Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Council

Switzerland's Second Initial Report under the Kyoto Protocol

Report to facilitate the calculation of the assigned amount pursuant to Article 3, paragraphs 7bis, 8 and 8bis, of the Kyoto Protocol for the second commitment period 2013–2020

15 April 2016

Imprint

This report was approved by the Federal Council on 23 March 2016.

Responsible Federal Office
Federal Office for the Environment FOEN
Climate Division
CH-3003 Bern
Switzerland

www.bafu.admin.ch/climate
www.climatereporting.ch

Further information
FOEN, Climate Division, CH-3003 Bern

climate@bafu.admin.ch

Bern, 15 April 2016

Contents

Foreword

Switzerland ratified the Kyoto Protocol, which extends and specifies the United Nations Framework Convention on Climate Change (UNFCCC), on 9 July 2003. Within the framework of the first commitment period (2008–2012), Switzerland committed to reduce its total greenhouse gas emissions on average by 8 per cent below 1990 levels. Within the framework of the second commitment period (2013–2020), Switzerland committed to reduce its total greenhouse gas emissions on average by 15.8 per cent below 1990 levels. Switzerland submitted its instrument of acceptance of the respective Doha Amendment to the Kyoto Protocol to the UNFCCC on 28 August 2015.

According to Decision 2/CMP.8 'each Party with a quantified emission limitation and reduction commitment inscribed in the third column of Annex B to the Kyoto Protocol, as contained in Annex I to Decision 1/CMP.8, shall submit to the secretariat, by 15 April 2015[1], a report to facilitate the calculation of its assigned amount pursuant to Article 3, paragraphs 7bis, 8 and 8bis, of the Kyoto Protocol for the second commitment period and to demonstrate its capacity to account for its emissions and assigned amount'. Switzerland submits the required information with this Second Initial Report under the Kyoto Protocol, in conjunction with its National Greenhouse Gas Inventory 1990–2014.

This Second Initial Report under the Kyoto Protocol was prepared by the Swiss Federal Office for the Environment (FOEN). It was sent to all ministries of the federal government for consultation in February 2016. At its meeting on 23 March 2016, the Federal Council approved the report and authorized the FOEN to submit it to the UNFCCC secretariat.

[1] However, consider also Decision 6/CMP.9, paragraph 4: '*Also requests* the secretariat to make available to Parties included in Annex I, by June 2014 at the latest, the upgraded CRF Reporter in order to enable them to submit their inventories by the due date of 15 April 2015; in case the upgraded CRF Reporter is not available by June 2014, Parties may submit their greenhouse gas inventory after 15 April 2015 but not later than the corresponding delay in the CRF Reporter availability'.

1 Summary

The key points of Switzerland's Second Initial Report under the Kyoto Protocol can be summarized as follows:

- Switzerland continues to use 1990 as the base year for emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6), and also chooses **1990 as the base year for emissions of nitrogen trifluoride (NF_3)**.

- Switzerland has **not reached an agreement under Article 4** of the Kyoto Protocol to fulfil its commitments under Article 3 of the Kyoto Protocol jointly with other Parties and is thus responsible for its own level of emissions.

- Switzerland's **assigned amount** for the second commitment period is **361'848'698 t CO_2 equivalent** (**361'848.698 kt CO_2 equivalent**).

- Switzerland's **commitment period reserve** is **325'663'828 t CO_2 equivalent** (**325'663.828 kt CO_2 equivalent**).

- The **definition of forest, the definition of afforestation and reforestation, the definition of deforestation, and the definition of forest management** for the second commitment period **remain the same** as defined in Switzerland's Initial Report for the first commitment period (*FOEN*, 2006h).

- **Forest management is accounted for** in the second commitment period and **Switzerland does not elect any additional activities** under Article 3, paragraph 4, of the Kyoto Protocol. All lands under activities under Article 3, paragraphs 3 and 4, starting from 1 January 1990 onwards, are accounted for.

- Switzerland chooses to **account over the entire commitment period for emissions and removals** from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

- Switzerland's **forest management reference level (FMRL)** inscribed in the appendix to the annex to Decision 2/CMP.7 **amounts to +220 kt CO_2 equivalent per year**. The FMRL may be subject to technical corrections.

- Switzerland **intends to apply**, in the case of significant magnitude events, **the provision to exclude emissions from natural disturbances for units of lands under forest management** under Article 3, paragraph 4, of the Kyoto Protocol during the second commitment period in accordance with Decision 2/CMP.7. **Switzerland will not apply this provision for afforestation and reforestation** under Article 3, paragraph 3, of the Kyoto Protocol.

2 Switzerland's National Greenhouse Gas Inventory 1990–2014

Switzerland's most recent annual National Greenhouse Gas Inventory (1990–2014; *FOEN*, 2016) is submitted in conjunction with this Second Initial Report under the Kyoto Protocol and serves as the basis to facilitate the calculation of Switzerland's assigned amount for the second commitment period (2013–2020). The Common Reporting Format (CRF) tables of Switzerland's National Greenhouse Gas Inventory 1990–2013 are submitted contemporaneously and on the basis of the same data as Switzerland's National Greenhouse Gas Inventory 1990–2014. While detailed information is provided in the submitted documents, namely the CRF tables and the National Inventory Report 2016, a brief overview is given in the following.

2.1 Base year inventory

Table 1 provides an overview of Switzerland's greenhouse gas emissions in 1990, listed by different sectors and the greenhouse gases carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3).

Table 1 > Switzerland's greenhouse gas emissions in the base year 1990.

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NF_3	Total (excl. indirect CO_2)	Indirect CO_2	Total (incl. indirect CO_2)
	[kt CO_2 equivalent]									
1 Energy	40'907	636.1	294.2	0.0	0.0	0.0	0.0	41'837	43.4	41'881
2 Industrial processes and product	3'095	1.8	171.4	0.0	116.5	137.0	0.0	3'521	371.2	3'893
3 Agriculture	49.3	4'509	2'246	0.0	0.0	0.0	0.0	6'804	NA	6'804
5 Waste	53.7	943.7	142.0	0.0	0.0	0.0	0.0	1'139	2.0	1'142
Total (excl. LULUCF)	44'105	6'091	2'853	0.0	116.5	137.0	0.0	53'302	416.7	53'719
4 Land use, land-use change and forestry	-994.0	24.5	85.3	0.0	0.0	0.0	0.0	-884.1	NA	-884.1
International bunkers	3'126	2.2	29.6	0.0	0.0	0.0	0.0	3'157	NA	3'157

2.2 Greenhouse gas emissions from different sectors in Switzerland

The calculation and reporting of greenhouse gas emissions in the different sectors is based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (*IPCC*, 2006), often complemented by country-specific methodologies.

2.2.1 Energy

As the dominant source of greenhouse gases in Switzerland, the sector 'energy' emitted 41'881 kt CO_2 equivalent in 1990, corresponding to a share of 78.0 per cent in total greenhouse gas emissions. In 2014, emissions from this sector were 10.5 per cent lower than in 1990, however, the annual emissions from heating fuels strongly depend on weather conditions. Normalized for weather conditions, the decrease in emissions from heating and process fuels about counterbalances the increase in emissions from motor fuels. Energy data are mainly taken from the Swiss overall energy statistics (e.g. *SFOE*, 2015), which are well-established national statistics that have been collected in detail since the 1970s. These statistics account for production, imports, exports, transformation, and stock changes of fossil fuels.

2.2.2 Industrial processes and product use

The sector 'industrial processes and product use' emitted 3'893 kt CO_2 equivalent in 1990, corresponding to a share of 7.2 per cent in total greenhouse gas emissions. In 2014, emissions from this sector were 7.9 per cent higher than in 1990. Non-energy CO_2 emissions from cement production dominate the emissions from this sector, but substantial and overall increasing contributions come from the use of HFCs, PFCs, SF_6 and NF_3. Minor emissions stem from metal production and the chemical industry. Data on clinker production rely on detailed statistics for the cement industry. To obtain the most reliable data on HFCs, PFCs, SF_6 and NF_3 two different approaches are applied: (i) a top-down

approach using statistics and estimates on the Swiss market from experts and associations, and (ii) a bottom-up approach by means of questionnaires sent to companies involved in the importation, production and maintenance of appliances. HFCs emissions from refrigeration and air conditioning equipment are calculated using a life-cycle model.

2.2.3 Agriculture

The sector 'agriculture' emitted 6'804 kt CO_2 equivalent in 1990, corresponding to a share of 12.7 per cent in total greenhouse gas emissions. In 2014, emissions from this sector were 9.3 per cent lower than in 1990. CH_4 emissions from enteric fermentation dominate the total emissions from this sector, followed by CH_4 and N_2O emissions from manure management and agricultural soils. The emissions are calculated on the basis of country-specific methods, which include details of livestock populations, feed intake, fertilizer use and other nitrogen fluxes.

2.2.4 Waste

The sector 'waste' emitted 1'142 kt CO_2 equivalent in 1990, corresponding to a share of 2.1 per cent in total greenhouse gas emissions. In 2014, emissions from this sector were 24.6 per cent lower than in 1990. The relevant sources in this sector are solid waste disposal, biological treatment of solid waste, incineration and open burning of waste, as well as wastewater treatment and discharge. CH_4 emissions from solid waste disposal are strongly decreasing owing to changes in the legislative framework. Since 1 January 2000, disposal of combustible wastes in landfill sites has been prohibited, and incineration in solid waste incineration plants with energy recovery became mandatory. Emissions from waste incineration and from the use of waste as an energy source in industries are reported in the sector 'energy'. On the other hand, CH_4 emissions from biological treatment of solid waste have increased.

2.2.5 Land use, land-use change and forestry

The sector 'land use, land-use change and forestry' (LULUCF) accounted for a net sink of -884 kt CO_2 equivalent in 1990. Data from the Swiss Land Use Statistics collected by the Swiss Federal Statistical Office were used to establish land-use change matrices. For the category 'forest land', data for carbon stocks and carbon fluxes are derived from the Swiss National Forest Inventories (NFI). For the other categories of this sector, carbon stocks and carbon fluxes are provided by Agroscope, the Swiss centre of excellence for agricultural research, and several academic partners. Within the framework of the second commitment period of the Kyoto Protocol, this sector's emissions or removals of greenhouse gases are accounted for as deviations from the forest management reference level (FMRL, see section 10).

2.3 Evolution of greenhouse gas emissions

Table 2 and Table 3 along with Figure 1 and Figure 2 show the evolution of greenhouse gas emissions in Switzerland from 1990 to 2014. Emissions and removals reported in the sector 'other' (sector 6) are not included in Annex A to the Kyoto Protocol and are therefore not included in national totals.

Table 2 > Switzerland's greenhouse gas emissions from 1990 to 2014 (two-year steps until 2008). The mean value of emissions of the years 2008, 2009 and 2010 (total excl. LULUCF, incl. indirect CO_2) is used for the calculations in Table 6. NA = Not applicable, NO = Not occurring.

	1990	1992	1994	1996	1998	2000	2002	2004
	[kt CO_2 equivalent]							
CO_2 (excl. LULUCF and indirect CO_2)	44'105	45'963	42'602	44'076	44'510	43'533	43'361	45'137
CH_4 (excl. LULUCF)	6'091	5'947	5'788	5'740	5'527	5'392	5'398	5'288
N_2O (excl. LULUCF)	2'853	2'814	2'716	2'697	2'596	2'555	2'547	2'458
HFCs	0.0	15.7	81.7	297.5	456.5	625.9	803.2	1'021
PFCs	116.5	80.6	20.9	20.4	23.8	49.9	32.9	65.3
SF_6	137.0	141.4	106.9	90.1	152.6	143.8	158.4	186.1
NF_3	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Total (excl. LULUCF)	**53'302**	**54'963**	**51'315**	**52'921**	**53'265**	**52'300**	**52'300**	**54'154**
Indirect CO_2	416.7	361.7	296.7	253.8	214.2	188.7	164.4	136.7
Total (excl. LULUCF, incl. indirect CO_2)	**53'719**	**55'324**	**51'612**	**53'175**	**53'480**	**52'488**	**52'465**	**54'291**

	2006	2008	2009	2010	2011	2012	2013	2014
	[kt CO_2 equivalent]							
CO_2 (excl. LULUCF and indirect CO_2)	45'338	44'664	43'496	45'014	40'960	42'229	43'169	39'252
CH_4 (excl. LULUCF)	5'319	5'377	5'293	5'273	5'208	5'166	5'096	5'096
N_2O (excl. LULUCF)	2'448	2'497	2'462	2'511	2'460	2'447	2'411	2'438
HFCs	1'118	1'243	1'253	1'329	1'410	1'489	1'513	1'501
PFCs	51.5	57.9	63.0	64.6	67.8	71.3	52.0	43.9
SF_6	185.6	222.2	179.6	148.0	159.5	208.9	252.5	258.8
NF_3	NA, NO	0.1	5.1	8.5	6.2	0.4	0.1	0.4
Total (excl. LULUCF)	**54'461**	**54'062**	**52'753**	**54'349**	**50'271**	**51'612**	**52'494**	**48'591**
Indirect CO_2	127.7	124.4	123.3	123.8	123.0	120.9	120.0	119.6
Total (excl. LULUCF, incl. indirect CO_2)	**54'588**	**54'186**	**52'876**	**54'472**	**50'394**	**51'733**	**52'614**	**48'711**

Figure 1 > Switzerland's greenhouse gas emissions from 1990 to 2014 (excluding LULUCF), subdivided into the contributions of CO_2 and indirect CO_2, CH_4, N_2O, as well as of F-gases (HFCs, PFCs, SF_6, NF_3).

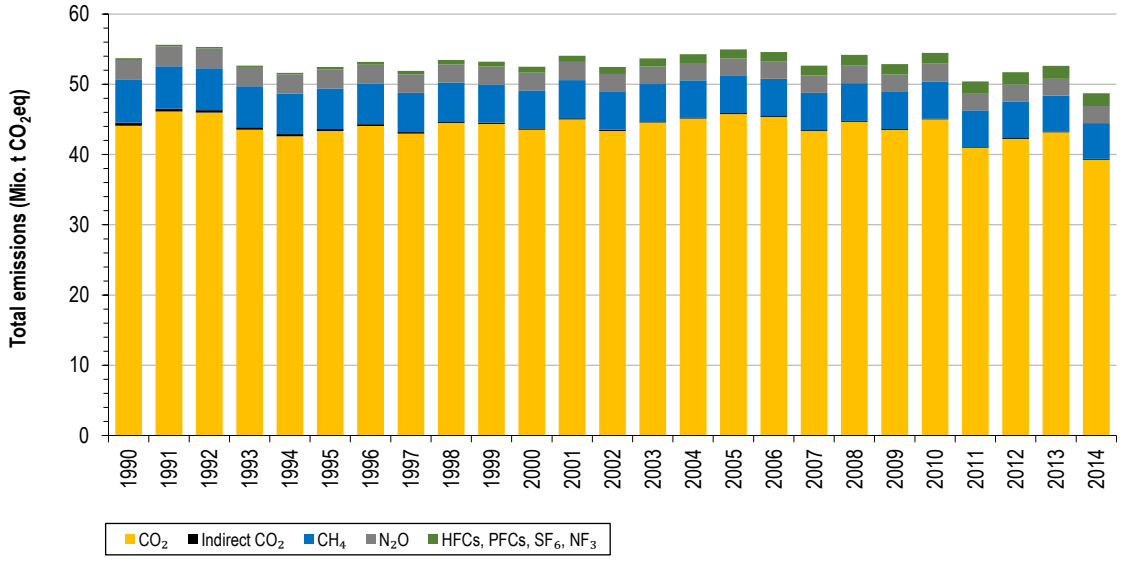
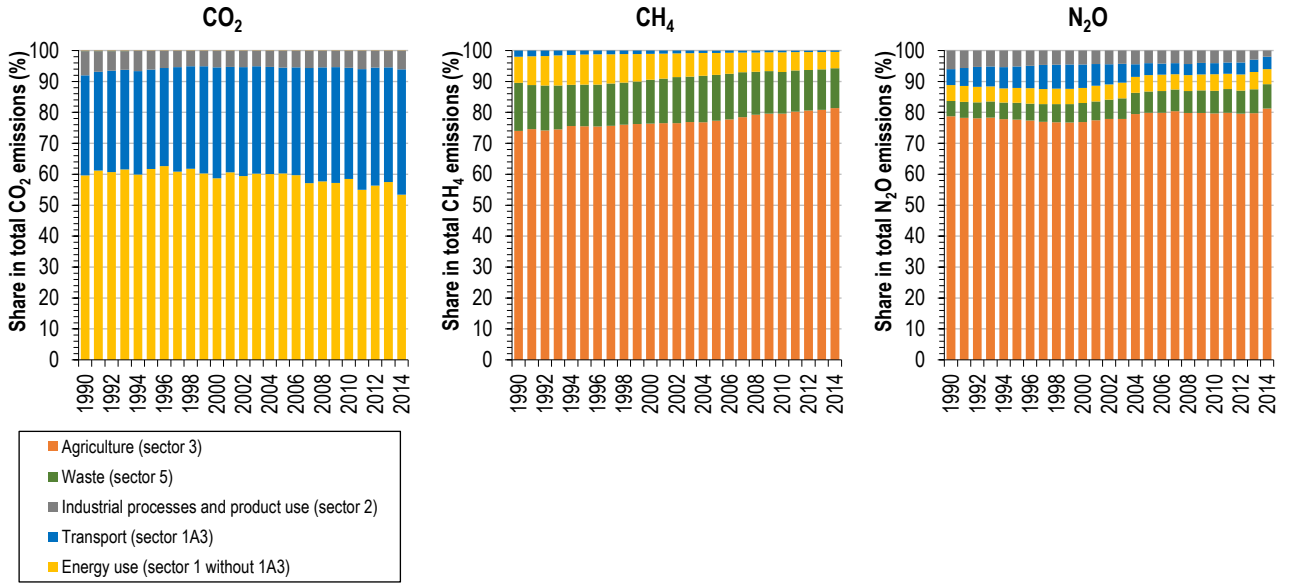


Table 3 > Switzerland's greenhouse gas emissions from different sectors/source categories in the years 1990, 1995, 2000, 2005, 2010 and 2014. For the years 1990 and 2014, the relative contributions of each sector/source category in per cent of total greenhouse gas emissions (excluding LULUCF) are given. Indirect CO_2 emissions are included in the respective sectors/source categories (1B, 2 and 5, no indirect CO_2 emissions from other sectors/source categories).

	1990		1995	2000	2005	2010	2014	
	[%]	[kt CO_2 equivalent]						[%]
1 Energy	78.0	41'881	41'890	42'156	44'009	43'202	37'478	76.9
1A1 Energy industries	4.7	2'521	2'632	3'149	3'817	3'847	3'602	7.4
1A2 Manufacturing industries and construction	12.0	6'457	6'210	5'932	6'003	5'829	5'117	10.5
1A3 Transport	27.3	14'660	14'263	15'924	15'851	16'323	16'062	33.0
1A4 Other sectors	32.8	17'632	18'170	16'631	17'879	16'777	12'317	25.3
1A5 Other	0.4	220.0	163.1	151.5	139.0	137.7	139.0	0.3
1B Fugitive emissions from fuels	0.7	389.7	451.3	369.4	321.9	288.3	241.0	0.5
1C CO_2 transport and storage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 Industrial processes and product use	7.2	3'893	3'118	3'269	3'892	4'122	4'198	8.6
3 Agriculture	12.7	6'804	6'503	6'123	6'098	6'241	6'174	12.7
5 Waste	2.1	1'142	956.8	940.5	968.9	907.7	860.8	1.8
Total (excl. LULUCF, incl. indirect CO_2)	**100.0**	**53'719**	**52'468**	**52'488**	**54'969**	**54'472**	**48'711**	**100.0**

Figure 2 > Relative contributions of different sectors/source categories to total emissions of CO_2 including indirect CO_2 (left), CH_4 (middle) and N_2O (right). Total CO_2 emissions are dominated by emissions from 'energy use' and 'transport', while the sector 'agriculture' dominates total CH_4 and N_2O emissions. LULUCF is excluded.



3 Selected base year for HFCs, PFCs, SF_6 and NF_3

For the first commitment period (2008–2012), Switzerland chose 1990 as the base year for HFCs, PFCs and SF_6, and this base year also applies for the second commitment period (2013–2020). Regarding NF_3, which is newly included for the second commitment period, Article 3, paragraph 8bis, of the Kyoto Protocol gives Parties the option to select 1995 or 2000 instead of 1990 as the base year.

The time series for the emissions of HFCs, PFCs, SF_6 and NF_3 in Switzerland are illustrated in Table 4. Between 1990 and 1993, total emissions of these gases decreased, followed by a strong increase starting in the mid-1990s, mainly due to the more widespread use of HFCs introduced as substitutes for ozone-depleting substances (CFCs/HCFCs).

Table 4 > Emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3) from 1990 to 2014 (in kt CO_2 equivalent, two-year steps until 2008). NA = Not applicable, NO = Not occurring.

	1990	1992	1994	1996	1998	2000	2002	2004
	[kt CO_2 equivalent]							
HFCs	0.0	15.7	81.7	297.5	456.5	625.9	803.2	1'021
PFCs	116.5	80.6	20.9	20.4	23.8	49.9	32.9	65.3
SF_6	137.0	141.4	106.9	90.1	152.6	143.8	158.4	186.1
NF_3	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO
Total	**253.5**	**237.7**	**209.4**	**408.0**	**633.0**	**819.6**	**994.4**	**1'272**

	2006	2008	2009	2010	2011	2012	2013	2014
	[kt CO_2 equivalent]							
HFCs	1'118	1'243	1'253	1'329	1'410	1'489	1'513	1'501
PFCs	51.5	57.9	63.0	64.6	67.8	71.3	52.0	43.9
SF_6	185.6	222.2	179.6	148.0	159.5	208.9	252.5	258.8
NF_3	NA, NO	0.1	5.1	8.5	6.2	0.4	0.1	0.4
Total	**1'355**	**1'523**	**1'501**	**1'550**	**1'644**	**1'770**	**1'818**	**1'804**

For consistency reasons (same base year for all gases as in the first commitment period), Switzerland chooses 1990 as the base year for emissions of nitrogen trifluoride (NF_3).

4 Agreement under Article 4

Switzerland has not reached an agreement under Article 4 of the Kyoto Protocol to fulfil its commitments under Article 3 of the Kyoto Protocol jointly with other Parties and is thus responsible for its own level of emissions.

5 Calculation of Switzerland's assigned amount

The assigned amount for the second commitment period is calculated according to Article 3, paragraphs 7bis, 8 and 8bis, of the Kyoto Protocol, on the basis of Switzerland's National Greenhouse Gas Inventory submitted in conjunction with this report (*FOEN*, 2016).

In line with Article 3, paragraph 7bis, of the Kyoto Protocol 'the assigned amount for each Party included in Annex I shall be equal to the percentage inscribed for it in the third column of the table contained in Annex B of its aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A in 1990 […] multiplied by eight'. For Switzerland, the quantified emission limitation or reduction commitment for the second commitment period (2013–2020), as inscribed in the third column of the table contained in Annex B to the Doha Amendment to the Kyoto Protocol, is 84.2 per cent of base year emissions.

Article 3, paragraph 7bis, of the Kyoto Protocol further prescribes that 'those Parties included in Annex I for whom land-use change and forestry constituted a net source of greenhouse gas emissions in 1990 shall include in their 1990 emissions base year or period the aggregate anthropogenic carbon dioxide equivalent emissions by sources minus removals by sinks in 1990 from land-use change for the purposes of calculating their assigned amount'. In Switzerland, land-use change and forestry constituted a net sink in 1990 (see section 2) and is thus not included in the base year emissions for the purposes of calculating the assigned amount.

With respect to the choice offered by Article 3, paragraph 8 and 8bis, of the Kyoto Protocol regarding the base year for HFCs, PFCs, SF_6 and NF_3, Switzerland decided to use 1990 as the base year for all gases (see section 3). The calculation of Switzerland's assigned amount including all relevant values is presented in Table 5.

Table 5 > Calculation of Switzerland's assigned amount for the second commitment period (2013–2020) on the basis of *FOEN* (2016).

Base year emissions	Base year emissions multiplied by eight	Quantified emission limitation or reduction commitment (2013–2020)	Assigned amount for the second commitment period
[t CO_2 equivalent]	[t CO_2 equivalent]	[% of base year]	[t CO_2 equivalent]
53'718'631	53'718'631 x 8 = 429'749'048	84.2	429'749'048 x 84.2/100 = 361'848'698

Switzerland's assigned amount for the second commitment period is 361'848'698 t CO_2 equivalent (361'848.698 kt CO_2 equivalent).

According to Article 3, paragraph 7ter, 'any positive difference between the assigned amount of the second commitment period for a Party included in the Annex I and average annual emissions for the first three years of the preceding commitment period multiplied by eight shall be transferred to the cancellation account of that Party'. As highlighted in Table 6, the respective difference is negative for Switzerland. Accordingly, no transfer of assigned amount units (AAUs) to the cancellation account is needed for Switzerland.

Table 6 > Calculations with regard to Article 3, paragraph 7ter, on the basis of *FOEN* (2016). See Table 2 for relevant emissions.

Average emissions for the first three years of preceding commitment period (2008, 2009, 2010)	Average emissions for the first three years of preceding commitment period (2008, 2009, 2010) multiplied by eight	Assigned amount for the second commitment period (see Table 5)	Difference between the assigned amount for the second commitment period and average annual emissions for the first three years of the preceding commitment period multiplied by eight
[kt CO_2 equivalent]	[kt CO_2 equivalent]	[kt CO_2 equivalent]	[kt CO_2 equivalent]
53'845	53'845 x 8 = 430'760	361'849	361'849 - 430'760 = -68'911

6 Calculation of Switzerland's commitment period reserve

According to the annex to Decision 11/CMP.1, paragraph 6, and taking into account Decision 1/CMP.8, paragraph 18, 'each Party included in Annex I shall maintain, in its national registry, a commitment period reserve which should not drop below 90 per cent of the Party's assigned amount calculated pursuant to Article 3, paragraphs 7bis, 8 and 8bis, of the Kyoto Protocol, or 100 per cent of eight times its most recently reviewed inventory, whichever is lowest'.

In view of the changes in the reporting guidelines for the second commitment period, Switzerland understands the 'most recently reviewed inventory' to be the National Greenhouse Gas Inventory submitted on 15 April 2016 (*FOEN*, 2016), i.e. the inventory submitted in conjunction with this Second Initial Report under the Kyoto Protocol. The values regarding the two criteria for the commitment period reserve are presented in Table 7.

Table 7 > Calculation of Switzerland's commitment period reserve on the basis of *FOEN* (2016). The lower value resulting from the two different calculations corresponds to the commitment period reserve.

90 per cent of assigned amount (see section 5)	Total emissions without LULUCF in 2013 (see Table 2) times eight
[t CO_2 equivalent]	[t CO_2 equivalent]
361'848'698 x 90/100 = 325'663'828	52'613'753 x 8 = 420'910'024

Accordingly, a commitment period reserve of 325'663'828 t CO_2 equivalent (325'663.828 kt CO_2 equivalent) results for Switzerland.

7 Selected definitions for reporting under Article 3, paragraphs 3 and 4

Switzerland defined forest, afforestation, reforestation, deforestation and forest management in its Initial Report for the first commitment period (*FOEN*, 2006h). According to Decision 2/CMP.7, paragraph 20, the definition of forest selected for the first commitment period (2008–2012) also applies for the second commitment period (2013–2020).

Therefore, the definition of forest, the definition of afforestation and reforestation, the definition of deforestation, and the definition of forest management for the second commitment period remain the same as defined in Switzerland's Initial Report for the first commitment period (*FOEN*, 2006h).

8 Election of activities under Article 3, paragraph 4

In the Initial Report for the first commitment period (*FOEN*, 2006h), Switzerland chose to account for forest management among the elective activities under Article 3, paragraph 4, of the Kyoto Protocol. Forest management remains, by definition, an elected activity during the following commitment periods. Moreover, in the second commitment period, accounting for forest management is mandatory for all Parties included in Annex I.

Forest management is accounted for in the second commitment period and Switzerland does not elect any additional activities under Article 3, paragraph 4, of the Kyoto Protocol. All lands under activities under Article 3, paragraphs 3 and 4, starting from 1 January 1990 onwards, are accounted for.

In accordance with the annex to Decision 2/CMP.7, paragraph 13, additions to the assigned amount resulting from forest management under Article 3, paragraph 4, and from forest management project activities undertaken under Article 6, are capped in the second commitment period (3.5 per cent of base year emissions excluding LULUCF times eight). For Switzerland the cap amounts to 53'718'631 x 3.5/100 x 8 = 15'041'217 t CO_2 for the entire commitment period 2013–2020.

The activity data of afforestation and deforestation under Article 3, paragraph 3, and forest management under Article 3, paragraph 4, of the Kyoto Protocol are retrieved from the Swiss Land Use Statistics (*FOEN*, 2016). The same database and methodology for the classification of lands is used for the first and for the second commitment period. As in the first commitment period, afforested and deforested areas since 1990 remain in the respective category over the entire second commitment period. Hence, the areas of afforestations and deforestations under Article 3, paragraph 3, have been increasing since 1990 and land that was accounted for in the first commitment period continues to be accounted for in the second commitment period. Also for the area under forest management (Article 3, paragraph 4) a continuous time series is available (see Table 11-5 in *FOEN*, 2016). The land transition matrix in *FOEN*, (2016; Table 11-2) shows the changes in areas between the inventory year 2013 and the inventory year 2014.

9 Choice of accounting periodicity for activities under Article 3, paragraphs 3 and 4

According to Decision 2/CMP.8, Annex I, paragraph 1(h), each Party shall determine for each activity under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, whether it intends to account annually or for the entire commitment period.

Switzerland chooses to account over the entire commitment period for emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

10 Definition of forest management reference level (FMRL)

Detailed information on the FMRL of Annex I Parties was requested in Decision 2/CMP.6, paragraph 4. Annex II to Decision 2/CMP.6 provides guidelines for the calculation of the national FMRL and the additional information to be submitted by 28 February 2011. The calculation of Switzerland's FMRL is documented in *FOEN* (2011l), see also annex to this report.

Switzerland's forest management reference level (FMRL) inscribed in the appendix to the annex to Decision 2/CMP.7 amounts to +220 kt CO_2 equivalent per year. The FMRL may be subject to technical corrections[2].

FOEN (2011l) was subject to a technical assessment following the guidelines in Part II of Annex II to Decision 2/CMP.6. A detailed description of this assessment (*UNFCCC*, 2011a) can be found in the annex to this report.

In December 2011, the details for accounting of the LULUCF sector under the Kyoto Protocol were adopted (Decision 2/CMP.7) and in December 2013, the IPCC supplement '2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol' (*IPCC*, 2014) was adopted. The latter provides inter alia detailed information on the development of the FMRL and also on the accounting of harvested wood products (HWP). Based on the technical assessment report (see annex in *UNFCCC*, 2011a) and following guidance of *IPCC* (2014), the following corrections of Switzerland's FMRL have been made:

- Modelling changes in carbon stocks of living biomass: To model changes in living biomass, the model MASSIMO3 is used. An updated version of this model is available, allowing to write output data on a five-year basis (in the previous version a time interval of 10 years was used). The implementation of the business-as-usual harvesting scenario into the model has also been corrected.
- Modelling changes in carbon stocks of soil carbon, dead wood and litter: The model YASSO07 has been implemented since Switzerland's National Greenhouse Gas Inventory submitted in 2013. An interface between MASSIMO3 and YASSO07 has been established to allow data transfer between the two models.
- Changes in the HWP stock were calculated using the C-HWP-Model, which estimates delayed emissions from the HWP pool on the basis of the annual stock change of semi-finished wood products as outlined in *IPCC* (2006) and *IPCC* (2014). For the calculation of the contribution of HWP to the FMRL, the inflow in the HWP pools was directly linked to the business-as-usual harvesting scenario.
- New elements: Emissions from forest fires and from organic soils have been incorporated into the FMRL.
- The area under forest management for 2013 to 2020 has been calculated using a linear extrapolation (paragraph 15 of *UNFCCC*, 2011a), based on updated activity data for 1990 to 2009 (as used for Switzerland's National Greenhouse Gas Inventory submitted in 2014; *FOEN*, 2014).

A detailed description of the corrections is given in Switzerland's National Inventory Report (*FOEN*, 2016; Chapter 11.5.2).

11 Calculation of harvested wood products (HWP) prior to the second commitment period

As defined in Decision 2/CMP.7, delayed emissions are calculated on the basis of the annual stock change of semi-finished wood products using the first-order decay function (*IPCC*, 2014; Tier 2, Equation 2.8.5):

[2] The FMRL may be subject to technical corrections according to the annex to Decision 2/CMP.7, paragraph 15: 'After adoption of the reference level for forest management, if the reported data on forest management or forest land remaining forest land used to establish the reference level are subject to recalculations, a technical correction shall be applied to include in the accounting the impact of the recalculations on the reported data that have been used by the Party to set the reference level'.

$$C(i+1) = e^{-k} \cdot C(i) + \left[\frac{(1-e^{-k})}{k}\right] \cdot Inflow(i)$$

$$\Delta C(i) = C(i+1) - C(i)$$

Equation 1

With *i*, the year; *C(i)*, the carbon stock of the HWP pool from the beginning of year i (in kt C); *k*, the decay constant of first-order decay (in year^{-1}, *k=ln(2)/HL*, where *HL* is the half-life, i.e. the number of years it takes to lose one half of the material currently in the HWP pool); *Inflow(i)*, the inflow to the HWP pool during year i (in kt C year^{-1}); *ΔC(i)*, the carbon stock change of the HWP pool during year *i* (in kt C year^{-1}).

To calculate the pool of HWP in use according to Equation 1, the half-lives were used as suggested in the annex to Decision 2/CMP.7, paragraph 29:

- 35 years for sawn wood.
- 25 years for wood based panels.
- Because of the limited contribution of paper and paperboard, this category was not taken into account.

The activity data (production and trade of sawn wood and wood based panels) are derived from the FAOstat-Forestry database (*FAO*, 2014), which provides, for most countries, time series from 1961 to 2013. This data was verified and complemented with data from national statistics. To estimate the HWP contribution for the period prior to 1961, historical production data and data from national statistics were used to avoid overestimation of the HWP pool.

Historical time series and the applied method are described in detail in Switzerland's National Inventory Report (*FOEN*, 2016; Chapter 6.11).

12 Exclusion of natural disturbances

Switzerland intends to apply, in the case of significant magnitude events, the provision to exclude emissions from natural disturbances for units of lands under forest management under Article 3, paragraph 4, of the Kyoto Protocol during the second commitment period in accordance with Decision 2/CMP.7. Switzerland will not apply this provision for afforestation and reforestation under Article 3, paragraph 3, of the Kyoto Protocol.

In cases or events in which emissions from natural disturbances are higher than the nationally established threshold value (i.e. background level plus the margin) and all other requirements defined in Decision 2/CMP.7 and *IPCC* (2014) are met, Switzerland will evaluate and decide whether the effort would be justified to exclude them. Basically, the event would have to be of sufficient magnitude to be worth the effort to exclude these lands from the reporting, including determining their exact geographical location, continued monitoring of them and provision of information on efforts taken to rehabilitate them.

To develop the Swiss background level and margin, country-specific information on the background level of emissions associated with natural disturbances in forests under forest management is given below.

12.1 Definition of the types of natural disturbances to be excluded from accounting

Disturbance types which are considered for the calculation of the background level and the margin are based on events which have occurred during the calibration period from 1990 to 2009 including inter alia wildfires (only CO_2 emissions), insect pest (e.g. *Scolytinae sp.)* and disease infestations, extreme weather events (such as the heat wave in summer 2003, which caused drought), as well as geological disturbances like landslides and avalanches.

12.2 Establishment of a consistent and initially complete time series for the calibration period

Except for forest fires, no complete time series are available for the calibration period. For some disturbance types, incomplete or regional data are available, but no regular inventory (e.g. insect attacks, drought stress). For some

disturbance types, there are no specific data at all since they are not systematically monitored (e.g. geological disturbances) or a monitoring network has not been established yet (e.g. insect attacks by recently introduced species like the Asian long-horned beetle, *Anoplophora glabripennis*).

Therefore, a time series of emissions from disturbances is derived from values of mortality from the Swiss National Forest Inventory (NFI). The NFI values for mortality include mortality caused by all types of natural disturbances, plus mortality after harvesting as well as density-related mortality (e.g. caused by competition for light). Non-CO_2 greenhouse gas emissions are not included in the NFI mortality and are thus not included in the calculation of the background level. These emissions are added to the FMRL (see section 10).

12.3 Definition of the background level and the margin

An average value for mortality is derived from the NFI 1 and NFI 2 datasets for the years 1985 to 1994, from the NFI 2 and NFI 3 datasets for the years 1995 to 2005 and from the NFI 3 and NFI 4a+ datasets for the years 2006 to 2012 (for more detailed information see Chapter 6.4.2.1 in *FOEN*, 2016). To calculate annual values of mortality for the years 1985 to 1994, 1995 to 2005 and 2006 to 2012, the average amount of mortality was weighted by the percentage of the relative harvesting amounts taken from the forest statistics (see description in Chapter 6.4.2.5 in *FOEN*, 2016). These relative harvesting amounts are considered to be a good proxy for mortality caused by natural disturbances, since in the past, in years with high mortality rates, harvesting rates (including salvage logging) were also higher.

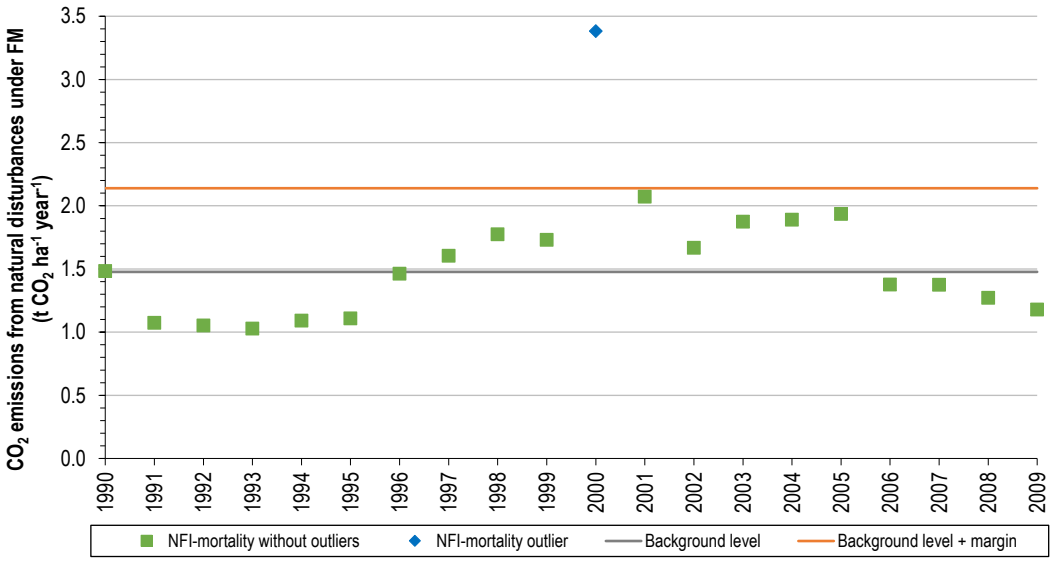
Table 8 > Yearly values of NFI mortality for the calibration period from 1990 to 2009 including all types of natural disturbances which occurred during that period. Shown are the results (arithmetic mean, twice the standard deviation and the upper confidence interval) of the first and the final (second) iteration.

	Iteration 1	Iteration 2
	Area specific emissions [t CO_2 ha^{-1} $year^{-1}$]	
1990	1.48	1.48
1991	1.07	1.07
1992	1.05	1.05
1993	1.03	1.03
1994	1.09	1.09
1995	1.11	1.11
1996	1.46	1.46
1997	1.61	1.61
1998	1.77	1.77
1999	1.73	1.73
2000	3.38	
2001	2.07	2.07
2002	1.67	1.67
2003	1.88	1.88
2004	1.89	1.89
2005	1.94	1.94
2006	1.38	1.38
2007	1.37	1.37
2008	1.27	1.27
2009	1.18	1.18
Arithmetic mean = background level	1.57	1.48
2 * SD = margin	1.05	0.66
Upper CI = background level + margin	**2.62**	**2.14**

Based on this time series, the background level and the margin have been calculated using the iterative approach described in Chapter 2.3.9.6 of *IPCC* (2014). Yearly values of NFI mortality, including all types of natural disturbances, are shown in Table 8. The times series for the calibration period from 1990 to 2009, the background level and the margin are visualized in Figure 3.

- Excluding outliers from the calibration period: One data point has been excluded from the time series covering 1990 to 2009. The reason for this outlier in the year 2000 is the winter storm 'Lothar' at the end of 1999 which caused great damages in the forest stands and increased harvesting.
- The background level amounts to 1.48 t CO_2 ha^{-1} $year^{-1}$, which is equal to a mortality of 16.34 per cent relative to the total mean cut and mortality (losses in living biomass) from 1990 to 2009 (9.04 t CO_2 ha^{-1} $year^{-1}$). This background level is included in the FMRL by setting mortality in the model MASSIMO3 equal to the background level.
- The margin amounts to 0.66 t CO_2 ha^{-1} $year^{-1}$.
- Emissions from natural disturbances higher than the upper confidence interval (background level + margin) of 2.14 t CO_2 ha^{-1} $year^{-1}$ or 23.67 per cent relative to total mean cut and mortality can be excluded from the accounting.

Figure 3 > Time series of NFI-mortality for the calibration period from 1990 to 2009, background level and upper confidence interval (background level + margin). The outlier in the year 2000 results from the winter storm 'Lothar' at the end of 1999.



Currently, it is not yet possible to tune mortality in the Model MASSIMO3 at a flexible level as required. For the calculations of Switzerland's FMRL, the mortality rate in MASSIMO3 amounts to the constant value of 14 per cent of total cut and mortality, reflecting the level of mortality in NFI 1–2 (from 1985 to 1994; 1.16 t CO_2 ha^{-1} $year^{-1}$) and NFI 3–4a+ (from 2006 to 2012; 1.26 t CO_2 ha^{-1} $year^{-1}$). Over the next years, MASSIMO3 will be substantially modified and adjusted, such that it will be possible to tune mortality at a desired level. As soon as this will be possible, Switzerland's FMRL will be subject to a technical correction.

12.4 Ensuring that the method applied does not lead to expectation of net credits or debits

To provide the information needed, the requirements listed in Box 2.3.6 of *IPCC* (2014) have to be evaluated. Using the standard procedure for the calculation of the background level and the margin, all of the *listed requirements* are fulfilled:

1. *There is no observed trend in natural disturbance emissions during the calibration period that is not considered in the background level estimation or expected during the commitment period.*

   Table 8 and Figure 3 show that all data within the background group are used for calculating the background level.

2. *The background level of emissions for FM, included in the FMRL is equal to the average of the annual emissions from natural disturbances during the calibration period which are in the background group.*

Yes, see Table 8.

3. *Any emissions from natural disturbances during the commitment period that fall into the background group are not separately excluded from accounting. During the commitment period, emissions are only excluded from accounting when the annual emissions are greater than the background level plus the margin.*

   Yes, see Table 8.

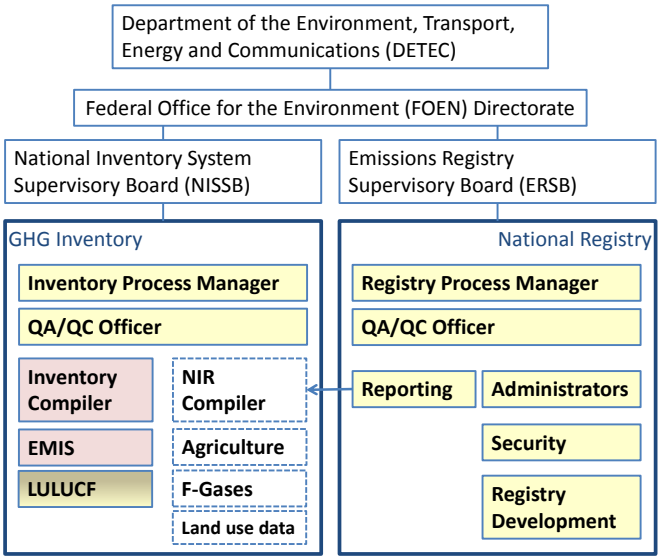
4. *A test application of the constructed background level and the margin on the annual emissions in the calibration period leads to the same background group as used during the construction of the background level.*

   Yes, see Table 8.

13 Description of Switzerland's National Greenhouse Gas Inventory System

Switzerland's National Greenhouse Gas Inventory System as described in Switzerland's Initial Report for the first commitment period (*FOEN*, 2006h) is still operational. While minor changes have been documented annually in the National Inventory Reports, a detailed description of the current National Greenhouse Gas Inventory System is presented in Switzerland's National Inventory Report (*FOEN*, 2016). The institutional setting is shown in Figure 4.

Figure 4 > Institutional setting of Switzerland's National Greenhouse Gas Inventory System. The coloured boxes correspond to divisions of the FOEN (yellow: Climate Division; red: Air Pollution Control and Chemicals Division; beige: Forest Division). The white boxes correspond to mandated experts outside the FOEN (marked with dashed lines) or to executive committees.



Switzerland's National Greenhouse Gas Inventory System is managed under the auspices of the Department of the Environment, Transport, Energy and Communication (DETEC). The Federal Office for the Environment (FOEN), as a DETEC agency, has the lead within the federal administration regarding climate policy and its implementation. Within FOEN, two supervisory boards – one for the inventory, the other for the registry – oversee all activities related to the greenhouse gas inventory and the national registry. For both, inventory and registry, a process manager and QA/QC officer have been appointed. Roles and responsibilities are defined and arrangements for collaboration between different divisions of the FOEN, between different institutions of the federal administration and with partners outside the federal administration are well-established. The arrangements for the greenhouse gas inventory include the Inventory Compiler and the National Inventory Report Compiler, the responsible persons for the emission database EMIS and various sectoral experts. The arrangements for the registry include specific responsibilities with regard to registry development, security, reporting obligations and general registry administration. Further elements of Switzerland's National Greenhouse Gas Inventory System are described in Chapter 1 of Switzerland's National Inventory Report (*FOEN*, 2016).

14 Description of Switzerland's National Registry

Switzerland's National Registry environment was completely renewed in April 2014. In order to connect the new registry environment to the International Transaction Log (ITL) a Registry Readiness Questionnaire was submitted to the ITL. The questionnaire corresponds to the plans and associated documents that must be submitted by a candidate registry requesting initialization with the ITL, as identified in the Technical Specifications of the Data Exchange Standards (DES). Based on the documentation provided, Switzerland has successfully passed the ITL readiness review and was able to switch to full operation with the new registry environment on 22 April 2014. Switzerland's National Registry is accessible under *https://www.emissionsregistry.admin.ch*.

A more detailed documentation is not provided here, because the respective information is regarded as confidential. However, the Registry Readiness Questionnaire will be made available to the ERT upon request. As before, annual changes of the registry environment will be reported in the National Inventory Reports.

References

FAO, 2014: FAOstat database of the Food and Agriculture Organization of the United Nations. Supply of data on production and trade of sawn wood and wood based panels. *http://faostat.fao.org/site/291/default.aspx* [06.04.2016]

FOEN, 2006h: Switzerland's Initial Report under Article 7, paragraph 4, of the Kyoto Protocol. Federal Office for the Environment, Bern. Including the Update following the UNFCCC review (FCCC/IRR/2007/CHE). *www.bafu.admin.ch/ghginv-CP1-IR* [06.04.2016]

FOEN, 2011l: Switzerland's Submission on Reference Levels as an accounting approach for Forest Management under the Kyoto Protocol. Submission of 28 February 2011 under the United Nations Framework Convention on Climate Change and under the Kyoto Protocol. Federal Office for the Environment, Bern. *http://unfccc.int/files/meetings/ad_hoc_working_groups/kp/application/pdf/awgkp_switzerland_2011.pdf* [06.04.2016]

FOEN, 2014: Switzerland's Greenhouse Gas Inventory 1990–2012: National Inventory Report, CRF-tables, Kyoto Protocol LULUCF tables 2008–2012, SEF and SIAR tables from the National Registry. Submission of 15 April 2014 under the United Nations Framework Convention on Climate Change and under the Kyoto Protocol. Federal Office for the Environment, Bern. *www.climatereporting.ch* [06.04.2016]

FOEN, 2016: Switzerland's Greenhouse Gas Inventory 1990–2014: National Inventory Report, CRF-tables, Kyoto Protocol LULUCF tables 2008–2014, SEF and SIAR tables from the National Registry. Submission of 15 April 2016 under the United Nations Framework Convention on Climate Change and under the Kyoto Protocol. Federal Office for the Environment, Bern. *www.climatereporting.ch* [06.04.2016]

IPCC, 2006: 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Intergovernmental Panel on Climate Change. *http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm* [06.04.2016]

IPCC, 2014: 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (KP Supplement). Intergovernmental Panel on Climate Change. Hiraishi, T., Krug, T., Tanabe, K., Srivastava, N., Baasansuren, J., Fukuda, M. and Troxler, T.G. (eds). Published: IPCC, Switzerland. *http://www.ipcc-nggip.iges.or.jp/home/2013KPSupplementaryGuidance_inv.html* [06.04.2016]

SFOE, 2015: Schweizerische Gesamtenergiestatistik 2014. Statistique globale suisse de l'énergie 2014. Swiss Federal Office of Energy, Bern. *http://www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=de&name=de_174190177.pdf* [in German and French] [06.04.2016]

UNFCCC, 2011a: Report of the technical assessment of the forest management reference level submission of Switzerland submitted in 2011 (FCCC/TAR/2011/CHE). Published online on 21 September 2011. *http://unfccc.int/resource/docs/2011/tar/che01.pdf* [06.04.2016]

Annex

Switzerland's Second Initial Report under the Kyoto Protocol is accompanied by the following two documents, as requested in footnote 1, page 5 of Decision 2/CMP.8 ('Parties shall include the submission pursuant to Decision 2/CMP.6, paragraph 4, and the corresponding technical assessment report pursuant to Decision 2/CMP.6, paragraph 5, as annexes to the report. Any technical corrections resulting from recommendations in the technical assessment report shall be reported in the inventory submission for the first year of the second commitment period'):

- **Switzerland's submission FMRL**
  FOEN, 2011l: Switzerland's Submission on Reference Levels as an accounting approach for Forest Management under the Kyoto Protocol. Submission of 28 February 2011 under the United Nations Framework Convention on Climate Change and under the Kyoto Protocol. Federal Office for the Environment, Bern. *http://unfccc.int/files/meetings/ad_hoc_working_groups/kp/application/pdf/awgkp_switzerland_2011.pdf* [06.04.2016]
- **Technical assessment of the submission FMRL**
  UNFCCC, 2011a: Report of the technical assessment of the forest management reference level submission of Switzerland submitted in 2011 (FCCC/TAR/2011/CHE). Published online on 21 September 2011. *http://unfccc.int/resource/docs/2011/tar/che01.pdf* [06.04.2016]