Annex I - IX

National Inventory Report 2012 – Norway

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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 2000) is used, both at the Tier 1 level and at the Tier 2 level with uncertainties. Second, a sensitivity analysis may be performed using the specification of the model for the uncertainty analysis, as described in Statistics Norway (2000). The uncertainty model is presented in Annex II. The discussion focuses primarily on the standard method. The sensitivity analysis has not been repeated since the 2000 report.

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 2000) which is based on Statistics Norway (2001). 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 (HFCs and PFCs are grouped together). 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 first step taken to find key categories with respect to level and trend was 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 2000, equation 6.4).

The next step was the use of sensitivity analysis to identify the parameters in the inventory that most influence the total GHG emissions in level and in trend. The standard method does not take into account correlations. 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 2006 IPCC guidelines (IPCC 2006). 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 a sensitivity analysis (Statistics Norway 2000), 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. From 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 is given in Table A1-2 for the emissions categories, and a summary for removal key categories is 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 (2000) it is good practice to give the results at the Tier 2 level if available. However, in the 2006 IPCC 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.

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

	Source category	**Gas**	**Level assessment Tier 1 1990**	**Level assessment Tier 1 2010**	**Trend assessment Tier 1 1990-2010**
2C2	Ferroalloys Production	CO_2	**5.13**	**4.03**	**2.53**
2A1	Cement Production	CO_2	**1.27**	**1.40**	0.29
2B1	Ammonia Production	CO_2	**1.00**	**0.66**	**0.81**
2C1	Iron and Steel Production[1)]	CO_2	0.43	**0.61**	**0.41**
4B	Manure Management	CH_4	**0.60**	**0.58**	0.03
2A2	Lime Production	CO_2	0.10	**0.46**	**0.83**
1A5b	Military - Mobile	CO_2	**0.79**	0.42	**0.86**
2D2	Food and Drink	CO_2	0.13	0.32	**0.43**
2C4	SF6 Used in Aluminium and Magnesium Foundries	SF_6	**4.31**	.	.

Bold figures indicate whether the source category is a key.

[1]) Due to a reallocation after the key category analysis was performed, 2C1 - Iron and Steel Production should be replaced as key by 2B5 Other Chemical Industry.

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 – and capture and storage of CO2 at the Sleipner oil field are all defined as key categories based on qualitative criteria.

The analyses have been performed for 1990 and 2010 GHG emission data. The main conclusion is that there are few differences in the result for 1990 compared with 2010.

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 the Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC 2003)[a].

[a] 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).

Uncertainties were not determined by a rigid analysis, see chapter 7.12. There are some differences between the two tiers. Tier 1 level analysis does not identify forest drained organic soil, cropland histosoils and cropland with reduced tillage. 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. Including LULUCF also influences other key categories identified. However, according to IPCC (2003) 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.

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 2010**	**Trend assessment Tier 2 1990-2010**	**Method (Tier) 2010**
Tier 2 key categories (large contribution to the total inventory uncertainty)						
4D1	Direct soil emissions	N_2O	**29.23**	**25.57**	**10.18**	Tier 1a
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Gaseous Fuels	CO2	**4.37**	**10.01**	**14.25**	Tier 2
1A3b	Road Transportation	CO_2	**4.65**	**5.68**	**2.54**	Tier 2
4D3	Indirect emissions	N_2O	**5.40**	**4.99**	**1.14**	Tier 1a
4A	Enteric Fermentation	CH_4	**5.31**	**4.69**	**1.66**	Tier 1/2*
1A3d	Navigation	CO_2	**3.59**	**4.11**	**1.28**	Tier 2
1B2a	Oil (incl. oil refineries, gasoline distribution)	CO_2	**4.80**	**3.99**	**2.16**	Tier 2
6A	Solid Waste Disposal on Land	CH_4	**6.34**	**3.79**	**6.60**	Tier 2
2F	Consumption of Halocarbons and Sulphur Hexafluoride	HFCs	0.00	**3.63**	**9.22**	Tier 2
1A3e	Other (snow scooters, boats, motorized equipment)	CO_2	**1.61**	**3.07**	**3.68**	Tier 2
1B2c	Venting and Flaring	CH_4	**1.15**	**2.56**	**3.56**	Tier 2
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Liquid Fuels	CO_2	**2.88**	**2.29**	**1.55**	Tier 2
1A3a	Civil Aviation	CO_2	**1.44**	**2.14**	**1.76**	Tier 2
1A4	Other sectors -	CO_2	**2.00**	**1.86**	0.40	Tier 2

	Mobile Fuel Combustion					
2C3	Aluminium Production	CO_2	**1.55**	**1.78**	0.56	Tier 2
1A3e	Other (snow scooters, boats, motorized equipment)	N_2O	0.73	**1.68**	**2.38**	Tier 2
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Other Fuels	CO_2	0.32	**1.62**	**3.30**	Tier 2
1B2c	Venting and Flaring	CO_2	**1.69**	**1.56**	0.36	Tier 2
4D2	Animal production	N_2O	**1.75**	**1.46**	**0.77**	Tier 1a
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Biomass	CH_4	**0.97**	**1.30**	**0.83**	Tier 2
6B	Wastewater Handling	N_2O	**0.91**	**1.14**	0.56	Tier 1
4B	Manure Management	N_2O	**1.07**	**0.96**	0.29	Tier 1
1B2a	Oil (incl. oil refineries, gasoline distribution)	CH_4	0.69	**0.90**	0.52	Tier 2
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Solid Fuels	CO_2	**0.91**	0.80	0.30	Tier 2
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Gaseous Fuels	CH_4	0.31	0.65	**0.85**	Tier 2
1A3d	Navigation	CH_4	0.03	0.41	**0.94**	Tier 2
2C3	Aluminium Production	PFCs	**7.12**	0.40	**17.20**	Tier 2
1B2b	Natural Gas	CH_4	0.02	0.33	**0.78**	Tier 2
2B2	Nitric Acid Production	N_2O	**1.30**	0.21	**2.79**	Tier 2
2B4	Carbide Production	CO_2	0.44	0.08	**0.92**	Tier 2
Tier 1 key categories (large contribution to the total emissions)						
4B	Manure Management	CH_4	0.79	0.78	0.05	Tier 2
2C2	Ferroalloys Production	CO_2	0.80	0.63	0.44	Tier 2
2B1	Ammonia Production	CO_2	0.40	0.26	0.35	Tier 2
2D2	Food and Drink	CO_2	0.10	0.24	0.35	Tier 2
1A5b	Military – Mobile	CO_2	0.29	0.16	0.35	Tier 2

2C1	Iron and Steel Production[1]	CO_2	0.04	0.06	0.04	Tier 2
2A1	Cement Production	CO_2	0.05	0.05	0.01	Tier 2
2A2	Lime Production	CO_2	0.00	0.01	0.03	Tier 2
2C4	SF6 Used in Aluminium and Magnesium Foundries	SF_6	0.06	.	.	Tier 2
Qualitative key categories						
1B1a	Coal Mining and Handling	CH_4	0.43	0.22	0.53	Tier 2
	Capture and storage	CO_2				CS (Tier 2)

Bold figures indicate whether the source category is a key in level and trend according to Tier 2 analyses.

[1)] Due to a reallocation after the key category analysis was performed, 2C1 - Iron and Steel Production should be replaced as key by 2B5 Other Chemical Industry.

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

	Source category	Gas	Level assessment Tier 2 1990	Level assessment Tier 2 2010	Trend assessment Tier 2 1990-2010	Method (Tier) 2010
Tier 2 key categories (large contribution to the total inventory uncertainty)						
5A1	Forest Land remaining Forest Land, Forest inventory area, Living Biomass	CO_2	**6.37**	**19.86**	**26.79**	Tier 3
5A1	Forest Land remaining Forest Land, Forest inventory area, Dead Biomass	CO_2	**6.80**	**8.51**	**9.15**	Tier 3
5C1	Grassland remaining Grassland, Histosols, Soils	CO_2	**12.49**	**7.85**	**4.90**	Tier 2*
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Mineral	CO_2	**5.09**	**6.16**	**6.53**	Tier 3
5E2	Land converted to Settlements, Living biomass	CO_2	**0.75**	**2.18**	**2.91**	Tier 3
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Organic	CO_2	**2.54**	**1.97**	**1.57**	Tier 1
5B1	Cropland remaining Cropland, Histosols, Soils	CO_2	**1.39**	**0.87**	0.54	Tier 2
5E2	Land converted to Settlements, Soils	CO_2	0.10	0.65	**0.93**	Tier 3
5A2	Land converted to Forest Land, Living biomass	CO_2	0.01	0.58	**0.89**	Tier 3
Tier 1 key categories (large contribution to the total emissions): No additional categories – all tier 1 key categories were also key at tier 2.						

Bold figures indicate whether the source category is a key.

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 2010**	**Trend assessment Tier 1 1990-2010**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Gaseous Fuels	CO_2	**10.41**	**23.69**	**30.61**
1A3b	Road Transportation	CO_2	**15.32**	**18.59**	**7.54**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Liquid Fuels	CO_2	**13.04**	**10.29**	**6.35**
2C2	Ferroalloys Production	CO_2	**5.13**	**4.03**	**2.53**
1A3d	Navigation	CO_2	**3.41**	**3.88**	**1.10**
4A	Enteric Fermentation	CH_4	**4.00**	**3.51**	**1.13**
1A4	Other sectors - Mobile Fuel Combustion	CO_2	**3.68**	**3.39**	**0.66**
2C3	Aluminium Production	CO_2	**2.85**	**3.25**	**0.93**
1A3e	Other (snow scooters, boats, motorized equipment)	CO_2	**1.53**	**2.89**	**3.15**
1B2c	Venting and Flaring	CO_2	**3.02**	**2.77**	**0.57**
4D1	Direct soil emissions	N_2O	**2.85**	**2.43**	**0.97**
1A3a	Civil Aviation	CO_2	**1.36**	**2.02**	**1.51**
6A	Solid Waste Disposal on Land	CH_4	**3.38**	**2.01**	**3.17**
1B2a	Oil (incl. oil refineries, gasoline distribution)	CO_2	**2.30**	**1.90**	**0.93**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Solid Fuels	CO_2	**2.04**	**1.78**	**0.60**
2A1	Cement Production	CO_2	**1.27**	**1.40**	0.29
2F	Consumption of Halocarbons and Sulphur Hexafluoride	HFCs	0.00	**1.39**	**3.19**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Other Fuels	CO_2	0.20	**1.01**	**1.88**
4D3	Indirect emissions	N_2O	**0.85**	**0.78**	0.16
1B2c	Venting and Flaring	CH_4	0.31	**0.68**	**0.85**
2B2	Nitric Acid Production	N_2O	**4.16**	**0.66**	**8.08**
2B1	Ammonia Production	CO_2	**1.00**	**0.66**	**0.81**
2C1	Iron and Steel Production[1]	CO_2	0.43	**0.61**	**0.41**
4B	Manure Management	CH_4	**0.60**	**0.58**	0.03
2A2	Lime Production	CO_2	0.10	**0.46**	**0.83**
1B2a	Oil (incl. oil refineries, gasoline distribution)	CH_4	0.33	**0.43**	0.23

1A5b	Military – Mobile	CO_2	**0.79**	0.42	**0.86**
2C3	Aluminium Production	PFCs	**6.77**	0.38	**14.73**
4D2	Animal production	N_2O	**0.45**	0.37	0.18
2D2	Food and Drink	CO_2	0.13	0.32	**0.43**
2B4	Carbide Production	CO_2	**0.80**	0.14	**1.53**
2C4	SF6 Used in Aluminium and Magnesium Foundries	SF_6	**4.31**	.	.

Bold figures indicate whether the source category is a key.

[1]) Due to a reallocation after the key category analysis was performed, 2C1 - Iron and Steel Production should be replaced as key by 2B5 Other Chemical Industry.

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 2 1990**	**Level assessment Tier 2 2010**	**Trend assessment Tier 2 1990-2010**
5A1	Forest Land remaining Forest Land, Forest inventory area, Living Biomass	CO_2	**6.37**	**19.86**	**26.79**
4D1	Direct soil emissions	N_2O	**18.63**	**12.86**	**8.06**
5A1	Forest Land remaining Forest Land, Forest inventory area, Dead Biomass	CO_2	**6.80**	**8.51**	**9.15**
5C1	Grassland remaining Grassland, Histosols, Soils	CO_2	**12.49**	**7.85**	**4.90**
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Mineral	CO_2	**5.09**	**6.16**	**6.53**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Gaseous Fuels	CO_2	**2.78**	**5.03**	**6.12**
1A3b	Road Transportation	CO_2	**2.96**	**2.86**	**2.68**
4D3	Indirect emissions	N_2O	**3.44**	**2.51**	**1.88**
4A	Enteric Fermentation	CH_4	**3.38**	**2.36**	**1.68**
5E2	Land converted to Settlements, Living biomass	CO_2	**0.75**	**2.18**	**2.91**
1A3d	Navigation	CO_2	**2.29**	**2.07**	**1.87**
1B2a	Oil (incl. oil refineries, gasoline distribution)	CO_2	**3.06**	**2.01**	**1.32**
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Organic	CO_2	**2.54**	**1.97**	**1.57**
6A	Solid Waste Disposal on Land	CH_4	**4.04**	**1.91**	0.61
2F	Consumption of Halocarbons and Sulphur Hexafluoride	HFCs	0.00	**1.83**	**2.80**

1A3e	Other (snow scooters, boats, motorized equipment)	CO_2	**1.02**	**1.54**	**1.78**
1B2c	Venting and Flaring	CH_4	**0.73**	**1.29**	**1.55**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Liquid Fuels	CO_2	**1.84**	**1.15**	**0.71**
1A3a	Civil Aviation	CO_2	**0.92**	**1.08**	**1.13**
1A4	Other sectors - Mobile Fuel Combustion	CO_2	**1.27**	**0.93**	0.70
2C3	Aluminium Production	CO_2	**0.99**	**0.90**	**0.81**
5B1	Cropland remaining Cropland, Histosols, Soils	CO_2	**1.39**	**0.87**	0.54
1A3e	Other (snow scooters, boats, motorized equipment)	N_2O	0.47	**0.84**	**1.02**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Other Fuels	CO_2	0.20	**0.81**	**1.13**
1B2c	Venting and Flaring	CO_2	**1.08**	**0.79**	0.59
4D2	Animal production	N_2O	**1.12**	0.73	0.49
5E2	Land converted to Settlements, Soils	CO_2	0.10	0.65	**0.93**
5A2	Land converted to Forest Land, Living biomass	CO_2	0.01	0.58	**0.89**
2C3	Aluminium Production	PFCs	**4.54**	0.20	**2.28**
2B2	Nitric Acid Production	N_2O	**0.83**	0.10	0.31

Bold figures indicate whether the source category is a key.

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 2010**	**Trend assessment Tier 1 1990-2010**
5A1	Forest Land remaining Forest Land, Forest inventory area, Living Biomass	CO_2	**9.93**	**28.94**	**35.76**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Gaseous Fuels	CO_2	**8.07**	**13.65**	**15.21**
1A3b	Road Transportation	CO_2	**11.88**	**10.71**	**9.22**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Liquid Fuels	CO_2	**10.11**	**5.93**	**3.37**
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Mineral	CO_2	**4.76**	**5.38**	**5.23**
5A1	Forest Land remaining Forest Land, Forest inventory area, Dead Biomass	CO_2	**3.18**	**3.72**	**3.67**
2C2	Ferroalloys Production	CO_2	**3.98**	**2.32**	**1.31**
1A3d	Navigation	CO_2	**2.64**	**2.24**	**1.85**
4A	Enteric Fermentation	CH_4	**3.10**	**2.02**	**1.32**
1A4	Other sectors - Mobile Fuel Combustion	CO_2	**2.85**	**1.95**	**1.35**
2C3	Aluminium Production	CO_2	**2.21**	**1.87**	**1.55**

5C1	Grassland remaining Grassland, Histosols, Soils	CO_2	**2.92**	**1.72**	**0.98**
1A3e	Other (snow scooters, boats, motorized equipment)	CO_2	**1.18**	**1.67**	**1.76**
1B2c	Venting and Flaring	CO_2	**2.34**	**1.59**	**1.09**
4D1	Direct soil emissions	N_2O	**2.39**	**1.54**	**0.88**
1A3a	Civil Aviation	CO_2	**1.06**	**1.16**	**1.12**
6A	Solid Waste Disposal on Land	CH_4	**2.62**	**1.16**	0.34
1B2a	Oil (incl. oil refineries, gasoline distribution)	CO_2	**1.78**	**1.09**	**0.66**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Solid Fuels	CO_2	**1.58**	**1.03**	**0.67**
5E2	Land converted to Settlements, Living biomass	CO_2	**0.35**	**0.95**	**1.16**
2A1	Cement Production	CO_2	**0.99**	**0.81**	**0.65**
2F	Consumption of Halocarbons and Sulphur Hexafluoride	HFCs	0.00	**0.80**	**1.12**
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Other Fuels	CO_2	0.16	**0.58**	**0.74**
5A2	Land converted to Forest Land, Living biomass	CO_2	0.01	**0.51**	**0.71**
4D3	Indirect emissions	N_2O	**0.66**	**0.45**	0.31
1B2c	Venting and Flaring	CH_4	0.24	**0.39**	**0.43**
2B2	Nitric Acid Production	N_2O	**3.23**	**0.38**	**1.05**
2B1	Ammonia Production	CO_2	**0.78**	**0.38**	0.15
2C1	Iron and Steel Production[1]	CO_2	0.33	**0.35**	0.33
4B	Manure Management	CH_4	**0.46**	0.34	0.24
1A5b	Military – Mobile	CO_2	**0.61**	0.24	0.04
2C3	Aluminium Production	PFCs	**5.25**	0.22	**2.26**
4D2	Animal production	N_2O	**0.35**	0.21	0.13
2B4	Carbide Production	CO_2	**0.62**	0.08	0.19
2C4	SF6 Used in Aluminium and Magnesium Foundries	SF_6	**3.34**	.	.

Bold figures indicate whether the source category is a key.

[1]) Due to a reallocation after the key category analysis was performed, 2C1 - Iron and Steel Production should be replaced as key by 2B5 Other Chemical Industry.

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

Category - Fuel		CO_2		CH_4		N_2O		Uncertainty activity	Uncertainty emission factor		
		1990	2010	1990	2010	1990	2010		CO_2	CH_4	N_2O
1A	Stationary Fuel Combustion (1A1-1A2-1A4), Biomass	.	.	119.20	171.93	46.01	57.55	30	.	72	1
	Stationary Fuel Combustion (1A1-1A2-1A4), Gaseous Fuels	5 185.35	12 767.11	41.05	92.27	13.51	31.86	4	7	72	1
	Stationary Fuel Combustion (1A1-1A2-1A4), Liquid Fuels	6 493.06	5 544.64	14.43	7.69	20.02	15.19	3	3	72	1
	Stationary Fuel Combustion (1A1-1A2-1A4), Other Fuels	99.77	546.77	1.92	4.97	4.31	7.49	5	30	72	1
	Stationary Fuel Combustion (1A1-1A2-1A4), Solid Fuels	1 017.57	960.48	2.03	0.55	2.79	2.88	5	7	72	1
1A3a	Civil Aviation	679.38	1 088.34	0.35	0.58	6.69	10.71	20	3	72	1
1A3b	Road Transportation	7 630.18	10 020.24	71.44	16.74	56.85	60.41	5	3	45	65
1A3c	Railways	96.05	39.38	0.11	0.05	11.27	4.62	5	3	72	1
1A3d	Navigation	1 696.41	2 092.65	4.47	55.78	11.06	14.49	20	3	72	1
1A3e	Other (snow scooters, boats, motorized equipment)	760.31	1 559.15	6.84	9.82	68.92	168.98	20	3	72	1
1A4	Other sectors - Mobile Fuel Combustion	1 831.92	1 828.32	3.46	2.95	67.02	60.83	10	3	72	1
1A5a	Military - Stationary	62.45	41.64	0.17	0.14	0.18	0.28	5	5	72	1
1A5b	Military - Mobile	393.74	225.68	0.33	0.20	5.96	4.30	5	5	72	1
1B1a	Coal Mining	7.37	4.11	56.49	31.48	.	.	3	72	72	.

1B2a	Oil (incl. oil refineries, gasoline distribution)	1 145.91	1 022.43	164.41	230.84	.	.	3	40	40	.
1B2b	Natural Gas	4.11	12.76	2.52	46.68	.	.	3	72	72	.
1B2c	Venting and Flaring	1 502.33	1 491.69	152.90	365.10	4.36	3.60	4	10	72	1
2A1	Cement Production	634.26	754.03	.	.	.	.	0.444398	0.56 6764	.	.
2A2	Lime Production	49.85	247.17	.	.	.	.	0.364965	0.48 2322	.	.
2A3	Limestone and Dolomite Use	23.74	26.04	.	.	.	.	14.12451	7	.	.
2A7	Other	2.22	2.15	.	.	.	.	0.08	7	.	.
2B1	Ammonia Production	500.12	353.08	.	.	.	.	3	7	.	.
2B2	Nitric Acid Production	.	.	.	.	2 073.59	355.5 9	0	.	.	5.987 344
2B4	Carbide Production	400.30	74.80	7.36	2.40	.	.	3	10	10	.
2B5	Other Chemical Industry[1]	17.85	111.55	1.59	2.96	.	0.64	9	0.74 173	72	0
2C1	Iron and Steel Production[1]	212.81	326.83	.	.	.	.	1.23	1.29 83	.	.
2C2	Ferroalloys Production	2 553.70	2 171.64	1.04	1.26	5.22	5.06	0	3	72	10
2C3	Aluminium Production	1 419.00	1 753.48	.	.	.	.	3	10	.	.
2C5	Other Metal Production	153.26	81.37	.	.	.	.	10	10	.	.
2D1	Pulp and Paper	10.43	10.27	.	.	.	.	0.915625	10	.	.
2D2	Food and Drink	66.87	171.76	.	.	.	.	10	10	.	.
3	Solvent and Other Product Use	147.38	125.42	.	.	35.53	44.18	0	10	.	15
4A	Enteric Fermentation	.	.	1 991.42	1 892.13	.	.	5 (CH_4) 25 (N_2O)	.	25	.
4B	Manure Management	.	.	298.17	314.66	134.72	130.2 3	14.5	.	25	72

4D1	Direct soil emissions	.	.	.	.	1 419.29	1 310.30	30	.	.	180
4D2	Animal production	.	.	.	.	222.79	199.54	22	.	.	72
4D3	Indirect emissions	.	.	.	.	423.40	420.46	70	.	.	1
4F1	Cereals	.	.	22.81	4.40	8.73	1.68	10	.	72	1
6A	Solid Waste Disposal on Land	.	.	1 682.83	1 080.77	.	.	20	.	30	.
6B	Wastewater Handling	.	.	19.51	9.43	117.07	157.31	25	.	50	70
6C	Waste Incineration	0.19	.	0.01	0.07	0.07	0.07	30	30	72	1

[1]) Reallocation of a plant from 2C1 to 2B5 is not reflected in this table.

Category - Fuel		HFCs		PFCs		SF6		Uncertainty activity	Uncertainty emission factor		
		1990	2010	1990	2010	1990	2010		HFCs	PFCs	SF6
2C3	Aluminium Production	.	.	3 370.40	205.08	.	.	3	.	20	.
2C4	SF6 Used in Aluminium and Magnesium Foundries	.	.	.	.	2 143.83	.	0	.	.	0.25
2F	Consumption of Halocarbons and Sulphur Hexafluoride	0.05	746.66	.	0.04	55.95	74.81	0	50	50	60

Category - Fuel		CO_2		CH_4		N_2O		Uncertainty activity	Uncertainty emission factor		
		1990	2010	1990	2010	1990	2010		CO_2	CH_4	N_2O
5A	Forest Land remaining Forest Land, Drainage	.	.	.	.	11.29	11.95	0	.	.	280
5A1	Forest Land remaining Forest Land, Fertilizer	.	.	.	.	1.37	0.37	0	.	.	180
	Forest Land remaining Forest Land, Forest inventory area, Dead Biomass	-2 042.50	-3 480.14	.	.	.	.	0	50	.	.
	Forest Land remaining Forest Land, Forest inventory area, Living Biomass	-6 377.52	-27 073.70	.	.	.	.	0	15	.	.
	Forest Land remaining Forest Land, Forest inventory area, Soils, Mineral	-3 055.68	-5 035.75	.	.	.	.	0	25	.	.
	Forest Land remaining Forest Land, Forest inventory area, Soils, Organic	136.00	143.98	.	.	.	.	0	280	.	.
	Forest Land remaining Forest Land, Wildfires	.	.	1.77	1.45	0.18	0.15	0	.	75	75
5A2	Land converted to Forest Land, Living biomass	-5.77	-477.40	.	.	.	.	0	25	.	.
	Land converted to Forest Land, Soils, Mineral	42.76	46.71	.	.	.	.	0	50	.	.
5B	Cropland remaining Cropland, Liming	216.66	65.11	.	.	.	.	0	10	.	.
5B1	Cropland remaining Cropland, Erosion of new agriculture land, Soils	5.51	0.73	.	.	.	.	0	72	.	.
	Cropland remaining Cropland, Histosols, Soils	208.25	178.41	.	.	.	.	0	1	.	.

	Cropland remaining Cropland, Reduced tillage, Soils	.	-186.66	.	.	.	.	0	72	.	.
	Cropland remaining Cropland, Horticulture, Living biomass	-24.75	-15.58	.	.	.	.	0	25	.	.
5B2	Cropland, Disturbance	.	.	.	.	0.68	0.11	0	.	.	280
	Land converted to Cropland, Living biomass	52.23	2.22	.	.	.	.	0	25	.	.
	Land converted to Cropland, Soils, Mineral	1.15	23.20	.	.	.	.	0	50	.	.
5C1	Grassland remaining Grassland, Histosols, Soils	1 874.22	1 605.72	.	.	.	.	0	1	.	.
5C2	Cropland converted to Grassland, Horticulture, Living biomass	.	1.18	.	.	.	.	0	25	.	.
5D	Land converted to Wetland, Drainage	.	.	.	.	0.05	0.05	0	.	.	280
5D1	Wetland remaining Wetland, Peat extraction, Soils	3.37	3.37	.	.	.	.	0	1	.	.
5E2	Land converted to Settlements, Living biomass	224.61	889.73	.	.	.	.	0	50	.	.
	Land converted to Settlements, Soils	31.22	265.02	.	.	.	.	0	50	.	.
5G	Other; Liming of lakes and rivers	10.12	12.04	.	.	.	.	0	10	.	.

Reference list

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Annex II: Uncertainties in the Norwegian Greenhouse Gas Emission Inventory

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 2000). Analyses have been made both excluding and including the sector LULUCF (land use, land-use change and forestry).

The uncertainty analysis performed in 2011 was an update of the uncertainty analyses performed for the greenhouse gas inventory in 2006 and 2000. The report *Uncertainties in the Norwegian Greenhouse Gas Emission Inventory* (Statistics Norway (2000)) includes more detailed documentation of the analysis method used in all analyses. In this note we mainly focus on the changes since last analysis in 2006. This includes new methodology for several source categories as well as revised uncertainty estimates.

During the project we have been in contact with experts, and have collected information about uncertainty from them. There has been a focus on the sources where methodological changes has been made since the last uncertainty analysis was performed in 2006. For the industries included in EU's emission trading system, new information from the reports about uncertainty in activity data and CO_2 emission factor has been used. This has improved the quality of the uncertainty estimates for the energy and manufacturing sectors.

The results show that the uncertainty in the calculated greenhouse gas emissions for 2009 is ±5 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.

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; solid, gaseous, liquid, waste and bio energy. The placement into groups has been made using international definitions based on the type of the original energy carrier, *e.g*, refinery gas and fuel gas is placed in "liquid" and CO gas is placed in "solid". This is a change from last analysis when all these three gases were placed on "gaseous" fuel. This change affects the allocation of emissions on sources with different uncertainty estimates. The definitions of sources have also been changed to some extent since

last analysis, and this also affects the results of the uncertainty analysis. The most important changes are:

- Emissions from mobile installations in oil and gas exploration have been moved from "Mobile combustion-Coastal traffic" to "Stationary combustion-Oil and gas extraction".
- Emissions from district heating and electricity production are now placed in a new category called Energy supply.
- There are some minor adjustments in limitation and also some changes of names and order.

In Table 3, 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 2C5 Other metal production). 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[1]. Emissions from landfills, HFCs and some other sources have been transferred into the form of emission factor multiplied with 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).

Table 6.2 from the IPCC good practice guidance is included in the Annex as Table 4. This is as a response to recommendations in previous ERT review reports. Column G in Table 4 (6.2) is estimated as uncertainty for source category divided by total GHG emissions.

Uncertainties in input parameters

Emission estimates

In the analysis emission estimates for the different source categories (Table 3) for the years 1990 and 2009 are taken from the Norwegian emission inventory.

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. Some data are based on expert judgements.

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

1 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.

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.

The densities were used in the following way: Normal or lognormal distributions were used for most of the categories. Normal distribution was used for uncertainties up to 30 percent, while lognormal distribution was used for higher uncertainties. Normal distribution was also used for carbon balances that were in principle a difference between larger gains and losses that likely were normally distributed with lower uncertainties. These carbon balances might take both positive and negative values. Beta distribution and truncated normal distribution were used only in a few special cases. Beta distribution was used for N_2O emissions from combustion. Truncated normal distribution was used for CH_4 emissions from stationary combustion of liquid fuels, and from flaring.

The uncertainties and densities given in the following sections are based on information for 2009. However, they were also used for 1990 and for the trend analysis. In reality, due to improved methods, the quality of the 2009 data inventory is higher than that of the 1990 data for several categories. Thus, the analysis may underestimate the uncertainty in 1990 emissions and in the trend. The CO_2 emissions are likely most affected by this problem.

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)
1A1B	Coal/coke – petroleum refining	1.1	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A2A	Coal/coke - iron and steel	4.1	Normal	Emission trading scheme (Klif 2011), Expert judgement industry, Norcem (2006)
1A2F	Coal/coke - other	0.8	Normal	Emission trading scheme (Klif 2011), Expert judgement industry, Norcem (2006)
1A4B	Coal/coke - residential	20	Normal	Expert judgement, Statistics Norway (2000)
1A4C	Coal/coke - agriculture	30	Normal	Expert judgement, Statistics Norway
1A1, 1A2, 1A4	Wood	30	Lognormal	Expert judgement, Statistics Norway (2000)
1A1A	Gas – public electricity and heat production	0.8	Normal	Emission trading scheme (Klif 2011), Expert judgement, Statistics Norway
1A2	Gas - general	4	Normal	Norwegian Petroleum Directorate, Statistics Norway (2000)
1A1C	Gas - manufacture of solid fuels and other energy industries	0.2	Normal	Emission trading scheme (Klif 2011), NPD (2006)
1A2C	Gas - chemicals	1.7	Normal	Emission trading scheme (Klif 2011), Norwegian Petroleum Directorate, Statistics Norway (2000)
1A2D	Gas - pulp, paper, print	1.7	Normal	Emission trading scheme (Klif 2011), Norwegian Petroleum Directorate, Statistics Norway (2000)
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, Statistics Norway (2000)
1A1B	Oil - petroleum refining	1.1	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A1C	Oil – manufacture of solid fuels and other energy industries	1.8	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A2A	Oil - iron and steel	0.5	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A2C	Oil - chemicals	14.4	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A2D	Oil – pulp, paper, print	0.7	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A2F	Oil - other	2.6	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A4A	Oil - commercial/institutional	20	Normal	Expert judgement, Statistics Norway
1A4B	Oil - residential	9.5	Normal	Emission trading scheme (Klif 2011), Expert judgement, Statistics Norway
1A4C	Oil - agriculture/forestry	10	Normal	Expert judgement, Statistics Norway
1A1A	Waste – general	5	Normal	Expert judgement, Statistics Norway (2000)
1A2F	Waste - other manufacturing	3.2	Normal	Emission trading scheme (Klif 2011), Expert judgement, Statistics Norway (2000)
1A4A	Waste - commercial/institutional	30	Lognormal	Expert judgement, Statistics Norway (2000)
1A3A, 1A3E	Transport fuel - civil aviation, motorized equipment and pipeline	20	Normal	Expert judgement, Statistics Norway (2000)
1A3B	Transport fuel - road	5	Normal	Expert judgement, Statistics Norway
1A3C	Transport fuel - railway	5	Normal	Expert judgement, Statistics Norway
1A3D	Transport fuel - navigation	20	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, Statistics Norway (2000)
1B2A	Extraction of oil - transport, refining/storage	3	Normal	Expert judgement, Statistics Norway (2000)

IPCC Source category	Pollutant source	Standard deviation (2σ). per cent[1]	Density shape	Source/ comment
1B2A	Extraction of oil - distribution gasoline	5	Normal	Expert judgement, Statistics Norway (2000)
1B2C	Venting	-	-	See emission factor
1B2C	Flaring	1.4	Normal	Emission trading scheme (Klif 2011), Expert judgement, Statistics Norway (2000)
1B2C	Well testing	30	Normal	Expert judgement, Statistics Norway (2000)
2A1	Cement production	0.4	Normal	Emission trading scheme (Klif 2011)
2A2	Lime production	0.4	Normal	Emission trading scheme (Klif 2011)
2A3	Limestone and dolomite use	14.1	Normal	Emission trading scheme (Klif 2011)
2A7	Other mineral production	0.1	Normal	Emission trading scheme (Klif 2011)
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, Statistics Norway (2000)
2B5	Methanol and plastic production	9.0	Normal	Emission trading scheme (Klif 2011)
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
2D1	Pulp and paper	0.9	Normal	Emission trading scheme (Klif 2011)
2D2	Carbonic acid, bio protein	10	Normal	Expert judgement, Statistics Norway
2F	Consumption of halocarbons and SF_6	-	-	See emission factor
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	Statistics Norway (2000)
4D1	Direct soil emission - other	64	Lognormal	Expert judgement[3], Statistics Norway and Statistics Norway (2000)
4D1	Direct soil emission - organic soil	Fac2	Lognormal	Expert judgement, Statistics Norway
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
5A1	Forest Land remaining Forest Land, - general	-	-	See emission factor
5A1	Forest Land remaining Forest Land - wildfires	20	Normal	Expert judgement, Statistics Norway
5A2	Land converted to Forest Land	-	-	See emission factor
5B1	Cropland remaining Cropland - general	-	-	See emission factor
5B1	Cropland remaining Cropland - liming	5	Normal	Expert judgement, Statistics Norway
5B2	Land converted to Cropland	-	-	See emission factor
5C1	Grassland remaining Grassland	-	-	See emission factor
5C2	Cropland converted to Grassland	-	-	See emission factor

IPCC Source category	Pollutant source	Standard deviation (2σ). per cent[1]	Density shape	Source/ comment
5D1	Wetlands remaining Wetlands	-	-	See emission factor
5D2	Land converted to Wetland	-	-	See emission factor
5E2	Land converted to Settlements	-	-	See emission factor
5F2	Land converted to Other land	-	-	See emission factor
5G	Other; Liming of lakes and rivers	5	Normal	Expert judgement, Statistics Norway
6A	Solid waste disposal	20	Normal	Expert judgement, Statistics Norway (2010) and SFT (2006a)
6B	Waste water treatment - CH_4	1	Lognormal	Expert judgement, Statistics Norway
6B	Waste water treatment - N_2O pipeline and plant	25	Normal	Expert judgement, Statistics Norway (2006e)
6B	Waste water treatment - N_2O, not connected	30	Normal	Expert judgement, Statistics Norway (2011)
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% (Statistics Norway 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.

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

IPCC Source category	Pollutant source	Gas	(2σ). per cent[1]	Density shape	Source/ comment
1A1, 1A2B, 1A2D, 1A2E, 1A4	Coal/coke - general	CO_2	7	Normal	Spread in data, Statistics Norway (2000)
1A1B	Coal/coke – petroleum refining	CO_2	0.9	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A2A	Coal/coke – iron and steel	CO_2	16.0	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A2F	Coal/coke - other	CO_2	2.0	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A2, 1A4	Gas - general	CO_2	3.5	Normal	IPCC (2006), expert judgement, Statistics Norway
1A1A	Gas – public electricity and heat prod	CO_2	0.6	Normal	Emission trading scheme (Klif 2011), Norwegian Petroleum Directorate, Statistics Norway (2000)
1A1C	Gas – Manufacture of solid fuels and other energy	CO_2	2.6	Normal	Emission trading scheme (Klif 2011), Norwegian Petroleum Directorate, Statistics Norway (2000)
1A2C	Gas - Chemicals	CO_2	1.6	Normal	Emission trading scheme (Klif 2011), Norwegian Petroleum Directorate, Statistics Norway (2000)
1A1, 1A2, 1A4	Oil - general	CO_2	3	Normal	Spread in data, Statistics Norway (2000)
1A1B	Oil – petroleum refining	CO_2	0.9	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A2C	Oil - Chemicals	CO_2	1.1	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A2F	Oil - other	CO_2	2.6	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A4B	Oil - residential	CO_2	3.4	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A1, 1A4	Waste - general	CO_2	30	Normal	Spread in data, Statistics Norway (2000)
1A2F	Waste - other	CO_2	25.2	Normal	Emission trading scheme (Klif 2011), Spread in data, Statistics Norway (2000)
1A3A, 1A3B, 1A3C, 1A3D	Transport fuel	CO_2	3	Normal	Spread in data, Statistics Norway (2000)
1A5	Military fuel - stationary and mobile	CO_2	5	Normal	Expert judgement, Statistics Norway
1A1, 1A2, 1A4	Coal/coke, wood, waste - general	CH_4	Fac2	Lognormal	Spread in data, Statistics Norway (2000)
1A1B	Coal/coke – petroleum refining	CH_4	Fac2	Truncated N	Spread in data, Statistics Norway (2000)
1A1, 1A2, 1A4, 1A5	Gas – general, military fuel – stationary and mobile	CH_4	Fac2	Lognormal	Expert judgement, Statistics Norway
1A1, 1A2, 1A4	Oil - general	CH_4	Fac2	Truncated N	Spread in data, Statistics Norway (2000)
1A3A, 1A3C, 1A3D	Transport fuel	CH_4	Fac2	Lognormal	Spread in data. Expert judgement, Statistics Norway (2000)
1A3B	Transport fuel	CH_4	45	Lognormal	(Gustafsson 2005)
1A1, 1A2, 1A4, 1A5	Coal/coke, wood, gas, waste – general, military fuel – stationary and mobile	N_2O	Fac3	Beta	Expert judgement, Statistics Norway
1A1, 1A2, 1A4	Oil - general	N_2O	Fac3	Beta	Spread in data. Expert judgement. IPCC (1997), Statistics Norway (2000)
1A1B	Coal/coke – petroleum refining	N_2O	Fac3	Beta	Spread in data. Expert judgement. IPCC (1997), Statistics Norway (2000)
1A3A, 1A3C, 1A3D	Transport fuel	N_2O	Fac3	Beta	Spread in data. Expert judgement, Statistics Norway (2000)
1A3B	Transport fuel	N_2O	65	Lognormal	(Gustafsson 2005)
1B1A, 1B2B	Coal mining, extraction of natural gas	CO_2	Fac2	Lognormal	Expert judgement, Statistics Norway
1B2A	Extraction of oil - transport, refining/storage, distribution gasoline	CO_2	40	Lognormal	Expert judgement, Statistics Norway
1B2C	Venting	CO_2	Fac2	Lognormal	Expert judgement, Statistics Norway (2000)
1B2C	Flaring	CO_2	4.5	Normal	Emission trading scheme (Klif 2011), Statistics Norway (2000)
1B2C	Well testing	CO_2	7	Normal	Expert judgement, Statistics Norway (2000)
1B1A, 1B2B, 1B2C	Coal mining, extraction of natural gas, venting	CH_4	Fac2	Lognormal	Expert judgement, Statistics Norway (2000)
1B2A	Extraction of oil - transport, refining/storage	CH_4	40	Lognormal	Expert judgement, Statistics Norway
1B2C	Flaring, well testing	CH_4	Fac2	Truncated N	Expert judgement, Statistics Norway (2000)

IPCC Source category	Pollutant source	Gas	(2σ). per cent[1]	Density shape	Source/ comment
1B2C	Flaring, well testing	N_2O	Fac3	Beta	Expert judgement, Statistics Norway (2000)
2A1	Cement production	CO_2	0.6	Normal	Emission trading scheme (Klif 2011), IPCC (1997)
2A2	Lime production	CO_2	0.5	Normal	Emission trading scheme (Klif 2011), Expert judgement, Statistics Norway
2A3, 2A7	Limestone and dolomite use, other mineral production	CO_2	7	Normal	Expert judgement, Statistics Norway
2B1	Ammonia production	CO_2	7	Normal	Expert judgement industry, Yara (2006)
2B4	Carbide production - SiC	CO_2	10	Normal	Expert judgement industry, St. Gobain and Orkla Exolon (2006)
2B4	Carbide production - CaC	CO_2	10	Normal	Spread in data, Statistics Norway (2000)
2B5	Methanol and plastic production	CO_2	0.7	Normal	Emission trading scheme (Klif 2011),Expert judgement, Statistics Norway
2B4	Carbide production - SiC	CH_4	10	Normal	SFT (2006b)
2B5	Methanol and plastic production	CH_4	Fac2	Lognormal	Expert judgement, Statistics Norway
2B2	Nitric acid production	N_2O	6.0	Normal	Expert judgement industry, Yara (2006), Emission trading scheme (Klif 2011)
2C1	Iron and steel production	CO_2	1.3	Normal	Emission trading scheme (Klif 2011), Expert judgement industry, Tinfos (2006)
2C2	Ferroalloys production	CO_2	3	Normal	Expert judgement, SINTEF (2006)
2C3	Aluminium production	CO_2	10	Normal	International Aluminium Institute (IAI), Norsk Hydro (2006a)
2C5	Mg production, Ni production, anodes	CO_2	10	Normal	Expert judgement, Statistics Norway
2C2	Ferroalloys production	CH_4	Fac2	Lognormal	Expert judgement, Statistics Norway
2C2	Ferroalloys production	N_2O	10	Normal	Expert judgement, Statistics Norway
2C3	Aluminium production	PFK	20	Normal	Expert judgement industry, Norsk Hydro (2006a)
2C4	SF_6 used in Al and Mg foundries	SF_6	0.25	Normal	Expert judgement industry, Norsk Hydro (2006b)
2D1	Pulp and paper	CO_2	10	Normal	Expert judgement, Statistics Norway
2D2	Carbonic acid, bio protein	CO_2	10	Normal	Expert judgement, Statistics Norway
2F	Consumption of HFK and PFK	HFK/PFK	50	Lognormal	Apply to HFK. Expert judgement, Statistics Norway
2F	Consumption of SF_6	SF_6	60	Lognormal	Expert judgement, Statistics Norway
3A, 3B,3C, 3D	Solvent and other product use	CO_2	10	Normal	Expert judgement, Statistics Norway (2010)
3D	Use of N_2O in anasthesia and as propellant	N_2O	15	Normal	Expert judgement, Statistics Norway (2010)
A1, 4A3	Enteric fermentation - cattle and sheep	CH_4	25	Normal	Expert judgement, UMB (2006)
4A4-10	Enteric fermentation - other animal	CH_4	40	Normal	IPCC (2006)
4B1-9, 4B13	Manure management	CH_4	25	Normal	IPCC (1997)
4B11-12	Manure management - N_2O	N_2O	Fac2	Lognormal	IPCC (1997)
4D1	Direct soil emission	N_2O	Fac5	Lognormal	IPCC (2000)
4D2	Animal production	N_2O	Fac2	Lognormal	IPCC (2000)
4D3	Indirect soil emission	N_2O	Fac3	Lognormal	IPCC (1997)
4F1	Agricultural residue burning	CH_4	Fac2	Lognormal	Expert judgement, Statistics Norway
4F1	Agricultural residue burning	N_2O	Fac3	Beta	Expert judgement, Statistics Norway
5A1	Forest Land remaining Forest Land, Fertilizer	N_2O	Fac5	Lognormal	NIJOS (2005)
5A1	Forest Land remaining Forest Land, Drainage	N_2O	Fac10	Lognormal	NIJOS (2005)
5A1	Forest Land remaining Forest Land, Wildfires	CH_4/ N_2O	75	Lognormal	NIJOS (2005)
5A1	Forest Land remaining Forest Land, Forest inventory area, Living Biomass	CO_2	15	Normal	NIJOS (2005)
5A1	Forest Land remaining Forest Land, Forest inventory area, Dead Biomass	CO_2	50	Lognormal	NIJOS (2005)
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Mineral	CO_2	25	Normal	NIJOS (2005)
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Organic	CO_2	Fac10	Lognormal	NIJOS (2005)
5A2	Land converted to Forest Land, Living biomass	CO_2	25	Normal	Expert judgement, Statistics Norway
5A2	Land converted to Forest Land, Soils, Mineral	CO_2	50	Lognormal	Expert judgement, Statistics Norway
5B1	Cropland remaining Cropland, Liming	CO_2	10	Normal	NIJOS (2005)
5B1	Cropland remaining Cropland, Horticulture, Living biomass	CO_2	25	Normal	NIJOS (2005)

IPCC Source category	Pollutant source	Gas	(2σ). per cent[1]	Density shape	Source/ comment
5B1	Cropland remaining Cropland, Reduced tillage, Soils	CO_2	Fac2	Lognormal	NIJOS (2005)
5B1	Cropland remaining Cropland, Erosion of new agriculture land, Soils				
5B1	Cropland remaining Cropland, Histosols, Soils	CO_2	Fac3	Lognormal	NIJOS (2005)
5B2	Land converted to Cropland, Living biomass	CO_2	25	Normal	NIJOS (2005)
5B2	Land converted to Cropland, Soils, Mineral	CO_2	50	Lognormal	Expert judgement, Statistics Norway
5B2	Cropland, Disturbance	N_2O	Fac10	Lognormal	NIJOS (2005)
5C1	Grassland remaining Grassland, Other Grassland, Living biomass	CO_2	50	Lognormal	Expert judgement, Statistics Norway
5C1	Grassland remaining Grassland, Histosols, Soils	CO_2	Fac3	Lognormal	NIJOS (2005)
5C2	Cropland converted to Grassland, Horticulture, Living biomass	CO_2	25	Normal	NIJOS (2005)
5D1	Wetlands remaining Wetlands, Living biomass	CO_2	25	Normal	Expert judgement, Statistics Norway
5D1	Wetland remaining Wetland, Peat extraction, Soils	CO_2	Fac3	Lognormal	NIJOS (2005)
5D2	Land converted to Wetland, Drainage	N_2O	Fac10	Lognormal	NIJOS (2005)
5E2	Land converted to Settlements, Living biomass	CO_2	50	Lognormal	NIJOS (2005)
5E2	Land converted to Settlements, Soils	CO_2	50	Lognormal	Expert judgement, Statistics Norway
5F2	Land converted to Other land, Living biomass	CO_2	50	Lognormal	Expert judgement, Statistics Norway
5G	Other; Liming of lakes and rivers	CO_2	10	Normal	NIJOS (2005)
6A	Solid waste disposal	CH_4	30	Lognormal	SFT (2006a)
6B	Waste water treatment - CH_4	CH_4	50	Lognormal	IPCC (2000) and expert judgement, Statistics Norway (2010)[2]
6B	Waste water treatment - N_2O, pipeline and plant	N_2O	70	Lognormal	Expert judgement, Statistics Norway (2000)
6B	Waste water treatment - N_2O, not connected	N_2O	Fac5	Lognormal	IPCC (2006) and expert judgement, Statistics Norway (2010)
6C	Waste incineration	CO_2	30	Normal	Expert judgement, Statistics Norway
6C	Waste incineration	CH_4	Fac2	Lognormal	Expert judgement, Statistics Norway
6C	Waste incineration	N_2O	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 2000) and MCF 25%. Dependencies between parameters

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 (Statistics Norway 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).

The cases when activity data are assumed dependent in the statistical modelling are:

- The consumption of oil products in each sector. The sum of all oil products has a lower uncertainty than the consumption in each sector. In practice, this is treated by assuming that sectors are independent, and then by scaling all uncertainties so that total uncertainty equals a specified value.
- 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 sheep 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 sheep 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.

There are also likely 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 large 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 2009 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 cannot 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 2009. 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.

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 D1 and table D2, 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.

Results of the Tier 2 Uncertainty analysis
Results for the uncertainties in the total emissions and trends for the GHG inventory, excluding and including the LULUCF sector are given in Chapter 1.7.

Source category level used in the analysis

Source category level used in the analysis is listed in Table 3.

Table 3. Source category level used in the analysis

IPCC	Source Category	Pollutant source
1A1A	Public electricity and heat prod	Coal/coke combustion
1A1A	Public electricity and heat prod	Wood combustion
1A1A	Public electricity and heat prod	Gas combustion
1A1A	Public electricity and heat prod	Oil combustion
1A1A	Public electricity and heat prod	Waste combustion
1A1B	Petroleum refining	Coal/coke combustion
1A1B	Petroleum refining	Oil combustion
1A1C	Manufacture of solid fuels and other energy	Gas combustion
1A1C	Manufacture of solid fuels and other energy	Oil combustion
1A2A	Iron and steel	Coal/coke combustion
1A2A	Iron and steel	Wood combustion
1A2A	Iron and steel	Gas combustion
1A2A	Iron and steel	Oil combustion
1A2B	Non-ferrous metal	Coal/coke combustion
1A2B	Non-ferrous metal	Wood combustion
1A2B	Non-ferrous metal	Gas combustion
1A2B	Non-ferrous metal	Oil combustion
1A2C	Chemicals	Coal/coke combustion
1A2C	Chemicals	Wood combustion
1A2C	Chemicals	Gas combustion
1A2C	Chemicals	Oil combustion
1A2D	Pulp, paper, print	Coal/coke combustion
1A2D	Pulp, paper, print	Wood combustion
1A2D	Pulp, paper, print	Gas combustion
1A2D	Pulp, paper, print	Oil combustion
1A2E	Food processing, beverages, tobacco	Coal/coke combustion
1A2E	Food processing, beverages, tobacco	Wood combustion
1A2E	Food processing, beverages, tobacco	Gas combustion
1A2E	Food processing, beverages, tobacco	Oil combustion
1A2F	Other manufacturing	Coal/coke combustion
1A2F	Other manufacturing	Wood combustion
1A2F	Other manufacturing	Gas combustion
1A2F	Other manufacturing	Oil combustion
1A2F	Other manufacturing	Waste combustion
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	Coal/coke combustion
1A4A	Commercial/institutional	Wood combustion
1A4A	Commercial/institutional	Gas combustion
1A4A	Commercial/institutional	Oil combustion
1A4A	Commercial/institutional	Waste combustion
1A4B	Residential	Coal/coke combustion
1A4B	Residential	Wood combustion
1A4B	Residential	Gas combustion
1A4B	Residential	Oil combustion
1A4C	Agriculture/forestry/fishing	Coal/coke combustion
1A4C	Agriculture/forestry/fishing	Wood combustion
1A4C	Agriculture/forestry/fishing	Gas combustion
1A4C	Agriculture/forestry/fishing	Oil combustion
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	Well testing	
1B2C	Flaring	
2A1	Cement production	
2A2	Lime production	
2A3	Limestone and dolomite use	
2A7	Other mineral production	
2B1	Ammonia production	

IPCC	Source Category	Pollutant source
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	
2D1	Pulp and paper	
2D2	Carbonic acid, bio protein	
2F	consumption of halocarbons and SF_6	
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 - CH_4 – cattle	
4B11	Manure management - N_2O - Liquid storage	
4B12	Manure management - N_2O - solid storage	
4B13	Manure management - CH_4 - other animal	
4B3	Manure management - CH_4 – sheep	
4B4	Manure management - CH_4 – goat	
4B6	Manure management - CH_4 - horse	
4B8	Manure management - CH_4 - swine	
4B9	Manure management - CH_4 - poultry	
4D1	Direct soil emission – Fertilizer	
4D1	Direct soil emission – Manure	
4D1	Direct soil emission- Other	
4D1	Direct soil emission- Organic soil	
4D2	Animal production	
4D3	Indirect soil emission- Deposition	
4D3	Indirect soil emission - Leaching, other	
4F1	Burning of straw	
5A1	Forest Land remaining Forest Land, Fertilizer	
5A1	Forest Land remaining Forest Land, Drainage	
5A1	Forest Land remaining Forest Land, Wildfires	
5A1	Forest Land remaining Forest Land, Forest inventory area, Living Biomass	
5A1	Forest Land remaining Forest Land, Forest inventory area, Dead Biomass	
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Mineral	
5A1	Forest Land remaining Forest Land, Forest inventory area, Soils, Organic	
5A2	Land converted to Forest Land, Living biomass	
5A2	Land converted to Forest Land, Soils, Mineral	
5B1	Cropland remaining Cropland, Liming	
5B1	Cropland remaining Cropland, Horticulture, Living biomass	
5B1	Cropland remaining Cropland, Reduced tillage, Soils	
5B1	Cropland remaining Cropland, Erosion of new agriculture land, Soils	
5B1	Cropland remaining Cropland, Histosols, Soils	
5B2	Land converted to Cropland, Living biomass	
5B2	Land converted to Cropland, Soils, Mineral	
5B2	Cropland, Disturbance	
5C1	Grassland remaining Grassland, Other Grassland, Living biomass	
5C1	Grassland remaining Grassland, Histosols, Soils	
5C2	Cropland converted to Grassland, Horticulture, Living biomass	
5D1	Wetlands remaining Wetlands, Living biomass	
5D1	Wetland remaining Wetland, Peat extraction, Soils	
5D2	Land converted to Wetland, Drainage	
5E2	Land converted to Settlements, Living biomass	
5E2	Land converted to Settlements, Soils	

IPCC	Source Category	Pollutant source
5F2	Land converted to Other land, Living biomass	
5G	Other; Liming of lakes and rivers	
6A	Managed waste disposal on land	
6B	Waste water -CH_4	
6B	Waste water - N_2O pipeline	
6B	Waste water - N_2O plant	
6B	Waste water - N_2O not connected	
6C	Waste incineration	

Table 4. Table 6.2 in the GPG. Tier 2 uncertainty reporting.

	A	A*	B	C	D	E	F	G	H	I	J
	IPCC Source category		Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
Total	Total			41,203	25,964				-37%		
1A1A_VT1	Coal/coke combustion	Public electricity and heat prod	CO2	205	112	-9	8	0.037	-45	-49	-41
1A1A_VT3	Gas combustion	Public electricity and heat prod	CO2	-	1,119	-1	1	0.046	…	-	-
1A1A_VT6	Oil combustion	Public electricity and heat prod	CO2	14	110	-4	4	0.017	662	635	686
1A1A_VT7	Waste combustion	Public electricity and heat prod	CO2	97	429	-28	29	**0.499**	344	314	378
1A1B_VT1	Coal/coke combustion	Petroleum refining	CO2	161	247	-1	2	0.014	53	51	56
1A1B_VT6	Oil combustion	Petroleum refining	CO2	793	767	-1	1	0.042	-3	-5	-2
1A1C_VT3	Gas combustion	Manufacture of solid fuels and other energy	CO2	5,185	10,541	-2	3	**1.052**	103	103	104
1A1C_VT6	Oil combustion	Manufacture of solid fuels and other energy	CO2	251	788	-3	3	0.101	213	207	220
1A2A_VT1	Coal/coke combustion	Iron and steel	CO2	60	12	-17	17	0.008	-79	-81	-78
1A2A_VT3	Gas combustion	Iron and steel	CO2	-	3	-5	5	0.001	…	-	-
1A2A_VT6	Oil combustion	Iron and steel	CO2	45	59	-3	3	0.007	31	30	32
1A2B_VT1	Coal/coke combustion	Non-ferrous metal	CO2	0	-	...	...	-	-100	-100	-100
1A2B_VT3	Gas combustion	Non-ferrous metal	CO2	-	104	-5	6	0.022	…	-	-
1A2B_VT6	Oil combustion	Non-ferrous metal	CO2	268	83	-4	4	0.013	-69	-70	-68
1A2C_VT1	Coal/coke combustion	Chemicals	CO2	133	110	-8	8	0.036	-17	-23	-11

	A	A*	B	C	D	E	F	G	H	I	J
	IPCC Source category		Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
1A2C_VT3	Gas combustion	Chemicals	CO2	-	369	-2	2	0.032	…	-	-
1A2C_VT6	Oil combustion	Chemicals	CO2	1,064	837	-14	15	0.468	-21	-36	-4
1A2D_VT1	Coal/coke combustion	Pulp, paper, print	CO2	16	-	...	...	-	-100	-100	-100
1A2D_VT3	Gas combustion	Pulp, paper, print	CO2	-	3	-4	4	0.000	…	-	-
1A2D_VT6	Oil combustion	Pulp, paper, print	CO2	210	336	-3	3	0.039	60	58	61
1A2E_VT1	Coal/coke combustion	Food prosessing, beverages, tobacco	CO2	10	-	...	...	-	-100	-100	-100
1A2E_VT3	Gas combustion	Food prosessing, beverages, tobacco	CO2	-	89	-5	5	0.018	…	-	-
1A2E_VT6	Oil combustion	Food prosessing, beverages, tobacco	CO2	456	237	-4	4	0.036	-48	-50	-46
1A2F_VT1	Coal/coke combustion	Other manufacturing	CO2	396	335	-2	2	0.029	-16	-16	-15
1A2F_VT3	Gas combustion	Other manufacturing	CO2	-	69	-6	5	0.015	…	-	-
1A2F_VT6	Oil combustion	Other manufacturing	CO2	1,135	815	-4	4	0.118	-28	-30	-26
1A2F_VT7	Waste combustion	Other manufacturing	CO2	-	47	-25	25	0.047	…	-	-
1A3A	Transport fuel - civil aviation		CO2	679	1,071	-16	17	**0.700**	58	25	104
1A3B	Transport fuel - road transportation		CO2	7,630	9,697	-5	5	**1.872**	27	20	34
1A3C	Transport fuel - railway		CO2	96	45	-5	5	0.009	-53	-56	-50
1A3D	Transport fuel - navigation		CO2	1,696	2,001	-16	17	**1.310**	18	-7	50
1A3E	Transport fuel - motorized equipment and pipeline		CO2	760	1,211	-15	16	**0.773**	59	24	102
1A4A_VT1	Coal/coke combustion	Commercial/institutional	CO2	-	5	-19	21	0.004	…	-	-
1A4A_VT3	Gas combustion	Commercial/institutional	CO2	-	50	-10	10	0.020	…	-	-
1A4A_VT6	Oil combustion	Commercial/institutional	CO2	812	734	-16	17	**0.496**	-10	-29	15

	A	A*	B	C	D	E	F	G	H	I	J
	IPCC Source category		Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
1A4A_VT7	Waste combustion	Commercial/institutional	CO2	3	-	...	...	-	-100	-100	-100
1A4B_VT1	Coal/coke combustion	Residential	CO2	24	2	-21	22	0.001	-93	-95	-91
1A4B_VT3	Gas combustion	Residential	CO2	-	8	-27	30	0.009	…	-	-
1A4B_VT6	Oil combustion	Residential	CO2	1,318	454	-8	9	0.150	-66	-69	-61
1A4C_VT1	Coal/coke combustion	Agriculture/forestry/fishing	CO2	12	-	...	...	-	-100	-100	-100
1A4C_VT3	Gas combustion	Agriculture/forestry/fishing	CO2	-	42	-31	29	0.050	…	-	-
1A4C_VT6	Oil combustion	Agriculture/forestry/fishing	CO2	1,975	1,883	-8	9	**0.646**	-5	-15	7
1A5A	Military fuel - stationary	Military	CO2	62	35	-7	7	0.010	-44	-48	-40
1A5B	Military fuel - mobile	Military	CO2	394	228	-7	7	0.063	-42	-46	-38
1B1A	Coal mining, Extraction of natural gas		CO2	7	5	-51	93	0.013	-38	-40	-35
1B2A_x	Extraction of oil - transport		CO2	367	124	-34	50	**0.199**	-66	-68	-65
1B2A_y	Extraction of oil - refining/storage		CO2	749	873	-32	44	**1.343**	17	12	22
1B2A_z	Extraction of oil - distribution gasoline		CO2	30	14	-35	44	0.023	-52	-55	-50
1B2B	Coal mining, Extraction of natural gas		CO2	4	13	-51	84	0.034	211	198	225
1B2C_x	Venting		CO2	27	117	-52	86	0.319	332	332	332
1B2C_z	Well testing		CO2	80	20	-31	30	0.024	-75	-84	-61
1B2C_y	Flaring		CO2	1,393	1,266	-4	5	0.233	-9	-11	-7
2A1	Cement production		CO2	634	842	-1	1	0.024	33	32	34
2A2	Lime production		CO2	47	137	-1	1	0.003	194	192	195
2A3	Limestone and dolomite use		CO2	24	31	-15	15	0.019	30	6	57
2A7	Other mineral production		CO2	2	2	-7	7	0.001	-15	-15	-15

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Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
2B1	Ammonia production		CO2	500	335	-8	7	0.098	-33	-36	-30
2B4_x	Silicium carbide production		CO2	222	51	-10	10	0.021	-77	-78	-76
2B4_y	Calcium carbide production		CO2	178	-	...	...	-	-100	-100	-100
2B5	Methanol and plastic production		CO2	3	95	-8	9	0.033	3,516	3,080	3,968
2C1	Iron and steel production		CO2	213	270	-2	2	0.019	27	25	29
2C2	Ferroalloys production		CO2	2,554	1,446	-3	3	0.171	-43	-43	-43
2C3	Aluminium production		CO2	1,419	1,725	-10	11	**0.718**	22	17	27
2C5_x	Mg production		CO2	128	-	...	...	-	-100	-100	-100
2C5_y	Ni production, anodes		CO2	26	95	-14	14	0.053	270	221	322
2D1	Pulp and paper		CO2	10	9	-10	9	0.003	-14	-15	-13
2D2	Carbonic acid, bio protein		CO2	67	172	-13	14	0.093	157	123	196
3A	Paint application		CO2	39	17	-10	9	0.007	-56	-56	-56
3B	Degreasing and dry cleaning		CO2	-	1	-10	10	0.000	…	-	-
3C	Chemical products, Manufaqcture and processing		CO2	8	1	-10	10	0.000	-89	-89	-89
3D	Other		CO2	100	96	-10	10	0.038	-4	-4	-4
5A1-1	Forest Land remaining Forest Land, Forest inventory area, Living Biomass		CO2	-6,413	-22,172	15	-13	12.691	246	246	246
5A1-2	Forest Land remaining Forest Land, Forest inventory area, Dead Biomass		CO2	-2,042	-1,002	49	-49	1.986	-51	-51	-51

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	IPCC Source category		Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
5A1-4	Forest Land remaining Forest Land, Forest inventory area, Soils, Mineral		CO2	-3,056	-4,584	24	-25	4.510	50	50	50
5A1-3	Forest Land remaining Forest Land, Forest inventory area, Soils, Organic		CO2	136	144	-103	100	0.585	6	6	6
5A2-BM	Land converted to Forest Land, Living biomass		CO2	-5	-365	26	-24	0.358	6,740	6,740	6,740
5A2-S	Land converted to Forest Land, Soils, Mineral		CO2	30	71	-50	51	0.139	136	136	136
5B-IV	Cropland remaining Cropland, Liming		CO2	217	83	-11	12	0.036	-62	-64	-59
5B1-1	Cropland remaining Cropland, Horticulture, Living biomass		CO2	-24	-18	24	-25	0.018	-23	-23	-23
5B1-3	Cropland remaining Cropland, Reduced tillage, Soils		CO2	-	-180	55	-57	0.398	…	-	-
5B1-5	Cropland remaining Cropland, Erosion of new agriculture land, Soils		CO2	6	1	0	0	-	-86	-86	-86
5B1-4	Cropland remaining Cropland, Histosols, Soils		CO2	208	208	-81	80	0.659	-	-	-
5B2-BM	Land converted to Cropland, Living biomass		CO2	52	-2	25	-24	0.002	-104	-104	-104

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	IPCC Source category		Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
5B2-S	Land converted to Cropland, Soils, Mineral		CO2	1	28	-49	46	0.055	1,807	1,807	1,807
5C1-1	Grassland remaining Grassland, Other Grassland, Living biomass		CO2	126	-	...	...	-	-100	-100	-100
5C1-2	Grassland remaining Grassland, Histosols, Soils		CO2	1,870	1,870	-84	81	5.790	-	-	-
5D1-2	Wetland remaining Wetland, Peat extraction, Soils		CO2	3	3	-79	74	0.010	-	-	-
5E2-BM	Land converted to Settlements, Living biomass		CO2	271	299	-49	46	0.556	11	11	11
5E2-S	Land converted to Settlements, Soils		CO2	39	259	-47	46	0.482	570	570	570
5F2	Land converted to Other land, Living biomass		CO2	-	-4	46	-50	0.008	…	-	-
5G-IV	Other; Liming of lakes and rivers		CO2	10	17	-10	12	0.007	64	54	77
6C	Waste incineration		CO2	0	-	...	...	-	-100	-100	-100
1A1A_VT1	Coal/coke combustion	Public electricity and heat prod	CH4	0	0	-55	89	0.000	-33	-37	-28
1A1A_VT2	Wood combustion	Public electricity and heat prod	CH4	0	2	-56	101	0.005	244	131	415
1A1A_VT3	Gas combustion	Public electricity and heat prod	CH4	-	9	-51	99	0.027	…	-	-
1A1A_VT6	Oil combustion	Public electricity and heat prod	CH4	0	0	-61	56	0.000	742	712	768

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Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
1A1A_VT7	Waste combustion	Public electricity and heat prod	CH4	2	4	-54	87	0.011	106	92	121
1A1B_VT6	Oil combustion	Petroleum refining	CH4	5	1	-58	61	0.002	-86	-86	-86
1A1C_VT3	Gas combustion	Manufacture of solid fuels and other energy	CH4	41	82	-53	82	0.223	101	100	101
1A1C_VT6	Oil combustion	Manufacture of solid fuels and other energy	CH4	0	0	-61	56	0.000	-100	-100	-100
1A2A_VT1	Coal/coke combustion	Iron and steel	CH4	0	0	-55	90	0.000	-53	-56	-51
1A2A_VT2	Wood combustion	Iron and steel	CH4	0	0	-59	97	0.000	269	144	453
1A2A_VT3	Gas combustion	Iron and steel	CH4	-	0	-54	84	0.000	…	-	-
1A2A_VT6	Oil combustion	Iron and steel	CH4	0	0	-61	56	0.000	-22	-22	-21
1A2B_VT2	Wood combustion	Non-ferrous metal	CH4	-	0	-55	108	0.000	…	-	-
1A2B_VT3	Gas combustion	Non-ferrous metal	CH4	-	0	-52	92	0.000	…	-	-
1A2B_VT6	Oil combustion	Non-ferrous metal	CH4	0	0	-62	57	0.000	-39	-41	-37
1A2C_VT1	Coal/coke combustion	Chemicals	CH4	0	0	-55	90	0.000	-11	-17	-4
1A2C_VT2	Wood combustion	Chemicals	CH4	0	0	-58	98	0.001	295	166	519
1A2C_VT3	Gas combustion	Chemicals	CH4	-	0	-52	94	0.001	…	-	-
1A2C_VT6	Oil combustion	Chemicals	CH4	1	1	-60	66	0.003	-6	-23	15
1A2D_VT1	Coal/coke combustion	Pulp, paper, print	CH4	0	-	...	...	-	-100	-100	-100
1A2D_VT2	Wood combustion	Pulp, paper, print	CH4	6	5	-57	99	0.015	-17	-45	30
1A2D_VT3	Gas combustion	Pulp, paper, print	CH4	-	0	-53	77	0.000	…	-	-
1A2D_VT6	Oil combustion	Pulp, paper, print	CH4	0	0	-61	56	0.000	107	105	108
1A2E_VT1	Coal/coke combustion	Food prosessing, beverages, tobacco	CH4	0	-	...	...	-	-100	-100	-100

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Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
1A2E_VT2	Wood combustion	Food prosessing, beverages, tobacco	CH4	0	0	-57	97	0.000	-96	-97	-93
1A2E_VT3	Gas combustion	Food prosessing, beverages, tobacco	CH4	-	0	-53	88	0.001	…	-	-
1A2E_VT6	Oil combustion	Food prosessing, beverages, tobacco	CH4	0	0	-62	56	0.000	-41	-43	-39
1A2F_VT1	Coal/coke combustion	Other manufacturing	CH4	0	0	-54	90	0.001	22	21	23
1A2F_VT2	Wood combustion	Other manufacturing	CH4	1	1	-57	93	0.003	-29	-52	9
1A2F_VT3	Gas combustion	Other manufacturing	CH4	-	0	-53	88	0.000	…	-	-
1A2F_VT6	Oil combustion	Other manufacturing	CH4	2	2	-61	55	0.004	-5	-8	-2
1A2F_VT7	Waste combustion	Other manufacturing	CH4	-	1	-53	86	0.001	…	-	-
1A3A	Transport fuel - civil aviation		CH4	0	1	-53	90	0.002	86	47	140
1A3B	Transport fuel - road transportation		CH4	71	18	-35	49	0.031	-75	-76	-73
1A3C	Transport fuel - railway		CH4	0	0	-54	85	0.000	-53	-56	-50
1A3D	Transport fuel - navigation		CH4	4	52	-54	90	0.145	1,061	816	1,374
1A3E	Transport fuel - motorized equipment and pipeline		CH4	7	9	-53	87	0.027	33	4	70
1A4A_VT1	Coal/coke combustion	Commercial/institutional	CH4	-	0	-52	84	0.000	…	-	-
1A4A_VT2	Wood combustion	Commercial/institutional	CH4	0	0	-56	93	0.001	9,944	6,531	15,274
1A4A_VT3	Gas combustion	Commercial/institutional	CH4	-	0	-51	87	0.000	…	-	-
1A4A_VT6	Oil combustion	Commercial/institutional	CH4	2	2	-58	68	0.005	-11	-30	13
1A4A_VT7	Waste combustion	Commercial/institutional	CH4	0	-	...	...	-	-100	-100	-100
1A4B_VT1	Coal/coke combustion	Residential	CH4	2	0	-55	83	0.000	-94	-95	-91
1A4B_VT2	Wood combustion	Residential	CH4	111	142	-54	104	0.446	27	-12	90

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Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
1A4B_VT3	Gas combustion	Residential	CH4	-	0	-55	98	0.000	…	-	-
1A4B_VT6	Oil combustion	Residential	CH4	3	1	-58	65	0.003	-66	-70	-61
1A4C_VT1	Coal/coke combustion	Agriculture/forestry/fishing	CH4	0	-	...	...	-	-100	-100	-100
1A4C_VT2	Wood combustion	Agriculture/forestry/fishing	CH4	-	0	-58	105	0.000	…	-	-
1A4C_VT3	Gas combustion	Agriculture/forestry/fishing	CH4	-	0	-53	96	0.000	…	-	-
1A4C_VT6	Oil combustion	Agriculture/forestry/fishing	CH4	4	3	-57	64	0.008	-16	-25	-5
1A5A	Military fuel - stationary	Military	CH4	0	0	-52	95	0.000	-29	-34	-24
1A5B	Military fuel - mobile	Military	CH4	0	0	-50	88	0.001	-36	-41	-32
1B1A	Coal mining, Extraction of natural gas		CH4	56	35	-51	93	0.098	-38	-40	-35
1B2A_x	Extraction of oil - transport		CH4	129	153	-34	50	0.246	18	14	23
1B2A_y	Extraction of oil - refining/storage		CH4	35	48	-33	41	0.072	36	31	42
1B2B	Coal mining, Extraction of natural gas		CH4	3	47	-50	85	0.124	1,753	1,680	1,837
1B2C_x	Venting		CH4	143	331	-52	86	**0.904**	131	131	131
1B2C_z	Well testing		CH4	0	0	-60	68	0.000	-75	-84	-61
1B2C_y	Flaring		CH4	10	14	-60	53	0.031	40	37	43
2B4_x	Silicium carbide production		CH4	7	2	-11	10	0.001	-77	-78	-76
2B5	Methanol and plastic production		CH4	2	3	-53	83	0.008	74	53	96
2C2	Ferroalloys production		CH4	1	1	-51	85	0.002	-23	-23	-23
4A1	Enteric fermentation - cattle		CH4	1,420	1,268	-23	24	**1.194**	-11	-16	-4
4A10	Enteric fermentation - other animal		CH4	102	111	-40	40	0.171	9	2	17
4A3	Enteric fermentation - sheep		CH4	431	461	-24	24	0.458	7	-0	14

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Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
4A4	Enteric fermentation - goat		CH4	9	7	-39	40	0.011	-24	-29	-19
4A6	Enteric fermentation - horse		CH4	12	25	-40	38	0.039	109	97	124
4A8	Enteric fermentation - swine		CH4	17	22	-38	40	0.035	32	23	42
4A9	Enteric fermentation - poultry		CH4	1	2	-40	37	0.003	49	39	59
4B1	Manure management - CH4 -cattle		CH4	215	194	-25	25	0.187	-10	-15	-3
4B13	Manure management - CH4 - other animal		CH4	4	5	-24	25	0.005	19	11	28
4B3	Manure management - CH4 - sheep		CH4	24	24	-23	25	0.024	0	-6	7
4B4	Manure management - CH4 -goat		CH4	2	1	-24	26	0.001	-31	-35	-26
4B6	Manure management - CH4- horse		CH4	11	23	-25	26	0.023	109	97	124
4B8	Manure management - CH4- swine		CH4	23	29	-26	23	0.028	30	21	39
4B9	Manure management - CH4- poultry		CH4	19	37	-26	25	0.036	97	83	110
4F1	Burning of straw		CH4	23	3	-54	87	0.010	-85	-87	-83
5A1-V	Forest Land remaining Forest Land, Wildfires		CH4	2	3	-54	100	0.008	42	8	92
6A	Managed waste disposal on land		CH4	1,682	1,065	-31	38	**1.457**	-37	-52	-17
6B_x	Waste water - CH4		CH4	20	10	-39	57	0.018	-50	-50	-49
6C	Waste incineration		CH4	0	0	-55	93	0.000	522	304	869

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Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
1A1A_VT1	Coal/coke combustion	Public electricity and heat prod	N2O	1	1	-74	105	0.002	-46	-50	-42
1A1A_VT2	Wood combustion	Public electricity and heat prod	N2O	2	5	-74	125	0.019	162	76	292
1A1A_VT3	Gas combustion	Public electricity and heat prod	N2O	-	3	-73	116	0.011	…	-	-
1A1A_VT6	Oil combustion	Public electricity and heat prod	N2O	0	0	-71	109	0.001	528	506	548
1A1A_VT7	Waste combustion	Public electricity and heat prod	N2O	4	6	-74	123	0.026	54	43	65
1A1B_VT1	Coal/coke combustion	Petroleum refining	N2O	0	0	-72	121	0.002	53	51	56
1A1B_VT6	Oil combustion	Petroleum refining	N2O	5	2	-73	121	0.009	-57	-57	-56
1A1C_VT3	Gas combustion	Manufacture of solid fuels and other energy	N2O	14	27	-74	121	0.107	101	101	102
1A1C_VT6	Oil combustion	Manufacture of solid fuels and other energy	N2O	1	2	-71	107	0.007	181	176	187
1A2A_VT1	Coal/coke combustion	Iron and steel	N2O	0	0	-72	116	0.001	-53	-56	-51
1A2A_VT2	Wood combustion	Iron and steel	N2O	0	0	-74	114	0.000	269	144	453
1A2A_VT3	Gas combustion	Iron and steel	N2O	-	0	-74	117	0.000	…	-	-
1A2A_VT6	Oil combustion	Iron and steel	N2O	0	0	-70	107	0.000	-57	-58	-57
1A2B_VT2	Wood combustion	Non-ferrous metal	N2O	-	0	-75	134	0.001	…	-	-
1A2B_VT3	Gas combustion	Non-ferrous metal	N2O	-	0	-69	128	0.001	…	-	-
1A2B_VT6	Oil combustion	Non-ferrous metal	N2O	1	0	-70	107	0.001	-71	-72	-69
1A2C_VT1	Coal/coke combustion	Chemicals	N2O	1	1	-72	115	0.002	-11	-17	-4
1A2C_VT2	Wood combustion	Chemicals	N2O	0	1	-74	124	0.003	295	166	519

	A	A*	B	C	D	E	F	G	H	I	J
	IPCC Source category		Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
1A2C_VT3	Gas combustion	Chemicals	N2O	-	0	-72	116	0.001	…	-	-
1A2C_VT6	Oil combustion	Chemicals	N2O	1	2	-71	125	0.008	64	33	100
1A2D_VT1	Coal/coke combustion	Pulp, paper, print	N2O	0	-	...	...	-	-100	-100	-100
1A2D_VT2	Wood combustion	Pulp, paper, print	N2O	27	20	-75	132	0.078	-28	-52	13
1A2D_VT3	Gas combustion	Pulp, paper, print	N2O	-	0	-70	120	0.000	…	-	-
1A2D_VT6	Oil combustion	Pulp, paper, print	N2O	1	1	-70	107	0.004	56	55	57
1A2E_VT1	Coal/coke combustion	Food prosessing, beverages, tobacco	N2O	0	-	...	...	-	-100	-100	-100
1A2E_VT2	Wood combustion	Food prosessing, beverages, tobacco	N2O	0	0	-76	125	0.000	-96	-97	-93
1A2E_VT3	Gas combustion	Food prosessing, beverages, tobacco	N2O	-	0	-71	115	0.000	…	-	-
1A2E_VT6	Oil combustion	Food prosessing, beverages, tobacco	N2O	1	1	-71	106	0.003	-47	-49	-45
1A2F_VT1	Coal/coke combustion	Other manufacturing	N2O	0	0	-72	119	0.001	146	143	148
1A2F_VT2	Wood combustion	Other manufacturing	N2O	6	4	-75	123	0.017	-29	-52	9
1A2F_VT3	Gas combustion	Other manufacturing	N2O	-	0	-73	115	0.000	…	-	-
1A2F_VT6	Oil combustion	Other manufacturing	N2O	3	2	-71	108	0.008	-28	-30	-25
1A2F_VT7	Waste combustion	Other manufacturing	N2O	-	1	-71	118	0.004	…	-	-
1A3A	Transport fuel - civil aviation		N2O	7	11	-74	113	0.041	58	25	104
1A3B	Transport fuel - road transportation		N2O	57	59	-51	70	**0.146**	5	-2	10
1A3C	Transport fuel - railway		N2O	11	5	-84	99	0.020	-53	-56	-50
1A3D	Transport fuel - navigation		N2O	11	14	-73	129	0.058	30	3	65

	A	A*	B	C	D	E	F	G	H	I	J
	IPCC Source category		Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
1A3E	Transport fuel - motorized equipment and pipeline		N2O	69	125	-77	110	0.487	81	41	130
1A4A_VT1	Coal/coke combustion	Commercial/institutional	N2O	-	0	-72	128	0.000	…	-	-
1A4A_VT2	Wood combustion	Commercial/institutional	N2O	0	0	-74	136	0.002	4,429	2,890	6,832
1A4A_VT3	Gas combustion	Commercial/institutional	N2O	-	0	-73	118	0.000	…	-	-
1A4A_VT6	Oil combustion	Commercial/institutional	N2O	2	2	-72	113	0.008	-10	-29	15
1A4A_VT7	Waste combustion	Commercial/institutional	N2O	0	-	...	...	-	-100	-100	-100
1A4B_VT1	Coal/coke combustion	Residential	N2O	0	0	-72	127	0.000	-94	-95	-91
1A4B_VT2	Wood combustion	Residential	N2O	10	13	-73	130	0.051	29	-11	92
1A4B_VT3	Gas combustion	Residential	N2O	-	0	-75	129	0.000	…	-	-
1A4B_VT6	Oil combustion	Residential	N2O	4	1	-71	110	0.005	-65	-69	-61
1A4C_VT1	Coal/coke combustion	Agriculture/forestry/fishing	N2O	0	-	...	...	-	-100	-100	-100
1A4C_VT2	Wood combustion	Agriculture/forestry/fishing	N2O	-	0	-74	118	0.000	…	-	-
1A4C_VT3	Gas combustion	Agriculture/forestry/fishing	N2O	-	0	-72	120	0.000	…	-	-
1A4C_VT6	Oil combustion	Agriculture/forestry/fishing	N2O	67	61	-71	112	0.231	-9	-19	2
1A5A	Military fuel - stationary	Military	N2O	0	0	-73	114	0.001	21	13	30
1A5B	Military fuel - mobile	Military	N2O	6	4	-76	104	0.015	-31	-36	-27
1B2C_z	Well testing		N2O	0	0	-74	136	0.000	-75	-84	-61
1B2C_y	Flaring		N2O	4	4	-75	112	0.013	-15	-16	-13
2B2	Nitric acid production		N2O	2,074	460	-6	6	0.108	-78	-78	-78
2B5	Methanol and plastic production		N2O	-	1	-9	9	0.000	…	-	-
2C2	Ferroalloys production		N2O	5	4	-10	10	0.001	-28	-28	-28
3D	Other		N2O	36	44	-15	15	0.026	25	25	25

	A	A*	B	C	D	E	F	G	H	I	J
	IPCC Source category		Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
4B11	Manure management - N2O - Liquid storage		N2O	17	18	-53	80	0.047	1	-5	6
4B12	Manure management - N2O - solid storage		N2O	116	109	-52	84	0.290	-6	-11	-1
4D1_x	Direct soil emission - Fertilizer		N2O	665	595	-82	220	**3.633**	-11	-16	-4
4D1_y	Direct soil emission - Manure		N2O	240	232	-82	219	**1.417**	-4	-9	1
4D1_xx	Direct soil emission- Other		N2O	160	138	-84	245	**0.944**	-13	-63	109
4D1_z	Direct soil emission- Organic soil		N2O	332	287	-86	228	**1.961**	-14	-68	120
4D2	Animal production		N2O	223	206	-54	84	**0.569**	-8	-13	-3
4D3_x	Indirect soil emission- Deposition		N2O	71	82	-70	142	0.345	15	10	21
4D3_y	Indirect soil emission - Leaching, other		N2O	346	322	-69	170	**1.496**	-7	-11	-3
4F1	Burning of straw		N2O	9	1	-70	112	0.005	-85	-87	-83
5A2-I	Forest Land remaining Forest Land, Fertilizer		N2O	1	1	-83	219	0.004	-58	-58	-58
5A-II	Forest Land remaining Forest Land, Drainage		N2O	11	12	-87	317	0.111	6	6	6
5A1-V	Forest Land remaining Forest Land, Wildfires		N2O	0	0	-55	95	0.001	42	8	92
5B2-III	Cropland, Disturbance		N2O	1	0	-90	328	0.001	-86	-86	-86
5D-II	Land converted to Wetland, Drainage		N2O	0	0	-89	309	0.001	-	-	-
6B_z	Waste water - N2O plant		N2O	-	37	-55	88	0.109	…	-	-

	A	A*	B	C	D	E	F	G	H	I	J
	IPCC Source category		Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Source		Subcategory		Gg CO_2 equivalent	Gg CO_2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%	%	Lower % (2.5 percentile)	Upper % (97.5 percentile)
6B_y	Waste water - N2O pipeline		N2O	91	97	-56	95	0.302	7	-24	51
6B_w	Waste water - N2O not connected		N2O	26	25	-80	209	0.157	-5	-38	50
6C	Waste incineration		N2O	0	0	-72	139	0.000	2	-34	59
2F	Consumption of halocarbons and SF6		HFK	0	708	-40	56	**1.358**	3,861,171	3,861,171	3,861,171
2C3	Aluminium production		PFK	3,370	379	-20	19	**0.291**	-89	-89	-88
2F	Consumption of halocarbons and SF6		PFK	-	0	-39	55	0.000	…	-	-
2C4	SF6 used in Al and Mg foundries		SF6	2,144	-	...	...	-	-100	-100	-100
2F	Consumption of halocarbons and SF6		SF6	56	64	-47	70	0.148	15	15	15

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Annex III: Energy Balance Sheets 1990 - 2010

Annex III

Energy balance	1990										
PJ											
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petroleum products	Natural gas and other gases	Waterfall energy	Electricity	District heating
1.1.1 Production of primary energy bearers	4 931	9	-	-	37	3 412	50	987	437	-	-
1.1.2 Production of natural gas that is flared off	21	-	-	-	-	-	-	21	-	-	-
2. Imports	258	20	15	13	0	69	140	-	-	1	-
3. Exports	4 266	7	0	4	0	2 897	373	925	-	58	-
4.1 Bunkering	19	-	-	-	-	-	19	-	-	-	-
4.2 Foreign aviation	8	-	-	-	-	-	8	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-64	-0	-0	-1	-	-62	-1	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	852	21	15	8	38	521	-213	82	437	-57	-
8. Energy converted	1 017	1	1	-	2	539	36	0	437	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	437	-	-	-	-	-	-	-	437	-	-
1.2. Production of derived energy bearers	1 035	-	-	6	-	-	542	43	-	439	5
9. Consumption by energy sector	141	-	-	-	-	-	4	130	-	7	-
9.1.1 Crude petroleum and natural gas production											
9.1.2 Natural gas which is flared off on oil fields											
9.2. Coal mines											
9.3. Petroleum refineries											
9.4. Pumping storage power plants											
9.5. Hydro electric power plants											
9.6. Thermal power plants											
9.7. Combined heat and power plants											
9.8. District heating plants											
9.9. Gas supply											
10. Losses in transport and distribution	29	-	-	-	-	-	-	2	-	25	2
11. Statistical differences (7-8+1.2-9-10-13.1)	-28	-1	1	0	-0	-18	12	-22	-	-0	0
13.1 Net domestic consumption including non-energy use	728	21	13	14	35	-	278	15	-	349	3
13. Net domestic consumption	681	21	13	0	35	-	245	15	-	349	3
14. Manufacturing, mining and quarrying	260	21	13	0	15	-	33	15	-	163	1
14.1. Mining and quarrying											
14.2. Manufacture of paper and paper products											
14.3. Manufacture of industrial chemicals											
14.4. Manufacture of iron, steel and ferro alloys											
14.5. Manufacture of aluminium and other non-ferrous metals											
14.6. Other manufacturing industries											
15. Transport	148	-	-	-	-	-	146	-	-	2	-
15.1. Railways and subways											
15.2. Air transport											
15.3. Road transport											
15.4. Coastal shipping											
16. Other sectors	273	0	0	-	20	-	66	0	-	183	2
16.1. Fishing											
16.2. Agriculture											
16.3. Households											
16.4. Other consumers											
16.5 Construction											
12. Consumption for non-energy purposes	47	-	-	13	-	-	34	-	-	-	-
12.1 Manufacture of industrial chemicals											
12.2 Other manufacturing											

Annex III

Energy balance	1991										
PJ											
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petroleum products	Natural gas and other gases	Waterfall energy	Electricity	District heating
1.1.1 Production of primary energy bearers	5 405	9	-	-	36	3 899	49	1 014	398	-	-
1.1.2 Production of natural gas that is flared off	13	-	-	-	-	-	-	13	-	-	-
2. Imports	251	17	14	12	0	69	128	-	-	12	-
3. Exports	4 757	8	0	3	0	3 459	333	932	-	22	-
4.1 Bunkering	16	-	-	-	-	-	16	-	-	-	-
4.2 Foreign aviation	8	-	-	-	-	-	8	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	14	1	-0	-0	-	10	4	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	903	19	14	9	36	518	-176	95	398	-10	-
8. Energy converted	949	1	2	-	2	510	35	0	398	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	398	-	-	-	-	-	-	-	398	-	-
1.2. Production of derived energy bearers	978	-	-	5	-	-	527	41	-	400	6
9. Consumption by energy sector	138	-	-	-	-	-	4	126	-	8	-
9.1.1 Crude petroleum and natural gas production											
9.1.2 Natural gas which is flared off on oil fields											
9.2. Coal mines											
9.3. Petroleum refineries											
9.4. Pumping storage power plants											
9.5. Hydro electric power plants											
9.6. Thermal power plants											
9.7. Combined heat and power plants											
9.8. District heating plants											
9.9. Gas supply											
10. Losses in transport and distribution	28	-	-	-	-	-	-	2	-	24	2
11. Statistical differences (7-8+1.2-9-10-13.1)	49	0	0	0	-	8	48	-8	-	-0	-0
13.1 Net domestic consumption including non-energy use	717	18	12	14	33	-	264	15	-	356	4
13. Net domestic consumption	676	18	12	0	33	-	237	15	-	356	4
14. Manufacturing, mining and quarrying	255	18	12	0	15	-	33	15	-	161	1
14.1. Mining and quarrying											
14.2. Manufacture of paper and paper products											
14.3. Manufacture of industrial chemicals											
14.4. Manufacture of iron, steel and ferro alloys											
14.5. Manufacture of aluminium and other non-ferrous metals											
14.6. Other manufacturing industries											
15. Transport	147	-	-	-	-	-	144	-	-	2	-
15.1. Railways and subways											
15.2. Air transport											
15.3. Road transport											
15.4. Coastal shipping											
16. Other sectors	274	0	0	-	18	-	60	0	-	193	3
16.1. Fishing											
16.2. Agriculture											
16.3. Households											
16.4. Other consumers											
16.5 Construction											
12. Consumption for non-energy purposes	41	-	-	13	-	-	27	-	-	-	-
12.1 Manufacture of industrial chemicals											
12.2 Other manufacturing											

Annex III

Energy balance	**1992**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	6 038	10	-	-	37	4 473	9	-	-	-	44	1 043	-	421	-	-
1.1.2 Production of natural gas that is flared off	12	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-
2. Imports	215	17	13	11	0	47	17	6	26	26	45	-	-	-	5	-
3. Exports	5 324	5	0	4	-	3 916	125	15	165	59	54	945	-	-	36	-
4.1 Bunkering	20	-	-	-	-	-	-	-	9	11	-	-	-	-	-	-
4.2 Foreign aviation	8	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-29	-4	0	0	-	-25	1	-1	-0	0	-0	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	883	18	14	7	37	580	-98	-17	-148	-44	34	110	-	421	-31	-
8. Energy converted	1 045	1	1	-	5	572	10	2	3	29	0	-	0	421	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	421	-	-	-	-	-	-	-	-	-	-	-	-	421	-	-
1.2. Production of derived energy bearers	1 064	-	-	6	-	-	186	45	275	68	10	-	46	-	423	6
9. Consumption by energy sector	148	-	-	-	-	-	0	0	4	0	-	107	29	-	8	-
9.1.1 Crude petroleum and natural gas production	99	-	-	-	-	-	-	-	3	0	-	95	-	-	1	-
9.1.2 Natural gas which is flared off on oil fields	12	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-
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. Losses in transport and distribution	29	-	-	-	-	-	-	-	-	-	-	-	3	-	25	2
11. Statistical differences (7-8+1.2-9-10-13.1)	10	-1	0	-0	-	8	4	7	-3	-18	11	3	-	-	0	-0
13.1 Net domestic consumption including non-energy use	715	18	12	13	32	-	74	20	123	12	33	-	14	-	358	4
13. Net domestic consumption	673	18	12	0	32	-	74	20	123	12	5	-	14	-	358	4
14. Manufacturing, mining and quarrying	248	18	12	0	14	-	-	0	14	11	4	-	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	35	-	1	-	-	-	-	-	0	2	2	-	13	-	17	0
14.4. Manufacture of iron, steel and ferro alloys	49	12	10	-	0	-	-	0	0	0	0	-	0	-	26	0
14.5. Manufacture of aluminium and other non-ferrous metals	63	-	0	-	-	-	-	-	2	1	0	-	1	-	59	-
14.6. Other manufacturing industries	62	6	0	0	4	-	-	0	11	5	2	-	-	-	33	0
15. Transport	151	-	-	-	-	-	73	10	64	1	-	-	-	-	2	-
15.1. Railways and subways	4	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	10	-	-	-	-	-	0	10	-	-	-	-	-	-	-	-
15.3. Road transport	109	-	-	-	-	-	72	-	37	-	-	-	-	-	-	-
15.4. Coastal shipping	28	-	-	-	-	-	2	-	25	1	-	-	-	-	-	-
16. Other sectors	274	0	0	-	18	-	1	10	46	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	92	-	-	-	0	-	-	4	12	0	0	-	0	-	74	2
16.5 Construction	6	-	-	-	-	-	0	0	4	-	-	-	-	-	2	-
12. Consumption for non-energy purposes	42	-	-	13	-	-	-	-	-	-	29	-	-	-	-	-
12.1 Manufacture of industrial chemicals	33	-	-	4	-	-	-	-	-	-	29	-	-	-	-	-
12.2 Other manufacturing	9	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-

Annex III

Energy balance	**1993**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel w ood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and w ind pow er	Electricity	District heating
1.1.1 Production of primary energy bearers	6 325	8	-	-	41	4 747	25	-	-	-	62	1 012	-	431	-	-
1.1.2 Production of natural gas that is flared off	13	-	-	-	-	-	-	-	-	-	-	13	-	-	-	-
2. Imports	229	20	13	12	0	56	19	3	22	35	46	-	-	-	2	-
3. Exports	5 599	6	0	5	0	4 212	133	17	161	60	66	908	-	-	31	-
4.1 Bunkering	22	-	-	-	-	-	-	-	10	12	-	-	-	-	-	-
4.2 Foreign aviation	9	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-33	2	-1	1	-	-31	-5	-3	3	1	-0	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	905	23	12	8	41	561	-95	-26	-145	-35	42	117	-	431	-28	-
8. Energy converted	1 051	1	1	-	5	570	7	2	6	27	1	-	0	431	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 pow er plants	0	-	-	-	-	-	-	-	0	0	-	-	-	-	-	-
8.4. In dual purpose pow er plants	3	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-
8.5. In district heating plants	4	-	-	-	2	-	-	-	0	0	-	-	0	-	1	-
8.6. In hydropow er plants	431	-	-	-	-	-	-	-	-	-	-	-	-	431	-	-
1.2. Production of derived energy bearers	1 078	-	-	7	-	-	180	46	282	66	12	-	48	-	432	6
9. Consumption by energy sector	156	-	-	-	-	-	0	0	4	0	0	114	29	-	8	-
9.1.1 Crude petroleum and natural gas production	105	-	-	-	-	-	-	-	4	0	-	100	-	-	1	-
9.1.2 Natural gas w hich is flared off on oil fields	13	-	-	-	-	-	-	-	-	-	-	13	-	-	-	-
9.2. Coal mines	0	-	-	-	-	-	0	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	32	-	-	-	-	-	0	-	0	0	0	-	29	-	2	-
9.4. Pumping storage pow er plants	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
9.5. Hydro electric pow er plants	3	-	-	-	-	-	0	0	0	0	-	-	-	-	3	-
9.6. Thermal pow er plants	0	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and pow er plants	0	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Losses in transport and distribution	33	-	-	-	-	-	-	-	-	-	-	-	3	-	29	2
11. Statistical differences (7-8+1.2-9-10-13.1)	2	2	-1	1	1	-9	4	-1	-5	-9	13	4	-	-	3	-0
13.1 Net domestic consumption including non-energy use	741	21	12	14	35	-	74	19	132	12	39	-	16	-	363	4
13. Net domestic consumption	690	19	12	0	35	-	74	18	132	11	6	-	16	-	363	4
14. Manufacturing, mining and quarrying	255	18	12	0	15	-	-	0	14	11	5	-	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	47	4	2	-	-	-	-	-	1	2	3	-	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	64	-	0	-	-	-	-	-	2	1	0	-	1	-	60	-
14.6. Other manufacturing industries	60	5	0	0	5	-	-	0	10	4	2	-	-	-	33	0
15. Transport	160	-	-	-	-	-	73	10	74	1	-	-	-	-	2	-
15.1. Railw ays and subw ays	4	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	10	-	-	-	-	-	0	10	-	-	-	-	-	-	-	-
15.3. Road transport	115	-	-	-	-	-	71	-	43	-	-	-	-	-	-	-
15.4. Coastal shipping	31	-	-	-	-	-	2	-	29	1	-	-	-	-	-	-
16. Other sectors	275	0	0	-	21	-	1	9	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	88	-	-	-	0	-	-	3	12	0	0	-	0	-	72	2
16.5 Construction	5	-	-	-	-	-	0	0	3	-	-	-	-	-	1	-
12. Consumption for non-energy purposes	50	2	-	14	-	-	0	0	0	1	34	-	-	-	-	-
12.1 Manufacture of industrial chemicals	38	-	-	4	-	-	-	0	-	-	34	-	-	-	-	-
12.2 Other manufacturing	13	2	-	10	-	-	0	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**1994**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel w ood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and w ind pow er	Electricity	District heating
1.1.1 Production of primary energy bearers	7 018	8	-	-	43	5 251	89	-	-	-	105	1 115	-	406	-	-
1.1.2 Production of natural gas that is flared off	14	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-
2. Imports	249	22	15	12	0	45	26	6	21	39	45	-	-	-	17	-
3. Exports	6 287	5	-	4	0	4 709	178	18	180	53	102	1 020	-	-	18	-
4.1 Bunkering	24	-	-	-	-	-	-	-	11	13	-	-	-	-	-	-
4.2 Foreign aviation	8	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-19	-0	0	-0	-	-11	3	0	-10	-1	0	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	943	26	16	7	43	575	-60	-20	-179	-28	49	110	-	406	-0	-
8. Energy converted	1 048	1	2	-	6	593	6	3	2	29	1	-	0	406	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 pow er plants	1	-	-	-	1	-	-	-	0	0	-	-	-	-	-	-
8.4. In dual purpose pow er plants	3	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-
8.5. In district heating plants	4	-	-	-	2	-	-	-	0	0	-	-	0	-	1	-
8.6. In hydropow er plants	406	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.2. Production of derived energy bearers	1 077	-	-	7	-	-	182	50	294	70	14	-	46	-	408	6
9. Consumption by energy sector	170	-	-	-	-	-	0	0	5	0	1	124	29	-	11	-
9.1.1 Crude petroleum and natural gas production	116	-	-	-	-	-	-	-	5	0	-	110	-	-	1	-
9.1.2 Natural gas w hich is flared off on oil fields	14	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-
9.2. Coal mines	0	-	-	-	-	-	0	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	31	-	-	-	-	-	0	-	0	0	1	-	29	-	2	-
9.4. Pumping storage pow er plants	5	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-
9.5. Hydro electric pow er plants	3	-	-	-	-	-	0	0	0	0	-	-	-	-	3	-
9.6. Thermal pow er plants	0	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and pow er plants	0	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.9. Gas supply	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Losses in transport and distribution	33	-	-	-	-	-	-	-	-	-	-	-	3	-	28	2
11. Statistical differences (7-8+1.2-9-10-13.1)	9	1	1	-1	-	-18	42	5	-24	-4	21	-14	-0	-	0	0
13.1 Net domestic consumption including non-energy use	760	24	13	15	38	-	74	23	131	18	40	0	14	-	366	4
13. Net domestic consumption	708	22	13	0	38	-	74	22	131	17	7	0	14	-	366	4
14. Manufacturing, mining and quarrying	268	21	13	0	16	-	-	0	16	16	6	0	14	-	164	1
14.1. Mining and quarrying	4	-	-	-	-	-	-	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	47	5	2	-	-	-	-	-	1	2	3	0	13	-	21	0
14.4. Manufacture of iron, steel and ferro alloys	47	10	11	-	-	-	-	0	0	0	0	-	0	-	24	0
14.5. Manufacture of aluminium and other non-ferrous metals	65	0	0	-	0	-	-	0	2	1	0	0	1	-	62	-
14.6. Other manufacturing industries	63	6	0	0	5	-	-	0	12	4	3	-	-	-	32	1
15. Transport	156	-	-	-	-	-	73	11	70	0	-	-	-	-	2	-
15.1. Railw ays and subw ays	4	-	-	-	-	-	-	-	2	-	-	-	-	-	2	-
15.2. Air transport	11	-	-	-	-	-	0	11	-	-	-	-	-	-	-	-
15.3. Road transport	112	-	-	-	-	-	71	-	41	-	-	-	-	-	-	-
15.4. Coastal shipping	30	-	-	-	-	-	2	-	28	0	-	-	-	-	-	-
16. Other sectors	284	0	0	-	22	-	1	12	46	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	-	-	5	13	0	0	0	0	-	70	2
16.5 Construction	6	-	-	-	-	-	0	0	4	-	-	-	-	-	2	-
12. Consumption for non-energy purposes	52	2	-	15	-	-	0	0	0	1	34	-	-	-	-	-
12.1 Manufacture of industrial chemicals	38	-	-	5	-	-	-	0	-	-	34	-	-	-	-	-
12.2 Other manufacturing	14	2	-	11	-	-	0	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**1995**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	7 525	8	-	-	44	5 636	114	-	-	-	126	1 156	-	441	-	-
1.1.2 Production of natural gas that is flared off	16	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-
2. Imports	260	26	15	14	0	59	35	4	28	27	43	-	-	-	8	-
3. Exports	6 768	5	-	4	0	5 155	184	14	154	53	128	1 038	-	-	32	-
4.1 Bunkering	30	-	-	-	-	-	-	-	14	16	-	-	-	-	-	-
4.2 Foreign aviation	8	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-3	-1	-1	1	-	-10	-2	8	7	2	-8	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	992	29	14	10	44	531	-37	-10	-133	-40	33	134	-	441	-24	-
8. Energy converted	1 035	1	2	0	6	542	9	3	9	20	1	-	0	441	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	441	-	-	-	-	-	-	-	-	-	-	-	-	441	-	-
1.2. Production of derived energy bearers	1 052	-	-	6	-	-	161	46	267	72	14	-	39	-	443	6
9. Consumption by energy sector	167	-	-	-	-	-	0	0	5	0	-	127	25	-	10	-
9.1.1 Crude petroleum and natural gas production	117	-	-	-	-	-	-	-	5	0	-	111	-	-	1	-
9.1.2 Natural gas which is flared off on oil fields	16	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-
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. Losses in transport and distribution	30	-	-	-	-	-	-	-	-	-	-	-	3	-	26	2
11. Statistical differences (7-8+1.2-9-10-13.1)	40	1	-1	0	-	-11	42	10	-16	-3	4	7	0	-	8	0
13.1 Net domestic consumption including non-energy use	771	27	14	16	38	-	73	23	135	14	42	1	11	-	374	4
13. Net domestic consumption	718	23	14	0	38	-	73	23	135	14	9	1	11	-	374	4
14. Manufacturing, mining and quarrying	273	23	14	0	16	-	-	0	15	13	8	1	11	-	170	1
14.1. Mining and quarrying	4	-	-	-	-	-	-	0	1	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	45	5	2	-	-	-	-	-	1	2	4	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	66	-	0	-	-	-	-	0	1	1	0	1	1	-	62	-
14.6. Other manufacturing industries	64	6	0	0	5	-	-	0	11	4	3	0	-	-	33	1
15. Transport	161	-	-	-	-	-	72	12	74	1	-	-	-	-	2	-
15.1. Railways and subways	4	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	12	-	-	-	-	-	0	12	-	-	-	-	-	-	-	-
15.3. Road transport	115	-	-	-	-	-	70	-	45	-	-	-	-	-	-	-
15.4. Coastal shipping	31	-	-	-	-	-	2	-	28	1	-	-	-	-	-	-
16. Other sectors	285	0	0	-	22	-	1	11	46	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	89	-	-	-	0	-	-	4	12	0	0	0	0	-	70	2
16.5 Construction	6	-	-	-	0	-	0	0	4	-	1	-	-	-	2	-
12. Consumption for non-energy purposes	53	3	-	16	-	-	0	0	0	1	33	-	-	-	-	-
12.1 Manufacture of industrial chemicals	38	-	-	5	-	-	-	0	-	-	33	-	-	-	-	-
12.2 Other manufacturing	15	3	-	11	-	-	0	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**1996**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	8 534	6	-	-	45	6 323	134	-	-	-	137	1 513	-	375	-	-
1.1.2 Production of natural gas that is flared off	18	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-
2. Imports	291	23	17	13	0	56	21	5	26	40	40	-	-	-	48	-
3. Exports	7 814	4	0	5	0	5 787	222	19	152	60	138	1 413	-	-	15	-
4.1 Bunkering	32	-	-	-	-	-	-	-	15	18	-	-	-	-	-	-
4.2 Foreign aviation	9	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-36	1	-1	-1	-	-27	-2	-8	-7	-1	10	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	951	26	16	8	45	565	-68	-31	-148	-38	50	119	-	375	32	-
8. Energy converted	1 034	1	1	-	6	601	5	4	12	27	1	-	0	375	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	375	-	-	-	-	-	-	-	-	-	-	-	-	375	-	-
1.2. Production of derived energy bearers	1 061	-	-	7	-	-	177	59	298	77	15	-	44	-	377	6
9. Consumption by energy sector	179	-	-	-	-	-	0	0	6	0	-	136	29	-	8	-
9.1.1 Crude petroleum and natural gas production	126	-	-	-	-	-	-	-	6	-	-	118	-	-	2	-
9.1.2 Natural gas which is flared off on oil fields	18	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-
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. Losses in transport and distribution	31	-	-	-	-	-	-	-	-	-	-	-	3	-	26	1
11. Statistical differences (7-8+1.2-9-10-13.1)	-28	-1	0	-1	-	-36	29	0	-20	-6	22	-18	0	-	3	-0
13.1 Net domestic consumption including non-energy use	796	26	14	16	39	-	74	24	153	19	42	1	12	-	371	5
13. Net domestic consumption	743	23	14	0	39	-	74	24	152	18	8	1	12	-	371	5
14. Manufacturing, mining and quarrying	269	23	14	0	16	-	-	0	18	17	7	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	2	-	0	-	-	0	1	2	4	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	61	-	0	0	-	-	-	0	1	1	1	1	1	-	57	-
14.6. Other manufacturing industries	63	6	0	0	6	-	-	0	13	5	3	0	0	-	30	1
15. Transport	169	-	-	-	-	-	73	13	80	0	-	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	13	-	-	-	-	-	0	13	-	-	-	-	-	-	-	-
15.3. Road transport	121	-	-	-	-	-	71	-	50	-	-	0	-	-	-	-
15.4. Coastal shipping	32	-	-	-	-	-	2	-	29	0	-	-	-	-	-	-
16. Other sectors	305	0	0	-	23	-	1	11	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	99	-	-	-	-	-	-	3	17	0	0	0	0	-	77	2
16.5 Construction	7	-	-	-	0	-	0	0	4	-	1	-	-	-	3	-
12. Consumption for non-energy purposes	53	3	-	15	-	-	0	0	0	1	34	-	-	-	-	-
12.1 Manufacture of industrial chemicals	39	-	-	5	-	-	-	0	-	-	34	-	-	-	-	-
12.2 Other manufacturing	14	3	-	11	-	-	0	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**1997**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	8 811	11	-	-	48	6 329	187	-	-	-	138	1 699	-	399	-	-
1.1.2 Production of natural gas that is flared off	16	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-
2. Imports	299	24	14	13	0	66	28	6	23	52	42	-	-	-	31	-
3. Exports	8 059	5	0	3	0	5 818	280	13	159	66	144	1 553	-	-	18	-
4.1 Bunkering	39	-	-	-	-	-	-	-	20	19	-	-	-	-	-	-
4.2 Foreign aviation	11	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	1	-2	1	-0	-	14	1	-3	-5	-0	-3	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 018	28	15	9	48	591	-64	-22	-161	-34	32	163	-	399	14	-
8. Energy converted	1 065	1	2	-	6	597	1	3	11	43	1	-	0	399	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	399	-	-	-	-	-	-	-	-	-	-	-	-	399	-	-
1.2. Production of derived energy bearers	1 087	-	-	7	-	-	177	46	309	77	17	-	46	-	401	6
9. Consumption by energy sector	188	-	-	-	-	-	0	0	7	0	-	138	30	-	13	-
9.1.1 Crude petroleum and natural gas production	132	-	-	-	-	-	-	-	6	-	-	122	-	-	3	-
9.1.2 Natural gas which is flared off on oil fields	16	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-
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. Losses in transport and distribution	32	-	-	-	-	-	-	-	-	-	-	0	3	-	27	2
11. Statistical differences (7-8+1.2-9-10-13.1)	11	1	-1	0	-	-6	39	-3	-17	-18	4	11	0	-	0	0
13.1 Net domestic consumption including non-energy use	809	26	14	16	42	-	73	24	149	17	43	13	13	-	374	5
13. Net domestic consumption	745	23	14	0	42	-	73	24	148	16	7	5	13	-	374	5
14. Manufacturing, mining and quarrying	273	23	14	0	18	-	-	0	15	16	7	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	-	-	11	-	-	-	0	7	0	-	-	-	23	0
14.3. Manufacture of industrial chemicals	51	5	2	-	0	-	-	0	1	3	3	4	12	-	22	0
14.4. Manufacture of iron, steel and ferro alloys	48	11	12	-	-	-	-	-	0	0	0	-	1	-	24	0
14.5. Manufacture of aluminium and other non-ferrous metals	66	-	0	0	-	-	-	0	1	1	1	1	1	-	61	0
14.6. Other manufacturing industries	63	6	0	0	6	-	-	0	12	4	2	0	0	-	30	1
15. Transport	172	-	-	-	-	-	72	13	84	1	-	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	13	-	-	-	-	-	0	13	-	-	-	-	-	-	-	-
15.3. Road transport	121	-	-	-	-	-	70	-	50	-	-	0	-	-	-	-
15.4. Coastal shipping	35	-	-	-	-	-	2	-	32	1	-	-	-	-	-	-
16. Other sectors	300	0	0	-	24	-	1	10	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	100	-	-	-	-	-	-	3	13	0	0	0	0	-	80	3
16.5 Construction	8	-	-	-	0	-	0	0	5	-	1	0	-	-	2	-
12. Consumption for non-energy purposes	64	3	-	16	-	-	0	0	0	1	36	8	-	-	-	-
12.1 Manufacture of industrial chemicals	49	-	-	5	-	-	-	0	-	-	36	8	-	-	-	-
12.2 Other manufacturing	15	3	-	11	-	-	0	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**1998**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	8 562	9	-	-	44	6 053	175	-	-	-	136	1 726	-	419	-	-
1.1.2 Production of natural gas that is flared off	17	-	-	-	-	-	-	-	-	-	-	17	-	-	-	-
2. Imports	282	27	16	13	0	81	21	11	21	40	22	-	-	-	29	-
3. Exports	7 742	8	0	3	0	5 553	269	10	162	58	108	1 555	-	-	16	-
4.1 Bunkering	38	-	-	-	-	-	-	-	21	17	-	-	-	-	-	-
4.2 Foreign aviation	11	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	26	1	-0	-0	-	23	1	1	-0	2	-2	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 095	29	16	10	45	605	-72	-9	-162	-33	47	188	-	419	13	-
8. Energy converted	1 071	1	2	-	6	598	2	2	6	33	1	0	0	419	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	419	-	-	-	-	-	-	-	-	-	-	-	-	419	-	-
1.2. Production of derived energy bearers	1 079	-	-	7	-	-	174	36	303	71	15	-	45	-	421	7
9. Consumption by energy sector	179	-	-	-	-	-	0	0	7	0	1	132	29	-	11	-
9.1.1 Crude petroleum and natural gas production	125	-	-	-	-	-	-	-	6	-	-	115	-	-	4	-
9.1.2 Natural gas which is flared off on oil fields	17	-	-	-	-	-	-	-	-	-	-	17	-	-	-	-
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. Losses in transport and distribution	34	-	-	-	-	-	-	-	-	-	-	1	3	-	28	2
11. Statistical differences (7-8+1.2-9-10-13.1)	51	-1	-1	2	-	6	26	2	-25	-12	20	34	-0	-	0	-
13.1 Net domestic consumption including non-energy use	839	29	15	14	38	-	74	23	154	17	41	21	13	-	395	5
13. Net domestic consumption	771	25	15	0	38	-	74	23	154	17	7	6	13	-	395	5
14. Manufacturing, mining and quarrying	288	24	15	0	15	-	-	0	16	16	6	6	13	-	175	1
14.1. Mining and quarrying	3	-	-	-	-	-	-	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	54	6	1	-	0	-	-	-	0	3	2	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	72	0	0	-	-	-	-	0	1	1	1	1	1	-	68	0
14.6. Other manufacturing industries	64	6	0	0	4	-	-	0	13	5	3	1	0	-	31	1
15. Transport	175	-	-	-	-	-	73	14	86	1	-	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	14	-	-	-	-	-	0	14	-	-	-	-	-	-	-	-
15.3. Road transport	121	-	-	-	-	-	71	-	50	-	-	0	-	-	-	-
15.4. Coastal shipping	38	-	-	-	-	-	2	-	35	1	-	-	-	-	-	-
16. Other sectors	307	0	0	-	23	-	1	9	52	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	164	0	0	-	23	-	1	6	7	0	0	-	-	-	126	1
16.4. Other consumers	101	-	-	-	-	-	-	3	13	0	0	0	0	-	82	3
16.5 Construction	8	-	-	-	0	-	0	0	5	-	1	0	-	-	2	-
12. Consumption for non-energy purposes	68	4	-	14	-	-	0	0	0	1	33	15	-	-	-	-
12.1 Manufacture of industrial chemicals	54	-	-	5	-	-	-	0	-	-	33	15	-	-	-	-
12.2 Other manufacturing	14	4	-	9	-	-	0	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**1999**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	8 697	11	-	-	47	6 001	181	-	-	-	162	1 856	-	439	-	-
1.1.2 Production of natural gas that is flared off	25	-	-	-	-	-	-	-	-	-	-	25	-	-	-	-
2. Imports	284	26	15	14	0	89	18	12	17	47	22	-	-	-	25	-
3. Exports	7 795	8	0	2	0	5 436	289	9	150	67	109	1 695	-	-	32	-
4.1 Bunkering	35	-	-	-	-	-	-	-	20	15	-	-	-	-	-	-
4.2 Foreign aviation	13	-	-	-	-	-	-	13	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-0	1	0	0	-	1	-8	-1	7	-1	2	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 162	29	15	12	47	654	-97	-11	-147	-36	76	186	-	439	-7	-
8. Energy converted	1 108	1	2	-	7	607	5	3	3	42	1	0	0	439	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	439	-	-	-	-	-	-	-	-	-	-	-	-	439	-	-
1.2. Production of derived energy bearers	1 131	-	-	7	-	-	184	34	321	74	15	-	46	-	442	7
9. Consumption by energy sector	181	-	-	-	-	-	0	0	7	0	1	131	30	-	12	0
9.1.1 Crude petroleum and natural gas production	117	-	-	-	-	-	-	-	7	-	-	106	-	-	4	-
9.1.2 Natural gas which is flared off on oil fields	25	-	-	-	-	-	-	-	-	-	-	25	-	-	-	-
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. Losses in transport and distribution	33	-	-	-	-	-	-	-	-	-	-	1	4	-	27	2
11. Statistical differences (7-8+1.2-9-10-13.1)	126	1	-0	5	-	48	9	-5	3	-18	52	31	-	-	0	-0
13.1 Net domestic consumption including non-energy use	845	27	13	14	40	-	73	26	161	15	37	24	12	-	396	6
13. Net domestic consumption	780	25	13	0	40	-	73	25	161	15	6	7	12	-	396	6
14. Manufacturing, mining and quarrying	285	25	13	0	17	-	-	0	15	14	5	7	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	51	6	-	-	-	-	-	0	0	3	1	6	11	-	23	0
14.4. Manufacture of iron, steel and ferro alloys	42	13	-	-	-	-	-	-	0	0	0	-	1	-	28	0
14.5. Manufacture of aluminium and other non-ferrous metals	72	0	-	-	-	-	-	-	1	1	1	1	1	-	68	0
14.6. Other manufacturing industries	61	5	-	-	5	-	-	0	11	4	3	0	0	-	32	1
15. Transport	184	-	-	-	-	-	72	16	93	1	-	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	16	-	-	-	-	-	0	16	-	-	-	-	-	-	-	-
15.3. Road transport	124	-	-	-	-	-	71	-	53	-	-	0	-	-	-	-
15.4. Coastal shipping	41	-	-	-	-	-	2	-	39	1	-	-	-	-	-	-
16. Other sectors	311	0	0	-	23	-	1	10	53	0	1	0	0	-	218	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	165	0	0	-	23	-	1	6	8	-	0	-	-	-	126	1
16.4. Other consumers	103	-	-	-	-	-	-	3	14	0	0	0	0	-	82	4
16.5 Construction	8	-	-	-	0	-	0	0	5	-	1	0	-	-	2	-
12. Consumption for non-energy purposes	65	3	-	14	-	-	0	0	0	1	31	17	-	-	-	-
12.1 Manufacture of industrial chemicals	52	-	-	4	-	-	-	0	-	-	31	17	-	-	-	-
12.2 Other manufacturing	13	3	-	10	-	-	0	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**2000**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	9 322	18	-	-	46	6 481	169	-	-	-	159	1 938	-	512	-	-
1.1.2 Production of natural gas that is flared off	26	-	-	-	-	-	-	-	-	-	-	26	-	-	-	-
2. Imports	235	26	15	13	0	43	20	9	28	52	23	-	-	-	5	-
3. Exports	8 245	16	0	1	0	5 822	271	9	149	63	76	1 764	-	-	74	-
4.1 Bunkering	34	-	-	-	-	-	-	-	20	15	-	-	-	-	-	-
4.2 Foreign aviation	12	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-28	1	1	1	-	-35	0	2	4	2	-3	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 264	28	16	13	46	667	-82	-10	-137	-23	104	199	-	512	-69	-
8. Energy converted	1 179	1	2	-	7	580	32	1	1	40	2	0	0	512	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	512	-	-	-	-	-	-	-	-	-	-	-	-	512	-	-
1.2. Production of derived energy bearers	1 191	-	-	7	-	-	192	34	308	67	15	-	45	-	515	7
9. Consumption by energy sector	199	-	-	-	-	-	0	-	7	0	1	150	29	-	11	0
9.1.1 Crude petroleum and natural gas production	135	-	-	-	-	-	-	-	6	-	-	124	-	-	4	-
9.1.2 Natural gas which is flared off on oil fields	26	-	-	-	-	-	-	-	-	-	-	26	-	-	-	-
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. Losses in transport and distribution	43	-	-	-	-	-	-	-	-	-	-	1	3	-	36	1
11. Statistical differences (7-8+1.2-9-10-13.1)	211	0	-1	7	-	86	7	2	19	-8	76	23	-	-	-0	-0
13.1 Net domestic consumption including non-energy use	823	27	15	14	39	-	71	20	144	12	40	25	12	-	398	5
13. Net domestic consumption	756	24	15	0	39	-	71	20	144	11	8	7	12	-	398	5
14. Manufacturing, mining and quarrying	290	24	15	0	15	-	-	0	14	10	7	7	12	-	184	1
14.1. Mining and quarrying	3	-	-	-	-	-	-	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	56	6	1	-	-	-	-	0	1	2	3	6	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	74	0	0	-	-	-	-	0	1	1	1	1	1	-	69	0
14.6. Other manufacturing industries	60	5	0	0	4	-	-	0	11	3	3	0	0	-	33	1
15. Transport	173	-	-	-	-	-	70	14	85	1	-	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	14	-	-	-	-	-	0	14	-	-	-	-	-	-	-	-
15.3. Road transport	118	-	-	-	-	-	68	-	50	-	-	0	-	-	-	-
15.4. Coastal shipping	37	-	-	-	-	-	2	-	34	1	-	0	-	-	-	-
16. Other sectors	293	0	0	-	24	-	1	5	45	0	1	0	0	-	212	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	93	-	-	-	-	-	-	1	11	0	0	0	0	-	77	4
16.5 Construction	8	-	-	-	0	-	0	0	5	-	1	-	-	-	2	-
12. Consumption for non-energy purposes	67	3	-	13	-	-	0	0	0	1	32	17	-	-	-	-
12.1 Manufacture of industrial chemicals	54	-	-	4	-	-	-	0	-	-	32	17	-	-	-	-
12.2 Other manufacturing	13	3	-	9	-	-	0	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**2001**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	9 524	50	-	-	49	6 461	211	-	-	-	230	2 086	-	436	-	-
1.1.2 Production of natural gas that is flared off	21	-	-	-	-	-	-	-	-	-	-	21	-	-	-	-
2. Imports	262	23	14	14	1	41	22	10	40	46	13	-	-	-	39	-
3. Exports	8 598	42	0	0	0	6 006	352	4	130	49	160	1 828	-	-	26	-
4.1 Bunkering	34	-	-	-	-	-	-	-	20	14	-	-	-	-	-	-
4.2 Foreign aviation	11	-	-	-	-	-	-	11	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	66	-6	0	1	-	60	2	4	2	2	1	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 229	26	14	14	49	557	-117	-2	-108	-15	85	279	-	436	13	-
8. Energy converted	1 064	1	1	-	7	538	30	1	4	42	2	0	0	436	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	2	-	-	-	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	436	-	-	-	-	-	-	-	-	-	-	-	-	436	-	-
1.2. Production of derived energy bearers	1 074	-	-	7	-	-	193	27	281	64	13	-	42	-	439	8
9. Consumption by energy sector	202	-	-	-	-	-	0	-	7	0	1	157	25	-	11	0
9.1.1 Crude petroleum and natural gas production	147	-	-	-	-	-	-	-	6	-	-	137	-	-	4	-
9.1.2 Natural gas which is flared off on oil fields	21	-	-	-	-	-	-	-	-	-	-	21	-	-	-	-
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. Losses in transport and distribution	42	-	-	-	-	-	-	-	-	-	-	1	4	-	36	1
11. Statistical differences (7-8+1.2-9-10-13.1)	138	1	-1	8	-	19	-29	2	13	-7	38	92	0	-	-	0
13.1 Net domestic consumption including non-energy use	858	24	13	13	42	-	74	21	150	14	57	28	13	-	403	7
13. Net domestic consumption	773	21	13	0	42	-	74	21	150	13	8	8	13	-	403	7
14. Manufacturing, mining and quarrying	281	21	13	0	17	-	-	0	14	13	7	7	13	-	175	1
14.1. Mining and quarrying	4	-	-	-	0	-	-	0	2	0	0	0	-	-	2	-
14.2. Manufacture of paper and paper products	42	-	-	-	13	-	-	0	0	6	0	0	-	-	23	-
14.3. Manufacture of industrial chemicals	55	6	1	-	-	-	-	0	1	2	3	5	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	74	0	0	-	-	-	-	-	1	1	1	1	1	-	69	-
14.6. Other manufacturing industries	58	5	0	0	4	-	-	0	10	3	3	0	0	-	32	0
15. Transport	176	-	-	-	-	-	73	14	86	0	-	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	15	-	-	-	-	-	0	14	-	-	-	-	-	-	-	-
15.3. Road transport	126	-	-	-	-	-	71	-	55	-	-	0	-	-	-	-
15.4. Coastal shipping	32	-	-	-	-	-	2	-	30	0	-	0	-	-	-	-
16. Other sectors	315	0	0	-	25	-	1	7	50	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	168	0	0	-	25	-	1	5	6	-	0	0	-	-	129	1
16.4. Other consumers	104	-	-	-	-	-	-	1	13	0	0	0	0	-	85	5
16.5 Construction	9	-	-	-	0	-	0	0	5	-	1	-	-	-	3	-
12. Consumption for non-energy purposes	86	3	-	13	-	-	0	0	0	1	49	21	-	-	-	-
12.1 Manufacture of industrial chemicals	74	-	-	4	-	-	-	0	-	-	49	21	-	-	-	-
12.2 Other manufacturing	12	3	-	8	-	-	0	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**2002**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	9 785	60	-	-	51	6 197	268	-	-	-	245	2 497	-	468	-	-
1.1.2 Production of natural gas that is flared off	16	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-
2. Imports	223	18	11	16	1	27	21	13	36	43	17	-	-	-	19	-
3. Exports	8 877	58	-	2	0	5 733	354	5	105	63	184	2 318	-	-	54	-
4.1 Bunkering	27	-	-	-	-	-	-	-	18	9	-	-	-	-	-	-
4.2 Foreign aviation	10	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-2	2	1	-0	-	-5	-2	1	2	-2	1	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 108	23	11	14	52	486	-66	-1	-85	-31	79	194	-	468	-35	-
8. Energy converted	1 059	1	1	-	7	502	37	2	5	32	3	0	0	468	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	468	-	-	-	-	-	-	-	-	-	-	-	-	468	-	-
1.2. Production of derived energy bearers	1 080	-	-	7	-	-	188	29	257	64	14	-	43	-	471	9
9. Consumption by energy sector	202	-	-	-	-	-	0	0	5	0	1	158	27	-	11	0
9.1.1 Crude petroleum and natural gas production	152	-	-	-	-	-	-	-	5	-	-	142	-	-	4	-
9.1.2 Natural gas which is flared off on oil fields	16	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-
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. Losses in transport and distribution	39	-	-	-	-	-	-	-	-	-	-	0	3	-	34	2
11. Statistical differences (7-8+1.2-9-10-13.1)	50	1	-1	7	-	-16	10	3	9	-12	32	15	-	-	0	-0
13.1 Net domestic consumption including non-energy use	839	21	11	14	45	-	73	22	152	12	58	21	13	-	390	7
13. Net domestic consumption	757	19	11	0	45	-	73	22	152	11	8	6	13	-	390	7
14. Manufacturing, mining and quarrying	265	19	11	0	16	-	-	0	14	11	7	5	13	-	168	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	0	5	0	0	-	-	23	0
14.3. Manufacture of industrial chemicals	49	5	1	-	-	-	-	0	1	2	2	4	12	-	22	0
14.4. Manufacture of iron, steel and ferro alloys	43	10	9	-	0	-	-	-	1	0	0	-	0	-	23	0
14.5. Manufacture of aluminium and other non-ferrous metals	71	0	0	-	0	-	-	-	1	0	1	1	-	-	68	-
14.6. Other manufacturing industries	58	5	0	0	4	-	-	0	10	3	3	0	0	-	31	1
15. Transport	175	-	-	-	-	-	72	12	87	0	0	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	12	-	-	-	-	-	0	12	-	-	-	-	-	-	-	-
15.3. Road transport	128	-	-	-	-	-	70	-	57	-	0	0	-	-	-	-
15.4. Coastal shipping	32	-	-	-	-	-	2	-	30	0	-	0	-	-	-	-
16. Other sectors	318	0	0	-	29	-	1	10	50	0	1	0	1	-	219	6
16.1. Fishing	21	-	-	-	-	-	0	0	20	0	-	-	-	-	0	-
16.2. Agriculture	13	-	-	-	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	107	-	-	-	-	-	-	5	13	-	0	0	1	-	84	5
16.5 Construction	8	-	-	-	0	-	0	0	4	0	1	-	-	-	3	-
12. Consumption for non-energy purposes	82	2	-	13	-	-	-	0	0	1	49	15	-	-	-	-
12.1 Manufacture of industrial chemicals	68	-	-	3	-	-	-	-	0	-	49	15	-	-	-	-
12.2 Other manufacturing	14	2	-	10	-	-	-	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**2003**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel w ood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and w ind pow er	Electricity	District heating
1.1.1 Production of primary energy bearers	9 846	83	-	-	52	5 905	366	-	-	-	272	2 785	-	383	-	-
1.1.2 Production of natural gas that is flared off	16	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-
2. Imports	260	19	11	13	2	26	18	12	33	58	18	-	-	-	48	-
3. Exports	8 912	76	0	3	0	5 372	478	4	117	73	199	2 568	-	-	20	-
4.1 Bunkering	27	-	-	-	-	-	-	-	17	10	-	-	-	-	-	-
4.2 Foreign aviation	10	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-39	-3	-1	-0	-	-28	-0	-0	-3	1	-5	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 134	23	10	10	54	531	-95	-3	-104	-24	87	233	-	383	28	-
8. Energy converted	1 042	1	1	-	9	560	36	1	6	42	3	0	0	383	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 pow er plants	2	-	-	-	1	-	-	-	0	-	-	0	-	-	-	-
8.4. In dual purpose pow er plants	4	1	-	-	4	-	-	-	-	-	-	-	-	-	0	-
8.5. In district heating plants	8	-	-	-	4	-	-	-	2	0	0	0	0	-	1	0
8.6. In hydropow er plants	383	-	-	-	-	-	-	-	-	-	-	-	-	383	-	-
1.2. Production of derived energy bearers	1 066	-	-	8	-	-	207	32	279	82	16	-	45	-	386	10
9. Consumption by energy sector	214	-	-	-	-	-	0	0	5	0	1	167	29	-	12	0
9.1.1 Crude petroleum and natural gas production	161	-	-	-	-	-	-	-	5	-	-	151	-	-	5	-
9.1.2 Natural gas w hich is flared off on oil fields	16	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-
9.2. Coal mines	0	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
9.3. Petroleum refineries	32	-	-	-	-	-	0	-	0	0	1	-	29	-	2	-
9.4. Pumping storage pow er plants	3	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
9.5. Hydro electric pow er plants	2	-	-	-	-	-	0	0	0	0	-	-	-	-	2	-
9.6. Thermal pow er plants	0	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and pow er plants	0	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	0	0	0	-	-	-	-	-	0	0
9.9. Gas supply	0	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-
10. Losses in transport and distribution	34	-	-	-	-	-	-	-	-	-	-	0	2	-	29	2
11. Statistical differences (7-8+1.2-9-10-13.1)	70	2	-2	4	-	-29	3	9	7	0	39	37	-	-	-0	-0
13.1 Net domestic consumption including non-energy use	840	21	11	13	45	-	73	20	158	16	61	29	14	-	373	8
13. Net domestic consumption	750	18	11	0	45	-	73	20	157	15	9	8	14	-	373	8
14. Manufacturing, mining and quarrying	271	18	11	0	16	-	-	0	16	11	7	7	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	52	5	1	-	0	-	-	0	1	2	2	5	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	78	0	-	-	-	-	-	-	1	0	1	1	-	-	74	-
14.6. Other manufacturing industries	57	5	0	0	4	-	-	0	11	3	3	0	0	-	29	1
15. Transport	179	-	-	-	-	-	72	13	88	3	0	0	-	-	2	-
15.1. Railw ays and subw ays	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	13	-	-	-	-	-	0	13	-	-	-	-	-	-	-	-
15.3. Road transport	131	-	-	-	-	-	70	-	61	-	0	0	-	-	-	-
15.4. Coastal shipping	32	-	-	-	-	-	2	-	27	3	-	0	-	-	-	-
16. Other sectors	300	0	0	-	29	-	1	7	53	0	1	0	1	-	201	7
16.1. Fishing	20	-	-	-	-	-	0	0	20	0	-	-	-	-	0	-
16.2. Agriculture	13	-	-	-	0	-	0	0	6	0	0	0	-	-	6	0
16.3. Households	160	0	0	-	28	-	1	6	8	-	1	0	-	-	115	1
16.4. Other consumers	99	-	-	-	0	-	-	1	15	0	0	0	1	-	77	5
16.5 Construction	7	-	-	-	0	-	0	0	4	0	1	-	-	-	2	-
12. Consumption for non-energy purposes	90	2	-	13	-	-	-	0	0	1	52	22	-	-	-	-
12.1 Manufacture of industrial chemicals	76	-	-	2	-	-	-	-	0	-	52	22	-	-	-	-
12.2 Other manufacturing	14	2	-	11	-	-	-	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**2004**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel w ood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and w ind pow er	Electricity	District heating
1.1.1 Production of primary energy bearers	9 906	82	-	-	51	5 843	322	-	-	-	290	2 924	-	394	-	-
1.1.2 Production of natural gas that is flared off	18	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-
2. Imports	268	22	13	12	1	21	24	11	35	58	16	-	-		55	-
3. Exports	8 907	77	0	1	0	5 261	420	4	118	71	187	2 755	-		14	-
4.1 Bunkering	26	-	-	-	-	-	-	-	16	10	-	-	-		-	-
4.2 Foreign aviation	12	-	-	-	-	-	-	12	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	15	-0	0	0	-	6	5	-1	3	1	2	-	-		-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 263	26	13	12	52	609	-69	-5	-96	-23	121	188	-	394	41	-
8. Energy converted	1 029	1	2	-	9	533	35	1	5	44	2	0	0	394	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 pow er plants	2	-	-	-	1	-	-	-	0	-	-	0	-		-	-
8.4. In dual purpose pow er plants	4	1	-	-	3	-	-	-	-	-	-	-	-		-	-
8.5. In district heating plants	8	-	-	-	5	-	-	-	1	0	0	0	0		2	0
8.6. In hydropow er plants	394	-	-	-	-	-	-	-	-	-	-	-	-	394	-	-
1.2. Production of derived energy bearers	1 057	-	-	6	-	-	203	29	273	78	15	-	44		398	11
9. Consumption by energy sector	222	-	-	-	-	-	0	0	5	0	0	176	28		12	0
9.1.1 Crude petroleum and natural gas production	168	-	-	-	-	-	-	-	5	-	-	157	-		6	-
9.1.2 Natural gas w hich is flared off on oil fields	18	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-
9.2. Coal mines	0	-	-	-	-	-	0	-	-	-	-	-	-		0	0
9.3. Petroleum refineries	30	-	-	-	-	-	0	-	0	0	0	-	28		2	-
9.4. Pumping storage pow er plants	3	-	-	-	-	-	-	-	-	-	-	-	-		3	-
9.5. Hydro electric pow er plants	2	-	-	-	-	-	0	0	0	-	-	-	-		2	-
9.6. Thermal pow er plants	0	-	-	-	-	-	-	-	-	-	-	-	-		0	-
9.7. Combined heat and pow er plants	0	-	-	-	-	-	-	-	0	-	-	-	-		0	-
9.8. District heating plants	0	-	-	-	-	-	0	-	0	-	-	-	-		0	0
9.9. Gas supply	0	-	-	-	-	-	-	-	-	-	-	0	-		-	-
10. Losses in transport and distribution	39	-	-	-	-	-	-	-	-	-	-	0	3		34	2
11. Statistical differences (7-8+1.2-9-10-13.1)	178	2	-1	6	-	76	26	2	11	-4	82	-23	-		0	-0
13.1 Net domestic consumption including non-energy use	853	23	13	12	43	-	72	21	155	16	51	34	14	-	391	8
13. Net domestic consumption	771	21	13	0	43	-	72	21	155	15	10	9	14	-	391	8
14. Manufacturing, mining and quarrying	286	21	13	0	16	-	-	0	13	11	8	8	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	-	-	-	11	-	-	-	1	6	0	0	-	-	23	0
14.3. Manufacture of industrial chemicals	54	6	1	-	0	-	-	-	0	2	3	5	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	84	-	-	0	-	-	-	-	1	0	1	1	-	-	81	-
14.6. Other manufacturing industries	55	4	1	0	4	-	-	0	9	3	3	1	0	-	30	1
15. Transport	184	-	-	-	-	-	71	13	94	4	0	0	-	-	2	-
15.1. Railw ays and subw ays	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	13	-	-	-	-	-	0	13	-	-	-	-	-	-	-	-
15.3. Road transport	135	-	-	-	-	-	69	-	66	-	0	0	-	-	-	-
15.4. Coastal shipping	33	-	-	-	-	-	2	-	27	4	-	0	-	-	-	-
16. Other sectors	301	0	0	-	27	-	1	8	48	0	2	1	0	-	207	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	103	-	-	-	0	-	-	3	12	0	0	0	0	-	81	6
16.5 Construction	7	-	-	-	0	-	0	0	5	0	1	-	-	-	2	-
12. Consumption for non-energy purposes	82	2	-	12	-	-	-	0	0	1	41	25	-	-	-	-
12.1 Manufacture of industrial chemicals	68	-	-	2	-	-	-	-	0	-	41	25	-	-	-	-
12.2 Other manufacturing	14	2	-	11	-	-	-	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**2005**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel w ood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and w ind pow er	Electricity	District heating
1.1.1 Production of primary energy bearers	9 687	41	-	-	54	5 320	301	-	-	-	347	3 131	-	493	-	-
1.1.2 Production of natural gas that is flared off	17	-	-	-	-	-	-	-	-	-	-	17	-	-	-	-
2. Imports	236	19	11	13	1	45	22	7	25	69	11	-	-	-	13	-
3. Exports	8 642	47	0	0	0	4 730	431	7	106	70	224	2 971	-	-	57	-
4.1 Bunkering	30	-	-	-	-	-	-	-	18	12	-	-	-	-	-	-
4.2 Foreign aviation	15	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-18	9	-1	-0	-	-17	-3	0	-5	-2	-0	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 235	22	10	12	55	618	-111	-14	-104	-15	134	177	-	493	-43	-
8. Energy converted	1 189	1	1	-	9	565	54	0	5	55	2	1	0	493	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 pow er plants	2	-	-	-	1	-	-	-	0	-	-	0	-	-	-	-
8.4. In dual purpose pow er plants	4	1	-	-	3	-	-	-	0	-	-	-	-	-	0	-
8.5. In district heating plants	8	-	-	-	5	-	-	-	1	-	0	0	0	-	3	0
8.6. In hydropow er plants	493	-	-	-	-	-	-	-	-	-	-	-	-	493	-	-
1.2. Production of derived energy bearers	1 221	-	-	8	-	-	239	34	299	69	18	-	46	-	497	11
9. Consumption by energy sector	223	-	-	-	-	-	0	0	5	-	-	171	31	-	16	0
9.1.1 Crude petroleum and natural gas production	166	-	-	-	-	-	-	-	5	-	-	154	-	-	8	-
9.1.2 Natural gas w hich is flared off on oil fields	17	-	-	-	-	-	-	-	-	-	-	17	-	-	-	-
9.2. Coal mines	0	-	-	-	-	-	0	-	-	-	-	-	-	-	0	0
9.3. Petroleum refineries	33	-	-	-	-	-	0	-	0	-	-	-	31	-	2	-
9.4. Pumping storage pow er plants	4	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
9.5. Hydro electric pow er plants	2	-	-	-	-	-	0	0	0	-	-	-	-	-	2	-
9.6. Thermal pow er plants	0	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
9.7. Combined heat and pow er plants	0	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	0	-	0	-	-	-	-	-	0	0
9.9. Gas supply	0	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-
10. Losses in transport and distribution	40	-	-	-	-	-	-	-	-	-	-	0	2	-	36	2
11. Statistical differences (7-8+1.2-9-10-13.1)	153	2	-2	7	-	53	5	2	29	-15	99	-26	-	-	-0	-0
13.1 Net domestic consumption including non-energy use	850	19	11	14	46	-	69	18	156	14	51	31	13	-	399	9
13. Net domestic consumption	769	17	11	0	46	-	69	18	156	13	9	9	13	-	399	9
14. Manufacturing, mining and quarrying	280	17	11	0	17	-	-	0	12	10	7	8	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	53	5	1	-	0	-	-	-	0	2	2	4	12	-	25	0
14.4. Manufacture of iron, steel and ferro alloys	38	9	9	-	-	-	-	-	0	-	0	0	0	-	20	0
14.5. Manufacture of aluminium and other non-ferrous metals	89	-	-	-	-	-	-	-	1	-	1	2	-	-	86	0
14.6. Other manufacturing industries	55	3	1	0	5	-	-	0	8	3	3	1	0	-	30	1
15. Transport	185	-	-	-	-	-	69	11	100	2	0	0	-	-	2	-
15.1. Railw ays and subw ays	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	11	-	-	-	-	-	0	11	-	-	-	-	-	-	-	-
15.3. Road transport	136	-	-	-	-	-	67	-	69	-	0	0	-	-	-	-
15.4. Coastal shipping	35	-	-	-	-	-	2	-	31	2	-	0	-	-	-	-
16. Other sectors	304	0	0	-	29	-	1	7	43	1	2	1	1	-	212	8
16.1. Fishing	19	-	-	-	-	-	0	0	18	0	-	-	-	-	1	-
16.2. Agriculture	14	-	-	-	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	100	-	-	-	0	-	-	3	10	0	0	0	1	-	79	6
16.5 Construction	8	-	-	-	0	-	0	0	5	0	1	0	-	-	3	-
12. Consumption for non-energy purposes	81	2	-	13	-	-	-	0	0	1	42	22	-	-	-	-
12.1 Manufacture of industrial chemicals	66	-	-	2	-	-	-	-	0	-	42	22	-	-	-	-
12.2 Other manufacturing	15	2	-	12	-	-	-	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**2006**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	9 325	67	-	-	52	4 936	298	-	-	-	335	3 203	-	433	-	-
1.1.2 Production of natural gas that is flared off	16	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-
2. Imports	240	15	11	13	1	16	15	10	40	72	11	-	-	-	35	-
3. Exports	8 274	64	0	0	0	4 231	439	10	128	88	246	3 035	-	-	32	-
4.1 Bunkering	30	-	-	-	-	-	-	-	17	13	-	-	-	-	-	-
4.2 Foreign aviation	17	-	-	-	-	-	-	17	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-18	-1	1	0	-	-12	-3	0	-2	2	-4	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 242	18	12	13	53	709	-129	-16	-107	-28	97	184	-	433	3	-
8. Energy converted	1 168	1	2	-	10	599	57	0	5	57	2	1	0	433	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	433	-	-	-	-	-	-	-	-	-	-	-	-	433	-	-
1.2. Production of derived energy bearers	1 203	-	-	7	-	-	246	38	310	83	19	-	50	-	438	12
9. Consumption by energy sector	227	-	-	-	-	-	0	0	5	-	0	174	32	-	15	0
9.1.1 Crude petroleum and natural gas production	173	-	-	-	-	-	-	-	5	-	-	159	-	-	10	-
9.1.2 Natural gas which is flared off on oil fields	16	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-
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. Losses in transport and distribution	41	-	-	-	-	-	-	-	-	-	-	0	2	-	36	2
11. Statistical differences (7-8+1.2-9-10-13.1)	163	1	1	6	-	110	-7	3	27	-18	64	-23	-	-	-0	-
13.1 Net domestic consumption including non-energy use	847	16	9	14	43	-	67	19	165	17	51	32	16	-	387	9
13. Net domestic consumption	765	15	9	0	43	-	67	19	165	16	9	10	16	-	387	9
14. Manufacturing, mining and quarrying	274	15	9	0	16	-	-	0	13	11	7	8	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	-	-	-	11	-	-	-	0	6	0	0	-	-	21	0
14.3. Manufacture of industrial chemicals	54	3	1	-	0	-	-	-	0	2	3	4	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	88	-	-	0	-	-	-	-	0	-	1	2	-	-	85	0
14.6. Other manufacturing industries	57	4	1	0	5	-	-	0	9	3	4	2	0	-	30	1
15. Transport	193	-	-	-	-	-	66	12	109	4	0	0	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	12	-	-	-	-	-	0	12	-	-	-	-	-	-	-	-
15.3. Road transport	143	-	-	-	-	-	64	-	78	-	0	0	-	-	-	-
15.4. Coastal shipping	36	-	-	-	-	-	2	-	30	4	-	0	-	-	-	-
16. Other sectors	298	0	0	-	27	-	1	7	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	98	-	-	-	0	-	-	3	11	0	0	0	1	-	76	7
16.5 Construction	8	-	-	-	0	-	0	0	5	-	1	0	-	-	3	-
12. Consumption for non-energy purposes	81	2	-	14	-	-	-	0	0	1	41	22	-	-	-	-
12.1 Manufacture of industrial chemicals	65	-	-	1	-	-	-	-	0	-	41	22	-	-	-	-
12.2 Other manufacturing	16	2	-	13	-	-	-	0	0	1	-	-	-	-	-	-

Annex III

Energy balance	**2007**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	9 008	114	-	-	54	4 604	144	-	-	-	335	3 269	-	488	-	-
1.1.2 Production of natural gas that is flared off	37	-	-	-	-	-	-	-	-	-	-	37	-	-	-	-
2. Imports	256	17	13	13	1	61	15	8	35	68	5	-	-	-	19	-
3. Exports	8 116	95	-	1	0	4 115	327	10	121	89	239	3 065	-	-	55	-
4.1 Bunkering	27	-	-	-	-	-	-	-	17	11	-	-	-	-	-	-
4.2 Foreign aviation	16	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	20	-16	-0	0	-	37	0	-1	-0	-1	1	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 162	21	12	12	55	587	-167	-18	-102	-33	102	241	-	488	-36	-
8. Energy converted	1 225	1	2	-	11	602	48	2	6	54	1	5	1	488	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	7	-	-	-	2	-	-	-	0	-	-	5	1	-	-	-
8.4. In dual purpose power plants	5	1	-	-	4	-	-	-	0	-	-	-	-	-	-	-
8.5. In district heating plants	9	-	-	-	5	-	-	-	1	-	0	1	0	-	3	0
8.6. In hydropower plants	488	-	-	-	-	-	-	-	-	-	-	-	-	488	-	-
1.2. Production of derived energy bearers	1 253	-	-	7	-	-	249	37	301	87	19	-	47	-	494	13
9. Consumption by energy sector	255	-	-	-	-	-	0	-	7	-	0	197	31	-	20	0
9.1.1 Crude petroleum and natural gas production	177	-	-	-	-	-	-	-	7	-	-	159	-	-	11	-
9.1.2 Natural gas which is flared off on oil fields	37	-	-	-	-	-	-	-	-	-	-	37	-	-	-	-
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	2	-	-	-	-	-	0	-	0	-	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Losses in transport and distribution	43	-	-	-	-	-	-	-	-	-	-	1	3	-	36	2
11. Statistical differences (7-8+1.2-9-10-13.1)	30	2	-0	5	-	-16	-30	-2	13	-15	63	9	-	-	0	-0
13.1 Net domestic consumption including non-energy use	863	18	10	14	44	-	63	19	172	15	57	29	13	-	398	10
13. Net domestic consumption	780	16	10	0	44	-	63	19	171	14	9	11	13	-	398	10
14. Manufacturing, mining and quarrying	268	16	10	0	18	-	-	0	11	9	7	8	12	-	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	-	-	-	12	-	-	-	0	4	0	0	-	-	21	-
14.3. Manufacture of industrial chemicals	52	5	3	-	1	-	-	-	0	2	2	3	11	-	25	0
14.4. Manufacture of iron, steel and ferro alloys	32	7	7	-	-	-	-	0	0	-	0	0	0	-	17	0
14.5. Manufacture of aluminium and other non-ferrous metals	86	-	-	-	-	-	-	-	0	0	1	2	-	-	82	0
14.6. Other manufacturing industries	55	4	1	0	5	-	-	0	7	3	4	2	0	-	29	1
15. Transport	203	-	-	-	-	-	62	14	118	5	0	2	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	14	-	-	-	-	-	0	14	-	-	-	-	-	-	-	-
15.3. Road transport	149	-	-	-	-	-	61	-	88	-	0	0	-	-	-	-
15.4. Coastal shipping	38	-	-	-	-	-	2	-	30	5	-	2	-	-	-	-
16. Other sectors	309	0	0	-	27	-	1	5	42	1	2	1	1	-	220	9
16.1. Fishing	17	-	-	-	-	-	0	0	17	0	-	-	-	-	1	-
16.2. Agriculture	14	-	-	-	0	-	0	0	6	0	0	1	-	-	7	0
16.3. Households	163	0	0	-	26	-	1	3	4	-	1	0	-	-	126	2
16.4. Other consumers	106	-	0	-	0	-	0	2	10	0	0	1	1	-	84	7
16.5 Construction	9	-	-	-	0	-	0	0	6	0	1	0	-	-	3	-
12. Consumption for non-energy purposes	83	2	-	13	-	-	-	0	0	1	48	18	-	-	-	-
12.1 Manufacture of industrial chemicals	66	-	-	1	-	-	-	-	0	-	46	18	-	-	-	-
12.2 Other manufacturing	17	2	-	12	-	-	-	0	0	1	2	-	-	-	-	-

Annex III

Energy balance	**2008**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	9 182	96	-	-	54	4 383	165	-	-	-	328	3 648	-	507	-	-
1.1.2 Production of natural gas that is flared off	33	-	-	-	-	-	-	-	-	-	-	33	-	-	-	-
2. Imports	237	18	13	17	1	35	20	11	41	60	8	-	-	-	12	-
3. Exports	8 117	94	-	0	0	3 768	292	12	105	111	227	3 445	-	-	62	-
4.1 Bunkering	27	-	-	-	-	-	-	-	16	11	-	-	-	-	-	-
4.2 Foreign aviation	16	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	-10	3	-0	-0	-	-14	-0	-1	1	-1	4	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 282	23	13	17	56	637	-108	-18	-80	-63	113	237	-	507	-50	-
8. Energy converted	1 189	1	2	-	12	551	44	0	16	47	1	3	1	507	2	0
8.1. In blast furnaces	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	660	-	-	-	-	551	44	0	16	47	1	-	-	-	-	-
8.3. In thermal power plants	5	-	-	-	2	-	-	-	0	-	-	3	1	-	-	-
8.4. In dual purpose power plants	5	1	-	-	4	-	-	-	0	-	-	-	-	-	0	-
8.5. In district heating plants	10	-	-	-	6	-	-	-	1	-	0	1	0	-	2	0
8.6. In hydropower plants	507	-	-	-	-	-	-	-	-	-	-	-	-	507	-	-
1.2. Production of derived energy bearers	1 218	-	-	6	-	-	208	40	279	99	16	-	43	-	512	14
9. Consumption by energy sector	256	-	-	-	-	-	0	-	8	-	0	201	27	-	21	0
9.1.1 Crude petroleum and natural gas production	186	-	-	-	-	-	-	-	7	-	-	168	-	-	12	-
9.1.2 Natural gas which is flared off on oil fields	33	-	-	-	-	-	-	-	-	-	-	33	-	-	-	-
9.2. Coal mines	0	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	29	-	-	-	-	-	0	-	0	-	-	-	27	-	2	-
9.4. Pumping storage power plants	5	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-
9.5. Hydro electric power plants	2	-	-	-	-	-	0	-	0	-	-	-	-	-	2	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.7. Combined heat and power plants	0	-	-	-	-	-	0	-	0	-	-	-	-	-	0	-
9.8. District heating plants	0	-	-	-	-	-	0	-	0	-	0	-	-	-	0	0
9.9. Gas supply	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Losses in transport and distribution	41	-	-	-	-	-	-	-	-	-	-	0	3	-	35	3
11. Statistical differences (7-8+1.2-9-10-13.1)	147	4	0	3	-	85	-4	3	6	-25	78	-3	-	-	-0	0
13.1 Net domestic consumption including non-energy use	868	19	11	20	44	-	59	18	169	14	50	36	13	-	403	11
13. Net domestic consumption	781	17	11	0	44	-	59	18	169	13	10	12	13	-	403	11
14. Manufacturing, mining and quarrying	272	17	10	0	18	-	-	0	11	8	8	9	12	-	179	1
14.1. Mining and quarrying	5	-	-	-	0	-	-	0	3	0	0	0	0	-	2	0
14.2. Manufacture of paper and paper products	37	-	-	-	13	-	-	-	0	4	0	0	-	-	20	-
14.3. Manufacture of industrial chemicals	56	6	3	-	0	-	-	0	0	1	3	4	12	-	27	1
14.4. Manufacture of iron, steel and ferro alloys	34	7	7	-	-	-	-	-	0	-	0	0	0	-	18	0
14.5. Manufacture of aluminium and other non-ferrous metals	86	-	-	-	-	-	-	-	0	-	1	2	-	-	83	0
14.6. Other manufacturing industries	55	3	1	0	4	-	-	0	6	3	4	3	0	-	30	1
15. Transport	198	-	-	-	-	-	58	14	117	5	0	2	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	14	-	-	-	-	-	0	14	-	-	-	-	-	-	-	-
15.3. Road transport	147	-	-	-	-	-	57	-	90	-	0	0	-	-	-	-
15.4. Coastal shipping	34	-	-	-	-	-	2	-	26	5	-	2	-	-	-	-
16. Other sectors	310	0	0	-	26	-	1	4	42	1	2	2	1	-	222	10
16.1. Fishing	17	-	-	-	-	-	0	0	16	0	-	0	-	-	1	-
16.2. Agriculture	14	-	-	-	0	-	0	0	6	0	0	1	-	-	7	0
16.3. Households	161	0	0	-	26	-	1	2	3	0	1	0	-	-	126	3
16.4. Other consumers	107	-	0	-	0	-	0	2	11	1	0	1	1	-	85	7
16.5 Construction	10	-	-	-	0	-	0	0	6	0	1	0	-	-	4	-
12. Consumption for non-energy purposes	87	2	-	20	-	-	-	0	0	1	40	23	-	-	-	-
12.1 Manufacture of industrial chemicals	63	-	-	1	-	-	-	-	0	-	38	23	-	-	-	-
12.2 Other manufacturing	24	2	-	19	-	-	-	0	0	1	2	-	-	-	-	-

Annex III

Energy balance	**2009**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	9 042	74	-	-	53	4 147	181	-	-	-	334	3 797	-	457	-	-
1.1.2 Production of natural gas that is flared off	18	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-
2. Imports	276	12	8	13	1	52	17	9	74	59	12	-	-	-	20	-
3. Exports	8 121	67	-	0	0	3 634	363	6	98	85	249	3 567	-	-	53	-
4.1 Bunkering	23	-	-	-	-	-	-	-	14	9	-	-	-	-	-	-
4.2 Foreign aviation	15	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	26	-4	0	0	-	23	0	0	2	-1	4	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 204	15	8	14	54	587	-165	-12	-37	-36	102	248	-	457	-32	-
8. Energy converted	1 165	1	2	-	12	548	46	1	15	55	2	23	1	457	3	0
8.1. In blast furnaces	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	665	-	-	-	-	548	46	1	14	55	1	-	-	-	-	-
8.3. In thermal power plants	24	-	-	-	1	-	-	-	0	-	-	23	1	-	-	-
8.4. In dual purpose power plants	6	1	-	-	5	-	-	-	0	-	-	-	-	-	0	-
8.5. In district heating plants	11	-	-	-	6	-	-	-	1	-	0	1	0	-	3	0
8.6. In hydropower plants	457	-	-	-	-	-	-	-	-	-	-	-	-	457	-	-
1.2. Production of derived energy bearers	1 190	-	-	5	-	-	232	35	279	85	20	-	44	-	474	16
9. Consumption by energy sector	241	-	-	-	-	-	0	0	9	-	0	178	29	-	25	0
9.1.1 Crude petroleum and natural gas production	185	-	-	-	-	-	-	-	8	-	-	160	-	-	17	-
9.1.2 Natural gas which is flared off on oil fields	18	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-
9.2. Coal mines	0	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	32	-	-	-	-	-	0	-	0	-	0	-	29	-	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	-	-	-	-	-	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Losses in transport and distribution	38	-	-	-	-	-	-	-	-	-	-	1	3	-	31	3
11. Statistical differences (7-8+1.2-9-10-13.1)	124	0	-0	3	-	40	-35	3	45	-18	72	14	-0	-	0	0
13.1 Net domestic consumption including non-energy use	825	14	7	16	42	-	56	18	174	13	48	32	11	-	382	12
13. Net domestic consumption	749	12	7	0	42	-	56	18	173	12	9	13	11	-	382	12
14. Manufacturing, mining and quarrying	223	12	7	0	14	-	-	0	9	7	7	9	11	-	145	1
14.1. Mining and quarrying	4	-	-	-	0	-	-	0	2	0	0	0	0	-	2	0
14.2. Manufacture of paper and paper products	30	-	-	-	10	-	-	0	0	4	0	0	-	-	17	-
14.3. Manufacture of industrial chemicals	48	4	1	-	0	-	-	0	1	1	3	4	10	-	22	0
14.4. Manufacture of iron, steel and ferro alloys	23	5	5	-	0	-	-	0	0	-	0	0	0	-	13	0
14.5. Manufacture of aluminium and other non-ferrous metals	72	-	-	0	-	-	-	0	0	-	1	2	-	-	69	0
14.6. Other manufacturing industries	45	3	0	0	4	-	-	0	5	2	3	3	0	-	23	1
15. Transport	197	-	-	-	-	-	55	15	119	4	0	2	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	15	-	-	-	-	-	0	15	-	-	-	-	-	-	-	-
15.3. Road transport	145	-	-	-	-	-	53	-	92	-	0	0	-	-	-	-
15.4. Coastal shipping	34	-	-	-	-	-	2	-	26	4	-	2	-	-	-	-
16. Other sectors	329	0	0	0	28	-	1	4	46	1	2	2	0	-	235	11
16.1. Fishing	21	-	-	-	-	-	0	0	20	0	-	-	-	-	1	-
16.2. Agriculture	14	-	-	-	0	-	0	0	6	-	0	1	-	-	7	0
16.3. Households	167	0	0	-	27	-	1	2	4	0	1	0	-	-	131	3
16.4. Other consumers	117	-	-	0	1	-	0	2	11	0	0	1	0	-	93	8
16.5 Construction	10	-	-	-	0	-	0	0	6	-	1	0	-	-	4	-
12. Consumption for non-energy purposes	76	2	-	16	-	-	-	0	0	1	39	19	-	-	-	-
12.1 Manufacture of industrial chemicals	57	-	-	1	-	-	-	-	0	-	37	19	-	-	-	-
12.2 Other manufacturing	19	2	-	15	-	-	-	0	0	1	2	-	-	-	-	-

Annex III

Energy balance	**2010**															
PJ																
	Total	Coal	Coke	Petrol coke	Fuel wood, black liquor, garbage	Crude oil	Petrol	Kerosene	Middle distillates	Heavy fuel oil	LPG	Natural gas	Other gases	Waterfall energy and wind power	Electricity	District heating
1.1.1 Production of primary energy bearers	8 703	54	-	-	62	3 749	169	-	-	-	325	3 917	-	428	-	-
1.1.2 Production of natural gas that is flared off	18	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-
2. Imports	337	19	12	14	2	64	17	17	51	72	15	-	-	-	53	-
3. Exports	7 662	46	0	1	0	3 223	316	8	90	73	223	3 656	-	-	26	-
4.1 Bunkering	18	-	-	-	-	-	-	-	12	7	-	-	-	-	-	-
4.2 Foreign aviation	18	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-
5. Changes in stocks (+ net decrease, - net increase)	14	-4	-0	0	-	6	8	-0	7	1	-4	-	-	-	-	-
7. Net domestic supply (1.1.1+1.1.2+2-3-4.1-4.2+5)	1 374	23	12	14	63	596	-122	-9	-44	-7	113	279	-	428	27	-
8. Energy converted	1 116	1	3	-	15	505	47	4	15	62	2	31	1	428	3	0
8.1. In blast furnaces	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
8.2. In crude petroleum refineries	631	-	-	-	-	505	47	4	12	62	1	-	-	-	-	-
8.3. In thermal power plants	32	-	-	-	1	-	-	-	0	-	-	30	1	-	-	-
8.4. In dual purpose power plants	6	1	-	-	5	-	-	-	0	-	-	-	0	-	0	-
8.5. In district heating plants	16	-	-	-	9	-	-	-	3	-	1	1	0	-	3	0
8.6. In hydropower plants	428	-	-	-	-	-	-	-	-	-	-	-	-	428	-	-
1.2. Production of derived energy bearers	1 134	-	-	6	-	-	220	32	264	79	19	-	45	-	448	20
9. Consumption by energy sector	236	-	-	-	-	-	0	0	9	-	0	173	27	-	27	0
9.1.1 Crude petroleum and natural gas production	184	-	-	-	-	-	-	-	9	-	-	155	-	-	19	-
9.1.2 Natural gas which is flared off on oil fields	18	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-
9.2. Coal mines	0	-	-	-	-	-	-	-	0	-	-	-	-	-	0	-
9.3. Petroleum refineries	29	-	-	-	-	-	0	-	0	-	0	-	27	-	2	-
9.4. Pumping storage power plants	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
9.5. Hydro electric power plants	3	-	-	-	-	-	0	0	0	-	-	-	-	-	3	-
9.6. Thermal power plants	0	-	-	-	-	-	-	-	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	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10. Losses in transport and distribution	44	-	-	-	-	-	-	-	-	-	-	1	4	-	36	4
11. Statistical differences (7-8+1.2-9-10-13.1)	222	4	1	2	-	92	-1	1	6	-1	79	40	0	-	-	-0
13.1 Net domestic consumption including non-energy use	889	19	8	18	48	-	53	19	190	11	51	34	13	-	409	16
13. Net domestic consumption	807	16	8	1	48	-	53	19	190	11	9	15	13	-	409	16
14. Manufacturing, mining and quarrying	249	16	8	1	16	-	0	0	11	8	7	11	12	-	156	2
14.1. Mining and quarrying	5	-	-	-	0	-	-	0	2	0	0	0	0	-	2	0
14.2. Manufacture of paper and paper products	34	-	-	-	12	-	-	-	0	4	0	0	-	-	18	0
14.3. Manufacture of industrial chemicals	56	6	2	0	0	-	-	0	1	1	2	5	11	-	27	0
14.4. Manufacture of iron, steel and ferro alloys	30	7	5	0	-	-	-	0	0	-	0	0	1	-	16	0
14.5. Manufacture of aluminium and other non-ferrous metals	73	-	-	0	0	-	-	0	0	0	1	4	-	-	67	0
14.6. Other manufacturing industries	51	3	1	0	4	-	0	0	6	3	3	2	0	-	26	1
15. Transport	206	-	-	-	-	-	52	15	132	2	0	2	-	-	2	-
15.1. Railways and subways	3	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
15.2. Air transport	15	-	-	-	-	-	0	15	-	-	-	-	-	-	-	-
15.3. Road transport	151	-	-	-	-	-	50	-	101	-	0	0	-	-	-	-
15.4. Coastal shipping	36	-	-	-	-	-	2	-	30	2	-	2	-	-	-	-
16. Other sectors	353	0	0	0	31	-	1	4	47	0	2	2	1	-	250	14
16.1. Fishing	20	-	-	-	-	-	0	0	19	0	-	-	-	-	1	-
16.2. Agriculture	14	-	-	-	0	-	0	0	6	-	0	1	-	-	7	0
16.3. Households	181	0	0	-	30	-	1	3	4	0	1	0	-	-	139	4
16.4. Other consumers	127	-	-	0	1	-	0	2	12	0	0	1	1	-	100	11
16.5 Construction	10	-	-	-	0	-	0	0	6	0	1	0	-	-	4	-
12. Consumption for non-energy purposes	82	2	-	17	-	-	-	0	0	1	41	19	-	-	-	-
12.1 Manufacture of industrial chemicals	61	-	-	1	-	-	-	-	0	-	40	19	-	-	-	-
12.2 Other manufacturing	21	2	-	16	-	-	-	0	0	1	2	-	-	-	-	-

Annex IV: CO_2 capture and storage at petroleum production fields – storage site characteristics and monitoring methodology

1 Capture from Sleipner Vest Field well stream and storage at Sleipner Øst Field

1.1 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 CO_2 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 at Sleipner Vest and storage at Sleipner Øst

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.

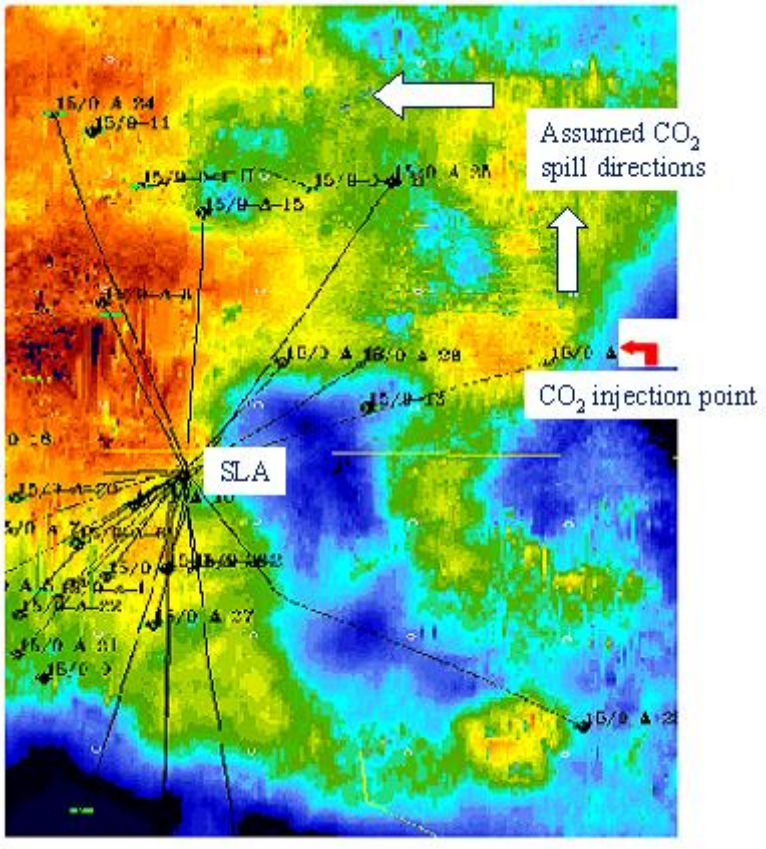

Figure 2 Position of CO_2 injection point and expected migration direction of CO_2 Sleipner field

1.2 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, 2006, 2008 and 2010

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, but plans are in place to have these measurements taken later in 2006.

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).

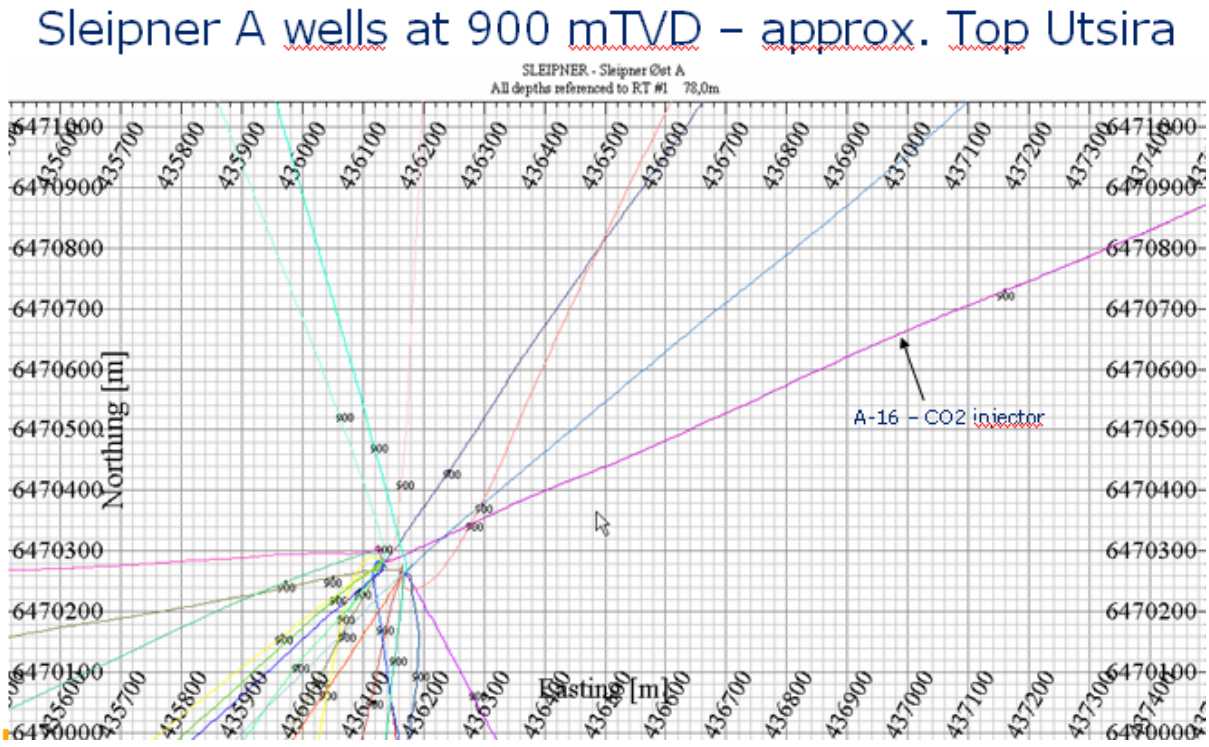

Figure 3 Positions of Sleipner production wells relative to the CO_2 injection well.

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.

1.3 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.

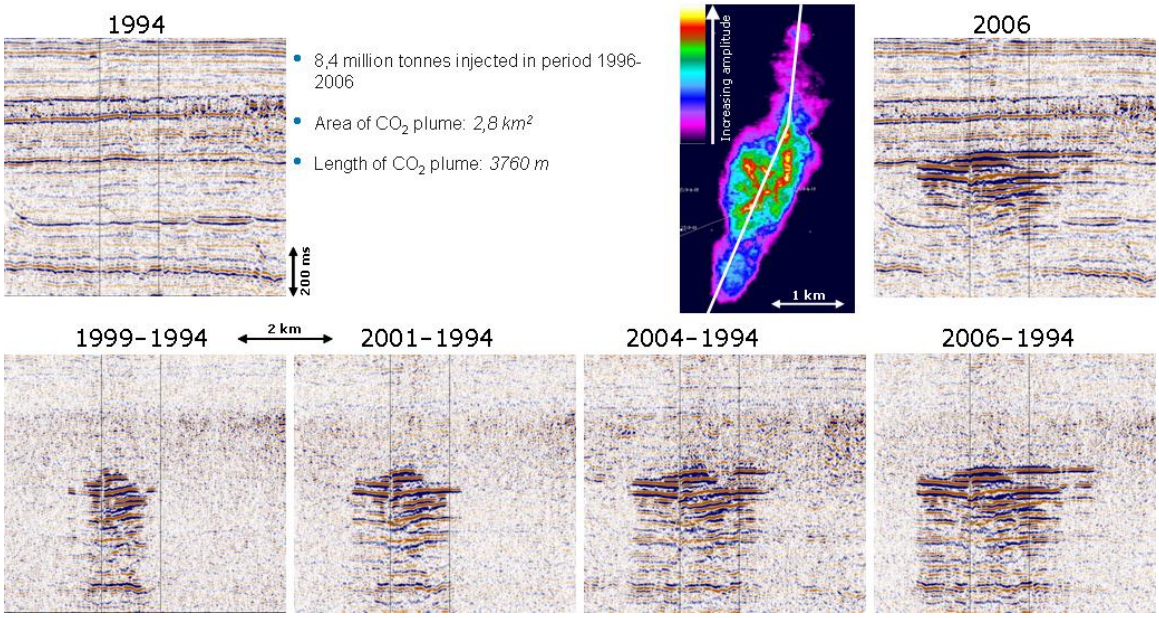

Figure 4 Results of seismic monitoring 1994 – 2006

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, 2006 and 2008

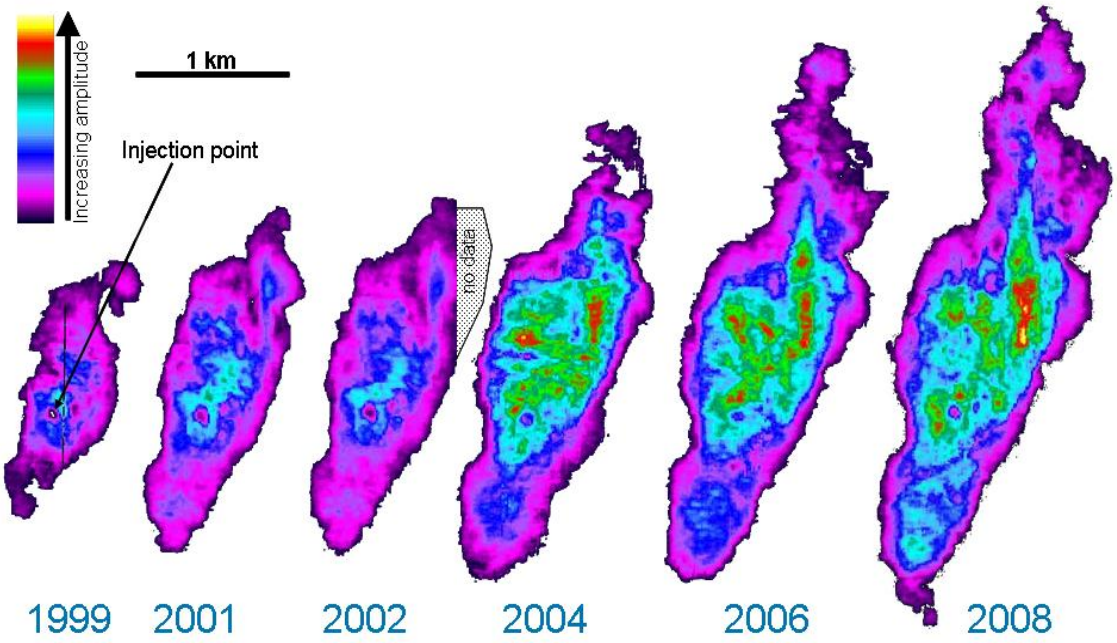

Figure 5 CO_2 plume extension in 1999 to 2008

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

In 2008, after close to 11 million tonnes had been injected during the last eight years, the maximum lateral migration from the injection point was 2.8 km to the northeast, and the area of the CO_2 plume was about 3.1 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.

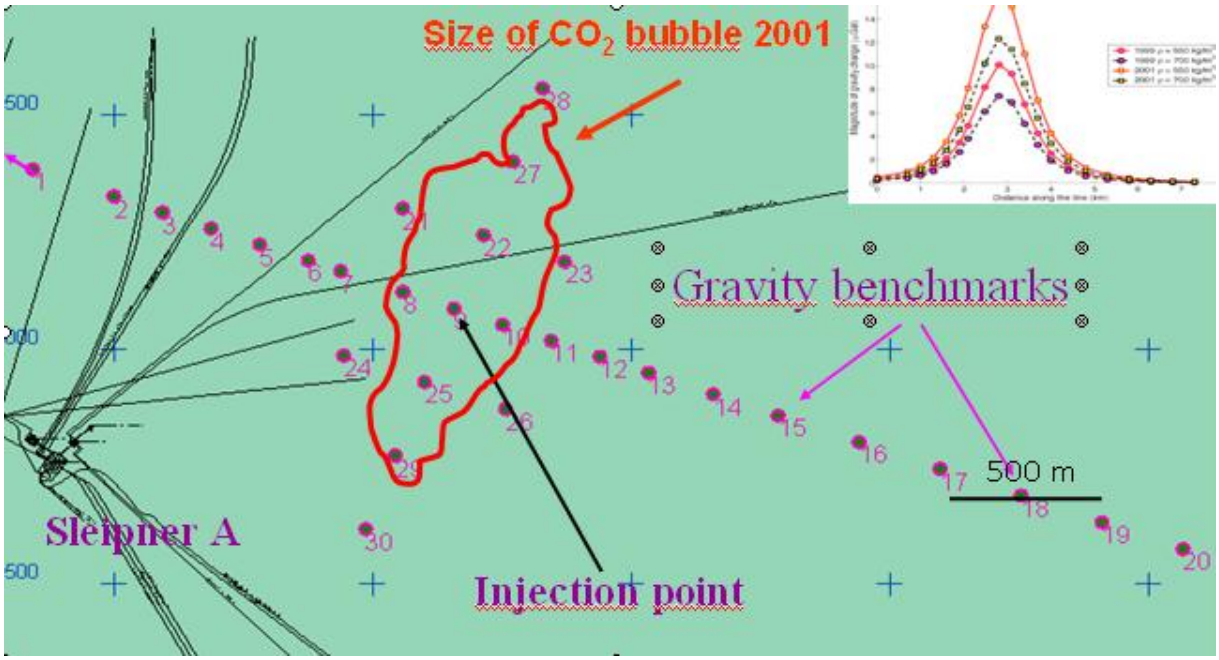

Figure 6 Gravimetric monitoring

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.

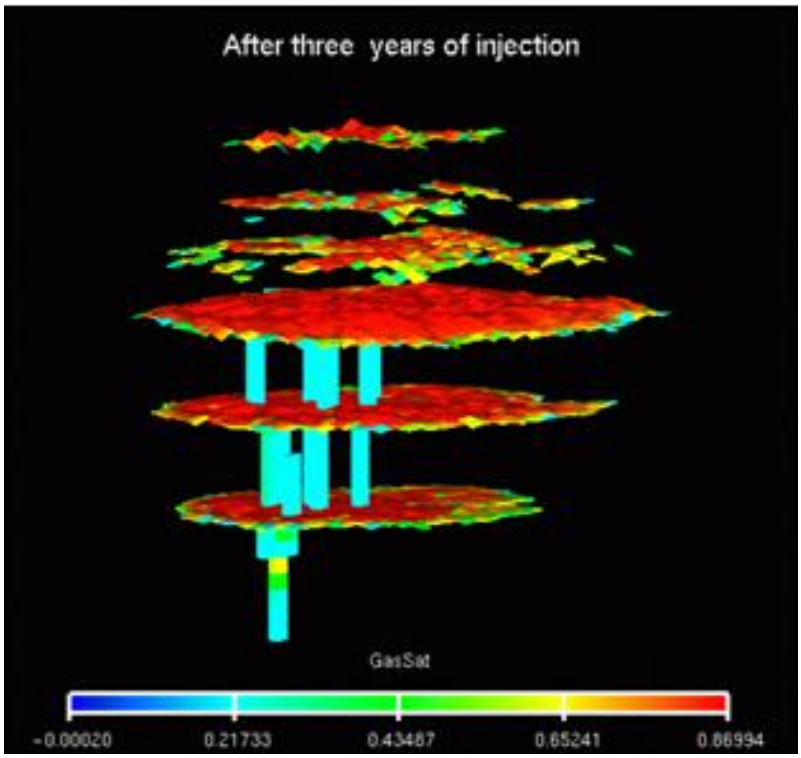

Figure 7 Flow simulation of CO_2

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.

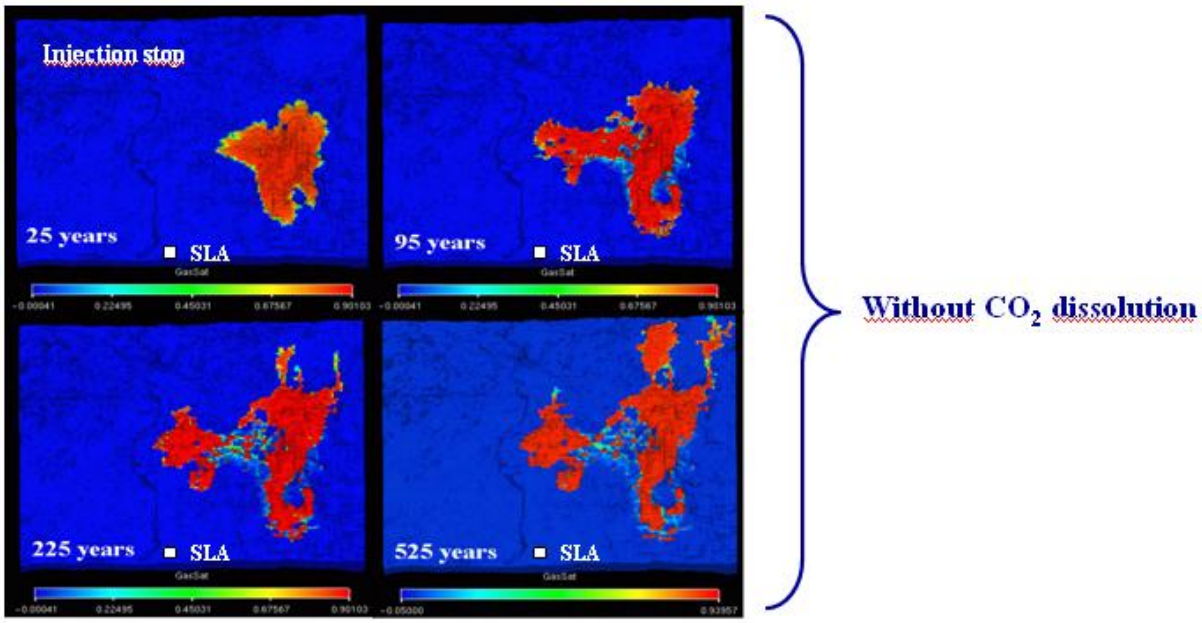

Figure 8

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.

1.4 Publications and conference presentations

Publications:

- **Chadwick, R.A.**; Arts, R.; Eiken, O.; **Kirby, G.A.**; Lindeberg, E.; Zweigel, P.. 2004 4D seismic imaging of an injected CO2 plume at the Sleipner Field, central North Sea. In: Davies, Richard J., (ed.) *3D seismic technology : application to the exploration of sedimentary basins.* London, UK, Geological Society of London, 311-320. (Geological Society of London Memoir, 29).
- 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

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- 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 Petroleum Geology Conference, October 2003, London

- Chadwick, R.A., R.Arts & O. Eiken, 2005, 4D seismic quantification of a growing CO2 plume at Sleipner, North Sea. In; DORÉ, A.G & VINING, B.A (eds) Petroleum Geology: North-West Europe and Global Perspectives, Proceedings of the 6th Petroleum Geology Conference, 1385-1399

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

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- 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.
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- 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)
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From CO2STORE project:

Title: Sleipner/Utsira CO_2 Geological Storage Full Field Flow and Geochemical Coupling to Assess the Long Term Fate of the CO_2
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 CO_2 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).
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- 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)

2 CO_2 capture from Snøhvit well stream at Hammerfest LNG and storage in the Tubåen formation in the Snøhvit area – injection well and monitoring methodology

2.1 CO_2 re-injection system and well specification:

Location of the CO_2 injection well F-2 H:

The CO_2 injection well is located at the F-segment at the western part of the Snøhvit reservoir (Figure 9). The injection pipeline is 152 km long (Figure 10).

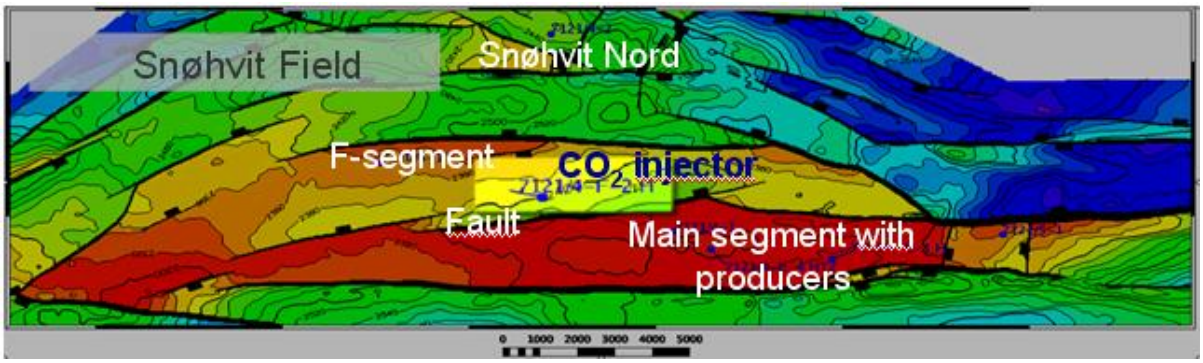


Figure 9 Location of the CO_2 well at Snøhvit

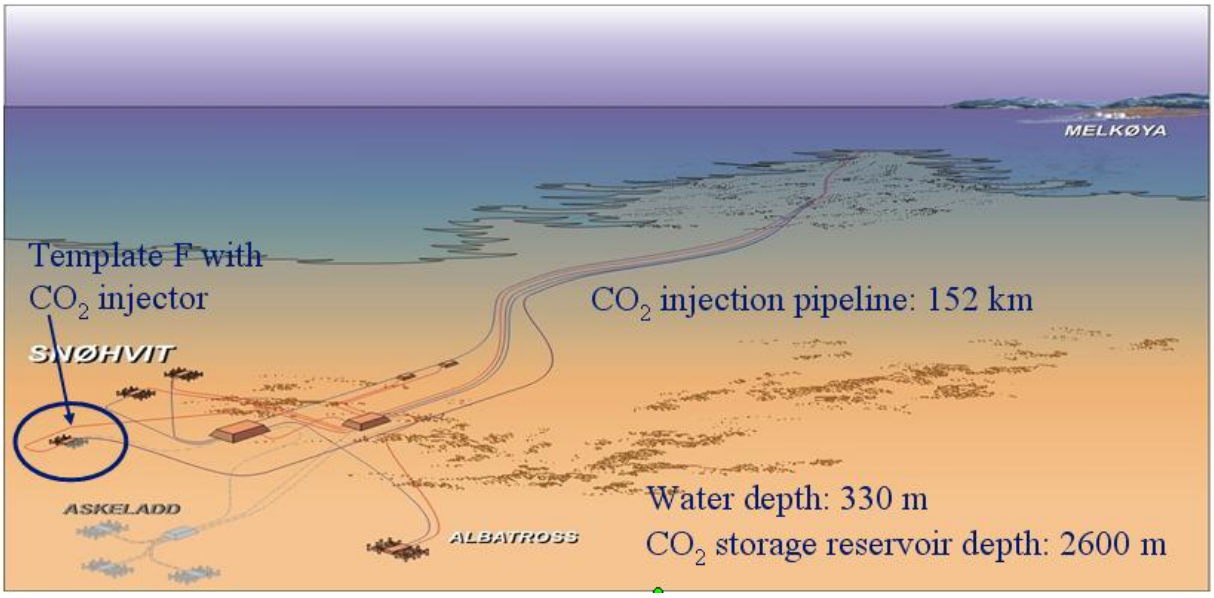


Figure 10 Field overview

Key parameters	TUBÅEN	STØ
Initial reservoir pressure	288 bar	255 bar
Initial temperature	98 °C	98 °C
Porosity	10- 16 %	15 %
Permeability	200-800 md	400 md
Reservoir depth	2600 m	2450 m
Water depth at F-template	330 m	330 m
Lenght pipline from Melkøya	152 km	152 km

Table 1 Key parameters for F-2 H into Tubåen and Stø reservior reservoir

To keep the CO_2 as deep as possible, it was decided to perforate the mid and lower part of Tubåen as shown in figure 11. If injection fails, additional perforations could be added in Tubåen, and/or bottom of Stø could be opened up for injection.

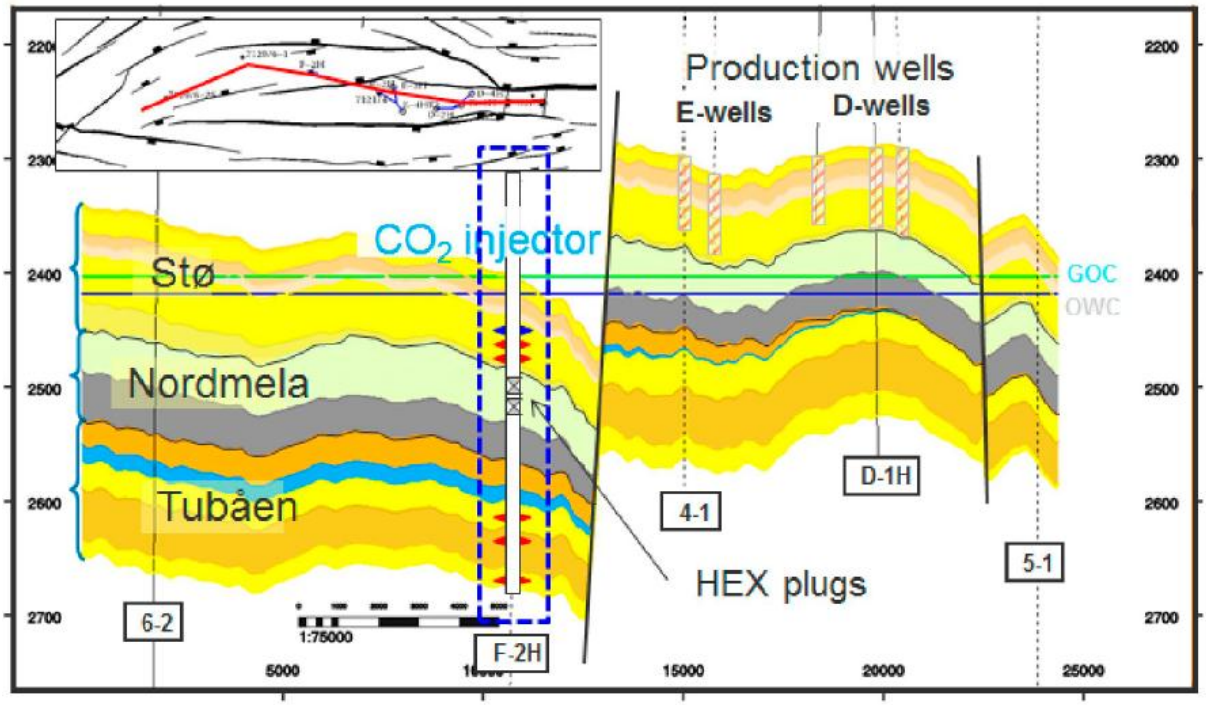


Figure 11 Cross-section of F-segment where CO_2 is injected

The completion design basis for the CO_2 injector is a perforated 7" liner. Downhole pressure and temperature gauge is installed. At Snøhvit and Hammerfest LNG, all facilities for separation and injection of CO_2 are placed onshore at the process plant at Melkøya. CO_2 in the feed gas are removed to avoid it freezing out in the downstream liquefaction process. An amine absorption unit performs this operation. The recovered CO_2 is condensed and recompressed before re-injected into Tubåen.

A schematic of the CO_2 re-injection system is shown in Figure 12. The indicated physical and measured values are expected initial values. Figure 13 shows the CO_2 phase diagram. The eight numbers in the phase diagram show CO_2 phase conditions at eight different locations indicated in Figure 13.

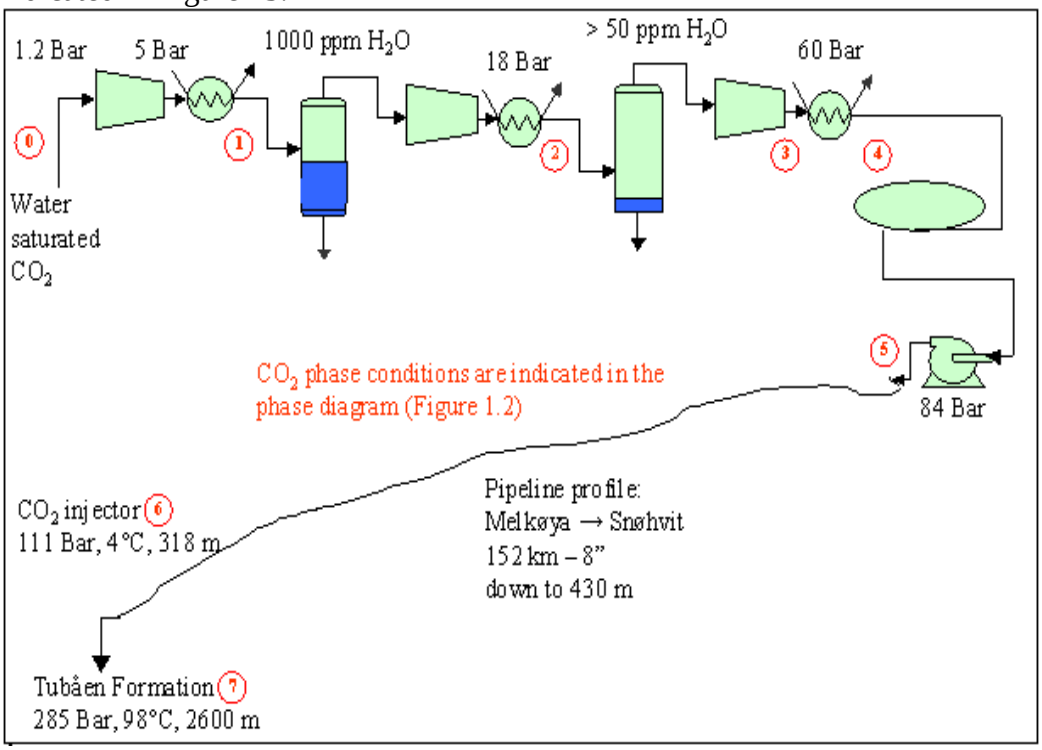


Figure 12 Schematic of the CO_2 injection system

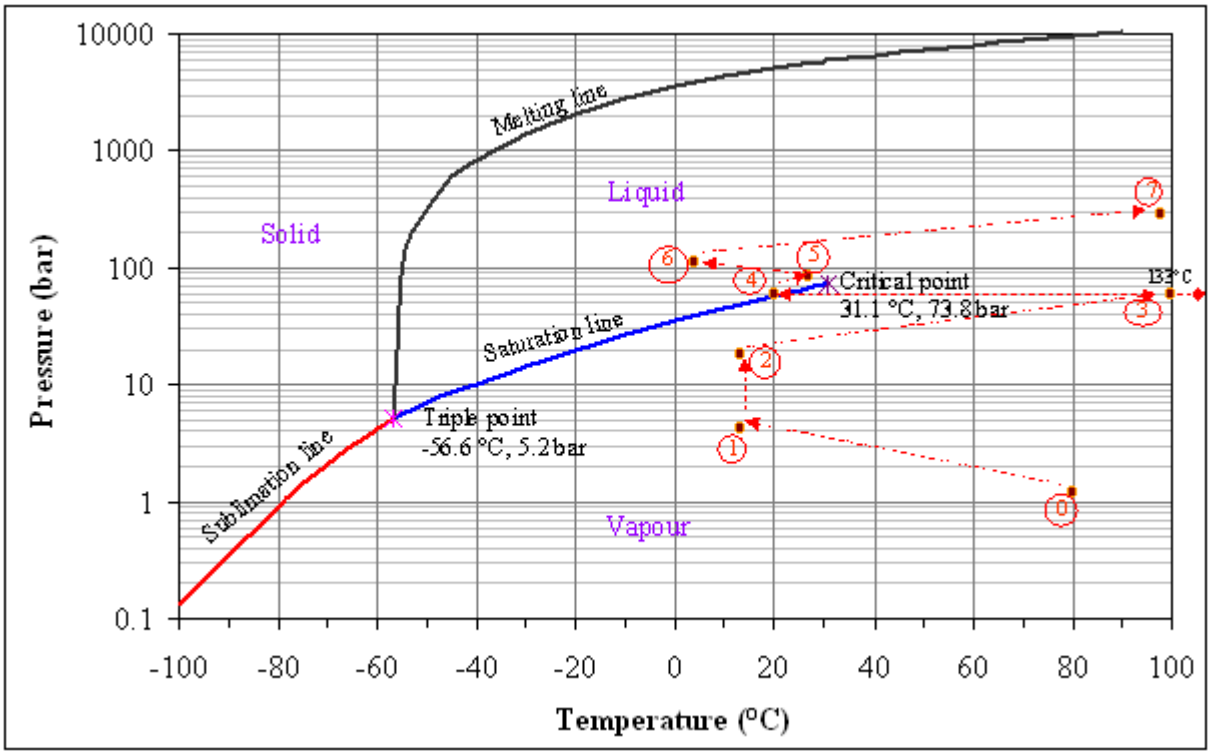


Figure 13 CO_2 phase diagram with eight phase conditions identified in the injection system in the Snøhvit area.

The figures (12 and 13) show that CO_2 most likely are re-injected as a single phase (liquid condition in the pipeline from the export pump (5) to the well head (6), transformed to supercritical condition in the reservoir where the temperature is higher).

CO_2 well stream specification

- >99% CO_2
- max 100 ppm (mol) H2S
- max 50 ppm (wt) H2O
- traces of HC and N2

CO_2 venting to atmosphere:

CO_2 venting is foreseen in case of shut down of the CO_2 reinjection system. The maximum vent rate is almost equal to the CO_2 removal flow rate. A separate vent stack for the CO_2 is provided at the plant.

2.2 Applied methods for monitoring the injected CO_2

a) Seismic monitoring

- 3D seismic shot in 2003
- 2D line shot in 2006
- 3D/4D seismic monitoring survey acquired in 2009
- Possible 3D/4D seismic in 2012

b) Gravimetric monitoring

- Pre-installed 41 concrete benchmarks across the Snøhvit reservoir in 2007
- The closest is 419 m from the CO_2 well
- Possible repeat survey in 2011

Benchmark number 21 is closest to the CO_2 injection well – see figure 14.

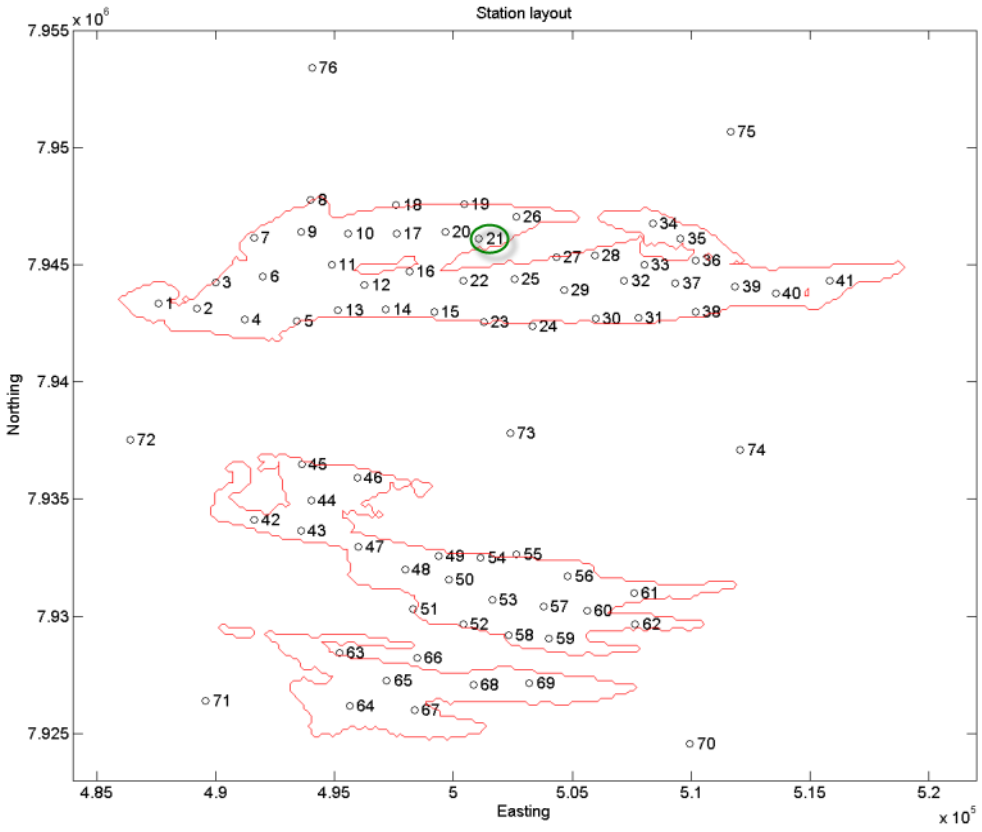


Figure 14 Benchmarks Gravimetric monitoring CO_2 storage in the Snøhvit area

c) Pressure measurements

Pressure and temperature gauge is installed in the well 800 metres above top reservoir and the pressure development in the injection well F-2 H is monitored on a daily basis. Data are used in history matching of the reservoir simulation model.

Annex V: National Greenhouse Gas Inventory System in Norway

Information about changes in the document

Date	Version	Performed by	Comment
Nov 2006	1	Norwegian Pollution Control Authority	Part of the initial report 2006
15.04.2010	2	Climate and Pollution Agency	Updates to 2010 Submission
25.05.2012	3	Climate and Pollution Agency	Updates to 2012 Submission

Version 3

2012

Contents

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 was 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 the Climate and Pollution Agency, Statistics Norway, the Center for International Climate and Environmental Research – Oslo (CICERO) and The Norwegian Forest and Landscape Institute.

1 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[1]:

- 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[2]/MOP[3] 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.

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).

[1] 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".

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

[3] Meeting of Parties to the Kyoto Protocol.

- 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.[4] 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 describes how the functions required for the national system are implemented in Norway.

2 National responsibilities

2.1 General overview

The Norwegian national system for greenhouse gas inventories is based on existing cooperation. The National entity, the Climate and Pollution Agency, 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 in collaboration between Statistics Norway and the Climate and Pollution Agency. 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.

2.2 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 Statistics Act (statistikkloven).

The *Pollution Control Act* gives the Climate and Pollution Agency 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 Pollution Control 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 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

[4] 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.

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.

2.3 The Climate and Pollution Agency's responsibilities as national entity

The Climate and Pollution Agency 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 Norwegian Pollution Control Authority (now the Climate and Pollution Agency) and i.a. Statistics Norway. On this background Norwegian Pollution Control Authority 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 national system is built around well-established institutional cooperation.

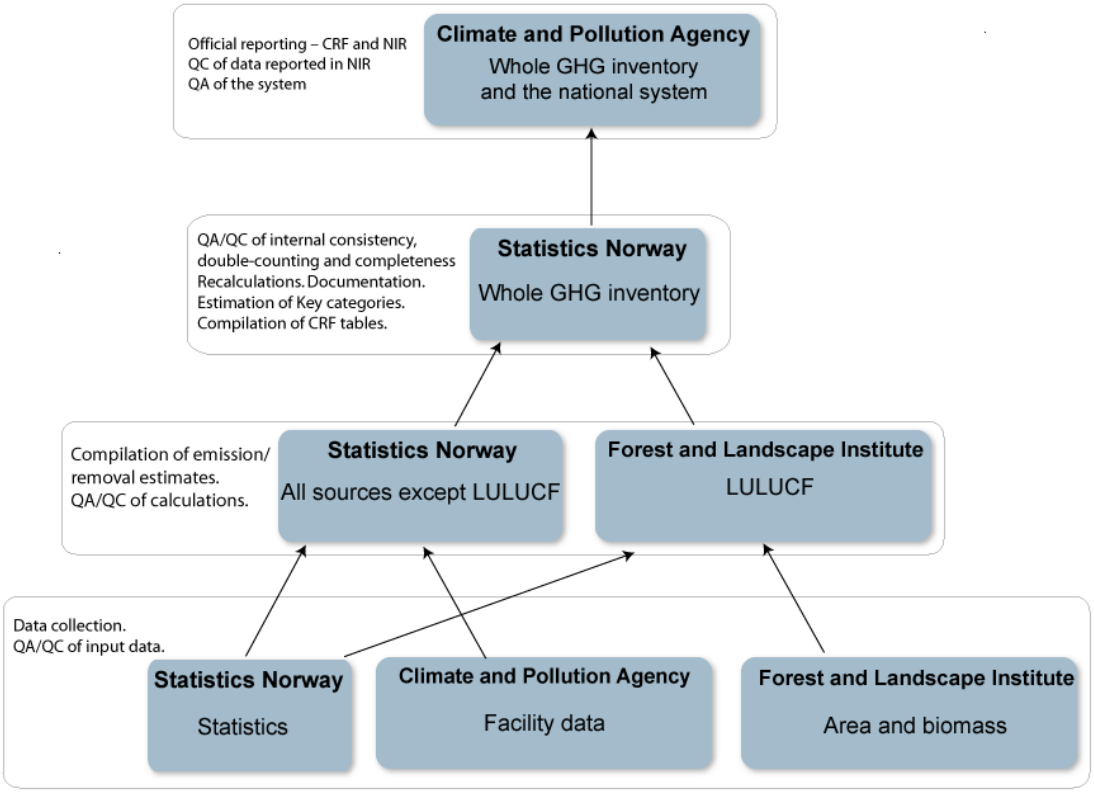
The Climate and Pollution Agency as a national entity are responsible for:

- 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.

2.4 Institutional cooperation, responsibilities and agreements

The three core institutions, the Climate and Pollution Agency, Statistics Norway and The Norwegian Forest and Landscape Institute, 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 the Climate and Pollution Agency 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.[5]

The establishment of the national system requires close collaboration between the three institutions. Two annual cooperation meetings have been formalized.[6] The Climate and Pollution Agency 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

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

[6] 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.

- 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.

2.5 Official consideration and approval of the inventory

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

- The QA/QC report from the QA/QC responsible in the Climate and Pollution Agency, 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

2.6 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.

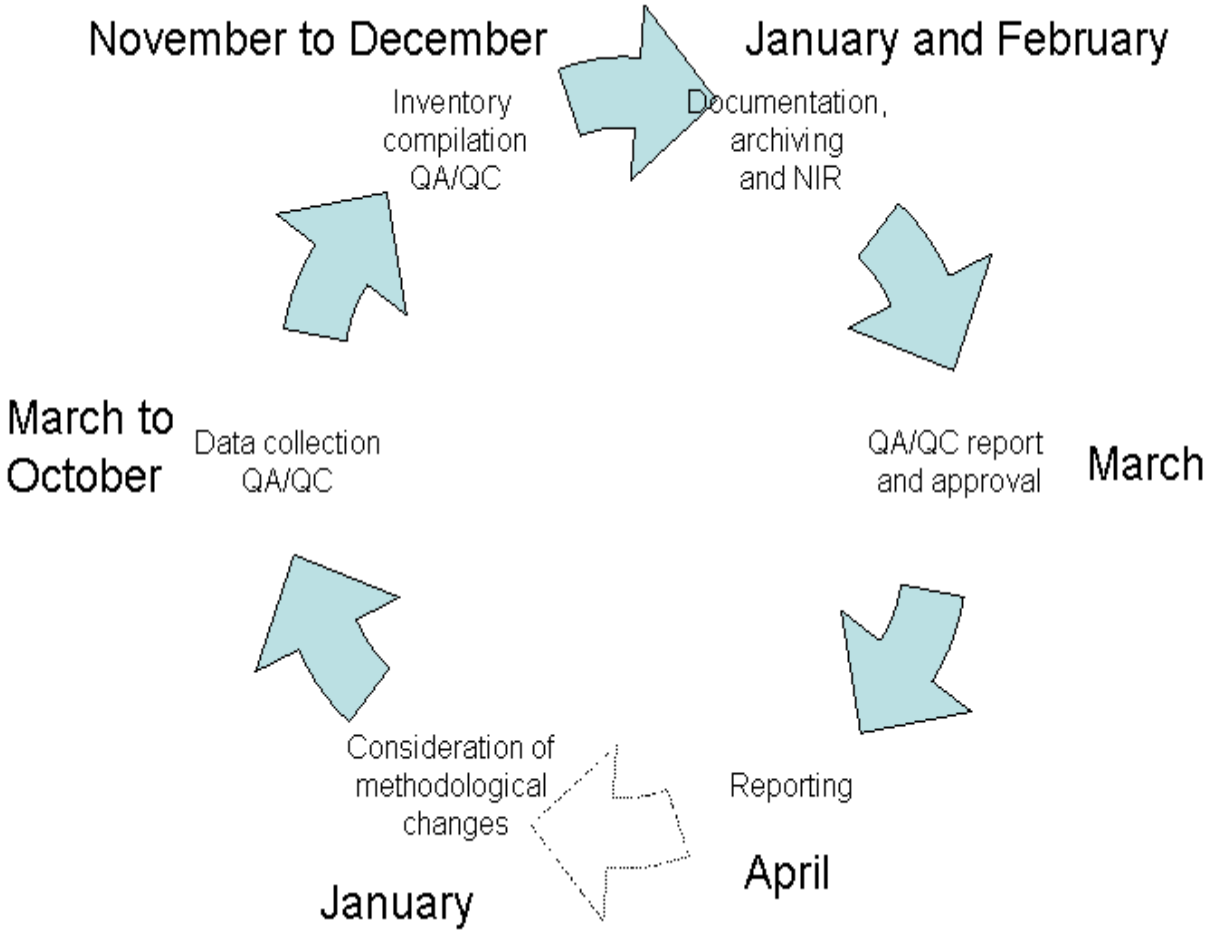
Table 1. Inventory production plan, milestones

	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	Climate and Pollution Agency[3]	Feb. 1
Agreement on major methodological changes needed for next year's reporting	All	May 15
Preliminary emissions data from plants sent to Statistics Norway	Climate and Pollution Agency	May 1
Final emissions from large industrial plants sent to Statistics Norway	Climate and Pollution Agency	Oct.
All LULUCF data collection for the previous calendar year completed	Forest and Landscape	Sept. 1
All non-LULUCF data collection completed	Statistics Norway	Nov. 1
LULUCF inventory for the previous calendar year sent to Statistics Norway in CRF format	Forest and Landscape	Feb. 15
Test runs, QA/QC (excluded LULUCF)	Statistics Norway	Nov. 15
Draft inventory to Climate and Pollution Agency for comments and QA/QC (excluded LULUCF)	Statistics Norway	Dec. 5
Final inventory including completion of QA/QC tests and recalculations (excluded LULUCF)	Statistics Norway	Jan. 15
Review of documentation and necessary updates made[1]	All	Feb. 1
NIR 1st draft	Climate and Pollution Agency and Forest and Landscape	March 1
Completion of CRF tables [2]	Statistics Norway	March 15
QA/QC reports sent to the Climate and Pollution Agency	All	March 20
NIR finalized	Climate and Pollution Agency	April 1
QA/QC report finalized	Klif[3]Climate and Pollution Agency	April 1
Formal approval of inventory for the purpose of reporting	Climate and Pollution Agency	April 10
Reporting	Climate and Pollution Agency	April 15

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

[2] Statistics Norway will send complete CRF tables to the Climate and Pollution Agency, data originally collected by the Climate and Pollution Agency are sent to Statistics Norway who is responsible for making these data available in the CRF.

Figure 2 The inventory preparation cycle



2.7 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.

The Climate and Pollution Agency 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 the Climate and Pollution Agency's key priorities and financial resources for the following year. The national system will involve several units in the Climate and Pollution Agency. To ensure that the requirements are met, the Climate and Pollution Agency 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 Statistics Norway. 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 the Climate and Pollution Agency.

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 the Climate and Pollution Agency.

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.

3 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[7] for emission/removal data, irrespective of which institution or company made the estimates. This includes appropriate references to supplementary information (e.g. scientific literature).
- 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.

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

- 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.

3.1 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.

The Climate and Pollution Agency 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 the Climate and Pollution Agency 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. The Climate and Pollution Agency 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 the Climate and Pollution Agency and Statistics Norway on any numbers of the emission inventory, the Climate and Pollution Agency 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 Climate and Pollution Agency with a copy to Statistics Norway. In addition the Climate and Pollution Agency needs to

complete the QC report as a basis of approval of the inventory and for information to Statistics Norway.

The Climate and Pollution Agency as the national entity is responsible for the overall QA of the national system, including the UNFCCC reviews and any national reviews undertaken.

3.2 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.

3.2.1 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.

In 2011, new routines for input data control were completed and implemented. Reported emissions, emission factors and activity data for the latest inventory year are now routinely compared to those of the previous inventory year. Changes larger than 50-185 %, depending on gas and source, are automatically flagged for further manual QC. In addition, implied emissions factors are calculated for emissions from stationary combustion at point sources. The IEFs are subjected to the same comparison between t and t-1.The most thorough checks are made for the gases and categories with the largest contribution to total emissions.

Furthermore, result control routines have been extended to include comparison of emission estimates at the level of IPCC and NFR reporting. Up to now the comparison has been performed for national source categories.

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.	The Climate and Pollution Agency
	Time series check of input data: Compare non-LULUCF input data (reported emissions, emission factors and activity data) for the latest inventory year to those of the previous inventory year. Changes larger than 50-185 %, depending on gas and source, is flagged for further QC. The most thorough checks are made for the gases and categories with the largest contribution to total emissions.	Statistics Norway
	Inventory version check of input data: Compare non-LULUCF input data (reported emissions, emission factors and activity data) to previous estimates for the same inventory year[8].	Statistics Norway
	Time series check of emissions, 1: Compare estimated emissions to those of previous inventory year at the level of IPCC reporting and flag changes of more than 50 % for further QC.[9]	Statistics Norway
	Time series check of emissions, 2: Compare all estimated emissions to those of previous inventory year at the level of IPCC reporting and flag changes of more than 0.1% of total emission of the gas for further QC.[10]	Statistics Norway
	Inventory version check of emissions: Compare all estimated emissions to previous estimates for the same inventory year[11] at the level of IPCC reporting and flag changes of more than 0.1% for further QC.	Statistics Norway
	Inventory version check of emissions: 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% of total emission of the gas for further QC.	Statistics Norway
	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.	The Norwegian Forest and Landscape Institute

[8] 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.

[9] 80-125 % for CO_2, 60-167 % for CH_4 and N_2O and 30-133 % for HFCs, PFCs and SF_6.

[10] 80-125 % for CO_2, 60-167 % for CH_4 and N_2O and 30-133 % for HFCs, PFCs and SF_6.

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

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

	Check	**Responsible**
	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.	The Norwegian Forest and Landscape Institute
	Compare all estimated emissions and removals from LULUCF to previous inventory years and flag changes of more than 5% for further QC.	The Norwegian Forest and Landscape Institute
Completeness checks		
	Identify large plants previously included in the inventory that no longer are included (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.	The Climate and Pollution Agency
	Check that aggregate energy use in the emission model reflect the most recent energy balance.	Statistics Norway
	Check the difference between estimated fuel use for road transport with fuel sales.	Statistics Norway
	Flag incomplete categories through use of the emission model and data reported for previous years. Empty cells are subject to additional checks.	Statistics Norway
	Check that all cells with energy consumption have a corresponding emission factor.	Statistics Norway
	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.	Statistics Norway
	Check for completeness/double-counting between the LULUCF inventory and the inventory of other sources.	Statistics Norway
	Flag incomplete categories of the LULUCF inventory by comparing to the previous inventory.	The Norwegian Forest and Landscape Institute
Consistency checks		
	Comparison of emissions in the main emission model with totals estimated in sub-model (e.g. road transport and waste models).	Statistics Norway
	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 Klif and The Norwegian F & L Institute with data used for the other categories.	Statistics Norway
	Checks for time-series consistency in cases where emissions from plants collected by Klif only are available for parts of the time-series.	Statistics Norway
	Checks for time-series consistency where activity data are only available on a non-annual or cyclical bases.	The Norwegian Forest and Landscape Institute

	Check	**Responsible**
		(Statistics Norway and the Climate and Pollution Agency)
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 (The Norwegian Forest and Landscape Institute 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

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3.2.2 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 the Climate and Pollution Agency, Statistics Norway and The Norwegian Forest and Landscape Institute, in collaboration with other relevant authorities, as a part of the improvement plan (with the Climate and Pollution Agency 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 the Climate and Pollution Agency, 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 the Climate and Pollution Agency, while the Climate and Pollution Agency 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 the Climate and Pollution Agency
    - 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 the Climate and Pollution Agency, 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
  - 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)

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

- 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 the Climate and Pollution Agency, 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 the Climate and Pollution Agency, 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

3.2.3 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.

The Climate and Pollution Agency 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. The Climate and Pollution Agency is responsible for making the final approval of the CRF tables.

3.2.4 NIR

The Climate and Pollution Agency 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)

3.2.5 Timeliness

The Climate and Pollution Agency, Statistics Norway and The Norwegian Forest and Landscape Institute have agreed on a timetable to enable the Climate and Pollution Agency to report to UNFCCC by April 15 (see Table 1). It is the responsibility of the

Climate and Pollution Agency, 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.

3.2.6 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.

3.3 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.

3.3.1 Statistical data and emissions reported from plants

Emissions reported from plants

Emissions reported from industrial sites are always checked by the Climate and Pollution Agency (see section 3.3.2) by the administrative department in charge of evaluating emission permits. The Climate and Pollution Agency 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 the Climate and Pollution Agency. 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.

The Climate and Pollution Agency 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 Section for Environmental Economics and Emission Inventories in the Climate and Pollution

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

Agency 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 performed by the Climate and Pollution Agency or 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 sampled in official statistics and compares these to the emission data from plants reported to the Climate and Pollution Agency, and deviations are explained through contact with the plants.

3.3.2 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. Any results of this review will be used by the cooperating institutions to improve the inventory.

Audits

The Climate and Pollution Agency, 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.

3.4 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 (Statistics Norway 2001a). 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.

3.5 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 produce a plan for improvements of the inventory. This plan may also point out needs that cannot be handled through ordinary inventory projects, but through research projects. The autumn cooperation meeting between the three institutions agree on priorities for the following year.

4 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" (Statistics Norway 2009) and "Emissions and removals of greenhouse gases from land use, land-use change and forestry in Norway" (NIJOS, 2005). The (Statistics Norway 2009) is 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.

4.1 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.

4.2 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
Climate and Pollution Agency		
	• Emissions from large industrial plants (point sources) (around 70 at present, but some of these do not report GHG emissions)	• Climate and Pollution Agency
	• 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 and the Climate and Pollution Agency
	• Methane recovery from landfills	• Climate and Pollution Agency
	• Import of HFCs, PFCs and SF_6 by application. Import HFCs, PFCs and SF_6 in products.	• Climate and Pollution Agency (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

4.3 Uncertainty calculations

Norway has quantified uncertainties in input data and in total emissions and its trend (Norwegian Pollution Control Authority 1999a; Statistics Norway 2000; Statistics Norway 2001b; Statistics Norway 2009, Appendix D; Statistics Norway 2011). 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 last uncertainty analysis of the total inventory was performed in 2011 on 1990 and 2009 emission data. Uncertainty estimates are also yearly updated for sources when the estimation methods or data sources are being changed.

Uncertainties in the LULUCF sector have been estimated less rigorously.

4.4 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.

4.5 Emission calculations

4.5.1 The main emissions model

The model was developed by Statistics Norway (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 the Climate and Pollution Agency). 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 the Climate and Pollution Agency, 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 (Statistics Norway 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.

4.5.2 The LULUCF model

The Norwegian Forest and Landscape Institute is in charge of estimating emissions and removals from Land use, Land-Use Change and Forestry (LULUCF) for all categories where area statistics is the activity level. They have developed a calculation system in the form of computer programs that uses SAS system software, FORTRAN and R for the implementation of the IPCC good practice guidance for the LULUCF sector. The systems use input data from different sources and create final output datasets. These final datasets include all data needed for the tables in the common reporting format (CRF), both for the Climate Convention and the Kyoto-protocol.

In light of the importance of the forest sector the National Forest Inventory (NFI) is used as the most important source of information of forestry and to establish total area of forest, cropland, wetlands, settlements and other land and land-use transitions between these. The data from the NFI is complemented with other data (e.g. horticulture, tillage practice, amount of fertilizer used, liming and drainage of forest soil, liming of lakes and forest fires) collected by Statistics Norway, Norwegian Agricultural Authority, Food Safety Authority, The Norwegian Directorate for Nature Management and The Directorate for Civil Protection and Emergency Planning.

The sampling design of the NFI is based on a systematic grid of geo-referenced sample plots covering the entire country. The NFI utilizes a 5-year cycle based on a re-sampling method of the permanent plots. Up to 2010 the estimates were based on detailed information from sample plots below the coniferous limit. To confirm the land use, the extent of the area of forest and other wooded land at higher altitudes and in Finnmark County, the NFI conducted a complete forest inventory during 2005–2010 for these areas. All areas are for the first time included in the estimates for the LULUCF sector in this inventory submission. The estimates for areas above the coniferous limit and in Finnmark County, may be recalculated in future greenhouse gas inventories as more information, e.g. from NFI, maps, old and new aeriel photos, may be used to improve the estimates back to 1990.

The calculations of biomass and carbon stock in forest are based on single tree measurements and stand attributes from the permanent sample plots on forest and other wooded land under the coniferous forest limit. Biomass is calculated using

single tree biomass equations developed in Sweden for Norway spruce, Scots pine and birch (Marklund 1987, 1988 and Petersson and Stähl 2006). These equations provide biomass estimates for various tree biomass components: stem, stem bark, living branches, dead branches and needles, stumps and roots.

These components are used to calculate above- and belowground biomass. The biomass of trees below and above coniferous limit and with diameter less than 50 mm (small trees) at 1.3 meter height (DBH) , trees from higher altitudes and trees in Finnmark County, are included in the estimates for the whole time-series. The standing volume of these biomass pools constitute 7 percent of the stem volume of standing trees with DBH equal to or larger than 50 mm from the area below the coniferous limit. Hence 7 percent of the net change of CO_2 removals of living trees below the coniferous limit is included in the estimates. It is assumed that these proportions have remained constant over the last twenty years.

The dynamic soil model Yasso, as described in detail by Liski et al. (2005), and for Norwegian conditions by de Wit et al. (2006), is used to calculate changes in carbon stock in dead organic matter and in soil for forest land remaining forest land. The Yasso07, a newer version of the model, has been used to obtain estimates of soil organic carbon for lands converted to forest land and forest land converted to other lands (Liski et al. 2009, Tuomi and Liski 2009, Tuomi et al. 2009, www.ymparisto.fi/syke/yasso). The Yasso07 model provides an aggregated estimate of carbon stock change for the total of litter, dead wood and soil organic matter. The system is still under development. All data used as input to the models is provided by the Norwegian Forest and Landscape Institute, Statistics Norway, Norwegian Meteorological Institute and Bioforsk. We assume the models are relevant for Norwegian conditions. The calculations are hence done in accordance to a Tier 3 method.

5 Handling of data

5.1 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, the Climate and Pollution Agency has started to build up a physical and electronic library with the most important methodology reports. Based on the reference list of the NIR, the Climate and Pollution Agency has started to collect physical copies of the most important methodology reports. The reports are placed in one of the inventory compilers' office. Electronic copies of the most important methodology reports are also collected. This is systemized in a catalogue in the agency's achieving system (ePhorte) and URLs are also included if available. Some of the older methodology reports have been scanned in order to make them more easily available. 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 Climate and Pollution Agency. 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.

	Climate and Pollution Agency	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	Climate and Pollution Agency 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	

5.2 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 the Climate and Pollution Agency. 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. The Climate and Pollution Agency, Statistics Norway and The Forest and Landscape Institute are responsible for having competent personnel on duty during a review to access data if requested.

5.3 Allocation of responsibilities during a review

The Climate and Pollution Agency 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. The Climate and Pollution Agency is responsible for informing Statistics Norway, The Forest and Landscape

Institute and the Climate and Pollution Agency 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)

	Climate and Pollution Agency	Statistics Norway	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		

6 References

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Norwegian Pollution Control Authority (1999a): Evaluation of uncertainty in the Norwegian emission inventory, Report 99:01 (Author: K. Rypdal), Oslo: Norwegian Pollution Control Authority.

7 Annexes

7.1 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.

7.2 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.

7.3 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).

7.4 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 organization.
[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 organizations 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.

7.5 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		
• Climate and Pollution Agency	X		
Forurensning	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

Until 2012 the emission inventory group at Statistics Norway was part of the division for environmental statistics. In January 2012 this division was split and the emission inventory group was merged with the division for energy statistics. The purpose of this reorganisation was to increase the consistency between the energy statistics and the emission inventories and improve the quality of both.

7.6 Annex 6. QC of activity data – existing routines

7.6.1 Statistics Norway

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

7.6.2 The Climate and Pollution Agency

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

- That the data in Forurensning 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 Section for Environmental Economics and Emission Inventories 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.

7.6.3 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.

7.7 Annex 7 Archiving – development of routines

7.7.1 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.

7.7.2 The Climate and Pollution Agency

Emissions from large industrial plants

Reports with emission data and QA control from large industrial plants are sent to the Climate and Pollution Agency 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 the Climate and Pollution Agency 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. The Forurensning database 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

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

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 the Climate and Pollution Agency'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, the Climate and Pollution Agency and the Norwegian Oil Industry Association. The Climate and Pollution Agency aggregates data from the Environmental Web. The data are stored and archived in a designated file on the Climate and Pollution Agency'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 the Climate and Pollution Agency's server, before being sent to Statistics Norway
Import of HFC/PFC and SF_6

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

The Climate and Pollution Agency 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 the Climate and Pollution Agency's server. Statistics Norway will also archive the CRF Reporter.

7.7.3 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.

Annex VI: SUMMARY II REPORT FOR CO_2 EQUIVALENT EMISSIONS 1990-2010

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

Inventory 1990
Submission 2012 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]	**26 114**	**4 669**	**4 773**	**0**	**3 370**	**2 200**	**41 126**
1. Energy	**28 606**	**642**	**319**				**29 567**
A. Fuel Combustion (Sectoral Approach)	25 946	266	315				26 527
1. Energy Industries	6 891	49	27				6 968
2. Manufacturing Industries and Construction	3 593	11	42				3 645
3. Transport	10 862	83	155				11 100
4. Other Sectors	4 144	122	84				4 350
5. Other	456	0	6				463
B. Fugitive Emissions from Fuels	2 660	376	4				3 040
1. Solid Fuels	7	56	NA,NO				64
2. Oil and Natural Gas	2 652	320	4				2 977
2. Industrial Processes	**6 044**	**10**	**2 079**	**0**	**3 370**	**2 200**	**13 703**
A. Mineral Products	710	NA	NA				710
B. Chemical Industry	1 119	9	2 074	NO	NO	NO	3 201
C. Metal Production	4 138	1	5	NO	3 370	2 144	9 659
D. Other Production	77						77
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				0	NA,NO	56	56
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**156**		**36**				**191**
4. Agriculture		**2 312**	**2 209**				**4 521**
A. Enteric Fermentation		1 991					1 991
B. Manure Management		298	135				433
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	2 065				2 065
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		23	9				32
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-8 692**	**2**	**14**				**-8 676**
A. Forest Land	-11 306	2	13				-11 292
B. Cropland	459	IE,NO	1				460
C. Grassland	1 886	NO	NO				1 886
D. Wetlands	3	NE,NO	0				3
E. Settlements	256	NE,NO	NE,NO				256
F. Other Land	NE,NO	NO	NO				NE,NO
G. Other	10	NO	NO				10
6. Waste	**0**	**1 702**	**117**				**1 820**
A. Solid Waste Disposal on Land	NA	1 683					1 683
B. Waste-water Handling		20	117				137
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 098	2	18				2 117
Aviation	619	0	6				626
Marine	1 478	2	12				1 492
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 477**						**4 477**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	49 803
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	41 126

[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 2012 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]	**24 079**	**4 712**	**4 628**	**0**	**2 993**	**2 079**	**38 491**
1. Energy	**27 663**	**669**	**317**				**28 649**
A. Fuel Combustion (Sectoral Approach)	25 557	253	314				26 124
1. Energy Industries	7 261	52	31				7 344
2. Manufacturing Industries and Construction	3 425	11	44				3 479
3. Transport	10 748	80	154				10 981
4. Other Sectors	3 718	110	80				3 908
5. Other	406	0	6				412
B. Fugitive Emissions from Fuels	2 106	416	3				2 525
1. Solid Fuels	8	60	NA,NO				68
2. Oil and Natural Gas	2 098	356	3				2 458
2. Industrial Processes	**5 549**	**9**	**1 921**	**0**	**2 993**	**2 079**	**12 550**
A. Mineral Products	665	NA	NA				665
B. Chemical Industry	989	8	1 916	NO	NO	NO	2 913
C. Metal Production	3 775	1	4	NO	2 993	2 020	8 793
D. Other Production	120						120
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				0	NA,NO	60	60
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**137**		**35**				**172**
4. Agriculture		**2 341**	**2 223**				**4 564**
A. Enteric Fermentation		2 017					2 017
B. Manure Management		306	143				450
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	2 073				2 073
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		18	7				25
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-9 270**	**3**	**15**				**-9 252**
A. Forest Land	-11 848	3	14				-11 831
B. Cropland	413	IE,NO	1				414
C. Grassland	1 886	NO	NO				1 886
D. Wetlands	3	NE,NO	0				3
E. Settlements	263	NE,NO	NE,NO				263
F. Other Land	NE,NO	NO	NO				NE,NO
G. Other	12	NO	NO				12
6. Waste	**0**	**1 691**	**117**				**1 808**
A. Solid Waste Disposal on Land	NA	1 672					1 672
B. Waste-water Handling		19	117				135
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	1 812	2	15				1 829
Aviation	560	0	6				565
Marine	1 252	2	10				1 264
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 380**						**4 380**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	47 743
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	38 491

[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 2012 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)]	**24 411**	**4 767**	**4 064**	**0**	**2 287**	**705**	**36 235**
1. Energy	**28 460**	**763**	**317**				**29 540**
A. Fuel Combustion (Sectoral Approach)	26 048	250	314				26 611
1. Energy Industries	7 833	55	34				7 923
2. Manufacturing Industries and Construction	3 336	10	45				3 391
3. Transport	10 984	77	151				11 212
4. Other Sectors	3 407	107	77				3 591
5. Other	487	1	8				496
B. Fugitive Emissions from Fuels	2 413	513	3				2 929
1. Solid Fuels	7	50	NA,NO				56
2. Oil and Natural Gas	2 406	463	3				2 872
2. Industrial Processes	**5 556**	**9**	**1 371**	**0**	**2 287**	**705**	**9 929**
A. Mineral Products	726	NA	NA				726
B. Chemical Industry	937	8	1 367	NO	NO	NO	2 311
C. Metal Production	3 774	1	5	NO	2 287	638	6 705
D. Other Production	120						120
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [(2)]				0	NA,NO	67	67
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**141**		**35**				**176**
4. Agriculture		**2 336**	**2 210**				**4 545**
A. Enteric Fermentation		2 019					2 019
B. Manure Management		307	142				450
C. Rice Cultivation		NO					NO
D. Agricultural Soils [(3)]		NA,NO	2 063				2 063
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		10	4				13
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [(1)]	**-9 747**	**3**	**14**				**-9 730**
A. Forest Land	-12 283	3	14				-12 267
B. Cropland	359	IE,NO	1				360
C. Grassland	1 886	NO	NO				1 886
D. Wetlands	3	NE,NO	0				3
E. Settlements	276	NE,NO	NE,NO				276
F. Other Land	NE,NO	NO	NO				NE,NO
G. Other	12	NO	NO				12
6. Waste	**0**	**1 657**	**116**				**1 774**
A. Solid Waste Disposal on Land	NA	1 640					1 640
B. Waste-water Handling		18	116				134
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [(4)]							
International Bunkers	2 170	2	18				2 190
Aviation	603	0	6				609
Marine	1 567	2	12				1 581
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 103**						**4 103**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	45 964
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	36 235

(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 2012 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]	**25 508**	**4 828**	**4 280**	**2**	**2 298**	**738**	**37 654**
1. Energy	**29 585**	**862**	**323**				**30 771**
A. Fuel Combustion (Sectoral Approach)	27 049	265	320				27 633
1. Energy Industries	8 105	57	33				8 195
2. Manufacturing Industries and Construction	3 583	10	48				3 641
3. Transport	11 634	76	156				11 865
4. Other Sectors	3 361	121	77				3 559
5. Other	367	0	5				372
B. Fugitive Emissions from Fuels	2 537	598	3				3 138
1. Solid Fuels	7	55	NA,NO				63
2. Oil and Natural Gas	2 530	543	3				3 075
2. Industrial Processes	**6 072**	**9**	**1 590**	**2**	**2 298**	**738**	**10 709**
A. Mineral Products	914	NA	NA				914
B. Chemical Industry	989	8	1 585	NO	NO	NO	2 583
C. Metal Production	4 042	1	5	NO	2 298	663	7 009
D. Other Production	127						127
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				2	NA,NO	74	77
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**141**		**36**				**177**
4. Agriculture		**2 309**	**2 198**				**4 507**
A. Enteric Fermentation		1 990					1 990
B. Manure Management		306	139				445
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	2 053				2 053
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		13	5				19
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-10 291**	**0**	**14**				**-10 276**
A. Forest Land	-12 822	0	13				-12 808
B. Cropland	364	IE,NO	0				364
C. Grassland	1 864	NO	NO				1 864
D. Wetlands	3	NE,NO	0				3
E. Settlements	288	NE,NO	NE,NO				288
F. Other Land	NE,NO	NO	NO				NE,NO
G. Other	12	NO	NO				12
6. Waste	**0**	**1 647**	**119**				**1 767**
A. Solid Waste Disposal on Land	NA	1 630					1 630
B. Waste-water Handling		17	119				136
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 312	3	19				2 334
Aviation	635	0	6				642
Marine	1 677	3	13				1 693
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 419**						**4 419**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	47 931
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	37 654

[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 2012 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]	**26 644**	**4 896**	**4 372**	**9**	**2 032**	**878**	**38 832**
1. Energy	**31 096**	**902**	**355**				**32 352**
A. Fuel Combustion (Sectoral Approach)	28 432	272	351				29 056
1. Energy Industries	8 788	59	36				8 882
2. Manufacturing Industries and Construction	4 146	12	59				4 217
3. Transport	11 485	73	176				11 734
4. Other Sectors	3 506	128	73				3 708
5. Other	508	0	7				515
B. Fugitive Emissions from Fuels	2 663	629	4				3 296
1. Solid Fuels	7	55	NA,NO				62
2. Oil and Natural Gas	2 656	574	4				3 234
2. Industrial Processes	**6 459**	**10**	**1 646**	**9**	**2 032**	**878**	**11 034**
A. Mineral Products	928	NA	NA				928
B. Chemical Industry	1 078	9	1 641	NO	NO	NO	2 728
C. Metal Production	4 326	1	6	NO	2 032	791	7 157
D. Other Production	126						126
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				9	NA,NO	87	96
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**152**		**38**				**190**
4. Agriculture		**2 344**	**2 194**				**4 537**
A. Enteric Fermentation		2 025					2 025
B. Manure Management		309	146				455
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	2 044				2 044
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		10	4				13
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-11 062**	**0**	**14**				**-11 048**
A. Forest Land	-13 539	0	13				-13 526
B. Cropland	318	IE,NO	0				318
C. Grassland	1 842	NO	NO				1 842
D. Wetlands	3	NE,NO	0				3
E. Settlements	299	NE,NO	NE,NO				299
F. Other Land	NE,NO	NO	NO				NE,NO
G. Other	15	NO	NO				15
6. Waste	**0**	**1 641**	**124**				**1 765**
A. Solid Waste Disposal on Land	NA	1 625					1 625
B. Waste-water Handling		16	124				140
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 462	3	20				2 486
Aviation	617	0	6				623
Marine	1 846	3	14				1 863
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 738**						**4 738**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	49 880
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	38 832

[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 2012 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]	**26 332**	**4 869**	**4 428**	**26**	**2 008**	**608**	**38 271**
1. Energy	**30 964**	**885**	**376**				**32 225**
A. Fuel Combustion (Sectoral Approach)	28 336	267	373				28 975
1. Energy Industries	8 647	59	36				8 742
2. Manufacturing Industries and Construction	3 855	12	62				3 929
3. Transport	11 880	70	197				12 147
4. Other Sectors	3 499	125	71				3 696
5. Other	454	0	7				461
B. Fugitive Emissions from Fuels	2 628	618	4				3 250
1. Solid Fuels	7	54	NA,NO				61
2. Oil and Natural Gas	2 621	564	4				3 189
2. Industrial Processes	**6 666**	**10**	**1 643**	**26**	**2 008**	**608**	**10 961**
A. Mineral Products	972	NA	NA				972
B. Chemical Industry	1 112	9	1 637	NO	NO	NO	2 758
C. Metal Production	4 449	1	6	NO	2 008	509	6 972
D. Other Production	134						134
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				26	0	99	125
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**148**		**39**				**187**
4. Agriculture		**2 370**	**2 229**				**4 600**
A. Enteric Fermentation		2 044					2 044
B. Manure Management		314	147				462
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	2 077				2 077
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		12	5				17
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-11 446**	**0**	**14**				**-11 432**
A. Forest Land	-13 943	0	13				-13 930
B. Cropland	340	IE,NO	0				341
C. Grassland	1 827	NO	NO				1 827
D. Wetlands	3	NE,NO	0				3
E. Settlements	309	NE,NO	NE,NO				309
F. Other Land	NE,NO	NO	NO				NE,NO
G. Other	19	NO	NO				19
6. Waste	**0**	**1 603**	**127**				**1 731**
A. Solid Waste Disposal on Land	NA	1 588					1 588
B. Waste-water Handling		15	127				143
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 841	4	23				2 868
Aviation	586	0	6				591
Marine	2 256	3	18				2 277
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 846**						**4 846**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	49 703
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	38 271

[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 2012 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]	**28 769**	**4 879**	**4 471**	**52**	**1 829**	**574**	**40 575**
1. Energy	**34 215**	**918**	**411**				**35 545**
A. Fuel Combustion (Sectoral Approach)	31 165	276	407				31 847
1. Energy Industries	9 694	63	38				9 796
2. Manufacturing Industries and Construction	4 382	12	62				4 455
3. Transport	12 452	66	228				12 746
4. Other Sectors	4 230	134	73				4 438
5. Other	407	0	5				412
B. Fugitive Emissions from Fuels	3 051	643	4				3 697
1. Solid Fuels	7	56	NA,NO				63
2. Oil and Natural Gas	3 043	587	4				3 635
2. Industrial Processes	**6 653**	**10**	**1 625**	**52**	**1 829**	**574**	**10 743**
A. Mineral Products	971	NA	NA				971
B. Chemical Industry	1 107	9	1 618	NO	NO	NO	2 734
C. Metal Production	4 439	1	6	NO	1 829	473	6 748
D. Other Production	135						135
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				52	0	102	154
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**156**		**40**				**196**
4. Agriculture		**2 380**	**2 249**				**4 629**
A. Enteric Fermentation		2 047					2 047
B. Manure Management		320	149				469
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	2 095				2 095
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		13	5				18
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-12 255**	**1**	**14**				**-12 241**
A. Forest Land	-14 729	1	13				-14 715
B. Cropland	316	IE,NO	0				317
C. Grassland	1 811	NO	NO				1 811
D. Wetlands	3	NE,NO	0				3
E. Settlements	318	NE,NO	NE,NO				318
F. Other Land	NE,NO	NO	NO				NE,NO
G. Other	25	NO	NO				25
6. Waste	**0**	**1 569**	**134**				**1 703**
A. Solid Waste Disposal on Land	NA	1 555					1 555
B. Waste-water Handling		14	134				148
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 172	4	26				3 202
Aviation	691	0	7				698
Marine	2 480	4	19				2 503
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 870**						**4 870**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	52 816
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	40 575

[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 2012 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]	**28 299**	**4 895**	**4 471**	**87**	**1 633**	**580**	**39 964**
1. Energy	**34 118**	**988**	**418**				**35 524**
A. Fuel Combustion (Sectoral Approach)	31 321	282	414				32 016
1. Energy Industries	10 061	67	38				10 166
2. Manufacturing Industries and Construction	4 342	12	64				4 418
3. Transport	12 699	64	233				12 996
4. Other Sectors	3 794	138	72				4 004
5. Other	425	0	7				432
B. Fugitive Emissions from Fuels	2 798	706	4				3 508
1. Solid Fuels	6	49	NA,NO				55
2. Oil and Natural Gas	2 792	657	4				3 453
2. Industrial Processes	**6 862**	**12**	**1 612**	**87**	**1 633**	**580**	**10 785**
A. Mineral Products	1 032	NA,NO	NA,NO				1 032
B. Chemical Industry	1 087	11	1 605	NO	NO	NO	2 703
C. Metal Production	4 590	1	6	NO	1 633	437	6 668
D. Other Production	152						152
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				87	0	142	229
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**151**		**39**				**190**
4. Agriculture		**2 363**	**2 246**				**4 609**
A. Enteric Fermentation		2 032					2 032
B. Manure Management		321	144				465
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	2 098				2 098
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		9	4				13
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-12 832**	**2**	**14**				**-12 817**
A. Forest Land	-15 295	2	13				-15 280
B. Cropland	309	IE,NO	0				309
C. Grassland	1 796	NO	NO				1 796
D. Wetlands	3	NE,NO	0				3
E. Settlements	327	NE,NO	NE,NO				327
F. Other Land	NE,NO	NO	NO				NE,NO
G. Other	27	NO	NO				27
6. Waste	**0**	**1 531**	**142**				**1 673**
A. Solid Waste Disposal on Land	NA	1 518					1 518
B. Waste-water Handling		13	142				156
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 773	5	31				3 809
Aviation	771	0	8				779
Marine	3 002	5	23				3 030
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 081**						**5 081**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	52 781
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	39 964

[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 2012 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]	**27 453**	**4 757**	**4 508**	**130**	**1 486**	**727**	**39 060**
1. Energy	**34 188**	**936**	**375**				**35 499**
A. Fuel Combustion (Sectoral Approach)	31 300	269	371				31 940
1. Energy Industries	9 750	65	38				9 852
2. Manufacturing Industries and Construction	4 471	12	50				4 533
3. Transport	12 861	60	201				13 122
4. Other Sectors	3 859	132	74				4 066
5. Other	360	0	8				368
B. Fugitive Emissions from Fuels	2 888	667	4				3 559
1. Solid Fuels	7	51	NA,NO				57
2. Oil and Natural Gas	2 881	617	4				3 502
2. Industrial Processes	**6 973**	**12**	**1 693**	**130**	**1 486**	**727**	**11 020**
A. Mineral Products	1 013	NA,NO	NA,NO				1 013
B. Chemical Industry	906	11	1 687	NO	NO	NO	2 603
C. Metal Production	4 952	1	7	NO	1 485	582	7 028
D. Other Production	103						103
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				130	0	145	275
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**151**		**40**				**190**
4. Agriculture		**2 383**	**2 245**				**4 628**
A. Enteric Fermentation		2 048					2 048
B. Manure Management		325	144				469
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	2 097				2 097
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		10	4				14
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-13 860**	**1**	**14**				**-13 845**
A. Forest Land	-16 282	1	13				-16 268
B. Cropland	288	IE,NO	0				288
C. Grassland	1 769	NO	NO				1 769
D. Wetlands	3	NE,NO	0				3
E. Settlements	339	NE,NO	NE,NO				339
F. Other Land	NE,NO	NO	NO				NE,NO
G. Other	23	NO	NO				23
6. Waste	**0**	**1 425**	**142**				**1 567**
A. Solid Waste Disposal on Land	NA	1 412					1 412
B. Waste-water Handling		13	142				155
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 687	5	30				3 722
Aviation	821	0	8				830
Marine	2 866	4	22				2 893
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 710**						**4 710**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	52 905
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	39 060

[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 2012 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]	**27 925**	**4 605**	**4 710**	**181**	**1 388**	**874**	**39 684**
1. Energy	**35 112**	**910**	**405**				**36 427**
A. Fuel Combustion (Sectoral Approach)	31 608	265	400				32 273
1. Energy Industries	9 714	60	38				9 812
2. Manufacturing Industries and Construction	4 090	12	42				4 144
3. Transport	13 460	58	240				13 757
4. Other Sectors	3 952	135	74				4 161
5. Other	392	0	6				398
B. Fugitive Emissions from Fuels	3 504	644	5				4 154
1. Solid Fuels	8	65	NA,NO				73
2. Oil and Natural Gas	3 496	580	5				4 081
2. Industrial Processes	**6 886**	**10**	**1 923**	**181**	**1 388**	**874**	**11 262**
A. Mineral Products	980	NA,NO	NA,NO				980
B. Chemical Industry	771	9	1 917	NO	NO	NO	2 696
C. Metal Production	5 056	1	6	NO	1 388	725	7 178
D. Other Production	79						79
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				181	0	149	329
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**148**		**40**				**188**
4. Agriculture		**2 373**	**2 185**				**4 558**
A. Enteric Fermentation		2 043					2 043
B. Manure Management		322	144				466
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	2 037				2 037
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		9	3				12
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-14 221**	**0**	**14**				**-14 207**
A. Forest Land	-17 210	0	13				-17 197
B. Cropland	385	IE,NO	0				385
C. Grassland	1 767	NO	NO				1 767
D. Wetlands	3	NE,NO	0				3
E. Settlements	808	NE,NO	NE,NO				808
F. Other Land	NE,NO	NO	NO				NE,NO
G. Other	26	NO	NO				26
6. Waste	**0**	**1 312**	**143**				**1 455**
A. Solid Waste Disposal on Land	NA	1 300					1 300
B. Waste-water Handling		12	143				155
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 620	4	30				3 654
Aviation	942	0	9				951
Marine	2 678	4	21				2 703
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 896**						**4 896**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 890
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	39 684

[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 2012 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]	**22 660**	**4 734**	**4 488**	**238**	**1 318**	**934**	**34 373**
1. Energy	**34 271**	**1 023**	**366**				**35 660**
A. Fuel Combustion (Sectoral Approach)	30 556	268	361				31 186
1. Energy Industries	10 653	66	37				10 756
2. Manufacturing Industries and Construction	3 834	11	39				3 883
3. Transport	12 635	54	211				12 900
4. Other Sectors	3 257	137	70				3 464
5. Other	178	0	4				182
B. Fugitive Emissions from Fuels	3 714	755	5				4 474
1. Solid Fuels	9	71	NA,NO				80
2. Oil and Natural Gas	3 705	684	5				4 394
2. Industrial Processes	**7 332**	**10**	**1 739**	**238**	**1 318**	**934**	**11 571**
A. Mineral Products	984	NA,NO	NA,NO				984
B. Chemical Industry	1 045	9	1 733	NO	NO	NO	2 787
C. Metal Production	5 071	1	6	NO	1 318	773	7 169
D. Other Production	232						232
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				238	0	161	400
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**142**		**40**				**182**
4. Agriculture		**2 340**	**2 200**				**4 540**
A. Enteric Fermentation		2 011					2 011
B. Manure Management		319	147				466
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	2 050				2 050
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		9	4				13
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-19 084**	**0**	**13**				**-19 070**
A. Forest Land	-21 789	0	13				-21 776
B. Cropland	142	IE,NO	0				143
C. Grassland	1 757	NO	NO				1 757
D. Wetlands	3	NE,NO	0				3
E. Settlements	776	NE,NO	NE,NO				776
F. Other Land	NE,NO	NO	NO				NE,NO
G. Other	26	NO	NO				26
6. Waste	**0**	**1 360**	**130**				**1 491**
A. Solid Waste Disposal on Land	NA	1 349					1 349
B. Waste-water Handling		11	130				141
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 515	4	29				3 548
Aviation	913	0	9				922
Marine	2 602	4	20				2 626
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**4 744**						**4 744**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 443
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	34 373

[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 2012 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)]	**22 312**	**4 740**	**4 392**	**304**	**1 329**	**791**	**33 868**
1. Energy	**36 042**	**1 129**	**396**				**37 567**
A. Fuel Combustion (Sectoral Approach)	32 624	278	391				33 294
1. Energy Industries	11 889	73	39				12 001
2. Manufacturing Industries and Construction	3 902	12	45				3 959
3. Transport	12 926	50	222				13 198
4. Other Sectors	3 612	143	80				3 836
5. Other	295	0	4				299
B. Fugitive Emissions from Fuels	3 418	851	4				4 273
1. Solid Fuels	8	64	NA,NO				73
2. Oil and Natural Gas	3 410	786	4				4 200
2. Industrial Processes	**6 924**	**10**	**1 689**	**304**	**1 329**	**791**	**11 047**
A. Mineral Products	944	NA,NO	NA,NO				944
B. Chemical Industry	1 015	9	1 683	NO	NO	NO	2 707
C. Metal Production	4 748	1	6	NO	1 329	645	6 728
D. Other Production	217						217
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [(2)]				304	0	146	450
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**144**		**40**				**184**
4. Agriculture		**2 294**	**2 122**				**4 417**
A. Enteric Fermentation		1 976					1 976
B. Manure Management		311	146				457
C. Rice Cultivation		NO					NO
D. Agricultural Soils [(3)]		NA,NO	1 974				1 974
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		7	3				10
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [(1)]	**-20 799**	**0**	**13**				**-20 786**
A. Forest Land	-23 517	0	13				-23 505
B. Cropland	243	IE,NO	0				243
C. Grassland	1 751	NO	NO				1 751
D. Wetlands	3	NE,NO	0				3
E. Settlements	698	NE,NO	NE,NO				698
F. Other Land	IE,NE,NO	NO	NO				IE,NE,NO
G. Other	24	NO	NO				24
6. Waste	**0**	**1 306**	**133**				**1 439**
A. Solid Waste Disposal on Land	NA	1 296					1 296
B. Waste-water Handling		10	133				142
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [(4)]							
International Bunkers	3 429	4	28				3 462
Aviation	835	0	8				844
Marine	2 594	4	20				2 618
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 187**						**5 187**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	54 654
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	33 868

(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 2012 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]	**16 487**	**4 572**	**4 580**	**363**	**1 438**	**238**	**27 677**
1. Energy	**35 736**	**1 066**	**387**				**37 189**
A. Fuel Combustion (Sectoral Approach)	32 819	297	384				33 500
1. Energy Industries	12 131	76	41				12 248
2. Manufacturing Industries and Construction	3 687	11	43				3 741
3. Transport	12 768	47	219				13 034
4. Other Sectors	3 779	163	78				4 020
5. Other	453	0	5				458
B. Fugitive Emissions from Fuels	2 917	769	3				3 689
1. Solid Fuels	8	59	NA,NO				67
2. Oil and Natural Gas	2 909	709	3				3 622
2. Industrial Processes	**6 363**	**12**	**1 914**	**363**	**1 438**	**238**	**10 328**
A. Mineral Products	970	NA,NO	NA,NO				970
B. Chemical Industry	899	11	1 910	NO	NO	NO	2 819
C. Metal Production	4 261	1	5	NO	1 438	142	5 845
D. Other Production	234						234
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				363	0	97	459
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**147**		**40**				**187**
4. Agriculture		**2 247**	**2 100**				**4 347**
A. Enteric Fermentation		1 936					1 936
B. Manure Management		305	142				447
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	1 956				1 956
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		6	2				8
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-25 759**	**0**	**13**				**-25 746**
A. Forest Land	-28 190	0	13				-28 176
B. Cropland	181	IE,NO	0				181
C. Grassland	1 716	NO	NO				1 716
D. Wetlands	3	NE,NO	0				3
E. Settlements	511	NE,NO	NE,NO				511
F. Other Land	IE,NE,NO	NO	NO				IE,NE,NO
G. Other	19	NO	NO				19
6. Waste	**0**	**1 247**	**125**				**1 372**
A. Solid Waste Disposal on Land	NA	1 238					1 238
B. Waste-water Handling		9	125				133
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 808	3	23				2 835
Aviation	740	0	7				747
Marine	2 068	3	16				2 088
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 310**						**5 310**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 423
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	27 677

[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 2012 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]	**15 384**	**4 668**	**4 418**	**403**	**909**	**228**	**26 011**
1. Energy	**37 004**	**1 124**	**402**				**38 530**
A. Fuel Combustion (Sectoral Approach)	34 174	304	399				34 878
1. Energy Industries	12 831	82	44				12 957
2. Manufacturing Industries and Construction	3 984	11	44				4 040
3. Transport	13 118	49	230				13 396
4. Other Sectors	4 068	162	79				4 309
5. Other	172	0	2				174
B. Fugitive Emissions from Fuels	2 830	820	3				3 653
1. Solid Fuels	12	91	NA,NO				103
2. Oil and Natural Gas	2 818	729	3				3 550
2. Industrial Processes	**6 449**	**8**	**1 715**	**403**	**909**	**228**	**9 713**
A. Mineral Products	1 022	NA,NO	NA,NO				1 022
B. Chemical Industry	939	7	1 711	NO	NO	NO	2 658
C. Metal Production	4 256	1	4	NO	909	172	5 343
D. Other Production	232						232
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				403	0	56	459
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**150**		**41**				**191**
4. Agriculture		**2 301**	**2 116**				**4 416**
A. Enteric Fermentation		1 988					1 988
B. Manure Management		308	127				435
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	1 987				1 987
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		5	2				6
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-28 219**	**2**	**13**				**-28 204**
A. Forest Land	-30 910	2	12				-30 896
B. Cropland	308	IE,NO	0				309
C. Grassland	1 746	NO	NO				1 746
D. Wetlands	3	NE,NO	0				3
E. Settlements	615	NE,NO	NE,NO				615
F. Other Land	IE,NE,NO	NO	NO				IE,NE,NO
G. Other	18	NO	NO				18
6. Waste	**0**	**1 233**	**132**				**1 365**
A. Solid Waste Disposal on Land	NA	1 225					1 225
B. Waste-water Handling		8	132				139
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 804	3	23				2 830
Aviation	747	0	7				755
Marine	2 056	3	16				2 075
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 430**						**5 430**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	54 215
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	26 011

[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 2012 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]	**16 583**	**4 647**	**4 579**	**439**	**880**	**276**	**27 404**
1. Energy	**36 945**	**1 152**	**413**				**38 510**
A. Fuel Combustion (Sectoral Approach)	34 255	298	410				34 963
1. Energy Industries	12 935	85	42				13 062
2. Manufacturing Industries and Construction	3 767	11	43				3 821
3. Transport	13 585	50	242				13 877
4. Other Sectors	3 638	152	79				3 870
5. Other	330	0	3				334
B. Fugitive Emissions from Fuels	2 691	854	3				3 548
1. Solid Fuels	8	58	NA,NO				66
2. Oil and Natural Gas	2 683	796	3				3 482
2. Industrial Processes	**6 944**	**7**	**1 854**	**439**	**880**	**276**	**10 401**
A. Mineral Products	835	NA,NO	NA,NO				835
B. Chemical Industry	978	6	1 849	NO	NO	NO	2 833
C. Metal Production	4 888	1	5	NO	880	206	5 980
D. Other Production	243						243
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				439	0	71	510
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**153**		**41**				**194**
4. Agriculture		**2 259**	**2 126**				**4 385**
A. Enteric Fermentation		1 943					1 943
B. Manure Management		311	126				436
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	1 998				1 998
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		5	2				7
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-27 460**	**0**	**12**				**-27 447**
A. Forest Land	-30 375	0	12				-30 362
B. Cropland	137	IE,NO	0				138
C. Grassland	1 691	NO	NO				1 691
D. Wetlands	3	NE,NO	0				3
E. Settlements	1 067	NE,NO	NE,NO				1 067
F. Other Land	IE,NE,NO	NO	NO				IE,NE,NO
G. Other	16	NO	NO				16
6. Waste	**0**	**1 228**	**132**				**1 360**
A. Solid Waste Disposal on Land	NA	1 219					1 219
B. Waste-water Handling		9	132				141
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 816	3	24				2 843
Aviation	847	0	8				855
Marine	1 969	3	15				1 987
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 213**						**5 213**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	54 851
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	27 404

[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 2012 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]	**13 148**	**4 461**	**4 643**	**482**	**829**	**312**	**23 875**
1. Energy	**36 437**	**1 021**	**364**				**37 822**
A. Fuel Combustion (Sectoral Approach)	33 839	293	361				34 493
1. Energy Industries	13 197	83	41				13 321
2. Manufacturing Industries and Construction	3 533	11	37				3 581
3. Transport	13 503	48	199				13 750
4. Other Sectors	3 316	151	80				3 548
5. Other	289	0	3				292
B. Fugitive Emissions from Fuels	2 598	728	3				3 330
1. Solid Fuels	7	42	NA,NO				49
2. Oil and Natural Gas	2 592	686	3				3 281
2. Industrial Processes	**6 472**	**7**	**1 960**	**482**	**829**	**312**	**10 062**
A. Mineral Products	896	NA,NO	NA,NO				896
B. Chemical Industry	722	6	1 956	NO	NO	NO	2 684
C. Metal Production	4 654	1	5	NO	829	240	5 728
D. Other Production	200						200
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				482	0	72	554
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**142**		**41**				**184**
4. Agriculture		**2 275**	**2 131**				**4 406**
A. Enteric Fermentation		1 955					1 955
B. Manure Management		315	126				441
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	2 003				2 003
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		5	2				7
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-29 904**	**1**	**13**				**-29 890**
A. Forest Land	-32 876	1	13				-32 862
B. Cropland	267	IE,NO	0				267
C. Grassland	1 683	NO	NO				1 683
D. Wetlands	3	NE,NO	0				3
E. Settlements	1 001	NE,NO	NE,NO				1 001
F. Other Land	IE,NE,NO	NO	NO				IE,NE,NO
G. Other	17	NO	NO				17
6. Waste	**0**	**1 157**	**134**				**1 291**
A. Solid Waste Disposal on Land	NA	1 148					1 148
B. Waste-water Handling		9	134				143
C. Waste Incineration	0	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 344	4	28				3 376
Aviation	1 080	0	11				1 091
Marine	2 264	3	18				2 285
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 336**						**5 336**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 765
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	23 875

[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 2012 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]	**18 840**	**4 333**	**4 302**	**520**	**742**	**212**	**28 949**
1. Energy	**37 250**	**950**	**388**				**38 588**
A. Fuel Combustion (Sectoral Approach)	34 733	293	385				35 411
1. Energy Industries	13 194	83	42				13 319
2. Manufacturing Industries and Construction	3 822	11	40				3 874
3. Transport	14 122	47	221				14 389
4. Other Sectors	3 317	151	79				3 548
5. Other	278	0	3				281
B. Fugitive Emissions from Fuels	2 517	657	3				3 177
1. Solid Fuels	5	41	NA,NO				46
2. Oil and Natural Gas	2 512	616	3				3 131
2. Industrial Processes	**6 124**	**7**	**1 630**	**520**	**742**	**212**	**9 236**
A. Mineral Products	937	NA	NA				937
B. Chemical Industry	881	6	1 627	NO	NO	NO	2 514
C. Metal Production	4 096	1	3	NO	742	120	4 962
D. Other Production	210						210
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				520	0	92	612
G. Other	IE	NO	NO	NO	NO	NO	IE,NO
3. Solvent and Other Product Use	**132**		**42**				**174**
4. Agriculture		**2 194**	**2 088**				**4 281**
A. Enteric Fermentation		1 883					1 883
B. Manure Management		307	133				439
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	1 954				1 954
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		4	2				6
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-24 666**	**7**	**13**				**-24 645**
A. Forest Land	-27 523	7	13				-27 503
B. Cropland	126	IE,NO	0				127
C. Grassland	1 675	NO	NO				1 675
D. Wetlands	3	NE,NO	0				3
E. Settlements	1 034	NE,NO	NE,NO				1 034
F. Other Land	IE,NE,NO	NO	NO				IE,NE,NO
G. Other	19	NO	NO				19
6. Waste	**IE,NA,NO**	**1 175**	**140**				**1 315**
A. Solid Waste Disposal on Land	NA	1 165					1 165
B. Waste-water Handling		10	140				150
C. Waste Incineration	IE,NA,NO	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 508	4	30				3 542
Aviation	1 244	0	12				1 257
Marine	2 264	3	18				2 285
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 403**						**5 403**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 594
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	28 949

[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.

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(Sheet 1 of 1)

Inventory 2007
Submission 2012 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]	**16 882**	**4 471**	**4 129**	**565**	**821**	**76**	**26 943**
1. Energy	**38 949**	**1 081**	**423**				**40 453**
A. Fuel Combustion (Sectoral Approach)	35 221	313	417				35 950
1. Energy Industries	13 529	84	43				13 656
2. Manufacturing Industries and Construction	3 475	11	41				3 527
3. Transport	14 897	70	253				15 220
4. Other Sectors	3 110	148	78				3 336
5. Other	210	0	2				212
B. Fugitive Emissions from Fuels	3 728	768	7				4 503
1. Solid Fuels	9	66	NA,NO				74
2. Oil and Natural Gas	3 720	702	7				4 429
2. Industrial Processes	**6 390**	**6**	**1 381**	**565**	**821**	**76**	**9 240**
A. Mineral Products	996	NA	NA				996
B. Chemical Industry	828	6	1 378	NO	NO	NO	2 212
C. Metal Production	4 401	1	3	NO	821	NO	5 225
D. Other Production	165						165
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				565	0	76	641
G. Other	IE	NO	NO	NA,NO	NA,NO	NO	IE,NA,NO
3. Solvent and Other Product Use	**133**		**42**				**175**
4. Agriculture		**2 235**	**2 123**				**4 359**
A. Enteric Fermentation		1 917					1 917
B. Manure Management		314	127				441
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	1 995				1 995
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		4	2				6
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-28 591**	**0**	**13**				**-28 578**
A. Forest Land	-30 673	0	12				-30 661
B. Cropland	97	IE,NO	0				97
C. Grassland	1 644	NO	NO				1 644
D. Wetlands	3	NE,NO	0				3
E. Settlements	321	NE,NO	NE,NO				321
F. Other Land	IE,NE,NO	NO	NO				IE,NE,NO
G. Other	16	NO	NO				16
6. Waste	**IE,NA,NO**	**1 147**	**147**				**1 294**
A. Solid Waste Disposal on Land	NA	1 138					1 138
B. Waste-water Handling		10	147				156
C. Waste Incineration	IE,NA,NO	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 235	3	28				3 266
Aviation	1 158	0	11				1 170
Marine	2 077	3	16				2 096
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 513**						**5 513**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	55 521
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	26 943

[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
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Inventory 2008
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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]	**9 657**	**4 357**	**3 650**	**624**	**773**	**65**	**19 126**
1. Energy	**37 617**	**1 014**	**409**				**39 040**
A. Fuel Combustion (Sectoral Approach)	34 582	323	403				35 308
1. Energy Industries	13 558	88	46				13 692
2. Manufacturing Industries and Construction	3 465	12	42				3 519
3. Transport	14 350	75	234				14 659
4. Other Sectors	2 957	147	77				3 181
5. Other	253	0	4				257
B. Fugitive Emissions from Fuels	3 035	692	6				3 733
1. Solid Fuels	6	45	NA,NO				51
2. Oil and Natural Gas	3 029	647	6				3 681
2. Industrial Processes	**6 626**	**6**	**939**	**624**	**773**	**65**	**9 034**
A. Mineral Products	1 016	NA	NA				1 016
B. Chemical Industry	876	6	935	NO	NO	NO	1 816
C. Metal Production	4 535	1	4	NO	773	NO	5 313
D. Other Production	199						199
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				624	0	65	689
G. Other	IE	NO	NO	NA,NO	NA,NO	NO	IE,NA,NO
3. Solvent and Other Product Use	**127**		**43**				**170**
4. Agriculture		**2 231**	**2 094**				**4 325**
A. Enteric Fermentation		1 910					1 910
B. Manure Management		316	129				445
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	1 963				1 963
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		5	2				7
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-34 713**	**6**	**13**				**-34 694**
A. Forest Land	-37 236	6	13				-37 217
B. Cropland	83	IE,NO	0				83
C. Grassland	1 631	NO	NO				1 631
D. Wetlands	3	NE,NO	0				3
E. Settlements	786	NE,NO	NE,NO				786
F. Other Land	IE,NE,NO	NO	NO				IE,NE,NO
G. Other	19	NO	NO				19
6. Waste	**IE,NA,NO**	**1 099**	**152**				**1 251**
A. Solid Waste Disposal on Land	NA	1 088					1 088
B. Waste-water Handling		10	152				163
C. Waste Incineration	IE,NA,NO	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	3 232	4	28				3 263
Aviation	1 150	0	11				1 162
Marine	2 082	3	16				2 101
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 597**						**5 597**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 820
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	19 126

[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 2009
Submission 2012 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]	**15 893**	**4 327**	**3 120**	**708**	**377**	**61**	**24 485**
1. Energy	**37 562**	**991**	**388**				**38 941**
A. Fuel Combustion (Sectoral Approach)	35 162	336	384				35 882
1. Energy Industries	14 323	94	48				14 465
2. Manufacturing Industries and Construction	3 236	10	33				3 278
3. Transport	14 088	80	221				14 389
4. Other Sectors	3 251	151	78				3 481
5. Other	264	0	4				268
B. Fugitive Emissions from Fuels	2 399	656	3				3 059
1. Solid Fuels	5	35	NA,NO				40
2. Oil and Natural Gas	2 395	620	3				3 019
2. Industrial Processes	**5 226**	**5**	**465**	**708**	**377**	**61**	**6 842**
A. Mineral Products	1 012	NA	NA				1 012
B. Chemical Industry	742	4	461	NO	NO	NO	1 208
C. Metal Production	3 291	1	4	NO	377	NO	3 672
D. Other Production	181						181
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				708	0	61	769
G. Other	IE	NO	NO	NA,NO	NA,NO	NO	IE,NA,NO
3. Solvent and Other Product Use	**106**		**44**				**151**
4. Agriculture		**2 214**	**2 050**				**4 264**
A. Enteric Fermentation		1 895					1 895
B. Manure Management		315	130				445
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	1 919				1 919
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		3	1				5
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-27 001**	**3**	**13**				**-26 985**
A. Forest Land	-29 254	3	13				-29 239
B. Cropland	67	IE,NO	0				67
C. Grassland	1 618	NO	NO				1 618
D. Wetlands	3	NE,NO	0				3
E. Settlements	548	NE,NO	NE,NO				548
F. Other Land	IE,NE,NO	NO	NO				IE,NE,NO
G. Other	17	NO	NO				17
6. Waste	**IE,NA,NO**	**1 114**	**159**				**1 273**
A. Solid Waste Disposal on Land	NA	1 104					1 104
B. Waste-water Handling		9	159				169
C. Waste Incineration	IE,NA,NO	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 854	3	24				2 882
Aviation	1 094	0	11				1 105
Marine	1 761	3	14				1 777
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**5 081**						**5 081**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	51 470
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	24 485

[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)

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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]	**12 496**	**4 347**	**3 081**	**747**	**205**	**75**	**20 951**
1. Energy	**39 245**	**1 038**	**443**				**40 726**
A. Fuel Combustion (Sectoral Approach)	36 714	364	440				37 518
1. Energy Industries	14 748	100	51				14 899
2. Manufacturing Industries and Construction	3 555	12	44				3 612
3. Transport	14 800	83	259				15 142
4. Other Sectors	3 343	168	80				3 592
5. Other	267	0	5				272
B. Fugitive Emissions from Fuels	2 531	674	4				3 209
1. Solid Fuels	4	31	NA,NO				36
2. Oil and Natural Gas	2 527	643	4				3 173
2. Industrial Processes	**6 084**	**7**	**361**	**747**	**205**	**75**	**7 479**
A. Mineral Products	1 029	NA	NA				1 029
B. Chemical Industry	845	5	356	NO	NO	NO	1 206
C. Metal Production	4 028	1	5	NO	205	NO	4 239
D. Other Production	182						182
E. Production of Halocarbons and SF_6				NA,NO	NA,NO	NA,NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				747	0	75	822
G. Other	IE	NO	NO	NA,NO	NA,NO	NO	IE,NA,NO
3. Solvent and Other Product Use	**125**		**44**				**170**
4. Agriculture		**2 211**	**2 062**				**4 273**
A. Enteric Fermentation		1 892					1 892
B. Manure Management		315	130				445
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NA,NO	1 930				1 930
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		4	2				6
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-32 959**	**1**	**13**				**-32 944**
A. Forest Land	-35 876	1	12				-35 862
B. Cropland	67	IE,NO	0				68
C. Grassland	1 680	NO	NO				1 680
D. Wetlands	3	NE,NO	0				3
E. Settlements	1 155	NE,NO	NE,NO				1 155
F. Other Land	IE,NE,NO	NO	NO				IE,NE,NO
G. Other	12	NO	NO				12
6. Waste	**IE,NA,NO**	**1 090**	**157**				**1 248**
A. Solid Waste Disposal on Land	NA	1 081					1 081
B. Waste-water Handling		9	157				167
C. Waste Incineration	IE,NA,NO	0	0				0
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	2 692	3	24				2 719
Aviation	1 301	0	13				1 314
Marine	1 391	2	11				1 404
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**6 264**						**6 264**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	53 896
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	20 951

[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 VII: Harvested wood products

1. Description

In the current accounting system, emissions of CO_2 from harvested wood products (HWP) 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 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, HWP 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, HWP will act as a source and emissions of CO_2 is recorded.

In Norway, as in many other countries, the stock of HWP 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 HWP. 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. In 2010 and 2011, emissions/removals of CO_2 due to harvested wood products, were estimated using the *stock change approach* (SCA). However, due to the Durban decision not to include imported wood products (Decision 2/CMP.7), the SCA approach could no longer be used and was thus replace by the *production approach* (PA) for the reporting to the UNFCCC. The whole time-series has hence been recalculated.

In the PA all domestically harvested wood is accounted for, including the amount that is exported. The exported HWP will thus remain in the inventory reported by the exporting country. The exporting country will therefore include the exported wood residing in other countries in its reporting, while imported wood thus does not need to be accounted for. This is in accordance with the Durban decision.

Inflow to HWP from domestic harvest ($\Delta C_{HWP\ IU\ DH}$)

The inflow to HWP products produced annually from domestic harvest is estimated by:

$$Inflow_{DH} = P \bullet \left[\frac{IRW_H}{IRW_H + IRW_{IM} - IRW_{EX} + WCH_{IM} - WCH_{EX} + WR_{IM} - WR_{EX}} \right]$$

Where:

$Inflow_{DH}$ = Carbon in annual consumption of solid wood or paper products that came from wood harvested domestically [Gg C yr^{-1}]

P = Carbon in annual production of solid wood or paper products [Gg C yr^{-1}]

IRW_H = Industrial roundwood harvest. This is the harvest of wood to make solid wood and paper products including IRW for export [Gg C yr^{-1}]

IRW_{IM} = Industrial roundwood imports [Gg C yr^{-1}]

IRW_{EX} = Industrial roundwood exports [Gg C yr^{-1}]

WCH_{IM} = Wood chip imports [Gg C yr^{-1}]

WCH_{EX} = Wood chip exports [Gg C yr^{-1}]

WR_{IM} = Wood residues from wood products mills imports [Gg C yr^{-1}]

WR_{EX} = Wood residues from wood products mills exports [Gg C yr^{-1}]

Note that even though imported harvested wood products are not included among the sinks/sources, import figures are used to estimate the correct amount of the wood products that are based on domestically harvested wood.

Emissions/removals of CO_2 due to harvested wood products, are estimated using the IPCC HWP model (IPCC 2006). 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. As there is no easy way to know the fate of exported HWP, it is assumed in the estimation model that exported HWP is used in the same manner as if it were in domestic use.

In Durban it was also decided that harvested wood products resulting from deforestation shall be accounted for on the basis of instantaneous oxidation. The model has been adjusted so that wood harvesting resulting from deforestation can be left out of the removal estimates. We have statistics on deforestation rates back to 1990. Since it is high degree of uncertainty in the statistics, we have assumed a deforestation rate of 3.3 % annually, which is the average deforestation rate over the last five years. We have further assumed the same rate for all products. We have made the same assumptions back to 1961. These assumptions are preliminary, and will be subject to further investigation.

3. Activity data and emission factors

Statistics on production, import and export of semi-finished wood products going back to 1960 are collected from the FAO statistical databases (FAO 2012), see Table A7-1.

Table A7-1: Activity data for the commodities from the FAO statistical databases (FAO 2011) shown below are needed in the calculations. The activity data is needed for all years going back to 1960.

	Production	Imports	Exports
Sawn wood	X		
Wood-based panels	X		
Industrial roundwood	X	X	X
Wood residues		X	X
Chips and particles		X	X
Paper and paperboard	X		

In addition to the FAO activity data, a set of lifetimes, conversion factors and growth rate of HWP prior to 1960 is needed in order to estimate the HWP contribution. Default values for all the factors are provided in the 2006 IPCC guidelines. Whenever possible, national values have been estimated for available statistical data and employed instead of the default values, turning the model into a Tier 2 method.

The half-lives used in the calculations are default values for the IPCC HWP model; two years for paper, 25 years for wood panels and 35 years for sawn wood. The half-lives are assumed to be constant for the entire period included in the model. The same half-lives were used for products consumed domestically as for products consumed by importing countries.

The wood factors used in the calculations are based on expert judgements by Fjulsrud and Bunkholt (pers. comm. 2009), see Table A7-2.

Table A7-2: Half-lives and conversion factors, given by the IPCC (2006).

Half lives	**Value**	**Unit**
Sawn wood products	35	years
Wood-based panels products	25	years
Paper products	2	years
Conversion factors		
Sawnwood, Oth.Ind.rw	0.198	t C/m3
Wood-based panels	0.294	t C/m3
Paper products	0.45	t C/adt
Charcoal	0.765	t C/adt
Bark	1.17	C overb/C underb
Deforestation fraction	3.3	%
Estimated growth rate of HWP consumption prior to 1961	0.90	% per year

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

Estimated emissions reported by using the product approach and IPCC default model and country specific conversion factors are shown in Table A7-3. Note that negative emissions are referred to as removals. We can see that the emissions/removal of CO_2 due to HWP has varied between emissions of 54 Gg tonnes CO_2eq and removals of 1 363 Gg tonnes CO_2eq in the reporting period. The removal in 2010 has been estimated to 338 Gg tonnes CO_2eq, which represents about 1.3 per cent of the total sink in the LULUCF sector.

Table A7-3: HWP Contribution by using the product approach and the IPCC model.

Year	Gg CO_2 /year
1990	-1 363
1991	-1 090
1992	-853
1993	-1 008
1994	-445
1995	-106
1996	-338
1997	-352
1998	-169
1999	-287
2000	-130
2001	-162
2002	-79
2003	54
2004	-24
2005	-184
2006	-558
2007	-363
2008	-268
2009	-118
2010	-338

5. Uncertainties

The production approach will always be associated with higher uncertainties than the other approaches, since the estimates of the fate of exported HWP are highly uncertain (Bache-Andreassen 2009). The highest uncertainty in the IPCC HWP model is connected to the lifetime assumption and is about 50 percent (IPCC 2006).

6. Recalculations

The whole time-series has been recalculated due to the changes in choice of methodology. In addition, following activity data were revised, due to minor changes in the FAO database FAOSTAT: Import of wood-based panels in 2008, production wood-based panels, production and export of sawn wood and production of paper and paperboard in 2009.

7. Planned improvements

The Durban decision states that a Party may use country-specific data to replace the default half-lives specified in the decision. In previous NIR submissions, Norway used the revised model which 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). 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 revised model was compatible with the SCA, but cannot be applied directly to the PA. It might however be possible to use the detailed Norwegian data i.e., to estimate national decay rates for the stock of building materials also in the PA. The Norwegian data indicated a higher decay rate (lower half- lives) than the default factors of the Durban decision. Norway will explore further the possibility to developing country-specific half-lives. If country-specific half-lives are developed, Norway will replace the default values in the future reporting.

The assumptions made regarding deforestation rates back to 1961 are preliminary. Norway will investigate how to improve these in the future reporting.

8. References

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Annex VIII: SEF and Registry Changes

Annex VIII consist of the files:

1. ETR 5.2 Release Notes_1.0.pdf
2. SFW V5.2 Test Report_1.0.pdf
3. SEF_NO_2012_1_12-54-24 15-2-2012

Annex IX: Reference Approach versus Sectoral Approach - Quantification of differences

In the review of the Norwegian greenhouse gas inventory submitted in 2011 the ERT raised potential problems with non-inventory elements of Norway's annual submission under the Kyoto Protocol. Norway was asked to explain the difference between Reference Approach (RA) and Sectoral Approach (SA). Norway has examined the differences and the results are explained in this annex. Remaining issues are to examine and reduce statistical differences.

Reference versus sectoral approach
Norway has calculated energy consumption and CO_2 emissions from energy combustion based on RA and SA. The supply side in the RA is from the national energy balance that is included in Annex III in the NIR. In previous submissions we have used energy balance data reported to IEA in RA even if the energy balance reported in Annex III also in previous submissions have been the national energy balance. The supply data in RA are now consistent with the energy balance data used in the SA.

The result of the estimation with the two methods is shown in Table 1. There are large differences between the output from RA and SA, both for the energy consumption data and the CO_2 emissions. The difference between the *fuel consumption* in the RA and SA ranges from about –14 per cent to + 45 per cent. The deviations for CO_2 emissions are generally around 5 percentage points higher. The highest discrepancy for CO_2 is in 1999-2001, 2004-2006, and 2008-2010. The large discrepancies are primarily due to statistical differences in the energy balance, as shown below.

Table 1. Comparison of fuel consumption and CO_2 emission data between the Reference Approach (RA) and the Sectoral Approach (SA). 1990-2010.

	Fuel Consumption			**CO_2 emissions**		
Year	RA, apparent consumption (PJ)	SA (PJ)	Difference RA-SA (%)	RA (Gg)	SA (Gg)	Difference (%)
1990	342	386	-11.4	24 617	25 946	-5.1
1991	402	382	5.3	28 661	25557	12.1
1992	383	389	-1.5	27 012	26 048	3.7
1993	379	405	-6.2	26 679	27 049	-1.4
1994	401	425	-5.6	28 489	28 432	0.2
1995	432	423	2.1	30 405	28 336	7.3
1996	395	461	-14.3	27 951	31 165	-10.3
1997	450	466	-3.3	31 752	31 321	1.4
1998	508	465	9.3	35 575	31 300	13.7
1999	569	464	22.4	40 089	31 608	26.8
2000	657	454	44.8	46 193	30 556	51.2
2001	613	479	27.9	41 872	32 624	28.3
2002	510	484	5.4	35 470	32 819	8.1
2003	547	505	8.2	37 866	34 174	10.8
2004	650	510	27.5	45 900	34 255	34.0
2005	612	499	22.6	42 994	33 839	27.1
2006	641	520	23.3	45 509	34 733	31.0
2007	529	529	-0.1	35 994	35 221	2.2
2008	641	528	21.3	44 006	34 582	27.3
2009	631	541	16.8	43 041	35 162	22.4
2010	755	561	34.5	51 750	36 714	41.0

Source: Statistics Norway/Climate and Pollution Agency

Quantification of differences between RA and SA

Summary. *We have made a comparison of the fuel consumption in RA and SA to the energy balance where we explain the differences between RA and SA. The comparison was made for natural gas and solid and liquid fuels separately. This is an answer to questions raised in the Saturday Paper by the ERT reviewing the Norwegian 2011 submission. The comparison is summarized in Table 3 in this annex.*

The main result is that the difference between the energy consumption in RA and SA is mainly due to statistical differences in the energy balance (column M in Table 3). In addition, a number of other smaller differences were identified. The remaining difference between RA and SA after adjusting for these items is within +/- 2 per cent for all years since 1992. For 1990-1991 the remaining difference is around -12 per cent.

There are very large statistical differences in the Norwegian energy balance, and they fluctuate strongly between years. Due to the large production and export of natural gas and crude oil, small errors in the figures reported to Statistics Norway can amount to large discrepancies when compared to the relatively small consumption figures. In general, the end use statistics which is the foundation for the SA is considered to be reliable. Errors in the production and export data can be due to both measurement errors and systematically errors related to omissions, double counting, etc. A recent example is an error in gas exports that was discovered after the energy balance was finalized: Gas export had been omitted from the foreign trade statistics for a number of new fields that deliver the gas through installations on the territory of neighbouring states. This error explains most of the change in the statistical difference for natural gas since 2008.

The Reference Approach is a method to use the supply part of the energy balance to calculate CO_2 emissions from fuels. A simple correction is used to exclude non-combustion emissions. The result is then compared with the sectoral approach to combustion emissions (source category 1A). For Norway, the RA gives for many years large deviations from the SA with respect to both energy use and CO_2 emissions.

The SA is based on the consumption part of the energy balance. This section shows how the RA and the SA corresponds to the energy balance. *The main conclusion is that the major cause of deviations between the approaches is the statistical differences in the energy balance.*

The supply data used in in the RA Table 1A(b) are from the national energy balance reported in the NIR. See the first paragraph under *Reference versus sectoral approach* in the annex. The only differences are in the NCV values for natural gas and crude oil production, and the inclusion of lubricants and bitumen in the RA. When corrected for these items, the total supply in the RA is equal to the net domestic supply (item 7) in the energy balance for these fuels.

Item 7 Net domestic supply in the energy balance is equal to the sum of the following items in the balance (according to the definition of the statistical difference (item 11)):

Table 2: Energy Balance and its allocation in the Reference Approach and the GHG inventory

8. Energy converted	8.1-8.2 (blast furnaces and petroleum refineries): Transformation to other fossil fuels. Not included in the inventory. Part of statistical differences in transformation 8-3-8.6 (power and heating plants): Sectoral Approach – 1A1a
1.2. Production of derived energy bearers	Not included in the inventory. Part of statistical differences in transformation
9. Consumption by energy sector	Sectoral Approach – 1A1a-c *Exceptions:* 9.1.2. Flaring on oil fields Inventory: 1B2c RA: Excluded 9.3. Petroleum refineries: In the inventory, burning off of coke is in 1B2a-4
10. Losses in transport and distribution	Only flares in manufacturing In the inventory, included in 2 Industrial processes
11. Statistical differences (7-(8-1.2)-9-10-12-13)	Not included in the inventory: Statistical differences
12. Consumption for non-energy purposes	- In the inventory: allocated to 2 Industrial processes - In the RA: included in the correction item for feedstock and non-energy use
13. Net domestic consumption	SA: 1A2-1A5. *Exceptions:* Coal and coke used as reducing agents with utilization of heat is accounted here in the energy balance, and not in item 12. - In the inventory, this use is allocated to 2 - Industrial processes - In the RA, this use is included in the correction item for feedstock and non-energy use

Note: Item 13.1 in the energy balance is the sum of items 12 and 13, *i.e*, net domestic consumption including non-energy use.

Table 2 shows that the net supply includes items that are handled in different ways in the inventory:

- Combustion which is included in the sectoral approach
- Emissions that are included elsewhere in the inventory
- Items that are not included in the inventory but appear as statistical differences.

In the RA, the energy consumption and CO_2 emissions are corrected for ”non-energy use and feedstocks”. As currently implemented, this correction includes item 12 Consumption for non-energy purposes and the part of item 13 Net domestic consumption which is reducing agents. The correction also includes lubricants and bitumen, which are not part of the national energy balance net supply.

This means that the following items will remain as differences between the Reference and Sectoral approaches:

- Statistical differences. This includes
    - Main statistical difference (item 11). Range: -30 PJ to 220 PJ (excluding waterfall energy, electricity, and district heating).
    - Statistical differences within the transformation sector. This appears when the production of derived energy bearers (item 1.2) is different from the consumption in the transformation sectors (item 8). Transformation to heat or power by consumption is handled in the sectoral approach and is excluded from this comparison. Range: -30 PJ to 30 PJ.

  Possible causes of the statistical differences are discussed in Section *Discussion of statistical differences*.
- Emissions that are included elsewhere in the inventory, but were omitted from the correction item in the RA:
    - Losses (item 10, i.e, flaring in manufacturing). Range: 0-4 PJ.
    - Burning off of coke in refinery crackers and related emissions. Range: 6-10 PJ.

Some differences between the Reference and Sectoral approaches still remain when correcting for these items. The remaining differences may be due to minor differences in definitions and scope, and to errors in the energy or emission inventories. More details are given in Section *Discussion of statistical differences*. Range: -3 PJ to 11 PJ, except for 1990-1991 when it is ≈-45 PJ, apparently due to some mistake in the transformation items in the energy balance (cf. Table 4).

The analysis is summarized in Table 3 below. The analysis in the CRF tables is shown in the left part. Further corrections are included in the following columns.

Table 3. Overview over the Reference and Sectoral approaches for energy. PJ.

Unit: PJ	Consumption data from CRF Table1.A(c)			Adjustments in RA consumption				Remaining difference RA-SA	
	RA: Apparent consumption (*incl.* non-energy use and feedstock)	SA: Consumption (*incl.* Other fuels)	Difference RA-SA	Correction for non-fuel use and feedstock in CRF	Statistical differences	Other corrections	*Other fuels* in SA excluded from comparison	PJ	% of SA
	A	B	C	D+P+R	M	E+O+Q		T*	U
1990	431	386	46	90	1	6	-4	-46	-12.0 %
1991	486	382	104	84	63	5	-4	-44	-11.5 %
1992	465	389	76	82	-9	10	-4	-2	-0.6 %
1993	470	405	66	91	-28	10	-5	-2	-0.5 %
1994	500	425	75	99	-20	7	-5	-6	-1.5 %
1995	534	423	111	102	14	5	-5	-6	-1.3 %
1996	500	461	39	105	-59	5	-5	-7	-1.6 %
1997	564	466	98	114	-11	4	-5	-4	-0.8 %
1998	629	465	164	121	43	5	-5	-0	0.0 %
1999	683	464	219	115	103	4	-6	2	0.5 %
2000	773	454	319	115	200	7	-6	2	0.5 %
2001	743	479	264	130	128	4	-7	9	2.0 %
2002	631	484	147	121	29	2	-7	2	0.4 %
2003	676	505	170	129	47	-1	-8	4	0.9 %
2004	777	510	268	128	150	0	-8	-2	-0.4 %
2005	735	499	236	123	122	2	-9	-2	-0.5 %
2006	760	520	240	119	129	2	-9	-1	-0.2 %
2007	653	529	124	124	-2	8	-9	3	0.5 %
2008	769	528	241	128	116	5	-10	2	0.3 %
2009	743	541	202	111	91	6	-9	3	0.6 %
2010	874	561	313	119	190	8	-11	7	1.2 %

Source: Statistics Norway/Climate and Pollution Agency

The following Tables 4-8 show in more detail how the energy balances and the Reference and Sectoral approaches are related for the different fuel groups. Table 4 is a combined table for liquid and solid fuels, in PJ. For natural gas there are Tables 4-7 in Sm^3, PJ, and CO_2.

The reasons for these choices are purely practical: Gaseous fuels comprise only a single fuel and thus simple to handle, and variations in NCV and C content means that data in Sm^3, PJ and CO_2 give different and relevant information. For liquid and solid fuels, transformation means that only tables covering all fuels are meaningful. The PJ table is the simplest one to prepare. Liquid and solid were combined because one of the energy types in the energy balance (”other gases”) is a combination of mainly secondary fuels derived from both liquid and solid primary fuels.

Solid fuels and liquids

Table 4 is organized in four parts, from left to right. After each part, the remaining difference between RA and SA is given.

1. The consumption according to RA (uncorrected) and SA
2. Differences between the RA and the energy balance: lubricants and bitumen, and differences in NCV values. When adjusted for these items, the RA supply is equal to the energy balance.
3. Statistical differences
4. Emissions that is included elsewhere in the inventory.

Table 4. Overview of discrepancies in energy goods. Solid and liquid fuels. PJ

Unit: PJ	Consumption data from CRF Table1.A(c)			Included in RA, but not in the NIR energy balance			Remaining difference RA-SA	Included in RA and energy balance, but not included in total emissions (in any source categories): Statistical differences and other discrepancies between supply and consumption in the energy balance						Remaining difference RA-SA
	RA: Apparent consumption (*incl* non-energy use and feedstocks)	SA: Consumption	Difference RA-SA	Fuel types not included in NIR energy balance (lubricants, bitumen)	Different NCV values for condensate production	Total adjustment		8.1. Transformation - In blast furnaces	8.2. Transformation - In crude petroleum refineries	1.2. Production of derived energy bearers	SDT. Statistical differences within transformation (8.1+8.2-1.2)	11. Statistical differences (7-8+1.2-9-10-13.1)	Total adjustment (SDT + 11)	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
			=A-B			=D+E	=C-F				=H+I+J		=K+L	=G-M
1990	363	289	74	11	-0	**10**	64	1	575	548	28	-6	**22**	41
1991	397	280	117	13	-0	**13**	104	2	545	532	14	56	**71**	33
1992	357	280	77	12	-0	**11**	65	1	615	635	-19	7	**-12**	78
1993	357	290	66	13	-1	**12**	54	1	613	640	-26	-6	**-32**	86
1994	397	303	94	15	-3	**12**	82	2	633	664	-29	23	**-6**	88
1995	407	299	108	14	-4	**10**	98	2	583	603	-18	26	**8**	91
1996	392	328	64	17	-5	**12**	52	1	648	678	-28	-13	**-41**	93
1997	404	322	81	16	-7	**9**	73	2	655	679	-22	-0	**-22**	95
1998	441	327	114	16	-6	**10**	104	2	641	651	-8	17	**10**	95
1999	505	333	172	15	-7	**8**	164	2	658	682	-22	95	**73**	91
2000	582	302	279	13	-6	**7**	272	2	656	669	-11	188	**177**	95
2001	458	313	145	12	-8	**5**	140	1	616	627	-10	45	**35**	105
2002	433	312	120	13	-10	**3**	117	1	579	601	-21	35	**14**	103
2003	435	321	113	13	-13	**-1**	114	1	645	670	-23	33	**10**	104
2004	590	317	273	14	-12	**2**	271	2	619	648	-28	201	**173**	98
2005	557	308	249	15	-11	**4**	245	1	681	713	-31	179	**148**	97
2006	572	323	249	15	-11	**4**	245	2	718	754	-34	186	**152**	93
2007	425	324	101	17	-5	**12**	89	2	713	747	-31	20	**-11**	100
2008	542	315	227	15	-6	**9**	218	2	660	693	-31	150	**119**	98
2009	488	314	174	18	-7	**11**	162	2	665	700	-33	110	**76**	86
2010	586	329	257	15	-6	**9**	248	3	631	666	-32	182	**150**	98

Source: Statistics Norway/Climate and Pollution Agency

Table 4 ***continue****. Overview of discrepancies in energy goods. Solid and liquid fuels. PJ*

Unit: PJ	Included in RA and energy balance, but reported in other source categories [than 1A=Sectoral Approach]					Remaining difference RA-SA	
	10. Losses in transport and distribution	12. Consumption for non-energy purposes	*part of* 9.3. Consumption in energy sectors (petrol coke/CO in refinery)	*part of* 13 Net domestic consumption (coal and coke as reducing agent)	Total adjustment: 10+12+(9.3pp+13pp)	PJ	% of SA
	O	P	Q	R	S	T	U
					=O+P+Q+R	=N-S =C-(F+M+S)	
1990	-	47	6	32	**85**	-44	-15.2 %
1991	-	41	6	30	**76**	-43	-15.4 %
1992	3	42	8	28	**80**	-2	-0.9 %
1993	3	50	8	27	**88**	-2	-0.8 %
1994	3	52	7	31	**94**	-5	-1.8 %
1995	3	53	6	35	**97**	-6	-2.0 %
1996	3	53	7	35	**99**	-6	-1.8 %
1997	3	56	8	33	**100**	-5	-1.6 %
1998	3	52	8	35	**99**	-5	-1.4 %
1999	4	49	7	33	**92**	-1	-0.4 %
2000	3	49	10	34	**97**	-2	-0.5 %
2001	4	65	8	30	**106**	-1	-0.4 %
2002	3	67	9	25	**103**	-0	-0.1 %
2003	2	68	10	24	**104**	-0	-0.1 %
2004	3	57	9	29	**99**	-0	-0.1 %
2005	2	59	11	24	**97**	-0	0.0 %
2006	2	59	11	20	**92**	1	0.4 %
2007	3	65	10	22	**100**	1	0.2 %
2008	3	64	8	23	**98**	1	0.2 %
2009	3	57	10	15	**85**	0	0.1 %
2010	4	62	10	20	**96**	2	0.5 %

Source: Statistics Norway/Climate and Pollution Agency

Note to Table 4: The correction for ”non-energy use and feedstock” in the CRF includes items D, P, and R in the table.

Natural gas

Tables 5-7 that follows are simpler than Table 4, but all relevant columns are included.

The difference between RA and SA with respect to energy consumption is presented in volume terms in Table 5. The primary data are usually by volume, and this approach avoids problems with finding the correct NCV values.

The following columns in Table 5 show that the remaining difference between RA and SA is almost wholly explained by non-energy use, losses, and statistical differences. When adjusted for these terms, the remaining difference is well below 1 per cent.

In Table 6, the same analysis is presented in energy units (PJ). Variations in NCV between years and between sectors blur the clearer picture from the Sm^3 data in Table 5.

Calculation notes to Table 6:

In this table, the data for RA and SA were converted using the NCVs from CRF Table 1 A(b). These values correspond to a large fraction of high-NCV gas used in offshore oil and gas extraction. The correction items from the energy balance were converted using the NCVs in the national energy balance. These values reflect the composition of produced gas, and are closer to dry gas values. The choice of NCV for the energy balance items is somewhat arbitrary, since it is not known in which part of the inventory the statistical differences originate, and the composition of feedstock gas is not known.

Table 5. Overview of discrepancies on energy goods. Natural gas. Million Sm^3

	Consumption data			Included in RA, but not in SA. Data from NIR energy balances, underlying data in Sm3				Remaining difference RA-SA	
Unit: 10^6 m^3	RA: Apparent consumption	SA: Consumption (recalculated with NCV of RA/SA)	Difference RA-SA	10. Losses in transport and distribution	11. Statistical differences (7-8+1.2-9-10-13.1)	12. Consumption for non-energy purposes	Total: 10+11 +12	10^6 m^3	% of SA
1990	1 698	2 293	-595	-	-595	-	-595	-0	0.0 %
1991	2 204	2 416	-212	-	-212	-	-212	0	0.0 %
1992	2 676	2 590	85	-	85	-	85	-	0.0 %
1993	2 826	2 724	102	-	102	-	102	0	0.0 %
1994	2 549	2 924	-376	-	-376	-	-376	1	0.0 %
1995	3 142	2 967	174	-	174	-	174	-0	0.0 %
1996	2 694	3 183	-489	-	-490	-	-490	0	0.0 %
1997	3 987	3 449	538	7	307	223	537	1	0.0 %
1998	4 693	3 319	1 374	22	926	419	1 367	8	0.2 %
1999	4 451	3 132	1 319	19	843	462	1 324	-5	-0.2 %
2000	4 772	3 619	1 153	37	636	480	1 153	1	0.0 %
2001	7 130	3 987	3 143	14	2 552	576	3 142	1	0.0 %
2002	4 958	4 107	851	11	409	429	849	2	0.1 %
2003	6 016	4 391	1 625	13	1 012	597	1 623	3	0.1 %
2004	4 687	4 614	72	14	-630	687	70	2	0.1 %
2005	4 441	4 548	-107	10	-723	605	-109	2	0.0 %
2006	4 694	4 714	-19	11	-655	621	-22	3	0.1 %
2007	5 709	4 916	793	26	256	511	794	-0	0.0 %
2008	5 693	5 101	592	13	-92	650	570	21	0.4 %
2009	6 445	5 484	962	20	405	520	945	16	0.3 %
2010	7 302	5 617	1 684	15	1 113	544	1 673	12	0.2 %

Source: Statistics Norway/Climate and Pollution Agency

Table 6. Overview of discrepancies on energy goods. Natural gas. PJ

Unit: PJ	Consumption data from CRF Table1.A(c)			Included in RA, but not in SA. Data from NIR energy balances				Remaining difference RA-SA	
	RA: Apparent consumption (*incl.* non-energy use and feedstock)	SA: Consumption	Difference RA-SA	10. Losses in transport and distribution	11. Statistical differences (7-8+1.2-9-10-13.1)	12. Consumption for non-energy purposes	Total: 10+11 +12	PJ	% of SA
	A	B	C	O	L	P	S	T	U
			=A-B				=O+L+P	=C-S	
1990	68	92	-24	-	-22	-	-22	-2	-2.5 %
1991	89	97	-9	-	-8	-	-8	-1	-0.7 %
1992	108	104	3	-	3	-	3	0	0.3 %
1993	114	110	4	-	4	-	4	0	0.3 %
1994	103	118	-15	-	-14	-	-14	-1	-0.9 %
1995	127	119	7	-	7	-	7	0	0.4 %
1996	108	128	-20	-	-18	-	-18	-1	-1.1 %
1997	160	138	22	0	11	8	20	2	1.3 %
1998	188	133	55	1	34	15	50	5	3.9 %
1999	178	125	53	1	31	17	48	5	3.8 %
2000	191	145	46	1	23	17	42	4	2.9 %
2001	286	160	126	1	92	21	114	12	7.6 %
2002	199	165	34	0	15	15	31	4	2.2 %
2003	241	176	65	0	37	22	59	7	3.7 %
2004	188	185	3	0	-23	25	3	0	0.2 %
2005	178	182	-4	0	-26	22	-4	-0	-0.2 %
2006	188	189	-1	0	-23	22	-1	0	0.0 %
2007	228	196	32	1	9	18	28	3	1.7 %
2008	227	204	24	0	-3	23	20	3	1.6 %
2009	255	217	38	1	14	19	34	4	2.0 %
2010	288	221	66	1	40	19	60	7	3.0 %

Source: Statistics Norway/Climate and Pollution Agency

Table 7 below presents the differences between RA and SA with respect to CO_2 emissions. Most of the difference is likely due to problems with assigning correct NCV values to both reference and sectoral approaches. The problems with NCV values in Table 8 feed directly into the CO_2 comparison. In addition, the Norwegian NCV and C content values now used might not fully reflect the actual content of gas burned offshore. For most years after 2000 the data indicate that the gas has a even higher energy and carbon content than the factors used. See Table 8. The inventory generally uses plant-specific data for consumption by volume and for CO_2 emissions, but plant specific NCV data have not been obtained so far.

Calculation notes to Table 7:
CO_2 emissions corresponding to the correction items are calculated using NCV and C content values of the energy balance.
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Table 7. Overview of discrepancies on energy goods. Natural gas. Gg CO_2

	Emission data from CRF Table1.A(c)			Included in RA, but not in SA				Remaining difference RA-SA	
Unit: Gg CO_2	RA: Actual CO_2 emissions	SA: CO_2 emissions	Difference RA - SA	10. Losses in transport and distribution	11. Statistical differences (7-8+1.2-9-10-13.1)	12. Consumption for non-energy purposes ---------- *RA emissions are already corrected*	Total: 10+11	Gg CO_2	% of SA
1990	3 975	5 185	-1 210	-	-1 227	-	-1 227	17	0.3 %
1991	5 158	5 486	-328	-	-445	-	-445	118	2.1 %
1992	6 263	5 903	360	-	178	-	178	182	3.1 %
1993	6 615	6 198	417	-	213	-	213	204	3.3 %
1994	5 965	6 726	-761	-	-805	-	-805	44	0.7 %
1995	7 346	6 797	549	-	374	-	374	175	2.6 %
1996	6 296	7 306	-1 009	-	-1 041	-	-1 041	32	0.4 %
1997	8 760	8 028	732	15	639	-	654	78	1.0 %
1998	9 934	7 682	2 252	46	1 909	-	1 955	296	3.9 %
1999	9 248	7 708	1 540	38	1 728	-	1 766	-226	-2.9 %
2000	9 962	8 754	1 207	76	1 307	-	1 383	-175	-2.0 %
2001	15 223	10 011	5 211	29	5 212	-	5 241	-30	-0.3 %
2002	10 540	10 331	209	23	831	-	853	-645	-6.2 %
2003	12 591	10 921	1 669	27	2 063	-	2 090	-421	-3.9 %
2004	9 285	11 319	-2 033	28	-1 284	-	-1 257	-777	-6.9 %
2005	8 899	11 381	-2 483	19	-1 468	-	-1 449	-1 034	-9.1 %
2006	9 445	11 297	-1 852	23	-1 323	-	-1 300	-552	-4.9 %
2007	12 002	11 628	374	53	514	-	567	-193	-1.7 %
2008	11 660	11 785	-125	26	-186	-	-160	36	0.3 %
2009	13 541	12 521	1 020	39	814	-	853	167	1.3 %
2010	15 373	12 895	2 478	31	2 237	-	2 268	210	1.6 %

Source: Statistics Norway/Climate and Pollution Agency

Table 8 gives the NCV and carbon content values used in the RA and SA in the 2012 submission. NCV values used in the national energy balance are also shown. The carbon content to be used with correction items from the energy balance was calculated for these tables and has not been published elsewhere (method shown below). Finally, an "actual" C content is calculated as the ratio between the implicit kg C/Sm^3 factor in the inventory and the NCV used. The high values between 2000 and 2010 indicate that the NCV now used may be too low for these years.

Calculation notes to Table 8:
The carbon content to be used with a given NCV is calculated by inverting the formula in OLF (2008) for estimating CO_2 factors (in kg/Sm^3) from the NCV (in MJ/Sm^3): $fCO_2 = 0.0724 * NCV - 0.5771$.

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Table 8. NCV and C content data for natural gas

	NCV used in energy balance	NCV used in RA and SA	C content to be used with Energy balance correction items	C content used in RA and SA	"Actual C content" (SA)
	MJ/S m^3	MJ/Sm^3	tC/TJ	tC/TJ	tC/TJ
1990	36.45	40.30	15.43	15.84	15.30
1991	36.99	40.30	15.49	15.84	15.37
1992	36.74	40.30	15.46	15.84	15.42
1993	36.81	40.30	15.47	15.84	15.40
1994	37.53	40.29	15.55	15.84	15.57
1995	37.62	40.27	15.56	15.84	15.51
1996	37.35	40.26	15.53	15.84	15.55
1997	36.72	40.11	15.46	15.82	15.82
1998	36.45	40.07	15.43	15.82	15.76
1999	36.27	39.99	15.41	15.81	16.78
2000	36.36	40.03	15.42	15.81	16.48
2001	36.18	40.05	15.40	15.82	17.10
2002	36.00	40.11	15.37	15.82	17.10
2003	36.12	40.06	15.39	15.82	16.93
2004	36.12	40.04	15.39	15.81	16.71
2005	36.01	40.01	15.38	15.81	17.06
2006	35.88	40.00	15.36	15.81	16.34
2007	35.70	39.86	15.34	15.80	16.18
2008	35.75	39.91	15.34	15.80	15.79
2009	35.72	39.54	15.34	15.76	15.75
2010	35.73	39.39	15.34	15.75	15.89

Source: Statistics Norway/Climate and Pollution Agency

Discussion of statistical differences

Statistics Norway has undertaken a review of supply data for natural gas. The emphasis was on consistency between monetary and physical data. The review showed that gas export from several new gas fields had been omitted from the foreign trade statistics. All of the fields deliver gas via installations on the continental shelf of neighboring countries. The export was approximately:

2008: $0.15 \cdot 10^9$ Sm^3, or 5 PJ
2009: $1.1 \cdot 10^9$ Sm^3, or 40 PJ
2010: $1.6 \cdot 10^9$ Sm^3, or 60 PJ

After this adjustment, the rise in statistical difference for natural gas in the recent years disappears. The difference is then around -20 PJ for most years since 2004, with somewhat higher value in 2007-2008.

For *natural gas*, measurement uncertainty might be a significant part of the statistical difference. The net supply is calculated as the difference between the much larger production and export. A relatively small uncertainty in the large numbers may then lead to a high uncertainty in the net supply.

There are official requirements to measurement uncertainty related to measurement of petroleum for fiscal purposes and for calculation of CO_2 tax. The limits for different energy commodities are shown in Table 9. The uncertainty for e.g. natural gas metered for sale is 1 per cent at the level of installations and should therefore be regarded as independent. This implies that the uncertainty in total production and export will be much lower. In this case, measurement uncertainty is less likely to be the cause of the statistical difference.

Table 9. Allowable measurement uncertainty related to measuring petroleum products.

Measurement system	**Uncertainty limit at 95 percent (%) confidence level** *(expanded uncertainty with coverage factor k=2)*
Oil metering for sale and allocation purposes	± 0.30 % of standard volume
Gas metering for sale and allocation purposes	± 1.0 % of mass
Sales measurement of LNG	± 0.50 % of measured energy contents per ship load
Fuel gas metering	± 1.8 % of standard volume
Flare gas metering	± 5.0 % of standard volume

Source: Norwegian Petroleum Directorate

For *liquids*, the statistical difference is often higher than for natural gas. Measurement uncertainty in the supply is lower than for natural gas, for two reasons: First, the basic measurement uncertainty is lower. Second, the net supply is a higher proportion of the production. This means that the uncertainty in the net supply will not be as high relative to the production uncertainty as is the case for natural gas. These moments indicate that measurement uncertainty might have a limited contribution to the statistical difference for liquid fuels.

The statistical differences in the transformation sector may have several causes. The most likely ones include:

- Effects of NCV values. The difference is lower in physical terms than in energy terms. This may reflect uncertainties in NCVs, particularly for crude oil. The NCV used is an average for all Norwegian production, and the crude oil used at the refineries may differ in composition.
- Fuel gas in petrochemical industry is included as secondary production with about 10 PJ. The gas is derived from LPG feedstocks. However, the transformation occurs outside the energy sectors, and no LPG consumption is entered.
- Gases derived from biomass (waste disposal sites, wastewater treatment, animal manure, etcetera) are included as secondary production, but no corresponding consumption is entered. The amounts are relatively small.

Note that the statistical difference in transformation is mirrored by definition in an opposite term in the general statistical difference: The statistical difference in transformation is defined as item 8 – item 1.2 (supply – secondary production). The general statistical difference (item 11) must then subtract this ”secondary net supply”, using the term –(8 – 1.2). Thus, including LPG that is transformed into fuel gas in item 8 will make the statistical difference in transformation less negative, and at the same time make the general statistical difference less positive.