Statistics Finland

22 December 2006

Report to facilitate the estimation of Finland's assigned amount under the Kyoto Protocol

Report to the UNFCCC

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Preface

This report is Finland's submission to the United Nations Framework Convention on Climate Change (UNFCCC) to facilitate the calculation of the assigned amount pursuant to Article 3, paragraphs 7 and 8 of the Kyoto Protocol, and to demonstrate Finland's capacity to account for its emissions and assigned amount during the first commitment period of the Protocol.

Statistics Finland has compiled the report in collaboration with the expert organisations participating in the inventory preparation as well as the Energy Market Authority, and relevant ministries. In accordance with the Government resolution of 30 January 2003 on the organisation of climate policy activities of Government authorities, Statistics Finland assumed the responsibilities of the National Authority for Finland's greenhouse gas inventory 1 January 2005. In this capacity, Statistic Finland is responsible for the compilation of Finland's national greenhouse gas inventory, and its submission to the UNFCCC and the European Commission (EC).

This report is divided into two parts in accordance with the Annex to the decision 13/CMP.1 (Modalities for the accounting of assigned amounts under Article 7, paragraph 4, of the Kyoto Protocol).

Part I contains following information:
- complete inventories of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol for the years 1990 - 2004;
- identification of the selected base year for emissions of hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF_6);
- the agreement under Article 4, in which the EC and its 15 Member States, including Finland, have agreed to fulfil their commitments under Article 3 jointly
- calculation of the assigned amount pursuant to Article 3.7 and 3.8 of the Kyoto Protocol.

Part II contains information on:
- calculation of the commitment period reserve pursuant to decision 11/CMP.1 (Modalities, rules and guidelines for emissions trading under Article 17 of the Kyoto Protocol);
- identification of the minimum values for tree crown cover, land area and tree height for use in accounting of activities under Article 3, paragraphs 3 and 4, with justification that the values are consistent with the information historically reported to the Food and Agriculture Organisation of the United Nations (FAO);
- identification of elected activities under Article 3, paragraph 4;
- identification how accounting of Article 3, paragraphs 3 and 4 accounting will be done, annually or for the whole commitment period.

Part II contains also descriptions of the National System in accordance with Article 5, paragraph 1 and the reporting guidelines under Article 7, and the National Registry in accordance with the guidelines under Article 7.

This report is complemented with following separate reports which are part of the submission:
- Greenhouse Gas Emissions in Finland 1990 - 2004 (Finland's national inventory report and the common reporting format (CRF) tables)
- National Greenhouse Gas Inventory System in Finland (a detailed description of the National System)
- Finland's National Registry under Article 7 (a detailed description of the National Registry).

This report has been reviewed by the ministries participating in the High Level Working Group of Government Officials on the national implementation issues of the Kyoto Protocol headed by the Ministry of Trade and Industry. The Cabinet Committee on European Union Affairs approved on 27 October 2006 the procedure to submit the report to the EC and the UNFCCC.

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Part I

1 Greenhouse gas inventory for 1990 - 2004

1.1 National Inventory Report and CRF Tables

A complete inventory on greenhouse gas emissions and removals for the years 1990 - 2004 is provided in the report *Greenhouse Gas Emissions in Finland 1990 - 2004* (Finland's national inventory report and the common reporting format tables). This report is prepared in accordance with the UNFCCC *Guidelines for the preparation of national communications by Parties included in Annex I to the Convention: Part I: UNFCCC reporting guidelines on annual inventories (following incorporation of the provisions of decision 13/CP.9)* and relevant parts of the Decision 15/CMP. 1 (Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol).

Information on emissions and removals from land-use, land-use change and forestry activities under Article 3.3 and Article 3.4, as well as information on minimization of adverse impacts in accordance with Article 3.14, are not included in the inventory report as the reporting on these activities and issues will begin only in the year 2010 during the commitment period of the Kyoto Protocol.

Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol (Decision 22/CP.7) require that the emissions from sources listed in Annex A to the Protocol are clearly distinguished from estimates for Articles 3.3 and 3.4. Even if reporting under these Articles is not yet done, Finland has clarified its reporting compared to the 2005 inventory submission to facilitate this task in the future. The emissions from peat production areas have been moved from the Energy sector to the land use, land-use change and forestry (LULUCF) sector, as part of the production areas will be reported as units of land subject to activities under Article 3.3. This change is also in accordance with the *IPCC Good Practice Guidance on Land Use, Land-Use Change and Forestry*. No other potential overlaps with the emission sectors (Energy, Industrial Processes, Solvents and Other Product Use, Agriculture and Waste) with the estimates to be reported under Article 3.3 and Article 3.4 have been identified.

The methodologies used in the preparation of Finland's greenhouse gas inventory are consistent with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* as complemented by the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and the *IPCC Good Practice Guidance on Land Use, Land-Use Change and Forestry*.

For the submission in 2006, Finland has made extensive quality checks and evaluation of the activity data and emission factors used in the inventory. This has resulted in more consistent allocation of the emissions as well as increased the accuracy of the emissions and removals. The quality checks have involved, among others, applying the current fuel classification consistently to the whole time series, revision of some fuel characteristics, oxidation factors and emission factors to take into account new national data. In the Energy sector some changes have been implemented to make the inventory system and the EU emission trading system compatible, as Finland plans to use the data from this scheme, included in the national emission trading register, in its future inventory submissions.

Also, the implementation of the *IPCC Good Practice Guidance on Land Use, Land-Use Change and Forestry* has continued, and inclusion of new pools (dead organic matter, soils) into the inventory have resulted in significant changes in the LULUCF sector.

The recalculations and the reasoning behind them are described in detail in the national inventory report. The recalculations have resulted in following changes: the base year emissions (without LULUCF) have increased

with 1%, and the emissions in 2003 with 0.1%. The corresponding changes with the LULUCF sector included are 4.3% and 0.1%, respectively.

1.2 Base year inventory and times series consistency

The greenhouse gas emissions in 1990 - 2004 are given in Table 1 by sector, and illustrated in Figure 1 (total emissions in CO_2 equivalent excluding the LULUCF sector) and Figure 2 (total emissions in CO_2 equivalent including the net removals from the LULUCF sector).

Table 1. Finnish greenhouse gas emissions and removals (Tg CO_2 eq) in 1990-2004.

(Tg CO_2 equivalents)	**1990** (base year)	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Energy	54.74	53.62	52.79	54.67	59.89	56.49	62.25	60.68	57.33	56.87	55.03	60.62	63.25	71.07	66.88
Industrial Processes (excluding F-gases)	4.98	4.60	4.33	4.33	4.55	4.51	4.65	4.91	4.83	4.88	4.99	4.87	4.84	5.25	5.44
F-gases	0.09	0.07	0.04	0.03	0.04	0.10	0.15	0.24	0.30	0.40	0.58	0.73	0.53	0.71	0.73
Solvent and Other Product Use	0.18	0.17	0.16	0.15	0.15	0.14	0.14	0.13	0.13	0.13	0.13	0.12	0.11	0.10	0.11
Agriculture	7.11	6.67	6.19	6.20	6.20	6.31	6.21	6.20	6.06	5.93	5.95	5.84	5.82	5.74	5.63
Waste	3.99	4.03	4.05	4.05	3.98	3.92	3.83	3.74	3.58	3.49	3.29	3.18	2.96	2.78	2.64
TOTAL	**71.09**	**69.16**	**67.55**	**69.43**	**74.81**	**71.47**	**77.22**	**75.91**	**72.22**	**71.70**	**69.97**	**75.37**	**77.50**	**85.66**	**81.44**
Land-Use Change and Forestry	-21.38	-36.13	-29.99	-27.60	-17.12	-15.38	-22.90	-16.85	-16.16	-16.98	-16.29	-19.02	-18.86	-17.85	-18.49

(Remark: Due to rounding the sum of subtotals does not always equal to total figures.)

Figure 1. Greenhouse gas emissions in Finland in 1990-2004 by reporting sectors (Tg CO_2 eq).

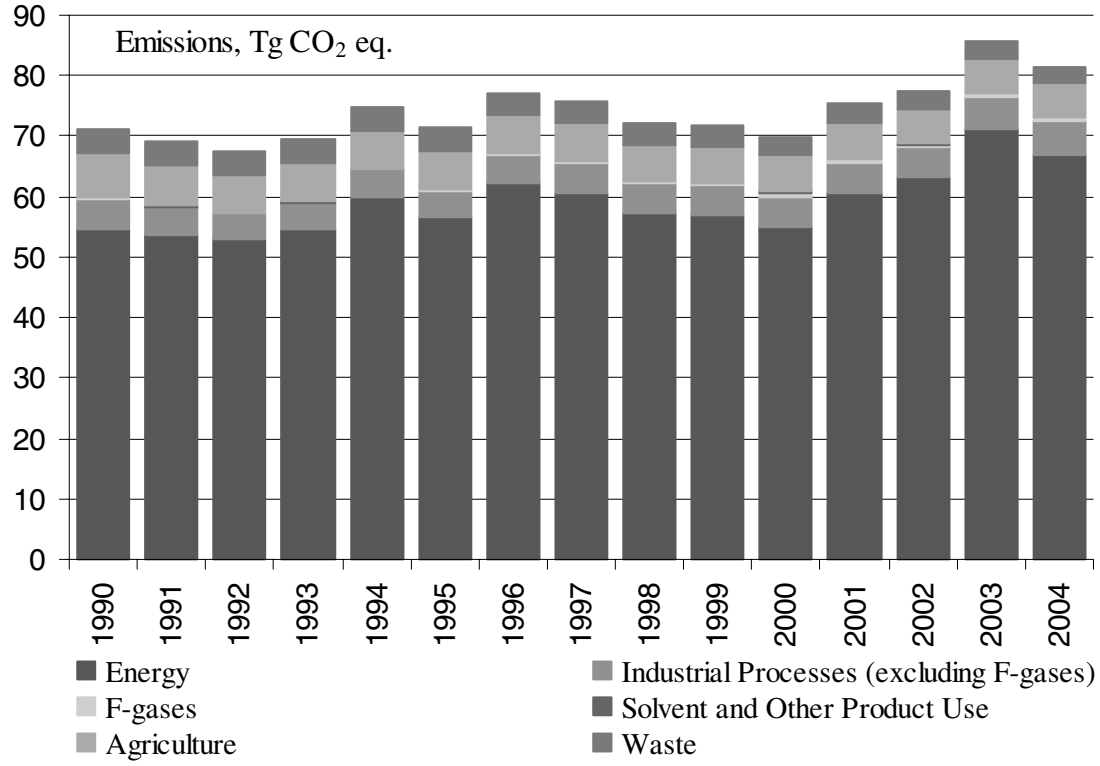
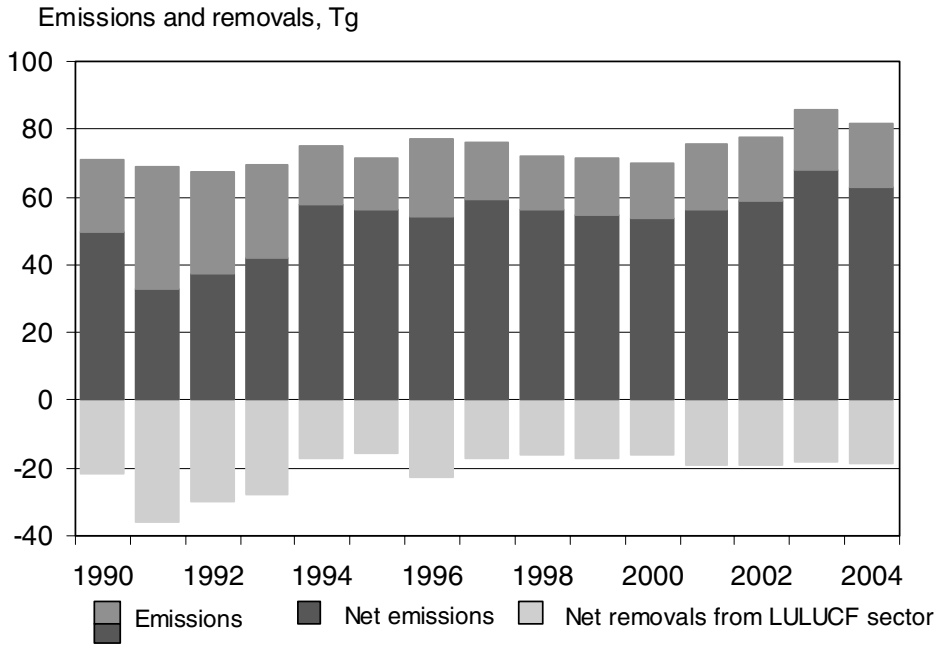


Figure 2. Net CO_2 equivalent emissions (total emissions including the net removals from the LULUCF sector) of greenhouse gases in 1990–2004. Emissions are shown as positive and removals as negative quantities.



In the base year the most important source of emissions was the Energy sector, which contributed about 77% to the total emissions without LULUCF. Agriculture (10%), Industrial Processes (7%) and Waste (6%) were also important sources of emissions, whereas Solvent and Other Product Use contributed less than 0.1% to the total emissions.

Between 1990 and 2004 the Energy emissions have grown about 22% and the sector has remained the most important category, in 2000 - 2004 its share of the total emissions has ranged from 79 to 83%. The emissions in the Industrial Processes sector have grown about 22% between 1990 and 2004, whereas emissions have decreased in the Agriculture (-21%) and Waste (-34%) sectors. The total national emissions (without LULUCF) in 2004 are about 15% (~10 Tg) higher than in 1990. In 2003 the emissions were even higher, about 20% over the base year emissions, whereas in 2000 the emissions were below the 1990 level. The reason for the fluctuation can be attributed largely to the structure of the electricity supply in Finland. Finland is part of the Nordic Electricity Market, and the availability of hydropower influences the emissions much. In 2003, the precipitation in Norway, Sweden and Finland was exceptionally low, and the shortage of hydropower was largely compensated by increased combustion of coal and peat in Finland, and also Denmark. The year 2004 was by large "a normal year" in this regard.

The Energy emissions have been calculated with the same model (ILMARI) at Statistics Finland for the whole time series, except for the year 1991. The ILMARI model was developed in early 1990's and the first inventory to be calculated with the model was the inventory for the year 1992. ILMARI uses plant-specific data for large point sources, whereas earlier inventories were produced using more aggregated data. Due to the importance of the base year, plant-specific data collected by the Air Protection Registry and data based on annual surveys by Statistics Finland have been included in the ILMARI model. Corresponding inclusions in the ILMARI for the year 1991 have not been initialised, as this is a very resource-consuming task, and these emissions for 1991 have been estimated by interpolation.

The emissions estimates for the Industrial Processes sector are calculated using the same methods for the whole time series. The emissions in 2004 were about 22% higher than in 1990, largely due to increased industrial activity. The most important sources of CO_2 emissions in the sector are the cement industry and the iron and steel industry, for the latter source the process emissions have for the first time been allocated to the Industrial Processes sector in the 2006 submission. The emissions from these sources have been calculated using plant-specific data.

For nitric acid production, the emission factors are based on a series of measurements done at the plants in recent years, the earliest measurements were done in 1999. Since 2004 the measurement frequency has been increased from occasional one-time measurements, to regular, periodic measurements. At the newest plant, which started its operation in late 2004, the emissions are measured online. The historical estimates for the plants have been estimated using the plant-specific emission factors that have been developed based on the measurements, assuming the emission factors constant for the whole time series. This is a conservative estimate (may underestimate base year emissions), as the processes have in recent years been run to limit also the N_2O emissions, within the constraints of the NO_x emission limits.

The emissions from the Solvent and Other Product Use are largely NMVOC emissions; the amount of N_2O emitted from its medical and other uses is very small. The indirect CO_2 emissions from the NMVOC emissions have been taken into account in the emissions from this sector for the first time, their importance to the total national emissions is very small.

In Agriculture, the emissions for the base year and the time series have been calculated using the same methods without exceptions. The activity data and emission factors are dependent on the agricultural practices and productivity, which have been taken into account in the emission estimates. Examples of changes in practices are improved feeding of animals, which has resulted in growing emission factors for enteric fermentation since 1990. The manure management practices have also changed; a larger amount of the manure is now treated in liquid systems than in 1990. This has resulted in growing methane, but declining nitrous oxide emissions from

manure management. The decreasing number of animals, decreasing nitrogen fertiliser use and decreasing area of organic arable land have lead to an overall decreasing trend in the emissions from Agriculture.

The emissions from the waste sector are calculated using the First Order Decay method (IPCC Tier 2 method). The activity data collection in the sector has improved significantly in recent years. All landfills require a permit, and the amount of waste annually disposed has been reported to the VAHTI database since 1997. The landfill tax has increased, and hence weighing of the disposed waste has become more frequent. Data on waste disposal for the years 1992 - 1996 are based on the landfill register, which is comparable to the current VAHTI database. The values for 1990 are based on estimates presented in the Development programme on municipal waste management 2000. In this context, surveys and research on the amount and composition of waste generated and treated in Finland in 1989 were done. The values for 1990 are based on results of these studies published by the Advisory Board for Waste Management in 1992. The waste composition data from these studies have been used for the whole times series.

The methane emissions from landfills show a declining trend. The Waste sector has undergone significant changes since the beginning of the 1990's. The new waste law in 1993 demanded waste reduction at source, to the extent possible, as well as increased utilisation of waste as material and energy. Similar requirements have since been introduced with legislation based on the EU landfill directive[1]. Waste has therefore been increasingly treated by other ways than landfilling, such as composting and energy utilisation. Also landfill gas recovery has increased substantially, in 1990 only one pilot landfill recovery plants was operational, in 2004 landfill gas is recovered from nearly 30 landfill sites. The possible changes in waste composition since 1990 have not been incorporated in the estimates yet. As the changes made have aimed at reducing the organic fraction in disposed waste, it is estimated that the emissions from recent years may be overestimated. However, this overestimation is estimated to be small.

The emissions from the LULUCF sector do not influence the estimation of the assigned amount for Finland, as the sector was a sink in 1990. This has been the case also for the whole time series since 1990. The LULUCF sector offsets about 20 - 30% of emissions from the other sectors in Finland. In 1991 this percentage was even higher, more than 50%, as Finland was experiencing a serious recession at that time. The total emissions were low due to decreased industrial and other activities, which include also reduced harvesting of wood that year.

Overall, the base year and the recent year estimates have been estimated with consistent methods, to the extent the available activity data and emission factors make it possible, taking the guidance in the IPCC Good Practice Guidance on time series into account. For some sectors, the accuracy of the data have increased in recent inventory years due to improved data collection measures and improved knowledge on the emission levels based on measurements and other research. However, no evidence suggests that this would have resulted in overestimation of the base year emissions in comparison with the recent inventory years. Detailed descriptions of the methods, activity data collection and emission factors, as well as associated uncertainties can be found in the national inventory report and the CRF tables.

[1] Directive 1999/31/EC on the Landfill of Waste

2 Selected base year for HFC, PFC and SF_6 in accordance with Article 3.8

Article 3.8 of the Kyoto Protocol reads *"any Party included in Annex I may use 1995 as its base year for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride"* for the purposes of calculating its assigned amount in accordance with Article 3.7. In accordance with this, Finland has chosen the year 1995 as the base year for the emissions of the hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF_6). Finland has done this decision according to the latest revised inventory information, and the earlier choice in favour of the year 1990 has been rejected.

The time series for the emissions of the hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF_6) can be seen in Table 2. The emissions expressed in CO_2 equivalent are 3.5Gg CO_2 equivalent higher in 1995 than in 1990, this being the reasoning for the choice of the base year for these gases, also called F-gases.

Table 2. Actual emissions of HFCs, PFCs and SF_6 in1990−2004 (CO_2 equivalent Gg).

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
HFCs	0.02	0.05	0.10	0.10	6.52	29.33	77.30	167.8	245.2	318.6	501.7	656.9	463.4	652.1	695.1
PFCs	0.07	0.08	0.09	0.10	0.12	0.14	0.16	0.18	0.21	27.97	22.46	20.06	13.37	14.85	12.23
SF_6	94.38	67.32	36.64	33.61	34.90	68.53	72.20	75.98	53.18	51.98	51.49	55.03	51.31	41.71	23.18
Total F-gases	**94.47**	**67.45**	**36.83**	**33.81**	**41.54**	**98.00**	**149.7**	**243.9**	**298.6**	**398.6**	**575.7**	**732.0**	**528.1**	**708.6**	**730.5**

3 Agreement under Article 4 of the Kyoto Protocol

According to Article 4 of the Kyoto Protocol, Parties can fulfil their commitments under Article 3 jointly. The European Community and its Member States (Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Austria, Portugal, Sweden, United Kingdom of Great Britain and Northern Ireland, and Finland – EU-15) have agreed to jointly fulfil these commitments in the Council Decision of 25 April 2002 concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments thereunder[2].

The full text of the agreement (EU burden sharing agreement) is contained in the above mentioned Council Decision (2002/358/EC), and has been notified to the UNFCCC upon ratification by the Community and its Member States. The UNFCCC secretariat has notified the Parties and signatories of the Convention of the terms of this agreement in the document FCCC/CP/2002/2.

The base year emissions for the European Community is the sum of the base year emissions in EU-15. The base year emission levels in terms of tonnes of carbon dioxide equivalents in EU-15 could not be determined at the time of the above agreement. Based on information received from the EU-15 in 2006, the Commission to the European Community has determined the base year emission level of the European Community and compiled the base year levels of each Member State (for details, see the Report to facilitate the calculation of the assigned amount of the European Community pursant to Article 3, paragraphs 7 and 9 of the Kyoto Protocol - Submission to the UNFCCC Secretariat). The base year levels for each member state and the corresponding assigned amounts have been adopted in Council Decision C(2006)6468 of 14 December 2006. In this decision Finland's assigned amount is given as 355 480 975 tonnes CO_2 equivalent (see following Chapter, 4 Calculation of Finland's assigned amount).

[2] Council Decision 2002/358/EC of 25 April 2002 concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments thereunder, OJ L130, 15.5.2002, p. 1 (see also document FCCC/CP/2002/2).

4 Calculation of Finland's assigned amount

The assigned amount is calculated according to Articles 3, paragraphs 7 and 8 of the Kyoto Protocol, on the basis of the base year inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol.

Finland's assigned amount pursuant to Articles 3, paragraphs 7 and 8 of the Kyoto Protocol is calculated in accordance with Decision 13/CMP.1 (Modalities for the accounting of the assigned amounts under Article 7, paragraph 4, of the Kyoto Protocol). The assigned amount is equal to the percentage corresponding to the emission level allocated to Finland in the EU burden sharing agreement of Finland's aggregate anthropogenic emissions of greenhouse gases in tonnes CO_2 equivalent in the base year (1990 except for emissions of HFC, PFC and SF_6 1995), multiplied by five.

Land use, land-use change and forestry constituted a net sink in 1990, therefore the emissions and removals from this sector do not affect the calculation of Finland's assigned amount.

Equation for the accounting of Finland's assigned amount is:

Finland Assigned Amount = Base year emissions (1990, except 1995 for the F-gases) x 5 x the percentage corresponding to the emission level allocated to Finland in the EU burden sharing agreement (100%)

The estimation of the Finland's assigned amount is illustrated in Table 3. The estimated assigned amount is **355480.975 Gg CO_2 equivalent**.

Table 3. Estimation of Finland's assigned amount.[3]

Base year emissions Gg CO_2 equivalent	Emissions in column 1 times five Gg CO_2 equivalent	Percentage corresponding to the emission level allocated to Finland in the EU burden sharing agreement	Estimated assigned amount Gg CO_2 equivalent
Emission without HFCs, PFCs and SF_6 and the LU-LUCF sector in 1990: 70998.195	354990.975	100%	354990.975
Emissions of HFCs, PFCs and SF6 in 1995 98.000	490.000	100%	490.000
Total Base Year Emissions **71096.195**	355480.975	100%	**355480.975**

[3] The total base year emissions have been calculated from the values in the Summary 2 CRF Tables for the years 1990 and 1995 in tonnes CO_2 equivalent.

Part II

1 Calculation of Finland's commitment period reserve

The commitment period reserve is calculated in accordance with decision 11/CMP.1 (Modalities, rules and guidelines for emissions trading under Article 17 of the Kyoto Protocol) as 90% of the proposed assigned amount or 100% of its most recently reviewed inventory times five, whichever is lowest.

Finland has interpreted the "most recently reviewed inventory" to mean the inventory, which will be reviewed as part of the reporting to facilitate the estimation of Finland's assigned amount, that is the inventory for the year 2004. This would mean, that the 90 % of the assigned amount would be lower, than five times the emissions from the total inventory of 2004. This would give an estimated commitment period reserve of **319932.878 Gg CO_2 equivalent**.

2 Selection of threshold values for the forest definition to be used for reporting under Articles 3.3 and 3.4

Finland has selected as threshold values for the forest definition for reporting under Article 3.3 (including activities afforestation, reforestation and deforestation) the following: forest land includes land with minimum tree crown cover of 10 % for trees capable to reach minimum height of 5 m in situ. The minimum area for forest land is 0.5 ha. Temporarily unstocked areas are included (forest regeneration areas). For linear formations, a minimum width of 20 m is applied. This forest definition is applicable also for reporting under Article 3.4.The selected threshold values are consistent with those values used in the reporting to the Food and Agriculture Organisation of the United Nations (the FAO TBFRA 2000 and FRA 2005 forest definition).

3 Election of activities under Article 3.4

Finland has decided **to elect Forest Management activity under the Article 3.4 of the Kyoto Protocol.** Finland will use the Reporting Method I provided in the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC 2003) for meeting the requirements of the Marrakesh Accords on geographical boundaries of areas encompassing units of land subject to forest management activities. In the reporting Finland will utilise regional National Forest Inventory data supplemented, as necessary, with some forest statistical information and remote sensing data.

Finland has decided **not to elect other Article 3.4 activities** (cropland management, grazing land management and revegetation) for meeting its commitment under the first commitment period of the Kyoto Protocol.

The decision on the election of activities under Article 3.4 as described above was confirmed by the Ministerial Committee for Economic Policy on 22 December 2006.

4 Accounting of activities under Article 3.3

Finland has chosen to account for the activities under Article 3.3 (afforestation, reforestation and deforestation) and 3.4 (forest management) for the whole commitment period.

5 Finland's national greenhouse gas inventory system

Finland's National System under Article 5.1 of the Kyoto Protocol is described in accordance with the guidelines for the preparation of information under Article 7 in the report *National Greenhouse Gas Inventory System in Finland*, which is part of this submission.

6 Finland's National Registry

Finland's National Registry under Article 7 of the Kyoto Protocol is described in accordance with the guidelines for the preparation of information under Article 7 in the report *Finland's National Registry under Article 7 of the Kyoto Protocol*, which is part of this submission.