	LULUCF - Land converted to Grassland	CO2	0.92	114.71	0.00	0%	97%
2Fa2HFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Foam blowing	HFCs	0.00	101.72	0.00	0%	97%
6CCO2	Waste - Waste Incineration	CO2	0.00	93.01	0.00	0%	97%
6B2N2O	Waste - Waste-water Handling - Domestic and Commercial	N2O	300.31	265.20	0.00	0%	98%
1A2otCO2	Energy - Manufacturing Industries and Construction	CO2	0.00	87.24	0.00	0%	98%
4A8swCH4	Agriculture - Enteric Fermentation /Swine	CH4	282.33	92.98	0.00	0%	98%
1A1bliCO2	Energy - Stationary Combustion - Petroleum refining	CO2	1783.76	976.98	0.00	0%	98%
1A3bllCO2	Energy - Mobile combustion - Road transportation	CO2	0.00	61.62	0.00	0%	98%
2Fa8SF6	Industrial Processes - Consumption of Halocarbons and SF6 - Electrical equipment	SF6	73.05	103.08	0.00	0%	98%
4A3shCH4	Agriculture - Enteric Fermentation /Sheep	CH4	419.71	191.69	0.00	0%	98%
6B1CH4	Waste - Waste-water Handling - Industrial	CH4	135.44	26.75	0.00	0%	98%
4B14otN2O	Agriculture - Manure Management /Other AWMS	N2O	459.04	216.04	0.00	0%	98%
2Fa9SF6	Industrial Processes - Consumption of Halocarbons and SF6 - Other	SF6	0.00	50.29	0.00	0%	99%
1B2cCO2	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO2	221.98	80.45	0.00	0%	99%
4D2N2O	Agriculture - Agricultural Soils - Pasture, range and paddock manure	N2O	307.95	226.69	0.00	0%	99%
2Fa4HFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Aerosols	HFCs	0.00	46.44	0.00	0%	99%
1A3bldN2O	Energy - Mobile combustion - Road transportation	N2O	48.67	71.82	0.00	0%	99%
1A1csoCO2	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CO2	233.17	178.04	0.00	0%	99%
5B2N2O	LULUCF - Cropland - converted to	N2O	4.62	38.10	0.00	0%	99%
1B2cCH4	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	127.27	40.35	0.00	0%	99%
4B9poCH4	Agriculture - Manure Management /Poultry	CH4	92.25	20.99	0.00	0%	99%
2B5CH4	Industrial Processes - Chemical Industry - Other	CH4	7.84	35.01	0.00	0%	99%
1A4biN2O	Energy - Stationary Combustion - Other	N2O	25.33	44.52	0.00	0%	99%
1A4soN2O	Energy - Stationary Combustion - Other	N2O	54.68	2.79	0.00	0%	99%

CRF Code + note	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (abs. Gg CO_2-eq.)	Current Year (2012) Emission (abs. Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total %
1B2aCH4	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	104.93	36.97	0.00	0%	99%
3aCO2	Solvent and Other Product Use - Paint Application	CO2	89.42	28.22	0.00	0%	99%
1A1abiN2O	Energy - Stationary Combustion - Public electricity and heat production	N2O	0.00	21.43	0.00	0%	99%
1A1botCO2	Energy - Stationary Combustion - Petroleum refining	CO2	0.00	20.30	0.00	0%	99%
4CCH4	Agriculture - Rice Cultivation	CH4	50.54	12.43	0.00	0%	100%
6DN2O	Waste - Other	N2O	0.00	17.01	0.00	0%	100%
3cCO2	Solvent and Other Product Use - Chemical Products	CO2	39.30	38.87	0.00	0%	100%
1B2bCO2	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO2	135.86	94.64	0.00	0%	100%
6DCH4	Waste - Other	CH4	0.00	15.36	0.00	0%	100%
5A1CH4	LULUCF - Forest Land - remaining	CH4	28.79	30.63	0.00	0%	100%
1A4gaCH4	Energy - Stationary Combustion - Other	CH4	8.62	18.64	0.00	0%	100%
4A(2,4,7,10,R)buf,goat,mule,rabbit,otCH4	Agriculture - Enteric Fermentation /Buffalo, goat,mule, rabbit, other	CH4	7.47	15.45	0.00	0%	100%
2Fa3HFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Fire extinguishers	HFCs	0.00	10.96	0.00	0%	100%
1A1abiCH4	Energy - Stationary Combustion - Public electricity and heat production	CH4	0.00	10.89	0.00	0%	100%
1A3blgN2O	Energy - Mobile combustion - Road transportation	N2O	42.49	34.01	0.00	0%	100%
1A1cgaCO2	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CO2	19.91	2.41	0.00	0%	100%
1A4liCH4	Energy - Stationary Combustion - Other	CH4	19.75	2.97	0.00	0%	100%
1A4liN2O	Energy - Stationary Combustion - Other	N2O	17.49	2.63	0.00	0%	100%
4A6horseCH4	Agriculture - Enteric Fermentation /Horse	CH4	37.31	28.76	0.00	0%	100%
1A2soN2O	Energy - Manufacturing Industries and Construction	N2O	14.16	1.60	0.00	0%	100%
5D1CO2	LULUCF - Wetlands remaining wetlands	CO2	21.46	6.55	0.00	0%	100%
1A2gaCH4	Energy - Manufacturing Industries and Construction	CH4	17.74	4.50	0.00	0%	100%
1A3blgCH4	Energy - Mobile combustion - Road transportation	CH4	40.61	18.17	0.00	0%	100%
1A2liN2O	Energy - Manufacturing Industries and Construction	N2O	10.30	0.69	0.00	0%	100%
1A1aliN2O	Energy - Stationary Combustion - Public electricity and heat production	N2O	9.78	0.42	0.00	0%	100%
1A1asoN2O	Energy - Stationary Combustion - Public electricity and heat production	N2O	61.27	30.67	0.00	0%	100%
1A4gaN2O	Energy - Stationary Combustion - Other	N2O	2.55	5.50	0.00	0%	100%
1A1aotN2O	Energy - Stationary Combustion - Public electricity and heat production	N2O	1.95	4.84	0.00	0%	100%
1A2soCH4	Energy - Manufacturing Industries and Construction	CH4	6.95	0.81	0.00	0%	100%

CRF Code + note	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (abs. Gg CO_2-eq.)	Current Year (2012) Emission (abs. Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total %
4B3shCH4	Agriculture - Manure Management /Sheep	CH4	12.89	4.45	0.00	0%	100%
4B12liN2O	Agriculture - Manure Management /Liquid	N2O	13.87	5.20	0.00	0%	100%
6CN2O	Waste - Waste Incineration	N2O	0.00	2.89	0.00	0%	100%
1A3bldCH4	Energy - Mobile combustion - Road transportation	CH4	3.27	4.62	0.00	0%	100%
1A2biN2O	Energy - Manufacturing Industries and Construction	N2O	0.94	3.21	0.00	0%	100%
3bCO2	Solvent and Other Product Use - Degreasing and Dry Cleaning	CO2	7.02	6.73	0.00	0%	100%
1A3bgnCO2	Energy - Mobile combustion - Road transportation	CO2	0.00	2.61	0.00	0%	100%
1A1aotCH4	Energy - Stationary Combustion - Public electricity and heat production	CH4	0.99	2.46	0.00	0%	100%
1A1aliCH4	Energy - Stationary Combustion - Public electricity and heat production	CH4	3.31	0.14	0.00	0%	100%
1A2gaN2O	Energy - Manufacturing Industries and Construction	N2O	5.24	1.33	0.00	0%	100%
1A2otN2O	Energy - Manufacturing Industries and Construction	N2O	0.00	1.64	0.00	0%	100%
1A1agaN2O	Energy - Stationary Combustion - Public electricity and heat production	N2O	2.64	3.15	0.00	0%	100%
4A9poCH4	Agriculture - Enteric Fermentation /Poultry	CH4	25.75	13.52	0.00	0%	100%
5C1CH4	LULUCF - Grassland remaining Grassland	CH4	0.73	1.91	0.00	0%	100%
5A1N2O	LULUCF - Forest Land - remaining	N2O	2.92	3.12	0.00	0%	100%
2Fa1PFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Refrigeration and air conditioning equipment	PFCs	0.00	1.37	0.00	0%	100%
1A2biCH4	Energy - Manufacturing Industries and Construction	CH4	0.48	1.64	0.00	0%	100%
1A3bllCH4	Energy - Mobile combustion - Road transportation	CH4	0.00	1.29	0.00	0%	100%
1A2liCH4	Energy - Manufacturing Industries and Construction	CH4	2.33	0.16	0.00	0%	100%
1A3cliN2O	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	N2O	2.69	0.38	0.00	0%	100%
6CCH4	Waste - Waste Incineration	CH4	0.00	1.16	0.00	0%	100%
1A1agaCH4	Energy - Stationary Combustion - Public electricity and heat production	CH4	1.79	2.14	0.00	0%	100%
5D2CO2	LULUCF - Land converted to Wetlands	CO2	3.42	3.02	0.00	0%	100%
1A2otCH4	Energy - Manufacturing Industries and Construction	CH4	0.00	0.83	0.00	0%	100%
5C1N2O	LULUCF - Grassland remaining Grassland	N2O	0.39	1.04	0.00	0%	100%
2C1CH4	Industrial Processes - Metal Production - Iron and steel production	CH4	8.25	4.11	0.00	0%	100%
1A3cliCH4	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	CH4	1.51	0.21	0.00	0%	100%
4B6horseCH4	Agriculture - Manure Management /Horse	CH4	2.88	2.22	0.00	0%	100%
5B1CH4	LULUCF - Cropland - remaining	CH4	1.24	1.23	0.00	0%	100%
4B(2,4,7,10,R)buf,goat,mule,rabbit,otC	Agriculture - Manure Management /Buffalo, goat,mule, rabbit, other	CH4	4.41	2.13	0.00	0%	100%

CRF Code + note	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (abs. Gg CO_2-eq.)	Current Year (2012) Emission (abs. Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total %
H4							
1A1botN2O	Energy - Stationary Combustion - Petroleum refining	N2O	0.00	0.34	0.00	0%	100%
1B2aCO2	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO2	0.67	0.21	0.00	0%	100%
2A4CO2	Industrial Processes - Mineral Products - Soda Ash Use	CO2	0.96	0.74	0.00	0%	100%
1A1botCH4	Energy - Stationary Combustion - Petroleum refining	CH4	0.00	0.17	0.00	0%	100%
1B2cN2O	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N2O	0.60	0.19	0.00	0%	100%
5B1N2O	LULUCF - Cropland - remaining	N2O	0.33	0.33	0.00	0%	100%
1A1asoCH4	Energy - Stationary Combustion - Public electricity and heat production	CH4	2.96	1.61	0.00	0%	100%
1A1bgaN2O	Energy - Stationary Combustion - Petroleum refining	N2O	0.30	0.24	0.00	0%	100%
1A1bliN2O	Energy - Stationary Combustion - Petroleum refining	N2O	4.76	2.71	0.00	0%	100%
1A3bllN2O	Energy - Mobile combustion - Road transportation	N2O	0.00	0.06	0.00	0%	100%
1A3bgnCH4	Energy - Mobile combustion - Road transportation	CH4	0.00	0.05	0.00	0%	100%
1A1csoCH4	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CH4	0.05	0.08	0.00	0%	100%
2B2CO2	Industrial Processes - Chemical Industry - Nitric acid production	CO2	0.08	0.00	0.00	0%	100%
1A1bgaCH4	Energy - Stationary Combustion - Petroleum refining	CH4	0.20	0.16	0.00	0%	100%
1A1csoN2O	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	N2O	0.25	0.12	0.00	0%	100%
1A1bliCH4	Energy - Stationary Combustion - Petroleum refining	CH4	1.61	0.92	0.00	0%	100%
1A1cbiN2O	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	N2O	0.00	0.01	0.00	0%	100%
1A1cbiCH4	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CH4	0.00	0.01	0.00	0%	100%
1A1cgaN2O	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	N2O	0.01	0.00	0.00	0%	100%
1A1cgaCH4	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CH4	0.01	0.00	0.00	0%	100%
1A3bgnN2O	Energy - Mobile combustion - Road transportation	N2O	0.00	0.00	0.00	0%	100%
1A1bbiCH4	Energy - Stationary Combustion - Petroleum refining	CH4	0.00	0.00	0.00	0%	100%
1A1bbiN2O	Energy - Stationary Combustion - Petroleum refining	N2O	0.00	0.00	0.00	0%	100%
1A1cliCH4	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CH4	0.02	0.00	0.00	0%	100%
1A1cliCO2	Energy - Stationary Combustion - Manuf. of solid fuels and other energy	CO2	23.50	0.00	0.00	0%	100%

CRF Code + note	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (abs. Gg CO_2-eq.)	Current Year (2012) Emission (abs. Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total %
	industries						
1A1cliN2O	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	N2O	0.06	0.00	0.00	0%	100%
1A3bbiCH4	Energy - Mobile combustion - Road transportation	CH4	0.00	0.00	0.00	0%	100%
1A3bbiN2O	Energy - Mobile combustion - Road transportation	N2O	0.00	0.00	0.00	0%	100%
1A3cgaCH4	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	CH4	0.00	0.00	0.00	0%	100%
1A3cgaCO2	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	CO2	0.00	0.00	0.00	0%	100%
1A3cgaN2O	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	N2O	0.00	0.00	0.00	0%	100%
1A3csoCH4	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	CH4	0.05	0.00	0.00	0%	100%
1A3csoCO2	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	CO2	22.66	0.00	0.00	0%	100%
1A3csoN2O	Energy - Mobile combustion - Other: Civil Aviation, Railways, Navigation	N2O	0.11	0.00	0.00	0%	100%
1B1aCO2	Energy - Fugitive Emissions from Fuels - Solid Fuels	CO2	3.60	0.00	0.00	0%	100%
1B1aN2O	Energy - Fugitive Emissions from Fuels - Solid Fuels	N2O	0.00	0.00	0.00	0%	100%
1B2aN2O	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N2O	0.00	0.00	0.00	0%	100%
1B2bN2O	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N2O	0.00	0.00	0.00	0%	100%
1B2dCO2	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO2	0.00	0.00	0.00	0%	100%
1B2dN2O	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N2O	0.00	0.00	0.00	0%	100%
2A5CO2	Industrial Processes - Mineral Products - Asphalt roofing	CO2	0.00	0.00	0.00	0%	100%
2A6CO2	Industrial Processes - Mineral Products - Road paving with asphalt	CO2	0.00	0.00	0.00	0%	100%
2A7CH4	Industrial Processes - Mineral Products - Other	CH4	0.00	0.00	0.00	0%	100%
2A7N2O	Industrial Processes - Mineral Products - Other	N2O	0.00	0.00	0.00	0%	100%
2B1CH4	Industrial Processes - Chemical Industry - Ammonia production	CH4	0.00	0.00	0.00	0%	100%
2B1N2O	Industrial Processes - Chemical Industry - Ammonia production	N2O	0.00	0.00	0.00	0%	100%
2B5CO2	Industrial Processes - Chemical Industry - Other	CO2	0.00	0.00	0.00	0%	100%
2B5N2O	Industrial Processes - Chemical Industry - Other	N2O	0.00	0.00	0.00	0%	100%
2C2CH4	Industrial Processes - Metal Production - Ferroalloys production	CH4	0.00	0.00	0.00	0%	100%
2C2CO2	Industrial Processes - Metal Production - Ferroalloys production	CO2	39.12	0.00	0.00	0%	100%
2C3CH4	Industrial Processes - Metal Production - Aluminium production	CH4	0.00	0.00	0.00	0%	100%
2C3CO2	Industrial Processes - Metal Production - Aluminium production	CO2	132.74	0.00	0.00	0%	100%
2C4PFCs	Industrial Processes - Metal Production - Aluminium production	PFCs	268.49	0.00	0.00	0%	100%
2DCO2	Industrial Processes - Other Production	CO2	0.00	0.00	0.00	0%	100%
2EHFCs	Industrial Processes - Production of Halocarbons and SF6	HFCs	0.00	0.00	0.00	0%	100%
2EPFCs	Industrial Processes - Production of Halocarbons and SF6	PFCs	0.00	0.00	0.00	0%	100%

CRF Code + note	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (abs. Gg CO_2-eq.)	Current Year (2012) Emission (abs. Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total %
2ESF6	Industrial Processes - Production of Halocarbons and SF6	SF6	0.00	0.00	0.00	0%	100%
2Fa2PFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Foam blowing	PFCs	0.00	0.00	0.00	0%	100%
2Fa3PFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Fire extinguishers	PFCs	0.00	0.00	0.00	0%	100%
2Fa4PFCs	Industrial Processes - Consumption of Halocarbons and SF6 - Aerosols	PFCs	0.00	0.00	0.00	0%	100%
4FCH4	Agriculture - Field Burning of Agricultural Residues	CH4	45.51	0.00	0.00	0%	100%
4FN2O	Agriculture - Field Burning of Agricultural Residues	N2O	13.34	0.00	0.00	0%	100%
5A2CH4	LULUCF - Forest Land - converted to	CH4	0.00	0.00	0.00	0%	100%
5A2N2O	LULUCF - Forest Land - converted to	N2O	0.00	0.00	0.00	0%	100%
5B2CH4	LULUCF - Cropland - converted to	CH4	0.00	0.00	0.00	0%	100%
5F2CO2	LULUCF - Land converted to Other Land	CO2	0.00	0.00	0.00	0%	100%

Table A1-5 *TIER2 Level assessment*

IPCC Categories	Direct Greenhouse Gas	Current Year (2012) Emission (Gg) (Gg CO_2-eq.)	Activity Data Uncer-tainty (Gg CO_2-eq.)	Emission Factor Uncer-tainty	Combined Uncertainty	Level Assess-ment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Direct N2O Emissions from Agricultural Soils	**N2O**	**2,930.60**	**0.00**	**381.46**	**381.46**	**19.42**	35.0%	35.0%
Indirect N2O Emissions from Nitrogen Used in Agriculture	**N2O**	**1,929.42**	**0.00**	**353.85**	**353.85**	**11.86**	21.3%	56.3%
Emissions from Wastewater Handling	**N2O**	**265.20**	**10.00**	**1000.00**	**1000.05**	**4.61**	8.3%	64.6%
Cropland remaining Cropland	**CO2**	**-1,590.94**	**0.00**	**89.65**	**89.65**	**2.48**	4.5%	69.1%
Stationary Combustion - Gas	**CO2**	**18,394.75**	**5.00**	**5.00**	**7.07**	**2.26**	4.1%	73.1%
Forest Land remaining forest Land	**CO2**	**-2,720.78**	**34.50**	**31.62**	**46.80**	**2.21**	4.0%	77.1%
Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	**CH4**	**2,036.32**	**2.00**	**50.00**	**50.04**	**1.77**	3.2%	80.3%
CH4 Emissions from Solid Waste Disposal Sites	**CH4**	**2,472.02**	**10.00**	**30.00**	**31.62**	**1.36**	2.4%	82.7%
Mobile Combustion - Road	**CO2**	**10,572.29**	**5.00**	**5.00**	**7.07**	**1.30**	2.3%	85.1%
N2O Emissions from Manure Management	**N2O**	**851.75**	**0.00**	**83.71**	**83.71**	**1.24**	2.2%	87.3%
Stationary Combustion - Coal	**CO2**	**10,719.01**	**2.00**	**5.00**	**5.39**	**1.00**	1.8%	89.1%
Grassland remaining Grassland	**CO2**	**462.79**	**0.00**	**90.49**	**90.49**	**0.73**	1.3%	90.4%
Land converted to Cropland	CO2	339.11	0.00	93.35	93.35	0.55	1.0%	91.4%
CH4 Emissions from Manure Management	CH4	1,252.36	0.00	19.01	19.01	0.41	1%	92%
Pasture, range and paddock manure	N2O	226.69	0.00	101.74	101.74	0.40	1%	93%
HFCs Emissions from Industry	HFCs	1,005.81	10.00	20.00	22.36	0.39	1%	94%
Fugitive Emissions from Oil and Gas Operations	CO2	175.30	100.00	80.00	128.06	0.39	1%	94%

Land converted to Grassland	CO2	-114.71	0.00	188.31	188.31	0.38	1%	95%
CH4 Emissions from Enteric Fermentation in Domestic Livestock	CH4	1,502.24	0.00	13.24	13.24	0.35	1%	96%
Land converted to Forest Land	CO2	-1,097.14	8.40	15.58	17.70	0.34	1%	96%
Stationary Combustion - Oil	CO2	2,466.79	2.00	5.00	5.39	0.23	0%	97%
SF6 Emissions from Industry	SF6	153.36	80.00	20.00	82.46	0.22	0%	97%
Feedstocks and non-energy use of fuels	CO2	1,070.95	5.00	10.00	11.18	0.21	0%	97%
Emissions from Wastewater Handling	CH4	309.60	20.00	30.00	36.06	0.19	0%	98%
Cropland	N2O	38.43	0.00	277.29	277.29	0.19	0%	98%
Mobile Combustion	N2O	106.27	5.00	100.00	100.12	0.18	0%	98%
Land converted to Settlements	CO2	228.61	0.00	39.23	39.23	0.16	0%	99%
Non-CO2 Emission from Stationary Fuel Combustion	N2O	127.86	3.00	50.00	50.09	0.11	0%	99%
Forest Land remaining Forest Land/Controlled burning	CH4	23.07	0.70	216.60	216.60	0.09	0%	99%
CO2 Emission from Soda Ash use and Other Mineral Products	CO2	138.25	10.00	30.00	31.62	0.08	0%	99%
Stationary Combustion - Other Fuel	CO2	379.93	5.00	10.00	11.18	0.07	0%	99%
Non-CO2 Emission from Stationary Fuel Combustion	CH4	314.55	3.00	8.00	8.54	0.05	0%	99%
CH4 Emission from Rice Cultivation	CH4	12.43	5.00	198.24	198.31	0.04	0%	99%
CO2 emissions from Waste Incineration	CO2	93.01	10.00	20.00	22.36	0.04	0%	100%
CO2 Emission from Cement Production	CO2	678.42	2.00	2.00	2.83	0.03	0%	100%
CO2 Emission from Solvent and Other Product Use	CO2	73.82	10.00	20.00	22.36	0.03	0%	100%
Wetlands	CO2	9.56	113.13	113.13	159.99	0.03	0%	100%
CO2 Emission from Ammonia Processes	CO2	481.68	2.00	2.00	2.83	0.02	0%	100%
Mobile Combustion	CH4	24.33	5.00	50.00	50.25	0.02	0%	100%
CO2 Emission from Metal Production	CO2	217.66	2.00	5.00	5.39	0.02	0%	100%
Mobile Combustion - Other	CO2	146.02	5.00	5.00	7.07	0.02	0%	100%

CH4 Emission from Industry	CH4	39.12	1.00	20.00	20.02	0.01	0%	100%
CO2 Emission from Lime Production	CO2	140.07	5.00	2.00	5.39	0.01	0%	100%
CO2 Emission from Limestone and Dolomit Use	CO2	324.40	2.00	1.00	2.24	0.01	0%	100%
N2O Emission from Solvent and Other Product Use	N2O	276.62	2.00	1.00	2.24	0.01	0%	100%
N2O Emissions from Other Waste	N2O	17.01	10.00	30.00	31.62	0.01	0%	100%
Forest Land remaining Forest Land/Controlled burning	N2O	2.36	0.70	218.60	218.60	0.01	0%	100%
CH4 Emissions from Other Waste	CH4	15.36	10.00	30.00	31.62	0.01	0%	100%
N2O Emissions from Waste Incineration	N2O	2.89	5.00	100.00	100.12	0.01	0%	100%
Forest Land remaining Forest Land/Wildfires	CH4	7.56	6.40	22.02	22.70	0.00	0%	100%
Grassland remaining Grassland	CH4	1.91	25.00	70.00	74.33	0.00	0%	100%
Fugitive Emissions from Coal Mining and Handling	CH4	10.98	3.00	10.00	10.44	0.00	0%	100%
Cropland remaining Cropland	CH4	1.23	25.00	70.00	74.33	0.00	0%	100%
Grassland remaining Grassland	N2O	1.04	25.00	70.00	74.33	0.00	0%	100%
Forest Land remaining Forest Land/Wildfires	N2O	0.77	6.40	88.93	89.10	0.00	0%	100%
CH4 Emissions from Waste Incineration	CH4	1.16	10.00	50.00	50.99	0.00	0%	100%
N2O Emission from Industry	N2O	22.80	2.00	1.00	2.24	0.00	0%	100%
Fugitive Emissions from Oil and Gas Operations	N2O	0.19	2.00	100.00	100.02	0.00	0%	100%
PFCs Emissions from Industry	PFCs	1.37	1.00	2.00	2.24	0.00	0%	100%
CO2 Emission from Nitric Acid Production	CO2	0.00	3.00	40.00	40.11	0.00	0%	100%
Fugitive Emissions from Coal Mining and Handling	CO2	IE,NA,NO	3.00	10.00	10.44	0.00	0%	100%
Field Burning of Agricultural Residues	CH4	NO	NO	NO	0.00	0.00	0%	100%
Field Burning of Agricultural Residues	N2O	NO	NO	NO	0.00	0.00	0%	100%

Table A1-6 *TIER 2 Trend assessment*

IPCC Categories	Direct Green-house Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2011) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Trend Assessment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Cropland remaining Cropland	CO2	181.82	-1,590.94	0.00	89.65	5.10	17.0%	17.0%
Emissions from Wastewater Handling	N2O	300.31	265.20	10.00	1000.00	3.74	12.5%	29.5%
Forest Land remaining forest Land	CO2	-2,776.67	-2,720.78	34.50	31.62	2.04	6.8%	36.3%
Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH4	1,613.47	2,036.32	2.00	50.00	2.04	6.8%	43.1%
Stationary Combustion - Gas	CO2	19,320.99	18,394.75	5.00	5.00	2.02	6.7%	49.8%
CH4 Emissions from Solid Waste Disposal Sites	CH4	1,471.30	2,472.02	10.00	30.00	1.83	6.1%	56.0%
Mobile Combustion - Road	CO2	6,845.64	10,572.29	5.00	5.00	1.68	5.6%	61.6%
Grassland remaining Grassland	CO2	13.12	462.79	0.00	90.49	1.39	4.7%	66.2%
Stationary Combustion - Coal	CO2	33,087.90	10,719.01	2.00	5.00	1.15	3.8%	70.1%
Stationary Combustion - Oil	CO2	16,801.10	2,466.79	2.00	5.00	1.12	3.7%	73.8%
Land converted to Cropland	CO2	18.96	339.11	0.00	93.35	1.04	3.5%	77.3%
HFCs Emissions from Industry	HFCs	0.00	1,005.81	10.00	20.00	0.76	2.5%	79.8%
Land converted to Grassland	CO2	0.92	-114.71	0.00	188.31	0.73	2.4%	82.2%
Land converted to Forest Land	CO2	-128.22	-1,097.14	8.40	15.58	0.62	2.1%	84.3%
Indirect N2O Emissions from Nitrogen Used in Agriculture	N2O	3,845.10	1,929.42	0.00	353.85	0.59	2.0%	86.3%
N2O Emissions from Manure	N2O	1,951.74	851.75	0.00	83.71	0.43	1.4%	87.7%

Management								
Cropland	**N2O**	**4.96**	**38.43**	**0.00**	**277.29**	**0.34**	**1.1%**	**88.8%**
SF6 Emissions from Industry	**SF6**	**73.05**	**153.36**	**80.00**	**20.00**	**0.32**	**1.1%**	**89.9%**
CH4 Emissions from Manure Management	**CH4**	**3,336.37**	**1,252.36**	**0.00**	**19.01**	**0.30**	**1.0%**	**90.9%**
Land converted to Settlements	**CO2**	**70.72**	**228.61**	**0.00**	**39.23**	**0.25**	**0.8%**	**91.7%**
Pasture, range and paddock manure	N2O	307.95	226.69	0.00	101.74	0.23	1%	93%
CO2 Emission from Soda Ash use and Other Mineral Products	CO2	643.09	138.25	10.00	30.00	0.21	1%	93%
Feedstocks and non-energy use of fuels	CO2	1,034.33	1,070.95	5.00	10.00	0.20	1%	94%
Mobile Combustion	N2O	93.96	106.27	5.00	100.00	0.20	1%	95%
Direct N2O Emissions from Agricultural Soils	N2O	5,668.78	2,930.60	0.00	381.46	0.18	1%	95%
N2O Emission from Industry	N2O	4,541.51	22.80	2.00	1.00	0.17	1%	96%
Fugitive Emissions from Coal Mining and Handling	CH4	923.01	10.98	3.00	10.00	0.16	1%	96%
Emissions from Wastewater Handling	CH4	858.30	309.60	20.00	30.00	0.16	1%	97%
Stationary Combustion - Other Fuel	CO2	44.08	379.93	5.00	10.00	0.13	0%	97%
CH4 Emissions from Enteric Fermentation in Domestic Livestock	CH4	3,368.89	1,502.24	0.00	13.24	0.10	0%	98%
Mobile Combustion - Other	CO2	1,065.21	146.02	5.00	5.00	0.10	0%	98%
CH4 Emission from Rice Cultivation	CH4	50.54	12.43	5.00	198.24	0.09	0%	98%
Forest Land remaining Forest Land/Controlled burning	CH4	24.39	23.07	0.70	216.60	0.08	0%	98%
CO2 emissions from Waste Incineration	CO2	0.00	93.01	10.00	20.00	0.07	0%	99%
Non-CO2 Emission from Stationary Fuel Combustion	CH4	909.28	314.55	3.00	8.00	0.04	0%	99%
Fugitive Emissions from Oil and Gas Operations	CO2	358.51	175.30	100.00	80.00	0.04	0%	99%
CO2 Emission from Metal Production	CO2	787.95	217.66	2.00	5.00	0.03	0%	99%
CO2 Emission from Ammonia Processes	CO2	1,616.22	481.68	2.00	2.00	0.03	0%	99%
Non-CO2 Emission from Stationary Fuel Combustion	N2O	211.70	127.86	3.00	50.00	0.03	0%	99%
CO2 Emission from Lime Production	CO2	606.79	140.07	5.00	2.00	0.03	0%	99%
CO2 Emission from Cement Production	CO2	1,778.28	678.42	2.00	2.00	0.02	0%	99%

CH4 Emission from Industry	CH4	16.09	39.12	1.00	20.00	0.02	0%	100%
N2O Emissions from Other Waste	N2O	0.00	17.01	10.00	30.00	0.02	0%	100%
Wetlands	CO2	24.88	9.56	113.13	113.13	0.02	0%	100%
CH4 Emissions from Other Waste	CH4	0.00	15.36	10.00	30.00	0.02	0%	100%
N2O Emission from Solvent and Other Product Use	N2O	154.17	276.62	2.00	1.00	0.01	0%	100%
CO2 Emission from Limestone and Dolomit Use	CO2	248.68	324.40	2.00	1.00	0.01	0%	100%
PFCs Emissions from Industry	PFCs	268.49	1.37	1.00	2.00	0.01	0%	100%
N2O Emissions from Waste Incineration	N2O	0.00	2.89	5.00	100.00	0.01	0%	100%
Forest Land remaining Forest Land/Controlled burning	N2O	2.48	2.36	0.70	218.60	0.01	0%	100%
Forest Land remaining Forest Land/Wildfires	CH4	4.40	7.56	6.40	22.02	0.00	0%	100%
Grassland remaining Grassland	CH4	0.73	1.91	25.00	70.00	0.00	0%	100%
CO2 Emission from Solvent and Other Product Use	CO2	135.75	73.82	10.00	20.00	0.00	0%	100%
Grassland remaining Grassland	N2O	0.39	1.04	25.00	70.00	0.00	0%	100%
CH4 Emissions from Waste Incineration	CH4	0.00	1.16	10.00	50.00	0.00	0%	100%
Forest Land remaining Forest Land/Wildfires	N2O	0.45	0.77	6.40	88.93	0.00	0%	100%
Mobile Combustion	CH4	45.45	24.33	5.00	50.00	0.00	0%	100%
Cropland remaining Cropland	CH4	1.24	1.23	25.00	70.00	0.00	0%	100%
Fugitive Emissions from Oil and Gas Operations	N2O	0.60	0.19	2.00	100.00	0.00	0%	100%
CO2 Emission from Nitric Acid Production	CO2	0.08	0.00	3.00	40.00	0.00	0%	100%
Fugitive Emissions from Coal Mining and Handling	CO2	3.60	IE,NA,NO	3.00	10.00	0.00	0%	100%
Field Burning of Agricultural Residues	CH4	45.51	NO	NO	NO	0.00	0%	100%
Field Burning of Agricultural Residues	N2O	13.34	NO	NO	NO	0.00	0%	100%

A1.3. References

Intergovernmental Panel on Climate Change (IPCC), 2000: Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. *Intergovernmental Panel on Climate Change National Greenhouse Gas Inventories Programme*. Institute for Global Environmental Strategies, Japan. Available online at: http://www.ipcc-nggip.iges.or.jp/public/gp/english/

Intergovernmental Panel on Climate Change (IPCC), 2003: Good practice guidance for Land Use, Land Use Change and Forestry. *Intergovernmental Panel on Climate Change National Greenhouse Gas Inventories Programme*. Institute for Global Environmental Strategies, Japan. Available online at: http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm

Annex 2 Detailed discussion of methodology and data for estimating CO_2 emissions from fossil fuel combustion

A2.1. EU ETS Data

In January 2005 the European Union Greenhouse Gas Emission Trading Scheme (EU ETS) commenced operation as the largest multi-country, multi-sector Greenhouse Gas emission trading scheme world-wide. The scheme is based on Directive 2003/87/EC, which entered into force on 25 October 2003 in the EU. This law came into force in the Hungarian legal system in 2005 (2005/XV.).
The companies falling into the scope of the EU ETS Directive (2003/87/EC Directive) have to report their annual emission of CO_2 to the EU ETS competent authority based on the 589/2007/EC Decision (Monitoring and Reporting Guidelines of greenhouse gas emissions (available at:
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007D0589:EN:NOT)
This decision is implemented into the Hungarian law by 213/2006 Government Decree.
The CO_2 emissions have to be monitored based on the GHG permit issued by the authority which makes the requirements (type of monitoring method including activity data and emission factor; use of measurement method; use of accredited laboratories; etc.) laid down in 589/2007/EC officially binding and enforceable. The monitoring usually consists of the measurement of activity data (with an uncertainty up to a 7.5 %, depending on the size of the emitter) and in the case of plant specific emission factor also the measurement of the composition of the input and/or output materials. The latter have to be determined with a frequency prescribed in the permit in ISO17025:2005 accredited laboratories. Continuous measurement would be also a possibility, but no operator applies this method in Hungary.

The calculation of emissions follows the same equation as in the case of IPCC Guidebooks:
Emission= EF x AD (x conversion/oxidation factor). Also in the case of EU ETS the combustion and process emissions have to be reported separately. In the trading period 2008-2012 in EU ETS solely CO_2 emissions have to be reported.

The annual emission reports have to be verified by an independent accredited verifier entity. (This task is very similar to the Accredited Independent Entities (AIE) in the case of JI projects). So, this is mentioned in the NIR in several cases as “verified data”.
Then the annual emission reports are also checked (and corrected, if needed) by the competent authority.

Please note that although the above mentioned legislation of the EU has already been updated, the amendments are just related to the period beginning from 2013 (the next trading period of the EU ETS).

A2.2. Comparison of energy statistics and EU ETS Data

For the sake of transparency and comparability with EU ETS data the ERT recommended reporting NCVs of both data sources. All of the coal based power plants are under the regulation of emission trading, so the comparison can be performed. The results are in the table below.

***Table A2-1** Power plants' coal consumption from EU ETS and energy statistics (2012)*

Consumption of public electricity and heat plants	EU ETS		Energy statistics (IEA)	
	kt	TJ	kt	TJ
Other bituminous coal	6	119	6	118
Sub bituminous coal	211	3,637	206	3,504
Lignite / brown coal	9,183	65,979	9,184	66,588
Total Coal	***9,400***	***69,735***	***9,396***	***70,210***

A2.3. Source of the Country Specific Emission Factors

The Act 2005/XV appoints which installation has to join in the EU ETS. It is required, for establishments that emit more than 500 kt CO_2/year, to measure the calorific value, the carbon content and oxidation factor of used coal in accredited laboratory. Recently installations with lower emission rate also began to report measured carbon content of used fuels to EU ETS.
The official laboratory reports of the measured values in the EU ETS are available for internal use for the GHG team, we use this data to define new emission factors that suit better to the Hungarian conditions. Instead of IPCC default emission factors we can calculate the national emissions using more appropriate values.

Solid fuels

The Hungarian coal terminology differs slightly from that of IPCC. The partitioning is created according to the age of coal. The table below shows the classification according to the Hungarian and IPCC (2006) categories. *(Sources: Bihari, 1998; IPCC, 2006)*

Table A2-2 Comparison of Hungarian and IPCC terminology for coal

Hungarian Terminology	Net Calorific Values	IPCC Category (Gross calorific value)
Hard Coal	17-33 MJ/kg	Other Bituminous Coal (>23.865 MJ/kg)
Hard Coal	17-33 MJ/kg	Sub-Bituminous Coal (17.435 MJ/kg -23.865 MJ/kg)
Brown Coal	10-17 MJ/kg	Lignite (<17.435 MJ/kg)
Lignite (young brown coal)	3.5-10 MJ/kg	Lignite (<17.435 MJ/kg)

In the CRF the lignite category is a mix of brown coal and lignite with very low NCV, so the reported emission factor vary for two different reasons in the time-series:

- share of the two coal types
- changes in carbon content.

Fott (1999) published his research about the emission factors for the European coal (especially for Czech coal). It was found that carbon emission factors of coals and lignite are dependent especially on the net calorific value. For brown coal-lignite with the lowest net calorific values (lower than 12 MJ/kg) the default (IPCC, 1997) value 27.6 t C/TJ (101.2 t CO_2/TJ) seems to be too small.

Sometimes the NCVs of coals in the energy statistics were different than the measured values from EU ETS therefore emission factors were corrected to achieve consistency in the energy balance and verified emissions, too. Measured oxidation factors were also applied in the calculation to have consistent datasets.

Liquid fuels

Measured EFs from EU ETS were also taken into account in the calculation of CO_2 emissions of main electricity plants – as recommended by the ERT. For the harmonization of the ETS and inventory the applied emission factors were determined from the weighted average of EFs from reports of power plants. As measurement is not required for all power plants and for all fuel types, the resulted EFs are a mixture of IPCC default and real measured values.

A2.4. Aggregated energy balance for 2012

2012	PJ	coal and coal products	crude oil and oil products	natural gas	nuclear	hydro	wind	other renewables and wastes	electricity	purchased heat	total
PRIMARY balance	Production*	67.00	43.00	74.00	173.00	1.00	3.00	82.00	-		443.00
	Imports	53.00	321.00	282.00				3.00	61.00		720.00
	Exports	-12.00	-114.00	-29.00				-11.00	-32.00		-198.00
	International aviation bunkers	-	-7.00	-				-	-		-7.00
	Stock changes	5.00	2.00	20.00				1.00	-		28.00
	Domestic supply	113.00	245.00	347.00	173.00	1.00	3.00	75.00	29.00	-	986.00
FINAL consumption	**Final consumption**	15.00	223.00	228.00				52.00	118.00	41.00	677.00
	Industry	9.00	4.00	34.00				4.00	32.00	13.00	96.00
	Transport	-	147.00	-				7.00	4.00	-	158.00
	Road**	-	145.00	-	-	-	-	7.00	-	-	152.00
	Rail	-	2.00	-	-	-	-	-	4.00	-	6.00
	Other	6.00	14.00	175.00				41.00	82.00	28.00	346.00
	Residential	6.00	4.00	113.00				31.00	38.00	22.00	214.00
	Commercial and public services	-	1.00	58.00				9.00	41.00	6.00	115.00
	Agriculture/forestry, fishing	-	9.00	4.00				1.00	3.00	-	17.00
	Non-energy use	-	58.00	19.00				-	-	-	77.00

* only primary product according to the IEA methodology

** included motor gasoline and transport diesel as well

A2.5. References

Bihari, P., 1998: Energetics II. – university manuscript (In Hungarian: Energetika II., kézirat), *Budapesti Műszaki Egyetem*, Budapest.

Fott, P., 1999: Carbon emission factors of coal and lignite: analysis of Czech coal data and comparison to European values. *Environmental Science & Policy,* 2, 347-354.

Intergovernmental Panel on Climate Change (IPCC), 1997: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, *Intergovernmental Panel on Climate Change, Organisation for Economic Cooperation and Development, and International Energy Agency*. *(IPCC/OECD/IEA),* UK Meteorological Office, Bracknell.
Available online at: http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm

Intergovernmental Panel on Climate Change, 2006: 2006 IPCC Guidelines for National Greenhouse Gas Inventories. *Prepared by the National Greenhouse Gas Inventories Programme*, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). ISBN 4-88788-032-4, published: IGES, Japan.
Available online at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm

Annex 3 Other detailed methodological descriptions for individual source or sink categories

A3.1. Energy

CH_4 and N_2O emission calculation for road transport

The previously used method for emission estimation of road transport consisted of the following steps:

1. Quantification of stock of each road vehicle type is based on data obtained from HCSO and KTI. The categories are the following:
   - Gasoline:
     a. Passenger car, uncontrolled
     b. Passenger car, early oxidation catalyst
     c. Passenger car, 2-stroke engine
     d. Passenger car, three-way catalyst
     e. Motorcycles
     f. Light duty vehicle
     g. Light duty vehicle, catalyst
     h. Heavy duty vehicle
     i. Heavy duty vehicle, catalyst
     j. Bus
   - LPG
   - Natural Gas
   - Other fuel
   - Diesel
     a. Passenger car
     b. Light duty vehicle
     c. Heavy duty vehicle
     d. Bus
2. Identification of fuel consumption for 100 km of each category is based on default values from Revised Guidelines, 2006 IPCC Guidelines and official fuel consumption database.
3. Correction of fuel consumption of each vehicle type with real sharing in traffic is based on KTI reports.
4. Calculation of proportion in total annual fuel consumption for each category and fuel type. Total annual fuel consumption for each fuel type is given in the Energy Statistics Yearbook.
5. Calculation of total annual fuel consumption for each category and fuel type.
6. Calculation of total annual emission from category specific emission factors (see *Table 3.9 in Chapter 3.4*) and total annual fuel consumption for each category and fuel type.
7. Addition of emissions in each fuel type.

The results of this method are still included in the inventory for the period of 1985-2004. From 2005, COPERT model was applied. Detailed description of this model application was given by the ***Institute for Transport Sciences Non-Profit Ltd***., and is presented in the following.

Institute for Transport Sciences Nonprofit Ltd: Determining the road, railway, airway and water transport emissions in Hungary for the year 2011

(Excerpts)

Applied method of calculation

For the emission calculations the COPERT-4 (Computer Programme to Calculate Emission from Road Transport) model, specifically its latest version 9.0 was used. The transition to the COPERT-4 programme which took place last year was a timely and necessary step in the area of national road transport emission calculations, since most countries use this programme, and this software is described in the related accompanying instructions as well [1], [2].
The structure of the input data was produced in a way which fully complies with that described in the software requirement.
Generally, the input data required by COPERT-4 are as follows:

- vehicle stock data
- emission categorization
- mileage data
- traffic situations, average speed values
- fuel used
- country-specific data.

Due to the circumstance that the data were not obtained from the same source and were not always suitable for direct use, the data types that are closely associated on the basis of the method of work will be presented jointly.
The largest bulk of work was processing the vehicle stock data, since this data ensures the basis for emission calculations performed by COPERT-4. Thus, with respect to the vehicle stock it was crucial to perform work of the utmost precision, therefore, in the course of the work, the vehicle stock related data of the Central Statistical Office (CSO) were used. At the request of the Institute for Transport Sciences, vehicle data tables required to perform the task were extracted from the CSO database. The **vehicle stock classifications** and **emission categorizations** for the year 2011 were prepared with the use of these data tables.
The **data on traffic situations**, that is, the percentage of runtime distribution within individual road categories by vehicle category, and, within road categories, the average speed values also by vehicle category were included based on emissions defined in the previous years. These earlier data were based on the results of previous research carried out by the Institute for Transport Sciences.
The **mileage data** were specified based on previous emission calculations with the use of the research outcomes of the Institute for Transport Sciences, as well as based on the annual emission calculation for the year 2009 provided by the Ministry of Environment from the extract of the Regular Environmental Audits database, subsequently corrected based on the annual fuel consumption.
The source of the **"amount of fuel used"** data was the Ministry of National Development (MND), while the basis for the control was the Communication of the Hungarian Petroleum Association (HPA) for the year 2011 [3], [4].
The **country-specific data** was taken partly from the Hungarian Meteorological Service (HMS) (average maximum and minimum temperatures by month), partly from the Hungarian fuel standards (Reid vapor pressure RVP).

Vehicle stock data

The scope and the use of data and method of work

The following subsections will provide a detailed overview of the data used, and a description of the principles on which they were applied. First, we will provide a general description of the principles on the basis of which the vehicles were classified into individual emission categories, then we will present separately the principles of the upload of the vehicle categories into the COPERT-4 model.
The vehicle stock database required for the work was obtained from the Central Statistical Office (CSO). The CSO's database is based primarily on the COAEPS's (Central Office for Administrative and Electronic Public Services) data which store information for each category of vehicle in the following table.

Table A3.1.1 *Properties related to motor vehicles contained in the CSO database*

Meaning of the field	**Length**
Vehicle license plate number	8
Type of license plate number (N = normal, T = taxi, V = freight carrier blank = no information)	1
Date of registration for traffic use **(**day**/**month/**year**)	8
Code of vehicle category (**1 = car , 2 = truck, 3 = bus** **4 = tow truck, 5 = motorcycle** 6 = trailer 7 = luggage trailer 8 = caravan 9 = slow vehicle)	1
Code of the vehicle make	10
Code of vehicle type	10
Code of vehicle trade name	10
Year of manufacture	4
Profile code	4
Number of passengers	3
Curb vehicle weight	5
Gross vehicle weight	6
Catalyzer code	1
Fuel code **(1=gasoline, 2=diesel, 3=hybrid, 4=electric, 5=mixed)**	1
Engine cubic capacity	5
Gear shift code	2
Type of owner* (N = natural person, L = legal entity)	1
Owner's nationality (H = Hungarian, F = foreign)	1
Ownership code	1
Owner Area code **	7
Type of operator* (N = natural person, L = legal entity)	1
Operator's nationality (H = Hungarian, F = foreign)	1
Ownership code	1
Operator's area code **	7

The data fields required for the task are marked in the table above in ***bold***. It was based on these data that it was possible to determine the input vehicle data stock of the COPERT-4 model.
Due to their very large size (per year data exceeding 100Mbytes), the traditional table and database management programs are not suitable for making searches in the database obtained from the CSO, therefore, similarly to the previous years, we used the statistical data modeling program (SDMP) specifically created for this purpose and which made it possible to search for the needed data.
In the following we present an overview of the criteria which had to be taken into consideration in the course of the work, and will also describe the principles of the applied methods.

Emission classification

For the total emission calculation, the breakdown of the vehicle stock by category in accordance with the COPERT-4 emission model was carried out, which was based on the UN-ECE, the EEC and the European Union emission standards. Classification based on the emission category had to be carried out separately for each category of motor vehicles, that is, passenger vehicles and trucks, buses and motorcycles. The number of mopeds was required as well, but since the CSO database is based on the COAEPS data and in Hungary no registration is required for mopeds, a different method had to be applied to determine the number of mopeds.
From the point of view of the work, it would have been ideal if the CSO database included the environmental code of vehicles, however, such information is currently not stored by the CSO. Therefore, the matching of individual emission categories was carried out based on the date of manufacture of the cars and the date of their registration. The need to use the date of registration next to the year of manufacture was due to the circumstance that the introduction of the increasingly stringent emission regulations in certain areas and countries was not implemented at the same time. Since Hungary's accession to the European Union, the dates of introducing certain emission categories have been the same as in other European Union countries, but this had not been the case in the years before the accession. Typically, an inspection and other requirements-tightening which also affects emission limit values (e.g., lifetime requirements) were introduced into the domestic legal order one to two years after its release. What makes the situation even more complicated is the fact that, generally, entry into force of a regulation does not lead to its immediate application, because sufficient time needs to be secured for vehicle manufacturers to prepare for the more stringent requirements. Even within individual vehicle categories there may be differences with respect to the start of the application, which additionally had to be taken into consideration within the detail of the database framework.

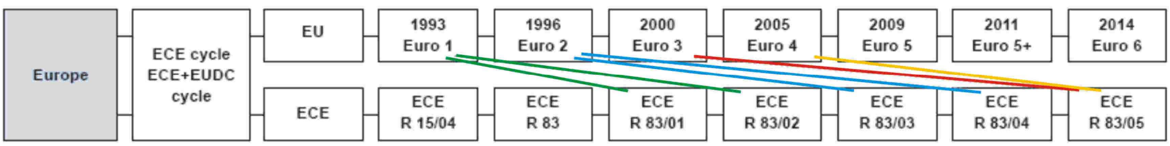

Chart 1*: Relationship of the EU and the UN-ECE motor vehicle regulations [11]*

Due to a lack of data on the environmental classification, we used the year of manufacture of the vehicle as a basis when classifying the emission category, taking into account also that the adoption of a regulation into the Hungarian legal system happened only after its introduction in Europe. During this work we had to round the numbers since, with respect to the date of manufacture, we possessed information only about the year, but it does happen sometimes that entering of a regulation into force does not happen on the 1st of January. Having examined such cases, we rounded the exact dates to the years. This usually involved rounding "up", which was due to the circumstance that mid-year entries into force, in most cases, fall on the 1st of October, which means a significantly smaller part of the year.

Furthermore, the older vehicles in Hungary, primarily trucks, are in a neglected state. Thus, we ended up with results that are closer to reality than if, in case of such fractional years, we had simply cut off the month of introduction and had used only the year of the date of introduction. In the course of the work, we had to pay attention the circumstance that, instead of the vehicle categories (M1, M2, M3, N1, N2, N3, L1, L2, L3, L4, L5) used by the UN / ECE and in the European Union, we had at our disposal only the name of the vehicle category (car, truck, tow truck), and the two classification systems do not necessarily correspond to each other unambiguously. This primarily includes car-size vans which pass a vehicle inspection in the "truck" category which are certified on the basis of the chassis dynamometer for emission test for passenger cars, in contrast with heavy duty trucks whose engine is removed for inspection. In the system of the Central Statistical Office, these small-size vans are listed together with trucks just as heavy duty trucks. Accordingly, in order to create the appropriate categorization, there was a need also for the gross vehicle weight rating (GVWR) to be able to place the vehicles in various categories.

- Motor cars M1
- vans N1
- heavy duty trucks N2, N3
- urban buses and coaches M2. M3
- two-wheeled vehicles L1, L2, L3, L4, L5.

Thus, the emission classification of vehicles can be carried out based on the year of manufacture and year of registration, as well as based on the total weight. It shall be noted that from among the emission categories used by COPERT-4 not all were used in the course of the work. The programme includes the following categories of emission for the period prior to the so-called "Euro" categories [1]:

- „pre" ECE vehicles before 1971
- ECE-15.00 and EC 15.01 between 1972 and 1977
- ECE-15.02 between 1978 and 1980
- ECE-15.03 between 1981 and 1985
- ECE-15.04 between 1985 and 1992.

Since in Hungary these requirements typically entered into force with a couple of years' delay, the vehicle stock in this period was composed primarily of makes manufactured in the COMECON countries, and, most likely, not even the *"western"* vehicles from this period can meet those emission requirements which they met when they were new vehicles, therefore, for this period we used only one category, the *pre ECE* category.

Categories of vehicles

The COPERT-4 programme contains the following major vehicle categories:

- Passenger cars
- Light duty trucks
- Heavy duty trucks
- Buses
- Mopeds
- Motorbikes

The CSO database contains the following vehicle categories:

Table A3.1.2 *Code table for vehicle categories*

Possible code-values	Meaning of codes
1	Passenger car
2	Truck
3	Bus
4	Tow truck
5	Motorbike

The individual categories are broken down into further subcategories according to the following criteria: engine cubic capacity, gross vehicle weight or other criteria. This is demonstrated in the table below.

Table A3.1.3 *Vehicle categories used by the COPERT-4 programme*

Passenger Cars	Gasoline <1,4 l
Passenger Cars	Gasoline 1,4 - 2,0 l
Passenger Cars	Gasoline >2,0 l
Passenger Cars	Diesel <2,0 l
Passenger Cars	Diesel >2,0 l
Passenger Cars	LPG
Passenger Cars	2-Stroke
Passenger Cars	Hybrid Gasoline <1,4 l
Passenger Cars	Hybrid Gasoline 1,4 - 2,0 l
Passenger Cars	Hybrid Gasoline >2,0 l
Light Duty Vehicles	Gasoline <3,5t
Light Duty Vehicles	Diesel <3,5 t
Heavy Duty Trucks	Gasoline >3,5 t
Heavy Duty Trucks	Rigid <=7,5 t
Heavy Duty Trucks	Rigid 7,5 - 12 t
Heavy Duty Trucks	Rigid 12 - 14 t
Heavy Duty Trucks	Rigid 14 - 20 t
Heavy Duty Trucks	Rigid 20 - 26 t
Heavy Duty Trucks	Rigid 26 - 28 t
Heavy Duty Trucks	Rigid 28 - 32 t
Heavy Duty Trucks	Rigid >32 t
Heavy Duty Trucks	Articulated 14 - 20 t
Heavy Duty Trucks	Articulated 20 - 28 t
Heavy Duty Trucks	Articulated 28 - 34 t
Heavy Duty Trucks	Articulated 34 - 40 t
Heavy Duty Trucks	Articulated 40 - 50 t
Heavy Duty Trucks	Articulated 50 - 60 t
Buses	Urban CNG Buses
Buses	Urban Biodiesel Buses
Buses	Urban Buses Midi <=15 t
Buses	Urban Buses Standard 15 - 18 t
Buses	Urban Buses Articulated >18 t
Buses	Coaches Standard <=18 t
Buses	Coaches Articulated >18 t
Mopeds	<50 cm^3
Motorcycles	2-stroke >50 cm^3
Motorcycles	4-stroke <250 cm^3
Motorcycles	4-stroke 250 - 750 cm^3
Motorcycles	4-stroke >750 cm^3

In the course of the work, the specification of the vehicle stock categories from the CSO's database had to be prepared in accordance with these vehicle categories. In the following sections we will present this in detail.

Passenger cars

With respect to passenger cars, the individual sub-categories need to be specified and placed in an emission class in accordance with the fuel used and the engine cubic capacity. The CSO database in the case of passenger cars can be used in a fairly straightforward way. The searches can be carried out with a relatively high precision according to the *vehicle type code*, the *fuel code* and the *engine cubic capacity*. As a general point of view, it shall be mentioned that in the course of the searches the LPG fuel was matched in the CSO database with code 5, the *mixed* fuel.

Table A3.1.4 *Fuel code table*

Possible code values	Meaning of codes
1	Gasoline
2	Diesel
3	Hybrid
4	Electric
5	Mixed

Table A3.1.5 *Passenger car categories in the COPERT-4 programme*

Passenger Cars	Gasoline <1,4 l
Passenger Cars	Gasoline 1,4 - 2,0 l
Passenger Cars	Gasoline >2,0 l
Passenger Cars	Diesel <2,0 l
Passenger Cars	Diesel >2,0 l
Passenger Cars	LPG
Passenger Cars	2-Stroke
Passenger Cars	Hybrid Gasoline <1,4 l
Passenger Cars	Hybrid Gasoline 1,4 - 2,0 l
Passenger Cars	Hybrid Gasoline >2,0 l

It is not clear from the database which vehicles belong in the 2-stroke category. In order to complete this category, there was a need for the *manufacturer codes* as well. The vehicle types of the 2-stroke category were selected based on identifying the manufacturers which produced vehicles equipped primarily with 2-stroke engines. Since in the case of several manufacturers the factory after some time started to equip its vehicles with 4-stroke engines, as well as there was a period when a relatively large number of such vehicles were reconstructed and equipped with 4-stroke engines, therefore in the searches we applied a cubic capacity limit, thus filtering those vehicles which do not fall in the category. Naturally, there was also a need to pay attention not to allow these vehicles to appear among the 4-stroke vehicles of less than 1.4 l cubic capacity, therefore, the inverse of the search for 2-stroke vehicles also had to be built into the search.
A further problem was that, with respect to vehicles marked with the *hybrid* code, we obtained a large number of results whereby, based on the year of manufacture, the vehicle cannot be a hybrid vehicle in the sense we understand it today and as the COPERT-4 programme uses it too. Therefore, in the case of hybrid vehicles, we applied a lower “age of the make” limit, whereby we marked 2001 as the year of the market appearance of hybrid cars. Naturally, for the cars which thus fell out we had to implement a separate search, and

with the received matches, using those as correction values, to expand the values of those categories where these vehicles belong indeed.

Light Duty Vehicles

The following are the COPERT categories for light duty vehicles:

Table A3.1.6 *Categories of light duty vehicles in the COPERT programme*

Light Duty Vehicles	Gasoline <3,5t
Light Duty Vehicles	Diesel <3,5 t

In this case the only criterion when breaking down to sub-categories is the fuel. The search, therefore, was carried out for gasoline and diesel trucks of under 3.5 tons of total weight, as well as for buses under 3.5 tons of total weight that were approved in accordance with the emission requirements for light duty vehicles (LDV).

Heavy Duty Trucks

The COPERT categories of heavy duty trucks are summarized in the following table:

Table A3.1.7 *Categories of heavy duty trucks in the COPERT programme*

Heavy Duty Trucks	Gasoline >3,5 t
Heavy Duty Trucks	Rigid <=7,5 t
Heavy Duty Trucks	Rigid 7,5 - 12 t
Heavy Duty Trucks	Rigid 12 - 14 t
Heavy Duty Trucks	Rigid 14 - 20 t
Heavy Duty Trucks	Rigid 20 - 26 t
Heavy Duty Trucks	Rigid 26 - 28 t
Heavy Duty Trucks	Rigid 28 - 32 t
Heavy Duty Trucks	Rigid >32 t
Heavy Duty Trucks	Articulated 14 - 20 t
Heavy Duty Trucks	Articulated 20 - 28 t
Heavy Duty Trucks	Articulated 28 - 34 t
Heavy Duty Trucks	Articulated 34 - 40 t
Heavy Duty Trucks	Articulated 40 - 50 t
Heavy Duty Trucks	Articulated 50 - 60 t

Heavy duty trucks shall be listed into three major categories: gasoline trucks above 3.5 tons, the so-called “*rigid*” and the articulated category. The articulated category in our case meant tow trucks because this is what we could obtain from the CSO database. Since the *articulated* category also includes agricultural and other tow machines which, although they do have a registration plate, yet cannot be listed among the participants of the road transport, therefore, in order to carry out the search, there was also a need for the type field to filter these vehicles. In the case of trucks, therefore, we carried out the search by fuel and total weight.

The situation was a little more difficult with respect to tow trucks because the gross vehicle weight according to the vehicle registration certificate means the maximum permitted total weight which is the weight increased with the maximum permitted semitrailer weight. However, in the COPERT-4 programme it is by the total weight of the vehicle that vehicles need to be categorized Therefore, we had to determine based on the available truck catalogues which total weight of a tow vehicle corresponds to which gross vehicle weight. In the course of the calculation we consistently took into account this correlation. The correlation used during the searches is summarized in the following table.

***Table A3.1.8** The total weight of tow vehicles matched with the gross vehicle weight categories for tow tucks*

Heavy Duty Trucks	Articulated 14 - 20 t	**3501 – 10500 kg**
Heavy Duty Trucks	Articulated 20 - 28 t	**10501 – 14000 kg**
Heavy Duty Trucks	Articulated 28 - 34 t	**14001 – 16000 kg**
Heavy Duty Trucks	Articulated 34 - 40 t	**16001 – 20000 kg**
Heavy Duty Trucks	Articulated 40 - 50 t	**20001 – 25000 kg**
Heavy Duty Trucks	Articulated 50 - 60 t	**> 25001 kg**

Buses

COPERT lists buses in the following sub-categories:

***Table A3.1.9** Categories of buses according to the COPERT programme*

Buses	Urban CNG Buses
Buses	Urban Biodiesel Buses
Buses	Urban Buses Midi <=15 t
Buses	Urban Buses Standard 15 - 18 t
Buses	Urban Buses Articulated >18 t
Buses	Coaches Standard <=18 t
Buses	Coaches Articulated >18 t

From among the above categories, the CSO database does not contain specific data on biodiesel1 and CNG2 buses. In earlier years this category was not taken into consideration, but when making the calculation for the year 2011, we listed the buses under the “mixed fuel” category here, similarly to that of the passenger cars. Although in the case of passenger cars the operation is indeed based on mixed fuel (gasoline/LPG), while the buses run on purely compressed gas, based on the result of the search, the number of vehicles that belong in this category seems realistic. Due to this circumstance, when making the calculation we took into consideration this category as well. Additionally, buses are subdivided into two major categories – urban buses and tourist buses. In order to elaborate the classification, in addition to the gross vehicle weight, there is a need for an additional characteristic/type based on which urban buses can be filtered from among all other buses. For this, again, we used the type field in which for the urban category we assigned the following characteristics:

- urban
- articulated bus
- suburban
- sightseeing
- school-bus

With the help of the searches carried out in this way, we were able to implement a most precise separation of the urban buses and coaches, and could determine the number of buses that belong to individual categories.

Motorcycles

Motorcycles can be listed in the following sub-categories:

[1] In Hungary, clearly biodiesel engines have not been used so far, while the standard diesel in the case of all vehicles does contain a mixed-in biodiesel component as well.

[2] In light of the available unofficial data, from the total of 17,000 large buses the number of buses run with the CNG fuel in the operation of the Volan company is 50, which is less than 3 percent of the total fleet. From the point of view of emissions it is negligible.

***Table A3.1.10** Categories of motorcycles according to the COPERT programme*

Motorcycles	2-stroke >50 cm³
Motorcycles	4-stroke <250 cm³
Motorcycles	4-stroke 250 - 750 cm³
Motorcycles	4-stroke >750 cm³

One can immediately see that, just as in the case of passenger cars, there is the issue of the 2-stroke category which characteristic does not have a clear match among the fields in the database. Therefore, we applied here the same principle as the one used for passenger cars, and the 2-stroke motorcycles were listed by way of using both their manufacturer and the engine cubic capacity, which allowed to narrow down the search.
In the case of 4-stroke motorcycles, there was no such issue. What needed attention was only to make sure that the vehicles identified as 2-stroke motorcycles should not be repeatedly listed.

Mopeds

There are no data on mopeds in the CSO database, therefore, in the course of the work we used data from other sources.
The report [7] of the Institute for Transport Sciences for the year 2007 entitled *"Estimating the stock of bicycle engines and creating an aid reference book"* contains the following founding:

> *"Since bicycle engines have not been registered until now and no records have been kept on them, therefore, we have no data on this stock. Their number can be determined only by way of estimation.*
> *The basis for the estimation was that we tracked down, for many years retrospectively, the data on the sales of new and second-hand bicycle engines, to which we added the estimated number of privately imported bicycle engines.*
> *Based on the above calculation method, currently the bicycle engine stock in Hungary can be estimated at somewhat above half a million."*

Another study published by the Institute for Transport Sciences in 2006 and entitled *"The Hungarian road motor vehicle stock and annual mileage of vehicles from 2000 until 2020"* [5] contains detailed information both about the estimated stock of mopeds and the yearly mileage of certain categories. Thus, the data on the moped stock was taken from the above study.

Vehicle mileage data

(mileage, traffic situations, speed values)

There was no possibility to carry out a detailed and accurate calculation of the vehicle mileage related data in the framework of this study, therefore, for the calculation we used a database accessible to us which we considered to be the most accurate one.
The aforementioned earlier study of the Institute for Transport Science entitled *"The Hungarian road motor vehicle stock and annual mileage of vehicles from 2000 until 2020"* [5] determined the mileage for the years 2006 and 2007, hence we used this information as a basis. The vehicle mileage data specified in the previous work was used based on the corrected values and the experience of past years, as well as the sold fuel and the vehicle fleet composition and consumption. The disposal (fx(1)) and mileage multiplier (fx(2)) functions that were used as a basis for mileage data calculation in the course of the work are presented in the figures on the following pages.

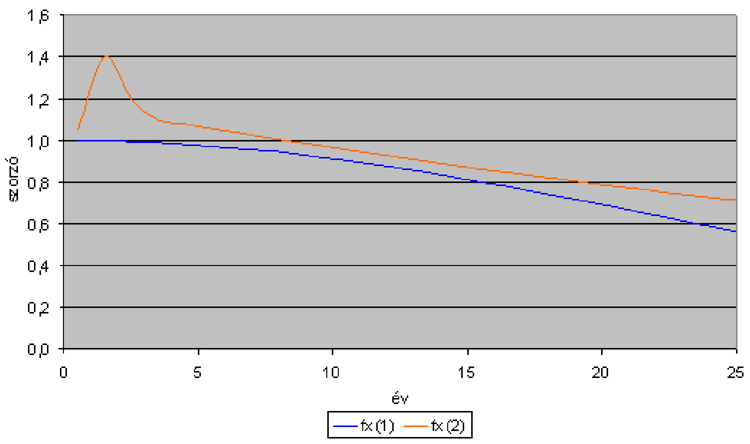

Figure A3.1.2: *Passenger cars mileage calculation functions*

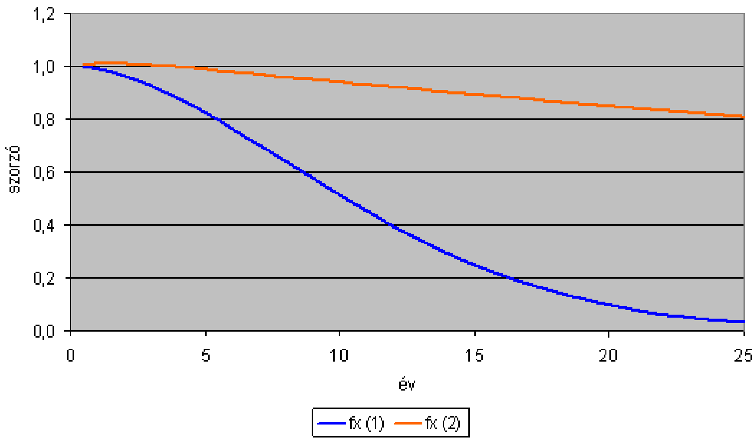

Figure A3.1.3 *Light duty trucks mileage calculation functions*

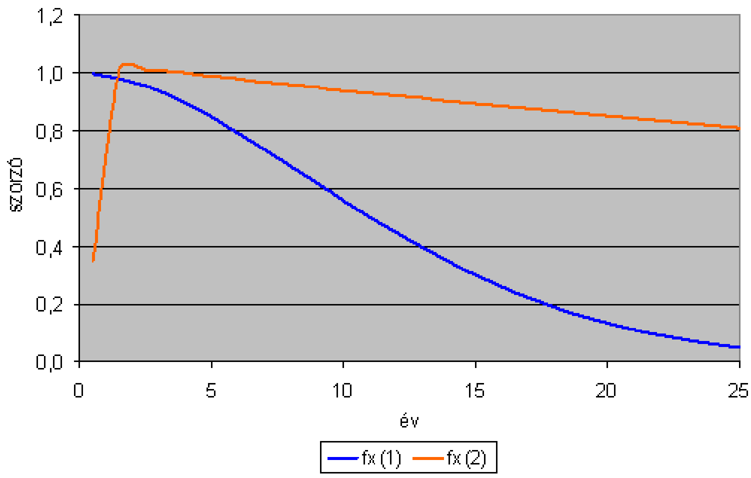

Figure A3.1.4 *Heavy duty trucks mileage calculation functions*

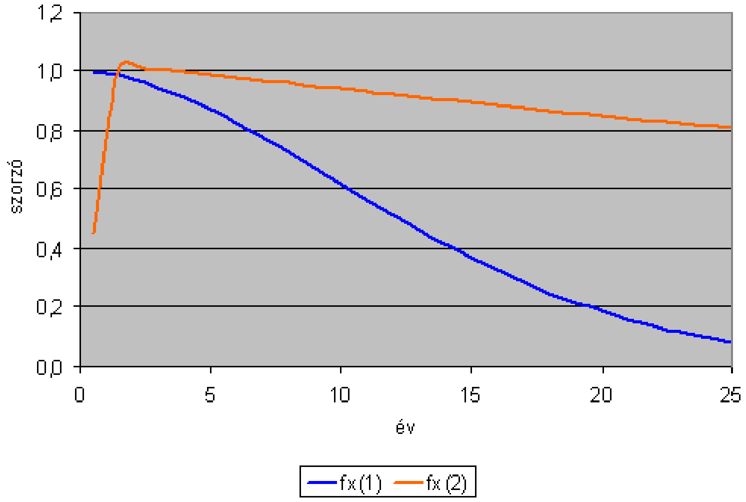

Figure A3.1.5 *Mileage calculation functions for buses*

In addition to the vehicle mileage data, there was also a need for the distribution ratio in the use of the road categories. These data were taken from an earlier study of the Institute for Transport Sciences entitled *"Developing a national, regional and local level calculation method and model for assessing the air polluting impact of the motor vehicle traffic"* [6]. The difference was in that the minor differences provided there with respect to the age of the model were not considered in this work, and within each category the same uniform application rate was used.
With respect to some of the categories, we deviated from the above. In the case of urban buses, we also took into consideration the data of a previous study published by the Institute for Transport Sciences [8] where we had a possibility - based on the knowledge of the complete bus fleet of the Budapest Transport Company Plc. and its total fuel consumption - to determine the average speed of urban and extra urban buses.
Adding accuracy to the mileage related data was realized through a search carried out in an extract from the REA (Regular Environmental Audits) database which had been previously provided by the ministry responsible for environmental protection. The Oracle database that had been provided to us contained somewhat more than six and a half million records. This means that it is not the complete database because, given the date of the introduction of the regular environmental audits, the frequency of audits and the size of the domestic vehicle stock, the entire database should contain by one order of magnitude more records. Nevertheless, even this amount of six and a half million records is such a volume which often makes its handling on an average computer very slow. It can further be concluded that it presumably contains sufficient data for the calculations of the average mileage.

The database consists of the following fields:

- CHASSIS_NUMBER
- VEHICLE_TYPE
- PROPELLANT
- ENGINE_CUBIC_CAPACITY
- OWN_WEIGHT
- ENVIRONMENTAL_CLASS
- ODOMETER1
- ODOMETER2
- DATE_OF_PERIODIC_TECHNICAL_INSPECTION1
- DATE_OF_PERIODIC_TECHNICAL_INSPECTION2

Compared to the joint Regulation 7/2002 (June 29) of the Ministry of Economy and Transport / Ministry of the Interior / Ministry of Environment and Water which is no longer in force, and examining the field values found in the records, it was found that the OWN_WEIGHT field contained the gross vehicle weight (GVW), thus all the information required to be classified into COPERT-4 categories was available. The first step was to filter out the records that were useless, thus reducing the size of the database.
Among the reasons for deletion were:

- one of the fields was not filled,
- a later inspection date had lower mileage (what is noteworthy is that in a database of the six and a half million entries this constituted hundreds of thousands of records).

The next step was putting in order the values of the VEHICLE_TYPE field, since the person who carries out the inspection selects this field not from a drop-down menu, but enters it during the measurement him/herself. The VEHICLE_TYPE field adopted a total of 69 types of values which we narrowed down to the following:

- Passenger car
- Light Duty trucks
- Heavy Duty Trucks
- Tow trucks
- Bus

Those records where it was not possible to clearly define the vehicle type, neither in the VEHICLE_TYPE field, nor from other values belonging to the records, were also deleted. After all this we created a TYPICAL and a EURO field in order to avoid making the searches one by one. The TYPICAL field included items of the COPERT-4 classifications, that is, the PROPELLANT field combined with the ENGINE_CUBIC_CAPACITY field and THE TYPE field which we had created.
In order to upload the EURO field, it was necessary to bring individual environmental classes in compliance with the so-called Euro-categories. Having carried out the compliance, the following results were obtained which we used for uploading into the EURO field:

Table A3.1.11 *Compliance of Euro categories with environmental categories*

Euro category	**Environmental category**
„pre" Euro	0, 1
Euro 1 or I	2, 3
Euro 2 or II	4
Euro 3 or III	6, 7, 8
Euro 4 or IV	9, 10, 11
Euro 5 or V	12, 14, 15
EEV	13

After completion of the above works, it was already possible to carry out the searches for data on annual average mileage. Among the results there were many which, for some reason, were not acceptable, therefore, the extremely high or low kilometer values had to be revised. The corrections were carried out in three steps.

When examining the dates we found that, with respect to many vehicles, the measurement was repeated on the same day, or the number of days between the two measurements was very small. At the first measurement these vehicles obviously were unable to meet the requirements, therefore the measurement had to be repeated. When examining the records, the minimum time between two measurements was finally determined at half-year, while the records of those motor vehicles that had shorter periods between measurement dates were deleted from the database.

With respect to cases of too high annual mileage, records where the average annual mileage was over 220,000 kilometers were deleted. Since there is an average of 220 working days in a year, and one vehicle is unlikely to travel more than a thousand kilometers per day, we chose this value. Before the deletion, we checked the accuracy of our assumption, and arranged the records in a list on the basis of the average annual mileage. It was fairly noticeable that approximately 218,000 kilometers was the limit over which the values suddenly increased, and it was not possible to apply any trend to the km line. Having examined the extremely high values of records, we found that the most frequent reasons for this error was that, in the course of the measurement, in many cases not only the km values were registered from the odometer position, but also the hundred meters, thus a greater value was entered into the database than the real one.

With respect to the too low values, a number of records was found in which the annual calculations showed less than one kilometer of mileage. Assuming that there may be vehicles which, for some reason, are moved only for the technical inspection / environmental review, and given that the average travel distance used by COPERT is 12 km, the limit was set at 24 km. Those records which contained values lower than this were deleted from the database. The database which initially contained six and a half million records eventually shrank to a database of one million three hundred thousand entries. Only these records were usable. It should be noted, however, that before the deletions in each case we examined what the number of items to be deleted was, and the deletions were performed only if the deletion clearly served to make the results more accurate.

From among the results, the data which were consistent with those previously used, and which were controlled via the fuel consumption and that seemed realistic, were used in the COPERT-4 model by rounding to hundreds, taking into account that the database contained measurements carried out between 1 January 2001 and 5 May 2010, therefore, the average

mileage values also reflected this period, and over the years may vary with respect to individual categories.
With respect to speed values, we used as a basis the data of the average European speed values used in the COPERT-4 calculations and the data from the thematic report entitled *"Developing a national, regional and local level calculation method and model for assessing the air polluting impact of the motor vehicle traffic"* [6], since, in relation to this report, the speed values related to certain road categories had also been determined. Subsequently, in the light of the fuel consumption compared to the urban bus average speed values, the speed value of other categories of vehicles was also slightly modified, thereby, for the final calculation we were able to use speed data that was closer to reality.

Country-specific data

For these calculations data received from the HMS's Climate Services Division was used. The monthly average of the daily maximum and minimum temperatures calculated for the territory of the country are demonstrated in the following table.

Table A3.1.12 *Minimum and maximum temperatures calculated for the territory of the country*

2011

Month	Minimum temperature [℃]	Maximum temperature [℃]
January	-3	2,6
February	-3.9	3.1
March	0.7	11.5
April	6.5	19
May	9.2	22.9
June	14.3	26.3
July	15	26.2
August	15.2	28.6
September	12.3	26.3
October	4.8	16
November	-1.5	6.8
December	-0.2	5.2

Fuel consumption data

The fuel consumption data for the year 2011 were received from the Ministry of National Development. The consumption of the diesel fuel compared to 2010 was essentially identical, while there was a further decrease in the use of the gasoline. (The amount of gasoline used had the lowest value in the period between 2000-2011.)

Table A3.1.13 *The quantity of fuel used in Hungary in 2011*

2011	**unit**	**quantity**
Gasoline total	million liters	1692.23
Diesel total	million liters	3293.17

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The Hungarian Petroleum Association, Annual Reports

3. Hungarian Petroleum Association - Report on the Hungarian Petroleum Association's activities (for 2005-2010)
4. „Prices through the roof: the least amount of fuel consumed in the past six years", Management forum (http://www.mfor.hu/cikkek/Egekben_az_arak__hat_eve_nem_fogyott_ilyen_keves_uzemanyag.html)

Institute for Transport Sciences studies

5. The Hungarian road vehicle stock and the annual mileage of vehicles up to 2000-2020, 2006.
6. Developing a national, regional and local level calculation method and model for assessing the air polluting impact of the motor vehicle traffic, 2006.
7. Assessment of the moped stock and developing an auxiliary reference book, 2007.
8. Developing a methodology for the environmental sector strategy and implementing it for the BKV Plc., 2008.
9. Environmental classification of passenger cars and heavy duty trucks and their territorial distribution, 2009.

DELPHI publications

10. https://delphi.com/pdf/emissions/Delphi-Heavy-Duty-Emissions-Brochure-2009.pdf
11. https://delphi.com/pdf/emissions/Delphi-Passenger-Car-Light-Duty-Truck-Emissions-Brochure-2009.pdf

Emission related regulations

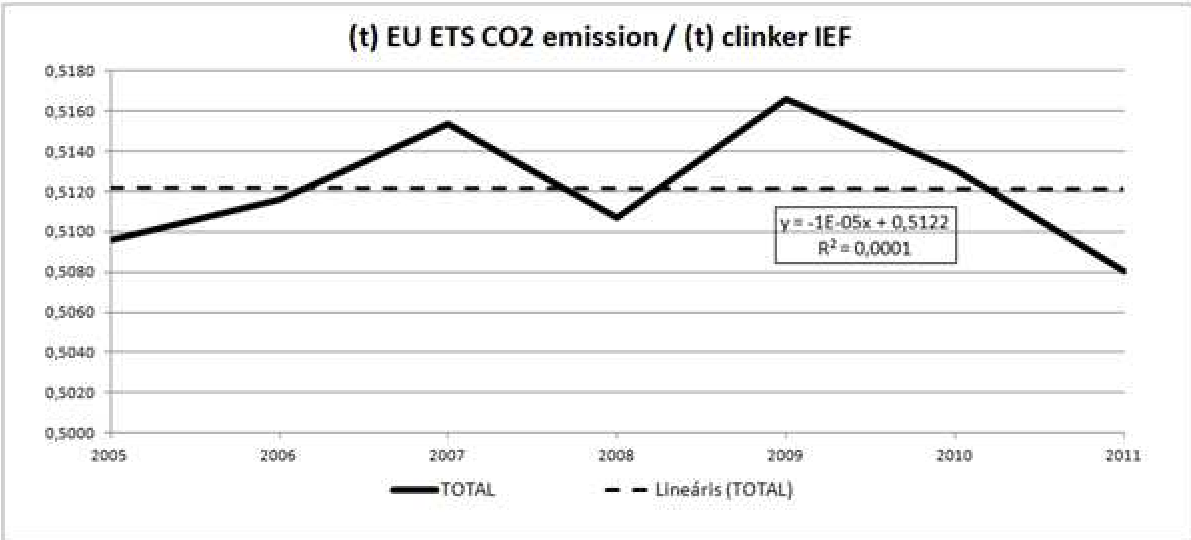
12. UN-ECE R83.01 –UN-ECE R83.05
13. 91/441/EEC
14. 93/59/EEC
15. 94/12/EC
16. 96/69/EC
17. 97/24/EC
18. 98/69/EC
19. 2002/51/EC
20. 2006/72/EC
21. 2007/715/EC
22. 2008/692/EC
23. UN-ECE R49.01 – UN-ECE R49.04
24. 88/77/EEC
25. 99/96/EEC
26. 2005/55/EC
27. 2005/78/EC
28. 5/1990 (April 12) KöHÉM regulation and its amendments
29. 6/1990 (April 12) KöHÉM regulation and its amendments
30. 7/2002 (June 29) Joint regulation of the Ministry of Economy and Environment / Ministry of the Interior / Ministry of Environment and Water

A3.2. Industry

A.3.2.1 Analysis of EU ETS emission data in Mineral Industry and results of verification within 2.A subsectors

2.A.1 Cement production

At the moment, in the case of 2.A.1 Cement sector, the average (t) EU ETS CO2 emission/ (t) clinker IEF of cement factories between 2005-2011 shows a quite linear trend, even if the trends of this IEF / plant are not so linear.

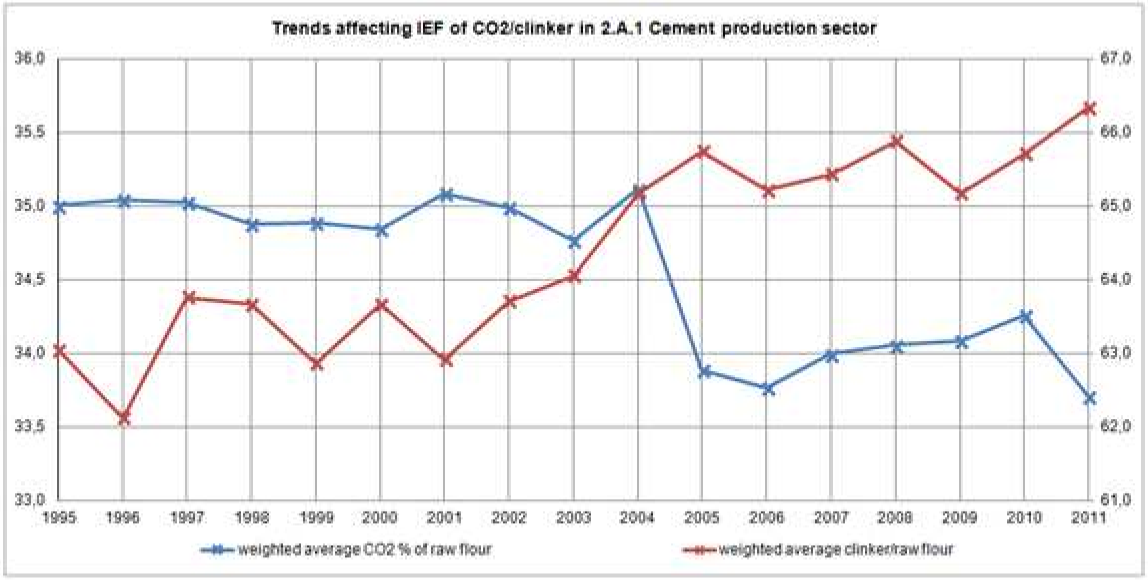


Further analysis of the trend of IEF is planned, especially due to the drop of the IEF between 2004 and 2005.

As it was already noted in chapter 4.4 of NIR 2013submission regarding the drop of IEF between 2004 and 2005, the change to the use of ETS data from 2005 is not attributable to the calculation methodology, as both before and after the kiln input based method was used with the same stoichiometric ratios as it is described in NIR sub-chapter 4.4.3.1.

On one hand the decrease could have been caused by the improvement of measurement methods of the laboratories. It is assumed that the data after 2005 is more accurate since in EU ETS accredited laboratories are to be used and because in several cases expert judgement was used by the data provider companies instead of real measurement. It is also justified that the IEF after 2005 is nearer to the default IEF (0.5071 t CO2 /t clinker). This fact might indicate the use of an IEF based on the 2005(-12) data for the calculation of years before 2005. But it is not yet applied, until the following other possible causes are not investigated and excluded.

The drop might also be caused by the change of the carbon content of the raw flour reported by the companies. The following diagram presents the trend of the weighted average carbon content reported by the companies either to ETS competent authority or directly to HMS.



As the CO2 emission is calculated from the raw flour, also the clinker/raw flour proportion may affect the IEF of CO2/ clinker. Therefore the diagram also consist the trend of the clinker/raw flour proportion. However in this regard a continuous change is notable from the beginning of the last decade. IPCC default clinker / raw flour proportion is: 64.6 % (Revised IPCC1996 Guidelines Reference Manual Section 2.3.2).

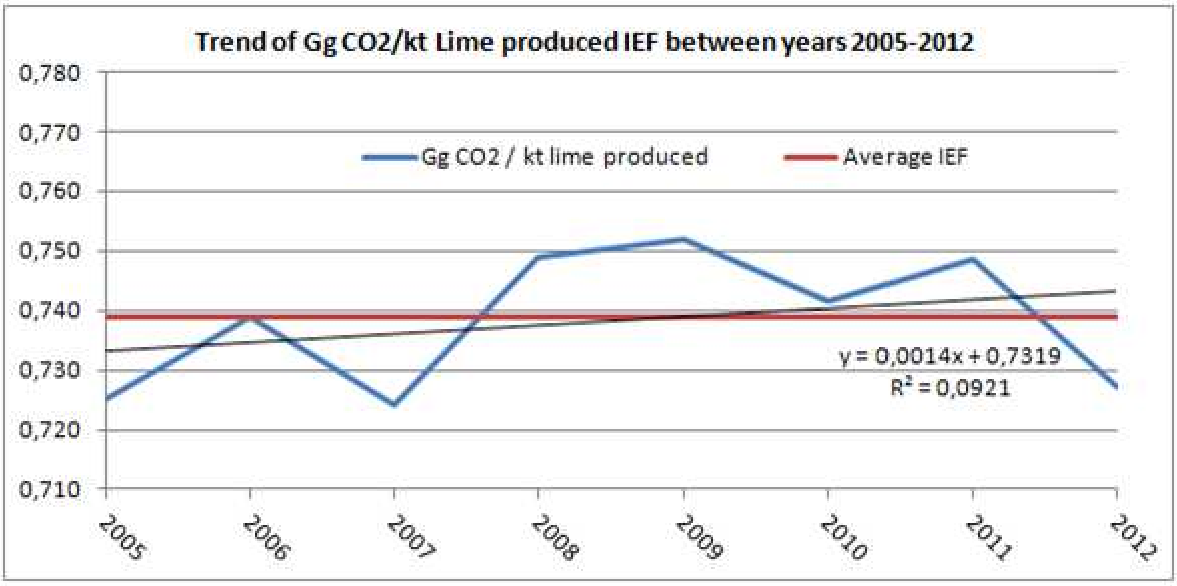
Both composition of raw flour and clinker/raw flour proportion might be influenced by special additives, etc., therefore this issue needs further investigation.

2.A.2 Lime

As it is mentioned both in NIR chapter 4.4.4 and 10.3, in 2.A.2. Lime production category time series have been recalculated by using EU ETS emission data of companies in years 2005-2012 and using the average of the IEFs of this years for the years before 2005.

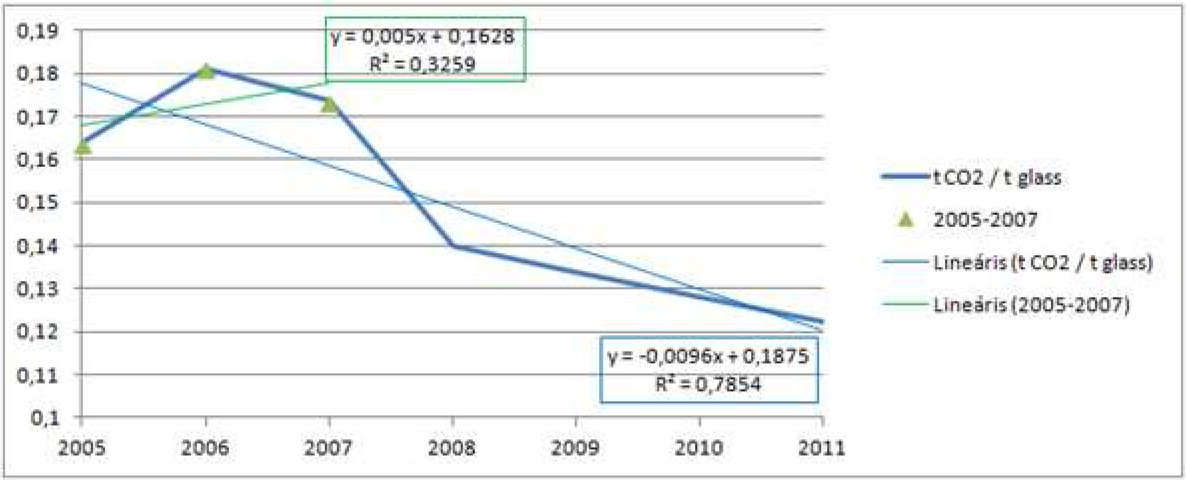
The IEF of years between 2005-2012 do not show a clear trend as it is presented in Figure 10.3.1. therefore the average seems to be applicable for extrapolation for the years before 2005 in order to reach consistent time series.

The average of years 2005-2012 results in 0.7388 t CO2/t lime produced which is 5.9% lower than the stochimetric IEF of 0.785 and it is well fitting in the IEF range 0.56-0.8 applied by other countries as presented in SAI 2013.



2.A.7. Glass

In the case of 2.A.7.1.Glass the recalculation using the average (t) EU ETS CO2 emission/ (t) Glass IEF (= 0,149) would cause -9% difference in the 2.A.7.1.Glass emissions for the years before 2005. However in this case the (t) EU ETS CO2 emission/ (t) Glass IEF shows a non-linear trend, which would indicate that the use of an average IEF for the years before 2005 is not the best solution.



In addition the trend of IEFs between 2005-2007 and 2008-2011 are very different. This might be attributed to the fact that from 2008 onwards the activity data are proxy data only provided by the Hungarian Statistical Office and, thus, the IEFs are not comparable with those of previous years. This fact does not affect the consistency of the time series as it is noted in the ARR2011, as the emissions are not calculated based on this activity data set but are calculated based on carbonate content in the EU ETS. Considering this facts the use of 2005 IEF (=0,163) for the years before 2005 seems still the more accurate solution.

2.A.7.2. Bricks

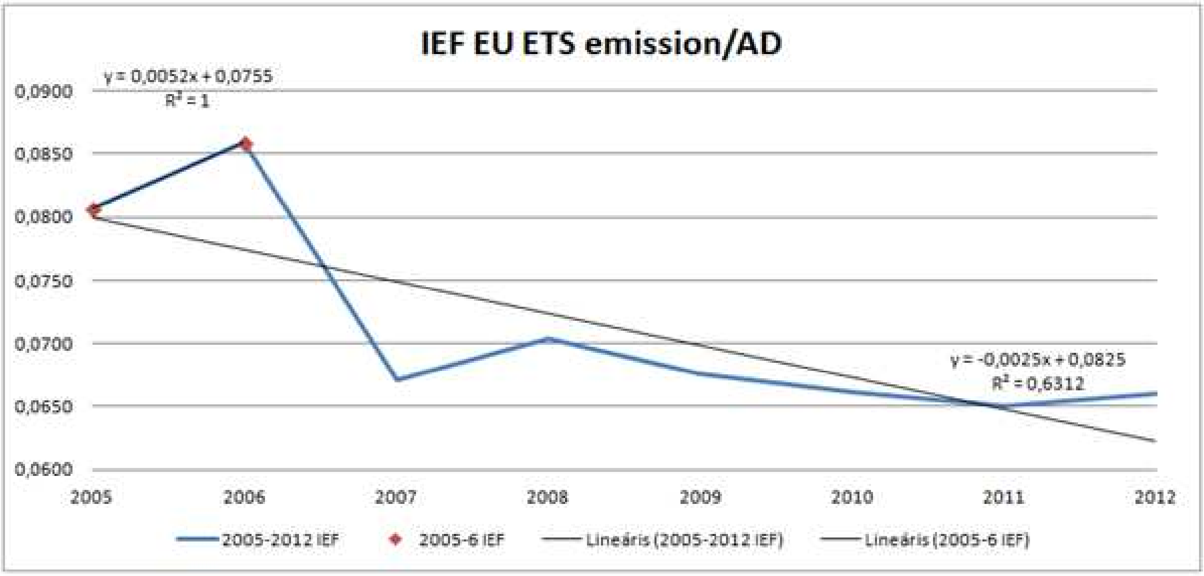
At the moment Hungary uses EU ETS data (only technological emission of bricks and ceramics producer companies) for the years after 2005. In order to produce consistent time series an IEF calculated from 2005 EU ETS emissions is used for the years before 2005.

It was a planned improvement to verify if the IEF calculated based on 2005 data is correct, or it would be better to apply the average IEF of 2005-2012 years.

The following IEFs are available within this sector:

	IEF t CO_2 / t product
IPCC default	(there is no method for bricks and ceramics in IPCC 1996 and GPG)
EU ETS (MRG (589/2007/EC Decision) default	0,096
average of IEF based on EU ETS 2005-2006	0,091
average of IEF based on EU ETS 2007-2012	0,073
average of IEF based on EU ETS 2005-2012	0,078
IEF based on EU ETS 2005 data – applied by HU for the calculation of time series before 2005	**0,088**

The following Figure presents the IEF calculated based on EU ETS emission by year.



As it is possible to observ, the trend is non-linear and the level of the IEFs are different for 2005-6 and 2007-2012. It is probable that the IEF of year 2005 is more realistic for the years before 2005, than the average of 2005-2012. In addition the former is nearer to the EU ETS default.
So, the IEF based on 2005 data seems still the most accurate solution for the calculation of time series before 2005.

A 3.2.2. Specific emission factors for aluminium production

According to the recommendations of the Revised Guidelines (IPCC, 1997) and the Good Practice Guidance (IPCC, 2000), the value of the specific emission factor was determined using a Tabereaux approximation as follows:

$$EF = Slope \cdot AEF \cdot AED \quad \text{.}$$

Equation A3-1.

where *EF* means the emission factor (kg/t). Slope is derived from

$$Slope = \begin{cases} 1.698 \cdot \dfrac{p}{CE} & \text{for } CF_4 \\ 0.1698 \cdot \dfrac{p}{CE} & \text{for } C_2F_6 \end{cases}$$

Equation A3-2.

According to the Revised Guidelines for the given technology *p=0.04* and *CE=0.91* were used as constants. In *Equation A3-1*. *AEF* means the effect number, *AED* is the effect time. On the basis of factory data, the value of AEF is between 0.8 to 2.8 pcs/pot-day and the value of AED is 4 minutes. Information on the pot types, effect number and effect time were supplied by the factories. Currently, only vertical-stud pots are used in Hungary, although horizontal-stud pots were also present in the beginning of the period. *Table A3-2.1* shows the calculated specific emission factors.

Emission factor (kg/t)	BY	1990	1991	1992	1993	1994	1995	1996	1997	1998
CF_4	0.4907	0.4856	0.5010	0.6775	0.7045	0.7225	0.7046	0.6419	0.6359	0.6837
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
CF_4	0.8390	0.7732	0.7703	0.7242	0.7849	0.8813	0.0000	0.0000	0.0000	0.0000

Table A3-2.1. *Specific emission factors for aluminium production*

A3.3. LULUCF

Implementation of the consistent area representation in Hungary

Land-use change database covering the total land area of the country according to six broad IPCC land-use categories, which contains information about former land-use categories of the converted areas as well, was not available for Hungary. Therefore the main steps of the implementation of consistent area representation were the classification of total area of the country into six IPCC land-use categories using the available land-use and land-cover statistics for the whole time series, and then the specification of land-use changes using the available land-cover change datasets. This type of land-use representation resulted in a mix of the Approach 1 and Approach 2 area representation methods.
To achieve a complete territorial coverage of the country, three different dataset were used. The next table summarizes the coverage of the IPCC land-use categories relating to Hungary, along with data sources.

Table A3-3.1 *Coverage and data sources of IPCC land-use categories in Hungary*

IPCC land-use categories	Category used in the database	Data sources
Forest Land	Land under Forest Management	NFI (CAO Forestry Directorate)
Cropland	Arable land	HCSO's land-use statistics
	Kitchen garden	
	Orchard	
	Vineyard	
	Set-aside Cropland	Expert judgement
Grassland	Grassland (meadows and pastures)	HCSO's land-use statistics
	Set-aside Grassland	Expert judgement
Settlements	Artificial surfaces	CLC2006, CLC-change$_{1985-1990}$, CLC-change$_{1990-2000}$, CLC-change$_{2000-2006}$.
Wetlands	Wetlands and Water bodies	CLC2006, CLC-change$_{1985-1990}$, CLC-change$_{1990-2000}$, CLC-change$_{2000-2006}$.
Other Land	Sparsely vegetated areas	HCL85, CLC90, CLC2000, CLC2006

Databases listed above are delineated in the NIR Chapter 7.1.2.

The NFI and the HCSO's land-use statistics provide data annually for the whole GHG inventory time series, although the HCSO's land-use statistics had to be adjusted due to the methodological changes of data collection and other data collection problems (for more details see the next chapter of the Annexes). The land-cover inventories were available for four year of the time series; data for other years were interpolated and extrapolated.
The area of abandoned agricultural areas was estimated by comparing the annual net change of the Cropland and Grassland areas calculated from the HCSO's land-use statistics and the gross change indicated by the land-cover change databases.

The combination of these three types of statistics resulted in a complete spatial coverage of the country for the whole inventory period with net area data. For specification of inter-category changes supplementary data were used.
Assumptions made and steps of harmonization of net land-use data with the land-use change datasets were as follows:

- The CLC-change$_{1990\text{-}2000}$ and CLC-change$_{2000\text{-}2006}$ were supplemented with a third database referring to 1985-1990. The supplementary database was implemented by processing satellite images (HCL-change$_{1985\text{-}1990}$). The other existing two databases were standardized according to the new one. The standardization and the processing of satellite images were developed according to the requirements of the LULUCF GHG inventory, and it was implemented by the Institute of Geodesy, Cartography and Remote Sensing (FÖMI, 2009b).
- The standardized land-cover categories implemented by the FÖMI were classified into the IPCC categories. The classification is shown in Table A3.-4.2.

Table A3-3.2 *Classification of the land-cover categories into IPCC land-use categories*

Standardized land-cover categories	IPCC category
100	Forest land
210, 220	Cropland
230	Grassland
310	Settlements
400, 500	Wetlands
330	Other land

- The land-cover data were taken into account according to their acquisition date. The acquisition dates of 1985, 1990, 2000 and 2006 databases are 1986, 1992, 2000 and 2006, respectively. (FÖMI, 2004; FÖMI, 2009a; FÖMI, 2009b)
- In the next step the net changes calculated from the three land-use change matrices derived from land-cover databases for the periods 1986-1992, 1992-2000 and 2000-2006 were compared with the net changes in the HCSO's land-use statistics calculated for the similar periods.
- It was assumed that the land-use change in a certain IPCC land-use change category is equal to the land-cover change in the corresponding land-cover change category (See Table A3-4.2). It was also presumed that the difference between the net change in the HCSO's land-use statistics and the land-cover change dataset in a certain land-use category arises due to the conversions on set-aside agricultural areas. Therefore the above-mentioned differences were eliminated with the estimated conversions on the set-aside grassland and cropland areas.
- From the three land-use change matrices, the land conversions were calculated for each year, so that the sum of the land-use changes in each land-use categories in the time period should be equal to the land-cover changes indicated by the land-cover database in that category for the given period.

- The procedures delineated above resulted in the gross annual changes of the needed land-use change categories. These matrices provided the activity data for the calculation of carbon stock changes in living non-woody biomass in Grassland and Cropland category.
- In the next step the 20 year transition period were taken into account. It was assumed that all land-use transitions originated from the remaining categories, and the conversion categories are not converted again during the 20 year transition period.

The annual land-use changes are presented for the period 1985-2010 in Table A3-3.3.

Table A3-3.3 *Annual land-use changes 1985-2012 (ha)*

ha	Forest Land	Cropland	SA-CL	Grassland	SA-GL	Wetlands	Settlements	Other Land
Forest Land	1,740,962	95	0	21	0	0	210	0
Cropland	2,778	5,280,646	0	5,338	0	0	838	0
SA-CL	8,388	7,640	186,619	0	0	0	0	0
Grassland	1,864	4,910	0	1,240,924	16,811	0	391	0
SA-GL	1,515	0	0	0	23,187	298	0	0
Wetlands	16	0	0	0	0	251,745	14	0
Settlements	118	9	0	117	0	23	525,344	0
Other Land	0	0	0	0	0	0	0	2,444
1985	1,755,640	5,293,300	186,619	1,246,400	39,997	252,067	526,798	2,444
Forest Land	1,755,314	95	0	21	0	0	210	0
Cropland	2,453	5,284,671	0	5,338	0	0	838	0
SA-CL	5,548	215	180,856	0	0	0	0	0
Grassland	1,864	4,910	0	1,228,224	11,011	0	391	0
SA-GL	558	0	0	0	39,142	298	0	0
Wetlands	11	0	0	0	0	252,041	14	0
Settlements	84	9	0	117	0	23	526,563	0
Other Land	0	0	0	0	0	0	0	2,444
1986	1,765,833	5,289,900	180,856	1,233,700	50,152	252,363	528,018	2,444
Forest Land	1,765,507	95	0	21	0	0	210	0
Cropland	2,778	5,281,530	4,753	0	0	0	838	0
SA-CL	5,730	0	175,126	0	0	0	0	0
Grassland	1,864	7,366	0	1,222,162	1,918	0	391	0
SA-GL	711	0	0	0	49,143	298	0	0
Wetlands	12	0	0	0	0	252,337	14	0
Settlements	90	9	0	117	0	23	527,777	0
Other Land	0	0	0	0	0	0	0	2,444
1987	1,776,691	5,289,000	179,879	1,222,300	51,061	252,658	529,232	2,444
Forest Land	1,776,365	95	0	21	0	0	210	0
Cropland	2,778	5,279,930	5,453	0	0	0	838	0
SA-CL	5,774	0	174,105	0	0	0	0	0
Grassland	1,864	7,366	0	1,209,762	2,918	0	391	0
SA-GL	724	0	0	0	50,039	298	0	0
Wetlands	12	0	0	0	0	252,632	14	0
Settlements	90	9	0	117	0	23	528,991	0
Other Land	0	0	0	0	0	0	0	2,444
1988	1,787,607	5,287,400	179,558	1,209,900	52,957	252,954	530,446	2,444
Forest Land	1,787,281	95	0	21	0	0	210	0
Cropland	2,778	5,279,130	4,653	0	0	0	838	0
SA-CL	7,989	0	171,570	0	0	0	0	0
Grassland	1,864	7,366	0	1,197,162	3,118	0	391	0
SA-GL	1,395	0	0	0	51,264	298	0	0
Wetlands	15	0	0	0	0	252,924	14	0
Settlements	114	9	0	117	0	23	530,182	0
Other Land	0	0	0	0	0	0	0	2,444
1989	1,801,435	5,286,600	176,223	1,197,300	54,382	253,246	531,636	2,444

***Table A3-3.3** (continued) Annual land-use changes 1985-2012 (ha)*

1989	1,801,435	5,286,600	176,223	1,197,300	54,382	253,246	531,636	2,444
Forest Land	1,800,822	180	0	40	0	0	393	0
Cropland	2,778	5,280,045	2,938	0	0	0	838	0
SA-CL	7,172	0	169,051	0	0	0	0	0
Grassland	1,864	7,366	0	1,185,442	2,237	0	391	0
SA-GL	1,147	0	0	0	52,937	298	0	0
Wetlands	14	0	0	0	0	253,218	14	0
Settlements	105	9	0	117	0	23	531,381	0
Other Land	0	0	0	0	0	0	0	2,444
1990	1,813,902	5,287,600	171,989	1,185,600	55,174	253,539	533,017	2,444
Forest Land	1,813,662	60	0	13	0	0	167	0
Cropland	2,778	5,238,343	29,627	16,013	0	0	838	0
SA-CL	6,154	0	165,835	0	0	0	0	0
Grassland	1,864	0	0	1,156,017	27,329	0	391	0
SA-GL	839	0	0	0	54,037	298	0	0
Wetlands	12	0	0	0	0	253,512	14	0
Settlements	94	9	0	117	0	23	532,773	0
Other Land	0	0	0	0	0	0	0	2,444
1991	1,825,404	5,238,413	195,462	1,172,160	81,366	253,834	534,184	2,444
Forest Land	1,825,278	44	0	9	0	0	72	0
Cropland	2,778	5,189,172	29,611	16,013	0	0	838	0
SA-CL	7,158	0	188,304	0	0	0	0	0
Grassland	1,864	0	0	1,142,580	27,325	0	391	0
SA-GL	1,143	0	0	0	79,925	298	0	0
Wetlands	14	0	0	0	0	253,806	14	0
Settlements	105	9	0	117	0	23	533,928	0
Other Land	0	0	0	0	0	0	0	2,444
1992	1,838,339	5,189,225	217,916	1,158,720	107,250	254,127	535,244	2,444
Forest Land	1,838,011	13	0	83	0	0	233	0
Cropland	3,349	5,131,728	46,503	6,707	0	0	938	0
SA-CL	3,356	0	214,560	0	0	0	0	0
Grassland	1,291	8,269	0	1,138,312	10,550	0	297	0
SA-GL	70	0	0	0	106,582	597	0	1
Wetlands	18	0	0	0	0	254,101	8	0
Settlements	244	28	0	178	0	16	534,779	0
Other Land	0	0	0	0	0	0	0	2,444
1993	1,846,338	5,140,038	261,063	1,145,280	117,132	254,714	536,255	2,445
Forest Land	1,846,120	28	0	27	0	0	163	0
Cropland	3,349	5,082,525	46,519	6,707	0	0	938	0
SA-CL	1,498	0	259,565	0	0	0	0	0
Grassland	984	8,269	0	1,124,928	10,802	0	297	0
SA-GL	0	0	0	0	116,535	597	0	1
Wetlands	13	0	0	0	0	254,693	8	0
Settlements	176	28	0	178	0	16	535,857	0
Other Land	0	0	0	0	0	0	0	2,445
1994	1,852,141	5,090,851	306,083	1,131,840	127,336	255,305	537,263	2,446

***Table A3-3.3** (continued) Annual land-use changes 1985-2012 (ha)*

1994	1,852,141	5,090,851	306,083	1,131,840	127,336	255,305	537,263	2,446
Forest Land	1,851,783	53	0	61	0	0	244	0
Cropland	3,349	5,033,313	46,543	6,707	0	0	938	0
SA-CL	4,410	0	301,673	0	0	0	0	0
Grassland	1,291	8,269	0	1,111,454	10,528	0	297	0
SA-GL	284	0	0	0	126,455	597	0	1
Wetlands	21	0	0	0	0	255,276	8	0
Settlements	282	28	0	178	0	16	536,759	0
Other Land	0	0	0	0	0	0	0	2,446
1995	1,861,421	5,041,664	348,216	1,118,400	136,983	255,889	538,247	2,447
Forest Land	1,861,075	79	0	79	0	0	188	0
Cropland	3,349	4,984,101	46,569	6,707	0	0	938	0
SA-CL	5,242	0	342,974	0	0	0	0	0
Grassland	1,291	8,269	0	1,097,996	10,546	0	297	0
SA-GL	453	0	0	0	135,932	597	0	1
Wetlands	23	0	0	0	0	255,858	8	0
Settlements	312	28	0	178	0	16	537,713	0
Other Land	0	0	0	0	0	0	0	2,447
1996	1,871,746	4,992,476	389,543	1,104,960	146,478	256,471	539,144	2,447
Forest Land	1,871,224	192	0	90	0	0	240	0
Cropland	3,349	4,934,800	46,682	6,707	0	0	938	0
SA-CL	6,590	0	382,953	0	0	0	0	0
Grassland	1,291	8,269	0	1,084,545	10,558	0	297	0
SA-GL	727	0	0	0	145,154	597	0	1
Wetlands	27	0	0	0	0	256,436	8	0
Settlements	361	28	0	178	0	16	538,561	0
Other Land	0	0	0	0	0	0	0	2,447
1997	1,883,569	4,943,289	429,635	1,091,520	155,712	257,049	540,044	2,448
Forest Land	1,883,167	89	0	42	0	0	271	0
Cropland	3,349	4,885,716	46,579	6,707	0	0	938	0
SA-CL	5,342	0	424,293	0	0	0	0	0
Grassland	1,291	8,269	0	1,071,153	10,509	0	297	0
SA-GL	473	0	0	0	154,641	597	0	1
Wetlands	23	0	0	0	0	257,017	8	0
Settlements	316	28	0	178	0	16	539,506	0
Other Land	0	0	0	0	0	0	0	2,448
1998	1,893,962	4,894,102	470,872	1,078,080	165,150	257,630	541,021	2,449
Forest Land	1,893,566	27	0	91	0	0	278	0
Cropland	3,349	4,836,591	46,517	6,707	0	0	938	0
SA-CL	7,879	0	462,994	0	0	0	0	0
Grassland	1,291	8,269	0	1,057,664	10,558	0	297	0
SA-GL	988	0	0	0	163,564	597	0	1
Wetlands	30	0	0	0	0	257,591	8	0
Settlements	408	28	0	178	0	16	540,391	0
Other Land	0	0	0	0	0	0	0	2,449
1999	1,907,512	4,844,915	509,511	1,064,640	174,122	258,204	541,912	2,450

***Table A3-3.3** (continued) Annual land-use changes 1985-2012 (ha)*

1999	1,907,512	4,844,915	509,511	1,064,640	174,122	258,204	541,912	2,450
Forest Land	1,906,793	68	0	56	0	0	595	0
Cropland	3,349	4,787,362	46,558	6,707	0	0	938	0
SA-CL	8,226	0	501,285	0	0	0	0	0
Grassland	1,598	8,269	0	1,044,259	10,217	0	297	0
SA-GL	752	0	0	0	172,773	597	0	1
Wetlands	31	0	0	0	0	258,165	8	0
Settlements	421	28	0	178	0	16	541,270	0
Other Land	0	0	0	0	0	0	0	2,450
2000	1,921,170	4,795,727	547,843	1,051,200	182,989	258,778	543,108	2,451
Forest Land	1,920,649	61	0	101	0	0	359	0
Cropland	7,613	4,768,973	15,329	1,847	0	0	1,965	0
SA-CL	6,017	0	541,826	0	0	0	0	0
Grassland	2,479	2,985	0	1,020,273	24,925	0	538	0
SA-GL	0	0	0	0	182,502	487	0	0
Wetlands	10	0	0	0	0	258,732	35	0
Settlements	177	1	0	119	0	30	542,781	0
Other Land	0	0	0	0	0	0	0	2,451
2001	1,936,944	4,772,020	557,155	1,022,340	207,428	259,249	545,679	2,451
Forest Land	1,936,307	109	0	89	0	0	439	0
Cropland	8,553	4,747,601	12,054	1,847	0	0	1,965	0
SA-CL	7,233	0	549,923	0	0	0	0	0
Grassland	2,871	2,985	0	991,425	24,521	0	538	0
SA-GL	0	0	0	0	206,941	487	0	0
Wetlands	12	0	0	0	0	259,202	35	0
Settlements	205	1	0	119	0	30	545,324	0
Other Land	0	0	0	0	0	0	0	2,451
2002	1,955,180	4,750,696	561,977	993,480	231,462	259,719	548,302	2,451
Forest Land	1,954,587	26	0	44	0	0	523	0
Cropland	5,194	4,726,359	15,329	1,847	0	0	1,965	0
SA-CL	5,668	0	556,309	0	0	0	0	0
Grassland	1,976	2,985	0	962,610	25,372	0	538	0
SA-GL	0	0	0	0	230,975	487	0	0
Wetlands	8	0	0	0	0	259,675	35	0
Settlements	141	1	0	119	0	30	548,011	0
Other Land	0	0	0	0	0	0	0	2,451
2003	1,967,573	4,729,371	571,639	964,620	256,347	260,192	551,073	2,451
Forest Land	1,966,629	74	0	119	0	0	750	0
Cropland	5,638	4,704,986	14,934	1,847	0	0	1,965	0
SA-CL	6,300	0	565,339	0	0	0	0	0
Grassland	2,171	2,985	0	933,675	25,251	0	538	0
SA-GL	0	0	0	0	255,860	487	0	0
Wetlands	9	0	0	0	0	260,148	35	0
Settlements	155	1	0	119	0	30	550,768	0
Other Land	0	0	0	0	0	0	0	2,451
2004	1,980,902	4,708,047	580,273	935,760	281,111	260,665	554,057	2,451

***Table A3-3.3** (continued) Annual land-use changes 1985-2012 (ha)*

2004	1,980,902	4,708,047	580,273	935,760	281,111	260,665	554,057	2,451
Forest Land	1,980,491	71	0	27	0	0	313	0
Cropland	1,192	4,683,665	19,377	1,847	0	0	1,965	0
SA-CL	1,141	0	579,132	0	0	0	0	0
Grassland	424	2,985	0	904,907	26,906	0	538	0
SA-GL	0	0	0	0	280,624	487	0	0
Wetlands	2	0	0	0	0	260,628	35	0
Settlements	30	1	0	119	0	30	553,877	0
Other Land	0	0	0	0	0	0	0	2,451
2005	1,983,280	4,686,722	598,510	906,900	307,530	261,145	556,729	2,451
Forest Land	1,982,771	44	0	21	0	0	443	0
Cropland	5,638	4,662,367	14,905	1,847	0	0	1,965	0
SA-CL	7,495	0	591,015	0	0	0	0	0
Grassland	2,301	2,985	0	876,053	25,024	0	538	0
SA-GL	88	0	0	0	306,955	487	0	0
Wetlands	10	0	0	0	0	261,099	35	0
Settlements	170	1	0	119	0	30	556,409	0
Other Land	0	0	0	0	0	0	0	2,451
2006	1,998,472	4,665,398	605,920	878,040	331,978	261,616	559,391	2,451
Forest Land	1,998,227	16	0	37	0	0	192	0
Cropland	5,638	4,641,071	14,877	1,847	0	0	1,965	0
SA-CL	14,396	0	591,524	0	0	0	0	0
Grassland	933	2,985	0	847,177	26,407	0	538	0
SA-GL	0	0	0	0	331,491	487	0	0
Wetlands	0	0	0	0	0	261,581	35	0
Settlements	0	1	0	119	0	30	559,241	0
Other Land	0	0	0	0	0	0	0	2,451
2007	2,019,194	4,644,073	606,401	849,180	357,898	262,098	561,972	2,451
Forest Land	2,018,900	98	0	35	0	0	160	0
Cropland	5,638	4,619,664	14,959	1,847	0	0	1,965	0
SA-CL	5,388	0	601,012	0	0	0	0	0
Grassland	643	2,985	0	818,318	26,696	0	538	0
SA-GL	0	0	0	0	357,411	487	0	0
Wetlands	0	0	0	0	0	262,062	35	0
Settlements	260	1	0	119	0	30	561,561	0
Other Land	0	0	0	0	0	0	0	2,451
2008	2,030,830	4,622,749	615,971	820,320	384,107	262,579	564,260	2,451
Forest Land	2,030,374	56	0	103	0	0	296	0
Cropland	5,638	4,598,382	14,917	1,847	0	0	1,965	0
SA-CL	2,465	0	613,505	0	0	0	0	0
Grassland	696	2,985	0	789,391	26,711	0	538	0
SA-GL	0	0	0	0	383,620	487	0	0
Wetlands	0	0	0	0	0	262,544	35	0
Settlements	174	1	0	119	0	30	563,936	0
Other Land	0	0	0	0	0	0	0	2,451
2009	2,039,347	4,601,424	628,422	791,460	410,330	263,061	566,771	2,451

Table A3-3.3 *(continued) Annual land-use changes 1985-2012 (ha)*

2009	2,039,347	4,601,424	628,422	791,460	410,330	263,061	566,771	2,451
Forest Land	2,039,138	59	0	47	0	0	102	0
Cropland	5,638	4,577,055	14,920	1,847	0	0	1,965	0
SA-CL	654	0	627,768	0	0	0	0	0
Grassland	373	2,985	0	760,587	26,977	0	538	0
SA-GL	0	0	0	0	409,843	487	0	0
Wetlands	0	0	0	0	0	263,025	35	0
Settlements	592	1	0	119	0	30	566,029	0
Other Land	0	0	0	0	0	0	0	2,451
2010	2,046,394	4,580,100	642,688	762,600	436,821	263,542	568,670	2,451
Forest Land	2,046,118	67	0	24	0	0	185	0
Cropland	3,898	4,572,390	0	1,847	0	0	1,965	0
SA-CL	0	2,908	639,779	0	0	0	0	0
Grassland	582	2,985	0	756,884	1,612	0	538	0
SA-GL	0	0	0	0	436,334	487	0	0
Wetlands	0	0	0	0	0	263,507	35	0
Settlements	65	1	0	119	0	30	568,456	0
Other Land	0	0	0	0	0	0	0	2,451
2011	2,050,662	4,578,351	639,779	758,874	437,946	264,024	571,179	2,451
Forest Land	2,049,880	113	0	389	0	0	280	0
Cropland	5,004	4,569,534	0	1,847	0	0	1,965	0
SA-CL	0	6,522	633,258	0	0	0	0	0
Grassland	663	2,985	0	754,688	0	0	538	0
SA-GL	0	0	0	1,817	435,642	487	0	0
Wetlands	0	0	0	0	0	263,988	35	0
Settlements	85	1	0	119	0	30	570,944	0
Other Land	0	0	0	0	0	0	0	2,451
2012	2,055,632	4,579,155	633,258	758,860	435,642	264,505	573,763	2,451

Adjustment of HCSO's land use data applied for area representation

One of the most important land-use dataset for the implementation of the consistent area representation in Hungary was the HCSO's land-use statistics. This database is collected annually, by questionnaires, but it is adjusted by the HCSO whenever more detailed dataset is available. Sometimes this adjustment of the HCSO causes significant drops in the year of the adjustment in the time series (e.g. reported Grassland area in the HCSO's statistics decreased by 241.6 thousand hectares from 2009 to 2010 in the HCSO's statistics, as a result of the more detailed General Agricultural survey, conducted in 2010).

After the change of the regime in Hungary at the beginning of the 1990's, the land of the former large collective farms was mainly distributed among individual farmers. This transformation, when changes in ownership took place, was not entirely transparent (Laczka and Soós, 2003) and it made the data collection more difficult. The changes in the ownership resulted in changes of the system and the method of data collection. (Kecskés, 1997)
Sometimes the time series are reconsidered by the HCSO, and the data for the years before the year of the adjustment are fitted backward to the adjusted, but sometimes not. (The HCSO's land-use statistics are published on the website of the office
http://portal.ksh.hu/pls/ksh/docs/eng/xstadat/xstadat_annual/tabl4_01_04iea.html
where the green colour signs the reconsideration.)

Significant changes in the time series derived from the problem of data collection which could cause emissions/removals from artefacts. In order to avoid these unreal effects, the dataset was further adjusted by the HMS before making GHG inventory. The adjustment was implemented after consultation with the HCSO's expert. The following paragraphs describe the steps and assumptions in developing the activity data from the HCSO's land-use statistics:

- Between 1985 and 1990 the system of landowners and data collection can be considered as to be in steady state, therefore the annual data was accepted without adjustment.
- The most significant changes of the landownership occurred in the period 1990-2000; therefore the annual dataset for the all categories with exception of orchards and vineyards was replaced with the interpolated values between the two general agricultural censuses which were held in 1990 and 2000. For the vineyards and orchard category the results of the more detailed and reliable census on vineyards and orchards were accepted instead of the results of the general agricultural census. Therefore the interpolation was applied for the years between 1990 and 2001.
- For the period 2000-2010, the annual Cropland and Grassland areas were interpolated between the areas reported for the years of Central Agricultural Surveys conducted in 2000 and 2010. Vineyard and Orchard areas were interpolated between the years for which the most detailed survey data are available (2001 and 2010).

Activity data for estimation of carbon stock change in Cropland living biomass

Table A3-3.4 *Vineyard activity data for calculation of carbon stock change in living biomass on Cropland 1985-2011*

Year	Vineyard Total Area	Adjusted Vineyard Area	Vineyard Area of Agricultural Enterprises	Vineyard Area of Private Farms	Adjusted Vineyard Area of Private Farms	Vineyard Removal of Agricultural Enterprises	Vineyard Removal of Private Farms (estimated)	Total Vineyard Removal
	[1,000 ha]					[ha]		
1985	153.6	153.6	69.6	84.0	84.0	7,706		7,706
BY	148.6	148.6	64.5	84.1	84.1	6,706		6,706
1986	147.4	147.4	63.5	83.9	83.9	6,267		6,267
1987	144.9	144.9	60.6	84.3	84.3	6,144		6,144
1988	142.2	142.2	55.2	86.9	86.9	3,485		3,485
1989	140.3	140.3	50.8	89.6	89.6	2,101		2,101
1990	138.5	138.5	47.1	91.4	91.4	2,152	3,042	5,194
1991	136.4	134.4	41.8	94.6	90.6	1,873	3,728	5,601
1992	135.0	130.2	43.5	91.5	89.9	1,384	3,705	5,089
1993	131.7	126.1	34.3	97.4	89.2	543	3,681	4,224
1994	131.9	121.9	20.5	111.4	88.5	404	3,657	4,061
1995	131.3	117.8	13.9	117.4	87.8	49	3,634	3,683
1996	130.9	113.6	14.6	116.3	87.1	58	3,61	3,668
1997	130.9	109.5	9.1	121.7	86.4	567	3,586	4,153
1998	129.7	105.3	8.1	121.6	85.7	127	3,563	3,69
1999	127.0	101.2	8.4	118.7	85.0	97	3,539	3,636
2000	105.9	97.0	8.7	97.1	84.3	139	3,516	3,655
2001	92.9	92.9	9.3	83.5	83.5	198	3,492	3,69
2002	92.8	91.8	10.0	82.8	82.0	202	3,851	4,053
2003	93.3	90.7	10.5	82.8	80.4	230	3,799	4,029
2004	94.5	89.5	11.3	83.2	78.8	258	3,746	4,004
2005	86.0	88.4	12.8	73.1	77.2	68	3,693	3,761
2006	86.0	87.3	13.3	72.8	75.6	462	3,641	4,102
2007	86.0	86.2	13.3	72.8	74.0	1329	3,588	4,917
2008	82.6	85.0	13.0	69.6	72.5	129	3,535	3,664
2009	82.8	83.9	14.3	68.5	70.9	213	3,483	3,695
2010	82.8	82.8	13.5	69.3	69.3	629	3,430	4,059
2011	82.1	82.1	13.5	68.7	68.7	301	2,903	3,204
2012	81.6	174.2	13.1	68.5	68.5	225	2440	2665

***Table A3-3.5** Orchard Activity data for calculation of carbon stock change in living biomass on Cropland (ha) (note: * interpolated value) 1985-2011*

Year	Orchard Total Area	Adjusted Orchard Area	Orchard Area of Agricultural Enterprises	Orchard Area of Private Farms	Adjusted Orchard Area of Private Farms	Orchard Removal of Agricultural Enterprises	Orchard Removal of Private Farms (estimated)	Total Orchard Removal
	kha					ha		
1985	103.5	103.5	71.2	32.3	32.3	5628	0	5628
BY	99.7	99.7	65.9	33.8	33.8	3777	0	3777
1986	99.0	99.0	65.0	34.0	34.0	2998	0	2998
1987	96.5	96.5	61.5	35.0	35.0	2705	0	2705
1988	94.9	94.9	59.3	35.6	35.6	2015	0	2015
1989	94.3	94.3	56.2	38.1	38.1	1208	0	1208
1990	95.1	95.1	61.1	34.0	34.0	2142	1132	3274
1991	94.1	95.3	53.1	41.0	38.0	1955	1264	3219
1992	94.5	95.5	52.1	42.4	41.9	973	1396	2369
1993	93.0	95.8	43.7	49.3	45.9	596	1528	2124
1994	92.7	96.0	37.4	55.3	49.9	469	1660	2129
1995	93.9	96.2	26.2	67.7	53.8	680	1792	2472
1996	94.3	96.4	27.7	66.6	57.8	526	1924	2450
1997	95.6	96.6	20.7	74.9	61.7	198	2056	2254
1998	96.3	96.8	19.8	76.6	65.7	538	2188	2726
1999	96.4	97.1	22.0	74.4	69.7	523	2320	2843
2000	95.4	97.3	21.2	74.2	73.6	350	2452	2802
2001	97.5	97.5	19.9	77.6	77.6	518	2584	3102
2002	97.4	97.1	21.2	76.2	77.0	803	2564	3790
2003	98.3	96.7	23.7	74.7	76.4	492	2545	3459
2004	102.6	96.2	24.7	77.9	75.8	181	2525	3128
2005	102.8	95.8	27.1	75.7	75.2	778	2506	3706
2006	102.8	95.4	26.6	76.2	74.7	966	2486	3874
2007	101.9	95.0	26.1	75.8	74.1	244	2466	3133
2008	98.5	94.5	23.7	74.7	73.5	318	2447	3187
2009	98.7	94.1	23.1	75.6	72.9	543	2427	3392
2010	93.7	93.7	21.4	72.3	72.3	476	2408	3306
2011	92.4	92.4	21.7	70.7	70.7	305	2354	3913
2012	92.6	92.6	20.3	72.3	72.3	244	2407	2651

Determination of activity data (A_G, A_L) from HCSO statistics for calculation of carbon stock change in living biomass in Cropland

The method recommended by the GPG for LULUCF (IPCC, 2003) requires agricultural statistics on land areas of growing stock and harvested land in perennial woody crops (orchard and vineyards in Hungary) and land conversion data from and to perennial woody Cropland.

The following statistics concerned are published by the HCSO, annually:

- Vineyard total area and areas by legal forms
- Orchard total area and areas by legal forms
- Vineyard removal in the area of agricultural enterprises
- Orchard removal in the area of agricultural enterprises

It can be seen that the HCSO statistics cannot provide information on land conversion by previous and following land-use. Only the total vineyard and orchard areas and removals are known. In addition to that removal statistics are published for the agricultural enterprises only, and this statistic is not available for the private farms that have increasing importance since 1990. (Areas reported as 'area unidentifiable with holdings' in the HCSO statistics was considered as area of private farms.) Thus an estimation procedure was developed for the estimation of removal of private farms as described below.

The following assumptions were made in the course of the estimation procedure:

1. Until 1989 the data on removal in the areas of agricultural enterprises comprises the removed areas by private farms as well. Before the economic change in 1989-90 the land areas of private farms were negligible, and the few private farms used mostly the land of agricultural enterprises thus the agricultural statistics on enterprises contains the activity of mostly private farms as well.

2. According to the Tier 1 methodology of GPG for LULUCF (IPCC, 2003), a 30 year harvest cycle is assumed for perennial woody crops as orchards and vineyards in temperate climate region on the area of private farms. It means that 3.33% of these cultures are removed and replanted in every year.

3. The change of the extent of orchard and vineyard area on private farms derives partially from legal acts (landowner change) instead of plantation and removal. It is evident from *Fig. A3-1*. After the economic change the land area of agricultural enterprises decreased continuously while the area of private farms increased. According to the farm structure survey in 2007 the private farms held possession of 74 percent of the total orchard area and 85 percent of the vineyard area. A significant restructuring (landowner changes) took place in the nineties, thus the growing of land areas of private farms derived from the landowner change instead of plantation and on the contrary, the decrease of land areas of agricultural enterprises is not primarily the result of removals.

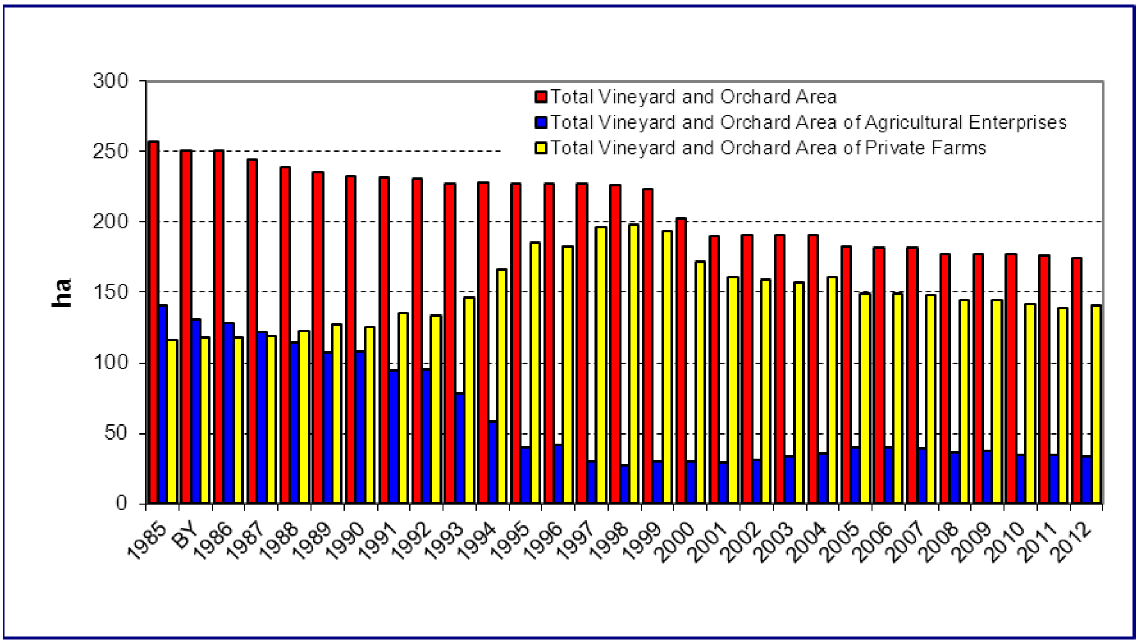


Figure A3-3.1. *Landowner changes of vineyards and orchards in Hungary 1985-2012*

To separate the area decrease resulting from the landowner change from real removals, the area decrease of private farms was considered as removal in a certain year if the total vineyard/ orchard area decreased as well. If the decrease of the area of private farms exceeds the decrease of the total area, the area decrease is considered as removal in private farms to such an extent that the total area decreased. (Eq. A3-7, A3-8, A3-9)
(To estimate the removal from land area decrease, the total vineyard area was adjusted similarly to the area of private farms, as described below.)

The HCSO collects statistics on vineyard and orchard areas by questionnaire, annually, but in the year of the agricultural censuses, these data derives from a more detailed and more widespread data collection. (There were General Agricultural Censuses in 1990, 2000 and 2010. There was a Census on Orchards and Vineyard in 2001, which is the most detailed data collection on Hungarian vineyard and orchard. There was a Census on the most significant fruit plantation in 2007 as well). As a result of the more widespread data collection in the years of censuses, the differences between the values given for the year of census and the values given for the previous and subsequent years are sometimes significant, especially in the time series of the vineyard area of private farms. Big differences in the time series are the result of the uncertainty of annual data collection among the private farms, as revealed on the course of the General Agricultural Census in 2000. The private farms often reported abandoned vineyards as managed vineyards in the nineties (HCSO, 2001). To insure the consistency of the time series of the area of private farms, this data set was adjusted by linear interpolation between the values given for 1990 and 2001, and between 2001 and 2010, only the most detailed and reliable data collection were taken into account. Results of annual data collection were ignored.

Determination of A_G

Following the assumptions described above, A_G was obtained from the subtracting vineyard and orchard total area (agricultural enterprises and private farms areas summed) the areas of orchard and vineyard plantation in the inventory year (Equation A3-3).

$$A_G = A_{VAE} + A_{VPF} + A_{OAE} + A_{OPF}$$

Equation A3-3.

Where:
A_G land areas of growing stock
A_{VAE} vineyard areas of agricultural enterprises
A_{VPF} vineyard areas of private farms
A_{OAE} orchard areas of agricultural enterprises
A_{OPF} orchard areas of private farms

These time series are available from the HCSO statistics (*Tables A3-4.4, A3-4.5*), although there is a data gap in the year of 2003, which was eliminated by interpolation from the values of the previous and the next years data.

Determination of A_L

The removal of perennial woody crops derives from the vineyard and orchard removal on the area of the agricultural enterprises and on the areas of private farms. The removal arises from rotation (replantation) and the area decrease (abandonment of vineyards and orchards)

$$A_L = A_{VRAE} + A_{VRPF} + A_{ORAE} + A_{ORPF}$$

Equation A3-4.

Where:
A_{VRAE} vineyard removal on the areas agricultural enterprises
A_{VRPF} vineyard removal on the areas private farms
A_{ORAE} orchard removal on the areas of agricultural enterprises
A_{ORPF} orchard removal on the areas of private farms

The time series of vineyard and orchard removal on the areas of agricultural enterprises are available from the HCSO statistics (*Tables A3-4.4, A3-4.5*), although there is a data gap in the year of 2003, which was eliminated by linear interpolation.

Estimation of removal of private farms as follows:

$$A_{VRPF} = \{0 \text{ until 1989 and } A_{VPF} \cdot 0.333 + \min(f(A_{VT}), f(A_{VPF})) \text{ since 1990}\}$$

Equation A3-5.

$$A_{ORPF} = \{0 \text{ until 1989 and } A_{VPF} \cdot 0.333 + \min(f(A_{OT}), f(A_{OPF})) \text{ since 1990}\}$$

Equation A3-6.

Where:
A_{VT} vineyard total area
A_{OT} orchard total area
f(x) area decrease function

$$f(x) = \{x_{iy-1} - x_{iy} \text{ if } x_{iy-1} - x_{iy} > 0 \text{ else } 0\}$$

Equation A3-7 .

Where:
x_{iy} area in the inventory year
x_{iy-1} area one year before the inventory year

Activity data and estimated carbon stocks for calculation of carbon stock change in mineral soils of Cropland and Grassland

Table A3-3.6 *Cropland areas by climate zones, soil type and management practices and estimated average carbon stocks*

Land-use	Sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1965	1966	1967	1968	1969	1970
	Climate	Soil	Management	Input					Area(ha)					
Cropland	cold dry	HAC	full till	low	48	0.82	1.00	0.92	968.1	966.8	964.0	961.7	960.3	958.5
				medium	48	0.82	1.00	1.00	704.1	703.1	701.1	699.4	698.4	697.1
				high with no manure	48	0.82	1.00	1.07	88.0	87.9	87.6	87.4	87.3	87.1
			reduced till	medium	48	0.82	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0
			no-till	medium	48	0.82	1.10	1.00	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry		full till	low	58	0.82	1.00	0.92	1431.4	1429.5	1425.3	1422.0	1420.0	1417.2
				medium	58	0.82	1.00	1.00	1041.0	1039.6	1036.6	1034.2	1032.7	1030.7
				high with no manure	58	0.82	1.00	1.07	130.1	130.0	129.6	129.3	129.1	128.8
			reduced till	medium	58	0.82	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0
			no-till	medium	58	0.82	1.10	1.00	0.0	0.0	0.0	0.0	0.0	0.0
	cold dry	HAC*	full till	low	48	0.82	1.00	0.92	37.2	37.2	37.0	37.0	36.9	36.8
				medium	48	0.82	1.00	1.00	27.1	27.0	26.9	26.9	26.8	26.8
				high with no manure	48	0.82	1.00	1.07	3.4	3.4	3.4	3.4	3.4	3.3
	warm dry			low	58	0.82	1.00	0.92	29.6	29.6	29.5	29.4	29.4	29.3
				medium	58	0.82	1.00	1.00	21.5	21.5	21.4	21.4	21.4	21.3
				high with no manure	58	0.82	1.00	1.07	2.7	2.7	2.7	2.7	2.7	2.7
	cold dry	sandy		low	15	0.82	1.00	0.92	74.2	74.1	73.9	73.7	73.6	73.5
				medium	15	0.82	1.00	1.00	54.0	53.9	53.7	53.6	53.5	53.4
				high with no manure	15	0.82	1.00	1.07	6.7	6.7	6.7	6.7	6.7	6.7
	warm dry			low	21	0.82	1.00	0.92	89.2	89.1	88.8	88.6	88.5	88.3
				medium	21	0.82	1.00	1.00	64.9	64.8	64.6	64.5	64.4	64.3
				high with no manure	21	0.82	1.00	1.07	8.1	8.1	8.1	8.1	8.0	8.0
	cold dry	aquic		low	166	0.82	1.00	0.92	188.9	188.7	188.1	187.7	187.4	187.0
				medium	166	0.82	1.00	1.00	137.4	137.2	136.8	136.5	136.3	136.0
				high with no manure	166	0.82	1.00	1.07	17.2	17.2	17.1	17.1	17.0	17.0
	warm dry			low	132	0.82	1.00	0.92	288.7	288.3	287.5	286.8	286.4	285.8
				medium	132	0.82	1.00	1.00	210.0	209.7	209.1	208.6	208.3	207.9
				high with no manure	132	0.82	1.00	1.07	26.2	26.2	26.1	26.1	26.0	26.0
Total Cropland									**5649.7**	**5642.2**	**5625.6**	**5612.7**	**5604.5**	**5593.8**
Carbon stock per ha (tC/ha)									**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**

Table A3-3.6 *(continued) Cropland areas by climate zones, soil type and management practices and estimated average carbon stocks*

Land-use	Sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
	Climate	Soil	Management	Input					Area(ha)									
Cropland	cold dry	HAC	full till	low	48	0.82	1.00	0.92	955.8	953.6	951.8	943.0	941.6	937.4	929.2	923.3	917.5	913.7
				medium	48	0.82	1.00	1.00	695.2	693.5	692.2	685.8	684.8	681.8	675.8	671.5	667.3	664.5
				high with no manure	48	0.82	1.00	1.07	86.9	86.7	86.5	85.7	85.6	85.2	84.5	83.9	83.4	83.1
			reduced till	medium	48	0.82	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			no-till	medium	48	0.82	1.10	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry		full till	low	58	0.82	1.00	0.92	1413.3	1410.0	1407.4	1394.4	1392.2	1386.1	1373.9	1365.3	1356.6	1351.0
				medium	58	0.82	1.00	1.00	1027.9	1025.5	1023.6	1014.1	1012.5	1008.0	999.2	992.9	986.6	982.5
				high with no manure	58	0.82	1.00	1.07	128.5	128.2	127.9	126.8	126.6	126.0	124.9	124.1	123.3	122.8
			reduced till	medium	58	0.82	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			no-till	medium	58	0.82	1.10	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	cold dry	HAC*	full till	low	48	0.82	1.00	0.92	36.7	36.6	36.6	36.2	36.2	36.0	35.7	35.5	35.3	35.1
				medium	48	0.82	1.00	1.00	26.7	26.7	26.6	26.4	26.3	26.2	26.0	25.8	25.6	25.5
				high with no manure	48	0.82	1.00	1.07	3.3	3.3	3.3	3.3	3.3	3.3	3.2	3.2	3.2	3.2
	warm dry			low	58	0.82	1.00	0.92	29.2	29.2	29.1	28.8	28.8	28.7	28.4	28.2	28.1	27.9
				medium	58	0.82	1.00	1.00	21.3	21.2	21.2	21.0	20.9	20.8	20.7	20.5	20.4	20.3
				high with no manure	58	0.82	1.00	1.07	2.7	2.7	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5
	cold dry	sandy		low	15	0.82	1.00	0.92	73.3	73.1	73.0	72.3	72.2	71.9	71.2	70.8	70.3	70.0
				medium	15	0.82	1.00	1.00	53.3	53.2	53.1	52.6	52.5	52.3	51.8	51.5	51.2	50.9
				high with no manure	15	0.82	1.00	1.07	6.7	6.6	6.6	6.6	6.6	6.5	6.5	6.4	6.4	6.4
	warm dry			low	21	0.82	1.00	0.92	88.1	87.9	87.7	86.9	86.8	86.4	85.6	85.1	84.6	84.2
				medium	21	0.82	1.00	1.00	64.1	63.9	63.8	63.2	63.1	62.8	62.3	61.9	61.5	61.2
				high with no manure	21	0.82	1.00	1.07	8.0	8.0	8.0	7.9	7.9	7.9	7.8	7.7	7.7	7.7
	cold dry	aquic		low	166	0.82	1.00	0.92	186.5	186.1	185.7	184.0	183.7	182.9	181.3	180.2	179.0	178.3
				medium	166	0.82	1.00	1.00	135.7	135.3	135.1	133.8	133.6	133.0	131.9	131.0	130.2	129.7
				high with no manure	166	0.82	1.00	1.07	17.0	16.9	16.9	16.7	16.7	16.6	16.5	16.4	16.3	16.2
	warm dry			low	132	0.82	1.00	0.92	285.0	284.4	283.8	281.2	280.8	279.5	277.1	275.3	273.6	272.5
				medium	132	0.82	1.00	1.00	207.3	206.8	206.4	204.5	204.2	203.3	201.5	200.3	199.0	198.2
				high with no manure	132	0.82	1.00	1.07	25.9	25.9	25.8	25.6	25.5	25.4	25.2	25.0	24.9	24.8
Total Cropland									**5578.3**	**5565.3**	**5554.9**	**5503.5**	**5495.1**	**5470.7**	**5422.7**	**5388.6**	**5354.6**	**5332.3**
Carbon stock per ha (tC/ha)									**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**

***Table A3-3.6** (continued) Cropland areas by climate zone, soil type and management practices and estimated average carbon stocks*

Land-use	Sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	Climate	Soil	Management	Input					Area(ha)									
Cropland	cold dry	HAC	full till	low	48	0.82	1.00	0.92	911.1	908.0	906.7	906.4	907.0	906.4	906.3	906.0	905.9	906.0
				medium	48	0.82	1.00	1.00	662.6	660.4	659.4	659.2	659.6	659.2	659.1	658.9	658.8	658.9
				high with no manure	48	0.82	1.00	1.07	82.8	82.5	82.4	82.4	82.5	82.4	82.4	82.4	82.4	82.4
			reduced till	medium	48	0.82	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			no-till	medium	48	0.82	1.10	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry		full till	low	58	0.82	1.00	0.92	1347.2	1342.6	1340.6	1340.2	1341.1	1340.2	1340.0	1339.6	1339.4	1339.7
				medium	58	0.82	1.00	1.00	979.8	976.4	975.0	974.7	975.4	974.7	974.6	974.3	974.1	974.3
				high with no manure	58	0.82	1.00	1.07	122.5	122.1	121.9	121.8	121.9	121.8	121.8	121.8	121.8	121.8
			reduced till	medium	58	0.82	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			no-till	medium	58	0.82	1.10	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	cold dry	HAC*	full till	low	48	0.82	1.00	0.92	35.0	34.9	34.8	34.8	34.9	34.8	34.8	34.8	34.8	34.8
				medium	48	0.82	1.00	1.00	25.5	25.4	25.3	25.3	25.4	25.3	25.3	25.3	25.3	25.3
				high with no manure	48	0.82	1.00	1.07	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
	warm dry			low	58	0.82	1.00	0.92	27.9	27.8	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7
				medium	58	0.82	1.00	1.00	20.3	20.2	20.2	20.2	20.2	20.2	20.2	20.1	20.1	20.2
				high with no manure	58	0.82	1.00	1.07	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
	cold dry	sandy		low	15	0.82	1.00	0.92	69.8	69.6	69.5	69.5	69.5	69.5	69.5	69.5	69.4	69.5
				medium	15	0.82	1.00	1.00	50.8	50.6	50.6	50.5	50.6	50.5	50.5	50.5	50.5	50.5
				high with no manure	15	0.82	1.00	1.07	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
	warm dry			low	21	0.82	1.00	0.92	84.0	83.7	83.6	83.5	83.6	83.5	83.5	83.5	83.5	83.5
				medium	21	0.82	1.00	1.00	61.1	60.9	60.8	60.8	60.8	60.8	60.8	60.7	60.7	60.7
				high with no manure	21	0.82	1.00	1.07	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
	cold dry	aquic		low	166	0.82	1.00	0.92	177.8	177.2	176.9	176.9	177.0	176.9	176.8	176.8	176.8	176.8
				medium	166	0.82	1.00	1.00	129.3	128.9	128.7	128.6	128.7	128.6	128.6	128.6	128.6	128.6
				high with no manure	166	0.82	1.00	1.07	16.2	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1
	warm dry			low	132	0.82	1.00	0.92	271.7	270.8	270.4	270.3	270.5	270.3	270.3	270.2	270.1	270.2
				medium	132	0.82	1.00	1.00	197.6	196.9	196.6	196.6	196.7	196.6	196.6	196.5	196.5	196.5
				high with no manure	132	0.82	1.00	1.07	24.7	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6
Total Cropland									**5317.2**	**5299.1**	**5291.3**	**5289.6**	**5293.3**	**5289.9**	**5289.0**	**5287.4**	**5286.6**	**5287.6**
Carbon stock per ha (tC/ha)									**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**

Table A3-3.6 *(continued) Cropland areas by climate zone, soil type and management practices and estimated average carbon stocks*

Land-use	Sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_{I}	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	Climate	Soil	Management	Input					Area(ha)									
Cropland	cold dry	HAC	full till	low	48	0.82	1.00	0.92	897.6	889.2	880.7	872.3	863.9	855.5	847.0	838.6	830.2	821.8
				medium	48	0.82	1.00	1.00	652.8	646.7	640.5	634.4	628.3	622.2	616.0	593.0	570.3	548.0
				high with no manure	48	0.82	1.00	1.07	81.6	80.8	80.1	79.3	78.5	77.8	77.0	76.2	75.5	74.7
			reduced till	medium	48	0.82	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.9	33.4	49.6
			no-till	medium	48	0.82	1.10	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry		full till	low	58	0.82	1.00	0.92	1327.2	1314.7	1302.3	1289.8	1277.4	1264.9	1252.4	1240.0	1227.5	1215.0
				medium	58	0.82	1.00	1.00	965.2	956.2	947.1	938.0	929.0	919.9	910.9	876.8	843.3	810.3
				high with no manure	58	0.82	1.00	1.07	120.7	119.5	118.4	117.3	116.1	115.0	113.9	112.7	111.6	110.5
			reduced till	medium	58	0.82	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	49.4	73.4
			no-till	medium	58	0.82	1.10	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	cold dry	HAC*	full till	low	48	0.82	1.00	0.92	34.5	34.2	33.8	33.5	33.2	32.9	32.6	32.2	31.9	31.7
				medium	48	0.82	1.00	1.00	25.1	24.9	24.6	24.4	24.1	23.9	23.7	23.4	23.2	23.1
				high with no manure	48	0.82	1.00	1.07	3.1	3.1	3.1	3.0	3.0	3.0	3.0	2.9	2.9	2.9
	warm dry			low	58	0.82	1.00	0.92	27.4	27.2	26.9	26.7	26.4	26.2	25.9	25.6	25.4	25.2
				medium	58	0.82	1.00	1.00	20.0	19.8	19.6	19.4	19.2	19.0	18.8	18.7	18.5	18.4
				high with no manure	58	0.82	1.00	1.07	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3
	cold dry	sandy		low	15	0.82	1.00	0.92	68.8	68.2	67.5	66.9	66.2	65.6	64.9	64.3	63.6	61.9
				medium	15	0.82	1.00	1.00	50.0	49.6	49.1	48.6	48.2	47.7	47.2	46.8	46.3	45.0
				high with no manure	15	0.82	1.00	1.07	6.3	6.2	6.1	6.1	6.0	6.0	5.9	5.8	5.8	5.6
	warm dry			low	21	0.82	1.00	0.92	82.7	82.0	81.2	80.4	79.6	78.8	78.1	77.3	76.5	74.4
				medium	21	0.82	1.00	1.00	60.2	59.6	59.0	58.5	57.9	57.3	56.8	56.2	55.6	54.1
				high with no manure	21	0.82	1.00	1.07	7.5	7.5	7.4	7.3	7.2	7.2	7.1	7.0	7.0	6.8
	cold dry	aquic		low	166	0.82	1.00	0.92	175.2	173.5	171.9	170.2	168.6	166.9	165.3	163.6	162.0	161.2
				medium	166	0.82	1.00	1.00	127.4	126.2	125.0	123.8	122.6	121.4	120.2	119.0	117.8	117.2
				high with no manure	166	0.82	1.00	1.07	15.9	15.8	15.6	15.5	15.3	15.2	15.0	14.9	14.7	14.7
	warm dry			low	132	0.82	1.00	0.92	267.7	265.2	262.6	260.1	257.6	255.1	252.6	250.1	247.6	246.3
				medium	132	0.82	1.00	1.00	194.7	192.8	191.0	189.2	187.4	185.5	183.7	181.9	180.0	179.1
				high with no manure	132	0.82	1.00	1.07	24.3	24.1	23.9	23.6	23.4	23.2	23.0	22.7	22.5	22.4
Total Cropland									**5238.4**	**5189.2**	**5140.0**	**5090.9**	**5041.7**	**4992.5**	**4943.3**	**4894.1**	**4844.9**	**4795.7**
Carbon stock per ha (tC/ha)									**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.02**	**52.19**	**52.23**	**52.34**

Table A3-3.6 *Cropland areas by climate zone, soil type and management practices and estimated average carbon stocks*

Land-use	Sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_{I}	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	Climate	Soil	Management	Input					Area(ha)									
Cropland	cold dry	HAC	full till	low	48	0.82	1.00	0.92	706.2	694.0	681.9	669.9	657.9	646.1	634.3	622.6	610.9	599.4
				medium	48	0.82	1.00	1.00	635.6	624.6	613.7	602.9	592.1	581.5	570.8	560.3	549.9	539.5
				high with no manure	48	0.82	1.00	1.07	70.6	69.4	68.2	67.0	65.8	64.6	63.4	62.3	61.1	59.9
			reduced till	medium	48	0.82	1.03	1.00	65.8	81.8	97.8	113.5	129.2	144.7	160.0	175.2	190.2	205.1
			no-till	medium	48	0.82	1.10	1.00	6.9	8.5	10.2	11.8	13.5	15.1	16.7	18.3	19.8	21.4
	warm dry		full till	low	58	0.82	1.00	0.92	1046.2	1028.1	1010.2	992.3	974.6	957.1	939.6	922.3	905.0	887.9
				medium	58	0.82	1.00	1.00	941.6	925.3	909.2	893.1	877.2	861.4	845.6	830.0	814.5	799.2
				high with no manure	58	0.82	1.00	1.07	104.6	102.8	101.0	99.2	97.5	95.7	94.0	92.2	90.5	88.8
			reduced till	medium	58	0.82	1.03	1.00	97.4	121.2	144.8	168.2	191.4	214.3	237.0	259.5	281.8	303.9
			no-till	medium	58	0.82	1.10	1.00	10.1	12.6	15.1	17.5	19.9	22.3	24.7	27.0	29.4	31.7
	cold dry	HAC*	full till	low	48	0.82	1.00	0.92	31.6	31.4	31.3	31.1	31.0	30.9	30.7	30.6	27.7	27.5
				medium	48	0.82	1.00	1.00	23.0	22.9	22.8	22.7	22.5	22.4	22.3	22.2	24.9	24.8
				high with no manure	48	0.82	1.00	1.07	2.9	2.9	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
	warm dry			low	58	0.82	1.00	0.92	25.1	25.0	24.9	24.8	24.7	24.6	24.4	24.3	22.0	21.9
				medium	58	0.82	1.00	1.00	18.3	18.2	18.1	18.0	17.9	17.9	17.8	17.7	19.8	19.7
				high with no manure	58	0.82	1.00	1.07	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.2	2.2
	cold dry	sandy		low	15	0.82	1.00	0.92	61.6	61.3	61.1	60.8	60.5	60.2	60.0	59.7	54.0	53.8
				medium	15	0.82	1.00	1.00	44.8	44.6	44.4	44.2	44.0	43.8	43.6	43.4	48.6	48.4
				high with no manure	15	0.82	1.00	1.07	5.6	5.6	5.6	5.5	5.5	5.5	5.5	5.4	5.4	5.4
	warm dry			low	21	0.82	1.00	0.92	74.1	73.7	73.4	73.1	72.8	72.4	72.1	71.8	64.9	64.6
				medium	21	0.82	1.00	1.00	53.9	53.6	53.4	53.2	52.9	52.7	52.4	52.2	58.4	58.2
				high with no manure	21	0.82	1.00	1.07	6.7	6.7	6.7	6.6	6.6	6.6	6.6	6.5	6.5	6.5
	cold dry	aquic		low	166	0.82	1.00	0.92	160.4	159.7	159.0	158.2	157.5	156.8	156.1	155.4	140.6	139.9
				medium	166	0.82	1.00	1.00	116.6	116.1	115.6	115.1	114.6	114.0	113.5	113.0	126.5	126.0
				high with no manure	166	0.82	1.00	1.07	14.6	14.5	14.5	14.4	14.3	14.3	14.2	14.1	14.1	14.0
	warm dry			low	132	0.82	1.00	0.92	245.1	244.0	242.9	241.8	240.7	239.6	238.5	237.4	214.9	213.9
				medium	132	0.82	1.00	1.00	178.3	177.5	176.7	175.9	175.1	174.3	173.5	172.7	193.4	192.5
				high with no manure	132	0.82	1.00	1.07	22.3	22.2	22.1	22.0	21.9	21.8	21.7	21.6	21.5	21.4
Total Cropland									**4772.0**	**4750.7**	**4729.4**	**4708.0**	**4686.7**	**4665.4**	**4644.1**	**4622.7**	**4601.4**	**4580.1**
Carbon stock per ha (tC/ha)									**52.38**	**52.41**	**52.44**	**52.48**	**52.51**	**52.54**	**52.58**	**52.61**	**52.73**	**52.76**

Table A3-3.6 *(continued) Cropland areas by climate zone, soil type and management practices and estimated average carbon stocks*

Land-use	Climate	Soil	Management	Input	SOC_{ref}	F_{LU}	F_{MG}	F_I	2011	2012
Cropland	cold dry	HAC	full till	low	48	0.82	1.00	0.92	590.5	581.9
				medium	48	0.82	1.00	1.00	531.4	523.7
				high with no manure	48	0.82	1.00	1.07	59.0	58.2
			reduced till	medium	48	0.82	1.03	1.00	220.8	236.6
			no-till	medium	48	0.82	1.10	1.00	23.0	24.7
	warm dry		full till	low	58	0.82	1.00	0.92	874.7	862.0
				medium	58	0.82	1.00	1.00	787.2	775.8
				high with no manure	58	0.82	1.00	1.07	87.5	86.2
			reduced till	medium	58	0.82	1.03	1.00	327.1	350.6
			no-till	medium	58	0.82	1.10	1.00	34.1	36.5
	cold dry	HAC*	full till	low	48	0.82	1.00	0.92	27.5	27.5
				medium	48	0.82	1.00	1.00	24.8	24.8
				high with no manure	48	0.82	1.00	1.07	2.8	2.8
	warm dry			low	58	0.82	1.00	0.92	21.9	21.9
				medium	58	0.82	1.00	1.00	19.7	19.7
				high with no manure	58	0.82	1.00	1.07	2.2	2.2
	cold dry	sandy		low	15	0.82	1.00	0.92	53.7	53.8
				medium	15	0.82	1.00	1.00	48.4	48.4
				high with no manure	15	0.82	1.00	1.07	5.4	5.4
	warm dry			low	21	0.82	1.00	0.92	64.6	64.6
				medium	21	0.82	1.00	1.00	58.1	58.2
				high with no manure	21	0.82	1.00	1.07	6.5	6.5
	cold dry	aquic		low	166	0.82	1.00	0.92	139.9	139.9
				medium	166	0.82	1.00	1.00	125.9	125.9
				high with no manure	166	0.82	1.00	1.07	14.0	14.0
	warm dry			low	132	0.82	1.00	0.92	213.8	213.8
				medium	132	0.82	1.00	1.00	192.4	192.4
				high with no manure	132	0.82	1.00	1.07	21.4	21.4
Total Cropland									**4578.4**	**4579.2**
Carbon stock per ha (tC/ha)									**52.79**	**52.83**

Table A3-3.7 *Grassland areas by climate zone and soil type and estimated average carbon stocks*

land-use	Sub-categories				SOC_{ref}	F_{LU}	F_{MG}	1965	1966	1967	1968	1969	1970
	Climate	Soil	Management	Input				Area(ha)					
Grassland	cold dry	HAC	non-degraded	-	48	1.00	1.00	233.6	230.3	230.7	231.1	230.0	229.6
		HAC	improved	medium	48	1.00	1.14	155.7	153.5	153.8	154.1	153.3	153.0
	warm dry	HAC	non-degraded	-	58	1.00	1.00	345.4	340.5	341.1	341.7	340.0	339.4
		HAC	improved	medium	58	1.00	1.14	230.3	227.0	227.4	227.8	226.7	226.3
	cold dry	HAC*	non-degraded	-	48	1.00	1.00	21.6	21.3	21.3	21.4	21.3	21.2
		HAC*	improved	medium	48	1.00	1.14	9.3	9.1	9.1	9.2	9.1	9.1
	warm dry	HAC*	non-degraded	-	58	1.00	1.00	12.3	12.1	12.1	12.1	12.1	12.1
		HAC*	improved	medium	58	1.00	1.14	12.3	12.1	12.1	12.1	12.1	12.1
	cold dry	sandy	non-degraded	-	15	1.00	1.00	14.6	14.4	14.4	14.4	14.3	14.3
		sandy	improved	medium	15	1.00	1.14	9.7	9.6	9.6	9.6	9.6	9.5
	warm dry	sandy	non-degraded	-	21	1.00	1.00	20.4	20.1	20.2	20.2	20.1	20.1
		sandy	improved	medium	21	1.00	1.14	8.8	8.6	8.6	8.7	8.6	8.6
	cold dry	aquic	non-degraded	-	166	1.00	1.00	77.3	76.2	76.4	76.5	76.1	76.0
		aquic	improved	medium	166	1.00	1.14	13.6	13.5	13.5	13.5	13.4	13.4
	warm dry	aquic	non-degraded	-	132	1.00	1.00	111.2	109.6	109.9	110.0	109.5	109.3
		aquic	improved	medium	132	1.00	1.14	27.8	27.4	27.5	27.5	27.4	27.3
Total Grassland								**1303.9**	**1285.3**	**1287.8**	**1289.9**	**1283.6**	**1281.3**
Carbon stock per ha (tC/ha)								**71.61**	**71.61**	**71.61**	**71.61**	**71.61**	**71.61**

Table A3-3.7 *(continued) Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	Sub-categories				SOC_{ref}	F_{LU}	F_{MG}	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
	Climate	Soil	Management	Input				Area(ha)									
Grassland	cold dry	HAC	non-degraded	-	48	1.00	1.00	228.7	229.5	229.3	229.2	228.4	230.5	234.1	234.6	232.3	231.9
		HAC	improved	medium	48	1.00	1.14	152.5	153.0	152.9	152.8	152.3	153.7	156.1	156.4	154.9	154.6
	warm dry	HAC	non-degraded	-	58	1.00	1.00	338.2	339.4	339.1	338.9	337.7	340.8	346.2	346.8	343.5	342.8
		HAC	improved	medium	58	1.00	1.14	225.5	226.3	226.1	225.9	225.1	227.2	230.8	231.2	229.0	228.6
	cold dry	HAC*	non-degraded	-	48	1.00	1.00	21.2	21.2	21.2	21.2	21.1	21.3	21.6	21.7	21.5	21.4
		HAC*	improved	medium	48	1.00	1.14	9.1	9.1	9.1	9.1	9.1	9.1	9.3	9.3	9.2	9.2
	warm dry	HAC*	non-degraded	-	58	1.00	1.00	12.0	12.1	12.1	12.0	12.0	12.1	12.3	12.3	12.2	12.2
		HAC*	improved	medium	58	1.00	1.14	12.0	12.1	12.1	12.0	12.0	12.1	12.3	12.3	12.2	12.2
	cold dry	sandy	non-degraded	-	15	1.00	1.00	14.3	14.3	14.3	14.3	14.2	14.4	14.6	14.6	14.5	14.5
		sandy	improved	medium	15	1.00	1.14	9.5	9.5	9.5	9.5	9.5	9.6	9.7	9.8	9.7	9.6
	warm dry	sandy	non-degraded	-	21	1.00	1.00	20.0	20.1	20.1	20.0	20.0	20.2	20.5	20.5	20.3	20.3
		sandy	improved	medium	21	1.00	1.14	8.6	8.6	8.6	8.6	8.6	8.6	8.8	8.8	8.7	8.7
	cold dry	aquic	non-degraded	-	166	1.00	1.00	75.7	76.0	75.9	75.9	75.6	76.3	77.5	77.7	76.9	76.8
		aquic	improved	medium	166	1.00	1.14	13.4	13.4	13.4	13.4	13.3	13.5	13.7	13.7	13.6	13.5
	warm dry	aquic	non-degraded	-	132	1.00	1.00	108.9	109.3	109.2	109.1	108.7	109.7	111.5	111.7	110.6	110.4
		aquic	improved	medium	132	1.00	1.14	27.2	27.3	27.3	27.3	27.2	27.4	27.9	27.9	27.7	27.6
Total Grassland								**1276.8**	**1281.2**	**1280.1**	**1279.2**	**1274.8**	**1286.5**	**1306.8**	**1309.3**	**1296.6**	**1294.2**
Carbon stock per ha (tC/ha)								**71.61**	**71.61**	**71.61**	**71.61**	**71.61**	**71.61**	**71.61**	**71.61**	**71.61**	**71.61**

Table A3-3.7 *(continued) Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	Sub-categories				SOC_{ref}	F_{LU}	F_{MG}	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
	Climate	Soil	Management	Input				Area(ha)									
Grassland	cold dry	HAC	non-degraded	-	48	1.00	1.00	230.0	229.9	229.2	226.6	223.3	221.0	219.0	216.8	214.5	212.4
		HAC	improved	medium	48	1.00	1.14	153.4	153.3	152.8	151.1	148.9	147.4	146.0	144.5	143.0	141.6
	warm dry	HAC	non-degraded	-	58	1.00	1.00	340.1	339.9	338.9	335.1	330.2	326.8	296.8	293.8	296.0	314.1
		HAC	improved	medium	58	1.00	1.14	226.8	226.6	225.9	223.4	220.1	217.9	242.8	240.4	232.6	209.4
	cold dry	HAC*	non-degraded	-	48	1.00	1.00	21.3	21.3	21.2	21.0	20.6	19.9	18.8	18.6	18.4	18.2
		HAC*	improved	medium	48	1.00	1.14	9.1	9.1	9.1	9.0	8.8	9.3	10.1	10.0	9.9	9.8
	warm dry	HAC*	non-degraded	-	58	1.00	1.00	12.1	12.1	12.0	11.9	11.7	11.6	11.5	11.4	11.3	12.5
		HAC*	improved	medium	58	1.00	1.14	12.1	12.1	12.0	11.9	11.7	11.6	11.5	11.4	11.3	9.8
	cold dry	sandy	non-degraded	-	15	1.00	1.00	14.3	14.3	14.3	14.1	13.9	13.8	12.5	12.4	12.3	13.2
		sandy	improved	medium	15	1.00	1.14	9.6	9.6	9.5	9.4	9.3	9.2	10.2	10.1	10.0	8.8
	warm dry	sandy	non-degraded	-	21	1.00	1.00	20.1	20.1	20.0	19.8	19.5	17.9	17.8	17.6	17.4	16.7
		sandy	improved	medium	21	1.00	1.14	8.6	8.6	8.6	8.5	8.4	9.7	9.6	9.5	9.4	9.8
	cold dry	aquic	non-degraded	-	166	1.00	1.00	76.2	76.1	75.9	75.0	73.9	74.9	72.5	73.4	72.7	74.5
		aquic	improved	medium	166	1.00	1.14	13.4	13.4	13.4	13.2	13.0	11.2	12.8	11.0	10.9	8.3
	warm dry	aquic	non-degraded	-	132	1.00	1.00	109.5	109.5	109.1	107.9	106.3	102.6	117.3	113.5	112.3	113.8
		aquic	improved	medium	132	1.00	1.14	27.4	27.4	27.3	27.0	26.6	28.9	13.0	15.5	15.3	12.6
Total Grassland								**1284.0**	**1283.3**	**1279.2**	**1264.9**	**1246.4**	**1233.7**	**1222.3**	**1209.9**	**1197.3**	**1185.6**
Carbon stock per ha (tC/ha)								**71.61**	**71.61**	**71.61**	**71.61**	**71.61**	**71.62**	**71.60**	**71.61**	**71.57**	**71.33**

***Table A3-3.7** (continued) Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	Sub-categories				SOC_{ref}	F_{LU}	F_{MG}	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	Climate	Soil	Management	Input				Area(ha)									
Grassland	cold dry	HAC	non-degraded	-	48	1.00	1.00	213.5	224.9	246.2	258.5	270.5	277.1	293.3	296.2	295.6	293.5
		HAC	improved	medium	48	1.00	1.14	136.5	121.1	95.8	79.4	63.5	52.8	32.6	25.8	22.3	20.4
	warm dry	HAC	non-degraded	-	58	1.00	1.00	310.5	317.2	348.9	404.8	424.6	434.2	443.4	447.4	451.2	447.9
		HAC	improved	medium	58	1.00	1.14	207.0	194.4	156.8	94.9	69.1	53.7	38.6	28.6	18.8	16.2
	cold dry	HAC*	non-degraded	-	48	1.00	1.00	18.0	18.1	19.2	21.2	22.2	22.5	23.2	23.5	23.4	23.4
		HAC*	improved	medium	48	1.00	1.14	9.7	9.3	7.9	5.6	4.2	3.7	2.6	2.0	1.8	1.5
	warm dry	HAC*	non-degraded	-	58	1.00	1.00	12.4	12.9	14.2	15.8	17.1	17.3	17.7	18.3	18.4	18.3
		HAC*	improved	medium	58	1.00	1.14	9.7	8.9	7.3	5.5	4.0	3.5	2.9	2.0	1.6	1.5
	cold dry	sandy	non-degraded	-	15	1.00	1.00	13.1	13.2	14.3	16.0	16.9	17.5	17.9	18.3	18.2	18.0
		sandy	improved	medium	15	1.00	1.14	8.7	8.4	7.0	5.1	4.0	3.1	2.4	1.8	1.6	1.6
	warm dry	sandy	non-degraded	-	21	1.00	1.00	16.5	16.6	17.4	19.0	20.3	21.3	22.0	22.4	22.4	22.4
		sandy	improved	medium	21	1.00	1.14	9.7	9.3	8.2	6.3	4.8	3.5	2.4	1.7	1.4	1.2
	cold dry	aquic	non-degraded	-	166	1.00	1.00	73.6	75.2	75.9	77.4	76.5	75.6	74.6	74.5	73.5	72.6
		aquic	improved	medium	166	1.00	1.14	8.2	5.7	4.0	1.6	1.6	1.5	1.5	0.8	0.7	0.7
	warm dry	aquic	non-degraded	-	132	1.00	1.00	112.5	111.2	112.3	112.2	112.1	113.1	111.7	111.5	110.1	109.8
		aquic	improved	medium	132	1.00	1.14	12.5	12.4	9.8	8.4	7.2	4.7	4.7	3.4	3.4	2.2
Total Grassland								**1172.2**	**1158.7**	**1145.3**	**1131.8**	**1118.4**	**1105.0**	**1091.5**	**1078.1**	**1064.6**	**1051.2**
Carbon stock per ha (tC/ha)								**71.31**	**71.11**	**70.62**	**70.00**	**69.68**	**69.46**	**69.22**	**69.06**	**68.96**	**68.91**

***Table A3-3.7** (continued) Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	Sub-categories				SOC_{ref}	F_{LU}	F_{MG}	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	Climate	Soil	Management	Input				Area(ha)									
Grassland	cold dry	HAC	non-degraded	-	48	1.00	1.00	291.7	285.5	279.9	271.3	264.2	257.0	249.7	238.7	232.9	224.4
		HAC	improved	medium	48	1.00	1.14	13.6	11.2	8.1	8.1	6.6	5.2	3.9	6.3	3.4	3.3
	warm dry	HAC	non-degraded	-	58	1.00	1.00	440.3	427.6	413.9	401.1	390.6	380.0	369.2	352.9	344.4	331.7
		HAC	improved	medium	58	1.00	1.14	11.0	11.0	12.0	12.0	9.8	7.7	5.7	9.3	5.1	4.9
	cold dry	HAC*	non-degraded	-	48	1.00	1.00	23.2	22.7	22.2	21.5	20.9	20.4	19.8	18.9	18.5	17.8
		HAC*	improved	medium	48	1.00	1.14	1.0	0.8	0.6	0.6	0.5	0.4	0.3	0.5	0.3	0.3
	warm dry	HAC*	non-degraded	-	58	1.00	1.00	18.3	17.9	17.7	17.1	16.7	16.2	15.7	15.1	14.7	14.2
		HAC*	improved	medium	58	1.00	1.14	1.0	0.8	0.5	0.5	0.4	0.3	0.2	0.4	0.2	0.2
	cold dry	sandy	non-degraded	-	15	1.00	1.00	17.8	17.7	17.5	17.4	16.9	16.3	15.8	15.3	14.7	14.2
		sandy	improved	medium	15	1.00	1.14	1.2	0.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry	sandy	non-degraded	-	21	1.00	1.00	21.9	21.6	21.0	20.9	20.3	19.7	19.0	18.4	17.7	17.1
		sandy	improved	medium	21	1.00	1.14	1.0	0.7	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	cold dry	aquic	non-degraded	-	166	1.00	1.00	70.9	69.0	67.3	65.3	63.3	61.3	59.3	57.2	55.2	53.2
		aquic	improved	medium	166	1.00	1.14	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry	aquic	non-degraded	-	132	1.00	1.00	107.6	105.0	102.9	99.8	96.7	93.6	90.5	87.5	84.4	81.3
		aquic	improved	medium	132	1.00	1.14	1.5	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Grassland								**1022.3**	**993.5**	**964.6**	**935.8**	**906.9**	**878.0**	**849.2**	**820.3**	**791.5**	**762.6**
Carbon stock per ha (tC/ha)								**68.81**	**68.78**	**68.74**	**68.75**	**68.72**	**68.69**	**68.66**	**68.73**	**68.66**	**68.66**

Table A3-3.7 *(continued) Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	Sub-categories				SOC_{ref}	F_{LU}	F_{MG}	2011	2012
	Climate	Soil	Management	Input				Area(ha)	
Grassland	cold dry	HAC	non-degraded	-	48	1.00	1.00	223.0	223.1
		HAC	improved	medium	48	1.00	1.14	3.6	3.4
	warm dry	HAC	non-degraded	-	58	1.00	1.00	329.8	330.0
		HAC	improved	medium	58	1.00	1.14	5.3	5.1
	cold dry	HAC*	non-degraded	-	48	1.00	1.00	17.7	17.7
		HAC*	improved	medium	48	1.00	1.14	0.3	0.3
	warm dry	HAC*	non-degraded	-	58	1.00	1.00	14.1	14.1
		HAC*	improved	medium	58	1.00	1.14	0.2	0.2
	cold dry	sandy	non-degraded	-	15	1.00	1.00	14.1	14.1
		sandy	improved	medium	15	1.00	1.14	0.0	0.0
	warm dry	sandy	non-degraded	-	21	1.00	1.00	17.0	17.0
		sandy	improved	medium	21	1.00	1.14	0.0	0.0
	cold dry	aquic	non-degraded	-	166	1.00	1.00	52.9	52.9
		aquic	improved	medium	166	1.00	1.14	0.0	0.0
	warm dry	aquic	non-degraded	-	132	1.00	1.00	80.9	80.9
		aquic	improved	medium	132	1.00	1.14	0.0	0.0
Total Grassland								**758.9**	**758.9**
Carbon stock per ha (tC/ha)								**68.67**	**68.66**

HAC* soils were reported as LAC soils in former submissions and were reclassified as HAC for the 2013 submission.

Rerefences

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A3.4. Waste sector

The following table summarizes the used activity data. Numbers *in italics* represent interpolated data. Linear interpolation was used between **bold** values.

	Deposited Gg	Food %	Paper %	Wood %	Textile %	Nappies %	Inert %
1950	*1224*	**30.1%**	**21.8%**	**7.5%**	**4.7%**	**0.0%**	**35.9%**
1951	*1245*	*30.2%*	*21.7%*	*7.3%*	*4.8%*	*0.0%*	*36.0%*
1952	*1265*	*30.2%*	*21.7%*	*7.1%*	*4.8%*	*0.0%*	*36.2%*
1953	*1286*	*30.3%*	*21.6%*	*6.9%*	*4.9%*	*0.0%*	*36.3%*
1954	*1306*	*30.3%*	*21.6%*	*6.8%*	*4.9%*	*0.0%*	*36.4%*
1955	*1327*	*30.4%*	*21.5%*	*6.6%*	*5.0%*	*0.0%*	*36.6%*
1956	*1347*	*30.4%*	*21.5%*	*6.4%*	*5.0%*	*0.0%*	*36.7%*
1957	*1368*	*30.5%*	*21.4%*	*6.2%*	*5.1%*	*0.0%*	*36.8%*
1958	*1389*	*30.5%*	*21.4%*	*6.0%*	*5.1%*	*0.0%*	*37.0%*
1959	*1409*	*30.6%*	*21.3%*	*5.8%*	*5.2%*	*0.0%*	*37.1%*
1960	*1430*	*30.7%*	*21.3%*	*5.6%*	*5.2%*	*0.0%*	*37.3%*
1961	*1455*	*30.7%*	*21.2%*	*5.4%*	*5.3%*	*0.0%*	*37.4%*
1962	*1481*	*30.8%*	*21.1%*	*5.3%*	*5.3%*	*0.0%*	*37.5%*
1963	*1506*	*30.8%*	*21.1%*	*5.1%*	*5.4%*	*0.0%*	*37.7%*
1964	*1532*	*30.9%*	*21.0%*	*4.9%*	*5.4%*	*0.0%*	*37.8%*
1965	*1558*	*30.9%*	*21.0%*	*4.7%*	*5.5%*	*0.0%*	*37.9%*
1966	*1583*	*31.0%*	*20.9%*	*4.5%*	*5.5%*	*0.0%*	*38.1%*
1967	*1609*	*31.0%*	*20.9%*	*4.3%*	*5.6%*	*0.0%*	*38.2%*
1968	*1634*	*31.1%*	*20.8%*	*4.1%*	*5.6%*	*0.0%*	*38.3%*
1969	*1660*	*31.1%*	*20.8%*	*3.9%*	*5.7%*	*0.0%*	*38.5%*
1970	*1685*	*31.2%*	*20.7%*	*3.8%*	*5.8%*	*0.0%*	*38.6%*
1971	*1470*	*31.3%*	*20.6%*	*3.6%*	*5.8%*	*0.0%*	*38.7%*
1972	*1560*	*31.3%*	*20.6%*	*3.4%*	*5.9%*	*0.0%*	*38.9%*
1973	*1667*	*31.4%*	*20.5%*	*3.2%*	*5.9%*	*0.0%*	*39.0%*
1974	*1766*	*31.4%*	*20.5%*	*3.0%*	*6.0%*	*0.0%*	*39.1%*
1975	**1872**	*31.5%*	*20.4%*	*2.8%*	*6.0%*	*0.0%*	*39.3%*
1976	*2095*	*31.5%*	*20.4%*	*2.6%*	*6.1%*	*0.0%*	*39.4%*
1977	*2318*	*31.6%*	*20.3%*	*2.4%*	*6.1%*	*0.0%*	*39.5%*
1978	*2540*	*31.6%*	*20.3%*	*2.3%*	*6.2%*	*0.0%*	*39.7%*
1979	*2763*	*31.7%*	*20.2%*	*2.1%*	*6.2%*	*0.0%*	*39.8%*
1980	**2986**	*31.8%*	*20.2%*	*1.9%*	*6.3%*	*0.0%*	*40.0%*
1981	3556	*31.8%*	*20.1%*	*1.7%*	*6.3%*	*0.0%*	*40.1%*
1982	3539	*31.9%*	*20.0%*	*1.5%*	*6.4%*	*0.0%*	*40.2%*
1983	*3657*	*31.9%*	*20.0%*	*1.3%*	*6.4%*	*0.0%*	*40.4%*
1984	*3775*	*32.0%*	*19.9%*	*1.1%*	*6.5%*	*0.0%*	*40.5%*
1985	**3893**	*32.0%*	*19.9%*	*0.9%*	*6.5%*	*0.0%*	*40.6%*
1986	4039	*32.1%*	*19.8%*	*0.7%*	*6.6%*	*0.0%*	*40.8%*
1987	4121	*32.1%*	*19.8%*	*0.6%*	*6.6%*	*0.0%*	*40.9%*
1988	4102	*32.2%*	*19.7%*	*0.4%*	*6.7%*	*0.0%*	*41.0%*
1989	3832	*32.2%*	*19.7%*	*0.2%*	*6.7%*	*0.0%*	*41.2%*
1990	3963	**32.3%**	**19.6%**	**0.0%**	**6.8%**	**0.0%**	**41.3%**
1991	3340	38.4%	17.9%	0.0%	3.1%	0.0%	40.6%
1992	3506	39.0%	18.5%	0.0%	4.3%	0.0%	38.2%
1993	3400	34.6%	17.1%	0.0%	6.6%	0.0%	41.7%
1994	3571	33.4%	18.2%	0.0%	5.3%	0.0%	43.1%
1995	3655	35.1%	17.0%	0.0%	4.3%	0.0%	43.6%
1996	3878	32.4%	19.0%	0.0%	3.4%	0.0%	45.2%
1997	4124	28.4%	19.2%	0.0%	5.8%	3.5%	43.1%
1998	4133	31.4%	18.3%	0.0%	6.4%	3.0%	40.9%
1999	4225	30.7%	20.2%	0.0%	5.1%	3.0%	41.0%
2000	3923	40.7%	13.7%	0.0%	3.5%	1.3%	40.8%
2001	3881	40.4%	16.0%	0.0%	2.5%	2.0%	39.1%
2002	4033	30.7%	16.3%	0.0%	3.0%	2.3%	47.7%
2003	4166	29.7%	15.6%	0.0%	3.0%	2.5%	49.2%
2004	4050	30.6%	15.2%	0.0%	2.9%	2.2%	49.1%
2005	4057	29.4%	14.6%	0.0%	3.0%	2.4%	50.6%
2006	3883	25.5%	15.1%	0.0%	3.4%	2.7%	53.3%
2007	3462	24.4%	11.3%	0.0%	3.6%	2.6%	58.1%
2008	3493	23.8%	13.1%	0.0%	4.1%	3.4%	55.6%
2009	3463	23.5%	12.2%	0.0%	4.3%	4.3%	55.7%
2010	2923	23.1%	13.5%	0.0%	4.7%	4.5%	54.2%
2011	2638	23.8%	13.4%	0.0%	4.8%	4.7%	53.3%
2012	2681	23.2%	13.2%	0.0%	4.6%	4.7%	54.3%

Annex 4 Comparison of Sectoral and Reference Approaches

Comparison of sectoral and reference approaches can be found in chapter 3.2.1 of the NIR.

Annex 5 Assessment of completeness

Justification for omitting some CRF categories is outlined in the following Table to increase the transparency of the NIR 2014 submission.

CRF code	CRF category	Reasons for omissions	NIR Chapter for further information
5.A.2.2	Grassland converted to Forest Land/Carbon stock change/Net carbon stock change in dead organic matter/Carbon	Hungary demonstrates that the deadwood, litter, and soil pools are not a source for the aggregated forest area.	Chapter 11.3.1.2
5.A.2.4	Settlements converted to Forest Land/Carbon stock change/Net carbon stock change in dead organic matter/Carbon		
5.B.2.4	Settlements converted to Cropland/Carbon stock change/Carbon stock change in living biomass/Carbon/Net change	Biological re-cultivation of abandoned surface mines. Omission of these categories can be considered as a conservative approach in Hungary.	Chapter 7.4.3.4
5.B.2.4	Settlements converted to Cropland/Carbon stock change/Net carbon stock change in soils/Carbon/Mineral Soils		
5.C.2.4	Settlements converted to Grassland/Carbon stock change/Carbon stock change in living biomass/Carbon/Net change		Chapter 7.5.3.4
5.C.2.4	Settlements converted to Grassland/Carbon stock change/Net carbon stock change in soils/Carbon/Mineral Soils		
5.D.2.4	Settlements converted to Wetlands/Carbon stock change/Net carbon stock change in soils/Carbon	Conversions from extraction and construction area, which are not covered by soil, therefore the potential emissions are assumed to be negligible, probably zero.	Chapter 7.6.1.2
5.E.2.4	Wetlands converted to Settlements/Carbon stock change/Carbon stock change in living biomass/Carbon/Net change	Anthropogenic emissions from these land-use conversions are assumed to be negligible, therefore not estimated.	Chapter 7.7.3.5
	Wetlands converted to Settlements/Carbon stock change/Net carbon stock change in soils/Carbon		
5.F.2.3	Grassland converted to Other Land/Carbon stock change/Net carbon stock change in soils/Carbon	It assumed to be not a source of anthropogenic emissions in Hungary.	Chapter 7.8.2.1
5.D.2.3	Grassland converted to Wetlands/Carbon stock change/Net carbon stock change in soils/Carbon		

Annex 6 Quality Assurance and Quality Control

QA/QC activities are explained in Chapter 1.6. The update of the QC Plan entered into force on 4th January 2013 (HMS ISO document n.: ELFO 401.01), which was again updated on the 21st May 2014 (ELFO 401.02.). Please see below the English translation of the QA/QC Plan:

HUNGARIAN METEOROLOGICAL SERVICE

Q A - Q C P L A N

ÉLFO/ÜHG 401

Preparation of Emission Inventories required by United Nations Framework Convention on Climate Change (UNFCCC) and Convention on Long-range, Transboundary Air Pollution (CLRTAP)

	Name	signature
Prepared (and translated) by:	Katalin Kőbányai	expert
Reviewed by:	Gábor Kis-Kovács	Head of Division
Approved by:	Krisztina Labancz	Head of Department

Version: 02

Pages: 14

21 May 2014

Content

OBJECTIVE

The GHG Division of Hungarian Meteorological Service (HMS) has been assigned by the Ministry of Rural Development as the ministry responsible for environmental protection to compile GHG inventory required by United Nations Framework Convention on Climate Change and the Air Pollutants Emission Inventory required by Convention on Long-range, Transboundary Air Pollution (CLRTAP). Several parts of the inventories, such as transport and forestry are delegated to other institutions by law.

The GHG Division of the HMS is appointed as Inventory Compiler within the National System by Act LX of 2007 on the implementation of United Nations Framework Convention on Climate Change and the Govt. Decree 528/2013 (XII.30.) on data provision relating to greenhouse gas emissions.

HMS is indicated as compiler of the inventory of air pollutants (required by the Convention on Long-range, Transboundary Air Pollution) by Govt. Decree 277/2005 (XII.20.) on the Hungarian Meteorological Service, which lists this task in addition to the task of preparation of reporting on air quality data required by any international reporting obligation.
Present ISO document (hereinafter QA-QC Plan) aims to fulfill both the requirements of quality management system ISO 9001:2008 and the QA-QC requirements of the Conventions mentioned above. Therefore the former ISO procedure ME04-16 of the GHG Division, the relevant parts of the former annual QA-QC Plans and the former Documentation and Archiving Manual are integrated into this single document.

TASKS AND RESPONSIBILITIES

Tasks and responsibilities connected to the implementation of activities defined within this QA-QC Plan:

- preparation of QA-QC Plan : expert appointed by the Head of the GHG Division
- implementation of the QA-QC Plan: expert(s) appointed by the Head of the GHG Division,
- supervision of the implementation of QA-QC Plan: Head of the GHG Division,
- internal audit of the implementation of activitie defined within this QA-QC Plan : QA/QC manager of HMS.

The names of sectoral experts, QA-QC coordinator, archiving manager and inventory compiler are specified in the quality record UHG04.

DESCRIPTION OF THE ACTIVITIES / ANNUAL INVENTORY CYCLE

1.Principles

All domestic and international reporting obligations in connection to the inventory of greenhouse gases and air pollutants to be submitted to any local or international organizations are meant as „Report" hereinafter. Guidelines and Guidebooks specified by the Conventions or Protocols have to be applied for the preparation of the reports

	UNFCCC	CLRTAP+ NEC
Guidelines	18/CP.8, 19/CP.8 and 14/CP.11 decisions	ECE/EB.AIR/97 + 81/2001/EC directive
Guidebooks (in 2012)	Revised GL (IPCC, 1996); GPG (IPCC, 2000); GPG for LULUCF (IPCC, 2003) (See References)	EMEP/EEA 2009 Guidebook (See References)

The format and content of the reports are determined by CRF (Common Reporting Form) in the case of UNFCCC and NFR (Nomenclature For Reporting) in the case of CLRTAP. Both are detailed in the Guidelines and Guidebooks mentioned above. The reports consist of tables (hereinafter: CRF/NFR Table) and text documents (hereinafter: NIR/IIR) containing descriptions specified in the Guidelines as well. The names, content, deadlines, process of the submission, public availability of the reports are summarized in Annex 1.

Inventory principles (TCCCA) included in Annex 4 as defined by the Conventions should always be taken into account during the inventory process:
- Transparency,
- Completeness,
- Comparability,
- Consistency,
- Accuracy,
- *in addition to timeliness and improvement.*

1.1.Main steps of the annual inventory cycle

– data collection and choice of estimation method;
– calculations i.e. estimation of emissions and removal by sinks;
– uncertainty analysis;
– QA/QC activities;
– compilation of the report;
– submission of the report;
– documentation and archiving;
– compilation of a development plan.

The outline of the process is included in Annex 3.

1.2. Tasks and responsibilities of persons involved in the inventory preparation

Sectoral experts:

- choice of emission estimation methods;
- collection, documentation and archiving of data needed for the calculations as detailed below and in chapter 2 and in Documentation and Archiving Regulation of

HMS;
- data quality check using quality record UHG02 (Data quality check) relating to the sector;
- communication with external experts;
- calculation and documentation and archiving of calculation files as detailed below and in chapter 2;
- compilation of QC checklists using quality record UHG01 (QA/QC checklist) ;
- compilation of CRF Reporter Program relating to the sector and export of xml files as described in chapter 2.5;
- providing input into the NIR relating to the sector;
- providing input for the responses of the review questions relating to the sector;
- providing input into the Development Plan.

Sectoral experts regarding documentation and archiving:
- all the incoming documents containing data used during the preparation of the inventory should be registered in the central register of the HMS as required by the Documentation and Archiving Regulation of HMS;
- all the data used during the preparation of the inventory and information on the source of these data should be documented and archived as detailed in chapter 2 ;
- all the calculation files and compiled reports should be archived ensuring tracking of changes (due to checks and reviews);
- continuous update of the documentation of all subsectors assigned, archiving of data and other documentation;
- recording, organizing, archiving and removing the files relating to their sector;

Head of GHG Division:
- check of input provided by sectoral experts;
- compilation, finalization of reports, forwarding for approval and submission in the case of UNFCCC;
- communication and finalization of responses to be sent during the international reviews;
- finalization of Development Plan.

Head of GHG Division regarding documentation and archiving:
- assigning of tasks for sectoral experts and monitoring of the implementation;
- recording, organizing, archiving and removing the general (non sector specific) files

QA/QC coordinator:
- updating present QA/QC Plan and the quality records;
- documentation and archiving relating to QA/QC activities.

QA/QC coordinator regarding documentation and archiving:
- recording, organizing, archiving and removing files relating to QC/QC activities,
- control of QA/QC folder within directory of GHG Division as included in Annex 2.

Archiving coordinator:
- development and definition of archiving processes and tasks,
- support for the sectoral experts relating to archiving problems,
- follow-up of the requirements relating to archiving and incorporation of new elements into the QA/QC Plan if needed

2. Main steps of the annual inventory cycle

2.1. Choice of estimation method

Sectoral experts are required to choose the appropriate estimation method or to coordinate it with external experts and to document it. Methods are to be improved continuously and to be amended or corrected if needed. Methods might be chosen from different tier methods (i.e. methods with different level of complexity) presented in the Guidebooks depending on the results of key source category analysis of the previous year or performed preliminary (as higher tier methods are suggested for key categories), the issues included in the Development Plan and the review results especially regarding recommended changes of methods.
The choice of the estimation method means in fact the choice of activity data set and emission factors to be applied for the calculations. Those methods are appropriate where the whole set of activity data is available and consistent or at least it is possible to apply an extrapolation technique and transparent, documented emission factors are available. Even if country specific emission factors and/or plant specific data (higher tier methods) might result in more realistic estimations, these are only applicable if consistency, comparability and transparency principles are also fulfilled.
The need for change of method might arise anytime during the preparation of the inventory (e.g. new data available, recommendations of the review, etc.), which causes the recalculation of the whole time series. Recalculations should be documented in CRF Table8 and in the appropriate chapter of the NIR/IIR.
The methods applied by subsector have to be documented transparently in the sector-specific chapters of the NIR/IIR, in the CRF and in the calculation files (at least activity data and its source + emission factor and its source).
It is necessary to consider the consistency of activity data, emission factors (and the results) among international reporting obligation (e.g. UNFCCC, CLRTAP, IEA, NAMEA) and the comparability of results with reports of other countries (and the EU).
Sectoral experts consult all general and sector specific issues including choice of method with the Head of GHG Division either during division meetings or individually. Head of GHG Division informs all the other experts eventually concerned regarding changes of methods.
In addition NIR/IIR chapters might be amended by sectoral experts only using “track change” mode. Head of the GHG Division accepts the changes before submission.

2.2. Data collection

Sectoral experts/institutions are required to ensure the appropriate quantity, quality, format and timeliness of the data needed for the estimation method. Data might be collected from public databases, based on authorization by law or by data provision agreements with institutions or organizations.
Act LX of 2007 and Govt. Decree 528/2013. (XII.30.) authorizes HMS to collect data needed for the preparation of the inventory, even for the collection of confidential data and to expose penalty in the case of non-compliance.
Special care is needed in the case where the number of data providers is less than three as *Govt. Decree 170/1993 (XII.3.) on the implementation of Act XLVI of 1993 on statistics* requires the Hungarian Statistical Office not to publish data - not even in an aggregated way- in such cases.
Sectoral experts may communicate also via e-mail, phone and mail with external experts, data providers and other persons involved in the National System.

Incoming documents that contain data used by the preparation of the inventory are to be registered in the central register of the HMS as required by the HMS Regulation on

documentation and archiving where special provisions are included regarding the GHG Division.
Any data base, reference or document relating to the preparation of the inventory either hard copies or electronically should be documented and archived as described in chapter 2.7 in order to ensure replicability and transparency of the reports. It is needed to document (e.g. in form of *„minutes of meeting/phone call/etc__IPCCcode_date_doc")* verbal information as well if it is used by the preparation of the inventory.
Check of the quality of incoming data might be documented using checklist included in quality record UHG02. Separate quality records should be created preferably for every data provider which should be saved within the directory used by the GHG Division as described in chapter 2.7.

Information regarding the sources of data should be documented on quality record *UHG05 Data source logbook*. This record should be completed by year and by sector with information on data sources (date of enquiry and receipt, contact person, Reg. No. etc.) in the case of mails, e-mails arriving thank to Govt. Decree 528/2013 and with information on the download (e.g. url, website, date, etc.) in the case the data source is on-line.

2.3. Calculations i.e. estimation of emissions and removal by sinks

Compilation of the inventory is the task of sectoral experts or external experts contracted by the HMS. Sectoral experts work in calculation files (separate for every year) which are saved in a specific place in the directory used by the GHG Division and treated as it is described in 2.7. Calculation files should contain in a transparent way the estimation method, activity data together with their source, emission factors together with their source and uncertainty together with their source (in addition to NIR/IIR and CRF/NFR Tables to be compiled in a later stage). This will ensure the reproducibility of emission estimates and enables substitution or replacement of sectoral experts when necessary.

Further recommendations regarding the content of the calculation files:

- it is favorable to include notes and/or to apply different coloring for the cells of the table that contain data from different sources;
- possibility automatic checks should be included in the calculation files (e.g. conditional formatting, crosschecks, references, macro, etc.) in order to minimize calculation or mistype errors;
- summary tables in the calculation files should possibly follow exactly the outline of the appropriate CRF Table in order to enable the final crosscheck with the compiled CRF
- the year to which the data relates should always be indicated clearly (e.g. above/next to the data set)
- activity data, emission factors, conversion factors, other parameters, units should be indicated separately, unit conversions should be presented step by step;
- the tables should be compiled in a way that makes possible to track the steps of the calculation based on the formulas or references (in the case the formula is on other worksheet or work file);
- data from external source should be clearly separated from elaborated data (i.e. unit conversions, after calculation steps, etc.);
- emission factors, conversion factors and other parameters should not be built in the formulas, but in a separate cell referenced by the formula;
- units of the dataset should be noted in the beginning of all the rows;

- special attention is needed for the update of conversion factors and temporary coefficients if necessary.

Calculation files should be amended based on the points above till the end of 2013.

Beyond the above recommendations, calculations should be checked using the quality record UHG01 as essential element of QC activities. The worksheet UHG01 might be treated as a worksheet in the calculation file or as a separate file.
The quality record UHG01 contains QC checklists based on recommendation of IPCC Guidelines. Generally, Tier1 checklist should be compiled every year for every sector (for the whole sector together or by subsectors depending on the preference of the sectoral expert). The more detailed Tier2 checklist should possibly be compiled at least for key categories.
All errors discovered during the calculations (even for earlier years) might be indicated on the appropriate section of the quality record UHG01 together with the results of reviews. These notes are the rationales of recalculations in the case the correction has been executed before compilation of the current inventory report. In the case it was not possible to perform the correction in the same year, they are to be copied into quality record UHG03 Development Plan together with the planned improvements.
It is also favorable to perform possible verification, using external data such as NIR/IIR of EU and other countries and to document the results in the appropriate section of the quality record UHG01.

Recalculations

In the case estimation method has been changed (either activity data or emission factor) the whole time-series need to be recalculated. Correction of data of earlier years is regarded as recalculation as well. The reasons of the recalculations and the comparison table including the old and the new time series together with their difference should be presented in the appropriate chapter of the NIR/IIR. It is recommended to clearly note (e.g. different coloring) the old and the new time series also in the calculation files. In addition, the new time series should be copied possibly from the final (before submission) state of the compiled CRF. CRF reporter requires the explanation of the reasons of the recalculation for every single cell where the data has been changed. The inclusion of recalculation explanations might be performed using the *Recalculation check* function of the CRF Reporter Program.

2.4. Uncertainty and key category analysis

Uncertainty analysis has to be performed using the sector list suggested by GPG (IPCC, 2000) and GPG for LULUCF (IPCC, 2003). Sectoral experts either copy the uncertainties associated to the sectors into one common file which has the format determined in quality record UHG06 and/or revise the table compiled by the expert responsible for the uncertainty analysis. The responsible expert calculates the aggregated uncertainty, the aggregated uncertainty by gas and uncertainty by main sectors. These results are to be included in the NIR. The responsible expert updates the relevant chapter of the NIR and the Annex containing the full calculation table.

Possibly any deviation from the sector list for key category analysis suggested by GPG (IPCC, 2000) and GPG for LULUCF (IPCC, 2003) should be explained. Obviously, the Tier2 key category analysis can be performed only on the sector list of uncertainty analysis.

The expert responsible for key category analysis updates the references in the common file which have the format determined in quality record UHG07 and performs the analysis using both Tier1 and Tier2 (with uncertainty) methods. Full tables are to be included in Annex of the NIR and summary tables are to be included in CRF Table7 and appropriate chapter of the NIR/IIR where also the comparison with results of last year should be indicated.

2.5. Compilation, approval and submission of the report

Sectoral experts copy the time series developed in the calculation files (and checked using the quality record UHG01) into the CRF Reporter program and run the „*Completeness check*" and „*Recalculation check*" automatic control functions.
Sectoral experts export the data of their sector in xml format and inform all the other experts and the Head of Division. Head of Division imports all the sectoral files, compiles the whole report and export data in xls format into a working folder. These xls files might be used for the figures of the NIR, for the presentation of trends, for the recalculations and for key category analysis.

In the case of NECD and CLRTAP, the sectoral experts copy the sectoral data from the calculation files into a specified common file.

In the same time the sectoral experts update the chapters of the NIR/IIR assigned to them and include also the descriptions and comparison tables of recalculations into the appropriate chapters. The treatment and archiving of NIR/IIR working files is described in chapter 2.7.4. Head of Division checks and finalizes the reports.

The process of approval and submission of the reports is determined by Act LX of 2007 and the implementing Govt. Decree 528/2013. In the case of UNFCCC reporting, the Head of GHG Division submits the reports to UNFCCC secretariat and the EU Commission. In the case of CLRTAP reporting, HMS sends the report to the Ministry of Rural Development (responsible for the environment) for submission.
Comments or opinions eventually arrived from the authorizing ministries, or other external experts, committees, institutions before submission of the reports should be documented on the quality record UHG08 QA Activities logbook.

2.6. International reviews

During international reviews (as detailed in Annex1) all the communication is managed by the Head of GHG Division. Questionnaires are saved in the GHG directory. After the sectoral experts prepare the concerning answers, the head of division checks and finalizes the official response. Responses prepared by sectoral experts should be sent only after the approval of the Head of Division in the case of on-line review as well.

2.7. Documentation and archiving

All the data, information and documents arising during the processes and activities of the GHG Division should be collected, treated, documented and archived in a way that the reports remain transparent and reproducible.

HMS Regulations regarding documentation and archiving

Documents and data of the GHG Division are registered, processed, treated, stored and archived within the central register and IT network of the HSM. Therefore central regulations are valid for the GHG Division as well. The HMS Regulation on documentation and archiving in force includes special provisions regarding the data collected by the GHG Division for the compilation of the inventory. Present QA/QC Plan includes only provisions not included in the general HMS Regulations mainly regarding sectoral experts and emission inventorying.

Collection, processing and storage of data and documents

Hard copies of documents and any hardware containing data are to be ordered by sector and located in the premises of the HMS. It is suggested to store an electronic version of the hard copies too (by scanning). Sectoral experts are required to store the electronic version of such documents together with other electronic data described later.

Electronic documents should be saved in the directory of the server of the GHG Division as described in Annex 2.and the following chapters. Sectoral experts might change the directory with the consent of the archiving coordinator and the Head of Division. Sectoral experts might organize their documents within the sectoral folders independently. Transparency principle should always be taken into consideration while creating new folders and documents. Sectoral experts are responsible for the organization, archiving and cancellation of the documents within their folders.
Electronic documents are collected, stored and archived in a password protected server accessible only for sectoral experts working in the GHG Division. Within the directory of the server of the GHG Division every expert and the Head of Division have the same access (both for writing and reading) in order that experts might be substituted or replaced if needed. However additional security measures might be applied by the Head of Division for the documents archived in the OFFICIAL ARCHIVE section of the directory especially where the submitted documents are archived in order to avoid any unintentional modification.

General principles for managing files and other recommendations

Names

Consistency, unambiguity and the inclusion of CRF/NFR sector codes should be aimed by naming the files and folders. Either the name of the file or the name of the folder should contain the CRF/NFR code. (In the case of incoming data files it is suggested to name the folder rather than change the original name of the file while in the case of calculation files CRF/NFR codes should be included in the filename.) Abbreviations of CRF/NFR codes and names should be consistent and homogenous. Different versions of the file might be distinguished by adding „v” and/or month of the submission within the filename (obviously in addition to the year within the name of the file or folder). Older versions of the calculation files should be stored temporarily at least within the annual inventory cycle. The storage of different versions and the names including the version number and/or month of submission allows tracking changes within the year. In the case the calculation file contains more sub-sectors, it is suggested to use the name/code of the lowest obvious level of sector. Calculation files should be distinguished from original data files by using „Calc_xxx” within the filename.

Capital letters might be used for name of a folder, while the rules of English grammar for writing titles might be followed for filenames. Separation of words might be noted with the character „_”. Based on the above, it is suggested to name the folders and (calculation files*):
Topic_CRF/NFRcode_year_(version/submission month*)

It is suggested to include „Draft_” into the name of a draft NIR/IIR together with name of the report, date of planned submission and version number (or month of planned submission). Text file names are therefore suggested as:
Subject_Draft_DateofSubmission_Version.doc
So, for example the 3rd version of draft NIR planned to be submitted on 15th April 2009 should be named as: HU_NIR_Draft_20090415_v3.doc

Allocation of files within the directory of the server of the GHG Division

Files relating data collection

However data provision is a legally binding obligation, HMS is usually sending reminder letters. The documents regarding mailing should be stored in the GHG directory.
Incoming documents containing data and databases directly used in the inventory should be stored in folder OFFICIAL ARCHIVE\ DATABASE\SECTOR.
Electronic version and possibly scanned hard copies of documents and data used or referenced indirectly in the inventory (notes, literature, descriptions, metadata) should be stored in OFFICIAL ARCHIVE\ BACKGROUND DOCUMENTS folder. In the case the size of the full document does not allow archiving, it is enough to scan the pages referenced or to compile a list containing all the pages and sections referenced. In the case the size of an electronic document does not allow archiving, it is sufficient to archive the section of the database referenced or to indicate exact information regarding the place of the full database (reference where it has been fully archived).
Within the same folder (OFFICIAL ARCHIVE\ BACKGROUND DOCUMENTS) should be archived the background documents and information used for expert judgments, notes and model descriptions used by the preparation of the inventory.

Calculation files and text files

Sectoral experts work within the folders WORKING\SECTOR folders. Files for uncertainty analysis and key category analysis are to be located within the folder WORKING\GENERAL folder as well as draft text files of NIR/IIR.

QA//QC documents

QA/QC documents including blank versions of quality records and documents relating to internal and external audits, etc. are stored within the folder QA-QC\QA/QC PLAN folder. Compiled quality records are to be located in a place clearly noted in the file *Quality_records_logbook.xls* within this folder.

Archiving of data and background documents and submissions at the end of the annual inventory cycle

Data and documents to be archived should be provided by the sectoral experts, while the appropriate execution is monitored by the archiving coordinator. It should be possible to reproduce the reports fully from the archived files mentioned below and files within OFFICAL ARCHIVE folder (together with the data stored in hard copies available in the physical archive of the GHG Division)

Every year after the end of the UNFCCC review all the files, data and documents used by the preparation of the inventory for all the submission version of the year have to be copied into the OFFICAL ARCHIVE folder, such as:

- Final, submitted CRF/NFR Tables and NIR/IIR files within SUBMISSION;
- calculation files used for the final submissions within BACKGROUND DOCUMENTS;
- recalculation database and final .xml (.mdf) files containing the full inventory of the different submissions within BACKGROUND DOCUMENTS;
- files relating to uncertainty and key category analysis within BACKGROUND DOCUMENTS;
- laws and guidelines repealed or not in force within BACKGROUND DOCUMENTS.

2.8. Development Plan

Planned improvements and corrections might be collected and noted on sector specific quality records UHG01 throughout the year, especially regarding:

- recommendations, encouragements and suggestions received during the reviews,
- errors discovered during the previous year,
- results of key-category analysis,
- lessons learned during previous inventory cycle,
- new data available (e.g. new data provisions, new international obligation, etc.)
- follow-up of regulatory changes affecting the inventory,
- continuous improvement.

All the mid-term and long-term planned improvements and the necessary corrections that had not been possible to perform in a given inventory cycle (collected on UHG01) should be included into the quality record UHG03 Development Plan by the sectoral experts and into the „Planned improvements" chapter of the NIR/IIR after the approval of the Head of GHG Division. Sectoral experts should update the quality record UHG03 Development Plan with further planned improvements and corrections (eventually collected on UHG01) emerged after the submission regarding their sector.
Development Plan should reflect the review results (especially EU and UNFCCC). Planned improvements and corrections should be categorized as mid-term or long-term.

3. Further notes on CLRTAP reporting

Activities described above should be applied in the case of CLRTAP reporting too, evidently except for CRF Reporter program, uncertainty analysis.
For the preparation of reports to be submitted under CLRTAP and NEC, sectoral experts include the most up-to-date (eventually recalculated) time series into the sheet of the appropriate pollutant within the file HU_timeseries_by-sector_by-gas_20XXsubmission.xls to be found in folder WORKING\GENERAL.
This file is referenced by the file HU_NFR-by-year_2014XXXsubmission_with_references.xls in order to convert the time series into NFR Table format as required by Annex IV Table 1 of ECE/EB.AIR/97 and 81/2001/EC Directive too. This file should be saved as HU_NFR_xxx_2014XXXsubmission.xls for the official submission after elimination of references (conversion to values).
In the case of CLRTAP/NEC reporting the following records might also be used:

- UHG 03 Development Plan
- UHG 04 Responsibility

During compilation of record UHG 05 Data source logbook, sectoral experts are encouraged to include additional data sources needed for CLRTAP reporting or to note if the data is used for both purposes.
Sectoral experts are also encouraged to apply the appropriate sections of the following records too:

- UHG 01 QA/QC checklist
- UHG 02 Data quality check

By the time being, key category and uncertainty analysis are performed without application of quality records in the case of CLRTAP reporting.

4. Requirements relating to external experts

Contracts with external experts providing input into the inventory should possibly include the following:

- external experts should deliver all the documentation (background documents and calculations) and transparency is to be taken into account also for external experts;
- external experts should be available during international reviews;
- inclusion of indemnity in the case of non keeping the deadline.

Legal background:

- HMS Regulation on organizational structure and operation;
- Govt. Decree 277/2005. (XII.20.) on the Hungarian Meteorological Service;
- Act LX of 2007 on the implementation of United Nations Framework Convention on Climate Change;
- Govt. Decree 528/2013 (XII.30.) on data provision relating to greenhouse gas emissions;
- 525/2013/EC 280/2004/ EC Regulation and implementing regulations;

Documents created as output of the activities described above:

- working files containing all the details of the calculations; compiled quality records; .xml files exported by sector from CRF Reporter; .xls files generated by CRF Reporter;
- HU_NIR_MonthSubmissionYear.pdf files;
- HU_NIR_ANNEXES_MonthSubmissionYear.pdf files;
- HU_NIR_MonthSubmissionYear_vezetoi_HU.pdf files (executive summary in Hungarian);
- Annex II Reporting template indicators SubmissionYear_HU.xls files;
- Uncertainty_InventoryYear_date.xls files;
- NFR_HU_InventoryYear_version.xls files;
- IIR_HU_InventoryYear_version.doc files;
- IIR_HU_InventoryYear_vezetoi_HU.doc files(executive summary in Hungarian);
- files containing tables or text required by international reviews.

Responsible: experts working at GHG Division as it is specified in their contract

Deadline: As included in Annex1.

Check points, monitoring, quality control points:
Accessibility checks: only experts assigned by the Head of the GHG Division have access
Operational checks: checks built-in the processes, self-checking, checks of the activities and data.
Hierarchical checks: Experts report on progress to the Head of the GHG Division during meetings of the GHG Division. Inputs provided by sectoral experts are controlled by the Head of Division.

Financial or accounting issues: n/a

LIST OF QUALITY RECORDS

- UHG 01 QA/QC checklist
- UHG 02 Data quality check
- UHG 03 Development Plan
- UHG 04 Responsibility
- UHG 05 Data source logbook
- UHG 06 Uncertainty
- UHG 07 Key category analysis
- UHG 08 QA activities logbook

REFERENCES

- HMS Regulation on procedures of the departments and the presidency of HSM
- HMS Regulation on documentation and archiving
- HMS QA/QC Manual
- Intergovernmental Panel on Climate Change (IPCC): Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Intergovernmental Panel on Climate Change; http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm
- Intergovernmental Panel on Climate Change (IPCC), 2000: Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, http://www.ipcc-nggip.iges.or.jp/public/gp/english/
- Intergovernmental Panel on Climate Change (IPCC), 2003: Good Practice Guidance for Land Use, Land-Use Change and Forestry (GPG-LULUCF) http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html
- Intergovernmental Panel on Climate Change (IPCC), 2006: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html
- National Inventory Report of Slovakia, 2012 http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php
- EMEP/EEA air pollutant emission inventory guidebook (European Environmental Agency Technical report No 9/2009) http://www.eea.europa.eu/publications/emep-eea-emission-inventory-guidebook-2009

ANNEXES

Annex 1: Summary table

Documents, deadlines and QA/QC activities in connection with reporting to UNFCCC and Kyoto Protocol, CLRTAP and its Protocols and NEC directive						
Deadline	**Task**	**QC**	**Document /Report**			**QA**
			name	**route of submission**	**availability**	
(May) Sept - Nov	search for new data available; data collection, documentation	Quality record: UHG 02 (Data quality); Legal authorization- Govt.Decree 345/2009. (XII.20.) ; Documentation and archiving	n.a.(data input)	n.a. (internal)	U:\GHG\ OFFICIAL ARCHIVE\DATABASE\ and/or hard copies	
Sept - Dec (- April)	methodological changes (if needed) ; calculation, recalculation; compilation of CollectER	UHG 01 (T1, T2 chacklists, verifications); Division meetings; documentation	n.a.(calculation files)	n.a. (internal)	U:\GHG\WORKING\…	possibly review by third parties, external experts
Sept - Dec (- April)	final results and calculations from external experts	HMS quality record ME-06 (Evaluation of contractors); documentation	n.a.(incoming files)	n.a. (internal)	U:\GHG\OFFICIAL ARCHIVE\ DATABASE\…	checks performed by sectoral expert
31.Dec.	*compilation and submission of* ***NECD*** *report*	*documentation*	***NECD report - Main pollutants (NOx, NMVOC, SO2, NH3) NFR Table***	***Ministry of Rural Development -> EU Commission (DG Environment)***	***http://rod.eionet.europa.eu/obligations/141/deliveries***	*EEA Report on NECD - CLRTAP*
Jan-April	compilation of CRF compilation of CollectER	Completeness check Recalculation check incorporated into CRF Reporter; possibly cross-check among *CALC files and sectoral experts*				
15.Jan.	**compilation and submission of preliminary report required by 525/2013/EC**	Documentation and archiving	**preliminary report required by 525/2013/EC (CRF table, preliminary NIR, indicators,** ***SEF*****)**	**EU Commission (DG Climate Action)**	**http://cdr.eionet.europa.eu/hu/eu/ghgmm**	EU Completeness check

Documents, deadlines and QA/QC activities in connection with reporting to UNFCCC and Kyoto Protocol, CLRTAP and its Protocols and NEC directive						
Deadline	**Task**	**QC**	**Document /Report**			**QA**
			name	**route of submission**	**availability**	
15.Febr.	*compilation and submission of **CLRTAP** report*	*Documentation and archiving;* *RepDab check*	***CLRTAP NFR Table***	***Ministry of Rural Development -> EMEP Centre on Emission Inventories and Projections (CEIP) -nek + letter to UNECE Secretariat***	***http://www.ceip.at/overview-of-submissions-under-clrtap/***	*CLRTAP review process:* *1. Status + 2. Synthesis and Assessment (Reports: http://www.ceip.at/review-results/ (password protected))* *(3. Centralized review in every 5 years)*
15.March	*compilation and submission of **CLRTAP** report*	Documentation and archiving	***CLRTAP IIR (+grid+LPS every 5 years)***	***Ministry of Rural Development -> EMEP Centre on Emission Inventories and Projections (CEIP) -nek + letter to UNECE Secretariat***	***http://www.ceip.at/overview-of-submissions-under-clrtap/***	
15.March	**compilation and submission of report required by 525/2013/EC**	Documentation and archiving	**report required by 525/2013/EC (CRF Tables, NIR, indicators, *SEF*)**	**Ministry of Rural Development (HMS) -> EU Commission DG Climate Action)**	**http://cdr.eionet.europa.eu/hu/eu/ghgmm**	Approval by Ministry of National Development; After submission: EU Consistency report (2012; 2015 : ESD review)
15.April	**compilation and submission of UNFCCC report**	Documentation and archiving	**UNFCCC report (CRF Tables, NIR, *SEF*)**	**Ministry of National Development (Hungarian Meteorological Service)** **->** **UNFCCC Secretariat**	**http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php**	Before submission: Approval by Ministry of Rural Development After submission: **UNFCCC review process:** 1. Status (Reports: http://unfccc.int/national_reports/annex_i_ghg_inventories/inventory_review_reports/items/6049.php) 2. Synthesis and Assessment (Reports: http://unfccc.int/documentation/documents/advanced_search/items/6911.php?priref=600006368)

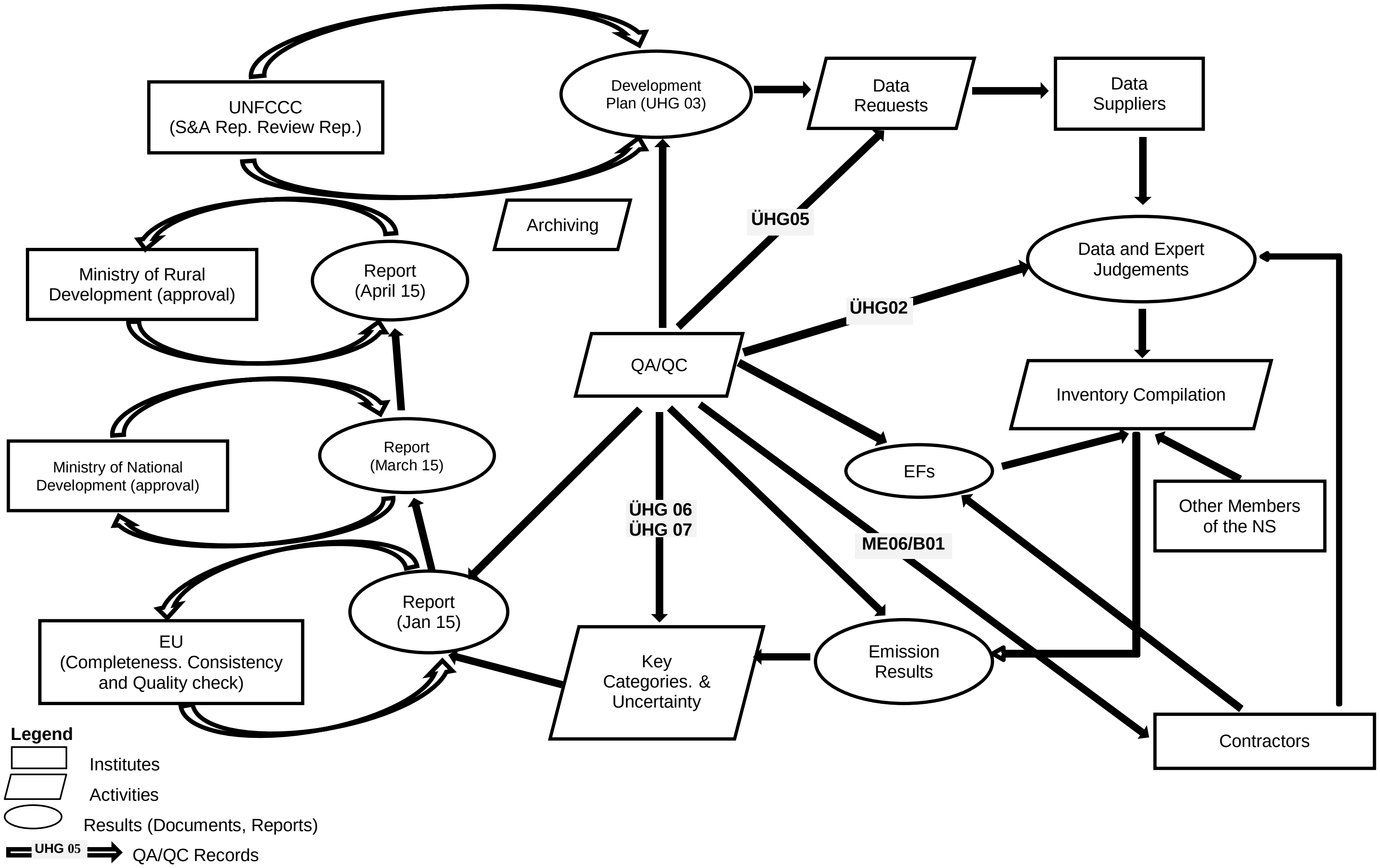
Documents, deadlines and QA/QC activities in connection with reporting to UNFCCC and Kyoto Protocol, CLRTAP and its Protocols and NEC directive						
Deadline	**Task**	**QC**	**Document /Report**			**QA**
			name	**route of submission**	**availability**	
30 July	**compilation and submission of report required by 525/2013/EC**	Documentation and archiving	**report required by 525/2013/EC (CRF Tables, NIR, indicators, *SEF*)**	**Ministry of Rural Development (HMS) -> EU Commission DG Climate Action)**	**http://cdr.eionet.europa.eu/hu/eu/ghgmm**	Approval by Ministry of National Development;
May-August-Oct	evaluation, corrective actions and planned improvements (incorporating results of actual review); update of QA/QC documents if needed	UHG 01 quality record – corrective actions and planned improvements; UHG 03 Development Plan; ÉLFO_UHG_401.01				
Aug-Sept.	HCSO data exchange		GHG - UNFCCC - CRF Tables; Air Pollutants - CLRTAP - NFR Tables; Climate data	Hungarian Central Statistical Office (HCSO)	HCSO Statistical Yearbook and Handbook + http://www.ksh.hu/stadat_eves_5 + NAMEA	crosscheck with NAMEA
Sept-Oct	responses to be sent during the UNFCCC review; recalculations and resubmission if needed	Division meetings; documentation	responses sent electronically	UNFCCC Secretariat	U:\GHG\ \QA-QC\	**UNFCCC review process**: 3. Annual centralized/in-country review (Reports: http://unfccc.int/national_reports/annex_i_ghg_inventories/inventory_review_reports/items/6048.php)
before the beginning of the new inventory cycle	archiving	archiving of all documents and data not yet archived on the server of GHG Division				
annually	Quality objectives of GHG Division for the HMS level quality objectives				HMS Quality objectives: http://www.met.hu/en/omsz/minosegiranyitas/	

Documents, deadlines and QA/QC activities in connection with reporting to UNFCCC and Kyoto Protocol, CLRTAP and its Protocols and NEC directive						
Deadline	**Task**	**QC**	**Document /Report**			**QA**
			name	**route of submission**	**availability**	
1-2 years	External audits within the ISO quality management system				Result of the audit http://www.met.hu/doc/minosegiranyitas/OMSZ_ISO-9001_tanusitvany_2012-15_en.pdf	external audit
1-2 years	Inernal audits within ISO quality management system				n.a.	internal audit

Annex 2 : Structure of directory used by the GHG Division

- OFFICIAL ARCHIVE
  - DATABASE
  - BACKGROUND DOCUMENTS
  - SUBMISSIONS
- WORKING
  - GENERAL
  - SECTORS
- MANAGEMENT
- QA/QC
- LITERATURE
- OTHER

Annex 3: Outline of the process



Annex 4 : Abbreviations and inventory principles

CRF	Common reporting format = table (UNFCCC)
NIR	National Inventory Report = text (UNFCCC)
SEF	Standard electronic format = table on the Registry (UNFCCC) (it is NOT a HMS task)
NFR	Nomenclature for reporting = table (CLRTAP)
IIR	Informative Inventory Reports = text (CLRTAP)
NEC	National Emission Ceiling Directive - 2001/81/EC of The European Parliament And Of The Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants
UNFCCC	United Nations Framework Convention on Climate Change (1992)
CLRTAP	Convention on Long-range, Transboundary Air Pollution (1979, Geneva)
GHG	greenhouse gas

CLRTAP (EMEP/EEA 2009.)	UNFCCC (18/CP.8)
Transparency means that Parties should provide clear documentation and report a level of disaggregation that sufficiently allows individuals or groups other than the designated emission expert or the compiler of the inventory to understand how the inventory was compiled and assure it meets good practice requirements. The transparency of emission reporting is fundamental to the effective use, review and continuous improvement of the inventory.	*Transparency* means that the assumptions and methodologies used for an inventory should be clearly explained to facilitate replication and assessment of the inventory by users of the reported information. The transparency of inventories is fundamental to the success of the process for the communication and consideration of information;
Consistency means that estimates for any different inventory years, pollutants (2) and source categories are made in such a way that differences in the results between years and source categories reflect real differences in emissions. Annual emissions, as far as possible, should be calculated using the same method, and data sources for all years, and resultant trends should reflect real fluctuations in emissions and not the changes resulting from methodological differences. Consistency also means that, as far as practicable and appropriate, the same data are reported under different international reporting obligations.	*Consistency* means that an inventory should be internally consistent in all its elements with inventories of other years. An inventory is consistent if the same methodologies are used for the base and all subsequent years and if consistent data sets are used to estimate emissions or removals from sources or sinks. Under certain circumstances referred to in paragraphs 15 and 16, an inventory using different methodologies for different years can be considered to be consistent if it has been recalculated in a transparent manner, in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories and Good Practice Guidance for Land Use, Land-Use Change and Forestry*;[1]
Comparability means that the national inventory is reported in such a way that allows it to be compared with national inventories of other Parties. This can be achieved by using accepted methodologies as	*Comparability* means that estimates of emissions and removals reported by Annex I Parties in inventories should be comparable

elaborated in the Reporting Guidelines by using the reporting templates and through the use of the harmonized Nomenclature For Reporting (NFR), as specified in Annex IV of the Reporting Guidelines.	among Annex I Parties. For this purpose, Annex I Parties should use the methodologies and formats agreed by the COP for estimating and reporting inventories. The allocation of different source/sink categories should follow the split of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*,[2] and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*, at the level of its summary and sectoral tables;
Completeness means that estimates are reported for all pollutants, all relevant source categories and all years and for the entire territorial areas of the Parties covered by the reporting requirements set forth in the provisions of the Convention and its protocols. Where numerical information on emissions under any source category is not provided, the appropriate notation key defined in Annex I of the Reporting Guidelines should be used when filling in the reporting template and their absence should be documented.	*Completeness* means that an inventory covers all sources and sinks, as well as all gases, included in the IPCC Guidelines as well as other existing relevant source/sink categories which are specific to individual Annex I Parties and, therefore, may not be included in the IPCC Guidelines. Completeness also means full geographic coverage of sources and sinks of an Annex I Party.
Accuracy means that emissions are neither systematically overestimated nor underestimated, as far as can be judged. This implies that Parties will endeavour to remove bias from the inventory estimates and minimize uncertainty.	*Accuracy* is a relative measure of the exactness of an emission or removal estimate. Estimates should be accurate in the sense that they are systematically neither over nor under true emissions or removals, as far as can be judged, and that uncertainties are reduced as far as practicable. Appropriate methodologies should be used, in accordance with the IPCC good practice guidance, to promote *accuracy* in inventories.

List of quality records used for documentation of QA/QC activities as required by QC Plan of the GHG Division (HMS ISO document n.: ELFO 401.01):

UHG 01 QA/QC checklist

T1 QC checklist					
QC checklist Sector:	**Y (no problem identified) /N /n.a**	**Notes, explanation, supporting documents, further details…**		**Date of the check**	**Correction date**
Check that AD is properly recorded, archived and referenced					
Check that EF is properly recorded, archived and referenced					
Check for transcription errors					
Check units and conversion factors					
Check integrity of database files (e.g.: processing steps are correct and represented in the calculation file)					
Check data consistency between source categories (e.g.: subtractions to avoid double counts)		Other sector(s) where the data is used:			
Check movement of data between steps correct (e.g. calculation file consistency with CRF?)					
Check uncertainties are estimated correctly					
Undertake review of documentation (e.g. replicability is assured?)					
Check recalculations (e.g. time-series consistency is assured? comparison table created, difference is explained, included in NIR?)					
Check the completeness (e.g.: Every year, every element of the sub-source is included? Base year correct? Data gaps are documented?)					
Compare estimates to previous ones (e.g.: differences from expected trends are explainable?)					

Corrective actions and improvements - OPTIONAL						
ERRATA (errors noticed by sectoral experts?)	**date**	**Years affected**	**Included in "Development plan" for year…**	**Actions/resources/data input needed for the correction**	**Correction date**	**If it causes recalculation, it is included in NIR submission year…**
Change required by review report (both UNFCCC and EU?)	**date**	**Years affected**	**Included in "Development plan" for year…**	**Actions/resources/data input needed for the correction**	**Correction date**	**If it causes recalculation, it is included in NIR submission year…**
Other (expert peer reviews, audits, non-binding improvements, etc.)	**date**	**Years affected**	**Included in "Development plan" for year…**	**Actions/resources/data input needed for the correction**	**Correction date**	**If it causes recalculation, it is included in NIR submission**

						year…

Verification - OPTIONAL					
	AD	**EF**	**Emission**	**Allocation**	**Other**
NFR consistency?					
ETS consistency?					
E-PRTR consistency?					
EU preliminary GHG?					
NIRs of other countries					

T2 QC checklist - OPTIONAL				
A2. CATEGORY-SPECIFIC QC CHECKLIST (CHECKS TO BE DESIGNED FOR EACH CATEGORY)	**Y (no problem identified) /N /n.a**	**Notes, explanation, supporting documents, further details…**	**Date of the check**	**Correction date**
Category-specific checklist - Part A: Data gathering and selection				
EMISSION DATA QUALITY CHECKS				
1. Emission comparisons: historical data for source, significant sub-source categories				
2. Checks against independent estimates or estimates based on alternative methods				
3. Reference calculations				
4. Completeness				
5. Other (detailed checks)				
EMISSION FACTOR QUALITY CHECK				
6. Assess representativeness of emission factors, given national circumstances and analogous emissions data				
7. Compare to alternative factors (e.g., IPCC default, cross-country, literature)				
8. Search for options for more representative data				
9. Other (detailed checks)				
ACTIVITY DATA QUALITY CHECK: NATIONAL LEVEL ACTIVITY DATA				
10. Check historical trends				
11. Compare multiple reference sources				
12. Check applicability of data				
13. Check methodology for filling in time series for data that are not available annually				
14. Other (detailed checks)				
ACTIVITY DATA QUALITY CHECK: SITE-SPECIFIC ACTIVITY DATA				
15. Check for inconsistencies across sites				
16. Compare aggregated and national data				
17. Other (detailed checks)				
Category-specific checklist - Part B: Secondary data and direct emission measurement				
SECONDARY DATA: SAMPLE QUESTIONS REGARDING THE QUALI Y OF INPUT DATA				
1. Are QC activities conducted during the original preparation of the data (either as reported in published literature or as indicated by personal communications) consistent with and adequate when compared against (as a minimum), general QC activities?				
2. Does the statistical agency have a QA/QC plan that covers the preparation of the data?				
3. For surveys, what sampling protocols were used and how recently were they reviewed?				
4. For site-specific activity data, are any national or international standards applicable to the measurement of the data? If so, have they been employed?				
5. Have uncertainties in the data been estimated and documented?				
6. Have any limitations of the secondary data been identified and documented, such as biases or incomplete estimates? Have errors been found?				
7. Have the secondary data undergone peer review and, if so, of what nature?				
8. Other (detailed checks)				
DIRECT EMISSION MEASUREMENT: CHECKS ON PROCEDURES TO MEASURE EMISSIONS				
9. Identify which variables rely on direct emission measurement				

10. Check procedures used to measure emissions, including sampling procedures, equipment calibration and maintenance.				
11. Identify whether standard procedures have been used, where they exist (such as IPCC methods or ISO standards).				
12. Other (detailed checks)				

UHG 02 Data quality check

Kérdőív adatminőség ellenőrzéshez és bizonytalanság becsléshez/ Questionnaire for quality check of secondary data and direct measurements		
Adat/ adatkör megnevezése / Revised data or dataset:		
I. Adat minőség/ Data quality		
1	**Ellenőrzik-e valamilyen módon a szolgáltatott adatokat?** **Is the quality of your data checked somehow?**	
2	Verifikálják-e az adatokat?/ Is the data verified?	
3	Van-e az adatszolgáltatónak olyan minőségbiztosítási rendszere, amely kiterjed az adat gyűjtésére és feldolgozására? / Does the data supplier have a QA/QC procedure that covers the collection and processing of data?	
4	Az adatgyűjtés hazai vagy nemzetközi szabvány/ jogszabály alapján történt-e? / Are there any national or international rules and regulations relating to the data collection?	
5	Az adat gyűjtéséhez létezik-e módszertani előírás / rendszeresített kérdő ív? Ha igen, milyen gyakran vizsgálják azt felül? / Is there any methodological description or questionnaire relating to the data collection? If yes, how often is it revised?	
6	Tapasztaltak-e valamilyen hibát az adatgyűjtéskor, feldolgozáskor?/ Have errors or limitations been found relating to the data collection and the data processing?	
II. Megbízhatóság/ **Uncertainty**		
1	**Történik-e számszerű becslés az adat megbízhatóságára vonatkozóan?/** **Is there any quantitative analysis relating to the uncertainty of the data?**	
2	Végeznek-e statisztikai elemzést az adat megbízhatóságára vonatkozóan? (Konfidencia intervallum, hibahatárok)/ Have the data undergone on statistical analysis to estimate the uncertainty?	
3	Ha nem, az adat bizonytalansága összehasonlítható-e/ összefüggésbe hozható-e más ismert bizonytalanságú adattal? Melyik adat az, és milyen kapcsolat ismert?/ If no, is there any other correlating data, which uncertainty is known? Which one and what is the correlation between them?	
4	Mekkora az adatszolgáltató szerint a közölt adat megbízhatósági tartománya? (Lehetőség szerint 95%-os konfidencia intervallum határait kérjük megadni.)/ What is the confidence range of the data in the opinion of the data supplier? (Please, provide the range from lower to upper 95% confidence limits, if it is possible.)	
A következő részt a szektorfelelős tölti ki!/ The follows are filled by the expert of the sector		
A szektorfelelős szerint az adat minősége alapján a leltárkészítésre az adat felhasználható (I/N):/ Is the data usable for making inventory? (Y/N)		
Az adat alapértelmezett bizonytalansága:/ Default uncertainty of the data in accordance with the IPCC guidelines		
A számított/becsült ország-specifikus érték:/ Calculated or estimated value of the uncertainty		
Az alapértelmezett bizonytalanságtól való eltérés indoklása:/ Reasons for the difference between the country-specific value of the uncertainty and the default one		
Dátum:/ Date:		Aláí Sig

UHG 03 Development Plan (Fejlesztési terv)

					Updated:	
SHORT TERM (WITHIN ONE INVENTORY CYCLE)						
GENERAL		**Who**		**Deadline**	**Compl.**	**Cause of non-compliance**
ENERGY	**Category**	**Who**	**Key**	**Deadline**	**Compl.**	**Cause of non-compliance**
INDUSTRIAL PROCESSES	**Category**	**Who**	**Key**	**Deadline**	**Compl.**	**Cause of non-compliance**
AGRICULTURE	**Category**	**Who**	**Key**	**Deadline**	**Compl.**	**Cause of non-compliance**
LULUCF	**Category**	**Who**	**Key**	**Deadline**	**Compl.**	**Cause of non-compliance**
WASTE	**Category**	**Who**	**Key**	**Deadline**	**Compl.**	**Cause of non-compliance**
LONG TERM						
GENERAL	**Category**	**Who**	**Key**	**Timeline**	**Status**	**Remarks**
ENERGY	**Category**	**Who**	**Key**	**Timeline**	**Status**	**Remarks**
INDUSTRIAL PROCESSES	**Category**	**Who**	**Key**	**Timeline**	**Status**	**Remarks**
AGRICULTURE	**Category**	**Who**	**Key**	**Timeline**	**Status**	**Remarks**
LULUCF	**Category**	**Who**	**Key**	**Timeline**	**Status**	**Remarks**
WASTE	**Category**	**Who**	**Key**	**Timeline**	**Status**	**Remarks**

UHG 04 Responsibilities

Task	Name	Date
Compiler		
QA/QC		
Archiving		
Sector experts		
Energy		
Industry, solvents		
Agriculture, LULUCF		
Waste		
Uncertainty, key category analysis		

UHG 05 Data source logbook

Data	**Email/Letter** */Internet*	**Instiution/** *Database, stb.*	**Officer**	**Contact details/** *exact source of downloaded data*	**Date of enquiry**	**Date of receipt/** *download*	**Reg. n.**	**Name of file received/** *downloaded*

UHG 06 Uncertainty – As of Tables in Annex 7

UHG 07 Key category analysis – As of Tables in Annex 1

UHG 08 QA Activities logbook

Document name	**Document sent to (name of the person/authority/institution/commette, etc.)**	**Comments arrived / No comments**	**Action needed / No action needed**
NIR 201x XXXMONTH submission			
NIR 201x XXXMONTH submission ES.			
IIR 201x submission			
IIR 201x submission ES.			

Annex 7 Uncertainty

A7.1 Description of methodology used for uncertainty calculation

The first uncertainty calculation for the Hungarian greenhouse gas inventory was reported in 2006 for the year 2004 to fulfill the IPCC requirements for a complete emission inventory. Since 2012 submission the full coverage of the emission sources and sinks has been achieved both in key category analysis and in uncertainty estimation. The disaggregation of the categories used in uncertainty analysis is the same as listed in *Table A1-2* used for Tier 2 key category analysis.

"Uncertainty estimates are an essential element of a complete emissions inventory. Uncertainty information is not intended to dispute the validity of the inventory estimates but to help prioritize efforts to improve the accuracy of inventories in the future and guide decisions on methodological choice." (IPCC, 2000)There are two methods for the uncertainty estimation suggested by the IPCC Good Practice Guidance (2000), a basic method (Tier 1) which is mandatory and an analytic one (Tier 2). The combination of uncertainties of the sectors "in order to arrive at the overall uncertainty in the national emissions and the trend" in the Hungarian inventory is carried out on the basis of Tier 1 method (error propagation rule)The uncertainty calculation was performed using Table 6.1 of the IPCC Good Practice Guidance (2000).

At the moment Tier 1 method is also used to combine emission factor and activity data uncertainties within all sectors except for 5A sector in LULUCF. In this case Tier 2 method (Monte-Carlo analysis) is applied. In Agriculture subsectors the combination of emission factor and activity data uncertainties are calculated and presented in NIR chapter 5 using both methods, but results of Tier 1 method are included in the calculation of overall national uncertainties at the moment.

The calculations of the emissions estimates uncertainty are presented with LULUCF sectors, in *Table A7-1*. Uncertainty calculation for each GHG (with LULUCF sector) is presented in *Table A7-2.*

Table A7-1 Uncertainty calculation with LULUCF, Tier 1 method

IPCC source category name and code		Pollu-tant	Base year emissions	Year t emissions	Activity data (AD) uncer-tainty	Emission factor (EF) uncer-tainty	Combined uncertainty	Combined uncertainty as % of total national emissions in the year t	Type A sensitivity	Type B sensitivity	Uncertainty introduced in trend in national emissions introduced by EF uncertainty	Uncertainty introduced in trend in national emissions introduced by AD uncertainty	Uncertainty introduced in trend in national emissions
A		B	C:Input data	D:Input data	E:Input data	F:Input data	$G=(E^2+F^2)^{1/2}$	H=(G • D)/ ΣD	I:see row Note A for formula	J=D/ ΣC	K = I • F	L = J • E • √2	$M = (K^2+L^2)^{1/2}$
			Gg CO2 eq		%								
1. A.	Stationary Combustion - Gas	CO2	19,320.99	18,394.75	5	5	7.071	2.259	0.075	0.164	0.377	1.162	1.222
1. A.	Stationary Combustion - Coal	CO2	33,087.90	10,719.01	2	5	5.385	1.003	-0.056	0.096	-0.281	0.271	0.390
1. A.	Stationary Combustion - Oil	CO2	16,801.10	2,466.79	2	5	5.385	0.231	-0.055	0.022	-0.276	0.062	0.283
1. A.	Non-CO2 Emission from Stationary Fuel Combustion	N2O	211.70	127.86	3	50	50.090	0.111	0.000	0.001	0.008	0.005	0.010
1. A.	Non-CO2 Emission from Stationary Fuel Combustion	CH4	909.28	314.55	3	8	8.544	0.047	-0.001	0.003	-0.011	0.012	0.016
1. A.	Stationary Combustion - Other Fuel	CO2	44.08	379.93	5	10	11.180	0.074	0.003	0.003	0.032	0.024	0.040

1. A. 3.	Mobile Combustion - Other	CO2	1,065.21	146.02	5	5	7.071	0.018	-0.004	0.001	-0.018	0.009	0.020
1. A. 3.	Mobile Combustion	N2O	93.96	106.27	5	100	100.125	0.185	0.001	0.001	0.052	0.007	0.052
1. A. 3.	Mobile Combustion	CH4	45.45	24.33	5	50	50.249	0.021	0.000	0.000	0.000	0.002	0.002
1. A. 3. B.	Mobile Combustion - Road	CO2	6,845.64	10,572.29	5	5	7.071	1.298	0.063	0.094	0.315	0.668	0.739
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CH4	923.01	10.98	3	10	10.440	0.002	-0.004	0.000	-0.041	0.000	0.041
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CO2	3.60	IE,NA,NO	3	10	10.440	0.000	0.000	0.000	0.000	0.000	0.000
1. B. 2.	Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH4	1,613.47	2,036.32	2	50	50.040	1.770	0.011	0.018	0.539	0.051	0.541
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	N2O	0.60	0.19	2	100	100.020	0.000	0.000	0.000	0.000	0.000	0.000
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	CO2	358.51	175.30	100	80	128.062	0.390	0.000	0.002	-0.007	0.222	0.222
2.	N2O Emission from Industry	N2O	4,541.51	22.80	2	1	2.236	0.001	-0.021	0.000	-0.021	0.001	0.021
2.	CH4 Emission from Industry	CH4	16.09	39.12	1	20	20.025	0.014	0.000	0.000	0.006	0.000	0.006

2. A. 1.	CO2 Emission from Cement Production	CO2	1,778.28	678.42	2	2	2.828	0.033	-0.002	0.006	-0.004	0.017	0.018
2. A. 2.	CO2 Emission from Lime Production	CO2	606.79	140.07	5	2	5.385	0.013	-0.002	0.001	-0.003	0.009	0.009
2. A. 3.	CO2 Emission from Limestone and Dolomit Use	CO2	248.68	324.40	2	1	2.236	0.013	0.002	0.003	0.002	0.008	0.008
2. A. 4-7.	CO2 Emission from Soda Ash use and Other Mineral Products	CO2	643.09	138.25	10	30	31.623	0.076	-0.002	0.001	-0.052	0.017	0.055
2. B. 1.	CO2 Emission from Ammonia Processes	CO2	1,616.22	481.68	2	2	2.828	0.024	-0.003	0.004	-0.006	0.012	0.014
2. B. 2.	CO2 Emission from Nitric Acid Production	CO2	0.082	0.001	3	40	40.112	0.000	0.000	0.000	0.000	0.000	0.000
2. C.	CO2 Emission from Metal Production	CO2	787.948	217.66	2	5	5.385	0.020	-0.002	0.002	-0.008	0.006	0.010
2.	PFCs Emissions from Industry	PFCs	268.49	1.37	1	2	2.236	0.000	-0.001	0.000	-0.002	0.000	0.002
2.	HFCs Emissions from Industry	HFCs	NA,NO	1,005.81	10	20	22.361	0.391	0.000	0.009	0.000	0.127	0.127
2.	SF6 Emissions from Industry	SF6	73.05	153.36	80	20	82.462	0.220	0.001	0.001	0.021	0.155	0.156
2. G.	Feedstocks and non-energy use of fuels	CO2	1,034.33	1,070.95	5	10	11.180	0.208	0.005	0.010	0.048	0.068	0.083

3.	N2O Emission from Solvent and Other Product Use	N2O	154.17	276.62	2	1	2.236	0.011	0.002	0.002	0.002	0.007	0.007
3.	CO2 Emission from Solvent and Other Product Use	CO2	135.75	73.82	10	20	22.361	0.029	0.000	0.001	0.001	0.009	0.009
4. A	CH4 Emissions from Enteric Fermentation in Domestic Livestock	CH4	3,368.89	1,502.24	0	13.24	13.24	0.345	-0.002	0.013	-0.027	0.000	0.027
4. B	CH4 Emissions from Manure Management	CH4	3,336.37	1,252.36	0	19.01	19.01	0.414	-0.004	0.011	-0.079	0.000	0.079
4. B.	N2O Emissions from Manure Management	N2O	1,951.74	851.75	0	83.71	83.71	1.238	-0.001	0.008	-0.114	0.000	0.114
4. C.	CH4 Emission from Rice Cultivation	CH4	50.54	12.43	5	198.24	198.31	0.043	0.000	0.000	-0.024	0.001	0.024
4. D. 1.	Direct N2O Emissions from Agricultural Soils	N2O	5,668.78	2,930.60	0	381.46	381.46	19.417	0.000	0.026	0.047	0.000	0.047
4. D. 2.	Pasture, range and paddock manure	N2O	307.95	226.69	0	101.74	101.74	0.401	0.001	0.002	0.062	0.000	0.062
4. D. 3.	Indirect N2O Emissions from Nitrogen Used in Agriculture	N2O	3,845.10	1,929.42	0	353.85	353.85	11.858	0.000	0.017	-0.155	0.000	0.155
4. F.	Field Burning of Agricultural Residues	CH4	45.51	NO	NO	NO	0.000	0.000	0.000	0.000	0.000	0.000	0.000

4. F.	Field Burning of Agricultural Residues	N2O	13.34	NO	NO	NO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.A.1	Forest Land remaining forest Land	CO2	-2776.67	-2720.78	35	31.623	46.800	-2.212	-0.012	-0.024	-0.365	-1.186	1.241
5.A.2	Land converted to Forest Land	CO2	-128.22	-1097.14	8	15.580	17.700	-0.337	-0.009	-0.010	-0.144	-0.116	0.185
5.A.1	Forest Land remaining Forest Land/Controlled burning	CH4	24.39	23.07	1	216.599	216.600	0.087	0.000	0.000	0.020	0.000	0.020
5.A.1	Forest Land remaining Forest Land/Wildfires	CH4	4.40	7.56	6	22.024	22.700	0.003	0.000	0.000	0.001	0.001	0.001
5.A.1	Forest Land remaining Forest Land/Controlled burning	N2O	2.48	2.36	1	218.60	218.60	0.009	0.000	0.000	0.002	0.000	0.002
5.A.1	Forest Land remaining Forest Land/Wildfires	N2O	0.45	0.77	6	88.93	89.10	0.001	0.000	0.000	0.000	0.000	0.000
5.B.1	Cropland remaining Cropland	CO2	181.82	-1590.94	0	89.650	89.650	-2.477	-0.015	-0.014	-1.350	0.000	1.350
5.B.2	Land converted to Cropland	CO2	18.96	339.11	0	93.355	93.355	0.550	0.003	0.003	0.275	0.000	0.275
5.B.1	Cropland remaining Cropland	CH4	1.24	1.23	25	70.000	74.330	0.002	0.000	0.000	0.000	0.000	0.001
5.B.	Cropland	N2O	4.96	38.43	0	277.29	277.29	0.185	0.000	0.000	0.089	0.000	0.089

5.C.1	Grassland remaining Grassland	CO2	13.12	462.79	0	90.493	90.493	0.727	0.004	0.004	0.369	0.000	0.369
5.C.2	Land converted to Grassland	CO2	0.92	-114.71	0	188.31	188.314	-0.375	-0.001	-0.001	-0.194	0.000	0.194
5.C.1	Grassland remaining Grassland	CH4	0.73	1.91	25	70.000	74.330	0.002	0.000	0.000	0.001	0.001	0.001
5.C.1	Grassland remaining Grassland	N2O	0.39	1.04	25	70.000	74.330	0.001	0.000	0.000	0.001	0.000	0.001
5.D.1-2	Wetlands	CO2	24.88	9.56	113	113.13	159.991	0.027	0.000	0.000	-0.003	0.014	0.014
5.E.2	Land converted to Settlements	CO2	70.72	228.61	0	39.23	39.23	0.156	0.002	0.002	0.067	0.000	0.067
6. A.	CH4 Emissions from Solid Waste Disposal Sites	CH4	1,471.30	2,472.02	10	30	31.623	1.358	0.015	0.022	0.460	0.312	0.556
6. B.	Emissions from Wastewater Handling	CH4	858.30	309.60	20	30	36.056	0.194	-0.001	0.003	-0.035	0.078	0.086
6. B.	Emissions from Wastewater Handling	N2O	300.31	265.20	10	1000	1000.050	4.606	0.001	0.002	0.989	0.034	0.990
6. C.	CO2 emissions from Waste Incineration	CO2	NA,NO	93.01	10	20	22.361	0.036	0.000	0.001	0.000	0.012	0.012
6. C.	CH4 Emissions from Waste Incineration	CH4	NA	1.16	10	50	50.990	0.001	0.000	0.000	0.000	0.000	0.000

6. C.	N2O Emissions from Waste Incineration	N2O	NA,NO	2.89	5	100	100.125	0.005	0.000	0.000	0.000	0.000	0.000
6.D	CH4 Emissions from Other Waste	CH4	0.00	15.36	10	30	31.623	0.008	0.000	0.000	0.000	0.002	0.002
6.D	N2O Emissions from Other Waste	N2O	0.00	17.01	10	30	31.623	0.009	0.000	0.000	0.000	0.002	0.002
			Σ C	**Σ D**				**$(\Sigma H^2)^{1/2}$**					**$(\Sigma M^2)^{1/2}$**
	TOTAL including LULUCF		**111,891.65**	**57,573.55**				**23.8**					**2.8**

Note A

$$\frac{0.01 \cdot D_x + \sum D_i - \left(0.01 \cdot C_x + \sum C_i\right)}{\left(0.01 \cdot C_x + \sum C_i\right)} \cdot 100 - \frac{\sum D_i - \sum C_i}{\sum C_i} \cdot 100$$

Note B : In the case only the total uncertainty is known (not for activity data and emission factor separately) uncertainties in the coloumn of the activity data are 0, while in the coloumn of the emission factor the total uncertainty is entered in accordance with the Note A of Table 6.1 of GPG (IPCC, 2000) as the uncertainties are not correlated across years.

Table A7-2 *Uncertainty calculation for each GHG with LULUCF, Tier 1 method*

Source category	GHG	Emissions in the current year (2011) (Gg CO2-eq)	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of of different GHG emissions in current year
Stationary Combustion - Gas	CO_2	18394.75	5.00	5.00	7.07	3.13
Stationary Combustion - Coal	CO_2	10719.01	2.00	5.00	5.39	1.39
Stationary Combustion - Oil	CO_2	2466.79	2.00	5.00	5.39	0.32
Stationary Combustion - Other Fuel	CO_2	379.93	5.00	10.00	11.18	0.10
Mobile Combustion - Other	CO_2	146.02	5.00	5.00	7.07	0.02
Mobile Combustion - Road	CO_2	10572.29	5.00	5.00	7.07	1.80
Fugitive Emissions from Coal Mining and Handling	CO_2	IE,NA,NO	3.00	10.00	10.44	0.00
Fugitive Emissions from Oil and Gas Operations	CO_2	175.30	100.00	80.00	128.06	0.54
CO_2 Emissions from Cement Production	CO_2	678.42	2.00	2.00	2.83	0.05
CO_2 Emissions from Lime Production	CO_2	140.07	5.00	2.00	5.39	0.02
CO_2 Emission from Limestone and Dolomit Use	CO_2	324.40	2.00	1.00	2.24	0.02
CO_2 Emission from Other Mineral Products	CO_2	138.25	10.00	30.00	31.62	0.11
CO_2 Emissions from Ammonia Processes	CO_2	481.68	2.00	2.00	2.83	0.03
CO_2 Emissions from Nitric Acid Production	CO_2	0.00	3.00	40.00	40.11	0.00
CO_2 Emissions from Metal Production	CO_2	217.66	2.00	5.00	5.39	0.03
Feedstocks and non-energy use of fuels	CO_2	1070.95	5.00	10.00	11.18	0.29
CO_2 Emission from Solvent and Other Product Use	CO_2	73.82	10.00	20.00	22.36	0.04
Non-biogenic CO_2 from Waste	CO_2	93.01	10.00	20.00	22.36	0.05
Forest Land remaining forest Land	CO_2	-2720.78	34.50	31.62	46.80	3.06
Land converted to Forest Land	CO_2	-1097.14	8.40	15.58	17.70	0.47
Cropland remaining Cropland	CO_2	-1590.94	0.00	89.65	89.65	3.43
Land converted to Cropland	CO_2	339.11	0.00	93.35	93.35	0.76
Grassland remaining Grassland	CO_2	462.79	0.00	90.49	90.49	1.01
Land converted to Grassland	CO_2	-114.71	0.00	188.31	188.31	0.52
Land converted to Wetlands	CO_3	9.56	113.13	113.13	159.99	0.04
Land converted to Settlements	CO_2	228.61	0.00	39.23	39.23	0.22

SZUM CO2		**41,588.87**				**6.22**
% of total emission including LULUCF		**72.2**				
Non-CO_2 Emission from Stationary Fuel Combustion	CH_4	314.55	3.00	8.00	8.54	0.33
Mobile Combustion	CH_4	24.33	5.00	50.00	50.25	0.15
Fugitive Emissions from Coal Mining and Handling	CH_4	10.98	3.00	10.00	10.44	0.01
Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH_4	2036.32	2.00	50.00	50.04	12.70
CH_4 Emission from Industry	CH_4	39.12	1.00	20.00	20.02	0.10
CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	1502.24	0.00	13.24	13.24	2.48
CH_4 Emissions from Manure Management	CH_4	1252.36	0.00	19.01	19.01	2.97
CH_4 Emission from Rice Cultivation	CH_4	12.43	5.00	198.24	198.31	0.31
Field Burning of Agricultural Residues	CH_4	NO	NO	NO	0.00	0.00
CH_4 Emissions from Solid Waste Disposal Sites	CH_4	2472.02	10.00	30.00	31.62	9.74
Emissions from Wastewater Handling	CH_4	309.60	20.00	30.00	36.06	1.39
CH_4 Emissions from Waste Incineration	CH_4	1.16	10.00	50.00	50.99	0.01
Forest Land remaining Forest Land/Controlled burning	CH4	23.07	0.70	216.60	216.60	0.62
Forest Land remaining Forest Land/Wildfires	CH4	7.56	6.40	22.02	22.70	0.02
Cropland remaining Cropland	CH_4	1.23	25.00	70.00	74.33	0.01
Grassland remaining Grassland	CH_4	1.91	25.00	70.00	74.33	0.02
CH4 Emissions from Other Waste	CH_4	15.36	10.00	30.00	31.62	0.06
SZUM CH4		**8024.25**				**16.54**
% of total emission including LULUCF		**13.94**				
Non-CO_2 Emission from Stationary Fuel Combustion	N_2O	127.86	3.00	50.00	50.09	0.94
Mobile Combustion	N_2O	106.27	5.00	100.00	100.12	1.56
Fugitive Emissions from Oil and Gas Operations	N_2O	0.19	2.00	100.00	100.02	0.00
N_2O Emission from Industry	N_2O	22.80	2.00	1.00	2.24	0.01
N_2O Emission from Solvent and Other Product Use	N_2O	276.62	2.00	1.00	2.24	0.09
N_2O Emissions from Manure Management	N_2O	851.75	0.00	83.71	83.71	10.49
Direct N_2O Emissions from Agricultural Soils	N_2O	2930.60	0.00	381.46	381.46	164.40
Pasture, range and paddock manure	N_2O	226.69	0.00	101.74	101.74	3.39
Indirect N_2O Emissions from Nitrogen Used in	N_2O	1929.42	0.00	353.85	353.85	100.40

Agriculture						
Field Burning of Agricultural Residues	N_2O	NO	NO	NO	0.00	0.00
Emissions from Wastewater Handling	N_2O	265.20	10.00	1000.00	1000.05	39.00
N_2O Emissions from Waste Incineration	N_2O	2.89	5.00	100.00	100.12	0.04
Forest Land remaining Forest Land/Controlled burning	N2O	2.36	0.70	218.60	218.60	0.08
Forest Land remaining Forest Land/Wildfires	N2O	0.77	6.40	88.93	89.10	0.01
Cropland	N_2O	38.43	0.00	277.29	277.29	1.57
Grassland remaining Grassland	N_2O	1.04	25.00	70.00	74.33	0.01
N2O Emissions from Other Waste	N_2O	17.01	10.00	30.00	31.62	0.08
SZUM N2O		**6,799.89**				**196.87**
% of total emission including LULUCF		**11.8**				
Emissions from Substitutes for Ozone Depleting Substances	HFCs	1005.81	10.00	20.00	22.36	19.38
PFCs Emissions	PFCs	1.37	1.00	2.00	2.24	0.003
SF6 Emissions from Electrical Equipment	SF6	153.36	80.00	20.00	82.46	10.90
SZUM HFCs, PFCs, SF6		**1,160.54**				**22.23**
% of total emission including LULUCF		**2.0**				

Annex 8 Responses to the review of the 2013 inventory submission

Hungary has just received the final ARR on the 21st of May 2014. Please find below the recommendations identified by the expert review team as included in Table 9 of the draft ARR and the present status of implementation of several issues.

CRF category / issue		Review recommendation	Review report para.	MS response / status of implementation	Chapter/ section in the NIR
Cross-cutting	Inventory planning	Explain in the NIR that the sectoral experts consult with the head of the GHG Inventory Division on the choice of method	8	Explanation included in NIR chapter 1.3.	1.3
		Improve the transparency of the information on the QA activities performed, including templates or records	16	Updated QA/QC Plan is included in NIR Annex 6.	Annex 6.
	Key category analysis	Include in the NIR and CRF table 7: the results from the key category analysis performed including and excluding LULUCF; report a disaggregated key category analysis for the base year	20	Results of the key category analysis excluding LULUCF are included in NIR Chapter 1.6. Table 1.2 and CRF Table 7 and disaggregated key category analysis for the base year is included in CRF 2014 May submission.	Chapter 1.6
Energy	Reference approach	Correct the bunker consumption for jet kerosene	27	Has been corrected.	
	Comparison with international statistics	Review the fuels classification used in the inventory and the data on coal consumption per coal type	28	The present inventory is fully based on IEA data therefore uses the IPCC fuel classification.	
		Address the inconsistency in the reporting of natural gas liquids and report on the progress	29	As current reporting is based on IEA statistics, the inconsistency has been removed.	

		Use the coal classification from the Revised 1996 IPCC Guidelines	30	This inventory follows the IPCC fuel classification.	
		Improve the consistency of the information on consumption of naphtha and gasoline	31	Naphtha and gasoline is reported now separately.	
		Disaggregate the estimates for lubricants and refinery feedstock	32	Disaggregation has been done based on IEA annual questionnaires.	
		Improve the consistency of the information on exports of gasoline	33	This inventory is based on the IEA annual oil questionnaire which increases the required consistency.	
		Report coking coal from 2004–2010 in the CRF tables	35	Done.	
		Report on the discussion on fuel consumption by international aviation between the CRF tables and the IEA data For jet kerosene in international bunkers, replace the notation key in CRF table 1.A(b) by the appropriate estimate Report on the investigation into the discrepancies in fuel consumption in domestic navigation	36, 37, 38	Consistency with the IEA data has been significantly improved. Jet kerosene consumption is taken now directly from the IEA annual oil questionnaire. International bunkers are properly reported for all years. Gasoline consumption has been allocated to domestic navigation based on IEA data. Recent jump in fuel consumption needs to be analyzed.	
		Investigate the discrepancies for stocks for liquid fuels and report the findings in its NIR, and explain any recalculations	39	This inventory is (almost) fully based on the IEA annual questionnaires, therefore increased consistency is a necessary consequence.	
	Stationary combustion: all fuels – CO_2, CH_4 and N_2O	For solid fuels use in public electricity and heat production, review the N_2O EFs, and in the NIR, explain the source of these EFs and justify their selection, and ensure the time-series consistency of the estimates (including methodologies and EFs)	40	In case of (real) solid fuels, we have switched to default EFfrom the 1996 IPCC Guidelines. As for derived gases (coke oven gas, blast furnace gas, and gas works gas) the default factors from the 2006 IPCC Guidelines is used.	Ch, 3.6.2

		For biomass use in public electricity and heat production, include more detailed information on biomass use, including fuels considered, AD and EFs, and explain any recalculation in its NIR	41	See NIR, e.g. Table 3.1.7	Ch, 3.2.6
		For gaseous fuels use in petroleum refining, review the EFs used, to ensure the consistency of the time series (including the methodologies and the EFs) and explain any deviation	42	For the period 2008-12, plant specific emission factors have been introduced based on the EU ETS database.	Ch. 3.2.6.5
		For liquid fuels use in non-ferrous metals, include more detailed information on the use of liquid fuels in the non-ferrous metal industry, including fuels used, AD and EFs, and explain any recalculation in its NIR	43	The activity data have been taken now from the IEA annual oil questionnaire also for this source category. Liquid fuel use has become negligible recently.	
		For biomass use in food processing, beverages and tobacco, apply a consistent methodological approach and applying consistent EFs across the entire time series, and review the “NO” reported for emissions for 1998–2005 and confirm that these emissions do not occur and are not reported elsewhere	44	In this renewed inventory, solid biomass use is reported for all years, and some biogas is included for recent years. The source of our activity data is the IEA annual questionnaire on renewable energy. Default EFs (partly from the 1996 IPCC Guidelines, and in case of biogases, from the 2006 Guidelines) are used consistently. As ETS data indicate also some liquid biofuel use, we might need further analyses.	

		For biomass use in other (manufacturing industries and construction): apply a consistent methodology and EFs across the entire time series; follow the IPCC good practice guidance for EFs (i.e. default EFs should not be used if a tier 2 or 3 methodology is applied); apply the correct notation key (“IE” instead of “NA” when emissions are included elsewhere) and include transparent information, including references, on how these emissions are estimated	45	Same as above. We have addressed also the issue on notation keys and made the necessary revisions,	
		For liquid fuels use in agriculture/forestry/fisheries, address the overestimation of CO_2 emissions	46	Our comprehensive revision of the energy sector solved also this issue of overestimation.	
		For CO_2 emissions from biomass use in agriculture/forestry/fisheries, report the information provided during the review	47	More information on biomass use is included in the NIR.	Ch 3.2.9.2
		For CH_4 and N_2O emissions from biomass use in agriculture/forestry/fisheries, explain how the CH_4 and N_2O EFs are estimated	48	See above	
	Civil aviation: liquid fuels – CO_2, CH_4, N_2O	report the emissions from gasoline use for civil aviation separately	49	For the time being, we have no reliable information on gasoline use for civil aviation therefore we had to postpone this issue. What we have done, however, is that we have allocated some jet kerosene use to domestic aviation based on Eurocontrol data.	

	Road transportation: liquid fuels – CO_2, CH_4, N_2O	Improve the consistency of the time-series for CH4 emissions from liquid fuels and explain any recalculations; review the time series of CH_4 and N_2O emissions for LPG, explain how the consistency of the time series is ensured, and explain any recalculation in its NIR	53,54,55	As for LPG, CH4 and N2O EFs from the 2006 IPCC Guidelines are used now consistently. We need to work, however, more on the consistency of the time series of CH4 and N2O emissions from gasoline and diesel oil. We plan to submit updated time series next year,	
	Railways: liquid fuels– CO_2	Review the AD for the category for 2009 and 2010 and explain any recalculation	50	The revision has been made and the necessary recalculations have been carried out.	
	Oil and natural gas: gaseous fuels – CO_2 and CH_4	For oil exploration, clearly indicate where AD and emission estimates are reported	52	Notation key has been corrected in 2014submissions. (IE to 1.B.2.b.i. and to 1.B.2.C.2.1.)	3.3.2.2
	Solid fuel transformation: CO_2 and CH_4	Review its use of notation keys for AD and CO_2 and CH_4 emissions to ensure that all emissions are accurately estimated and reported. If "IE" is used, clearly explain under which category the AD or the emissions are reported	56	Notation key has been corrected in 2014submissions.	3.3.1.1
Industrial processes and solvent and other product use	General	continue to improve the transparency of the information provided on QA/QC activities and category-specific uncertainties;	58, 60	Several chapters of the NIR are amended.	4
	Time-series consistency	Ensure the consistency of the time series, including for cement production and glass production, and report the findings and the explanations for all recalculations	59	Findings and explanations regarding time-series consistency of the EU ETS sectors are included in NIR Annex A3.2.	Annex 3.2
	Ammonia production – CO_2	Explain the decreasing trend of the CO2 IEF	61	Further information is included in NIR chapter 4.4.1 regarding the investments of the ammonia producer, which might justify the decreasing trend of CO2 IEF.	4.4.1

	Consumption of halocarbons and SF_6 – HFCs, PFCs	For refrigeration and air-conditioning equipment, develop a country-specific value for recovery efficiency and include all the information related to the estimations of emissions from disposal	62	Recalculation was made applying 0% recovery efficiency (and subtraction of amount of intentional destruction) in 2013 November submission. The development of country specific recovery efficiency value will be included in the Development Plan of the next year.	-
	Soda ash production and use – CO_2	Estimate the emissions from soda ash use in industries other than glass production and explain the recalculations	63	Emissions from soda ash production has been included since 2013 November submission. Description of the method is included in NIR chapter 4.3.4.	4.3.4
	Solvent and other product use – N_2O	determine whether the import of products into Hungary occurs and, if appropriate, collect appropriate data and report relevant estimates of N_2O emissions	64	Recalculation was made in order to include N2O emissions from imported whipped cream products. Description of the method has been included in NIR chapter 5.3 together with description of the present state of the investigation regarding import in products of other uses of N2O.	5.3
Agriculture	General	Improve the explanations on the recalculations; address the inconsistency of the information on the tier used in the uncertainty analysis	66, 67	Significant effort was made to report recalculations transparently. Annex 7 has been complemented with additional explanation.	Annex 7
	Enteric fermentation – CH_4	Explain how net energy for dairy cattle is calculated; improve the information on the expert judgement on body mass for non-dairy cattle; review the population data used in the inventory	68, 69, 70, 71	GE was recalculated to enable the more transparent reporting. Information on calculation of body mass for Cattle has been improved. The population data has been checked and corrected for Poultry for 2011.	Chapter 6.2

	Agricultural soils – N_2O	Correct the information on the method used to estimate direct and indirect N2O emissions from agricultural soils; improve the transparency of the information on histosols; correct the information on liquid manure management; improve the information on N2O emissions from crop residues	73, 74, 75, 76	NIR, 2014 was supplemented with the required additional information. The documentation box in the CRF was corrected according to the recommendation.	Section 6.5.2
	Rice cultivation – CH_4	Correct the notation key for organic amendments	77	Notation key is corrected in the CRF table	
	Field burning of agricultural residues – CH_4	Report the information on recalculations in the right section of the NIR; correct the notation key for sugar cane; correct the value of the change in emissions between the base year and 2011	78, 79, 80	The NIR, 2014 and the CRF tables were corrected according to the recommendation.	Chapter 6.6 and 6.7
LULUCF	General	Report estimates of emissions for the currently not-estimated mandatory categories and carbon pools for which methodologies are provided in the IPCC good practice guidance for LULUCF	82	Emissions from 5.E.2.4 Wetlands converted to Settlements and organic soils in 5.A Forest Land have been reported in this submission.	Section 7.7.3.8 and Section 7.3.1.2.2
		Improve the information on: net CSCs in soils for grassland converted to other land; report the area affected by wildfires for forest land remaining forest land and report emissions from wildfires on land converted to forest land	83	Concerning ’Grassland converted to Other Land’ improved explanation is provided. Following the recommendation of the ERT the wildfire area and emission values are under recalculation.	Section 7.8.2.1
		Justify that net CSCs in dead organic matter and in mineral and organic soils are not occurring in wetlands converted to forest land or use the notation key “NE”; provide information on the status of the initiative on the identification of organic soils	84		

		Increase the transparency of the figures in CRF table 5.A by disaggregating the area of the forest subcompartments and the ‘permanently’ unstocked areas	85	Following the recommendation of the ERT, the area of the forest subcompartments and the ‘permanently’ unstocked areas has been disaggregated in CRF table 5.A.	
		Report the tier 1 uncertainty analysis for forest land in order to compare the results of the two tiers	86		
		Further investigate the presence of management activities on organic soils in its territory	87	Significant improvements have been made concerning the reporting of management activity on organic soils: Emissions from lands converted to peat extraction under 5.D.1, 5.E.2.4 Wetland converted to Settlements and organic soils in 5.A. Forest Land are now reported.	Section 7.6.2, Section 7.7.3.8 and Section 7.3.1.2.2
	Forest land remaining forest land – CO_2	Correct the reporting of the land-use matrices in the NIR and make the information in the CRF tables and in the NIR consistent; provide numerical examples to better clarify the methodology applied and to report its impact on the accuracy of the calculation of carbon stocks	88, 89		

	Land converted to forest land – CO_2	Improve the consistency of the land-use change areas reported Estimate changes in carbon stock in the soil and dead organic matter pools from conversion of grassland to forest land Periodically revise the function used for the estimates of net CSC in biomass for land converted to forest land	90, 91, 92	Yield tables are standard tools to estimate both volume stocks and volume increment, and are based on the assumption that the growth and yield of stands is rather constant over time. This is true for simplified yield tables that we use for the area in the L-FL category. In fact, growth has a rather high variability due to high inter-annual variability in annual climatic conditions, however, yield is rather stable in a period of a few decades. This is even true for the recent decades with climate change at least in the sense that it is not practicable to re-create yield tables for each year. A periodical review of the yield tables is possible, and we will consider such a review based on priorities. In the estimation of carbon stock changes on AR lands, no simplified yield tables are used. AR stands are identified and mapped at the sub-compartment level and National Forest Database contains information regarding their age, height and volume stock, and emissions and removals are calculated using the stock change method based on these volume stocks. As a result of the review in 2013, we considerably improved the description of the related estimation methodology, and the NIR submitted this year already includes that description.	

	Grassland remaining grassland – CO_2	Use the notation key “NE” for reporting of CSC for living biomass, and report in the appropriate documentation box of the CRF table that a tier 1 methodology was used, assuming CSCs to be zero. Clarify the assumption of static management practices assumed for the entire time series	94, 95	Explanation in the NIR, 2014 has been corrected in line with the notation key reported in the CRF Table.	Section 7.5.2.1
	Land converted to settlements – CO_2	For wetlands converted to settlements, estimate the CSC in soils and living biomass	97	Emissions from “wetlands converted to settlements” are now reported in this submission 2014.	Section 7.7.3.8
	CO_2 emissions from agricultural lime application	Review the notation key for grassland	98	Notation key and justification are checked.	Section 7.5.4
Waste	Solid waste disposal on land – CH_4	Explain the recalculation in its NIR; explain in detail how the data for waste composition between 1950 and 1980 have been interpolated; continue to use zero as the value of the oxidation factor until the Party is able to appropriately apply the 0.1	100, 101, 102	Our estimations have been significantly improved taking into account more types of disposal sites, For modern disposal sites we have started using the oxidation factor of 0.1 starting in year 2004. The interpolation of waste composition data is shown in Annex3.4	Ch. 10.6 Annex 3.4
	Wastewater handling – CH_4	Report disaggregated AD and CH_4 emissions for sludge in CRF table 6.B; justify its use of the method included in the 2006 IPCC Guidelines in the NIR; address the inconsistency on the information on degradable organic component in the pulp and paper industry;	103, 104, 105, 106	We still report AD and emissions together for wastewater and sludge. However, we made some revisions of the reported parameters and notation keys as recommended. Justification of the use of the 2006 IPCC Guidelines is given. The DOC component of the pulp and paper industry has been revised for the period 2008-2010.	Ch. 8.3

KP-LULUCF	Afforestation and reforestation – CO_2	Provide all of the necessary information on recalculations; Improve the description of afforestation in its NIR to set the beginning of the site preparation as the onset of the afforestation activity; Over time, complement the methodology used in the estimates of CSC in biomass with data collected through the national forest inventory.	109, 110, 111	Following the recommendation of the ERT, the description of afforestation in NIR chapter 7.3.2.1 has been improved.	chapter 7.3.2.1
	Deforestation – CO_2	Correct the inconsistency on the information on net CO2 emission from biomass and improve its QC procedures to minimize inconsistencies.	112	Following the recommendation of the ERT the reported values were recalculated.	
	Forest management – CO_2	Include “found forest” in its reporting	113		
National registry		Address the recommendations contained in the SIAR	114,125	Updated information is provided in Chapter 12 and 14.	
National system		Report any change(s) in its national system in accordance with decision 15/CMP.1, annex, chapter I.F	122	See NIR.	Ch. 13.
Article 3, paragraph 14		Report any change(s) in its information provided under Article 3, paragraph 14, in accordance with decision 15/CMP.1, annex, chapter I.H	126	Basically the same information is submitted.	

Annex 9 List of abbreviations and units

Abbreviations

AED	anode effect duration in minutes
AEF	number of anode effects per cellday
BOF	basic oxygen furnace
CAO	Central Agricultural Office
CE	current efficiency
CLC	CORINE Land Cover inventory
CLC-changes	CORINE Land Cover-changes databases
CLRTAP	Convention on Long-range Transboundary Air Pollution
CORINAIR	CORe INventory of AIR emissions
CKD	cement kiln dust
CRF	common reporting format
EAF	electric arc furnace
EF	emission factor
ERT	expert review team
EU	European Union
ETS	Emission Trading Scheme
FÖMI	Institute of Geodesy, Cartography and Remote Sensing (Földmérési és Távérzékelési Intézet)
GDP	gross domestic product
HCSO	Hungarian Central Statistical Office
HKVSZ	Association of Cooling and Air Conditioning Businesses (Hűtő- és Klímatechnikai Vállalkozások Szövetsége)
HMBC	Hungarian Monitoring Body for Certification (OMKT)
HLC	Land cover inventory implemented for GHG-inventory purposes
HLC-change	Land cover-change database implemented for GHG-inventory purposes
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
KTI	Institute for Transport Sciences (Közlekedéstudományi Intézet Kht.)
LULUCF	land use, land-use change and forestry
LPG	liquified petroleum gas
MVM Rt.	Hungarian Power Companies Ltd.
NCV	net calorific value
NFI	National Forest Inventory
OHF	open hearth furnace
QA	quality assurance
QC	quality control
UNFCCC	United Nations Framework Convention on Climate Change

Chemical formulas

C	carbon
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
HFCs	hydrofluorocarbons
NMVOC	non-methane volatile organic compound
N_2O	nitrous oxide
NO_x	nitrogen oxide
PFCs	perfluorocarbons

SF_6	sulphur hexafluoride
SO_2	sulphur dioxide
$CaCO_3$	calcium carbonate, limestone
$MgCO_3$	magnesium carbonate
CaO	calcium oxide, quicklime
$Ca(OH)_2$	slack lime
NH_3	ammonia
HNO_3	nitric acid
CF_4	tetrafluoromethane
C_2F_6	hexafluoroethane

Units

PJ	petajoule (10^{15} J)
TJ	terajoule (10^{12} J)
Gg	gigagram (10^{9} g)
kt	kilotonnes (1000 t)