ANNEXES TO THE NATIONAL INVENTORY REPORT

2010

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Annex 1 Key Categories

A1.1. Description of methodology used for identifying key sources

This annex describes the key category analysis conducted for the 2010 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 prioritised 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 A1-2* and *Table A1-3*.
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 suggested by the IPCC GPGs (with LULUCF) complemented by some HU specific points is presented. 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 A1-1 below.
In this way the recommendation of the review of last year is fulfilled as the disaggregation level of sources analysed is corresponding in the NIR and in CRF.
The results of TIER1 key category analysis is presented in Table A1-6, using the format suggested in GPG2000 Table 7A1. and Table 7A2.

Only for information purposes (and for being in line with the EU analysis) and to maintain the comparability with recent years, also result of the TIER1 key category analysis on the more disaggregated level of sources (list suggested by the EU) is included in Table A1-7.

Since in 2012 uncertainty values became available for LULUCF sectors too, the list of source categories analysed using TIER2 approach is the same as for TIER1 (presented in Table A1-1). 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.

Reference to the key source tables in the CRF

In CRF Table 7 the results of TIER1 level and trend assessments are included for both including and excluding LULUCF sectors using the disaggregation level suggested by GPG2000 Table 7.1 and GPG2003 as it is described above. The list is presented in the following Table.

Table A1-1. *List of source categories used for TIER1 and TIER2 assessment presented in Table 7 of CRF and in NIR chapter 1.6.*

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 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 Dolomit 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	N_2O	GPG LULUCF 2003
5. A. 1.	Forest Land Remaining Forest Land	CH_4	GPG LULUCF 2003
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
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 A1-2 *TIER1 Level assessment*

CRF code + note	IPCC Categories	Direct Greenhouse Gas	Current Year (2010) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment	Cumulative Total %
1. A. gas	Stationary Combustion - Gas	CO2	22 184,35	22 184,35	0,304	30,44%
1. A. 3. B.	Mobile Combustion - Road Vehicles	CO2	11 212,42	11 212,42	0,154	45,83%
1. A. coal	Stationary Combustion - Coal	CO2	8 841,74	8 841,74	0,121	57,96%
6. A.	CH4 Emissions from Solid Waste Disposal Sites	CH4	140,31	2 946,57	0,040	62,00%
1. A. oil	Stationary Combustion - Oil	CO2	2 939,87	2 939,87	0,040	66,04%
4. D. 1.	Direct N2O Emissions from Agricultural Soils	N2O	9,10	2 821,79	0,039	69,91%
2. C.	CO2 Emissions from Metal Production	CO2	2 242,87	2 242,87	0,031	72,99%
1. B. 2. ch4	Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH4	101,36	2 128,65	0,029	75,91%
5. A. 1. co2	Forest Land Remaining Forest Land	CO2	-1 994,60	1 994,60	0,027	78,65%
4. D. 3.	Indirect N2O Emissions from Nitrogen Used in Agriculture	N2O	5,81	1 801,69	0,025	81,12%
4. A.	CH4 Emissions from Enteric Fermentation in Domestic Livestock	CH4	76,14	1 598,93	0,022	83,31%
5. B. 1.	Cropland Remaining Cropland	CO2	-1 165,26	1 165,26	0,016	84,91%
5. A. 2.	Land converted Forest Land	CO2	-1 123,79	1 123,79	0,015	86,45%
2. G.	Feedstocks and non-energy use	CO2	1 060,66	1 060,66	0,015	87,91%
4. B. ch4	CH4 Emissions from Manure Management	CH4	45,51	955,71	0,013	89,22%
2.	HFCs emissions from Industry	HFCs	----	914,26	0,013	90,48%
4. B. n2o	N2O Emissions from Manure Management	N2O	2,94	910,13	0,012	91,72%
2. A. 1.	CO2 Emissions from Cement Production	CO2	735,35	735,35	0,010	92,73%
2. B. 1.	CO2 Emissions from Ammonia Processes	CO2	470,55	470,55	0,006	93,38%
6. B. ch4	Emissions from Wastewater Handling	CH4	21,77	457,14	0,006	94,01%
1. A. other	Stationary Combustion - Other Fuel	CO2	420,76	420,76	0,006	94,58%
5. C. 1.	Grassland Remaining Grassland	CO2	405,31	405,31	0,006	95,14%

1. A. 3. n2o	Mobile Combustion	N2O	1,18	364,93	0,005	95,64%
2. A. 3.	CO2 Emission from Limestone and Dolomit Use	CO2	309,72	309,72	0,004	96,07%
1. A. ch4	Non-CO2 Emission from Stationary Fuel Combustion	CH4	14,73	309,38	0,004	96,49%
1. A. 3. other	Mobile Combustion - Other	CO2	271,01	271,01	0,004	96,86%
3. n2o	N2O Emission from Solvent and Other Product Use	N2O	0,76	236,31	0,003	97,19%
2.	SF6 Emissions from Industry	SF6	0,01	234,94	0,003	97,51%
1. B. 2. co2	Fugitive Emissions from Oil and Gas Operations	CO2	218,96	218,96	0,003	97,81%
5. B. 2.co2	Land converted Cropland	CO2	217,51	217,51	0,003	98,11%
2. A. 2.	CO2 Emissions from Lime Production	CO2	211,28	211,28	0,003	98,40%
5. E. 2.	Land converted Settlements	CO2	198,97	198,97	0,003	98,67%
6. B. n2o	Emissions from Wastewater Handling	N2O	0,63	195,42	0,003	98,94%
4. D. 2.	Pasture, Range and Paddock Manure	N2O	0,55	170,09	0,002	99,17%
2. A. 7.	CO2 Emission from Other Mineral Products	CO2	156,22	156,22	0,002	99,39%
1. A. n2o	Non-CO2 Emission from Stationary Fuel Combustion	N2O	0,47	144,22	0,002	99,58%
6. C. co2	Non-biogenic CO2 from Waste	CO2	84,31	84,31	0,001	99,70%
2. ch4	CH4 Emission from Industry	CH4	1,89	39,59	0,001	99,75%
5. C. 2.	Land converted Grassland	CO2	38,97	38,97	0,001	99,81%
3. co2	CO2 Emission from Solvent and Other Product Use	CO2	32,57	32,57	0,000	99,85%
5. B. 2.n2o	Land converted Cropland	N2O	0,08	25,32	0,000	99,89%
5. A. 1. ch4	Forest Land Remaining Forest Land	CH4	1,07	22,53	0,000	99,92%
1. A. 3. ch4	Mobile Combustion	CH4	1,03	21,64	0,000	99,95%
1. B. 1. ch4	Fugitive Emissions from Coal Mining and Handling	CH4	0,56	11,69	0,000	99,96%
2. n2o	N2O Emission from Industry	N2O	0,03	10,64	0,000	99,98%
4. C.	CH4 Emission from Rice Cultivation	CH4	0,40	8,40	0,000	99,99%
6. C. n2o	Emissions from Waste Incineration	N2O	0,01	2,62	0,000	99,99%
5. A. 1. n2o	Forest Land Remaining Forest Land	N2O	0,01	2,29	0,000	100,00%
6. C. ch4	Emissions from Waste Incineration	CH4	0,05	1,05	0,000	100,00%
2.	PFCs Emissions from Industry	PFCs	----	0,36	0,000	100,00%
5. B. 1. ch4	Cropland Remaining Cropland	CH4	0,01	0,30	0,000	100,00%
1. B. 2. n2o	Fugitive Emissions from Oil and Gas Operations	N2O	0,00	0,22	0,000	100,00%

5. C. 1. ch4	Grassland Remaining Grassland	CH4	0,01	0,17	0,000	100,00%
5. C. 1. n2o	Grassland Remaining Grassland	N2O	0,00	0,09	0,000	100,00%
5. B. 1. n2o	Cropland Remaining Cropland	N2O	0,00	0,08	0,000	100,00%
2. B. 2.	CO2 Emissions from Nitric Acid Production	CO2	0,00	0,00	0,000	100,00%
5. F. 2.	Land converted Other Land	CO2	0,00	0,00	0,000	100,00%
1. B. 1. co2	Fugitive Emissions from Coal Mining and Handling	CO2	0,00	0,00	0,000	100,00%
4. F. ch4	Field Burning of Agricultural Residues	CH4	0,00	0,00	0,000	100,00%
4. F. n2o	Field Burning of Agricultural Residues	N2O	0,00	0,00	0,000	100,00%

***Table A1-3** TIER1 Trend Assessment*

CRF Code + note	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (abs. Gg CO_2-eq.)	Current Year (2010) Emission (abs. Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total %
1. A. coal	**Stationary Combustion - Coal**	**CO2**	30787,45	8841,74	0,2257	19,555	19,55
1. A. gas	**Stationary Combustion - Gas**	**CO2**	19924,15	22184,35	0,2202	19,078	38,63
1. A. oil	**Stationary Combustion - Oil**	**CO2**	16277,89	2939,87	0,1580	13,683	52,32
1. A. 3. B.	**Mobile Combustion - Road**	**CO2**	6807,45	11212,42	0,1561	13,521	65,84
2. n2o	**N2O Emission from Industry**	**N2O**	4541,51	10,64	0,0621	5,378	71,22
6. A.	**CH4 Emissions from Solid Waste Disposal Sites**	**CH4**	1917,30	2946,57	0,0393	3,401	74,62
1. B. 2. ch4	**Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)**	**CH4**	1613,47	2128,65	0,0252	2,185	76,80
5. A. 2.	**Land converted Forest Land**	**CO2**	5,28	1123,79	0,0249	2,160	78,96
5. B. 1.	**Cropland Remaining Cropland**	**CO2**	357,02	1165,26	0,0210	1,822	80,78
2.	**HFC emissions from Industry**	**HFCs**	0,00	914,26	0,0203	1,762	82,55
2. G.	**Feedstocks and non-energy use**	**CO2**	550,97	1060,66	0,0160	1,390	83,94
4. A.	**CH4 Emissions from Enteric**	**CH4**	3637,94	1598,93	0,0143	1,242	85,18

	Fermentation in Domestic Livestock						
4. D. 3.	**Indirect N2O Emissions from Nitrogen Used in Agriculture**	**N2O**	3900,85	1801,69	0,0134	1,164	86,34
4. D. 1.	**Direct N2O Emissions from Agricultural Soils**	**N2O**	5534,79	2821,79	0,0132	1,140	87,48
1. B. 1. ch4	**Fugitive Emissions from Coal Mining and Handling**	**CH4**	923,01	11,69	0,0124	1,075	88,56
4. B. ch4	**CH4 Emissions from Manure Management**	**CH4**	2427,28	955,71	0,0120	1,043	89,60
2. B. 1.	**CO2 Emissions from Ammonia Processes**	**CO2**	1616,22	470,55	0,0117	1,014	90,61
5. C. 1.	**Grassland Remaining Grassland**	**CO2**	9,38	405,31	0,0089	0,770	91,38
2. C.	**CO2 Emissions from Metal Processes**	**CO2**	4257,20	2242,87	0,0085	0,737	92,12
2. A. 1.	**CO2 Emissions from Cement Production**	**CO2**	1778,28	735,35	0,0080	0,696	92,82
1. A. other	**Stationary Combustion - Other Fuel**	**CO2**	96,89	420,76	0,0080	0,696	93,51
4. B. n2o	**N2O Emissions from Manure Management**	**N2O**	1985,11	910,13	0,0070	0,605	94,12
1. A. 3. n2o	**Mobile Combustion**	**N2O**	95,63	364,93	0,0068	0,590	94,71
5. A. 1. co2	**Forest Land Remaining Forest Land**	**CO2**	2792,79	1994,60	0,0061	0,525	95,23
2. A. 7.	CO2 Emission from Other Mineral Products	CO2	642,13	156,22	0,0053	0,462	95,70
1. A. ch4	Non-CO2 Emissions from Stationary Fuel Combustion	CH4	876,89	309,38	0,0051	0,446	96,14
1. A. 3. other	Mobile Combustion - Other	CO2	813,47	271,01	0,0051	0,445	96,59
5. B. 2.co2	Land converted Cropland	CO2	5,19	217,51	0,0048	0,413	97,00
2.	SF6 Emissions from Industry	SF6	73,05	234,94	0,0042	0,366	97,37
2. A. 2.	CO2 Emissions from Lime Production	CO2	645,03	211,28	0,0042	0,360	97,73
2.	PFCs Emissions from Industry	PFCs	268,49	0,36	0,0037	0,318	98,04
2. A. 3.	CO2 Emission from Limestone and Dolomit Use	CO2	248,68	309,72	0,0035	0,301	98,35
5. E. 2.	Land converted Settlements	CO2	84,14	198,97	0,0033	0,284	98,63

3. n2o	N2O Emission from Solvent and Other Product Use	N2O	154,17	236,31	0,0031	0,272	98,90
6. B. ch4	Emissions from Wastewater Handling	CH4	951,30	457,14	0,0029	0,250	99,15
6. C. co2	Non-biogenic CO2 from Waste	CO2	0,00	84,31	0,0019	0,163	99,31
5. C. 2.	Land converted Grassland	CO2	185,33	38,97	0,0017	0,145	99,46
6. B. n2o	Emissions from Wastewater Handling	N2O	207,70	195,42	0,0015	0,130	99,59
3. co2	CO2 Emission from Solvent and Other Product Use	CO2	130,36	32,57	0,0011	0,092	99,68
4. D. 2.	Pasture, Range and Paddock Manure	N2O	351,01	170,09	0,0010	0,089	99,77
2. ch4	CH4 Emission from Industry	CH4	15,81	39,59	0,0007	0,058	99,83
5. B. 2.n2o	Land converted Cropland	N2O	3,29	25,32	0,0005	0,045	99,87
4. C.	CH4 Emission from Rice Cultivation	CH4	50,54	8,40	0,0005	0,044	99,92
1. B. 2. co2	Fugitive Emissions from Oil and Gas Operations	CO2	330,80	218,96	0,0003	0,029	99,95
1. A. n2o	Non-CO2 Emissions from Stationary Fuel Combustion	N2O	214,23	144,22	0,0003	0,023	99,97
1. A. 3. ch4	Mobile Combustion	CH4	45,19	21,64	0,0001	0,012	99,98
5. A. 1. ch4	Forest Land Remaining Forest Land	CH4	28,79	22,53	0,0001	0,009	99,99
6. C. n2o	N2O Emissions from Waste Incineration	N2O	0,00	2,62	0,0001	0,005	99,99
6. C. ch4	CH4 Emissions from Waste Incineration	CH4	0,00	1,05	0,0000	0,002	100,00
5. A. 1. n2o	Forest Land Remaining Forest Land	N2O	2,92	2,29	0,0000	0,001	100,00
5. B. 1. ch4	Cropland Remaining Cropland	CH4	1,24	0,30	0,0000	0,001	100,00
5. C. 1. ch4	Grassland Remaining Grassland	CH4	0,73	0,17	0,0000	0,001	100,00
5. C. 1. n2o	Grassland Remaining Grassland	N2O	0,39	0,09	0,0000	0,000	100,00
1. B. 2. n2o	Fugitive Emissions from Oil and Gas Operations	N2O	0,60	0,22	0,0000	0,000	100,00
5. B. 1. n2o	Cropland Remaining Cropland	N2O	0,33	0,08	0,0000	0,000	100,00
2. B. 2.	CO2 Emissions from Nitric Acid Production	CO2	0,08	0,00	0,0000	0,000	100,00

5. F. 2.	Land converted Other Land	CO2	0,00	0,00	0,0000	0,000	100,00
1. B. 1. co2	Fugitive Emissions from Coal Mining and Handling	CO2	3,60	0,00	0,0000	0,000	100,00
4. F. ch4	Field Burning of Agricultural Residues	CH4	45,51	0,00	0,0000	0,000	100,00
4. F. n2o	Field Burning of Agricultural Residues	N2O	13,34	0,00	0,0000	0,000	100,00

Table A1-4 *TIER2 Level assessment*

IPCC Categories	Direct Greenhouse Gas	Current Year (2010) Emission (Gg) (Gg CO_2-eq.)	Activity Data Uncer-tainty (Gg CO_2-eq.)	Emission Factor Uncer-tainty	Combined Uncer-tainty	Level Assess-ment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Direct N2O Emissions from Agricultural Soils	**N2O**	**2 821,79**	**0**	**381,30**	**381,30**	**16,73**	**39,81**	**39,81**
Indirect N2O Emissions from Nitrogen Used in Agriculture	**N2O**	**1 801,69**	**0**	**148,50**	**148,50**	**4,16**	**9,90**	**49,70**
Emissions from Wastewater Handling	**N2O**	**195,42**	**10**	**1000,00**	**1000,05**	**3,04**	**7,23**	**56,93**
Cropland remaining Cropland	**CO2**	**-1 165,26**	**0**	**135,19**	**135,19**	**2,45**	**5,83**	**62,76**
Stationary Combustion - Gas	**CO2**	**22 184,35**	**5**	**5,00**	**7,07**	**2,44**	**5,80**	**68,56**
Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	**CH4**	**2 128,65**	**2**	**50,00**	**50,04**	**1,66**	**3,94**	**72,51**
CH4 Emissions from Solid Waste Disposal Sites	**CH4**	**2 946,57**	**10**	**30,00**	**31,62**	**1,45**	**3,45**	**75,95**
N2O Emissions from Manure Management	**N2O**	**910,13**	**0**	**100,31**	**100,31**	**1,42**	**3,38**	**79,33**
Mobile Combustion - Road	**CO2**	**11 212,42**	**5**	**5,00**	**7,07**	**1,23**	**2,93**	**82,26**
Land converted to Forest Land	**CO2**	**-1 123,79**	**20**	**47,90**	**51,76**	**0,90**	**2,15**	**84,42**
Forest Land remaining forest Land	**CO2**	**-1 994,60**	**6**	**25,39**	**26,02**	**0,81**	**1,92**	**86,34**
Stationary Combustion - Coal	**CO2**	**8 841,74**	**2**	**5,00**	**5,39**	**0,74**	**1,76**	**88,10**
Mobile Combustion	**N2O**	**364,93**	**5**	**100,00**	**100,12**	**0,57**	**1,35**	**89,45**
Fugitive Emissions from Oil and Gas Operations	**CO2**	**218,96**	**100**	**80,00**	**128,06**	**0,44**	**1,04**	**90,49**
Land converted to Grassland	CO2	38,97	0	592,62	592,62	0,36	0,85	91,34
CH4 Emissions from Manure Management	CH4	955,71	0	24,00	24,00	0,36	0,85	92,19
CH4 Emissions from Enteric	CH4	1 598,93	0	13,35	13,35	0,33	0,79	92,98

Fermentation in Domestic Livestock								
HFCs Emissions from Industry	HFCs	914,26	10	20,00	22,36	0,32	0,76	93,73
Grassland remaining Grassland	CO2	405,31	0	48,81	48,81	0,31	0,73	94,47
SF6 Emissions from Industry	SF6	234,94	80	20,00	82,46	0,30	0,72	95,18
Pasture, range and paddock manure	N2O	170,09	0	105,45	105,45	0,28	0,66	95,85
Emissions from Wastewater Handling	CH4	457,14	20	30,00	36,06	0,26	0,61	96,46
Stationary Combustion - Oil	CO2	2 939,87	2	5,00	5,39	0,25	0,59	97,04
CO2 Emission from Metal Production	CO2	2 242,87	2	5,00	5,39	0,19	0,45	97,49
Feedstocks and non-energy use of fuels	CO2	1 060,66	5	10,00	11,18	0,18	0,44	97,93
Land converted to Cropland	CO2	217,51	0	51,43	51,43	0,17	0,41	98,34
Land converted to Settlements	CO2	198,97	0	44,83	44,83	0,14	0,33	98,67
Non-CO2 Emission from Stationary Fuel Combustion	N2O	144,22	3	50,00	50,09	0,11	0,27	98,94
CO2 Emission from Other Mineral Products	CO2	156,22	10	30,00	31,62	0,08	0,18	99,12
Stationary Combustion - Other Fuel	CO2	420,76	5	10,00	11,18	0,07	0,17	99,30
Non-CO2 Emission from Stationary Fuel Combustion	CH4	309,38	3	8,00	8,54	0,04	0,10	99,39
CO2 Emission from Cement Production	CO2	735,35	2	2,00	2,83	0,03	0,08	99,47
Mobile Combustion - Other	CO2	271,01	5	5,00	7,07	0,03	0,07	99,54
Cropland	N2O	25,40	0	74,33	74,33	0,03	0,07	99,61
CO2 emissions from Waste Incineration	CO2	84,31	10	20,00	22,36	0,03	0,07	99,68
CH4 Emission from Rice Cultivation	CH4	8,40	5	153,47	198,24	0,03	0,06	99,74
CO2 Emission from Ammonia Processes	CO2	470,55	2	2,00	2,83	0,02	0,05	99,79
CO2 Emission from Lime Production	CO2	211,28	5	2,00	5,39	0,02	0,04	99,83
Mobile Combustion	CH4	21,64	5	50,00	50,25	0,02	0,04	99,87
CH4 Emission from Industry	CH4	39,59	1	20,00	20,02	0,01	0,03	99,90
CO2 Emission from Solvent and Other Product Use	CO2	32,57	10	20,00	22,36	0,01	0,03	99,93

CO2 Emission from Limestone and Dolomit Use	CO2	309,72	2	1,00	2,24	0,01	0,03	99,96
N2O Emission from Solvent and Other Product Use	N2O	236,31	2	1,00	2,24	0,01	0,02	99,98
N2O Emissions from Waste Incineration	N2O	2,62	5	100,00	100,12	0,00	0,01	99,99
Forest Land remaining forest Land	CH4	22,53	0	5,54	5,54	0,00	0,00	99,99
Fugitive Emissions from Coal Mining and Handling	CH4	11,69	3	10,00	10,44	0,00	0,00	99,99
CH4 Emissions from Waste Incineration	CH4	1,05	10	50,00	50,99	0,00	0,00	100,00
N2O Emission from Industry	N2O	10,64	2	1,00	2,24	0,00	0,00	100,00
Cropland remaining Cropland	CH4	0,30	25	70,00	74,33	0,00	0,00	100,00
Fugitive Emissions from Oil and Gas Operations	N2O	0,22	2	100,00	100,02	0,00	0,00	100,00
Grassland remaining Grassland	CH4	0,17	25	70,00	74,33	0,00	0,00	100,00
Grassland remaining Grassland	N2O	0,09	25	70,00	74,33	0,00	0,00	100,00
Forest Land remaining forest Land	N2O	2,29	0	0,84	0,84	0,00	0,00	100,00
PFCs Emissions from Industry	PFCs	0,36	1	2,00	2,24	0,00	0,00	100,00
CO2 Emission from Nitric Acid Production	CO2	0,00	3	40,00	40,11	0,00	0,00	100,00
Fugitive Emissions from Coal Mining and Handling	CO2	IE,NA,NO	3	10,00	10,44	0,00	0,00	100,00
Field Burning of Agricultural Residues	CH4	NO	NO	NO	0,00	0,00	0,00	100,00
Field Burning of Agricultural Residues	N2O	NO	NO	NO	0,00	0,00	0,00	100,00

Table A1-5 *TIER 2 Trend assessment*

IPCC Categories	Direct Green-house Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2010) 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**	**357,02**	**-1 165,26**	**0**	**135,19**	**5,04**	**16,92**	**16,92**
Direct N2O Emissions from Agricultural Soils	**N2O**	**5 534,79**	**2 821,79**	**0**	**381,30**	**3,51**	**11,79**	**28,71**
Emissions from Wastewater Handling	**N2O**	**207,70**	**195,42**	**10**	**1000,00**	**2,09**	**7,03**	**35,74**
Stationary Combustion - Gas	**CO2**	**19 924,15**	**22 184,35**	**5**	**5,00**	**2,08**	**6,99**	**42,73**
Indirect N2O Emissions from Nitrogen Used in Agriculture	**N2O**	**3 900,85**	**1 801,69**	**0**	**148,50**	**1,72**	**5,78**	**48,50**
Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	**CH4**	**1 613,47**	**2 128,65**	**2**	**50,00**	**1,65**	**5,52**	**54,03**
CH4 Emissions from Solid Waste Disposal Sites	**CH4**	**1 917,30**	**2 946,57**	**10**	**30,00**	**1,60**	**5,35**	**59,38**
Land converted to Forest Land	**CO2**	**-5,28**	**-1 123,79**	**20**	**47,90**	**1,58**	**5,30**	**64,68**
Mobile Combustion - Road	**CO2**	**6 807,45**	**11 212,42**	**5**	**5,00**	**1,41**	**4,74**	**69,42**
Stationary Combustion - Coal	**CO2**	**30 787,45**	**8 841,74**	**2**	**5,00**	**1,28**	**4,30**	**73,72**
Land converted to Grassland	**CO2**	**185,33**	**38,97**	**0**	**592,62**	**1,08**	**3,62**	**77,34**
Stationary Combustion - Oil	**CO2**	**16 277,89**	**2 939,87**	**2**	**5,00**	**0,93**	**3,13**	**80,47**
Mobile Combustion	**N2O**	**95,63**	**364,93**	**5**	**100,00**	**0,85**	**2,84**	**83,31**
N2O Emissions from Manure Management	**N2O**	**1 985,11**	**910,13**	**0**	**100,31**	**0,61**	**2,05**	**85,36**
HFCs Emissions from Industry	**HFCs**	**0,00**	**914,26**	**10**	**20,00**	**0,56**	**1,87**	**87,23**
Grassland remaining Grassland	**CO2**	**9,38**	**405,31**	**0**	**48,81**	**0,53**	**1,79**	**89,01**
SF6 Emissions from Industry	**SF6**	**73,05**	**234,94**	**80**	**20,00**	**0,43**	**1,46**	**90,47**
Land converted to Cropland	CO2	5,19	217,51	0	51,43	0,30	1,01	91,48
Forest Land remaining forest Land	CO2	-2 792,79	-1 994,60	6	25,39	0,28	0,95	92,43
CH4 Emissions from Manure	CH4	2 427,28	955,71	0	24,00	0,28	0,94	93,37

Management								
Feedstocks and non-energy use of fuels	CO2	550,97	1 060,66	5	10,00	0,23	0,76	94,14
Land converted to Settlements	CO2	84,14	198,97	0	44,83	0,18	0,62	94,76
CO2 Emission from Other Mineral Products	CO2	642,13	156,22	10	30,00	0,18	0,61	95,36
CH4 Emissions from Enteric Fermentation in Domestic Livestock	CH4	3 637,94	1 598,93	0	13,35	0,17	0,58	95,95
N2O Emission from Industry	N2O	4 541,51	10,64	2	1,00	0,16	0,53	96,48
Fugitive Emissions from Coal Mining and Handling	CH4	923,01	11,69	3	10,00	0,15	0,49	96,97
Stationary Combustion - Other Fuel	CO2	96,89	420,76	5	10,00	0,11	0,37	97,34
CH4 Emission from Rice Cultivation	CH4	50,54	8,40	5	153,47	0,11	0,37	97,71
Fugitive Emissions from Oil and Gas Operations	CO2	330,80	218,96	100	80,00	0,10	0,35	98,06
Pasture, range and paddock manure	N2O	351,01	170,09	0	105,45	0,09	0,29	98,36
Emissions from Wastewater Handling	CH4	951,30	457,14	20	30,00	0,08	0,28	98,64
CO2 emissions from Waste Incineration	CO2	0,00	84,31	10	20,00	0,05	0,17	98,81
Cropland	N2O	3,62	25,40	0	74,33	0,05	0,16	98,97
Non-CO2 Emission from Stationary Fuel Combustion	CH4	876,89	309,38	3	8,00	0,04	0,15	99,12
Mobile Combustion - Other	CO2	814,20	271,01	5	5,00	0,04	0,13	99,25
CO2 Emission from Ammonia Processes	CO2	1 616,22	470,55	2	2,00	0,03	0,12	99,36
Non-CO2 Emission from Stationary Fuel Combustion	N2O	214,23	144,22	3	50,00	0,03	0,10	99,46
CO2 Emission from Metal Production	CO2	4 257,20	2 242,87	2	5,00	0,03	0,09	99,56
CO2 Emission from Solvent and Other Product Use	CO2	130,36	32,57	10	20,00	0,03	0,09	99,64
CO2 Emission from Lime Production	CO2	645,03	211,28	5	2,00	0,02	0,08	99,72
CO2 Emission from Cement Production	CO2	1 778,28	735,35	2	2,00	0,02	0,07	99,79
CH4 Emission from Industry	CH4	15,81	39,59	1	20,00	0,02	0,06	99,85
CO2 Emission from Limestone and Dolomit Use	CO2	248,68	309,72	2	1,00	0,01	0,03	99,88
PFCs Emissions from Industry	PFCs	268,49	0,36	1	2,00	0,01	0,03	99,91
N2O Emission from Solvent and Other Product Use	N2O	154,17	236,31	2	1,00	0,01	0,03	99,94

N2O Emissions from Waste Incineration	N2O	0,00	2,62	5	100,00	0,01	0,02	99,97
Mobile Combustion	CH4	45,19	21,64	5	50,00	0,01	0,02	99,99
CH4 Emissions from Waste Incineration	CH4	0,00	1,05	10	50,00	0,00	0,00	99,99
Forest Land remaining forest Land	CH4	28,79	22,53	0	5,54	0,00	0,00	99,99
Cropland remaining Cropland	CH4	1,24	0,30	25	70,00	0,00	0,00	100,00
Grassland remaining Grassland	CH4	0,73	0,17	25	70,00	0,00	0,00	100,00
Fugitive Emissions from Oil and Gas Operations	N2O	0,60	0,22	2	100,00	0,00	0,00	100,00
Grassland remaining Grassland	N2O	0,39	0,09	25	70,00	0,00	0,00	100,00
CO2 Emission from Nitric Acid Production	CO2	0,08	0,00	3	40,00	0,00	0,00	100,00
Forest Land remaining forest Land	N2O	2,92	2,29	0	0,84	0,00	0,00	100,00
Fugitive Emissions from Coal Mining and Handling	CO2	3,60	IE,NA,NO	3	10,00	0,00	0,00	100,00
Field Burning of Agricultural Residues	CH4	45,51	NO	NO	NO	0,00	0,00	100,00
Field Burning of Agricultural Residues	N2O	13,34	NO	NO	NO	0,00	0,00	100,00

A1.3. Summary assessment

Table A1-6 *Summary of Key category assessment using TIER1 approach*

KEY SOURCE CATEGORY ANALYSIS SUMMARY – GPG2000+GPG2003+HU specific category aggregation					
Quantitative Method Used: ☒ Tier 1 ☐ Tier 2					
A		B	C	D	E
1. A.	Stationary Combustion - Gas	CO_2	Yes	L, T	
1. A.	Stationary Combustion - Oil	CO_2	Yes	L, T	
1. A.	Stationary Combustion - Coal	CO_2	Yes	L, T	
1. A.	Stationary Combustion - Other Fuel	CO_2	Yes	L, T	
1. A.	Stationary Combustion - all subcategories	N_2O	No		
1. A.	Stationary Combustion - all subcategories	CH_4	No		
1. A. 3. B.	Mobile Combustion - Road Vehicles	CO_2	Yes	L, T	
1. A. 3.	Mobile Combustion - Other vehicles	CO_2	No		
1. A. 3.	Mobile Combustion - all subcategories	CH_4	No		
1. A. 3.	Mobile Combustion - all subcategories	N_2O	Yes	T	
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CH_4	Yes	T	
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	CO_2	No		
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	N_2O	No		
1. B. 2.	Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH_4	Yes	L , T	
2.	Industry - all subcategories	CH_4	No		
2.	Industry - all subcategories	N_2O	Yes	T	
2. A. 1.	Cement Production	CO_2	Yes	L, T	
2. A. 2.	Lime Production	CO_2	No		
2. A. 3.	Limestone and Dolomit Use	CO_2	No		
2. A. 7.	Other Mineral Products	CO_2	No		
2. B. 1.	Ammonia Processes	CO_2	Yes	L, T	
2. B. 2.	Nitric Acid Production	CO_2	No		
2. C.	Metal Production	CO_2	Yes	L, T	
2.-3.	All PCF emissions	PFCs	No		
2.-3.	All HCF emissions	HFCs	Yes	L, T	
2.-3.	All SF6 emissions	SF_6	No		
2. G.	Feedstocks and non-energy use	CO2	Yes	L, T	
3.	Solvent and Other Product Use	CO_2	No		
3.	Solvent and Other Product Use	N_2O	No		
4. A.	Enteric Fermentation in Domestic Livestock	CH_4	Yes	L, T	
4. B.	Manure Management	CH_4	Yes	L, T	
4. B.	Manure Management	N_2O	Yes	L, T	
4. C.	Rice Cultivation	CH_4	No		
4. D. 1.	Direct N_2O Emissions from Agricultural Soils	N_2O	Yes	L, T	

4. D. 2.	Pasture, Range and Paddock Manure	N_2O	No		
4. D. 3.	Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O	Yes	L, T	
5. A. 1.	Forest Land Remaining Forest Land	CO_2	Yes	L, T	
5. A. 1.	Forest Land Remaining Forest Land	N_2O	No		
5. A. 1.	Forest Land Remaining Forest Land	CH_4	No		
5. A. 2.	Land converted Forest Land	CO_2	Yes	L,T	
5. B. 1.	Cropland Remaining Cropland	CO_2	Yes	L,T	
5. B. 1.	Cropland Remaining Cropland	CH4	No		
5. B. 1.	Cropland Remaining Cropland	N2O	No		
5. B. 2.	Land converted Cropland	CO_2	No		
5. B. 2.	Land converted Cropland	N_2O	No		
5. C. 1.	Grassland Remaining Grassland	CO_2	Yes	L, T	
5. C. 1.	Grassland Remaining Grassland	CH4	No		
5. C. 1.	Grassland Remaining Grassland	N2O	No		
5. C. 2.	Land converted Grassland	CO_2	No		
5. E. 2.	Land converted Settlements	CO_2	No		
5. F. 2.	Land converted Other Land	CO_2	No		
6. A.	Solid Waste Disposal Sites	CH_4	Yes	L, T	
6. B.	Wastewater Handling	N_2O	No		
6. B.	Wastewater Handling	CH_4	Yes	L	
6. C.	Waste Incineration	CO_2	No		
6. C.	Waste Incineration	CH_4	No		
6. C.	Waste Incineration	N_2O	No		

Notation key:
A= IPCC Source Categories
B = Direct Greenhouse Gas
C= Key Source Category Flag (Yes or No)
D= If C Yes. Criteria for Identification
E= Comments

Table A1-7. *Summary of TIER1 key category assessment on a disaggregated list of source categories (for information only)*

KEY SOURCE CATEGORY ANALYSIS SUMMARY – DETAILED SECTOR LIST WITH LULUCF				
Quantitative Method Used: ☒ **Tier 1** ☐ **Tier 2**				
A	**B**	**C**	**D**	**E**
1. Energy				
Stationary Combustion - Public electricity and heat production	CO_2	Yes	L. T	ga. li. so. ot
Stationary Combustion - Public electricity and heat production	CH_4	No		
Stationary Combustion - Public electricity and heat production	N_2O	No		
Stationary Combustion - Petroleum refining	CO_2	Yes	L. T	L: li. ga; T: li
Stationary Combustion - Petroleum refining	CH_4	No		
Stationary Combustion - Petroleum refining	N_2O	No		

KEY SOURCE CATEGORY ANALYSIS SUMMARY – DETAILED SECTOR LIST WITH LULUCF

Quantitative Method Used: ☒ **Tier 1** ☐ **Tier 2**

A	B	C	D	E
Stationary Combustion - Manuf. of solid fuels and other energy industries	CO_2	No		
Stationary Combustion - Manuf. of solid fuels and other energy industries	CH_4	No		
Stationary Combustion - Manuf. of solid fuels and other energy industries	N_2O	No		
Stationary Combustion - Iron and steel	CO_2	Yes	L. T	L: so; T: so. ga . li
Stationary Combustion - Iron and steel	CH_4	No		
Stationary Combustion - Iron and steel	N_2O	No		
Stationary Combustion - Non-ferrous metals	CO_2	No		
Stationary Combustion - Non-ferrous metals	CH_4	No		
Stationary Combustion - Non-ferrous metals	N_2O	No		
Stationary Combustion - Chemicals	CO_2	Yes	L. T	L: ga ; T: li
Stationary Combustion - Chemicals	CH_4	No		
Stationary Combustion - Chemicals	N_2O	No		
Stationary Combustion - Pulp, paper and print	CO_2	No		
Stationary Combustion - Pulp, paper and print	CH_4	No		
Stationary Combustion - Pulp, paper and print	N_2O	No		
Stationary Combustion - Food processing, beverages and tobacco	CO_2	Yes	L. T	L: ga; T: li. so
Stationary Combustion - Food processing, beverages and tobacco	CH_4	No		
Stationary Combustion - Food processing, beverages and tobacco	N_2O	No		
Stationary Combustion - Other	CO_2	Yes	L. T	L: li, ga; T: so, ga. li
Stationary Combustion - Other	CH_4	No		
Stationary Combustion - Other	N_2O	No		
Mobile combustion - Civil aviation	CO_2	No		IE.NO
Mobile combustion - Civil aviation	CH_4	No		IE.NO
Mobile combustion - Civil aviation	N_2O	No		IE.NO
Mobile combustion - Road transportation	CO_2	Yes	L. T	L. T: ld. lg
Mobile combustion - Road transportation	CH_4	No		
Mobile combustion - Road transportation	N_2O	Yes	L. T	lg
Mobile combustion - Railways	CO_2	Yes	L	li
Mobile combustion - Railways	CH_4	No		
Mobile combustion - Railways	N_2O	No		
Mobile combustion - Navigation	CO_2	No		
Mobile combustion - Navigation	CH_4	No		
Mobile combustion - Navigation	N_2O	No		
Stationary Combustion - Commercial/institutional	CO_2	Yes	L. T	L: ga; T: ga. li. so
Stationary Combustion - Commercial/institutional	CH_4	No		
Stationary Combustion - Commercial/institutional	N_2O	No		
Stationary Combustion - Residential	CO_2	Yes	L, T	ga. li. so
Stationary Combustion - Residential	CH_4	No	T	so
Stationary Combustion - Residential	N_2O	No		

KEY SOURCE CATEGORY ANALYSIS SUMMARY – DETAILED SECTOR LIST WITH LULUCF				
Quantitative Method Used: ☒ **Tier 1** ☐ **Tier 2**				
A	**B**	**C**	**D**	**E**
Stationary Combustion - Agriculture/Forestry/Fisheries	CO_2	Yes	L. T	L: li. ga; T: li. so
Stationary Combustion - Agriculture/Forestry/Fisheries	CH_4	No		
Stationary Combustion - Agriculture/Forestry/Fisheries	N_2O	No		
Fugitive Emissions from Fuels - Solid Fuels	CO_2	No		IE.NA.NO
Fugitive Emissions from Fuels - Solid Fuels	CH_4	Yes	T	coal mining
Fugitive Emissions from Fuels - Solid Fuels	N_2O	No		NA. NO
Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2	No		
Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	Yes	L. T	natural gas
Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O	No		
2. Industrial Processes				
Mineral Products - Cement production	CO_2	Yes	L. T	
Mineral Products - Lime production	CO_2	Yes	L.T	
Mineral Products - Limestone and dolomite use	CO_2	Yes	L	
Mineral Products - Asphalt roofing	CO_2	No		NA
Mineral Products - Road paving with asphalt	CO_2	No		NA
Mineral Products - Other	CO_2	Yes	T	Bricks and ceramics
Mineral Products - Other	CH_4	No		IE. NA
Mineral Products - Other	N_2O	No		IE. NA
Chemical Industry - Ammonia production	CO_2	Yes	L. T	
Chemical Industry - Ammonia production	CH_4	No		NO
Chemical Industry - Ammonia production	N_2O	No		NO
Chemical Industry - Nitric acid production	CO_2	No		
Chemical Industry - Nitric acid production	N_2O	Yes	T	
Chemical Industry - Other	CO_2	No		
Chemical Industry - Other	CH_4	No		
Chemical Industry - Other	N_2O	No		NO
Metal Production - Iron and steel production	CO_2	Yes	L, T	
Metal Production - Iron and steel production	CH_4	No		IE. NA
Metal Production - Ferroalloys production	CO_2	No		NO
Metal Production - Ferroalloys production	CH_4	No		NO
Metal Production - Aluminium production	CO_2	No		NO
Metal Production - Aluminium production	CH_4	No		NO
Metal Production - Aluminium production	PFCs	No		NO
Other Production	CO_2	No		
Production of Halocarbons and SF_6	HFCs	No		NA. NO
Production of Halocarbons and SF_6	PFCs	No		NA
Production of Halocarbons and SF_6	SF_6	No		NA. NO
Consumption of Halocarbons and SF_6 - Refrigeration and air conditioning equipment	HFCs	Yes	L, T	
Consumption of Halocarbons and SF_6 - Refrigeration and air conditioning equipment	PFCs	No		

KEY SOURCE CATEGORY ANALYSIS SUMMARY – DETAILED SECTOR LIST WITH LULUCF				
Quantitative Method Used: [X] **Tier 1** [ ] **Tier 2**				
A	**B**	**C**	**D**	**E**
Consumption of Halocarbons and SF_6 - Refrigeration and air conditioning equipment	SF_6	No		NO
Consumption of Halocarbons and SF_6 - Foam blowing	HFCs	No		
Consumption of Halocarbons and SF_6 - Foam blowing	PFCs	No		NO
Consumption of Halocarbons and SF_6 - Foam blowing	SF_6	No		NO
Consumption of Halocarbons and SF_6 - Aerosols	HFCs	No		
Consumption of Halocarbons and SF_6 - Aerosols	PFCs	No		NO
Consumption of Halocarbons and SF6 - Aerosols	SF_6	No		NO
Consumption of Halocarbons and SF6 - Electrical equipment	HFCs	No		NO
Consumption of Halocarbons and SF6 - Electrical equipment	PFCs	No		NO
Consumption of Halocarbons and SF6 - Electrical equipment	SF_6	Yes	L,T	
Consumption of Halocarbons and SF_6 - Other	HFCs	No		NA
Consumption of Halocarbons and SF_6 - Other	PFCs	No		NA
Consumption of Halocarbons and SF_6 - Other	SF_6	No		
Feedstocks and non-energy use of fuels	CO_2	Yes	L. T	feedstocks
3. Solvent and Other Product Use				
Solvent and Other Product Use	CO_2	No		
Solvent and Other Product Use	N_2O	Yes	L	other
4. Agriculture				
Enteric Fermentation	CH_4	Yes	L. T	L: ca,sh T: ca
Manure Management	CH_4	Yes	L. T	sw
Manure Management	N_2O	Yes	L. T	so
Rice Cultivation	CH_4	No		
Agricultural Soils - Direct soil emissions	CH_4	No		NO
Agricultural Soils - Direct soil emissions	N_2O	Yes	L. T	
Agricultural Soils - Pasture, range and paddock manure	N_2O	No		
Agricultural Soils - Indirect emissions	CH_4	No		NO
Agricultural Soils - Indirect emissions	N_2O	Yes	L. T	
Field Burning of Agricultural Residues	CH_4	No		NA. NO
Field Burning of Agricultural Residues	N_2O	No		NA. NO
5. Land Use. Land-Use Change and Forestry				
Forest Land remaining Forest Land	CO_2	Yes	L. T	
Forest Land remaining Forest Land	CH_4	No		
Forest Land remaining Forest Land	N_2O	No		
Land converted to Forest Land	CO_2	No	L. T	
Land converted to Forest Land	CH_4	No		
Land converted to Forest Land	N_2O	No		
Cropland remaining Cropland	CO_2	Yes	L. T	
Cropland remaining Cropland	CH_4	No		
Cropland remaining Cropland	N_2O	No		
Land converted to Cropland	CO_2	Yes	L. T	
Land converted to Cropland	CH_4	No		IE. NO
Land converted to Cropland	N_2O	No		

KEY SOURCE CATEGORY ANALYSIS SUMMARY – DETAILED SECTOR LIST WITH LULUCF				
Quantitative Method Used: ☒ **Tier 1** ☐ **Tier 2**				
A	**B**	**C**	**D**	**E**
Grassland remaining Grassland	CO_2	Yes	L. T	
Grassland remaining Grassland	CH_4	No		
Grassland remaining Grassland	N_2O	No		
Land converted to Grassland	CO_2	No		
Land converted to Grassland	CH_4	No		IE. NO
Land converted to Grassland	N_2O	No		IE. NO
Land converted to Settlements	CO_2	Yes	L	
Land converted to Other Land	CO_2	No		
6. Waste				
Solid Waste Disposal on Land	CO_2	No		NA. NO
Solid Waste Disposal on Land	CH_4	Yes	L. T	
Waste-water Handling	CH_4	Yes	L	
Waste-water Handling	N_2O	No		
Waste Incineration	CO_2	No		
Waste Incineration	CH_4	No		
Waste Incineration	N_2O	No		

Notation key:
A= IPCC Source Categories
B = Direct Greenhouse Gas
C= Key Source Category Flag (Yes or No)
D= If C Yes. Criteria for Identification
E= Comments

A1.4. 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.
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Annex 2 Detailed discussion of methodology and data for estimating CO_2 emissions from fossil fuel combustion

A2.1. Fuel Consumption Data

The GHG emission calculations of fossil fuel combustion are based on the Hungarian energy balance prepared by Energia Központ Kht. The summary table of the energy balance for 2010 can be seen in *Table A2-6***.**

Energia Központ Kht. collects fuel consumption data from users and prepares the energy balance and other statistics. Independent experts check the raw data of the energy balance and they compare them with energy consumption data from other sources (e.g. data from MVM Rt.). After the quality check the Energy Statistics is published.

The energy statistics has a chapter about the energy carries balances by branches. Nowadays, division into branches (**Hiba! A hivatkozási forrás nem található.**) follows mainly the structure of ISIC 3.1. Detailed EU-conform statistics from industrial and energy industrial activities help to compile the *sectoral approach*.

Table A2-1. *Categories in the energy carries balances of the Energy Statistics*

Branches	ISIC 3.1 code	IPCC code as treated in the Hungarian inventory
Manufacture of food, beverage and tobacco products	DA	1.AA.2.E
Man. of textiles and textile products	DB	1.AA.2.F
Man. of leather and leather products	DC	1.AA.2.F
Man. of wood and wood products	DD	1.AA.2.F
Man. of pulp, paper and paper products	DE	1.AA.2.D
Man of coke, refined petroleum products	DF	1.AA.1.B and 1.AA.1.C
Man. of chemicals, chemical products	DG	1.AA.2.C
Man. of rubber and plastic products	DH	1.AA.2.C and 1.AA.2.F
Man. of other non-metallic mineral products	DI	1.AA.2.F
Man. of basic metals and fabricated metal products	DJ	1.AA.2.A
Man. of machinery and equipment n.e.c.	DK	1.AA.2.F
Man. of electrtical and optical equipment	DL	1.AA.2.F
Manufacture of transport equipment	DM	1.AA.2.F
Manufacturing n.e.c.	DN	1.AA.2.F
Total of manufacture industries	*D*	
Mining and Quarrying	C	1.AA.2.F
Electr., Gas, Steam and Hot Water Supply	E40	1.AA.1.A and 1.AA.4.A
Water Management	E41	1.AA.4.A
Total Industry		
Construction	F	1.AA.2.F
Agriculture	A 01	1.AA.4.C
Forestry and Logging	A 02	1.AA.4.C
Agriculture, Forestry and Logging	*A*	
Transport and Storage	I 60–63	1.AA.4.A
Communications	I 64	1.AA.4.A
Transport, Storage and Communication	*I*	
Residential	P	1.AA.4.B
Public Services and Commerce *	G, H, J–O	1.AA.4.A
Total Inland Consumption		

* included Real estate activities, Public administration and Sewage and refuse disposal sections

A2.2. 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 follow 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 2008-2013 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 have already been updated, the amendments are just related to the period beginning from 2013 (the next trading period of the EU ETS).

A2.3. Comparison of energy statistics and EU ETS Data

For the sake of transparency and comparability with EU ETS data the ERT recommended to report 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 (**Hiba! A hivatkozási forrás nem található.**) below.

Table A2-2. Power plants' coal consumption from EU ETS and energy statistics

Consumption of public electricity and heat plants	EU ETS		Energy statistics (IEA)	
	kt	TJ	kt	TJ
Other bituminous coal	270	6,829	279	6,836
Sub.bituminous coal	74	1,421	89	1,434
Lignite / brown coal	8,697	61,928	8,742	62,251
Total Coal	***9,041***	***70,178***	***9,110***	***70,521***

A2.4. Source of the Country Specific Emission Factors

Table A2-3. *Country specific emission factors in the Energy Industries subsector*

Fuel type	Emission factor (CO_2 t/TJ)	Oxidation factor
Other Bituminous Coal	92.8	0.96
Sub-Bituminous Coal	97.6	0.98
Lignite / Brown Coal)	110.9	0.97
Gas/Diesel Oil	82.2	0.99
Other Oil	80.1	1.00
Waste	61.6	1.00

The Act 2005/XV. appoints which installation have 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. These country specific emission factors are listed in **Hiba! A hivatkozási forrás nem található.**.

A2.4.1. Solid fuels

The Hungarian coal terminology differs slightly from that of IPCC. The partitioning is created according to the age of coal; **Hiba! A hivatkozási forrás nem található.**. shows the classification according to the Hungarian and IPCC (2006) categories. *(Sources: Bihari, 1998; IPCC, 2006)*

Table A2-4. 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 factor 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.

Measured carbon contents and oxidation factors of coals in 2010 are listed in **Hiba! A hivatkozási forrás nem található.**. NCVs of coals in the energy statistics were different than the measured values from EU ETS (see **Hiba! A hivatkozási forrás nem található.**), therefore emission factors were corrected to achieve consistency in the energy balance and verified emissions, too. Measured oxidation factors was also applied in the calculation to have consistent datasets.

Table A2-5. Measured carbon contents and oxidation factors from EU ETS for solid fuels in 2010 and derived gas

Fuel type	Measured carbon content (C t/TJ)	Oxidation factor
Hard Coal (17-33 MJ/kg)	25.3	0.963
Brown coal (10-17 MJ/kg)	26.6	0.985
Lignite (3.5-10 MJ/kg)	30.2	0.9737
Coke oven gas	12.58*	default

*(*valid for 2009)*

A2.4.2. 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 determinated 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 (in **Hiba! A hivatkozási forrás nem található.**) is a mixture of IPCC default and real measured values.

A2.5. Reference approach

Energy Centre publishes Energy Statistics Yearbooks, which contain the used activity data (production, imports, exports, stock change, non-energy use) for each fuel type in summary tables (see *Table A2-6*), individual tables for time-series of each fuel type from 1985 until the previous year of publishing date (whole time-series can be seen only in the electronic format). Conversion factor was taken as 1.0 in all categories, because Energy Statistics Yearbook represents fuels in energy units (TJ), as well. Default emission factors were used in most cases. There are only two exceptions, namely, the category of lignite and other bituminous coal (see explanation above in *section A2.3*). Fraction of carbon stored is the default IPCC value for bitumen and coal oils and tars. It was decided to remove all carbon content of feedstocks and non-energy use for all other fuels. Also coke used accounted for in iron and steel industry was removed from the reference approach. With this method the *reference* and *sectoral approach* are comparable (see in chapter 3.2.1 of the NIR). Fraction of carbon oxidized is in accordance with Revised Guidelines (IPCC, 1997).

A2.6. 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.
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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.
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2010

Table 19/b table 2 Unit: TJ — 19/b táblázat 2. táblázat M.e.: TJ

		TOTAL SOURCE AND DISTRIBUTION	Domestic Consumption	direct	of which: non-energy use	for transformation	Exports	For Stock Increasing	Statistical Differences	Transformation Losses
		FORRÁS ÉS ELOSZTÁS ÖSSZESEN	Belföldi felhasználás	közvetlen	e b b ő l : anyagjellegű és nem energetikai	átalakításra	Kivitelre	Készlet-növelésre	Átszámítási veszteség	Átalakítási veszteség
PRIMARY ENERGY	ALAPENERGIAHORDOZÓK	1,095,412	892,098	344,423	15,149	547,675	10,245	11,578		
Coal	Szén	126,498	123,914	7,665		116,249	294	2,290		
Crude OIL	Kőolaj	270,233	267,012	35		267,007	0	3,191		
Natural Gas	Földgáz	424,853	410,055	287,381	15,149	123,574	7,801	6,007		
NGL	Dúsítászati PB	7,097	Elosztás a PB kőolajfeldolgozásból c. sorban							
Hydro Power	Vízerőművi villamos energia	677	Elosztás a villamosenergia c. sorba							
Nuclear Power	Atomerőművi villamos energia	171,795	Elosztás a villamosenergia c. sorba							
Prod.of Wind Power Plant	Szélerőművi termelés	1,922	Elosztás a villamosenergia c. sorba							
Firewood	Tűzifa	31,450	29,300	16,763		12,537	2,150			
Other Primary Energy	Egyéb alapenergiahordozók	8,126	8,126	0		8,126				
Estimated Renewabes Energy	Becsült megújuló energia *	48,303	48,303	32,580		15,723				
Municipal Solid Waste	Komm. Hulladék és egyéb biomassza	4,458	4,458	0		4,458				
SECONDARY ENERGY	ÁTALAKÍTOTT ENERGIAHORDOZÓK	599,252	530,349	512,895	65,728	26,453	124,329	1,992		
Bricuette	Brikett	357	354	354		0	3	0		
Anhydrated Lignite	Anhydrált lignit	0	0	0						
Coke	Koksz	31,600	22,607	22,452		155	8,993	0		
Other Product from Coal Proc.	Egyéb szénfeldolgozási termék	2,424	2,424	2,424	2,424					
LPG	PB kőolajfeldolgozásból	15,910	18,577	18,577	7,426		4,383	47		
Gasoline	Benzin	114,198	96,432	96,432	38,770		17,766	0		
Petroleum	Petróleum	10,030	9,610	9,610	0		420	0		
Gas / Diesel Oil	Gázolaj és tüzelőolaj	184,674	130,368	123,807	7,453	6,561	53,970	336		
Heavy Fuel Oil	Fűtőolaj	14,191	13,136	10,182		3,004	1,005	0		
Bitumen	Bitumen	23,902	8,106	8,105	8,106	0	15,796	0		
Other Refinery Product	Egyéb kőolajepárlási termék	28,981	10,149	2,127	1,549	8,022	17,223	1,609		
Coke Oven Gas	Kamragáz	8,298	8,298	6,989		1,309				
Blast Furnace Gas	Kohógáz	8,360	8,360	3,122		5,238				
Purchased Heat	Vásárolt Hőenergia*	53,050	53,050	53,050						
Electricity	Villamos energia	75,215	153,238	151,074		2,164				
Import-Export Electricity Saldo	Villamos energia import-export egyenleg	18,702	Elosztás a villamosenergia c. sorba							
Petroleum Coke	Kőolajkoksz	9,360	4,590	4,590		0	4,770	0		
TOTAL ENERGY	ENERGIAHORDOZÓK ÖSSZESEN	1,694,664	1,431,446	857,319	80,877	574,127	134,574	13,570	115,073	122,710

Table A2-6 Hungarian energy balance for 2010

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 used method for emission estimation of road transport consist 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 dafault 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.

A3.2. Industry

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 A3-1* 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 A3-1. *Specific emission factors for aluminium production*

A3.3. Solvent and Other Product Use

Carbon and NMVOC ratio of solvents

The Revised Guidelines (IPCC, 1997) provide little help for calculation of specific emission factor for solvents. Compositions and solvent contents were previously coordinated with the Paint Industry. Due to these discussions, paints, lacquers, kits etc. were classified into several groups according to the mean solvent content and NMVOC emissions were taken to be equal to the amount of solvent.

On the basis of solvent composition, the mean carbon content of each category was determined using the method described in the following exemplary calculation.

“Usual” solvent composition of solvent based paints: 48 % white spirit, 40% xylene, 12 % esters. In accordance with the empirical formula of chemical substance, the carbon content can be calculated. E.g., the empirical formula of xylene is C_8H_{10}. From this, the carbon content is 90.5 % w/w. Similarly, carbon contents were obtained by calculating the other components and their carbon contents, and weighting it according to the solvent composition. These are shown in the second column of *Table A3-2*.

	Carbon content (%)	Solvent content (%)
Solvent based paints	81.4	50
Water based paints	57.0	6-8
Other paints, lacquers etc.	80.0	25
Glues etc.	57.0	8
Solvents	81.6	100

Table A3-2. *Solvent and carbon contents of paints, lacquers, glues etc.*

By this, the amount of carbon (C) from NMVOC (for each type of paint) and, upon multiplying it by 44/12, the amount of CO_2 may be calculated. In *Table A3-3* the mean carbon and NMVOC ratios are shown for the last 10 years. The decreasing numbers indicate the increasing proportion of water based paints. However, the proportion of water based paints has continued to increase in 2005, this C/NMVOC ratio has increased due to decreasing amount of the group of glues and thinners, which has changed the previous ratio of solvents' composition.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
C/NMVOC	0.7690	0.7607	0.7540	0.7426	0.7650	0.7682	0.7705	0.7607	0.7567	0,7411

Table A3-3. *Mean carbon and NMVOC ratio of solvents for the last 10 years*

A3.4. 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 summarises the coverage of the IPCC land-use categories relating to Hungary, along with data sources.

Table A3-4 *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 (medows 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.-5.

Table A3-5 *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 A3-5). 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 A3-6.

***Table A3-6** Annual land-use changes 1985-2010 (ha)*

ha	Forest Land	Cropland	SA-CL	Grassland	SA-GL	Wetlands	Settlements	Other Land
Forest Land		95	0	21	0	0	210	0
Cropland	2 778		0	5 338	0	0	838	0
SA-CL	8 388	7 640		0	0	0	0	0
Grassland	1 864	4 910	0		16 811	0	391	0
SA-GL	1 515	0	0	0		298	0	0
Wetlands	16	0	0	0	0		14	0
Settlements	118	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1985	1 755 640	5 293 300	186 619	1 246 400	39 997	252 067	526 798	2 444
Forest Land		95	0	21	0	0	210	0
Cropland	2 453		0	5 338	0	0	838	0
SA-CL	5 548	215		0	0	0	0	0
Grassland	1 864	4 910	0		11 011	0	391	0
SA-GL	558	0	0	0		298	0	0
Wetlands	11	0	0	0	0		14	0
Settlements	84	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1986	1 765 833	5 289 900	180 856	1 233 700	50 152	252 363	528 018	2 444
Forest Land		95	0	21	0	0	210	0
Cropland	2 778		4 753	0	0	0	838	0
SA-CL	5 730	0		0	0	0	0	0
Grassland	1 864	7 366	0		1 918	0	391	0
SA-GL	711	0	0	0		298	0	0
Wetlands	12	0	0	0	0		14	0
Settlements	90	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1987	1 776 691	5 289 000	179 879	1 222 300	51 061	252 658	529 232	2 444
Forest Land		95	0	21	0	0	210	0
Cropland	2 778		5 453	0	0	0	838	0
SA-CL	5 774	0		0	0	0	0	0
Grassland	1 864	7 366	0		2 918	0	391	0
SA-GL	724	0	0	0		298	0	0
Wetlands	12	0	0	0	0		14	0
Settlements	90	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1988	1 787 607	5 287 400	179 558	1 209 900	52 957	252 954	530 446	2 444
Forest Land		95	0	21	0	0	210	0
Cropland	2 778		4 653	0	0	0	838	0
SA-CL	7 989	0		0	0	0	0	0
Grassland	1 864	7 366	0		3 118	0	391	0
SA-GL	1 395	0	0	0		298	0	0
Wetlands	15	0	0	0	0		14	0
Settlements	114	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1989	1 801 435	5 286 600	176 223	1 197 300	54 382	253 246	531 636	2 444

***Table A3-6** (continued) Annual land-use changes 1985-2010 (ha)*

1989	1 801 435	5 286 600	176 223	1 197 300	54 382	253 246	531 636	2 444
Forest Land		180	0	40	0	0	393	0
Cropland	2 778		2 938	0	0	0	838	0
SA-CL	7 172	0		0	0	0	0	0
Grassland	1 864	7 366	0		2 237	0	391	0
SA-GL	1 147	0	0	0		298	0	0
Wetlands	14	0	0	0	0		14	0
Settlements	105	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1990	1 813 902	5 287 600	171 989	1 185 600	55 174	253 539	533 017	2 444
Forest Land		60	0	13	0	0	167	0
Cropland	2 778		29 627	16 013	0	0	838	0
SA-CL	6 154	0		0	0	0	0	0
Grassland	1 864	0	0		27 329	0	391	0
SA-GL	839	0	0	0		298	0	0
Wetlands	12	0	0	0	0		14	0
Settlements	94	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1991	1 825 404	5 238 413	195 462	1 172 160	81 366	253 834	534 184	2 444
Forest Land		44	0	9	0	0	72	0
Cropland	2 778		29 611	16 013	0	0	838	0
SA-CL	7 158	0		0	0	0	0	0
Grassland	1 864	0	0		27 325	0	391	0
SA-GL	1 143	0	0	0		298	0	0
Wetlands	14	0	0	0	0		14	0
Settlements	105	9	0	117	0	23		0
Other Land	0	0	0	0	0	0	0	
1992	1 838 339	5 189 225	217 916	1 158 720	107 250	254 127	535 244	2 444
Forest Land		13	0	83	0	0	233	0
Cropland	3 349		46 503	6 707	0	0	938	0
SA-CL	3 356	0		0	0	0	0	0
Grassland	1 291	8 269	0		10 550	0	297	0
SA-GL	70	0	0	0		597	0	1
Wetlands	18	0	0	0	0		8	0
Settlements	244	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1993	1 846 338	5 140 038	261 063	1 145 280	117 132	254 714	536 255	2 445
Forest Land		28	0	27	0	0	163	0
Cropland	3 349		46 519	6 707	0	0	938	0
SA-CL	1 498	0		0	0	0	0	0
Grassland	984	8 269	0		10 802	0	297	0
SA-GL	0	0	0	0		597	0	1
Wetlands	13	0	0	0	0		8	0
Settlements	176	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1994	1 852 141	5 090 851	306 083	1 131 840	127 336	255 305	537 263	2 446

***Table A3-6** (continued) Annual land-use changes 1994-2010 (ha)*

1994	1 852 141	5 090 851	306 083	1 131 840	127 336	255 305	537 263	2 446
Forest Land		53	0	61	0	0	244	0
Cropland	3 349		46 543	6 707	0	0	938	0
SA-CL	4 410	0		0	0	0	0	0
Grassland	1 291	8 269	0		10 528	0	297	0
SA-GL	284	0	0	0		597	0	1
Wetlands	21	0	0	0	0		8	0
Settlements	282	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1995	1 861 421	5 041 664	348 216	1 118 400	136 983	255 889	538 247	2 447
Forest Land		79	0	79	0	0	188	0
Cropland	3 349		46 569	6 707	0	0	938	0
SA-CL	5 242	0		0	0	0	0	0
Grassland	1 291	8 269	0		10 546	0	297	0
SA-GL	453	0	0	0		597	0	1
Wetlands	23	0	0	0	0		8	0
Settlements	312	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1996	1 871 746	4 992 476	389 543	1 104 960	146 478	256 471	539 144	2 447
Forest Land		192	0	90	0	0	240	0
Cropland	3 349		46 682	6 707	0	0	938	0
SA-CL	6 590	0		0	0	0	0	0
Grassland	1 291	8 269	0		10 558	0	297	0
SA-GL	727	0	0	0		597	0	1
Wetlands	27	0	0	0	0		8	0
Settlements	361	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1997	1 883 569	4 943 289	429 635	1 091 520	155 712	257 049	540 044	2 448
Forest Land		89	0	42	0	0	271	0
Cropland	3 349		46 579	6 707	0	0	938	0
SA-CL	5 342	0		0	0	0	0	0
Grassland	1 291	8 269	0		10 509	0	297	0
SA-GL	473	0	0	0		597	0	1
Wetlands	23	0	0	0	0		8	0
Settlements	316	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1998	1 893 962	4 894 102	470 872	1 078 080	165 150	257 630	541 021	2 449
Forest Land		27	0	91	0	0	278	0
Cropland	3 349		46 517	6 707	0	0	938	0
SA-CL	7 879	0		0	0	0	0	0
Grassland	1 291	8 269	0		10 558	0	297	0
SA-GL	988	0	0	0		597	0	1
Wetlands	30	0	0	0	0		8	0
Settlements	408	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
1999	1 907 512	4 844 915	509 511	1 064 640	174 122	258 204	541 912	2 450

***Table A3-6** (continued) Annual land-use changes 1999-2010 (ha)*

1999	1 907 512	4 844 915	509 511	1 064 640	174 122	258 204	541 912	2 450
Forest Land		68	0	56	0	0	595	0
Cropland	3 349		46 558	6 707	0	0	938	0
SA-CL	8 226	0		0	0	0	0	0
Grassland	1 598	8 269	0		10 217	0	297	0
SA-GL	752	0	0	0		597	0	1
Wetlands	31	0	0	0	0		8	0
Settlements	421	28	0	178	0	16		0
Other Land	0	0	0	0	0	0	0	
2000	1 921 170	4 795 727	547 843	1 051 200	182 989	258 778	543 108	2 451
Forest Land		61	0	101	0	0	359	0
Cropland	7 613		15 329	1 847	0	0	1 965	0
SA-CL	6 017	0		0	0	0	0	0
Grassland	2 479	2 985	0		24 925	0	538	0
SA-GL	0	0	0	0		487	0	0
Wetlands	10	0	0	0	0		35	0
Settlements	177	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2001	1 936 944	4 772 020	557 155	1 022 340	207 428	259 249	545 679	2 451
Forest Land		109	0	89	0	0	439	0
Cropland	8 553		12 054	1 847	0	0	1 965	0
SA-CL	7 233	0		0	0	0	0	0
Grassland	2 871	2 985	0		24 521	0	538	0
SA-GL	0	0	0	0		487	0	0
Wetlands	12	0	0	0	0		35	0
Settlements	205	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2002	1 955 180	4 750 696	561 977	993 480	231 462	259 719	548 302	2 451
Forest Land		26	0	44	0	0	523	0
Cropland	5 194		15 329	1 847	0	0	1 965	0
SA-CL	5 668	0		0	0	0	0	0
Grassland	1 976	2 985	0		25 372	0	538	0
SA-GL	0	0	0	0		487	0	0
Wetlands	8	0	0	0	0		35	0
Settlements	141	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2003	1 967 573	4 729 371	571 639	964 620	256 347	260 192	551 073	2 451
Forest Land		74	0	119	0	0	750	0
Cropland	5 638		14 934	1 847	0	0	1 965	0
SA-CL	6 300	0		0	0	0	0	0
Grassland	2 171	2 985	0		25 251	0	538	0
SA-GL	0	0	0	0		487	0	0
Wetlands	9	0	0	0	0		35	0
Settlements	155	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2004	1 980 902	4 708 047	580 273	935 760	281 111	260 665	554 057	2 451

***Table A3-6** (continued) Annual land-use changes 2004-2010 (ha)*

2004	1 980 902	4 708 047	580 273	935 760	281 111	260 665	554 057	2 451
Forest Land		71	0	27	0	0	313	0
Cropland	1 192		19 377	1 847	0	0	1 965	0
SA-CL	1 141	0		0	0	0	0	0
Grassland	424	2 985	0		26 906	0	538	0
SA-GL	0	0	0	0		487	0	0
Wetlands	2	0	0	0	0		35	0
Settlements	30	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2005	1 983 280	4 686 722	598 510	906 900	307 530	261 145	556 729	2 451
Forest Land		44	0	21	0	0	443	0
Cropland	5 638		14 905	1 847	0	0	1 965	0
SA-CL	7 495	0		0	0	0	0	0
Grassland	2 301	2 985	0		25 024	0	538	0
SA-GL	88	0	0	0		487	0	0
Wetlands	10	0	0	0	0		35	0
Settlements	170	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2006	1 998 472	4 665 398	605 920	878 040	331 978	261 616	559 391	2 451
Forest Land		16	0	37	0	0	192	0
Cropland	5 638		14 877	1 847	0	0	1 965	0
SA-CL	14 396	0		0	0	0	0	0
Grassland	933	2 985	0		26 407	0	538	0
SA-GL	0	0	0	0		487	0	0
Wetlands	0	0	0	0	0		35	0
Settlements	0	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2007	2 019 194	4 644 073	606 401	849 180	357 898	262 098	561 972	2 451
Forest Land		98	0	35	0	0	160	0
Cropland	5 638		14 959	1 847	0	0	1 965	0
SA-CL	5 388	0		0	0	0	0	0
Grassland	643	2 985	0		26 696	0	538	0
SA-GL	0	0	0	0		487	0	0
Wetlands	0	0	0	0	0		35	0
Settlements	260	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2008	2 030 830	4 622 749	615 971	820 320	384 107	262 579	564 260	2 451
Forest Land		56	0	103	0	0	296	0
Cropland	5 638		14 917	1 847	0	0	1 965	0
SA-CL	2 465	0		0	0	0	0	0
Grassland	696	2 985	0		26 711	0	538	0
SA-GL	0	0	0	0		487	0	0
Wetlands	0	0	0	0	0		35	0
Settlements	174	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2009	2 039 347	4 601 424	628 422	791 460	410 330	263 061	566 771	2 451

***Table A3-6** (continued) Annual land-use changes 2009-2010 (ha)*

2009	2 039 347	4 601 424	628 422	791 460	410 330	263 061	566 771	2 451
Forest Land		59	0	47	0	0	102	0
Cropland	5 638		14 920	1 847	0	0	1 965	0
SA-CL	654	0		0	0	0	0	0
Grassland	373	2 985	0		26 977	0	538	0
SA-GL	0	0	0	0		487	0	0
Wetlands	0	0	0	0	0		35	0
Settlements	592	1	0	119	0	30		0
Other Land	0	0	0	0	0	0	0	
2010	2 046 394	4 580 100	642 688	762 600	436 821	263 542	568 670	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 A3-7 *Vineyard activity data for calculation of carbon stock change in living biomass on Cropland 1985-2010*

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

Table A3-8 *Orchard Activity data for calculation of carbon stock change in living biomass on Cropland (ha) (note: * interpolated value) 1985-2010*

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	5,628		5,628
BY	99.7	99.7	65.9	33.8	33.8	3,777		3,777
1986	99.0	99.0	65.0	34.0	34.0	2,998		2,998
1987	96.5	96.5	61.5	35.0	35.0	2,705		2,705
1988	94.9	94.9	59.3	35.6	35.6	2,015		2,015
1989	94.3	94.3	56.2	38.1	38.1	1,208		1,208
1990	95.1	95.1	61.1	34.0	34.0	2,142	1,132	3,274
1991	94.1	95.3	53.1	41.0	38.0	1,955	1,264	3,219
1992	94.5	95.5	52.1	42.4	41.9	973	1,396	2,369
1993	93.0	95.8	43.7	49.3	45.9	596	1,528	2,124
1994	92.7	96.0	37.4	55.3	49.9	469	1,660	2,129
1995	93.9	96.2	26.2	67.7	53.8	680	1,792	2,472
1996	94.3	96.4	27.7	66.6	57.8	526	1,924	2,450
1997	95.6	96.6	20.7	74.9	61.7	198	2,056	2,254
1998	96.3	96.8	19.8	76.6	65.7	538	2,188	2,726
1999	96.4	97.1	22.0	74.4	69.7	523	2,320	2,843
2000	95.4	97.3	21.2	74.2	73.6	350	2,452	2,802
2001	97.5	97.5	19.9	77.6	77.6	518	2,584	3,102
2002	97.4	97.1	21.2	76.2	77.0	803	2,987	3,790
2003	98.3	96.7	23.7	74.7	76.4	492	2,967	3,459
2004	102.6	96.2	24.7	77.9	75.8	181	2,947	3,128
2005	102.8	95.8	27.1	75.7	75.2	778	2,928	3,706
2006	102.8	95.4	26.6	76.2	74.7	966	2,908	3,874
2007	101.9	95.0	26.1	75.8	74.1	244	2,889	3,133
2008	98.5	94.5	23.7	74.7	73.5	318	2,869	3,187
2009	98.7	94.1	23.1	75.6	72.9	543	2,849	3,392
2010	93.7	93.7	21.4	72.3	72.3	476	2,830	3,306

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.

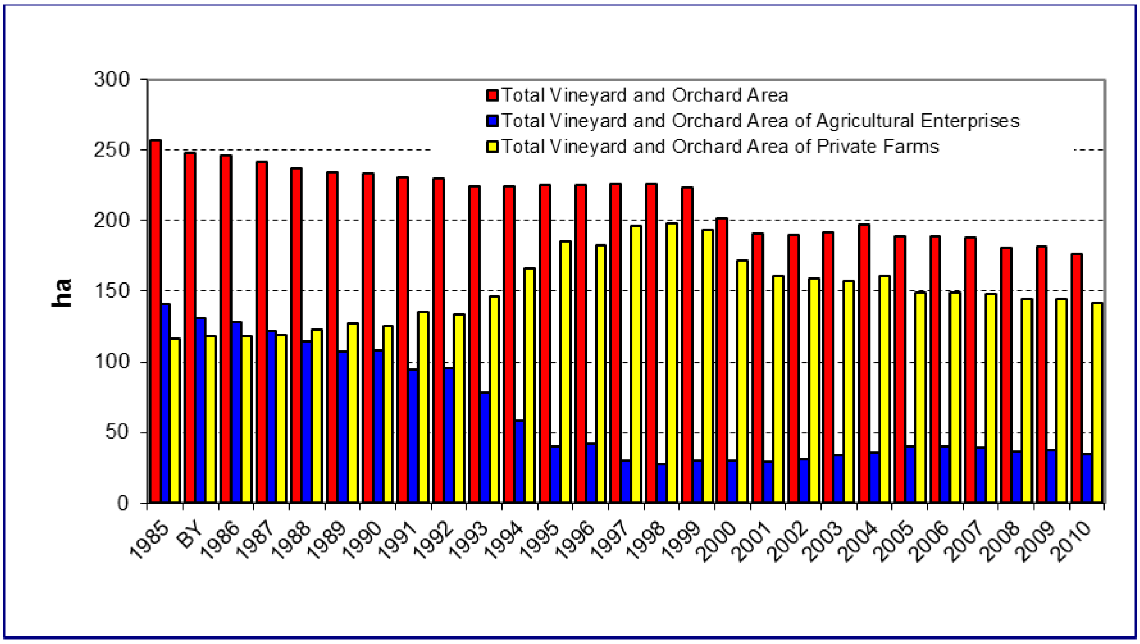

Figure A3-1. *Landowner changes of vineyards and orchards in Hungary 1985-2010*

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 20010, 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 A3-7, A3-8*), 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 A3-7, A3-8*), 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 A3-9 *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	50	0.82	1.00	0.92	968.1	966.8	964.0	961.7	960.3	958.5
				medium	50	0.82	1.00	1.00	704.1	703.1	701.1	699.4	698.4	697.1
				high with no manure	50	0.82	1.00	1.07	88.0	87.9	87.6	87.4	87.3	87.1
			reduced till	medium	50	0.82	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0
			no-till	medium	50	0.82	1.10	1.00	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry		full till	low	38	0.82	1.00	0.92	1431.4	1429.5	1425.3	1422.0	1420.0	1417.2
				medium	38	0.82	1.00	1.00	1041.0	1039.6	1036.6	1034.2	1032.7	1030.7
				high with no manure	38	0.82	1.00	1.07	130.1	130.0	129.6	129.3	129.1	128.8
			reduced till	medium	38	0.82	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0
			no-till	medium	38	0.82	1.10	1.00	0.0	0.0	0.0	0.0	0.0	0.0
	cold dry	LAC	full till	low	33	0.82	1.00	0.92	37.2	37.2	37.0	37.0	36.9	36.8
				medium	33	0.82	1.00	1.00	27.1	27.0	26.9	26.9	26.8	26.8
				high with no manure	33	0.82	1.00	1.07	3.4	3.4	3.4	3.4	3.4	3.3
	warm dry			low	24	0.82	1.00	0.92	29.6	29.6	29.5	29.4	29.4	29.3
				medium	24	0.82	1.00	1.00	21.5	21.5	21.4	21.4	21.4	21.3
				high with no manure	24	0.82	1.00	1.07	2.7	2.7	2.7	2.7	2.7	2.7
	cold dry	sandy		low	34	0.82	1.00	0.92	74.2	74.1	73.9	73.7	73.6	73.5
				medium	34	0.82	1.00	1.00	54.0	53.9	53.7	53.6	53.5	53.4
				high with no manure	34	0.82	1.00	1.07	6.7	6.7	6.7	6.7	6.7	6.7
	warm dry			low	19	0.82	1.00	0.92	89.2	89.1	88.8	88.6	88.5	88.3
				medium	19	0.82	1.00	1.00	64.9	64.8	64.6	64.5	64.4	64.3
				high with no manure	19	0.82	1.00	1.07	8.1	8.1	8.1	8.1	8.0	8.0
	cold dry	aquic		low	87	0.82	1.00	0.92	188.9	188.7	188.1	187.7	187.4	187.0
				medium	87	0.82	1.00	1.00	137.4	137.2	136.8	136.5	136.3	136.0
				high with no manure	87	0.82	1.00	1.07	17.2	17.2	17.1	17.1	17.0	17.0
	warm dry			low	88	0.82	1.00	0.92	288.7	288.3	287.5	286.8	286.4	285.8
				medium	88	0.82	1.00	1.00	210.0	209.7	209.1	208.6	208.3	207.9
				high with no manure	88	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)									38.18	38.18	38.18	38.18	38.18	38.18

Table A3-9 *(continued) Cropland areas by climate zones, soil type and management practices and estimated average carbon stocks*

Land-use	Climate	Soil	Management	Input	SOC_{ref}	F_{LU}	F_{MG}	F_I	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
									Area(ha)									
Cropland	cold dry	HAC	full till	low	50	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	50	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	50	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	50	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	50	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	38	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	38	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	38	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	38	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	38	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	LAC	full till	low	33	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	33	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	33	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	24	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	24	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	24	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	34	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	34	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	34	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	19	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	19	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	19	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	87	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	87	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	87	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	88	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	88	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	88	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)									**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.18**

***Table A3-9** (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	50	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	50	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	50	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	50	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	50	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	38	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	38	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	38	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	38	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	38	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	LAC	full till	low	33	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	33	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	33	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	24	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	24	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	24	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	34	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	34	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	34	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	19	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	19	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	19	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	87	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	87	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	87	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	88	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	88	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	88	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)									**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.18**

Table A3-9 *(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	50	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	50	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	50	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	50	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	50	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	38	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	38	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	38	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	38	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	38	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	LAC	full till	low	33	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	33	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	33	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	24	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	24	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	24	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	34	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	34	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	34	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	19	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	19	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	19	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	87	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	87	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	87	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	88	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	88	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	88	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)									**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.18**	**38.19**	**38.20**	**38.25**

***Table A3-9** (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}	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	Climate	Soil	Management	Input									Area(ha)					
Cropland	cold dry	HAC	full till	low	50	0.82	1.00	0.92	817.7	814.0	810.4	806.7	803.1	799.4	795.8	720.1	669.6	603.3
				medium	50	0.82	1.00	1.00	526.6	505.7	484.9	464.2	443.8	423.5	403.4	455.4	487.2	531.8
				high with no manure	50	0.82	1.00	1.07	74.3	74.0	73.7	73.3	73.0	72.7	72.3	72.0	67.0	65.1
			reduced till	medium	50	0.82	1.03	1.00	65.8	81.9	97.9	113.7	129.3	144.8	160.2	175.4	190.5	205.4
			no-till	medium	50	0.82	1.10	1.00	2.2	4.4	6.6	8.8	10.9	13.1	15.2	17.3	19.3	21.4
	warm dry		full till	low	38	0.82	1.00	0.92	1209.0	1203.6	1198.2	1192.8	1187.4	1182.0	1176.6	1064.7	990.1	892.1
				medium	38	0.82	1.00	1.00	778.7	747.7	716.9	686.4	656.2	626.2	596.4	673.4	720.3	786.3
				high with no manure	38	0.82	1.00	1.07	109.9	109.4	108.9	108.4	107.9	107.5	107.0	106.5	99.0	96.2
			reduced till	medium	38	0.82	1.03	1.00	97.3	121.1	144.7	168.1	191.2	214.1	236.8	259.3	281.6	303.7
			no-till	medium	38	0.82	1.10	1.00	3.3	6.6	9.8	13.0	16.2	19.3	22.5	25.5	28.6	31.6
	cold dry	LAC	full till	low	33	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	33	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	33	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	24	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	24	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	24	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	34	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	34	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	34	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	19	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	19	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	19	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	87	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	87	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	87	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	88	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	88	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	88	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)									**38,26**	**38,27**	**38,29**	**38,30**	**38.31**	**38.33**	**38.34**	**38.46**	**38.59**	**38.70**

Table A3-10 *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	-	50	1.00	1.00	233.6	230.3	230.7	231.1	230.0	229.6
		HAC	improved	medium	50	1.00	1.14	155.7	153.5	153.8	154.1	153.3	153.0
	warm dry	HAC	non-degraded	-	38	1.00	1.00	345.4	340.5	341.1	341.7	340.0	339.4
		HAC	improved	medium	38	1.00	1.14	230.3	227.0	227.4	227.8	226.7	226.3
	cold dry	LAC	non-degraded	-	33	1.00	1.00	21.6	21.3	21.3	21.4	21.3	21.2
		LAC	improved	medium	33	1.00	1.14	9.3	9.1	9.1	9.2	9.1	9.1
	warm dry	LAC	non-degraded	-	24	1.00	1.00	12.3	12.1	12.1	12.1	12.1	12.1
		LAC	improved	medium	24	1.00	1.14	12.3	12.1	12.1	12.1	12.1	12.1
	cold dry	sandy	non-degraded	-	34	1.00	1.00	14.6	14.4	14.4	14.4	14.3	14.3
		sandy	improved	medium	34	1.00	1.14	9.7	9.6	9.6	9.6	9.6	9.5
	warm dry	sandy	non-degraded	-	19	1.00	1.00	20.4	20.1	20.2	20.2	20.1	20.1
		sandy	improved	medium	19	1.00	1.14	8.8	8.6	8.6	8.7	8.6	8.6
	cold dry	aquic	non-degraded	-	87	1.00	1.00	77.3	76.2	76.4	76.5	76.1	76.0
		aquic	improved	medium	87	1.00	1.14	13.6	13.5	13.5	13.5	13.4	13.4
	warm dry	aquic	non-degraded	-	88	1.00	1.00	111.2	109.6	109.9	110.0	109.5	109.3
		aquic	improved	medium	88	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)								51.74	51.74	51.74	51.74	51.74	51.74

Table A3-10 *(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	-	50	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	50	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	-	38	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	38	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	LAC	non-degraded	-	33	1.00	1.00	21.2	21.2	21.2	21.2	21.1	21.3	21.6	21.7	21.5	21.4
		LAC	improved	medium	33	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	LAC	non-degraded	-	24	1.00	1.00	12.0	12.1	12.1	12.0	12.0	12.1	12.3	12.3	12.2	12.2
		LAC	improved	medium	24	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	-	34	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	34	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	-	19	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	19	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	-	87	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	87	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	-	88	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	88	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)								51.74	51.74	51.74	51.74	51.74	51.74	51.74	51.74	51.74	51.74

Table A3-10 *(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	-	50	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	50	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	-	38	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	38	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	LAC	non-degraded	-	33	1.00	1.00	21.3	21.3	21.2	21.0	20.6	19.9	18.8	18.6	18.4	18.2
		LAC	improved	medium	33	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	LAC	non-degraded	-	24	1.00	1.00	12.1	12.1	12.0	11.9	11.7	11.6	11.5	11.4	11.3	12.5
		LAC	improved	medium	24	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	-	34	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	34	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	-	19	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	19	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	-	87	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	87	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	-	88	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	88	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)								51.74	51.74	51.74	51.74	51.74	51.75	51.73	51.74	51.72	51.57

Table A3-10 *(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	-	50	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	50	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	-	38	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	38	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	LAC	non-degraded	-	33	1.00	1.00	18.0	18.1	19.2	21.2	22.2	22.5	23.2	23.5	23.4	23.4
		LAC	improved	medium	33	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	LAC	non-degraded	-	24	1.00	1.00	12.4	12.9	14.2	15.8	17.1	17.3	17.7	18.3	18.4	18.3
		LAC	improved	medium	24	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	-	34	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	34	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	-	19	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	19	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	-	87	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	87	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	-	88	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	88	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)								**51.55**	**51.39**	**51.01**	**50.57**	**50.33**	**50.16**	**49.95**	**49.83**	**49.76**	**49.73**

Table A3-10 *(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	-	50	1.00	1.00	296.1	292.2	285.2	278.0	269.4	260.9	252.3	243.7	235.1	226.6
		HAC	improved	medium	50	1.00	1.14	9.2	4.4	2.9	1.4	1.4	1.3	1.3	1.2	1.2	1.1
	warm dry	HAC	non-degraded	-	38	1.00	1.00	440.1	432.0	423.8	411.1	398.4	385.7	373.0	360.4	347.7	335.0
		HAC	improved	medium	38	1.00	1.14	11.3	6.6	2.1	2.1	2.0	1.9	1.9	1.8	1.7	1.7
	cold dry	LAC	non-degraded	-	33	1.00	1.00	23.0	22.8	22.6	21.9	21.2	20.7	20.0	19.3	18.6	18.0
		LAC	improved	medium	33	1.00	1.14	1.2	0.7	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	warm dry	LAC	non-degraded	-	24	1.00	1.00	18.1	18.0	18.0	17.4	16.9	16.5	15.9	15.4	14.8	14.3
		LAC	improved	medium	24	1.00	1.14	1.2	0.7	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	cold dry	sandy	non-degraded	-	34	1.00	1.00	18.5	18.1	17.6	17.4	16.9	16.3	15.8	15.3	14.7	14.2
		sandy	improved	medium	34	1.00	1.14	0.6	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry	sandy	non-degraded	-	19	1.00	1.00	22.2	21.8	21.2	20.9	20.3	19.7	19.0	18.4	17.7	17.1
		sandy	improved	medium	19	1.00	1.14	0.7	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	cold dry	aquic	non-degraded	-	87	1.00	1.00	70.6	68.6	67.3	65.3	63.3	61.3	59.3	57.2	55.2	53.2
		aquic	improved	medium	87	1.00	1.14	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry	aquic	non-degraded	-	88	1.00	1.00	107.9	104.9	102.9	99.8	96.7	93.6	90.5	87.5	84.4	81.3
		aquic	improved	medium	88	1.00	1.14	1.1	1.1	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)								**49.61**	**49.55**	**49.49**	**49.48**	**49.48**	**49.47**	**49.47**	**49.47**	**49.47**	**49.47**

A3.5. References

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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 are outlined in the following Table to increase the transparency of the NIR 2012 submission.

CRF code	CRF category	Reasons for omissions	NIR Chapter for further information
5.A.1	Forest Land remaining 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.1	Forest Land remaining Forest Land/Carbon stock change/Net carbon stock change in soils/Carbon/Mineral Soils		
5.A.1	Forest Land remaining Forest Land/Carbon stock change/Net carbon stock change in soils/Carbon/Organic Soils		
5.A.2.1	Cropland converted to Forest Land/Carbon stock change/Net carbon stock change in dead organic matter/Carbon		
5.A.2.1	Cropland converted to Forest Land/Carbon stock change/Net carbon stock change in soils/Carbon/Mineral Soils		
5.A.2.2	Grassland converted to Forest Land/Carbon stock change/Net carbon stock change in dead organic matter/Carbon		
5.A.2.2	Grassland converted to Forest Land/Carbon stock change/Net carbon stock change in soils/Carbon/Mineral Soils		
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/Carbon stock change in living biomass/Carbon/Net change	These conversions are assumed to be the results of natural processes.	Chapter 7.6.1.1
5.D.2.3	Grassland converted to Wetlands/Carbon stock change/Net carbon stock change in soils/Carbon		
5.C.2.4	Settlements converted to Grassland/Carbon stock change/Carbon stock change in living biomass/Carbon/Net change	Biological re-cultivation of abandoned surface mines. Omission of these category can be considered as a conservative approach in Hungary.	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.A.2.4	Settlements 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 soils/Carbon/Mineral Soils		
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 category 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.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
5.E.2.4	Wetlands converted to Settlements/Carbon stock change/Net carbon stock change in soils/Carbon		
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.A.2.5	Other Land 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.2.5	Other Land converted to Forest Land/Carbon stock change/Net carbon stock change in soils/Carbon/Mineral Soils		

Annex 6 Quality Assurance and Quality Control

QA/QC activities are explained in Chapter 1.6. The following registers are used for documenting data sources, calculation methods, reason and effect of recalculations etc.

Documentation for the National Inventory Report/ Módszertan						
Validity/Érvényesség						
IPCC Sector						
IPCC category code						
Data and sources/ Adatok és források						
Input data (activity data, conversion factors, etc.)/ Bemenő adatok						
Uncertainties (upper and lower) associated with activity data/Bizonytalanság						
Source of input data/Adatforrás						
Type of emission factor						
Uncertainties (upper and lower) associated with emission factor/Bizonytalanság						
Used method/Alkalmazott eljárás						
Type of method /A módszer típusa						
Source or description of method/A módszer leírása						
Documented by/Készítette						
Name/Név						
Signature/Aláírás						
Date/Dátum	Budapest,					

Recalculation/Újraszámolás				
Validity/Érvényesség				
IPCC Sector				
IPCC category				
Reasons for recalculations/Az újraszámolás okai				
Description of the new method/ Az új módszer leírása				
Alternative recalculation techniques can be applied/ Alternatív újrakalkulációs technika alkalmazható	*igen/yes*	☐	*nem/no*	☐
Comparison of the methods/A régi és az új módszer összehasonlítása				
Documented by/Készítette				
Name/Név				
Signature/Aláírás				
Date/Dátum	Budapest,			

Figure A6-1. *Register of used data, data sources and calculation methods and register of recalculations*

Errata/ Hibajegyzék Quality Control	
Inventory year	
IPCC Sector or other	
List of errata	
Documented by/Készítette	
Name/Név	
Signature/Aláírás	
Date/Dátum	Budapest,

Developing plan/Intézkedési terv Quality Control	
Inventory year	
IPCC Sector or other	
List of developing plan	
Documented by/Készítette	
Name/Név	
Signature/Aláírás	
Date/Dátum	Budapest,

Figure A6-2. *Register for errata and developing plan*

Quality Control of the National Inventory Report/
Adatminőség ellenőrzés

A./ General QC activity/
Általános QC tevékenység

IPCC code of the audited sector/ Vizsgált szektor és IPCC kódja:	
Inventory year/Vizsgált év:	
Controller/Ellenőrző neve:	

Summary of general findings/
Általános megállapítások összefoglalása

Date/
Dátum: …………….. ……………………… ………………………
auditor / ellenőr sectoral expert / szektorfelelős

Measures suggested by the sectoral expert/
A szektorfelelős javaslata alapján teendő intézkedések

Date/
Dátum: …………….. ……………………… ………………………
head of division / osztályvezető sectoral expert / szektorfelelős

Verification, after the implemented measures still exsisting problems/
Utóellenőrzés, a javító intézkedések után is fennálló problémák

Date/
Dátum: …………….. ……………………… ………………………
auditor / ellenőr sectoral expert / szektorfelelős

Launch of new procedure/Új eljárás indítása:	End of the audit/A vizsgálat lezárása:
Date/ Dátum: …………….. ……………………… head of division / osztályvezető	Date/ Dátum: …………….. ………………… head of division / osztályvezető

B./ CHECKLIST

QC activity/ ***QC tevékenység***	***Procedure of audit/*** ***Az ellenőrzés folyamata***	***Result of audit/*** ***Az ellenőrzés eredménye***
1. Check that assumptions and criteria for the selection of activity data and emission factors are documented. (Ellenőrizze, hogy az alkalmazott tevékenységi adatok, emissziós faktorok, módszertanok dokumentálásra kerültek.)		
2. Confirm that bibliographical data references are properly cited in the internal documentation. (Ellenőrizze, hogy a könyvtári adatokra történő hivatkozásokat pontosan idézték a belső dokumentációban.)		
3. Check that activity data could be reproduced. (Ellenőrizze, hogy a tevékenységi adatok reprodukálhatóak.)		
4. Check that emission factors could be reproduced. (Ellenőrizze, hogy az emissziós faktorok reprodukálhatóak.)		
5. Check that emissions/removals are calculated correctly. (Ellenőrizze, hogy az emissziókat/nyeléseket helyesen számolták ki.)		
6. Compare estimates to previous estimates. (Hasonlítsa össze a becsléseket a korábbi becslésekkel.)		
7. Undertake completeness checks. (Check completeness elvégzése.)		
8. Check methodological and data changes resulting in recalculations. (Ellenőrizze az újraszámításokból előálló módszertani és adatváltozásokat.)		

Figure A6-3. *Registers for quality control*

Annex 7 Uncertainty

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. “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 uncertainty analysis for the Hungarian inventory was carried out on the basis of Tier 1 method.. The disaggregation of the inventory into categories is the same listed in *Table A1-1* and reported in previous submissions but in this year LULUCF categories are included in uncertainty calculation as well. Thus, the full coverage of the emission sources and sinks has been achieved both in key category analysis and in uncertainty estimation. .

The uncertainty calculation was performed using Table 6.1 of the IPCC Good Practice Guidance (2000).

The calculations of the emissions estimates uncertainty are presented, for the first time with LULUCF sectors (noted with red color), in *Table A7-1* **Hiba! A hivatkozási forrás nem található.**. Uncertainty calculation for each GHG (with LULUCF sector noted with red color) 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	CO_2	19924,1	22184,35	5	5	7,071	2,441	0,096	0,197	0,479	1,393	1,473
1. A.	Stationary Combustion - Coal	CO_2	30787,4	8841,74	2	5	5,385	0,741	-0,077	0,078	-0,386	0,222	0,445
1. A.	Stationary Combustion - Oil	CO_2	16277,8	2939,87	2	5	5,385	0,246	-0,056	0,026	-0,281	0,074	0,291
1. A.	Non-CO_2 Emission from Stationary Fuel Combustion	N_2O	214,23	144,22	3	50	50,090	0,112	0,000	0,001	0,010	0,005	0,011
1. A.	Non-CO_2 Emission from Stationary Fuel Combustion	CH_4	876,89	309,38	3	8	8,544	0,041	-0,002	0,003	-0,014	0,012	0,018
1. A.	Stationary Combustion - Other Fuel	CO_2	96,89	420,76	5	10	11,180	0,073	0,003	0,004	0,032	0,026	0,042
1. A. 3.	Mobile Combustion - Other	CO_2	814,20	271,01	5	5	7,071	0,030	-0,002	0,002	-0,009	0,017	0,019
1. A. 3.	Mobile Combustion	N_2O	95,63	364,93	5	100	100,125	0,569	0,003	0,003	0,276	0,023	0,276
1. A. 3.	Mobile Combustion	CH_4	45,19	21,64	5	50	50,249	0,017	0,000	0,000	-0,002	0,001	0,002
1. A. 3. B.	Mobile Combustion - Road	CO_2	6807,45	11212,42	5	5	7,071	1,234	0,065	0,100	0,325	0,704	0,775
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CH_4	923,01	11,69	3	10	10,440	0,002	-0,005	0,000	-0,046	0,000	0,046
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CO_2	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)	CH_4	1613,47	2128,65	2	50	50,040	1,658	0,011	0,019	0,536	0,053	0,539
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	N_2O	0,60	0,22	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	CO_2	330,80	218,96	100	80	128,062	0,436	0,000	0,002	0,021	0,275	0,276
2.	N_2O Emission from Industry	N_2O	4541,51	10,64	2	1	2,236	0,000	-0,023	0,000	-0,023	0,000	0,023
2.	CH_4 Emission from Industry	CH_4	15,81	39,59	1	20	20,025	0,012	0,000	0,000	0,005	0,000	0,005
2. A. 1.	CO_2 Emissions from Cement Production	CO_2	1778,28	735,35	2	2	2,828	0,032	-0,002	0,007	-0,005	0,018	0,019
2. A. 2.	CO_2 Emissions from Lime Production	CO_2	645,03	211,28	5	2	5,385	0,018	-0,001	0,002	-0,003	0,013	0,014
2. A. 3.	CO_2 Emission from Limestone and Dolomit Use	CO_2	248,68	309,72	2	1	2,236	0,011	0,001	0,003	0,001	0,008	0,008
2. A. 7.	CO_2 Emission from Other Mineral Products	CO_2	642,13	156,22	10	30	31,623	0,077	-0,002	0,001	-0,056	0,020	0,059
2. B. 1.	CO_2 Emissions from Ammonia Processes	CO_2	1616,22	470,55	2	2	2,828	0,021	-0,004	0,004	-0,008	0,012	0,014
2. B. 2.	CO_2 Emissions from Nitric Acid Production	CO_2	0,082	0,000	3	40	40,112	0,000	0,000	0,000	0,000	0,000	0,000
2. C.	CO_2 Emissions from Metal Production	CO_2	4257,204	2242,87	2	5	5,385	0,188	-0,002	0,020	-0,008	0,056	0,057
2. C. 3.	PFCs Emissions	PFCs	268,49	0,36	1	2	2,236	0,000	-0,001	0,000	-0,003	0,000	0,003
2. F.	Emissions from Substitutes for Ozone Depleting Substances	HFCs	NA,NO	914,26	10	20	22,361	0,318	0,000	0,008	0,000	0,115	0,115
2. F. 7.	SF_6 Emissions from Electrical Equipment	SF_6	73,05	234,94	80	20	82,462	0,302	0,002	0,002	0,034	0,236	0,238
2. G.	Feedstocks and non-energy use of fuels	CO_2	550,97	1060,66	5	10	11,180	0,185	0,007	0,009	0,066	0,067	0,094
3.	N_2O Emission from Solvent and Other Product Use	N_2O	154,17	236,31	2	1	2,236	0,008	0,001	0,002	0,001	0,006	0,006
3.	CO_2 Emission from Solvent and Other Product Use	CO_2	130,36	32,57	10	20	22,361	0,011	0,000	0,000	-0,007	0,004	0,008
4. A	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	3637,94	1598,93	0	13,35	13,35	0,332	-0,004	0,014	-0,056	0,000	0,056
4. B	CH_4 Emissions from Manure Management	CH_4	2427,28	955,71	0	24,00	24,00	0,357	-0,004	0,008	-0,091	0,000	0,091
4. B.	N_2O Emissions from Manure Management	N_2O	1985,11	910,13	0	100,31	100,31	1,421	-0,002	0,008	-0,198	0,000	0,198
4. C.	CH_4 Emission from Rice Cultivation	CH_4	50,54	8,40	5	153,47	198,24	0,026	0,000	0,000	-0,028	0,001	0,028

4. D. 1.	Direct N_2O Emissions from Agricultural Soils	N_2O	5534,79	2821,79	0	381,30	381,30	16,746	-0,003	0,025	-1,134	0,000	1,134
4. D. 2.	Pasture, range and paddock manure	N_2O	351,01	170,09	0	105,45	105,45	0,279	0,000	0,002	-0,028	0,000	0,028
4. D. 3.	Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O	3900,85	1801,69	0	148,50	148,50	4,164	-0,004	0,016	-0,558	0,000	0,558
4. F.	Field Burning of Agricultural Residues	CH_4	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	N_2O	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	-2792,79	-1994,60	5,71	25,38	26,02	-0,808	-0,004	-0,018	-0,091	-0,143	0,169
5.A.2	Land converted to Forest Land	CO2	-5,28	-1123,79	19,62	47,89	51,76	-0,905	-0,010	-0,010	-0,477	-0,277	0,551
5.A.1	Forest Land remaining forest Land	CH4	28,79	22,53	0	5,542	5,542	0,002	0,000	0,000	0,000	0,000	0,000
5.A.1	Forest Land remaining forest Land	N2O	2,92	2,29	0	1	1	0,000	0,000	0,000	0,000	0,000	0,000
5.B.1	Cropland remaining Cropland	CO2	366,58	-1220,14	0	126,65	126,651	-2,405	-0,013	-0,011	-1,607	0,000	1,607
5.B.2	Land converted to Cropland	CO2	5,19	217,51	0	51,432	51,432	0,174	0,002	0,002	0,098	0,000	0,098
5.B.1	Cropland remaining Cropland	CH4	1,24	0,30	25,0	70,0	74,330	0,000	0,000	0,000	0,000	0,000	0,000
5.B.	Cropland	N2O	3,62	25,40	0	273,25	273,25	0,108	0,000	0,000	0,057	0,000	0,057
5.C.1	Grassland remaining Grassland	CO2	9,38	405,31	0	48,814	48,814	0,308	0,004	0,004	0,173	0,000	0,173
5.C.2	Land converted to Grassland	CO2	185,33	38,97	0	592,62	592,625	0,359	-0,001	0,000	-0,351	0,000	0,351
5.C.1	Grassland remaining Grassland	CH4	0,73	0,17	25,00	70,00	74,330	0,000	0,000	0,000	0,000	0,000	0,000
5.C.1	Grassland remaining Grassland	N2O	0,39	0,09	25,00	70,00	74,330	0,000	0,000	0,000	0,000	0,000	0,000
5.E.2	Land converted to Settlements	CO2	84,14	198,97	0	44,83	44,83	0,139	0,001	0,002	0,060	0,000	0,060
6. A.	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	1917,30	2946,57	10	30	31,623	1,450	0,016	0,026	0,493	0,370	0,617
6. B.	Emissions from Wastewater Handling	CH_4	951,30	457,14	20	30	36,056	0,257	-0,001	0,004	-0,023	0,115	0,117
6. B.	Emissions from Wastewater Handling	N_2O	207,70	195,42	10	1000	1000,05	3,042	0,001	0,002	0,683	0,025	0,684
6. C.	CO_2 emissions from Waste Incineration	CO_2	NA,NO	84,31	10	20	22,361	0,029	0,000	0,001	0,000	0,011	0,011

6. C.	CH_4 Emissions from Waste Incineration	CH_4	NA	1,05	10	50	50,990	0,001	0,000	0,000	0,000	0,000	0,000
6. C.	N_2O Emissions from Waste Incineration	N_2O	NA,NO	2,62	5	100	100,125	0,004	0,000	0,000	0,000	0,000	0,000
			Σ C	**Σ D**				**$(\Sigma H^2)^{1/2}$**					**$(\Sigma M^2)^{1/2}$**
	TOTAL including LULUCF		**112646,3**	**64 252,07**				**18,2**					**3,0**

Note A

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

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

Source category	GHG	Emissions in the current year (2010) (Gg CO2-eq)	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in current year
Stationary Combustion - Gas	CO_2	22 184,35	5,00	5,00	7,07	3,27387
Stationary Combustion - Coal	CO_2	8 841,74	2,00	5,00	5,39	0,99372
Stationary Combustion - Oil	CO_2	2 939,87	2,00	5,00	5,39	0,33041
Stationary Combustion - Other Fuel	CO_2	420,76	5,00	10,00	11,18	0,09818
Mobile Combustion - Other	CO_2	271,01	5,00	5,00	7,07	0,03999
Mobile Combustion - Road	CO_2	11 212,42	5,00	5,00	7,07	1,65468
Fugitive Emissions from Coal Mining and Handling	CO_2	IE,NA,NO	3,00	10,00	10,44	0,00000
Fugitive Emissions from Oil and Gas Operations	CO_2	218,96	100,00	80,00	128,06	0,58520
CO_2 Emissions from Cement Production	CO_2	735,35	2,00	2,00	2,83	0,04341
CO_2 Emissions from Lime Production	CO_2	211,28	5,00	2,00	5,39	0,02375
CO_2 Emission from Limestone and Dolomit Use	CO_2	309,72	2,00	1,00	2,24	0,01445
CO_2 Emission from Other Mineral Products	CO_2	156,22	10,00	30,00	31,62	0,10310
CO_2 Emissions from Ammonia Processes	CO_2	470,55	2,00	2,00	2,83	0,02778
CO_2 Emissions from Nitric Acid Production	CO_2	0,00	3,00	40,00	40,11	0,00000
CO_2 Emissions from Metal Production	CO_2	2 242,87	2,00	5,00	5,39	0,25208
Feedstocks and non-energy use of fuels	CO_2	1 060,66	5,00	10,00	11,18	0,24749
CO_2 Emission from Solvent and Other Product Use	CO_2	32,57	10,00	20,00	22,36	0,01520
Non-biogenic CO_2 from Waste	CO_2	84,31	10,00	20,00	22,36	0,03935
Forest Land remaining forest Land	CO_2	-1 994,60	5,71	25,39	26,02	1,08316
Land converted to Forest Land	CO_2	-1 123,79	19,62	47,90	51,76	1,21397
Cropland remaining Cropland	CO_2	-1 220,14	0,00	126,65	126,65	-2,40509
Land converted to Cropland	CO_2	217,51	0,00	51,43	51,43	0,17411
Grassland remaining Grassland	CO_2	405,31	0,00	48,81	48,81	0,30792
Land converted to Grassland	CO_2	38,97	0,00	592,62	592,62	0,35945
Land converted to Settlements	CO_2	198,97	0,00	44,83	44,83	0,13883
SZUM CO2		**47 914,89**				**4,9**
% of total emission		**74,6**				

Non-CO_2 Emission from Stationary Fuel Combustion	CH_4	309,38	3,00	8,00	8,54	0,31092
Mobile Combustion	CH_4	21,64	5,00	50,00	50,25	0,12792
Fugitive Emissions from Coal Mining and Handling	CH_4	11,69	3,00	10,00	10,44	0,01435
Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH_4	2 128,65	2,00	50,00	50,04	12,52889
CH_4 Emission from Industry	CH_4	39,59	1,00	20,00	20,02	0,09326
CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	1 598,93	0,00	13,35	13,35	2,51035
CH_4 Emissions from Manure Management	CH_4	955,71	0,00	24,00	24,00	2,69742
CH_4 Emission from Rice Cultivation	CH_4	8,40	5,00	153,47	198,24	0,19587
Field Burning of Agricultural Residues	CH_4	NO	NO	NO	0,00	0,00000
CH_4 Emissions from Solid Waste Disposal Sites	CH_4	2 946,57	10,00	30,00	31,62	10,95991
Emissions from Wastewater Handling	CH_4	457,14	20,00	30,00	36,06	1,93870
CH_4 Emissions from Waste Incineration	CH_4	1,05	10,00	50,00	50,99	0,00631
Forest Land remaining forest Land	CH_4	22,53	0,00	5,54	5,54	0,00194
Cropland remaining Cropland	CH_4	0,30	25,00	70,00	74,33	0,00035
Grassland remaining Grassland	CH_4	0,17	25,00	70,00	74,33	0,00019
SZUM CH4		**8 501,77**				**17,2**
% of total emission		**13,2**				
Non-CO_2 Emission from Stationary Fuel Combustion	N_2O	144,22	3,00	50,00	50,09	0,84968
Mobile Combustion	N_2O	364,93	5,00	100,00	100,12	4,29780
Fugitive Emissions from Oil and Gas Operations	N_2O	0,22	2,00	100,00	100,02	0,00264
N_2O Emission from Industry	N_2O	10,64	2,00	1,00	2,24	0,00280
N_2O Emission from Solvent and Other Product Use	N_2O	236,31	2,00	1,00	2,24	0,06215
N_2O Emissions from Manure Management	N_2O	910,13	0,00	100,31	100,31	10,73871
Direct N_2O Emissions from Agricultural Soils	N_2O	2 821,79	0,00	381,30	381,30	126,55642
Pasture, range and paddock manure	N_2O	170,09	0,00	105,45	105,45	2,10966
Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O	1 801,69	0,00	148,50	148,50	31,46918
Field Burning of Agricultural Residues	N_2O	NO	NO	NO	0,00	0,00000
Emissions from Wastewater Handling	N_2O	195,42	10,00	1 000,00	1 000,05	22,98726
N_2O Emissions from Waste Incineration	N_2O	2,62	5,00	100,00	100,12	0,03086
Forest Land remaining forest Land	N_2O	2,29	0,00	0,84	0,84	0,00003

Cropland	N_2O	25,40	0,00	273,25	273,25	0,10801
Grassland remaining Grassland	N_2O	0,09	25,00	70,00	74,33	0,00010
SZUM N2O		**6 685,85**				**132,9**
% of total emission		**10,4**				
Emissions from Substitutes for Ozone Depleting Substances	HFCs	909,74	10,00	20,00	22,36	2,397
PFCs Emissions	PFCs	0,35	1,00	2,00	2,24	0,001
SF6 Emissions from Electrical Equipment	SF6	234,94	80,00	20,00	82,46	16,920
SZUM HFCs, PFCs, SF6		**1 149,55**				**17,0**
% of total emission		**1,8**				

Annex 8 Responses to the review of the 2011 inventory submission

Hungary received the draft ARR on March 22 which gave us not too much time to follow all recommendations. Still, lots of improvements were made as summarized in the following table following the structure of the ARR report.

ARR para.	Recommendation	Party response	NIR Chapter
	A. Overview		
	1. Annual submission and other sources of information		
	Completeness of inventory		
10.	(…) The ERT recommends that Hungary improve the completeness of its reporting by reducing the number of categories reported as “NE” under the LULUCF sector, in accordance with the IPCC good practice guidance for LULUCF in its next annual submission.	Notation keys ‘NE’ were corrected to the required emissions under information items in CRF Table 5. (See also para. 97 below).	
11.	In annex 5 to the NIR, Hungary has reported that no detailed information is available on the assessment of the completeness of the inventory and on potentially excluded categories of GHG emissions. In order to obtain an overview of the completeness of the Hungarian inventory, and in order to facilitate future reviews, the ERT recommends that the Party include, in annex 5 to the NIR, a discussion on and an assessment of the categories reported as “NE” in its annual submission. This could include an assessment of the potential impact on emission levels of the categories reported as “NE”, the reasons why they are not estimated, and plans for acquiring and reporting the missing data. For the subcategory refrigeration and air-conditioning equipment under consumption of halocarbons and SF6 in the industrial processes sector, the ERT recommends that Hungary use the notation key “IE” (included elsewhere) instead of the notation key “NO” (not occurring) when the subcategories have been calculated in a more aggregated way than the subcategories presented in the CRF tables or when the subcategories have been reported elsewhere together with another (sub)category.	Justification for omitting sub-categories in LULUCF sector is now provided in ANNEX5. Regarding the subcategory refrigeration and air-conditioning equipment under consumption of halocarbons and SF6 in the industrial processes sector recommendation of the ERT has been implemented see para 66.	ANNEX 5
	2. A description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management		
	Inventory planning		
16.	In response to a question raised by the ERT during the review, Hungary provided an overview of the annual inventory cycle, including information on the	Chapter 1.3 was supplemented with a table describing the inventory cycle.	Ch. 1.3.

	responsibilities of the institutions involved in the preparation of the inventory, and a timeline for the application of QA/QC procedures during the inventory preparation process. The ERT encourages the Party to provide a transparent overview of the inventory preparation process, including the QA/QC procedures performed, in the NIR of its next annual submission, in line with the information provided to the ERT during the review.		
	Inventory preparation		
	Key categories		
17.	Hungary has reported key category tier 1 and tier 2 analyses, both level and trend assessment, as part of its 2011 annual submission. The key category analysis performed by the Party (tier 1) and that performed by the secretariat produced different results owing to the different level of disaggregation of the categories used by the Party. Hungary has included the LULUCF sector in its tier 1 key category analysis, which was performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (hereinafter referred to as the IPCC good practice guidance) and the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (hereinafter referred to as the IPCC good practice guidance for LULUCF). However, Hungary has not included the LULUCF sector in its tier 2 key category analysis due to the unavailability of uncertainty estimates for the LULUCF sector.	The required information has been provided in NIR 2012.	Chapter 1.6
19.	In CRF table 7, Hungary has reported 29 key categories (level and trend) for 2009. In NIR table 1.2, the Party has also reported a tier 1 key category analysis, where the key categories are identified at a more disaggregated level than in the analysis presented in the CRF table 7. In response to a question raised by the ERT during the review regarding the different levels of aggregation and the use of the results of the key category analyses, Hungary explained that the more detailed key category analysis was introduced in order to be more consistent with the key category analysis required by the European Union. The Party also explained that it uses this more detailed key category analysis to prioritize its inventory improvements. The ERT agrees that this is a reasonable approach. The ERT recommends Hungary report key categories in CRF table 7 using the same disaggregated level with what the Party reports in the NIR. 4 The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance for LULUCF. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are	In the 2012 submission the list of source categories for TIER1 and TIER2 key category analysis is the same as in CRF Table 7. This is a list suggested by IPCC GPG2000 Table 7.1 and IPCC GPG LULUCF 2003, complemented by some HU specific points and some additional sectors in order to reach the complete coverage. The list and the notes are presented in Table A1-1 of the Annex I of the NIR. Only for information purposes (and for being in line with the EU analysis) and to maintain the comparability with recent years, also result of the TIER1 key category analysis on the more disaggregated level of sources (list suggested by the EU) is included in Table A1-7.	1.6 and Annex

	presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat. FCCC/ARR/2011/HUN 10		
	Uncertainties		
21.	Both in the 2010 and in the 2011 NIR, Hungary has reported the results of the uncertainties for selected categories in the LULUCF sector. In response to a question raised by the ERT during the review, the Party explained that work is in progress regarding the uncertainty estimates for the LULUCF sector, and that information will be presented in the NIR as results become available. Hungary also reported that this work will continue, and that it will report on the progress made in the next annual submission, even though the Party expects that comprehensive final results will not be available by the time of the annual submission in 2012. The ERT strongly recommends that Hungary include uncertainty estimates for the LULUCF sector in the overall uncertainty analysis in its next annual submission, at least the preliminary estimates if comprehensive final results are not available at the time of the preparation of the annual submission.	The required information is now provided in NIR 2012.	Chapters 7.3.4 & 7.4.4, 7.5.4, 7.7.4, 7.10, 11.3.1.5
22.	The ERT noted that the combined total uncertainty estimate (excluding the LULUCF sector) for 2009 was higher (17.6 per cent) than that reported for 2007 and 2008 in the 2009 and 2010 submissions (8.0 per cent and 8.2 per cent, respectively). The ERT recommends that Hungary explain the reasons for these variations in its next annual submission.	The NIR were supplemented with additional information relating to the change in the reported combined total uncertainty between 2009 and 2010 submissions.	Chapter 6.1.4
	Recalculations and time-series consistency		
23.	Not all recalculations have been performed and reported in accordance with the IPCC good practice guidance (e.g. the industrial processes sector, where in some cases the rationale for the recalculations and a description of the specific changes are not clearly provided). In addition, the time series of the original and recalculated emission estimates and the differences in each subcategory (e.g. for ammonia production and nitric acid production under chemical industry; the subcategory other(metal production); and the subcategories of consumption of halocarbons and SF6), are not reported in accordance with the IPCC good practice guidance. The ERT noted that the recalculations reported by the Party of the time series 1990–2008 and the base year (the average of the period 1985–1987) have been undertaken to take into account changes and/or improvements in AD (e.g. in the energy and industrial processes sectors where errors in AD were corrected, and in the agriculture sector) and EFs (e.g. in the energy sector, where extensive changes were made to the country-specific EFs, which the previous ERT considered to be too low compared to the IPCC default CH4 and N2O EFs, and in the agriculture sector). Recalculations were also undertaken in the LULUCF sector due to the reallocation of emissions and removals in carbon pools to other land-use categories and due to newly available data for the estimation of the carbon stock changes in	More detailed information have been provided as explanation and justification for recalculations in the NIR 2012 relating to the Agriculture and the LULUCF sectors than the submissions up to 2011. The reasons for recalculations and the effect of the recalculations on the reported emissions are outlined by land-use categories and carbon pools for the LULUCF sector, and by source categories and emitted gas for the Agriculture sector.	

	pools (see para. 90 below). The magnitude of the impact of the recalculations is a decrease in estimated total GHG emissions (excluding LULUCF) of 1.0 per cent for the base year, and a decrease of 0.5 per cent for 2008. The impact of the recalculations on the LULUCF sector is a decrease in net removals of 3.4 per cent for the base year and an increase in net removals of 8.4 per cent for 2008. The rationale for the recalculations is not always provided in the NIR and/or in CRF table 8(b). The ERT FCCC/ARR/2011/HUN 11 recommends that Hungary always include a detailed description of and rationale for all recalculations, in line with the IPCC good practice guidance, both in the NIR and in the CRF tables, in its next annual submission.		
	Verification and quality assurance/quality control approaches		
27.	(…) The ERT reiterates the recommendation from the previous review report that the Party include information on the procedures for the handling of confidential information as a part of its QA/QC plan.	Chapter 1.4 was supplemented with information regarding handling of confidential information.	Ch. 1.4.
	3. Follow-up to previous reviews		
32.	The ERT commends Hungary for the improvements implemented in its 2011 submission in response to the previous review report. The Party has made efforts to implement many of the recommendations from the previous review report, such as: the inclusion of several categories in the LULUCF sector that were previously reported as “NE” (e.g. soil organic carbon in forest land converted to cropland and all pools in land converted to settlements); the inclusion of information in the NIR explaining and justifying the recalculations; the removal of almost all inconsistencies between the CRF tables and the NIR; and the improvement of transparency in the NIR. However, the ERT noted that there are some issues that have still not been addressed, including: the provision of estimates for the categories that are still reported as “NE” in the LULUCF sector (see para. 97 below); the completion of the uncertainty analysis for the LULUCF sector; the finalization and formalization of the archiving manual; and the provision of updated information in the NIR.	Notation keys ‘NE’ were corrected to the required emissions under information items in CRF Table 5. (See also para. 97 below). Uncertainty analysis is now complete for the LULUCF sector. (See also para 21.) The main issues of the archiving manual have been finalized in the new general record management regulation of the HMS (see also para. 31).	
33.	In the 2011 NIR, the Party did not provide explicit information regarding its actions in response to the recommendations of the 2010 review report. In annex 8 to the NIR, Hungary stated that it had not received the review report of the 2010 review at the time of compiling and submitting the NIR. In response to questions raised by the ERT during the review, the Party provided a list of actions taken in response to recommendations from the list of potential problems raised by the ERT, as well as the presentations made by the ERT during the review. Hungary also stated its intention to include information on its responses to the review process in its next annual submission. The ERT welcomes this intention and recommends that Hungary implement, in its next annual submission, the completion of annex 8 to the NIR and include information on the actions taken in response to the review of the	Annex 8 is presented here in this submission	

	2011 submission.		
	B. Energy		
	1. Sector overview		
39.	The ERT commends Hungary for improving the transparency of the energy sector chapter of its NIR and for the improvements made in response to previous review reports. The ERT notes that the Party has begun to incorporate facility-level emissions data into its GHG inventory since 2006. To further improve transparency and ensure time-series consistency, the ERT encourages Hungary to include the following elements in future NIRs: information on the methods for incorporating the emissions data into the inventory; details of how the energy data are reconciled with the national energy balance; and information on how the Party ensures the correspondence of the estimation methods used by the facilities with those of the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the IPCC good practice guidance. In particular, the ERT recommends that Hungary pay more attention to the carbon balances in categories where there is non-energy use of fuels, where recovered gases are used for energy purposes and where there are backflows or transfers of secondary energy products to other facilities. This increased transparency will assist future ERTs to determine whether appropriate QA/QC procedures are in place for these facility-level data and whether the uncertainty in the overall inventory is being reduced.	A new chapter has been added on the use of plant specific ETS data We started analyzing coke oven and blast furnace gas use within domestic energy consumption which led to a few recalculations. This work will be continued.	3.2.5 10.2.1 10.2.3 10.2.4
40.	During the review, the ERT noted that emissions of raw CO2 venting from natural gas processing had been omitted from the inventory. In response to a question raised by the ERT during the review, Hungary explained that an estimate could be calculated using default figures provided in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance, and subsequently submitted revised figures. The ERT reviewed and accepted the calculations provided by Hungary for raw CO2 venting from natural gas production, which were added by the country to the inventory totals when the revised CRF tables were submitted.	In 2012 submission CO2 emissions of raw CO2 venting was recalculated together with further CO2 emission sources suggested by GPG2000 in category 1.B.2. Details of the new method, AD and EF used are included in chapter 3.3.2 of the NIR, recalculated figures are presented in chapter 10.2.1.	3.3.2 and 10.2.1
42	The ERT noted that Hungary has reported emissions from non-ferrous metals as included under the iron and steel category. In response to questions raised by the ERT during the review, the Party explained that its national energy balance does not provide disaggregated AD for these two categories, but that the energy data reported to the International Energy Agency (IEA) may be more disaggregated. The ERT recommends that Hungary confirm that the national data reported to IEA are disaggregated into these two categories and that these data can be used for its emission estimates and, where necessary, that the Party use interpolation or extrapolation techniques to complete the time series, as recommended in the IPCC good practice guidance.	Emissions are reported separately for gaseous fuel and heavy fuel oil.	10.2.2

	2. Reference and sectoral approaches		
	Feedstocks and non-energy use of fuels		
45.	Hungary uses facility-level emission estimates from the European Union emissions trading scheme (EU ETS) for some sectors where there is non-energy use of fuels (e.g. petroleum refining, petrochemicals, iron and steel). The Party does not explain how the reporting facilities ensure that the non-energy use of fuels is accounted for within these EU ETS GHG inventories. The ERT encourages Hungary to increase the transparency of its reporting by explaining how non-energy fuel use data from the reporting facilities are accounted for within these facility-level emission inventories and how these data are consistent with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance.	In an EU ETS annual emission report the operators are required to report combustion and process emissions divided. (It is required by 589/2007/EC - EU ETS Monitoring and reporting guidelines). The EU ETS annual emission reports are verified by an independent accredited verifier and reviewed the EU ETS competent authority. In the case EU ETS data is used by the preparation of the Inventory, this division is of course taken into account. However please note that Hungary **does not use** EU ETS data in sectors Iron and steel, petroleum refining and petrochemicals for inventory reporting purposes but IPCC1996 default emission factors. (EU ETS data may be used solely for verification purposes in the sectors mentioned). Hungary uses EU ETS data for inventory reporting exclusively in sector 2.A.1 Cement, 2.A.7 Bricks and Glass (and CO2 emissions from Oil refinery flaring as additional emission source in subsector 1.B.2.C Fugitive emissions from Venting and flaring, because no specific EF is available for oil refinery flaring. In this case the emissions from flaring are separated from other combustion and process emissions by the operator itself.)	
	3. Key categories		
	Stationary combustion: liquid fuels – CO2		
46.	The inter-annual change in the value of the CO2 implied emission factors (IEFs) for liquid fuels used in public electricity and heat production between 2008 (80.66 kg/TJ) and 2009 (76.81 kg/TJ) has been identified as significant. Hungary explained, in response to questions raised by the ERT during the review, that the use of EU ETS facility-specific data leads to this variation in the value of the CO2 IEFs. The ERT considers that this should not normally occur unless there is a wide	A new table in chapter 3.2.5 gives an overview of the country specific emission factors derived from facility level ETS data. Besides, chapter 3.2.6.2 discusses the used activity data and changes in the fuel mix for the last six years.	3.2.5. 3.2.6.2

	variability in the different fuels used in this category. Therefore, the ERT recommends that Hungary provide more detailed information on the fuel mix for this category to explain the inter-annual difference in the value of the IEFs by enhancing the transparency of the NIR of its next annual submission.		
48.	The inter-annual changes in the value of the CO2 IEFs for liquid fuels used in iron and steel are significant for several years of the time series (ranging between –8.1 and 30.8 per cent). In response to questions raised by the ERT during the review, Hungary explained that the EU ETS facility-level GHG inventory data used in the Party's inventory show this variability. The ERT considers that these variations could be caused by changes in the fuel mix at the facilities but that there is not sufficient information in the NIR or in the answers to the questions raised during the review to determine if this is the case. The ERT recommends that Hungary increase the transparency of the explanations for the significant variations in the fuel mix of liquid fuels used in iron and steel leading to the fluctuations in the value of the CO2 IEFs.	Data in CRF were checked with domestic and international energy statistics, and an erroneous outlier was corrected for the year 2004. Liquid fuel use is discussed in a more general form for the entire manufacturing industry category.	10.2.2 3.2.7.2
	Stationary combustion: solid fuels – CO2		
50.	The inter-annual changes in the value of the CO2 IEFs for solid fuels used in iron and steel are significant for several years of the time series (e.g. 2005 (93.94 t/TJ) and 2006 (87.25 t/TJ) – the 2006 value is 7.1 per cent lower than the 2005 value, and between 2008 (85.72 t/TJ) and 2009 (90.17 t/TJ) – the 2009 value is 5.2 per cent higher than the 2008 value). The following variations are also significant: the 2009 value (90.17 t/TJ) is 3.3 per cent lower than the 1990 value, and 4.67 per cent lower than the base year value (the average of the period 1985–1987 (94.58 t/TJ)). In response to questions raised by the ERT during the review, Hungary explained that the EU ETS facility-level GHG inventory data used in the Party's inventory show this variability. The ERT considers that these variations could be caused by changes in the fuel mix at the facilities but that there is not enough information in the Party's NIR to determine if this is the case. The ERT recommends that Hungary increase the transparency of the explanations for the significant variations in the fuel mix of solid fuels used in iron and steel leading to the fluctuations in the value of the CO2 IEFs.	In this submission substantial effort was concentrated on the proper allocation of coke oven coke use between energy and industrial processes sector. Specific consideration was given to coke oven gas as well. This all changed the fuel use and the corresponding emissions in this category quite significantly.	10.2.3 10.3.2
51.	The inter-annual changes in the value of the CO2 IEFs for solid fuels used in food processing, beverages and tobacco are significant for several years of the time series (e.g. in 2007/2008 the change in the value of the IEF was 4.0 per cent). In 2008 and 2009, the value of the CO2 IEF (106.0033 t/TJ) is one of the highest among the values reported by Parties for those years (ranging from 79.20 t/TJ to 106.92 t/TJ). The inter-annual change in the value of the CO2 IEF between 1990 (99.76 t/TJ) and 2009 (106.00 TJ) is 6.3 per cent. All the inter-annual changes except for 1991/1992, 1996/1997 and 1998/1999 are significant (ranging from –7.5	Solid fuel use is discussed in a more general form for the entire manufacturing industry category. Nevertheless the changes in fuel mix are discussed and reference is made to the high IEF in food processing, beverages and tobacco due to coke oven coke use.	3.2.7.2

	per cent to +8.2 per cent), and the trend is unstable. In response to questions raised by the ERT during the review, Hungary explained that these variations are due to changes in the mix of solid fuels used in this category (e.g. in more recent years coke has been used in the industry, while in previous years lower grades of coal and brown coal briquettes were used). The ERT considers that these variations are sufficiently significant to require further explanation in Hungary's NIR. The ERT recommends that the Party explain this issue more transparently in the NIR of its next annual submission.		
	4. Non-key categories		
	Other transportation: gaseous fuels – CO2		
53.	The ERT noted that pipeline transport emissions are reported as "NO", even though there is natural gas production in the country and a natural gas pipeline network. In response to questions raised by the ERT during the review, Hungary informed the ERT that fuel-use data are not reported separately for this activity in the national energy statistics. The ERT strongly recommends that the Party investigate equipment-based methods consistent with the IPCC good practice guidance to estimate fuel consumption combined with country-specific or IPCC default EFs for the estimation of emissions from pipeline transport, in order to properly allocate these emissions under the category other transportation.	We still do not have separate time series of fuel use for natural gas transport. Nevertheless, we started to analyze the EU-ETS data regarding this issue. It turned out that five compressor stations reported under the EU-ETS in 2010, and their aggregated natural gas use was 1.9 PJ which led to a CO_2 emission of 106 Gg.	3.2.8.1
	Oil and natural gas: liquid fuels – CH4 and CO2		
54.	CH4 and CO2 emissions from the distribution of oil products are reported as "NE" and "NO", respectively. In response to questions raised by the ERT during the review, Hungary explained that these emissions will be estimated when appropriate EFs become available. The ERT encourages Hungary to explore the possibility of estimating emissions from this category in its next annual submission.	The notation key was corrected to NA, because IPCC1996, GPG2000 do not mention emission estimation methodology for 1.B.2.a.v.subsector, while IPCC2006 explicitly notes CO2 and CH4 emission as NA. Only NMVOC EF is provided in IPCC2006, which in fact seems the only notable emission source in the case of Distribution of Oil products. The review of the emissions of indirect gases in subsector 1.B.2 is mentioned as planned improvement.	3.3.2.(5)
	C. Industrial processes and solvent and other product use		
	1. Sector overview		
57.	The recalculations are briefly described in the NIR and the types of changes (e.g. in AD, EFs or methods) are summarized in CRF table 8(b). However, in some cases, the rationale for the recalculations and the description of the specific changes are not clearly provided. In addition, a time series of the original and recalculated emission estimates and the differences in each subcategory (e.g. for ammonia	Recalculations have been documented as it is required in chapter 10 of the NIR.	10.

	production, nitric acid production, iron and steel production and consumption of halocarbons and SF6), as recommended by the IPCC good practice guidance, are not provided in the NIR. In response to a request made by the ERT during the review, Hungary provided this information. The ERT recommends that the Party provide detailed information on the recalculations, in particular the rationale for and description of the specific changes per subcategory, in the relevant sections of the NIR of its next annual submission, where applicable.		
58.	For consumption of halocarbons and SF6, the NIR and CRF table summary 3 do not provide transparent and complete information per subcategory on the methodological tiers and data sources used, as well as the AD and EFs, and any relevant assumptions made. The ERT reiterates the recommendation of the previous review report that the Party further improve the transparency of its reporting by providing this information in the NIR for all subcategories under consumption of halocarbons and SF6, with an emphasis on the largest subcategories, such as refrigeration.	The relevant chapter in the NIR was expanded, and of course continous improvement is planned. In CRF the documentation box connected to Table 2(II)F s is completed, several cell comments are added and notation key of the method used in subcategory 2.F.1.1 Refrigeration is also corrected.	4.8
59.	In the NIR (section 3.2), Hungary lists key examples of plant closures, most of which were related to the economic transition during the 1990s, which is very useful to understand the significant changes in AD or IEFs. The ERT encourages the Party to include other significant plant closures or new start-ups in this list (e.g. cement plants).	Further dates of plant closures in Nitric acid production are included in NIR chapter 4.4.2.	4.4.2
61.	For historical reasons, Hungary does not report CO2 emissions from the use of coke as a reducing agent in blast furnaces for pig iron production under iron and steel production or ferroalloys production in the industrial processes sector but reports them under fuel combustion in the energy sector. The ERT observed that, according to the Revised 1996 IPCC Guidelines and the IPCC good practice guidance, these emissions should be reported under metal production in the industrial processes sector. The ERT agrees that, in cases where secondary fuels such as blast furnace gas are produced, the associated combustion emissions of CO2 are logically reported under the energy sector with all remaining emissions to be reported under the industrial processes sector. The ERT recommends that Hungary allocate these CO2 emissions to the industrial processes sector in line with the IPCC good practice guidance, taking into account the reporting of CO2 emissions from combustion of secondary fuels under the energy sector, and provide clear documentation in the NIR on the subcategories to which the emissions are allocated, the amount of CO2 reported and how the consistency of the carbon balance is maintained. During the review, Hungary expressed its intention to implement this recommendation in the NIR of its next annual submission.	Reallocation between Energy sector and Industrial Processes sector is performed. The new method is explained in NIR chapter 4.5.1 and details and tables of recalculation are included in NIR chapter 10.3. The relevant notation key and cell comments are updated in CRF.	4.5.1 and 10.3
	2. Key categories		
	Cement production – CO2		

62.	To assess time-series consistency, during the review Hungary provided the ERT with additional plant-specific information on cement kiln dust factors and on the amount and composition of the limestone used. However, this information is not sufficient to explain why the values of the CO2 IEFs in 2003 and 2004 (0.539 and 0.537 t CO2/t cement, respectively) are about 2 per cent higher than in subsequent years (e.g. 0.51 t CO2/t cement in 2005 and 0.52 t CO2/t cement in 2009) and why the latter values are about 5 per cent lower than the 2004 value. Therefore, the ERT recommends that Hungary further investigate the time-series consistency of the EFs used, in particular for 2002 and 2005, and, if necessary, recalculate the entire time series as recommended by the IPCC good practice guidance.	Please note that the IEF is t CO2 / t clinker, as in CRF the activity data is kt clinker produced. The question was further investigated, please see details in chapter 4.3.1 of the NIR.	4.3.1
	Ammonia production – CO2		
63.	The NIR states that some ammonia is produced from hydrogen which is produced in another chemical plant from natural gas, and that the resulting CO2 emissions are reported under the energy sector. In response to an allocation issue raised by the ERT, the Party informed the ERT that no hydrogen production occurs in Hungary. The ERT recommends that Hungary clarify, in the NIR of its next annual submission, that the hydrogen used in ammonia production is produced abroad and, therefore, no hydrogen production emissions are reported.	Unfortunately no consistent and verifiable data have yet been found whether hydrogen production is occurring at all. If yes, further investigation is needed if it causes process emissions not reported in Energy sector or it is already included in Refinery processes, etc. As none of the Guidebooks contain methods or EFs for hydrogen production process emissions, it is also needed to find which type of process is used in order to find appropriate stochiometric equation. In addition we have yet discovered only one country reporting process emissions from hydrogen production. NIR chapter will be updated as soon as possible.	4.4.1
	Nitric acid production – CO2		
64.	The ERT observed that the value of the N2O IEFs for 2008 and 2009 was 0.000042 and 0.00011 t N2O/t nitric acid, which is equivalent to about 0.3 per cent and 0.8 per cent, respectively, of the unabated EF of 0.0137 t/t for 2004. Thus, the value of the IEF is very low when compared to the reduction efficiency resulting from the abatement technology, as reported in the IPCC good practice guidance and the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the 2006 IPCC Guidelines) and compared to other reporting Parties (the 2009 IEF value is lower by a factor of 10 compared to the lowest value of other reporting Parties). During the review, Hungary described how this low IEF was	Relevant NIR chapter is updated.	4.4.2

	technically achieved and explained that the abated emissions are monitored continuously after the installation of the catalyst, also in periods with interruptions. The ERT concluded that the reported emissions are correct and that there is no underestimation. Although nitric acid production is a very small category since 2008, the ERT recommends that Hungary report a summary of the information provided to the ERT during the review in the NIR of its next annual submission.		
	Consumption of halocarbons and SF6 – HFCs		
65.	In the subcategory refrigeration and air-conditioning equipment, the ERT observed that Hungary has reported zero HFC emissions from the manufacture of domestic refrigerators, in contrast to the default product manufacturing factor (PMF) values of 0.2 to 1 per cent of the initial charge referred to as the EF for initial emissions in the IPCC good practice guidance and the values of between 0.6 and 3 per cent of the initial charge reported by other reporting Parties. The Party has also reported product life factor (PLF) values for HFC emissions of 100 per cent. During the review, Hungary confirmed that, during the manufacture of refrigerators, the filling of the refrigerators is performed in a closed system and, therefore, it is assumed that no manufacturing emissions occur, except for some potential small handling emissions. The ERT recommends that Hungary check whether any other losses occur at the manufacturer and, if so, use a country-specific PMF value or a value from the IPCC good practice guidance and/or a value from a country with similar circumstances.	In 2012 submission recalculation was made in subsector 2.F.1.1 Refrigeration and air-conditioning due to inclusion of PMF.	4.8.3.1
66.	With regard to the unrealistic PLF values used for HFC emissions from domestic refrigeration of 100 per cent, the Party informed the ERT that no stock information on HFC emissions is available. The ERT recommends that Hungary estimate the stock for the large subcategory commercial refrigeration by calculating the PLF values as the number of appliances in use times the average amount contained per appliance and report those values in the NIR, in order to facilitate comparison with other reporting Parties and for domestic verification. In addition, the ERT observed that no HFC emissions data were reported in the CRF tables for other refrigeration subcategories, which is not consistent with the information provided in the NIR. During the review, Hungary confirmed that it has estimated emissions from commercial, industrial and transport refrigeration, and mobile airconditioning, as also suggested by the information provided in the NIR, but has not reported them in the CRF tables under these subcategories. The ERT recommends that Hungary use the notation key “IE” for the refrigeration subcategories in CRF table 2(II).F, where applicable, and explain where these emissions have been included. In addition, the ERT recommends that the Party use the notation key “IE” instead of “NO” for these subcategories, when the subcategories have been calculated in a more aggregated way than the subcategories defined in the CRF tables or when the	The item (100%) included in the column of PLF is also explained in the NIR chapter 4.8.3.1 and in the cell comments in CRF tables. Hungary reports all subcategories within 2.F.1. in and aggregated manner under 2.F.1.1. Other subcategories are included in CRF table using the notation key:IE.	4.8.3.1

	subcategories have been reported elsewhere.		
67.	The ERT observed that CRF table summary 3 only reports the use of a tier 1 method for the category consumption of halocarbons and SF6, but that Hungary actually uses a tier 2a method for the subcategory refrigeration and air-conditioning equipment. The ERT recommends that Hungary include, in the NIR, precise information on the methodological tiers used for its estimates per subcategory, as well as in the CRF table summary 3.	Notation key of the method used in sector 2.F.1 Refrigeration and air-conditioning is corrected.	4.8.3.1
	Other– CO2		
68.	Hungary has reported in the CRF tables 2(I) and 2(I).A-G CO2 emissions from ethylene production under other (chemical industry) as “NO”, while stating in section 4.9 of the NIR (on the category “other”) that, for example, the natural gas used as feedstock in ammonia and nitric acid production, and ethylene and carbon black manufacturing is not reported in order to avoid the double counting of emissions as they are reported in the energy sector. The ERT recommends that Hungary correct the notation key to “IE” in CRF table 2(I).A-G, where applicable, for the relevant categories and improve the information provided on this subject in the NIR of its next annual submission.	Notation key is corrected to IE (to 2.G - Feedstcks) in the case of CO2 emissions from ethylene production. However it is worth to mention that ethylene is mainly produced from refinery products (e.g.naphta) in Hungary instead of Natural gas. Anyway it is reported in 2.G sector. NIR chapter 4.9 and 4.4.4 is updated accordingly.	4.9 and 4.4.4.
	3. Non-key categories		
	Other (mineral products) – CO2		
69.	The ERT observed that the values of the CO2 IEFs for 2008 and 2009 of 0.14 and 0.13 t CO2/t glass production, respectively, were 14.6 per cent and 18.3 per cent lower than the fixed country-specific values of 1.64 t/t used for 2005 and previous years. In response to the recommendation from a previous review report, Hungary has made a comparison of the EU ETS data for the CO2 emissions for 2006 and subsequent years, which were based on the amount of carbonate used, and the CO2 emissions for the same years calculated using the old country-specific EF and glass production figures. In the NIR, Hungary concluded that the CO2 emissions from the EU ETS data were higher in 2006 and 2007 by 10.6 per cent and 6.1 per cent, respectively, but lower in 2008 and 2009, by 14.4 per cent and 18.2 per cent, respectively. The lower value was due to the new data logging methodology of the Hungarian Central Statistical Office (i.e. the emission estimates were calculated using sales figures). From the additional information provided by the Party during the review, the ERT concludes that the AD for glass production in kt for 2008 and 2009 are not available but have been derived using glass sales data as a proxy instead of actual glass production data, which introduces a considerable uncertainty into the AD and thus into the IEF, which may explain the difference in the CO2 emissions from this category for 2008 and 2009 compared with previous years, as reported in table 4.5 in the NIR. The ERT also concludes that the large uncertainty	Recommendation is included in NIR chapter 4.3.4.2.	4.3.4.2

	in the AD expressed as glass production does not affect the accuracy of the reported emissions for 2008 and 2009 since these were determined using the amount of carbonate used for glass production as AD, and that the time series 2005–2009 can therefore be considered as consistent. However, the ERT recommends that Hungary more clearly report in the NIR that the AD in the CRF table 2(I).A-G for 2008 onwards are proxy data only and, thus, the IEFs are not comparable with those of previous years.		
	Consumption of halocarbons and SF6 – SF6		
70.	During the review, Hungary informed the ERT that it had not implemented the recommendation in the previous review report regarding the inclusion of specific information on potential SF6 emissions from electrical equipment estimated with data from an import/export balance and on actual SF6 emissions estimated with data from the energy distribution company on SF6 use for filling in new equipment or refilling old equipment, as the 2010 draft review report was received one month after the submission deadline of 15 April 2011. Considering these circumstances, the ERT reiterates the recommendation that Hungary include this specific information in the NIR of its next annual submission.	Tables of actual and potential emissions to SF6 are included in NIR as well as recalculations due to this years comprehensive checking.	4.8.3.5, 4.8.3.6 and 4.8.6
	Solvent and other product use – N2O		
71.	During the review, Hungary informed the ERT that data on N2O use is obtained from the manufacturers; however, no data on imported products are available. The ERT recommends that the Party check and collect appropriate data and report the results in the NIR of its next annual submission, including N2O emissions from imported products, if applicable.	Results will be included in the case import and export data becomes available. However it is a very intricate task as this data is not collected by the Statistical Office.	5.3
	D. 4. Agriculture		
73.	All relevant sector categories have been estimated, with the exception of emissions from prescribed burning of savannas and field burning of agriculture residues. These activities are reported as not occurring in the NIR; however, in the CRF table 4.E, Hungary has used the notation key “NA” instead of “NO”. The ERT recommends that the Party use the correct notation key “NO” consistently in its next annual submission.	Notation keys have been in the CRF submission for 2012.	Chapter 6.6.5
75.	In the 2011 submission, QC procedures have been undertaken for the agriculture sector, including: a check for transcription errors; a check of the reasons for data gaps; cross-checks across the subcategories; checks of country-specific EFs with the values reported by other Parties; a comparison of the applied country-specific methodologies with the default methods provided by the IPCC; and a comparison of the calculation sheets with the CRF tables for transcription errors. All findings were summarized in a special QC report (“Agricultural CH4 and N2O emissions in Hungary QC report”) that was provided to the ERT during the review. The ERT	As a result of the annual QC procedure some inconsistencies revealed in the time-series of the activity data and recalculations were needed to eliminate these inconsistencies. The QC findings are reported together with the resulted recalculations.	Chapter 6.1.6.

	welcomes the efforts of Hungary and recommends that the Party include the findings and some of the plans outlined in the QC report in the NIR of its next annual submission, as well more information about the QA procedures.		
	4. A Enteric fermentation – CH4		
78.	As indicated in the previous review report, there are some differences between the methods used for the development of country-specific EFs and the ones recommended by the IPCC. As a result, the gross energy (GE) intake of dairy cattle continues to be the highest among all reporting Parties (346.98 MJ/head/day, where the second highest is343.21 MJ/head/day for Denmark). In response to the recommendations in the previous review report, Hungary has provided more detailed information related to the GE intake; however, country-specific conversion factors (net energy (NE)/GE) representing the Hungarian circumstances are not available and a Swiss factor continues to be used. During the review, the Party indicated that the development of a country-specific conversion factor is ongoing, and, although there are some differences between Hungarian and Swiss cattle husbandry, the nutrition of the high-yield cows tends to be similar; therefore, the ERT considers that the Swiss conversion factor is applicable to the Hungarian circumstances. Hungary also indicated that it plans to revise the calculation method used to derive the country-specific EFs for dairy cattle and non-dairy cattle. The ERT welcomes the efforts of Hungary and encourages the Party to report on these issues in its next annual submission.	The GE intake for Dairy-Cattles has been revised and recalculated according to the revised milk yield data and new, country-specific fat content and protein content of milk data. The NIR has been supplemented with the input and output data of the WINLP (Hungarian nutrition optimization software) runs.	Chapter 6.2.2.3
79.	During the review, Hungary also explained further the expert judgement used for the estimation of the dairy cattle average body mass and the use of the Italian EF for rabbits (0.08 kg CH4/head/year), which is also used for CH4 emissions from manure management. The explanation provided by the Party helps to increase the transparency of the NIR. The ERT, therefore, recommends that Hungary include such explanations in the NIR of its next annual submission.	The NIR were supplemented with the required additional information to increase the transparency.	Chapter 6.2.2.3
	4. B Manure management – CH4 and N2O		
80.	Hungary indicated in the NIR that it plans to revise the country-specific CH4 and N2O EFs for dairy cattle, non-dairy cattle and poultry for manure management. The ERT welcomes this plan and recommends that, when applying the plan, the Party give special attention to the VS values and the amount of N excreted by the livestock for animals with a major share in the emissions (i.e. dairy cattle, non-dairy cattle and swine).	For the 2012 submission VS for dairy and non-dairy cattle and poultry have been revised, which resulted in changes of the emission factors for CH_4 emissions from manure management. The N-excretion rates have also been revised for cattle and swine for the 2012 submission.	Chapter 6.3.5
81.	For poultry, the recalculation of the entire time series was calculated based on the overall VS weighted mean of the default values provided by the 2006 IPCC Guidelines. This method was used because a QC procedure revealed that the VS values for poultry used in the 2010 submission were approximately one seventh of	VS for poultry has been revised for the 2012 submission.	Chapter 6.3.5

	the IPCC default values. Further research has been initiated to establish a country-specific VS value. The ERT agrees with the recalculations made and encourages Hungary to update the VS values as soon as possible.		
82.	The description of the animal waste management systems (AWMS) in the NIR, in particular “pit storage < 1 month” and “pit storage > 1 month”, continues to be not transparent. During the review, the Party provided the ERT with additional information on this issue that helped to understand the country’s AWMS. The ERT recommends that Hungary present this information in its next annual submission. In the previous review report, the ERT also recommended that the Party provide more information on AWMS in the documentation box of CRF table 4.B(a). However, during the review, the ERT was informed that Hungary had not received the 2010 review report at the time of the preparation of the 2011 submission. The ERT reiterates the recommendation in the previous review report that the Party improve the transparency of the description of the AWMS.	The allocation was revised in accordance with the ERT recommendation in the CRF submission for 2012. For the MCF for swine the weighted average of the MCFs suggested by the GPG (IPCC, 2000) are reported.	Chapter 6.3.2
83.	In the NIR and during the review, Hungary informed the ERT that it plans to revise the AWMS distribution based on the General Agricultural Survey 2010. During the review, the Party also informed the ERT that, since the document had not yet been published by the Hungarian Central Statistical Office, the new results will be included in the next GHG inventory depending on the date of publication of the new results (probably at the beginning of 2012). The ERT welcomes Hungary’s plan and encourages the Party to provide this information in future annual submissions as soon as it become available.	Revision of the animal waste management system (AWMS) distribution data, which was planned for 2011 could not be performed, because of the preliminary data of the General Agriculture Census, 2010 provided by the HCSO were not detailed enough for the purpose of GHG inventory. (All animal manure was reported altogether by AWMS. The manure of different animal species could not be separated.) The HMS has initiated the reprocessing of the data by the HCSO. The revision of the AWMS distribution data will be undertaken as the reprocessed data will be available, probably for the 2013 submission.	Chapter 6.1.6
	4. D Direct and indirect emissions from agricultural soils – N2O		
86.	The NIR states that planned improvements to this category include the elaboration of country-specific Nex rates for all livestock categories and the development of country-specific parameters for residue to crop product mass ratios and N fractions for sunflower and rape, since the IPCC good practice guidance does not provide default parameters for the estimation of emissions from the crop residues of these plants. The ERT welcomes this plan and encourages the Party to provide these information in future annual submissions as soon as it becomes available.	Research project on the development of country specific parameters for the estimation of N-input from crop residues of oilseed rape and sunflower has finished. The new parameters have been applied in the 2012 submission.	Chapter 6.5.2
	E. 5. Land use, land-use change and forestry		

	Sector overview		
92.	Since the impacts of the recalculations performed for many categories are relatively significant, the ERT recommends that Hungary include, in its next NIR, quantifications of the changes on a more disaggregated level (i.e. on the level at which the recalculations were made, especially for the base year and for the latest year of the inventory, but also for intermediate years, if necessary), in order to improve the transparency of the recalculations.	Quantifications of the changes have been included on the level of land-use categories, or on the level of carbon-stocks in NIR 2012.	Chapters 7.3.6 7.4.5 7.5.5 7.12
93.	The ERT commends the Party for its efforts in reducing the number of categories reported using notation keys. During the review, Hungary explained to the ERT the rationale for using notation keys for certain categories. The ERT encourages Hungary to further improve the description in the NIR of its use of notation keys.	The number of categories reported using notation keys has been reduced in the CRF submission for 2012. Additional information on categories reported using notation key 'NE' is provided in NIR 2012.	Chapter 7.1.2 & Annex 5
94.	Even though the ERT noted considerable improvements in the NIR, several mandatory categories (including DOM and the soil organic carbon stock for forest land remaining forest land and land converted to forest land (see also paras. 101 and 104 below) are still reported as "NE". Therefore, the ERT concludes that the reporting of the LULUCF sector is partially complete. The ERT recommends that Hungary continue its work to improve the reporting on the stock changes in carbon pools for mandatory land-use categories.	Hungary demonstrates that the DOM and soil pools are not a source for the aggregated forest area (i.e., AR, FM and L-FL, FL-FL). See chapter 11.3.1.2 in NIR for details. "NE" is reported in CRF.	Chapter 11.3.1.2
95.	The ERT noted that Hungary has reported the carbon stock changes in organic soils as "NO". According to the NIR, organic soils in Hungary are not cultivated. During the review, the Party provided some information on the amount of organic soils in forest land, which is relatively small (about 0.5 per cent). The ERT encourages Hungary to estimate the relative proportion of organic soils, to further explore the importance of carbon stock changes in organic soils for the mandatory reporting categories (i.e. forest land, cropland and grassland) and to report the carbon stock changes in organic soils separately in its next annual submission.	A small project started to derive a methodology to sampling possible organic soils (marshes) under forests areas. Until 2014 we may have some data on whether these marshes (approx. 9500 ha) could be regarded as organic soils by GL (Annex 3. A.5, p. 3.37) definitions.	Chapter 7.3.7
96.	Some of the carbon stock change statistics (e.g. perennial croplands such as vineyards and orchards) for living biomass in cropland converted to settlements and cropland converted to other land are available only in aggregated form and are, therefore, reported under cropland remaining cropland. During the review, the ERT suggested that Hungary use the standing stock per area to allocate the carbon stock changes to the relevant land use and land-use change categories. In its response, Hungary informed the ERT that the improvement plan for the LULUCF sector contains the development of the estimation methods for cropland, grassland and settlements (including the separate estimation of emissions from perennials on cropland in the appropriate land-use conversion category). Hungary also explained that the improvements would be implemented following the official approval of the improvement plan. The ERT welcomes this information and encourages the Party to	The allocation has been revised in the CRF submission for 2012. The emissions have been reported according to the appropriate land-use categories.	Chapter 7.12

	implement the improvement plan in its next annual submission.		
97.	In the NIR (page 171), Hungary has reported the area and related emissions and removals from soils from forest land converted to other land uses from 1985 to 2009. These aggregated emissions and removals, as well as the emissions and removals associated with grassland converted to other land uses, should be reported under information items in CRF table 5, where Hungary currently reports these emissions and removals as "NE", citing a lack of data. Since data are available for the changes in the carbon pools for many of the land conversion categories included in the aggregated categories as described above, the ERT recommends that Hungary calculate the corresponding data and emissions and include them under information items in CRF table 5 in its next annual submission.	These errors have been corrected in the CRF submission for 2012.	
98.	The ERT noted that uncertainty estimates have not been provided for all reported categories due to a lack of data. The ERT recommends that Hungary provide uncertainty estimates for all reported categories and gases as well as an aggregated uncertainty estimate for the entire LULUCF sector in its next annual submission.	The required information is now provided in NIR 2012.	Chapters 7.3.4 & 7.4.4, 7.5.4, 7.7.4 7.10 11.3.1.5
	Key categories		
	5.A.1 Forest land remaining forest land – CO2		
99.	Hungary has reported increases in the total forest area which are attributed to the fact that the forest inventory each year identifies additional forest areas (classified as "found forests") due to unregistered afforestation and the natural expansion of the forest area as explained in the NIR. The Party provided information during the review that clarified the issues related to the consistency of the description of land representation that were raised by the ERT during the review. The ERT encourages Hungary to further improve the description of its land representation and related issues in its next annual submission.	Since there is no evidence of the formal status of these forest before entering NFD (natural expansion of the forest area is unknown ab ovo; unregistered afforestations escaped from administration's perspective), the FF cannot be regarded as managed forest. Harvest statistics incorporate all harvest of Total Forest (TF), including FF, the estimation of non-CO2 emissions is a conservative approach in this way. Identified FF will be presented on map in the next annual submission.	Chapter 7.3
100.	As noted in previous review reports, the inter-annual fluctuations in the net removals reported by Hungary are relatively large, mainly with regard to the carbon stock changes reported for living biomass on forest land. In the NIR, the Party has provided detailed information on how the national forest inventory is conducted and on how the information is used to estimate the annual carbon stock changes for the inventory years and for the years between different inventory years. The ERT found this information useful and encourages Hungary to further explore possible reasons	 Removals of the L-FL were recalculated between 1985-2010 due to switching to the system of assuming the default 20 years lead-time. It made the L-FL graph pretty smooth. Since NR (net removals) of FL-FL calculated from NR of Total Forest minus NR of L-FL, that	Chapter 7.3.1.1

	for the inter-annual variations in net removals. For example, the Party could validate the carbon stock estimates predicted for the years between different inventory years using yield tables against interpolated data based on consecutive inventories. The ERT recommends that Hungary provide information on such efforts as well as justifications for the inter-annual fluctuations in the estimates in its next annual submission.	makes FL-FL smoother, too. Some variability may remain because of the changing annual harvest rates and other reasons.	
101.	Hungary has reported the net carbon stock changes in DOM and soils under forest land remaining forest land using the notation key "NE", arguing that it is possible to verify that these pools are not net sources. The ERT notes that demonstrating that a pool is not a net source as a reason for not reporting a carbon pool is an accounting possibility given in the reporting under the Kyoto Protocol. The UNFCCC reporting guidelines require complete reporting, including all sources and sinks from categories, consistent with the IPCC good practice guidance for LULUCF. The ERT, therefore, recommends that Hungary report estimates for these carbon pools in its next annual submission, or provide information in its NIR demonstrating that the net carbon stock change in DOM and soils can be assumed to be zero and, in that case, use the appropriate notation keys in the corresponding CRF table 5.A (see also paras. 94 above and 104 below).	Hungary demonstrates that the DOM and soil pools are not a source for the aggregated forest area (i.e., AR, FM and L-FL, FL-FL). See chapter 11.3.1.2 in NIR for details. "NE" is reported in CRF.	Chapter 11.3.1.2
	Non-key categories		
	5. A.2 Land converted to forest land – CO2		
102.	As in previous review reports, the ERT noted that the conversion period used by Hungary to estimate CO2 emissions and removals from land converted to forest land differs from the IPCC default time frame of 20 years for reporting land under a conversion state. The Party uses different time frames ranging from two to 14 years based on the species and other growth conditions of the forests. The ERT acknowledges that a different time frame can be used based on national circumstances; however, it believes that Hungary has not transparently described how the long-term dynamics in carbon pools are taken into account when using the country-specific time frames. The ERT, therefore, recommends that Hungary provide additional justification for using these time frames to estimate the carbon stock changes associated with land-use conversions, or report land-use conversions using the 20-year time frame consistent with the IPCC good practice guidance for LULUCF in its next annual submission.	Done. Removals of the L-FL were recalculated between 1985-2010 due to switching to the system of assuming the default 20 years lead-time.	Chapter 7.3.2.2
103.	Hungary has aggregated the reporting of all land-use conversion to forest land (and the related carbon stock changes) under cropland converted to forest land with the explanation that the former land use is not known. During the review, the Party provided information on the allocation of afforestation to different land-use categories (81 per cent occurs on cropland and on grassland). To increase the transparency and comparability of the reporting, the ERT recommends that Hungary	Done. L-FL reported separately by formal land-use category.	Chapter 7.3.2.

	report these land conversion categories separately in its next annual submission.		
104.	Hungary has reported the net carbon stock changes in DOM and soils under land converted to forest land using the notation key "NE", arguing that it is possible to verify that these pools are not net sources. The ERT notes that demonstrating that a pool is not a net source as a reason for not reporting a carbon pool is an accounting possibility given in the reporting under the Kyoto Protocol. The UNFCCC reporting guidelines require complete reporting, including all sources and sinks from categories, consistent with the IPCC good practice guidance for LULUCF. The ERT therefore recommends that Hungary report estimates for these carbon pools in its next annual submission, or provide information in its NIR demonstrating that the net carbon stock change in DOM and soils can be assumed to be zero and, in that case, use the appropriate notation keys in the corresponding CRF table 5.A (see also paras. 94 and 101 above).	Hungary demonstrates that the DOM and soil pools are not a source for the aggregated forest area (i.e., AR, FM and L-FL, FL-FL). See chapter 11.3.1.2 in NIR for details. "NE" is reported in CRF.	Chapter 11.3.1.2
	Direct N2O emissions from N fertilization of forest land and other – N2O		
105.	Direct N2O emissions from N fertilization of forest land are reported as "NO". According to the NIR, very little fertilization of forest soils occurs in Hungary (in very intensively managed poplar stands), and it is not possible to separate fertilization statistics for forestry. In response to questions raised by the ERT during the review, the Party confirmed that the amount of fertilizer used in forest land is included under the agriculture sector. The ERT therefore recommends that Hungary report the direct fertilization of forest land as "IE" in its next annual submission.	Done. CRF corrected, explanation included in comments.	Chapter 7.3.1.2.3
	CO2 emissions from agricultural liming – CO2		
106.	The ERT notes that the EF for dolomite used by Hungary to calculate the CO2 emissions from agricultural lime application on cropland is incorrect. The Party uses a value of 0.122 (as provided in the IPCC good practice guidance for LULUCF); however, based on the stoichiometric formula this value should be 0.13. The ERT recommends that Hungary use the correct EF and revise its estimates for this category in its next annual submission.	Emissions have been recalculated according to the ERT recommendation using the emission factor based on the stoichiometric formula of dolomite.	Chapter 7.4.2.2.2
	Biomass burning – CO2, CH4 and N2O		
107.	In its 2011 submission, Hungary has improved the reporting of biomass burning, which now also includes wildfires on cropland and grassland. In response to questions raised by the ERT during the review, Hungary provided information clarifying the assumptions used for the burned quantities of biomass and the allocation of the emissions in CRF table 5(V). The ERT encourages the Party to include such explanations in the NIR of its next annual submission, in order to make it consistent with the values reported in the CRF table 5(V).	Additional information has been provided in the NIR, 2012 to increase the transparency.	Chapter 7.9.4
	F. Waste		
	2. Key categories		

	Solid waste disposal on land – CH4		
111.	CH4 emissions from this category amounted to 2,990.24 Gg CO2 eq and were calculated by applying the waste model from the 2006 IPCC Guidelines, which is consistent with the tier 2 methodology provided in the IPCC good practice guidance. Hungary uses a weighted average value of the methane generation constant (k) of solid waste landfilled for its calculations. The ERT recommends that the Party revise its emission estimate by applying the waste composition k values instead of using the weighted average value. Also, the ERT reiterates the recommendation of the previous review reports that Hungary clarify the issues regarding unmanaged waste disposal sites, determine the representative composition data of solid wastes, and estimate the recovery of CH4 in a more complete manner in its next annual submission.	Currently, waste specific methane generation rate constants (k) are used which are documented in the supplemented Table 8.2.	8.2.2
	Wastewater handling – CH4		
112.	CH4 emissions from wastewater handling amounted to 475.82 Gg CO2 eq and were calculated by applying country-specific AD and EFs. For industrial wastewater, the CH4 IEF reported was constant (0.0325 kg/kg degradable organic component (DC)) until 1996 followed by fluctuations until 2002. The value of 0.01875 kg/kg DC was constant until 2007, followed by fluctuations in 2008 (0.0204 kg/kg DC) and 2009 (0.0196 kg/kg DC). During the review, Hungary explained that recalculations were performed for the period 2002–2006 and acknowledged the time-series inconsistency. The ERT recommends that the Party revise its CH4 emission estimates for the entire time series to ensure consistency. The ERT also reiterates the recommendation of the previous review report that Hungary continue its efforts to collect more information on sludge in wastewater handling.	CH4 emissions from industrial wastewater have been reestimated for the period 1985-2001 to ensure consistency in the time series. We started to collect information on sludge produced and its handling practices which are summarized in a new table.	10.6 8.3.2
	G. Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol		
	Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol		
	Overview		
119.	The ERT noted that the Convention and the Kyoto Protocol reporting are not completely comparable with regard to the total forest land area. This is not uncommon due to the different rules for the reporting of land-use changes. During the review, Hungary provided information which clarified the issues raised by the ERT. However, the ERT encourages the Party to further improve the information on the differences in land use reported under the Convention and under the Kyoto Protocol.	The total forest land area includes forest subcompartments that at least potentially are covered by trees, as well as unstocked areas like roads, openings, wildlife forage grounds, glades, buildings serving forest management purposes etc.). The area of forest land using this definition was 2,046.4 thousand ha by the end of 2010. Note that, before 2009 we only reported the stocked area (see below) under UNFCCC, however, beginning with 2010, we report the	See NIR 7.3.

		total land under forest management as forest land, and this area is reported in the land-use change matrix. Under KP we report the area of forest subcompartment in CRF for the more reasonable IEFs. The total area of all forest subcompartments (i.e. the potentially stocked area) amounted to 1,922.1 thousand ha in 2010. Differences in area doesn't affect emissions/removals, because they derived from the the same Total Forest (TF) stock change data both for KP & UNFCCC.	
120.	Hungary has reported the carbon stock changes for dead wood, litter and soil organic carbon for afforestation and reforestation, and forest management activities as "NE", but has provided information in the NIR demonstrating that these pools are not net sources. The ERT found the information useful when assessing the relevance of the exclusion of these pools. The approach to verify that the soil organic carbon pool is not a net source is based on the stratification of the forest land area according to land-use status and management practices. For each strata, different sources of information are used to assess whether the soil organic carbon pool is not a net source, including literature describing the measurements of carbon stocks and models/equations developed to calculate the carbon stocks in soils. However, for the soil organic carbon pool, Hungary has provided estimates for the different forest land strata and has used the sum of those estimates to justify that the soil organic carbon pool for afforestation and reforestation, and forest management is not a net source, although soils under forest management result in a small source. Since these activities are of a slightly different nature and are accounted for differently under the Kyoto Protocol, the ERT recommends that Hungary report the estimates and/or provide potential information in the NIR demonstrating that the soil organic carbon pool is not a net source for afforestation and reforestation, and forest management activities separately. If no evidence is available to justify the exclusion of the pool by activity, the ERT strongly recommends that the Party study and use approaches adopted by other reporting Parties and report the carbon stock changes in soils for afforestation and reforestation, and forest management in the next annual submission.	Hungary demonstrates that the DOM and soil pools are not a source for the aggregated forest area (i.e., AR, FM and L-FL, FL-FL). See chapter 11.3.1.2 in NIR for details. "NE" is reported in CRF.	11.3.1.2
121.	Hungary generally fulfils the requirements regarding the provision of information set out in paragraphs 5–9 of the annex to decision 15/CMP.1. Hungary follows the	AR, FM and D are separated areas. Each forest subcompartement belongs to only one category	11.2.2

	annotated NIR for the provision of supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol. However, information to justify that activities under Article 3, paragraph 4, of the Kyoto Protocol are not accounted for under Article 3, paragraph 3, activities, and information on the possible offset of afforestation, reforestation and deforestation debits is missing. The ERT recommends that Hungary provide this information in its next annual submission.	(from the above three). No double accounting occurs. See NIR 11.2.2 for detailed tracking of area.	
122.	In addition to the revised estimates provided during the review week (see para. 117 above), the ERT noted that Hungary made minor recalculations for deforestation in the inventory for 2008 in its 2011 annual submission. In the NIR, the Party refers to recalculations made to the LULUCF sector for the reporting under the Convention (chapter 7). However, since the reporting of the LULUCF sector under the Kyoto Protocol is not completely comparable to the reporting under the Convention, the ERT recommends that Hungary provide all the necessary information on the recalculations related to the KPLULUCF activities in the relevant section in chapter 11 of the NIR. Activities under Article 3, paragraph 3, of the Kyoto Protocol Afforestation and reforestation – CO_2	See para 127.	
125.	For afforestation and reforestation, Hungary has reported the dead wood, litter and soil organic carbon pools using the notation key "NE" and has provided relevant information to demonstrate that these pools are not a net source of emissions for afforestation and reforestation, and forest management activities. As noted in paragraph 120 above, the ERT strongly recommends that Hungary provide separate information for afforestation and reforestation, and forest management activities. The ERT further encourages the Party to improve the data and methods used to demonstrate that the soil organic carbon pool is not a net source. The ERT recommends that Hungary report the estimated carbon stock changes in soils for afforestation and reforestation in its next annual submission.	Hungary demonstrates that the DOM and soil pools are not a source for the aggregated forest area (i.e., AR, FM and L-FL, FL-FL - separately). See chapter 11.3.1.2 in NIR for details. "NE" is reported in CRF.	11.3.1.2
	Activities under Article 3, paragraph 4, of the Kyoto Protocol		
	Forest management – CO_2		
129.	Hungary applies a broad definition to identify land under forest management activities. The area under forest management is estimated based on the known area of forest land on 31 December 1989 (this area is equal to the total forest land area at that time). For subsequent years, the forest management area is estimated by subtracting the accumulated area of deforestation from the initial forest management area. No new land areas have been added to the forest management area, which means that "found forests" (see para. 99 above) are not included in the accounting under the Kyoto Protocol, nor are they included in the estimate of afforestation and reforestation. The ERT notes that this implies that the area of forest management is underestimated.	Since there is no evidence of the formal status of these forest before entering NFD (natural expansion of the forest area is unknown ab ovo; unregistered afforestations escaped from administration's perspective), the FF cannot be regarded as managed forest. Harvest statistics incorporate all harvest of Total Forest (TF), including FF, the estimation of non-CO_2 emissions is a conservative approach in this way.	7.3
130.	The derivation of the area of forest management is described in section 11.2.2 of	See para. 129.	7.3

	the NIR. However, the ERT believes that the transparency of the Convention reporting and the rationale for not including "found forests" in the forest management area can be further improved and encourages Hungary to do so in its next annual submission.		
131.	The methods and parameters used to estimate net removals in living biomass (above-ground and below-ground) for forest management are appropriate. Hungary has reported the soil, dead wood and litter pools as "NE" and has provided information to demonstrate that these pools are not a net source of emissions. The justification for omitting the dead wood and litter pools is appropriate, but the justification for omitting the soil organic carbon pool is provided only for the combined total of afforestation and reforestation, and forest management activities. For afforestation and reforestation (see paras. 120 and 125 above), the soil organic carbon pool is assumed not to be a net source. However, for forest management, the information provided by the Party does not prove that the pool is not a net source. In response to a question raised by the ERT during the review, Hungary agreed with the principle of the requirement to demonstrate that these pools are not a net source for each activity separately. However, the Party also reiterated that its approach to demonstrate that the soil organic carbon pool on forest management land is not a net source is conservative, and that the uncertainties related to the estimates are rather high. Taking into consideration the concerns raised by the Party, the ERT recommends that Hungary improve the information included in the NIR demonstrating that the soil organic carbon pool is not a net source for forest management activities, and include estimates of uncertainties associated with the emission estimates from this pool. If no evidence is available to prove that the soil organic carbon pool is not a net source, the ERT strongly recommends that Hungary report the carbon stock changes in soils for forest management in its next annual submission.	Hungary demonstrates that the DOM and soil pools are not a source for the aggregated forest area (i.e., AR, FM and L-FL, FL-FL - separately). See chapter 11.3.1.2 in NIR for details. "NE" is reported in CRF.	11.3.1.2

Annex 9 List of abbrevations and units

Abbrevations

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)
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)