ANNEXES TO THE NATIONAL INVENTORY REPORT

2008

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Annex 1 Key Categories

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

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).

This annex describes the key category analysis conducted for the 2008 Hungarian inventory. Good practice first requires that inventories be disaggregated into categories from which key sources and sinks may be identified. Adopting the detailed categorization of sources/sinks that is recommended by the European Union (see *Table A1-1*), analysis of key categories was conducted according to the Tier1 methodology described in the IPCC Good Practice Guidance. This approach identifies key categories 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 analysis are shown in *Table A1-3* and *Table A1-4*.

Since uncertainty estimates are not available for the LULUCF sector Tier 2 method was applied to find key categories only for source categories (without LULUCF) and for more aggregated categories, which were used in the previos submissions (see *Table A1-2*). 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 A1-5*, *Table A1-6.*

A1.2. Reference to the key source tables in the CRF

Table A1-1. *IPCC source/sink categories for Tier 1 key source analysis*

CRF code	sub-categories	IPCC Source/Sink Categories	Direct Greenhouse Gas
1A1a	li, so, ga, ot	Energy - Stationary Combustion - Public electricity and heat production	CO_2
1A1a	li, so, ga, ot, bi	Energy - Stationary Combustion - Public electricity and heat production	CH_4
1A1a	li, so, ga, ot, bi	Energy - Stationary Combustion - Public electricity and heat production	N_2O
1A1b	li, ga, ot	Energy - Stationary Combustion - Petroleum refining	CO_2
1A1b	li, ga, ot, bi	Energy - Stationary Combustion - Petroleum refining	CH_4
1A1b	li, ga, ot, bi	Energy - Stationary Combustion - Petroleum refining	N_2O
1A1c	li, so, ga	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CO_2
1A1c	li, so, ga, bi	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	CH_4
1A1c	li, so, ga, bi	Energy - Stationary Combustion - Manuf. of solid fuels and other energy industries	N_2O
1A2a	li, so, ga	Energy - Stationary Combustion - Iron and steel	CO_2
1A2a	l li, so, ga, bi	Energy - Stationary Combustion - Iron and steel	CH_4
1A2a	li, so, ga, bi	Energy - Stationary Combustion - Iron and steel	N_2O
1A2b	li, so, ga, ot	Energy - Stationary Combustion - Non-ferrous metals	CO_2
1A2b	li, so, ga, ot, bi	Energy - Stationary Combustion - Non-ferrous metals	CH_4
1A2b	li, so, ga, ot, bi	Energy - Stationary Combustion - Non-ferrous metals	N_2O
1A2c	li, so, ga	Energy - Stationary Combustion - Chemicals	CO_2
1A2c	li, so, ga, bi	Energy - Stationary Combustion - Chemicals	CH_4
1A2c	li, so, ga, bi	Energy - Stationary Combustion - Chemicals	N_2O
1A2d	li, so, ga	Energy - Stationary Combustion - Pulp, paper and print	CO_2
1A2d	li, so, ga, bi	Energy - Stationary Combustion - Pulp, paper and print	CH_4
1A2d	li, so, ga, bi	Energy - Stationary Combustion - Pulp, paper and print	N_2O
1A2e	li, so, ga	Energy - Stationary Combustion - Food processing, beverages and tobacco	CO_2
1A2e	li, so, ga, bi	Energy - Stationary Combustion - Food processing, beverages and tobacco	CH_4
1A2e	li, so, ga, bi	Energy - Stationary Combustion - Food processing, beverages and tobacco	N_2O
1A2f	li, so, ga, ot	Energy - Stationary Combustion - Other	CO_2
1A2f	li, so, ga, ot, bi	Energy - Stationary Combustion - Other	CH_4
1A2f	li, so, ga, ot, bi	Energy - Stationary Combustion - Other	N_2O
1A3a	lg, lk	Energy - Mobile combustion - Civil aviation	CO_2
1A3a	lg, lk	Energy - Mobile combustion - Civil aviation	CH_4
1A3a	lg, lk	Energy - Mobile combustion - Civil aviation	N_2O
1A3b	lg, ld, ll, gn	Energy - Mobile combustion - Road transportation	CO_2
1A3b	lg, ld, ll, gn, bi	Energy - Mobile combustion - Road transportation	CH_4
1A3b	lg, ld, ll, gn, bi	Energy - Mobile combustion - Road transportation	N_2O
1A3c	li, so, ga	Energy - Mobile combustion - Railways	CO_2
1A3c	li, so, ga	Energy - Mobile combustion - Railways	CH_4

Table A1-1. *IPCC source/sink categories for Tier 1 key source analysis*

CRF code	sub-categories	IPCC Source/Sink Categories	Direct Greenhouse Gas
1A3c	li, so, ga	Energy - Mobile combustion - Railways	N_2O
1A3d	lr, ld, lg, lu, sc	Energy - Mobile combustion - Navigation	CO_2
1A3d	lr, ld, lg, lu, sc	Energy - Mobile combustion - Navigation	CH_4
1A3d	lr, ld, lg, lu, sc	Energy - Mobile combustion - Navigation	N_2O
1A4a	li, so, ga	Energy - Stationary Combustion - Commercial/institutional	CO_2
1A4a	li, so, ga, bi	Energy - Stationary Combustion - Commercial/institutional	CH_4
1A4a	li, so, ga, bi	Energy - Stationary Combustion - Commercial/institutional	N_2O
1A4b	li, so, ga	Energy - Stationary Combustion - Residential	CO_2
1A4b	li, so, ga, bi	Energy - Stationary Combustion - Residential	CH_4
1A4b	li, so, ga, bi	Energy - Stationary Combustion - Residential	N_2O
1A4c	li, so, ga	Energy - Stationary Combustion - Agriculture/Forestry/Fisheries	CO_2
1A4c	li, so, ga, bi	Energy - Stationary Combustion - Agriculture/Forestry/Fisheries	CH_4
1A4c	li, so, ga, bi	Energy - Stationary Combustion - Agriculture/Forestry/Fisheries	N_2O
1B1a		Energy - Fugitive Emissions from Fuels - Solid Fuels	CO_2
1B1a		Energy - Fugitive Emissions from Fuels - Solid Fuels	CH_4
1B1a		Energy - Fugitive Emissions from Fuels - Solid Fuels	N_2O
1B2a		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2
1B2b		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2
1B2c		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2
1B2d		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CO_2
1B2a		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4
1B2b		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4
1B2c		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4
1B2d		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4
1B2a		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O
1B2b		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O
1B2c		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O
1B2d		Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	N_2O
2A1		Industrial Processes - Mineral Products - Cement production	CO_2
2A2		Industrial Processes - Mineral Products - Lime production	CO_2
2A3		Industrial Processes - Mineral Products - Limestone and dolomit use	CO_2
2A5		Industrial Processes - Mineral Products - Asphalt roofing	CO_2
2A6		Industrial Processes - Mineral Products - Road paving with asphalt	CO_2
2A7		Industrial Processes - Mineral Products - Other	CO_2
2A7		Industrial Processes - Mineral Products - Other	CH_4
2A7		Industrial Processes - Mineral Products - Other	N_2O
2B1		Industrial Processes - Chemical Industry - Ammonia production	CO_2
2B1		Industrial Processes - Chemical Industry - Ammonia production	CH_4

Table A1-1. *IPCC source/sink categories for Tier 1 key source analysis*

CRF code	sub-categories	IPCC Source/Sink Categories	Direct Greenhouse Gas
2B1		Industrial Processes - Chemical Industry - Ammonia production	N_2O
2B2		Industrial Processes - Chemical Industry - Nitric acid production	CO_2
2B2		Industrial Processes - Chemical Industry - Nitric acid production	N_2O
2B5		Industrial Processes - Chemical Industry - Other	CO_2
2B5		Industrial Processes - Chemical Industry - Other	CH_4
2B5		Industrial Processes - Chemical Industry - Other	N_2O
2C1		Industrial Processes - Metal Production - Iron and steel production	CO_2
2C1		Industrial Processes - Metal Production - Iron and steel production	CH_4
2C2		Industrial Processes - Metal Production - Ferroalloys production	CO_2
2C2		Industrial Processes - Metal Production - Ferroalloys production	CH_4
2C3		Industrial Processes - Metal Production - Aluminium production	CO_2
2C3		Industrial Processes - Metal Production - Aluminium production	CH_4
2C4		Industrial Processes - Metal Production - Aluminium production	PFCs
2D		Industrial Processes - Other Production	CO_2
2E		Industrial Processes - Production of Halocarbons and SF6	HFCs
2E		Industrial Processes - Production of Halocarbons and SF6	PFCs
2E		Industrial Processes - Production of Halocarbons and SF6	SF_6
2Fa1		Industrial Processes - Consumption of Halocarbons and SF6 - Refrigeration and iar conditioning equipment	HFCs
2Fa1		Industrial Processes - Consumption of Halocarbons and SF6 - Refrigeration and iar conditioning equipment	PFCs
2Fa1		Industrial Processes - Consumption of Halocarbons and SF6 - Refrigeration and iar conditioning equipment	SF_6
2Fa2		Industrial Processes - Consumption of Halocarbons and SF6 - Foam blowing	HFCs
2Fa2		Industrial Processes - Consumption of Halocarbons and SF6 - Foam blowing	PFCs
2Fa2		Industrial Processes - Consumption of Halocarbons and SF6 - Foam blowing	SF_6
2Fa4		Industrial Processes - Consumption of Halocarbons and SF6 - Aerosols	HFCs
2Fa4		Industrial Processes - Consumption of Halocarbons and SF6 - Aerosols	PFCs
2Fa4		Industrial Processes - Consumption of Halocarbons and SF6 - Aerosols	SF_6
2Fa8		Industrial Processes - Consumption of Halocarbons and SF6 - Electrical equipment	HFCs
2Fa8		Industrial Processes - Consumption of Halocarbons and SF6 - Electrical equipment	PFCs
2Fa8		Industrial Processes - Consumption of Halocarbons and SF6 - Electrical equipment	SF_6
2Fa9		Industrial Processes - Consumption of Halocarbons and SF6 - Other	HFCs
2Fa9		Industrial Processes - Consumption of Halocarbons and SF6 - Other	PFCs
2Fa9		Industrial Processes - Consumption of Halocarbons and SF6 - Other	SF_6
2G1		Industrial Processes - Feedstocks	CO_2
2G2		Industrial Processes - Non-energy use of fuels	CO_2
3a		Solvent and Other Product Use - Paint Application	CO_2

Table A1-1. *IPCC source/sink categories for Tier 1 key source analysis*

CRF code	sub-categories	IPCC Source/Sink Categories	Direct Greenhouse Gas
3b		Solvent and Other Product Use - Degreasing and Dry Cleaning	CO_2
3d		Solvent and Other Product Use - Other	N_2O
4A1	ca	Agriculture - Enteric Fermentation	CH_4
4A2	bu	Agriculture - Enteric Fermentation	CH_4
4A3	sh	Agriculture - Enteric Fermentation	CH_4
4A4	ot	Agriculture - Enteric Fermentation	CH_4
4A	ot	Agriculture - Enteric Fermentation	CH_4
4B1	ca	Agriculture - Manure Management	CH_4
4B2	bu	Agriculture - Manure Management	CH_4
4B3	sh	Agriculture - Manure Management	CH_4
4B4	ot	Agriculture - Manure Management	CH_4
4B8	sw	Agriculture - Manure Management	CH_4
4B13	so	Agriculture - Manure Management	CH_4
4B	ot	Agriculture - Manure Management	CH_4
4B1	ca	Agriculture - Manure Management	N_2O
4B2	bu	Agriculture - Manure Management	N_2O
4B3	sh	Agriculture - Manure Management	N_2O
4B4	ot	Agriculture - Manure Management	N_2O
4B8	sw	Agriculture - Manure Management	N_2O
4B13	so	Agriculture - Manure Management	N_2O
4B	ot	Agriculture - Manure Management	N_2O
4C		Agriculture - Rice Cultivation	CH_4
4D1		Agriculture - Agricultural Soils - Direct soil emissions	CH_4
4D1		Agriculture - Agricultural Soils - Direct soil emissions	N_2O
4D2		Agriculture - Agricultural Soils - Pasture, range and paddock manure	N_2O
4D3		Agriculture - Agricultural Soils - Indirect emissions	CH_4
4D3		Agriculture - Agricultural Soils - Indirect emissions	N_2O
4F		Agriculture - Field Burning of Agricultural Residues	CH_4
4F		Agriculture - Field Burning of Agricultural Residues	N_2O
5A1		Land Use, Land-Use Change and Forestry - Forest Land - remaining	CO_2
5A1		Land Use, Land-Use Change and Forestry - Forest Land - remaining	CH_4
5A1		Land Use, Land-Use Change and Forestry - Forest Land - remaining	N_2O
5A2		Land Use, Land-Use Change and Forestry - Forest Land - converted to	CO_2
5A2		Land Use, Land-Use Change and Forestry - Forest Land - converted to	CH_4
5A2		Land Use, Land-Use Change and Forestry - Forest Land - converted to	N_2O
5B1		Land Use, Land-Use Change and Forestry - Cropland - remaining	CO_2
5B1		Land Use, Land-Use Change and Forestry - Cropland - remaining	CH_4
5B1		Land Use, Land-Use Change and Forestry - Cropland - remaining	N_2O

Table A1-1. *IPCC source/sink categories for Tier 1 key source analysis*

CRF code	sub-categories	IPCC Source/Sink Categories	Direct Greenhouse Gas
5B2		Land Use, Land-Use Change and Forestry - Cropland - converted to	CO_2
5B2		Land Use, Land-Use Change and Forestry - Cropland - converted to	CH_4
5B2		Land Use, Land-Use Change and Forestry - Cropland - converted to	N_2O
5C1		Land Use, Land-Use Change and Forestry - Grassland remaining Grassland	CO_2
5C2		Land Use, Land-Use Change and Forestry - Land converted to Grassland	CO_2
5E2		Land Use, Land-Use Change and Forestry - Land converted to Settlements	CO_2
5F2		Land Use, Land-Use Change and Forestry - Land converted to Other Land	CO_2
6A		Waste - Solid Waste Disposal on Land	CO_2
6A		Waste - Solid Waste Disposal on Land	CH_4
6B1		Waste - Waste-water Handling - Industrial	CH_4
6B2		Waste - Waste-water Handling - Domestic and Commercial	CH_4
6B1		Waste - Waste-water Handling - Industrial	N_2O
6B2		Waste - Waste-water Handling - Domestic and Commercial	N_2O
6C		Waste - Waste Incineration	CO_2
6C		Waste - Waste Incineration	CH_4
6C		Waste - Waste Incineration	N_2O

Abbrevations in this table:

li – liquid fuels
so – solid fuels/category
ga – gaseous fuels
ot – other fuels/category
bi – biomass
lr – liquid fuels, residual fuel oil
ld – liquid fuel, diesel oil
lg – liquid fuel, gasoline
lu – liquid fuel, lubricants
sc – solid fuel, coal
lk – liquid fuel, kerosene
ll – liquid fuel, LPG
gn – gaseous fuel, natural gas
ca – cattle
bu –buffalo
sh – sheep
sw – swine

***Table A1-2.** IPCC source/sink categories for Tier 2 key source analysis*

CRF code	IPCC Source/Sink Categories	Direct Greenhouse Gas
1. A	Stationary Combustion - Gas	CO_2
1. A	Stationary Combustion - Coal	CO_2
1. A	Stationary Combustion - Oil	CO_2
1. A	Non-CO_2 Emission from Stationary Fuel Combustion	N_2O
1. A	Non-CO_2 Emission from Stationary Fuel Combustion	CH_4
1. A	Stationary Combustion - Other Fuel	CO_2
1. A. 3	Mobile Combustion	N_2O
1. A. 3	Mobile Combustion - Other	CO_2
1. A. 3	Mobile Combustion	CH_4
1. A. 3. B	Mobile Combustion - Road Vehicles	CO_2
1. B. 1	Fugitive Emissions from Coal Mining and Handling	CH_4
1. B. 1	Fugitive Emissions from Coal Mining and Handling	CO_2
1. B. 2	Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH_4
1. B. 2	Fugitive Emissions from Oil and Gas Operations	CO_2
1. B. 2	Fugitive Emissions from Oil and Gas Operations	N_2O
2.	N_2O Emission from Industry	N_2O
2.	CH_4 Emission from Industry	CH_4
2. A. 1	CO_2 Emissions from Cement Production	CO_2
2. A. 2	CO_2 Emissions from Lime Production	CO_2
2. A. 3	CO_2 Emission from Limestone and Dolomit Use	CO_2
2. A. 7	CO_2 Emission from Other Mineral Products	CO_2
2. B. 1	CO_2 Emissions from Ammonia Processes	CO_2
2. B. 2	CO_2 Emissions from Nitric Acid Production	CO_2
2. C	CO_2 Emissions from Metal Production	CO_2
2. C. 3	PFCs Emissions from Industry	PFCs
2. F	Emissions from HFCs consumption	HFCs
2. F. 7	SF_6 Emissions from Electrical Equipment	SF_6
2. G	Feedstocks and non-energy use of fuels	CO_2
3.	N_2O Emission from Solvent and Other Product Use	N_2O
3.	CO_2 Emission from Solvent and Other Product Use	CO_2
4. A	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4
4. B	CH_4 Emissions from Manure Management	CH_4
4. B	N_2O Emissions from Manure Management	N_2O
4. C	CH_4 Emission from Rice Cultivation	CH_4
4. D. 1	Direct N_2O Emissions from Agricultural Soils	N_2O
4. D. 2	Pasture, Range and Paddock Manure	N_2O

Table A1-2. *IPCC source/sink categories for Tier 2 key source analysis*

CRF code	IPCC Source/Sink Categories	Direct Greenhouse Gas
4. D. 3	Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O
4. F	Field Burning of Agricultural Residues	N_2O
4. F	Field Burning of Agricultural Residues	CH_4
6. A	CH_4 Emissions from Solid Waste Disposal Sites	CH_4
6. B	Emissions from Wastewater Handling	CH_4
6. B	Emissions from Wastewater Handling	N_2O
6. C	Non-biogenic CO_2 from Waste	CO_2
6. C	Emissions from Waste Incineration	CH_4
6. C	Emissions from Waste Incineration	N_2O

A1.3. Results of the key category analysis

Table A1-3. *Key Categories with LULUCF, Tier 1 Level Assessment*

CRF Code + subcat.	IPCC Categories	Direct Greenhouse Gas	Current Year (2008) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment	Cumulative Total
1A1aga	Energy - Stationary Combustion - Public electricity and heat production	CO_2	8 620.71	8620.71	0.1098	0.1098
1A1aso	Energy - Stationary Combustion - Public electricity and heat production	CO_2	8 495.91	8495.91	0.1082	0.2180
1A4bga	Energy - Stationary Combustion - Residential	CO_2	7 983.95	7983.95	0.1017	0.3197
1A3bld	Energy - Mobile combustion - Road transportation	CO_2	7 764.46	7764.46	0.0989	0.4186
1A3blg	Energy - Mobile combustion - Road transportation	CO_2	4 414.87	4414.87	0.0562	0.4748
5A1	Land Use, Land-Use Change and Forestry - Forest Land - remaining	CO_2	-4 039.07	4039.07	0.0514	0.5262
1A4aga	Energy - Stationary Combustion - Commercial/institutional	CO_2	3 367.48	3367.48	0.0429	0.5691
4D1	Agriculture - Agricultural Soils - Direct soil emissions	N_2O	10.14	3141.92	0.0400	0.6092
6A	Waste - Solid Waste Disposal on Land	CH_4	143.88	3021.39	0.0385	0.6476
1A2aso	Energy - Stationary Combustion - Iron and steel	CO_2	2 367.66	2367.66	0.0302	0.6778
4D3	Agriculture - Agricultural Soils - Indirect emissions	N_2O	6.05	1875.82	0.0239	0.7017
1B2b	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	70.82	1487.29	0.0189	0.7206
1A2fga	Energy - Stationary Combustion - Other	CO_2	1 357.00	1357.00	0.0173	0.7379
4A1ca	Agriculture - Enteric Fermentation	CH_4	60.05	1261.04	0.0161	0.7540
2A1	Industrial Processes - Mineral Products - Cement production	CO_2	1 260.65	1260.65	0.0161	0.7700
1A1bli	Energy - Stationary Combustion - Petroleum refining	CO_2	919.21	919.21	0.0117	0.7817
4B13so	Agriculture - Manure Management	N_2O	2.93	909.82	0.0116	0.7933
2G1	Industrial Processes - Feedstocks	CO_2	855.36	855.36	0.0109	0.8042
4B8sw	Agriculture - Manure Management	CH_4	39.80	835.90	0.0106	0.8149
1A4cli	Energy - Stationary Combustion - Agriculture/Forestry/Fisheries	CO_2	789.51	789.51	0.0101	0.8249
1A2cga	Energy - Stationary Combustion - Chemicals	CO_2	689.64	689.64	0.0088	0.8337

Table A1-3. *Key Categories with LULUCF, Tier 1 Level Assessment*

CRF Code + subcat.	IPCC Categories	Direct Greenhouse Gas	Current Year (2008) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment	Cumulative Total
2Fa1	Industrial Processes - Consumption of Halocarbons and SF_6 - Refrigeration and iar conditioning equipment	HFCs	687.57	687.57	0.0088	0.8425
1A4bso	Energy - Stationary Combustion - Residential	CO_2	667.41	667.41	0.0085	0.8510
1A2fli	Energy - Stationary Combustion - Other	CO_2	564.49	564.49	0.0072	0.8581
1A2ega	Energy - Stationary Combustion - Food processing, beverages and tobacco	CO_2	560.87	560.87	0.0071	0.8653
1A2fso	Energy - Stationary Combustion - Other	CO_2	512.97	512.97	0.0065	0.8718
1A2aga	Energy - Stationary Combustion - Iron and steel	CO_2	476.29	476.29	0.0061	0.8779
1B2d	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	22.27	467.69	0.0060	0.8838
6B2	Waste - Waste-water Handling - Domestic and Commercial	CH_4	22.19	466.06	0.0059	0.8898
1A1bga	Energy - Stationary Combustion - Petroleum refining	CO_2	417.19	417.19	0.0053	0.8951
2B1	Industrial Processes - Chemical Industry - Ammonia production	CO_2	393.28	393.28	0.0050	0.9001
1A4cga	Energy - Stationary Combustion - Agriculture/Forestry/Fisheries	CO_2	388.28	388.28	0.0049	0.9050
5C1	Land Use, Land-Use Change and Forestry - Grassland remaining Grassland	CO_2	377.68	377.68	0.0048	0.9099
2A7	Industrial Processes - Mineral Products - Other	CO_2	374.94	374.94	0.0048	0.9146
3d	Solvent and Other Product Use - Other	N_2O	1.10	340.93	0.0043	0.9190
2A2	Industrial Processes - Mineral Products - Lime production	CO_2	318.50	318.50	0.0041	0.9230
1A1ali	Energy - Stationary Combustion - Public electricity and heat production	CO_2	316.84	316.84	0.0040	0.9271
2A3	Industrial Processes - Mineral Products - Limestone and dolomit use	CO_2	315.60	315.60	0.0040	0.9311
1A1aot	Energy - Stationary Combustion - Public electricity and heat production	CO_2	285.10	285.10	0.0036	0.9347
5B2	Land Use, Land-Use Change and Forestry - Cropland - converted to	CO_2	271.78	271.78	0.0035	0.9382
2C1	Industrial Processes - Metal Production - Iron and steel production	CO_2	271.60	271.60	0.0035	0.9416
1A3blg	Energy - Mobile combustion - Road transportation	N_2O	0.87	269.13	0.0034	0.9451
1A4bli	Energy - Stationary Combustion - Residential	CO_2	229.30	229.30	0.0029	0.9480

Table A1-3. *Key Categories with LULUCF, Tier 1 Level Assessment*

CRF Code + subcat.	IPCC Categories	Direct Greenhouse Gas	Current Year (2008) Emission (Gg)	Emission in absolute value (Gg CO_2-eq.)	Level Assessment	Cumulative Total
4A3sh	Agriculture - Enteric Fermentation	CH_4	10.16	213.28	0.0027	0.9507

Table A1-4. *Key Categories with LULUCF, Tier 1 Trend Assessment*

CRF Code + subcat.	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2008) Emission (Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total
1A4bso	Energy - Stationary Combustion - Residential	CO_2	10 622.06	667.41	0.1224	0.1063	0.1063
1A4bga	Energy - Stationary Combustion - Residential	CO_2	2 737.18	7 983.95	0.1189	0.1032	0.2095
1A3bld	Energy - Mobile combustion - Road transportation	CO_2	2 950.93	7 764.46	0.1119	0.0972	0.3067
1A1aga	Energy - Stationary Combustion - Public electricity and heat production	CO_2	6 212.71	8 620.71	0.0869	0.0754	0.3821
2B2	Industrial Processes - Chemical Industry - Nitric acid production	N_2O	4 541.51	5.08	0.0577	0.0501	0.4322
1A1ali	Energy - Stationary Combustion - Public electricity and heat production	CO_2	4 429.88	316.84	0.0503	0.0437	0.4759
1A4aga	Energy - Stationary Combustion - Commercial/institutional	CO_2	1 535.43	3 367.48	0.0453	0.0393	0.5152
5A1	Land Use, Land-Use Change and Forestry - Forest Land - remaining	CO_2	-2 963.88	-4 039.07	0.0400	0.0348	0.5500
1A3blg	Energy - Mobile combustion - Road transportation	CO_2	3 856.51	4 414.87	0.0359	0.0312	0.5812
6A	Waste - Solid Waste Disposal on Land	CH_4	1 917.30	3 021.39	0.0338	0.0293	0.6105
1A4bli	Energy - Stationary Combustion - Residential	CO_2	2 831.45	229.30	0.0316	0.0275	0.6380
1A2fga	Energy - Stationary Combustion - Other	CO_2	4 101.08	1 357.00	0.0261	0.0227	0.6606
1A2aso	Energy - Stationary Combustion - Iron and steel	CO_2	5 378.60	2 367.66	0.0229	0.0199	0.6805
1A1aso	Energy - Stationary Combustion - Public electricity and heat production	CO_2	14 582.44	8 495.91	0.0221	0.0192	0.6997
1A4cli	Energy - Stationary Combustion - Agriculture/Forestry/Fisheries	CO_2	2 887.15	789.51	0.0216	0.0187	0.7184
1B2b	Energy - Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	946.54	1 487.29	0.0166	0.0144	0.7328
1A4aso	Energy - Stationary Combustion - Commercial/institutional	CO_2	1 295.15	15.81	0.0162	0.0141	0.7469
1A2aga	Energy - Stationary Combustion - Iron and steel	CO_2	1 980.58	476.29	0.0161	0.0139	0.7608
1A2fso	Energy - Stationary Combustion - Other	CO_2	1 984.61	512.97	0.0154	0.0134	0.7742
1A4ali	Energy - Stationary Combustion - Commercial/institutional	CO_2	1 395.85	131.84	0.0152	0.0132	0.7874
2Fa1	Industrial Processes - Consumption of Halocarbons and SF_6 - Refrigeration and iar conditioning equipment	HFCs	0.78	687.57	0.0132	0.0115	0.7989
4D3	Agriculture - Agricultural Soils - Indirect emissions	N_2O	3 851.08	1 875.82	0.0129	0.0112	0.8101

Table A1-4. *Key Categories with LULUCF, Tier 1 Trend Assessment*

CRF Code + subcat.	IPCC Categories	Direct GHG	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2008) Emission (Gg CO_2-eq.)	Trend Assess-ment	% Contribu-tion to Trend	Cumulative Total
2B1	Industrial Processes - Chemical Industry - Ammonia production	CO_2	1 502.70	393.28	0.0116	0.0100	0.8202
1B1a	Energy - Fugitive Emissions from Fuels - Solid Fuels	CH_4	923.01	21.10	0.0113	0.0099	0.8300
1A2eli	Energy - Stationary Combustion - Food processing, beverages and tobacco	CO_2	916.21	19.84	0.0113	0.0098	0.8398
1A2fli	Energy - Stationary Combustion - Other	CO_2	1 709.26	564.49	0.0109	0.0095	0.8493
2G1	Industrial Processes - Feedstocks	CO_2	468.07	855.36	0.0105	0.0091	0.8584
4B8sw	Agriculture - Manure Management	CH_4	2 035.74	835.90	0.0098	0.0085	0.8670
4A1ca	Agriculture - Enteric Fermentation	CH_4	2 664.41	1 261.04	0.0097	0.0084	0.8753
4D1	Agriculture - Agricultural Soils - Direct soil emissions	N_2O	5 481.04	3 141.92	0.0093	0.0081	0.8834
1A2ali	Energy - Stationary Combustion - Iron and steel	CO_2	722.92	7.72	0.0091	0.0079	0.8913
1A4bso	Energy - Stationary Combustion - Residential	CH_4	699.38	44.23	0.0081	0.0070	0.8983
5B1	Land Use, Land-Use Change and Forestry - Cropland - remaining	CO_2	651.03	13.39	0.0080	0.0070	0.9052
5C1	Land Use, Land-Use Change and Forestry - Grassland remaining Grassland	CO_2	-1.00	377.68	0.0073	0.0063	0.9115
4B13so	Agriculture - Manure Management	N_2O	1 860.58	909.82	0.0062	0.0054	0.9169
1A1bli	Energy - Stationary Combustion - Petroleum refining	CO_2	919.97	919.21	0.0060	0.0052	0.9221
1A3cli	Energy - Mobile combustion - Railways	CO_2	677.35	187.57	0.0050	0.0044	0.9265
5B2	Land Use, Land-Use Change and Forestry - Cropland - converted to	CO_2	-37.72	271.78	0.0048	0.0041	0.9306
1A3blg	Energy - Mobile combustion - Road transportation	N_2O	42.49	269.13	0.0046	0.0040	0.9346
3d	Solvent and Other Product Use - Other	N_2O	154.17	340.93	0.0046	0.0040	0.9386
1A4cso	Energy - Stationary Combustion - Agriculture/Forestry/Fisheries	CO_2	363.55	7.79	0.0045	0.0039	0.9425
1A1aot	Energy - Stationary Combustion - Public electricity and heat production	CO_2	97.62	285.10	0.0042	0.0037	0.9462
1A2cli	Energy - Stationary Combustion - Chemicals	CO_2	380.99781	45.401076	0.0040	0.0035	0.9496
1A2eso	Energy - Stationary Combustion - Food processing, beverages and tobacco	CO_2	310.47	3.18	0.0039	0.0034	0.9530

Table A1-5. *Key Categories (in blue) without LULUCF, Tier 2 Level Assessment*

IPCC Categories	Direct Greenhouse Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2008) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Level Assess-ment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Direct N_2O Emissions from Agricultural Soils	**N_2O**	**5 481.04**	**3 141.92**		**154.087**	**6.59**	**28.60**	**28.60**
Emissions from Wastewater Handling	**N_2O**	**207.70**	**199.58**	**10**	**1000**	**2.72**	**11.79**	**40.39**
Stationary Combustion - Gas	**CO_2**	**19 924.15**	**23 981.08**	**5**	**5.00**	**2.31**	**10.02**	**50.40**
Indirect N_2O Emissions from Nitrogen Used in Agriculture	**N_2O**	**3 851.08**	**1 875.82**		**61.1613**	**1.56**	**6.78**	**57.18**
Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	**CH_4**	**1 613.47**	**2 045.80**	**2**	**50.00**	**1.39**	**6.05**	**63.22**
CH_4 Emissions from Solid Waste Disposal Sites	**CH_4**	**1 917.30**	**3 021.39**	**10**	**30**	**1.30**	**5.64**	**68.87**
Mobile Combustion - Road	**CO_2**	**6 807.45**	**12 262.09**	**5**	**5.00**	**1.18**	**5.12**	**73.99**
Stationary Combustion - Coal	**CO_2**	**34 678.65**	**12 231.13**	**2**	**5**	**0.90**	**3.89**	**77.88**
N_2O Emissions from Manure Management	**N_2O**	**1 899.61**	**925.04**		**70.0694**	**0.88**	**3.83**	**81.71**
CH_4 Emissions from Enteric Fermentation in Domestic Livestock	**CH_4**	**3 435.62**	**1 636.94**		**29**	**0.64**	**2.77**	**84.48**
CH_4 Emissions from Manure Management	**CH_4**	**2 398.17**	**1 020.12**		**42.2383**	**0.59**	**2.55**	**87.02**
Mobile Combustion	**N_2O**	**112.07**	**410.29**	**5**	**100**	**0.56**	**2.43**	**89.45**
Pasture, range and paddock manure	**N_2O**	**336.01**	**172.61**		**153**	**0.36**	**1.56**	**91.01**
Non-CO_2 Emission from Stationary Fuel Combustion	N_2O	797.22	424.93	3	50.00	0.29	1.26	92.27
SF_6 Emissions from Electrical Equipment	SF_6	70.15	231.89	80	20	0.26	1.13	93.40
Emissions from Wastewater Handling	CH_4	847.03	526.63	20	30	0.26	1.12	94.52
Stationary Combustion - Oil	CO_2	16 277.89	3 233.75	2	5	0.24	1.03	95.55
Emissions from Substitutes for Ozone Depleting Substances	HFCs	0.78	703.38	10	20	0.21	0.93	96.48
Fugitive Emissions from Oil and Gas Operations	CO_2	195.68	99.86	100	80	0.17	0.76	97.23
CO_2 Emission from Other Mineral Products	CO_2	642.13	374.94	10	30	0.16	0.70	97.93
Feedstocks and non-energy use of fuels	CO_2	550.97	919.59	5	10	0.14	0.61	98.54

Table A1-5. *Key Categories (in blue) without LULUCF, Tier 2 Level Assessment*

IPCC Categories	Direct Greenhouse Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2008) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Level Assess-ment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Stationary Combustion - Other Fuel	CO_2	96.89	394.05	5	10	0.06	0.26	98.80
CO_2 Emissions from Cement Production	CO_2	1 778.28	1 260.65	2	2	0.05	0.21	99.01
Non-CO_2 Emission from Stationary Fuel Combustion	CH_4	1 092.14	291.71	3.00	8.00	0.03	0.15	99.16
CH_4 Emission from Rice Cultivation	CH_4	50.54	10.64	201.618	80	0.03	0.14	99.29
CO_2 Emissions from Lime Production	CO_2	645.03	318.50	5	2	0.02	0.10	99.39
CO_2 Emissions from Metal Production	CO_2	641.57	271.60	2.00	5	0.02	0.09	99.48
CO_2 Emission from Solvent and Other Product Use	CO_2	130.36	65.37	10	20	0.02	0.09	99.57
Non-biogenic CO_2 from Waste	CO_2	NA,NO	64.12	10	20	0.02	0.08	99.65
Mobile Combustion - Other	CO_2	814.20	190.84	5	5	0.02	0.08	99.73
Mobile Combustion	CH_4	45.64	23.52	5	50.00	0.02	0.07	99.80
CO_2 Emissions from Ammonia Processes	CO_2	1 502.70	393.28	2	2	0.02	0.07	99.87
N_2O Emission from Solvent and Other Product Use	N_2O	154.173	340.926	2	1	0.01	0.05	99.91
CO_2 Emission from Limestone and Dolomit Use	CO_2	248.68	315.60	2	1	0.01	0.04	99.95
CH_4 Emission from Industry	CH_4	7.84	15.26	1	20	0.00	0.02	99.97
Fugitive Emissions from Coal Mining and Handling	CH_4	923.01	21.10	3	10.00	0.00	0.01	99.98
N_2O Emissions from Waste Incineration	N_2O	NA,NO	1.97	5	100	0.00	0.01	100.00
CH_4 Emissions from Waste Incineration	CH_4	NA	0.49	10	50	0.00	0.00	100.00
Fugitive Emissions from Oil and Gas Operations	N_2O	0.60	0.23	2	100	0.00	0.00	100.00
N_2O Emission from Industry	N_2O	4 541.51	5.08	2	1	0.00	0.00	100.00
PFCs Emissions	PFCs	166.82	2.41	1	2	0.00	0.00	100.00
CO_2 Emissions from Nitric Acid Production	CO_2	0.08	0.00	3	40	0.00	0.00	100.00
Fugitive Emissions from Coal Mining and Handling	CO_2	3.60		3	10	0.00	0.00	100.00

Table A1-5. *Key Categories (in blue) without LULUCF, Tier 2 Level Assessment*

IPCC Categories	Direct Greenhouse Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2008) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Level Assess-ment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Field Burning of Agricultural Residues	CH_4	45.51		NE	NE	0.00	0.00	100.00
Field Burning of Agricultural Residues	N_2O	13.34		NE	NE	0.00	0.00	100.00

Table A1-6. *Key Categories (in blue) without LULUCF, Tier 2 Trend Assessment*

IPCC Categories	Direct Greenhouse Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2008) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Trend Assessment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Stationary Combustion - Gas	CO_2	19 924.15	23 981.08	5	5	1.70	11.88	11.88
Emissions from Wastewater Handling	N_2O	207.70	199.58	10	1000	1.43	9.99	21.87
CH_4 Emissions from Solid Waste Disposal Sites	CH_4	1 917.30	3 021.39	10	30	1.21	8.48	30.36
Mobile Combustion - Road	CO_2	6 807.45	12 262.09	5	5	1.19	8.36	38.71
Direct N_2O Emissions from Agricultural Soils	N_2O	5 481.04	3 141.92		154.087	1.18	8.27	46.98
Stationary Combustion - Coal	CO_2	34 678.65	12 231.13	2	5	1.14	7.98	54.96
Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH_4	1 613.47	2 045.80	2	50	1.08	7.59	62.54
Stationary Combustion - Oil	CO_2	16 277.89	3 233.75	2	5	0.82	5.76	68.30
Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O	3 851.08	1 875.82		61.1613	0.76	5.34	73.64
Mobile Combustion	N_2O	112.07	410.29	5	100	0.72	5.06	78.70
CH_4 Emissions from Manure Management	CH_4	2 398.17	1 020.12		42.2383	0.46	3.23	81.93
N_2O Emissions from Manure Management	N2O	1 899.61	925.04		70.0694	0.43	3.02	84.95
CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	3 435.62	1 636.94		28.658	0.34	2.39	87.33
Emissions from Substitutes for Ozone Depleting Substances	HFCs	0.78	703.38	10	20	0.34	2.35	89.68
SF_6 Emissions from Electrical Equipment	SF_6	70.15	231.89	80	20	0.33	2.30	91.98
N_2O Emission from Industry	N_2O	4 541.51	5.08	2	1	0.14	0.97	92.95
Pasture, range and paddock manure	N_2O	336.01	172.61		152.819	0.14	0.96	93.91
Feedstocks and non-energy use of fuels	CO_2	550.97	919.59	5	10	0.14	0.95	94.86
Fugitive Emissions from Coal Mining and Handling	CH_4	923.01	21.10	3	10	0.13	0.89	95.74
CH_4 Emission from Rice Cultivation	CH_4	50.54	10.64	201.618	80	0.10	0.70	96.44
Non-CO_2 Emission from Stationary Fuel Combustion	N_2O	797.22	424.93	3	50	0.09	0.63	97.07

Table A1-6. *Key Categories (in blue) without LULUCF, Tier 2 Trend Assessment*

IPCC Categories	Direct Greenhouse Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2008) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Trend Assessment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Stationary Combustion - Other Fuel	CO_2	96.89	394.05	5	10	0.08	0.55	97.63
Non-CO_2 Emission from Stationary Fuel Combustion	CH_4	1 092.14	291.71	3	8	0.07	0.52	98.15
Fugitive Emissions from Oil and Gas Operations	CO_2	195.68	99.86	100	80	0.07	0.48	98.63
Mobile Combustion - Other	CO_2	814.20	190.84	5	5	0.05	0.35	98.97
CO_2 Emissions from Ammonia Processes	CO_2	1 502.70	393.28	2	2	0.03	0.24	99.21
CO_2 Emission from Other Mineral Products	CO_2	642.13	374.94	10	30	0.02	0.17	99.38
CO_2 Emissions from Metal Production	CO_2	641.57	271.60	2	5	0.02	0.11	99.49
N_2O Emission from Solvent and Other Product Use	N_2O	154.17	340.93	2	1	0.01	0.08	99.57
Emissions from Wastewater Handling	CH_4	847.03	526.63	20	30	0.01	0.08	99.65
CO_2 Emissions from Lime Production	CO_2	645.03	318.50	5	2	0.01	0.08	99.72
CO_2 Emission from Solvent and Other Product Use	CO_2	130.36	65.37	10	20	0.01	0.06	99.78
CO_2 Emissions from Cement Production	CO_2	1 778.28	1 260.65	2	2	0.01	0.05	99.84
CO_2 Emission from Limestone and Dolomit Use	CO_2	248.68	315.60	2	1	0.01	0.05	99.89
Mobile Combustion	CH_4	45.64	23.52	5	50	0.01	0.04	99.93
PFCs Emissions	PFCs	166.82	2.41	1	2	0.00	0.03	99.97
CH_4 Emission from Industry	CH_4	7.84	15.26	1	20	0.00	0.03	100.00
Fugitive Emissions from Oil and Gas Operations	N_2O	0.60	0.23	2	100	0.00	0.00	100.00
CO_2 Emissions from Nitric Acid Production	CO_2	0.08	0.00	3	40	0.00	0.00	100.00
Non-biogenic CO_2 from Waste	CO_2	NA,NO	64.12	10	20	0.00	0.00	100.00
N_2O Emissions from Waste Incineration	N_2O	NA,NO	1.97	5	100	0.00	0.00	100.00
CH_4 Emissions from Waste Incineration	CH_4	NA	0.49	10	50	0.00	0.00	100.00
Fugitive Emissions from Coal Mining and Handling	CO_2	3.60		3	10	0.00	0.00	100.00

Table A1-6. *Key Categories (in blue) without LULUCF, Tier 2 Trend Assessment*

IPCC Categories	Direct Greenhouse Gas	Base Years (1985-87) Emission (Gg CO_2-eq.)	Current Year (2008) Emission (Gg CO_2-eq.)	Activity Data Uncer-tainty	Emission Factor Uncer-tainty	Trend Assessment with Uncertainty	Contribution to Total Uncertainty (%)	Cumulative Total (%)
Field Burning of Agricultural Residues	CH_4	45.51		NE	NE	0.00	0.00	100.00
Field Burning of Agricultural Residues	N_2O	13.34		NE	NE	0.00	0.00	100.00

A1.4. Summary assessment

Table A1-7. *Key category analysis summary – with LULUCF*

SOURCE CATEGORY ANALYSIS SUMMARY – WITH LULUCF				
Quantitative Method Used: [X] **Tier 1** [ ] **Tier 2**				
A	**B**	**C**	**D**	**E**
IPCC Source Categories	**Direct Greenhouse Gas**	**Key Source Category Flag (Yes or No)**	**If C Yes. Criteria for Identification**	**Comments**
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		
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, ga; 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		re-allocated
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,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		

Table A1-7. *Key category analysis summary – with LULUCF*

SOURCE CATEGORY ANALYSIS SUMMARY – WITH LULUCF				
Quantitative Method Used: [X] **Tier 1** [ ] **Tier 2**				
A	**B**	**C**	**D**	**E**
IPCC Source Categories	**Direct Greenhouse Gas**	**Key Source Category Flag (Yes or No)**	**If C Yes. Criteria for Identification**	**Comments**
Mobile combustion - Road transportation	N_2O	Yes	L, T	lg
Mobile combustion - Railways	CO_2	Yes	T	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	Yes	T	so
Stationary Combustion - Residential	N_2O	No		
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	
Mineral Products - Lime production	CO_2	Yes	L	
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	L	
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		NO
Chemical Industry - Other	N_2O	No		NO

Table A1-7. *Key category analysis summary – with LULUCF*

SOURCE CATEGORY ANALYSIS SUMMARY – WITH LULUCF				
Quantitative Method Used: [X] **Tier 1** [ ] **Tier 2**				
A	**B**	**C**	**D**	**E**
IPCC Source Categories	**Direct Greenhouse Gas**	**Key Source Category Flag (Yes or No)**	**If C Yes. Criteria for Identification**	**Comments**
Metal Production - Iron and steel production	CO_2	Yes	L	
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		
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 SF_6 - Aerosols	SF_6	No		NO
Consumption of Halocarbons and SF_6 - Electrical equipment	HFCs	No		NO
Consumption of Halocarbons and SF_6 - Electrical equipment	PFCs	No		NO
Consumption of Halocarbons and SF_6 - Electrical equipment	SF_6	No		
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, T	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		

Table A1-7. *Key category analysis summary – with LULUCF*

SOURCE CATEGORY ANALYSIS SUMMARY – WITH LULUCF				
Quantitative Method Used: [X] **Tier 1** [ ] **Tier 2**				
A	**B**	**C**	**D**	**E**
IPCC Source Categories	**Direct Greenhouse Gas**	**Key Source Category Flag (Yes or No)**	**If C Yes. Criteria for Identification**	**Comments**
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	CO_2	Yes	L, T	
Forest Land - remaining	CH_4	No		
Forest Land - remaining	N_2O	No		
Forest Land - converted to	CO_2	No		
Forest Land - converted to	CH_4	No		NE, NO
Forest Land - converted to	N_2O	No		NE, NO
Cropland - remaining	CO_2	Yes	T	
Cropland - remaining	CH_4	No		IE, NE
Cropland - remaining	N_2O	No		IE, NE
Cropland - converted to	CO_2	Yes	L, T	
Cropland - converted to	CH_4	No		NO
Cropland - converted to	N_2O	No		NE, NO
Grassland - remaining	CO_2	Yes	L, T	
Grassland - remaining	CH_4	No		NE, NO
Grassland - remaining	N_2O	No		NE, NO
Grassland - converted to	CO_2	Yes	T	
Grassland - converted to	CH_4	No		NO
Grassland - converted to	N_2O	No		NO
Settlements - converted to	CO_2	No		
Other Land - converted to	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		

Abbrevations in this table:

li – liquid fuels

so – solid fuels/category
ga – gaseous fuels
ot – other fuels/category
bi – biomass
lr – liquid fuels, residual fuel oil
ld – liquid fuel, diesel oil
lg – liquid fuel, gasoline
lu – liquid fuel, lubricants
sc – solid fuel, coal
lk – liquid fuel, kerosene
ll – liquid fuel, LPG
gn – gaseous fuel, natural gas
ca – cattle
bu –buffalo
sh – sheep
sw – swine

A1.5. 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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Intergovernmental Panel on Climate Change (IPCC), 2003: Good practice guidance for Land Use, Land Use Change and Forestry. *Intergovernmental Panel on Climate Change National Greenhouse Gas Inventories Programme*. Institute for Global Environmental Strategies, Japan.
Available online at: http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm

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

A2.1. 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 2008 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 (*Table A2-1*) follows mainly the structure of ISIC 3.1. Detailed EU-conform statistics from industrial and energy industrial activities help to compile the *sectoral approach*.

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
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		

Table A2-1. *Categories in the energy carries balances of the Energy Statistics*
* included Real estate activities, Public administration and Sewage and refuse disposal sections
** for the first time it is reported in the appropriate CRF category

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.).

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

For the sake of transparency and comparability with EU ETS data the ERT recomended to report NCVs of both data sources. All of the coal based power plants are under the regulation of emission trading, so the comparision can be performed. The results are in the table (*Table A2-2*) below.

Consumption of public electricity and heat plants	EU ETS		Energy statistics	
	kt	TJ	kt	TJ
Other bituminous or sub-bituminous coal (NCV: 17-33 MJ/kg)	251.9	5,932	259	5,935
Lignite (NCV: 10-17 MJ/kg)*	1,561.6	20,991	1,642	20,557
Lignite (NCV: 3.5-10 MJ/kg)	7,893.6	53,814	7,893	54,246
Total Coal	***9,708***	***80,737***	***9,794***	***80,738***

Table A2-2. *Power plants' coal consumption from EU ETS and energy statistics*
** One power plant reported brown coal to ETS with 25.6 TJ/kt NCV, therefore this amount of ETS in NCV is higher than the amount of the energy statistics with higher fuel consumption in physical unit.*

A2.4. Source of the Country Specific Emission Factors

Fuel type	Emission factor (CO_2 t/TJ)	Oxidation factor
Other Bituminous Coal	95.76	0.98
Lignite (brown coal + lignite)	107.86	0.977
Coke Oven Gas	43.5	0.98
Gas/Diesel Oil	74.06	0.99
Residual Fuel Oil	81.96	0.99
Other Oil	80.50	0.99
Waste	55.71	1.00

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

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. Last years 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 *Table A2-3*.

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; *Table A2-4*. shows the classification according to the Hungarian and IPCC (2006) categories.

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)

Table A2-4. *Comparison of Hungarian and IPCC terminology for coal (Sources: Bihari, 1998; IPCC, 2006)*

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 2008 are listed in *Table A2-5*. NCVs of coals in the energy statistics were different than the measured values from EU ETS (see *Table A2-2*), 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.

Fuel type	Measured carbon content (C t/TJ)	Oxidation factor
Hard Coal (17-33 MJ/kg)	26.1	0.9795
Brown coal (10-17 MJ/kg)	26.6	0.9800
Lignite (3.5-10 MJ/kg)	30.5	0.9756
Coke oven gas	11.86	deafault

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

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 recomended 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 measurment is not required for all power plants and for all fuel types, the resulted EFs (in *Table A2-3*) 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. 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.
Available online at: http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm

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Available online at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm

Hungarian Energy Balance for 2008

Unit: TJ	Primary Energy Produc-tion	Import	From Stock Decreas-ing	From Trans-forma-tion	Waste Energy	Total Source and Distribu-tion	Domestic Consump-tion	Direct Consump-tion	Direct: Non-energy use	For Trans-forma-tion	Exports	For Stock Increas-ing	Statist-ical Differ-ences	Trans-formation Losses
PRIMARY ENERGY	**435 855**	**743 549**	**0**			1 179 404	**948 802**	**330 310**	**14 719**	618 492	**24 602**	**35 203**		
Coal	70 884	70 961	0			141 845	137 659	11 577		126 082	1 891	2 295		
Crude OIL	33 908	278 578	0			312 486	291 198	1 422		289 776	19 855	1 433		
Natural Gas	83 981	390 442	0			474 423	442 161	279 152	14 719	163 009	787	31 475		
NGL	7 770					7 770	*see LPG*							
Hydro Power	767					767	*see Electricity*							
Nuclear Power	161 521					161 521	*see Electricity*							
Prod.of Wind Power Plant	738					738	*see Electricity*							
Firewood	25 079	1 044				26 123	24 053	10 662		13 391	2 070			
Other Primary Energy	10 891					10 891	10 891	0		10 891				
Estimated Renewables Energy [1)]	37 050					37 050	37 050	25 570		11 480				
Municipal Solid Waste	3 266	2 524				5 790	5 790	1 927		3 863				
SECONDARY ENERGY	**0**	**124 524**	**5 384**	487 470	6 823	624 200	**563 595**	**540 539**	**67 766**	23 056	**120 734**	**2 493**		
Briquette		335	77	149		561	561	547		14		0		
Ahydrated Lignite						0	0	0						
Coke		453	0	29 447		29 900	21 666	21 608		58	7 390	844		
Other Product from Coal Proc.				2 754		2 754	2 754	2 754	2 754					
LPG		9 917	0	3 688		13 605	15 829	15 829	8 136		5 123	423		
Gasoline		31 290	0	97 272		128 562	110 586	110 586	42 882		16 800	1 176		
Petroleum		450	326	10 960		11 736	11 303	11 303	0		433	0		
Gas / Diesel Oil		58 296	3 318	124 236		185 850	129 570	126 914	2 468	2 656	56 280	0		
Heavy Fuel Oil		490	241	15 276		16 007	14 045	11 105		2 940	1 962	0		
Bitumen		2 775	0	21 527		24 302	9 338	9 317	9 317	21	14 949	15		
Other Refinery Product		6 467	1 421	19 004		26 892	11 776	3 961	2 209	7 815	15 115	0		
Coke Oven Gas				8 097		8 097	8 097	3 147		4 950				
Blast Furnace Gas					6 823	6 823	6 823	2 513		4 310				
Heat energy				56 126		56 126	56 126	56 126						
Electricity				89 240		89 240	158 142	158 142						
Import Electricity		14 051				14 051	*see Electricity*							
Petroleum Coke		0	0	9 694		9 694	6 977	6 685		292	2 682	35		
TOTAL ENERGY	**435 855**	**868 073**	**5 384**	487 470	6 823	1 803 605	**1 512 397**	**870 849**	**82 485**	641 548	**145 336**	**37 697**	108 175	154 079
Unaccumulated Consumption	435 855	868 073	5 384			1 309 312	1 126 279							

1) incl. the estemated firewood, biomass and waste, geothermal, biogas, wind, solar, etc. energy

Source: Energia Központ Kht., 2009: Energy Statistics Yearbook, 2008 (In Hungarian: Energia Statisztika Évkönyv, 2008), Table 19/a and 19/b

Table A2-6. *Hungarian energy balance for 2008*

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

$$Slope = \begin{cases} 1.698 \cdot \frac{p}{CE} & \text{for } CF_4 \\ 0.1698 \cdot \frac{p}{CE} & \text{for } C_2F_6 \end{cases} \quad \text{Equation A3-2.}$$

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
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
CF_4	0.7015	0.8390	0.7732	0.7703	0.7242	0.7849	0.8813	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 8 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
C/NMVOC	0.7690	0.7607	0.7540	0.7426	0.7650	0.7682	0.7705	0.7607

Table A3-3. *Mean carbon and NMVOC ratio of solvents for the last 8 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 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	
Grassland	Grassland	HCSO's land-use statistics
Settlements	Artificial surfaces	HCL85, CLC90, CLC2000, CLC2006
Wetlands	Wetlands and Water bodies	HCL85, CLC90, CLC2000, CLC2006

Databases used for this purpose 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.
The area of the Other Land category was calculated as the difference between the sum of the areas of the other five land-use categories and the official area of the country. The area of abandoned agricultural areas was estimated from annual changes of the areas of Grassland and Cropland.
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$_{1990-2000}$ and CLC-change$_{2000-2006}$ were supplemented with a third database referring to 1985-1990. The supplementary database was implemented by processing satellite images (HCL-change$_{1985-1990}$). 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 managed transformation category was equal to the land-cover change in that category, and the difference between the net changes in the land-cover databases and in the land-use databases derived from land-use changes in Other Land categories. This is because the Other Land category in the land-use database contains the abandoned agricultural lands while the Other Land category in the land-cover database does not contain them. Accordingly, the difference was eliminated in the Land converted to Other Land and in the Other Land converted to other land-use categories.
- 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. This assumption can not be made for the sat-aside category, because the land area which would have to converted exceeded the area in the remaining category. Probably, the abandoned croplands are afforested, or cultivated again within 20 years time. Therefore it was assumed, that the set-aside croplands reach equilibrium in ten years time after abandonment, and they are converted again. (It has to be noted that the HCSO reports abandoned lands, which are not cultivated less then five years in the Arable land category. Therefore areas which have been in our set-aside category for ten years have not been cultivated for 15 years, actually.) Although, this assumption contradicts the IPCC default 20 years conversion period, but the estimation reference with the set asides were conservative. Elements of our conservative estimations, which guarantee, that the shorter transition period does not result in over estimation of the removals or under estimation of emissions are the follows:

- Only ten times the 1/20 of the increment of carbon stock of mineral soils is accounted for Cropland converted to set-aside croplands.
- If a set-aside cropland is cultivated again (Other Land converted to Cropland conversion) it is assumed that the carbonstock of mineral soils of the Set-aside Cropland at the time of conversion have already reached the carbon-stock of a Set-Aside Cropland that have not been cultivated for 20 years (i.e. F_{LU}=0.93).
- Mineralization is also accounted for in the Set-Aside Cropland converted to Cropland conversions.
- The biomass of Set-Aside Croplands is considered to be similar to a non-improved grassland, if the Set-Aside Cropland is cultivated again. It is a conservative approach, because of the overestimation of the carbon stock of living biomass before the conversion.

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. 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.)
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)
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 years after 2000, in case of orchard and vineyards after 2001, in each land-use categories only those values were accepted in the time series, which were confirmed by other more detailed data collection. Between the years with confirmed data interpolated values were taken into account. For the arable land and kitchen garden category the data published for 2008 were accepted, because the farm structure survey in 2007 confirmed the result of the annual data collection. (The results of the farm structure survey had not been available yet when the land-use

statistics for 2007 were published.) For the orchard category the values published for 2008 were accepted. A survey of the most important fruit species was implemented in 2007. The orchard land area published for 2008 was adjusted using the result of the survey. For the vineyard area the data published for 2006 and 2008 were accepted. Data, published for 2006 is a reconsidered data, and data published in 2008 was confirmed by the farm structure survey in 2007. For grassland areas data published for 2006 and 2008 were accepted, which were adjusted reflecting the results of the farm structure surveys in 2005, and in 2007.

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

Table A3-6 *Vineyard activity data for calculation of carbon stock change in living biomass on Cropland (ha) (note: * interpolated value)*

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	Total vineyard Removal
1985	153,600	153,600	69,553	84,011	84,011	7,706	no	7,706
BY	148,633	148,633	64,535	84,088	84,088	6,706	no	6,706
1986	147,400	147,400	63,501	83,943	83,943	6,267	no	6,267
1987	144,900	144,900	60,551	84,310	84,310	6,144	no	6,144
1988	142,200	142,200	55,231	86,937	86,937	3,485	no	3,485
1989	140,300	140,300	50,771	89,574	89,574	2,101	no	2,101
1990	138,500	138,500	47,050	91,350	91,350	2,152	3,042	5,194
1991	136,400	134,355	41,800	94,600	90,640	1,873	3,728	5,601
1992	135,000	130,209	43,500	91,500	89,930	1,384	3,705	5,089
1993	131,700	126,064	34,300	97,400	89,220	543	3,681	4,224
1994	131,900	121,918	20,500	111,400	88,510	404	3,657	4,061
1995	131,300	117,773	13,900	117,400	87,800	49	3,634	3,683
1996	130,900	113,627	14,600	116,300	87,090	58	3,610	3,668
1997	130,900	109,482	9,140	121,740	86,380	567	3,586	4,153
1998	129,700	105,336	8,100	121,600	85,670	127	3,563	3,690
1999	127,000	101,191	8,350	118,650	84,960	97	3,539	3,636
2000	105,900	97,045	8,740	97,140	84,250	139	3,516	3,655
2001	92,900	92,900	9,340	83,540	83,540	198	3,492	3,690
2002	92,800	91,520	10,000	82,800	81,382	202	4,090	4,292
2003	93,300	90,140	10,500	82,800	79,224	230	4,018	4,248
2004	94,500	88,760	11,300	83,200	77,066	258	3,946	4,204
2005	86,000	87,380	12,840	73,140	74,908	68	3,874	3,942
2006	86,000	86,000	13,250	72,750	72,750	500	3,803	4,303
2007	86,000	84,300	13,250	72,750	71,175	230	3,945	4,175
2008	82,600	82,600	13,000	69,600	69,600	100	3,893	3,993

***Table A3-7** Orchard Activity data for calculation of carbon stock change in living biomass on Cropland (ha) (note: * interpolated value)*

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	Total Orchard Removal
1985	103,500	103,500	71,210	7,706,000	32,290	5,628		5,628
BY	99,667	99,667	65,908	6,705,667	33,759	3,777		3,777
1986	99,000	99,000	65,013	6,267,000	33,987	2,998		2,998
1987	96,500	96,500	61,500	6,144,000	35,000	2,705		2,705
1988	94,900	94,900	59,347	3,485,000	35,553	2,015		2,015
1989	94,300	94,300	56,178	2,101,000	38,122	1,208		1,208
1990	95,100	95,100	61,100	5,193,955	34,000	2,142	1,132	3,274
1991	94,100	95,318	53,100	5,601,312	37,964	1,955	1,264	3,219
1992	94,500	95,536	52,100	5,088,669	41,927	973	1,396	2,369
1993	93,000	95,755	43,700	4,224,026	45,891	596	1,528	2,124
1994	92,700	95,973	37,400	4,061,383	49,855	469	1,660	2,129
1995	93,900	96,191	26,200	3,682,740	53,818	680	1,792	2,472
1996	94,300	96,409	27,700	3,668,097	57,782	526	1,924	2,450
1997	95,600	96,627	20,700	4,153,454	61,745	198	2,056	2,254
1998	96,300	96,845	19,800	3,689,811	65,709	538	2,188	2,726
1999	96,400	97,064	22,000	3,636,168	69,673	523	2,320	2,843
2000	95,400	97,282	21,200	3,654,525	73,636	350	2,452	2,802
2001	97,500	97,500	19,900	3,689,882	77,600	518	2,584	3,102
2002	97,400	97,643	21,200	4,292,021	77,186	803	2,570	3,373
2003	98,300	97,786	23,650	4,248,159	76,771	492	2,556	3,048
2004	102,600	97,929	24,700	4,204,298	76,357	181	2,543	2,724
2005	102,800	98,071	27,100	3,942,436	75,943	778	2,529	3,307
2006	102,800	98,214	26,600	4,302,575	75,529	100	2,515	2,615
2007	101,900	98,357	26,100	4,175,128	75,114	200	2,501	2,701
2008	98,500	98,500	23,700	3,992,680	74,700	300	2,488	2,788

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 *Figure 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.

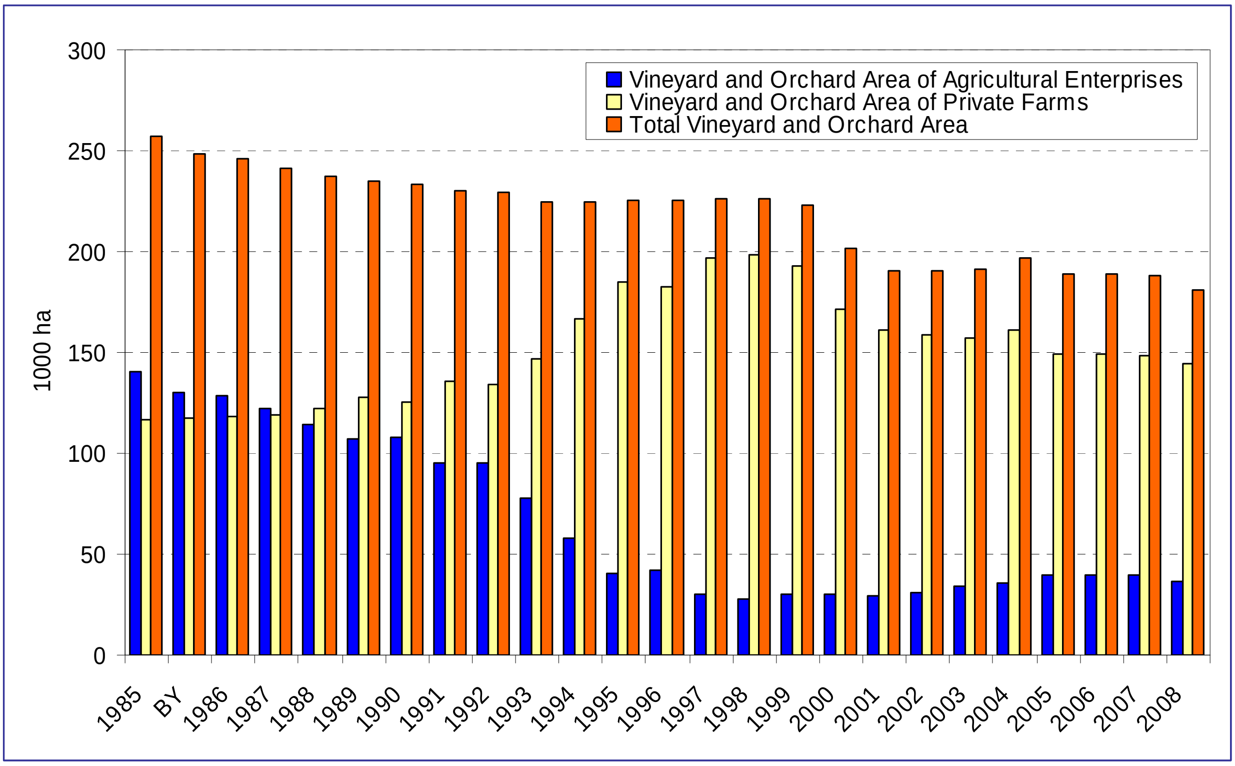

Figure A3-1. *Landowner changes of vineyards and orchards in Hungary 1985-2008*

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 and 2000. 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 2007, 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 (*Table A3-6*, *Table A3-7*), 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 (*Table A3-6* and *Table A3-7*), although there is a data gap in the year of 2003, which was eliminated by linear interpolation.

Estimation of removal of private farms as fallows:

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

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 in carbon stock change in mineral soils of Cropland, Grassland and Other Land

Table A3-8 *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	1971	1972	1973	1974	1975	1976
	Climate	Soil	Management	Input					Area (ha)											
	cold dry	HAC	full till	low	50	0.8	1.00	0.92	968.1	966.8	964.0	961.7	960.3	958.5	955.8	953.6	951.8	943.0	941.6	937.4
	cold dry	HAC	full till	medium	50	0.8	1.00	1.00	704.1	703.1	701.1	699.4	698.4	697.1	695.2	693.5	692.2	685.8	684.8	681.8
	cold dry	HAC	full till	high with no manure	50	0.8	1.00	1.07	88.0	87.9	87.6	87.4	87.3	87.1	86.9	86.7	86.5	85.7	85.6	85.2
	cold dry	HAC	reduced till	medium	50	0.8	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry	HAC	full till	low	38	0.8	1.00	0.92	1431.4	1429.5	1425.3	1422.0	1420.0	1417.2	1413.3	1410.0	1407.4	1394.4	1392.2	1386.1
	warm dry	HAC	full till	medium	38	0.8	1.00	1.00	1041.0	1039.6	1036.6	1034.2	1032.7	1030.7	1027.9	1025.5	1023.6	1014.1	1012.5	1008.0
	warm dry	HAC	full till	high with no manure	38	0.8	1.00	1.07	130.1	130.0	129.6	129.3	129.1	128.8	128.5	128.2	127.9	126.8	126.6	126.0
	warm dry	HAC	reduced till	medium	38	0.8	1.03	1.00	0.0	0.0	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	0.8	1.00	0.92	37.2	37.2	37.0	37.0	36.9	36.8	36.7	36.6	36.6	36.2	36.2	36.0
	cold dry	LAC	full till	medium	33	0.8	1.00	1.00	27.1	27.0	26.9	26.9	26.8	26.8	26.7	26.7	26.6	26.4	26.3	26.2
	cold dry	LAC	full till	high with no manure	33	0.8	1.00	1.07	3.4	3.4	3.4	3.4	3.4	3.3	3.3	3.3	3.3	3.3	3.3	3.3
	warm dry	LAC	full till	low	24	0.8	1.00	0.92	29.6	29.6	29.5	29.4	29.4	29.3	29.2	29.2	29.1	28.8	28.8	28.7
Cropland	warm dry	LAC	full till	medium	24	0.8	1.00	1.00	21.5	21.5	21.4	21.4	21.4	21.3	21.3	21.2	21.2	21.0	20.9	20.8
	warm dry	LAC	full till	high with no manure	24	0.8	1.00	1.07	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.6
	cold dry	sandy	full till	low	34	0.8	1.00	0.92	74.2	74.1	73.9	73.7	73.6	73.5	73.3	73.1	73.0	72.3	72.2	71.9
	cold dry	sandy	full till	medium	34	0.8	1.00	1.00	54.0	53.9	53.7	53.6	53.5	53.4	53.3	53.2	53.1	52.6	52.5	52.3
	cold dry	sandy	full till	high with no manure	34	0.8	1.00	1.07	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.6	6.6	6.6	6.6	6.5
	warm dry	sandy	full till	low	19	0.8	1.00	0.92	89.2	89.1	88.8	88.6	88.5	88.3	88.1	87.9	87.7	86.9	86.8	86.4
	warm dry	sandy	full till	medium	19	0.8	1.00	1.00	64.9	64.8	64.6	64.5	64.4	64.3	64.1	63.9	63.8	63.2	63.1	62.8
	warm dry	sandy	full till	high with no manure	19	0.8	1.00	1.07	8.1	8.1	8.1	8.1	8.0	8.0	8.0	8.0	8.0	7.9	7.9	7.9
	cold dry	aquic	full till	low	87	0.8	1.00	0.92	188.9	188.7	188.1	187.7	187.4	187.0	186.5	186.1	185.7	184.0	183.7	182.9
	cold dry	aquic	full till	medium	87	0.8	1.00	1.00	137.4	137.2	136.8	136.5	136.3	136.0	135.7	135.3	135.1	133.8	133.6	133.0
	cold dry	aquic	full till	high with no manure	87	0.8	1.00	1.07	17.2	17.2	17.1	17.1	17.0	17.0	17.0	16.9	16.9	16.7	16.7	16.6
	warm dry	aquic	full till	low	88	0.8	1.00	0.92	288.7	288.3	287.5	286.8	286.4	285.8	285.0	284.4	283.8	281.2	280.8	279.5
	warm dry	aquic	full till	medium	88	0.8	1.00	1.00	210.0	209.7	209.1	208.6	208.3	207.9	207.3	206.8	206.4	204.5	204.2	203.3
	warm dry	aquic	full till	high with no manure	88	0.8	1.00	1.07	26.2	26.2	26.1	26.1	26.0	26.0	25.9	25.9	25.8	25.6	25.5	25.4
Total Cropland area (ha)									**5649.7**	**5642.2**	**5625.60**	**5612.7**	**5604.5**	**5593.8**	**5578.3**	**5565.3**	**5554.9**	**5503.5**	**5495.1**	**5470.7**
Carbon stock (Gg C ha^{-1})									**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**

Table A3-8 *(continued) Cropland areas by climate zones, soil type and management practices and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	Climate	Soil	Management	Input					Area (ha)											
Cropland	cold dry	HAC	full till	low	50	0.8	1.00	0.92	929.2	923.3	905.7	892.5	880.1	876.8	874.7	873.4	907.0	906.4	906.3	906.0
	cold dry	HAC	full till	medium	50	0.8	1.00	1.00	675.8	671.5	658.7	649.1	640.1	637.7	636.2	635.2	659.6	659.2	659.1	658.9
	cold dry	HAC	full till	high with no manure	50	0.8	1.00	1.07	84.5	83.9	82.3	81.1	80.0	79.7	79.5	79.4	82.5	82.4	82.4	82.4
	cold dry	HAC	reduced till	medium	50	0.8	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry	HAC	full till	low	38	0.8	1.00	0.92	1373.9	1365.3	1339.1	1319.6	1301.4	1296.4	1293.4	1291.5	1341.1	1340.2	1340.0	1339.6
	warm dry	HAC	full till	medium	38	0.8	1.00	1.00	999.2	992.9	973.9	959.7	946.4	942.8	940.6	939.3	975.4	974.7	974.6	974.3
	warm dry	HAC	full till	high with no manure	38	0.8	1.00	1.07	124.9	124.1	121.7	120.0	118.3	117.9	117.6	117.4	121.9	121.8	121.8	121.8
	warm dry	HAC	reduced till	medium	38	0.8	1.03	1.00	0.0	0.0	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	0.8	1.00	0.92	35.7	35.5	34.8	34.3	33.8	33.7	33.6	33.6	34.9	34.8	34.8	34.8
	cold dry	LAC	full till	medium	33	0.8	1.00	1.00	26.0	25.8	25.3	24.9	24.6	24.5	24.4	24.4	25.4	25.3	25.3	25.3
	cold dry	LAC	full till	high with no manure	33	0.8	1.00	1.07	3.2	3.2	3.2	3.1	3.1	3.1	3.1	3.1	3.2	3.2	3.2	3.2
	warm dry	LAC	full till	low	24	0.8	1.00	0.92	28.4	28.2	27.7	27.3	26.9	26.8	26.7	26.7	27.7	27.7	27.7	27.7
	warm dry	LAC	full till	medium	24	0.8	1.00	1.00	20.7	20.5	20.1	19.8	19.6	19.5	19.5	19.4	20.2	20.2	20.2	20.1
	warm dry	LAC	full till	high with no manure	24	0.8	1.00	1.07	2.6	2.6	2.5	2.5	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5
	cold dry	sandy	full till	low	34	0.8	1.00	0.92	71.2	70.8	69.4	68.4	67.5	67.2	67.1	67.0	69.5	69.5	69.5	69.5
	cold dry	sandy	full till	medium	34	0.8	1.00	1.00	51.8	51.5	50.5	49.8	49.1	48.9	48.8	48.7	50.6	50.5	50.5	50.5
	cold dry	sandy	full till	high with no manure	34	0.8	1.00	1.07	6.5	6.4	6.3	6.2	6.1	6.1	6.1	6.1	6.3	6.3	6.3	6.3
	warm dry	sandy	full till	low	19	0.8	1.00	0.92	85.6	85.1	83.5	82.3	81.1	80.8	80.6	80.5	83.6	83.5	83.5	83.5
	warm dry	sandy	full till	medium	19	0.8	1.00	1.00	62.3	61.9	60.7	59.8	59.0	58.8	58.6	58.5	60.8	60.8	60.8	60.7
	warm dry	sandy	full till	high with no manure	19	0.8	1.00	1.07	7.8	7.7	7.6	7.5	7.4	7.3	7.3	7.3	7.6	7.6	7.6	7.6
	cold dry	aquic	full till	low	87	0.8	1.00	0.92	181.3	180.2	176.7	174.2	171.7	171.1	170.7	170.4	177.0	176.9	176.8	176.8
	cold dry	aquic	full till	medium	87	0.8	1.00	1.00	131.9	131.0	128.5	126.7	124.9	124.4	124.1	124.0	128.7	128.6	128.6	128.6
	cold dry	aquic	full till	high with no manure	87	0.8	1.00	1.07	16.5	16.4	16.1	15.8	15.6	15.6	15.5	15.5	16.1	16.1	16.1	16.1
	warm dry	aquic	full till	low	88	0.8	1.00	0.92	277.1	275.3	270.1	266.1	262.5	261.5	260.8	260.5	270.5	270.3	270.3	270.2
	warm dry	aquic	full till	medium	88	0.8	1.00	1.00	201.5	200.3	196.4	193.6	190.9	190.2	189.7	189.4	196.7	196.6	196.6	196.5
	warm dry	aquic	full till	high with no manure	88	0.8	1.00	1.07	25.2	25.0	24.6	24.2	23.9	23.8	23.7	23.7	24.6	24.6	24.6	24.6
Total Cropland area (ha)									**5422.7**	**5388.6**	**5285.5**	**5208.4**	**5136.4**	**5116.9**	**5104.8**	**5097.4**	**5293.3**	**5289.9**	**5289.0**	**5287.4**
Carbon stock (Gg C ha^{-1})									38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2

***Table A3-8** (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	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
	Climate	Soil	Management	Input					Area (ha)									
Cropland	cold dry	HAC	full till	low	50	0.8	1.00	0.92	905.9	906.0	897.6	889.2	880.7	872.3	863.9	855.5	847.0	838.6
	cold dry	HAC	full till	medium	50	0.8	1.00	1.00	658.8	658.9	652.8	646.7	640.5	634.4	628.3	622.2	616.0	596.7
	cold dry	HAC	full till	high with no manure	50	0.8	1.00	1.07	82.4	82.4	81.6	80.8	80.1	79.3	78.5	77.8	77.0	76.2
	cold dry	HAC	reduced till	medium	50	0.8	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.2
	warm dry	HAC	full till	low	38	0.8	1.00	0.92	1339.4	1339.7	1327.2	1314.7	1302.3	1289.8	1277.4	1264.9	1252.4	1240.0
	warm dry	HAC	full till	medium	38	0.8	1.00	1.00	974.1	974.3	965.2	956.2	947.1	938.0	929.0	919.9	910.9	882.0
	warm dry	HAC	full till	high with no manure	38	0.8	1.00	1.07	121.8	121.8	120.7	119.5	118.4	117.3	116.1	115.0	113.9	112.7
	warm dry	HAC	reduced till	medium	38	0.8	1.03	1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.8
	cold dry	LAC	full till	low	33	0.8	1.00	0.92	34.8	34.8	34.5	34.2	33.8	33.5	33.2	32.9	32.6	32.2
	cold dry	LAC	full till	medium	33	0.8	1.00	1.00	25.3	25.3	25.1	24.9	24.6	24.4	24.1	23.9	23.7	23.4
	cold dry	LAC	full till	high with no manure	33	0.8	1.00	1.07	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	3.0	2.9
	warm dry	LAC	full till	low	24	0.8	1.00	0.92	27.7	27.7	27.4	27.2	26.9	26.7	26.4	26.2	25.9	25.6
	warm dry	LAC	full till	medium	24	0.8	1.00	1.00	20.1	20.2	20.0	19.8	19.6	19.4	19.2	19.0	18.8	18.7
	warm dry	LAC	full till	high with no manure	24	0.8	1.00	1.07	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.3
	cold dry	sandy	full till	low	34	0.8	1.00	0.92	69.4	69.5	68.8	68.2	67.5	66.9	66.2	65.6	64.9	64.3
	cold dry	sandy	full till	medium	34	0.8	1.00	1.00	50.5	50.5	50.0	49.6	49.1	48.6	48.2	47.7	47.2	46.8
	cold dry	sandy	full till	high with no manure	34	0.8	1.00	1.07	6.3	6.3	6.3	6.2	6.1	6.1	6.0	6.0	5.9	5.8
	warm dry	sandy	full till	low	19	0.8	1.00	0.92	83.5	83.5	82.7	82.0	81.2	80.4	79.6	78.8	78.1	77.3
	warm dry	sandy	full till	medium	19	0.8	1.00	1.00	60.7	60.7	60.2	59.6	59.0	58.5	57.9	57.3	56.8	56.2
	warm dry	sandy	full till	high with no manure	19	0.8	1.00	1.07	7.6	7.6	7.5	7.5	7.4	7.3	7.2	7.2	7.1	7.0
	cold dry	aquic	full till	low	87	0.8	1.00	0.92	176.8	176.8	175.2	173.5	171.9	170.2	168.6	166.9	165.3	163.6
	cold dry	aquic	full till	medium	87	0.8	1.00	1.00	128.6	128.6	127.4	126.2	125.0	123.8	122.6	121.4	120.2	119.0
	cold dry	aquic	full till	high with no manure	87	0.8	1.00	1.07	16.1	16.1	15.9	15.8	15.6	15.5	15.3	15.2	15.0	14.9
	warm dry	aquic	full till	low	88	0.8	1.00	0.92	270.1	270.2	267.7	265.2	262.6	260.1	257.6	255.1	252.6	250.1
	warm dry	aquic	full till	medium	88	0.8	1.00	1.00	196.5	196.5	194.7	192.8	191.0	189.2	187.4	185.5	183.7	181.9
	warm dry	aquic	full till	high with no manure	88	0.8	1.00	1.07	24.6	24.6	24.3	24.1	23.9	23.6	23.4	23.2	23.0	22.7
Total Cropland area (ha)									**5286.6**	**5287.6**	**5238.4**	**5189.2**	**5140.0**	**5090.9**	**5041.7**	**4992.5**	**4943.3**	**4894.1**
Carbon stock (Gg C ha^{-1})									**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.2**

***Table A3-8** (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}	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
	Climate	Soil	Management	Input					Area (ha)									
Cropland	cold dry	HAC	full till	low	50	0.8	1.00	0.92	830.2	821.8	821.2	821.1	821.0	820.9	820.8	820.7	819.9	744.6
	cold dry	HAC	full till	medium	50	0.8	1.00	1.00	582.8	569.1	561.0	553.1	545.3	537.5	529.6	521.8	513.5	579.7
	cold dry	HAC	full till	high with no manure	50	0.8	1.00	1.07	75.5	74.7	74.7	74.6	74.6	74.6	74.6	74.6	74.5	74.5
	cold dry	HAC	reduced till	medium	50	0.8	1.03	1.00	21.0	28.5	36.3	44.0	51.8	59.6	67.3	75.1	82.8	90.4
	warm dry	HAC	full till	low	38	0.8	1.00	0.92	1227.5	1215.0	1214.2	1214.1	1214.0	1213.8	1213.7	1213.5	1212.3	1101.0
	warm dry	HAC	full till	medium	38	0.8	1.00	1.00	861.3	840.9	828.7	816.9	805.2	793.4	781.7	770.0	757.5	855.2
	warm dry	HAC	full till	high with no manure	38	0.8	1.00	1.07	111.6	110.5	110.4	110.4	110.4	110.3	110.3	110.3	110.2	110.1
	warm dry	HAC	reduced till	medium	38	0.8	1.03	1.00	31.4	42.8	54.4	66.1	77.7	89.3	101.0	112.6	124.1	135.6
	cold dry	LAC	full till	low	33	0.8	1.00	0.92	31.9	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.6
	cold dry	LAC	full till	medium	33	0.8	1.00	1.00	23.2	23.1	23.1	23.1	23.1	23.1	23.0	23.0	23.0	23.0
	cold dry	LAC	full till	high with no manure	33	0.8	1.00	1.07	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
	warm dry	LAC	full till	low	24	0.8	1.00	0.92	25.4	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2
	warm dry	LAC	full till	medium	24	0.8	1.00	1.00	18.5	18.4	18.3	18.3	18.3	18.3	18.3	18.3	18.3	18.3
	warm dry	LAC	full till	high with no manure	24	0.8	1.00	1.07	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
	cold dry	sandy	full till	low	34	0.8	1.00	0.92	63.6	61.9	61.9	61.9	61.9	61.9	61.9	61.8	61.8	61.7
	cold dry	sandy	full till	medium	34	0.8	1.00	1.00	46.3	45.0	45.0	45.0	45.0	45.0	45.0	45.0	44.9	44.9
	cold dry	sandy	full till	high with no manure	34	0.8	1.00	1.07	5.8	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
	warm dry	sandy	full till	low	19	0.8	1.00	0.92	76.5	74.4	74.4	74.4	74.4	74.4	74.4	74.4	74.3	74.2
	warm dry	sandy	full till	medium	19	0.8	1.00	1.00	55.6	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.0	54.0
	warm dry	sandy	full till	high with no manure	19	0.8	1.00	1.07	7.0	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.7
	cold dry	aquic	full till	low	87	0.8	1.00	0.92	162.0	161.2	161.1	161.1	161.0	161.0	161.0	161.0	160.8	160.7
	cold dry	aquic	full till	medium	87	0.8	1.00	1.00	117.8	117.2	117.2	117.1	117.1	117.1	117.1	117.1	117.0	116.8
	cold dry	aquic	full till	high with no manure	87	0.8	1.00	1.07	14.7	14.7	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6
	warm dry	aquic	full till	low	88	0.8	1.00	0.92	247.6	246.3	246.2	246.1	246.1	246.1	246.1	246.0	245.8	245.5
	warm dry	aquic	full till	medium	88	0.8	1.00	1.00	180.0	179.1	179.0	179.0	179.0	179.0	178.9	178.9	178.7	178.6
	warm dry	aquic	full till	high with no manure	88	0.8	1.00	1.07	22.5	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.3	22.3
Total Cropland area (ha)									**4844.9**	**4795.7**	**4792.5**	**4792.0**	**4791.4**	**4790.9**	**4790.4**	**4789.8**	**4784.9**	**4780.0**
Carbon stock (Gg C ha^{-1})									**38.2**	**38.2**	**38.2**	**38.2**	**38.2**	**38.3**	**38.3**	**38.3**	**38.3**	**38.4**

Table A3-9 *Set-Aside Cropland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	Climate	Soil	Management	Input	SOC_{ref}	F_{LU}	F_{MG}	F_I	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
									Area (ha)													
Set-Aside Cropland	cold dry	HAC	-	-	50	0.93	1	1	0.0	2.3	7.5	11.5	14.1	17.4	22.2	26.3	29.5	45.5	48.2	55.8	70.7	81.3
	warm dry	HAC			38	0.93	1	1	0.0	3.5	11.1	17.0	20.8	25.8	32.9	38.9	43.7	67.3	71.2	82.5	104.6	120.3
	cold dry	LAC			33	0.93	1	1	0.0	0.1	0.3	0.4	0.5	0.7	0.9	1.0	1.1	1.8	1.9	2.1	2.7	3.1
	warm dry	LAC			24	0.93	1	1	0.0	0.1	0.2	0.4	0.4	0.5	0.7	0.8	0.9	1.4	1.5	1.7	2.2	2.5
	cold dry	sandy			34	0.93	1	1	0.0	0.2	0.6	0.9	1.1	1.3	1.7	2.0	2.3	3.5	3.7	4.3	5.4	6.2
	warm dry	sandy			19	0.93	1	1	0.0	0.2	0.7	1.1	1.3	1.6	2.1	2.4	2.7	4.2	4.4	5.1	6.5	7.5
	cold dry	aquic			87	0.93	1	1	0.0	0.5	1.5	2.2	2.7	3.4	4.3	5.1	5.8	8.9	9.4	10.9	13.8	15.9
	warm dry	aquic			88	0.93	1	1	0.0	0.7	2.2	3.4	4.2	5.2	6.6	7.8	8.8	13.6	14.4	16.6	21.1	24.3
Total Set-Aside Cropland area (ha)									**0.0**	**7.5**	**24.1**	**37.0**	**45.2**	**55.9**	**71.4**	**84.4**	**94.8**	**146.2**	**154.6**	**179.0**	**227.0**	**261.1**
Carbon stock (Gg C ha^{-1})									**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**

Table A3-9 *(continued) Set-Aside Cropland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	Climate	Soil	Management	Input	SOC_{ref}	F_{LU}	F_{MG}	F_I	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
									Area (ha)									
Set-Aside Cropland	cold dry	HAC	-	-	50	0.93	1	1	113.5	137.5	159.9	166.0	169.8	172.1	111.0	112.1	112.4	112.9
	warm dry	HAC			38	0.93	1	1	167.7	203.3	236.4	245.4	251.0	254.4	164.2	165.7	166.2	166.9
	cold dry	LAC			33	0.93	1	1	4.4	5.3	6.1	6.4	6.5	6.6	4.3	4.3	4.3	4.3
	warm dry	LAC			24	0.93	1	1	3.5	4.2	4.9	5.1	5.2	5.3	3.4	3.4	3.4	3.5
	cold dry	sandy			34	0.93	1	1	8.7	10.5	12.3	12.7	13.0	13.2	8.5	8.6	8.6	8.7
	warm dry	sandy			19	0.93	1	1	10.5	12.7	14.7	15.3	15.6	15.9	10.2	10.3	10.4	10.4
	cold dry	aquic			87	0.93	1	1	22.1	26.8	31.2	32.4	33.1	33.6	21.7	21.9	21.9	22.0
	warm dry	aquic			88	0.93	1	1	33.8	41.0	47.7	49.5	50.6	51.3	33.1	33.4	33.5	33.7
Total Set-Aside Cropland area (ha)									**364.2**	**441.3**	**513.3**	**532.8**	**544.9**	**552.3**	**356.4**	**359.8**	**360.7**	**362.3**
Carbon stock (Gg C ha^{-1})									**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**

***Table A3-9** (continued) Set-Aside Cropland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
	Climate	Soil	Management	Input					Area (ha)									
Set-Aside Cropland	cold dry	HAC	-	-	50	0.93	1	1	113.1	112.8	128.1	143.5	158.8	174.1	189.4	204.8	220.1	235.4
	warm dry	HAC			38	0.93	1	1	167.3	166.8	189.5	212.1	234.8	257.4	280.1	302.8	325.4	348.1
	cold dry	LAC			33	0.93	1	1	4.3	4.3	4.9	5.5	6.1	6.7	7.3	7.9	8.5	9.0
	warm dry	LAC			24	0.93	1	1	3.5	3.4	3.9	4.4	4.9	5.3	5.8	6.3	6.7	7.2
	cold dry	sandy			34	0.93	1	1	8.7	8.6	9.8	11.0	12.2	13.3	14.5	15.7	16.9	18.0
	warm dry	sandy			19	0.93	1	1	10.4	10.4	11.8	13.2	14.6	16.0	17.5	18.9	20.3	21.7
	cold dry	aquic			87	0.93	1	1	22.1	22.0	25.0	28.0	31.0	34.0	37.0	40.0	42.9	45.9
	warm dry	aquic			88	0.93	1	1	33.7	33.6	38.2	42.8	47.4	51.9	56.5	61.1	65.6	70.2
Total Set-Aside Cropland area (ha)									**363.1**	**362.1**	**411.3**	**460.5**	**509.7**	**558.8**	**608.0**	**657.2**	**706.4**	**755.6**
Carbon stock (Gg C ha^{-1})									**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**	**45.1**

***Table A3-9** (continued) Set-Aside Cropland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	$F_{LU(0)}$	F_{MG}	F_I	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
	Climate	Soil	Management	Input					Area (ha)									
Set-Aside Cropland	cold dry	HAC	-	-	50	0.93	1	1	250.7	266.1	267.1	267.2	267.4	267.6	267.7	267.9	269.4	271.0
	warm dry	HAC			38	0.93	1	1	370.7	393.4	394.9	395.1	395.4	395.6	395.9	396.1	398.4	400.6
	cold dry	LAC			33	0.93	1	1	9.6	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.1	10.1
	warm dry	LAC			24	0.93	1	1	7.7	7.9	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.1
	cold dry	sandy			34	0.93	1	1	19.2	22.4	22.4	22.4	22.5	22.5	22.5	22.5	22.6	22.7
	warm dry	sandy			19	0.93	1	1	23.1	26.9	27.0	27.0	27.0	27.0	27.0	27.0	27.2	27.3
	cold dry	aquic			87	0.93	1	1	48.9	50.4	50.6	50.6	50.7	50.7	50.7	50.8	51.1	51.4
	warm dry	aquic			88	0.93	1	1	74.8	77.0	77.3	77.4	77.4	77.5	77.5	77.6	78.0	78.5
Total Set-Aside Cropland area (ha)									**804.8**	**854.0**	**857.2**	**857.7**	**858.3**	**858.8**	**859.3**	**859.9**	**864.8**	**869.7**
Carbon stock (Gg C ha^{-1})									**45.1**	**44.9**	**44.9**	**44.9**	**44.9**	**44.9**	**44.9**	**44.9**	**44.9**	**44.9**

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}	F_I	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
	Climate	Soil	Management	Input					Area (ha)													
Grassland	cold dry	HAC	non-degraded	-	50	1	1	1	233.6	230.3	230.7	231.1	230.0	229.6	228.7	229.5	229.3	229.2	228.4	230.5	234.1	234.6
	cold dry	HAC	improved	medium	50	1	1.14	1	155.7	153.5	153.8	154.1	153.3	153.0	152.5	153.0	152.9	152.8	152.3	153.7	156.1	156.4
	warm dry	HAC	non-degraded	-	38	1	1	1	345.4	340.5	341.1	341.7	340.0	339.4	338.2	339.4	339.1	338.9	337.7	340.8	346.2	346.8
	warm dry	HAC	improved	medium	38	1	1.14	1	230.3	227.0	227.4	227.8	226.7	226.3	225.5	226.3	226.1	225.9	225.1	227.2	230.8	231.2
	cold dry	LAC	non-degraded	-	33	1	1	1	21.6	21.3	21.3	21.4	21.3	21.2	21.2	21.2	21.2	21.2	21.1	21.3	21.6	21.7
	cold dry	LAC	improved	medium	33	1	1.14	1	9.3	9.1	9.1	9.2	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.3	9.3
	warm dry	LAC	non-degraded	-	24	1	1	1	12.3	12.1	12.1	12.1	12.1	12.1	12.0	12.1	12.1	12.0	12.0	12.1	12.3	12.3
	warm dry	LAC	improved	medium	24	1	1.14	1	12.3	12.1	12.1	12.1	12.1	12.1	12.0	12.1	12.1	12.0	12.0	12.1	12.3	12.3
	cold dry	sandy	non-degraded	-	34	1	1	1	14.6	14.4	14.4	14.4	14.3	14.3	14.3	14.3	14.3	14.3	14.2	14.4	14.6	14.6
	cold dry	sandy	improved	medium	34	1	1.14	1	9.7	9.6	9.6	9.6	9.6	9.5	9.5	9.5	9.5	9.5	9.5	9.6	9.7	9.8
	warm dry	sandy	non-degraded	-	19	1	1	1	20.4	20.1	20.2	20.2	20.1	20.1	20.0	20.1	20.1	20.0	20.0	20.2	20.5	20.5
	warm dry	sandy	improved	medium	19	1	1.14	1	8.8	8.6	8.6	8.7	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.8	8.8
	cold dry	aquic	non-degraded	-	87	1	1	1	77.3	76.2	76.4	76.5	76.1	76.0	75.7	76.0	75.9	75.9	75.6	76.3	77.5	77.7
	cold dry	aquic	improved	medium	87	1	1.14	1	13.6	13.5	13.5	13.5	13.4	13.4	13.4	13.4	13.4	13.4	13.3	13.5	13.7	13.7
	warm dry	aquic	non-degraded	-	88	1	1	1	111.2	109.6	109.9	110.0	109.5	109.3	108.9	109.3	109.2	109.1	108.7	109.7	111.5	111.7
	warm dry	aquic	improved	medium	88	1	1.14	1	27.8	27.4	27.5	27.5	27.4	27.3	27.2	27.3	27.3	27.3	27.2	27.4	27.9	27.9
Total Grassland area (ha)									**1303.9**	**1285.3**	**1287.8**	**1289.9**	**1283.6**	**1281.3**	**1276.8**	**1281.2**	**1280.1**	**1279.2**	**1274.8**	**1286.5**	**1306.8**	**1309.3**
Carbon stock (Gg C ha^{-1})									**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**

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}	F_I	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	Climate	Soil	Management	Input					Area (ha)									
Grassland	cold dry	HAC	non-degraded	-	50	1	1	1	232.3	231.9	230.0	229.9	229.2	226.6	223.3	221.0	219.0	216.8
	cold dry	HAC	improved	medium	50	1	1.14	1	154.9	154.6	153.4	153.3	152.8	151.1	148.9	147.4	146.0	144.5
	warm dry	HAC	non-degraded	-	38	1	1	1	343.5	342.8	340.1	339.9	338.9	335.1	330.2	326.8	296.8	293.8
	warm dry	HAC	improved	medium	38	1	1.14	1	229.0	228.6	226.8	226.6	225.9	223.4	220.1	217.9	242.8	240.4
	cold dry	LAC	non-degraded	-	33	1	1	1	21.5	21.4	21.3	21.3	21.2	21.0	20.6	19.9	18.8	18.6
	cold dry	LAC	improved	medium	33	1	1.14	1	9.2	9.2	9.1	9.1	9.1	9.0	8.8	9.3	10.1	10.0
	warm dry	LAC	non-degraded	-	24	1	1	1	12.2	12.2	12.1	12.1	12.0	11.9	11.7	11.6	11.5	11.4
	warm dry	LAC	improved	medium	24	1	1.14	1	12.2	12.2	12.1	12.1	12.0	11.9	11.7	11.6	11.5	11.4
	cold dry	sandy	non-degraded	-	34	1	1	1	14.5	14.5	14.3	14.3	14.3	14.1	13.9	13.8	12.5	12.4
	cold dry	sandy	improved	medium	34	1	1.14	1	9.7	9.6	9.6	9.6	9.5	9.4	9.3	9.2	10.2	10.1
	warm dry	sandy	improved	medium	19	1	1.14	1	8.7	8.7	8.6	8.6	8.6	8.5	8.4	9.7	9.6	9.5
	cold dry	aquic	non-degraded	-	87	1	1	1	76.9	76.8	76.2	76.1	75.9	75.0	73.9	74.9	72.5	73.4
	cold dry	aquic	improved	medium	87	1	1.14	1	13.6	13.5	13.4	13.4	13.4	13.2	13.0	11.2	12.8	11.0
	warm dry	aquic	non-degraded	-	88	1	1	1	110.6	110.4	109.5	109.5	109.1	107.9	106.3	102.6	117.3	113.5
	warm dry	aquic	improved	medium	88	1	1.14	1	27.7	27.6	27.4	27.4	27.3	27.0	26.6	28.9	13.0	15.5
Total Grassland area (ha)									**1296.6**	**1294.2**	**1284.0**	**1283.3**	**1279.2**	**1264.9**	**1246.4**	**1233.7**	**1222.3**	**1209.9**
Carbon stock (Gg C ha^{-1})									**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**	**51.7**

***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}	F_I	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
	Climate	Soil	Management	Input					Area (ha)									
Grassland	cold dry	HAC	non-degraded	-	50	1	1	1	214.5	212.4	213.5	224.9	246.2	258.5	270.5	277.1	293.3	296.2
	cold dry	HAC	improved	medium	50	1	1.14	1	143.0	141.6	136.5	121.1	95.8	79.4	63.5	52.8	32.6	25.8
	warm dry	HAC	non-degraded	-	38	1	1	1	296.0	314.1	310.5	317.2	348.9	404.8	424.6	434.2	443.4	447.4
	warm dry	HAC	improved	medium	38	1	1.14	1	232.6	209.4	207.0	194.4	156.8	94.9	69.1	53.7	38.6	28.6
	cold dry	LAC	non-degraded	-	33	1	1	1	18.4	18.2	18.0	18.1	19.2	21.2	22.2	22.5	23.2	23.5
	cold dry	LAC	improved	medium	33	1	1.14	1	9.9	9.8	9.7	9.3	7.9	5.6	4.2	3.7	2.6	2.0
	warm dry	LAC	non-degraded	-	24	1	1	1	11.3	12.5	12.4	12.9	14.2	15.8	17.1	17.3	17.7	18.3
	warm dry	LAC	improved	medium	24	1	1.14	1	11.3	9.8	9.7	8.9	7.3	5.5	4.0	3.5	2.9	2.0
	cold dry	sandy	non-degraded	-	34	1	1	1	12.3	13.2	13.1	13.2	14.3	16.0	16.9	17.5	17.9	18.3
	cold dry	sandy	improved	medium	34	1	1.14	1	10.0	8.8	8.7	8.4	7.0	5.1	4.0	3.1	2.4	1.8
	warm dry	sandy	non-degraded	-	19	1	1	1	17.4	16.7	16.5	16.6	17.4	19.0	20.3	21.3	22.0	22.4
	warm dry	sandy	improved	medium	19	1	1.14	1	9.4	9.8	9.7	9.3	8.2	6.3	4.8	3.5	2.4	1.7
	cold dry	aquic	non-degraded	-	87	1	1	1	72.7	74.5	73.6	75.2	75.9	77.4	76.5	75.6	74.6	74.5
	cold dry	aquic	improved	medium	87	1	1.14	1	10.9	8.3	8.2	5.7	4.0	1.6	1.6	1.5	1.5	0.8
	warm dry	aquic	non-degraded	-	88	1	1	1	112.3	113.8	112.5	111.2	112.3	112.2	112.1	113.1	111.7	111.5
	warm dry	aquic	improved	medium	88	1	1.14	1	15.3	12.6	12.5	12.4	9.8	8.4	7.2	4.7	4.7	3.4
Total Grassland area (ha)									**1197.3**	**1185.6**	**1172.2**	**1158.7**	**1145.3**	**1131.8**	**1118.4**	**1105.0**	**1091.5**	**1078.1**
Carbon stock (Gg C ha^{-1})									**51.7**	**51.6**	**51.5**	**51.4**	**51.0**	**50.6**	**50.3**	**50.2**	**50.0**	**49.8**

***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}	F_{I}	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
	Climate	Soil	Management	Input					Area (ha)									
Grassland	cold dry	HAC	non-degraded	-	50	1	1	1	295.6	293.5	302.7	305.6	305.3	305.0	301.7	301.4	300.7	300.0
	cold dry	HAC	improved	medium	50	1	1.14	1	22.3	20.4	9.4	4.7	3.1	1.5	3.0	1.5	1.5	1.5
	warm dry	HAC	non-degraded	-	38	1	1	1	451.2	447.9	449.9	451.8	453.7	451.0	448.4	445.7	444.6	443.6
	warm dry	HAC	improved	medium	38	1	1.14	1	18.8	16.2	11.5	6.9	2.3	2.3	2.3	2.2	2.2	2.2
	cold dry	LAC	non-degraded	-	33	1	1	1	23.4	23.4	23.5	23.9	24.2	24.1	23.9	23.9	23.8	23.8
	cold dry	LAC	improved	medium	33	1	1.14	1	1.8	1.5	1.2	0.7	0.2	0.2	0.2	0.1	0.1	0.1
	warm dry	LAC	non-degraded	-	24	1	1	1	18.4	18.3	18.5	18.8	19.3	19.1	19.0	19.0	19.0	18.9
	warm dry	LAC	improved	medium	24	1	1.14	1	1.6	1.5	1.2	0.8	0.2	0.2	0.2	0.1	0.1	0.1
	cold dry	sandy	non-degraded	-	34	1	1	1	18.2	18.0	18.9	19.0	18.8	19.1	19.0	18.9	18.8	18.8
	cold dry	sandy	improved	medium	34	1	1.14	1	1.6	1.6	0.6	0.4	0.4	0.0	0.0	0.0	0.0	0.0
	warm dry	sandy	non-degraded	-	19	1	1	1	22.4	22.4	22.7	22.8	22.7	23.0	22.8	22.7	22.7	22.6
	warm dry	sandy	improved	medium	19	1	1.14	1	1.4	1.2	0.7	0.5	0.5	0.0	0.0	0.0	0.0	0.0
	cold dry	aquic	non-degraded	-	87	1	1	1	73.5	72.6	72.2	71.8	72.1	71.6	71.2	70.8	70.6	70.5
	cold dry	aquic	improved	medium	87	1	1.14	1	0.7	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0
	warm dry	aquic	non-degraded	-	88	1	1	1	110.1	109.8	110.3	109.7	110.1	109.5	108.8	108.2	107.9	107.7
	warm dry	aquic	improved	medium	88	1	1.14	1	3.4	2.2	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0
Total Grassland area (ha)									**1064.6**	**1051.2**	**1045.1**	**1039.0**	**1032.9**	**1026.7**	**1020.6**	**1014.5**	**1012.2**	**1009.8**
Carbon stock (Gg C ha^{-1})									**49.8**	**49.7**	**49.6**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**

Table A3-11 *Set-Aside Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
	Climate	Soil	Management	Input					Area (ha)													
Set-Aside Grassland	cold dry	HAC	-	-	50	1	1	1	3.9	9.4	8.7	8.1	10.0	10.6	12.0	10.7	11.0	11.3	12.6	9.1	3.0	2.3
	warm dry	HAC			38	1	1	1	5.8	14.0	12.9	11.9	14.7	15.7	17.7	15.8	16.3	16.7	18.6	13.4	4.5	3.4
	cold dry	LAC			33	1	1	1	0.3	0.7	0.7	0.6	0.8	0.8	0.9	0.8	0.9	0.9	1.0	0.7	0.2	0.2
	warm dry	LAC			24	1	1	1	0.2	0.6	0.5	0.5	0.6	0.7	0.8	0.7	0.7	0.7	0.8	0.6	0.2	0.1
	cold dry	sandy			34	1	1	1	0.2	0.6	0.5	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.6	0.2	0.1
	warm dry	sandy			19	1	1	1	0.3	0.7	0.7	0.6	0.7	0.8	0.9	0.8	0.8	0.8	0.9	0.7	0.2	0.2
	cold dry	aquic			87	1	1	1	0.9	2.2	2.0	1.9	2.3	2.5	2.8	2.5	2.6	2.6	2.9	2.1	0.7	0.5
	warm dry	aquic			88	1	1	1	1.4	3.4	3.1	2.9	3.6	3.8	4.3	3.8	3.9	4.0	4.5	3.2	1.1	0.8
Total Set-Aside Grassland area (ha)									**13.0**	**31.6**	**29.1**	**27.0**	**33.3**	**35.6**	**40.1**	**35.7**	**36.8**	**37.7**	**42.1**	**30.4**	**10.1**	**7.6**
Carbon stock (Gg C ha^{-1})									**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**

Table A3-11 *(continued) Set-Aside Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
	Climate	Soil	Management	Input					Area (ha)									
Set-Aside Grassland	cold dry	HAC	-	-	50	1	1	1	6.1	6.8	9.8	10.0	11.3	15.5	21.1	24.9	28.3	32.0
	warm dry	HAC			38	1	1	1	9.0	10.0	14.5	14.9	16.7	23.0	31.1	36.8	41.8	47.3
	cold dry	LAC			33	1	1	1	0.5	0.5	0.8	0.8	0.9	1.2	1.7	2.0	2.2	2.5
	warm dry	LAC			24	1	1	1	0.4	0.4	0.6	0.6	0.7	1.0	1.3	1.6	1.8	2.0
	cold dry	sandy			34	1	1	1	0.4	0.4	0.6	0.6	0.7	1.0	1.3	1.5	1.8	2.0
	warm dry	sandy			19	1	1	1	0.5	0.5	0.7	0.8	0.8	1.2	1.6	1.9	2.1	2.4
	cold dry	aquic			87	1	1	1	1.4	1.6	2.3	2.3	2.6	3.6	4.9	5.8	6.6	7.5
	warm dry	aquic			88	1	1	1	2.2	2.4	3.5	3.6	4.0	5.5	7.5	8.9	10.1	11.4
Total Set-Aside Grassland area (ha)									**20.3**	**22.7**	**32.9**	**33.6**	**37.7**	**52.0**	**70.5**	**83.2**	**94.6**	**107.0**
Carbon stock (Gg C ha^{-1})									**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**

Table A3-11 *(continued) Set-Aside Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
	Climate	Soil	Management	Input					Area (ha)									
Set-Aside Grassland	cold dry	HAC	-	-	50	1	1	1	35.7	39.2	43.2	47.2	51.3	55.3	59.3	63.3	67.3	71.3
	warm dry	HAC			38	1	1	1	52.8	58.0	63.9	69.9	75.8	81.7	87.7	93.6	99.5	105.5
	cold dry	LAC			33	1	1	1	2.8	3.1	3.4	3.7	4.1	4.4	4.7	5.0	5.3	5.7
	warm dry	LAC			24	1	1	1	2.3	2.5	2.7	3.0	3.2	3.5	3.7	4.0	4.2	4.5
	cold dry	sandy			34	1	1	1	2.2	2.4	2.7	2.9	3.2	3.4	3.7	3.9	4.2	4.4
	warm dry	sandy			19	1	1	1	2.7	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.3
	cold dry	aquic			87	1	1	1	8.3	9.2	10.1	11.0	12.0	12.9	13.9	14.8	15.7	16.7
	warm dry	aquic			88	1	1	1	12.8	14.0	15.4	16.9	18.3	19.7	21.2	22.6	24.0	25.5
Total Set-Aside Grassland area (ha)									**119.6**	**131.3**	**144.8**	**158.2**	**171.7**	**185.1**	**198.5**	**212.0**	**225.4**	**238.9**
Carbon stock (Gg C ha^{-1})									**12.6**	**11.7**	**13.4**	**13.4**	**13.4**	**13.4**	**13.4**	**13.4**	**13.4**	**13.4**

Table A3-11 *(continued) Set-Aside Grassland areas by climate zone and soil type and estimated average carbon stocks*

Land-use	sub-categories				SOC_{ref}	F_{LU}	F_{MG}	F_I	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
	Climate	Soil	Management	Input					Area (ha)									
Set-Aside Grassland	cold dry	HAC	-	-	50	1	1	1	75.3	79.3	81.2	83.0	84.8	86.7	88.5	90.3	91.0	91.7
	warm dry	HAC			38	1	1	1	111.4	117.3	120.0	122.7	125.4	128.1	130.8	133.5	134.6	135.6
	cold dry	LAC			33	1	1	1	6.0	6.3	6.4	6.6	6.7	6.9	7.0	7.2	7.2	7.3
	warm dry	LAC			24	1	1	1	4.8	5.0	5.1	5.2	5.4	5.5	5.6	5.7	5.7	5.8
	cold dry	sandy			34	1	1	1	4.7	4.9	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.7
	warm dry	sandy			19	1	1	1	5.6	5.9	6.1	6.2	6.4	6.5	6.6	6.8	6.8	6.9
	cold dry	aquic			87	1	1	1	17.6	18.5	19.0	19.4	19.8	20.2	20.7	21.1	21.3	21.4
	warm dry	aquic			88	1	1	1	26.9	28.3	29.0	29.6	30.3	30.9	31.6	32.2	32.5	32.7
Total Set-Aside Grassland area (ha)									**252.3**	**265.7**	**271.9**	**278.0**	**284.1**	**290.2**	**296.3**	**302.4**	**304.8**	**307.1**
Carbon stock (Gg C ha^{-1})									**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**	**49.5**

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

To date, no detailed information is available on assessment of completeness and of potentially excluded sources and sinks of greenhouse gas emissions.

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 sectoral expert
ellenőr szektorfelelős

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

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

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

Date/
Dátum: …………….. ……………………… ………………………
auditor sectoral expert
ellenőr 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 prioritise 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 without the LULUCF sector since uncertainty estimates for activity data are not available for this sector. The disaggregation of the inventory into categories is the same listed in *Table A1-2* and reported in previous submissions, because the uncertainty values were available only for those categories.

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, without the sector of LULUCF, in *Table A7-1*.

Table A7-1. *Uncertainty calculation without LULUCF, Tier 1 method*

CRF code	IPCC source category	Direct green-house gas	Base year emission (Gg CO_2-eq.)	Current year (2008) emission (Gg CO_2-eq.)	Activity data uncer-tainty (%)	Emission factor uncer-tainty (%)	Combined uncertainty (%)	Combined uncertainty as % of total emissions in current year
	A	B	C	D	E	F	G	H
			Input data	Input data	Input data	Input data	$\sqrt{E^2+F^2}$	$\frac{G \cdot D}{\sum D}$
1. A.	Stationary Combustion - Gas	CO_2	19 924.15	23 981.08	5	5	7.071	2.309
1. A.	Stationary Combustion - Coal	CO_2	34 678.65	12 231.13	2	5	5.385	0.897
1. A.	Stationary Combustion - Oil	CO_2	16 277.89	3 233.75	2	5	5.385	0.237
1. A.	Non-CO_2 Emission from Stationary Fuel Combustion	N_2O	797.22	424.93	3	50	50.090	0.290
1. A.	Non-CO_2 Emission from Stationary Fuel Combustion	CH_4	1 092.14	291.71	3	8	8.544	0.034
1. A.	Stationary Combustion - Other Fuel	CO_2	96.89	394.05	5	10	11.180	0.060
1. A. 3.	Mobile Combustion - Other	CO_2	814.20	190.84	5	5	7.071	0.018
1. A. 3.	Mobile Combustion	N_2O	112.07	410.29	5	100	100.125	0.559
1. A. 3.	Mobile Combustion	CH_4	45.64	23.52	5	50	50.249	0.016
1. A. 3. B.	Mobile Combustion - Road	CO_2	6 807.45	12 262.09	5	5	7.071	1.181
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CH_4	923.01	21.10	3	10	10.440	0.003
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CO_2	3.60	NO	3	10	10.440	0.000
1. B. 2.	Fugitive Emissions from Oil and Gas Operations (Main Source: Gas Distribution)	CH_4	1 613.47	2 045.80	2	50	50.040	1.394
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	N_2O	0.60	0.23	2	100	100.020	0.000
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	CO_2	195.68	99.86	100	80	128.062	0.174
2.	N_2O Emission from Industry	N_2O	4 541.51	5.08	2	1	2.236	0.000
2.	CH_4 Emission from Industry	CH_4	7.84	15.26	1	20	20.025	0.004

Table A7-1. *Uncertainty calculation without LULUCF, Tier 1 method*

CRF code	IPCC source category	Direct green-house gas	Base year emission (Gg CO_2-eq.)	Current year (2008) emission (Gg CO_2-eq.)	Activity data uncer-tainty (%)	Emission factor uncer-tainty (%)	Combined uncertainty (%)	Combined uncertainty as % of total emissions in current year
	A	B	C	D	E	F	G	H
			Input data	Input data	Input data	Input data	$\sqrt{E^2+F^2}$	$\frac{G \cdot D}{\sum D}$
2. A. 1.	CO_2 Emissions from Cement Production	CO_2	1 778.28	1 260.65	2	2	2.828	0.049
2. A. 2.	CO_2 Emissions from Lime Production	CO_2	645.03	318.50	5	2	5.385	0.023
2. A. 3.	CO_2 Emission from Limestone and Dolomit Use	CO_2	248.68	315.60	2	1	2.236	0.010
2. A. 7.	CO_2 Emission from Other Mineral Products	CO_2	642.13	374.94	10	30	31.623	0.161
2. B. 1.	CO_2 Emissions from Ammonia Processes	CO_2	1 502.70	393.28	2	2	2.828	0.015
2. B. 3.	CO_2 Emissions from Nitric Acid Production	CO_2	0.082	0.000	3	40	40.112	0.000
2. C.	CO_2 Emissions from Metal Production	CO_2	641.57	271.60	2	5	5.385	0.020
2. C. 3.	PFCs Emissions	PFCs	166.82	2.41	1	2	2.236	0.000
2. F.	Emissions from Substitutes for Ozone Depleting Substances	HFCs	0.78	703.38	10	20	22.361	0.214
2. F. 7.	SF_6 Emissions from Electrical Equipment	SF_6	70.15	231.89	80	20	82.462	0.260
2. G.	Feedstocks and non-energy use of fuels	CO_2	550.97	919.59	5	10	11.180	0.140
3.	N_2O Emission from Solvent and Other Product Use	N_2O	154.17	340.93	2	1	2.236	0.010
3.	CO_2 Emission from Solvent and Other Product Use	CO_2	130.36	65.37	10	20	22.361	0.020
4. A	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	3 435.62	1 636.94		28.66	28.66	0.639
4. B	CH_4 Emissions from Manure Management	CH_4	2 398.17	1 020.12		42.24	42.24	0.587
4. B.	N_2O Emissions from Manure Management	N_2O	1 899.61	925.04		70.07	70.07	0.883
4. C.	CH_4 Emission from Rice Cultivation	CH_4	50.54	10.64	201.62	80.00	216.91	0.031
4. D. 1.	Direct N_2O Emissions from Agricultural Soils	N_2O	5 481.04	3 141.92		154.09	154.09	6.593

Table A7-1. *Uncertainty calculation without LULUCF, Tier 1 method*

CRF code	IPCC source category	Direct green-house gas	Base year emission (Gg CO_2-eq.)	Current year (2008) emission (Gg CO_2-eq.)	Activity data uncer-tainty (%)	Emission factor uncer-tainty (%)	Combined uncertainty (%)	Combined uncertainty as % of total emissions in current year
	A	B	C	D	E	F	G	H
			Input data	Input data	Input data	Input data	$\sqrt{E^2+F^2}$	$\frac{G \cdot D}{\sum D}$
4. D. 2.	Pasture, range and paddock manure	N_2O	336.01	172.61		152.82	152.82	0.359
4. D. 3.	Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O	3 851.08	1 875.82		61.16	61.16	1.562
4. F.	Field Burning of Agricultural Residues	CH_4	45.51	NO	NE	NE	0.000	0.000
4. F.	Field Burning of Agricultural Residues	N_2O	13.34	NO	NE	NE	0.000	0.000
6. A.	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	1 917.30	3 021.39	10	30	31.623	1.301
6. B.	Emissions from Wastewater Handling	CH_4	847.03	526.63	20	30	36.056	0.259
6. B.	Emissions from Wastewater Handling	N_2O	207.70	199.58	10	1000	1000.050	2.718
6. C.	Non-biogenic CO_2 from Waste	CO_2	NA,NO	64.12	10	20	22.361	0.020
6. C.	CH_4 Emissions from Waste Incineration	CH_4	NA	0.49	10	50	50.990	0.000
6. C.	N_2O Emissions from Waste Incineration	N_2O	NA,NO	1.97	5	100	100.125	0.003

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 without LULUCF, Tier 1 method*

CRF code	IPCC source category	Direct green-house gas	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend in emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total emissions (%)
	A	B	I	J	K	L	M
			Note A	$\frac{D}{\sum C}$	$I \cdot F$	$J \cdot E \cdot \sqrt{2}$	$\sqrt{K^2 + L^2}$
1. A.	Stationary Combustion - Gas	CO_2	0.098	0.209	0.489	1.475	1.554
1. A.	Stationary Combustion - Coal	CO_2	-0.086	0.106	-0.430	0.301	0.525
1. A.	Stationary Combustion - Oil	CO_2	-0.062	0.028	-0.311	0.080	0.321
1. A.	Non-CO_2 Emission from Stationary Fuel Combustion	N_2O	-0.001	0.004	-0.037	0.016	0.040
1. A.	Non-CO_2 Emission from Stationary Fuel Combustion	CH_4	-0.004	0.003	-0.028	0.011	0.030
1. A.	Stationary Combustion - Other Fuel	CO_2	0.003	0.003	0.029	0.024	0.038
1. A. 3.	Mobile Combustion - Other	CO_2	-0.003	0.002	-0.014	0.012	0.019
1. A. 3.	Mobile Combustion	N_2O	0.003	0.004	0.295	0.025	0.296
1. A. 3.	Mobile Combustion	CH_4	0.000	0.000	-0.002	0.001	0.003
1. A. 3. B.	Mobile Combustion - Road	CO_2	0.069	0.107	0.344	0.754	0.829
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CH_4	-0.005	0.000	-0.049	0.001	0.049
1. B. 1.	Fugitive Emissions from Coal Mining and Handling	CO_2	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	0.009	0.018	0.442	0.050	0.444
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	N_2O	0.000	0.000	0.000	0.000	0.000
1. B. 2.	Fugitive Emissions from Oil and Gas Operations	CO_2	0.000	0.001	-0.017	0.123	0.124
2.	N_2O Emission from Industry	N_2O	-0.025	0.000	-0.025	0.000	0.025
2.	CH_4 Emission from Industry	CH_4	0.000	0.000	0.002	0.000	0.002

Table A7-2. *Uncertainty calculation without LULUCF, Tier 1 method*

CRF code	IPCC source category	Direct green-house gas	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend in emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total emissions (%)
	A	B	I	J	K	L	M
			Note A	$\frac{D}{\sum C}$	$I \cdot F$	$J \cdot E \cdot \sqrt{2}$	$\sqrt{K^2 + L^2}$
2. A. 1.	CO_2 Emissions from Cement Production	CO_2	0.001	0.011	0.002	0.031	0.031
2. A. 2.	CO_2 Emissions from Lime Production	CO_2	-0.001	0.003	-0.002	0.020	0.020
2. A. 3.	CO_2 Emission from Limestone and Dolomit Use	CO_2	0.001	0.003	0.001	0.008	0.008
2. A. 7.	CO_2 Emission from Other Mineral Products	CO_2	0.000	0.003	-0.009	0.046	0.047
2. B. 1.	CO_2 Emissions from Ammonia Processes	CO_2	-0.005	0.003	-0.010	0.010	0.014
2. B. 3.	CO_2 Emissions from Nitric Acid Production	CO_2	0.000	0.000	0.000	0.000	0.000
2. C.	CO_2 Emissions from Metal Production	CO_2	-0.001	0.002	-0.006	0.007	0.009
2. C. 3.	PFCs Emissions	PFCs	-0.001	0.000	-0.002	0.000	0.002
2. F.	Emissions from Substitutes for Ozone Depleting Substances	HFCs	0.006	0.006	0.122	0.087	0.150
2. F. 7.	SF_6 Emissions from Electrical Equipment	SF_6	0.002	0.002	0.033	0.228	0.231
2. G.	Feedstocks and non-energy use of fuels	CO_2	0.005	0.008	0.049	0.057	0.075
3.	N_2O Emission from Solvent and Other Product Use	N_2O	0.002	0.003	0.002	0.008	0.009
3.	CO_2 Emission from Solvent and Other Product Use	CO_2	0.000	0.001	-0.003	0.008	0.009
4. A	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	-0.005	0.014	-0.139	0.000	0.139
4. B	CH_4 Emissions from Manure Management	CH_4	-0.004	0.009	-0.188	0.000	0.188
4. B.	N_2O Emissions from Manure Management	N_2O	-0.003	0.008	-0.176	0.000	0.176
4. C.	CH_4 Emission from Rice Cultivation	CH_4	0.000	0.000	-0.015	0.026	0.030
4. D. 1.	Direct N_2O Emissions from Agricultural Soils	N_2O	-0.003	0.027	-0.481	0.000	0.481

Table A7-2. *Uncertainty calculation without LULUCF, Tier 1 method*

CRF code	IPCC source category	Direct green-house gas	Type A sensitivity (%)	Type B sensitivity (%)	Uncertainty in trend in emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total emissions (%)
	A	B	I	J	K	L	M
			Note A	$\frac{D}{\sum C}$	$I \cdot F$	$J \cdot E \cdot \sqrt{2}$	$\sqrt{K^2 + L^2}$
4. D. 2.	Pasture, range and paddock manure	N_2O	0.000	0.002	-0.056	0.000	0.056
4. D. 3.	Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O	-0.005	0.016	-0.311	0.000	0.311
4. F.	Field Burning of Agricultural Residues	CH_4	0.000	0.000	0.000	0.000	0.000
4. F.	Field Burning of Agricultural Residues	N_2O	0.000	0.000	0.000	0.000	0.000
6. A.	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	0.016	0.026	0.469	0.372	0.598
6. B.	Emissions from Wastewater Handling	CH_4	0.000	0.005	-0.004	0.130	0.130
6. B.	Emissions from Wastewater Handling	N_2O	0.001	0.002	0.582	0.025	0.583
6. C.	Non-biogenic CO_2 from Waste	CO_2		0.001	0.000	0.008	0.008
6. C.	CH_4 Emissions from Waste Incineration	CH_4		0.000	0.000	0.000	0.000
6. C.	N_2O Emissions from Waste Incineration	N_2O		0.000	0.000	0.000	0.000

Table A7-3 *Uncertainty calculation for each GHG without LULUCF, Tier 1 method.*

Source category	GHG	Emissions int he current year (2008)	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in current year
		Gg CO_2-eq.	%			
Emission from Stationary Fuel Combustion	CH_4	291.71	3.00	8.000	8.544	0.289
Mobile Combustion	CH_4	23.52	5	50	50.249	0.137
Fugitive Emissions from Coal Mining and Handling	CH_4	21.10	3.00	10.000	10.440	0.026
Fugitive Emissions from Oil and Gas Operations	CH_4	2 045.80	2	50	50.040	11.885
Emission from Industry	CH_4	15.26	1	20	20.025	0.035
Emissions from Enteric Fermentation in Domestic Livestock	CH_4	1 636.94		28.658	28.658	5.446
Emissions from Manure Management	CH_4	1 020.12		42.23829	42.238	5.002
Emission from Rice Cultivation	CH_4	10.64	201.6185	80	216.910	0.268
Field Burning of Agricultural Residues	CH_4		NE	NE	0.000	0.000
Emissions from Solid Waste Disposal Sites	CH_4	3 021.39	10	30	31.623	11.092
Emissions from Wastewater Handling	CH_4	526.63	20	30	36.056	2.204
Emissions from Waste Incineration	CH_4	0.49	10	50	50.990	0.003
CH_4 uncertainty		**8 613.60**				**18.0**
% of total emission		**11.7**				
Stationary Combustion - Gas	CO_2	23 981.08	5	5	7.071	3.008
Stationary Combustion - Coal	CO_2	12 231.13	2.00	5.000	5.385	1.168
Stationary Combustion - Oil	CO_2	3 233.75	2	5	5.385	0.309
Stationary Combustion - Other Fuel	CO_2	394.048	5	10	11.180	0.078
Mobile Combustion - Other	CO_2	190.84	5	5	7.071	0.024

***Table A7-3** Uncertainty calculation for each GHG without LULUCF, Tier 1 method.*

Source category	GHG	Emissions int he current year (2008)	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in current year
Mobile Combustion - Road	CO_2	12 262.09	5.00	5.000	7.071	1.538
Fugitive Emissions from Coal Mining and Handling	CO_2	NO	3	10	10.440	0.000
Fugitive Emissions from Oil and Gas Operations	CO_2	99.86	100	80	128.062	0.227
Emissions from Cement Production	CO_2	1 260.65	2.00	2.000	2.828	0.063
Emissions from Lime Production	CO_2	318.50	5	2	5.385	0.030
Emission from Limestone and Dolomit Use	CO_2	315.60	2	1	2.236	0.013
Emission from Other Mineral Products	CO_2	374.94	10	30	31.623	0.210
Emissions from Ammonia Processes	CO_2	393.28	2	2	2.828	0.020
Emissions from Nitric Acid Production	CO_2	0.00	3	40	40.112	0.000
Emissions from Metal Production	CO_2	271.60	2	5	5.385	0.026
Feedstocks and non-energy use of fuels	CO_2	919.59	5	10	11.180	0.182
Emission from Solvent and Other Product Use	CO_2	65.37	10	20	22.361	0.026
Non-biogenic CO_2 from Waste	CO_2	64.12	10	20	22.361	0.025
CO_2 uncertainty		**56 376.45**				**3.6**
% of total emission		**76.8**				
	N_2O	424.93	3	50	50.090	2.839
Mobile Combustion	N_2O	410.29	5	100	100.125	5.479
Fugitive Emissions from Oil and Gas Operations	N_2O	0.23	2	100	100.020	0.003
Emission from Industry	N_2O	5.08	2	1	2.236	0.002
Emission from Solvent and Other Product Use	N_2O	340.93	2	1	2.236	0.102

***Table A7-3** Uncertainty calculation for each GHG without LULUCF, Tier 1 method.*

Source category	GHG	Emissions int he current year (2008)	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in current year
Emissions from Manure Management	N_2O	925.04		70.06935	70.069	8.644
Direct N_2O Emissions from Agricultural Soils	N_2O	3 141.92		154.087	154.087	64.565
Pasture, range and paddock manure	N_2O	172.61		152.8192	152.819	3.518
Indirect N_2O Emissions from Nitrogen Used in Agriculture	N_2O	1 875.82		61.161	61.161	15.300
Field Burning of Agricultural Residues	N_2O		NE	NE	0.000	0.000
Emissions from Wastewater Handling	N_2O	199.58	10	1000	1000.050	26.617
Emissions from Waste Incineration	N_2O	1.97	5	100	100.125	0.026
N_2O uncertainty		**7 498.39**				**72.4**
% of total emission		**10.2**				
PFCs Emissions	PFCs	2.41	1	2	2.236	0.006
SF_6 Emissions from Electrical Equipment	SF_6	231.89	80	20	82.462	20.393
Emissions from Substitutes for Ozone Depleting Substances	HFCs	703.38	10	20	22.361	16.773
HFCs, PFCs, SF_6 uncertainty		**937.68**				**26.405**
% of total emission		**1.3**				

Annex 8 Responses to the review of the 2009 inventory submission

<table>
<tr><th>CRF</th><th>Comment</th><th>Hungary's response</th><th>Where in the NIR</th></tr>
<tr><td>1.AA.2. Manufacturing industries and construction</td><td>45. Hungary has removed natural gas used as feedstock and for non-energy purposes from the energy sector. The ERT reiterates the recommendation from the previous review that Hungary reallocate the AD for feedstocks and non-energy use of fuel for all fuels to the industrial processes sector. The change should include the implementation of appropriate QA/QC procedures.</td><td rowspan="2">Feedstocks and non-energy use of fuels were allocated to 2G (industrial processes sector) in line with the Revised 1996 IPCC Guidelines. QA/QC check was performed.</td><td rowspan="2">Chapter 3.2.7.5 and 4.9</td></tr>
<tr><td>1.AA.2.C Chemicals/liquid fuels</td><td>46. The ERT noted that the inter-annual changes of the CO_2 IEF for chemicals for liquid fuel show large variations (ranging from -34.4 to 52.6 per cent) over the entire time series. The CO_2 IEF (18.18 t/TJ) reported by Hungary for 2007 is the lowest of reporting Parties (ranging from 18.18.78.30 t/TJ) and below the IPCC default range (63.1.100.8 t/TJ), attributed to the inclusion of feedstocks in the AD. The ERT recommends that Hungary include available underlying AD for the subcategory in its next submission and to exclude feedstocks from the energy sector and report it in the industrial processes sector in line with the Revised 1996 IPCC Guidelines.</td></tr>
</table>

CRF	Comment	Hungary's response	Where in the NIR
1.AA.3.B Road transportation	48. The ERT noted that the time series for the N_2O IEF for gasoline and diesel used in road transportation as well as the CH4 IEF for gasoline used in road transportation are not consistent for the years 1988.2003. Hungary stated that it is waiting for more information to correct the emissions data for previous years. There were no changes in this category since the previous submission, so the ERT reiterates the recommendation of the previous review that Hungary update the entire time series for gasoline and diesel used in road transportation. The ERT encourages Hungary to use the recalculation approaches suggested by the IPCC good practice guidance (e.g. trend extrapolation), until better data are available.	The entire time-series was updated.	Chapter 3.2.8.5
1.B.2.A.5. Distribution of oil products	51. The ERT commends Hungary's efforts to improve completeness of reporting of this category, including CH4 and N2O emissions from flaring. The ERT noted that Hungary reports fugitive CH4 emissions from the distribution of oil products as 'NE'. The ERT encourages Hungary to explore the possibility of reporting these emissions in its next submission.	We couldn't find appropriate emission factors for these categories.	

CRF	Comment	Hungary's response	Where in the NIR
1.AA.3.A Civil aviation	50. The previous ERT noted that emissions and AD for civil aviation are only reported for the base year, 1999, 2000, 2001 and 2006. Hungary reported that, in recent years, aviation gasoline has not been separated from other gasoline due to a lack of information in national statistics. Emissions from civil aviation are reported with road transportation in the missing years. The ERT recommends Hungary to report both fuels separately and suggests that aviation data could be used to correlate energy statistics data with actual aviation activity. During the review the ERT noted inconsistencies in the aviation gasoline EF for the entire time series. In response to a question by the ERT, Hungary stated that it is aware of the inconsistencies and will correct the data in the next submission. The ERT recommends that Hungary recalculate the emissions from domestic aviation for the entire time series and document in the next NIR the EFs, methodology and any assumptions made. The ERT also noted that there is no information in the NIR and CRF tables on where aviation fuel used for military activity is allocated. The ERT recommends that Hungary include such information in the next annual submission.	The inconsistency problem was solved, default EFs were used for all reported years. Emissions from civil aviation is equal to the emissions from aviation gasoline in Hungary. According to the new government decree (from the end of 2009) those companies from air transport, who emit more than 100 t CO_2 eq./year, have to report their domestic and international fuel consumption. Hopefully, we will able to fill in this category with the new information. As the top-down and bottom-up approaches in the Hungarian energy statistics are harmonized, the aviation fuels used for military activities are also included somewhere in the transport sector.	Chapter 3.2.8.5

CRF	Comment	Hungary's response	Where in the NIR
1.AC Difference – Reference and Sectoral Approach	43. In 2007, Hungary reported a difference of 3.18 per cent in CO2 emissions and a 1.81 per cent difference in energy consumption between the reference and the sectoral approaches. Due to the reallocation of natural gas used as feedstocks, the differences in fuel consumption have decreased since the 2008 submission.The ERT encourages Hungary to follow the UNFCCC reporting guidelines and include explanations on causes for differences in CO_2 emissions higher than 2 per cent in the documentation box to CRF table 1.A(c).	We presented some explanations on causes for differences in CO_2 emissions higher than 2 per cent in the documentation box to CRF table, and also the references of the detailed analysis written in the NIR.	In the CRF table
2.F.	53. Potential emissions of HFCs from foam blowing are reported as „NE” and potential HFC emissions from aerosols/metered dose inhalers are reported as not occurring „NO”, while actual emissions from these categories are reported.	Potential emissions were added.	Chapter 4.8 and CRF table
2.F.	53. The HFC emissions from fire extinguishers are reported as „NE” for the years up to 2006 and „NO” for 2007, and HFC-134a emissions from hard foam disposal are reported as „IE” till 2004 and as „NO” for years 2004-2007. The ERT recommends that Hungary further examine the occurrence of the emission sources reported as „NO” and to provide estimates for the categories reported as „NE”.	Corrections were made.	Chapter 4.8 and CRF table

CRF	Comment	Hungary's response	Where in the NIR
2.A.1 Cement	56. CO_2 emissions from cement production are estimated based on plant-specific data from EU ETS for the years 2005.2007. The plant-specific data are derived from a derivatographic analysis of carbonates. This method corresponds to the IPCC tier 2 method.	Corrected to T2.	CRF table
2.F.	60. The NIR includes information on methodology, AD sources and EFs; however, the methodology and parameters used are not described transparently in the NIR. In response to a question by the ERT, Hungary clarified the principles on which the emissions are estimated. The ERT recommends that Hungary improve the transparency of the NIR by explaining which IPCC tiers are used for the estimation of emissions and by reporting the relevant parameters used for each subcategory.	More details are provided in the NIR.	Chapter 4.8

CRF	Comment	Hungary's response	Where in the NIR
2.C.	63. As indicated in the previous review, process emissions from iron and steel production are included partly in the industrial processes, and partly in the energy sector. CO2 emissions from steel production are reported in industrial processes sector, but CO2 and CH4 emissions from pig iron and sinter production and coke consumption are reported as included elsewhere (.IE.), as are CH4 emissions from steel production. In CRF table 9, it is explained that these emissions are included in the chemicals category in the energy sector. The ERT recommends that Hungary correctly allocate the emissions from the consumption of the reducing agent to the industrial processes sector in accordance with the IPCC good practice guidance.	Allocation is corrected in the CRF (1.AA.2.A Iron and Steel)	Chapter 4.5.1 and CRF table 9.
4.	65. The inventory for the agriculture sector is complete and the NIR included descriptions of the methods, uncertainty estimates and QA/QC procedures. Hungary applied higher tier methodologies to key categories. The ERT encourages Hungary to improve the transparency of the NIR by including additional information on assumptions and rationale for choices of parameters for developing EFs, particularly where tier 2 methodologies are used.	The NIR chapters have been supplemented with more details.	Chapter Chapter 6.1.7

CRF	Comment	Hungary's response	Where in the NIR
4.A	68. For dairy cattle, the average gross energy intake was determined based on data from the Hungarian Nutrition Codex (2004). The time series for the methane conversion rate (Ym) and gross energy intake (GE) were provided in NIR. However, there is insufficient information in the NIR describing how these time series were developed. In response to a question from the ERT, Hungary provided additional information and a calculation sheet on Ym and GE. The ERT recommends that Hungary include this information in its next annual submission.	The NIR chapters have been supplemented with more details.	Chapter 6.2.2.1
4.A	69. Using a tier 2 method for non-dairy cattle, Hungary used average values from the IPCC default ranges to develop EFs. There is no indication whether Eastern or Western Europe parameters on feed digestibility and average weight were applied for non-dairy cattle. In response to a question from the ERT, Hungary clarified that the default values for Western Europe were applied. Hungary stated that it plans to use country-specific data in its next submission. The ERT encourages Hungary.s efforts to develop country-specific data.		Chapter 6.2.6

CRF	Comment	Hungary's response	Where in the NIR
4.B	71. The ERT noted inconsistencies with volatile solid values between CRF table 6.6 (for dairy) and CRF table 6.8 (for poultry) in the NIR and CRF table 4.B(a). For example, the volatile solid excretion rates for poultry in the NIR and CRF table were 0.014 kg dm/day and 0.10 kg dm/day, respectively, and the volatile solid excretion rates for dairy cattle in the NIR and CRF tables were 0.057.0.059 kg dm/day and 4.5.4.9 kg dm/day. In response to a question from the ERT, Hungary clarified that there are errors in the volatile solid excretion rates for dairy cattle in the NIR and in the volatile solid excretion rates for poultry in the CRF. The ERT recommends that Hungary improve category-specific QA/QC procedures for inventory preparation in order to remove inconsistencies in future submissions.	In the 2008 inventory cycle the QA/QC procedures was implemented according to the QA/QC plan. A member of the inventory team undertook a re-examination of the activity data and the calculation sheet. The main goal of the QA/QC process to avoid the over and the under estimation of the emissions. The QA/QC procedures have resulted in improvements and recalculations that are taken into account in the 2010 inventory submission. The effect of the QA/QC procedures is described in the recalculation chapter. (It is important to note that the revealed inconsistencies in course of centralized review were in the CRF additional information table, so they did not influence on the results of the estimations.)	Chapter 6.1

CRF	Comment	Hungary's response	Where in the NIR
4.B	72. Hungary used an IPCC tier 1 method to estimate the N2O emissions from manure management. The ERT noted there was insufficient information in the NIR to support the allocation of waste to animal waste management systems. In response to a question from ERT, Hungary explained that the allocation is based on a country-specific study. The ERT recommends that Hungary support the allocation of waste to animal waste management systems by including a summary of the country-specific study in its next submission.	The NIR chapters have been supplemented with more details; although the referred study has not been translated into English.	Chapter 6.1.7 Chapter 6.3.2 Chapter 6.3.6
4.D.1	73. In accordance with the IPCC good practice guidance, a tier 1b method was applied to calculate the direct N2O emissions from agricultural soil. The NIR includes a table that includes the EFs and most parameters used in the calculations. The ERT noted that there is no information supporting the parameters used for calculating emissions from nitrogen fixing crops and crop residues. The ERT recommends that Hungary include additional documentation and a justification of the parameters in its next submission.	The parameters used have been outlined in Table 6.23	Chapter 6.5.2

CRF	Comment	Hungary's response	Where in the NIR
4.D.3	74. Hungary uses IPCC tier 1 and default values to calculate indirect N2O emissions from agricultural soil. The ERT noted that there is an inconsistency in the values of fraction of nitrogen input to soils that is lost through leaching and run-off (FracLEACH) between the NIR and CRF tables (FracLEACH values in the NIR and CRF tables for 2006 and 2007 are 0.3 and 0.0, respectively). In response to a question from the ERT, Hungary clarified that it is due to an error in the CRF table. The ERT recommends that Hungary correct this in next submission and improve QA/QC for inventory preparation.	See the response for the paragraph 71.	Chapter 6.1
4.C	75. Tier 1 method and an IPCC default EF were applied to estimate CH4 emissions from rice cultivation without any explanation. The ERT recommends that Hungary include information to support its choice of EF and related parameters in the next NIR.	The NIR chapter has been supplemented with more details.	Chapter 6.4.2

CRF	Comment	Hungary's response	Where in the NIR
5.A	80. While Hungary has made continuous improvements to reporting in this sector, it is still not reporting changes between land-use categories, aside from land converted to forest land. In the NIR Hungary references a new approach to estimate changes in land use. Hungary stated in its 2008 and 2009 NIR that improvements are planned for the identification of deforested areas, as well as inventory system improvements for reporting activities under Article 3, paragraphs 3 and 4 of the Kyoto Protocol. In the 2009 NIR, Hungary states that it is currently in the evaluation phase of a new data collection method that was initiated in 2008, and that this method should allow Hungary to describe the location and volume of deforested areas, including damage caused by fires.	Forest fires are separately reported in NIR 2008. Deforestations in 2008 (294 ha) are localized, digitally mapped and will be reported in KP LULUCF tables 2008.	Chapter 7.2. Forest Land (CRF sector 5.A) Table 7.4. Chapter 7.2.1. Forest Land remaining Forest Land (CRF sector 5.A.1) Table 7.7.

CRF	Comment	Hungary's response	Where in the NIR
5.A	81. In response to a question from the ERT, Hungary has described this new approach. However, the approach was only started in 2008 and Hungary states that the tracking of deforestation is only possible from 2008. The new land use of deforested land is not known. The ERT noted that an inability to estimate deforestation before 2008 will cause a problem with time-series consistency when the new method is implemented. The ERT encourages the Party to explore alternative means to estimate historical changes from forest land to other land uses so that time-series consistency can be ensured. Hungary noted the need to improve reporting of disaggregated land-use changes and has described plans for improved reporting of land-use changes from forest land to other land uses in its next submission.	(1) Emissions of deforestations between 1990-2007 are reported elsewhere (IE), in the category of forest land remaining forest land. Because of the stand based inventory-system and the continuous forest planning, the losses of deforestations appears in the GHG-inventory as losses of FL-FL growing stock and this way as emission. (2) Historical data of area (ha) of deforestations are available from 2003, but these areas can not be exactly localized. A rough estimation of the growing stock of deforestations between 2003-2007 can be given based on country-specific average growing stock (m3/ha).	Chapter 7.2. Forest Land (CRF sector 5.A) Table 7.4.

CRF	Comment	Hungary's response	Where in the NIR
5.A.1	83. Hungary allocates afforested areas from land converted to forest land to forest land remaining forest land in a time frame less than the 20 year default value provided by the IPCC good practice guidance for LULUCF. Hungary stated that the length of time between category changes varies between species, and that the range is 2-15 years. In response to questions from the ERT, Hungary described an afforestation subsidy programme that uses these time ranges for verification for successful afforestation.	The subsidy-system required a detailed inventory of afforestations, and intensive surveys took place year-by-year by the Forest Authority. Every afforestation (exceptions are administrative errors) can be tracked year-by-year in these records. The time of the various stands in this category, i.e. the time that elapses from soil preparation until the stand is regarded as forest, changes by species, site, as well as climatic conditions and the appearance of pests/pathogens. This time can change between 2-3 years to 10+ years, the average being 8 years for slow growing species, 4-5 years for the faster growing Black Locust (Robinia pseudoacacia), and even less for poplars. The ratio of the various species in the afforestations in any given year of course keeps fluctuating over time.	Chapter 7.2.2. Land converted to Forest Land (CRF sector 5.A.2)
5.A.1	85. The NIR reports that dead organic matter pools are assumed not to be sources. Hungary uses a tier 1 approach assuming that its carbon stock changes are zero and lists them as .NE. in the CRF tables. The assumptions listed in the NIR support the proposal that these pools are not sources. However, the ERT reiterates the recommendation made by the previous ERT that Hungary continue its efforts to improve information on dead organic matter. The ERT encourages Hungary to use tier 2 method for forest land remaining forest land, as a key category.	To demonstrate, that DOM is not emitter, we can present the results published in IPC-Forest, Forest Focus and Life+ programs on forest health (based on systematic sampling) showing the expectable constant accumulation of biomass of standing dead trees. There are plans to collect data on some DOM pools (i.e., litter and lying deadwood based on a systematic sampling grid of 4×4 km, used in ICP Forest, Forest Focus and Life+ programs. Over a thousand plots will be surveyed in 2010.	Chapter 7.2.1 Forest Land remaining Forest Land (CRF sector 5.A.1) Figure 7.4. Chapter 7.2.6 Category-specific planned improvements

CRF	Comment	Hungary's response	Where in the NIR
5.A.1	86. Hungary is still not reporting information on carbon stock changes due to wildfires, although it was noted in the last review report that Hungary intended to begin this reporting in 2009. In response to a question from the ERT, Hungary has provided preliminary information on a new database that will be used to estimate emissions from wildfires. This information suggests that data will only be available from 2007. Hungary states that these emissions will be included in the next inventory submission. The ERT welcomes this planned improvement and encourages its inclusion in the next submission and recommends that Hungary seek methods to estimate these emissions for the entire time-series.	Forest fires are separately reported in the NIR 2008.	Chapter 7.2. Forest Land (CRF sector 5.A) Table. 7.4
6:A	97. The ERT noted some inconsistencies between the CRF tables and the NIR (different values for fraction of degradable organic carbon (DOC) in MSW and the DOC value for food and beverage)	Inconsistencies were removed	Chapter 8.2.2
6.B	100. The ERT noted that Hungary used chemical oxygen demand (COD) values per wastewater streams for industrial wastewater for previous years. However, CRF table 6.B does not contain COD or wastewater output values, and the notation key .NE. is reported for 2007.	COD and wastewater output values were added to CRF for 2008	

CRF	Comment	Hungary's response	Where in the NIR
6.C	104. There were no recalculations for this category. Therefore, the ERT reiterates the recommendations from the previous review for allocation of the emissions from incineration with energy recovery to the energy sector with clear explanation of the allocation of emissions in the NIR.	Emissions from incineration with energy recovery were re-allocated to the energy sector	Chapter 3.2.6.5, 3.2.7.5 and 8. 8.4.1.

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
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)