Annex I - IX
National Inventory Report 2009 – Norway

Annex I: Key Categories

This chapter outlines the Tier 2 methodologies used to find which sources are key categories in the Norwegian greenhouse gas emission inventory.

Two different methods are used for the key category analysis. First, the standard method as described in IPCC Good Practice Guidance (IPCC 2001) is used, both at the Tier 1 level and at the Tier 2 level with uncertainties. Second, a sensitivity analysis is performed using the specification of the model for the uncertainty analysis, as described in Rypdal and Zhang 2000). The uncertainty model is presented in Annex II. The discussion focuses primarily on the standard method. The sensitivity analysis is presented as supporting data.

Key categories are identified as the emission sources that add up to 90 per cent of total uncertainty in level and/or trend. This definition of a key category is according to (IPCC 2001) which is based on (Statistics Norway 2001e). A Tier 2 analysis for the LULUCF sector has also been performed. However, key categories for non-LULUCF sources are based on the analysis without LULUCF.

The key category analysis is performed at the level of IPCC source categories and each GHG from each source category is considered separately with respect to total GWP weighted emissions. The advantage in using a Tier 2 rather than the Tier 1 methodology is that uncertainties are taken into account so the ranking shows where uncertainties can be reduced.

The steps taken to find key categories with respect to level and trend were the determination of uncertainties in input parameters (AD = activity data and EF = emission factors). Uncertainties of activity data and emissions factors were combined to source uncertainty by the error propagation rule $U_{source} = \sqrt{U_{AD}^2 + U_{EF}^2}$ (IPCC 2001, equation 6.4).

The next step was the use of sensitivity analysis to identify which parameters in the inventory influence most the total GHG emissions in level and in trend. The standard method does not take correlations into account. This has partly been handled by aggregating sources with the same emission factors. However, sources with similar emission factors in stationary combustion, categories 1A1, 1A2, and 1A4, were treated separately as suggested in the proposed 2006 guidelines.]. Also, correlations due to common activity data for several pollutants have not been taken into account. This may lead to an underestimation of the uncertainty importance for such sources. In the sensitivity analysis, such correlations may be specified in the model. The sensitivity analysis also allows separate treatment of activity data and emission factors.

Compilations of the uncertainty importance elasticity lead to the estimation of uncertainty importance of each input parameter with respect to total level and trend uncertainty. Out of this we get a ranked list of parameters which add up to 90 per cent of total uncertainty in level and trend. The LULUCF key categories come in addition to this.

A summary of the key categories are given in Table A1-2 for the emissions categories, and a summary for removal key categories are given in Table A1-3. The result in level and trend from the Tier 1 analysis for emissions sources is in Table A1-1.

According to IPCC (2001) it is good practice to give the results at the Tier 2 level if available. However, in the proposed 2006 guidelines it is suggested that good practice reporting should include key categories from both the Tier 1 and Tier 2 analyses. The Tier 1 analysis includes the following sources which were not assigned as key at Tier 2. All sources were key categories at tier 1 also in the 2006 NIR.

Table A1-1. Summary of identified key categories only in the Tier 1 analysis.

1A1 Energy Industries, Coal/coke	CO_2	level
1A1 Energy Industries, Oil	CO_2	level, trend
1A2 Manufacturing Industries and Construction, Coal/coke	CO_2	level, trend
1A4 Other Sectors, Gas	CO_2	trend, trend
1A5b Military – Mobile	CO_2	level, trend
2A1 Cement Production	CO_2	level
2B1 Ammonia Production	CO_2	level, trend
2C1 Iron and Steel Production	CO_2	level
2C4 SF_6 used in Aluminium and Magnesium Foundries	SF_6	level, trend

The other differences between the current analysis and Statistics Norway (2000) have no bearings on the conclusions on key categories. There are some differences in ranking and in whether the sources are identified by the level, trend or both analyses.

CH_4 from coal mining - 1B1a - has been designated key in the previous National Inventory Reports. This source is not identified by the quantitative method. It is included because the national emission factor we use is in an order of magnitude less than IPCC's default factors (not shown in the tables). CO_2 from clinker production - 2A1 – and from ammonia production – 2B1 – are also based on qualitative criteria define as key categories and the same is capture and storage of CO_2 at the Sleipner oil field.

The *sensitivity* analysis generally supports the results from the standard key category analysis. Using thresholds for the uncertainty importance at 0.002 for level and 0.01 for trend (Rypdal and Zhang 2000), no sources were identified that were not identified in the standard method. The sensitivity to changes in activity data and emission factors were assessed separately. In general, the uncertainty importance of activity data is lower than that of emission factors.

The analyses have been performed for 1990 and 2004 GHG emission data. The main conclusion is that there are few differences in the result for 1990 compared with 2004.

Land-use, Land-use Change and Forestry (LULUCF)

Table A1-3 shows the results of the Tier 2 key category analysis performed as described in GPG2004[1]. Uncertainties were not determined by a rigid analysis, see Section 7.12 . There are some differences between the two tiers. Tier 1 level analysis does not identify forest drained organic soil, cropland histosoils and forest converted for settlements. The reason is that these categories have large uncertainties. For the trend analysis there are small differences between the two tiers with respect to the LULUCF categories identified, and the trend analysis does not identify any additional LULUCF categories to those identified in the level analysis. Including LULUCF also influences other key categories identified. However, according to GPG2004 the LULUCF key categories are additional to those identified analyzing the inventory excluding LULUCF. In both analyses, forest remaining forest (all three pools) are among the top key categories.

[1] Tier 1 is based on only the size of emissions/removals and estimate their contribution to the level and trend. In the Tier 2 method the contribution is also multiplied with the relative uncertainty (two standard deviations).

Table A1-2. Summary of identified emission key categories. Excluding LULUCF.
Per cent contribution to the total uncertainty in level and/or trend in the tier 2 analysis.

	Source category	**Gas**	**Level assessment Tier 2 1990**	**Level assessment Tier 2 2006**	**Trend assessment Tier 2 1990-2006**	**Calculation method (Tier) 2006**
4D1	Direct soil emissions	N_2O	**26.41**	**23.16**	**9.99**	Tier 1a
1A3b	Road Transportation	CO_2	**8.29**	**9.94**	**5.20**	Tier 2
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Gaseous Fuels	CO_2	**4.34**	**8.79**	**13.95**	Tier 2
4D3	Indirect emissions	N_2O	**5.91**	**5.31**	**1.84**	Tier 1a
1B2a	Oil (incl. oil refineries, gasoline distribution)	CO_2	**4.79**	**4.86**	0.27	Tier 2
6A	Solid Waste Disposal on Land	CH_4	**6.41**	**4.71**	**5.27**	Tier 2
4A	Enteric Fermentation	CH_4	**5.17**	**4.52**	**1.98**	Tier 1/2***
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Liquid Fuels	CO_2	**3.53**	**2.92**	**1.89**	Tier 2
1B2c	Venting and Flaring	CH_4	**1.62**	**2.83**	**3.79**	Tier 2
1A3e	Other (snow scooters, boats, motorized equipment)	CO_2	**1.63**	**2.58**	**2.98**	Tier 2
1A3d	Navigation	CO_2	**2.10**	**2.53**	**1.36**	Tier 2
2F	Consumption of Halocarbons and Sulphur Hexafluoride	HFCs	0.00	**2.50**	**7.82**	Tier 2
2C3	Aluminium Production	CO_2	**1.54**	**2.21**	**2.09**	Tier 2
1A3a	Civil Aviation	CO_2	**1.43**	**1.68**	**0.78**	Tier 2
1A3b	Road Transportation	N_2O	0.49	**1.63**	**3.57**	Tier 2
4D2	Animal production	N_2O	**1.74**	**1.54**	**0.63**	Tier 1a
2C3	Aluminium Production	PFCs	**7.10**	**1.45**	**17.61**	Tier 2
1B2c	Venting and Flaring	CO_2	**1.68**	**1.30**	**1.17**	Tier 2
1A3e	Other (snow scooters, boats, motorized equipment)	N_2O	0.69	**1.27**	**1.83**	Tier 2
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Biomass	CH_4	**0.97**	**1.15**	0.57	Tier 2
2B2	Nitric Acid Production	N_2O	**1.51**	**1.10**	**1.28**	Tier 2
6B	Wastewater Handling	N_2O	**0.91**	**1.00**	0.31	Tier 1
4B	Manure Management	N_2O	**1.05**	**0.87**	0.55	Tier 1
1B2a	Oil (incl. oil refineries, gasoline distribution)	CH_4	0.69	**0.86**	0.55	Tier 2
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Solid Fuels	CO_2	**1.00**	0.79	**0.65**	Tier 2
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Liquid Fuels	N_2O	**0.92**	0.75	0.51	Tier 2
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Other Fuels	CO_2	0.32	0.58	**0.81**	Tier 2
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Gaseous Fuels	CH_4	0.31	0.53	**0.72**	Tier 2
2C2	Ferroalloys Production	CO_2	0.80	0.53	**0.84**	Tier 2
1B2b	Natural Gas	CH_4	0.02	0.26	**0.75**	Tier 2

	Source category	Gas	Level assessment Tier 2 1990	Level assessment Tier 2 2006	Trend assessment Tier 2 1990-2006	Calculation method (Tier) 2006
4D1	Direct soil emissions	N_2O	**26.41**	**23.16**	**9.99**	Tier 1a
1A3b	Road Transportation	CH_4	0.45	0.25	**0.61**	Tier 2
2B4	Carbide Production	CO_2	0.43	0.07	**1.13**	Tier 2
	Tier 1 key categories					
4B	Manure Management*	CH_4	0.79	0.75	0.11	Tier 2
2A1	Cement *	CO_2	0.47	0.54	0.22	Tier 2
2B1	Ammonia Production *	CO_2	0.40	0.27	0.39	Tier 2
2D2	Food and Drink*	CO_2	0.10	0.27	0.53	Tier 2
1A5b	Military – Mobile*	CO_2	0.29	0.16	0.39	Tier 2
2C1	Iron and Steel Production*	CO_2	0.04	0.06	0.07	Tier 2
2C4	SF_6 used in Aluminium and Magnesium Foundries*	SF_6	0.06	0.00	0.17	Tier 2
	Qualitative key categories					
1B1a	Coal Mining and Handling **	CH_4	0.42	0.28	0.43	Tier 2
	Capture and storage **	CO_2				CS (Tier 2)

Bold figures indicate whether the source category is key.

***** Identified as key category because of large contribution to the total emissions (Tier 1).

** Defined as key category from qualitative criteria

*** Tier 2 used for the significant animal groups

Table A1-3. Summary of identified LULUCF key categories Tier 2.

IPCC Category		Gas	Level assessment 1990	Level assessment 2006	Trend assessment 1990-2006	Calculation method (Tier) 2006
5A1	Forest Land remaining Forest Land, Forest inventory area, Living Biomass	CO2	**9.48**	**17.24**	**25.65**	Tier 3
5C1	Grassland remaining Grassland, Histosols, Soils	CO2	**13.44**	**11.32**	**7.59**	Tier 2*
5A2	Land converted to Forest Land, Living biomass	CO2	**1.61**	**5.18**	**9.30**	Tier 3
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Mineral	CO2	**4.71**	**3.85**	**2.40**	Tier 3
5A1	Forest Land remaining Forest Land, Forest inventory area, Dead Biomass	CO2	**6.29**	**3.46**	0.46	Tier 3
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Organic	CO2	**2.36**	**2.11**	**1.59**	Tier 1
5B1	Cropland remaining Cropland, Histosols, Soils	CO2	**1.49**	**1.26**	**0.84**	Tier 2
5D1	Wetlands remaining Wetlands, Living biomass	CO2	0.19	0.49	**0.83**	Tier 3

Table A1-4. Summary of identified key categories Tier 1. Excluding LULUCF.
Per cent contribution to the total uncertainty in level and/or trend

	Source category	Gas	Level assessment tier 1 1990	Level assessment tier 1 2005	Cumulative assessment 2005
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Gaseous Fuels	CO_2	**10.41**	**21.13**	**26.75**
1A3b	Road Transportation	CO_2	**15.35**	**18.44**	**7.70**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Liquid Fuels	CO_2	**16.09**	**13.33**	**6.87**
1A3d	Navigation	CO_2	**3.88**	**4.69**	**2.01**
2C3	Aluminium Production	CO_2	**2.86**	**4.09**	**3.09**
4A	Enteric Fermentation	CH_4	**3.92**	**3.43**	**1.20**
2C2	Ferroalloys Production	CO_2	**5.14**	**3.40**	**4.34**
2B2	Nitric Acid Production	N_2O	**4.17**	**3.04**	**2.83**
6A	Solid Waste Disposal on Land	CH_4	**3.44**	**2.53**	**2.26**
1A3e	Other (snow scooters, boats, motorized equipment)	CO_2	**1.56**	**2.47**	**2.28**
4D1	Direct soil emissions	N_2O	**2.81**	**2.47**	**0.85**
1B2a	Oil (incl. oil refineries, gasoline distribution)	CO_2	**2.31**	**2.35**	0.11
1B2c	Venting and Flaring	CO_2	**3.02**	**2.35**	**1.68**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Solid Fuels	CO_2	**2.26**	**1.79**	**1.17**
1A3a	Civil Aviation	CO_2	**1.37**	**1.61**	**0.60**
2A1	Cement Production	CO_2	**1.31**	**1.50**	0.49
2C3	Aluminium Production	PFCs	**6.78**	**1.39**	**13.46**
2F	Consumption of Halocarbons and Sulphur Hexafluoride	HFCs	0.00	**0.97**	**2.42**
4D3	Indirect emissions	N_2O	**0.84**	**0.76**	0.21
2B1	Ammonia Production	CO_2	**1.01**	**0.69**	**0.79**
2C1	Iron and Steel Production	CO_2	0.40	**0.62**	**0.55**
4B	Manure Management	CH_4	**0.60**	**0.57**	0.07
1B2c	Venting and Flaring	CH_4	0.31	**0.54**	**0.57**
1A5b	Military - Mobile	CO_2	**0.79**	**0.45**	**0.86**
1B2a	Oil (incl. oil refineries, gasoline distribution)	CH_4	0.33	**0.42**	0.21
2D2	Food and Drink	CO_2	0.13	0.37	**0.58**
1A3b	Road Transportation	N_2O	0.09	0.31	**0.55**
2C4	SF6 Used in Aluminium and Magnesium Foundries	SF_6	**4.31**	0.22	**10.21**
2B4	Carbide Production	CO_2	**0.80**	0.13	**1.67**

Table A1-5. Summary of identified key categories Tier 2. Including LULUCF. Per cent contribution to the total uncertainty in level and/or trend. Categories identified only in the analysis without LULUCF are included

	Source category	Gas	Level assessment tier 1 1990	Level assessment tier 1 2005	Cumulative assessment 2005
5A1	Forest Land remaining Forest Land, Forest inventory area, Living Biomass	CO2	**11.74**	**18.27**	**25.35**
4D1	Direct soil emissions	N2O	**15.89**	**12.36**	**6.58**
5C1	Grassland remaining Grassland, Histosols, Soils	CO2	**13.65**	**11.22**	**7.00**
5A1	Forest Land remaining Forest Land, Forest inventory area, Dead Biomass	CO2	**2.54**	**6.39**	**10.93**
1A3b	Road Transportation	CO2	**4.99**	**5.30**	**5.26**
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Mineral	CO2	**6.41**	**5.03**	**2.75**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Gaseous Fuels	CO2	**2.61**	**4.69**	**7.05**
4D3	Indirect emissions	N2O	**3.55**	**2.83**	**1.62**
1B2a	Oil (incl. oil refineries, gasoline distribution)	CO2	**2.88**	**2.59**	**1.99**
6A	Solid Waste Disposal on Land	CH4	**3.86**	**2.51**	0.51
4A	Enteric Fermentation	CH4	**3.11**	**2.41**	**1.28**
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Organic	CO2	**2.40**	**2.09**	**1.48**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Liquid Fuels	CO2	**2.12**	**1.56**	0.67
1B2c	Venting and Flaring	CH4	**0.98**	**1.51**	**2.09**
1A3e	Other (snow scooters, boats, motorized equipment)	CO2	**0.98**	**1.38**	**1.78**
1A3d	Navigation	CO2	**1.26**	**1.35**	**1.34**
2F	Consumption of Halocarbons and Sulphur Hexafluoride	HFCs	0.00	**1.33**	**2.99**
5.00E+01	Forest converted to Settlements, Living biomass	CO2	**0.69**	**1.31**	**2.02**
5B1	Cropland remaining Cropland, Histosols, Soils	CO2	**1.52**	**1.25**	0.78
2C3	Aluminium Production	CO2	**0.93**	**1.18**	**1.41**
1A3a	Civil Aviation	CO2	**0.86**	**0.90**	**0.86**
1A3b	Road Transportation	N2O	0.30	**0.87**	**1.56**
4D2	Animal production	N2O	**1.05**	**0.82**	0.45
2C3	Aluminium Production	PFCs	**4.27**	**0.77**	**3.94**
1B2c	Venting and Flaring	CO2	**1.01**	**0.70**	0.22
1A3e	Other (snow scooters, boats, motorized equipment)	N2O	0.41	0.68	**0.97**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Biomass	CH4	0.58	0.61	0.60
2B2	Nitric Acid Production	N2O	**0.91**	0.59	0.10
6B	Wastewater Handling	N2O	0.54	0.53	0.47
4B	Manure Management	N2O	0.63	0.47	0.20
1B2a	Oil (incl. oil refineries, gasoline distribution)	CH4	0.41	0.46	0.48
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Solid Fuels	CO2	0.60	0.42	0.15
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Liquid Fuels	N2O	0.55	0.40	0.17

Table A1-6. Summary of identified key categories Tier 1. Including LULUCF.
Per cent contribution to the total uncertainty in level and/or trend. Categories identified only in the analysis without LULUCF are included.

	Source category	Gas	Level assessment tier 1 1990	Level assessment tier 1 2005	Cumulative assessment 2005
5A1	Forest Land remaining Forest Land, Forest inventory area, Living Biomass	CO2	**17.74**	**27.20**	**33.71**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Gaseous Fuels	CO2	**7.34**	**13.00**	**17.44**
1A3b	Road Transportation	CO2	**10.83**	**11.34**	**10.04**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Liquid Fuels	CO2	**11.35**	**8.20**	**3.15**
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Mineral	CO2	**5.81**	**4.49**	**2.20**
1A3d	Navigation	CO2	**2.74**	**2.88**	**2.57**
5A1	Forest Land remaining Forest Land, Forest inventory area, Dead Biomass	CO2	**1.15**	**2.85**	**4.36**
2C3	Aluminium Production	CO2	**2.01**	**2.52**	**2.69**
5C1	Grassland remaining Grassland, Histosols, Soils	CO2	**2.65**	**2.15**	**1.20**
4A	Enteric Fermentation	CH4	**2.76**	**2.11**	**1.00**
2C2	Ferroalloys Production	CO2	**3.63**	**2.09**	0.05
2B2	Nitric Acid Production	N2O	**2.94**	**1.87**	0.30
6A	Solid Waste Disposal on Land	CH4	**2.42**	**1.56**	0.28
1A3e	Other (snow scooters, boats, motorized equipment)	CO2	**1.10**	**1.52**	**1.76**
4D1	Direct soil emissions	N2O	**1.98**	**1.52**	**0.72**
1B2a	Oil (incl. oil refineries, gasoline distribution)	CO2	**1.63**	**1.44**	**0.99**
1B2c	Venting and Flaring	CO2	**2.13**	**1.44**	**0.40**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Solid Fuels	CO2	**1.59**	**1.10**	**0.34**
1A3a	Civil Aviation	CO2	**0.96**	**0.99**	**0.85**
2A1	Cement Production	CO2	**0.92**	**0.92**	**0.77**
2C3	Aluminium Production	PFCs	**4.78**	**0.85**	**3.89**
2F	Consumption of Halocarbons and Sulphur Hexafluoride	HFCs	0.00	**0.60**	**1.19**
5.00E+01	Forest converted to Settlements, Living biomass	CO2	0.31	**0.59**	**0.81**
4D3	Indirect emissions	N2O	**0.59**	**0.46**	0.24
2B1	Ammonia Production	CO2	**0.71**	**0.43**	0.02
5B	Cropland remaining Cropland, Liming	CO2	**1.13**	**0.38**	**0.55**
2C1	Iron and Steel Production	CO2	0.28	**0.38**	**0.44**
4B	Manure Management	CH4	0.42	**0.35**	0.21
1B2c	Venting and Flaring	CH4	0.22	0.33	**0.41**
1A5b	Military - Mobile	CO2	**0.56**	0.27	0.10
1B2a	Oil (incl. oil refineries, gasoline distribution)	CH4	0.23	0.26	0.24
2C4	SF6 Used in Aluminium and Magnesium Foundries	SF6	**3.04**	0.14	**3.28**
2B4	Carbide Production	CO2	**0.56**	0.08	**0.50**

Table A1-7. Background data for the key category analyses.

Category - Fuel		CO_2		CH_4		N_2O		Uncertainty activity	Uncertainty emission factor		
		1990	2006	1990	2006	1990	2006		CO_2	CH_4	N_2O
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Biomass	.	19.30	119.37	152.73	46.40	47.26	30	0	71.8	100.2
	Stationary Fuel Combustion (1A1-1A2-1A4), Gaseous Fuels	5172.00	11308.76	40.95	77.11	13.47	26.98	4	7	71.8	100.6
	Stationary Fuel Combustion (1A1-1A2-1A4), Liquid Fuels	7996.07	7138.22	16.66	10.31	87.92	77.87	3	3	102	100.4
	Stationary Fuel Combustion (1A1-1A2-1A4), Other Fuels	100.38	196.03	1.92	3.83	4.31	6.52	5	30	71.8	100.4
	Stationary Fuel Combustion (1A1-1A2-1A4), Solid Fuels	1121.42	957.72	2.03	0.57	2.79	2.46	5	7	71.8	100.2
1A3a	Civil Aviation	679.38	860.28	0.35	0.58	6.69	8.47	20	3	71.8	99.8
1A3b	Road Transportation	7630.18	9870.58	59.03	35.71	46.99	168.27	10	3	71.8	1
1A3c	Railways	96.05	41.51	0.11	0.05	11.27	4.87	5	3	71.8	87.8
1A3d	Navigation	1929.46	2508.98	5.71	12.23	11.52	15.47	10	3	71.8	1
1A3e	Other (snow scooters, boats, motorized equipment)	773.66	1321.60	6.70	7.63	68.95	137.58	20	3	71.8	93.6
1A5a	Military - Stationary	62.45	38.75	0.17	0.10	0.18	0.11	5	5	71.8	100.4
1A5b	Military - Mobile	393.74	238.89	0.32	0.13	5.94	2.65	5	5	71.8	99.8
1B1a	Coal Mining	7.37	5.37	56.49	41.12	.	.	3	71.8	71.8	.
1B2a	Oil (incl. oil refineries, gasoline distribution)	1145.91	1256.84	164.41	222.40	.	.	3	40	40	.
1B2b	Natural Gas	4.11	13.38	2.52	37.09	.	.	3	71.8	71.8	.
1B2c	Venting and Flaring	1499.81	1255.71	152.65	287.54	4.11	3.11	4	10	102	100.4
2A1	Cement Production	648.66	804.52	.	.	.	.	0.3	7	.	.
2A2	Lime Production	46.65	98.25	.	.	.	.	3	7	.	.
2A3	Limestone and Dolomite Use	20.00	28.00	.	.	.	.	3	7	.	.
2B1	Ammonia Production	500.12	369.98	.	.	.	.	3	7	.	.
2B2	Nitric Acid Production	.	.	.	.	2073.59	1626.38	0	.	.	7
2B4	Carbide Production	397.62	69.49	7.36	2.33	.	.	3	10	10	.
2B5	Other Chemical Industry	2.63	21.24	1.59	4.03	.	0.05	10	10	71.8	0
2C1	Iron and Steel Production	200.46	334.35	.	.	.	.	1.23	1.4	.	.
2C2	Ferroalloys Production	2553.70	1820.81	1.04	0.62	5.22	2.92	0	3	71.8	10
2C3	Aluminium Production	1419.00	2191.25	.	.	.	.	3	10	.	.
2C5	Other Metal Production	145.44	132.04	.	.	.	.	10	10	.	.

Category - Fuel		CO_2		CH_4		N_2O		Uncertainty activity	Uncertainty emission factor		
		1990	2006	1990	2006	1990	2006		CO_2	CH_4	N_2O
2D1	Pulp and Paper	10.43	14.30	.	.	.	.	10	10	.	.
2D2	Food and Drink	66.87	196.00	.	.	.	.	10	10	.	.
2G	Other (Paraffin Wax)	6.23	38.97	.	.	.	.	30	10	.	.
3	TOTAL SOLVENT AND OTHER PRODUCT USE	144.49	126.82	.	.	35.53	42.43	0	30	.	10
4A	Enteric Fermentation	.	.	1946.11	1838.78	.	.	5	.	25	.
4B	Manure Management	.	.	298.17	306.49	133.36	119.47	14.5	.	25	71.8
4D1	Direct soil emissions	.	.	.	.	1396.19	1321.59	30	.	.	179.2
4D2	Animal production	.	.	.	.	222.79	212.35	22	.	.	71.8
4D3	Indirect emissions	.	.	.	.	417.23	404.57	70	.	.	116.6
4F1	Cereals	.	.	23.85	4.46	6.88	1.28	10	.	71.8	100.2
6A	Solid Waste Disposal on Land	.	.	1708.12	1355.18	.	.	20	.	30	.
6B	Wastewater Handling	.	.	19.51	6.61	117.07	139.74	25	.	70	70
6C	Waste Incineration	0.19	.	0.01	0.16	0.07	0.12	30	30	71.8	116.6

Category - Fuel		HFCs		PFCs		SF_6		Uncertainty activity	Uncertainty emission factor		
		1990	2006	1990	2006	1990	2006		HFCs	PFCs	SF_6
2C3	Aluminium Production	.	.	3370.40	742.46	.	.	3	.	20	.
2C4	SF6 Used in Aluminium and Magnesium Foundries	.	.	.	.	2143.83	120.07	0	.	.	0.25
2F	Consumption of Halocarbons and Sulphur Hexafluoride	0.02	518.44	.	0.04	55.95	92.01	0	50	50	60

Category - Fuel		CO_2		CH_4		N_2O		Uncertainty activity	Uncertainty emission factor		
		1990	2006	1990	2006	1990	2006		CO_2	CH_4	N_2O
5A	Forest Land remaining Forest Land, Drainage	.	.	.	.	11.16	11.95	0	.	.	282.2
5A1	Forest Land remaining Forest Land, Forest inventory area, Dead Biomass	-2040.21	-1334.76	.	.	.	.	0	50	.	.
	Forest Land remaining Forest Land, Forest inventory area, Living Biomass	-10250.70	-22151.60	.	.	.	.	0	15	.	.
	Forest Land remaining Forest Land, Forest inventory area, Soils, Mineral	-3055.08	-2963.87	.	.	.	.	0	25	.	.
	Forest Land remaining Forest Land, Forest inventory area, Soils, Organic	136.00	143.91	.	.	.	.	0	282.2	.	.
	Forest Land remaining Forest Land, Wildfires	.	.	1.77	7.24	0.19	0.74	0	.	75	.
5A2	Forest Land remaining Forest Land, Fertilizer	.	.	.	.	1.37	0.25	0	.	.	179.2
	Land converted to Forest Land, Living biomass	-1046.50	-3996.37	.	.	.	.	0	25	.	.
5B	Cropland remaining Cropland, Liming	794.42	309.81	.	.	.	.	0	10	.	.
5B1	Cropland remaining Cropland, Erosion of new agriculture land, Soils	5.51	1.30	.	.	.	.	0	71.8	.	.
	Cropland remaining Cropland, Histosols, Soils	208.01	208.01	.	.	.	.	0	116.6	.	.
	Cropland remaining Cropland, Reduced tillage, Soils	.	-135.91	.	.	.	.	0	71.8	.	.
	Cropland remaining Cropland, Horticulture, Living biomass	-25.16	-17.15	.	.	.	.	0	25	.	.
5B2	Cropland, Disturbance	.	.	.	.	0.68	0.16	0	.	.	282.2
5C1	Grassland remaining Grassland, Histosols, Soils	1870.00	1870.00	.	.	.	.	0	116.6	.	.
5C2	Cropland converted to Grassland, Horticulture, Living biomass	-13.74	-17.88	.	.	.	.	0	25	.	.
5D	Land converted to Wetland, Drainage	.	.	.	.	0.05	0.05	0	.	.	282.2
5D1	Wetland remaining Wetland, Peat extraction, Soils	3.37	3.37	.	.	.	.	0	116.6	.	.
	Wetlands remaining Wetlands, Living biomass	-121.74	-375.14	.	.	.	.	0	25	.	.
5E2	Forest Land converted to Settlements, Living biomass	.	-45.32	.	.	.	.	0	50	.	.
5F2	Forest Land converted to Other land, Living biomass	-127.82	-71.90	.	.	.	.	0	50	.	.
5G	Other; Liming of lakes and rivers	37.11	68.18	.	.	.	.	0	10	.	.

Annex II: Uncertainties in the Norwegian Greenhouse Gas Emission Inventory

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Summary
The national greenhouse gas (GHG) emission inventory is compiled from estimates based on emission factors and activity data and direct measurements by plants. All these data and parameters will contribute to the overall inventory uncertainty. The uncertainties and probability distributions of the inventory input parameters have been assessed based on available data and expert judgements. Finally, the level and trend uncertainties of the national GHG emission inventory have been estimated using Monte Carlo simulation. The methods used in the analysis correspond to an IPCC Tier 2 method, as described in (IPCC 2001). Analyses have been made both excluding and including the sector LULUCF (land use, land-use change and forestry).
This project has been an update of the uncertainty analysis *Uncertainties in the Norwegian Greenhouse Gas Emission Inventory*, documented in (Rypdal and Zhang 2000), which also include more detailed documentation of the analysis method used, and result discussions. In this note we mainly focus on the changes since (Rypdal and Zhang 2000). This includes new methodology for several source categories as well as revised uncertainty estimates.
During the project we have been in contact with the manufacturing industries, which contribute the main emission sources in the industry sector, and other experts, and have collected information about uncertainty from them.
The results show that the uncertainty in the calculated greenhouse gas emissions for 2004 is ±6 per cent. The uncertainty estimate is lower now than earlier analyses have shown. This is partly due to a considerable work made to improve the calculation methodology. It is also partly the uncertainty estimates themselves that have been improved.

1. Level of the analysis

The uncertainty analysis is performed at the most detailed level of IPCC source categories (IPCC 2000). For some sources even a more detailed separation is made, e.g. where different pollutants from a source sector have to be connected to different activity measures, as for example for the source category 6B Waste water, or to be able to consider dependencies between only parts of the source groups, which for example is the case for the source categories 4D1 Direct soil emissions and 4D3 Indirect soil emissions. Energy carriers have been grouped into five main types; oil, gas, coal, waste and bio energy. In Appendix A, Table 7, source category level used in the study is listed.
For some emission sources a separation into activity and emission factors is not possible due to lack of information. Examples are estimates based on measurements, emissions reported by plants (in the cases when the plants have only reported emissions and not activity data and emission factor used), and emissions that are aggregated from sources with diverse methods (for example emissions from road traffic, which is calculated separately in a complex road traffic model). These emissions have been assigned activity equal to 1, and emission factor to be equal to the estimated value. This is possible since the total uncertainty estimate is independent of scale for activity and emission factor.[2] Emissions from landfills, HFCs and some other sources have been transferred into the form of emission factor multiplied with

[2] We may state the activity in any given unit, as long as the emission factor is stated in the corresponding unit. Examples: tonnes and kg/tonne, Gg and kg/Gg, or, as in this case, unit value and total emissions in kg.

activity rate, in spite of the fact that the estimates are based on more complex estimation models (e.g. taking time lag into account and using several activity data and emission factors).

2. Uncertainties in input parameters

Emission estimates

In the analysis emission estimates for the different source categories (Appendix A, Table 7) for the years 1990 and 2004 are given from the Norwegian emission inventory. Data published 09.02.2006 is used for all categories, with an exception for LULUCF, where data from the UNFCCC reporting 2005 is used (NIJOS 2005). Because of lack of LULUCF data for 2004 we had to use emission data for 2003 instead.
The emission estimates used in the analysis comes from the national GHG emission inventory and is based on Norwegian measurements, literature data or statistical surveys. Uncertainty estimates for some data are based on expert judgements. The uncertainty estimates for many LULUCF categories are not of the same quality as the rest of the inventory. More information about the uncertainty estimates for LULUCF is given in (NIJOS 2005).

Standard deviation and probability density

The probability densities used in this study have been divided into four types of model shapes:
1. Normal distribution
2. Truncated normal distribution
3. Lognormal distribution
4. Beta distribution

For low uncertainties all the distributions 2-4 above approach the normal distributions. For large uncertainties the normal distribution may lead to negative values. To avoid this, the distributions are when necessary truncated at 0, which means that there is a given probability of the value 0. The lognormal distribution and beta distribution are both asymmetrical distributions, giving a heavier tail of probabilities towards higher values. These two distributions are very similar in shape for low to medium size uncertainties. For higher uncertainties the beta distribution is more flat and the peak in the distribution is more close to the mean value. The beta distribution is, however, only defined for variables taking values between 0 and 1.

Activity data

The assessed standard deviations and corresponding probability densities are summarised in Table 1.

Table 1. Summary of standard deviation and probability density of activity data.

IPCC Source category	Pollutant source	Standard deviation (2σ). per cent[1]	Density shape	Source/ comment
1A1, 1A2	Coal/coke - general	5	Normal	Expert judgement industry, Norcem (2006)
1A4B	Coal/coke - residential	20	Normal	Expert judgement, Rypdal and Zhang (2000)
1A4C	Coal/coke - agriculture	30	Normal	Expert judgement, Statistics Norway
1A1, 1A2, 1A4	Wood	30	Lognormal	Expert judgement, Rypdal and Zhang (2000)
1A1A, 1A1B, 1A2	Gas - general	4	Normal	Norwegian Petroleum Directorate, Rypdal and Zhang (2000)
1A1C	Gas - manufacture of solid fuels and other energy industries	1.8	Normal	Norwegian Petroleum Directorate, NPD (2006)
1A4A	Gas - commercial/institutional	10	Normal	Expert judgement, Statistics Norway
1A4B, 1A4C	Gas - residential, agriculture/forestry/fishing	30	Normal	Expert judgement, Statistics Norway
1A1, 1A2	Oil - general	3	Normal	Spread in data, Rypdal and Zhang (2000)
1A4A	Oil - commercial/institutional	20	Normal	Expert judgement, Statistics Norway
1A4B, 1A4C	Oil - residential, agriculture/forestry	10	Normal	Expert judgement, Statistics Norway
1A1A	Waste – general	5	Normal	Expert judgement, Rypdal and Zhang (2000)
1A2F, 1A4A	Waste - other manufacturing, commercial/institutional	30	Lognormal	Expert judgement, Rypdal and Zhang (2000)
1A3A, 1A3E	Transport fuel - civil aviation, motorized equipment and pipeline	20	Normal	Expert judgement, Rypdal and Zhang (2000)
1A3C	Transport fuel - railway	5	Normal	Expert judgement, Statistics Norway
1A3B, 1A3D	Transport fuel - road, navigation	10	Normal	Expert judgement, Statistics Norway
1A5A, 1A5B	Military fuel - stationary and mobile	5	Normal	Expert judgement, Statistics Norway
1B1A, 1B2B	Coal mining, extraction of natural gas	3	Normal	Expert judgement, Rypdal and Zhang (2000)
1B2A	Extraction of oil - transport, refining/storage	3	Normal	Expert judgement, Rypdal and Zhang (2000)
1B2A	Extraction of oil - distribution gasoline	5	Normal	Expert judgement, Rypdal and Zhang (2000)
1B2C	Venting	-	-	See emission factor
1B2C	Flaring	4	Normal	Expert judgement, Rypdal and Zhang (2000)
1B2C	Well testing	30	Normal	Expeert judgement, Rypdal and Zhang (2000)
2A1	Cement production	0.3	Normal	Expert judgement industry, Norcem (2006)
2A2, 2A3	Lime production, limestone and dolomite use	3	Normal	Expert judgement, Statistics Norway
2B1	Ammonia production	3	Normal	Expert judgement industry, Yara (2006)
2B2	Nitric acid production	-	-	See emission factor
2B4	Carbide production - SiC	3	Normal	Expert judgement industry, St. Gobain and Orkla Exolon (2006)
2B4	Carbide production - CaC	3	Normal	Expert judgement, Rypdal and Zhang (2000)
2B5	Methanol and plastic production	10	Normal	Expert judgement, Statistics Norway
2C1	Iron and steel production	1.23	Normal	Expert judgement industry, Tinfos (2006)
2C2	Ferroalloys production	-	-	See emission factor
2C3	Aluminium production	3	Normal	Expert judgement industry, Norsk Hydro (2006a)
2C4	SF_6 used in Al and Mg foundries	-	-	See emission factor
2C5	Mg production	0.25	Normal	Expert judgement industry, Norsk Hydro (2006b)
2C5	Ni production, anodes	10	Normal	Expert judgement, Statistics Norway
2D2	Carbonic acid, bio protein	10	Normal	Expert judgement, Statistics Norway
2F	Consumption of halocarbons and SF_6	-	-	See emission factor

IPCC Source category	Pollutant source	Standard deviation (2σ). per cent[1]	Density shape	Source/ comment
3A, 3B, 3C, 3D	Solvent and other product use - CO_2	-	-	See emission factor
3D	Use of N_2O in anasthesia and as propellant – N_2O	-	-	See emission factor
4A	Enteric fermentation	5	Normal	Expert judgement, Statistics Norway (2006a), Division for agricultural statistics
4B1-9, 4B13	Manure management - CH_4	5	Normal	Expert judgement, Statistics Norway (2006a), Division for agricultural statistics
4B11-12	Manure management - N_2O	24	Normal	Expert judgement[2], Statistics Norway (2006a), Statistics Norway (2006b), and Statistics Norway (2006c)
4D1	Direct soil emission - fertilizer	5	Normal	SFT (1999a)
4D1	Direct soil emission - manure	20	Normal	Rypdal and Zhang (2000)
4D1	Direct soil emission - organic soil	Fac3	Lognormal	SFT (1999a)
4D1	Direct soil emission - other	64	Lognormal	Expert judgement[3], Statistics Norway and Rypdal and Zhang (2000)
4D2	Animal production	22	Normal	Expert judgement[4], Statistics Norway
4D3	Indirect soil emission - deposition	30	Lognormal	SFT (1999a)
4D3	Indirect soil emission - leakage	70	Lognormal	SFT (1999a)
4F1	Agricultural residue burning	10	Normal	Expert judgement, Statistics Norway
5A	Forest remaining forest	-	-	See emission factor
5B	Cropland remaining cropland, Forest converted to cropland	-	-	See emission factor
5C	Grassland remaining grassland, Cropland converted to grassland	-	-	See emission factor
5D1	Wetland remaining wetland, peat extraction, soil	-	-	See emission factor
5E1	Forest converted to settlements, living biomass	-	-	See emission factor
5P1	Forest fertilizer	-	-	See emission factor
5Q1, 5Q2	Forest drainage, Wetland drainage	-	-	See emission factor
5S1	Cropland disturbance	-	-	See emission factor
5T1, 5T2	Cropland liming, Other liming (lakes and rivers)	5	Normal	Expert judgement, Statistics Norway
5U1	Forest fires	20	Normal	Expert judgement, Statistics Norway
6A	Solid waste disposal	20	Normal	Statistics Norway (2006d) and SFT (2006a)
6B	Waste water treatment - CH_4	1	Normal	Expert judgement, Statistics Norway
6B	Waste water treatment - N_2O	25	Normal	Expert judgement, Statistics Norway (2006e)
6C	Waste incineration	30	Normal	Expert judgement, Statistics Norway

[1] Strongly skewed distributions are characterised as *fac3* etc, indicating that 2σ is a factor 3 below and above the mean.
[2] Population 5% (Statistics Norway 2006a), Nex 15% (Statistics Norway 2006b), distribution AWMS 10% (Statistics Norway 2006c), distribution pasture/ storage 15% (Statistics Norway 2006b)
[3] N fixation 40% and crop residues 50% (Rypdal and Zhang 2000)
[4] Population 5% (Statistics Norway 2006a), Nex 15% (Statistics Norway 2006b, distribution pasture/ storage 15% (Statistics Norway 2006b)

Emission factors

The assigned values and probability densities are shown in.

Table 2. Summary of standard deviation and probability density of emission factors.

IPCC Source category	Pollutant source	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment
		CO2			CH4			N2O			HFK, PFK or SF6 (specified in source/comment column)		
1A1, 1A2B, 1A2D, 1A2E, 1A2F, 1A4	Coal/coke - general	7	Normal	Spread in data, Rypdal and Zhang (2000)	Fac2	Lognormal	Spread in data, Rypdal and Zhang (2000)	Fac3	Beta	Expert judgement, Statistics Norway			
1A2A	Coal/coke – iron and steel	7	Normal	Spread in data, Rypdal and Zhang (2000)									
1A1, 1A2, 1A4	Wood				Fac2	Lognormal	Spread in data, Rypdal and Zhang (2000)	Fac3	Beta	Expert judgement, Statistics Norway			
1A1, 1A2, 1A4	Gas - general	7	Normal	Norwegian Petroleum Directorate, Rypdal and Zhang (2000)	Fac2	Lognormal	Expert judgement, Statistics Norway	Fac3	Beta	Expert judgement, Statistics Norway			
1A1, 1A2, 1A4	Oil - general	3	Normal	Spread in data, Rypdal and Zhang (2000)	Fac2	Truncated N	Spread in data, Rypdal and Zhang (2000)	Fac3	Beta	Spread in data. Expert judgement. IPCC (1997), Rypdal and Zhang (2000)			
1A1, 1A2, 1A4	Waste - general	30	Normal	Spread in data, Rypdal and Zhang (2000)	Fac2	Lognormal	Spread in data, Rypdal and Zhang (2000)	Fac3	Beta	Expert judgement, Statistics Norway			

IPCC Source category	Pollutant source	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment
1A3	Transport fuel	3	Normal	Spread in data, Rypdal and Zhang (2000)	Fac2	Lognormal	Spread in data. Expert judgement, Rypdal and Zhang (2000)	Fac3	Beta	Spread in data. Expert judgement, Rypdal and Zhang (2000)			
1A5	Military fuel - stationary and mobile	5	Normal	Expert judgement, Statistics Norway	Fac2	Lognormal	Expert judgement, Statistics Norway	Fac3	Beta	Expert judgement, Statistics Norway			
1B1A, 1B2B	Coal mining, extraction of natural gas	Fac2	Lognor mal	Expert judgement, Statistics Norway	Fac2	Lognormal	Expert judgement, Rypdal and Zhang (2000)						
1B2A	Extraction of oil - transport, refining/storage	40	Lognor mal	Expert judgement, Statistics Norway	40	Lognormal	Expert judgement, Statistics Norway						
1B2A	Extraction of oil - distribution gasoline	40	Lognor mal	Expert judgement, Statistics Norway									
1B2C	Venting	Fac2	Lognor mal	Expert judgement, Rypdal and Zhang (2000)	Fac2	Lognormal	Expert judgement, Rypdal and Zhang (2000)						
1B2C	Flaring	10	Normal	As combustion of gas, Rypdal and Zhang (2000)	Fac2	Truncated N	As combustion of gas, Rypdal and Zhang (2000)	Fac3	Beta	As combustion of gas, Rypdal and Zhang (2000)			
1B2C	Well testing	7	Normal	Expert judgement, Rypdal and Zhang (2000)	Fac2	Truncated N	Expert judgement, Rypdal and Zhang (2000)	Fac3	Beta	Expert judgement, Rypdal and Zhang (2000)			
2A1	Cement production	7	Normal	IPCC (1997)									
2A2, 2A3	Lime production, limestone and dolomite use	7	Normal	Expert judgement, Statistics Norway									
2B1	Ammonia production	7	Normal	Expert judgement industry, Yara (2006)									

IPCC Source category	Pollutant source	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment
2B2	Nitric acid production							7	Normal	Expert judgement industry, Yara (2006)			
2B4	Carbide production - SiC	10	Normal	Expert judgement industry, St. Gobain and Orkla Exolon (2006)	10	Normal	SFT (2006b)						
2B4	Carbide production - CaC	10	Normal	Spread in data, Rypdal and Zhang (2000)									
2B5	Methanol and plastic production	10	Normal	Expert judgement, Statistics Norway	Fac2	Lognormal	Expert judgement, Statistics Norway						
2C1	Iron and steel production	1.4	Normal	Expert judgement industry, Tinfos (2006)									
2C2	Ferroalloys production	3	Normal	Expert judgement, Sintef (2006)	Fac2	Lognormal	Expert judgement, Statistics Norway						
2C3	Aluminium production	10	Normal	International Aluminium Institute (IAI), Norsk Hydro (2006[a])							20	Normal	Apply to PFK. Expert judgement industry, Norsk Hydro (2006a)
2C4	SF6 used in Al and Mg foundries										0.25	Normal	Apply to SF_6. Expert judgement industry, Norsk Hydro (2006b)
2C5	Mg production, Ni production, anodes	10	Normal	Expert judgement, Statistics Norway									

IPCC Source category	Pollutant source	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment
2D2	Carbonic acid, bio protein	10	Normal	Expert judgement, Statistics Norway									
2F	Consumption of HFK										50	Lognormal	Apply to HFK. Expert judgement, Statistics Norway
2F	Consumption of PFK										50	Lognormal	Apply to PFK. Expert judgement, Statistics Norway
2F	Consumption of SF_6										60	Lognormal	Apply to SF6. Expert judgement, Statistics Norway
3A, 3B,3C, 3D	Solvent and other product use - CO_2	30	Normal	Rypdal and Zhang (2001)									
3D	Use of N_2O in anasthesia and as propellant – N_2O							10	Normal	Expert judgement, Statistics Norway			
4A1, 4A3	Enteric fermentation - cattle and sheep				25	Normal	Expert judgement, UMB (2006)						
4A4-10	Enteric fermentation - other animal				25	Normal	IPCC (1997)						
4B1-9, 4B13	Manure management - CH_4				25	Normal	IPCC (1997)						
4B11-12	Manure management - N_2O							Fac2	Lognormal	IPCC (1997)			
4D1	Direct soil emission							Fac5	Lognormal	IPCC (2001)			
4D2	Animal production							Fac2	Lognormal	IPCC (2001)			
4D3	Indirect soil emission							Fac3	Lognormal	IPCC (1997)			
4F1	Agricultural residue burning				Fac2	Lognormal	Expert judgement, Statistics Norway	Fac3	Beta	Expert judgement, Statistics Norway			
5A1	Forest remaining forest, living biomass	15	Normal	NIJOS (2005)									
5A2	Forest remaining forest, soil, drained organic soils	Fac10	Lognormal	NIJOS (2005)									

IPCC Source category	Pollutant source	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment
5A3	Forest remaining forest, dead biomass	50	Lognormal	NIJOS (2005)									
5A4	Forest remaining forest, soil, other	25	Normal	NIJOS (2005)									
5B1, 5B2, 5B3	Cropland remaining cropland, horticulture, living biomass, increase. Cropland remaining cropland, horticulture, living biomass, decrease. Forest converted to cropland, living biomass	25	Normal	NIJOS (2005)									
5B4	Cropland remaining cropland, reduced tillage, soil	Fac2	Lognormal	NIJOS (2005)									
5B5	Cropland remaining cropland, histosols, soil	Fac3	Lognormal	NIJOS (2005)									
5C1	Grassland remaining grassland, histosols, soil	Fac3	Lognormal	NIJOS (2005)									
5C2	Cropland converted to grassland, soil	Fac2	Lognormal	NIJOS (2005)									
5C3	Cropland converted to grassland, horticulture, living biomass, decrease	25	Normal	NIJOS (2005)									
5D1	Wetland remaining wetland, peat extraction, soil	Fac3	Lognormal	NIJOS (2005)									
5E1	Forest converted to settlements, living biomass	50	Lognormal	NIJOS (2005)									
5P1	Forest fertilizer							Fac5	Lognormal	NIJOS (2005)			
5Q1, 5Q2	Forest drainage, Wetland drainage							Fac10	Lognormal	NIJOS (2005)			
5S1	Cropland disturbance							Fac10	Lognormal	NIJOS (2005)			

IPCC Source category	Pollutant source	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment	(2σ). per cent[1]	Density shape	Source/ comment
5T1, 5T2	Cropland liming, Other liming (lakes and rivers)	10	Normal	NIJOS (2005)									
5U1	Forest fires				75	Lognormal	NIJOS (2005)	75	Lognormal	NIJOS (2005)			
6A	Solid waste disposal				30	Lognormal	SFT (2006a)						
6B	Waste water treatment - CH_4				70	Lognormal	IPCC (2001) and expert judgement, Statistics Norway[2]						
6B	Waste water treatment - N_2O							70	Lognormal	Expert judgement, Rypdal and Zhang (2000)			
6C	Waste incineration	30	Normal	Expert judgement, Statistics Norway	Fac2	Lognormal	Expert judgement, Statistics Norway	Fac3	Lognormal	Expert judgement, Statistics Norway			

[1] Strongly skewed distributions are characterised as *fac2*, *fac3*, *fac5 and fac10*, indicating that 2σ is respectively a factor 2, 3, 5 and 10 below and above the mean.
[2] BOD/ person 30%, Bo 30% (IPCC 2001) and fraction anaerobic treated 55%

3. Dependencies between parameters

Some of the input parameters (emission factors and activity data) are for various reasons not independent, that means that their values are dependent (or correlated). The problem of dependencies may be solved by appropriate aggregation of the data or explicitly by modelling. In this work we have partly designed the dataset to reduce the problem with dependencies as well as introduced a number of dependence assumptions into the model.
The determination of dependencies is sometimes a difficult task and requires some understanding of the data set and the assumptions it is based on. Initial estimates with variable assumptions have shown that the assumptions on dependencies generally have little effect on the final conclusions on uncertainties. The assumptions of dependencies of data between years are, however, crucial for the determination of trend uncertainty (Rypdal and Zhang 2000).

Dependencies between activity data

The activity data are in principle independent. However, the same activity data may be used to estimate more than one source category (e.g. in the agriculture sector). Also the same activity data are used for estimating emissions of more than one pollutant (especially in the case of energy emissions). For the energy sector we are aware of the dependencies between the activity data used, but we have not found a way to handle this in the statistical modelling.
The cases when activity data are assumed dependent in the statistical modelling are:

- Where the same activity data are used to estimate emissions of more than one pollutant.
- The number of domestic animals. The same population data are used for estimation of a) methane from enteric fermentation, b) methane and nitrous oxide from manure management and c) nitrous oxide from agricultural soils
- For estimation of N_2O from manure management, N_2O from manure spreading and N_2O from animal production (pasture) the following dependency estimation has been used for the activity data:
    - 70 % of emissions dependent on cattle population
    - 30 % of emissions dependent on cattle population
- For estimation of N_2O from indirect soil emissions the following dependency estimation has been used for the activity data:
    - 23 % of emissions dependent on cattle population
    - 10 % of emissions dependent on cattle population
    - 67 % of emissions dependent on amount of synthetic fertilizer used

Dependencies between emission factors

Where emission factors have been assumed equal, we have treated them as dependent in the analysis.
The following assumptions have been made:

- The CO_2 emission factors for each fuel type are dependent
- The methane and nitrous oxide emission factors from combustion are dependent where they have been assumed equal in the emission inventory model
- In a few cases the emission factors of different pollutants are correlated. That is in cases when CO_2 is oxidised from methane (oil extraction, loading and coal mining).
- For all direct emissions of N_2O from agricultural soils, except for N_2O from cultivation of organic soil, the same emission factor is being used, and the sources are dependent.
- There is a dependency between the emission factor used for calculating emissions from cropland liming and other liming.

We know that it also exists dependencies between other sources in LULUCF, e.g. between the activity data in the sources *5A2 Forest remaining forest* and *5Q1 Forest drainage*. But we have no estimates for the

uncertainty in activity data, and anyhow the uncertainty in the emission factors is so big that even if the activity data is given an uncertainty it will have a minimal effect on the total uncertainty estimate for the source.

Dependencies between data in base year and end year

The estimates made for 1990 and 2004 will to a large extent be based on the same data and assumptions.

Activity data

The activity data are determined independently in the two years and are in principle not dependent. Correlation could be considered in cases where activity data can not be updated annually or where updates are based on extrapolations or interpolations of data for another year
This implies that we have assumed that errors in activity data are random, hence that systematic method errors are insignificant. It is, however, likely that there is a certain correlation between the activity data as they have been determined using the same methods.

Emission factors

Most of the emission factors are assumed unchanged from 1990 and 2004. Those that are not are all based on the same assumptions. This implies that all the emission factors are fully correlated between the two years.
This means that we have assumed that the emission factors assumed unchanged actually are unchanged from the base to end year. In reality it is expected that most emission factors are changing, but the degree of change is usually not known.

4. The statistical modelling

Uncertainty analysis based on probabilistic analysis implies that uncertainties in model inputs are used to propagate uncertainties in model outputs. The result of the uncertainty estimation gives us the range and likelihood of various output values (Cullen and Frey 1999).
Having generated a data set according to the specified parametric simultaneous distribution of the data described in Table 1 and Table 2, we may calculate any desired output defined as a function of the data. This gives us one simulated random realisation of this output, according to its marginal distribution derived from the underlying simultaneous distribution of the data. Independent repetition of the simulation gives an independent sample of the desired output according to its marginal distribution. The size of the sample is given by the number of repeated simulations, and has nothing to do with the size of the original data set. Based on such an independent and identically distributed sample, we may use the sample mean as an estimate of the mean of the output; we may also use the sample standard deviation as an estimate of the standard deviation of the output.

5. Results of the Tier 2 Uncertainty analysis

Table 3 to 6 give the results for the uncertainties in the total emissions and trends for the GHG inventory, excluding and including the LULUCF sector.

Uncertainties in emission level

The estimated uncertainties of the level of total emissions and in each gas are shown in Table 3 and 4.

Table 3. Uncertainties in emission level. Each gas and total GWP weighted emissions. Excluding the LULUCF sector.

1990	**μ (mean)**	**Fraction of total emissions**	**Uncertainty 2σ (per cent of mean)**
Total	50 mill. Tonnes	1	7
CO_2	35 mill. Tonnes	0.69	3
CH_4	4.8 mill. Tonnes	0.10	15
N_2O	5.0 mill. Tonnes	0.10	57
HFC	18 tonnes	0.00	49
PFC	3.4 mill. Tonnes	0.07	21
SF_6	2.2 mill. Tonnes	0.04	2

2004	**μ (mean)**	**Fraction of total emissions**	**Uncertainty 2σ (per cent of mean)**
Total	55 mill. Tonnes	1	6
CO_2	44 mill. Tonnes	0.80	3
CH_4	4.8 mill. Tonnes	0.09	14
N_2O	4.9 mill. Tonnes	0.09	59
HFC	401 ktonnes	0.01	51
PFC	880 ktonnes	0.02	20
SF_6	274 ktonnes	0.00	15

Table 4. Uncertainties in emission level. Each gas and total GWP weighted emissions. Including the LULUCF sector..

1990	**μ (mean)**	**Fraction of total emissions**	**Uncertainty 2σ (per cent of mean)**
Total	35 mill. Tonnes	1	14
CO_2	20 mill. Tonnes	0.56	20
CH_4	4.9 mill. Tonnes	0.14	16
N_2O	5.0 mill. Tonnes	0.14	59
HFC	18 tonnes	0.00	51
PFC	3.4 mill. Tonnes	0.10	20
SF_6	2.2 mill. Tonnes	0.06	2
2004	**μ (mean)**	**Fraction of total emissions**	**Uncertainty 2σ (per cent of mean)**
Total	34 mill. Tonnes	1	14
CO_2	23 mill. Tonnes	0.67	18
CH_4	4.8 mill. Tonnes	0.14	14
N_2O	4.9 mill. Tonnes	0.14	53
HFC	401 ktonnes	0.01	52
PFC	880 ktonnes	0.03	20
SF_6	274 ktonnes	0.01	15

The total national emissions of GHG in Norway in 1990 are estimated with an uncertainty of 7 per cent of the mean. The main emission component CO_2 is known with an uncertainty of 3 per cent of the mean. In 2004, the total uncertainty has decreased to 6 per cent of the mean. The highest uncertainty change between 1990 and 2004 is in the uncertainty estimates for the SF_6 emissions, which has increased from 2 to 15 per cent of the mean. However, the SF_6 emissions are strongly reduced. For N_2O and HFC there are a minor increase in the uncertainty between the years, for CH_4 and PFC a minor decrease, while the uncertainty for CO_2 remained constant.

By including the LULUCF sector the results from the analysis show a total uncertainty of 14 per cent of the mean both in 1990 and in 2004. The doubling of uncertainty is caused mainly by forest biomass and grassland histosoils.

In the uncertainty analysis carried out in the year 2000 (Rypdal and Zhang 2000), the uncertainty for the total national emissions of GHG (LULUCF sector excluded) in 1990 was estimated to be 21 per cent of the mean. In the new analysis the uncertainty estimate is reduced to one third. There are several reasons for the new lower estimate. One reason is that Statistics Norway and the Norwegian Pollution Control Authorities have increased the inventory quality by using higher tiers for some key categories and also improved methodologies for other sources. But the main reason for the reduced uncertainty is that Statistics Norway has collected new and lower uncertainty estimates for some activity data and emission factors that contributed substantially to the total uncertainty in the emission estimate. This means that the total uncertainty of the inventory have not been reduced as much as the estimates indicates, since it is partly the uncertainty estimates themselves that have been improved. The main reduction lies is in the estimate of the uncertainty for the N_2O emissions. In 2000 the uncertainty in this components estimate was estimated to 200 per cent

of the mean. In this years' analysis the uncertainty estimate is reduced to 57 per cent of the mean, see explanation to this reduction in the paragraph below. For CO_2 the uncertainty estimate is unchanged between the two analyses (3 per cent), while all the other emission components show a decrease in the uncertainty estimates in the new analysis compared to the analysis from 2000.

The main reason for the high uncertainty estimate for the N_2O emissions in the 2000 analysis was the high uncertainty estimate used for the emission factor used for estimating N_2O from agricultural soils (2 orders of magnitude). This uncertainty is in the new analysis reduced to an uncertainty of factor 5 for direct soil emission, factor 2 for animal production and factor 3 for indirect soil emission. These new uncertainty estimates are collected from the guidelines IPCC (2001) and IPCC (1997b), where also the emission factor used is collected.

As mentioned above, another reason for the reduced uncertainty is that in the years between the two analyses important inventory improvement work has been carried through. New emission sources have also been included to make the greenhouse gas inventory for Norway more complete, and the inventory is today even more in line with the IPCC Guidelines than the case was in 2000.

Uncertainties in emission trend

The estimated uncertainties of the trend of total emissions and each gas are shown in Table 5 and 6.

Table 5. Uncertainty of emission trend. 1990-2004. Excluding the LULUCF sector.

	per cent change $((\mu_{2004}-\mu_{1990})*100/\mu_{1990})$	Uncertainty $(2*\sigma*100/\mu_{1990})$
Total	10	4
CO_2	26	4
CH_4	-1	11
N_2O	-2	18
HFC	-	-
PFC	-74	15
SF_6	-88	0

Table 6. Uncertainty of emission trend. 1990-2004. Including the LULUCF sector.

	Per cent change $((\mu_{2004}-\mu_{1990})*100/\mu_{1990})$	Uncertainty $(2*\sigma*100/\mu_{1990})$
Total	-2.1	7
CO_2	18	11
CH_4	-1	12
N_2O	-2	20
HFC	-	-
PFC	-74	15
SF_6	-88	0

The result shows that the increase in the total GHG emissions from 1990 to 2004 is 10 ±4 per cent when the LULUCF sector is not included. Norway has by the ratification of the Kyoto Protocol obliged to limit the emissions of greenhouse gases in the period 2008-2012 to 1 per cent over the emissions in 1990 after trading with CO_2 quotas and the other Kyoto

mechanisms is taken into account. It is important to keep in mind that the emission figures reported in connection to the Kyoto Protocol has an uncertainty connected to the reported values.

In (Rypdal and Zhang 2000) the increase from 1990 to 2010 (in a given projection scenario) was 21 ±4 per cent. It is reasonable that the emission increase was higher in the 2000 analysis, since it was estimated for a longer period.

With the sector LULUCF included in the calculations there has been a decrease in the total trend uncertainty with -2 ±7 per cent.

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Appendix A

Table 7. Source category level used in the analysis.

IPCC Source

Category	Pollutant source	
1A1A	Public electricity and heat prod	General fuel combustion- Coal/coke
1A1A	Public electricity and heat prod	General fuel combustion- Wood
1A1A	Public electricity and heat prod	General fuel combustion- Gas
1A1A	Public electricity and heat prod	General fuel combustion- Oil
1A1A	Public electricity and heat prod	General fuel combustion- Waste
1A1B	Petroleum refining	General fuel combustion- Gas
1A1B	Petroleum refining	General fuel combustion- Oil
1A1C	Manufacture of solid fuels and other energy	General fuel combustion- Gas
1A1C	Manufacture of solid fuels and other energy	General fuel combustion- Oil
1A2A	Iron and steel	General fuel combustion- Coal/coke
1A2A	Iron and steel	General fuel combustion- Wood
1A2A	Iron and steel	General fuel combustion- Gas
1A2A	Iron and steel	General fuel combustion- Oil
1A2B	Non-ferrous metal	General fuel combustion- Coal/coke
1A2B	Non-ferrous metal	General fuel combustion- Wood
1A2B	Non-ferrous metal	General fuel combustion- Gas
1A2B	Non-ferrous metal	General fuel combustion- Oil
1A2C	Chemicals	General fuel combustion- Wood
1A2C	Chemicals	General fuel combustion- Gas
1A2C	Chemicals	General fuel combustion- Oil
1A2D	Pulp, paper, print	General fuel combustion- Coal/coke
1A2D	Pulp, paper, print	General fuel combustion- Wood
1A2D	Pulp, paper, print	General fuel combustion- Gas
1A2D	Pulp, paper, print	General fuel combustion- Oil
1A2E	Food processing, beverages, tobacco	General fuel combustion- Coal/coke
1A2E	Food processing, beverages, tobacco	General fuel combustion- Wood
1A2E	Food processing, beverages, tobacco	General fuel combustion- Gas
1A2E	Food processing, beverages, tobacco	General fuel combustion- Oil
1A2F	Other	General fuel combustion- Coal/coke
1A2F	Other	General fuel combustion- Wood
1A2F	Other	General fuel combustion- Gas
1A2F	Other	General fuel combustion- Oil
1A2F	Other	Waste combustion- other manufacturing
1A3A	Transport fuel - civil aviation	
1A3B	Transport fuel - road transportation	

1A3C	Transport fuel - railway	
1A3D	Transport fuel - navigation	
1A3E	Transport fuel - motorized equipment and pipeline	
1A4A	Commercial/institutional	General fuel combustion- Wood
1A4A	Commercial/institutional	Gas combustion- commercial/institutional
1A4A	Commercial/institutional	General fuel combustion- Oil
1A4A	Commercial/institutional	Waste combustion - commercial/institutional
1A4B	Residential	Coal/coke combustion- residential
1A4B	Residential	General fuel combustion- Wood
1A4B	Residential	Gas - residential
1A4B	Residential	General fuel combustion- Oil
1A4C	Agriculture/forestry/fishing	Coal/coke combustion- agriculture
1A4C	Agriculture/forestry/fishing	General fuel combustion- Wood
1A4C	Agriculture/forestry/fishing	Gas combustion - agriculture/forestry/fishing
1A4C	Agriculture/forestry/fishing	General fuel combustion- Oil
1A5A	Military	Military fuel - stationary
1A5B	Military	Military fuel - mobile
1B1A	Coal mining, Extraction of natural gas	
1B2A	Extraction of oil - transport	
1B2A	Extraction of oil - refining/storage	
1B2A	Extraction of oil - distribution gasoline	
1B2B	Coal mining, Extraction of natural gas	
1B2C	Venting	
1B2C	Flaring	
1B2C	Well testing	
2A1	Cement production	
2A2	Lime production	
2A3	Limestone and dolomite use	
2B1	Ammonia production	
2B2	Nitric acid production	
2B4	Silicium carbide production	
2B4	Calcium carbide production	
2B5	Methanol and plastic production	
2C1	Iron and steel production	
2C2	Ferroalloys production	
2C3	Aluminium production	
2C4	SF6 used in Al and Mg foundries	
2C5	Mg production	
2C5	Ni production, anodes	
2D2	Carbonic acid, bio protein	
2F	consumption of halocarbons and SF6	
3A	Paint application	
3B	Degreasing and dry cleaning	
3C	Chemical products, Manufacture and processing	
3D	Other	
4A1	Enteric fermentation - cattle	
4A10	Enteric fermentation - other animal	
4A3	Enteric fermentation - sheep	
4A4	Enteric fermentation - goat	
4A6	Enteric fermentation - horse	
4A8	Enteric fermentation - swine	
4A9	Enteric fermentation - poultry	
4B1	Manure management - CH4 -cattle	
4B11	Manure management - N2O - Liquid storage	
4B12	Manure management - N2O - solid storage	
4B13	Manure management - CH4 - other animal	
4B3	Manure management - CH4 - sheep	
4B4	Manure management - CH4 -goat	
4B6	Manure management - CH4- horse	
4B8	Manure management - CH4- swine	
4B9	Manure management - CH4- poultry	
4D1	Direct soil emission - Fertilizer	
4D1	Direct soil emission - Manure	
4D1	Direct soil emission- Organic soil	
4D1	Direct soil emission- Other	
4D2	Animal production	
4D3	Indirect soil emission- Deposition	

4D3	Indirect soil emission - Leaching, other
4F1	Burning of straw
5A1	Forest remaining Forest, Living biomass
5A2	Forest remaining Forest, Soil, Drained organic soils
5A3	Forest remaining Forest, Dead biomass
5A4	Forest remaining Forest, Soil, Other
5B1	Cropland remaining Cropland, Horticulture, Living biomass, increase
5B2	Cropland remaining Cropland, Horticulture, Living biomass, decrease
5B3	Forest converted to Cropland, Living biomass
5B4	Cropland remaining Cropland, Reduced tillage, Soil
5B5	Cropland remaining Cropland, Histosols, Soil
5B6	Cropland remaining Cropland Erosion of new agriculture land Soil, net change
5C1	Grassland remaining Grassland, Histosols, Soil
5C2	Cropland converted to Grassland, Soil
5C3	Cropland converted to Grassland, Horticulture, Living biomass, decrease
5D1	Wetland remaining Wetland, Peat extraction, Soil
5E1	Forest converted to Settlements, Living biomass
5P1	Forest Fertilizer
5Q1	Forest Drainage
5Q2	Wetland Drainage
5S1	Cropland Disturbance
5T1	Cropland Liming
5T2	Other Liming (Lakes and rivers)
5U1	Forest Fires
6A	Managed waste disposal on land
6B	Waste water -CH4
6B	Waste water - N2O pipeline
6B	Waste water - N2O plant
6C	Waste incineration

Annex III: QA/QC performed for GHG emissions from industrial plants included in the national GHG inventory

1. Introduction

In 2006, SFT performed QA/QC on time series from 1990 to 2004 of greenhouse gas (GHG) emissions from the largest industrial plants in Norway.

The following sectors of industry were covered: Cement production, mineral fertilizers, carbide industry, production of ferroalloys, production of primary aluminium, anode manufacture, production of iron and steel, nickel production, pulp and paper manufacture, oil refineries, gas terminals, lime production, other mineral production, methanol production, plastics, other chemical industry and production of magnesium.

The main documentation from this work is contained in Excel spread sheets giving the resulting time series for each plant included in this revision, and in a documentation report (SFT 2006). The methodology was also presented in Annex III of the National Inventory Report 2006, 2007 and 2008.

The methodology is again presented in the National Inventory Report 2009 since it is the same methodology that is used and will be used for GHG emissions from the largest industrial plants in Norway.

There have been several changes since the methodology was described and hence are not reflected in the remaining Annex.

- The 2005 GHG inventory data from the preliminary emission trading system (2005-2007) has been used. Note that the 2008 GHG and onwards will include data from the emissions trading scheme (2008-2012) that is linked with the EU emission trading scheme. There was a voluntary agreement between industry and authorities covering the most carbon-intensive industry not included in the trading system in 2005-2007. This has led to that the reporting requirements are stricter than before and QC is even more detailed.
- Changes of more than 20% (10% for plants included in emission trading) are flagged in the Excel spread sheets for further QC in collaboration with the plant.
- The Inkosys database has been replaced by the “Forurensing” database. Data has been transferred from Inkosys to Forurensing.
- Based on responses from ERT, more attention is given to implied emission factors (IEF).
- New plants and a new sector (gas-fired power plants) are now included
- Several time series have been recalculated

2. Method for establishing and verifying data series of emissions

The following work procedure was established to verify data series:

1. For each plant; a first time series of emission data as well as activity data were established with basis on existing sources of data (see section on data sources).

2. The first time series of emission data and activity data were presented in both a table format as well as a graphic presentation. See figures AIII.1 and AIII.2 for examples.

3. Based on the table with compiled data and the graphic presentation, it was possible to identify:
   - Lack of emission data and activity data for any year or time series.
   - Possible errors in the reported data. Possible errors were typically identified if there were discrepancies between reported activity data (consumption of raw materials, production volumes etc) and emissions, or if there were large variations in the existing time series of emissions.

4. The emission data where supplemented and/or corrected if possible by one or more of the following sources of information:
   - Supply of new data from the company
   - Supplementary data from SFT paper archives.
   - Verification of reported emission data by new calculations based on reported activity data.
   - Calculation of missing emissions (if sufficient activity data were present).

5. A final time series of greenhouse gas emissions from 1990 to 2004 were established, and presented both as a tables and a figure. The origin of the data was documented by the use of colour codes. (see chapter 3.1.2)

6. The differences between former and new time series of emissions were identified and documented.

In the tables, colour codes were used to describe the source and type of the data. See figure AIII.1 as an example of a data table with the explanations of the colour codes.

Figure AIII.1 – Examples of presentation in data tables and the use of colour codes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
CO2 process (1000 ton)	218,0	232,6	252,0	256,0	243,6	273,0	271,9	242,0	265,4	272,7	272,5	218,0	129,1	209,0	229,5
CH4 (ton)	79,5	69	72	77	74	84	84	80	88	86	87	74	52	69	76
N2O (ton)	26,5	26	27	29	27	31	31	30	33	32	33	28	20	28	31
Activity data -whitebook(1000 ton)	69,68								84,33	85,1	84,55	70,05			
Activity data -Inkosys (1000 ton)		61	64	78,6	80,2	87,9	85,4	73,2	79,7	80,3	79,8	53,5	45,6	72,4	

Time Serie	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
total CO2 (1000 tons)	47	32	64	84	161	151	207	207	202	185	128	213	153	135	137
CO2 combustion (1000 tons)	38	23	55	75	152	143	199	198	193	177	119	205	145	127	127
CO2 process (1000 tons)	9	9	9	9	9	9	9	9	9	8	9	8	8	9	10
CH4 (ton)	2,0	2,2	2,5	0,9	7,4	7,0	9,8	9,9	9,6	8,7	5,8	10,1	7,1	6,0	6,2
N2O (ton)	0,40	0,42	0,43	0,63	1,33	1,33	1,83	1,83	1,80	1,60	1,10	1,90	1,4	1,1	1,2
Activity data white book (1000 tons)	12,2								60,5	55,4	37,2	64,1			
Activity data Inkosys (1000 tons)			17,3	7,4	48,1	45,1	62,6	63,0	60,7	55,4	35,6	64,1	45,7	39,4	41,3

Data from:	**Color code**
White book on GHG	
Inkosys database	
Former time serie reported to Statistics Norway	
New, calculations by SFT	
New, by intrapolation	

New, provided by company	

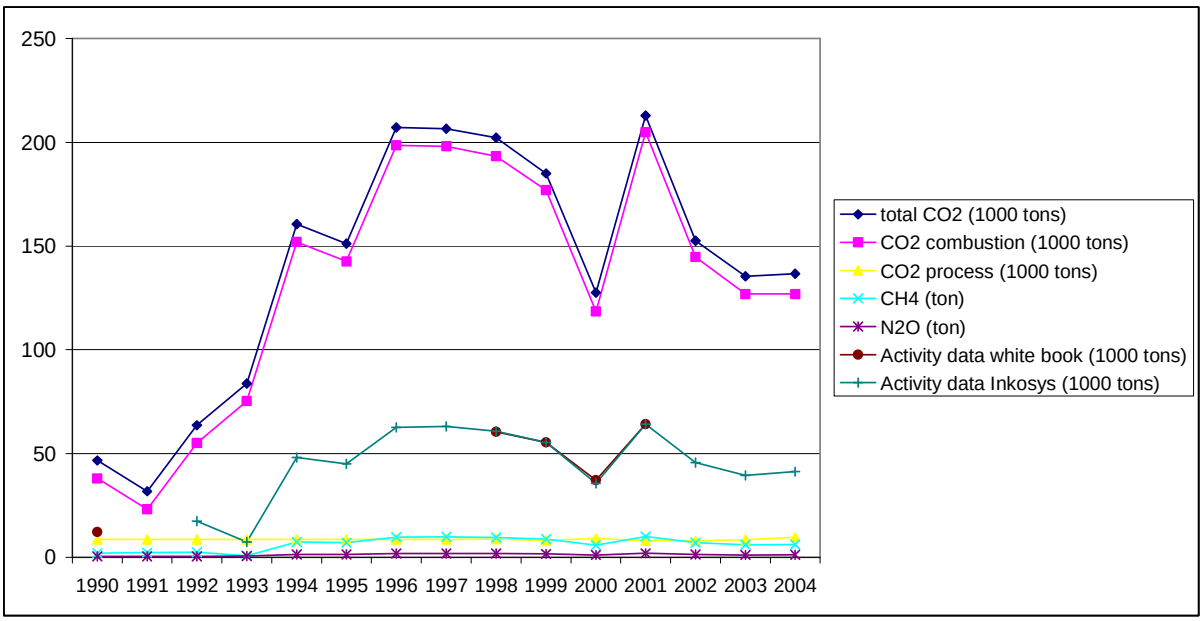
Figure AIII.1 illustrates different data tables with indication of the data sources with colour codes.

As the figure shows, there were six main sources of final data to the time series: the white book on GHG, the Inkosys database (described in section on data sources), new data calculated by SFT based on reported activity data, new data provided by company, and new data based on intrapolation between. Intrapolation was typically used as a method to establish data for the year 1991, if the emissions from 1990 and 1992 were given.

The emission data and the activity data were presented in graphic presentation for a visual presentation.

Figure AIII.2 illustrates a presentation of the emissions and activity data from a pulp and paper plant.

Figure AIII.2 – Example of graphic presentation



3. Data sources

The Inkosys Database

Data from the annual company emission reports are stored in the SFT database INKOSYS. The database contains data from 1992, and holds emission and activity data from all companies reporting emissions to SFT. The Inkosys database holds reported emissions and activity data from Norwegian companies. The companies report the data according to a manual (SFT, 2004). In SFT, the respective responsible officer in the State Pollution Control Authority undertakes a control of the data, before they are inserted in the database.

The white book on GHG from Norwegian process industry

The white book on GHG from Norwegian process industry was initiated by the Federation of Norwegian Process industry (PIL), Norwegian Chemical Industrial Worker's Union (NKIF) and Norwegian Oil- and Petrochemical Worker`s Union (NOPEF). The work was carried out by DNV and Sintef, who collected, compiled, controlled and verified all emissions of climate gasses from these industrial plants for the years 1990, 1998, 1999, 2000 and 2001. The method of work as well as the main results are described in the reports from this project (Federation of Norwegian Process Industry 2003). The main data files and verification tables from this work have been made available for the State Pollution Control Authority. The white book includes data from 60 process industry plants.

Since the emission data in this white book has gone through a thorough verification process, these emissions were assumed to be correct, unless any other information proved them incorrect. If several data sources reported different series of emissions, the data series from the white book were used.

The white book on GHG from Norwegian pulp and paper industry
The white book on GHG from Norwegian pulp and paper industry work was initiated by the Norwegian Pulp and Paper Association, and was carried out by DNV, Sintef and the Norwegian Association of Energy Users and Suppliers. They collected, compiled, controlled and verified all emissions of climate gasses from the relevant pulp and paper plants for the years 1990, 1998, 1999, 2000 and 2001. The method of work as well as the main results are described in the reports from this project (Norwegian Pulp and Paper Association 2003). The main data files from this work have been made available for the State Pollution Control Authority.

Since the emission data in this white book has gone through a thorough verification process, these emissions were assumed to be correct, unless any other information proved them incorrect. If several data sources reported different series of emissions, the data series from the white book were used.

Other sources
Other data sources also available for this work were:

- Annual update of the climate gas inventories based on annual reports from Norwegian industry. Reported to Statistics Norway.
- Yearly (paper) reports from industry of emission to air, water and soil (Egenrapportering).
- Applications for CO_2-permits for the Norwegian emissions trading scheme.

4. Documentation of calculations and time series

The main documentation from the work is contained in Excel spread sheets giving the resulting time series for each plant included in this revision. Each spread sheet includes emission data and activity data from the relevant data sources for each production plant. It includes the proposed time series for the relevant greenhouse gases, and states the sources for this information. Relevant information related to the QA/QC process for the specific site is noted as a comment or as a text box for each plant.

Annex IV: Energy Balance Sheets 1990 - 2007

Energy balance **1990**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petroleum products	Natural gas and other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	5 141	9	-	37	3 412	50	1 119	514	-	-
2. Imports	258	20	28	0	69	140	-	-	1	-
3. Exports	4 368	7	4	0	2 897	373	1 028	-	58	-
4. Bunkering	19	-	-	-	-	19	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-64	-0	-1	-	-62	-1	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	947	21	23	38	521	-204	92	514	-57	-
8. Energy converted	1 094	1	1	2	539	36	0	514	1	-
8.1. In blast furnaces	1	-	1	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	575	-	-	-	539	36	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	0	-	-	-	-
8.4. In dual purpose power plants	1	1	-	1	-	-	-	-	-	-
8.5. In district heating plants	2	-	-	1	-	0	0	-	1	-
8.6. In hydropower plants	514	-	-	-	-	-	-	514	-	-
1.2. Production of derived energy bearers	1 035	-	6	-	-	542	43	-	439	5
9. Consumption by energy sector	152	-	-	-	-	4	141	-	7	-
10. Consumption for non-energy purposes	36	-	-	-	-	36	-	-	-	-
11. Losses in transport and distribution	29	-	-	-	-	-	2	-	25	2
12. Statistical differences (7-8+1.2-9-10-11-13)	-31	-1	0	-0	-18	12	-24	-	-0	0
13. Net domestic consumption	702	21	27	36	-	251	15	-	349	3
14. Manufacturing, mining and quarrying	272	21	27	15	-	29	15	-	163	1
15. Transport	161	-	-	-	-	159	-	-	2	-
16. Other sectors	269	0	0	20	-	62	0	-	183	2

Energy balance **1991**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petroleum products	Natural gas and other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	5 603	9	-	36	3 899	49	1 142	468	-	-
2. Imports	251	17	26	0	69	128	-	-	12	-
3. Exports	4 861	8	3	0	3 459	333	1 036	-	22	-
4. Bunkering	16	-	-	-	-	16	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	14	1	-0	-	10	4	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	991	19	23	36	518	-168	106	468	-10	-
8. Energy converted	1 019	1	2	2	510	35	0	468	1	-
8.1. In blast furnaces	2	-	2	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	545	-	-	-	510	35	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	0	-	-	-	-
8.4. In dual purpose power plants	1	1	-	1	-	-	-	-	-	-
8.5. In district heating plants	2	-	-	1	-	0	0	-	1	-
8.6. In hydropower plants	468	-	-	-	-	-	-	468	-	-
1.2. Production of derived energy bearers	978	-	5	-	-	527	41	-	400	6
9. Consumption by energy sector	150	-	-	-	-	4	138	-	8	-
10. Consumption for non-energy purposes	32	-	-	-	-	32	-	-	-	-
11. Losses in transport and distribution	28	-	-	-	-	-	2	-	24	2
12. Statistical differences (7-8+1.2-9-10-11-13)	48	0	0	-	8	48	-9	-	-0	-0
13. Net domestic consumption	693	18	26	34	-	240	15	-	356	4
14. Manufacturing, mining and quarrying	263	18	26	15	-	27	15	-	161	1
15. Transport	159	-	-	-	-	157	-	-	2	-
16. Other sectors	271	0	0	18	-	56	0	-	193	3

Energy balance **1992**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	6 241	10	-	37	4 473	9	-	-	-	44	1 172	-	496	-	-
2. Imports	215	17	25	0	47	17	6	26	26	45	-	-	-	5	-
3. Exports	5 429	5	4	-	3 916	125	15	165	59	54	1 050	-	-	36	-
4. Bunkering	20	-	-	-	-	-	-	9	11	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-29	-4	0	-	-25	1	-1	-0	0	-0	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	977	18	21	37	580	-98	-9	-148	-44	34	122	-	496	-31	-
8. Energy converted	1 119	1	1	5	572	10	2	3	29	0	-	0	496	1	-
8.1. In blast furnaces	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	615	-	-	-	572	10	2	3	29	0	-	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	-	-	0	0	-	-	-	-	-	-
8.4. In dual purpose power plants	3	1	-	2	-	-	-	-	-	-	-	-	-	-	-
8.5. In district heating plants	4	-	-	2	-	-	-	0	0	-	-	0	-	1	-
8.6. In hydropower plants	496	-	-	-	-	-	-	-	-	-	-	-	496	-	-
1.2. Production of derived energy bearers	1 064	-	6	-	-	186	45	275	68	10	-	46	-	423	6
9. Consumption by energy sector	160	-	-	-	-	0	0	4	0	-	119	29	-	8	-
9.1. Crude petroleum and natural gas production	122	-	-	-	-	-	-	3	0	-	119	-	-	1	-
9.2. Coal mines	0	-	-	-	-	0	0	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	31	-	-	-	-	0	-	0	0	-	-	29	-	2	-
9.4. Pumping storage power plants	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-
9.5. Hydro electric power plants	4	-	-	-	-	0	0	0	0	-	-	-	-	3	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	-	-	0	-	-	-	-	0	-
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Consumption for non-energy purposes	31	-	-	-	-	-	-	-	-	31	-	-	-	-	-
11. Losses in transport and distribution	29	-	-	-	-	-	-	-	-	-	-	3	-	25	2
12. Statistical differences (7-8+1.2-9-10-11-13)	10	-1	0	-	8	4	7	-3	-18	11	3	-	-	0	-0
13. Net domestic consumption	692	18	26	32	-	74	28	123	12	3	-	14	-	358	4
14. Manufacturing, mining and quarrying	258	18	25	14	-	-	0	13	11	2	-	14	-	160	1
14.1. Mining and quarrying	4	-	-	-	-	-	0	1	1	0	-	-	-	2	-
14.2. Manufacture of paper and paper products	35	0	-	10	-	-	0	0	2	0	-	-	-	23	-
14.3. Manufacture of industrial chemicals	38	-	5	-	-	-	-	0	2	0	-	13	-	17	0
14.4. Manufacture of iron, steel and ferro alloys	49	12	11	0	-	-	0	0	0	0	-	0	-	26	0
14.5. Manufacture of aluminium and other non-ferrous metals	68	-	5	-	-	-	-	2	1	0	-	1	-	59	-
14.6. Other manufacturing industries	65	6	4	4	-	-	0	10	5	2	-	-	-	33	0
15. Transport	164	-	-	-	-	73	21	66	1	-	-	-	-	2	-
15.1. Railways and subways	4	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	22	-	-	-	-	0	21	-	-	-	-	-	-	-	-
15.3. Road transport	110	-	-	-	-	72	-	39	-	-	-	-	-	-	-
15.4. Coastal shipping	28	-	-	-	-	2	-	25	1	-	-	-	-	-	-
16. Other sectors	270	0	0	18	-	1	6	45	0	0	-	0	-	196	3
16.1. Fishing	16	-	-	-	-	0	0	16	0	-	-	-	-	-	0
16.2. Agriculture	10	0	-	-	-	0	0	7	0	-	-	-	-	2	0
16.3. Households	151	0	0	18	-	1	6	7	0	0	-	-	-	118	1
16.4. Other consumers	93	-	-	0	-	0	0	15	0	0	-	0	-	76	2

Energy balance **1993**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	6 528	8	-	41	4 747	25	-	-	-	62	1 140	-	507	-	-
2. Imports	229	20	25	0	56	19	3	22	35	46	-	-	-	2	-
3. Exports	5 700	6	5	0	4 212	133	17	161	60	66	1 009	-	-	31	-
4. Bunkering	22	-	-	-	-	-	-	10	12	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-33	2	-0	-	-31	-5	-3	3	1	-0	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 002	23	20	41	561	-95	-18	-145	-35	42	131	-	507	-28	-
8. Energy converted	1 127	1	1	5	570	7	2	6	27	1	-	0	507	1	-
8.1. In blast furnaces	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	613	-	-	-	570	7	2	6	27	1	-	-	-	-	-
8.3. In thermal power plants	0	-	-	-	-	-	-	0	0	-	-	-	-	-	-
8.4. In dual purpose power plants	3	1	-	2	-	-	-	-	-	-	-	-	-	-	-
8.5. In district heating plants	4	-	-	2	-	-	-	0	0	-	-	0	-	1	-
8.6. In hydropower plants	507	-	-	-	-	-	-	-	-	-	-	-	507	-	-
1.2. Production of derived energy bearers	1 078	-	7	-	-	180	46	282	66	12	-	48	-	432	6
9. Consumption by energy sector	168	-	-	-	-	0	0	4	0	0	126	29	-	8	-
9.1. Crude petroleum and natural gas production	131	-	-	-	-	-	-	4	0	-	126	-	-	1	-
9.2. Coal mines	0	-	-	-	-	0	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	32	-	-	-	-	0	-	0	0	0	-	29	-	2	-
9.4. Pumping storage power plants	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-
9.5. Hydro electric power plants	3	-	-	-	-	0	0	0	0	-	-	-	-	3	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Consumption for non-energy purposes	37	-	-	-	-	0	0	0	1	36	-	-	-	-	-
11. Losses in transport and distribution	33	-	-	-	-	-	-	-	-	-	-	3	-	29	2
12. Statistical differences (7-8+1.2-9-10-11-13)	2	2	-0	1	-9	4	-1	-5	-9	13	4	-	-	3	-0
13. Net domestic consumption	713	21	26	35	-	74	27	132	11	3	-	16	-	363	4
14. Manufacturing, mining and quarrying	268	21	26	15	-	-	0	13	11	3	-	15	-	164	1
14.1. Mining and quarrying	4	-	-	-	-	-	0	1	1	0	-	-	-	2	-
14.2. Manufacture of paper and paper products	39	0	-	10	-	-	0	0	3	0	-	-	-	25	-
14.3. Manufacture of industrial chemicals	49	4	6	-	-	-	-	1	2	0	-	14	-	21	0
14.4. Manufacture of iron, steel and ferro alloys	41	9	10	0	-	-	0	0	0	0	-	0	-	22	0
14.5. Manufacture of aluminium and other non-ferrous metals	69	-	6	-	-	-	-	1	1	0	-	1	-	60	-
14.6. Other manufacturing industries	66	7	5	5	-	-	0	9	4	2	-	-	-	33	0
15. Transport	172	-	-	-	-	73	21	76	1	-	-	-	-	2	-
15.1. Railways and subways	4	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	21	-	-	-	-	0	21	-	-	-	-	-	-	0	-
15.3. Road transport	116	-	-	-	-	71	-	45	-	-	-	-	-	-	-
15.4. Coastal shipping	31	-	-	-	-	2	-	29	1	-	-	-	-	0	-
16. Other sectors	272	0	0	21	-	1	6	44	0	0	-	0	-	197	3
16.1. Fishing	16	-	-	-	-	0	0	16	0	-	-	-	-	0	-
16.2. Agriculture	13	0	-	-	-	0	0	7	0	-	-	-	-	5	0
16.3. Households	153	0	0	21	-	1	6	6	0	0	-	-	-	118	1
16.4. Other consumers	90	-	-	0	-	0	0	15	0	0	-	0	-	73	2

Energy balance **1994**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	7 229	8	-	43	5 251	89	-	-	-	105	1 255	-	477	-	-
2. Imports	249	22	27	0	45	26	6	21	39	45	-	-	-	17	-
3. Exports	6 400	5	4	0	4 709	178	18	180	53	102	1 133	-	-	18	-
4. Bunkering	24	-	-	-	-	-	-	11	13	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-19	-0	-0	-	-11	3	0	-10	-1	0	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 035	26	23	43	575	-60	-12	-179	-28	49	122	-	477	-0	-
8. Energy converted	1 120	1	2	6	593	6	3	2	29	1	-	0	477	1	-
8.1. In blast furnaces	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	633	-	-	-	593	6	3	2	29	1	-	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	-	-	0	0	-	-	-	-	-	-
8.4. In dual purpose power plants	3	1	-	2	-	-	-	-	-	-	-	-	-	-	-
8.5. In district heating plants	4	-	-	2	-	-	-	0	0	-	-	0	-	1	-
8.6. In hydropower plants	477	-	-	-	-	-	-	-	-	-	-	-	477	-	-
1.2. Production of derived energy bearers	1 077	-	7	-	-	182	50	294	70	14	-	46	-	408	6
9. Consumption by energy sector	184	-	-	-	-	0	0	5	0	1	138	29	-	11	-
9.1. Crude petroleum and natural gas production	144	-	-	-	-	-	-	5	0	-	138	-	-	1	-
9.2. Coal mines	0	-	-	-	-	0	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	31	-	-	-	-	0	-	0	0	1	-	29	-	2	-
9.4. Pumping storage power plants	5	-	-	-	-	-	-	-	-	-	-	-	-	5	-
9.5. Hydro electric power plants	3	-	-	-	-	0	0	0	0	-	-	-	-	3	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Consumption for non-energy purposes	37	-	-	-	-	0	0	0	1	36	-	-	-	-	-
11. Losses in transport and distribution	33	-	-	-	-	-	-	-	-	-	-	3	-	28	2
12. Statistical differences (7-8+1.2-9-10-11-13)	8	1	-0	-	-18	42	5	-24	-4	21	-16	-0	-	0	0
13. Net domestic consumption	732	24	29	38	-	74	31	131	17	4	0	14	-	366	4
14. Manufacturing, mining and quarrying	282	24	29	16	-	-	0	14	16	4	0	14	-	164	1
14.1. Mining and quarrying	5	-	-	-	-	-	0	1	1	0	-	-	-	2	-
14.2. Manufacture of paper and paper products	42	0	-	11	-	-	0	0	7	0	-	-	-	23	-
14.3. Manufacture of industrial chemicals	48	5	6	-	-	-	-	1	2	0	0	13	-	21	0
14.4. Manufacture of iron, steel and ferro alloys	47	10	12	-	-	-	0	0	0	0	-	0	-	24	0
14.5. Manufacture of aluminium and other non-ferrous metals	71	0	7	0	-	-	0	1	1	0	0	1	-	62	-
14.6. Other manufacturing industries	68	8	4	5	-	-	0	10	4	3	-	-	-	32	1
15. Transport	171	-	-	-	-	73	24	72	0	-	-	-	-	2	-
15.1. Railways and subways	4	-	-	-	-	-	-	2	-	-	-	-	-	2	-
15.2. Air transport	24	-	-	-	-	0	24	-	-	-	-	-	-	0	-
15.3. Road transport	114	-	-	-	-	71	-	43	-	-	-	-	-	-	-
15.4. Coastal shipping	30	-	-	-	-	2	-	28	0	-	-	-	-	0	-
16. Other sectors	279	0	0	22	-	1	7	45	0	0	0	0	-	200	3
16.1. Fishing	17	-	-	-	-	0	0	17	0	-	-	-	-	0	-
16.2. Agriculture	13	0	-	-	-	0	0	7	0	-	-	-	-	6	0
16.3. Households	159	0	0	22	-	1	7	6	0	0	-	-	-	122	1
16.4. Other consumers	90	-	-	0	-	0	0	16	0	0	0	0	-	71	2

Energy balance **1995**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	7 748	8	-	44	5 636	114	-	-	-	126	1 303	-	519	-	-
2. Imports	260	26	29	0	59	35	4	28	27	43	-	-	-	8	-
3. Exports	6 883	5	4	0	5 155	184	14	154	53	128	1 154	-	-	32	-
4. Bunkering	30	-	-	-	-	-	-	14	16	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-3	-1	0	-	-10	-2	8	7	2	-8	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 093	29	25	44	531	-37	-2	-133	-40	33	149	-	519	-24	-
8. Energy converted	1 112	1	2	6	542	9	3	9	20	1	-	0	519	1	-
8.1. In blast furnaces	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	583	-	0	-	542	9	3	9	20	1	-	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	-	-	0	0	-	-	-	-	-	-
8.4. In dual purpose power plants	3	1	-	2	-	-	-	-	-	-	-	-	-	-	-
8.5. In district heating plants	4	-	-	3	-	-	-	0	-	-	-	0	-	1	-
8.6. In hydropower plants	519	-	-	-	-	-	-	-	-	-	-	-	519	-	-
1.2. Production of derived energy bearers	1 052	-	6	-	-	161	46	267	72	14	-	39	-	443	6
9. Consumption by energy sector	182	-	-	-	-	0	0	5	0	-	141	25	-	10	-
9.1. Crude petroleum and natural gas production	147	-	-	-	-	-	-	5	0	-	141	-	-	1	-
9.2. Coal mines	0	-	-	-	-	0	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	27	-	-	-	-	0	-	0	0	-	-	25	-	2	-
9.4. Pumping storage power plants	5	-	-	-	-	-	-	-	-	-	-	-	-	5	-
9.5. Hydro electric power plants	2	-	-	-	-	0	0	0	0	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Consumption for non-energy purposes	38	-	-	-	-	0	0	0	1	37	-	-	-	-	-
11. Losses in transport and distribution	30	-	-	-	-	-	-	-	-	-	-	3	-	26	2
12. Statistical differences (7-8+1.2-9-10-11-13)	41	1	-1	-	-11	42	10	-16	-3	4	7	0	-	8	0
13. Net domestic consumption	742	27	30	38	-	73	31	135	14	5	1	11	-	374	4
14. Manufacturing, mining and quarrying	286	26	30	16	-	-	0	13	13	4	1	11	-	170	1
14.1. Mining and quarrying	4	-	-	-	-	-	0	2	1	0	-	-	-	2	-
14.2. Manufacture of paper and paper products	43	0	-	11	-	-	0	0	6	0	-	-	-	25	-
14.3. Manufacture of industrial chemicals	46	5	6	-	-	-	-	1	2	0	0	10	-	22	0
14.4. Manufacture of iron, steel and ferro alloys	51	12	12	-	-	-	0	0	0	0	-	1	-	26	0
14.5. Manufacture of aluminium and other non-ferrous metals	73	-	7	-	-	-	0	1	1	0	1	1	-	62	-
14.6. Other manufacturing industries	70	9	4	5	-	-	0	9	4	3	0	-	-	33	1
15. Transport	175	-	-	-	-	72	24	76	1	-	-	-	-	2	-
15.1. Railways and subways	4	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	24	-	-	-	-	0	24	-	-	-	-	-	-	0	-
15.3. Road transport	117	-	-	-	-	70	-	47	-	-	-	-	-	-	-
15.4. Coastal shipping	31	-	-	-	-	2	-	28	1	-	-	-	-	-	-
16. Other sectors	280	0	0	22	-	1	7	45	0	1	0	0	-	201	3
16.1. Fishing	17	-	-	-	-	0	0	17	0	-	-	-	-	0	-
16.2. Agriculture	12	0	-	-	-	0	0	7	0	-	-	-	-	5	0
16.3. Households	161	0	0	21	-	1	6	6	0	0	-	-	-	125	1
16.4. Other consumers	90	-	-	0	-	0	0	16	0	1	0	0	-	71	2

Energy balance **1996**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	8 788	6	-	45	6 323	134	-	-	-	137	1 702	-	441	-	-
2. Imports	291	23	30	0	56	21	5	26	40	40	-	-	-	48	-
3. Exports	7 971	4	5	0	5 787	222	19	152	60	138	1 570	-	-	15	-
4. Bunkering	32	-	-	-	-	-	-	15	18	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-36	1	-2	-	-27	-2	-8	-7	-1	10	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 040	26	23	45	565	-68	-21	-148	-38	50	132	-	441	32	-
8. Energy converted	1 100	1	1	6	601	5	4	12	27	1	-	0	441	1	-
8.1. In blast furnaces	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	648	-	-	-	601	5	4	10	27	1	-	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	-	-	0	-	-	-	-	-	-	-
8.4. In dual purpose power plants	3	1	-	2	-	-	-	-	-	-	-	-	-	-	-
8.5. In district heating plants	5	-	-	3	-	-	-	2	-	-	-	0	-	1	-
8.6. In hydropower plants	441	-	-	-	-	-	-	-	-	-	-	-	441	-	-
1.2. Production of derived energy bearers	1 061	-	7	-	-	177	59	298	77	15	-	44	-	377	6
9. Consumption by energy sector	194	-	-	-	-	0	0	6	0	-	151	29	-	8	-
9.1. Crude petroleum and natural gas production	159	-	-	-	-	-	-	6	-	-	151	-	-	2	-
9.2. Coal mines	0	-	-	-	-	0	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	31	-	-	-	-	0	-	0	0	-	-	29	-	2	-
9.4. Pumping storage power plants	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-
9.5. Hydro electric power plants	2	-	-	-	-	0	0	0	0	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Consumption for non-energy purposes	39	-	-	-	-	0	0	0	1	38	-	-	-	-	-
11. Losses in transport and distribution	31	-	-	-	-	-	-	-	-	-	-	3		26	1
12. Statistical differences (7-8+1.2-9-10-11-13)	-30	-1	-1	-	-36	29	0	-20	-6	22	-20	0		3	-0
13. Net domestic consumption	767	26	30	39	-	74	34	152	18	4	1	12	-	371	5
14. Manufacturing, mining and quarrying	282	26	30	17	-	-	0	16	17	3	1	12	-	158	1
14.1. Mining and quarrying	4	-	-	-	-	-	0	1	1	0	-	-	-	2	-
14.2. Manufacture of paper and paper products	45	0	-	11	-	-	-	1	9	0	-	-	-	24	-
14.3. Manufacture of industrial chemicals	47	5	6	0	-	-	0	1	2	0	0	11	-	22	0
14.4. Manufacture of iron, steel and ferro alloys	50	12	12	-	-	-	0	0	0	0	-	0	-	24	0
14.5. Manufacture of aluminium and other non-ferrous metals	67	-	7	-	-	-	0	1	1	1	1	1	-	57	-
14.6. Other manufacturing industries	69	8	5	6	-	-	0	12	5	3	0	0	-	30	1
15. Transport	183	-	-	-	-	73	26	82	0	-	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	26	-	-	-	-	0	26	-	-	-	-	-	-	0	-
15.3. Road transport	123	-	-	-	-	71	-	51	-	-	0	-	-	-	-
15.4. Coastal shipping	32	-	-	-	-	2	-	29	0	-	-	-	-	-	-
16. Other sectors	302	0	0	23	-	1	8	55	0	1	0	0	-	211	4
16.1. Fishing	19	-	-	-	-	0	0	19	0	-	-	-	-	0	-
16.2. Agriculture	12	0	-	-	-	0	0	7	0	-	-	-	-	4	0
16.3. Households	168	0	0	23	-	1	8	8	-	0	-	-	-	127	1
16.4. Other consumers	103	-	-	0	-	0	0	21	0	1	0	0	-	79	2

Energy balance **1997**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	9 089	11	-	48	6 329	187	-	-	-	138	1 906	-	470	-	-
2. Imports	299	24	27	0	66	28	6	23	52	42	-	-	-	31	-
3. Exports	8 232	5	3	0	5 818	280	13	159	66	144	1 725	-	-	18	-
4. Bunkering	39	-	-	-	-	-	-	20	19	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	1	-2	1	-	14	1	-3	-5	-0	-3	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 117	28	24	48	591	-64	-11	-161	-34	32	181	-	470	14	-
8. Energy converted	1 135	1	2	6	597	1	3	11	43	1	-	0	470	1	-
8.1. In blast furnaces	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	655	-	-	-	597	1	3	10	43	1	-	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	-	-	0	0	-	-	-	-	-	-
8.4. In dual purpose power plants	3	1	-	2	-	-	-	0	-	-	-	-	-	-	-
8.5. In district heating plants	5	-	-	3	-	-	-	1	-	-	-	0	-	1	-
8.6. In hydropower plants	470	-	-	-	-	-	-	-	-	-	-	-	470	-	-
1.2. Production of derived energy bearers	1 087	-	7	-	-	177	46	309	77	17	-	46	-	401	6
9. Consumption by energy sector	204	-	-	-	-	0	0	7	0	-	153	30	-	13	-
9.1. Crude petroleum and natural gas production	163	-	-	-	-	-	-	6	-	-	153	-	-	3	-
9.2. Coal mines	0	-	-	-	-	0	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	32	-	-	-	-	0	-	0	0	-	-	30	-	2	-
9.4. Pumping storage power plants	6	-	-	-	-	-	-	-	-	-	-	-	-	6	-
9.5. Hydro electric power plants	2	-	-	-	-	0	0	0	0	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Consumption for non-energy purposes	49	-	-	-	-	0	0	0	1	39	9	-	-	-	-
11. Losses in transport and distribution	32	-	-	-	-	-	-	-	-	-	0	3	-	27	2
12. Statistical differences (7-8+1.2-9-10-11-13)	12	1	-1	-	-6	39	-3	-17	-18	4	13	0	-	0	0
13. Net domestic consumption	772	26	30	42	-	73	34	148	16	5	5	13	-	374	5
14. Manufacturing, mining and quarrying	288	26	30	18	-	-	0	13	16	4	5	13	-	163	1
14.1. Mining and quarrying	3	-	-	-	-	-	0	1	0	0	-	-	-	2	-
14.2. Manufacture of paper and paper products	42	0	-	12	-	-	-	0	7	0	-	-	-	23	0
14.3. Manufacture of industrial chemicals	53	5	6	0	-	-	0	0	3	0	4	12	-	22	0
14.4. Manufacture of iron, steel and ferro alloys	49	11	12	-	-	-	-	0	0	0	-	1	-	24	0
14.5. Manufacture of aluminium and other non-ferrous metals	72	-	7	-	-	-	0	1	1	1	1	1	-	61	0
14.6. Other manufacturing industries	69	9	5	6	-	-	0	10	4	2	0	0	-	30	1
15. Transport	188	-	-	-	-	72	27	86	1	-	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	27	-	-	-	-	0	27	-	-	-	-	-	-	0	-
15.3. Road transport	123	-	-	-	-	70	-	52	-	-	0	-	-	-	-
15.4. Coastal shipping	35	-	-	-	-	2	-	32	1	-	-	-	-	0	-
16. Other sectors	296	0	0	24	-	1	7	50	0	1	0	0	-	209	4
16.1. Fishing	20	-	-	-	-	0	0	20	0	-	-	-	-	0	-
16.2. Agriculture	10	0	-	-	-	0	0	6	0	-	-	-	-	4	0
16.3. Households	161	0	0	24	-	1	7	6	-	0	-	-	-	122	1
16.4. Other consumers	104	-	-	0	-	0	0	18	0	1	0	0	-	82	3

Energy balance **1998**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	8 846	9	-	44	6 053	175	-	-	-	136	1 937	-	492	-	-
2. Imports	282	27	29	0	81	21	11	21	40	22	-	-	-	29	-
3. Exports	7 915	8	3	0	5 553	269	10	162	58	108	1 728	-	-	16	-
4. Bunkering	38	-	-	-	-	-	-	21	17	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	26	1	-0	-	23	1	1	-0	2	-2	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 201	29	26	45	605	-72	2	-162	-33	47	209	-	492	13	-
8. Energy converted	1 144	1	2	6	598	2	2	6	33	1	0	0	492	1	-
8.1. In blast furnaces	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	641	-	-	-	598	2	2	4	33	1	-	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	-	-	0	0	-	-	-	-	-	-
8.4. In dual purpose power plants	3	1	-	2	-	-	-	-	-	-	-	-	-	-	-
8.5. In district heating plants	5	-	-	3	-	-	-	1	0	-	0	0	-	1	-
8.6. In hydropower plants	492	-	-	-	-	-	-	-	-	-	-	-	492	-	-
1.2. Production of derived energy bearers	1 079	-	7	-	-	174	36	303	71	15	-	45	-	421	7
9. Consumption by energy sector	194	-	-	-	-	0	0	7	0	1	147	29	-	11	-
9.1. Crude petroleum and natural gas production	157	-	-	-	-	-	-	6	-	-	147	-	-	4	-
9.2. Coal mines	0	-	-	-	-	0	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	31	-	-	-	-	0	-	0	0	1	-	29	-	2	-
9.4. Pumping storage power plants	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
9.5. Hydro electric power plants	3	-	-	-	-	0	0	0	0	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	-	0	0	-	-	-	-	0	-
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Consumption for non-energy purposes	54	-	-	-	-	0	0	0	1	36	17	-	-	-	-
11. Losses in transport and distribution	34	-	-	-	-	-	-	-	-	-	1	3	-	28	2
12. Statistical differences (7-8+1.2-9-10-11-13)	55	-1	1	-	6	26	2	-25	-12	20	38	-0	-	0	-
13. Net domestic consumption	799	29	29	39	-	74	34	154	17	5	6	13	-	395	5
14. Manufacturing, mining and quarrying	304	28	29	16	-	-	0	15	16	4	6	13	-	175	1
14.1. Mining and quarrying	4	-	-	-	-	-	0	1	0	0	-	-	-	2	-
14.2. Manufacture of paper and paper products	41	0	-	11	-	-	0	0	7	0	-	-	-	23	0
14.3. Manufacture of industrial chemicals	57	6	6	0	-	-	-	0	3	0	5	11	-	24	0
14.4. Manufacture of iron, steel and ferro alloys	54	13	13	-	-	-	0	0	0	0	-	1	-	28	0
14.5. Manufacture of aluminium and other non-ferrous metals	76	0	5	-	-	-	0	1	1	1	1	1	-	68	0
14.6. Other manufacturing industries	71	10	5	4	-	-	0	11	5	3	1	0	-	31	1
15. Transport	192	-	-	-	-	73	27	89	1	-	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	28	-	-	-	-	0	27	-	-	-	-	-	-	0	-
15.3. Road transport	126	-	-	-	-	71	-	55	-	-	0	-	-	-	-
15.4. Coastal shipping	35	-	-	-	-	2	-	33	1	-	-	-	-	0	-
16. Other sectors	303	0	0	23	-	1	7	50	0	1	0	0	-	217	4
16.1. Fishing	21	-	-	-	-	0	0	20	-	-	-	-	-	0	-
16.2. Agriculture	14	-	-	0	-	0	0	7	0	0	-	-	-	7	0
16.3. Households	163	0	0	23	-	1	6	6	0	0	-	-	-	126	1
16.4. Other consumers	105	-	-	0	-	0	0	17	0	1	0	0	-	84	3

Energy balance **1999**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	9 008	11	-	47	6 001	181	-	-	-	162	2 090	-	516	-	-
2. Imports	284	26	29	0	89	18	12	17	47	22	-	-	-	25	-
3. Exports	7 983	8	2	0	5 436	289	9	150	67	109	1 883	-	-	32	-
4. Bunkering	35	-	-	-	-	-	-	20	15	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-0	1	0	-	1	-8	-1	7	-1	2	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 273	29	27	47	654	-97	2	-147	-36	76	207	-	516	-7	-
8. Energy converted	1 185	1	2	6	607	5	3	3	42	1	0	0	516	0	-
8.1. In blast furnaces	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	658	-	-	-	607	5	3	1	42	1	-	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	-	-	0	0	-	-	-	-	-	-
8.4. In dual purpose power plants	3	1	-	2	-	-	-	0	-	-	-	-	-	-	-
8.5. In district heating plants	5	-	-	3	-	-	-	2	0	-	0	0	-	0	-
8.6. In hydropower plants	516	-	-	-	-	-	-	-	-	-	-	-	516	-	-
1.2. Production of derived energy bearers	1 131	-	7	-	-	184	34	321	74	15	-	46	-	442	7
9. Consumption by energy sector	196	-	-	-	-	0	0	7	0	1	145	30	-	12	0
9.1. Crude petroleum and natural gas production	157	-	-	-	-	-	-	7	-	-	145	-	-	4	-
9.2. Coal mines	0	-	-	-	-	-	-	0	-	-	-	-	-	0	0
9.3. Petroleum refineries	33	-	-	-	-	0	-	0	0	1	-	30	-	2	-
9.4. Pumping storage power plants	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-
9.5. Hydro electric power plants	4	-	-	-	-	0	0	0	0	-	-	-	-	4	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Consumption for non-energy purposes	51	-	-	-	-	0	0	0	1	31	19	-	-	-	-
11. Losses in transport and distribution	33	-	-	-	-	-	-	-	-	-	1	4	-	27	2
12. Statistical differences (7-8+1.2-9-10-11-13)	128	1	5	-	48	9	-5	3	-18	51	34	-	-	0	-0
13. Net domestic consumption	811	27	28	41	-	73	38	161	15	7	8	12	-	396	6
14. Manufacturing, mining and quarrying	302	27	28	17	-	-	0	13	14	5	8	12	-	176	1
14.1. Mining and quarrying	3	-	-	-	-	-	0	1	0	0	-	-	-	2	-
14.2. Manufacture of paper and paper products	42	0	-	12	-	-	0	0	6	0	-	-	-	23	0
14.3. Manufacture of industrial chemicals	58	6	5	-	-	-	0	0	3	2	7	11	-	23	0
14.4. Manufacture of iron, steel and ferro alloys	53	13	12	-	-	-	-	0	0	0	-	1	-	28	0
14.5. Manufacture of aluminium and other non-ferrous metals	77	0	6	-	-	-	-	1	1	1	1	1	-	68	0
14.6. Other manufacturing industries	68	8	5	5	-	-	0	10	4	3	0	0	-	32	1
15. Transport	203	-	-	-	-	72	32	96	1	-	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	32	-	-	-	-	0	32	-	-	-	-	-	-	0	-
15.3. Road transport	129	-	-	-	-	71	-	58	-	-	0	-	-	-	-
15.4. Coastal shipping	39	-	-	-	-	2	-	37	1	-	-	-	-	0	-
16. Other sectors	306	0	0	23	-	1	6	51	0	1	0	0	-	217	5
16.1. Fishing	21	-	-	-	-	0	0	20	0	-	-	-	-	0	-
16.2. Agriculture	13	0	-	0	-	0	0	7	0	0	-	-	-	7	0
16.3. Households	164	0	0	23	-	1	6	6	-	0	-	-	-	126	1
16.4. Other consumers	107	-	-	0	-	0	0	18	0	1	0	0	-	84	4

Energy balance **2000**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	9 656	18	-	46	6 481	169	-	-	-	159	2 182	-	603	-	-
2. Imports	235	26	29	0	43	20	9	28	52	23	-	-	-	5	-
3. Exports	8 441	16	1	0	5 822	271	9	149	63	76	1 960	-	-	74	-
4. Bunkering	34	-	-	-	-	-	-	20	15	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-28	1	1	-	-35	0	2	4	2	-3	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 389	28	29	46	667	-82	2	-137	-23	104	222	-	603	-69	-
8. Energy converted	1 270	1	2	6	580	32	1	1	40	2	0	0	603	2	-
8.1. In blast furnaces	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	656	-	-	-	580	32	1	0	40	2	-	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	-	-	0	0	-	-	-	-	-	-
8.4. In dual purpose power plants	3	1	-	2	-	-	-	0	-	-	-	-	-	-	-
8.5. In district heating plants	5	-	-	3	-	-	-	1	0	0	0	0	-	2	-
8.6. In hydropower plants	603	-	-	-	-	-	-	-	-	-	-	-	603	-	-
1.2. Production of derived energy bearers	1 191	-	7	-	-	192	34	308	67	15	-	45	-	515	7
9. Consumption by energy sector	215	-	-	-	-	0	-	7	0	1	167	29	-	11	0
9.1. Crude petroleum and natural gas production	178	-	-	-	-	-	-	6	-	-	167	-	-	4	-
9.2. Coal mines	0	-	-	-	-	-	-	0	-	-	-	-	-	0	0
9.3. Petroleum refineries	32	-	-	-	-	0	-	0	0	1	-	29	-	2	-
9.4. Pumping storage power plants	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-
9.5. Hydro electric power plants	3	-	-	-	-	0	-	0	0	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	-	-
9.8. District heating plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Consumption for non-energy purposes	53	-	-	-	-	0	0	0	1	32	19	-	-	-	-
11. Losses in transport and distribution	43	-	-	-	-	-	-	-	-	-	1	3	-	36	1
12. Statistical differences (7-8+1.2-9-10-11-13)	213	0	6	-	86	7	2	19	-8	74	26	-	-	-0	-0
13. Net domestic consumption	787	27	28	40	-	71	32	144	11	9	8	12	-	398	5
14. Manufacturing, mining and quarrying	307	27	28	16	-	-	0	13	10	8	8	12	-	184	1
14.1. Mining and quarrying	4	-	-	-	-	-	0	1	0	0	-	-	-	2	-
14.2. Manufacture of paper and paper products	42	-	-	12	-	-	0	0	4	0	0	-	-	26	-
14.3. Manufacture of industrial chemicals	62	6	5	-	-	-	0	1	2	4	7	11	-	25	0
14.4. Manufacture of iron, steel and ferro alloys	55	13	13	-	-	-	0	0	0	0	-	1	-	28	0
14.5. Manufacture of aluminium and other non-ferrous metals	78	0	5	-	-	-	0	1	1	1	1	1	-	69	0
14.6. Other manufacturing industries	66	8	5	4	-	-	0	9	3	3	0	0	-	33	1
15. Transport	188	-	-	-	-	70	27	87	1	-	0	-	-	3	-
15.1. Railways and subways	3	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	28	-	-	-	-	0	27	-	-	-	-	-	-	0	-
15.3. Road transport	121	-	-	-	-	68	-	53	-	-	0	-	-	-	-
15.4. Coastal shipping	36	-	-	-	-	2	-	33	1	-	0	-	-	0	-
16. Other sectors	292	0	0	24	-	1	5	44	0	1	0	0	-	211	5
16.1. Fishing	19	-	-	-	-	0	0	19	-	-	-	-	-	0	-
16.2. Agriculture	13	0	-	0	-	0	0	6	0	0	-	-	-	7	0
16.3. Households	160	0	0	24	-	1	5	5	-	0	0	-	-	125	1
16.4. Other consumers	99	-	-	0	-	0	0	15	0	1	0	0	-	79	4

Energy balance **2001**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	9 855	50	-	49	6 461	211	-	-	-	230	2 341	-	513	-	-
2. Imports	262	23	27	1	41	22	10	40	46	13	-	-	-	39	-
3. Exports	8 801	42	0	0	6 006	352	4	130	49	160	2 031	-	-	26	-
4. Bunkering	34	-	-	-	-	-	-	20	14	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	66	-6	1	-	60	2	4	2	2	1	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 349	26	28	49	557	-117	9	-108	-15	85	310	-	513	13	-
8. Energy converted	1 140	1	1	7	538	30	1	4	42	2	0	0	513	2	0
8.1. In blast furnaces	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	616	-	-	-	538	30	1	3	42	2	-	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	-	-	0	-	-	-	-	-	-	-
8.4. In dual purpose power plants	3	1	-	2	-	-	-	-	-	-	-	-	-	-	-
8.5. In district heating plants	7	-	-	4	-	-	-	1	-	0	0	0	-	2	0
8.6. In hydropower plants	513	-	-	-	-	-	-	-	-	-	-	-	513	-	-
1.2. Production of derived energy bearers	1 074	-	7	-	-	193	27	281	64	13	-	42	-	439	8
9. Consumption by energy sector	220	-	-	-	-	0	-	7	0	1	175	25	-	11	0
9.1. Crude petroleum and natural gas production	186	-	-	-	-	-	-	6	-	-	175	-	-	4	-
9.2. Coal mines	0	-	-	-	-	-	-	-	-	-	-	-	-	0	0
9.3. Petroleum refineries	28	-	-	-	-	0	-	0	0	1	-	25	-	2	-
9.4. Pumping storage power plants	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
9.5. Hydro electric power plants	3	-	-	-	-	0	-	0	0	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	-	-
9.8. District heating plants	0	-	-	-	-	0	-	0	-	-	-	-	-	0	0
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Consumption for non-energy purposes	73	-	-	-	-	0	0	0	1	49	23	-	-	-	-
11. Losses in transport and distribution	42	-	-	-	-	-	-	-	-	-	1	4	-	36	1
12. Statistical differences (7-8+1.2-9-10-11-13)	147	1	8	-	19	-29	2	13	-7	37	103	0	-	-	0
13. Net domestic consumption	801	24	26	42	-	74	32	150	13	9	8	13	-	403	7
14. Manufacturing, mining and quarrying	297	24	26	17	-	-	0	12	13	8	8	13	-	175	1
14.1. Mining and quarrying	4	-	-	0	-	-	0	2	0	0	0	-	-	2	-
14.2. Manufacture of paper and paper products	43	-	-	13	-	-	0	0	6	0	0	-	-	23	-
14.3. Manufacture of industrial chemicals	61	6	5	-	-	-	0	0	2	4	6	12	-	24	0
14.4. Manufacture of iron, steel and ferro alloys	49	11	11	0	-	-	-	1	-	0	-	0	-	25	0
14.5. Manufacture of aluminium and other non-ferrous metals	78	0	5	-	-	-	-	1	1	1	1	1	-	69	-
14.6. Other manufacturing industries	63	7	4	4	-	-	0	9	3	3	0	0	-	32	0
15. Transport	191	-	-	-	-	73	27	88	0	-	0	-	-	3	-
15.1. Railways and subways	3	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	27	-	-	-	-	0	27	-	-	-	-	-	-	0	-
15.3. Road transport	128	-	-	-	-	71	-	57	-	-	0	-	-	-	-
15.4. Coastal shipping	32	-	-	-	-	2	-	30	0	-	0	-	-	0	-
16. Other sectors	313	0	0	25	-	1	6	49	0	1	0	0	-	225	6
16.1. Fishing	20	-	-	-	-	0	0	19	0	-	-	-	-	0	-
16.2. Agriculture	15	0	-	0	-	0	0	7	0	0	-	-	-	8	0
16.3. Households	167	0	0	25	-	1	5	6	-	0	0	-	-	129	1
16.4. Other consumers	111	-	-	0	-	0	0	17	0	1	0	0	-	88	5

Energy balance **2002**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	10 163	60	-	51	6 197	268	-	-	-	245	2 792	-	550	-	-
2. Imports	223	18	27	1	27	21	13	36	43	17	-	-	-	19	-
3. Exports	9 134	58	2	0	5 733	354	5	105	63	184	2 576	-	-	54	-
4. Bunkering	27	-	-	-	-	-	-	18	9	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-2	2	0	-	-5	-2	1	2	-2	1	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 222	23	25	52	486	-66	9	-85	-31	79	216	-	550	-35	-
8. Energy converted	1 141	1	1	7	502	37	2	5	32	3	0	0	550	2	0
8.1. In blast furnaces	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	579	-	-	-	502	37	2	4	32	2	-	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	-	-	0	-	-	-	-	-	-	-
8.4. In dual purpose power plants	3	1	-	2	-	-	-	-	-	-	-	-	-	0	-
8.5. In district heating plants	7	-	-	4	-	-	-	1	0	0	0	0	-	2	0
8.6. In hydropower plants	550	-	-	-	-	-	-	-	-	-	-	-	550	-	-
1.2. Production of derived energy bearers	1 080	-	7	-	-	188	29	257	64	14	-	43	-	471	9
9. Consumption by energy sector	219	-	-	-	-	0	0	5	0	1	176	27	-	11	0
9.1. Crude petroleum and natural gas production	185	-	-	-	-	-	-	5	-	-	176	-	-	4	-
9.2. Coal mines	0	-	-	-	-	-	-	-	-	-	-	-	-	0	0
9.3. Petroleum refineries	29	-	-	-	-	0	-	0	0	1	-	27	-	2	-
9.4. Pumping storage power plants	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-
9.5. Hydro electric power plants	2	-	-	-	-	0	0	0	0	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	0	-	0	-	-	-	-	-	0	0
9.9. Gas supply	0	-	-	-	-	-	-	-	-	-	0	-	-	-	-
10. Consumption for non-energy purposes	68	-	-	-	-	-	0	0	1	49	17	-	-	-	-
11. Losses in transport and distribution	39	-	-	-	-	-	-	-	-	-	0	3	-	34	2
12. Statistical differences (7-8+1.2-9-10-11-13)	50	1	6	-	-16	10	3	9	-12	31	16	-	-	0	-0
13. Net domestic consumption	785	21	25	45	-	73	32	152	11	10	6	13	-	390	7
14. Manufacturing, mining and quarrying	282	21	25	16	-	-	0	13	11	8	6	13	-	168	1
14.1. Mining and quarrying	3	-	-	0	-	-	0	2	0	0	0	-	-	2	0
14.2. Manufacture of paper and paper products	41	-	-	12	-	-	0	0	5	0	0	-	-	23	0
14.3. Manufacture of industrial chemicals	54	5	4	-	-	-	0	1	2	4	4	12	-	22	0
14.4. Manufacture of iron, steel and ferro alloys	43	10	10	0	-	-	-	1	0	0	-	0	-	23	0
14.5. Manufacture of aluminium and other non-ferrous metals	75	0	4	0	-	-	-	1	0	1	1	-	-	68	-
14.6. Other manufacturing industries	66	7	7	4	-	-	0	9	3	3	0	0	-	31	1
15. Transport	191	-	-	-	-	72	27	89	0	0	0	-	-	3	-
15.1. Railways and subways	3	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	27	-	-	-	-	0	27	-	-	-	-	-	-	0	-
15.3. Road transport	129	-	-	-	-	70	-	58	-	0	0	-	-	-	-
15.4. Coastal shipping	32	-	-	-	-	2	-	30	0	-	0	-	-	0	-
16. Other sectors	313	0	0	29	-	1	6	50	0	1	0	1	-	219	6
16.1. Fishing	21	-	-	-	-	0	0	20	0	-	-	-	-	0	-
16.2. Agriculture	14	-	-	0	-	0	0	6	0	0	-	-	-	7	0
16.3. Households	168	0	0	28	-	1	5	7	-	0	0	-	-	125	1
16.4. Other consumers	110	-	-	0	-	0	0	17	0	1	0	1	-	86	5

Energy balance **2003**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	10 240	83	-	52	5 905	366	-	-	-	272	3 113	-	449	-	-
2. Imports	260	19	24	2	26	18	12	33	58	18	-	-	-	48	-
3. Exports	9 197	76	3	0	5 372	478	4	117	73	199	2 853	-	-	20	-
4. Bunkering	27	-	-	-	-	-	-	17	10	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-39	-3	-1	-	-28	-0	-0	-3	1	-5	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 237	23	20	54	531	-95	8	-104	-24	87	259	-	449	28	-
8. Energy converted	1 109	1	1	9	560	36	1	6	42	3	0	0	449	1	0
8.1. In blast furnaces	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	645	-	-	-	560	36	1	3	42	2	-	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	-	-	0	-	-	0	-	-	-	-
8.4. In dual purpose power plants	4	1	-	4	-	-	-	-	-	-	-	-	-	0	-
8.5. In district heating plants	8	-	-	4	-	-	-	2	0	0	0	0	-	1	0
8.6. In hydropower plants	449	-	-	-	-	-	-	-	-	-	-	-	449	-	-
1.2. Production of derived energy bearers	1 066	-	8	-	-	207	32	279	82	16	-	45	-	386	10
9. Consumption by energy sector	233	-	-	-	-	0	0	5	0	1	186	29	-	12	0
9.1. Crude petroleum and natural gas production	196	-	-	-	-	-	-	5	-	-	186	-	-	5	-
9.2. Coal mines	0	-	-	-	-	-	-	-	-	-	-	-	-	0	0
9.3. Petroleum refineries	32	-	-	-	-	0	-	0	0	1	-	29	-	2	-
9.4. Pumping storage power plants	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
9.5. Hydro electric power plants	2	-	-	-	-	0	0	0	0	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	0	0	0	-	-	-	-	-	0	0
9.9. Gas supply	0	-	-	-	-	-	-	-	-	-	0	-	-	-	-
10. Consumption for non-energy purposes	77	-	-	-	-	-	0	0	1	52	24	-	-	-	-
11. Losses in transport and distribution	34	-	-	-	-	-	-	-	-	-	1	2	-	29	2
12. Statistical differences (7-8+1.2-9-10-11-13)	72	2	3	-	-29	3	9	7	0	38	41	-	-	-0	-0
13. Net domestic consumption	777	21	24	45	-	73	30	157	15	10	8	14	-	373	8
14. Manufacturing, mining and quarrying	287	21	24	17	-	-	0	14	11	9	8	13	-	170	1
14.1. Mining and quarrying	4	-	-	0	-	-	0	2	0	0	0	-	-	2	0
14.2. Manufacture of paper and paper products	41	-	-	12	-	-	0	1	6	0	0	-	-	22	0
14.3. Manufacture of industrial chemicals	57	5	3	0	-	-	0	1	2	4	6	13	-	22	0
14.4. Manufacture of iron, steel and ferro alloys	40	9	9	0	-	-	0	1	0	0	-	0	-	21	0
14.5. Manufacture of aluminium and other non-ferrous metals	82	0	5	-	-	-	-	1	0	1	1	-	-	74	-
14.6. Other manufacturing industries	64	7	6	4	-	-	0	10	3	3	0	0	-	29	1
15. Transport	191	-	-	-	-	72	23	90	3	0	0	-	-	3	-
15.1. Railways and subways	3	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	24	-	-	-	-	0	23	-	-	-	-	-	-	1	-
15.3. Road transport	132	-	-	-	-	70	-	62	-	0	0	-	-	-	-
15.4. Coastal shipping	32	-	-	-	-	2	-	27	3	-	0	-	-	0	-
16. Other sectors	299	0	0	29	-	1	6	53	0	1	0	1	-	201	7
16.1. Fishing	20	-	-	-	-	0	0	20	0	-	-	-	-	0	-
16.2. Agriculture	13	-	-	0	-	0	0	7	0	0	0	-	-	6	0
16.3. Households	160	0	0	28	-	1	6	8	-	1	0	-	-	115	1
16.4. Other consumers	106	-	-	0	-	0	1	19	0	1	0	1	-	78	5

Energy balance **2004**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	10 320	82	-	51	5 843	322	-	-	-	290	3 270	-	463	-	-
2. Imports	268	22	25	1	21	24	11	35	58	16	-	-	-	55	-
3. Exports	9 213	77	1	0	5 261	420	4	118	71	187	3 061	-	-	14	-
4. Bunkering	26	-	-	-	-	-	-	16	10	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	15	-0	0	-	6	5	-1	3	1	2	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 364	26	25	52	609	-69	7	-96	-23	121	209	-	463	41	-
8. Energy converted	1 097	1	2	9	533	35	1	5	44	2	0	0	463	2	0
8.1. In blast furnaces	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	619	-	-	-	533	35	1	4	44	2	-	-	-	-	-
8.3. In thermal power plants	1	-	-	1	-	-	-	0	-	-	0	-	-	-	-
8.4. In dual purpose power plants	4	1	-	3	-	-	-	-	-	-	-	-	-	-	-
8.5. In district heating plants	8	-	-	5	-	-	-	1	0	0	0	0	-	2	0
8.6. In hydropower plants	463	-	-	-	-	-	-	-	-	-	-	-	463	-	-
1.2. Production of derived energy bearers	1 057	-	6	-	-	203	29	273	78	15	-	44	-	398	11
9. Consumption by energy sector	242	-	-	-	-	0	0	5	0	0	196	28	-	12	0
9.1. Crude petroleum and natural gas production	206	-	-	-	-	-	-	5	-	-	195	-	-	6	-
9.2. Coal mines	0	-	-	-	-	0	-	-	-	-	-	-	-	0	0
9.3. Petroleum refineries	30	-	-	-	-	0	-	0	0	0	-	28	-	2	-
9.4. Pumping storage power plants	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
9.5. Hydro electric power plants	2	-	-	-	-	0	0	0	-	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	0	-	0	-	-	-	-	-	0	0
9.9. Gas supply	0	-	-	-	-	-	-	-	-	-	0	-	-	-	-
10. Consumption for non-energy purposes	70	-	-	-	-	-	0	0	1	41	28	-	-	-	-
11. Losses in transport and distribution	39	-	-	-	-	-	-	-	-	-	1	3	-	34	2
12. Statistical differences (7-8+1.2-9-10-11-13)	176	2	4	-	76	26	2	11	-4	82	-25	-	-	0	-0
13. Net domestic consumption	798	23	25	43	-	72	32	155	15	10	10	14	-	391	8
14. Manufacturing, mining and quarrying	299	23	25	16	-	-	0	12	11	8	9	13	-	182	1
14.1. Mining and quarrying	4	-	-	0	-	-	0	2	0	0	0	0	-	2	0
14.2. Manufacture of paper and paper products	41	-	-	12	-	-	-	0	6	0	0	-	-	23	0
14.3. Manufacture of industrial chemicals	56	6	3	0	-	-	-	0	2	3	6	12	-	23	0
14.4. Manufacture of iron, steel and ferro alloys	47	11	11	0	-	-	0	0	-	0	0	0	-	24	0
14.5. Manufacture of aluminium and other non-ferrous metals	89	-	5	-	-	-	-	1	0	1	1	-	-	81	-
14.6. Other manufacturing industries	62	6	6	4	-	-	0	8	3	3	1	0	-	30	1
15. Transport	201	-	-	-	-	71	27	96	4	0	0	-	-	3	-
15.1. Railways and subways	3	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	28	-	-	-	-	0	27	-	-	-	-	-	-	1	-
15.3. Road transport	137	-	-	-	-	69	-	68	-	0	0	-	-	-	-
15.4. Coastal shipping	33	-	-	-	-	2	-	27	4	-	0	-	-	0	-
16. Other sectors	298	0	0	27	-	1	5	48	0	2	1	0	-	206	7
16.1. Fishing	20	-	-	-	-	0	0	19	0	-	-	-	-	0	-
16.2. Agriculture	14	-	-	0	-	0	0	6	0	0	0	-	-	7	0
16.3. Households	157	0	0	26	-	1	5	5	-	1	0	-	-	117	2
16.4. Other consumers	107	-	-	0	-	0	0	17	0	1	0	0	-	82	6

Energy balance **2005**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	10 139	41	-	54	5 320	301	-	-	-	347	3 498	-	578	-	-
2. Imports	236	19	24	1	45	22	7	25	69	11	-	-	-	13	-
3. Exports	8 973	47	0	0	4 730	431	7	106	70	224	3 301	-	-	57	-
4. Bunkering	30	-	-	-	-	-	-	18	12	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-18	9	-1	-	-17	-3	0	-5	-2	-0	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 354	22	22	55	618	-111	1	-104	-15	134	196	-	578	-43	-
8. Energy converted	1 274	1	1	9	565	54	0	5	55	2	1	0	578	3	0
8.1. In blast furnaces	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	681	-	-	-	565	54	0	5	55	2	-	-	-	-	-
8.3. In thermal power plants	2	-	-	1	-	-	-	0	-	-	0	-	-	-	-
8.4. In dual purpose power plants	4	1	-	3	-	-	-	0	-	-	-	-	-	0	-
8.5. In district heating plants	8	-	-	5	-	-	-	1	-	0	0	0	-	3	0
8.6. In hydropower plants	578	-	-	-	-	-	-	-	-	-	-	-	578	-	-
1.2. Production of derived energy bearers	1 221	-	8	-	-	239	34	299	68	18	-	46	-	497	11
9. Consumption by energy sector	242	-	-	-	-	0	0	5	-	-	190	31	-	16	0
9.1. Crude petroleum and natural gas production	202	-	-	-	-	-	-	5	-	-	190	-	-	8	-
9.2. Coal mines	0	-	-	-	-	0	-	-	-	-	-	-	-	0	0
9.3. Petroleum refineries	33	-	-	-	-	0	-	0	-	-	-	31	-	2	-
9.4. Pumping storage power plants	4	-	-	-	-	-	-	-	-	-	-	-	-	4	-
9.5. Hydro electric power plants	2	-	-	-	-	0	0	0	-	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	0	-	0	-	-	-	-	-	0	0
9.9. Gas supply	0	-	-	-	-	-	-	-	-	-	0	-	-	-	-
10. Consumption for non-energy purposes	68	-	-	-	-	-	0	0	1	42	24	-	-	-	-
11. Losses in transport and distribution	40	-	-	-	-	-	-	-	-	-	0	2	-	36	2
12. Statistical differences (7-8+1.2-9-10-11-13)	150	2	4	-	53	5	2	29	-15	99	-29	-	-	-0	-0
13. Net domestic consumption	800	19	24	46	-	69	33	156	13	9	10	13	-	399	9
14. Manufacturing, mining and quarrying	295	19	24	17	-	-	0	10	10	7	9	13	-	185	1
14.1. Mining and quarrying	4	-	-	0	-	-	0	2	0	0	0	0	-	2	0
14.2. Manufacture of paper and paper products	41	-	-	12	-	-	-	0	5	0	0	-	-	23	0
14.3. Manufacture of industrial chemicals	55	5	3	0	-	-	-	0	2	2	5	12	-	25	0
14.4. Manufacture of iron, steel and ferro alloys	39	9	9	-	-	-	-	0	-	0	0	0	-	20	0
14.5. Manufacture of aluminium and other non-ferrous metals	94	-	5	-	-	-	-	0	-	1	2	-	-	86	0
14.6. Other manufacturing industries	63	6	7	5	-	-	0	7	3	3	1	0	-	30	1
15. Transport	204	-	-	-	-	69	28	102	2	0	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	29	-	-	-	-	0	28	-	-	-	-	-	-	0	-
15.3. Road transport	139	-	-	-	-	67	-	73	-	0	0	-	-	-	-
15.4. Coastal shipping	33	-	-	-	-	2	-	29	2	-	0	-	-	0	-
16. Other sectors	301	0	0	29	-	1	4	43	0	2	1	1	-	211	8
16.1. Fishing	19	-	-	-	-	0	0	18	0	-	-	-	-	1	-
16.2. Agriculture	15	-	-	0	-	0	0	6	0	0	1	-	-	7	0
16.3. Households	162	0	0	28	-	1	4	4	-	1	0	-	-	122	2
16.4. Other consumers	105	-	-	0	-	0	0	15	0	1	0	1	-	81	6

Energy balance **2006**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	9 772	67	-	52	4 936	298	-	-	-	335	3 577	-	507	-	-
2. Imports	240	15	24	1	16	15	10	40	72	11	-	-	-	35	-
3. Exports	8 612	64	0	0	4 231	439	10	128	88	246	3 372	-	-	32	-
4. Bunkering	30	-	-	-	-	-	-	17	13	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-18	-1	1	-	-12	-3	0	-2	2	-4	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 353	18	25	53	709	-129	1	-107	-28	97	204	-	507	3	-
8. Energy converted	1 241	1	2	10	599	57	0	5	57	2	1	0	507	2	0
8.1. In blast furnaces	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	718	-	-	-	599	57	0	4	57	1	-	-	-	-	-
8.3. In thermal power plants	2	-	-	1	-	-	-	0	-	-	0	-	-	-	-
8.4. In dual purpose power plants	4	1	-	3	-	-	-	-	-	-	-	-	-	-	-
8.5. In district heating plants	9	-	-	5	-	-	-	1	-	0	0	0	-	2	0
8.6. In hydropower plants	507	-	-	-	-	-	-	-	-	-	-	-	507	-	-
1.2. Production of derived energy bearers	1 202	-	7	-	-	246	38	310	82	19	-	50	-	438	12
9. Consumption by energy sector	246	-	-	-	-	0	0	5	-	0	193	32	-	15	0
9.1. Crude petroleum and natural gas production	208	-	-	-	-	-	-	5	-	-	193	-	-	10	-
9.2. Coal mines	0	-	-	-	-	0	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	33	-	-	-	-	0	-	0	-	-	-	32	-	2	-
9.4. Pumping storage power plants	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-
9.5. Hydro electric power plants	2	-	-	-	-	0	0	0	-	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	0	-	0	-	0	-	-	-	0	0
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Consumption for non-energy purposes	67	-	-	-	-	-	0	0	1	41	25	-	-	-	-
11. Losses in transport and distribution	41	-	-	-	-	-	-	-	-	-	0	2	-	36	2
12. Statistical differences (7-8+1.2-9-10-11-13)	161	1	7	-	110	-7	3	27	-18	64	-26	-	-	-0	-
13. Net domestic consumption	799	16	24	44	-	67	36	165	15	9	11	17	-	387	9
14. Manufacturing, mining and quarrying	290	16	24	17	-	-	0	11	11	7	9	16	-	177	1
14.1. Mining and quarrying	4	-	-	0	-	-	0	2	0	0	0	0	-	2	0
14.2. Manufacture of paper and paper products	39	-	-	12	-	-	-	0	6	0	0	-	-	21	0
14.3. Manufacture of industrial chemicals	55	3	2	0	-	-	-	0	2	3	5	15	-	25	0
14.4. Manufacture of iron, steel and ferro alloys	31	8	8	-	-	-	0	0	-	0	0	0	-	15	0
14.5. Manufacture of aluminium and other non-ferrous metals	95	-	6	-	-	-	-	0	-	1	2	-	-	85	0
14.6. Other manufacturing industries	65	6	7	5	-	-	0	8	3	4	2	0	-	30	1
15. Transport	214	-	-	-	-	66	31	110	4	0	0	-	-	3	-
15.1. Railways and subways	3	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	31	-	-	-	-	0	31	-	-	-	-	-	-	0	-
15.3. Road transport	147	-	-	-	-	64	-	83	-	0	0	-	-	-	-
15.4. Coastal shipping	33	-	-	-	-	2	-	27	4	-	0	-	-	0	-
16. Other sectors	296	0	0	27	-	1	5	43	1	2	1	1	-	207	8
16.1. Fishing	18	-	-	-	-	0	0	17	0	-	-	-	-	1	-
16.2. Agriculture	14	-	-	0	-	0	0	6	0	0	1	-	-	7	0
16.3. Households	160	0	0	27	-	1	4	4	-	1	0	-	-	121	2
16.4. Other consumers	103	-	-	0	-	0	0	15	0	1	1	1	-	79	7

Energy balance **2007**

PJ

	Total	Coal	Coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy	Electricity	District heating
1.1. Production of primary energy bearers	9 494	112	-	52	4 604	144	-	-	-	335	3 674	-	573	-	-
2. Imports	256	17	25	1	61	15	8	35	68	5	-	-	-	19	-
3. Exports	8 457	95	1	0	4 115	326	10	127	83	239	3 406	-	-	55	-
4. Bunkering	27	-	-	-	-	-	-	16	11	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	20	-16	-0	-	37	0	-1	-0	-1	1	-	-	-	-	-
7. Net domestic supply (1.1+2-3-4+5)	1 286	19	24	53	587	-167	-2	-108	-27	102	268	-	573	-36	-
8. Energy converted	1 306	1	2	10	602	48	2	7	54	1	4	0	573	3	0
8.1. In blast furnaces	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	713	-	-	-	602	48	2	5	54	1	-	-	-	-	-
8.3. In thermal power plants	5	-	-	1	-	-	-	0	-	-	3	-	-	-	-
8.4. In dual purpose power plants	4	1	-	4	-	-	-	0	-	-	-	-	-	-	-
8.5. In district heating plants	10	-	-	6	-	-	-	1	-	0	1	0	-	3	0
8.6. In hydropower plants	573	-	-	-	-	-	-	-	-	-	-	-	573	-	-
1.2. Production of derived energy bearers	1 254	-	7	-	-	249	37	301	86	19	-	46	-	496	13
9. Consumption by energy sector	279	-	-	-	-	0	0	6	-	0	220	31	-	23	0
9.1. Crude petroleum and natural gas production	236	-	-	-	-	-	-	6	-	-	220	-	-	11	-
9.2. Coal mines	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	33	-	-	-	-	0	-	0	-	-	-	31	-	2	-
9.4. Pumping storage power plants	6	-	-	-	-	-	-	-	-	-	-	-	-	6	-
9.5. Hydro electric power plants	4	-	-	-	-	0	0	0	-	-	-	-	-	4	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	0	-	0	-	0	-	-	-	0	0
9.9. Gas supply	0	-	-	-	-	-	-	-	-	-	0	-	-	-	-
10. Consumption for non-energy purposes	69	-	-	-	-	-	0	0	1	48	20	-	-	-	-
11. Losses in transport and distribution	41	-	-	-	-	-	-	-	-	-	1	2	-	36	2
12. Statistical differences (7-8+1.2-9-10-11-13)	30	0	5	-	-16	-30	-2	7	-9	63	11	-	-	0	0
13. Net domestic consumption	814	18	24	43	-	63	35	173	13	9	13	14	-	398	10
14. Manufacturing, mining and quarrying	286	18	24	18	-	-	0	11	8	7	9	13	-	176	1
14.1. Mining and quarrying	4	-	-	0	-	-	0	2	0	0	0	0	-	2	0
14.2. Manufacture of paper and paper products	38	-	-	13	-	-	-	0	4	0	0	-	-	21	0
14.3. Manufacture of industrial chemicals	53	3	2	1	-	-	-	0	2	2	4	13	-	26	0
14.4. Manufacture of iron, steel and ferro alloys	35	9	10	-	-	-	0	0	-	0	0	0	-	15	0
14.5. Manufacture of aluminium and other non-ferrous metals	91	-	5	-	-	-	-	0	0	1	2	-	-	82	0
14.6. Other manufacturing industries	65	6	7	5	-	-	0	8	3	4	2	0	-	30	1
15. Transport	225	-	-	-	-	62	31	122	5	0	2	-	-	3	-
15.1. Railways and subways	3	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	31	-	-	-	-	0	31	-	-	-	-	-	-	0	-
15.3. Road transport	153	-	-	-	-	61	-	93	-	0	0	-	-	-	-
15.4. Coastal shipping	37	-	-	-	-	2	-	28	5	-	2	-	-	0	-
16. Other sectors	303	0	0	25	-	1	4	40	0	2	1	1	-	220	9
16.1. Fishing	16	-	-	-	-	0	0	15	0	-	-	-	-	1	-
16.2. Agriculture	13	-	-	0	-	0	0	6	0	0	1	-	-	6	0
16.3. Households	163	0	0	24	-	1	3	4	-	1	0	-	-	127	2
16.4. Other consumers	111	-	-	1	-	0	0	15	0	1	1	1	-	86	7

Annex V: CO_2 capture and storage at Sleipner Vest Field – storage site characterisation, monitoring methodology and results

1. The reservoir's ability to store CO_2 over time

Key goals for geological CO_2 storage site selection and characterization are to; assess how much CO_2 can be stored at a potential storage site, demonstrate that the site is capable of meeting required storage performance criteria; and establish a baseline for the management and monitoring of the CO2 injection and storage.

Excess CO_2 from the Sleipner Vest Field is injected into the Utsira Formation at Sleipner Øst for storage. The Utsira Formation aquifer, which is located above the producing reservoirs at a depth of 800 – 1000 m below sea level, was chosen for CO_2 storage because of its large extension (which guarantees sufficient volume), and its excellent porosity and permeability (which is well suited for high injectivity). Furthermore, the formation is overlain by a thick, widespread sequence of Hordaland Group shales, which should act as an effective barrier to vertical CO_2 leakage, see figure below:

Figure 1 CO_2 capture from Sleipner Vest well stream and storage at Sleipner Øst
Source: Statoil

The Utsira formation has the following properties:

- Dome type of structure
- Large extension
- Thickness: 150 – 200 m

- Temp. = 37 degC, P = 104 bar (hydrostatic)
- Unconsolidated fine-grained sand
- High permeability (~ 2 D) and high porosity (35-40%)
- Homogeneous
- Water filled

It also contains several thin intercalated shale layers (1-1.5m), as well as a 5 m thick shaly interval about 20 m below the top.

In the Sleipner case it has been very important to locate the injection well and the storage site such that the injected CO_2 could not migrate back to the Sleipner A platform (SLA) and the production wells. This will both prevent corrosion problems in the production wells and minimise the risk of CO_2 leakage through production wells. The injection point is located 2.5 km east of the Sleipner A platform. Following is a figure illustrating the distance between the injection point and the Sleipner installation. Migration evaluations have been based on the Top Utsira map (figure below) with the CO_2 expected to migrate vertically to the sealing shales and horizontally along the saddle point of the structure. This will take the CO_2 away from other wells drilled from the Sleipner platform.

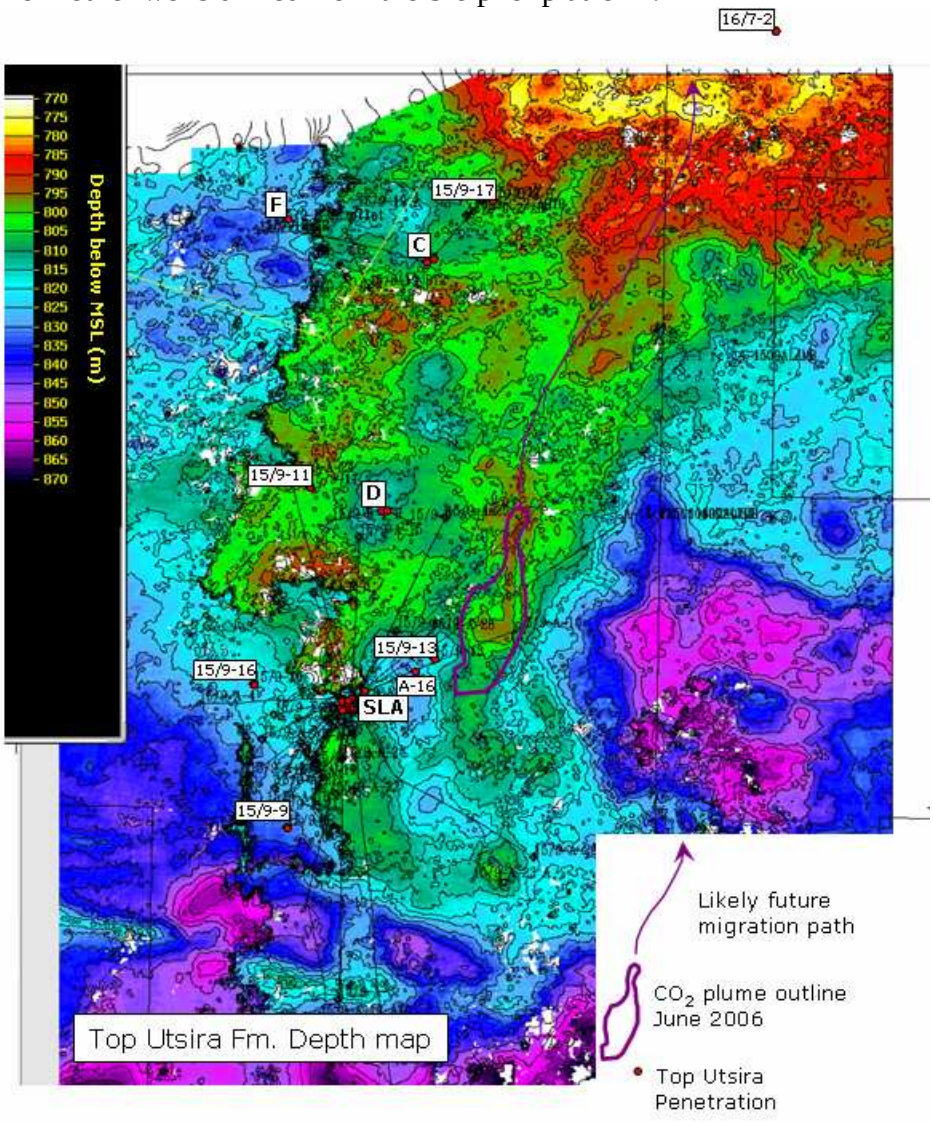


Figure 2 Position of CO_2 injection point and expected migration direction of CO_2

2. Applied methods for monitoring the injected CO_2:

a) 4D seismic monitoring:

- Baseline seismic survey was shot prior to injection in 1994.
- Repeat time lapse seismic monitoring have been acquired in 1999, 2001, 2002, 2004 and 2006

b) Gravimetric monitoring:

- Pre-installed 30 concrete benchmarks in 2002 across the CO_2 bubble
- Repeat survey 2005.

c) Pressure measurements:

The need for reservoir measurements of pressure and temperature in the injection well is being continuously evaluated. Up until now, these measurements have not been deemed critical.

d) Well monitoring, safety precautions (leakage):

The wells in the Sleipner area are plotted on a chart to indicate the positioning relative to the CO_2 injection well. The relative distances are given at the top of the Utsira formation. . The labels numbered "900" indicate where the wells are penetrating the 900 meter depth level (top of Utsira formation).

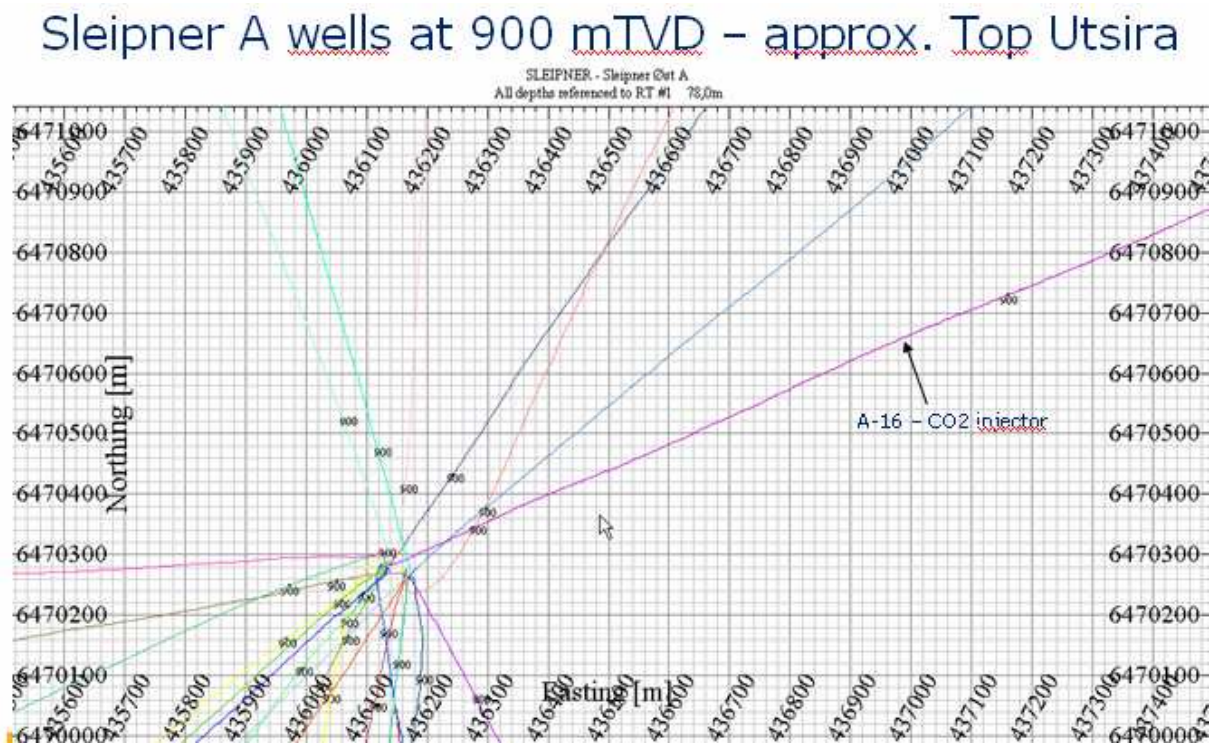


Figure 3 Positions of Sleipner production wells relative to the CO_2 injection well.

The figure shows that the distance from the CO_2 injection well to the closest neighbouring well is 1000 metres at top of the Utsira formation. Note that the extension of the CO_2 plume is found to be extending NE-SW from the injection point, based on seismic data, and that no production wells (other than the injector) are exposed to the CO_2 plume. This is in accordance with the simulations carried out for the injection on Sleipner.

The main well design at Utsira level:

- 18 5/8" casing set above Utsira Formation
- 13 3/8" casing through Utsira Formation
  - 13 Cr casing from 10 m MD below to 50 m MD above Utsira Formation
  - cemented into 18 5/8" casing

The material quality chosen for the casing through Utsira formation, increases the wells' resistance against CO_2 corrosion.

The reported amounts of CO_2 which are injected in the Utsira formation are based on continuous metering of the gas stream by orifice meter.

3. Results of the monitoring programme:

a) 4D seismic monitoring:

The stored CO_2 has been monitored using time lapse seismic to confirm its behaviour and evaluate

- whether any of it has migrated towards the Sleipner installations, potentially leading to corrosion problems for well casing, or
- whether any of it has leaked into the overburden seal, the ocean or the atmosphere

The results show that neither of these eventualities has occurred.

The seismic response to the CO_2 is remarkably clear and the bounding geometry of the plume is well defined, see figure below.

Several high-amplitude reflective horizons, which occur at various levels, are interpreted to arise from thin layers of high-saturation CO_2 trapped beneath the intercalated Utsira Formation shales.

There are no signs of CO_2 above the top of Utsira Formation.

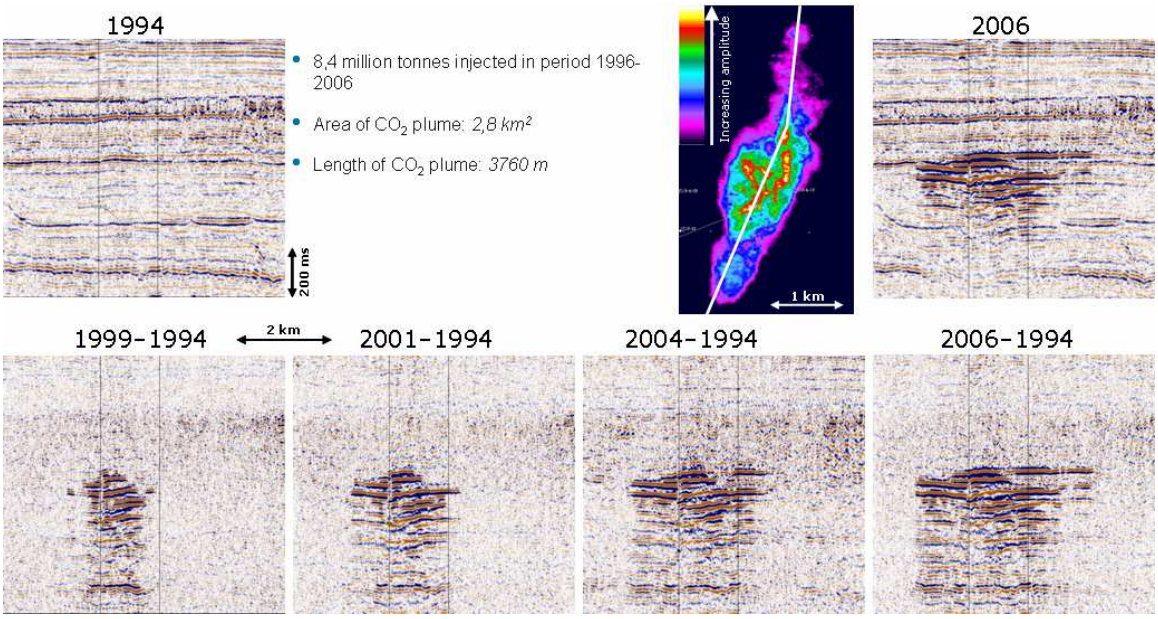


Figure 4 Results of seismic monitoring 1994 – 2006

The figure above is based on seismic data from 1994 – 2006.

Based on the seismic data, the extent of the CO_2 plume has been estimated. The figure below shows the CO_2 plume extension in the years 1999, 2001, 2002, 2004 and 2006.

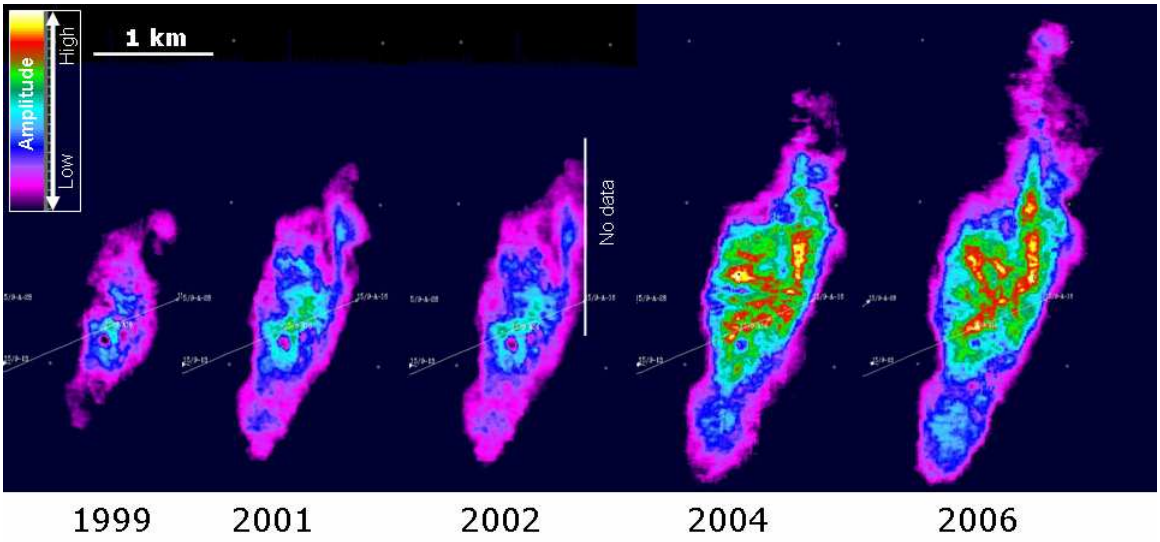


Figure 5 CO_2 plume extension in 1999, 2001, 2002, 2004 and 2006

The label "No data" in the above figure marks the eastern edge of the mapped area.

In 2004, after close to 7 million tonnes had been injected during the last eight years, the maximum lateral migration from the injection point was 1.5 km to the northeast, and the area of the CO_2 plume was about 2 km^2. Since the injection started, the plume has steadily grown, and has adopted a preferred NE-SW elongation, which is believed to be caused by the topography of the aquifer/cap rock interface and the inherent buoyancy of the injected CO_2 within the saline aquifer.

b) Gravimetric monitoring:

There is a large uncertainty on in-situ CO_2 density, related to temperature, which cannot be resolved by seismic measurements. CO_2 is close to critical point, and possible densities range from 0.2 to more than 0.7. The gravity data supports a low-density/high temperature CO_2 plume.

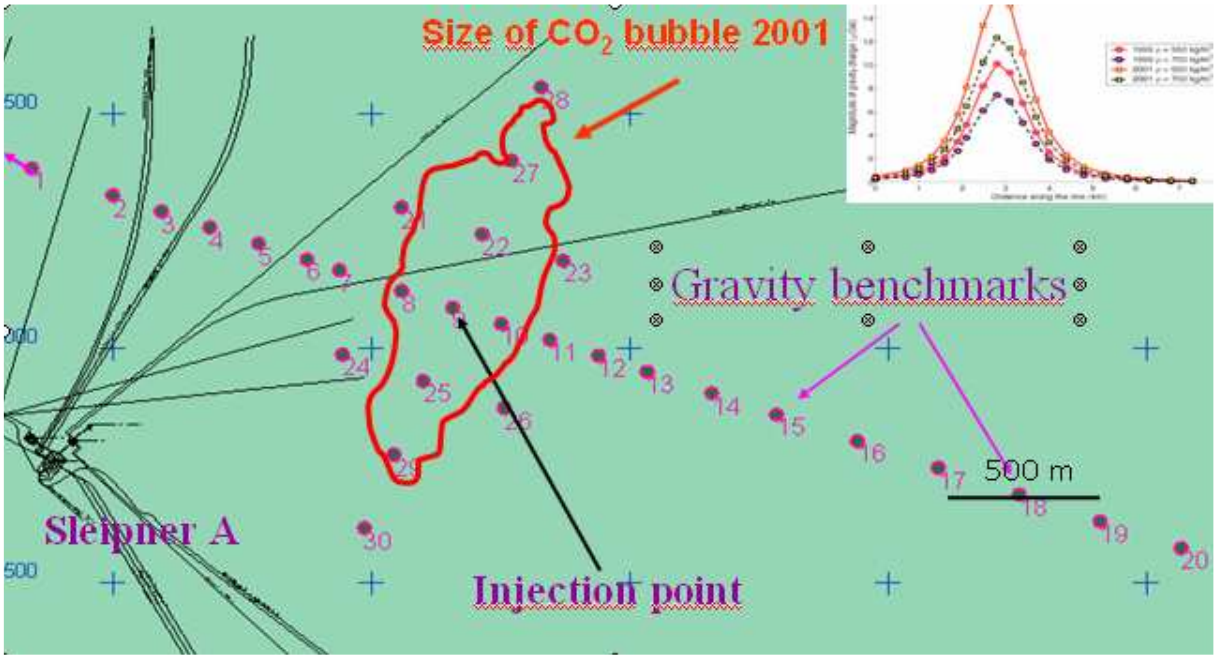


Figure 6 Gravimetric monitoring

c) Reservoir simulation:

Flow simulation models, which match the 4D seismic data reasonably well, have been used to predict the CO_2 behaviour. The figure below illustrates results from the simulation model.

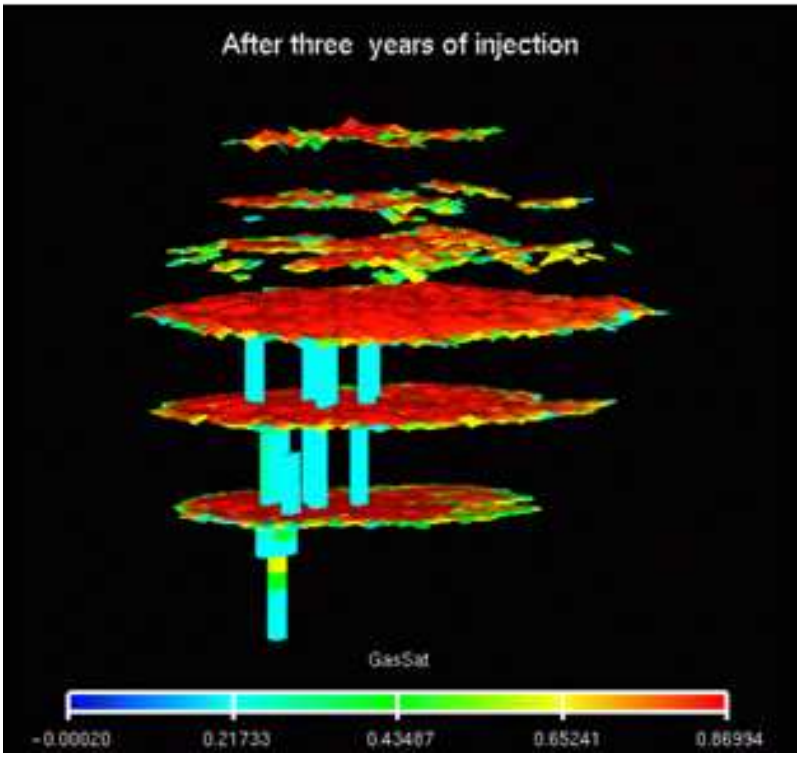


Figure 7 Flow simulation of CO_2

The results from the simulations indicate that cap rock shales provide a capillary seal for the CO_2 phase.

Dissolution of CO_2 from the gas cap into the underlying brine column will have a most pronounced effect. The brine on top of the column, which becomes enriched in CO_2, is denser than the brine below due to the special volumetric properties of the CO_2 – brine system. This instability could induce convection currents and enhance the dissolution of CO_2.

The following figure shows simulation results (seen from above) without taking into account the effect of CO_2 dissolution. This gives a conservative estimate of the extent of the CO_2 plume, as dissolution of the CO_2 will contribute to the CO_2 "sinking" inside the Utsira formation, thus reducing the size of the plume. The figure assumes stop of CO_2 injection after 25 years.

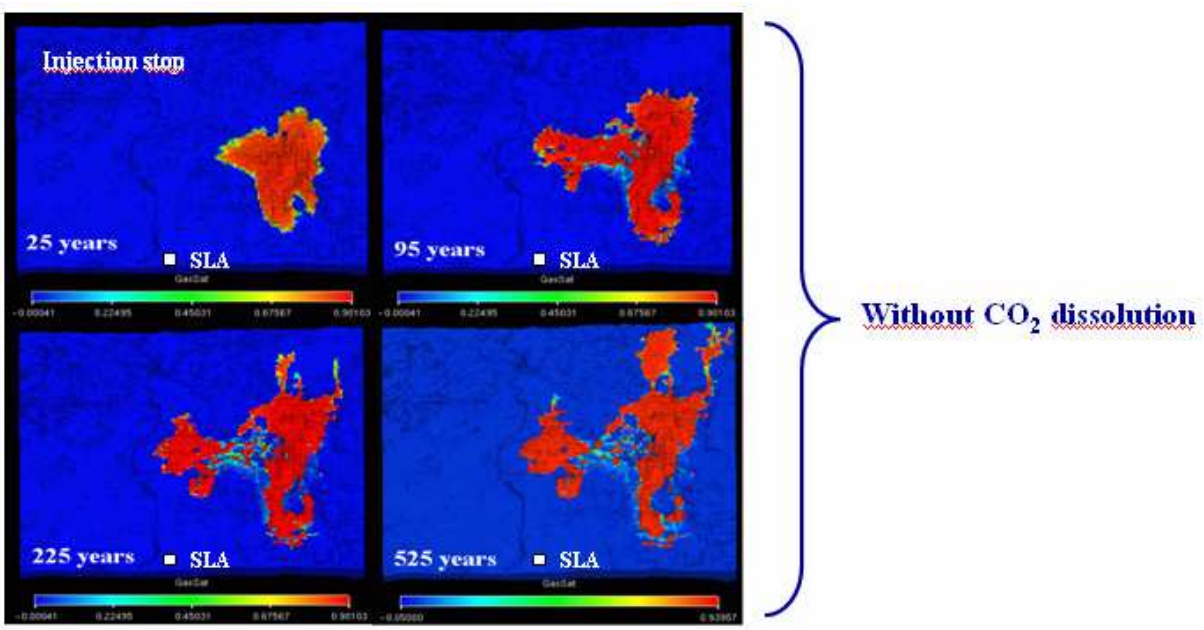


Figure 8

Dependent on the model parameters, most of the free CO_2 will have dissolved into the aquifer after between 5000 and 50000 years.

Note that the CO_2 migrates away from the SLA platform. The migration route is controlled by the topography of the Utsira Formation/cap rock interface. This means that no production wells on Sleipner are exposed too the CO_2 plume.

4. Injected and vented CO_2 volumes - the Sleipner fields:

Status 1.1.2007:

- 8.8 million tonnes CO_2 has been injected into the Utsira Formation
- 0.2 million tonnes CO_2 has been vented.

The following figure shows the yearly injected and vented volumes for the entire injection period on Sleipner.

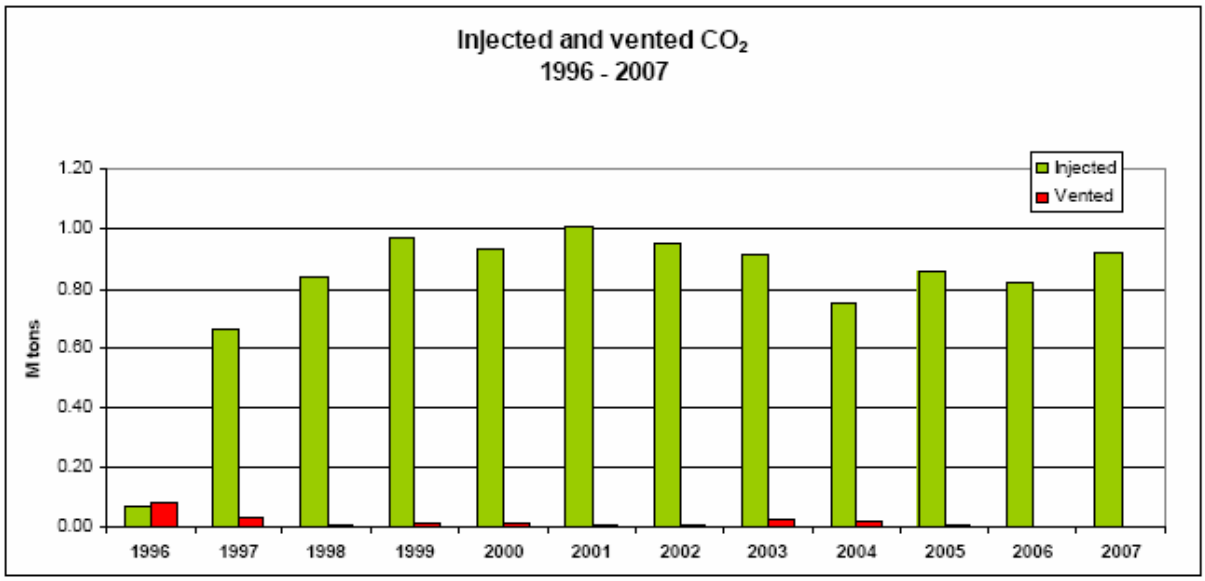


Figure 9 Injected and vented CO_2 at Sleipner Vest

5. Publications and conference presentations

Publications:

- Gale, J., Christensen, N. P., Cutler, A., & Torp, T.A., 2001: Demonstrating the Potential for Geological Storage of CO_2: The Sleipner and GESTCO Projects. Environmental Geosciences, 8 (3), 160 –165.
- Chadwick, A., Holloway, S. & Riley, N., 2001: Deep subsurface CO_2 sequestration - a viable greenhouse mitigation strategy. Geoscientist, vol 11, No 2, Feb 2001, 4-5.
- Zweigel, P. & Gale, J., 2000: Storing CO_2 underground shows promising results.- EOS, Transactions, American Geophysical Union, 81 (45), 529 & 534. (Reprinted with added figure in Earth in Space, 13 (6), 8-9.)
- Carstens, H. (& Torp, T.), 2000: Send CO2 tilbake til undergrunnen. GEO, 3, (6), 12-15.
- Zweigel, P., Lindeberg, E., & Eiken, O., 2000: 4D seismikk løser gåten. GEO, 3, (6), 16-18.

Conference presentations:

Greenhouse Gas Technology-8, Trondheim:

- Nooner et al. (in press, 2006): Constraining the density of CO2 within the Utsira formation using time-lapse gravity measurements. Extended abstract.

Offshore Europe, SPE conference 6-9 september 2005, Aberdeen, Scotland:

- Hansen, H.,Eiken, O. and Aasum, T.O, 2005: Tracing the path of the carbondioxide from a gas-condensate reservoir, through an amine plant and back into a subsurface acquifer. Case study: The Sleipner area, Norwegian North Sea

2nd Annual Conference on Carbon Sequestration, 5-8 May 2003, Alexandria, VA, US:

- Gaus, I., Azarounal, M., & Czernichowski-Lauriol, I., 2003: Reactive transport modeling of dissolved CO2 in the cap rock base during CO2 sequestration (Sleipner site, North Sea). Abstracts of the 2nd Annual Conference on Carbon Sequestration, 5-8 May 2003, Alexandria, VA, US.

6th Greenhouse Gas Control Technologies Conference (GHGT6), October 2003, Kyoto:

- Arts; R., Eiken, O., Chadwick, A., Zweigel, P., van der Meer, L., & Zinszner, B., 2002: Monitoring of CO2 Injected at Sleipner Using Time Lapse Seismic Data. Abstracts of the 6th International conference on Greenhouse Gas Control Technology (GHGT-6), Kyoto, Japan, 1-4 October 2002

- Chadwick, A., Zweigel, P., Gregersen, U., Kirby, G., & Johannessen, P., 2002: Geological Characterisation of CO2 Storage Sites: Lessons from the Sleipner, Northern North Sea. Abstracts of the 6th International conference on Greenhouse Gas Control Technology (GHGT-6), Kyoto, Japan, 1-4 October 2002

- Czernichowski-Lauriol, C.A. Rochelle, E. Brosse, N. Springer, K. Bateman, C. Kervevan, J.M. Pearce, B. Sanjuan, 2002: Reactivity of injected CO_2 with the Utsira Sand reservoir at Sleipner. Abstracts of the 6th International conference on Greenhouse Gas Control Technology (GHGT-6), Kyoto, Japan, 1-4 October 2002, p 341.

- Lindeberg, E., Bergmo, P., & Moen, A., 2002: The Long-term Fate of CO2 Injected into an Aquifer. Abstracts of the 6th International conference on Greenhouse Gas Control Technology (GHGT-6), Kyoto, Japan, 1-4 October 2002. Short abstract. Extended abstract

- Torp, T.A. & Gale, J. 2002: Demonstrating Storage of CO2 in Geological Reservoirs: The Sleipner and Sacs Projects. Abstracts of the 6th International conference on Greenhouse Gas Control Technology (GHGT-6), Kyoto, Japan, 1-4 October 2002

EAGE Annual meeting 2002, Florence:

- Arts, R., Elsayed, R., van der Meer, L., Eiken, O., Østmo, S., Chadwick, A., Kirby, G., Zinszner, B., 2002: Estimation of the mass of injected CO2 at Sleipner using time-lapse seismic data. EAGE, Annual meeting 2002, Florence, Italy.

Geological Society of London, '3D Seismic Data: Advances in the Understanding of Stratigraphic and Structural Architecture' conference, 14-16 November 2001

- Chadwick, A., Williamson, P., Zweigel, P., Arts, R., Eiken, O., 2001: Time-lapse geophysical monotoring of a subsurface CO2 bubble in the Utsira Sand, Sleipner, northgern North Sea. Presentation at '3D Seismic Data: Advances in the Understanding of Stratigraphic and Structural Architecture' conferece at the Geological Society of London, Burlington House, 14-16 November 2001.

American Association of Petroleum Geologists (AAPG), Annual Meeting, June 2001, Denver

- Eiken, O., Brevik, I., Art, R., Lindeberg, E., Fagervik, K. 2001: Seismic monitoring of CO2 injected into a marine aquifer. American Association of Petroleum Geologists, Annual Meeting, June 2001, Denver, abstract volume.

- Zweigel, P., Arts, R., Bidstrup, T., Chadwick, A., Eiken, O., Gregersen, U., Hamborg, M., Johanessen, P., Kirby, G., Kristensen, L., & Lindeberg, E., 2001: Results and experiences from the first Industrial-scale underground CO_2 sequestration case (Sleipner Field, North Sea). American Association of Petroleum Geologists, Annual Meeting, June 2001, Denver, abstract volume (CD) 6p.

European Union of Geosciences (EUG), XI meeting, April 2001, Strasbourg

- Chadwick, A., Kirby,G., Holloway, S., Zweigel, P., & Arts, R. 2001: The case for underground carbon dioxide sequestration in Northern Europe.- European Union of Geosciences, XI meeting, April 2001, Strasbourg, Abstract volume, 172.
- Czernichowski-Lauriol, I., Rochelle, C.A., Brosse, E., Springer, N., Pearce, J.M., Bateman, K.A., Sanjuan, B., Kervévan, C., 2001: Disposal of CO2 in deep aquifers: geochemical investigations of water-rock-CO2 interactions at Sleipner (North Sea) as part of the SACS project. European Union of Geosciences, XI meeting, April 2001, Strasbourg, Abstract volume, 172.

5th Greenhouse Gas Control Technologies Conference (GHGT5), August 2000, Cairns

- Arts, R., Brevik, I., Eiken, O., Sollie, R., Causse, E., & van der Meer, B. 2000b: Geophysical methods for monitoring marine aquifer CO_2 storage - Sleipner experiences. 5th International Conference on Greenhouse Gas Control Technologies, Cairns (Australia), August 2000. (PDF 922 KB / 6 pages)

- Chadwick, R.A., Holloway, S., Kirby, G.A., Gregersen, U., & Johannessen, P.N. 2000: The Utsira Sand, Central North Sea - An assessment of its potential for regional CO_2 disposal. 5th International Conference on Greenhouse Gas Control Technologies, Cairns (Australia), August 2000. (PDF 446 KB / 6 pages)

- Lindeberg, E., Zweigel, P., Bergmo, P., Ghaderi, A., & Lothe, A. 2000b: Prediction of CO_2 dispersal pattern improved by geology and reservoir simulation and verified by time lapse seismic. 5th International Conference on Greenhouse Gas Control Technologies, Cairns (Australia), August 2000. (PDF 91 KB / 6 pages)

- Pearce, J.M., Czernichowski-Lauriol, I., Rochelle, C.A., Springer, N., Brosse, E., Sanjuan, B., Bateman, K., & Lanini, S. 2000: How will reservoir and caprock react with injected CO_2 at Sleipner? Preliminary evidence from experimental investigations. 5th International Conference on Greenhouse Gas Control Technologies, Cairns (Australia), August 2000. (PDF 14 KB / 6 pages)

- Van der Meer, L.G.H., Arts, R.A., & Paterson, L. (2000): Prediction of migration of CO_2 after injection in a saline aquifer: reservoir history matching of a 4D seismic image with a compositional gas/water model. 5th International Conference on Greenhouse Gas Control Technologies, Cairns (Australia), August 2000. (PDF 14 KB / 6 pages)

- Zweigel, P., Hamborg, M., Arts, R., Lothe A., & Tømmerås, A. 2000: Prediction of migration of CO_2 injected into an underground depository: Reservoir geology and migration modelling in the Sleipner case (North Sea). 5th International Conference on Greenhouse Gas Control Technologies, Cairns (Australia), August 2000. (PDF 1170 KB / 6 pages)

SEG International Conference 2000, Calgary

- Eiken, O., Brevik, I., Arts. R., Lindeberg, E., & Fagervik, K. 2000: Seismic monitoring of CO2 injected into a marine aquifer. SEG Calgary 2000 International conference and 70th Annual meeting, Calgary. (PDF 208 KB / 4 pages)

EAGE Annual Meeting 2000, Glasgow

- Arts, R. J., Zweigel, P., & Lothe, A.E. 2000a: Reservoir geology of the Utsira Sand in the Southern Viking Graben area – a site for potential CO2 storage.- 62nd EAGE meeting, Glasgow, paper B-20. (PDF 269 KB / 4 pages)
- Brevik, I., Eiken, O., Arts, R.J., Lindeberg, E., & Causse E. 2000: Expectations and results from seismic monitoring of CO2 injection into a marine acquifer. 62nd EAGE meeting, Glasgow, paper B-21.
- Gregersen, U, Johannessen, P.N., Chadwick, R.A., Holloway, S. & Kirby, G.A. 2000: Regional study of the Neogene deposits in the southern Viking Graben area - a site for potential CO_2 storage. 62nd EAGE meeting, Glasgow. (PDF 123 KB / 4 pages)

AAPG Int'l Conf. & Exhib. 1999, Birmingham

- Zweigel, P., Lothe, A. E., & Lindeberg, E., 1999: Offshore underground CO2-disposal: Reservoir geology of the Neogene Utsira Formation, Sleipner Field, North Sea.- AAPG Bull., 83, 1346-1347. (Poster at AAPG International Conference, Birmingham, UK, September 1999)

From CO2STORE project:

Title: Sleipner/Utsira CO2 Geological Storage Full Field Flow and Geochemical Coupling to Assess the Long Term Fate of the CO2
Authors: Frangeul, Johann, Long Nghiem, Emmanuel Caroli, Sylvain Thibeau
Conference: AAPG Annual Meeting, Dallas USA, April 18-21, 2004
Publication: AAPG Bulletin Vol. 88 (2004), No. 13 (Supplement)
Abstract: available at AAPG
Website:http://www.searchanddiscovery.com/documents/abstracts/annual2004/Dallas/Frangeu.htm

From Saline Aquifer CO_2 Storage (SACS) project:

Geology

- Rock mechanical tests of shale samples from the cap rock of the Utsira Sand in well 15/9-A11 – A contribution to the Saline Aquifer CO2 Storage (SACS) project. Pillitteri et al. 2003. (PDF 1.7MB)
- Seismic mapping and simulation of CO2 migration in the upper Utsira sand wedge east of the Sleipner injection site – A contribution to the Saline Aquifer CO2 Storage (SACS) project. Hamborg et al. 2003. (PDF 1.4MB)
- Studies on the likelihood for caprock fracturing in the Sleipner CO2 injection case – A contribution to the Saline Aquifer CO2 Storage (SACS) project. Zweigel & Heill 2003. (PDF 2.0MB)
- The effect of time-depth conversion procedure on key seismic horizons relevant for underground CO2 storage in the Sleipner field (North Sea). Zweigel & Hamborg 2002. (PDF 2.6 MB).
- SACS, Task 1.4: Evaluation of cap rock sealing the reservoir. Clay mineralogy investigation of core and cuttings from the Ekofisk and Sleipner areas. Lindgren et al. 2002. (PDF 513 KB).
- Characterisation of the Nordland Shale in the Sleipner area by XRD analysis - A contribution to the Saline Aquifer CO2 Storage (SACS) project. Bøe, R., & Zweigel, P. (Feb. 2001). (PDF 547 KB)
- Reservoir geology of the storage units in the Sleipner CO2 injection case. Zweigel et al (Dec 2000). (ZIP 13.5 MB). Main report only. (PDF 7926 KB)
- Mineralogical and petrographical characterisation of a 1 m core from the Utsira Formation, Central North Sea. Pearce, J.M., Kemp, S.J., and Wetton, P.D., 1999. BGS Technical Report - Mineralogy & Petrology Series, Report WG/99/24C, 26pp. + 3 plates. (ZIP 23562 KB)
- The biostratigraphical and palaeo-ecological application of calcareous microfaunas from the Utsira Formation in Norwegian Well 15/9-A-23. Wilkinson, I. P., 1999. BGS Technical Report – Stratigraphy Series, Report WH/99/124R, 4pp. (PDF 29 KB / 4 pages)

Geochemistry

- Preliminary modelling of the geochemical impact of CO_2 injection on the caprock at Sleipner. Gaus et al. 2002. (PDF 254 KB)
- The solubility of supercritical CO_2 into pure water and synthetic Utsira porewater. Rochelle & Moore 2002. (PDF 1.7 MB)
- Geochemical interactions between supercritical CO_2 and the Utsira Formation: an experimental study. Rochelle et al. 2002. (PDF 4.5 MB)

Geophysics

- Multi-component seismic monitoring of CO2 gas cloud in the Utsira Sand: A feasibility study (Report Work Area 5.6) . Liu et al. (April 2001). (PDF 1586 KB)

Annex VI: National Greenhouse Gas Inventory System in Norway

Oslo, November 2006

Preface

According to the decision on Article 5.1 of the Kyoto Protocol all Annex 1 parties (industrialized countries) must implement a national system for greenhouse gas inventories, which includes (see Annex to decision 19/CMP.1):

> "*all institutional, legal and procedural arrangements made within a Party included in Annex I [to the Kyoto Protocol] for estimating anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and for reporting and archiving inventory information*"

A description of this national system must be reported as part of a country's Initial Report to the Kyoto Protocol, see decision 13/CMP.1. The purpose of the Initial Report is to facilitate calculation of assigned amount and demonstrate the capacity to account for emissions, removals and assigned amount. The Initial Report must be submitted to the Climate Convention before 1 January 2007. The report on the national system for greenhouse gas inventories will be attached to this Initial Report as an appendix.

The report on national system for greenhouse gas inventories has been prepared by a project team consisting of representatives from Norwegian Pollution Control Authority (SFT), Statistics Norway (SSB), the Center for International Climate and Environmental Research – Oslo (CICERO) and The Norwegian Forest and Landscape Institute.

Introduction

A national system for greenhouse gas inventories is introduced in Article 5.1 of the Kyoto Protocol. The objectives of the national system are[3]:

- To enable Annex I Parties to estimate anthropogenic greenhouse gas (GHG) emissions by sources and removals by sinks in accordance with the Kyoto Protocol and decisions made by the Parties
- To assist Annex I Parties in meeting their commitments
- To facilitate review of the submitted information
- To assist Annex I Parties to ensure and improve the quality of their inventories

The Guidelines for national systems are defined in the Annex to COP[4]/MOP[5] decisions 20/CP.7 and 19/CMP.1 (FCCC/CP/2001/13/Add.3). These guidelines describe various functions that need to be in place in the national system, but leave the details of implementation to each Party in accordance with their national circumstances.

[3] Annex to COP decision 20/CP.7 and COP/MOP decision 19/CMP.1 "Guidelines for national systems for the estimation of anthropogenic greenhouse gas emissions by sources and removals by sinks under Article 5, paragraph 1, of the Kyoto Protocol" here called "guidelines for national systems".

[4] Conference of the Parties to the United Nations Framework Convention on Climate Change.

[5] Meeting of Parties to the Kyoto Protocol.

The functions are described as *general and specific* functions.

The general functions include:

- Establishing and maintaining *institutional, legal and procedural arrangements* necessary to perform the functions defined in the guidelines for national systems.
- Ensuring s*ufficient capacity* for timely performance of the functions defined in the guidelines, including data collection and arrangements for technical competence of the staff involved in the inventory development process.
- *Preparing national greenhouse gas inventories* and supplementary information *in a timely manne*r in accordance with the Kyoto Protocol and relevant decisions by the Parties.
- Providing information necessary to meet the *reporting requirements*.

The specific functions include:

Planning

- Designate a single *national entity*.
- Define and allocate s*pecific responsibilities* in the inventory preparation and development process including methodological choice, data collection, processing and archiving, and quality assurance and quality control (QA/QC).
- Elaborate a *QA/QC plan* describing specific QA/QC procedures to be implemented during the inventory preparation and development process, facilitate the overall QA/QC procedures to be conducted, and establish data quality objectives.
- Establish a process for the *official consideration* and approval of the greenhouse gas inventory, including recalculations, prior to submission, and to respond to any issues raised by the inventory review process.

Preparation

- Identify *key categories*
- Prepare estimates in accordance with the Revised 1996 Guidelines and the good practice guidance
- Collect sufficient data (activity data and emission factors) to support the selected methods
- Make a qualitative estimate of inventory uncertainty
- Ensure that recalculations of previously submitted estimates are made in accordance with the good practice guidance
- Compile the national inventory
- Implement general QC procedures
- Consider source-specific QC procedures and provide for a basic review of the inventory of personnel that have not been included in the inventory development.

Management

- Archive information for each year in accordance with relevant decisions.
- Provide a review team with access to archived information used by the Party
- Respond to requests for clarifying inventory information resulting from different stages of the review process in a timely manner.

Good practice is in the guidelines for national systems defined as *a set of procedures intended to ensure that greenhouse gas inventories are accurate in the sense that they are systematically neither over- nor underestimates as far as can be judged, and that uncertainties are reduced as far as possible.* Guidance on preparing greenhouse gas inventories is given in the 1996 IPCC Revised Guidelines for Inventory Preparation (IPCC, 1996) and the IPCC Good Practice Guidance for Uncertainty Management in National Greenhouse Gas Inventories from 2000 (IPCC, 2000). The most extensive guidelines on QA/QC and resource prioritization are given in the latter report, which in this document is referred to as the "good practice guidance". For the land use, land-use change and forestry (LULUCF) sector, the IPCC has prepared a supplementary good practice report in 2004 (IPCC, 2004).

The Parties to the UN Framework Convention on Climate Change (UNFCCC) have agreed on guidelines for reporting data on emissions and removals, building on the guidance described in the IPCC reports listed in the previous paragraph.[6] Data are to be reported annually before April 15 to the UNFCCC. Reporting includes tables (using the so-called Common Reporting Format (CRF)), the National Inventory Report (NIR) describing data, methodologies and the main results of the inventory and additional documentation. For LULUCF, reporting under the Kyoto Protocol will be different from that under the UNFCCC.

This report will describe how the functions required for the national system will be implemented in Norway.

National responsibilities

General overview

The Norwegian national system for greenhouse gas inventories is based on existing cooperation. The National entity, SFT, and Statistics Norway and the Norwegian Forest and Landscape Institute are the core institutions in the national system.
The Norwegian greenhouse gas inventory has been produced in more than two decades as a collaboration between Statistics Norway (SSB) and the Norwegian Pollution Control Authority (SFT). The reporting to the UNFCCC has been based on this greenhouse gas inventory.
Statistics Norway is responsible for the official statistics on emissions to air.
The Norwegian Forest and Landscape Institute is responsible for the calculations of emission and removals from Land Use and Land Use Change and Forestry - LULUCF.

Legal basis

The data collection and data management is secured through three main acts, the Pollution Control Act (forurensningsloven), the Greenhouse Gas Emission Trading Act (klimakvoteloven) and the Statistical Act (statistikkloven).
The *Pollution Control Act* gives SFT the authority to collect and review emission data from large industrial plants (http://odin.dep.no/md/engelsk/regelverk/lover/022051-200014/dok-bn.html). Greenhouse gases are considered part of the Air Pollution Act. The Pollution Control Act is a typical enabling act. This means that the details in each case are outlined in discharge permits and regulations issued by the pollution control authorities. The Act was

[6] Guidelines for National Communications by Parties included in Annex I to the Convention, Part I: UNFCCC Reporting Guidelines on Annual Inventories. FCCC/CP/2002/7/Add.2.

established for the purpose of preventing and reducing harm and nuisance from pollution. This is reflected in the main rule of the act, which says that pollution is forbidden, unless it is specifically permitted by law, regulations or individual permits. Particular relevant extracts of this act for the national system are shown in Annex 1.
Collection and checking of GHG emission data are also covered by the *Greenhouse Gas Emission Trading Act* (http://odin.dep.no/md/english/doc/regelverk/acts/022051-200015/dok-bn.html). Chapter 4 of this act addresses reporting and control. The relevant extract is shown in Annex 2. The implementation rules are stipulated in a regulation (in Norwegian only). An explanation of this regulation is given in Annex 3.

Statistics Norway is a professional independent institution, which through The Statistics Act has been given the right to impose upon any person, firm or governmental institution an obligation to provide information necessary for the production of official statistics. The Statistics Act gives Statistics Norway unlimited access to administrative registers and to choose the statistical methods which form the basis for the preparation of official statistics. Statistics Norway is responsible for how and when official statistics are published. The Ministry of Finance is administratively responsible for Statistics Norway, and fiscal budget for its business is set by the Government and the Norwegian parliament.

The parts of the Statistics Act most relevant for the national system are shown in Annex 4.

SFT's responsibilities as national entity

SFT has been appointed by the Ministry of the Environment as the national entity through the budget proposition to the Norwegian parliament (Stortinget) for 2006, which states that "*The Norwegian system will build on existing cooperation between SFT and i.a. Statistics Norway. On this background SFT is appointed as a national entity with overall responsibility for the inventory and reporting*". (St. prop. Nr. 1 (2005-2006)). This point of the proposition has been accepted by the Norwegian parliament without any remarks. The Ministry of the Environment proposes building the national system around well-established institutional cooperation.

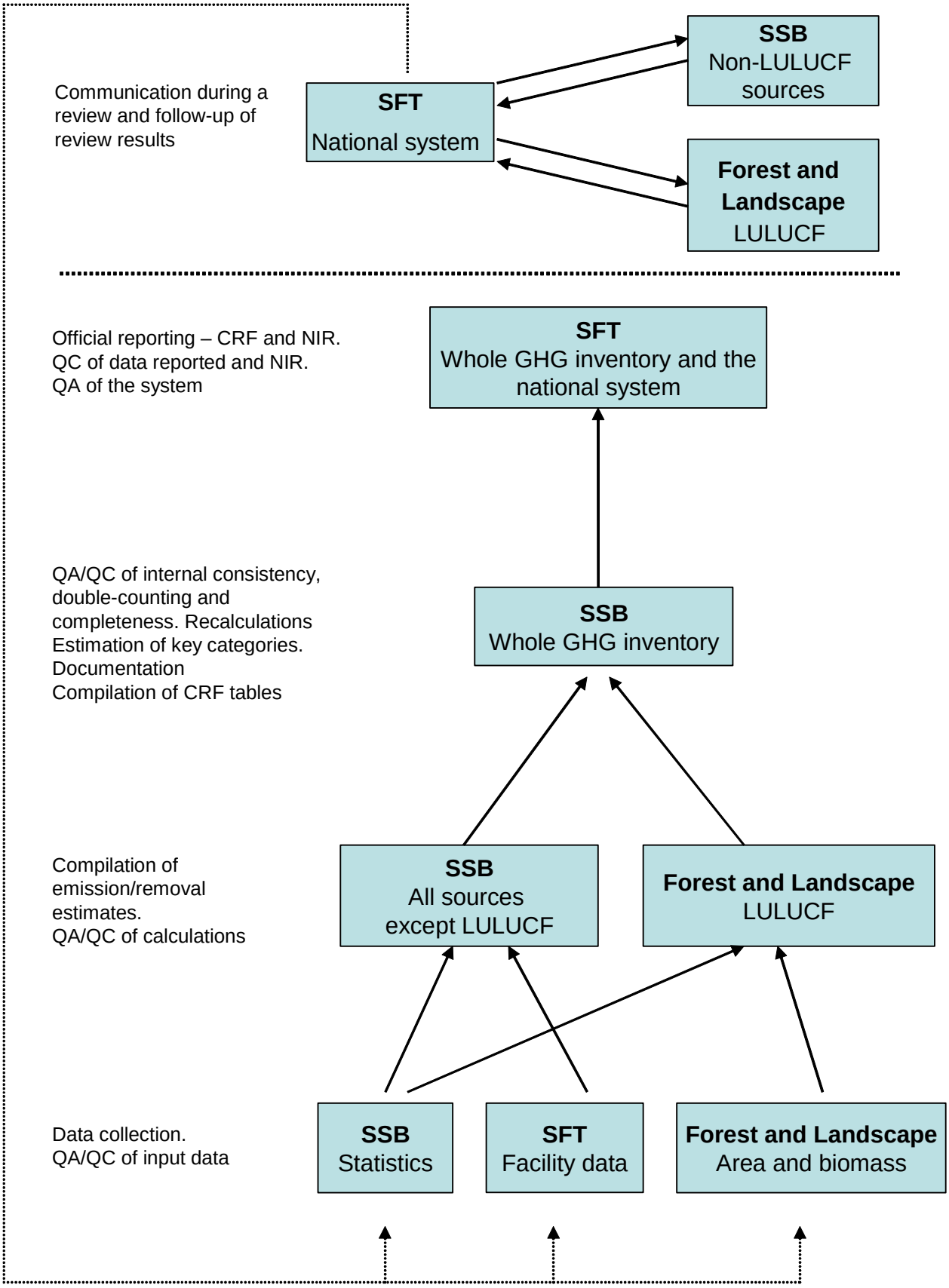
SFT as a national entity will be responsible for

- Reporting the greenhouse gas inventory to the UNFCCC, including the National Inventory report and CRF tables
- Completing the National Inventory report
- Implementation of the QA/QC plan
- Preparing for UNFCCC inventory reviews and coordinating the communication with the expert review team, including responses to review findings
- Coordinating the cooperative work between the core institutions, including the establishment of formal agreements
- Informing the cooperating institutions about relevant decisions and meetings
- Informing national institutions (e.g. ministries and data providers) about the requirements of the national system and ensuring that existing information in national institutions is considered and used in the inventory where appropriate
- Working to secure adequate funding for all parts of the national system in collaboration with the Ministry of the Environment, The Ministry of Agriculture and Food and the Ministry of Finance.

Institutional cooperation, responsibilities and agreements

The three core institutions, SFT, Statistics Norway and The Norwegian Forest and Landscape Institute, will work together to fulfill the requirements for the national system. The allocation of responsibilities for producing estimates of emissions and removals, QA/QC and archiving is presented in chapter 3, 4 and 5. An overview is shown in Figure 1.

Figure 1. Overview of institutional responsibilities and cooperation



To ensure that the institutions comply with their responsibilities, Statistics Norway and The Norwegian Forest and Landscape Institute have signed agreements with SFT as a national entity. The Forest and Landscape Institute's obligations will also be guided by the annual allotment letter (*tildelingsbrev*) from the Ministry of Agriculture and food. Through these agreements, the institutions are committed to implementing the QA/QC and archiving procedures, providing documentation, making information available for review, and delivering data and information in a timely manner to meet the deadline for reporting to the UNFCCC.[7]

The establishment of the national system requires close collaboration between the three institutions. Two annual cooperation meetings have been formalized.[8] SFT as a national entity is responsible for preparing, organizing and reporting from these meetings. The purpose of the cooperation meetings is to discuss and agree on methodological issues, prioritize resources (e.g. in light of the review reports) and generally facilitate the implementation of the national system. The cooperation meeting takes decisions collectively.

More specifically the cooperation meetings will

- Prepare for the annual review and address comments received
- Agree on methodological changes in light of review reports, QA/QC findings, new scientific information and available resources
- Agree to implement new data into the inventory
- Agree to recalculations and appropriate methodologies
- Prioritize source-specific QC and methodology studies to improve the estimates in the short and long-term
- Prioritize and interpret QA-procedures
- Review documentation and QA/QC and archiving systems and point out needs for improvements
- Address other relevant technical issues
- Point out weaknesses in capacity
- Point out problems with the implementation of the national systems (institutional and overall)
- Exchange relevant information
- Report the conclusions from the meetings and flag issues for follow-up to the responsible heads of departments in the three institutions

The key data providers are shown in Annex 5. As can be seen, most of the key data are collected by the three core institutions. Additional key data providers include the Norwegian Petroleum Directorate, the Norwegian Petroleum Industry Association, and the Norwegian Road Federation.

Official consideration and approval of the inventory

[7] The agreement between SFT and Statistics Norway also includes commitments for data deliveries for reporting under the Convention on Long-range Transboundary Air Pollution (LRTAP).

[8] A proposal has been made to have one meeting in the early autumn and another in January/February. Extraordinary meetings may be held as needed.

SFT as the national entity is in charge of approving the inventory before official submission to the UNFCCC. As a basis for approving the inventory, SFT will consider the completion of the inventory and the National Inventory Report. SFT will also review

- The QA/QC report from the QA/QC responsible in SFT, attaching QA/QC reports from the core institutions
- Methodological changes and recalculations
- Minutes from the cooperation meetings between the institutions
- Other matters of relevance for the approval of the inventory

Inventory production plan

The core institutions have agreed on a "milestone" production plan (Table 1). The plan will be supplemented by internal production plans in the three core institutions.

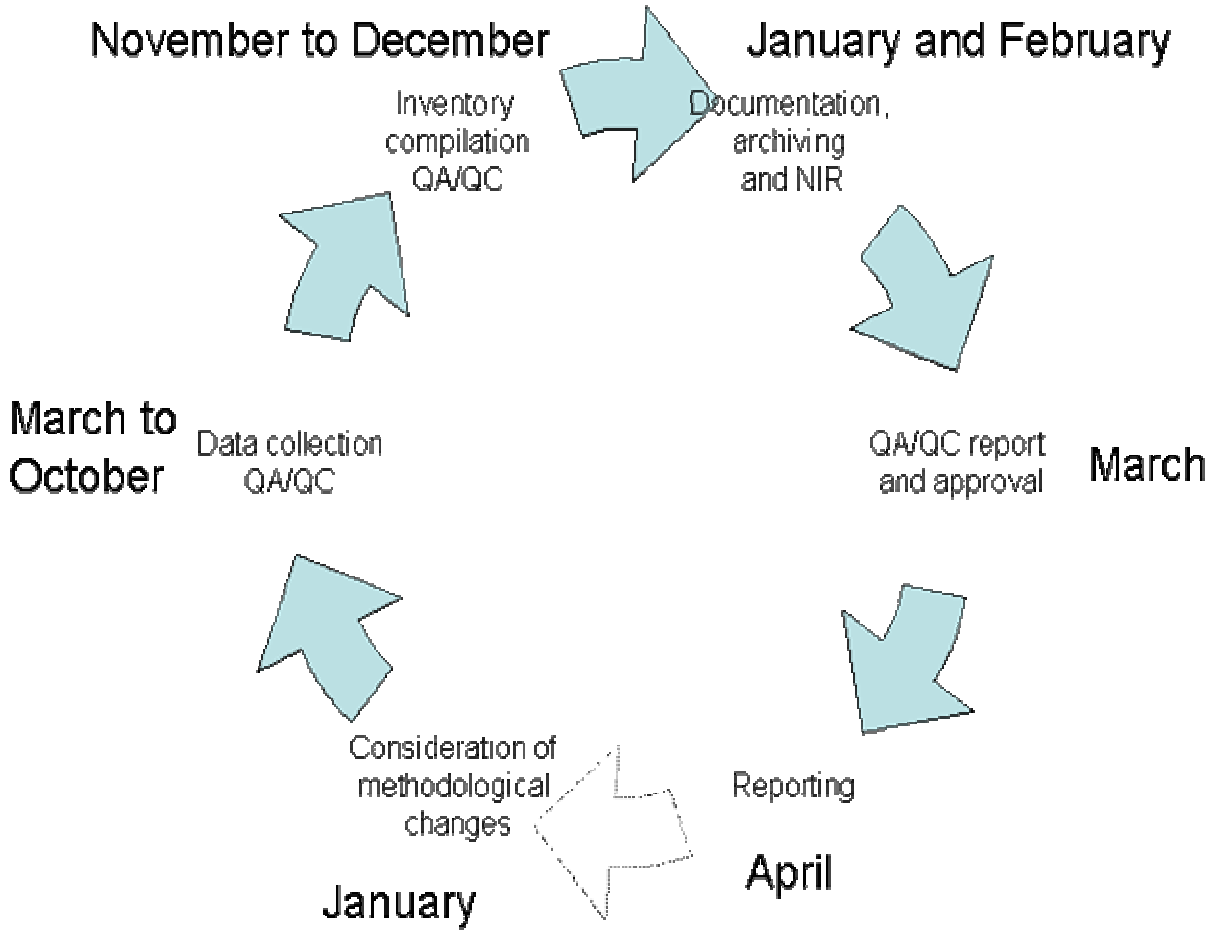
Table 1. Inventory production plan, milestones

	Responsible	**Deadline**
Consideration of methodological changes needed for the next year's reporting, including those based on the review report from last years reporting round	SFT	Feb. 1
Agreement on methodological changes needed for next year's reporting	All	May 15
Emissions from plants participating in emission trading and emissions from oil and gas facilities sent to Statistics Norway	SFT	May 1
Emissions from large industrial plants sent to Statistics Norway	SFT	July 1
All LULUCF data collection for the previous calendar year completed	Forest and Landscape	Sept. 1
LULUCF data collected by Statistics Norway sent to Forest and Landscape	SSB	Sept. 1
All non-LULUCF data collection completed	SSB	Nov. 1
LULUCF inventory for the previous calendar year sent to Statistics Norway in CRF format	Forest and Landscape	Nov. 1
Test runs, QA/QC	SSB	Nov. 15
Draft inventory to SFT for comments and QA/QC	SSB	Dec. 5
Final inventory including completion of QA/QC tests and recalculations	SSB	Jan. 15
Review of documentation and necessary updates made[1]	All	Feb. 1
NIR 1st draft	SFT	Feb. 15
Completion of CRF tables [2]	SSB	March 15
QA/QC reports sent SFT	All	March 20
NIR finalized	SFT	April 1
QA/QC report finalized	SFT	April 1
Formal approval of inventory for the purpose of reporting	SFT	April 10
Reporting	SFT	April 15

[1] This point includes internal documentation in all institutions while SSB and The Norwegian Forest and Landscape Institute are responsible for external documentation

[2] SSB will send complete CRF tables to SFT, data originally collected by SFT are sent to SSB who is responsible for making these data available in the CRF.

Figure 2 The inventory preparation cycle



Securing and developing capacity

Norwegian authorities will secure financial and human capacity to the national system to fulfill the reporting obligations and ensure that the data quality objectives are met.

SFT is a government institution. Their responsibility for the national system will be described in the annual letter from the Ministry of the Environment where they give directions on SFT's key priorities and financial resources for the following year. The national system will involve several units in SFT. To ensure that the requirements are met, SFT has established an internal project group for the national system.

Statistics Norway is an independent government institution. The production of the emission inventory is a permanent responsibility for SSB. The expenses for production and development of the emission inventory are partly covered by Statistics Norway through its financing from the government budget, and partly through specific project funding from SFT.

The Norwegian Forest and Landscape Institute is an independent government institution. The institution is mainly funded through the Ministry of Agriculture and Food. Several units within the institution will be involved in the LULUCF inventory, but the responsibility for coordination, QA/QC and reporting will be placed within one of these units. The expenses for production and development of the greenhouse gas inventory are partly covered by the Norwegian Forest and Landscape Institute through its funding over the government budget and partly through specific project funding from SFT.

Each institution is obliged to implement internal procedures to fulfill the requirements of the national system, in particular with respect to meeting deadlines, implementation of QA/QC procedures and archiving. Each institution is also obliged to develop the competence of their staff as required.

In addition to the cooperation meetings, the three institutions will meet to discuss and share experiences with respect to key topics like QA/QC, uncertainty assessment, archiving and the Kyoto Protocol. These meetings will be used to increase the capacity in the project groups in the three institutions. The core institutions of the national system may also need to seek partners with particular knowledge to participate in a Tier 2 QA/QC and improve methodologies and data, for example with respect to industrial processes technology, agriculture, soil processes and waste.

QA/QC-plan

Data quality objectives

Good practice defines the data quality objectives to be *transparency, completeness, consistency, comparability and accuracy*. These objectives are used as a foundation of the QA/QC system to be implemented in Norway. In addition we consider *timeliness* as part of the data quality objectives. Below we describe the objectives in more detail as they have been elaborated for the national system in Norway:

Transparency implies:

- Availability of sufficient documentation to enable estimates to be replicable from emission factors, activity data or plant emission measurement[9] for emission/removal data, irrespective of which institution or company made the estimates. This includes appropriate references to supplementary information (e.g. scientific literature).

[8] This criterion can be difficult to fulfill in cases where complex models are used.

- Availability of supplementary documentation (in English if practical) of models to enable a review, including a description of main assumptions and sources of data.
- Availability of supplementary documentation (in English if practical) of data collection of key activity data.
- Availability of sufficient documentation of methodological choices, including choice of measurement methods.
- Explanation of reasons for not estimating an emission or removal occurring in Norway, for example an explanation of why an estimate is considered negligible.
- Documentation of QA/QC procedures.

Completeness implies that:

- Estimates are made for all sources and sinks identified unless it can be documented that emissions/removals are negligible.
- Notation keys are used for all cells to be reported in the CRF.
- Reviews are regularly undertaken to assess potential new sources and include these in the inventory.

Consistency implies that:

- The same data sources and assumptions are used across gases, sectors and years of the inventory.
- The same methodology has been used for all years of a time-series.
- Data (activity data and measured data) have been collected using the same method for all years of the time-series.
- Appropriate splicing techniques in accordance with the good practice guidance have been applied in cases of inconsistencies of time-series or changes in methodologies.

Comparability implies that:

- Methodologies are consistent with the IPCC Guidelines and the good practice guidance.
- Reporting guidelines are followed.
- Emissions and removals are allocated to appropriate categories of the CRF as described in the IPCC Guidelines and good practice guidance.

Accuracy implies that:

- Uncertainties are reduced by selecting higher tiers for key categories or increased sampling /frequency of surveyed data and emission measurements (taking costs into account).
- Data collected are checked to assess their reliability and possible under- or underestimates and identified biases are reduced.
- Uncertainty estimates are collected and reported for all data.
- Data are compared with independent information where possible.

Timeliness implies that:

- Data are collected, processed and reported in accordance with a timetable that allows reporting within the official deadline for submission to the UNFCCC.

QA/QC responsibilities

All three institutions are responsible for implementing QC procedures to meet the data quality objectives of the data they collect. Each institution is also responsible for implementing QA-procedures of data originally collected by another institution in addition to reviewing the QC performed on these data by the institution collecting the data.

SFT as the national entity is responsible for overall QC and in charge of checking on an annual basis that the appropriate QC procedures are implemented internally in SFT and in Statistics Norway and The Norwegian Forest and Landscape Institute. Statistics Norway has an overall responsibility for QC of the data of the emission inventory, including the estimate of total emissions. SFT will check the QC reports and may request Statistics Norway to revise the inventory if and only if, the QC report is not satisfactory, if they have identified errors in the inventory, or if any of the methodologies used are not as agreed by the cooperation meeting. In the case of a disagreement between SFT and Statistics Norway on any numbers of the emission inventory, SFT may change the estimates in the CRF. They will inform Statistics Norway about this decision and the reasons for it, and they will document in the NIR why the data in the CRF are different from those of the national inventory compiled by Statistics Norway.

Each institution is responsible for reporting on their completion of the QC procedures on an annual basis and before March 1. This reporting is based on a checklist of general and source-specific QC checks and a textual description of possible recalculations, issues to be followed up before the next submissions, and other relevant information. The QC report is sent to the SFT with a copy to Statistics Norway. In addition SFT needs to complete the QC report as a basis of approval of the inventory and for information to Statistics Norway.

SFT as the national entity is responsible for the overall QA of the national system, including the UNFCCC reviews and any national reviews undertaken.

QC procedures

The input data used in the Norwegian national inventory are classified as emission factors and other estimation parameters, activity data (statistical data) and emissions from industrial and large plants (point sources). The output is classified as estimated emissions and removals, CRF tables and NIR information. QC procedures are established for each element of input data and output.

Chapter 8 of the IPCC good practice guidance (IPCC, 2000) gives guidance on QC. Consistent information for LULUCF is given in chapter 5.5 of the good practice guidance for LULUCF (IPCC, 2004).

QC is defined *as a system of routine technical activities, to measure and control the quality of the inventory as it is being developed*. The QC system is designed to:

i) Provide routine and consistent checks to ensure data integrity, correctness, and completeness;
ii) Identify and address errors and omissions;
iii) Document and archive inventory material and record all QC activities

The IPCC good practice guidance distinguishes between *general* and *source-specific* QC procedures. The general procedures focus on the processing, handling, and documentation procedures that are common to all inventory source categories. The source-category specific QC procedures are directed at specific types of data used in the methods for individual source-categories and require knowledge of the source-category, the types of data available and the parameters associated with emissions.

General QC procedures

The general QC procedures are performed annually for all data collected and all estimated data. Most of these checks are performed automatically through use of Statistics Norway's emission model. However, checks are also performed manually on some data, for example emission data collected from plants and activity data, emission factors and other estimation parameters for key categories. Identified problems are normally corrected before the final submission or flagged for correction in the next submission.

The general checks are summarized in Table 2.

Table 2. General annual QC checks

	Check	Responsible
Time-series and inventory version comparisons to detect problems with units, computational errors as well as other human errors.		
	Compare all emissions reported from industrial and other large plants to those of the previous inventory year and flag changes of more than 20% (10% for plants included in emission trading) for further QC in collaboration with the plant.	SFT
	Compare all (non-LULUCF) model input data (emission factors and activity data) to those of the previous inventory year and flag changes of more than 10-20% (at the most detailed level) for further QC. The most thorough checks are made for the categories with a largest contribution to total emissions.	SSB
	Compare all LULUCF model input data (emission factors, other estimation parameters and activity data) to those of previous inventory years and flag changes of more than 3% for categories not changing land use and 20% for categories of land-use change for further QC.	Forest and Landscape (LULUCF)
	Compare all (non-LULUCF) model input data (emission factors and activity data) to previous estimates for the same inventory	SSB

	Check	Responsible
	year[10] and flag changes of more than 0.1% for further QC.	
	Compare all LULUCF model input data (emission factors, other estimation parameters and activity data) to previous estimates for the same inventory year and flag changes of more than 1% for further QC.	Forest and Landscape (LULUCF)
	Compare all estimated emissions to those of previous inventory year at the level of IPCC reporting and flag changes of more than 10-20 % for further QC.[11]	SSB
	Compare all estimated emissions to previous estimates for the same inventory year[12] at the level of IPCC reporting and flag changes of more than 0.1% for further QC.	SSB
	Compare all estimated emissions and removals from LULUCF to previous inventory years and flag changes of more than 5% for further QC	Forest and Landscape
Completeness checks		
	Check that aggregate energy use in the emission model reflect the most recent energy balance.	SSB
	Check the difference between estimated fuel use for road transport with fuel sales.	SSB
	Identify large plants previously included in the inventory but no longer are (and explain the reason for exclusion) and new plants included in the inventory (including an explanation of whether this plant is new) and communicate this information to Statistics Norway.	SFT
	Flag incomplete categories through use of the emission model and data reported for previous years. Empty cells are subject to additional checks.	SSB
	Check that all cells with energy consumption have a corresponding emission factor.	SSB
	Flag incomplete categories of the LULUCF	Forest and Landscape

[10] Norway is preparing a preliminary inventory shortly after the inventory year. The comparison is made for all inventory years for which a previous estimate is available, that is all but the most recent year.

[11] 80-125 % for CO_2, 60-167 % for CH_4 and N_2O and 30-133 % for HFCs, PFCs and SF_6.

[12] Norway is preparing a preliminary inventory shortly after the inventory year.

	Check	Responsible
	inventory by comparing to the previous inventory.	
	Check for completeness/double-counting with emission data reported from industrial plants by ensuring that the corresponding energy use is appropriately subtracted from the energy data of the emission model.	SSB
	Check for completeness/double-counting between the LULUCF inventory and the inventory of other sources.	SSB
Consistency checks		
	Comparison of emissions in the main emission model with totals estimated in sub-model (e.g. road transport and waste models).	
	Check for consistency where the same data are used in more than one category (SSB). The emission model of SSB is designed to avoid duplicating data by entering of the same data only once. This check also includes consistency checks between data used by SFT and The Norwegian Forest and Landscape Institute with data used for the other categories.	SSB
	Checks for time-series consistency in cases where emissions from plants collected by SFT only are available for parts of the time-series.	SSB
	Checks for time-series consistency where activity data are only available on a non-annual or cyclical bases.	Forest and Landscape (SSB and SFT)
Recalculations		
	Check that appropriate recalculations are made, if needed, whenever methodologies or data sources have changed.	All
	Check that appropriate recalculations are made when preliminary data have been replaced with final data.	All (Forest and Landscape in particular)
	Check that when recalculations are performed these are made consistently throughout the time-series.	All
	Check that where splicing techniques are needed, these are applied in accordance with good practice and are documented.	All
Documentation	Check documentation for completeness and need for general revisions	All

Check	Responsible

Category-specific QC

These checks are normally not performed on an annual basis, but are performed regularly and in addition to the general QC checks. The goal is to perform a category-specific QC, including an updated uncertainty analysis, within cycles of approximately 5 years for key categories and potential key categories, and at least every 10 years for other categories. An annual and long-term prioritization will be made annually by SFT, Statistics Norway and The Norwegian Forest and Landscape Institute, in collaboration with other relevant authorities, as a part of the improvement plan (with SFT in charge) (see Section 3.6). For example, the review reports, QA/QC conclusions and need for improved emission data for emission reduction plans will be important for a final prioritization. QC findings are followed up by revising emission factors, activity data, other estimation parameters or the methodologies. The changes are approved in the autumn meeting between SFT, Statistics Norway and The Forest and Landscape Institute.

Estimated emissions and removals
The QC checks on emission and removal estimates come in addition to those undertaken on the input data as described below.

The QC checks of estimates include:

- A comparison of the methodologies used to estimate emissions and removals with those recommended in the newest Guidelines
- A review of availability of data and resource requirements for selecting a higher tier
- A review of alternative methodologies
- A comparison of (higher tier) estimates with lower tiers
- A comparison of estimates to those of inventories from countries with similar national circumstances using appropriate drivers.
- An assessment of time-series consistency (for example, that the same method has been used for all years of the time-series) and use of splicing techniques (where relevant)
- A review and documentation of model assumptions
- A review and update of documentation, including archiving of supplementary documentation
- A check of whether the allocation to categories in the CRF is correct

QC checks for completeness include:

- A review of relevant emission sources not included in the inventory (the Guidelines, inventories from countries with similar national circumstances, literature)
- A review of methodologies and data availability for these potential sources
- A documentation of reasons for not including a source in the inventory
-

Emission data reported from plants
Plant emission data that are used in the emission trading system will undergo annual QC

checks. The source-specific QC checks for other plants are performed less frequently (every 3 years) for emission estimates within key categories which account for 25-30 % of the total of that (key) category. The frequency of checking of non-key plants which are not included in the emission trading scheme is every 5 years. Statistics Norway is responsible for reporting the results of the key category analysis to SFT, while SFT will perform the assessment of the "key plants" within a category.

The QC checks include:

- An assessment of the internal QC/QC of the plants reporting data to SFT
  - Their QA/QC system including archiving
  - Any changes to the QA/QC system
- An assessment and documentation of measurements and sampling
  - Measurement frequency
  - Sampling
  - Use of standards (e.g. ISO)
  - Documentation for archiving
- An assessment and explanation of changes in emissions over time (e.g. changes in technology, production level or fuels) (annual check)
- An assessment of time-series consistency back to 1990 in cooperation with Statistics Norway[13] (if plant emission data are missing for some years and estimates are made using aggregate activity data and emission factors)
- A comparison of plant emissions to production ratios with those of other plants, including explanations of differences
- A comparison of the production level and/or fuel consumption with independent statistics (in collaboration with Statistics Norway)
- An assessment of reported uncertainties (including statistical and non-statistical errors) to the extent this has been included in the reporting

The QC checks should be made in close cooperation with the emission reporting plants.

Emission factors & other estimation parameters

The category specific QC will be performed by SFT, Statistics Norway, The Forest and Landscape Institute and/or another institution with expertise in the category subject to review. It can address a single category or several related categories (e.g. road transportation, LULUCF and agriculture) and will include an assessment of the emissions factors currently in use and conclude on the need for revisions.

This QC will include the following elements:

- A comparison of the emission factor with those
  - recommended in the Guidelines

[13] For plants included in the emission trading scheme historical data are derived in cooperation with the industry organization

  - identified through a literature search (peer reviewed literature and other reports)
  - identified by national source-experts (e.g. industry organizations and researchers)
  - that can be derived from emission data reported from the plants
- An assessment of the representativity of the emission factors used for national circumstances (particularly when they are based on default emission factors and international research)
- A quantification of the uncertainty (addressing statistical and non-statistical errors)
- An assessment of the content of documentation, including technical documentation
- An assessment of the availability (archiving) of documentation, including technical documentation
- An assessment of changes in emission factors over time due to changes in technology and/or management

Activity data

The category specific QC will be performed by SFT, Statistics Norway and The Forest and Landscape Institute for the data collected by each institution. Some activity data are originally collected by another institution. In this situation SFT, Statistics Norway or The Forest and Landscape Institute (as appropriate) are responsible for assessing the QC applied on these data and perform their own additional QC on aggregate data.

The activity data QC will include the following elements:

- An evaluation and documentation of the QC routines applied at the survey level (at the point of interview/field work and the data checking/processing level)
- An evaluation of the techniques used to obtain annual data (if applicable)
- An assessment of sampling and representativity, including an evaluation of possible bias for application of the data in inventories (for LULUCF area data and for statistical survey data)
- An assessment of the classification of land areas and assumptions needed to apply data from the national forest inventory and area frame land resource surveys (NFI)
- An assessment of the completeness compared to the category definitions of the IPCC guidelines and good practice guidance for LULUCF and the reporting requirements
- A review and assessment of alternative data sources
- A comparison with independent data sources (if possible)
- A quantification of uncertainties (including statistical and non-statistical errors)

Documentation

For each category, a review and update of the documentation will be performed if needed. The requirements for documentation will be highest for key categories. The QC should include

- an assessment of whether the documentation is sufficient to understand the data, methods and assumptions behind an estimate of emissions or removals
- a recording of changes that have been made as a response to the QC checks
- a description of consequences for the time-series of changes in data or methods

- writing and archiving of additional technical documentation as needed (in English if practical or in Norwegian) to enable the replicability of estimates for a reviewer

CRF tables

Through use of the new UNFCCC software for reporting it is anticipated that data from the emission model can be transferred directly to the CRF, and this will reduce the need for dedicated QA/QC checks. Statistics Norway will develop a separate dataset for notation keys. QC consistency checks are built in the new CRF. Statistics Norway will be responsible for additional checks on an annual basis:

- Check of total emissions against those of the emission model
- Check of sectoral totals against those of the emission model
- Check of notable changes from previous submissions for individual categories
- Check of correct use of notation keys

LULUCF data needs to be entered manually to the CRF. The Norwegian Forest and Landscape Institute is responsible for checking all LULUCF entries with data from its database. Statistics Norway is responsible for a consistency check of the LULUCF data compared to the rest of the inventory.

SFT is responsible for a final check of the CRF for completeness and for checking that Statistics Norway and The Norwegian Forest and Landscape Institute have completed the QC checks they are responsible for. SFT is responsible for making the final approval of the CRF tables.

NIR

SFT is responsible for the annual QC of the NIR. This includes checking that

- All figures on emissions and removals (including the key category analysis) in tables and text are consistent with those reported in the CRF
- Trends in emissions and removals are explained
- All methodological changes are explained
- All recalculations are explained and the effect on time-series consistency reported
- The textual description reflects methodologies used
- Responses to the review report are reflected
- Priorities for improvements are described in line with decisions
- All other information is correct (including QA/QC plan, uncertainties and completeness)

Timeliness

SFT, Statistics Norway and The Norwegian Forest and Landscape Institute have agreed on a timetable to enable SFT to report to UNFCCC by April 15 (see Table 1). It is the responsibility of SFT, Statistics Norway and The Forest and Landscape Institute to make this timetable known in their respective institutions to ensure that internal deadlines for data

collection and processing in each institution as far as possible suits the emission inventory production cycle.

QC documentation

The members of the inventory team working with individual sectors or parts of a sector write a QC report to the person at each institution in charge of QC, who then reports to the person in charge of QC for the national system. The reports include a description of the general and source-specific tests that have been conducted, and whether these have or will be used to correct any data. The list of general and category-specific QC tests described above will be used as a checklist for the QC reports.

QA procedures

According to the IPCC Good Practice Guidance (IPCC, 2004), "*good practice for QA procedures requires an objective review to assess the quality of the inventory, and also to identify areas where improvements could be made*". QA involves reviewers that have not been involved in preparing the inventory. They should be independent from the institutions involved in the national system, or not closely involved in the inventory compilation. We distinguish between QA of input data and of the entire inventory.

Statistical data and emissions reported from plants

Emissions reported from plants

Emissions reported from industrial sites are always checked by the SFT (see section 3.3.2) by the administrative department in charge of evaluating emission permits. SFT has a separate department of Control and International Affairs, which consists of three sections for product and industrial control working independently from the sections evaluating emissions permits. They inspect and monitor industrial sites, including underlying documentation for the emission estimates.

There are two types of controls, one is a *frequency-based control* and the other is a *specific campaign control*.

The frequency-based control is as shown in Table 3.

Table 3. Independent control frequency of industrial plants

Control class[1]	Inspection	Audit	Self-reporting
1	Every four years	Every four years	Annually
2	Every six years	Every six years	Annually
3	Every 3-4 years	-	Annually
4	If needed	-	If needed

[1]Industrial sites are divided into four control classes. Those that have the largest potential to generate pollution are included in class 1. Those that are included in class 4 have a relatively limited potential to generate pollution. The potential to generate pollution is determined by the hazard of their emissions and discharges, the quality/sensitivity of the recipient and the use of hazardous chemicals

There are three main methods of determining compliance at industrial sites:

- *Inspections* are normally a one-day unannounced visit at the site. An inspection is a useful method to verify compliance with the specific requirements.
- *Audits* and source testing of emissions: Environmental audits and source testing are used not only to monitor compliance but also to evaluate the environmental management system in the enterprise. These audits are more comprehensive than inspections and are planned well in advance in cooperation with the industrial site.
- *Self-reporting* of data: For enterprises in control class 1, 2 and 3, the permit includes a requirement to establish and maintain a well-defined self-monitoring program. Once a year they must submit an account of their emissions to SFT. This report should include their total emissions, any discharges exceeding the discharge limits or other violations. The reasons for violations must be given together with an explanation of corrective actions taken to avoid recurrence. This self-reported data is often checked during inspections and audits.

An inspection is a one-day on-site control, while an audit may take 3-5 days. The focus of a control/revision may vary. The administrative department in charge of evaluating emission permits can suggest topics for focus of the controls.

Control campaigns take place after a consideration of experiences and results of previous campaigns. Typically such campaigns will be used to check reported emissions.

SFT has several possibilities for sanctions and other enforcement instruments to ensure compliance at industrial sites. They include the requirement to provide information to the authorities, coercive fines, withdrawal of the permit, and reporting violations to the prosecuting authorities.

Particular controls are directed to the plants included in the emission trading system to check that reported emissions are in line with the emission trading regulation (Annex 3). All plants will be controlled once over a period of three years. These controls have focused on the plant's implementation of the reporting requirements. The basis for the reporting, including activity data, emission factors, and uncertainty estimates have been reviewed. So far the controls have aimed at facilitating reporting, and the plants have not been punished for possible weaknesses. These controls will continue, and it is expected that deficiencies will be met with stringent requests for improvements. Future requirements for controls will be consistent with international rules, particularly the rules associated with the EU Emissions Trading System.[14]

For the purpose of the inventory, additional QA is undertaken by the Division for Climate and Energy in SFT before the data are sent to Statistics Norway. These QA checks include consideration of time-series consistency and a comparison of emissions per unit produced.

Statistical data

All data collected by institutions not included in the national system undergo a QA by either SFT, Statistics Norway or The Norwegian Forest and Landscape Institute as appropriate Furthermore, the inventory teams perform a QA of data collected in their institutions in addition to the QC performed by the units responsible for the data collection. For example, Statistics Norway, where possible, makes emission calculations based on activity data

[14] It is expected that Norway will adopt the Directive.

sampled in official statistics and compares these to the emission data from plants reported to SFT, and deviations are explained through contact with the plants.

The entire inventory

UNFCCC review

The annual review of the inventory and NIR under the UNFCCC is considered to be part of the QA. This review is performed by a team of experts (sector experts and generalists) from other Parties. Their tasks include examining the data and methods used by Norway and the documentation and concluding whether they are in accordance with current guidelines. The review results in a review report point indicating specific areas where the inventory is in need of improvements.

Expert peer review

The inventory and its documentation will be published annually, and industry associations, relevant research institutions, directorates and environmental organizations are invited to review and suggest improvements in the inventory. The results of this review will used by the cooperating institutions to improve the inventory.

Audits

SFT, Statistics Norway and The Norwegian Forest and Landscape Institute are audited by the Auditor General of Norway. In addition to financial audits, the auditor general also performs performance audits, a systematic analysis of the economy, efficiency and effectiveness of the government administration on the basis of the decisions and intentions of the Norwegian parliament. The Office of the Auditor General uses performance audits to shed light on specific areas within the government administration where there is a risk of noncompliance and/or deficiencies in relation to the resolutions and intentions of the Norwegian parliament. An audit of the national system may be initiated as a part of this.

The usefulness of having a private company conduct an independent audit of the implementation of the national system will be considered at a later stage.

Implementation of QA/QC procedures

The core institutions of the national system will implement the QA/QC plans by establishing internal procedures. These procedures will assign internal responsibilities for the QA/QC checks suggested in chapter 3.3 and facilitate input to the QA/QC report. Each institution will organize project teams to handle the implementation of the QA/QC plan. The project teams will be informed about the data quality objectives of the national system.

Box 1. The Total Quality Management project of Statistics Norway

In 2001, Statistics Norway started a Total Quality Management project to broaden the quality concept of the national emission inventory (Haakonsen 2001). The goal was not just to achieve traditional data quality, but also to take into account the need to meet the deadlines of international reporting of emission data.

For this task a project team was established. The team had representatives from both the users of the emission inventory data and the input data providers, as well as members at different levels of the inventory team. Early in the project, the team made a flow chart of the different processes involved in the inventory work – from receiving all the different input data to international reporting and the publishing of the results in a press release. Based on this, "bottlenecks" (critical process variables) and connected processes were identified. The energy data for the manufacturing industry (as provided by Statistics Norway) was identified as the most critical dataset because it is not only essential for the results but also finished quite late compared with the need for timeliness of inventory data (with respect to deadlines for international reporting). The inventory team must therefore try to involve the key data providers more closely in the inventory preparation process, give them information about the applications and invite them to try to adjust their internal deadlines to better support the essential deadlines for the inventory work.

The project team concluded that the data providers must be more closely involved in the work:

- - Data providers must know that their data is important for the quality of the whole inventory. Data providers must know that the Norwegian reporting to the UNFCCC and LRTAP Convention and be delayed if their work is delayed.
- - The data providers may be able to change their time limits to be able to deliver the data earlier.
- - The inventory team should improve information to the providers about what kind of data they need and at what time they need the data.
- - The data providers should be responsible for reporting any delay as soon as possible to the inventory team.

Plan for improving the data

The inventory may need to be further developed before it can fulfill the data quality objectives. The three institutions will collectively produce plans for improving the data. The plan will be based on the key category analysis, the UNFCCC review, QA/QC activities, new information and other needs, for example needs for better data for the development of emission reduction strategies and regional statistics.

The cooperating institutions will in 2007 produce a 5-year strategy plan for improvements of the inventory. This plan will be distributed to stakeholders and it will be revised after five years. This plan may also point out needs that not can be handled through ordinary inventory projects, but through research projects. The autumn cooperation meeting between the three institutions will agree on priorities for the following year.

Production of emission data

Details of the methods and framework for the production of the emission inventory are given in the reports “Documentation of the Norwegian system of emission inventories” (Hoem (ed.) 2005) and “Emissions and removals of greenhouse gases from land use, land-use change and forestry in Norway” (NIJOS, 2005). These reports will be updated annually in conjunction with important methodological changes and used as a basis for the NIR.

Norway has an integrated inventory system for producing inventories of the greenhouse gases included in the Kyoto Protocol and the air pollutants SO_2, NO_x, non-methane volatile organic compounds (NMVOC), ammonia, CO, particulate matter, heavy metals and persistent organic pollutants reported under the LRTAP Convention. The data flow and QA/QC procedures are to a large extent common to all pollutants.

Assessment of key categories

The key category assessment is made by Statistics Norway using the IPCC Tier 1 and the Tier 2 method, which includes uncertainty estimates. The assessment is updated annually and is made for the level and trend since 1990. Statistics Norway also considers the qualitative criteria for identification of key categories. In accordance with the IPCC good practice guidance for LULUCF (IPCC, 2004) the analysis is made in two parts, one excluding LULUCF emissions and removals and another integrating LULUCF with the rest of the inventory. Due to the large LULUCF sink in Norway, the results of these two parts are quite different.

Data collection

In the agreements, the three institutions of the national system have defined areas of responsibility for data collection. The current division of responsibility for the most important data is shown in Table 4. The table focuses on data that are updated regularly and not emission factors that are assumed constant over several years. Emission factors are normally collected through dedicated projects. Through the cooperation meetings, the institutions may agree to reallocate responsibilities.

Table 4. Main responsibilities for data collection

	Data	Institution in charge of primary data collection
SFT		
	Emissions from large industrial plants (point sources) (around 70 at present, but some of these do not report GHG emissions)	SFT
	Emissions from off-shore activities, including drilling activities, fugitive emissions, well-testing oil burning and emission factors for crude oil loading	The Norwegian Petroleum Directorate (Oljedirektoratet) and SFT
	Methane recovery from landfills	SFT
	Import of HFCs, PFCs and SF_6 by application. Import HFCs, PFCs and SF_6 in products.	SFT (The customs authorities "Toll og avgiftsdirektoratet" in the future)
Statistics Norway		
	Energy balance/account (energy use by sector and application), energy use in point sources. This statistics is building on a number of primary data sources (surveys and censuses)	Statistics Norway
	Production data, import and export	Statistics Norway
	Vehicle registrations	Statistics Norway
	Transport statistics	Statistics Norway, Institute for Transport Economics (TØI), Norwegian Road Federation (opplysningsrådet for veitrafikk)
	Agriculture statistics, including animal population and manure management	Statistics Norway
	Fertilizer use and lime application	Norwegian Food Safety Authority (Mattilsynet), Directorate for Nature Management (Direktoratet for naturforvaltning)
	Waste disposal and waste characteristics	Statistics Norway
	Waste water statistics	Statistics Norway
Forest and Landscape	Area statistics from the national forest inventory and national area frame land resource surveys	Forest and Landscape
	Parameters needed to estimate changes in biomass stocks from the national forest inventory and national area frame land resource surveys	Forest and Landscape
	Area statistics from administrative sources, e.g. agriculture statistics	Statistics Norway

Uncertainty calculations

Norway has quantified uncertainties in input data and in total emissions and its trend (SFT 1999a; Rypdal and Zhang 2000; Rypdal and Zhang 2001). The uncertainties in input data were made in consultation with sector experts, combining expert judgments by source experts, information in the IPCC good practice guidance (IPCC, 2000) with other sources of information. The uncertainties were combined using the IPCC Tier 2 method (bootstrap techniques). The uncertainty calculation will be developed into a routine in 2006 and uncertainties in input data will be revised based on expert judgments and the IPCC 2006 Guidelines. In the future uncertainties will be updated as a part of the source-specific QC procedures.

Uncertainties in the LULUCF sector have been estimated less rigorously.

Recalculations

In accordance with the IPCC good practice guidance IPCC (2000), Norway routinely evaluates whether recalculations of historical data are needed. Recalculations are made if there have been methodological changes influencing emissions in previous years or changes in data due to correction of errors or changes in preferred data sources.

When data sources are not available for the whole time-series since 1990, one of the proposed methods from the IPCC good practice guidance IPCC (2000) is used to splice data. Normally extrapolations using drivers correlated with emissions or the overlap method is used. Smaller emission sources may be linearly extrapolated (or kept constant). The method is chosen on the basis of available data and suitability of drivers.

Data from the National Forest Inventory are collected over a period of five years. Each year provides a statistically representative coverage of Norwegian forests, but with only 1/5 of the statistical support of the full inventory. Annual reports can be issued based on the annual data, but are expected to fluctuate somewhat. It is therefore proposed to recalculate the estimates using a five year moving average with extrapolation of the last two years.

Estimates based on the national area frame survey of land resources will be calculated using the data available each year. Aerial photographs will be used in order to detect changes in land use. Weather conditions in Norway are unpredictable and it is known from experience that flight plans usually will be changed somewhat. It is therefore expected that the annual data reported from this survey will fluctuate somewhat from one year to another and that recalculation of reports are required as the data set is replenished with new observations offering stronger statistical support.

Emission calculations

The main emissions model

The model was developed by Statistics Norway (Daasvatn et al. 1992, 1994). It was redesigned in 2003 in order to improve reporting to the UNFCCC and LRTAP, and to

improve QA/QC procedures. The model is programmed in SAS system software and is flexible with respect to output, i.e. it can produce tables (input and output) in accordance with different aggregation levels and parameters. Furthermore, it has been designed to fit the availability and aggregation of input data and is flexible with respect to changes. Emission factors can be entered for groups of years.

The model is called "Kuben" ("the Cube"). Several emission sources – e.g. road traffic, air traffic, waste and solvents – are covered by more detailed satellite models. Aggregated results from these side models are used as input to the general model.

The general emission model is based on equation (1).

(1) Emissions (E) = Activity level (A) · Emission Factor (EF)

For emissions from *combustion*, the activity data is based on energy use. In the Norwegian energy accounts, the use of different forms of energy is distributed by industries (economic sectors). In order to calculate emissions to air, energy use must also be allocated to technical sources (e.g. equipment). After energy use has been allocated in this way, the energy accounts may be viewed as a cube in which the three axes are fuels, industries, and sources.

The energy use data are combined with a corresponding matrix of emission factors. In principle, there should be one emission factor for each combination of fuel, industry, source, and pollutant. Thus, the factors may be viewed as a four-dimensional "cube" with pollutants as the additional dimension. However, in a matrix with a cell for each combination, most of the cells would be empty (no consumption). In addition, the same emission factor would apply to many cells. There are about 25 fuels and about 25 technical sources used for energy combustion.

Emissions of some pollutants from major manufacturing plants (point sources) are available from measurements or other plant-specific calculations (collected by SFT). When such measured data are available, the estimated values are replaced by the measured ones:

$$(2) \quad Emissions\ (E) = [\ (A - A_{PS})\ \cdot EF] + E_{PS}$$

where A_{PS} and E_{PS} are the activity and the measured emissions at the point sources, respectively. Emissions from activities for which no point source estimate is available (A-A_{PS}) are still estimated with the regular emission factor.

Non-combustion emissions are generally calculated in the same way, by combining appropriate activity data with emission factors. Some emissions are measured directly and reported to SFT, and some may be obtained from current reports and investigations. The emissions are fitted into the general model using the parameters industry, source, and pollutant. The fuel parameter is not relevant here. The sources for non-combustion emissions and for combustion without energy use are based on EMEP/NFR and UNFCCC/CRF categories, with further subdivisions where more detailed methods are available.

The model uses approximately 130 *industries* (economic sectors). The classification is almost identical to that used in the National Accounts, which is aggregated from the European NACE (rev. 1) classification (Daasvatn et al. 1994). The large number of sectors is an advantage in dealing with important emissions from manufacturing industries. The disadvantage is an unnecessary disaggregation of sectors with very small emissions. To make the standard

sectors more appropriate for calculation of emissions, a few changes have been made, e.g. "Private households" is defined as a sector. Information about the geographical distribution of emissions is useful for modelling and control purposes and constitutes a fifth axis.

The LULUCF model

The Norwegian Forest and Landscape Institute is in charge of estimating emissions and removals from LULUCF for all categories where area statistics is the activity level. They have developed a calculation system in the form of a computer program that uses SAS system software and Fortran for the implementation of the IPCC good practice guidance for the LULUCF.

The system uses input data from different sources and creates final output datasets. The final datasets include all the data needed for the reporting tables (CRF) of the LULUCF. So far, the LULUCF data needs to be entered manually into the CFR. However, through the use of the new UNFCCC software for reporting, it is anticipated that the data from the model can be transferred directly to the CRF.

Calculations of biomass and carbon stock in forest (except for Finnmark County) will use single tree measurements and stand attributes from the permanent sample plots of the Norwegian National Forest Inventory (NFI). Sample plots located on forest and other wooded land are used in the calculations. Biomass is calculated from the national forest inventory data using the SAS system using a set of equations (NIJOS, 2005) developed in Sweden for single tree biomass. These equations provide biomass estimates for various tree biomass components: stem, stem bark, living branches, dead branches and needles. Biomass of stump and below-ground biomass is also calculated using functions. Change in carbon stock in dead organic matter due to harvest residues and stumps and roots from harvested trees and natural mortality has been calculated from annual harvest volume (NIJOS, 2005). In addition, biomass from annual litter fall from living trees is calculated and added to carbon stock in dead organic matter. The calculations are based on input data from 1960 to establish soil carbon equilibrium.

Data from the national area frame survey of land resources (AR18X18) will be used for calculations in areas above the coniferous tree line and in Finnmark County. This survey does not include single tree measurements. Biomass and carbon stock will have to calculated from measurements of area and area changes using appropriate models.

Handling of data

Archiving

The guidelines for the national system specify the requirements for archiving. Archiving shall include:

- Disaggregated emission factors
- Activity data
- Documentation of data collection, assumption and aggregation
- Internal documentation on QA/QC procedures
- External and internal reviews
- Documentation on annual key sources

- Planned inventory improvements

All three core institutions are responsible for archiving the data they collect and the estimates they calculate with associated methodology documentation and internal documentation on QA/QC. The Guidelines for National Systems, however, state that "Annex I Parties should make the archived information accessible by compiling it at a single location.

Due to the differences in the character of data collected, Norway has chosen to keep archiving systems in the three core institutions, which means that not all information is archived at a single location, see Table 5 for an overview. These archiving systems are, however, consistent, and operate under the same rules. Although the data are archived separately, all can be accessed efficiently during a review. In addition, SFT will build up a library with the most important methodology reports. The archiving systems in all three institutions will be developed for the implementation of the national system, see Annex 7.

The common rules for archiving of data are the following:

- Data and information are archived for each submission year
- Data and information are archived in a single location within each institution (this may imply double archiving)
- Archiving for a submission year includes
    - All input data
    - All estimated emissions
    - All partly filled-in or final CRF
    - All technical documentation
    - Recalculations of previous estimates, if any
    - The NIR (where relevant)
- The file structure is documented
- The platform at which the data and information is archived undergoes a daily backup and the backup is securely saved

Confidentiality could be an issue for some of the data collected by Statistics Norway when there are few entities reporting for a source-category. However, confidential data used in the inventory are now almost entirely replaced by non-confidential data collected by the SFT. Consequently, confidential data are not expected to cause any difficulty during a review.

Table 5. Responsibilities for archiving information. Capital X indicates archiving also of datasets sent from the other institutions.

	SFT	Statistics Norway	Forest and Landscape	Comments
Disaggregated emission factors	x	X	x	All are archived by Statistics Norway
Activity data	x	X	x	
Emission data collected from large plants	X	X		Statistics Norway does not collect these data, but will archive them as part of their emission model
Documentation of data collection, assumption and aggregation	X	x	x	SFT will build up a library of all important reports (including background reports)
Internal documentation on QA/QC procedures	x	x	x	
External and internal reviews	X	x	x	
Documentation on annual key categories		x		
Planned inventory improvements	X			
Estimated emissions (model output)		x		
CRF	X	(x)		Statistics Norway will archive a copy
NIR	X			
Recalculations	X	X	x	

Access to archived data during a review

By systematic archiving as described above, all information can be made available to a review team in the course of a few hours. It is expected that the most relevant documentation will be available in the central archive of SFT. Comprehensive documentations for LULUCF and other emission sources are available in English (Hoem (ed.), 2005; NIJOS, 2005). Additional technical documentation may be in Norwegian only, as will the emission reports from the plants. SFT, Statistics Norway and The Forest and Landscape Institute are responsible for having competent personnel on duty during a review to access data if requested.

Allocation of responsibilities during a review

SFT has the main responsibility for coordinating the review. Statistics Norway and The Norwegian Forest and Landscape Institute will be allocated specific responsibilities during the review. SFT is responsible for informing Statistics Norway, The Forest and Landscape Institute and SFT experts about the timing of the review at least two months before it takes place to ensure their availability.

Table 6. Main responsibilities during a review (lead in capital)

	SFT	SSB	Forest and Landscape
Preparation and coordination	x		
General, national system and cross-cutting issues	X	X	
Energy	x	X	
Industrial processes	X	x	
Agriculture		X	
LULUCF		x	X
Waste	x	X	
Direct communication with UNFCCC Secretariat	x		

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Annexes

Annex 1. The Norwegian Air Pollution Act (Chapter 7)

Chapter 7. Inspection and control measures relating to pollution and waste

§ 48. The responsibilities of the pollution control authority

The pollution control authority shall be responsible for monitoring the general pollution situation and pollution from individual sources. The pollution control authority shall also be responsible for monitoring waste management.

The pollution control authority shall by means of advice, guidance and information seek to counteract pollution and waste problems and shall ensure compliance with the provisions of this Act and of decisions made pursuant thereto.

§ 49. Duty to provide information

On orders from the pollution control authority, any person that possesses, does, or initiates anything that may generate pollution or result in waste problems has a duty, notwithstanding any duty of secrecy, to provide the pollution control authority or other public bodies with any information necessary to enable them to carry out their tasks pursuant to this Act. If special reasons so indicate, the pollution control authority may require that information shall be provided by any person who works for the person that is subject to the duty to provide information pursuant to the first sentence.

Information as mentioned in the first paragraph may also be required from other public authorities, notwithstanding any duty of secrecy that otherwise applies.

Decisions made pursuant to the first or second paragraphs may be made by regulations or by individual decision.

§ 50. Right of inspection

The pollution control authority shall be given unimpeded access to property where pollution may occur or has occurred, or which is or may be exposed to pollution, if this is necessary for the exercise of its duties pursuant to this Act. The same applies to any enterprise that has resulted or may result in waste problems.

The pollution control authority may require documents and other material that may be of importance for the exercise of its duties pursuant to the Act to be submitted for its inspection.

Before inspection of an enterprise, the pollution control authority shall contact representatives of the management.

§ 51. Orders to carry out investigations

The pollution control authority may order any person that possesses, does, or initiates anything that results in or that there is reason to believe may result in pollution to arrange or pay for any investigations or similar measures that may reasonably be required in order to:

a. determine whether and to what extent the activity results in or may result in pollution,

b. ascertain the cause of or impact of pollution that has occurred,

c. ascertain how the pollution is to be combated.

The provision of the first paragraph applies correspondingly to any activity that result in or may result in waste problems.

Orders pursuant to the first and second paragraphs may be laid down by regulations or in individual cases.

§ 52. Approval of laboratories and analytical methods

The pollution control authority may by regulations or individual decision lay down that investigations and analyses carried out in accordance with decisions made pursuant to this Act shall be carried out in the way decided by the pollution control authority or must be carried out by a person approved by the pollution control authority.

Annex 2. The Greenhouse Gas Emission Trading Act (chapter 4)

Chapter 4. Reporting and control

§ 16. (reporting)

An operator shall by 1 March each year report to the pollution control authorities on CO_2 emissions during the previous calendar year to which the duty to surrender allowances applies.

The King may by regulations lay down further provisions on reporting, including the information to be provided and how emissions are to be calculated or measured.

§ 17. (control by the pollution control authorities)

The pollution control authorities will control and verify the reports on CO_2 emissions submitted by each operator pursuant to section 16.

In special cases, the pollution control authorities may issue an order for the emissions report from an operator to be verified by an independent third party before it is submitted. The King may by regulations lay down further provisions on requirements relating to and accreditation of verification bodies, including how verification reports are to be drawn up and their contents.

The King may by regulations prescribe that the costs incurred by the pollution control authorities in verifying emissions reports pursuant to this section are to be met by the operators.

§ 18. (requirement to provide information or make investigations)

The pollution control authority may require operators to provide information or carry out or pay for investigations or other measures it is reasonable to require to determine whether it is necessary to alter the provisions on reporting laid down pursuant to section 16.

Annex 3. Regulation on Greenhouse Gas Emission Trading (The Emission Trading Act)

Regulations relating to greenhouse gas emissions trading (the Emission Trading Regulations) were adopted on 23 December 2004 and entered into force on 1 January 2005. Chapter 2 of the Emission Trading Regulations contains general and activity-specific provisions concerning monitoring and reporting of emissions. Annex 1 of the domestic regulations contains detailed activity-specific rules for calculating and measuring emissions. Annex 2 is a non-exhaustive list of materials that are considered to be biomass. The provisions are based on the guidelines for monitoring and reporting emissions set out in Decision 2004/156/EC (the MRG), and adapted to Norwegian conditions.

The monitoring methodology to be used by operators to whom the Norwegian trading scheme applies is all specified in these regulations, and not in the permit for each installation.

Section 2-1 of the regulations states that emissions covered by the trading scheme shall be reported by 1 March the following year in accordance with the provisions set out in Chapter 2 and Annex 1 of the regulations.

Section 2-2 states that calculations and measurements shall be made in accordance with the provisions set out in Annex 1. If it is obvious that use of a different monitoring methodology will give more accurate emission figures, the operator shall use that methodology. This provision refers to those cases where use of an alternative monitoring methodology described in MRG would provide more accurate emission figures.

Section 2-3 contains general requirements for reports from operators. These requirements include:

- a description of sources of emissions for each activity carried out at the installation, together with emission figures for each source and total emissions
- a description of how activity data (fuels, input material, production output) have been gathered and assessed. If a mass balance is applied, the operator shall report the mass flow, carbon and energy content for each fuel and material stream into and out of the installation and their respective stocks
- a description of how emission factors have been determined
- information concerning any temporal or permanent changes in monitoring methodology, and grounds for such changes
- Any other changes in the installation during the reporting period that may be relevant for the emission report.
- amounts of biomass combusted (TJ) or employed in processes (t)
- amounts of fossil fuels subject to the CO_2 tax (e.g. mineral oil and petrol) combusted and employed in processes (t), and calculated CO_2 emission figures from these activities.
- amounts of hazardous waste and municipal waste combusted (t)
- amounts of CO_2 or CO transferred from the installation (t)
- copies of relevant quality assurance and control procedures established so that emissions can be monitored and reported in accordance with the regulations.

If the emissions have been determined using a continuous measurement system, the operator must report which method has been used. If a standardized measurement method has not been used, the operator must give a detailed description of the method. The operator must report the level of uncertainty associated with the measurements, and must be able to justify that use

of a measurement-based methodology gives higher accuracy than the relevant calculation-based methodology.

Sections 2-4 to 2-9 contain activity-specific provisions (combustion installations above 20 MW, refineries, coke ovens, steel production, cement plants and other mineral-based production) relating to data that the operator must submit in the report. Annex 1 gives detailed rules for calculating emissions from each of the activities set out in section 2-4 to 2-9. Annex 1 also contains information on sources that are to be included in the calculation and formulae to be used for calculating emissions from each of the activities. The rules set out in Annex 1 are unambiguous and predictable for each activity. In principal, all installations engaged in the same activity must use the same methodology. The activity-specific methodologies are in principle consistent with the highest tiers as set out in Annexes II to X in MRG. Process emissions from pulp and paper installations are not included by the Norwegian trading scheme because they are subject to the CO_2 tax.

Annex 1 contains reference emission factors (t CO_2/t) and net calorific value (TJ/kt) for various fossil fuel types.

Emission reports must be submitted in a standardized electronic format directly to the Pollution Control Authority by 1 March each year. The Authority may require third-party verification of emission reports from installations with multiple and complex processes. In addition to technical data on emissions, a report must include identification data for the installation, such as its name, address and identification number.

An operator's right to transfer allowances will be suspended if he has not reported in accordance with the rules by the time limit (Greenhouse Gas Emission Trading Act § 19). The same applies if the content of the report is not satisfactory or it contains errors. In such cases, the Pollution Control Authority will in those cases give the operator a quick response indicating which parts of the report must be improved. At the same time the operator will be given notice of suspension if the report is not corrected in accordance with the rules within a specified deadline. The deadline will be set so that the Authority can assess whether the report has been corrected satisfactorily in line with the regulations before it has to decide whether or not to suspend the operator with effect from 1 April. The operator will be informed that suspension will be upheld until a complete emission report in line with the regulations has been submitted.

The Pollution Control Authority may in addition impose a coercive fine in the event of contravention of the duty to report on emissions (see Greenhouse Gas Emission Trading Act § 20). If an operator does not report in accordance with the rules despite the possibility of being suspended from the right to transfer allowances, it is to be hoped that a satisfactory report will be received shortly after suspension is effectuated. If not, the Pollution Control Authority may impose coercive fines which will continue to be effective for as long as the unlawful situation persists.

Before determining whether to impose an excess emissions fine in accordance with the Greenhouse Gas Emission Trading Act § 21, the Pollution Control Authority must determine an operator's emissions and compare the result with the allowances surrendered by the same operator.. If an operator has not reported in accordance with the rules despite suspension and the imposition of a coercive fine, the Pollution Control Authority must estimate the emissions based on the rules that the operator should have followed in the first place. In such cases, the Authority will probably have to carry out an on-site inspection to obtain the necessary information.

It follows from the Greenhouse Emission Trading Act § 22 that any person who wilfully or through negligence contravenes the provisions on the duty to report emissions is liable to fines or to a term of imprisonment not exceeding three months, or both. Such a breach could also be punishable in accordance with the provisions of the Penal Code relating to false testimony (see the general civil penal code § 166, first paragraph).

Annex 4 The Statistics Act (Chapter 2 and 3)

Chapter 2. Official statistics

§ 2-1. Decisions concerning the production of official statistics
Decisions concerning the production of official statistics shall be taken by the King[l].
[1] Ministry of Finance pursuant to Royal Decree No. 387 of 16 June l989.

§ 2-2. Obligation to provide information

(1) The King[1] may by regulation or resolution impose upon any person an obligation to provide the information which is necessary for the production of official statistics in so far as any legally prescribed obligation of secrecy is no obstacle thereto.
[1] Ministry of Finance pursuant to Royal Decree No. 387 of 16 June 1989.

(2) A deadline may be set for the provision of information and stipulations may be made regarding the form in which the information shall be given. The obligation to provide information is breached when the information required is not given before the expiry of the deadline.

§ 2-3[1]). Compulsory fines
The body which has laid down the obligation to provide information may impose compulsory fines payable to the state upon such person as breaches this obligation. The imposition of compulsory fines shall be grounds for enforcing payment. Such compulsory fines may be collected by distraint. In special cases compulsory fines that have been incurred may be waived wholly or in part. The King[2] may issue more detailed provisions concerning such compulsory fines.

When the State Agency for the Recovery of Fines has been instructed to collect a compulsory fine as mentioned in the first paragraph, it can do so by garnishing wages and other similar payments pursuant to the rules in Section 2-7 of the Creditors Security Act. The Agency may also enforce payment of the fine by establishing an attachment charge in respect of the claim, provided the claim can be given legal protection by being registered in a register or notified to a third party, cf. Chapter 5 of the Mortgage Act, and the attachment proceedings can be conducted on the premises of the Agency according to the first paragraph of Section 7-9 of the Act relating to the Enforcement of Claims.
[1] Amended by Act No. 86 of 26 June 1992 (effective as of 1 January 1993 pursuant to Proposition No. 765 of 23 October 1992), and by Act No. 4 of 18 March 1994 (effective immediately pursuant to Proposition No. 217 of 18 March 1994, and retroactive for compulsory fines fallen due prior to its entry into force.)
[2]Ministry of Finance pursuant to Royal Decree No. 387 of 16 June 1989.

§ 2-4. Obligation of secrecy

(1) Any person performing work or service for a body which prepares or produces official statistics has a duty to prevent unauthorised persons from gaining access to or

knowledge of whatever information he or she obtains concerning personal matters, administrative or business matters, or of technical appliances and methods used during the preparation or production of statistics. The obligation of secrecy applies only to such information as is collected for the purpose of producing official statistics.

(2) The obligation of secrecy also applies after the person concerned has completed the work or service. Furthermore, the person concerned may not use such information as is mentioned in this section in his or her own business or in work or in the service of others.

(3) Sections 13 to 13 e of the Public Administration Act do not apply.

§ 2-5. The use of information

(1) Information collected in accordance with any prescribed obligation to provide information, or which is given voluntarily, may only be used for the production of official statistics or for such other use as is approved by the Data Inspectorate and is not detrimental to the security of the realm. If information is handed over, the obligation of secrecy pursuant to § 2-4 shall also apply to the recipient of the information. When particular grounds so indicate, the Data Inspectorate may nevertheless make exceptions to such obligation of secrecy for certain types of information.

(2) Any agency which hands over such information may stipulate conditions *inter alia* concerning the use of the information and who shall be responsible for the information and have access thereto, concerning the storage and return of borrowed material, the destruction of copies, etc.

§ 2-6. The publication of information

Information collected in accordance with any prescribed obligation to provide information, or which is given voluntarily, shall under no circumstances be published in such a way that it may be traced back to the supplier of any data or to any other identifiable individual to the detriment of the person concerned, or to the unreasonable detriment of the latter if the supplier of the data or the individual is an undertaking of the kind mentioned in § 5-1 third paragraph[1] or a public organisation.
[1] Repealed by Act No. 66 of 20 July 1991.

§ 2-7. Cessation of the obligation of secrecy

The obligation of secrecy pursuant to this Act with respect to information concerning personal matters shall cease after 100 years. The obligation of secrecy pursuant to this Act with respect to information concerning management and business matters and technical appliances and methods shall cease after 60 years.

Chapter 3. The duties and activities of Statistics Norway

§ 3-1. The duties of Statistics Norway
Statistics Norway is the central body for production and dissemination of official statistics and bears the main responsibility for ensuring that the object of this Act pursuant to §1-1 is fulfilled. With respect thereto, Statistics Norway shall:

a) identify and place in order of priority the needs for official statistics

b) coordinate comprehensive statistics which are produced by administrative agencies,

c) develop statistical methods and apply statistics to analysis and research,

d) provide information for statistical use for research purposes and for public planning within the framework of § 2-5 of this Act,

e) bear the main responsibility for international statistical cooperation.

§ 3-2. Administrative data-processing systems

(1) Statistics Norway shall have the right to use administrative data-processing systems in the state administration and in nationwide municipal organisations as the basis for official statistics.

(2) When state bodies or nationwide municipal organisations are to establish or modify a major administrative data-processing system, notice thereof shall be sent in advance to Statistics Norway. Statistics Norway may seek additional information. Statistics Norway may also put forward proposals concerning the manner in which data-processing systems should be designed in order to safeguard consideration for statistics.

(3) The King[1] may issue more detailed provisions concerning the practice of the rules in subsections 1 and 2.
[1] Ministry of Finance pursuant to Royal Decree No. 387 of 16 June 1989.

§ 3-3. Coordination of statistics

(1) When an administrative body is to carry out major statistical investigations, notice thereof shall be sent in advance to Statistics Norway. Statistics Norway may seek additional information. Statistics Norway may forward proposals concerning the manner in which information shall be sought and the manner in which statistics shall be produced in order to safeguard consideration for statistics and coordination.

(2) The King[1] may determine that public research institutes shall be considered to be administrative bodies pursuant to the provisions of this section.
[1] Ministry of Finance pursuant to Royal Decree No. 387 of 16 June 1989.

Annex 5. Key data providers

Data providers and sources for the emission inventory ranked in accordance with the importance.

	Very important	Important	Less important
1. Data from Statistics Norway			
Energy statistics	X		
Consumer surveys			X
Living condition survey			X
Foreign trade statistics			X
Production statistics			X
Petroleum statistics	X		
Agriculture statistics		X	
Waste statistics		X	
Waste water statistics			X
Vehicle registry		X	
Transport statistics		X	

2. Other institutions			
The Norwegian Forest and Landscape Institute	X		
Norwegian Pollution Control Authority (SFT)	X		
- INKOSYS	X		
- Environmental Web (including data from the Norwegian Petroleum Directorate)	X		
Norwegian Petroleum Industry Association (NP, norsk petroleumsinstitutt)			X
Norwegian Petroleum Directorate (Oljedirektoratet)		X	
Institute of Transport Economics (TØI)			X
Norwegian Road Federation (Opplysningsrådet for veitrafikk)		X	
Norwegian Food Safety Authority (Mattilsynet)			X

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Annex 6. QC of activity data – existing routines

Statistics Norway (SSB)

Documentation of the statistics and routines is available on web (www.ssb.no/en/ (for each statistics click at "about the index")). An example from the energy statistics is given below. As a part of the statistical production reported data are checked and the primary data providers are contacted for explanations/revisions if needed.

Example: Energy use in the manufacturing sector

The purpose of the statistics is to give information about energy use in mining and manufacturing. Since the 70s the energy use data are collected as a part of the structural business statistics for manufacturing. From the reference year 1998 the energy use data are collected in a single survey, as a part of an ongoing project between Statistics Norway and the Norwegian Water Resources and Energy Directorate (Enova SF from 2003). The purpose of this is to improve the quality of the energy use information and to develop and produce some new statistics products.

Population

From the reference year 1998 the statistics cover all existing local kind of activity units within mining and manufacturing, which means division 10, 12-37 in the Norwegian Standard Industrial Classification. Statistics Norway collects data for a sample. For de other units the energy use data are estimated. The estimation is based on turnover and information from the sample. There are about 25000 units in the population. Until the reference year 1997 enterprises with individual proprietorship where the owner is working alone (one-man-enterprise), and other local kind of activity units with employment less than half a man-year worked, are not included. The change in the population from the reference year 1998 leads to a break in the statistics.

Data sources

Data of energy use are collected from a sample of local units in manufacturing, mining and quarrying. Turnover data from the short-term turnover statistics (by preliminary figures) and energy costs from the structural data for the manufacturing sector (by final figures) are used by estimating energy use data for units outside the sample. Information on activity codes, addresses and other information are also collected from the Central Register of Establishments and Enterprises of Statistics Norway.

Sampling

The survey has a sample of 3 200 local kind of activity units. The sample consists of the biggest units in each subgroup, chosen by number of employees in each subgroup, and some small and medium sized units. Each industry is represented with as much units as possible. Small units are chosen randomly from a stratified sample. The units in the sample cover about 96 per cent of the total energy use and about 92 per cent of the total energy costs in the mining and manufacturing sector.

Collection of data

The survey is based on questionnaires that are sent out in January the year after the reference year. It is possible to choose between paper forms and electronic forms. The Statistics Act is used, and the units are required to respond. The deadline is in February. There are three reminders. Units that have not responded after the third reminder have to pay a fine. Even if the units pay the fine, they still have to respond.

Control and revision

When we receive the data we first have a consistence check against the previous year to identify serious errors. If we detect serious error we correct the data. Afterwards we are doing a more intimate control of the units with the largest energy consume. The units are classified after this criterion:

Group 1: Energy use > 50 GWh (120 units in 2004)

Group 2: 10 GWh < energy use < 50 GWh (280 units in 2004)

Group 3: Energy use > 5 GWh or/else energy cost. > 1 mil. NOK (600 units)

Group 4: Energy use < 5 GWh or/else energy cost. < 1 mil. NOK (2 200 units)

The local kind of activity units in group 1 have highest priority and will be controlled first. Then we continue with the units in group 2 and 3. Here we have a more intimate consistence check against the previous year and against energy costs in the Central Register of Establishments and Enterprises. If we detect errors in the data we contact the local kind of activity units. At the end we have a consistence check of total energy use and costs in each industry against the previous year.

Estimation

Turnover data from the short-term turnover statistics (by preliminary figures) and energy costs from the structural data for the manufacturing sector (by final figures) are used by estimating energy use data for units outside the sample.

Frequency and timeliness

Yearly

Preliminary figures are published within 6 months after the end of the reference year.

Final figures are published within 18 months after the end of the reference year.

Legal authority

The Statistics Act §§2-2 and 2-3

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SFT

Emission data reported from the plants to SFT are entered into the database INKOSYS and the information is forwarded to an officer in charge. The officer in charge will check the following:

- That the data in INKOSYS are registered as reported from the plants and appropriate corrections are made
- The methodology that was used for estimating emissions
- Emission in comparison to the emission level reported for the previous year. Emissions are displayed graphically. In the case of large deviations the plant is contacted to provide an explanation.
- Emission relative to the production level. In the case of large variations in this ratio the plant is contacted to provide an explanation.
- The emissions seen in relation to other factors, for example changes in production technologies, control technologies or fuels

The Division of Climate and Energy are performing additional checks of data before they are sent Statistics Norway, including assessment of time-series consistency and consistency of data reported from plants using comparable technologies.

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The Norwegian Forest and Landscape Institute

Survey level

The Norwegian National Forest Inventory has long traditions, and the attributes assessed or measured in the field are subject to frequent revisions, while at the same time it will try to preserve the long time series of key attributes. The main objectives of the NFI are to provide updated forest information to national forest administrations, to be able to report adequately to international forest resources assessments and to provide data for special studies.

Prior to every field season, all field workers will be gathered for one week of briefing of the inventory work. New attributes or altered definitions of attributes will especially be emphasized. The course includes practical training and exercises, under which the

assessments and measurements made by each of the fieldworkers will be compared and discussed in plenary.

During the field season, each team will usually be visited a number of times by a representative from the head office. The supervisor will join the team on some sample plots in the field, giving an opportunity to discuss possible problems and misunderstandings with regard to classifications and measurements. Normally a check assessment will also be performed, i.e. a subset of the sample plots will be measured a second time by an independent control team. Normally the proportion of plots selected for checking constitutes about 5%. The results from the check assessment will not be used to replace or adjust the original data, but only to assess data quality, detect misunderstandings and incorrect working techniques. Thus, it may lead to improvement of field instructions. Due to capacity reasons, any check assessment has not been carried out during the two last seasons, but the plan is to reintroduce it in the near future.

Data is being entered directly into a handheld data logger during the inventory work. A number of consistency checks has been built into this data logger, e.g. to ensure that the correct attributes will be assessed under the current area class. For inventory on permanent sample plots, data from the previous inventory cycle will be stored in the data logger and a warning will appear if the data is not in accordance with what has been assessed before. That also includes single tree data where current diameter will be checked against the one measured 5 years earlier, in order to detect an unlikely increment rate.

Data processing

After the data has been transferred to the office and preliminary stored in a database, further checks on completeness and consistency are taking place. Checks are being performed to control that all the planned field plots have been visited in the field, or at least have been considered by the field team if the plot for some reason has been inaccessible. Further testing for correspondence between different attributes will also be carried out. That would include e.g. checking the likeliness of diameter/height relationship for individual trees.

After calculation of volume and annual increment of each sampled tree, the estimates will be aggregated to each sample plot, after which expansion factors will be used to produce results for each geographical region and for the whole country. One sample plot will generally represent an area close to 900 ha. After having made the appropriate summaries, the results will be compared with corresponding data from last inventory and the entire time series of data.

Annex 7 Archiving – development of routines

Statistics Norway

The national emissions inventory is a part of Statistics Norway's data archiving system. All input data to and results from the general Norwegian emission inventory model from every publication cycle are stored and documented in this system. Archiving is made after each inventory calculation has been finalised.

Several input data are used in preliminary calculations before entering into the general Norwegian emission inventory model. This includes satellite models such as road traffic, waste and air traffic, as well as a number of simpler calculations that do not fit into the

framework of the general model. The preliminary calculations are not included in the central archiving system, which is not suited for such a diverse collection of data. For some satellite models there is an established archiving routine where all input data and results from every calculation cycle are stored. Also CRF tables are systematically archived.

Statistics Norway will improve its archiving system in line with the requirements for the national system. This will include improved archiving of input and output from side models (satellite models). These will be archived in one place and the storage of revised versions due to recalculations will be improved as will the documentation of recalculations.

Statistics Norway will also improve the file structure of the archiving for better accessibility (naming, structure and use of sub-catalogues). They will also improve the archiving of documentation. Present practice is that the information in the documentations is overwritten as they are updated.

Recalculations are documented for internal use. This document will receive increased status and its accessibility will be improved.

The Norwegian Pollution Control Authority (SFT)

Emissions from large industrial plants

Reports with emission data and QA control from large industrial plants are sent to SFT and archived in Ephorte. Ephorte is an electronic recordkeeping tool that meets the specifications set by the Noark Standard. The Noark Standard is a specification of functional requirements for electronic recordkeeping systems used in public administration in Norway and has been approved by the Norwegian National Archives. These data reported from the plants are then stored in the FORURENSNING database[15]. All written correspondence between the plants and SFT is archived in Ephorte. If a plant submits additional information as a result of the QA/QC, this information will also be archived in Ephorte and FORURENSNING will be corrected accordingly. FORURENSNING does currently not have the functionality to store the original emission data if previously reported data are corrected, but this functionality may be developed. After QA/QC described in 2.3.2, the data (with supplementary notes) for the large industrial plants are stored and archived in a designated file on SFT's server, before being sent to Statistics Norway.

Emissions from off-shore activities

Emission data from off-shore activities are archived in Environmental Web. This is a database operated by the Norwegian Petroleum Directorate, SFT and the Norwegian Oil Industry Association. SFT aggregates data from the Environmental Web. The data are stored and archived in a designated file on SFT's server before being sent to Statistics Norway.

Methane recovery from landfills

Emission data from the landfill owners are sent to the County Departments of Environmental Affairs and are then stored FORURENSNING database. After QA/QC, these data (with supplementary notes) are stored and archived in a designated file on SFT's server, before being sent to Statistics Norway

Import of HFC/PFC and SF_6

[15] The FORURENSNING database replaced the previous database INKOSYS in 2006. All data in INKOSYS is transferred to FOURENSNING. .

Companies that import *HFC/PFC and SF_6* in bulk report this information to SFT annually. The reports are archived in Ephorte. After QA/QC, these data (with supplementary notes) are stored and archived in a designated file on SFT's server, before being sent to Statistics Norway.

SFT will work to improve its archiving routines for emissions and other data reported from industrial plants and for emissions and other data reported from oil and gas facilities. Most important will be the improvements with respect to transparency of recalculated data, as FORURENSNING in the future may be able to store the original data.

The CRFs tables and NIR are archived in REPORTNET from 2002 and will also be archived there in the future. Before 2002 the reports are stored at SFT's server. Statistics Norway will the archive the CRF Reporter.

The Norwegian Forest and Landscape Institute

Because The Norwegian Forest and Landscape Institute has recently been assigned the responsibility for the LULUCF inventory no dedicated procedures for archiving have so far been established to secure long-term storage of the LULUCF data. The Norwegian Forest and Landscape Institute will develop such routines in 2007 to meet the requirements of the national system. The data can be divided into two separate groups. One group would comprise the archiving of reporting tables (CRF), documents and programmes etc. The requirements here would be that the data 1) should be kept in a systematic way, easy to access and to identify for people who are involved in the reporting; and 2) securely stored with no risk of being accidentally deleted or altered.

The tables, data programmes etc. are currently being stored on the institute's server. Every night a new backup copy will be made and stored outside the building. This will ensure that no data can disappear due to technical failure. Files that have been left unchanged, thus will exist as long as there is a wish to keep them. Even after purposely deleting or changing the data, the files will exist for 2-3 months, or until the data tapes will be written over with new data.

The second group refers to the basic data for calculating land use and biomass. These are being kept in an Oracle database (the NFI database). The current data at some points in time will be secured by means of the regular backup procedures, but the database will change frequently and the basic data used for a certain LULUCF reporting will not be stored on a long-term basis. Mainly the changes of older data will consist of corrections of errors, thus improve the data, but at the same time it will not be possible to replicate the calculations carried out for a specific year. The Norwegian Forest and Landscape Institute will consider practical approaches to change the routines and permanently save a copy of the database, for example immediately after filling in the CRF tables.

Annex VII: CRF Summary 2 Tables 1990 - 2007

This annex contains Summary II-tables for the whole period 1990-2007.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 1990
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [(1)]	CH_4	N_2O	HFCs [(2)]	PFCs [(2)]	SF_6 [(2)]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [(1)]	**22 487.53**	**4 616.39**	**4 731.94**	**0.02**	**3 370.40**	**2 199.78**	**37 406.06**
1. Energy	**28 596.57**	**629.37**	**310.55**				**29 536.48**
A. Fuel Combustion (Sectoral Approach)	25 939.37	253.30	306.44				26 499.11
1. Energy Industries	6 647.60	48.17	26.88				6 722.65
2. Manufacturing Industries and Construction	3 597.24	10.98	44.15				3 652.37
3. Transport	11 108.73	71.90	145.42				11 326.05
4. Other Sectors	4 129.61	121.78	83.87				4 335.25
5. Other	456.19	0.48	6.12				462.79
B. Fugitive Emissions from Fuels	2 657.19	376.07	4.11				3 037.37
1. Solid Fuels	7.37	56.49	NA,NO				63.86
2. Oil and Natural Gas	2 649.82	319.58	4.11				2 973.52
2. Industrial Processes	**6 039.17**	**9.99**	**2 078.81**	**0.02**	**3 370.40**	**2 199.78**	**13 698.18**
A. Mineral Products	721.27	NA	NA				721.27
B. Chemical Industry	900.36	8.95	2 073.59	NO	NO	NO	2 982.90
C. Metal Production	4 334.00	1.04	5.22	NO	3 370.40	2 143.83	9 854.50
D. Other Production	77.30						77.30
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [(2)]				0.02	NA,NO	55.95	55.97
G. Other	6.23	NA	NA	NO	NO	NO	6.23
3. Solvent and Other Product Use	**155.65**		**35.53**				**191.18**
4. Agriculture		**2 268.13**	**2 176.45**				**4 444.57**
A. Enteric Fermentation		1 946.11					1 946.11
B. Manure Management		298.17	133.36				431.53
C. Rice Cultivation		NO					NO
D. Agricultural Soils[(3)]		NA,NO	2 036.21				2 036.21
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		23.85	6.88				30.72
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[(1)]	**-12 304.04**	**1.77**	**13.45**				**-12 288.82**
A. Forest Land	-15 145.82	1.77	12.72				-15 131.33
B. Cropland	482.33	IE,NO	0.68				483.01
C. Grassland	1 887.15	NO	NO				1 887.15
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	458.81	NE,NO	NE,NO				458.81
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	10.12	NO	NO				10.12
6. Waste	**0.19**	**1 707.13**	**117.14**				**1 824.46**
A. Solid Waste Disposal on Land	IE,NA	1 687.61					1 687.61
B. Waste-water Handling		19.51	117.07				136.58
C. Waste Incineration	0.19	0.01	0.07				0.27
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [(4)]							
International Bunkers	2 097.52	75.26	6 107.88				8 280.65
Aviation	619.47	73.01	6 096.37				6 788.85
Marine	1 478.05	2.24	11.51				1 491.80
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 474.82**						**4 474.82**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	49 694.88
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	37 406.06

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 1991
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**21 873.10**	**4 665.04**	**4 587.74**	**0.11**	**2 992.92**	**2 079.15**	**36 198.06**
1. Energy	**27 675.15**	**656.39**	**310.35**				**28 641.90**
A. Fuel Combustion (Sectoral Approach)	25 566.93	240.29	307.48				26 114.70
1. Energy Industries	6 981.49	50.46	30.59				7 062.53
2. Manufacturing Industries and Construction	3 447.17	10.36	42.76				3 500.30
3. Transport	11 024.95	69.51	148.85				11 243.31
4. Other Sectors	3 707.56	109.53	79.60				3 896.69
5. Other	405.75	0.43	5.68				411.86
B. Fugitive Emissions from Fuels	2 108.22	416.11	2.87				2 527.20
1. Solid Fuels	7.84	60.08	NA,NO				67.92
2. Oil and Natural Gas	2 100.39	356.03	2.87				2 459.28
2. Industrial Processes	**5 566.49**	**8.52**	**1 920.71**	**0.11**	**2 992.92**	**2 079.15**	**12 567.90**
A. Mineral Products	665.43	NA	NA				665.43
B. Chemical Industry	797.57	7.65	1 916.26	NO	NO	NO	2 721.47
C. Metal Production	3 977.15	0.87	4.45	NO	2 992.92	2 019.55	8 994.94
D. Other Production	120.29						120.29
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				0.11	NA,NO	59.60	59.71
G. Other	6.06	NA	NA	NO	NO	NO	6.06
3. Solvent and Other Product Use	**136.83**		**35.30**				**172.14**
4. Agriculture		**2 299.21**	**2 190.12**				**4 489.33**
A. Enteric Fermentation		1 974.31					1 974.31
B. Manure Management		306.16	142.03				448.19
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	2 042.69				2 042.69
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		18.74	5.41				24.15
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-11 505.56**	**2.97**	**14.55**				**-11 488.04**
A. Forest Land	-14 316.00	2.97	13.88				-14 299.15
B. Cropland	435.49	IE,NO	0.62				436.10
C. Grassland	1 900.89	NO	NO				1 900.89
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	458.81	NE,NO	NE,NO				458.81
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	11.88	NO	NO				11.88
6. Waste	**0.19**	**1 697.95**	**116.70**				**1 814.84**
A. Solid Waste Disposal on Land	IE,NA	1 679.25					1 679.25
B. Waste-water Handling		18.67	116.63				135.30
C. Waste Incineration	0.19	0.03	0.07				0.29
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	1 811.80	78.43	5 517.42				7 407.65
Aviation	559.65	76.53	5 507.68				6 143.86
Marine	1 252.15	1.90	9.75				1 263.79
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 372.77**						**4 372.77**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	47 686.10
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	36 198.06

[1] For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[2] Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

[3] Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

[4] See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 1992
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**23 086.88**	**4 726.86**	**4 027.06**	**0.34**	**2 286.92**	**705.03**	**34 833.09**
1. Energy	**28 484.79**	**753.57**	**314.52**				**29 552.88**
A. Fuel Combustion (Sectoral Approach)	26 077.00	241.01	311.88				26 629.89
1. Energy Industries	7 581.27	54.13	33.38				7 668.78
2. Manufacturing Industries and Construction	3 376.20	9.67	43.14				3 429.02
3. Transport	11 241.57	70.08	150.56				11 462.20
4. Other Sectors	3 391.05	106.61	76.73				3 574.39
5. Other	486.91	0.52	8.07				495.50
B. Fugitive Emissions from Fuels	2 407.79	512.56	2.64				2 922.99
1. Solid Fuels	6.51	49.90	NA,NO				56.41
2. Oil and Natural Gas	2 401.28	462.66	2.64				2 866.58
2. Industrial Processes	**5 554.61**	**8.81**	**1 371.42**	**0.34**	**2 286.92**	**705.03**	**9 927.12**
A. Mineral Products	720.57	NA,NO	NA,NO				720.57
B. Chemical Industry	750.81	7.92	1 366.84	NO	NO	NO	2 125.58
C. Metal Production	3 950.09	0.88	4.57	NO	2 286.92	638.25	6 880.72
D. Other Production	119.85						119.85
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				0.34	NA,NO	66.78	67.12
G. Other	13.29	NA	NA	NO	NO	NO	13.29
3. Solvent and Other Product Use	**140.81**		**35.21**				**176.02**
4. Agriculture		**2 294.10**	**2 175.28**				**4 469.38**
A. Enteric Fermentation		1 976.53					1 976.53
B. Manure Management		307.31	141.02				448.32
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	2 031.31				2 031.31
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		10.26	2.96				13.22
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-11 093.52**	**2.73**	**14.34**				**-11 076.45**
A. Forest Land	-13 848.52	2.73	13.74				-13 832.06
B. Cropland	380.05	IE,NO	0.55				380.61
C. Grassland	1 900.89	NO	NO				1 900.89
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	458.81	NE,NO	NE,NO				458.81
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	11.88	NO	NO				11.88
6. Waste	**0.19**	**1 667.66**	**116.29**				**1 784.14**
A. Solid Waste Disposal on Land	IE,NA	1 649.79					1 649.79
B. Waste-water Handling		17.83	116.22				134.04
C. Waste Incineration	0.19	0.04	0.07				0.30
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Memo Items: [4]							
International Bunkers	2 169.53	96.21	5 945.16				8 210.89
Aviation	602.87	93.83	5 932.97				6 629.66
Marine	1 566.66	2.37	12.19				1 581.23
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 088.76**						**4 088.76**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	45 909.54
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	34 833.09

[1] For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[2] Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

[3] Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

[4] See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 1993
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**24 548.33**	**4 794.58**	**4 255.44**	**2.42**	**2 297.72**	**737.71**	**36 636.20**
1. Energy	**29 672.98**	**855.49**	**329.00**				**30 857.47**
A. Fuel Combustion (Sectoral Approach)	27 143.19	257.91	325.93				27 727.03
1. Energy Industries	7 891.13	56.11	33.00				7 980.24
2. Manufacturing Industries and Construction	3 696.82	10.11	46.82				3 753.75
3. Transport	11 853.29	70.86	163.67				12 087.81
4. Other Sectors	3 335.16	120.43	77.34				3 532.93
5. Other	366.79	0.40	5.10				372.29
B. Fugitive Emissions from Fuels	2 529.79	597.58	3.07				3 130.44
1. Solid Fuels	7.22	55.33	NA,NO				62.55
2. Oil and Natural Gas	2 522.57	542.25	3.07				3 067.89
2. Industrial Processes	**6 092.10**	**8.91**	**1 590.34**	**2.42**	**2 297.72**	**737.71**	**10 729.20**
A. Mineral Products	919.57	NA,NO	NA,NO				919.57
B. Chemical Industry	803.01	7.91	1 585.34	NO	NO	NO	2 396.27
C. Metal Production	4 217.66	0.99	5.00	NO	2 297.72	663.23	7 184.59
D. Other Production	126.96						126.96
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				2.42	NA,NO	74.49	76.91
G. Other	24.90	NA	NA	NO	NO	NO	24.90
3. Solvent and Other Product Use	**141.24**		**35.94**				**177.17**
4. Agriculture		**2 268.71**	**2 167.34**				**4 436.05**
A. Enteric Fermentation		1 949.05					1 949.05
B. Manure Management		305.56	137.87				443.43
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	2 025.40				2 025.40
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		14.10	4.07				18.16
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-11 358.14**	**0.42**	**13.67**				**-11 344.06**
A. Forest Land	-14 119.43	0.42	13.12				-14 105.89
B. Cropland	386.34	IE,NO	0.49				386.83
C. Grassland	1 900.89	NO	NO				1 900.89
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	458.81	NE,NO	NE,NO				458.81
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	11.88	NO	NO				11.88
6. Waste	**0.16**	**1 661.05**	**119.16**				**1 780.37**
A. Solid Waste Disposal on Land	IE,NA	1 644.03					1 644.03
B. Waste-water Handling		16.98	119.09				136.07
C. Waste Incineration	0.16	0.04	0.07				0.28
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 312.09	113.39	6 263.67				8 689.15
Aviation	635.14	110.85	6 250.62				6 996.62
Marine	1 676.94	2.54	13.05				1 692.53
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 397.99**						**4 397.99**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	47 980.26
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	36 636.20

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 1994
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**27 034.45**	**4 867.49**	**4 352.22**	**9.20**	**2 032.47**	**877.98**	**39 173.82**
1. Energy	**31 267.76**	**895.57**	**362.16**				**32 525.50**
A. Fuel Combustion (Sectoral Approach)	28 610.45	266.54	358.97				29 235.97
1. Energy Industries	8 596.27	57.99	35.25				8 689.51
2. Manufacturing Industries and Construction	4 344.67	11.20	57.57				4 413.44
3. Transport	11 683.93	68.67	185.95				11 938.55
4. Other Sectors	3 477.93	128.25	73.36				3 679.54
5. Other	507.65	0.43	6.85				514.92
B. Fugitive Emissions from Fuels	2 657.31	629.03	3.19				3 289.53
1. Solid Fuels	7.20	55.18	NA,NO				62.38
2. Oil and Natural Gas	2 650.11	573.85	3.19				3 227.15
2. Industrial Processes	**6 461.24**	**9.62**	**1 646.36**	**9.20**	**2 032.47**	**877.98**	**11 036.88**
A. Mineral Products	927.53	NA,NO	NA,NO				927.53
B. Chemical Industry	816.00	8.51	1 640.83	NO	NO	NO	2 465.34
C. Metal Production	4 578.81	1.11	5.53	NO	2 032.47	791.09	7 409.02
D. Other Production	125.64						125.64
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				9.20	NA,NO	86.89	96.09
G. Other	13.26	NA	NA	NO	NO	NO	13.26
3. Solvent and Other Product Use	**151.80**		**38.50**				**190.29**
4. Agriculture		**2 303.30**	**2 167.10**				**4 470.40**
A. Enteric Fermentation		1 984.30					1 984.30
B. Manure Management		308.88	144.58				453.47
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	2 019.59				2 019.59
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		10.12	2.92				13.04
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-10 846.52**	**0.44**	**13.67**				**-10 832.41**
A. Forest Land	-13 566.84	0.44	13.18				-13 553.21
B. Cropland	341.90	IE,NO	0.44				342.33
C. Grassland	1 900.89	NO	NO				1 900.89
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	458.81	NE,NO	NE,NO				458.81
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	15.34	NO	NO				15.34
6. Waste	**0.18**	**1 658.56**	**124.43**				**1 783.16**
A. Solid Waste Disposal on Land	IE,NA	1 642.39					1 642.39
B. Waste-water Handling		16.12	124.35				140.47
C. Waste Incineration	0.18	0.05	0.07				0.30
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 462.27	122.05	6 082.18				8 666.50
Aviation	616.57	119.26	6 067.82				6 803.64
Marine	1 845.70	2.80	14.36				1 862.86
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 709.36**						**4 709.36**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	50 006.23
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	39 173.82

[1] For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[2] Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

[3] Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

[4] See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 1995
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**26 128.24**	**4 847.95**	**4 417.66**	**25.82**	**2 007.74**	**607.79**	**38 035.21**
1. Energy	**30 991.93**	**880.80**	**391.74**				**32 264.47**
A. Fuel Combustion (Sectoral Approach)	28 364.06	262.52	388.27				29 014.86
1. Energy Industries	8 445.45	58.10	35.58				8 539.12
2. Manufacturing Industries and Construction	3 907.75	11.25	59.93				3 978.93
3. Transport	12 084.63	67.59	214.89				12 367.12
4. Other Sectors	3 472.04	125.20	71.02				3 668.27
5. Other	454.19	0.37	6.86				461.42
B. Fugitive Emissions from Fuels	2 627.87	618.28	3.47				3 249.61
1. Solid Fuels	7.09	54.32	NA,NO				61.41
2. Oil and Natural Gas	2 620.78	563.96	3.47				3 188.21
2. Industrial Processes	**6 672.81**	**10.13**	**1 642.93**	**25.82**	**2 007.74**	**607.79**	**10 967.22**
A. Mineral Products	970.74	NA,NO	NA,NO				970.74
B. Chemical Industry	845.44	8.97	1 637.17	NO	NO	NO	2 491.58
C. Metal Production	4 707.61	1.16	5.76	NO	2 007.72	509.07	7 231.32
D. Other Production	133.88						133.88
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				25.82	0.02	98.72	124.57
G. Other	15.14	NA	NA	NO	NO	NO	15.14
3. Solvent and Other Product Use	**147.79**		**38.94**				**186.74**
4. Agriculture		**2 331.25**	**2 202.98**				**4 534.23**
A. Enteric Fermentation		2 004.48					2 004.48
B. Manure Management		314.23	145.84				460.07
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	2 053.53				2 053.53
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		12.54	3.62				16.16
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-11 684.44**	**0.21**	**13.60**				**-11 670.62**
A. Forest Land	-14 430.98	0.21	13.16				-14 417.60
B. Cropland	364.66	IE,NO	0.39				365.05
C. Grassland	1 900.89	NO	NO				1 900.89
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	458.81	NE,NO	NE,NO				458.81
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	18.80	NO	NO				18.80
6. Waste	**0.15**	**1 625.57**	**127.46**				**1 753.17**
A. Solid Waste Disposal on Land	IE,NA	1 610.28					1 610.28
B. Waste-water Handling		15.24	127.39				142.63
C. Waste Incineration	0.15	0.05	0.07				0.27
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 841.18	127.74	5 780.27				8 749.19
Aviation	585.57	124.32	5 762.71				6 472.60
Marine	2 255.62	3.42	17.56				2 276.59
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 812.17**						**4 812.17**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	49 705.83
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	38 035.21

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 1996
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**29 864.50**	**4 869.07**	**4 468.29**	**52.24**	**1 829.08**	**574.10**	**41 657.28**
1. Energy	**34 080.68**	**917.56**	**434.93**				**35 433.17**
A. Fuel Combustion (Sectoral Approach)	31 034.05	275.20	431.04				31 740.29
1. Energy Industries	9 295.25	61.69	37.58				9 394.52
2. Manufacturing Industries and Construction	4 408.12	11.16	59.83				4 479.10
3. Transport	12 726.91	67.70	255.41				13 050.02
4. Other Sectors	4 197.17	134.26	73.24				4 404.68
5. Other	406.60	0.39	4.98				411.97
B. Fugitive Emissions from Fuels	3 046.63	642.36	3.89				3 692.88
1. Solid Fuels	7.24	55.52	NA,NO				62.76
2. Oil and Natural Gas	3 039.39	586.84	3.89				3 630.12
2. Industrial Processes	**6 661.55**	**9.91**	**1 624.53**	**52.24**	**1 829.08**	**574.10**	**10 751.40**
A. Mineral Products	970.49	NA,NO	NA,NO				970.49
B. Chemical Industry	818.00	8.68	1 618.40	NO	NO	NO	2 445.07
C. Metal Production	4 718.17	1.23	6.13	NO	1 829.04	472.50	7 027.06
D. Other Production	135.43						135.43
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				52.24	0.04	101.60	153.88
G. Other	19.46	NA	NA	NO	NO	NO	19.46
3. Solvent and Other Product Use	**156.06**		**39.51**				**195.57**
4. Agriculture		**2 343.67**	**2 221.87**				**4 565.55**
A. Enteric Fermentation		2 009.97					2 009.97
B. Manure Management		320.02	146.93				466.95
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	2 071.00				2 071.00
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		13.68	3.95				17.63
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-11 033.93**	**0.97**	**13.63**				**-11 019.33**
A. Forest Land	-13 762.86	0.97	13.21				-13 748.68
B. Cropland	341.33	IE,NO	0.37				341.69
C. Grassland	1 900.89	NO	NO				1 900.89
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	458.81	NE,NO	NE,NO				458.81
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	24.53	NO	NO				24.53
6. Waste	**0.13**	**1 596.96**	**133.82**				**1 730.91**
A. Solid Waste Disposal on Land	IE,NA	1 582.55					1 582.55
B. Waste-water Handling		14.35	133.75				148.10
C. Waste Incineration	0.13	0.06	0.07				0.26
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 171.59	155.73	6 823.93				10 151.25
Aviation	691.44	151.98	6 804.62				7 648.04
Marine	2 480.16	3.76	19.30				2 503.22
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 832.30**						**4 832.30**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	52 676.60
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	41 657.28

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 1997
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**29 643.88**	**4 890.57**	**4 475.92**	**86.52**	**1 632.94**	**579.86**	**41 309.69**
1. Energy	**33 983.22**	**987.18**	**446.83**				**35 417.23**
A. Fuel Combustion (Sectoral Approach)	31 190.35	281.79	443.18				31 915.32
1. Energy Industries	9 660.04	65.40	37.76				9 763.20
2. Manufacturing Industries and Construction	4 375.81	11.73	61.13				4 448.66
3. Transport	12 972.51	66.01	266.18				13 304.69
4. Other Sectors	3 757.42	138.25	71.57				3 967.24
5. Other	424.57	0.42	6.54				431.52
B. Fugitive Emissions from Fuels	2 792.87	705.38	3.65				3 501.91
1. Solid Fuels	6.34	48.61	NA,NO				54.95
2. Oil and Natural Gas	2 786.53	656.78	3.65				3 446.96
2. Industrial Processes	**6 862.80**	**11.83**	**1 611.77**	**86.52**	**1 632.94**	**579.86**	**10 785.72**
A. Mineral Products	1 031.42	NA,NO	NA,NO				1 031.42
B. Chemical Industry	862.72	10.53	1 605.29	NO	NO	NO	2 478.54
C. Metal Production	4 798.25	1.29	6.49	NO	1 632.90	437.37	6 876.30
D. Other Production	152.14						152.14
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				86.52	0.04	142.49	229.05
G. Other	18.27	NA	NA	NO	NO	NO	18.27
3. Solvent and Other Product Use	**150.60**		**39.44**				**190.04**
4. Agriculture		**2 325.27**	**2 221.91**				**4 547.19**
A. Enteric Fermentation		1 994.82					1 994.82
B. Manure Management		320.61	142.66				463.27
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	2 076.41				2 076.41
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		9.85	2.84				12.69
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-11 352.87**	**1.64**	**13.82**				**-11 337.41**
A. Forest Land	-14 077.77	1.64	13.42				-14 062.71
B. Cropland	334.61	IE,NO	0.35				334.96
C. Grassland	1 900.89	NO	NO				1 900.89
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	458.81	NE,NO	NE,NO				458.81
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	27.22	NO	NO				27.22
6. Waste	**0.14**	**1 564.65**	**142.14**				**1 706.93**
A. Solid Waste Disposal on Land	IE,NA	1 551.12					1 551.12
B. Waste-water Handling		13.45	142.06				155.52
C. Waste Incineration	0.14	0.08	0.07				0.29
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 772.86	179.76	7 609.88				11 562.51
Aviation	770.89	175.21	7 586.51				8 532.60
Marine	3 001.98	4.55	23.37				3 029.90
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 038.84**						**5 038.84**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	52 647.10
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	41 309.69

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 1998
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**29 937.27**	**4 765.01**	**4 555.16**	**129.82**	**1 485.53**	**726.74**	**41 599.52**
1. Energy	**34 009.04**	**938.56**	**444.79**				**35 392.39**
A. Fuel Combustion (Sectoral Approach)	31 124.15	271.41	440.97				31 836.53
1. Energy Industries	9 254.27	62.62	37.01				9 353.90
2. Manufacturing Industries and Construction	4 459.38	11.49	49.18				4 520.05
3. Transport	13 307.07	64.98	272.78				13 644.83
4. Other Sectors	3 743.86	131.95	73.93				3 949.74
5. Other	359.57	0.37	8.07				368.01
B. Fugitive Emissions from Fuels	2 884.89	667.15	3.82				3 555.86
1. Solid Fuels	6.59	50.52	NA,NO				57.12
2. Oil and Natural Gas	2 878.29	616.63	3.82				3 498.74
2. Industrial Processes	**6 956.34**	**12.03**	**1 693.08**	**129.82**	**1 485.53**	**726.74**	**11 003.53**
A. Mineral Products	975.64	NA,NO	NA,NO				975.64
B. Chemical Industry	651.86	10.70	1 686.54	NO	NO	NO	2 349.10
C. Metal Production	5 204.99	1.33	6.55	NO	1 485.49	581.97	7 280.32
D. Other Production	102.81						102.81
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				129.82	0.04	144.77	274.63
G. Other	21.03	NA	NA	NO	NO	NO	21.03
3. Solvent and Other Product Use	**151.34**		**39.51**				**190.86**
4. Agriculture		**2 348.52**	**2 222.10**				**4 570.62**
A. Enteric Fermentation		2 013.45					2 013.45
B. Manure Management		324.73	142.37				467.11
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	2 076.74				2 076.74
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		10.34	2.98				13.32
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-11 179.60**	**0.52**	**13.59**				**-11 165.48**
A. Forest Land	-13 865.87	0.52	13.22				-13 852.13
B. Cropland	313.71	IE,NO	0.33				314.04
C. Grassland	1 887.15	NO	NO				1 887.15
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	458.81	NE,NO	NE,NO				458.81
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	23.23	NO	NO				23.23
6. Waste	**0.15**	**1 465.38**	**142.08**				**1 607.61**
A. Solid Waste Disposal on Land	IE,NA	1 452.72					1 452.72
B. Waste-water Handling		12.55	142.01				154.56
C. Waste Incineration	0.15	0.11	0.07				0.33
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Memo Items: [4]							
International Bunkers	3 687.43	197.19	8 105.85				11 990.47
Aviation	821.39	192.84	8 083.53				9 097.76
Marine	2 866.04	4.35	22.32				2 892.71
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 654.07**						**4 654.07**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	52 765.01
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	41 599.52

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 1999
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**28 174.99**	**4 621.52**	**4 766.39**	**180.56**	**1 388.46**	**873.96**	**40 005.87**
1. Energy	**34 947.57**	**913.67**	**481.82**				**36 343.06**
A. Fuel Combustion (Sectoral Approach)	31 448.83	269.42	476.72				32 194.97
1. Energy Industries	9 223.37	58.31	37.15				9 318.83
2. Manufacturing Industries and Construction	4 105.38	11.78	41.63				4 158.78
3. Transport	13 903.94	64.20	318.37				14 286.51
4. Other Sectors	3 824.58	134.76	73.23				4 032.57
5. Other	391.56	0.36	6.35				398.28
B. Fugitive Emissions from Fuels	3 498.73	644.25	5.10				4 148.08
1. Solid Fuels	8.47	64.88	NA,NO				73.35
2. Oil and Natural Gas	3 490.26	579.37	5.10				4 074.73
2. Industrial Processes	**6 884.42**	**10.03**	**1 923.30**	**180.56**	**1 388.46**	**873.96**	**11 260.73**
A. Mineral Products	960.94	NA,NO	NA,NO				960.94
B. Chemical Industry	506.19	8.75	1 916.94	NO	NO	NO	2 431.88
C. Metal Production	5 317.08	1.28	6.36	NO	1 388.42	725.37	7 438.51
D. Other Production	79.28						79.28
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				180.56	0.04	148.59	329.19
G. Other	20.92	NA	NA	NO	NO	NO	20.92
3. Solvent and Other Product Use	**148.40**		**40.20**				**188.59**
4. Agriculture		**2 338.64**	**2 164.41**				**4 503.05**
A. Enteric Fermentation		2 007.37					2 007.37
B. Manure Management		321.98	142.08				464.06
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	2 019.66				2 019.66
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		9.29	2.68				11.97
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-13 805.52**	**0.16**	**13.54**				**-13 791.82**
A. Forest Land	-16 814.49	0.16	13.18				-16 801.15
B. Cropland	386.56	IE,NO	0.30				386.86
C. Grassland	1 900.89	NO	NO				1 900.89
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	692.11	NE,NO	NE,NO				692.11
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	26.04	NO	NO				26.04
6. Waste	**0.12**	**1 359.03**	**143.11**				**1 502.26**
A. Solid Waste Disposal on Land	IE,NA	1 347.24					1 347.24
B. Waste-water Handling		11.65	143.04				154.69
C. Waste Incineration	0.12	0.13	0.08				0.33
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Memo Items: [4]							
International Bunkers	3 619.86	232.20	9 288.13				13 140.18
Aviation	941.67	228.13	9 267.26				10 437.07
Marine	2 678.18	4.06	20.86				2 703.11
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 824.27**						**4 824.27**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 797.69
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	40 005.87

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 2000
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**24 499.27**	**4 759.37**	**4 530.71**	**238.36**	**1 317.90**	**934.42**	**36 280.04**
1. Energy	**34 123.29**	**1 029.12**	**427.15**				**35 579.56**
A. Fuel Combustion (Sectoral Approach)	30 423.01	274.26	422.39				31 119.66
1. Energy Industries	10 099.23	63.72	35.84				10 198.79
2. Manufacturing Industries and Construction	3 887.32	10.92	38.42				3 936.66
3. Transport	13 025.12	62.40	273.04				13 360.56
4. Other Sectors	3 233.19	136.94	71.33				3 441.46
5. Other	178.16	0.27	3.76				182.20
B. Fugitive Emissions from Fuels	3 700.28	754.85	4.76				4 459.90
1. Solid Fuels	9.25	70.86	NA,NO				80.11
2. Oil and Natural Gas	3 691.04	683.99	4.76				4 379.79
2. Industrial Processes	**7 325.53**	**10.06**	**1 739.10**	**238.36**	**1 317.90**	**934.42**	**11 565.37**
A. Mineral Products	962.29	NA,NO	NA,NO				962.29
B. Chemical Industry	762.35	8.76	1 732.87	NO	NO	NO	2 503.97
C. Metal Production	5 348.37	1.30	6.24	NO	1 317.86	773.17	7 446.93
D. Other Production	232.01						232.01
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				238.36	0.04	161.26	399.65
G. Other	20.50	NA	NA	NO	NO	NO	20.50
3. Solvent and Other Product Use	**142.01**		**40.04**				**182.05**
4. Agriculture		**2 308.06**	**2 181.03**				**4 489.09**
A. Enteric Fermentation		1 978.99					1 978.99
B. Manure Management		319.17	144.91				464.08
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	2 033.27				2 033.27
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		9.90	2.85				12.75
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-17 091.62**	**0.33**	**13.03**				**-17 078.27**
A. Forest Land	-20 093.32	0.33	12.69				-20 080.30
B. Cropland	145.80	IE,NO	0.28				146.08
C. Grassland	2 042.71	NO	NO				2 042.71
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	783.38	NE,NO	NE,NO				783.38
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	26.43	NO	NO				26.43
6. Waste	**0.07**	**1 411.81**	**130.36**				**1 542.25**
A. Solid Waste Disposal on Land	IE,NA	1 400.97					1 400.97
B. Waste-water Handling		10.74	130.29				141.03
C. Waste Incineration	0.07	0.10	0.07				0.25
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 514.91	231.94	9 004.13				12 750.99
Aviation	912.88	228.00	8 983.86				10 124.73
Marine	2 602.03	3.95	20.27				2 626.25
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 681.09**						**4 681.09**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 358.31
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	36 280.04

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 2001
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**24 014.12**	**4 772.28**	**4 442.00**	**303.71**	**1 328.63**	**791.20**	**35 651.93**
1. Energy	**35 892.56**	**1 137.26**	**461.09**				**37 490.91**
A. Fuel Combustion (Sectoral Approach)	32 501.37	286.87	457.10				33 245.34
1. Energy Industries	11 384.39	71.25	38.43				11 494.07
2. Manufacturing Industries and Construction	3 961.44	11.35	44.16				4 016.94
3. Transport	13 299.72	60.73	288.91				13 649.36
4. Other Sectors	3 560.92	143.11	81.39				3 785.42
5. Other	294.91	0.42	4.22				299.55
B. Fugitive Emissions from Fuels	3 391.19	850.40	3.98				4 245.57
1. Solid Fuels	8.39	64.30	NA,NO				72.68
2. Oil and Natural Gas	3 382.80	786.10	3.98				4 172.88
2. Industrial Processes	**6 930.78**	**10.28**	**1 688.58**	**303.71**	**1 328.63**	**791.20**	**11 053.17**
A. Mineral Products	924.99	NA,NO	NA,NO				924.99
B. Chemical Industry	692.61	9.13	1 682.98	NO	NO	NO	2 384.71
C. Metal Production	5 074.49	1.15	5.60	NO	1 328.59	645.30	7 055.13
D. Other Production	217.26						217.26
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				303.71	0.04	145.90	449.65
G. Other	21.42	NA	NA	NO	NO	NO	21.42
3. Solvent and Other Product Use	**144.63**		**40.04**				**184.67**
4. Agriculture		**2 263.38**	**2 106.79**				**4 370.17**
A. Enteric Fermentation		1 944.33					1 944.33
B. Manure Management		311.25	144.08				455.33
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	1 960.46				1 960.46
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		7.80	2.25				10.05
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-18 953.93**	**0.17**	**12.80**				**-18 940.95**
A. Forest Land	-21 843.52	0.17	12.53				-21 830.81
B. Cropland	366.98	IE,NO	0.22				367.20
C. Grassland	1 894.76	NO	NO				1 894.76
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	600.66	NE,NO	NE,NO				600.66
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	23.81	NO	NO				23.81
6. Waste	**0.07**	**1 361.19**	**132.70**				**1 493.97**
A. Solid Waste Disposal on Land	IE,NA	1 351.30					1 351.30
B. Waste-water Handling		9.79	132.63				142.43
C. Waste Incineration	0.07	0.10	0.07				0.24
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 428.96	212.59	8 241.84				11 883.38
Aviation	835.42	208.65	8 221.63				9 265.71
Marine	2 593.53	3.94	20.21				2 617.67
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 119.03**						**5 119.03**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	54 592.89
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	35 651.93

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 2002
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**18 318.38**	**4 603.77**	**4 631.56**	**362.68**	**1 437.60**	**238.30**	**29 592.29**
1. Energy	**35 537.45**	**1 075.50**	**454.88**				**37 067.82**
A. Fuel Combustion (Sectoral Approach)	32 628.48	306.93	451.66				33 387.06
1. Energy Industries	11 574.10	74.03	39.73				11 687.87
2. Manufacturing Industries and Construction	3 692.02	10.79	41.38				3 744.19
3. Transport	13 161.17	58.84	287.36				13 507.37
4. Other Sectors	3 747.96	162.94	78.58				3 989.47
5. Other	453.23	0.32	4.61				458.16
B. Fugitive Emissions from Fuels	2 908.97	768.57	3.21				3 680.76
1. Solid Fuels	7.74	59.36	NA,NO				67.10
2. Oil and Natural Gas	2 901.23	709.21	3.21				3 613.66
2. Industrial Processes	**6 353.21**	**11.62**	**1 914.33**	**362.68**	**1 437.60**	**238.30**	**10 317.75**
A. Mineral Products	936.82	NA,NO	NA,NO				936.82
B. Chemical Industry	585.81	10.66	1 909.67	NO	NO	NO	2 506.15
C. Metal Production	4 576.65	0.96	4.66	NO	1 437.56	141.73	6 161.57
D. Other Production	233.60						233.60
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				362.68	0.04	96.58	459.29
G. Other	20.32	NA	NA	NO	NO	NO	20.32
3. Solvent and Other Product Use	**147.38**		**40.10**				**187.48**
4. Agriculture		**2 211.16**	**2 084.61**				**4 295.77**
A. Enteric Fermentation		1 900.22					1 900.22
B. Manure Management		305.09	140.15				445.24
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	1 942.78				1 942.78
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		5.85	1.69				7.53
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-23 719.70**	**0.42**	**13.04**				**-23 706.24**
A. Forest Land	-26 738.77	0.42	12.80				-26 725.55
B. Cropland	185.47	IE,NO	0.19				185.66
C. Grassland	1 874.16	NO	NO				1 874.16
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	937.55	NE,NO	NE,NO				937.55
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	18.52	NO	NO				18.52
6. Waste	**0.04**	**1 305.07**	**124.59**				**1 429.70**
A. Solid Waste Disposal on Land	IE,NA	1 296.13					1 296.13
B. Waste-water Handling		8.84	124.51				133.36
C. Waste Incineration	0.04	0.10	0.07				0.21
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 808.04	187.89	7 296.10				10 292.04
Aviation	739.74	184.75	7 279.98				8 204.47
Marine	2 068.30	3.14	16.13				2 087.57
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 231.30**						**5 231.30**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 298.53
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	29 592.29

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 2003
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**17 648.26**	**4 629.93**	**4 479.47**	**402.84**	**909.10**	**234.86**	**28 304.47**
1. Energy	**36 763.15**	**1 065.78**	**476.27**				**38 305.21**
A. Fuel Combustion (Sectoral Approach)	33 924.04	313.64	473.18				34 710.85
1. Energy Industries	12 288.55	79.84	43.06				12 411.46
2. Manufacturing Industries and Construction	3 998.61	11.34	43.28				4 053.24
3. Transport	13 446.64	60.10	304.75				13 811.49
4. Other Sectors	4 017.75	162.06	80.51				4 260.32
5. Other	172.48	0.30	1.58				174.36
B. Fugitive Emissions from Fuels	2 839.12	752.14	3.09				3 594.35
1. Solid Fuels	11.89	91.16	NA,NO				103.05
2. Oil and Natural Gas	2 827.22	660.99	3.09				3 491.30
2. Industrial Processes	**6 443.64**	**8.06**	**1 715.49**	**402.84**	**909.10**	**234.86**	**9 714.00**
A. Mineral Products	982.20	NA,NO	NA,NO				982.20
B. Chemical Industry	594.95	7.16	1 711.16	NO	NO	NO	2 313.27
C. Metal Production	4 612.18	0.91	4.33	NO	909.07	172.08	5 698.57
D. Other Production	231.57						231.57
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				402.84	0.04	62.78	465.66
G. Other	22.73	NA	NA	NO	NO	NO	22.73
3. Solvent and Other Product Use	**150.04**		**40.69**				**190.73**
4. Agriculture		**2 261.67**	**2 102.61**				**4 364.27**
A. Enteric Fermentation		1 948.30					1 948.30
B. Manure Management		308.46	124.93				433.39
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	1 976.26				1 976.26
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		4.91	1.42				6.32
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-25 708.62**	**1.78**	**12.65**				**-25 694.19**
A. Forest Land	-28 898.54	1.78	12.40				-28 884.36
B. Cropland	312.46	IE,NO	0.20				312.66
C. Grassland	2 154.28	NO	NO				2 154.28
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	701.39	NE,NO	NE,NO				701.39
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	18.41	NO	NO				18.41
6. Waste	**0.04**	**1 292.64**	**131.76**				**1 424.44**
A. Solid Waste Disposal on Land	IE,NA	1 284.96					1 284.96
B. Waste-water Handling		7.59	131.69				139.28
C. Waste Incineration	0.04	0.09	0.07				0.20
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 803.69	189.81	7 372.14				10 365.64
Aviation	747.48	186.69	7 356.11				8 290.28
Marine	2 056.22	3.12	16.03				2 075.37
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 323.20**						**5 323.20**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 998.65
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	28 304.47

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 2004
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**18 003.56**	**4 594.93**	**4 637.17**	**439.42**	**879.94**	**275.68**	**28 830.69**
1. Energy	**36 752.32**	**1 084.44**	**492.04**				**38 328.81**
A. Fuel Combustion (Sectoral Approach)	34 068.09	307.01	488.73				34 863.84
1. Energy Industries	12 421.27	83.31	40.76				12 545.34
2. Manufacturing Industries and Construction	3 823.33	10.82	41.48				3 875.63
3. Transport	13 901.20	60.92	322.78				14 284.91
4. Other Sectors	3 592.06	151.65	80.42				3 824.13
5. Other	330.24	0.30	3.29				333.83
B. Fugitive Emissions from Fuels	2 684.23	777.43	3.31				3 464.97
1. Solid Fuels	7.61	58.34	NA,NO				65.95
2. Oil and Natural Gas	2 676.62	719.09	3.31				3 399.01
2. Industrial Processes	**6 997.07**	**7.42**	**1 853.99**	**439.42**	**879.94**	**275.68**	**10 453.51**
A. Mineral Products	844.67	NA,NO	NA,NO				844.67
B. Chemical Industry	620.74	6.34	1 848.74	NO	NO	NO	2 475.82
C. Metal Production	5 257.57	1.08	5.25	NO	879.90	205.54	6 349.35
D. Other Production	242.97						242.97
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				439.42	0.04	70.14	509.59
G. Other	31.12	NA	NA	NO	NO	NO	31.12
3. Solvent and Other Product Use	**153.29**		**41.19**				**194.47**
4. Agriculture		**2 215.77**	**2 105.21**				**4 320.98**
A. Enteric Fermentation		1 899.62					1 899.62
B. Manure Management		310.66	122.22				432.88
C. Rice Cultivation		NO					NO
D. Agricultural Soils[3]		NA,NO	1 981.41				1 981.41
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		5.50	1.59				7.09
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry[1]	**-25 899.16**	**0.22**	**12.50**				**-25 886.44**
A. Forest Land	-29 176.33	0.22	12.25				-29 163.86
B. Cropland	144.52	IE,NO	0.20				144.72
C. Grassland	1 941.81	NO	NO				1 941.81
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	1 171.62	NE,NO	NE,NO				1 171.62
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	15.84	NO	NO				15.84
6. Waste	**0.04**	**1 287.07**	**132.24**				**1 419.36**
A. Solid Waste Disposal on Land	IE,NA	1 277.87					1 277.87
B. Waste-water Handling		9.11	132.18				141.29
C. Waste Incineration	0.04	0.09	0.07				0.20
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 815.92	214.51	8 350.01				11 380.43
Aviation	846.91	211.52	8 334.66				9 393.09
Marine	1 969.01	2.99	15.35				1 987.34
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 093.70**						**5 093.70**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	54 717.14
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	28 830.69

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 2005
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**14 973.34**	**4 434.18**	**4 750.50**	**482.17**	**828.65**	**312.03**	**25 780.87**
1. Energy	**36 217.85**	**959.96**	**489.51**				**37 667.32**
A. Fuel Combustion (Sectoral Approach)	33 597.27	302.54	486.22				34 386.03
1. Energy Industries	12 472.36	82.55	40.04				12 594.95
2. Manufacturing Industries and Construction	3 567.34	10.78	36.65				3 614.77
3. Transport	14 008.45	57.86	325.09				14 391.40
4. Other Sectors	3 259.97	151.13	81.54				3 492.64
5. Other	289.15	0.21	2.90				292.26
B. Fugitive Emissions from Fuels	2 620.58	657.43	3.29				3 281.30
1. Solid Fuels	6.77	42.27	NA,NO				49.04
2. Oil and Natural Gas	2 613.80	615.16	3.29				3 232.26
2. Industrial Processes	**6 533.46**	**7.20**	**1 960.05**	**482.17**	**828.65**	**312.03**	**10 123.55**
A. Mineral Products	893.85	NA,NO	NA,NO				893.85
B. Chemical Industry	442.33	6.25	1 955.52	NO	NO	NO	2 404.09
C. Metal Production	4 958.69	0.95	4.53	NO	828.61	240.15	6 032.94
D. Other Production	200.35						200.35
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				482.17	0.04	71.88	554.09
G. Other	38.23	NA	NA	NO	NO	NO	38.23
3. Solvent and Other Product Use	**155.60**		**41.47**				**197.07**
4. Agriculture		**2 231.16**	**2 112.51**				**4 343.67**
A. Enteric Fermentation		1 911.15					1 911.15
B. Manure Management		315.00	122.59				437.59
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	1 988.47				1 988.47
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		5.01	1.45				6.46
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-27 933.61**	**0.65**	**12.95**				**-27 920.01**
A. Forest Land	-30 828.59	0.65	12.71				-30 815.22
B. Cropland	271.09	IE,NO	0.18				271.27
C. Grassland	1 901.73	NO	NO				1 901.73
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	701.76	NE,NO	NE,NO				701.76
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	17.02	NO	NO				17.02
6. Waste	**0.04**	**1 235.20**	**134.02**				**1 369.27**
A. Solid Waste Disposal on Land	IE,NA	1 225.77					1 225.77
B. Waste-water Handling		9.36	133.95				143.31
C. Waste Incineration	0.04	0.07	0.07				0.18
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other ***(as specified in Summary 1.A)***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Memo Items: [4]							
International Bunkers	3 343.66	273.17	10 646.33				14 263.16
Aviation	1 080.01	269.74	10 628.69				11 978.44
Marine	2 263.65	3.44	17.64				2 284.72
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 209.88**						**5 209.88**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 700.88
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	25 780.87

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 2006
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**20 778.22**	**4 266.59**	**4 411.36**	**521.32**	**742.50**	**212.09**	**30 932.07**
1. Energy	**37 072.36**	**889.90**	**526.54**				**38 488.81**
A. Fuel Combustion (Sectoral Approach)	34 532.85	301.72	523.41				35 357.99
1. Energy Industries	12 459.96	82.32	41.40				12 583.67
2. Manufacturing Industries and Construction	3 920.19	11.56	39.94				3 971.69
3. Transport	14 617.25	56.63	359.30				15 033.18
4. Other Sectors	3 257.82	150.98	80.02				3 488.82
5. Other	277.63	0.23	2.76				280.63
B. Fugitive Emissions from Fuels	2 539.51	588.18	3.13				3 130.82
1. Solid Fuels	5.37	41.12	NA,NO				46.48
2. Oil and Natural Gas	2 534.15	547.06	3.13				3 084.34
2. Industrial Processes	**6 124.23**	**6.98**	**1 629.67**	**521.32**	**742.50**	**212.09**	**9 236.78**
A. Mineral Products	936.67	NA,NO	NA,NO				936.67
B. Chemical Industry	460.71	6.36	1 626.75	NO	NO	NO	2 093.82
C. Metal Production	4 477.58	0.62	2.92	NO	742.46	120.08	5 343.66
D. Other Production	210.30						210.30
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				521.32	0.04	92.01	613.37
G. Other	38.97	NA	NA	NO	NO	NO	38.97
3. Solvent and Other Product Use	**140.05**		**42.43**				**182.48**
4. Agriculture		**2 150.20**	**2 059.76**				**4 209.96**
A. Enteric Fermentation		1 839.24					1 839.24
B. Manure Management		306.51	119.58				426.08
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	1 938.89				1 938.89
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		4.46	1.28				5.74
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-22 558.42**	**7.24**	**13.16**				**-22 538.02**
A. Forest Land	-25 248.38	7.24	12.95				-25 228.19
B. Cropland	138.28	IE,NO	0.16				138.44
C. Grassland	1 889.95	NO	NO				1 889.95
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	639.76	NE,NO	NE,NO				639.76
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	18.59	NO	NO				18.59
6. Waste	**IE,NA,NO**	**1 212.26**	**139.81**				**1 352.07**
A. Solid Waste Disposal on Land	IE,NA	1 202.41					1 202.41
B. Waste-water Handling		9.78	139.74				149.52
C. Waste Incineration	NA,NO	0.07	0.07				0.14
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 508.39	314.20	12 262.73				16 085.32
Aviation	1 244.26	310.76	12 245.09				13 800.11
Marine	2 264.13	3.44	17.64				2 285.21
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 271.79**						**5 271.79**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 470.09
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	30 932.07

[1] For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[2] Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

[3] Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

[4] See footnote 8 to table Summary 1.A.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 2007
Submission 2009 v1.1
NORWAY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**19 066.76**	**4 411.72**	**4 245.92**	**565.51**	**801.41**	**76.24**	**29 167.55**
1. Energy	**38 448.53**	**1 022.29**	**559.69**				**40 030.51**
A. Fuel Combustion (Sectoral Approach)	34 777.96	315.41	552.79				35 646.16
1. Energy Industries	12 683.31	81.38	42.29				12 806.99
2. Manufacturing Industries and Construction	3 519.73	11.36	40.33				3 571.42
3. Transport	15 441.81	84.65	390.39				15 916.85
4. Other Sectors	2 923.74	137.82	77.57				3 139.14
5. Other	209.37	0.19	2.21				211.77
B. Fugitive Emissions from Fuels	3 670.57	706.88	6.90				4 384.35
1. Solid Fuels	8.59	65.85	NA,NO				74.44
2. Oil and Natural Gas	3 661.98	641.04	6.90				4 309.92
2. Industrial Processes	**6 367.91**	**6.32**	**1 380.23**	**565.51**	**801.41**	**76.24**	**9 197.61**
A. Mineral Products	1 005.06	NA,NO	NA,NO				1 005.06
B. Chemical Industry	412.12	5.60	1 377.43	NO	NO	NO	1 795.15
C. Metal Production	4 785.44	0.72	2.80	NO	801.37	NO	5 590.33
D. Other Production	165.23						165.23
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				565.51	0.04	76.24	641.78
G. Other	0.06	NA	NA	NA,NO	NO	NO	0.06
3. Solvent and Other Product Use	**145.71**		**42.15**				**187.86**
4. Agriculture		**2 190.03**	**2 107.26**				**4 297.29**
A. Enteric Fermentation		1 871.27					1 871.27
B. Manure Management		313.97	122.99				436.96
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	1 982.90				1 982.90
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		4.79	1.38				6.17
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-25 895.43**	**0.24**	**12.62**				**-25 882.57**
A. Forest Land	-28 023.62	0.24	12.42				-28 010.96
B. Cropland	116.86	IE,NO	0.15				117.01
C. Grassland	1 875.17	NO	NO				1 875.17
D. Wetlands	3.37	NE,NO	0.05				3.43
E. Settlements	116.24	NE,NO	NE,NO				116.24
F. Other Land	NA,NE,NO	NO	NO				NA,NE,NO
G. Other	16.54	NO	NO				16.54
6. Waste	**0.04**	**1 192.84**	**143.97**				**1 336.84**
A. Solid Waste Disposal on Land	0.04	1 183.19					1 183.22
B. Waste-water Handling		9.58	143.90				153.47
C. Waste Incineration	NA,NO	0.07	0.07				0.14
D. Other	NA,NO	NA,NO	NA,NO				NA,NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 269.95	314.72	12 296.10				15 880.77
Aviation	1 247.84	311.65	12 280.34				13 839.84
Marine	2 022.11	3.07	15.76				2 040.94
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 198.39**						**5 198.39**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	55 050.12
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	29 167.55

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

Annex VIII: Harvested Wood Products

1. Description

In the current system, emissions of CO_2 from harvested wood products are attributed to the year of harvest and the country of harvest. All harvested wood is thus assumed to be oxidised to CO_2 in the year of harvesting, and no wood goes into long term storage. This is called the IPCC default approach. Much of the harvested wood will however be stored in products for a short or long period of time before it oxidises, and this will cause a delayed emission of CO_2. If more wood is stored than oxidised in a given year, harvested wood products will act as a sink, and a removal of CO_2 is recorded. However, if the consumption of wood decreases to a level below what is oxidised, harvested wood products will act as a source, and hence emissions of CO_2 is recorded.

In Norway, as in many other countries, the stock of harvested wood products has been increasing for many years, and is likely to increase further.

2. Methodological issues

The approaches describe how emissions are allocated to countries, depending on production, imports and exports of harvested wood products. Estimation methods/models, on the other hand, are how the emissions and HWP stocks are estimated from national data and statistics.

In Bache-Andreassen (2009) five approaches are investigated; the stock change approach, the atmospheric flow approach, the production approach, the simple decay approach and the stock change approach for HWP of domestic origin. The results from the stock change approach were chosen for the reporting to UNFCCC.

In the *stock change approach* (SCA), all HWP residing within the national boundaries are considered, regardless of country of origin. The SCA resembles the estimation methods used for other sources most closely, and it is consistent with how the Land Use, Land Use Change and Forestry (LULUCF) sector is treated in the Kyoto protocol and in the 1996 IPCC Guidelines (IPCC 1996; Kyoto protocol 1997). It is also the simplest of the approaches with regard to data requirements. However, since a country can build up a stock of imported HWP, the SCA may give incentives to import wood from deforestation or other unsustainable sources like illegal loggings.

Two models have been utilised in Bache-Andreassen (2009) for estimating the emissions/removals of CO_2 due to harvested wood products, the IPCC HWP model (IPCC 2006a) and the “revised” model. The IPCC HWP model (Tier 1) is a flux method with a life-time analysis. Activity data on production, imports and exports of semi-finished wood products are required together with estimates on the lifetimes of the different products. The revised model is a combination of a country specific Tier 3 method developed at Statistics Norway (Gjesdal *et al.* 1996; Flugsrud *et al.* 2001) and the IPCC HWP model (IPCC 2006a). The results from the revised model were chosen for the reporting to UNFCCC.

In the revised model (Tier 3), a total inventory of the solid wood carbon stock is, among others factors, based on information concerning the Norwegian building stock. Data from the

Population and Housing census is vital to this work, and the total inventory will give the most accurate results if it is performed in the same years as the census (normally every 10 years). The most important modifications of the direct inventories compared to the old method (Gjesdal *et al.* 1996; Flugsrud *et al.* 2001) are the inclusion of wood in uninhabited buildings like cabins, outbuildings and garages, the renovation sector and the civil engineering structures. The method has also been improved by assigning different wood contents to dwellings depending on type of building and year of construction. Changes in building tradition are thus incorporated in the model. The solid wood carbon stock in the IPCC HWP model is then fitted to the direct inventories, giving different half-lives for solid wood products for the different decades. The stock and stock changes in the non-inventory years are then estimated with the IPCC HWP model, both for solid wood products and paper products.

3. Activity data and emission factors

In the revised model, the solid wood stock is estimated by a direct inventory of the Norwegian building stock for the years 1990 and 2001. The statistical data sources are indicated in Table A8-1, the wood factors are based on expert judgements by Fjulsrud and Bunkholt (pers. comm. 2009). Fjulsrud and Bunkholt have also provided estimates of the total annual consumption of wood in the renovation and extension sector, and the total annual consumption and life-times of wood in civil engineering structures and for furniture, windows, doors, fixtures and fittings etc.

Table A8-1. Statistical data sources for the components in the direct inventory

The Population and Housing census (Statistics Norway 2008c)	
	Number and average utility floor space of dwellings, divided by building type and construction year
Building statistics (Statistics Norway 2009)	
	Share of wooden dwellings
The Ground Property, Address and Building Register (GAB) (Norwegian Mapping Authority 2009)	
	Total basal area of garages, outhouses and annexes linked to dwellings
	Total basal area of holiday houses, detached houses and farmhouses used as holiday houses
	Total basal area of garages, outhouses and annexes linked to holiday houses
	Total basal area of fishermen’s shack, cabins, turf huts etc., boat-houses, wharfside sheds
	Total basal area of non-residential buildings

The annual stock changes are however estimated with the IPCC HWP model (after it is fitted to the direct inventories). The activity data for this part of the calculations are the same for the revised model as for the IPCC HWP model, except for the half-life of solid wood products. Statistics on production, import and export of semi-finished wood products are collected from the FAO statistical databases (FAO 2008), see TableA8-2. The half-lives are determined by the fitting of the IPCC HWP model to the direct inventories.

Table A8-2. Activity data for the commodities from the FAO statistical databases (FAO 2008) shown below are needed in the calculations. The activity data is needed for all years going back to 1960.

	Production	**Imports**	**Exports**
Roundwood	X	X	X
Sawnwood	X	X	X
Wood-based panels	X	X	X
Industrial roundwood	X	X	X
Other industrial roundwood	X		
Wood charcoal		X	X
Wood residues		X	X
Chips and particles		X	X
Paper and paperboard	X	X	X
Recovered paper		X	X
Wood pulp		X	X

The direct inventory in the revised model depends on high quality data regarding the Norwegian building stock. The most accurate information about residential buildings is found in the Population and Housing Census. It is therefore highly recommended that the direct inventories are updated every 10 years, following the cycle of the Population and Housing Census.

HWP in landfills is not included in the estimates. Including it may give incentives for storing HWP in landfills. This is in contradiction with the regulative from the Ministry of the Environment which comes into force July 1st 2009 (Ministry of the Environment 2008) concerning a prohibition on landfilling of biodegradable waste. If all wood and paper delivered to landfills are to be burned for bio energy, the annual change in carbon stock will decrease until it reaches zero (or close to zero).

4. Results

The direct inventories give the most accurate results if they follow the cycle of the Population and Housing Census. The two last censuses were in 1990 and 2001. In Norway in 2001, HWP in dwellings, landfills, non-residential buildings and furniture, fixtures and fittings were the most significant contributors to the total carbon stock. The distribution is shown in Figure A8-1. All products of the solid wood stock constitute in sum 78 per cent of the total carbon stock, HWP in landfills constitute 18 per cent and paper and paper products only 4 per cent. All categories have increased from 1990 to 2001, with a total of 21 per cent (4.2 million tonnes of carbon) for the entire carbon stock. This corresponds to an annual increase of 0.4 million tonnes of the carbon stock in Norway.

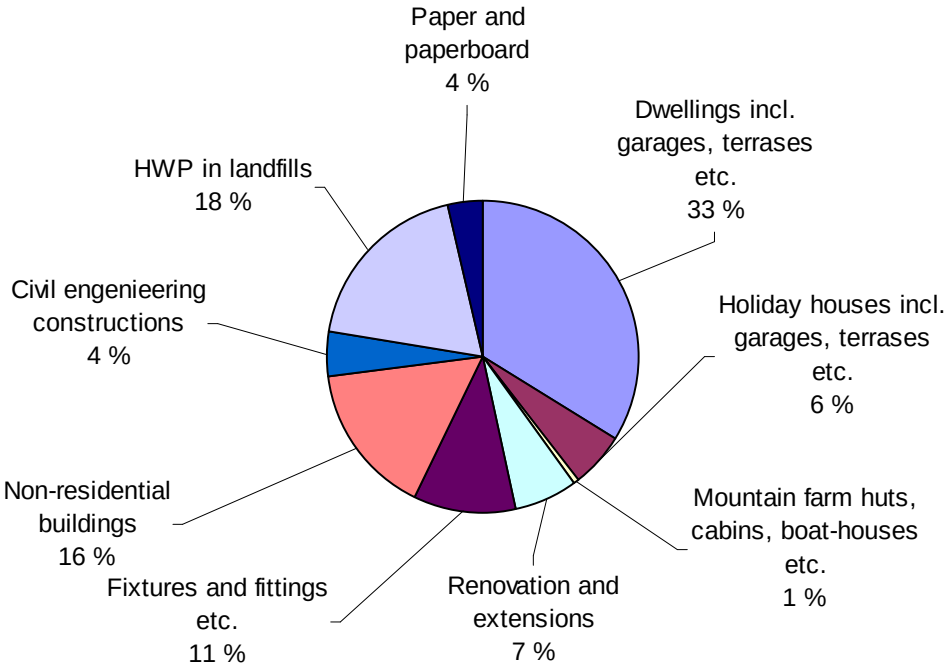

Figure A8-1. The total carbon stock in Norway in 2001, estimated with the revised model

Estimated emissions reported by using the stock change approach and the revised model are shown in Table A8-3, note that negative emissions are referred to as removals. We see that the removal of CO_2 due to HWP has varied between 0.4 and 1.2 million tonnes in the reporting period. The mean removal has been 0.5 million tonnes CO_2, which represents about 4 per cent of the total sink in the LULUCF sector.

Table A8-3. HWP Contribution to AFOLU CO_2 emissions/ removals by using the Stock change approach and the revised model.

Year	Gg CO_2 /yr
1990	-732
1991	-479
1992	-436
1993	-347
1994	-811
1995	-641
1996	-762
1997	-807
1998	-844
1999	-445
2000	-621
2001	-432
2002	-482
2003	-514
2004	-699
2005	-986
2006	-1 014
2007	-1 231

5. Uncertainties

For the revised model the amount of wood used in buildings is burdened with the highest uncertainty, which is about 25 per cent (Bache-Andreassen 2009). When taken as a mean over the years where two direct inventories have been performed, the estimates of solid wood stocks from the revised model should not be any more uncertain than the results from the direct inventory years.

6. Recalculations

This is the first year emissions/removals of CO_2 from harvested wood products are calculated.

7. References

Bache-Andreassen, L. (2009): Harvested wood products in the context of climate change – A comparison of different models and approaches for the Norwegian greenhouse gas inventory, Reports Statistics Norway.

FAO (2008): Food and Agriculture Organization of the United Nations. Statistical Databases. FAOSTAT Forestry. http://faostat.fao.org

Fjulsrud K.E. & Bunkholt Aa. (2009): Personal communication. Norwegian Sawmill Industries Association and Wood Focus Norway.

Flugsrud K., Hoem B., Kvingedal E. & Rypdal K. (2001): Estimating the net emissions of CO2 from harvested wood products; A comparison between different approaches. SFT Report 1831:2001.

Gjesdal S.F.T., Flugsrud K., Mykkelbost T.C. & Rypdal K. (1996): A balance of use of wood products in Norway. SFT Report 96:04.

IPCC (1996): 1996 IPCC Guidelines for National Greenhose Gas Inventories. http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html.

IPCC (2006a): Chapter 12. Harwested Wood Products + HWP Worksheet MS Excel (V4_12_Ch12_HWP_Worksheet.xls). In: 2006 IPCC Guidelines for National Greenhose Gas Inventories (Pingoud K., Skog K.E., Martino D.L., Tonosaki M., Xiaoquan Z. & Ford-Robertson J.). http://www.ipcc-nggip.iges.or.jp/public/2006gl

Kyoto protocol (1997). http://unfccc.int/kyoto_protocol/items/2830.php

Ministry of the Environment (2008): Forbud mot deponering av nedbrytbart avfall. http://www.regjeringen.no/en/dep/md/press-centre/Press-releases/2008/forbud-mot-deponering-av-nedbrytbart-avf.html?id=520348

Norwegian Mapping Authority (2009): The Ground Property, Address and Building Register. http://www.statkart.no/

Statistics Norway (2008c): Population and Housing Census. http://www.ssb.no/english/subjects/02/01/

Statistics Norway (2009): Building statistics. http://www.ssb.no/english/subjects/10/09/

Annex IX: Supplementary information on land use, land-use change and forestry (LULUCF) activities under Article 3.3 and 3.4 of the Kyoto Protocol

1. General information

The supplementary information in this Annex is provided in accordance with Decision 15/CP.10 (FCCC/CP/2004/10/Add.2). Norway has chosen commitment-period accounting. For LULUCF sector Norway has used the Accounting rules described in section 7.3 in Kyoto Protocol Reference Manual on Accounting of Emissions and Assigned Amounts UNFCCC secretariat, February 2007.

1.1 Definition of forest

Forest land is defined according to the Global Forest Resources Assessment (FRA) 2004. Forest land is land with tree crown cover of more than 10 per cent and area of more than 0.5 ha. The trees should be able to reach a minimum height of 5 m at maturity in situ. No minimum width for Forest land is considered in the Norwegian inventory causing a small discrepancy according to the definition in FRA 2004. Young natural stands and all plantations established for forestry purposes, as well as forest land which are temporarily unstocked as a result of human intervention are included under Forest land.

Table A9-1. Parameters for defining Forest land

Parameter	Range	Selected value
Minimum land area	0.05 -1 ha	0.5 ha
Minimum crown cover	10 - 30%	>10%
Minimum height	2 – 5 m	5 m

1.2 Elected activities under Article 3.4

In accordance with Paragraph 6 of the Annex to Decision 16/CMP.1 Norway has decided to elect the activity Forest Management under Article 3.4 of the Kyoto Protocol, for inclusion in the accounting for the first commitment period. The government's policy is that Norway will meet the commitment under article 3.1 without using RMUs issued on the basis of forest management activities.

Practically all forest in Norway is used either for wood harvesting, protecting and protective purposes, recreation and/or to a greater or smaller extent for hunting and picking berries. On more marginal and less productive forest land the intensity of the various management practices will decrease, but will still be present. Hence, all forest in Norway is defined as managed.

1.3 Description of how the definitions of each activity under Article 3.3 and 3.4 have been applied consistently over time

The National Forest Inventory of Norway (NFI) provide data for land use, land use change and forestry for the greenhouse gas reporting related to Article 3.3 and Article 3.4.
The information about the areas subjected to Afforestation/Reforestation (**AR**) and Deforestation (**D**) is based on the NFI, which has been carried out continuously since 1986 and up to present. Land use obtained between 1986 and 1993 serves as the 1990-status. Because no data from permanent sample plots exists before 1986 and relatively small changes has been detected in total forest land, we have chosen not to take into account changes that may have occurred prior to 1990. This implies that stock changes in lands converted to forest are underestimated, but the biomass changes are included in the reporting category for "forest land remaining forest land". All land use change to and from forest taken place after 1990 are considered human induced.

AR activities refer to the conversion of non-forested land to a forested state and are reported together (IPCC 2003, Section 4.2.5.1) and **D** refers to the conversion of forested land to a non-forested state (IPCC 2003, Ssection 4.2.5.1).

All Forest land is considered managed. This also includes recreation areas, protected areas and nature reserves. All forests are used either for wood harvesting, hunting, picking berries, hiking etc., and are therefore subjected to Forest Management (**FM**).

2. Land-related information

2.1 Spatial assessment units used for determining the area of the units of land under article 3.3

The NFI utilize a 5-year cycle based on a re-sampling method with georeferenced permanent plots. NFI provides data for all areas under the coniferous tree limit in a 3x3 km grid. Each plot covers a circular area of 250 m^2 and represents approximately 0.9 kha. Since 1986 all plots are classified according to a national land cover and land use classification system which is further converted consistently to the UNFCCC Land use categories. ARD activities are accounted as long as the forest definition is met.

The plan is to include land use, land use change and biomass for the areas above the coniferous forest limit and Finnmark County in the 2014 report. Information from NFI, maps and old and new areal photos will be used to establish land use of each new plot in the base year 1990.

Further description is given in Section 7.2.2.1 in NIR.

2.2 Methodology used to develop the land transition matrix in Kyoto reporting table NIR 2

The land use transition matrix is based upon changes in the land use class of the sample plots surveyed in a given year. Changes in land use are recorded for the year the land use is observed.

2.3 Maps and/or database to identify the geographical locations, and the system of identification codes for the geographical locations, all of which can be provided electronically.

All the NFI permanent plots are georeferenced. The coordinates of these plots are classified information.

3. Activity specific Information

3.1 Methods for carbon stock change and GHG emission and removal estimates

3.1.1 Description of the methodologies and the underlying assumptions used

The calculations of carbon stock changes in living biomass are based on data obtained from NFI. The reported carbon refers to the biomass of all living trees with a height of at least 1.3 m. Thus, small trees, shrubs and other vegetation, such as herbs are not included in the figures. The biomass of trees with a stem diameter larger then 50 mm measured 1.3 m above the ground is individually monitored. Swedish single tree allometric regression functions developed for Norway spruce, Scots pine and birch are applied to estimate the biomass (Marklund 1987, 1988, Petersson and Ståhl 2006). It is possible to match the biomass to land use of each tree.

The dynamic soil model YASSO as described in detailed by Liski et al. 2005 and applied to Norwegian conditions by de Wit et al. (2006), are used to calculated changes in carbon stock in litter, dead wood and soil organic carbon. Change in carbon stock in dead organic matter due to litter from standing biomass, un-recovered fellings (trees that were felled but not removed from the forest), harvested residues and natural mortality, stumps and roots from harvested trees have been calculated from the growing stock, and annual harvest volume. The volume and increment estimates and amount of dead wood are taken from NFI and removals as forest harvest are from Statistics Norway. Dry matter biomass of different litter compartment (foliage, fine roots, branches, coarse roots, stems and stumps) are calculated using biomass expansion factors described for Norway in FAO/ECE (1985) and in Lethonen et al. (2004).

The YASSO model describes accumulation of soil organic matter and dead wood in upland forest soils and is designed to process data derived from forest inventories (Liski et al. 2005).

The model does not distinguish between mineral and organic soil. The model requests estimates of litter production (dead organic matter) and simple climate data.

Further description is given in Section 7.3 in NIR.

3.1.2 Justification when omitting any carbon pool or GHG emissions/removals from activities under Article 3.3 and elected activities under Article 3.4 (table NIR 1 should be accompanied by such information in all cases where NR is entered)

Both above ground biomass and below ground biomass are reported (**R in NIR 1**) both for Article 3.3 and Article 3.4. activities.

With the current system it is not possible to estimate net carbon stock change for litter, dead wood and soil for areas subjected to ARD activities (**NR in NIR 1**). Those calculations are only possible for Forest remaining forest and are reported under FM (**R in NIR 1)**.

Controlled biomass burning does not occur (**NO in NIR 1**) on land subjected to ARD and FM activities. The reported emission for biomass burning is in accordance with wild fires. It is not possible to assign wild fires to land subjected to ARD activities. Therefore emission is reported under FM (**R in NIR 1**).

Middle aged or older forest stands on mineral soils are sometimes fertilized to increase the forest production. All fertilization is therefore assumed to occur on Forest land remaining Forest land and reported under FM (**R in NIR 1**). Furthermore it is assumed that forests subjected to AR activities are too young to be fertilized; hence it is reported **NO in NIR 1.**

3.1.3 Information on whether or not indirect and natural GHG emissions and removals have been factored out

Indirect and natural GHG emissions/removals have not been factored out.

3.1.4 Changes in data and methods since the previous submission (recalculations) (see, inter alia, section 4.2.4.1 of the IPCC good practice guidance for LULUCF)

Not applicable in this instance.

3.1.5 Uncertainty estimates

Not available for this submission.

3.1.6 Information on other methodological issues

The method used to estimate emissions/removals from ARD activities are of the same tier method as those used for the UNFCCC reporting.

3.1.7 For the purpose of accounting as required in paragraph 18 of the annex to draft decision -/CMP. 1 (Land use, land-use change and forestry) attached to decision 11/CP.7, an indication of the year of the onset of an activity, if after 2008.

Not applicable for this submission.

3.2 Article 3.3

3.2.1 Information that demonstrates that activities under Article 3.3 began on or after l January 1990 and before 31 December 2012 and are direct human-induced

The NFI will cover the period of consideration. The permanent plots were installed from 1986 until 1993. From 1994 and onwards the plots have been surveyed continuously in a five year cycle. By assessing the national land cover- and land use class for all the plots the NFI records directly land use changes to and from forests. Since 1994 all the ARD activities are considered to be human induced.

3.2.2 Information on how harvesting or forest disturbance that is followed by the re-establishment of forest is distinguished from deforestation

Young natural stands and all plantations established for forestry purposes, as well as forest land which are temporarily unstocked as a result of human intervention are included under Forest land and not treated as deforestation. The NFI teams assess land cover and land use according to national criteria that are defined in the field instruction[16]. They are also trained to distinguish between forest management operations and land use change.

3.2.3 Information on the size and geographical location of forest areas that have lost forest cover but which are not yet classified as deforested.

Not applicable for this submission.

3.3 Article 3.4

3.3.1 Information that demonstrates that activities under Article 3.4 have occurred since l January 1990 and are human-induced

All forests in Norway are subject to FM. Hence, all land use change to and from Forests occurred after 1990 are human-induced.

3.3.2 Information relating to Cropland Management, Grazing Land Management and Revegetation, if elected, for the base year

Norway has not elected Cropland Management, Grazing Land Management and Revegetation and have therefore used the notation key NA in Table NIR 1.

3.3.3 Information relating to Forest Management:

(a) That the definition of forest for this category conforms to the definition in item l. l above.

For the purpose of the reporting under the Kyoto-protocol the definition of forest is in accordance with the definition in item 1.1. above.

[16] Landsskogtakseringens feltinstruks 2008, http://www.skogoglandskap.no/publikasjon/landsskogtakseringens_feltinstruks_2008

(b) That forest management is a system of practices for stewardship and use of forest land aimed to fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner (paragraph l (f) of the annex to draft decision -/CMP.l (Land use, land-use change and forestry), attached to decision 11/CP.7).

Practically all forest in Norway is used either for wood harvesting, protecting and protective purposes, recreation and/or to a greater or smaller extent for hunting and picking berries. On more marginal and less productive forest land the intensity of the various management practices will decrease, but will still be present. Hence, all forest in Norway is defined as managed.

4. Other information

4.1 Key category analysis for Article 3.3 activities and any elected activities under Article 3.4 (as in, inter alia, table NIR 3, section 5.4 of the IPCC good practice guidance for LULUCF).

Information in NIR 3 is not provided for this submission. A description of the key categories can however be seen in Section 7.1.3 in NIR.

5. Information relating to Article 6

There are no Article 6 activities concerning the LULUCF sector in Norway.

TABLE NIR 1. SUMMARY TABLE
Activity coverage and other information relating to activities under Article 3.3 and elected activities under Article 3.4

Norway
2007
2009

Activity		Change in carbon pool reported[1]					Greenhouse gas sources reported[2]						
		Above-ground biomass	Below-ground biomass	Litter	Dead wood	Soil	Fertilization[3]	Drainage of soils under forest management	Disturbance associated with land-use conversion to croplands	Liming	Biomass burning[4]		
							N_2O	N_2O	N_2O	CO_2	CO_2	CH_4	N_2O
Article 3.3 activities	Afforestation and Reforestation	R	R	NR	NR	NR	NO			NO	NO	NO	NO
	Deforestation	R	R	NR	NR	NR			R	NO	NO	NO	NO
Article 3.4 activities	Forest Management	R	R	R	R	R	R	R		NO	IE	R	R
	Cropland Management	NA	NA	NA	NA	NA			NA	NA	NA	NA	NA
	Grazing Land Management	NA	NA	NA	NA	NA				NA	NA	NA	NA
	Revegetation	NA	NA	NA	NA	NA				NA	NA	NA	NA

(1) Indicate R (reported), NR (not reported), IE (included elsewhere) or NO (not occurring), for each relevant activity under Article 3.3 or elected activity under Article 3.4. If changes in a carbon pool are not reported, it must be demonstrated in the NIR that this pool is not a net source of greenhouse gases. Indicate NA (not applicable) for each activity that is not elected under Article 3.4. Explanation about the use of notation keys should be provided in the text.

(2) Indicate R (reported), NE (not estimated), IE (included elsewhere) or NO (not occurring) for greenhouse gas sources reported, for each relevant activity under Article 3.3 or elected activity under Article 3.4. Indicate NA (not applicable) for each activity that is not elected under Article 3.4. Explanation about the use of notation keys should be provided in the text.

(3) N_2O emissions from fertilization for Cropland Management, Grazing Land Management and Revegetation should be reported in the Agriculture sector. If a Party is not able to separate fertilizer applied to Forest Land from Agriculture, it may report all N_2O emissions from fertilization in the Agriculture sector.

(4) If CO_2 emissions from biomass burning are not already included under changes in carbon stocks, they should be reported under biomass burning; this also includes the carbon component of CH_4. Parties that include CO_2 emissions from biomass burning in their carbon stock change estimates should report IE (included elsewhere)

Table NIR 1.1 Additional information
Selection of parameters for defining "Forest"under the Kyoto Protocol

Parameter	Range	Selected value
Minimum land area	0.05 - 1 ha	0,5 ha
Minimum crown cover	10 - 30 %	10 %
Minimum height	2 - 5 m	5m

Table NIR 2. LAND TRANSITION MATRIX
Area change between the previous and the current inventory year [1], [2], [3]

Norway
2007
2009

FROM... \ TO...		Article 3.3 activities		Article 3.4 activities				Other	Total
		Afforestation and reforestation	Deforestation	Forest Management (if elected)	Cropland Management (if elected)	Grazing Land Management (if elected)	Revegetation (if elected)		
		(kha)							
Article 3.3 activities	Afforestation and Reforestation	536,89	1,89						538,78
	Deforestation		237,00						237,00
Article 3.4 activities	Forest Management (if elected)		11,80	8911,93					8923,73
	Cropland Management[4] (if elected)	NA	NA		NA	NA	NA		0,00
	Grazing Land Management[4] (if elected)	NA	NA		NA	NA	NA		0,00
	Revegetation[4] (if elected)	NA			NA	NA	NA		0,00
Other		71,91	NO	NO	NA	NA	NA	22608,74	22680,65
Total area		608,80	250,69	8911,93	0,00	0,00	0,00	22608,74	32380,16

[1] This table should be used to report land area and changes in land area subject to the various activities in the inventory year. For each activity it should be used to report area change between the previous year and the current inventory year. For example, the total area of land subject to Forest Management in the year preceeding the inventory year, and which was deforested in the inventory year, should be reported in the cell in column B and in the row of Forest Management.

[2] Some of the transitions in the matrix are not possible and the cells concerned have been shaded.

[3] In accordance with section 4.2.3.2 of the IPCC good practice guidance for LULUCF, the value of the reported area subject to the various activities under Article 3.3 and 3.4 for the inventory year should be that on 31 December of that year.

[4] Lands subject to Cropland Management, Grazing Land Management or Revegetation which, after 2008, are subject to activities other than those under Article 3.3 and 3.4, should still be tracked and reported under Cropland Management, Grazing Land Management or Revegetation, respectively.

TABLE NIR 3. SUMMARY OVERVIEW FOR KEY CATEGORIES FOR LAND USE, LAND USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL

Norway
2007
2009

KEY CATEGORIES OF EMISSIONS AND REMOVALS	GAS	CRITERIA USED FOR KEY CATEGORY IDENTIFICATION			COMMENTS [3]
		Associated category in UNFCCC inventory[1] is key (indicate which category)	Category contribution is greater than the smallest category considered key in the UNFCCC inventory [1] (including LULUCF)	Other [2]	
Specify key categories according to the national level of disaggregation used[1]					
For example: *Cropland Management*	CO_2	*X(Cropland remaining Cropland)*			

[1] See section 5.4 of the IPCC good practice guidance for LULUCF.
[2] This should include qualitative consideration as per section 5.4.3 of the IPCC good practice guidance for LULUCF or any other criteria.
[3] Describe the criteria identifying the category as key.

Documentation box:
Parties should provide in the NIR the full information on methodologies used for identifying key categories (according to section 5.4 of the IPCC good practice guidance for LULUCF).

TABLE 5(KP) REPORT OF SUPPLEMENTARY INFORMATION FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL [1], [2]

Norway
2007
2009

GREENHOUSE GAS SOURCE AND SINK ACTIVITIES	Net CO_2 emissions/ removals [3], [4]	CH_4 [5]	N_2O [6]	Net CO_2 Equivalent emissions/removals [8]
	(Gg)			
A. Article 3.3 activities				**142,00**
A.1. Afforestation and Reforestation [7]	41,00	IE,NO	IE,NO	41,00
A.1.1. Units of land not harvested since the beginning of the commitment period	-421,00	IE,NO	IE,NO	-421,00
A.1.2. Units of land harvested since the beginning of the commitment period	462,00	NO	NO	462,00
A.2. Deforestation	101,00	NO	0,00	101,00
B. Article 3.4 activities				**-27730,00**
B.1. Forest Management (if elected)	-27730,00	0,01	0,04	-27730,00
B.2. Cropland Management (if elected)	0,00	0,00	0,00	0,00
B.3. Grazing Land Management (if elected)	0,00	0,00	0,00	0,00
B.4. Revegetation (if elected)	0,00	0,00	0,00	0,00

Information item [9]:				
A.1.2. Units of land harvested since the beginning of the commitment period	0,00	0,00	0,00	0,00
[specify identification code]				0,00

Documentation box

Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

(1) All estimates in this table include emissions and removals from projects under Article 6 hosted by the reporting Party.

(2) If Cropland Management, Grazing Land Management and/or Revegetation are elected, this table and all relevant tables should also be reported for the base year for these activities.

(3) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by

(4) CO_2 emissions from liming, biomass burning and drained organic soils, where applicable, are included in this column.

(5) CH_4 emissions reported here for Cropland Management, Grazing Land Management and Revegetation, if elected, include only emissions from biomass burning (with the exception of savannah burning and agricultural residue burning which are reported in the Agriculture sector). Any other CH_4 emissions from Agriculture should be reported in the Agriculture sector.

(6) N_2O emissions reported here for Cropland Management, if elected, include only emissions from biomass burning (with the exception of savannah burning and agricultural residue burning which are reported in the Agriculture sector) and N_2O from conversion to Cropland of lands other than Forest Land (Table 5(KP-II)3). Any other N_2O emissions from Agriculture should be reported in the Agriculture sector.

(7) As both Afforestation and Reforestation under Article 3.3 are subject to the same provisions specified in the annex to draft decision -/CMP.1 (*Land use, land-use change and forestry*), attached to decision 11/CP.7, they can be reported together.

(8) This cell should be internally calculated based on values reported in columns A, B and C and the relevant GWP values.

(9) This section has been added to facilitate accounting of harvested land areas , according to decision 16 CMP.1.

TABLE 5(KP-I)A.1.1. SUPPLEMENTARY BACKGROUND DATA ON CARBON STOCK CHANGES AND NET CO_2 EMISSIONS AND REMOVALS FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL
Article 3.3 activities: Afforestation and Reforestation [(1), (2)]
Units of land not harvested since the beginning of the commitment period

Norway
2007
2009

GEOGRAPHICAL LOCATION [(3)]	ACTIVITY DATA		IMPLIED CARBON STOCK CHANGE FACTORS [(7)]									Implied emission/ removal factor per area [(8)]	CHANGE IN CARBON STOCK [(7)]									Net CO_2 emissions/ removals [(8)]
			Carbon stock change in above-ground biomass per area [(5), (6)]			Carbon stock change in below-ground biomass per area [(5), (6)]			Net carbon stock change in litter per area [(5)]	Net carbon stock change in dead wood per area [(5)]	Net carbon stock change in soils per area [(5)]		Carbon stock change in above-ground biomass [(5), (6)]			Carbon stock change in below-ground biomass [(5), (6)]			Net carbon stock change in litter [(5)]	Net carbon stock change in dead wood [(5)]	Net carbon stock change in soils [(5)]	
Identification code	Subdivision [(4)]	Area subject to the activity	Gains	Losses	Net change	Gains	Losses	Net change					Gains	Losses	Net change	Gains	Losses	Net change				
		(kha)	(Mg C/ha)									(Mg CO_2/ha)	(Gg C)									(Gg CO_2)
Total for activity A.1.1		**530,13**	**0,17**	**-0,01**	**0,17**	**0,05**	**0,00**	**0,05**	**0,00**	**0,00**	**0,00**	**-0,80**	**91,62**	**-3,25**	**88,37**	**27,62**	**-0,91**	**26,71**	**0,00**	**0,00**	**0,00**	**-421,96**
Norway		530,13	0,17	-0,01	0,17	0,05	0,00	0,05	0,00	0,00	0,00	-0,80	91,62	-3,25	88,37	27,62	-0,91	26,71	0,00	0,00	0,00	-421,96
	[specify subdivision]		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00			0,00			0,00				0,00

Documentation box
Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

With the current system it is not possible to estimate net carbon stock change for litter, dead wood and soil for Afforestaion and Reforestation areas.Those calculations are only possible for Forest remaing forest.

(1) Report here information on anthropogenic change in carbon stock for the inventory year for all geographical locations that encompass units of land subject to Afforestation and Reforestation under Article 3.3 not harvested since the beginning of the commitment period.

(2) As both Afforestation and Reforestation under Article 3.3 are subject to the same provisions specified in the annex to draft decision -/CMP.1 (*Land use, land-use change and forestry*), attached to decision 11/CP.7, they can be reported together.

(3) Geographical location refers to the boundaries of the areas that encompass units of land subject to Afforestation and Reforestation.

(4) Activity data may be further subdivided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone, national land classification or other criteria. Complete one row for each subdivision.

(5) The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

(6) In all cases where the good practice guidance methods used give separate estimates of gains and losses, these estimates should be reported.

(7) Note that net change corresponds to increase/decrease of carbon stock (see table 4.2.6a of the IPCC good practice guidance for LULUCF).

(8) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+).

TABLE 5(KP-I)A.1.2. SUPPLEMENTARY BACKGROUND DATA ON CARBON STOCK CHANGES AND NET CO_2 EMISSIONS AND REMOVALS FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL
Article 3.3 activities: Afforestation and Reforestation [1], [2]
Units of land harvested since the beginning of the commitment period

Norway
2007
2009

GEOGRAPHICAL LOCATION[3]	ACTIVITY DATA		IMPLIED CARBON STOCK CHANGE FACTORS[7]										CHANGE IN CARBON STOCK[7]									
Identification code	Subdivision[4]	Area subject to the activity	Carbon stock change in above-ground biomass per area[5], [6]			Carbon stock change in below-ground biomass per area[5], [6]			Net carbon stock change in litter per area[5]	Net carbon stock change in dead wood per area[5]	Net carbon stock change in soils per area[5]	Implied emission/ removal factor per area[8]	Carbon stock change in above-ground biomass[5], [6]			Carbon stock change in below-ground biomass[5], [6]			Net carbon stock change in litter[5]	Net carbon stock change in dead wood[5]	Net carbon stock change in soils[5]	Net CO_2 emissions/ removals[8]
			Gains	Losses	Net change	Gains	Losses	Net change					Gains	Losses	Net change	Gains	Losses	Net change				
		(kha)	(Mg C/ha)									(Mg CO_2/ha)	(Gg C)									(Gg CO_2)
Total for activity A.1.2		**6,76**	**0,18**	**-15,24**	**-15,07**	**0,07**	**-3,68**	**-3,61**	**0,00**	**0,00**	**0,00**	**68,46**	**1,20**	**-103,05**	**-101,85**	**0,50**	**-24,87**	**-24,37**	**0,00**	**0,00**	**0,00**	**462,81**
Norway		6,76	0,18	-15,24	-15,07	0,07	-3,68	-3,61	0,00	0,00	0,00	68,46	1,20	-103,05	-101,85	0,50	-24,87	-24,37	0,00	0,00	0,00	462,81
	[specify subdivision]		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00			0,00			0,00				0,00

Documentation box

Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

With the current system it is not possible to estimate net carbon stock change for litter, dead wood and soil for Afforestaion and Reforestation areas. Those calculations are only possible for Forest remaining forest. The NFI provides direct information if the plots have been harvested since last visit.

[1] Report here information on anthropogenic change in carbon stock for the inventory year for all geographical locations that encompass units of land subject to Afforestation and Reforestation under Article 3.3 harvested since the beginning of the commitment period.

[2] As both Afforestation and Reforestation under Article 3.3 are subject to the same provisions specified in the annex to draft decision -/CMP.1 (*Land use, land-use change and forestry*), attached to decision 11/CP.7, they can be reported together.

[3] Geographical location refers to the boundaries of the areas that encompass units of land subject to Afforestation and Reforestation.

[4] Activity data may be further subdivided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone, national land classification or other criteria. Complete one row for each subdivision.

[5] The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

[6] In all cases where the good practice guidance methods used give separate estimates of gains and losses, these estimates should be reported.

[7] Note that net change corresponds to increase / decrease of carbon stock (see table 4.2.6a of the IPCC good practice guidance for LULUCF).

[8] According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+).

TABLE 5(KP-I)A.1.3. SUPPLEMENTARY BACKGROUND FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL

Article 3.3 activities: Afforestation and Reforestation [1, 2]

Units of land otherwise subject to elected activities under Article 3.4 (information item)

Norway
2007
2009

GEOGRAPHICAL LOCATION[3]	ACTIVITY DATA	
Identification code	**Subdivision**[4]	**Area subject to the activity (kha)**
Total for activity A.1.3		**0,00**
[specify identification code]		0,00
	[specify subdivision]	

Documentation box
Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

[1] Units of land subject to Afforestation or Reforestation under Article 3.3 otherwise subject to elected activities under Article 3.4 are implicitly included under A.1.1 or A.1.2. They are reported here for transparency and to fulfil the requirement of paragraph 6 (b) (ii) of the annex to draft decision -/CMP.1 (Article 7), attached to decision 22/CP.7.

[2] As both Afforestation and Reforestation under Article 3.3 are subject to the same provisions specified in the annex to draft decision -/CMP.1 (*Land use, land-use change and forestry*), attached to decision 11/CP.7, they can be reported together.

[3] Geographical location refers to the boundaries of the areas that encompass units of land subject to Afforestation and Reforestation, which would otherwise be included in land subject to elected activities under Article 3.4.

[4] Activity data may be further subdivided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone, national land classification or other criteria. Complete one row for each subdivision.

TABLE 5(KP-I)A.2. SUPPLEMENTARY BACKGROUND DATA ON CARBON STOCK CHANGES AND NET CO_2 EMISSIONS AND REMOVALS FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL
Article 3.3 activities: Deforestation [1]

Norway
2007
2009

GEOGRAPHICAL LOCATION[2]	ACTIVITY DATA		IMPLIED CARBON STOCK CHANGE FACTORS [6]									Implied emission/ removal factor per area[7]	CHANGE IN CARBON STOCK [6]									Net CO_2 emissions/ removals[7]
			Carbon stock change in above-ground biomass per area[4], [5]			Carbon stock change in below-ground biomass per area[4], [5]			Net carbon stock change in litter per area[4]	Net carbon stock change in dead wood per area[4]	Net carbon stock change in soils per area[4]		Carbon stock change in above-ground biomass[4], [5]			Carbon stock change in below-ground biomass[4], [5]			Net carbon stock change in litter[4]	Net carbon stock change in dead wood[4]	Net carbon stock change in soils[4]	
Identification code	Subdivision[3]	Area subject to the activity	Gains	Losses	Net change	Gains	Losses	Net change					Gains	Losses	Net change	Gains	Losses	Net change				
		(kha)	(Mg C/ha)									(Mg CO_2/ha)	(Gg C)									(Gg CO_2)
Total for activity A.2.		**13,70**	**0,33**	**-2,06**	**-1,72**	**0,24**	**-0,53**	**-0,29**	**0,00**	**0,00**	**0,00**	**7,38**	**4,56**	**-28,16**	**-23,60**	**3,33**	**-7,30**	**-3,97**	**0,00**	**0,00**	**0,00**	**101,09**
Norway		13,70	0,33	-2,06	-1,72	0,24	-0,53	-0,29	0,00	0,00	0,00	7,38	4,56	-28,16	-23,60	3,33	-7,30	-3,97	0,00	0,00	0,00	101,09
	[specify subdivision]		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00			0,00			0,00				0,00

Documentation box

Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

With the current system it is not possible to estimate net carbon stock change for litter, dead wood and soil for Deforestation ares due to lack of emission factors and data. An area experiencing deforestation will remain classified as "Deforestation" for 20 years following a deforestation event. Thus there are areas with growing forest (and hence a increasing carbon stock) in the category "Deforestation".

[1] Report here information on anthropogenic change in carbon stock for the inventory year for all geographical locations that encompass units of land subject to Deforestation under Article 3.3.
[2] Geographical location refers to the boundaries of the areas that encompass units of land subject to Deforestation.
[3] Activity data may be further subdivided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone, national land classification or other criteria. Complete one row for each subdivision.
[4] The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).
[5] In all cases where the good practice guidance methods used give separate estimates of gains and losses, these estimates should be reported.
[6] Note that net change corresponds to increase / decrease of carbon stock (see table 4.2.6a of the IPCC good practice guidance for LULUCF).
[7] According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+).

TABLE 5(KP-I)A.2.1. SUPPLEMENTARY BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL

Article 3.3 activities: Deforestation [1]

Units of land otherwise subject to elected activities under Article 3.4 (information item)

Norway
2007
2009

GEOGRAPHICAL LOCATION[2]	ACTIVITY DATA	
Identification code	**Subdivision**[3]	**Area subject to the activity (kha)**
Total for activity A.2.1.		**0,00**
[specify identification code]		0,00
	[specify subdivision]	

Documentation box
Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

[1] Units of lands subject to Deforestation under Article 3.3 otherwise subject to elected activities under Article 3.4 are implicitly included under A.2. They are reported here for transparency and to fulfil the requirement of paragraph 6 (b) (ii) of the annex to draft decision -/CMP.1 (*Article 7*), attached to decision 22/CP.7.

[2] Geographical location refers to the boundaries of the areas that encompass units of land subject to Deforestation which would otherwise be included in land subject to elected activities under Article 3.4.

[3] Activity data may be further subdivided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone, national land classification or other criteria. Complete one row for each subdivision.

TABLE 5(KP-I)B.1. SUPPLEMENTARY BACKGROUND DATA ON CARBON STOCK CHANGES AND NET CO_2 EMISSIONS AND REMOVALS FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL
Elected Article 3.4 activities: Forest Management [1]

Norway
2007
2009

GEOGRAPHICAL LOCATION[2]	ACTIVITY DATA		IMPLIED CARBON STOCK CHANGE FACTORS [6]										CHANGE IN CARBON STOCK [6]									
			Carbon stock change in above-ground biomass per area [4], [5]			Carbon stock change in below-ground biomass per area [4], [5]			Net carbon stock change in litter per area[4]	Net carbon stock change in dead wood per area[4]	Net carbon stock change in soils per area[4]	Implied emission/ removal factor per area[7]	Carbon stock change in above-ground biomass[4], [5]			Carbon stock change in below-ground biomass[4], [5]			Net carbon stock change in litter[4]	Net carbon stock change in dead wood[4]	Net carbon stock change in soils[4]	Net CO_2 emissions/ removals[7]
Identification code	Subdivision[3]	Area subject to the activity	Gains	Losses	Net change	Gains	Losses	Net change					Gains	Losses	Net change	Gains	Losses	Net change				
		(kha)	(Mg C/ha)									(Mg CO_2/ha)	(Gg C)									(Gg CO_2)
Total for activity B.1		**8911,93**	**0,90**	**-0,37**	**0,53**	**0,23**	**-0,09**	**0,14**	**0,03**	**0,05**	**0,10**	**-3,11**	**8045,96**	**-3286,56**	**4759,40**	**2041,44**	**-815,41**	**1226,03**	**222,87**	**455,73**	**898,92**	**-27730,82**
Norway		8911,93	0,90	-0,37	0,53	0,23	-0,09	0,14	0,03	0,05	0,10	-3,11	8045,96	-3286,56	4759,40	2041,44	-815,41	1226,03	222,87	455,73	898,92	-27730,82
	[specify subdivision]		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00			0,00			0,00				0,00

Documentation box

Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

The change in carbon pools are calculated according to the description for Forest land remaining forest land in NIR, section 7.3.1

[1] If Forest Management has been elected, report here information on anthropogenic carbon stock change for the inventory year for all geographical locations that encompass lar

[2] Geographical location refers to the boundaries of the areas that encompass land subject to Forest Management (if elected).

[3] Activity data may be further subdivided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone, national land classification or other criteria. Complete one row for each subdivision.

[4] The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

[5] In all cases where the good practice guidance methods used give separate estimates of gains and losses, these estimates should be reported.

[6] Note that net change corresponds to increase / decrease of carbon stock (see table 4.2.6a of the IPCC good practice guidance for LULUCF).

[7] According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+).

TABLE 5(KP-I)B.2 SUPPLEMENTARY BACKGROUND DATA ON CARBON STOCK CHANGES AND NET CO_2 EMISSIONS AND REMOVALS FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL
Elected Article 3.4 activities: Cropland Management [1], [2]

Norway
2007
2009

GEOGRAPHICAL LOCATION[3]	ACTIVITY DATA			IMPLIED CARBON STOCK CHANGE FACTORS [7]										Implied emission/ removal factor per area[10]	CHANGE IN CARBON STOCK [7]										Net CO_2 emissions/ removals[10]
Identification code	Subdivision[4]	Area subject to the activity	Area of organic soils[9]	Carbon stock change in above-ground biomass per area [5], [6]			Carbon stock change in below-ground biomass per area [5], [6]			Net carbon stock change in litter per area[5]	Net carbon stock change in dead wood per area[5]	Net carbon stock change in soils per area[5]			Carbon stock change in above-ground biomass[5], [6]			Carbon stock change in below-ground biomass [5], [6]			Net C stock change in litter[5]	Net carbon stock change in dead wood[5]	Net carbon stock change in soils[5]		
				Gains	Losses	Net change	Gains	Losses	Net change			Mineral soils	Organic soils		Gains	Losses	Net change	Gains	Losses	Net change			Mineral soils	Organic soils[8]	
		(kha)	(kha)	(Mg C/ha)										(Mg CO_2/ha)	(Gg C)										(Gg CO_2)
Total for activity B.2		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
[specify identification code]		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	[specify subdivision]			0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00			0,00			0,00					0,00

Documentation box
Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any addition details are needed to understand the content of this table.

(1) If Cropland Management has been elected, report here information on anthropogenic carbon stock change for the inventory year for all geographical locations that encompass land subject to Cropland Management under Article 3.4.

(2) If Cropland Management has been elected, this table and all relevant tables should also be reported for the base year for Cropland Management.

(3) Geographical location refers to the boundaries of the areas that encompass land subject to Cropland Management (if elected).

(4) Activity data may be further subdivided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone, national land classification or other criteria. Complete one row for each subdivision.

(5) The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

(6) In all cases where the good practice guidance methods used give separate estimates of gains and losses, these estimates should be reported.

(7) Note that net change corresponds to increase / decrease of carbon stock (see table 4.2.6b of the IPCC good practice guidance for LULUCF).

(8) The value reported here is an emission and not a carbon stock change.

(9) This information is needed for the calculation of the net carbon stock changes in soils per area.

(10) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+).

TABLE 5(KP-I)B.3 SUPPLEMENTARY BACKGROUND DATA ON CARBON STOCK CHANGES AND NET CO_2 EMISSIONS AND REMOVALS FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL
Elected Article 3.4 activities: Grazing Land Management [1], [2]

Norway
2007
2009

GEOGRAPHICAL LOCATION[3]	ACTIVITY DATA			IMPLIED CARBON STOCK CHANGE FACTORS [7]											CHANGE IN CARBON STOCK [7]											
				Carbon stock change in above-ground biomass per area [5], [6]			Carbon stock change in below-ground biomass per area [5], [6]			Net carbon stock change in litter per area [5]	Net carbon stock change in dead wood per area [5]	Net carbon stock change in soils per area [5]		Implied emission/ removal factor per area [10]	Carbon stock change in above-ground biomass [5], [6]			Carbon stock change in below-ground biomass [5], [6]			Net C stock change in litter [5]	Net carbon stock change in dead wood [5]	Net carbon stock change in soils [5]		Net CO_2 emissions/ removals [10]
Identification code	Subdivision[4]	Area subject to the activity	Area of organic soils[9]	Gains	Losses	Net change	Gains	Losses	Net change			Mineral soils	Organic soils		Gains	Losses	Net change	Gains	Losses	Net change			Mineral soils	Organic soils[8]	
		(kha)	(kha)	(Mg C/ha)										(Mg CO_2/ha)	(Gg C)										(Gg CO_2)
Total for activity B.3		**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
[specify identification code]		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	[specify subdivision]			0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00			0,00			0,00					0,00

Documentation box
Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

[1] If Grazing Land Management has been elected, report here information on anthropogenic carbon stock change for the inventory year for all geographical locations that encompass land subject to Grazing Land Management under Article 3.4.
[2] If Grazing Land Management has been elected, this table and all relevant CRF Tables should also be reported for the base year for Cropland Management.
[3] Geographical location refers to the boundaries of the areas that encompass land subject to Grazing Land Management (if elected).
[4] Activity data may be further subdivided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone, national land classification or other criteria. Complete one row for each subdivision.
[5] The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).
[6] In all cases where the good practice guidance methods used give separate estimates of gains and losses, these estimates should be reported.
[7] Note that net change corresponds to increase / decrease of carbon stock (see table 4.2.6b of the IPCC good practice guidance for LULUCF).
[8] The value reported here is an emission and not a carbon stock change.
[9] This information is needed for the calculation of the net carbon stock changes in soils per area.
[10] According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO2 removals to be negative (-) and for net CO2 emissions to be positive (+).

TABLE 5(KP-I)B.4 SUPPLEMENTARY BACKGROUND DATA ON CARBON STOCK CHANGES AND NET CO_2 EMISSIONS AND REMOVALS FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL
Elected Article 3.4 activities: Revegetation [1], [2]

Norway
2007
2009

GEOGRAPHICAL LOCATION[3]	ACTIVITY DATA			IMPLIED CARBON STOCK CHANGE FACTORS[7]											CHANGE IN CARBON STOCK[7]											
Identification code	Subdivision[4]	Area subject to the activity	Area of organic soils [9]	Carbon stock change in above-ground biomass per area [5], [6]			Carbon stock change in below-ground biomass per area [5], [6]			Net carbon stock change in litter per area[5]	Net carbon stock change in dead wood per area[5]	Net carbon stock change in soils per area[5]		Implied emission/ removal factor per area [10]	Carbon stock change in above-ground biomass[5], [6]			Carbon stock change in below-ground biomass [5], [6]			Net C stock change in litter[5]	Net carbon stock change in dead wood[5]	Net carbon stock change in soils[5]		Net CO_2 emissions/ removals[10]
				Gains	Losses	Net change	Gains	Losses	Net change			Mineral soils	Organic soils		Gains	Losses	Net change	Gains	Losses	Net change			Mineral soils	Organic soils[8]	
		(kha)	(kha)	(Mg C/ha)										(Mg CO_2/ha)	(Gg C)										(Gg CO_2)
Total for activity B.4		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
[specify identification code]		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	[specify subdivision]			0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00			0,00			0,00					0,00

Documentation box
Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

(1) If Revegetation has been elected, report here information on anthropogenic carbon stock change for the inventory year for all geographical locations that encompass land subject to Revegetation under Article 3.4.
(2) If Revegetation has been elected, this table and all relevant tables should also be reported for the base year for Revegetation.
(3) Geographical location refers to the boundaries of the areas that encompass land subject to Revegetation (if elected).
(4) Activity data may be further subdivided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone, national land classification or other criteria. Complete one row for each subdivision.
(5) The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).
(6) In all cases where the good practice guidance methods used give separate estimates of gains and losses, these estimates should be reported
(7) Note that net change corresponds to increase / decrease of carbon stock (see table 4.2.6b of the IPCC good practice guidance for LULUCF)
(8) The value reported here is an emission and not a carbon stock change.
(9) This information is needed for the calculation of the net carbon stock changes in soils per area.
(10) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+).

TABLE 5(KP-II)1 SUPPLEMENTARY BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL
Direct N_2O emissions from N fertilization [1], [2]

Norway
2007
2009

Identification code of geographical location	ACTIVITY DATA	IMPLIED EMISSION FACTOR	EMISSIONS
	Total amount of fertilizer applied (Gg N/year)	N_2O-N emissions per unit of fertilizer (kg N_2O-N/kg N) [3]	N_2O (Gg)
A.1.1. Afforestation/Reforestation: units of land not harvested since the beginning of the commitment period [4]	**NO**	**NO**	**NO**
Norway	NO	NO	NO
A.1.2. Afforestation/Reforestation: units of land harvested since the beginning of the commitment period [4]	**NO**	**NO**	**NO**
Norway	NO	NO	NO
B.1. Forest Management (if elected) [5]	**0,31**	**0,00**	**0,00**
Norway	0,31	0,00	0,00

Documentation box
Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

It is assumed that the fertilizer is only applyed to middle aged or older forests stands on mineral soils and is therfore reported under Forest Management.

(1) N_2O emissions from fertilization for Cropland Management, Grazing Land Management and Revegetation should be reported in the Agriculture sector. If a Party is not able to separate fertilizer applied to Forest Land from Agriculture, it may report all N2O emissions from fertilization in the Agriculture sector. This should be explicitly indicated in the documentation box.

(2) Direct N_2O emissions from fertilization are estimated following section 3.2.1.4.1 of the IPCC good practice guidance for LULUCF based on the amount of fertilizer applied to land under Forest Management. The indirect N2O emissions from Afforestation and Reforestation and land under Forest Management are estimated as part of the total indirect emissions in the Agriculture sector based on the total amount of fertilizer used in the country. Parties should show that double counting of N2O emissions from fertilization with Agriculture sector estimates has been avoided.

(3) In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

(4) Geographical location refers to the boundaries of the areas that encompass units of land subject to Afforestation and Reforestation.

(5) Geographical location refers to the boundaries of the areas that encompass land subject to Forest Management (if elected).

TABLE 5(KP-II)2 SUPPLEMENTARY BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL

Norway
2007
2009

N_2O emissions from drainage of soils [1, 2]

Identification code of geographical location [3]	ACTIVITY DATA Area of drained soils (kha)	IMPLIED EMISSION FACTOR N_2O-N per area drained (kg N_2O-N/ha) [4]	EMISSIONS N_2O (Gg)
B.1. Forest Management (if elected)	**245,51**	**0,10**	**0,04**
Total for organic soils	245,51	0,10	0,04
Total for mineral soils	0,00	0,00	0,00
Norway	245,51	0,10	0,04
Organic soils	245,51	0,10	0,04
Mineral soils		0,00	

Documentation box
Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.
N2O emision from drainage of soil is documentet in NIR, section 7.10.1

(1) Methodologies for estimating N_2O emissions from drainage of soils are not addressed in the Revised 1996 IPCC Guidelines, but Appendix 3a.2 of the IPCC good practice guidance for LULUCF provides methodologies for consideration.

(2) N_2O emissions from drainage of soils include those resulting from Forest Management. N_2O emissions from drained Cropland and Grassland soils are covered in the Agriculture sector under Cultivation of Histosols.

(3) Geographical location refers to the boundaries of the areas that encompass land subject to Forest Management (if elected).

(4) In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

TABLE 5(KP-II)3 SUPPLEMENTARY BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL

Norway
2007
2009

N_2O emissions from disturbance associated with land-use conversion to cropland [1], [2]

Identification code of geographical location	ACTIVITY DATA Land area converted (kha)	IMPLIED EMISSION FACTOR N_2O-N per area converted [5] (kg N_2O-N/ha)	EMISSIONS N_2O (Gg)
A.2. Deforestation [3], [6]	**51,27**	**0,01**	**0,00**
Total organic soils	51,27	0,01	0,00
Total mineral soils	NO	NO	NO
Norway	51,27	0,01	0,00
Organic soils [7]	51,2745	0,01	0,00
Mineral soils [7]	NO	NO	NO
B.2. Cropland Management (if elected) [4], [8]	**0,00**	**0,00**	**0,00**
Total organic soils	0,00	0,00	0,00
Total mineral soils	0,00	0,00	0,00
[specify identification code]	0,00	0,00	0,00
Organic soils [7]		0,00	
Mineral soils [7]		0,00	
Information items [9]			
A.2.1. Deforestation: units of land otherwise subject to elected activities under Article 3.4 [6]	**0,00**		
Total organic soils	0,00		
Total mineral soils	0,00		
[specify identification code]	0,00		
Organic soils [7]			
Mineral soils [7]			

Documentation box

Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

N2O emision from disturbance assosiated with land use convertion to croplandis documentet in NIR, section 7.10.2

[1] Methodologies for N_2O emissions from disturbance associated with land-use conversion to Croplands are found in section 3.3.2.3.1.1 of the IPCC good practice guidance for LULUCF. N2O emissions from fertilization in the preceding land use and new land use should not be reported here. Parties should avoid double counting with N2O emissions from drainage and from cultivation of organic soils reported in Agriculture under Cultivation of Histosols.

[2] According to the IPCC good practice guidance for LULUCF N_2O emissions from disturbance of soils are only relevant for land conversions to Cropland. N_2O emissions from Cropland Management when Cropland is remaining Cropland are included in the Agriculture sector.

[3] Geographical location refers to the boundaries of the areas that encompass units of land subject to Deforestation.

[4] Geographical location refers to the boundaries of the areas that encompass land subject to Cropland Management, if elected.

[5] In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

[6] N_2O emissions associated with Deforestation followed by the establishment of Cropland should be reported under Deforestation even if Cropland Management is not elected under Article 3.4.

[7] Parties may separate data for organic and mineral soils, if they have data available.

[8] This includes N_2O emissions in land subject to Cropland Management from disturbance of soils due to the conversion to Cropland of lands other than Forest Lands.

[9] Units of land subject to Deforestation under Article 3.3 otherwise subject to elected activities under Article 3.4 are implicitly included under A.2. They are reported here for transparency and to fulfil the requirement of paragraph 6 (b) (ii) of the annex to draft decision -/CMP.1 (Article 7), attached to decision 22/CP.7.

TABLE 5(KP-II)4 SUPPLEMENTARY BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL
Carbon emissions from lime application [1]

Norway
2007
2009

Identification code of geographical location [2]	ACTIVITY DATA	IMPLIED EMISSION FACTOR	EMISSIONS
	Total amount of lime applied (Mg/year)	Carbon emission per unit of lime (Mg C/Mg)	Carbon (Gg)
A.1.1. Afforestation/Reforestation: units of land not harvested since the beginning of the commitment period [2], [8], [9]	**NO**	**NO**	**NO**
Total for limestone	NO	NO	NO
Total for dolomite	NO	NO	NO
Norway	NO	NO	NO
Limestone ($CaCO_3$)	NO	NO	NO
Dolomite ($CaMg(CO_3)_2$)	NO	NO	NO
A.1.2. Afforestation/Reforestation: units of land harvested since the beginning of the commitment period [2], [8], [9]	**NO**	**NO**	**NO**
Total for limestone	NO	NO	NO
Total for dolomite	NO	NO	NO
Norway	NO	NO	NO
Limestone ($CaCO_3$)	NO	NO	NO
Dolomite ($CaMg(CO_3)_2$)	NO	NO	NO
A.2. Deforestation [3], [8], [9]	**NO**	**NO**	**NO**
Total for limestone	NO	NO	NO
Total for dolomite	NO	NO	NO
Norway	NO	NO	NO
Limestone ($CaCO_3$)	NO	NO	NO
Dolomite ($CaMg(CO_3)_2$)	NO	NO	NO
B.1. Forest Management (if elected) [4], [8], [9]	**NO**	**NO**	**NO**
Total for limestone	NO	NO	NO
Total for dolomite	NO	NO	NO
Norway	NO	NO	NO
Limestone ($CaCO_3$)	NO	NO	NO
Dolomite ($CaMg(CO_3)_2$)	NO	NO	NO
B.2. Cropland Management (if elected) [5], [8], [9]	**0,00**	**0,00**	**0,00**
Total for limestone	0,00	0,00	0,00
Total for dolomite	0,00	0,00	0,00
[specify identification code]	0,00	0,00	0,00
Limestone ($CaCO_3$)		0,00	
Dolomite ($CaMg(CO_3)_2$)		0,00	
B.3. Grazing Land Management (if elected) [6], [8], [9]	**0,00**	**0,00**	**0,00**
Total for limestone	0,00	0,00	0,00
Total for dolomite	0,00	0,00	0,00
[specify identification code]	0,00	0,00	0,00
Limestone ($CaCO_3$)		0,00	
Dolomite ($CaMg(CO_3)_2$)		0,00	
B.4. Revegetation (if elected) [7], [8], [9]	**0,00**	**0,00**	**0,00**
Total for limestone	0,00	0,00	0,00
Total for dolomite	0,00	0,00	0,00
[specify identification code]	0,00	0,00	0,00
Limestone ($CaCO_3$)		0,00	
Dolomite ($CaMg(CO_3)_2$)		0,00	

Documentation box

Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

[1] Carbon emissions from agricultural lime application are addressed in sections 3.3.1.2.1.1 and 3.3.2.1.1.1 of the IPCC good practice guidance for LULUCF.
[2] Geographical locations refers to the boundaries of the areas that encompass units of land subject to Afforestation and Reforestation.
[3] Geographical locations refers to the boundaries of the areas that encompass units of land subject to Deforestation.
[4] Geographical locations refers to the boundaries of the areas that encompass land subject to Forest Management, if elected.
[5] Geographical locations refers to the boundaries of the areas that encompass land subject to Cropland Management, if elected.
[6] Geographical locations refers to the boundaries of the areas that encompass land subject to Grazing Land Management, if elected.
[7] Geographical locations refers to the boundaries of the areas that encompass land subject to Revegetation, if elected.
[8] If Parties are not able to separate lime application for different geographical locations, they should include liming for all geographical locations in the total.
[9] A Party may report aggregate estimates for total lime applications when data are not available for limestone and dolomite.

TABLE 5(KP-II)5 SUPPLEMENTARY BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL
GHG emissions from biomass burning

Norway
2007
2009

Identification code of geographical location	ACTIVITY DATA			IMPLIED EMISSION FACTOR			EMISSIONS		
	Description[7]	Unit	Values	CO_2	CH_4	N_2O	CO_2 [8]	CH_4 [8]	N_2O
	Area (AB) or biomass burned (BB)	ha or kg dm		(Mg/activity data unit)			(Gg)		
A.1.1. Afforestation/Reforestation: units of land not harvested since the beginning of the commitment period[1],[9]	**0,00**			**IE,NO**	**IE,NO**	**IE,NO**	**IE,NO**	**IE,NO**	**IE,NO**
Total for controlled burning	0,00			NO	NO	NO	NO	NO	NO
Total for wildfires	0,00			IE	IE	IE	IE	IE	IE
Norway				IE,NO	IE,NO	IE,NO	IE,NO	IE,NO	IE,NO
Controlled burning				NO	NO	NO	NO	NO	NO
Wildfires				IE	IE	IE	IE	IE	IE
A.1.2. Afforestation/Reforestation: units of land harvested since the beginning of the commitment period[1],[9]	**0,00**			**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total for controlled burning	0,00			NO	NO	NO	NO	NO	NO
Total for wildfires	0,00			NO	NO	NO	NO	NO	NO
Norway				NO	NO	NO	NO	NO	NO
Controlled burning				NO	NO	NO	NO	NO	NO
Wildfires				NO	NO	NO	NO	NO	NO
A.2. Deforestation[2],[9]	**0,00**			**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Total for controlled burning	0,00			NO	NO	NO	NO	NO	NO
Total for wildfires	0,00			NO	NO	NO	NO	NO	NO
Norway				NO	NO	NO	NO	NO	NO
Controlled burning				NO	NO	NO	NO	NO	NO
Wildfires				NO	NO	NO	NO	NO	NO
B.1. Forest Management (if elected) [3],[9]	**AB**	**ha**	**128,25**	**IE,NO**	**0,09**	**0,00**	**IE,NO**	**0,01**	**0,00**
Total for controlled burning	0,00			NO	NO	NO	NO	NO	NO
Total for wildfires	AB	ha	128,25	IE	0,09	0,00	IE	0,01	0,00
Norway	AB	ha	128,25	IE,NO	0,09	0,00	IE,NO	0,01	0,00
Controlled burning				NO	NO	NO	NO	NO	NO
Wildfires	AB	ha	128,25	IE	0,09	0,00	IE	0,01	0,00
B.2. Cropland Management (if elected) [4],[9],[10]	**0,00**						**0,00**	**0,00**	**0,00**
Total for controlled burning	0,00						0,00	0,00	0,00
Total for wildfires	0,00						0,00	0,00	0,00
[specify identification code]							0,00	0,00	0,00
Controlled burning				0,00	0,00	0,00			
Wildfires				0,00	0,00	0,00			
B.3. Grazing Land Management (if elected) [5],[9],[11]	**0,00**						**0,00**	**0,00**	**0,00**
Total for controlled burning	0,00						0,00	0,00	0,00
Total for wildfires	0,00						0,00	0,00	0,00
[specify identification code]							0,00	0,00	0,00
Controlled burning				0,00	0,00	0,00			
Wildfires				0,00	0,00	0,00			
B.4. Revegetation (if elected) [6],[9]	**0,00**						**0,00**	**0,00**	**0,00**
Total for controlled burning	0,00						0,00	0,00	0,00
Total for wildfires	0,00						0,00	0,00	0,00
[specify identification code]							0,00	0,00	0,00
Controlled burning				0,00	0,00	0,00			
Wildfires				0,00	0,00	0,00			

Documentation box

Parties should provide detailed explanation on the land use, land-use change and forestry sector in the relevant annex of the NIR: Supplementary information on LULUCF activities under the Kyoto Protocol. Use this documentation box to provide references to relevant sections of the NIR if any additional details are needed to understand the content of this table.

Emission due to forest fires is treated in NIR, section 7.10.1

(1) Geographical locations refers to the boundaries of the areas that encompass units of land subject to Afforestation and Reforestation.
(2) Geographical location refers to the boundaries of the areas that encompass units of land subject to Deforestation.
(3) Geographical location refers to the boundaries of the areas that encompass land subject to Forest Management, if elected
(4) Geographical location refers to the boundaries of the areas that encompass land subject to Cropland Management, if elected
(5) Geographical location refers to the boundaries of the areas that encompass land subject to Grazing Land Management, if elected
(6) Geographical location refers to the boundaries of the areas that encompass land subject to Revegetation, if elected
(7) For each activity, activity data should be selected between area burned (AB) or biomass burned (BB). Units will be ha for area burned, and kg dm for biomass burned. The implied emission fact with an automatic change in the units.
(8) If CO_2 emissions from biomass burning are not already included in Tables 5(KP-I)A.1.1 to 5(KP-I)B.4, they should be reported here. This also includes the carbon component of CH This should be clearly documented in the documentation box and in the NIR. Parties that include all carbon stock changes in the carbon stock tables (5(KP-I)A.1.1 to 5(KP-I)B.4) should report IE (included elsewhere) in the CO2 column.
(9) Parties should report controlled/prescribed burning and wildfires emissions separately, where appropriate.
(10) Burning of agricultural residues is included in the Agriculture sector.
(11) Greenhouse gas emissions from prescribed savannah burning are reported in the Agriculture sector.

ACCOUNTING FOR ACTIVITIES UNDER ARTICLES 3.3 AND 3.4 OF THE KYOTO PROTOCOL

Norway
2007
2009

Number of the reported year in the commitment period: 1

GREENHOUSE GAS SOURCE AND SINK ACTIVITIES		Net emissions/removals [1]						Accounting Parameters [2]	Accounting Quantity [3]
	BY [4]	2008	2009	2010	2011	2012	Total [5]		
	(Mt CO_2 equivalent)								
A. Article 3.3 activities									-320,00
A.1. Afforestation & Reforestation [a]									-421,00
A.1.1. Units of land not harvested since the beginning of the commitment period [b]		-421,00					-421,00		-421,00
A.1.2. Units of land harvested since the beginning of the commitment period [c]									0,00
Norway		462,00					462,00		0,00
A.2. Deforestation [e]		101,00					101,00		101,00
B. Article 3.4 activities									-14,66
B.1. Forest Management (if elected) [f]		-27730,00					-27730,00		-7,33
FM cap [g]								7,33	-7,33
3.3 offset [h]								0,00	0,00
B.2. Cropland Management (if elected) [i]							0,00	0,00	0,00
B.3. Grazing Land Management (if elected) [i]							0,00	0,00	0,00
B.4. Revegetation (if elected) [i]							0,00	0,00	0,00

[1] All values are as reported in table 5(KP) of the CRF for the relevent inventory year as reported in the current submission, converted to Mt CO_2 eq.

[2] Accounting parameters apply for the calculation of the accounting quantity for Article 3, paragraph 4, activities as follows:

[g] Value as recorded for the Party in the appendix to decision 16/CMP.1, converted to Mt CO_2 eq. and multiplied by five.

[h] In accordance with paragaraph 10 of the annex to decision 16/CMP.1, when a Party's total CO_2 eq. net emissions/removals to date for activities under Article 3, paragraph 3, are positive, the Party may issue the equivalent number of additional RMUs under forest management up to a limit of 165 Mt CO_2 eq. over the commitment period. If the sum of the accounting quantities for article 3, paragraph 3, activities is negative, then the 3.3 offset equals zero. If the sum of these Article 3, paragraph 3, accounting quantities is positive, then the 3.3 offset equals the lesser of this sum and 165;

[i] Net emissions and removals in the base year for the activity, multiplied by the year of the commitment period (cell J5).

[3] The total quantity of units to be added to or subtracted from a Party's assigned amount for a particular activitity, calculated as follows:

[a] The sum of the accounting quantity for A.1.1 and the accounting quantity for A.1.2

[b] The accounting quantity for A.1.1 equals the total net emissions and removals

[c] The sum of the accounting quantities for each individual land unit under category A.1.2

[d] For each individual unit of land under category A.1.2, if total net emissions and removals are positive, than the accounting quantity equals zero. Otherwise the accounting quantity equals the total net emissions and removals.

[e] The accounting quantity for A.2 equals the total net emissions and removals.

[f] The accounting quantiy for B.1 equals the sum of the accounting quantity up to the FM Cap, and any accounting quantity for the 3.3 offset.

[g] If total net emissions and removals to date are negative, the accounting quantity toward the FM cap equals the negative of the lesser of the absolute value of net emissions and removals or its forest management cap. If net emissions and removals are positive, then the accounting quantity toward the FM cap equals the lesser of the net emissions and removals to date or the forest management cap.

[h] If total net emissions and removals to date are negative and the absolute value of net emissions and removals exceeds the forest management cap, then the accounting quantity for the 3.3. offset equals the negative of the lesser of the difference of the absolute value of net emissions and removals minus the forest management cap, and 165. Otherwise, the accounting quantity for the 3.3 offset equals zero.

[i] The accounting quantity for category B.2, B.3 and B.4 equals the cumulative net emissions and removals for all years of the commitment period to date, minus the accounting parameter for that category.

[4] Net emissions and removalsys in the Party's baseyear, as established in decision 9/CP.2

[5] Cumulative net emissions and removals for all years of the commitment period reported in the current submission.