



REPUBLIC OF ESTONIA  
MINISTRY OF THE ENVIRONMENT

# **GREENHOUSE GAS EMISSIONS IN ESTONIA 1990–2020 NATIONAL INVENTORY REPORT**

**SUBMISSION TO THE UNFCCC SECRETARIAT**

*Annexes to the national inventory report*

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## **Annex 1. Key categories**

This annex contains tables with detailed information on key categories which follow the format and methodology (Tier 1) suggested in 2006 IPCC Guidelines.

Annex 1 includes following tables:

- Tier 1 and Tier 2 level assessment year 1990 without LULUCF;
- Tier 1 and Tier 2 level assessment year 1990 with LULUCF;
- Tier 1 and Tier 2 level assessment year 2020 without LULUCF;
- Tier 1 and Tier 2 level assessment year 2020 with LULUCF;
- Tier 1 and Tier 2 trend assessment without LULUCF;
- Tier 1 and Tier 2 trend assessment with LULUCF

**Table A.1.1.** Tier 1 level assessment year 1990 without LULUCF

IPCC Source Category	Gas	Emissions 1990	Tier 1 level as- sessment	Cumulative total
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO2	22 017.06	0.548	54.80%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CO2	3 518.60	0.088	63.56%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO2	2 234.91	0.056	69.12%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	CO2	1 815.26	0.045	73.64%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Peat	CO2	841.33	0.021	75.74%
3.A.1 Enteric Fermentation - Dairy Cattle	CH4	733.07	0.018	77.56%
1.A.2.g Manufacturing Industries and Construction/Other - Liquid Fuels	CO2	702.34	0.017	79.31%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Liquid Fuels	CO2	695.49	0.017	81.04%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	CO2	595.12	0.015	82.52%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Liquid Fuels	CO2	487.05	0.012	83.73%
2.A.1 Cement production	CO2	483.04	0.012	84.94%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Liquid Fuels	CO2	448.15	0.011	86.05%
3.A.1 Enteric Fermentation - Non-Dairy Cattle	CH4	436.09	0.011	87.14%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N2O	337.35	0.008	87.98%
1.A.4.b Other Sectors/Residential - Solid Fuels	CO2	336.77	0.008	88.82%
1.A.4.b Other Sectors/Residential - Peat	CO2	308.79	0.008	89.58%
2.B.1 Ammonia production	CO2	307.73	0.008	90.35%
1.A.2.g Manufacturing Industries and Construction/Other - Gaseous Fuels	CO2	286.15	0.007	91.06%
1.A.4.b Other Sectors/Residential - Liquid Fuels	CO2	247.01	0.006	91.68%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Liquid Fuels	CO2	228.63	0.006	92.25%
5.A Solid waste disposal	CH4	213.72	0.005	92.78%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	CO2	194.01	0.005	93.26%
3.D.1.4 Direct Soil Emissions - Crop Residue	N2O	189.26	0.005	93.73%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N2O	158.96	0.004	94.13%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Gaseous Fuels	CO2	156.71	0.004	94.52%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Liquid Fuels	CO2	145.24	0.004	94.88%

**Table A.1.2.** Tier 1 level assessment year 2020 without LULUCF

IPCC Source Category	Gas	Emissions 2020	Tier 1 level assessment	Cumulative total
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO2	3612.66	0.313	31.26%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO2	2150.66	0.186	49.87%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO2	1559.71	0.135	63.37%
3.A.1 Enteric Fermentation - Dairy Cattle	CH4	329.27	0.028	66.22%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	CO2	258.21	0.022	68.45%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N2O	194.27	0.017	70.14%
1.A.4.c.ii Other Sectors/Agriculture/Forestry/Fishing/Off-road vehicles and other machinery - Liquid Fuels	CO2	178.90	0.015	71.68%
1.A.4.a Other Sectors/Commercial/Institutional - Gaseous Fuels	CO2	173.92	0.015	73.19%
5.A Solid waste disposal	CH4	173.91	0.015	74.69%
3.A.1 Enteric Fermentation - Non-Dairy Cattle	CH4	166.87	0.014	76.14%
1.A.2.g Manufacturing Industries and Construction/Other - Liquid Fuels	CO2	165.52	0.014	77.57%
3.D.1.4 Direct Soil Emissions - Crop Residue	N2O	156.86	0.014	78.93%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	CO2	143.46	0.012	80.17%
3.D.1.6 Direct Soil Emissions - Cultivation of Organic Soils	N2O	139.50	0.012	81.38%
1.A.4.b Other Sectors/Residential - Gaseous Fuels	CO2	129.94	0.011	82.50%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Peat	CO2	126.70	0.011	83.60%
1.A.4.b Other Sectors/Residential - Biomass	CH4	124.50	0.011	84.67%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CO2	107.82	0.009	85.61%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N2O	100.88	0.009	86.48%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Liquid Fuels	CO2	92.92	0.008	87.29%
3.D.1.2a Direct Soil Emissions - Animal Manure Applied to Soils	N2O	79.68	0.007	87.97%
1.A.4.a Other Sectors/Commercial/Institutional - Liquid Fuels	CO2	77.54	0.007	88.65%
3.B.1.1 Manure Management - Dairy Cattle	CH4	72.34	0.006	89.27%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Gaseous Fuels	CO2	69.99	0.006	89.88%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Other Fuels	CO2	66.46	0.00575	90.45%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Gaseous Fuels	CO2	62.29	0.005	90.99%
1.A.2.g Manufacturing Industries and Construction/Other - Gaseous Fuels	CO2	55.81	0.005	91.47%
5.D.1 Domestic wastewater	CH4	48.70	0.004	91.90%

IPCC Source Category	Gas	Emissions 2020	Tier 1 level assessment	Cumulative total
3.B.1.3 Manure Management - Swine	CH4	48.13	0.004	92.31%
2.A.2 Lime production	CO2	40.65	0.004	92.66%
3.B.1.1 Manure Management -Non-Dairy Cattle	CH4	40.31	0.003	93.01%
2.F.1.a Commercial Refrigeration	HFC	39.88	0.003	93.36%
3.D.2.1 Indirect Emissions - Atmospheric Deposition	N2O	38.87	0.003	93.69%
2.F.1.c Industrial Refrigeration	HFC	31.75	0.003	93.97%
5.D.1 Domestic wastewater	N2O	31.64	0.003	94.24%
1.A.3.c Transport/Railways - Liquid Fuels	CO2	31.08	0.003	94.51%
1.A.4.b Other Sectors/Residential - Liquid Fuels	CO2	29.75	0.003	94.77%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Liquid Fuels	CO2	28.01	0.002	95.01%

**Table A.1.3.** Tier 1 level assessment year 1990 with LULUCF

IPCC Source Category	Gas	Emissions 1990	Emissions 1990 (ABS)	Tier 1 level assessment	Cumulative total
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO2	22017.06	22017.06	47.14%	47.14%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CO2	3518.60	3518.60	7.53%	54.68%
4.A.1. Forest Land remaining Forest Land - living biomass	CO2	-3449.53	3449.53	0.074	62.07%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO2	2234.91	2234.91	4.79%	66.85%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	CO2	1815.26	1815.26	3.89%	70.74%
4.A.1. Forest Land remaining Forest Land - mineral soils	CO2	-1063.28	1063.28	2.28%	73.02%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Peat	CO2	841.33	841.33	1.80%	74.82%
3.A.1 Enteric Fermentation - Dairy Cattle	CH4	733.07	733.07	0.016	76.39%
1.A.2.g Manufacturing Industries and Construction/Other - Liquid Fuels	CO2	702.34	702.34	1.50%	77.89%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Liquid Fuels	CO2	695.49	695.49	1.49%	79.38%
4.B.1 Cropland remaining Cropland - organic soils	CO2	668.54	668.54	0.014	80.81%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	CO2	595.12	595.12	0.013	82.09%

IPCC Source Category	Gas	Emissions 1990	Emissions 1990 (ABS)	Tier 1 level assessment	Cumulative total
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Liquid Fuels	CO2	487.05	487.05	1.0%	83.13%
2.A.1 Cement production	CO2	483.04	483.04	0.010	84.16%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Liquid Fuels	CO2	448.15	448.15	0.96%	85.12%
3.A.1 Enteric Fermentation - Non-Dairy Cattle	CH4	436.09	436.09	0.93%	86.06%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N2O	337.35	337.35	0.7%	86.78%
1.A.4.b Other Sectors/Residential - Solid Fuels	CO2	336.77	336.77	0.72%	87.50%
4.A.1. Forest Land remaining Forest Land - organic soils	CO2	331.31	331.31	0.71%	88.21%
1.A.4.b Other Sectors/Residential - Peat	CO2	308.79	308.79	0.66%	88.87%
2.B.1 Ammonia production	CO2	307.73	307.73	0.007	89.53%
4.D.1.1 Peat extraction remaining Peat extraction - organic soils	CO2	298.77	298.77	0.006	90.17%
1.A.2.g Manufacturing Industries and Construction/Other - Gaseous Fuels	CO2	286.15	286.15	0.61%	90.78%
4.D Forest Land 4(II) Emissions and removals from drainage and rewetting	N2O	260.53	260.53	0.006	91.34%
1.A.4.b Other Sectors/Residential - Liquid Fuels	CO2	247.01	247.01	0.53%	91.87%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Liquid Fuels	CO2	228.63	228.63	0.49%	92.36%
5.A Solid waste disposal	CH4	213.72	213.72	0.005	92.82%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	CO2	194.01	194.01	0.42%	93.23%
3.D.1.4 Direct Soil Emissions - Crop Residue	N2O	189.26	189.26	0.004	93.64%
4.A.1. Forest Land remaining Forest Land - dead wood	CO2	-160.88	160.88	0.34%	93.98%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N2O	158.96	158.96	0.3%	94.32%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Gaseous Fuels	CO2	156.71	156.71	0.34%	94.66%
Wood panels and sawnwood	CO2	-156.26	156.26	0.003	94.99%

**Table A.1.4.** Tier 1 level assessment year 2020 with LULUCF

IPCC Source Category	Gas	Emissions 2020	Emissions 2020 (ABS)	Tier 1 level assessment	Cumulative total
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO2	3612.66	3612.66	0.195	19.47%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO2	2150.66	2150.66	0.116	31.07%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO2	1559.71	1559.71	0.084	39.47%
4.D.1.1 Peat extraction remaining Peat extraction - organic soils	CO2	1104.40	1104.40	0.060	45.43%
4.A.1. Forest Land remaining Forest Land - mineral soils	CO2	-1073.54	1073.54	0.058	51.21%
4.A.1. Forest Land remaining Forest Land - living biomass	CO2	1029.67	1029.67	0.056	56.76%
Wood panels and sawnwood	CO2	-932.90	932.90	0.050	61.79%
4.B.1 Cropland remaining Cropland - organic soils	CO2	585.04	585.04	0.032	64.95%
4.A.1. Forest Land remaining Forest Land - organic soils	CO2	334.25	334.25	0.018	66.75%
3.A.1 Enteric Fermentation - Dairy Cattle	CH4	329.27	329.27	0.018	68.52%
4.B.1 Cropland remaining Cropland - mineral soils	CO2	-272.68	272.68	0.015	69.99%
4.D Forest Land 4(II) Emissions and removals from drainage and rewetting	N2O	266.04	266.04	0.014	71.43%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	CO2	258.21	258.21	0.014	72.82%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N2O	194.27	194.27	0.010	73.87%
1.A.4.c.ii Other Sectors/Agriculture/Forestry/Fishing/Off-road vehicles and other machinery - Liquid Fuels	CO2	178.90	178.90	0.010	74.83%
1.A.4.a Other Sectors/Commercial/Institutional - Gaseous Fuels	CO2	173.92	173.92	0.009	75.77%
5.A Solid waste disposal	CH4	173.91	173.91	0.009	76.70%
3.A.1 Enteric Fermentation - Non-Dairy Cattle	CH4	166.87	166.87	0.009	77.60%
1.A.2.g Manufacturing Industries and Construction/Other - Liquid Fuels	CO2	165.52	165.52	0.009	78.50%
3.D.1.4 Direct Soil Emissions - Crop Residue	N2O	156.86	156.86	0.008	79.34%
4.A.2.2. Grassland converted to Forest Land - living biomass	CO2	-153.78	153.78	0.008	80.17%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	CO2	143.46	143.46	0.008	80.94%
4.E.2.1 Forest Land converted to Settlements – living biomass	CO2	140.07	140.07	0.008	81.70%
3.D.1.6 Direct Soil Emissions - Cultivation of Organic Soils	N2O	139.50	139.50	0.008	82.45%
1.A.4.b Other Sectors/Residential - Gaseous Fuels	CO2	129.94	129.94	0.007	83.15%



IPCC Source Category	Gas	Emissions 2020	Emissions 2020 (ABS)	Tier 1 le- vel as- sessment	Cumula- tive total
4.A.1. Forest Land remaining Forest Land - dead wood	CO2	-129.72	129.72	0.007	83.85%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Peat	CO2	126.70	126.70	0.007	84.53%
1.A.4.b Other Sectors/Residential - Biomass	CH4	124.50	124.50	0.007	85.20%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CO2	107.82	107.82	0.006	85.79%
4.E.2.1 Forest Land converted to Settlements (min+org soils)	CO2	102.21	102.21	0.006	86.34%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N2O	100.88	100.88	0.005	86.88%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Liquid Fuels	CO2	92.92	92.92	0.005	87.38%
3.D.1.2a Direct Soil Emissions - Animal Manure Applied to Soils	N2O	79.68	79.68	0.004	87.81%
4.E.2.2 Cropland converted to Settlements - soils	CO2	78.73	78.73	0.004	88.24%
1.A.4.a Other Sectors/Commercial/Institutional - Liquid Fuels	CO2	77.54	77.54	0.004	88.65%
3.B.1.1 Manure Management - Dairy Cattle	CH4	72.34	72.34	0.004	89.04%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Ga- seous Fuels	CO2	69.99	69.99	0.004	89.42%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Other Fuels	CO2	66.46	66.46	0.004	89.78%
4.D Forest Land 4(II) Emissions and removals from drainage and rewetting	CH4	65.87	65.87	0.004	90.13%
4.A.2.1. Cropland converted to Forest Land - living biomass	CO2	-65.74	65.74	0.004	90.49%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Gaseous Fuels	CO2	62.29	62.29	0.003	90.82%
1.A.2.g Manufacturing Industries and Construction/Other - Gaseous Fuels	CO2	55.81	55.81	0.003	91.12%
4.C.2.1 Forest Land converted to Grassland - living biomass	CO2	52.05	52.05	0.003	91.41%
5.D.1 Domestic wastewater	CH4	48.70	48.70	0.003	91.67%
3.B.1.3 Manure Management - Swine	CH4	48.13	48.13	0.003	91.93%
4.C.2 Land converted to Grassland – mineral soils	CO2	-46.39	46.39	0.003	92.18%
4.C.1 Grassland remaining Grassland – organic soils	CO2	46.04	46.04	0.002	92.43%
2.A.2 Lime production	CO2	40.65	40.65	0.002	92.64%
3.B.1.1 Manure Management -Non-Dairy Cattle	CH4	40.31	40.31	0.002	92.86%
2.F.1.a Commercial Refrigeration	HFC	39.88	39.88	0.002	93.08%

IPCC Source Category	Gas	Emissions 2020	Emissions 2020 (ABS)	Tier 1 le- vel as- sessment	Cumula- tive total
3.D.2.1 Indirect Emissions - Atmospheric Deposition	N2O	38.87	38.87	0.002	93.29%
4.B.2.2 Grassland converted to Cropland - organic soils	CO2	35.67	35.67	0.002	93.48%
4.A.2.3 Wetlands converted to Forest Land - living biomass	CO2	-35.48	35.48	0.002	93.67%
4.F.2.1 Forest land converted to Other land – living biomass	CO2	34.89	34.89	0.002	93.86%
4.B.2.2 Grassland converted to Cropland - mineral soils	CO2	33.51	33.51	0.002	94.04%
4.A.2.2. Grassland converted to Forest Land - litter	CO2	-32.67	32.67	0.002	94.21%
2.F.1.c Industrial Refrigeration	HFC	31.75	31.75	0.002	94.39%
5.D.1 Domestic wastewater	N2O	31.64	31.64	0.002	94.56%
1.A.3.c Transport/Railways - Liquid Fuels	CO2	31.08	31.08	0.002	94.72%
4.E.2.1 Forest Land converted to Settlements – litter	CO2	30.23	30.23	0.002	94.89%
1.A.4.b Other Sectors/Residential - Liquid Fuels	CO2	29.75	29.75	0.002	95.05%

**Table A.1.5.** Tier 1 trend assessment with LULUCF

IPCC Source Category	Gas	Emissions 1990	Emissions 2020	Tier 1 trend assessment	% Contribution to Trend	Cumulative total
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO2	22017.06	3612.66	10.9%	19.97%	19.97%
4.A.1. Forest Land remaining Forest Land - living biomass	CO2	-3449.53	1029.67	6.0%	11.0%	31.00%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO2	2234.91	2150.66	5.8%	10.6%	41.65%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO2	78.38	1559.71	4.1%	7.59%	49.24%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CO2	3518.60	107.82	3.0%	5.52%	54.75%
4.D.1.1 Peat extraction remaining Peat extraction - organic soils	CO2	298.77	1104.40	2.7%	4.96%	59.71%
Wood panels and sawnwood	CO2	-156.26	-932.90	2.5%	4.6%	64.33%

<b>IPCC Source Category</b>	<b>Gas</b>	<b>Emissions 1990</b>	<b>Emissions 2020</b>	<b>Tier 1 trend assessment</b>	<b>% Contribution to Trend</b>	<b>Cumulative total</b>
4.A.1. Forest Land remaining Forest Land - mineral soils	CO2	-1063.28	-1073.54	1.9%	3.5%	67.81%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	CO2	1815.26	258.21	1.0%	1.8%	69.66%
4.B.1 Cropland remaining Cropland - organic soils	CO2	668.54	585.04	1.0%	1.7%	71.40%
4.A.1. Forest Land remaining Forest Land - organic soils	CO2	331.31	334.25	0.9%	1.7%	73.06%
4.B.1 Cropland remaining Cropland - mineral soils	CO2	0.00	-272.68	0.7%	1.35%	74.41%
4.D Forest Land 4(II) Emissions and removals from drainage and rewetting	N2O	260.53	266.04	0.7%	1.32%	75.73%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Liquid Fuels	CO2	695.49	28.01	0.6%	1.1%	76.78%
1.A.4.c.ii Other Sectors/Agriculture/Forestry/Fishing/Off-road vehicles and other machinery - Liquid Fuels	CO2	87.08	178.90	0.5%	0.9%	77.67%
5.A Solid waste disposal	CH4	213.72	173.91	0.5%	0.9%	78.53%
1.A.4.a Other Sectors/Commercial/Institutional - Gaseous Fuels	CO2	18.65	173.92	0.5%	0.8%	79.36%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Peat	CO2	841.33	126.70	0.4%	0.82%	80.18%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Liquid Fuels	CO2	448.15	0.09	0.4%	0.77%	80.95%
4.A.2.2. Grassland converted to Forest Land - living biomass	CO2	-3.90	-153.78	0.4%	0.75%	81.70%
2.A.1 Cement production	CO2	483.04	20.12	0.4%	0.7%	82.44%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	CO2	0.000	143.46	0.4%	0.71%	83.15%
4.E.2.1 Forest Land converted to Settlements – living biomass	CO2	0.000	140.07	0.4%	0.7%	83.84%
4.A.1. Forest Land remaining Forest Land - dead wood	CO2	-160.88	-129.72	0.4%	0.6%	84.48%
1.A.4.b Other Sectors/Residential - Biomass	CH4	38.20	124.50	0.3%	0.6%	85.03%
1.A.4.b Other Sectors/Residential - Peat	CO2	308.79	0.00	0.3%	0.5%	85.56%
4.E.2.1 Forest Land converted to Settlements (min+org soils)	CO2	0.000	102.21	0.3%	0.5%	86.07%
3.D.1.4 Direct Soil Emissions - Crop Residue	N2O	189.26	156.86	0.2%	0.5%	86.52%

<b>IPCC Source Category</b>	<b>Gas</b>	<b>Emissions 1990</b>	<b>Emissions 2020</b>	<b>Tier 1 trend assessment</b>	<b>% Contribution to Trend</b>	<b>Cumulative total</b>
3.D.1.6 Direct Soil Emissions - Cultivation of Organic Soils	N2O	144.12	139.50	0.2%	0.44%	86.96%
1.A.4.b Other Sectors/Residential - Gaseous Fuels	CO2	131.64	129.94	0.2%	0.4%	87.38%
4.E.2.2 Cropland converted to Settlements - soils	CO2	0.000	78.73	0.2%	0.4%	87.77%
1.A.2.g Manufacturing Industries and Construction/Other - Liquid Fuels	CO2	702.34	165.52	0.2%	0.4%	88.16%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N2O	337.35	194.27	0.2%	0.4%	88.54%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Liquid Fuels	CO2	487.05	92.92	0.2%	0.4%	88.92%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Liquid Fuels	CO2	228.63	3.66	0.2%	0.4%	89.29%
3.A.1 Enteric Fermentation - Dairy Cattle	CH4	733.07	329.27	0.2%	0.4%	89.66%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Gaseous Fuels	CO2	0.000	69.99	0.2%	0.3%	90.01%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Other Fuels	CO2	0.000	66.46	0.2%	0.3%	90.34%
4.A.2.1. Cropland converted to Forest Land - living biomass	CO2	-1.73	-65.74	0.2%	0.32%	90.66%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Gaseous Fuels	CO2	0.00	62.29	0.2%	0.3%	90.97%
3.B.1.1 Manure Management - Dairy Cattle	CH4	35.68	72.34	0.2%	0.30%	91.27%
1.A.4.b Other Sectors/Residential - Liquid Fuels	CO2	247.01	29.75	0.2%	0.28%	91.54%
1.A.2.g Manufacturing Industries and Construction/Other - Gaseous Fuels	CO2	286.15	55.81	0.2%	0.3%	91.82%
4.C.2.1 Forest Land converted to Grassland - living biomass	CO2	0.000	52.05	0.1%	0.3%	92.08%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Liquid Fuels	CO2	145.24	0.68	0.1%	0.2%	92.32%
5.D.1 Domestic wastewater	CH4	112.70	48.70	0.1%	0.2%	92.57%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Gaseous Fuels	CO2	156.71	7.10	0.1%	0.23%	92.80%
4.C.2 Land converted to Grassland – mineral soils	CO2	-0.17	-46.39	0.1%	0.2%	93.03%

IPCC Source Category	Gas	Emissions 1990	Emissions 2020	Tier 1 trend assessment	% Contribution to Trend	Cumulative total
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N2O	158.96	100.88	0.1%	0.2%	93.26%
4.D Forest Land 4(II) Emissions and removals from drainage and rewetting	CH4	63.75	65.87	0.1%	0.2%	93.47%
2.F.1.a Commercial Refrigeration	HFC	0.000	39.88	0.1%	0.2%	93.67%
4.B.2.2 Grassland converted to Cropland - organic soils	CO2	0.000	35.67	0.1%	0.2%	93.85%
4.A.2.3 Wetlands converted to Forest Land - living biomass	CO2	-0.28	-35.48	0.1%	0.2%	94.02%
4.F.2.1 Forest land converted to Other land – living biomass	CO2	0.00	34.89	0.1%	0.2%	94.19%
3.B.1.1 Manure Management -Non-Dairy Cattle	CH4	16.42	40.31	0.1%	0.2%	94.37%
4.B.2.2 Grassland converted to Cropland - mineral soils	CO2	0.000	33.51	0.1%	0.17%	94.53%
4.A.2.2. Grassland converted to Forest Land - litter	CO2	-0.83	-32.67	0.1%	0.2%	94.69%
2.F.1.c Industrial Refrigeration	HFC	0.000	31.75	0.1%	0.2%	94.85%
5.D.1 Domestic wastewater	N2O	38.66	31.64	0.1%	0.2%	95.01%

**Table A.1.6.** Tier 1 trend assessment without LULUCF

IPCC Source Category	Gas	Emissions 1990	Emissions 2020	Tier 1 trend as- sessment	% Cont- ribution to Trend	Cumu- lative total
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO2	22017.06	3612.66	6.8%	25.8%	25.8%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO2	78.38	1559.71	3.8%	14.6%	40.3%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO2	2234.91	2150.66	3.8%	14.3%	54.6%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CO2	3518.60	107.82	2.3%	8.6%	63.2%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	CO2	1815.26	258.21	0.7%	2.5%	65.7%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Liquid Fuels	CO2	695.49	28.01	0.4%	1.6%	67.3%
1.A.4.a Other Sectors/Commercial/Institutional - Gaseous Fuels	CO2	18.65	173.92	0.4%	1.6%	68.9%
3.D.1.4 Direct Soil Emissions - Crop Residue	N2O	189.26	156.86	0.4%	1.5%	70.4%

IPCC Source Category	Gas	Emissions 1990	Emissions 2020	Tier 1 trend as- essment	% Cont- ribution to Trend	Cumu- lative total
1.A.4.c.ii Other Sectors/Agriculture/Forestry/Fishing/Off-road vehicles and other machinery - Liquid Fuels	CO2	87.08	178.90	0.4%	1.5%	71.8%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	CO2	595.12	25.01	0.4%	1.4%	73.2%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	CO2	0.000	143.46	0.4%	1.4%	74.6%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Liquid Fuels	CO2	448.15	0.09	0.3%	1.2%	75.8%
2.A.1 Cement production	CO2	483.04	20.12	0.3%	1.1%	76.9%
3.A.1 Enteric Fermentation - Dairy Cattle	CH4	733.07	329.27	0.3%	1.1%	78.1%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Peat	CO2	841.33	126.70	0.3%	1.1%	79.1%
1.A.4.b Other Sectors/Residential - Biomass	CH4	38.20	124.50	0.3%	1.1%	80.2%
5.A Solid waste disposal	CH4	213.72	173.91	0.3%	1.1%	81.3%
3.D.1.6 Direct Soil Emissions - Cultivation of Organic Soils	N2O	144.12	139.50	0.2%	0.9%	82.2%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N2O	337.35	194.27	0.2%	0.9%	83.1%
1.A.4.b Other Sectors/Residential - Solid Fuels	CO2	336.77	3.79	0.2%	0.9%	84.0%
1.A.4.b Other Sectors/Residential - Gaseous Fuels	CO2	131.64	129.94	0.2%	0.9%	84.9%
1.A.4.b Other Sectors/Residential - Peat	CO2	308.79	0.000	0.2%	0.8%	85.7%
2.B.1 Ammonia production	CO2	307.73	0.000	0.2%	0.8%	86.6%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Gaseous Fuels	CO2	0.000	69.99	0.2%	0.7%	87.2%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Other Fuels	CO2	0.000	66.46	0.2%	0.6%	87.9%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Gaseous Fuels	CO2	0.000	62.29	0.2%	0.6%	88.5%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Liquid Fuels	CO2	228.63	3.66	0.2%	0.6%	89.0%
3.B.1.1 Manure Management - Dairy Cattle	CH4	35.68	72.34	0.2%	0.6%	89.6%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	CO2	194.01	0.14	0.1%	0.5%	90.2%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N2O	158.96	100.88	0.1%	0.5%	90.7%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Liquid Fuels	CO2	487.05	92.92	0.1%	0.4%	91.1%
3.A.1 Enteric Fermentation - Non-Dairy Cattle	CH4	436.09	166.87	0.1%	0.4%	91.5%

<b>IPCC Source Category</b>	<b>Gas</b>	<b>Emissions 1990</b>	<b>Emissions 2020</b>	<b>Tier 1 trend as- sessment</b>	<b>% Con- tribution to Trend</b>	<b>Cumu- lative total</b>
1.A.4.b Other Sectors/Residential - Liquid Fuels	CO2	247.01	29.75	0.1%	0.4%	91.9%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Liquid Fuels	CO2	145.24	0.68	0.1%	0.4%	92.3%
2.F.1.a Commercial Refrigeration	HFC	0.000	39.88	0.1%	0.4%	92.7%
3.D.1.2a Direct Soil Emissions - Animal Manure Applied to Soils	N2O	139.49	79.68	0.1%	0.4%	93.1%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Gaseous Fuels	CO2	156.71	7.10	0.1%	0.4%	93.4%
1.A.4.a Other Sectors/Commercial/Institutional - Liquid Fuels	CO2	139.79	77.54	0.1%	0.4%	93.8%
1.A.2.g Manufacturing Industries and Construction/Other - Liquid Fuels	CO2	702.34	165.52	0.1%	0.3%	94.1%
3.B.1.1 Manure Management -Non-Dairy Cattle	CH4	16.42	40.31	0.1%	0.3%	94.4%
2.F.1.c Industrial Refrigeration	HFC	0.000	31.75	0.1%	0.3%	94.7%
2.F.1.d Refrigerated Vehicles	HFC	0.000	27.01	0.1%	0.3%	95.0%

**Table A.1.7.** Tier 2 level assessment year 1990 without LULUCF

IPCC Source Category	Gas	Emissions 1990	Lxt	Uxt	Tier 2 level assessment	Normali- sed Tier 2 level as- essment	Cumulative total
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO2	22017.06	0.548	4%	0.022	0.155	15.5%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N2O	337.35	0.008	200%	0.017	0.117	27.2%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N2O	158.96	0.004	287%	0.011	0.079	35.1%
3.D.1.4 Direct Soil Emissions - Crop Residue	N2O	189.26	0.005	202%	0.010	0.066	41.7%
3.D.2.1 Indirect Emissions - Atmospheric Deposition	N2O	69.71	0.002	435%	0.008	0.052	47.0%
3.D.1.2a Direct Soil Emissions - Animal Manure Applied to Soils	N2O	139.49	0.003	212%	0.007	0.051	52.1%
3.A.1 Enteric Fermentation - Dairy Cattle	CH4	733.07	0.018	40%	0.007	0.051	57.2%
3.D.1.6 Direct Soil Emissions - Cultivation of Organic Soils	N2O	144.12	0.004	201%	0.007	0.050	62.2%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	CO2	595.12	0.015	39%	0.006	0.040	66.2%
5.A Solid waste disposal	CH4	213.72	0.005	89%	0.005	0.033	69.5%
3.A.1 Enteric Fermentation - Non-Dairy Cattle	CH4	436.09	0.011	40%	0.004	0.030	72.5%
3.D.1.3 Direct Soil Emissions Urine and Dung Deposited by Grazing Animals	N2O	73.25	0.002	212%	0.004	0.027	75.2%
3.B.2.5 Indirect N2O Emissions from Manure Management	N2O	32.74	0.001	403%	0.003	0.023	77.5%
1.A.4.b Other Sectors/Residential - Solid Fuels	CO2	336.77	0.008	39%	0.003	0.023	79.7%
1.A.4.b Other Sectors/Residential - Peat	CO2	308.79	0.008	39%	0.003	0.021	81.8%
5.D.1 Domestic wastewater	CH4	112.70	0.003	90%	0.003	0.017	83.6%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CO2	3518.60	0.088	2%	0.002	0.015	85.1%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	CO2	194.01	0.005	39%	0.002	0.013	86.4%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	CO2	1815.26	0.045	4%	0.002	0.012	87.6%
1.A.4.b Other Sectors/Residential - Biomass	CH4	38.20	0.001	150%	0.001	0.010	88.6%
3.B.1.3 Manure Management - Swine	CH4	103.42	0.003	54%	0.001	0.010	89.6%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO2	2234.91	0.056	2%	0.001	0.010	90.5%



**Table A.1.8.** Tier 2 level assessment year 2020 without LULUCF

IPCC Source Category	Gas	Emissions 2020	Lxt	Uxt	Tier 2 level assessment	Normali- sed Tier 2 level as- sessment	Cumulative total
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO2	1559.71	0.135	39%	0.053	0.165	16.5%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N2O	194.27	0.017	200%	0.034	0.105	27.0%
3.D.1.4 Direct Soil Emissions - Crop Residue	N2O	156.86	0.014	202%	0.027	0.086	35.6%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N2O	100.88	0.009	287%	0.025	0.078	43.4%
3.D.1.6 Direct Soil Emissions - Cultivation of Organic Soils	N2O	139.50	0.012	201%	0.024	0.076	51.0%
1.A.4.b Other Sectors/Residential - Biomass	CH4	124.50	0.011	150%	0.016	0.051	56.0%
3.D.1.2a Direct Soil Emissions - Animal Manure Applied to Soils	N2O	79.68	0.007	212%	0.015	0.046	60.6%
3.D.2.1 Indirect Emissions - Atmospheric Deposition	N2O	38.87	0.003	435%	0.015	0.046	65.2%
5.A Solid waste disposal	CH4	173.91	0.015	89%	0.013	0.042	69.4%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO2	3612.66	0.313	4%	0.013	0.040	73.3%
3.A.1 Enteric Fermentation - Dairy Cattle	CH4	329.27	0.028	40%	0.011	0.036	76.9%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	CO2	143.46	0.012	60%	0.007	0.023	79.2%
3.B.2.5 Indirect N2O Emissions from Manure Management	N2O	19.00	0.002	403%	0.007	0.021	81.3%
3.A.1 Enteric Fermentation - Non-Dairy Cattle	CH4	166.87	0.014	40%	0.006	0.018	83.1%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO2	2150.66	0.186	2%	0.005	0.014	84.6%
5.D.1 Domestic wastewater	CH4	48.70	0.004	90%	0.004	0.012	85.7%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Other Fuels	CO2	66.46	0.006	60%	0.003	0.011	86.8%
3.B.1.1 Manure Management - Dairy Cattle	CH4	72.34	0.006	54%	0.003	0.011	87.9%
5.D.1 Domestic wastewater	N2O	31.64	0.003	109%	0.003	0.009	88.8%
3.B.2.1 Manure Management - Dairy Cattle	N2O	27.71	0.002	122%	0.003	0.009	89.7%

**Table A.1.9.** Tier 2 level assessment year 1990 with LULUCF

IPCC Source Category	Gas	Emissions 1990	Absolute value	Lxt	Uxt	Tier 2 level assessment	Normali- sed Tier 2 level as- sessment	Cumulative total
4.A.1. Forest Land remaining Forest Land - living biomass	CO2	-3449.53	3449.53	0.074	47%	0.035	0.183	18.3%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO2	22017.06	22017.06	0.471	4%	0.019	0.101	28.5%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N2O	337.35	337.35	0.007	200%	0.014	0.076	36.1%
4.A.1. Forest Land remaining Forest Land - mineral soils	CO2	-1063.28	1063.28	0.023	60%	0.014	0.072	43.3%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N2O	158.96	158.96	0.003	287%	0.010	0.052	48.5%
3.D.1.4 Direct Soil Emissions - Crop Residue	N2O	189.26	189.26	0.004	202%	0.008	0.043	52.8%
3.D.2.1 Indirect Emissions - Atmospheric Deposition	N2O	69.71	69.71	0.001	435%	0.006	0.034	56.3%
3.D.1.2a Direct Soil Emissions - Animal Manure Applied to Soils	N2O	139.49	139.49	0.003	212%	0.006	0.034	59.6%
3.A.1 Enteric Fermentation - Dairy Cattle	CH4	733.07	733.07	0.016	40%	0.006	0.033	62.9%
3.D.1.6 Direct Soil Emissions - Cultivation of Organic Soils	N2O	144.12	144.12	0.003	201%	0.006	0.033	66.2%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	CO2	595.12	595.12	0.013	39%	0.005	0.026	68.9%
5.A Solid waste disposal	CH4	213.72	213.72	0.005	89%	0.004	0.021	71.0%
3.A.1 Enteric Fermentation - Non-Dairy Cattle	CH4	436.09	436.09	0.009	40%	0.004	0.020	73.0%
4.D.1.1 Peat extraction remaining Peat extraction - organic soils	CO2	298.77	298.77	0.006	55%	0.004	0.019	74.8%
4.B.1 Cropland remaining Cropland - organic soils	CO2	668.54	668.54	0.014	24%	0.003	0.018	76.6%
3.D.1.3 Direct Soil Emissions Urine and Dung Deposited by Grazing Animals	N2O	73.25	73.25	0.002	212%	0.003	0.018	78.4%
4.A.1. Forest Land remaining Forest Land - organic soils	CO2	331.31	331.31	0.007	40%	0.003	0.015	79.9%
Wood panels and sawnwood	CO2	-156.26	156.26	0.003	85%	0.003	0.015	81.4%
3.B.2.5 Indirect N2O Emissions from Manure Management	N2O	32.74	32.74	0.001	403%	0.003	0.015	82.9%
1.A.4.b Other Sectors/Residential - Solid Fuels	CO2	336.77	336.77	0.007	39%	0.003	0.015	84.4%
1.A.4.b Other Sectors/Residential - Peat	CO2	308.79	308.79	0.007	39%	0.003	0.014	85.8%
4.D Forest Land 4(II) Emissions and removals from drainage and rewetting	N2O	260.53	260.53	0.006	39%	0.002	0.012	86.9%
5.D.1 Domestic wastewater	CH4	112.70	112.70	0.002	90%	0.002	0.011	88.1%

IPCC Source Category	Gas	Emissions 1990	Absolute value	Lxt	Uxt	Tier 2 level assessment	Normali- sed Tier 2 level as- sessment	Cumulative total
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CO2	3518.60	3518.60	0.075	2%	0.002	0.010	89.0%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	CO2	194.01	194.01	0.004	39%	0.002	0.009	89.9%

**Table A.1.10.** Tier 2 level assessment year 2020 with LULUCF

IPCC Source Category	Gas	Emissions 2020	Lxt	Uxt	Tier 2 level assessment	Normalised Tier 2 level assessment	Cumu- lative total	IPCC Source Category
Wood panels and sawnwood	CO2	-932.90	932.90	0.050	85%	0.043	10.42%	10.4%
4.A.1. Forest Land remaining Forest Land - mineral soils	CO2	-1073.54	1073.54	0.058	60%	0.035	8.48%	18.9%
4.D.1.1 Peat extraction remaining Peat extraction - organic soils	CO2	1104.40	1104.40	0.060	55%	0.033	8.05%	27.0%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO2	1559.71	1559.71	0.084	39%	0.033	8.02%	35.0%
4.A.1. Forest Land remaining Forest Land - living biomass	CO2	1029.67	1029.67	0.056	47%	0.026	6.37%	41.3%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N2O	194.27	194.27	0.010	200%	0.021	5.12%	46.5%
3.D.1.4 Direct Soil Emissions - Crop Residue	N2O	156.86	156.86	0.008	202%	0.017	4.18%	50.6%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N2O	100.88	100.88	0.005	287%	0.016	3.82%	54.5%
3.D.1.6 Direct Soil Emissions - Cultivation of Organic Soils	N2O	139.50	139.50	0.008	201%	0.015	3.70%	58.2%
1.A.4.b Other Sectors/Residential - Biomass	CH4	124.50	124.50	0.007	150%	0.010	2.46%	60.6%
3.D.1.2a Direct Soil Emissions - Animal Manure Applied to Soils	N2O	79.68	79.68	0.004	212%	0.009	2.23%	62.9%
3.D.2.1 Indirect Emissions - Atmospheric Deposition	N2O	38.87	38.87	0.002	435%	0.009	2.23%	65.1%
4.B.1 Cropland remaining Cropland - mineral soils	CO2	-272.68	272.68	0.015	60%	0.009	2.16%	67.2%
5.A Solid waste disposal	CH4	173.91	173.91	0.009	89%	0.008	2.04%	69.3%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO2	3612.66	3612.66	0.195	4%	0.008	1.94%	71.2%
4.B.1 Cropland remaining Cropland - organic soils	CO2	585.04	585.04	0.032	24%	0.008	1.83%	73.0%
4.A.1. Forest Land remaining Forest Land - organic soils	CO2	334.25	334.25	0.018	40%	0.007	1.77%	74.8%
3.A.1 Enteric Fermentation - Dairy Cattle	CH4	329.27	329.27	0.018	40%	0.007	1.73%	76.5%

IPCC Source Category	Gas	Emissions 2020	Lxt	Uxt	Tier 2 level assessment	Normalised Tier 2 level assessment	Cumu- lative total	IPCC Source Category
4.D Forest Land 4(II) Emissions and removals from drainage and rewetting	N2O	266.04	266.04	0.014	39%	0.006	1.37%	77.9%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	CO2	143.46	143.46	0.008	60%	0.005	1.14%	79.1%
3.B.2.5 Indirect N2O Emissions from Manure Management	N2O	19.00	19.00	0.001	403%	0.004	1.01%	80.1%
4.A.2.2. Grassland converted to Forest Land - living biomass	CO2	-153.78	153.78	0.008	49%	0.004	0.98%	81.0%
4.E.2.1 Forest Land converted to Settlements – living biomass	CO2	140.07	140.07	0.008	52%	0.004	0.95%	82.0%
3.A.1 Enteric Fermentation - Non-Dairy Cattle	CH4	166.87	166.87	0.009	40%	0.004	0.88%	82.9%
4.E.2.1 Forest Land converted to Settlements (min+org soils)	CO2	102.21	102.21	0.006	57%	0.003	0.77%	83.6%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO2	2150.66	2150.66	0.116	2%	0.003	0.70%	84.3%
4.E.2.2 Cropland converted to Settlements - soils	CO2	78.73	78.73	0.004	65%	0.003	0.68%	85.0%
5.D.1 Domestic wastewater	CH4	48.70	48.70	0.003	90%	0.002	0.58%	85.6%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Other Fuels	CO2	66.46	66.46	0.004	60%	0.002	0.53%	86.1%
3.B.1.1 Manure Management - Dairy Cattle	CH4	72.34	72.34	0.004	54%	0.002	0.51%	86.6%
4.C.2.1 Forest Land converted to Grassland - living biomass	CO2	52.05	52.05	0.003	72%	0.002	0.49%	87.1%
4.D Forest Land 4(II) Emissions and removals from drainage and rewetting	CH4	65.87	65.87	0.004	55%	0.002	0.48%	87.6%
5.D.1 Domestic wastewater	N2O	31.64	31.64	0.002	109%	0.002	0.45%	88.1%
3.B.2.1 Manure Management - Dairy Cattle	N2O	27.71	27.71	0.001	122%	0.002	0.45%	88.5%
3.D.1.3 Direct Soil Emissions Urine and Dung Deposited by Grazing Animals	N2O	15.41	15.41	0.001	212%	0.002	0.43%	88.9%
4.A.2.1. Cropland converted to Forest Land - living biomass	CO2	-65.74	65.74	0.004	48%	0.002	0.42%	89.4%
1.A.4.b Other Sectors/Residential - Biomass	N2O	19.79	19.79	0.001	150%	0.002	0.39%	89.8%
4.E.2. Land converted to Settlements - (4III) direct N2O emissions	N2O	18.73	18.73	0.001	158%	0.002	0.39%	90.1%

**Table A.1.11.** Tier 2 trend assessment without LULUCF

IPCC Source Category	Gas	Emissions 1990	Emissions 2020	Txt	Uxt	Tier 2 trend assessment	Normalised Tier 2 trend assessment	Cumulative total
3.D.1.4 Direct Soil Emissions - Crop Residue	N2O	189.26	156.86	0.009	202%	0.018	9.49%	9.5%
3.D.1.6 Direct Soil Emissions - Cultivation of Organic Soils	N2O	144.12	139.50	0.008	201%	0.017	9.03%	18.5%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N2O	337.35	194.27	0.008	200%	0.017	8.92%	27.4%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO2	78.38	1559.71	0.039	39%	0.015	8.02%	35.5%
1.A.4.b Other Sectors/Residential - Biomass	CH4	38.20	124.50	0.010	150%	0.015	7.82%	43.3%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N2O	158.96	100.88	0.005	287%	0.014	7.26%	50.5%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO2	22017.06	3612.66	0.235	4%	0.010	5.08%	55.6%
5.A Solid waste disposal	CH4	213.72	173.91	0.010	89%	0.009	4.58%	60.2%
3.D.1.2a Direct Soil Emissions - Animal Manure Applied to Soils	N2O	139.49	79.68	0.003	212%	0.007	3.85%	64.0%
3.D.2.1 Indirect Emissions - Atmospheric Deposition	N2O	69.71	38.87	0.002	435%	0.007	3.75%	67.8%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	CO2	595.12	25.01	0.013	39%	0.005	2.61%	70.4%
3.A.1 Enteric Fermentation - Dairy Cattle	CH4	733.07	329.27	0.010	40%	0.004	2.17%	72.6%
3.B.2.5 Indirect N2O Emissions from Manure Management	N2O	32.74	19.00	0.001	403%	0.003	1.77%	74.3%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO2	2234.91	2150.66	0.130	2%	0.003	1.71%	76.0%
1.A.4.b Other Sectors/Residential - Solid Fuels	CO2	336.77	3.79	0.008	39%	0.003	1.66%	77.7%
1.A.4.b Other Sectors/Residential - Peat	CO2	308.79	0	0.008	39%	0.003	1.59%	79.3%
3.B.1.1 Manure Management - Dairy Cattle	CH4	35.68	72.34	0.005	54%	0.003	1.53%	80.8%
1.A.4.b Other Sectors/Residential - Biomass	N2O	6.07	19.79	0.002	150%	0.002	1.24%	82.1%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	CO2	0.00	143.46	0.004	60%	0.002	1.14%	83.2%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CO2	3518.60	107.82	0.078	2%	0.002	1.03%	84.2%
5.D.1 Domestic wastewater	N2O	38.66	31.64	0.002	109%	0.002	1.02%	85.3%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	CO2	194.01	0.14	0.005	39%	0.002	1.00%	86.3%
3.B.2.1 Manure Management - Dairy Cattle	N2O	40.38	27.71	0.001	122%	0.002	0.90%	87.2%

IPCC Source Category	Gas	Emissions 1990	Emissions 2020	Txt	Uxt	Tier 2 trend assessment	Normalised Tier 2 trend assessment	Cumulative total
3.B.1.1 Manure Management -Non-Dairy Cattle	CH4	16.42	40.31	0.003	54%	0.002	0.88%	88.0%
3.B.2.1 Manure Management -Non-Dairy Cattle	N2O	19.28	20.18	0.001	122%	0.002	0.82%	88.9%
3.A.1 Enteric Fermentation - Non-Dairy Cattle	CH4	436.09	166.87	0.004	40%	0.001	0.76%	89.6%
5.D.1 Domestic wastewater	CH4	112.70	48.70	0.001	90%	0.001	0.67%	90.3%

**Table A.1.12.** Tier 2 trend assessment with LULUCF

IPCC Source Category	Gas	Emissions 1990	Emissions 2020	Txt	Uxt	Tier 2 trend assessment	Normalised Tier 2 trend assessment	Cumulative total
4.A.1. Forest Land remaining Forest Land - living biomass	CO2	-3449.53	1029.67	0.173	47%	0.081	17.18%	17.2%
Wood panels and sawnwood	CO2	-156.26	-932.90	0.068	85%	0.058	12.23%	29.4%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO2	78.38	1559.71	0.119	39%	0.047	9.82%	39.2%
4.D.1.1 Peat extraction remaining Peat extraction - organic soils	CO2	298.77	1104.40	0.078	55%	0.043	9.10%	48.3%
4.A.1. Forest Land remaining Forest Land - mineral soils	CO2	-1063.28	-1073.54	0.055	60%	0.033	6.94%	55.3%
3.D.1.4 Direct Soil Emissions - Crop Residue	N2O	189.26	156.86	0.007	202%	0.014	3.03%	58.3%
3.D.1.6 Direct Soil Emissions - Cultivation of Organic Soils	N2O	144.12	139.50	0.007	201%	0.014	2.95%	61.2%
1.A.4.b Other Sectors/Residential - Biomass	CH4	38.20	124.50	0.009	150%	0.013	2.74%	64.0%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO2	22017.06	3612.66	0.314	4%	0.013	2.70%	66.7%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N2O	337.35	194.27	0.006	200%	0.012	2.54%	69.2%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N2O	158.96	100.88	0.004	287%	0.010	2.15%	71.4%
5.A Solid waste disposal	CH4	213.72	173.91	0.008	89%	0.007	1.45%	72.8%
4.A.1. Forest Land remaining Forest Land - organic soils	CO2	331.31	334.25	0.017	40%	0.007	1.44%	74.3%
4.B.1 Cropland remaining Cropland - organic soils	CO2	668.54	585.04	0.027	24%	0.007	1.38%	75.7%
4.A.2.2. Grassland converted to Forest Land - living biomass	CO2	-3.90	-153.78	0.012	49%	0.006	1.22%	76.9%

IPCC Source Category	Gas	Emissions 1990	Emissions 2020	Txt	Uxt	Tier 2 trend as- sessment	Normalised Tier 2 trend as- sessment	Cumula- tive total
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	CO2	595.12	25.01	0.014	39%	0.006	1.16%	78.0%
4.D Forest Land 4(II) Emissions and removals from drainage and rewetting	N2O	260.53	266.04	0.014	39%	0.005	1.13%	79.2%
3.D.1.2a Direct Soil Emissions - Animal Manure Applied to Soils	N2O	139.49	79.68	0.002	212%	0.005	1.09%	80.2%
3.D.2.1 Indirect Emissions - Atmospheric Deposition	N2O	69.71	38.87	0.001	435%	0.005	1.05%	81.3%
4.B.1 Cropland remaining Cropland - mineral soils	CO2	0.00	-272.68	0.007	60%	0.004	0.93%	82.2%
1.A.4.b Other Sectors/Residential - Solid Fuels	CO2	336.77	3.79	0.009	39%	0.003	0.73%	83.0%
1.A.4.b Other Sectors/Residential - Peat	CO2	308.79	0.00	0.008	39%	0.003	0.69%	83.6%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO2	2234.91	2150.66	0.107	2%	0.003	0.56%	84.2%
3.B.1.1 Manure Management - Dairy Cattle	CH4	35.68	72.34	0.005	54%	0.003	0.53%	84.7%
4.A.2.1. Cropland converted to Forest Land - living biomass	CO2	-1.73	-65.74	0.005	48%	0.002	0.52%	85.2%
3.B.2.5 Indirect N2O Emissions from Manure Management	N2O	32.74	19.00	0.001	403%	0.002	0.51%	85.8%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	CO2	0.00	143.46	0.004	60%	0.002	0.49%	86.2%
3.A.1 Enteric Fermentation - Dairy Cattle	CH4	733.07	329.27	0.006	40%	0.002	0.49%	86.7%
4.C.2 Land converted to Grassland – mineral soils	CO2	-0.17	-46.39	0.004	61%	0.002	0.47%	87.2%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CO2	3518.60	107.82	0.087	2%	0.002	0.45%	87.7%
1.A.4.b Other Sectors/Residential - Biomass	N2O	6.07	19.79	0.001	150%	0.002	0.44%	88.1%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	CO2	194.01	0.14	0.005	39%	0.002	0.43%	88.5%
4.E.2.1 Forest Land converted to Settlements – living biomass	CO2	0.00	140.07	0.004	52%	0.002	0.41%	88.9%
4.D Forest Land 4(II) Emissions and removals from drainage and rewetting	CH4	63.75	65.87	0.003	55%	0.002	0.40%	89.3%
3.D.1.3 Direct Soil Emissions Urine and Dung Deposited by Grazing Animals	N2O	73.25	15.41	0.001	212%	0.002	0.35%	89.7%
4.E.2.1 Forest Land converted to Settlements (min+org soils)	CO2	0.00	102.21	0.003	57%	0.002	0.33%	90.0%
4.A.2.3 Wetlands converted to Forest Land - living biomass	CO2	-0.28	-35.48	0.003	56%	0.002	0.33%	90.3%

## Annex 2. Assessment of uncertainty

**Table A.2. 1.** Tier 1 uncertainty analysis without LULUCF

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CO <sub>2</sub>	3518.60	107.82	2%	1.80%	2.48%	0.0000	2.25%	0.27%	0.04%	0.01%	0.00002%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO <sub>2</sub>	22017.06	3612.66	3%	2.39%	4.07%	0.0002	6.73%	8.99%	0.16%	0.42%	0.00202%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	CO <sub>2</sub>	1815.26	258.21	1%	3.60%	3.86%	0.0000	0.66%	0.64%	0.02%	0.01%	0.00001%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Peat	CO <sub>2</sub>	841.33	126.70	3%	2.39%	4.07%	0.0000	0.29%	0.32%	0.01%	0.01%	0.00000%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	CO <sub>2</sub>	0.00	143.46	5%	60.00%	60.21%	0.0001	0.36%	0.36%	0.21%	0.03%	0.00047%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CH <sub>4</sub>	1.75	0.04	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CH <sub>4</sub>	0.21	0.34	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	CH <sub>4</sub>	0.25	0.09	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Peat	CH <sub>4</sub>	0.33	0.04	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Biomass	CH <sub>4</sub>	0.27	10.99	5%	50.00%	50.25%	0.0000	0.03%	0.03%	0.01%	0.00%	0.00000%



IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	N <sub>2</sub> O	5.31	0.15	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	N <sub>2</sub> O	2.07	5.00	5%	60.00%	60.21%	0.0000	0.01%	0.01%	0.01%	0.00%	0.00000%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	N <sub>2</sub> O	1.11	0.15	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Peat	N <sub>2</sub> O	5.69	0.71	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	N <sub>2</sub> O	0.00	0.13	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Biomass	N <sub>2</sub> O	0.53	18.24	5%	60.00%	60.21%	0.0000	0.05%	0.05%	0.03%	0.00%	0.00001%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO <sub>2</sub>	78.38	1559.71	3%	38.90%	39.04%	0.0028	3.83%	3.88%	1.49%	0.18%	0.02248%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CH <sub>4</sub>	0.08	1.49	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	N <sub>2</sub> O	0.10	1.77	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Liquid Fuels	CO <sub>2</sub>	0.00	0.00	2%	1.80%	2.48%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Solid Fuels	CO <sub>2</sub>	0.00	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Gaseous Fuels	CO <sub>2</sub>	0.00	0.48	1%	3.60%	3.86%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Peat	CO <sub>2</sub>	0.00	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Liquid Fuels	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Solid Fuels	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Gaseous Fuels	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Peat	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Biomass	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Liquid Fuels	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Solid Fuels	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Gaseous Fuels	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Peat	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Biomass	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Liquid Fuels	CO <sub>2</sub>	0.00	0.00	2%	1.80%	2.48%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Solid Fuels	CO <sub>2</sub>	0.00	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Gaseous Fuels	CO <sub>2</sub>	0.00	1.24	1%	3.60%	3.86%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Peat	CO <sub>2</sub>	0.00	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Liquid Fuels	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Solid Fuels	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Gaseous Fuels	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Peat	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Biomass	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Liquid Fuels	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Solid Fuels	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Gaseous Fuels	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Peat	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Biomass	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Liquid Fuels	CO <sub>2</sub>	228.63	3.66	2%	1.80%	2.48%	0.0000	0.15%	0.01%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Solid Fuels	CO <sub>2</sub>	4.88	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Gaseous Fuels	CO <sub>2</sub>	156.71	7.10	1%	3.60%	3.86%	0.0000	0.09%	0.02%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Peat	CO <sub>2</sub>	0.00	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Liquid Fuels	CH <sub>4</sub>	0.01	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Solid Fuels	CH <sub>4</sub>	0.01	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Gaseous Fuels	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Peat	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Biomass	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Liquid Fuels	N <sub>2</sub> O	0.17	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Solid Fuels	N <sub>2</sub> O	0.02	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Gaseous Fuels	N <sub>2</sub> O	0.10	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Peat	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Biomass	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Liquid Fuels	CO <sub>2</sub>	145.24	0.68	2%	1.80%	2.48%	0.0000	0.10%	0.00%	0.00%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Solid Fuels	CO <sub>2</sub>	0.00	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Gaseous Fuels	CO <sub>2</sub>	0.00	62.29	1%	3.60%	3.86%	0.0000	0.16%	0.16%	0.01%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Peat	CO <sub>2</sub>	0.00	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Liquid Fuels	CH <sub>4</sub>	0.01	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Solid Fuels	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Gaseous Fuels	CH <sub>4</sub>	0.00	0.01	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Peat	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Biomass	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Liquid Fuels	N <sub>2</sub> O	0.11	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Solid Fuels	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Gaseous Fuels	N <sub>2</sub> O	0.00	0.04	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Peat	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Biomass	N <sub>2</sub> O	0.00	0.02	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Liquid Fuels	CO <sub>2</sub>	695.49	28.01	2%	1.80%	2.48%	0.0000	0.43%	0.07%	0.01%	0.00%	0.00000%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Solid Fuels	CO <sub>2</sub>	0.00	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Gaseous Fuels	CO <sub>2</sub>	0.00	69.99	1%	3.60%	3.86%	0.0000	0.17%	0.17%	0.01%	0.00%	0.00000%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Peat	CO <sub>2</sub>	0.00	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Liquid Fuels	CH <sub>4</sub>	0.41	0.02	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Solid Fuels	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Gaseous Fuels	CH <sub>4</sub>	0.00	0.01	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Peat	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Biomass	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Liquid Fuels	N <sub>2</sub> O	1.18	0.05	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Solid Fuels	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Gaseous Fuels	N <sub>2</sub> O	0.00	0.04	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Peat	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Biomass	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Liquid Fuels	CO <sub>2</sub>	448.15	0.09	2%	1.80%	2.48%	0.0000	0.32%	0.00%	0.01%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	CO <sub>2</sub>	595.12	25.01	3%	38.90%	39.04%	0.0000	0.36%	0.06%	0.14%	0.00%	0.00020%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Gaseous Fuels	CO <sub>2</sub>	0.00	22.04	1%	3.60%	3.86%	0.0000	0.05%	0.05%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Peat	CO <sub>2</sub>	9.49	0.00	3%	38.90%	39.04%	0.0000	0.01%	0.00%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Other Fuels	CO <sub>2</sub>	0.00	66.46	5%	60.00%	60.21%	0.0000	0.17%	0.17%	0.10%	0.01%	0.00010%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Liquid Fuels	CH <sub>4</sub>	0.22	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	CH <sub>4</sub>	1.39	0.06	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Gaseous Fuels	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Peat	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Other Fuels	CH <sub>4</sub>	0.00	0.63	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Biomass	CH <sub>4</sub>	0.00	0.02	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%



IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Liquid Fuels	N <sub>2</sub> O	0.68	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	N <sub>2</sub> O	2.32	0.11	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Gaseous Fuels	N <sub>2</sub> O	0.00	0.01	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Peat	N <sub>2</sub> O	0.06	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Other Fuels	N <sub>2</sub> O	0.00	1.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Biomass	N <sub>2</sub> O	0.00	0.08	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.g Manufacturing Industries and Construction/Other - Liquid Fuels	CO <sub>2</sub>	702.34	165.52	2%	1.80%	2.48%	0.0000	0.09%	0.41%	0.00%	0.01%	0.00000%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	CO <sub>2</sub>	194.01	0.14	3%	38.90%	39.04%	0.0000	0.14%	0.00%	0.05%	0.00%	0.00003%
1.A.2.g Manufacturing Industries and Construction/Other - Gaseous Fuels	CO <sub>2</sub>	286.15	55.81	1%	3.60%	3.86%	0.0000	0.07%	0.14%	0.00%	0.00%	0.00000%
1.A.2.g Manufacturing Industries and Construction/Other - Peat	CO <sub>2</sub>	0.00	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.g Manufacturing Industries and Construction/Other - Liquid Fuels	CH <sub>4</sub>	0.06	0.07	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	CH <sub>4</sub>	0.49	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.2.g Manufacturing Industries and Construction/Other - Gaseous Fuels	CH <sub>4</sub>	0.01	0.01	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.g Manufacturing Industries and Construction/Other - Peat	CH <sub>4</sub>	0.00	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.g Manufacturing Industries and Construction/Other - Biomass	CH <sub>4</sub>	0.03	0.01	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.g Manufacturing Industries and Construction/Other - Liquid Fuels	N <sub>2</sub> O	0.58	0.48	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	N <sub>2</sub> O	0.88	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.g Manufacturing Industries and Construction/Other - Gaseous Fuels	N <sub>2</sub> O	0.18	0.03	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.g Manufacturing Industries and Construction/Other - Peat	N <sub>2</sub> O	0.00	0.00	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.2.g Manufacturing Industries and Construction/Other - Biomass	N <sub>2</sub> O	0.06	0.04	5%	60.00%	60.21%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.3.a Transport/Domestic Aviation - Liquid Fuels	CO <sub>2</sub>	5.52	3.56	2%	1.80%	2.48%	0.0000	0.00%	0.01%	0.00%	0.00%	0.00000%
1.A.3.a Transport/Domestic Aviation - Liquid Fuels	CH <sub>4</sub>	0.00	0.00	5%	40.00%	40.31%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.3.a Transport/Domestic Aviation - Liquid Fuels	N <sub>2</sub> O	0.05	0.03	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO <sub>2</sub>	2234.91	2150.66	2%	1.80%	2.48%	0.0000	3.75%	5.35%	0.07%	0.13%	0.00021%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CH <sub>4</sub>	21.65	2.84	5%	40.00%	40.31%	0.0000	0.01%	0.01%	0.00%	0.00%	0.00000%
1.A.3.b Transport/Road Transportation - Biomass	CH <sub>4</sub>	0.00	0.09	5%	100.00%	100.12%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.3.b Transport/Road Transportation - Liquid Fuels	N <sub>2</sub> O	21.67	20.56	5%	50.00%	50.25%	0.0000	0.04%	0.05%	0.02%	0.00%	0.00000%
1.A.3.b Transport/Road Transportation - Biomass	N <sub>2</sub> O	0.00	0.00	5%	150.00%	150.08%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.3.c Transport/Railways - Liquid Fuels	CO <sub>2</sub>	142.27	31.08	2%	1.80%	2.48%	0.0000	0.02%	0.08%	0.00%	0.00%	0.00000%
1.A.3.c Transport/Railways - Solid Fuels	CO <sub>2</sub>	17.08	0.00	3%	38.90%	39.04%	0.0000	0.01%	0.00%	0.00%	0.00%	0.00000%
1.A.3.c Transport/Railways - Liquid Fuels	CH <sub>4</sub>	0.20	0.04	5%	40.00%	40.31%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.3.c Transport/Railways - Solid Fuels	CH <sub>4</sub>	0.01	0.00	5%	40.00%	40.31%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.3.c Transport/Railways - Liquid Fuels	N <sub>2</sub> O	16.58	3.62	4%	50.00%	50.16%	0.0000	0.00%	0.01%	0.00%	0.00%	0.00000%
1.A.3.c Transport/Railways - Solid Fuels	N <sub>2</sub> O	0.08	0.00	5%	40.00%	40.31%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.3.d Transport/Domestic Navigation - Liquid Fuels	CO <sub>2</sub>	21.65	19.82	5%	50.00%	50.25%	0.0000	0.03%	0.05%	0.02%	0.00%	0.00000%
1.A.3.d Transport/Domestic Navigation - Liquid Fuels	CH <sub>4</sub>	0.05	0.05	5%	40.00%	40.31%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.3.d Transport/Domestic Navigation - Liquid Fuels	N <sub>2</sub> O	0.18	0.16	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Liquid Fuels	CO <sub>2</sub>	139.79	77.54	2%	1.80%	2.48%	0.0000	0.09%	0.19%	0.00%	0.00%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Solid Fuels	CO <sub>2</sub>	0.00	4.08	3%	38.90%	39.04%	0.0000	0.01%	0.01%	0.00%	0.00%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Gaseous Fuels	CO <sub>2</sub>	18.65	173.92	1%	3.60%	3.86%	0.0000	0.42%	0.43%	0.02%	0.01%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Peat	CO <sub>2</sub>	6.21	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Liquid Fuels	CH <sub>4</sub>	0.10	0.24	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Solid Fuels	CH <sub>4</sub>	0.00	0.01	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Gaseous Fuels	CH <sub>4</sub>	0.01	0.10	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.4.a Other Sectors/Commercial/Institutional - Peat	CH <sub>4</sub>	0.01	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Biomass	CH <sub>4</sub>	5.80	1.06	10%	150.00%	150.33%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Liquid Fuels	N <sub>2</sub> O	0.15	0.17	5%	75.00%	75.17%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Solid Fuels	N <sub>2</sub> O	0.00	0.02	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Gaseous Fuels	N <sub>2</sub> O	0.01	0.11	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Peat	N <sub>2</sub> O	0.04	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.a Other Sectors/Commercial/Institutional - Biomass	N <sub>2</sub> O	1.01	0.20	10%	150.00%	150.33%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.b Other Sectors/Residential - Liquid Fuels	CO <sub>2</sub>	247.01	29.75	2%	1.80%	2.48%	0.0000	0.10%	0.07%	0.00%	0.00%	0.00000%
1.A.4.b Other Sectors/Residential - Solid Fuels	CO <sub>2</sub>	336.77	3.79	3%	38.90%	39.04%	0.0000	0.23%	0.01%	0.09%	0.00%	0.00008%
1.A.4.b Other Sectors/Residential - Gaseous Fuels	CO <sub>2</sub>	131.64	129.94	1%	3.60%	3.86%	0.0000	0.23%	0.32%	0.01%	0.01%	0.00000%
1.A.4.b Other Sectors/Residential - Peat	CO <sub>2</sub>	308.79	0.00	3%	38.90%	39.04%	0.0000	0.22%	0.00%	0.09%	0.00%	0.00007%
1.A.4.b Other Sectors/Residential - Liquid Fuels	CH <sub>4</sub>	0.81	0.33	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.b Other Sectors/Residential - Solid Fuels	CH <sub>4</sub>	26.39	0.30	5%	50.00%	50.25%	0.0000	0.02%	0.00%	0.01%	0.00%	0.00000%
1.A.4.b Other Sectors/Residential - Gaseous Fuels	CH <sub>4</sub>	0.30	0.29	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.b Other Sectors/Residential - Peat	CH <sub>4</sub>	23.88	0.00	5%	50.00%	50.25%	0.0000	0.02%	0.00%	0.01%	0.00%	0.00000%
1.A.4.b Other Sectors/Residential - Biomass	CH <sub>4</sub>	38.20	124.50	10%	150.00%	150.33%	0.0003	0.28%	0.31%	0.42%	0.04%	0.00182%
1.A.4.b Other Sectors/Residential - Liquid Fuels	N <sub>2</sub> O	0.46	0.42	5%	75.00%	75.17%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.b Other Sectors/Residential - Solid Fuels	N <sub>2</sub> O	1.57	0.02	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%

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		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.4.b Other Sectors/Residential - Gaseous Fuels	N <sub>2</sub> O	0.07	0.07	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.b Other Sectors/Residential - Peat	N <sub>2</sub> O	1.33	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.b Other Sectors/Residential - Biomass	N <sub>2</sub> O	6.07	19.79	10%	150.00%	150.33%	0.0000	0.04%	0.05%	0.07%	0.01%	0.00005%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Liquid Fuels	CO <sub>2</sub>	487.05	92.92	2%	1.80%	2.48%	0.0000	0.12%	0.23%	0.00%	0.01%	0.00000%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Solid Fuels	CO <sub>2</sub>	21.96	0.57	3%	38.90%	39.04%	0.0000	0.01%	0.00%	0.01%	0.00%	0.00000%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Gaseous Fuels	CO <sub>2</sub>	3.68	8.28	1%	3.60%	3.86%	0.0000	0.02%	0.02%	0.00%	0.00%	0.00000%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Peat	CO <sub>2</sub>	1.55	0.00	3%	38.90%	39.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Liquid Fuels	CH <sub>4</sub>	0.85	0.23	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Solid Fuels	CH <sub>4</sub>	1.72	0.04	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Gaseous Fuels	CH <sub>4</sub>	0.00	0.01	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Peat	CH <sub>4</sub>	0.12	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Biomass	CH <sub>4</sub>	2.05	0.90	10%	150.00%	150.33%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Liquid Fuels	N <sub>2</sub> O	0.77	0.18	5%	75.00%	75.17%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Solid Fuels	N <sub>2</sub> O	0.10	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Gaseous Fuels	N <sub>2</sub> O	0.00	0.01	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Peat	N <sub>2</sub> O	0.01	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Biomass	N <sub>2</sub> O	0.33	0.15	10%	150.00%	150.33%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.c.ii Other Sectors/Agriculture/Forestry/Fishing/Off-road vehicles and other machinery - Liquid Fuels	CO <sub>2</sub>	87.08	178.90	2%	1.80%	2.48%	0.0000	0.38%	0.45%	0.01%	0.01%	0.00000%
1.A.4.c.ii Other Sectors/Agriculture/Forestry/Fishing/Off-road vehicles and other machinery - Liquid Fuels	CH <sub>4</sub>	0.13	0.09	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.A.4.c.ii Other Sectors/Agriculture/Forestry/Fishing/Off-road vehicles and other machinery - Liquid Fuels	N <sub>2</sub> O	1.05	2.32	5%	75.00%	75.17%	0.0000	0.01%	0.01%	0.00%	0.00%	0.00000%
1.B.2.b.iv - Gaseous Fuels	CO <sub>2</sub>	0.00	0.00	10%	25.00%	26.93%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.B.2.b.iv - Gaseous Fuels	CH <sub>4</sub>	7.35	2.14	10%	25.00%	26.93%	0.0000	0.00%	0.01%	0.00%	0.00%	0.00000%
1.B.2.b.v - Gaseous Fuels	CO <sub>2</sub>	0.09	0.03	10%	25.00%	26.93%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.B.2.b.v - Gaseous Fuels	CH <sub>4</sub>	48.67	14.19	10%	25.00%	26.93%	0.0000	0.00%	0.04%	0.00%	0.00%	0.00000%
1.B.2.c.ii - Gaseous Fuels	CO <sub>2</sub>	0.01	0.00	10%	25.00%	26.93%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
1.B.2.c.ii - Gaseous Fuels	CH <sub>4</sub>	8.05	2.35	10%	25.00%	26.93%	0.0000	0.00%	0.01%	0.00%	0.00%	0.00000%
2.A.1 Cement production	CO <sub>2</sub>	483.04	20.12	0%	1.24%	1.24%	0.0000	0.30%	0.05%	0.00%	0.00%	0.00000%
2.A.2 Lime production	CO <sub>2</sub>	129.69	40.65	0%	2.00%	2.02%	0.0000	0.01%	0.10%	0.00%	0.00%	0.00000%
2.A.3 Glass production	CO <sub>2</sub>	1.23	9.03	0%	1.00%	1.05%	0.0000	0.02%	0.02%	0.00%	0.00%	0.00000%
2.A.4.a Ceramics	CO <sub>2</sub>	0.00	0.51	0%	2.00%	2.00%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.A.4.d Other - Limestone use for flue gas desulphurisation	CO <sub>2</sub>	0.00	0.00	0%	0.00%	0.00%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.B.1 Ammonia production	CO <sub>2</sub>	307.73	0.00	0%	0.00%	0.00%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.C.5 Lead production	CO <sub>2</sub>	0.76	2.90	3%	5.00%	5.83%	0.0000	0.01%	0.01%	0.00%	0.00%	0.00000%
2.D.1 Lubricant use	CO <sub>2</sub>	16.11	2.96	5%	50.90%	51.14%	0.0000	0.00%	0.01%	0.00%	0.00%	0.00000%
2.D.2 Paraffin wax use	CO <sub>2</sub>	1.29	2.66	50%	100.05%	111.84%	0.0000	0.01%	0.01%	0.01%	0.00%	0.00000%

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		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
2.D.3 Other - Urea based catalysts for motor vehicles	CO <sub>2</sub>	0.00	1.13	30%	0.70%	30.01%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.D.3 Other - Solvent use	indirect CO <sub>2</sub>	18.40	24.70	25%	10.00%	26.93%	0.0000	0.05%	0.06%	0.00%	0.02%	0.00000%
2.D.3 Other - Road paving with asphalt	indirect CO <sub>2</sub>	0.05	0.05	100%	100.50%	141.78%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.F.1.a Commercial Refrigeration	HFC	0.00	39.88	10%	30.80%	32.48%	0.0000	0.10%	0.10%	0.03%	0.01%	0.00001%
2.F.1.b Domestic Refrigeration	HFC	0.00	1.09	20%	10.00%	22.36%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.F.1.c Industrial Refrigeration	HFC	0.00	31.75	9%	22.80%	24.55%	0.0000	0.08%	0.08%	0.02%	0.01%	0.00000%
2.F.1.d Refrigerated Vehicles	HFC	0.00	27.01	9%	5.00%	9.86%	0.0000	0.07%	0.07%	0.00%	0.01%	0.00000%
2.F.1.d Reefer Containers	HFC	0.00	1.85	8%	5.00%	9.78%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.F.1.f Heat Pumps	HFC	0.00	10.66	9%	5.00%	10.30%	0.0000	0.03%	0.03%	0.00%	0.00%	0.00000%
2.F.1.f Stationary and Room Air-Conditioning	HFC	0.00	25.77	15%	18.00%	23.43%	0.0000	0.06%	0.06%	0.01%	0.01%	0.00000%
2.F.1.e Mobile Air-Conditioning - Passenger cars	HFC	0.00	15.85	9%	5.00%	9.86%	0.0000	0.04%	0.04%	0.00%	0.00%	0.00000%
2.F.1.e Mobile Air-Conditioning - Trucks	HFC	0.00	5.32	9%	5.00%	9.86%	0.0000	0.01%	0.01%	0.00%	0.00%	0.00000%
2.F.1.e Mobile Air-Conditioning - Buses	HFC	0.00	4.33	9%	5.00%	10.03%	0.0000	0.01%	0.01%	0.00%	0.00%	0.00000%
2.F.1.e Mobile Air-Conditioning - Ships	HFC	0.00	8.57	3%	4.00%	5.00%	0.0000	0.02%	0.02%	0.00%	0.00%	0.00000%
2.F.1.e Mobile Air-Conditioning - Railcars	HFC	0.00	0.01	3%	5.00%	5.83%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.F.1.e Mobile Air-Conditioning - Wheel tractors and mobile machinery	HFC	0.00	5.35	15%	10.00%	17.61%	0.0000	0.01%	0.01%	0.00%	0.00%	0.00000%
2.F.2.a Foam blowing agents; PU Insulation Panels	HFC	0.00	0.10	10%	10.00%	14.14%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.F.2.a Spray and Injection PU Foam	HFC	0.00	0.00	10%	10.00%	14.14%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.F.2.a XPS Insulation Foam	HFC	0.00	0.07	20%	10.00%	22.36%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.F.2.b One Component PU Foam	HFC	0.00	1.28	15%	0.00%	15.00%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.F.3 Fire protection	HFC	0.00	2.58	10%	10.00%	14.14%	0.0000	0.01%	0.01%	0.00%	0.00%	0.00000%
2.F.4 Aerosols; Metered dose inhalers	HFC	0.00	3.28	10%	0.00%	10.00%	0.0000	0.01%	0.01%	0.00%	0.00%	0.00000%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
2.G.1 Electrical equipment	SF <sub>6</sub>	0.00	2.84	3%	10.00%	10.44%	0.0000	0.01%	0.01%	0.00%	0.00%	0.00000%
2.G.2 Particle accelerators	SF <sub>6</sub>	0.00	0.08	21%	21.00%	29.70%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
2.G.3 N <sub>2</sub> O from product use	N <sub>2</sub> O	5.45	3.09	5%	2.00%	5.39%	0.0000	0.00%	0.01%	0.00%	0.00%	0.00000%
3.A.1 Enteric Fermentation - Dairy Cattle	CH <sub>4</sub>	733.07	329.27	1%	40.00%	40.01%	0.0001	0.29%	0.82%	0.12%	0.01%	0.00014%
3.A.1 Enteric Fermentation - Non-Dairy Cattle	CH <sub>4</sub>	436.09	166.87	1%	40.00%	40.02%	0.0000	0.10%	0.42%	0.04%	0.01%	0.00002%
3.A.2 Enteric Fermentation - Sheep	CH <sub>4</sub>	31.70	15.06	7%	40.00%	40.53%	0.0000	0.01%	0.04%	0.01%	0.00%	0.00000%
3.A.3 Enteric Fermentation - Swine	CH <sub>4</sub>	22.21	9.06	0%	40.00%	40.00%	0.0000	0.01%	0.02%	0.00%	0.00%	0.00000%
3.A.4 Enteric Fermentation - Goats	CH <sub>4</sub>	0.26	0.62	10%	40.00%	41.23%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.A.4 Enteric Fermentation - Horses	CH <sub>4</sub>	3.87	2.57	10%	40.00%	41.23%	0.0000	0.00%	0.01%	0.00%	0.00%	0.00000%
3.A.4 Enteric Fermentation - Fur animals	CH <sub>4</sub>	0.58	0.01	10%	40.00%	41.23%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.1.1 Manure Management - Dairy Cattle	CH <sub>4</sub>	35.68	72.34	50%	20.00%	53.86%	0.0000	0.15%	0.18%	0.03%	0.13%	0.00017%
3.B.1.1 Manure Management - Non-Dairy Cattle	CH <sub>4</sub>	16.42	40.31	50%	20.00%	53.86%	0.0000	0.09%	0.10%	0.02%	0.07%	0.00005%
3.B.1.2 Manure Management - Sheep	CH <sub>4</sub>	0.75	0.36	50%	30.00%	58.67%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.1.3 Manure Management - Swine	CH <sub>4</sub>	103.42	48.13	50%	20.00%	53.85%	0.0000	0.05%	0.12%	0.01%	0.08%	0.00007%
3.B.1.4 Manure Management - Goats	CH <sub>4</sub>	0.01	0.02	51%	30.00%	59.16%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.1.4 Manure Management - Horses	CH <sub>4</sub>	0.34	0.22	51%	30.00%	59.16%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.1.4 Manure Management - Poultry	CH <sub>4</sub>	3.81	1.56	51%	30.00%	59.16%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.1.4 Manure Management - Fur animals	CH <sub>4</sub>	3.92	0.05	51%	30.00%	59.16%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.1.4 Manure Management - Rabbits	CH <sub>4</sub>	0.17	0.04	51%	30.00%	59.16%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.2.1 Manure Management - Dairy Cattle	N <sub>2</sub> O	40.38	27.71	50%	111.80%	122.48%	0.0000	0.04%	0.07%	0.04%	0.05%	0.00004%
3.B.2.1 Manure Management - Non-Dairy Cattle	N <sub>2</sub> O	19.28	20.18	50%	111.80%	122.48%	0.0000	0.04%	0.05%	0.04%	0.04%	0.00003%



IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
3.B.2.2 Manure Management - Sheep	N <sub>2</sub> O	2.88	1.37	50%	111.80%	122.65%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.2.3 Manure Management - Swine	N <sub>2</sub> O	2.36	0.62	50%	111.80%	122.48%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.2.4 Manure Management - Goats	N <sub>2</sub> O	0.05	0.11	51%	111.80%	122.88%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.2.4 Manure Management - Horses	N <sub>2</sub> O	0.71	0.47	51%	111.80%	122.88%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.2.4 Manure Management - Poultry	N <sub>2</sub> O	6.39	2.62	51%	111.80%	122.88%	0.0000	0.00%	0.01%	0.00%	0.00%	0.00000%
3.B.2.4 Manure Management - Fur animals	N <sub>2</sub> O	3.98	0.04	51%	111.80%	122.88%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.2.4 Manure Management - Rabbits	N <sub>2</sub> O	1.63	0.38	51%	111.80%	122.88%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.B.2.5 Indirect N <sub>2</sub> O Emissions from Manure Management	N <sub>2</sub> O	32.74	19.00	51%	400.12%	403.36%	0.0000	0.02%	0.05%	0.10%	0.03%	0.00010%
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N <sub>2</sub> O	337.35	194.27	10%	200.00%	200.25%	0.0011	0.24%	0.48%	0.48%	0.07%	0.00239%
3.D.1.2a Direct Soil Emissions - Animal Manure Applied to Soils	N <sub>2</sub> O	139.49	79.68	51%	206.16%	212.37%	0.0002	0.10%	0.20%	0.20%	0.14%	0.00062%
3.D.1.2b Direct Soil Emissions - Sewage Sludge Applied to Soils	N <sub>2</sub> O	0.17	1.81	20%	200.00%	201.00%	0.0000	0.00%	0.00%	0.01%	0.00%	0.00000%
3.D.1.2c Direct Soil Emissions - Compost Applied to Soils	N <sub>2</sub> O	0.23	6.23	20%	200.00%	201.00%	0.0000	0.02%	0.02%	0.03%	0.00%	0.00001%
3.D.1.3 Direct Soil Emissions Urine and Dung Deposited by Grazing Animals	N <sub>2</sub> O	73.25	15.41	51%	206.16%	212.37%	0.0000	0.01%	0.04%	0.03%	0.03%	0.00002%
3.D.1.5 Direct Soil Emissions - Mineralization/Immobilization Associated with Loss/Gain of Soil Organic Matter	N <sub>2</sub> O	0.00	0.00	33%	30.00%	44.77%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
3.D.1.4 Direct Soil Emissions - Crop Residue	N <sub>2</sub> O	189.26	156.86	30%	200.00%	202.24%	0.0008	0.25%	0.39%	0.51%	0.17%	0.00287%
3.D.1.6 Direct Soil Emissions - Cultivation of Organic Soils	N <sub>2</sub> O	144.12	139.50	21%	200.00%	201.14%	0.0006	0.24%	0.35%	0.49%	0.11%	0.00249%
3.D.2.1 Indirect Emissions - Atmospheric Deposition	N <sub>2</sub> O	69.71	38.87	15%	434.95%	435.20%	0.0002	0.05%	0.10%	0.20%	0.02%	0.00042%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty	Contribution to variance by category in year x	Type A sensitivity	Type B sensitivity	UN in trend in national emissions introduced by EF / estimation parameter UN	UN in trend in national emissions introduced by AD UN	UN introduced into the trend in total national emissions
		kt CO <sub>2</sub> eq.	kt CO <sub>2</sub> eq.	%	%	%		%	%	%	%	%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N <sub>2</sub> O	158.96	100.88	18%	286.74%	287.28%	0.0006	0.14%	0.25%	0.39%	0.06%	0.00159%
3.G Liming	CO <sub>2</sub>	12.11	15.73	29%	50.00%	57.88%	0.0000	0.03%	0.04%	0.02%	0.02%	0.00000%
3.H Urea Application	CO <sub>2</sub>	1.00	0.13	2%	50.00%	50.04%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
5.A Solid waste disposal	CH <sub>4</sub>	213.72	173.91	17%	87.16%	88.86%	0.0002	0.28%	0.43%	0.24%	0.11%	0.00071%
5.B.1 Biological treatment of waste	CH <sub>4</sub>	0.68	18.20	14%	74.63%	75.95%	0.0000	0.04%	0.05%	0.03%	0.01%	0.00001%
5.B.1 Biological treatment of waste	N <sub>2</sub> O	0.48	13.02	14%	65.00%	66.52%	0.0000	0.03%	0.03%	0.02%	0.01%	0.00000%
5.C.1 Waste incineration	CH <sub>4</sub>	0.06	0.00	5%	50.00%	50.25%	0.0000	0.00%	0.00%	0.00%	0.00%	0.00000%
5.C.1 Waste incineration	N <sub>2</sub> O	0.01	0.00	5%	100.00%	100.12%	0.00	0.00%	0.00%	0.00%	0.00%	0.00000%
5.C.1 Waste incineration	CO <sub>2</sub>	0.76	0.00	5%	40.00%	40.31%	0.00	0.00%	0.00%	0.00%	0.00%	0.00000%
5.C.2 Open Burning of Waste	CH <sub>4</sub>	1.16	0.24	32%	50.00%	59.37%	0.00	0.00%	0.00%	0.00%	0.00%	0.00000%
5.C.2 Open Burning of Waste	N <sub>2</sub> O	0.22	0.05	32%	100.00%	105.00%	0.00	0.00%	0.00%	0.00%	0.00%	0.00000%
5.C.2 Open Burning of Waste	CO <sub>2</sub>	1.49	0.49	32%	40.00%	51.23%	0.00	0.00%	0.00%	0.00%	0.00%	0.00000%
5.D.1 Domestic wastewater	CH <sub>4</sub>	112.70	48.70	60%	66.33%	89.72%	0.00	0.04%	0.12%	0.03%	0.10%	0.00011%
5.D.1 Domestic wastewater	N <sub>2</sub> O	38.66	31.64	25%	105.91%	108.82%	0.00	0.05%	0.08%	0.05%	0.03%	0.00004%
5.D.2 Industrial wastewater	CH <sub>4</sub>	0.00	4.26	50%	36.06%	61.85%	0.00	0.01%	0.01%	0.00%	0.01%	0.00000%

## Annex 3. Detailed methodological description for individual source or sink categories

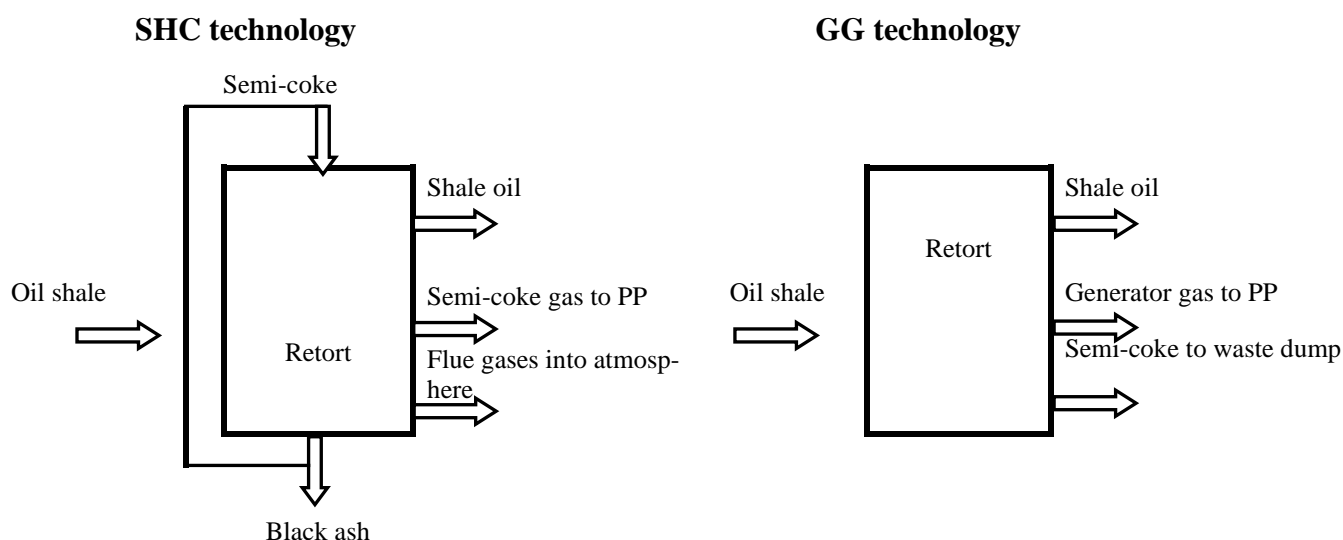
### A.3.1. Energy

#### A.3.1.1. Description of shale oil production technologies and detailed methodology for estimation of carbon emission factors of oil shale gases

There are two different technologies for shale oil production in Estonia: oil shale thermal processing with solid heat carrier (SHC technology) and oil shale thermal processing with gaseous heat carrier in gas generators (GG technology). In 2016 three oil production companies and 7 oil plants were in operation:

1. AS Eesti Energia Narva Oil Plant – two SHC technology plants;
2. Viru Chemistry Group AS (VKG) Oil Plant – three SHC technology plants (since 2010, 2014, and 2015) and a GG technology plant;
3. Kiviõli Oil Plant – SHC technology plant (since 2010) and GG technology plant.

The following simplified schemes describe the output products and waste by different oil shale thermal processing technologies.



During oil shale thermal processing in retort shale oil (a liquid fuel) and semi-coke or generator gas will be formed (depending on the technology). Oil shale gases are usually delivered to power plants nearby for combustion and no GHG or other emissions will be emitted at the oil plant. The waste product of the oil shale processing is semi-coke. Using GG technology formed semi-coke will be delivered to the waste dump and the small amount of carbon in the semi-coke will be stored. Using SHC technology formed semi-coke will be delivered for combustion in the aerofountain chamber. The combustion product – flue gases have been used for oil shale draining and after that delivered into the atmosphere. To find the amount of CO<sub>2</sub> emitted with flue gases into the atmosphere a carbon balance method has been developed. The idea of the carbon balance method is very simple: from the carbon amount delivered with oil shale into the retorting process will be taken off carbon amount of shale oil, semi-coke gas, and black ash. The rest of the carbon is emitted into the atmosphere. For generator gas technology the carbon balance method was used to estimate the amount of carbon delivered with semi-coke to waste dump.

**Table A.3.1.1.** Composition of semi-coke gas from the Narva Solid Heat Carrier-140 processes

Composi- tion of semi- coke gas	Content in vo- lume, %	Carbon mole ratio	Density (kg/Nm <sup>3</sup> )	Density rate (kg/Nm <sup>3</sup> )	Rate of C in gas vo- lume, %	Rate of C in gas weight, %	Heat va- lue of gas $Q_{scg}^r$ (MJ/Nm <sup>3</sup> )	Rate of $Q_{scg}^r$ (MJ/Nm <sup>3</sup> )
1	2	3	4	5=2x4/100	6=2x3	7=6x4/sum(5)	8	9=2x8/100
CO <sub>2</sub>	8.670	0.273	1.964	0.212	2.941	3.796		0.000
H <sub>2</sub> S	2.360		1.520	0.044	0.000	0.000	23.384	0.676
N <sub>2</sub>	0.200		1.257	0.002	0.000	0.000		0.000
O <sub>2</sub>	1.460		1.428	0.038	0.000	0.000		0.000
CO	8.492	0.429	1.250	0.105	3.614	2.969	12.636	1.065
H <sub>2</sub>	12.270		0.090	0.010	0.000	0.000	10.798	1.227
CH <sub>4</sub>	17.842	0.750	0.720	0.118	12.269	5.806	35.820	5.860
C <sub>2</sub> H <sub>6</sub>	8.851	0.800	1.340	0.114	6.813	6.000	63.751	5.429
C <sub>2</sub> H <sub>4</sub>	11.000	0.857	1.250	0.132	9.066	7.448	59.066	6.247
C <sub>3</sub> H <sub>4</sub>	0.013	0.900	1.787	0.000	0.012	0.014	69.120	0.009
C <sub>3</sub> H <sub>8</sub>	2.500	0.818	1.970	0.061	2.516	3.257	91.256	2.806
C <sub>3</sub> H <sub>6</sub>	8.180	0.857	1.880	0.148	6.747	8.336	86.005	6.769
C <sub>4</sub> H <sub>6</sub>	1.240	0.889	2.330	0.030	1.144	1.752	112.070	1.442
C <sub>4</sub> H <sub>10</sub>	1.180	0.828	2.590	0.030	0.962	1.638	118.651	1.379
C <sub>4</sub> H <sub>8</sub> +C <sub>4</sub> H <sub>6</sub>	4.251	0.857	2.500	0.104	3.562	5.853	113.514	4.717
C <sub>5</sub> H <sub>12</sub>	0.314	0.833	3.220	0.023	0.583	1.235	146.087	1.023
C <sub>5</sub> H <sub>10</sub>	5.580	0.857	3.120	0.187	5.143	10.546	140.780	8.447
C <sub>6</sub> H <sub>14</sub>	5.620	0.837	3.791	0.163	3.600	8.970	160.773	6.913
Total	100.024			1.521		67.620		54.009

The carbon emission factor from semi-coke gas combustion can be calculated by the following formula based on equation 3.1:

$$q_{c\ scg} = 10 (12/16 \times CH_4 + 24/30 \times C_2H_6 + 24/28 \times C_2H_4 + 24/30 \times C_2H_6 + 36/40 \times C_3H_4 + 36/44 \times C_3H_8 + 36/42 \times C_3H_6 + 48/54 \times C_4H_6 + 48/58 \times C_4H_{10} + 48/56 \times C_4H_8 + 60/72 \times C_5H_{12} + 60/70 \times C_5H_{10} + 72/86 \times C_6H_{14} + 12/44 \times CO_2 + 12/28 \times CO) / Q_{scg}^r, \text{ tC/TJ}, \quad (1)$$

where

$q_{c\ scg}$  – carbon emission factor of semi-coke gas, tC/TJ,

$C_{\Sigma}$  – total carbon content in semi-coke gas, % and

$Q_{scg}^r$  – lower heating value of semi-coke gas, MJ/kg.

$Q_{scg}^r$  – lower heating value of semi-coke gas: = **54.009 MJ/Nm<sup>3</sup>**,

$\rho_{scg}$  – density of semi-coke gas 1.521 kg/Nm<sup>3</sup> and

$Q_{scg}^r = Q_{sg}^r / \rho_{sg} = 54.009/1.521 = 35.499 \text{ MJ/kg}$ .

The carbon emission factor of Narva semi-coke gas:

$$q_{c\ scg} = 10 \times C_{\Sigma} / Q_{scg}^r = 10 \times 67.620/35.499 = \mathbf{19.049 \text{ tC/TJ}}$$

**Table A.3.1.2.** Composition of semi-coke gas from the Narva Solid Heat Carrier-280 processes

Composition of semi-coke gas	Content in volume, %	Carbon mole ratio	Density (kg/Nm <sup>3</sup> )	Density rate (kg/Nm <sup>3</sup> )	Rate of C in gas volume, %	Rate of C in gas weight, %	Heat value of gas Q <sup>r</sup> <sub>scg</sub> (MJ/Nm <sup>3</sup> )	Rate of Q <sup>r</sup> <sub>scg</sub> (MJ/Nm <sup>3</sup> )
1	2	3	4	5=2x4/100	6=2x3	7=6x4/sum(5)	8	9=2x8/100
CO <sub>2</sub>	12.435	0.273	1.964	0.236	3.271	4.041		0.000
H <sub>2</sub> S	1.378		1.520	0.022	0.000	0.000	23.384	0.345
N <sub>2</sub>	0.200		1.257	0.003	0.000	0.000		0.000
O <sub>2</sub>	18.727		1.428	0.288	0.000	0.000		0.000
CO	7.191	0.429	1.250	0.089	3.048	2.396	12.636	0.899
H <sub>2</sub>	8.925		0.090	0.007	0.000	0.000	10.798	0.898
CH <sub>4</sub>	10.643	0.750	0.720	0.079	8.199	3.713	35.820	3.916
C <sub>2</sub> H <sub>6</sub>	6.452	0.800	1.340	0.085	5.066	4.270	63.751	4.037
C <sub>2</sub> H <sub>4</sub>	7.600	0.857	1.250	0.099	6.768	5.321	59.066	4.664
C <sub>3</sub> H <sub>4</sub>	0.012	0.900	1.787	0.000	0.011	0.012	69.120	0.008
C <sub>3</sub> H <sub>8</sub>	2.040	0.818	1.970	0.049	2.016	2.499	91.256	2.249
C <sub>3</sub> H <sub>6</sub>	6.200	0.857	1.880	0.115	5.244	6.201	86.005	5.262
C <sub>4</sub> H <sub>6</sub>	1.230	0.889	2.330	0.028	1.067	1.563	112.070	1.345
C <sub>4</sub> H <sub>10</sub>	0.990	0.828	2.590	0.025	0.794	1.293	118.651	1.138
C <sub>4</sub> H <sub>8</sub> +C <sub>4</sub> H <sub>6</sub>	3.380	0.857	2.500	0.083	2.852	4.485	113.514	3.777
C <sub>5</sub> H <sub>12</sub>	0.190	0.833	3.220	0.013	0.333	0.675	146.087	0.584
C <sub>5</sub> H <sub>10</sub>	7.740	0.857	3.120	0.240	6.600	12.952	140.780	10.840
C <sub>6</sub> H <sub>14</sub>	4.620	0.837	3.791	0.129	2.847	6.787	160.773	5.466
<b>Total</b>	<b>99.952</b>			<b>1.590</b>		<b>56.208</b>		<b>45.429</b>

Using the formula 1,

$$q_{c\ scg} = 10 (12/16 \times CH_4 + 24/30 \times C_2H_6 + 24/28 \times C_2H_4 + 24/30 \times C_2H_6 + 36/40 \times C_3H_4 + 36/44 \times C_3H_8 + 36/42 \times C_3H_6 + 48/54 \times C_4H_6 + 48/58 \times C_4H_{10} + 48/56 \times C_4H_8 + 60/72 \times C_5H_{12} + 60/70 \times C_5H_{10} + 72/86 \times C_6H_{14} + 12/44 \times CO_2 + 12/28 \times CO) / Q_{scg}^r, \text{ tC/TJ}, \quad (2)$$

where

$q_{c\ scg}$  – carbon emission factor of semi-coke gas, tC/TJ,

$C_{\Sigma}$  – total carbon content in semi-coke gas, % and

$Q_{scg}^r$  – lower heating value of semi-coke gas, MJ/kg.

$Q_{scg}^r$  – lower heating value of semi-coke gas: = **45.429 MJ/Nm<sup>3</sup>**,

$\rho_{scg}$  – density of semi-coke gas 1.590 kg/Nm<sup>3</sup> and

$Q_{scg}^r = Q_{sg}^r / \rho_{sg} = 45.429 / 1.590 = 28.574 \text{ MJ/kg}$ .

The carbon emission factor of Narva semi-coke gas:

$$q_{c\ scg} = 10 \times C_{\Sigma} / Q_{scg}^r = 10 \times 56.208 / 28.574 = \mathbf{19.671 \text{ tC/TJ}}$$

**Table A.3.1.3.** Composition of semi-coke gas from the VKG Solid Heat Carrier (Petroter I) processes

Composi- tion of semi- coke gas	Content in vo- lume, %	Carbon mole ratio	Density (kg/Nm <sup>3</sup> )	Density rate (kg/Nm <sup>3</sup> )	Rate of C in gas vo- lume, %	Rate of C in gas weight, %	Heat va- lue of gas $Q_{scg}^r$ (MJ/Nm <sup>3</sup> )	Rate of $Q_{scg}^r$ (MJ/Nm <sup>3</sup> )
1	2	3	4	5=2x4/100	6=2x3	7=6x4/sum(5)	8	9=2x8/100
CO <sub>2</sub>	9.686	0.273	1.964	0.197	2.734	3.926		0.000
H <sub>2</sub> S	2.122		1.52	0.040	0.000	0.000	23.384	0.618
N <sub>2</sub>	5.168		1.257	0.062	0.000	0.000		0.000
O <sub>2</sub>	0.166		1.428	0.003	0.000	0.000		0.000
CO	10.108	0.429	1.25	0.124	4.246	3.880	12.636	1.252
H <sub>2</sub>	13.693		0.09	0.012	0.000	0.000	10.798	1.464
CH <sub>4</sub>	16.690	0.750	0.72	0.113	11.814	6.218	35.82	5.642
C <sub>2</sub> H <sub>6</sub>	8.682	0.800	1.34	0.112	6.684	6.548	63.751	5.327
C <sub>2</sub> H <sub>4</sub>	11.860	0.857	1.25	0.144	9.876	9.025	59.066	6.805
C <sub>3</sub> H <sub>8</sub>	2.863	0.818	1.97	0.063	2.618	3.770	91.256	2.920
C <sub>3</sub> H <sub>6</sub>	7.815	0.857	1.88	0.142	6.488	8.917	86.005	6.510
C <sub>4</sub> H <sub>10</sub>	0.884	0.828	2.59	0.022	0.700	1.325	118.651	1.003
C <sub>4</sub> H <sub>8</sub> +C <sub>4</sub> H <sub>6</sub>	10.281	0.857	2.5	0.130	4.460	8.152	113.514	5.907
C <sub>5</sub> H <sub>12</sub>		0.833	3.22	0.204	5.273	12.412	146.087	9.243
C <sub>5</sub> H <sub>10</sub>		0.857	3.12	0.000	0.000	0.000	140.780	0.000
C <sub>6</sub> H <sub>10</sub>		0.878	3.21	0.000	0.000	0.000	141.571	0.000
<b>Total</b>	<b>100.019</b>			<b>1.368</b>		<b>64.173</b>		<b>46.692</b>

Using the formula 1,

$$q_{c\ scg} = 10 (12/16 \times CH_4 + 24/30 \times C_2H_6 + 24/28 \times C_2H_4 + 36/44 \times C_3H_8 + 36/42 \times C_3H_6 + 48/58 \times C_4H_{10} + 48/56 \times C_4H_8 + 60/72 \times C_5H_{12} + 60/70 \times C_5H_{10} + 72/82 \times C_6H_{10} + 12/44 \times CO_2 + 12/28 \times CO) / Q_{scg}^r, \text{ tC/TJ}, \quad (3)$$

where

$q_{c\ scg}$  – carbon emission factor of semi-coke gas, tC/TJ,

$C_{\Sigma}$  – total carbon content in semi-coke gas, % and

$Q_{scg}^r$  – lower heating value of semi-coke gas, MJ/kg.

$Q_{scg}^r$  – lower heating value of semi-coke gas: = **46.692 MJ/Nm<sup>3</sup>**,

$\rho_{scg}$  – density of semi-coke gas 1.368 kg/Nm<sup>3</sup> and

$Q_{scg}^r = Q_{sg}^r / \rho_{sg} = 46.692 / 1.368 = \mathbf{34.135 \text{ MJ/kg.}}$

The carbon emission factor of VKG semi-coke gas:

$$q_{c\ scg} = 10 \times C_{\Sigma} / Q_{scg}^r = 10 \times 64.173 / 34.135 = \mathbf{18.800 \text{ tC/TJ}}$$

**Table A.3.1.4.** Composition of semi-coke gas from the VKG Solid Heat Carrier (Petroter II and Petroter III) processes

Composi- tion of semi- coke gas	Content in vo- lume, %	Carbon mole ratio	Density (kg/Nm <sup>3</sup> )	Density rate (kg/Nm <sup>3</sup> )	Rate of C in gas vo- lume, %	Rate of C in gas weight, %	Heat va- lue of gas Q <sup>r</sup> <sub>scg</sub> (MJ/Nm <sup>3</sup> )	Rate of Q <sup>r</sup> <sub>scg</sub> (MJ/Nm <sup>3</sup> )
1	2	3	4	5=2x4/100	6=2x3	7=6x4/sum(5)	8	9=2x8/100
CO <sub>2</sub>	12.782	0.273	1.964	0.262	3.634	5.044		0.000
H <sub>2</sub> S	3.133		1.520	0.055	0.000	0.000	23.384	0.839
N <sub>2</sub>	2.516		1.257	0.029	0.000	0.000		0.000
O <sub>2</sub>	0.189		1.428	0.002	0.000	0.000		0.000
CO	9.171	0.429	1.250	0.118	4.057	3.584	12.636	1.196
H <sub>2</sub>	12.218		0.090	0.011	0.000	0.000	10.798	1.293
CH <sub>4</sub>	16.895	0.750	0.720	0.113	11.803	6.006	35.820	5.637
C <sub>2</sub> H <sub>6</sub>	9.038	0.800	1.340	0.117	6.987	6.616	63.751	5.568
C <sub>2</sub> H <sub>4</sub>	11.665	0.857	1.250	0.139	9.562	8.447	59.066	6.589
C <sub>3</sub> H <sub>8</sub>	3.049	0.818	1.970	0.065	2.719	3.785	91.256	3.032
C <sub>3</sub> H <sub>6</sub>	7.927	0.857	1.880	0.145	6.625	8.802	86.005	6.647
C <sub>4</sub> H <sub>10</sub>	0.933	0.828	2.590	0.024	0.777	1.422	118.651	1.114
C <sub>4</sub> H <sub>8</sub> +C <sub>4</sub> H <sub>6</sub>	9.940	0.857	2.500	0.134	4.592	8.114	113.514	6.082
C <sub>5</sub> H <sub>12</sub>		0.833	3.220	0.199	5.162	11.747	146.087	9.049
C <sub>5</sub> H <sub>10</sub>		0.857	3.120	0.000	0.000	0.000	140.780	0.000
C <sub>6</sub> H <sub>10</sub>		0.878	3.210	0.000	0.000	0.000	141.571	0.000
<b>Total</b>	<b>100.000</b>			<b>1.415</b>		<b>63.567</b>		<b>47.047</b>

Using the formula 1,

$$q_{c\ scg} = 10 (12/16 \times CH_4 + 24/30 \times C_2H_6 + 24/28 \times C_2H_4 + 36/44 \times C_3H_8 + 36/42 \times C_3H_6 + 48/58 \times C_4H_{10} + 48/56 \times C_4H_8 + 60/72 \times C_5H_{12} + 60/70 \times C_5H_{10} + 72/82 \times C_6H_{10} + 12/44 \times CO_2 + 12/28 \times CO) / Q_{scg}^r, \text{ tC/TJ}, \quad (4)$$

where

$q_{c\ scg}$  – carbon emission factor of semi-coke gas, tC/TJ,

$C_{\Sigma}$  – total carbon content in semi-coke gas, % and

$Q_{scg}^r$  – lower heating value of semi-coke gas, MJ/kg.

$Q_{scg}^r$  – lower heating value of semi-coke gas: = **47.047 MJ/Nm<sup>3</sup>**,

$\rho_{scg}$  – density of semi-coke gas 1.415 kg/Nm<sup>3</sup> and

$Q_{scg}^r = Q_{sg}^r / \rho_{sg} = 47.047 / 1.415 = \mathbf{33.248\ MJ/kg}.$

The carbon emission factor of VKG semi-coke gas:

$$q_{c\ scg} = 10 \times C_{\Sigma} / Q_{scg}^r = 10 \times 63.567 / 33.248 = \mathbf{19.119\ tC/TJ}$$

**Table A.3.1.5.** Composition of semi-coke gas from the Kiviõli Solid Heat Carrier processes

Composition of semi-coke gas	Content in volume, %	Carbon mole ratio	Density (kg/Nm <sup>3</sup> )	Density rate (kg/Nm <sup>3</sup> )	Rate of C in gas volume, %	Rate of C in gas weight, %	Heat value of gas Q <sup>r</sup> <sub>scg</sub> (MJ/Nm <sup>3</sup> )	Rate of Q <sup>r</sup> <sub>scg</sub> (MJ/Nm <sup>3</sup> )
1	2	3	4	5=2x4/100	6=2x3	7=6x4/sum(5)	8	9=2x8/100
CO <sub>2</sub>	3.310	0.273	1.964	0.048	0.665	1.076		0.000
H <sub>2</sub> S	0.250		1.520	0.000	0.000	0.000	23.384	0.000
N <sub>2</sub>	11.070		1.257	0.092	0.000	0.000		0.000
O <sub>2</sub>	0.630		1.428	0.008	0.000	0.000		0.000
CO	10.400	0.429	1.250	0.098	3.364	3.463	12.636	0.992
H <sub>2</sub>	15.580		0.090	0.016	0.000	0.000	10.798	1.966
CH <sub>4</sub>	16.780	0.750	0.720	0.137	14.220	8.431	35.820	6.791
C <sub>2</sub> H <sub>6</sub>	8.870	0.800	1.340	0.124	7.416	8.183	63.751	5.910
C <sub>2</sub> H <sub>4</sub>	11.890	0.857	1.250	0.162	11.126	11.452	59.066	7.667
C <sub>3</sub> H <sub>8</sub>	2.880	0.818	1.970	0.055	2.299	3.730	91.256	2.564
C <sub>3</sub> H <sub>6</sub>	7.900	0.857	1.880	0.156	7.131	11.040	86.005	7.156
C <sub>4</sub> H <sub>10</sub>	0.870	1.714	2.590	0.021	1.423	3.035	118.651	0.985
C <sub>4</sub> H <sub>8</sub> +C <sub>4</sub> H <sub>6</sub>	9.780	0.857	2.500	0.130	4.457	9.176	113.514	5.903
C <sub>5</sub> H <sub>12</sub>		0.833	3.220	0.166	4.283	11.358	146.087	7.509
C <sub>5</sub> H <sub>10</sub>		0.857	3.120	0.000	0.000	0.000	140.780	0.000
C <sub>6</sub> H <sub>10</sub>		0.878	3.210	0.000	0.000	0.000	141.571	0.000
<b>Total</b>	<b>100.030</b>			<b>1.214</b>		<b>70.943</b>		<b>47.443</b>

Using the formula 1,

$$q_{c\ scg} = 10 (12/16 \times CH_4 + 24/30 \times C_2H_6 + 24/28 \times C_2H_4 + 36/44 \times C_3H_8 + 36/42 \times C_3H_6 + 48/58 \times C_4H_{10} + 48/56 \times C_4H_8 + 60/72 \times C_5H_{12} + 60/70 \times C_5H_{10} + 72/82 \times C_6H_{10} + 12/44 \times CO_2 + 12/28 \times CO) / Q_{scg}^r, \text{ tC/TJ}, \quad (5)$$

where

$q_{c\ scg}$  – carbon emission factor of semi-coke gas, tC/TJ,

$C_{\Sigma}$  – total carbon content in semi-coke gas, % and

$Q_{scg}^r$  – lower heating value of semi-coke gas, MJ/kg.

$Q_{scg}^r$  – lower heating value of semi-coke gas: = **47.443 MJ/Nm<sup>3</sup>**,

$\rho_{scg}$  – density of semi-coke gas 1.214 kg/Nm<sup>3</sup> and

$Q_{scg}^r = Q_{sg}^r / \rho_{sg} = 47.443 / 1.214 = 39.067 \text{ MJ/kg}$ .

The carbon emission factor of Kiviõli semi-coke gas:

$$q_{c\ scg} = 10 \times C_{\Sigma} / Q_{scg}^r = 10 \times 70.943 / 39.067 = \mathbf{18.159 \text{ tC/TJ}}$$



**Table A.3.1.6.** Composition of the VKG generator gas

Composition of semi-coke gas	Content in volume, %	Carbon mole ratio	Density (kg/Nm <sup>3</sup> )	Density rate (kg/Nm <sup>3</sup> )	Rate of C in gas volume, %	Rate of C in gas weight, %	Heat value of gas Q <sup>r</sup> <sub>sg</sub> (MJ/Nm <sup>3</sup> )	Rate of Q <sup>r</sup> <sub>sg</sub> (MJ/Nm <sup>3</sup> )
1	2	3	4	5=2x4/100	6=2x3	7=6x4/sum(5)	8	9=2x8/100
CO <sub>2</sub>	10.550	0.273	1.964	0.201	2.797	4.072		0.000
H <sub>2</sub> S	2.410		1.520	0.041	0.000	0.000	23.384	0.623
N <sub>2</sub>	4.833		1.257	0.064	0.000	0.000		0.000
O <sub>2</sub>	0.202		1.428	0.004	0.000	0.000		0.000
CO	9.848	0.429	1.250	0.124	4.261	3.948	12.636	1.256
H <sub>2</sub>	12.984		0.090	0.012	0.000	0.000	10.798	1.467
CH <sub>4</sub>	16.612	0.750	0.720	0.119	12.376	6.605	35.820	5.911
C <sub>2</sub> H <sub>6</sub>	8.848	0.800	1.340	0.115	6.841	6.795	63.751	5.452
C <sub>2</sub> H <sub>4</sub>	11.700	0.857	1.250	0.139	9.554	8.852	59.066	6.583
C <sub>3</sub> H <sub>8</sub>	2.982	0.818	1.970	0.059	2.458	3.589	91.256	2.742
C <sub>3</sub> H <sub>6</sub>	7.851	0.857	1.880	0.138	6.310	8.794	86.005	6.332
C <sub>4</sub> H <sub>10</sub>	0.889	0.828	2.590	0.023	0.742	1.424	118.651	1.063
C <sub>4</sub> H <sub>8</sub> +C <sub>4</sub> H <sub>6</sub>	5.265	0.857	2.500	0.126	4.333	8.030	113.514	5.738
C <sub>5</sub> H <sub>12</sub>	5.025	0.833	3.220	0.183	4.738	11.309	146.087	8.306
C <sub>5</sub> H <sub>10</sub>		0.857	3.120	0.000	0.000	0.000	140.780	0.000
C <sub>6</sub> H <sub>10</sub>		0.878	3.210	0.000	0.000	0.000	141.571	0.000
<b>Total</b>	<b>100.000</b>			<b>1.349</b>		<b>63.418</b>		<b>45.473</b>

Using the formula 1,

$$q_{c\ scg} = 10 (12/16 \times CH_4 + 24/30 \times C_2H_6 + 24/28 \times C_2H_4 + 36/44 \times C_3H_8 + 36/42 \times C_3H_6 + 48/58 \times C_4H_{10} + 48/56 \times C_4H_8 + 60/72 \times C_5H_{12} + 60/70 \times C_5H_{10} + 72/82 \times C_6H_{10} + 12/44 \times CO_2 + 12/28 \times CO) / Q_{sg}^r, \text{ tC/TJ}, \quad (5)$$

where

$q_{c\ gg}$  – carbon emission factor of generator gas, tC/TJ,

$C_{\Sigma}$  – total carbon content in generator gas, % and

$Q_{gg}^r$  – lower heating value of generator gas, MJ/kg.

$Q_{gg}^r$  – lower heating value of generator gas: = **45.473 MJ/Nm<sup>3</sup>**,

$\rho_{gg}$  – density of generator gas 1.349 kg/Nm<sup>3</sup> and

$Q_{gg}^r = Q_{sg}^r / \rho_{sg} = 45.473 / 1.349 = \mathbf{33.708\ MJ/kg}$ .

The carbon emission factor of VKG generator gas:

$$q_{c\ gg} = 10 \times C_{\Sigma} / Q_{sg}^r = 10 \times 63.418 / 33.708 = \mathbf{18.814\ tC/TJ}$$

**Table A.3.1.7.** Composition of the Kiviõli generator gas

Compositiion of semi-coke gas	Content in volume, %	Carbon mole ratio	Density (kg/Nm <sup>3</sup> )	Density rate (kg/Nm <sup>3</sup> )	Rate of C in gas volume, %	Rate of C in gas weight, %	Heat value of gas Q <sup>r</sup> <sub>scg</sub> (MJ/Nm <sup>3</sup> )	Rate of Q <sup>r</sup> <sub>scg</sub> (MJ/Nm <sup>3</sup> )
1	2	3	4	5=2x4/100	6=2x3	7=6x4/sum(5)	8	9=2x8/100
CO <sub>2</sub>	16.480	0.273	1.964	0.328	4.555	6.827		0.000
H <sub>2</sub> S	0.420		1.520	0.007	0.000	0.000	23.384	0.105
N <sub>2</sub>	66.280		1.257	0.830	0.000	0.000		0.000
O <sub>2</sub>	2.170		1.428	0.028	0.000	0.000		0.000
CO	4.340	0.429	1.250	0.053	1.804	1.721	12.636	0.532
H <sub>2</sub>	5.970		0.090	0.006	0.000	0.000	10.798	0.675
CH <sub>4</sub>	2.110	0.750	0.720	0.015	1.553	0.853	35.820	0.741
C <sub>2</sub> H <sub>6</sub>	0.400	0.800	1.340	0.005	0.312	0.319	63.751	0.249
C <sub>2</sub> H <sub>4</sub>	0.840	0.857	1.250	0.010	0.711	0.679	59.066	0.490
C <sub>3</sub> H <sub>8</sub>	0.130	0.818	1.970	0.003	0.106	0.160	91.256	0.119
C <sub>3</sub> H <sub>6</sub>	0.310	0.857	1.880	0.006	0.266	0.381	86.005	0.267
C <sub>4</sub> H <sub>10</sub>	0.090	1.714	2.590	0.002	0.137	0.271	118.651	0.095
C <sub>4</sub> H <sub>8</sub> +C <sub>4</sub> H <sub>6</sub>	0.230	0.857	2.500	0.006	0.189	0.360	113.514	0.250
C <sub>5</sub> H <sub>12</sub>	0.280	0.833	3.220	0.013	0.333	0.819	146.087	0.584
C <sub>5</sub> H <sub>10</sub>		0.857	3.120	0.000	0.000	0.000	140.780	0.000
C <sub>6</sub> H <sub>10</sub>		0.878	3.210	0.000	0.000	0.000	141.571	0.000
<b>Total</b>	<b>100.050</b>			<b>1.310</b>		<b>12.391</b>		<b>4.107</b>

Using the formula 1,

$$q_{c\ scg} = 10 (12/16 \times CH_4 + 24/30 \times C_2H_6 + 24/28 \times C_2H_4 + 36/44 \times C_3H_8 + 36/42 \times C_3H_6 + 48/58 \times C_4H_{10} + 48/56 \times C_4H_8 + 60/72 \times C_5H_{12} + 60/70 \times C_5H_{10} + 72/82 \times C_6H_{10} + 12/44 \times CO_2 + 12/28 \times CO) / Q^r_{scg},\ tC/TJ, \quad (5)$$

where

$q_{c\ gg}$  – carbon emission factor of generator gas, tC/TJ,

$C_{\Sigma}$  – total carbon content in generator gas, % and

$Q^r_{gg}$  – lower heating value of generator gas, MJ/kg.

$Q^r_{gg}$  – lower heating value of generator gas: = **4.107 MJ/Nm<sup>3</sup>**,

$\rho_{gg}$  – density of generator gas 1.310 kg/Nm<sup>3</sup> and

$Q^r_{gg} = Q^r_{sg} / \rho_{sg} = 4.107 / 1.310 = \mathbf{3.134\ MJ/kg}.$

The carbon emission factor of Kiviõli generator gas:

$$q_{c\ gg} = 10 \times C_{\Sigma} / Q^r_{gg} = 10 \times 12.391 / 3.134 = \mathbf{39.532\ tC/TJ}$$

### Carbon Balances

Activity data used in calculations in carbon balances are collected from private companies and are therefore considered confidential. Activity data on oil shale, shale oil, and oil shale gases production by oil companies and calculations of carbon balances are not part of the national inventory report and are allocated into the archive. The data can be made available during the review process for the review team.

Table A.3.1.8 Carbon stored with semi-coke

Narva 140	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Amount of black ash to landfill	TJ	152	83	126	207	232	210	227	249	206	196	277	298	329	377	387	425	401	390	533	631	715	685	770	755	781	1191	753	817	614	734	1318
Carbon stored with black ash	kt	5	3	4	6	7	6	7	8	6	6	8	9	10	11	12	13	12	12	16	19	22	21	23	23	24	36	23	25	19	22	40

Enefit 280

Amount of black ash to landfill	TJ																									0	0	0	0	0	0	0
Carbon stored with black ash	kt																									0	0	0	0	0	0	0

VKG GG Technology	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Semi-coke to landfill	TJ	4404	3913	3522	4375	2694	4277	3928	4164	3251	2087	2687	3987	3040	3142	2688	3275	2966	2761	2663	2524	3032	3330	3466	3624	3653	3339	1469	4179	4785	4362	5899
Carbon stored with semi-coke	kt	134	119	107	133	82	130	120	127	99	64	82	122	93	96	82	100	90	84	81	77	92	102	106	110	111	102	45	127	146	133	180

VKG

SHC

Semi-coke to landfill	TJ																					101	258	282	302	300	333	344	330	351	439	472
Carbon stored with black ash	kt																					3	8	9	9	9	10	10	10	11	13	14

VKG Pet-

roter II

Semi-coke to landfill																										93	410	323	391	370	361	394
Carbon stored with black ash																										3	13	10	12	11	11	12

VKG Pet-

roter III

Semi-coke to landfill																											112	265	361	450	447	480
Carbon stored with black ash																											3	8	11	14	14	15

Kiviõli GG Technology	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
-----------------------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

Semi-coke to landfill	TJ	713	704	707	715	643	680	696	712	555	62	692	693	726	741	767	779	782	803	820	817	685	677	681	684	749	910	889	981	957	957	897
Carbon stored with semi-coke	kt	22	21	22	22	20	21	21	22	17	2	21	21	22	23	23	24	24	24	25	25	21	21	21	21	23	28	27	30	29	29	27

**Kiviõli  
SHC**

Semi-coke to landfill	TJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Carbon stored with black ash	kt	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	6	6	6	6	6	5	5	5	5	5	6	6	6	5	6	5

**Total carbon stored with semi-coke**

	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Oil Shale Total	TJ	5269	4700	4354	5298	3570	5167	4851	5124	4012	2345	3657	4978	4095	4259	3841	4479	4149	3954	4015	3972	4533	4949	5200	5366	5576	6295	4043	7061	7527	7301	9460
Carbon stored with semi-coke and black ash	kt	165	147	137	166	113	161	152	160	126	76	115	156	129	134	122	142	132	126	129	127	143	156	164	169	175	198	129	221	235	228	294

**Table A.3.1.9.** Fuel combustion by fuel types, PJ

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Solid Fuels</b>	<b>256.3</b>	<b>233.1</b>	<b>190.8</b>	<b>154.9</b>	<b>157.6</b>	<b>147.5</b>	<b>152.8</b>	<b>151.4</b>	<b>128.4</b>	<b>115.9</b>	<b>125.0</b>	<b>124.7</b>	<b>122.3</b>	<b>141.5</b>	<b>142.1</b>	<b>140.9</b>	<b>135.4</b>	<b>167.1</b>	<b>149.8</b>	<b>130.4</b>	<b>173.1</b>	<b>175.8</b>	<b>162.6</b>	<b>180.1</b>	<b>177.4</b>	<b>162.5</b>	<b>168.7</b>	<b>193.8</b>	<b>189.8</b>	<b>143.0</b>	<b>118.2</b>
Oil Shale	242.1	220.1	181.1	147.3	151.1	140.9	145.6	144.7	123.9	111.9	119.4	117.9	116.7	136.2	135.9	134.5	128.0	157.9	140.8	121.9	165.1	167.2	153.7	171.3	167.5	149.0	156.8	178.9	174.6	127.4	104.2
Coal	9.7	9.5	6.0	3.4	2.4	2.5	2.8	2.4	1.9	2.0	2.3	2.9	1.7	1.2	1.6	1.5	1.9	3.5	3.5	2.4	1.6	1.9	1.7	1.7	2.1	0.7	0.7	1.1	1.1	1.3	0.3
Oil shale semi-coke gas	0.7	0.4	0.6	1.1	0.9	0.9	1.0	1.0	0.9	0.8	1.0	1.3	1.3	1.3	1.5	1.6	1.5	1.4	1.8	2.2	3.1	3.4	3.8	3.7	4.6	9.5	8.5	8.5	10.8	11.1	11.1
Oil shale generator gas	3.2	2.8	2.9	3.1	3.1	3.1	3.3	3.3	1.7	1.2	2.2	2.4	2.6	2.7	3.2	3.3	4.0	4.2	3.7	3.9	3.3	3.3	3.4	3.3	3.2	3.4	1.4	2.2	3.2	3.2	2.6
Gas gasoline	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	3.1	0.1	0.0	0.0
Coke	0.6	0.4	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Liquid Fuels</b>	<b>120.8</b>	<b>108.5</b>	<b>61.0</b>	<b>63.2</b>	<b>58.9</b>	<b>46.3</b>	<b>50.3</b>	<b>49.0</b>	<b>48.5</b>	<b>44.3</b>	<b>36.6</b>	<b>43.0</b>	<b>43.2</b>	<b>42.4</b>	<b>42.0</b>	<b>42.9</b>	<b>43.4</b>	<b>44.7</b>	<b>43.3</b>	<b>39.2</b>	<b>41.0</b>	<b>41.6</b>	<b>42.6</b>	<b>40.8</b>	<b>40.8</b>	<b>42.7</b>	<b>44.0</b>	<b>44.1</b>	<b>43.8</b>	<b>42.4</b>	<b>39.5</b>
Heavy fuel oil	67.0	59.5	34.7	35.7	30.4	20.8	21.8	19.2	17.8	16.2	8.3	8.3	6.4	5.3	5.8	5.3	4.5	3.2	3.2	3.0	3.4	2.5	2.7	2.1	1.7	2.4	3.2	2.4	1.9	1.4	1.4
Light fuel oil	8.1	7.5	3.9	2.9	1.2	1.3	2.3	2.1	2.5	2.0	2.7	4.6	5.1	6.9	5.4	6.3	5.1	6.2	5.5	5.1	5.0	6.6	6.6	6.0	6.2	6.2	5.6	5.1	5.0	4.3	4.2
Motor gasoline	23.0	20.4	10.0	10.3	12.6	10.9	12.4	13.4	13.0	12.4	12.5	14.8	13.6	13.5	12.6	12.8	13.6	14.2	14.1	12.9	12.1	11.2	10.8	10.1	10.3	10.2	10.9	11.4	11.5	11.6	9.1
Diesel oil	21.3	19.7	11.9	14.0	14.3	12.9	13.5	13.8	14.7	13.4	12.9	14.7	17.9	16.3	17.7	18.2	19.8	20.7	19.9	17.7	20.1	20.7	21.8	22.0	22.0	23.1	23.3	24.0	24.4	23.8	23.7
LPG	1.3	1.4	0.5	0.3	0.3	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.4	0.3	0.4	0.4	0.5	0.4	0.5	0.4	0.6	0.6	0.6	0.8	1.0	1.1	0.9	1.3	1.1
Aviation Gasoline	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1
Shale oil (heavy fraction)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shale oil (light fraction)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Gaseous fuels</b>	<b>43.6</b>	<b>44.5</b>	<b>26.4</b>	<b>13.5</b>	<b>16.7</b>	<b>19.5</b>	<b>22.1</b>	<b>21.4</b>	<b>20.0</b>	<b>19.8</b>	<b>23.9</b>	<b>25.6</b>	<b>24.0</b>	<b>26.3</b>	<b>28.2</b>	<b>28.8</b>	<b>29.1</b>	<b>29.4</b>	<b>27.9</b>	<b>21.9</b>	<b>24.0</b>	<b>21.5</b>	<b>22.8</b>	<b>20.7</b>	<b>18.5</b>	<b>16.6</b>	<b>19.0</b>	<b>16.7</b>	<b>17.9</b>	<b>16.5</b>	<b>14.6</b>
Natural Gas	43.6	44.5	26.4	13.5	16.7	19.5	22.1	21.4	20.0	19.8	23.9	25.6	24.0	26.3	28.2	28.8	29.1	29.4	27.9	21.9	24.0	21.5	22.8	20.7	18.5	16.6	19.0	16.7	17.9	16.5	14.6
<b>Peat</b>	<b>11.3</b>	<b>11.9</b>	<b>7.8</b>	<b>5.9</b>	<b>5.9</b>	<b>6.3</b>	<b>7.8</b>	<b>6.9</b>	<b>4.4</b>	<b>4.0</b>	<b>3.4</b>	<b>4.2</b>	<b>4.7</b>	<b>4.4</b>	<b>3.1</b>	<b>2.9</b>	<b>3.5</b>	<b>4.6</b>	<b>3.4</b>	<b>2.7</b>	<b>3.8</b>	<b>3.3</b>	<b>2.8</b>	<b>2.6</b>	<b>2.4</b>	<b>1.5</b>	<b>1.4</b>	<b>1.6</b>	<b>1.4</b>	<b>1.0</b>	<b>1.2</b>
Milled Peat	8.0	8.8	5.4	4.0	4.4	4.4	5.7	5.8	3.7	3.4	2.8	3.9	4.4	4.1	2.9	2.6	3.4	4.4	3.1	2.6	3.6	3.0	2.6	2.4	2.2	1.3	1.4	1.6	1.4	1.0	1.2
Sod Peat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Peat Briquette	3.3	3.0	2.4	1.9	1.5	1.9	2.1	1.1	0.6	0.6	0.5	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0
<b>Other Fuels</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.1</b>	<b>0.3</b>	<b>0.4</b>	<b>0.8</b>	<b>0.6</b>	<b>0.6</b>	<b>0.7</b>	<b>0.9</b>	<b>0.5</b>	<b>0.5</b>	<b>1.1</b>	<b>1.3</b>	<b>3.6</b>	<b>4.0</b>	<b>3.7</b>	<b>3.7</b>	<b>4.5</b>	<b>4.2</b>	<b>3.2</b>	<b>3.2</b>
Waste oils	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.7	0.6	0.6	0.7	0.6	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Plastics	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Municipal Solid Waste	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.3	0.2	0.3	1.0	1.2	3.5	3.9	3.6	3.6	4.4	4.1	3.0	3.1
<b>Biomass</b>	<b>10.0</b>	<b>10.1</b>	<b>9.1</b>	<b>8.6</b>	<b>14.8</b>	<b>20.6</b>	<b>25.4</b>	<b>25.2</b>	<b>21.2</b>	<b>21.8</b>	<b>21.5</b>	<b>22.6</b>	<b>22.9</b>	<b>24.1</b>	<b>25.1</b>	<b>24.4</b>	<b>22.1</b>	<b>24.9</b>	<b>26.8</b>	<b>29.4</b>	<b>35.0</b>	<b>33.7</b>	<b>34.4</b>	<b>33.9</b>	<b>34.0</b>	<b>35.5</b>	<b>38.8</b>	<b>41.5</b>	<b>45.9</b>	<b>46.7</b>	<b>50.8</b>
Solid biomass	10.0	10.1	9.1	8.6	14.8	20.5	25.4	25.2	21.1	21.6	21.4	22.5	22.8	24.0	25.0	24.3	21.8	24.7	26.5	29.2	34.5	33.4	34.2	33.5	33.4	34.8	37.9	40.9	44.4	45.0	48.4
Liquid biomass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.3	0.2	0.2	0.1	0.2	0.1	0.1	0.0	0.7	1.1	1.6
Gaseous biomass	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.3	0.4	0.6	0.7	0.5	0.7	0.6	0.8

**Table A.3.1.10.** CO<sub>2</sub> emissions from fuel combustion, Mt

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Solid Fuels</b>	<b>23.27</b>	<b>21.30</b>	<b>16.99</b>	<b>12.98</b>	<b>13.50</b>	<b>12.26</b>	<b>12.64</b>	<b>12.47</b>	<b>11.04</b>	<b>10.50</b>	<b>10.49</b>	<b>10.24</b>	<b>9.88</b>	<b>11.70</b>	<b>11.68</b>	<b>11.44</b>	<b>10.67</b>	<b>13.77</b>	<b>11.96</b>	<b>9.73</b>	<b>13.86</b>	<b>13.84</b>	<b>12.31</b>	<b>14.26</b>	<b>13.81</b>	<b>11.10</b>	<b>12.60</b>	<b>13.70</b>	<b>12.91</b>	<b>7.67</b>	<b>5.21</b>
Oil Shale	21.71	19.87	15.89	12.07	12.69	11.45	11.76	11.64	10.53	10.06	9.84	9.46	9.20	11.05	10.92	10.79	9.92	12.83	10.98	8.87	12.91	12.93	11.38	13.34	12.81	10.08	11.64	12.48	11.70	6.30	3.97
Coal	0.93	0.91	0.57	0.32	0.23	0.24	0.27	0.23	0.18	0.19	0.22	0.28	0.16	0.11	0.15	0.15	0.18	0.34	0.34	0.23	0.16	0.18	0.17	0.16	0.20	0.07	0.07	0.10	0.10	0.12	0.03
Oil shale semi-coke gas	0.05	0.03	0.04	0.07	0.06	0.06	0.07	0.07	0.06	0.05	0.07	0.09	0.09	0.09	0.10	0.09	0.08	0.08	0.10	0.12	0.15	0.14	0.16	0.16	0.18	0.24	0.61	0.60	0.70	0.76	0.77
Oil shale generator gas	0.52	0.46	0.47	0.50	0.51	0.51	0.54	0.53	0.27	0.20	0.35	0.40	0.43	0.45	0.51	0.41	0.48	0.53	0.54	0.51	0.64	0.58	0.60	0.59	0.62	0.72	0.19	0.29	0.40	0.49	0.43
Gas gasoline	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.23	0.00	0.00	0.00
Coke	0.06	0.04	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Liquid Fuels</b>	<b>9.06</b>	<b>8.13</b>	<b>4.60</b>	<b>4.80</b>	<b>4.54</b>	<b>3.51</b>	<b>3.80</b>	<b>3.71</b>	<b>3.67</b>	<b>3.28</b>	<b>2.75</b>	<b>3.19</b>	<b>3.23</b>	<b>3.12</b>	<b>3.11</b>	<b>3.08</b>	<b>3.14</b>	<b>3.23</b>	<b>3.11</b>	<b>2.83</b>	<b>2.93</b>	<b>2.92</b>	<b>2.99</b>	<b>2.87</b>	<b>2.91</b>	<b>3.04</b>	<b>3.15</b>	<b>3.14</b>	<b>3.11</b>	<b>2.99</b>	<b>2.79</b>
Heavy fuel oil	5.21	4.63	2.70	2.77	2.37	1.61	1.70	1.50	1.39	1.26	0.64	0.65	0.49	0.41	0.45	0.41	0.35	0.25	0.25	0.23	0.26	0.20	0.21	0.17	0.13	0.18	0.25	0.19	0.15	0.11	0.11
Light fuel oil	0.64	0.56	0.33	0.26	0.20	0.15	0.21	0.21	0.24	0.17	0.26	0.38	0.43	0.51	0.43	0.41	0.37	0.45	0.37	0.35	0.29	0.36	0.37	0.33	0.37	0.37	0.34	0.30	0.30	0.25	0.24
Motor gasoline	1.57	1.41	0.67	0.72	0.90	0.78	0.88	0.96	0.93	0.88	0.88	1.05	0.98	0.97	0.91	0.90	0.95	0.99	0.99	0.92	0.88	0.81	0.78	0.73	0.75	0.74	0.79	0.83	0.82	0.81	0.64
Diesel oil	1.56	1.44	0.87	1.02	1.05	0.94	0.99	1.02	1.08	0.94	0.94	1.08	1.31	1.20	1.29	1.33	1.45	1.51	1.46	1.30	1.47	1.52	1.60	1.61	1.61	1.68	1.70	1.75	1.78	1.74	1.73
LPG	0.08	0.09	0.03	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.02	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.06	0.07	0.06	0.08	0.07
Aviation Gasoline	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shale oil (heavy fraction)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shale oil (light fraction)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Natural Gas</b>	<b>2.41</b>	<b>2.46</b>	<b>1.46</b>	<b>0.75</b>	<b>0.92</b>	<b>1.08</b>	<b>1.22</b>	<b>1.18</b>	<b>1.11</b>	<b>1.09</b>	<b>1.32</b>	<b>1.42</b>	<b>1.33</b>	<b>1.45</b>	<b>1.56</b>	<b>1.59</b>	<b>1.61</b>	<b>1.62</b>	<b>1.54</b>	<b>1.21</b>	<b>1.33</b>	<b>1.19</b>	<b>1.26</b>	<b>1.14</b>	<b>1.02</b>	<b>0.91</b>	<b>1.04</b>	<b>0.91</b>	<b>0.98</b>	<b>0.90</b>	<b>0.79</b>
<b>Peat</b>	<b>1.17</b>	<b>1.23</b>	<b>0.80</b>	<b>0.61</b>	<b>0.61</b>	<b>0.65</b>	<b>0.81</b>	<b>0.72</b>	<b>0.46</b>	<b>0.42</b>	<b>0.35</b>	<b>0.44</b>	<b>0.50</b>	<b>0.47</b>	<b>0.33</b>	<b>0.30</b>	<b>0.37</b>	<b>0.48</b>	<b>0.36</b>	<b>0.28</b>	<b>0.40</b>	<b>0.34</b>	<b>0.29</b>	<b>0.27</b>	<b>0.25</b>	<b>0.16</b>	<b>0.15</b>	<b>0.17</b>	<b>0.15</b>	<b>0.10</b>	<b>0.13</b>
Milled Peat	0.85	0.93	0.58	0.43	0.47	0.47	0.61	0.61	0.40	0.36	0.30	0.41	0.47	0.43	0.30	0.28	0.36	0.46	0.33	0.27	0.39	0.32	0.27	0.25	0.24	0.14	0.14	0.17	0.15	0.10	0.13
Sod Peat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peat Briquette	0.32	0.29	0.23	0.19	0.14	0.18	0.20	0.11	0.06	0.06	0.05	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00
<b>Other Fuels</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.03</b>	<b>0.03</b>	<b>0.06</b>	<b>0.05</b>	<b>0.04</b>	<b>0.05</b>	<b>0.07</b>	<b>0.04</b>	<b>0.04</b>	<b>0.09</b>	<b>0.11</b>	<b>0.24</b>	<b>0.28</b>	<b>0.25</b>	<b>0.26</b>	<b>0.32</b>	<b>0.30</b>	<b>0.22</b>	<b>0.21</b>
Waste oils	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.05	0.04	0.04	0.05	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Plastics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municipal Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.02	0.02	0.08	0.10	0.23	0.27	0.24	0.25	0.31	0.29	0.21	0.20

**Table A.3.1.11.** CH<sub>4</sub> emissions from fuel combustion, kt CO<sub>2</sub> eq

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Solid Fuels</b>	<b>30.31</b>	<b>32.07</b>	<b>11.33</b>	<b>5.75</b>	<b>2.10</b>	<b>6.01</b>	<b>10.27</b>	<b>10.01</b>	<b>7.61</b>	<b>8.52</b>	<b>7.30</b>	<b>6.38</b>	<b>7.20</b>	<b>4.88</b>	<b>7.62</b>	<b>7.25</b>	<b>5.81</b>	<b>4.07</b>	<b>3.71</b>	<b>2.75</b>	<b>2.97</b>	<b>3.61</b>	<b>3.34</b>	<b>3.26</b>	<b>3.11</b>	<b>2.50</b>	<b>3.08</b>	<b>2.96</b>	<b>2.67</b>	<b>2.78</b>	<b>2.25</b>
Oil Shale	1.47	1.55	0.96	0.75	0.96	0.92	0.93	0.93	0.93	0.64	0.69	0.69	0.62	0.59	0.64	0.86	0.70	0.90	0.94	0.64	0.84	1.00	0.96	0.90	1.03	1.22	1.28	1.51	1.56	1.65	1.50
Coal	28.60	30.34	10.25	4.88	1.03	4.98	9.23	8.97	6.61	7.83	6.51	5.58	6.47	4.19	6.87	6.26	4.98	3.03	2.64	1.96	1.97	2.45	2.21	2.15	1.88	0.96	1.56	1.18	0.75	0.77	0.41
Oil Shale Gas	0.10	0.08	0.09	0.10	0.10	0.10	0.11	0.11	0.06	0.05	0.08	0.09	0.10	0.10	0.12	0.12	0.14	0.14	0.14	0.15	0.16	0.17	0.18	0.17	0.20	0.32	0.25	0.27	0.35	0.36	0.34
Coke	0.14	0.10	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Liquid Fuels</b>	<b>26.06</b>	<b>24.39</b>	<b>11.46</b>	<b>12.50</b>	<b>15.62</b>	<b>13.76</b>	<b>15.18</b>	<b>15.93</b>	<b>15.74</b>	<b>14.21</b>	<b>12.97</b>	<b>15.17</b>	<b>13.77</b>	<b>12.38</b>	<b>11.19</b>	<b>11.16</b>	<b>10.94</b>	<b>10.59</b>	<b>9.57</b>	<b>8.21</b>	<b>7.45</b>	<b>6.90</b>	<b>6.30</b>	<b>5.61</b>	<b>5.38</b>	<b>5.33</b>	<b>5.21</b>	<b>4.99</b>	<b>4.79</b>	<b>4.67</b>	<b>3.63</b>
Heavy fuel oil	2.02	1.84	1.02	1.22	0.97	0.62	0.68	0.60	0.67	0.61	0.26	0.27	0.21	0.18	0.20	0.14	0.11	0.09	0.11	0.09	0.10	0.09	0.10	0.09	0.09	0.14	0.13	0.09	0.09	0.09	0.06
Light fuel oil	1.08	0.89	0.52	0.36	0.35	0.24	0.35	0.38	0.41	0.38	0.52	0.82	0.95	0.96	0.79	0.76	0.72	0.79	0.76	0.73	0.51	0.65	0.63	0.57	0.70	0.67	0.56	0.51	0.48	0.35	0.29
Motor gasoline	20.02	18.96	8.31	9.07	12.26	10.80	12.05	12.83	12.30	11.19	10.19	11.78	9.94	8.78	7.62	7.62	7.50	7.27	6.38	5.58	4.92	4.33	3.89	3.46	3.23	3.23	3.36	3.29	3.22	3.26	2.44
Diesel oil	2.78	2.53	1.54	1.82	1.99	2.06	2.06	2.08	2.32	1.99	1.96	2.25	2.63	2.42	2.53	2.59	2.54	2.38	2.25	1.73	1.85	1.75	1.59	1.40	1.26	1.17	1.02	0.93	0.83	0.78	0.68
LPG	0.16	0.17	0.07	0.04	0.05	0.05	0.04	0.05	0.05	0.05	0.05	0.06	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.07	0.09	0.09	0.10	0.13	0.15	0.17	0.17	0.19	0.17
Aviation Gasoline	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shale oil (heavy fraction)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shale oil (light fraction)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Natural Gas</b>	<b>0.56</b>	<b>0.53</b>	<b>0.38</b>	<b>0.38</b>	<b>0.52</b>	<b>0.51</b>	<b>0.51</b>	<b>0.47</b>	<b>0.46</b>	<b>0.48</b>	<b>0.58</b>	<b>0.60</b>	<b>0.57</b>	<b>0.60</b>	<b>0.64</b>	<b>0.67</b>	<b>0.69</b>	<b>0.69</b>	<b>0.65</b>	<b>0.57</b>	<b>0.64</b>	<b>0.58</b>	<b>0.61</b>	<b>0.56</b>	<b>0.57</b>	<b>0.53</b>	<b>0.60</b>	<b>0.52</b>	<b>0.55</b>	<b>0.54</b>	<b>0.51</b>
<b>Peat</b>	<b>24.35</b>	<b>22.93</b>	<b>17.87</b>	<b>14.58</b>	<b>11.15</b>	<b>13.10</b>	<b>14.81</b>	<b>8.06</b>	<b>4.23</b>	<b>4.06</b>	<b>3.42</b>	<b>2.14</b>	<b>2.35</b>	<b>2.02</b>	<b>1.74</b>	<b>1.54</b>	<b>1.19</b>	<b>1.46</b>	<b>1.91</b>	<b>0.92</b>	<b>1.19</b>	<b>1.41</b>	<b>1.33</b>	<b>1.33</b>	<b>1.21</b>	<b>0.84</b>	<b>0.20</b>	<b>0.05</b>	<b>0.04</b>	<b>0.03</b>	<b>0.04</b>
Milled Peat	0.34	0.37	0.23	0.17	0.19	0.18	0.20	0.21	0.13	0.12	0.10	0.14	0.18	0.14	0.11	0.09	0.11	0.14	0.10	0.08	0.11	0.09	0.07	0.07	0.07	0.04	0.04	0.05	0.04	0.03	0.04
Sod Peat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peat Briquette	24.01	22.56	17.64	14.42	10.97	12.92	14.61	7.84	4.10	3.94	3.32	2.00	2.18	1.88	1.64	1.45	1.08	1.32	1.81	0.85	1.08	1.32	1.26	1.26	1.15	0.80	0.16	0.00	0.00	0.00	0.00
<b>Biomass</b>	<b>46.35</b>	<b>46.1</b>	<b>47.3</b>	<b>47.2</b>	<b>66.9</b>	<b>114.0</b>	<b>133.2</b>	<b>140.7</b>	<b>110.1</b>	<b>106.7</b>	<b>107.5</b>	<b>106.6</b>	<b>101.1</b>	<b>111.5</b>	<b>110.1</b>	<b>96.7</b>	<b>96.0</b>	<b>122.3</b>	<b>125.6</b>	<b>135.0</b>	<b>141.2</b>	<b>124.5</b>	<b>132.0</b>	<b>124.9</b>	<b>124.6</b>	<b>121.6</b>	<b>129.0</b>	<b>132.2</b>	<b>133.9</b>	<b>130.3</b>	<b>137.6</b>
Solid Biomass	46.35	46.1	47.3	47.2	66.9	114.0	133.2	140.7	110.1	106.7	107.5	106.6	101.1	111.5	110.1	96.7	96.0	122.3	125.6	135.0	141.2	124.5	132.0	124.9	124.6	121.6	128.9	132.2	133.8	130.2	137.5
Liquid Biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.06	0.09
Gaseous Biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.03	0.02	0.02	0.01	0.01
<b>Other Fuels</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.10</b>	<b>0.26</b>	<b>0.30</b>	<b>0.58</b>	<b>0.46</b>	<b>0.45</b>	<b>0.54</b>	<b>0.69</b>	<b>0.39</b>	<b>0.35</b>	<b>0.84</b>	<b>0.99</b>	<b>1.24</b>	<b>1.41</b>	<b>0.98</b>	<b>1.08</b>	<b>1.73</b>	<b>1.48</b>	<b>0.92</b>	<b>0.63</b>
Waste oils	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.09	0.25	0.25	0.55	0.45	0.43	0.49	0.44	0.19	0.15	0.11	0.08	0.07	0.08	0.11	0.10	0.08	0.08	0.11	0.09
Plastics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.00	0.00
Municipal Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.04	0.04	0.01	0.02	0.05	0.25	0.17	0.19	0.74	0.91	1.17	1.33	0.88	0.97	1.63	1.39	0.81	0.54

Table A.3.1.12. N<sub>2</sub>O emissions from fuel combustion, kt CO<sub>2</sub> eq

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Solid Fuels</b>	<b>7.14</b>	<b>7.07</b>	<b>4.41</b>	<b>2.87</b>	<b>2.78</b>	<b>2.76</b>	<b>2.89</b>	<b>2.71</b>	<b>2.41</b>	<b>1.98</b>	<b>2.24</b>	<b>2.54</b>	<b>1.83</b>	<b>1.55</b>	<b>4.72</b>	<b>8.29</b>	<b>8.73</b>	<b>9.58</b>	<b>10.22</b>	<b>7.80</b>	<b>8.26</b>	<b>8.72</b>	<b>7.22</b>	<b>9.57</b>	<b>9.08</b>	<b>9.28</b>	<b>10.78</b>	<b>11.05</b>	<b>11.58</b>	<b>8.88</b>	<b>6.93</b>
Oil Shale	2.42	2.57	1.58	1.20	1.55	1.49	1.50	1.49	1.50	1.02	1.08	1.07	0.96	0.89	3.88	7.47	7.71	7.83	8.49	6.56	7.34	7.67	6.23	8.56	7.90	8.58	10.15	10.26	10.67	7.89	6.38
Coal	4.35	4.23	2.68	1.52	1.08	1.14	1.26	1.07	0.83	0.88	1.05	1.31	0.74	0.53	0.70	0.68	0.85	1.58	1.57	1.06	0.73	0.85	0.78	0.74	0.95	0.32	0.33	0.47	0.49	0.56	0.14
Oil Shale Gas	0.12	0.10	0.11	0.12	0.12	0.12	0.13	0.13	0.08	0.06	0.10	0.11	0.12	0.12	0.14	0.15	0.16	0.17	0.17	0.18	0.19	0.20	0.21	0.21	0.23	0.38	0.30	0.32	0.42	0.43	0.41
Coke	0.25	0.18	0.05	0.04	0.03	0.01	0.01	0.01	0.01	0.01	0.03	0.05	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Liquid Fuels</b>	<b>48.81</b>	<b>45.33</b>	<b>27.18</b>	<b>29.67</b>	<b>32.67</b>	<b>31.46</b>	<b>34.50</b>	<b>34.29</b>	<b>38.03</b>	<b>36.94</b>	<b>36.62</b>	<b>39.84</b>	<b>43.46</b>	<b>39.37</b>	<b>37.45</b>	<b>38.15</b>	<b>36.70</b>	<b>34.80</b>	<b>30.29</b>	<b>31.17</b>	<b>36.83</b>	<b>31.56</b>	<b>31.15</b>	<b>29.82</b>	<b>28.05</b>	<b>29.37</b>	<b>28.61</b>	<b>29.36</b>	<b>29.98</b>	<b>28.46</b>	<b>27.91</b>
Heavy fuel oil	6.61	5.93	3.29	3.72	3.08	1.98	2.10	1.88	1.92	1.74	0.73	0.70	0.56	0.50	0.53	0.46	0.39	0.30	0.31	0.28	0.32	0.25	0.28	0.24	0.20	0.30	0.34	0.24	0.20	0.17	0.15
Light fuel oil	1.01	0.86	0.50	0.38	0.33	0.24	0.35	0.37	0.40	0.33	0.47	0.71	0.81	0.93	0.77	0.73	0.68	0.83	0.73	0.70	0.54	0.69	0.71	0.64	0.73	0.74	0.65	0.58	0.57	0.45	0.39
Motor gasoline	14.63	13.92	6.00	6.81	9.84	9.34	10.88	11.69	11.16	11.00	12.62	16.10	15.03	13.99	13.55	13.19	10.06	9.72	9.03	7.90	7.07	6.23	5.51	4.66	4.14	4.14	4.02	3.66	3.34	3.39	2.56
Diesel oil	26.47	24.53	17.35	18.71	19.40	19.85	21.12	20.30	24.49	23.81	22.74	22.26	26.99	23.87	22.50	23.66	25.43	23.82	20.07	22.14	28.76	24.23	24.50	24.07	22.77	23.94	23.35	24.59	25.52	24.15	24.59
LPG	0.04	0.04	0.01	0.01	0.01	0.02	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.05	0.06	0.07	0.10	0.09	0.12	0.12	0.11	0.13	0.12	0.17	0.18	0.21	0.23	0.25	0.31	0.27	0.19
Aviation Gasoline	0.05	0.05	0.02	0.03	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.04	0.05	0.03	0.02	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Shale oil (heavy fraction)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shale oil (light fraction)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Natural Gas</b>	<b>1.48</b>	<b>1.53</b>	<b>0.91</b>	<b>0.45</b>	<b>0.54</b>	<b>0.62</b>	<b>0.70</b>	<b>0.69</b>	<b>0.65</b>	<b>0.64</b>	<b>0.76</b>	<b>0.82</b>	<b>0.77</b>	<b>0.85</b>	<b>0.91</b>	<b>0.93</b>	<b>0.94</b>	<b>0.95</b>	<b>0.90</b>	<b>0.71</b>	<b>0.78</b>	<b>0.70</b>	<b>0.74</b>	<b>0.67</b>	<b>0.60</b>	<b>0.53</b>	<b>0.61</b>	<b>0.54</b>	<b>0.58</b>	<b>0.53</b>	<b>0.46</b>
<b>Peat</b>	<b>7.13</b>	<b>7.59</b>	<b>4.87</b>	<b>3.63</b>	<b>3.81</b>	<b>3.90</b>	<b>4.37</b>	<b>4.18</b>	<b>2.55</b>	<b>2.30</b>	<b>1.89</b>	<b>2.56</b>	<b>3.17</b>	<b>2.56</b>	<b>1.96</b>	<b>1.70</b>	<b>1.97</b>	<b>2.54</b>	<b>1.88</b>	<b>1.44</b>	<b>1.93</b>	<b>1.63</b>	<b>1.37</b>	<b>1.34</b>	<b>1.24</b>	<b>0.77</b>	<b>0.74</b>	<b>0.91</b>	<b>0.75</b>	<b>0.50</b>	<b>0.71</b>
Milled Peat	5.75	6.31	3.89	2.83	3.18	3.07	3.46	3.69	2.26	2.04	1.65	2.41	3.02	2.41	1.84	1.59	1.90	2.46	1.76	1.38	1.86	1.52	1.28	1.25	1.16	0.71	0.70	0.91	0.75	0.50	0.71
Sod Peat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peat Briquette	1.38	1.28	0.98	0.80	0.63	0.83	0.90	0.49	0.28	0.26	0.24	0.15	0.15	0.15	0.12	0.11	0.07	0.08	0.12	0.06	0.07	0.11	0.09	0.09	0.08	0.06	0.04	0.00	0.00	0.00	0.00
<b>Biomass</b>	<b>8.00</b>	<b>8.00</b>	<b>7.95</b>	<b>7.86</b>	<b>11.67</b>	<b>19.28</b>	<b>22.80</b>	<b>23.85</b>	<b>19.25</b>	<b>18.80</b>	<b>19.08</b>	<b>18.93</b>	<b>18.39</b>	<b>19.63</b>	<b>19.61</b>	<b>17.76</b>	<b>16.92</b>	<b>20.70</b>	<b>21.45</b>	<b>26.62</b>	<b>31.03</b>	<b>30.84</b>	<b>33.42</b>	<b>28.50</b>	<b>29.21</b>	<b>29.01</b>	<b>31.28</b>	<b>33.20</b>	<b>34.46</b>	<b>35.49</b>	<b>38.53</b>
Solid Biomass	8.00	8.00	7.95	7.86	11.67	19.28	22.80	23.85	19.25	18.79	19.08	18.93	18.39	19.62	19.60	17.75	16.91	20.70	21.45	26.62	31.03	30.83	33.42	28.49	29.19	28.99	31.25	33.18	34.44	35.48	38.51
Liquid Biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gaseous Biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.02
<b>Other Fuels</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.16</b>	<b>0.42</b>	<b>0.47</b>	<b>0.93</b>	<b>0.73</b>	<b>0.72</b>	<b>0.85</b>	<b>1.10</b>	<b>0.62</b>	<b>0.56</b>	<b>1.34</b>	<b>1.58</b>	<b>2.07</b>	<b>2.35</b>	<b>1.69</b>	<b>1.83</b>	<b>2.86</b>	<b>2.47</b>	<b>1.56</b>	<b>1.13</b>
Waste oils	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.15	0.40	0.40	0.87	0.71	0.68	0.78	0.71	0.30	0.24	0.17	0.13	0.11	0.12	0.17	0.16	0.13	0.13	0.17	0.14
Plastics	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.02	0.00	0.00	0.00	0.01	0.00	0.01	0.03	0.01	0.00	0.00
Municipal Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.07	0.06	0.02	0.03	0.08	0.39	0.26	0.30	1.17	1.45	1.96	2.22	1.52	1.66	2.70	2.33	1.38	0.98





1918

TALLINNA TEHNIKAÜLIKOOL  
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March 14, 2011 nr

Subject: Possible methane emission from  
Estonian oil shale mining

In reply to your question whether methane exists in Estonian oil shale mining and in which kinds of Estonian studies this topic is treated, our answer is the following:

Estonian underground mines are continually ventilated and quality of air inside the mines is controlled. Oil shale is a mixture of clay and kerogen matter, and does not emit methane. During the 90-year long period of mining in Estonia there have never been any problems related to methane. Methane is non-existent in Estonian oil shale.

Risk of fire is related only to the kerogen matter in the oil shale, which can ignite. While oil shale is being crushed, fine dust is produced and it may explode.

So as methane does not exist in Estonian mines, it has not been an issue for scientific studies and there are no related publications dealing with Estonia.

Sincerely

Prof. Ingo Valgma  
Director

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### **A.3.1.2. Feedstocks and non-energy use of fuels**

In this annex, additional information regarding CRF category 1.AD Feedstocks and non-energy use is presented. Under this category carbon stored in products is reported.

The following fuels are reported under CRF category 1.AD Feedstocks and non-energy use of fuels: Lubricants, Bitumen, Natural Gas, Other/Oil Shale

Activity data on lubricants and bitumen consumption is received from IEA statistics; the national statistics do not publish this data. Data on natural gas use for non-energy use are taken from the national energy balance sheet. Activity data on oil shale reported in the CRF

1.AD.10 is calculated. This is oil shale semi-coke – the by-product of shale oil production and contains a small amount of organic matter (carbon). Oil shale semi-coke is stored in the oil shale waste dumps (carbon stored).

In Table A.3.1.13 stored carbon in products is presented.

Table A.3.1.13. Stored carbon in products

Lubricants	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Fuel con- sumption, TJ	1134	1092	714	546	714	462	462	378	420	294	336	294	252	252	252	168	168	294	210	168	168	168	126	126	126	126	126	126	84	97	185
Fraction of C stored	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
CEF, tC/TJ	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
C stored, kt	4.5	4.4	2.9	2.2	2.9	1.8	1.8	1.5	1.7	1.2	1.3	1.2	1.0	1.0	1.0	0.7	0.7	1.2	0.8	0.7	0.7	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.4	0.7
CO <sub>2</sub> not emitted, kt	16.6	16.0	10.5	8.0	10.5	6.8	6.8	5.5	6.2	4.3	4.9	4.3	3.7	3.7	3.7	2.5	2.5	4.3	3.1	2.5	2.5	2.5	1.8	1.8	1.8	1.8	1.8	1.8	1.2	1.4	2.7
Bitumen	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Fuel con- sumption, TJ	2106	1755	936	1209	1326	1131	1365	1287	1443	1521	1599	1404	2418	2067	2574	3549	4095	3978	3588	3315	2964	2613	2340	3198	3549	2769	1794	2691	2262	2340	4329
Fraction of C stored	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
CEF, tC/TJ	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
C stored, kt	46.3	38.6	20.6	26.6	29.2	24.9	30.0	28.3	31.7	33.5	35.2	30.9	53.2	45.5	56.6	78.1	90.1	87.5	78.9	72.9	65.2	57.5	51.5	70.4	78.1	60.9	39.5	59.2	49.8	51.5	95.2
CO <sub>2</sub> not emitted, kt	169.9	141.6	75.5	97.5	107.0	91.2	110.1	103.8	116.4	122.7	129.0	113.3	195.1	166.7	207.6	286.3	330.3	320.9	289.4	267.4	239.1	210.8	188.8	258.0	286.3	223.4	144.7	217.1	182.5	188.8	349.2
Natural Gas	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Fuel con- sumption, TJ	7 592	7 014	3 635	1 430	4 677	4 932	4 875	4 794	4 837	4 661	4 161	4 460	1 141	2 488	4 532	4 908	4 896	4 694	4 859	539	0	0	443	2 873	0	0	0	0	0	0	0
Fraction of C stored	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
CEF, tC/TJ	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07	15.07
C stored, kt	114.4	105.7	54.8	21.6	70.5	74.3	73.5	72.3	72.9	70.2	62.7	67.2	17.2	37.5	68.3	74.0	73.8	70.7	73.2	8.1	0.0	0.0	6.7	43.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO <sub>2</sub> not emitted, kt	419.5	387.6	200.9	79.0	258.5	272.5	269.4	264.9	267.3	257.6	229.9	246.5	63.1	137.5	250.4	271.2	270.5	259.4	268.5	29.8	0.0	0.0	24.5	158.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Oil Shale	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Fuel con- sumption, TJ	5269	4700	4354	5298	3570	5167	4851	5124	4012	2345	3657	4978	4095	4259	3841	4479	4149	3954	4015	3972	4533	4949	5200	5366	5576	6295	4043	7061	7527	7301	9460
Fraction of C stored	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CEF, tC/TJ	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5
C stored, kt	160.7	143.4	132.8	161.6	108.9	157.6	148.0	156.3	122.4	71.5	111.5	151.8	124.9	129.9	117.2	136.6	126.5	120.6	122.5	121.1	138.3	151.0	158.6	163.7	170.1	192.0	123.3	215.4	229.6	222.7	288.5
CO <sub>2</sub> not emitted, kt	589.2	525.7	486.9	592.5	399.2	577.9	542.5	573.1	448.6	262.2	409.0	556.7	458.0	476.3	429.6	500.9	464.0	442.2	449.1	444.2	507.0	553.5	581.5	600.1	623.6	704.0	452.2	789.6	841.8	816.5	1058.0

**Table A.3.1.14.** Emission factors for LTO-cycle (kg/LTO)

	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NM VOC	SO <sub>2</sub>
<b>Turbofans (Jets)*</b>							
Airbus A310	4 853	0.5	0.2	23.2	25.8	5	1.5
Airbus A320	2 527	0.2	0.1	10.8	17.6	1.7	0.8
Bae 111	2 147	2.1	0.1	4.9	37.7	19.3	0.7
Bae 146	1 794	0.1	0.1	4.2	9.7	0.9	0.6
B727	4 450	0.7	0.1	12.6	26.4	6.5	1.4
B737-100	2 897	0.1	0.1	8	4.8	0.5	0.9
B737-400	2 600	0.1	0.1	8.3	11.8	0.6	0.8
B747-100-300	10 754	3.7	0.3	55.9	78.2	33.6	3.4
B747-400	10 717	0.2	0.3	56.6	19.5	1.6	3.4
B757	3 947	0.1	0.1	19.7	12.5	1.1	1.3
B767-300	5 094	0.1	0.2	26	6.1	0.8	1.6
B777	8 073	2.3	0.3	53.6	61.4	20.5	2.6
Fokker 100	2 345	0.1	0.1	5.8	13.7	1.3	0.7
Fokker 28	2 098	3.3	0.1	5.2	32.7	29.6	0.7
2XB737-100	5 794	0.2	0.2	16	9.6	1	1.8
McDonnell Douglas DC-9	2 760	0.1	0.1	7.3	5.4	0.7	0.9
McDonnell Douglas DC-10	7 501	2.3	0.2	41.7	61.6	20.5	2.4
McDonnell Douglas	3 160	0.2	0.1	12.3	6.5	1.4	1
C525	1 070	0.33	0.03	0.74	34.07	3.01	0.34
EC RJ_100ER	1 060	0.06	0.03	2.27	6.7	0.56	0.33
ERJ-145	990	0.06	0.03	2.69	6.18	0.5	0.31
GLF4	2 160	0.14	0.1	5.63	8.88	1.23	0.68
GLF5	1 890	0.03	0.1	5.58	8.42	0.28	0.6
RJ85	1 910	0.13	0.1	4.34	11.21	1.21	0.6
<b>Turboprop**</b>							
turboprop, <1000sph/engine	230	0.06	0.01	0.3	2.97	0.58	0.07
turboprop, 1000-2000 sph/engine	640	0	0.02	1.51	2.24	0	0.2
turboprop, >2000sph/engine	620	0.03	0.02	1.82	2.33	0.26	0.2
<b>Piston engine***</b>							
microlight aircraft	4.41	0.00	0.00	0.03	0.94	0.04	0.00
4 seat single engine (<180hp)	12.29	0.01	0.00	0.01	3.93	0.06	0.00
single engine high performance (180-360hp)	23.63	0.02	0.00	0.02	7.33	0.16	0.00
twin engine high performance (2x235hp)	68.04	0.02	0.00	0.05	19.33	0.22	0.01
<b>Helicopters****</b>							
A109	103.32	0.10	0.00	0.13	1.31	0.89	0.02
A139	189.95	0.08	0.01	0.38	0.97	0.68	0.03
ALO3	67.47	0.03	0.00	0.11	0.40	0.28	0.01
AS32	243.81	0.05	0.01	0.65	0.68	0.49	0.04
AS35	86.63	0.02	0.00	0.18	0.32	0.22	0.01
AS50	79.38	0.03	0.00	0.15	0.35	0.24	0.01
AS55	109.62	0.09	0.00	0.15	1.20	0.82	0.02
H269	20.79	0.01	0.00	0.01	6.59	0.09	0.00
B412	242.55	0.05	0.01	0.64	0.69	0.49	0.04
B06	57.33	0.04	0.00	0.08	0.50	0.35	0.01
EC35	129.47	0.08	0.00	0.21	1.03	0.71	0.02
EN48	58.59	0.04	0.00	0.08	0.48	0.34	0.01
MI8	220.50	0.06	0.01	0.53	0.78	0.55	0.04
R22	19.53	0.01	0.00	0.01	6.21	0.09	0.00
R44	27.72	0.01	0.00	0.02	8.79	0.11	0.00
S76	151.83	0.07	0.00	0.29	0.85	0.59	0.02

**\*Turbofans (Jet engine)** – The original data source for the Large Commercial Aircraft group LTO emissions factors is the EMEP/EEA guidebook (EMEP/EEA air pollutant emission inventory guidebook — 2009, [www.eea.europa.eu/emep-eea-guidebook](http://www.eea.europa.eu/emep-eea-guidebook)), the ICAO Engine Exhaust Emissions Data Bank (<http://www.dera.gov.uk>) and IPCC Guidelines (2006 IPCC Guidelines for National Greenhouse Gas Inventories).

**\*\*Turboprops (Turbojet engine, driving a propeller)** - This group is represented by three typical aircraft size based on engine shaft horsepower (2006 IPCC Guidelines for National Greenhouse Gas Inventories).

**\*\*\*Piston engine aircraft** – This group is represented by four typical aircraft size based on engine horsepower by “Aircraft Piston Engine Emissions Summary Report” (Federal Office of Civil Aviation FOCA) in Estonia's report.

**\*\*\*\*Helicopters** – Emission factor of helicopters used are taken from “Guidance on the Determination of Helicopter Emissions” (Federal Office of Civil Aviation FOCA).

### A.3.2. Agriculture

#### A.3.2\_I. LIVESTOCK POPULATION IN ESTONIA IN 1990–2020

**Table A.3.2\_I.1.** Cattle population size in 1990–1998 in Estonia, 1000 heads

Year	Cattle, total	Dairy Cattle	Non-dairy cattle			
			Mature males	Mature females	Bovine animals (aged between 1 and 2 years)	Calves (less than 1 year old)
1990	757.8	280.7	4.2	47	172.1	251.9
1991	706.2	264.3	4.2	46.8	171.1	220
1992	613	253.4	3.4	38.1	139.4	178.8
1993	462.6	226.7	2.3	25.1	91.8	116.9
1994	419.5	211.4	1.9	21.3	78	105.8
1995	369.7	185.4	1.7	18.4	67.3	97
1996	343	171.6	1.6	17.2	63	89.1
1997	325.6	167.7	1.5	16.2	59.3	80.4
1998	307.5	158.6	1.4	15	54.8	77.1

**Table A3.2\_I.2.** Swine population size in 1990–1998 in Estonia, 1000 heads

Year	Swine, total	Swine total of which					
		Piglets, live weight less than 20 kg	Young pigs, live weight 20–50 kg	Pigs, live weight 50–80 kg	Pigs, live weight 80–110 kg	Pigs, live weight more than 110 kg	Breeding pigs, live weight more than 50 kg
1990	859.9	279.6	237.5	185	103.2	7.6	47.1
1991	798.6	260.4	221.3	172.3	96.1	7	41.5
1992	541.1	176.6	150	116.8	65.2	4.8	27.7
1993	424.3	137.2	116.6	90.8	50.6	3.7	25.3
1994	459.8	149	126.6	98.6	55	4	26.6
1995	448.8	146.3	124.3	96.8	54	4	23.4
1996	298.4	96.6	82.1	63.9	35.6	2.6	17.6
1997	306.3	98	83.3	64.9	36.2	2.6	21.3
1998	326.4	104.5	88.8	69.1	38.6	2.8	22.6

**Table A.3.2\_I.3** Cattle population size in 1999–2020 in Estonia, 1000 heads (SE, 2021)

Year	Total	Total of which													
		cows, bulls and heifers (2 years and over)						bovine animals (aged between 1 and 2 years)				calves (less than 1 year old)*			
		cows		bulls	heifers*			bulls	heifers*			total	for slaughter	for breeding	
		dairy cows	other*		total	for slaughter	for breeding		total	for slaughter	for breeding			heifers	bulls
1999	267.3	138.4	0.5	1.6	14.0	0.5	13.5	8.3	40.2	1.8	38.4	64.3	10.8	42.9	10.6
2000	252.8	131.0	0.7	1.2	14.0	0.2	13.8	9.2	35.6	1.1	34.5	61.1	10.5	39.5	11.1
2001	260.5	128.6	0.8	1.2	11.2	0.4	10.8	11.1	37.7	3.6	34.1	69.9	16.8	38.9	14.2
2002	253.9	115.6	1.6	1.1	10.5	0.2	10.3	11.5	43.6	2.2	41.4	70.0	6.0	40.7	23.3
2003	257.2	116.8	2.0	0.8	12.5	0.4	12.1	12.6	40.2	1.7	38.5	72.3	7.3	42.7	22.3
2004	249.8	116.5	2.7	1.3	12.0	0.1	11.9	10.2	40.8	1.1	39.7	66.3	3.5	40.1	22.7
2005	249.5	112.8	4.8	0.8	12.0	0.4	11.6	11.2	40.7	1.1	39.6	67.2	3.8	40.6	22.8
2006	244.8	108.4	6.0	1.7	11.1	0.4	10.7	8.7	42.9	1.5	41.4	66.0	3.1	42.4	20.5
2007	240.5	103.0	8.5	1.8	11.6	0.7	10.9	8.4	42.7	1.4	41.3	64.5	3.0	42.3	19.2
2008	237.9	100.4	8.2	2.2	14.5	1.0	13.5	7.5	39.5	1.4	38.1	65.6	3.2	41.8	20.6
2009	234.7	96.7	10.3	2.0	14.3	1.0	13.3	8.3	39.6	1.4	38.2	63.5	3.2	40.4	19.9
2010	236.3	96.5	12.1	2.3	15.0	1.0	14.0	8.1	39.6	1.4	38.2	62.7	3.1	41.7	17.9
2011	238.3	96.2	14.5	2.4	15.3	1.2	14.1	6.5	40.8	1.4	39.4	62.6	3.2	42.1	17.3
2012	246.0	96.8	15.4	2.6	16.2	1.2	15.0	6.7	42.8	1.4	41.4	65.5	3.1	44.3	18.1
2013	261.4	97.9	19.8	3.0	16.4	1.3	15.1	9.8	43.8	1.5	42.3	70.7	3.4	46.3	21.0
2014	264.7	95.6	22.8	3.5	15.7	1.3	14.4	9.3	44.8	1.9	42.9	73.0	4.2	48.3	20.5
2015	256.2	90.6	25.1	3.3	14.3	1.2	13.1	7.7	44.9	1.5	43.2	70.3	3.3	47.9	19.1
2016	248.2	86.1	27.8	3.4	12.9	1.2	11.7	6.8	43.3	1.5	41.8	67.9	3.3	45.9	18.7
2017	250.9	86.4	28.7	3.0	13.4	1.0	12.4	6.8	42.6	1.3	41.3	70.0	3.3	47.1	19.6
2018	251.9	85.2	30.4	3.5	13.0	1.0	12.0	7.1	42.1	1.4	40.7	70.6	3.3	47.6	19.7
2019	254.0	85.0	31.4	3.6	13.2	1.0	12.4	6.9	42.9	1.4	41.5	70.9	3.5	48.2	19.4
2020	253.3	84.3	31.6	3.7	12.2	1.0	11.2	7.5	42.0	1.3	40.6	72.0	3.4	49.7	18.9

**Table A.3.2\_I.4.** Swine population size in 1999–2020 in Estonia, 1000 heads (SE, 2021)

	Total	piglets, live weight less than 20 kg	young pigs, live weight 20–50 kg	Total of which									
				fattening pigs				breeding pigs, live weight more than 50 kg					
				total	of which, live weight*			boars*	sows*				
					50–80 kg	80–110 kg	more than 110 kg		total	covered sows	of which covered for the first time	other sows	of which gilts not yet covered
1999	285.7	75.2	77.9	98.8	66.0	29.0	3.8	1.6	32.2	18.5	6.1	13.7	6.2
2000	300.2	81.2	79.5	99.0	63.8	32.0	3.2	1.9	38.6	26.1	6.7	12.5	8.0
2001	345.0	100.3	103.6	99.5	57.0	40.8	1.7	1.5	40.1	26.1	7.4	14.0	7.4
2002	340.8	104.1	82.8	114.1	64.7	45.8	3.6	2.1	37.7	27.4	5.5	10.3	4.8
2003	344.6	104.1	91.9	110.7	64.3	44.6	1.8	1.3	36.6	26.3	5.4	10.2	3.1
2004	340.1	113.7	83.9	106.6	65.5	37.8	3.3	1.2	34.7	22.6	5.0	12.1	4.2
2005	346.5	113.3	87.2	110.4	77.2	31.7	1.5	1.3	34.3	26.3	5.3	8.0	4.3
2006	345.8	118.8	76.9	111.7	72.8	36.5	2.4	1.0	37.4	26.3	5.3	11.1	4.5
2007	379.0	123.3	81.8	137.4	78.5	56.3	2.6	0.8	35.7	25.1	5.1	10.6	3.5
2008	364.9	117.1	96.2	116.9	70.1	44.2	2.6	0.6	34.1	22.5	5.0	11.6	4.0
2009	365.1	120.7	94.6	115.2	68.4	36.7	10.1	0.5	34.1	24.1	4.7	10.0	3.5
2010	371.7	116.1	100.2	119.7	73.7	44.5	1.5	0.6	35.1	27.0	4.9	8.1	4.0
2011	365.7	113.9	98.4	117.2	72.6	42.2	2.4	0.6	35.6	27.5	5.8	8.0	4.3
2012	375.1	125.6	94.4	120.2	68.5	48.4	3.3	0.6	34.3	26.3	4.8	8.0	4.3
2013	358.7	118.6	86.7	119.6	67.5	44.2	7.9	0.5	33.3	26.1	4.8	7.2	4.0
2014	357.9	111.6	89.9	121.8	71.1	42.4	8.3	1.0	33.6	26.0	4.1	7.6	3.8
2015	304.5	96.7	76.2	106.5	62.2	38.0	6.3	0.5	24.6	19.1	3.4	5.5	3.1
2016	265.9	85.0	60.4	94.6	49.9	37.8	6.9	0.5	25.4	19.6	3.0	5.8	4.2
2017	289.1	98.4	52.3	111.9	63.0	33.0	15.9	0.5	26.0	19.8	2.9	6.2	4.4
2018	290.4	104.7	42.0	118.8	51.2	49.7	17.9	0.5	24.4	18.9	2.6	5.5	3.7
2019	301.6	111.4	59.2	105.0	53.3	43.1	8.6	0.3	25.8	19.8	3.0	6.0	2.8
2020	316.8	103.4	55.6	130.1	58.0	55.3	16.9	0.3	27.3	18.2	3.1	9.1	4.5

**Table A.3.2\_I.5.** Sheep and goats population quarterly data 2004–2020, 1000 heads (SE, 2021)

Sheep and goats quarterly data				
Year	March 31 <sup>st</sup>	June 30 <sup>th</sup>	September 30 <sup>th</sup>	December 31 <sup>st</sup>
2004	55.5	57.4	54.6	41.7
2005	60.1	63.0	58.8	52.4
2006	75.4	77.3	70.1	66.0
2007	88.2	90.8	87.0	76.4
2008	100.5	100.0	95.0	81.8

Sheep and goats quarterly data				
Year	March 31 <sup>st</sup>	June 30 <sup>th</sup>	September 30 <sup>th</sup>	December 31 <sup>st</sup>
2009	101.0	100.4	101.5	80.4
2010	108.8	108.5	103.0	82.7
2011	101.7	105.3	99.9	88.2
2012	99.3	105.3	99.5	81.4
2013	82.6	88.6	92.9	86.8
2014	83.0	91.5	97.6	89.8
2015	85.8	97.1	99.3	90.9
2016	97.5	102.9	95.9	90.6
2017	97.3	104.9	93.5	85.9
2018	97.1	104.5	87.7	78.3
2019	85.0	95.7	89.3	75.6
2020	80.4	83.6	84.6	72.6

**Table A.3.2\_I.6.** Number of poultry in Estonia 1990–2020, 1000 heads (SE, 2021)

Year	Eggs, mln pcs	Eggs production per layer per year	Layers	Broilers + dead and perished (average yearly population)	Other poultry	Other hens and roosters	Yearly average population calculated
1990	547.1	246.0	2 224.0	1 951.8	161.9	1 259.5	5 597.2
1991	559.1	254.0	1 788.9	1 653.7	161.9	1 067.2	4 671.7
1992	456.0	228.0	1 816.1	1 020.6	97.7	658.6	3 593.1
1993	345.8	222.0	1 207.8	963.3	45.3	621.6	2 838.0
1994	359.4	246.0	912.5	904.7	41.0	603.1	2 461.3
1995	326.7	260.0	828.3	862.2	22.1	561.0	2 273.6
1996	300.8	285.0	843.4	528.2	19.4	448.0	1 838.9
1997	295.7	280.0	719.2	517.5	16.6	501.4	1 754.6
1998	305.2	298.0	780.9	779.1	13.9	507.9	2 081.7
1999	275.4	302.0	791.7	645.4	11.1	349.3	1 797.5
2000	254.7	306.0	723.5	616.7	18.9	313.5	1 672.6
2001	277.9	295.0	995.6	724.9	42.2	359.0	2 121.7
2002	252.8	303.0	834.3	924.6	31.8	404.6	2 195.3
2003	234.3	290.0	807.9	1 103.6	20.1	450.1	2 381.8
2004	230.9	275.0	839.6	1 142.2	21.4	495.7	2 498.9
2005	209.0	288.0	725.7	1 033.8	24.5	279.8	2 063.8



Year	Eggs, mln pcs	Eggs production per layer per year	Layers	Broilers + dead and perished (average yearly population)	Other poultry	Other hens and roosters	Yearly average population calculated
2006	183.0	287.0	637.6	980.9	29.6	369.0	2 017.1
2007	157.6	245.0	643.3	956.0	34.1	125.9	1 759.2
2008	146.5	290.0	550.1	1 031.0	33.5	395.6	2 010.2
2009	173.3	281.0	644.8	1 083.2	43.9	314.4	2 086.3
2010	181.9	283.0	578.2	1 212.2	48.8	377.2	2 216.4
2011	183.8	288.0	568.9	1 298.3	59.6	513.7	2 440.6
2012	179.5	292.0	693.9	1 267.9	74.0	456.5	2 492.3
2013	189.9	288.0	716.6	1 361.5	91.4	191.5	2 361.0
2014	199.4	291.0	752.8	1 359.6	54.3	450.8	2 617.5
2015	204.4	281.0	825.0	1 376.9	59.0	416.6	2 677.5
2016	199.0	286.0	727.6	1 417.0	57.8	407.0	2 609.4
2017	207.0	289.0	819.4	1 452.8	56.9	434.1	2 763.2
2018	205.6	262.0	608.2	1 451.7	65.9	409.6	2 535.4
2019	NA	287.0	562.8	1 453.5	70.7	414.5	2 501.5
2020	NA	NA	436.1	1 593.2	93.5	414.1	2 536.8

**Table A.3.2\_I.7.** Average number of rabbits in Estonia (calculated) 1990–2020 (SE, 2021)

Year	Breeding females	Breeding males	Young (yearly average population)	Yearly average population (calculated)
1990	8 298.5	922.1	76 732.4	85 952.9
1991	8 780.8	975.6	81 192.7	90 949.2
1992	9 276.5	1 030.7	85 775.7	96 082.9
1993	9 307.4	1 034.2	86 061.2	96 402.7
1994	7 847.2	871.9	72 560.2	81 279.3
1995	7 241.4	804.6	66 958.1	75 004.1
1996	5 452.7	605.9	50 418.6	56 477.2
1997	4 587.2	509.7	42 415.7	47 512.6
1998	4 818.0	535.3	44 549.8	49 903.1
1999	3 981.3	442.4	36 813.6	41 237.3
2000	5 798.9	644.3	53 619.8	60 063.0
2001	10 069.0	1 118.8	93 103.8	104 291.5

Year	Breeding females	Breeding males	Young (yearly average population)	Yearly average population (calculated)
2002	8 580.5	953.4	79 340.2	88 874.1
2003	7 092.0	788.0	65 576.7	73 456.7
2004	5 067.0	563.0	46 852.4	52 482.4
2005	8 061.0	895.7	74 536.6	83 493.3
2006	7 038.5	782.1	65 082.0	72 902.6
2007	6 016.0	668.4	55 627.4	62 311.8
2008	5 137.0	570.8	47 499.7	53 207.4
2009	4 258.0	473.1	39 371.9	44 103.0
2010	3 379.0	375.4	31 244.2	34 998.6
2011	3 243.5	360.4	29 991.3	33 595.2
2012	3 108.0	345.3	28 738.4	32 191.7
2013	4 778.0	530.9	44 180.1	49 489.0
2014	3 864.7	429.4	35 734.9	40 029.0
2015	2 951.3	327.9	27 289.7	30 569.0
2016	2 038.0	226.4	18 844.5	21 109.0
2017	2 038.0	226.4	18 844.5	21 109.0
2018	2 038.0	226.4	18 844.5	21 109.0
2019	2 038.0	226.4	18 844.5	21 109.0
2020	1 926.0	214.0	17 808.9	19 948.9

**Table A.3.2\_I.8.** Average number of fur animals in Estonia 1990–2020 (SE, 2021)

Year	Foxes and racoon dogs			Minks, chinchillas and other fur animals		
	For breeding (calculated)	Killed for fur	Average population	For breeding (calculated)	Killed for fur	Yearly average population calculated
1990	–	–	85.2	–	–	145.6
1991	–	–	85.2	–	–	145.6
1992	–	–	85.4	–	–	117.4
1993	–	–	85.7	–	–	89.1
1994	26.0	59.9	86.0	18.4	42.5	60.9
1995	28.0	65.3	93.3	8.8	29.7	38.5
1996	25.5	15.3	40.8	3.7	10.5	14.3
1997	23.2	52.5	75.7	4.7	9.3	14.0
1998	22.5	49.9	72.4	6.5	13.4	19.9

Year	Foxes and racoon dogs			Minks, chinchillas and other fur animals		
	For breeding (calculated)	Killed for fur	Average population	For breeding (calculated)	Killed for fur	Yearly average population calculated
1999	12.8	50.3	63.1	2.7	7.9	10.6
2000	10.8	32.9	43.6	2.1	4.7	6.8
2001	14.9	29.6	44.5	5.7	11.8	17.5
2002	14.2	32.4	46.6	11.1	21.2	32.3
2003	14.2	28.7	42.8	17.4	37.7	55.2
2004	14.5	28.5	42.9	18.7	39.7	58.4
2005	12.0	26.8	38.8	26.0	61.2	87.2
2006	10.2	22.5	32.7	21.4	49.6	71.0
2007	11.9	26.8	38.7	23.8	56.3	80.1
2008	3.6	9.1	12.7	21.3	57.2	78.6
2009	4.0	9.0	13.0	26.7	63.8	90.6
2010	3.9	8.7	12.6	26.3	61.3	87.7
2011	4.3	9.7	14.0	28.9	68.7	97.6
2012	4.2	9.7	13.9	28.0	68.5	96.6
2013	4.3	9.8	14.1	29.0	69.4	98.4
2014	4.4	9.6	14.0	29.5	67.7	97.2
2015	4.2	10.4	14.6	28.3	73.6	101.9
2016	1.7	4.6	6.3	11.4	32.5	43.9
2017	1.9	4.7	6.7	13.0	33.6	46.6
2018	1.3	3.9	5.2	8.5	27.8	36.3
2019	0.1	0.4	0.5	0.6	2.8	3.4
2020	0.0	0.4	0.4	0.0	2.7	2.7

### A.3.2\_II. MILK YIELD PER COW, FAT CONTENT OF MILK AND PERCENTAGE OF COW THAT GAVE BIRTH IN ESTONIA IN 1990–2019

**Table A.3.2\_II.1.** Average milk yield per cow in 1991–1993, kg/cow (SE, 1994)

Year	Average yield per cow, kg
1991	3 968
1992	3 530
1993	3 322

**Table A.3.2\_II.2.** Average milk yield per cow in 1994–2020, kg/cow/year (SE 1994–2005; SE, 2021)

County	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Average yield per cow, kg	3 455	3 588	3 809	4 210	4 456	4 171	4 660	5 152	5 138	5 176	5 528	5 886	6 285
Harju county	3 016	3 027	3 301	3 775	4 137	3 831	3 951	4 843	4 588	4 816	5 141	5 756	5 937
Hiiu county	2 566	2 498	2 669	3 079	3 132	3 964	4 540	5 603	4 589	4 663	4 510	4 987	4 720
Ida-Viru county	2 374	2 143	2 449	2 960	3 320	3 397	4 057	4 425	4 767	4 593	4 706	5 492	5 612
Jõgeva county	3 399	3 596	3 769	3 870	4 731	4 218	4 960	5 392	5 461	5 362	5 744	6 188	6 715
Järva county	4 066	4 224	4 458	5 020	5 399	4 751	5 375	6 216	6 057	6 058	6 243	6 330	6 900
Lääne county	2 520	2 513	2 742	3 017	3 297	3 494	3 513	4 039	4 111	4 223	4 558	4 731	5 343
Lääne-Viru county	3 548	3 418	3 950	4 394	4 721	4 061	4 685	5 420	5 291	5 391	5 954	6 205	6 542
Põlva county	3 134	3 616	4 111	4 684	4 874	4 517	5 040	6 310	5 868	6 213	6 180	6 506	7 123
Pärnu county	3 220	3 256	3 380	3 666	4 210	3 736	4 451	5 005	4 920	4 986	5 373	5 806	6 326
Rapla county	3 088	3 301	3 763	4 077	4 673	4 301	4 767	5 232	5 047	5 066	5 809	6 105	6 101
Saare county	2 732	2 573	2 894	3 330	3 657	3 817	4 071	5 162	4 341	4 496	5 034	5 113	5 464
Tartu county	3 337	3 417	3 785	4 089	4 457	3 767	4 898	5 099	5 028	5 556	6 070	6 423	6 812
Valga county	2 553	2 776	2 961	3 135	3 384	3 076	3 496	4 089	4 503	3 866	4 878	5 259	5 598
Viljandi county	3 143	2 865	3 140	3 544	3 829	3 406	4 167	4 921	4 918	4 663	4 894	5 098	5 436
Võru county	3 126	3 188	3 431	3 747	3 972	3 581	3 880	4 982	4 893	4 996	5 070	5 481	5 810

**Table A.3.2\_II.2.** Average milk yield per cow in 1994–2019, kg/cow/year (continued)

County	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Average yield per cow, kg	6 484	6 781	6 838	7 021	7 168	7 526	7 990	8 233	8 442	8 878	9 159	9 287	9 633	9 943
Harju county	6 019	6 396	6 359	6 402	6 600	6 769	7 377	7 351	7 725	8 386	8 677	9 205	8 667	9 105
Hiiu county	4 687	4 646	5 052	4 520	4 667	5 266	4 650	5 468	4 998	5 875	6 559	7 558	7 372	7 274
Ida-Viru county	5 438	6 053	6 039	6 334	6 298	6 554	7 250	7 237	7 204	6 668	7 562	7 670	8 175	7 770
Jõgeva county	6 812	7 119	7 058	7 230	7 465	7 657	7 807	8 176	8 496	9 651	9 506	9 479	9 887	10 162
Järva county	7 045	7 164	7 048	7 254	7 473	7 816	8 338	8 728	8 895	9 532	9 892	10 193	10 178	10 417
Lääne county	5 512	6 295	6 281	6 368	6 388	6 802	7 552	7 674	7 944	7 706	8 969	8 568	8 765	9 512
Lääne-Viru county	6 823	7 096	7 139	7 390	7 524	7 783	8 186	8 317	8 306	9 031	9 266	9 058	10 141	10 175
Põlva county	7 339	7 562	7 581	7 671	7 737	7 980	8 306	9 543	8 983	9 315	9 228	10 054	10 102	10 410
Pärnu county	6 407	6 651	6 733	6 948	7 294	7 690	8 054	8 128	8 694	8 941	9 233	9 200	9 708	10 068
Rapla county	6 325	6 796	7 078	7 355	7 267	7 784	8 108	7 974	9 005	8 712	9 304	9 020	9 646	9 915
Saare county	5 619	5 844	6 008	6 243	6 179	6 633	7 371	7 588	7 476	7 726	8 139	8 336	8 620	8 907
Tartu county	7 103	7 880	8 019	7 997	8 237	8 544	9 520	9 463	9 230	9 896	10 127	10 243	10 264	10 696
Valga county	5 870	5 851	5 926	6 127	6 470	7 125	7 581	7 894	8 149	8 191	8 527	8 941	9 414	10 109

County	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Viljandi county	5 932	6 205	6 530	6 784	6 711	7 220	7 485	7 818	8 344	8 718	9 048	9 210	9 247	9 504
Võru county	6 281	6 319	6 493	6 461	6 345	6 948	7 290	7 667	7 586	7 877	8 162	6 803	8 130	8 254

**Table A.3.2\_II.3.** Average fat content of milk in Estonia in 1990–1997, % (EARC, 2012)<sup>1</sup>

Year	Fat content, %
1990	4.09
1991	4.06
1992	3.98
1993	4.00
1994	4.01
1995	4.08
1996	4.21
1997	4.21

**Table A.3.2\_II.4.** Fat content of milk in 1998–2020 by county of Estonia, % (EARC, 2021)<sup>1</sup>

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Average	4.26	4.23	4.29	4.31	4.29	4.31	4.27	4.21	4.17	4.15	4.12
Harju	4.25	4.23	4.31	4.38	4.32	4.34	4.29	4.27	4.21	4.18	4.14
Hiiu	4.46	4.4	4.25	4.29	4.38	4.38	4.26	4.19	4.24	4.28	4.34
Ida-Viru	4.32	4.33	4.31	4.29	4.21	4.25	4.23	4.09	4.06	4.08	4.08
Jõgeva	4.37	4.32	4.36	4.39	4.46	4.46	4.3	4.28	4.24	4.2	4.18
Järva	4.18	4.19	4.25	4.25	4.23	4.29	4.27	4.17	4.14	4.11	4.08
Lääne	4.36	4.24	4.34	4.36	4.28	4.27	4.28	4.25	4.28	4.28	4.24
Lääne-Viru	4.18	4.14	4.19	4.21	4.19	4.2	4.16	4.11	4.07	4.03	4.02
Põlva	4.29	4.24	4.28	4.38	4.33	4.3	4.3	4.23	4.14	4.11	4.09
Pärnu	4.23	4.2	4.36	4.41	4.32	4.35	4.33	4.27	4.2	4.19	4.16
Rapla	4.23	4.16	4.21	4.27	4.19	4.2	4.21	4.11	4.05	4.06	4.0
Saare	4.46	4.4	4.38	4.36	4.4	4.4	4.38	4.27	4.26	4.23	4.17
Tartu	4.3	4.26	4.25	4.28	4.32	4.28	4.28	4.22	4.19	4.13	4.08
Valga	4.25	4.18	4.27	4.3	4.25	4.26	4.29	4.21	4.19	4.22	4.25
Viljandi	4.28	4.19	4.32	4.31	4.31	4.39	4.31	4.26	4.27	4.26	4.21

<sup>1</sup> EARC. Eesti Jõudluskontrolli aastaraamatud. [www] <https://www.jkkeskus.ee/jkk/piimaveised/statistika/j%C3%B5udluskontrolli-aastaraamatud/> (22.12.2021).

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Võru	4.22	4.25	4.35	4.33	4.34	4.32	4.25	4.26	4.28	4.29	4.21

**Table A.3.2\_II.4.** Fat content of milk in 1998–2020 by county of Estonia, % (EARC, 2020)<sup>1</sup> (continued)

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Average	4.14	4.11	4.1	4.04	4	4	3.98	4	3.94	3.91	3.89	3.89
Harju	4.17	4.11	4.07	4.03	3.96	4	3.93	4	3.95	3.94	3.92	3.91
Hiiu	4.44	4.41	4.37	4.22	4.27	4.17	4.2	4.17	4.16	4.16	4.20	4.17
Ida-Viru	4.09	4.07	4.11	4.09	4.09	4.01	3.94	4.03	3.93	3.85	3.77	3.86
Jõgeva	4.17	4.14	4.14	4.06	4.05	4.07	3.99	4.1	3.95	3.97	3.89	3.86
Järva	4.09	4.07	4.03	4.03	3.99	3.98	3.93	4.03	3.94	3.84	3.81	3.88
Lääne	4.29	4.2	4.13	4.03	4.03	4.02	4.01	4.01	4.06	4.03	3.96	3.78
Lääne-Viru	4.01	4.01	4.05	4.02	3.95	3.9	3.83	3.82	3.81	3.81	3.77	3.85
Põlva	4.08	4.14	4.12	4.13	4.01	4	3.96	4.03	4.01	3.98	3.98	3.91
Pärnu	4.17	4.12	4.08	3.99	4.01	3.98	3.9	3.94	3.91	3.9	3.91	3.86
Rapla	4.12	4.18	4.21	4.09	4.01	4.03	3.96	3.97	3.99	3.97	3.88	3.86
Saare	4.22	4.15	4.13	3.98	3.96	4.06	4.08	4.11	4.02	3.92	3.92	3.96
Tartu	4.09	4.02	4.03	3.91	3.91	3.89	3.81	3.81	3.79	3.78	3.78	3.73
Valga	4.29	4.17	4.14	4.16	4.08	4.11	4.08	4.13	4.11	4.08	4.03	3.95
Viljandi	4.22	4.12	4.1	4.08	4.05	4.07	3.98	4.12	3.99	4.02	4.06	4.04
Võru	4.29	4.24	4.22	4.16	4.05	4.03	3.95	4	3.97	3.99	4.08	4.04

**Table A.3.2\_II.5.** Percentage of cows that gave birth in 1990–2020, %

Year	%
1990	74
1991	80
1992	86
1993	100
1994	98
1995	100
1996	100
1997	100
1998	100
1999	100
2000	99
2001	100
2002	100
2003	99
2004	100
2005	98
2006	100
2007	100
2008	100
2009	100
2010	100
2011	100
2012	100
2013	100
2014	100
2015	100
2016	100
2017	100
2018	100
2019	100
2020	100

### A.3.2\_III. WEIGHT OF DAIRY CATTLE BY CATTLE BREED IN ESTONIA IN 1990–2020

**Table A.3.2\_III.1.** Average weight of dairy cattle by breed in Estonia in 1990–2020

Year	Population by dairy-cattle breed				Average weight of cows, kg
	Estonian Red	Estonian Holstein	Estonian Native	Total number in Registry	
Typical weight, kg	540 <sup>2</sup>	550 <sup>2</sup>	460 <sup>3</sup>		
1990	121 125	125 235	566	246 926	544.9
1991	107 873	121 077	549	229 499	547.7
1992	94 610	116 722	577	211 909	550.6
1993	74 543	106 033	563	181 139	553.6
1994	59 691	91 676	564	151 931	556.4
1995	49 285	79 767	555	129 607	559.2
1996	43 537	74 968	570	119 075	562.1
1997	40 118	74 186	535	114 839	565.0
1998	38 705	77 717	504	116 926	568.1
1999	33 820	75 589	472	109 881	571.1
2000	29 875	71 799	443	102 117	574.1
2001	27 981	73 173	481	101 635	577.1
2002	26 726	74 733	507	101 966	580.1
2003	26 314	74 981	490	101 785	583.1
2004	26 571	73 781	538	100 890	585.8
2005	26 607	73 261	537	100 405	588.7
2006	25 348	72 894	544	98 786	591.7
2007	23 842	70 816	514	95 172	594.7
2008	22 357	69 599	517	92 473	597.7
2009	20 578	68 058	475	89 111	600.9
2010	19 724	67 904	461	88 089	604.0
2011	18 917	69 216	493	88 626	607.1
2012	18 294	70 511	479	89 284	610.3
2013	18 175	71 716	441	90 332	613.4
2014	18 356	72 810	459	91 625	616.5
2015	17 247	69 772	484	87 503	619.5
2016	15 899	65 896	466	82 261	622.5
2017	14 742	66 713	520	81 975	625.5
2018	13 682	68 044	518	82 244	629.3
2019	12 321	67 990	567	80 878	632.6
2020	11 297	68 754	601	80 652	635.9

**Table A.3.2\_III.2.** Data on weight and weight gain of non-dairy cattle used in the estimates

Cattle category	Weight, kg	Weight gain, kg/day
Manure non-dairy cattle <sup>4</sup> :		
Mature females	500	
Mature males	600	
Bovine animals (aged between 1 and 2 years)	300	0.70

<sup>2</sup> Ling, K., Samarütel, J., Jaakson, H. Ainevahetuslased uurimised põlulas. [www] <http://www.eau.ee/~polulakf/ainevahetus.php> (12.03.2012).

<sup>3</sup> Kalamees, K. Eesti Maakari. [www] [http://www.etl.ee/?Veised:Eesti\\_maakari](http://www.etl.ee/?Veised:Eesti_maakari) (12.03.2012).

<sup>4</sup> Revised 1996 IPCC Guidelines, Volume 3, Chapter 4: Agriculture, pages 4.42–4.43, table A-2 (for Eastern European countries). The data correspond to Estonian data on weight of mature cattle.



Cattle category	Weight, kg	Weight gain, kg/day
Calves (6–12 months) <sup>5</sup>	205	0.55
Calves (0–6 months) <sup>6</sup>	41	0.90

**Table A.3.2\_III.3.** Data on weight of main swine categories used in the estimates, kg

Swine category	Weight, kg
Piglets, live weight less than 20 kg	10
Young pigs, live weight 20–<50 kg	35
Fattening pigs	
live weight 50–<80 kg	65
live weight 80–<110 kg	95
live weight 110 kg or more	110
Breeding pigs, live weight 50 kg or more	110

### A.3.2\_IV. MANURE MANAGEMENT SYSTEMS

#### Manure management systems: cattle and swine livestock categories

The distributions of cattle and swine MMS are based on the results of the study by Estonian University of Life Sciences and the EERC (2018)<sup>7</sup>. As the study covered the years 1990, 1995, 2000, 2005, 2010, 2015 and 2020, the values for the distribution of MMS in-between of those years were interpolated. The corresponding MMS distributions are shown in tables A.3.2\_IV.1. and A.3.2\_IV.2.

In general, a major number of holdings, which kept cattle and swine, were large in the beginning of ninetieth: about 90% of the total number of farms were with more than 1000 heads of cattle and swine<sup>8</sup>. High number of animals per swine farm, in greater degree, stipulated housing technology occurred in holdings – mostly partially or completely slatted floors, with liquid/slurry MMS, was applied. A smaller number of swine were kept in private farms, where mainly solid storage MMS was applied in Estonia.

In 1990, mainly tie stall housing system occurred in dairy-cattle and non-dairy cattle (including young animals) holdings. The housing technology assumes generation and storage of solid manure. It means that in the beginning of the nineties, mainly solid storage MMS was applied in cattle breeding holdings. The housing technology applied in dairy cattle as well non-dairy cattle breeding holdings has started to be changed in the beginning of 2000s – in 2003, the first farm with loose-housing technology was built up. The technology of young cattle housing started to change also in that time, the changes from tie stall technology to loose-technology with slatted floor and deep litter, namely from solid storage MMS to liquid/slurry MMS or Deep Litter MMS (in accordance, with the definitions established in the IPCC) have started to be launched. In the nineties, calves (0–6 months) were kept in groups or individual boxes with solid storage MMS.

<sup>5</sup> The start weight was calculated based on the final weight of calves (0–6 months) and their weight gain. The weight gain of calves was estimated taking into account the start weight of mature cattle. Production cycle at 183 days per year was applied.

<sup>6</sup> Lehtsalu, S., Kaart, T., Kiiman, H., (2010). Lehmvasikate kasvatamine sündimisest seemendamiseni. Agraarteadus, 21 (1), lk 14–23 – ki the start weight and weight gain. Production cycle at 182 days per year was applied.

<sup>7</sup> Kaasik, A., Möls, M. Loomakasvatusest eralduvate saasteainete heitkoguste inventuurimetoodikate täiendamise ja heite vähendamistehnoloogiate kaardistamine. [www] [https://www.envir.ee/sites/default/files/nh3\\_eri-heite\\_ja\\_sonnikukaitlustehnoloogiate\\_ajaloolise\\_ulevaate\\_lopparuanne\\_0.pdf](https://www.envir.ee/sites/default/files/nh3_eri-heite_ja_sonnikukaitlustehnoloogiate_ajaloolise_ulevaate_lopparuanne_0.pdf) (16.02.2021).

<sup>8</sup> SE. (1991). Eesti statistika 1990. Lk. 445.

**Table A.3.2\_IV.1.** Country-specific MMS of cows in 1990–2020, %

Year	Dairy cows, %				Bovine animals and bulls,%				Mature non-dairy females,%				Calves,%			
	Liquid/ Slurry	Solid Storage	Deep litter	Pasture/ Range	Liquid/ Slurry	Solid Storage	Deep litter	Pasture/ Range	Liquid/ Slurry	Solid Storage	Deep litter	Pasture/ Range	Liquid/ Slurry	Solid Storage	Deep litter	Pasture/ Range
1990	0	82.7	0	17.3	0	67.1	0	32.9	0	67.8	0	32.2	0	85.7	0	14.3
1991	0	82.3	0	17.7	0	67.1	0	32.9	0	67.8	0	32.2	0	85.7	0	14.3
1992	0	81.8	0	18.2	0	67.1	0	32.9	0	67.8	0	32.2	0	85.7	0	14.3
1993	0	81.4	0	18.6	0	67.1	0	32.9	0	67.8	0	32.2	0	85.7	0	14.3
1994	0	80.9	0	19.1	0	67.1	0	32.9	0	67.8	0	32.2	0	85.7	0	14.3
1995	0	80.5	0	19.5	0	67.1	0	32.9	0	67.8	0	32.2	0	85.7	0	14.3
1996	0	80.9	0	19.1	0	67.1	0	32.9	0	67.8	0	32.2	0	85.7	0	14.3
1997	0	81.4	0	18.6	0	67.1	0	32.9	0	67.8	0	32.2	0	85.7	0	14.3
1998	0	81.8	0	18.2	0	67.1	0	32.9	0	67.8	0	32.2	0	85.7	0	14.3
1999	0	82.3	0	17.7	0	67.1	0	32.9	0	67.8	0	32.2	0	85.7	0	14.3
2000	0	82.7	0	17.3	0	67.1	0	32.9	0	67.8	0	32.2	0	85.7	0	14.3
2001	0	82.8	0	17.2	0.4	64.6	2.4	32.6	0.5	66.7	0	32.8	0.6	83.1	2	14.3
2002	0	82.9	0	17.1	0.9	62	4.8	32.3	1	65.7	0	33.4	1.1	80.5	4.1	14.3
2003	6.7	76.3	0	17	1.3	59.4	7.3	32	1.5	64.6	0	34	1.7	77.9	6.1	14.3
2004	13.41	69.6	0	16.9	1.8	56.8	9.7	31.8	2	63.5	0	34.6	2.2	75.3	8.1	14.4
2005	20.1	63	0	16.9	2.2	54.2	12.1	31.5	2.5	62.4	0	35.1	2.8	72.7	10.2	14.4
2006	26.3	59.4	0	14.3	2.9	52.8	14.9	29.4	7.8	59.2	0	33	3.6	70.6	12.4	13.4
2007	32.5	55.8	0	11.7	3.5	51.5	17.7	27.3	13.2	56	0	30.9	4.4	68.6	14.6	12.4
2008	38.7	52.2	0	9.1	4.2	50.2	20.4	25.2	18.6	52.7	0	28.7	5.2	66.5	16.9	11.4
2009	44.8	48.6	0	6.5	4.9	48.8	23.2	23.1	23.9	49.5	0	26.6	6	64.5	19.1	10.4
2010	51	45	0	3.9	5.5	47.5	26	21	29.3	46.3	0	24.4	6.8	62.4	21.4	9.4
2011	57.2	38.7	0	4.1	10.2	44.9	22.3	22.6	29.2	44	1.4	25.4	9.6	57	23.1	10.3
2012	63.3	32.4	0	4.3	14.9	42.3	18.7	24.2	29.1	41.7	2.9	26.3	12.4	51.5	24.9	11.2
2013	69.5	26.1	0	4.4	19.4	39.8	15.1	25.8	29	39.4	4.3	27.2	15.2	46	26.7	12.1
2014	75.6	19.8	0	4.6	24.1	37.2	11.4	27.3	29	37.2	5.7	28.2	18	40.5	28.4	13.1
2015	81.8	13.5	0	4.8	28.7	34.6	7.8	28.1	28.9	34.9	7.1	29.1	20.8	35.1	30.2	14
2016	83.4	12.1	0.4	4.2	25.8	27.7	19.4	27.1	31.8	28.8	13.3	26.1	19.7	28.1	38.1	14.2
2017	84.9	10.6	0.8	3.6	22.9	20.8	31	25.2	34.7	22.8	19.5	23	18.5	21	45.9	14.5
2018	86.3	9.2	1.2	3	20.1	13.9	42.6	23.4	37.6	16.8	25.7	20	17.4	14	53.8	14.8
2019	88.1	7.8	1.7	2.4	17.2	7	54.2	21.6	40.5	10.7	31.9	16.9	16.3	7	61.7	15.1
2020	89.7	6.4	2	1.8	14.3	0.1	65.8	19.7	43.4	4.7	38.1	13.8	15.1	0	69.5	15.3

**Table A.3.2\_IV.2.** Country-specific MMS of swine in 1990–2020, %

Year	Fattening pigs				Sows and boars				Young pigs			
	Liquid/ Slurry	Solid Sto- rage	Deep litter	Pasture/ Range	Liquid/ Slurry	Solid Sto- rage	Deep litter	Pasture/ Range	Liquid/ Slurry	Solid Sto- rage	Deep litter	Pasture/ Range
	%	%	%	%	%	%	%	%	%	%	%	%
1990	87.0	13.0	0	0	85.5	14.5	0	0	87.0	13.0	0	0
1991	85.6	14.4	0	0	84.0	16.0	0	0	85.6	14.4	0	0
1992	84.2	15.8	0	0	82.5	17.5	0	0	84.2	15.8	0	0
1993	82.8	17.2	0	0	80.9	19.1	0	0	82.8	17.2	0	0
1994	81.4	18.6	0	0	79.4	20.6	0	0	81.4	18.6	0	0
1995	80.0	20.0	0	0	77.9	22.1	0	0	80.0	20.0	0	0
1996	79.6	20.4	0	0	77.5	22.5	0	0	79.6	20.4	0	0
1997	79.2	20.8	0	0	77.0	23.0	0	0	79.2	20.8	0	0
1998	78.8	21.2	0	0	76.6	23.4	0	0	78.8	21.2	0	0
1999	78.4	21.6	0	0	76.2	23.8	0	0	78.4	21.6	0	0
2000	78.0	22.0	0	0	75.8	24.3	0	0	78.0	22.0	0	0
2001	78.2	21.8	0	0	76.0	24.0	0	0	78.2	21.8	0	0
2002	78.4	21.6	0	0	76.2	23.8	0	0	78.4	21.6	0	0
2003	78.6	21.4	0	0	76.4	23.6	0	0	78.6	21.4	0	0
2004	78.8	21.2	0	0	76.6	23.4	0	0	78.8	21.2	0	0
2005	79.0	21.0	0	0	76.8	23.2	0	0	79.0	21.0	0	0
2006	79.2	20.8	0	0	77.0	23.0	0	0	79.2	20.8	0	0
2007	79.4	20.6	0	0	77.2	22.8	0	0	79.4	20.6	0	0
2008	79.6	20.4	0	0	77.5	22.5	0	0	79.6	20.4	0	0
2009	79.8	20.2	0	0	77.7	22.3	0	0	79.8	20.2	0	0
2010	80.0	20.0	0	0	77.9	22.1	0	0	80.0	20.0	0	0
2011	81.3	18.7	0	0	82.3	17.7	0	0	84.0	16.0	0	0
2012	82.6	17.4	0	0	86.7	13.3	0	0	88.0	12.0	0	0
2013	83.9	16.1	0	0	91.1	8.9	0	0	92.0	8.0	0	0
2014	85.2	14.8	0	0	95.6	4.4	0	0	96.0	4.0	0	0
2015	86.4	6.4	7.2	0	99.98	0	0.02	0	100.0	0	0	0
2016	87.5	5.1	7.3	0	98.7	1.3	0.02	0	100.0	0	0	0
2017	88.6	3.8	7.5	0	97.5	2.5	0.01	0	100.0	0	0	0
2018	89.7	2.6	7.7	0	96.2	3.8	0.01	0	100.0	0	0	0
2019	90.8	1.3	7.9	0	95.0	5.0	0.004	0	100.0	0	0	0
2020	92.0	0	8.1	0	93.7	6.3	0	0	100.0	0	0	0

### Manure management systems: poultry

The module on MMS for poultry manure storage was developed based on data on poultry population kept by legal and in private agricultural holdings (Table A.3.2.\_IV.3).

According to the information presented in the environmental permits, which were submitted by large poultry holdings to the Environmental Board, the holdings use 'solid storage MMS' for all amount of waste generated by poultry. Manure, generated by poultry kept by private holdings (farms), is stored in 'solid storage MMS'. However, in addition, in private holdings, in the summer time during solar time, poultry are kept outside of hen-house, which could be classified as 'dry lot' MMS (Table A.3.2.\_IV.4).

**Table A.3.2\_IV.3.** Poultry population in agricultural holdings by form in Estonia in 1990–2016, 1000 heads (SE, 2019)

Year	Total population	incl. in private holdings
1990	6 537	1 170
2001	2 214	479
2003	2 276	328
2005	2 132	296
2007	1 719	147
2010	1 941	139
2013	2 166	84
2016	1 903	53

**Table A.3.2\_IV.4.** Country-specific MMS of poultry in 1990–2020, %

Year	Solid storage	Dry lot
1990	96.7	3.3
1991	96.6	3.4
1992	96.6	3.4
1993	96.5	3.5
1994	96.5	3.5
1995	96.4	3.6
1996	96.4	3.6
1997	96.3	3.7
1998	96.3	3.7
1999	96.2	3.8
2000	96.2	3.8
2001	96.1	3.9
2002	96.7	3.3
2003	97.2	2.8
2004	97.3	2.7
2005	97.3	2.7
2006	97.8	2.2
2007	98.3	1.7
2008	98.4	1.6
2009	98.4	1.6
2010	98.5	1.5
2011	98.8	1.2
2012	99	1
2013	99.2	0.8
2014	99.3	0.7
2015	99.3	0.7
2016	99.4	0.6
2017	99.4	0.6
2018	99.4	0.6
2019	99.4	0.6

Year	Solid storage	Dry lot
2020	99.4	0.6

### A.3.2\_V. NITROGEN EXCRETION RATES

**Table A.3.2\_V.1.** Nitrogen content of feed, % (Kaasik jt, 2002)<sup>9</sup>

Cattle category	Nitrogen content of feed, %
Dairy cattle	2.4
Mature females	1.6
Mature males	2.3
Bovine animals (aged between 1 and 2 years)	2.3
Calves (0–6 months)	2.3

**Table A.3.2\_V.2.** Content of N in body weight and embryo, g/kg (DIAS, 1997)<sup>10</sup>

	Nitrogen, g/kg
	Dairy cattle
Weight gain	25.6
Embryo	29.6
	Growing cattle
Weight gain	29.6

**Table A.3.2\_V.3.** Average protein content of milk in Estonia in 1990–1997, % of mass (EARC, 2012)<sup>11</sup>

Year	Fat content, %
1990	3.22
1991	3.25
1992	3.14
1993	3.11
1994	3.15
1995	3.17
1996	3.20
1997	3.15

<sup>9</sup> Kaasik, A., Leming, R., Rimmel, T. (2002). Toitainete (N, P, K) kadu veise- ja seakasvatustes. Agraarteadus, nr 13 (4), lk 201–211.

<sup>10</sup> DIAS. Standard Values for Farm Manure. [www] <https://dcapub.au.dk/djfpublikation/djfpdf/djfh7.pdf> (02.11.2020).

<sup>11</sup> <sup>10</sup> Results of animal recording in Estonia in 1997–2012. Annual Reports. [www] <https://www.jkkes-kus.ee/jkk/piimaveised/statistika/aastaruanded/> (02.11.2020).

**Table A.3.2\_V.4.** Protein content of milk in 1998–2020 in Estonia, % in mass (EARC, 2021)

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
The average of Estonia	3.18	3.15	3.28	3.31	3.27	3.3	3.31	3.34	3.32	3.36	3.36	3.37	3.36	3.39	3.39	3.38	3.37	3.38	3.36	3.38	3.39	3.41	3.39
Harju	3.13	3.11	3.25	3.3	3.2	3.22	3.25	3.28	3.28	3.29	3.3	3.32	3.32	3.34	3.37	3.35	3.33	3.36	3.34	3.37	3.36	3.39	3.35
Hiiu	3.21	3.21	3.31	3.3	3.27	3.3	3.29	3.26	3.26	3.26	3.33	3.32	3.3	3.34	3.34	3.31	3.32	3.31	3.31	3.38	3.46	3.46	3.43
Ida-Viru	3.16	3.14	3.29	3.31	3.25	3.25	3.3	3.35	3.39	3.38	3.37	3.38	3.38	3.4	3.38	3.4	3.38	3.4	3.41	3.4	3.42	3.49	3.47
Jõgeva	3.26	3.22	3.36	3.4	3.36	3.39	3.39	3.41	3.41	3.4	3.4	3.41	3.42	3.43	3.44	3.41	3.41	3.41	3.41	3.43	3.41	3.41	3.41
Järva	3.17	3.15	3.26	3.3	3.27	3.31	3.31	3.35	3.34	3.36	3.38	3.37	3.37	3.4	3.39	3.36	3.36	3.37	3.33	3.35	3.36	3.40	3.38
Lääne	3.15	3.1	3.22	3.26	3.2	3.2	3.24	3.24	3.28	3.28	3.3	3.31	3.31	3.31	3.34	3.31	3.33	3.36	3.32	3.39	3.41	3.40	3.39
Lääne-Viru	3.13	3.11	3.22	3.27	3.24	3.25	3.28	3.32	3.36	3.36	3.36	3.34	3.36	3.39	3.38	3.38	3.35	3.35	3.35	3.36	3.37	3.40	3.39
Põlva	3.2	3.19	3.32	3.28	3.32	3.33	3.34	3.34	3.35	3.34	3.34	3.36	3.32	3.39	3.4	3.36	3.33	3.35	3.34	3.37	3.36	3.38	3.34
Pärnu	3.14	3.12	3.26	3.28	3.22	3.26	3.29	3.33	3.33	3.33	3.34	3.34	3.33	3.38	3.36	3.35	3.34	3.37	3.35	3.37	3.38	3.39	3.36
Rapla	3.16	3.12	3.26	3.27	3.25	3.26	3.3	3.3	3.29	3.31	3.32	3.33	3.34	3.36	3.36	3.35	3.37	3.38	3.33	3.38	3.39	3.43	3.39
Saare	3.27	3.24	3.34	3.39	3.36	3.36	3.38	3.38	3.39	3.38	3.4	3.41	3.39	3.39	3.39	3.4	3.41	3.44	3.4	3.42	3.45	3.49	3.47
Tartu	3.18	3.16	3.31	3.34	3.32	3.36	3.37	3.38	3.39	3.39	3.37	3.38	3.39	3.42	3.41	3.39	3.37	3.39	3.37	3.37	3.37	3.38	3.40
Valga	3.14	3.11	3.25	3.29	3.24	3.29	3.32	3.37	3.4	3.41	3.42	3.43	3.44	3.43	3.44	3.43	3.4	3.39	3.38	3.41	3.44	3.42	3.41
Viljandi	3.22	3.17	3.31	3.33	3.29	3.31	3.31	3.34	3.38	3.38	3.38	3.38	3.36	3.39	3.41	3.4	3.39	3.42	3.4	3.42	3.42	3.43	3.42
Võru	3.14	3.12	3.24	3.26	3.23	3.26	3.23	3.29	3.32	3.32	3.34	3.36	3.35	3.42	3.42	3.38	3.36	3.38	3.37	3.34	3.36	3.41	3.41

### A.3.2\_VI. SYNTHETIC FERTILIZERS APPLIED ON AGRICULTURAL SOILS IN ESTONIAN IN 1990–2019

**Table A.3.2\_VI.1.** Amounts of synthetic fertilizers applied on agricultural soils, tonnes (SE, 2021)

Year	Use of mineral fertilizers (nitrogen)
1990	72 039
1991	69 824
1992	58 360
1993	29 949
1994	26 068
1995	18 905
1996	16 560
1997	20 471
1998	24 932
1999	19 895
2000	22 396
2001	19 603
2002	16 700
2003	23 255
2004	24 833
2005	20 083
2006	22 610
2007	24 982
2008	35 455
2009	27 328
2010	28 626
2011	29 803
2012	32 978
2013	33 659
2014	35 806
2015	36 276
2016	36 390
2017	37 333
2018	38 867
2019	41 438
2020	41 486

### A.3.2\_VII. PRODUCTION OF CROPS IN ESTONIA IN 1990–2019

**Table A.3.2\_VII.1.** Production of field crops in 1990–2020, 1000 tonnes (SE, 2021)

Year	Cereals	Legumes	Rape seed	Open-field vegetables	Potatoes	Forage roots
1990	957.3	0.2	1.1	86	618.1	534.8
1991	939.2	0.2	1.1	103.8	592.1	493.8
1992	598.1	0.4	2.3	63.0	669.1	176.8
1993	810.7	0.7	1.7	58.9	538.6	198.5
1994	510.4	1.1	2.2	69.9	563	216.3
1995	513.5	6.3	7	48.8	537.4	240.8
1996	629.2	13.8	10	48.1	500.2	180.8
1997	650.5	17	9.6	44.2	437.5	146.8
1998	576.2	8.3	17.9	43.1	316.7	96.7
1999	401.6	3.1	29.8	37.5	403.7	58.4
2000	696.6	6.6	38.6	45.5	471.7	49.5

Year	Cereals	Legumes	Rape seed	Open-field vegetables	Potatoes	Forage roots
2001	558.4	6.5	41.3	40.0	343.1	36.1
2002	524.7	5	63.9	27.3	210.9	7.3
2003	505.7	5	69.2	50.4	244.4	7.2
2004	608.1	3.3	68.6	44.1	166.5	6.7
2005	760.1	5.7	83.1	50.7	209.8	3.1
2006	619.3	5.5	84.6	48.9	152.6	2
2007	879.5	9.5	133.3	57.4	191.8	3.4
2008	864.2	3.3	111.1	50.7	125.2	0.4
2009	873.5	7.6	136	59.1	139.1	0.7
2010	678.4	12.6	131	59.2	163.4	0.3
2011	771.6	15.5	144.2	74.1	164.7	0.5
2012	991.2	12.9	157.8	53.8	138.9	0.2
2013	975.5	31.4	174.0	67.4	127.7	0.2
2014	1 221.6	39.5	166.2	55.5	117.3	0.3
2015	1 535.3	86.2	196.3	72.4	117.2	0.5
2016	934.1	109.5	102.5	54.4	89.8	1.8
2017	1 311.9	75.3	165.3	49.3	91.2	0.6
2018	919.8	71.0	113.6	52.8	88.4	1.1
2019	1 624.6	111.2	191.4	77.0	120.5	6.1
2020	1 632.8	120.5	203.0	52.4	94.4	3.7

**Table A.3.2\_VII.2.** Sown area of field crops in 1990–2020, 1000 ha (SE, 2021)

Year	Cereals	Legumes	Industrial crops	Open-field vegetables	Potatoes	Fodder roots
1990	397	0.1	3.2	5.2	45.5	11.1
1991	418.1	0.1	3	5.7	52.2	12.3
1992	423.1	0.4	4.7	5.1	46.3	11.8
1993	375.1	0.4	2.1	4.6	42.6	11.4
1994	319.5	0.7	3.6	4.4	39.9	12
1995	304.3	3.7	7.3	4.6	36.9	10.8
1996	288.8	5.8	9.5	4.2	35.3	8.8
1997	326.6	8.7	9	3.9	35.2	6.9
1998	354.1	6.4	17.8	4.2	32.6	4.7
1999	321	2.9	24.6	3.9	31.1	3.5
2000	329.3	3.9	29.1	3.8	30.9	2.5
2001	274.1	3.7	28.3	3.3	22.1	1.4
2002	259.2	2.4	33.2	3	16	0.4
2003	263.2	4.4	46.7	3.4	17	0.3
2004	261	4.3	50.6	3.5	16.1	0.2
2005	282.1	4.4	47.1	3	14	0.2
2006	280.3	4.6	62.9	2.8	11.5	0.1
2007	292.3	5.7	74.7	2.8	11.2	0.2
2008	309.3	4.8	78.5	2.4	8.7	0.03
2009	316.4	4.9	83.4	2.8	9.1	0.04
2010	275.3	7.3	99.3	2.8	9.4	0.1
2011	296.9	8.6	90.0	3.0	9.2	0.03
2012	290.5	11.0	87.9	2.9	7.6	0.01
2013	311.0	13.6	87.2	2.8	6.6	0.02
2014	332.9	19.1	81.0	2.9	6.4	0.01
2015	350.4	31.3	72.6	3.1	5.8	0.03
2016	351.4	55.4	75.3	3.1	5.6	0.3
2017	330.7	65.6	85.5	3.4	5.4	0.1
2018	350.4	46.8	79.2	3.1	5.2	0.2
2019	364.4	43.0	79.1	3.1	5.3	0.4
2020	370.1	49.5	79.1	2.2	3.6	0.3



**Table A.3.2\_VII.3.** Average yields of field crops by field crop in 1990–2020, kg/ha (SE, 2021)

Year	Cereals	Legumes	Rape seed	Potatoes	Fodder roots
1990	2 411	1 370	1 780	13 600	48 020
1991	2 247	1 310	991	11 340	40 050
1992	1 414	920	799	14 450	14 950
1993	2 161	1 550	1 324	12 640	17 350
1994	1 597	1 619	819	14 096	18 069
1995	1 687	1 711	1 165	14 559	22 429
1996	2 179	2 398	1 170	14 176	20 651
1997	1 992	1 945	1 216	12 415	21 333
1998	1 627	1 303	1 024	9 729	20 297
1999	1 251	1 044	1 232	12 970	16 489
2000	2 115	1 706	1 339	15 281	19 596
2001	2 037	1 780	1 499	15 503	25 838
2002	2 024	2 115	1 944	13 160	18 087
2003	1 922	1 131	1 494	14 393	21 809
2004	2 330	757	1 362	10 342	30 825
2005	2 694	1 282	1 781	15 028	19 686
2006	2 210	1 198	1 354	13 261	24 650
2007	3 009	1 668	1 812	17 196	18 934
2008	2 794	691	1 431	14 315	12 882
2009	2 761	1 547	1 657	15 275	19 917
2010	2 464	1 713	1 334	17 456	5 460
2011	2 598	1 811	1 620	17 836	13 939
2012	3 412	1 179	1 811	18 217	17 000
2013	3 136	2 315	2 021	19 245	13 294
2014	3 669	2 070	2 078	18 472	23 000
2015	4 382	2 756	2 771	20 138	15 903
2016	2 658	1 975	1 462	15 920	6 865
2017	3 967	1 149	2 240	16 925	8 796
2018	2 625	1 516	1 563	16 990	5 236
2019	4 459	2 590	2 643	22 585	13 572
2020	4 412	2 432	2 861	25 945	13 574

### A.3.2\_VIII AMOUNTS OF LIME FERTILIZERS USED IN ESTONIA

**Table A.3.2\_VIII.1.** Amounts of lime fertilizers applied to soils in 1990–2020, tonnes

Year	Annual amount of calcic limestone (CaCO <sub>3</sub> ) (t/yr)	Annual amount of clinker dust (t/yr)	Annual amount of limestone and other meliorants (t/yr)	Annual amount of dolomite (CaMg(CO <sub>3</sub> ) <sub>2</sub> ) (t/yr)
1990	27 529.4	68 000	0	0
1991	25 388.7	62 700	0	0
1992	5 910.7	14 600	0	0
1993	5 404.7	13 350	0	0
1994	4 898.6	12 100	0	0
1995	8 167.2	13 388.2	2 747.1	0
1996	8 291.8	10 286.8	4 127.3	0
1997	13 087.6	13 277.9	7 712.1	0
1998	56 709.2	47 241.1	37 583.9	0
1999	58 719.4	50 172.7	38 407.3	0
2000	44 123.5	39 051.0	28 314.0	0
2001	47 334.7	44 131.8	29 468.2	0
2002	42 797.6	43 446.4	25 208.6	0
2003	38 300.4	45 869.7	19 730.3	0

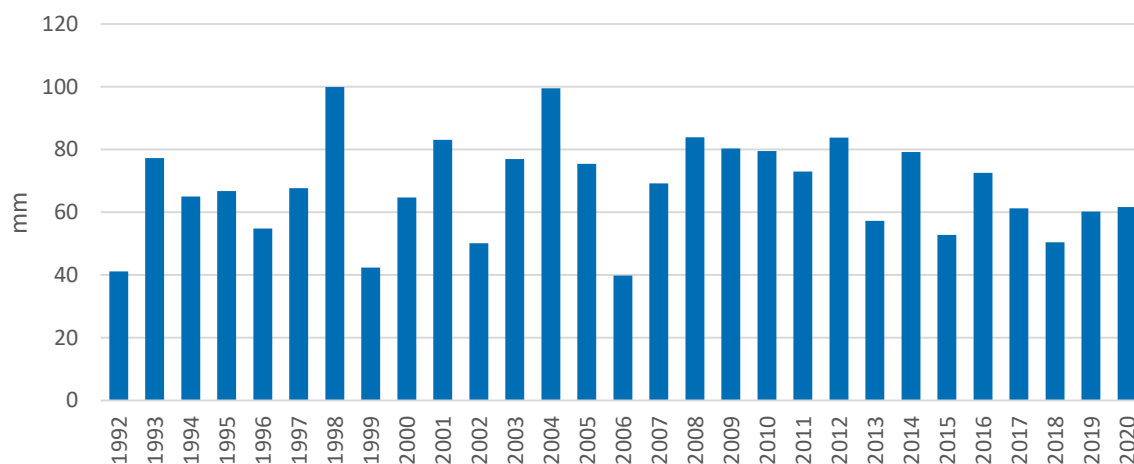
Year	Annual amount of calcic limestone (CaCO <sub>3</sub> ) (t/yr)	Annual amount of clinker dust (t/yr)	Annual amount of limestone and other meliorants (t/yr)	Annual amount of dolomite (CaMg(CO <sub>3</sub> ) <sub>2</sub> ) (t/yr)
2004	22 030.0	42 704.1	4 741.4	84.5
2005	16 290.3	22 860.5	7 035.3	111.2
2006	13 095.5	19 426.6	5 230.7	81.6
2007	8 914.0	12 989.9	3 655.1	677.0
2008	11 635.8	20 953.5	3 152.9	40.7
2009	2 690.0	5 623.0	413.5	32.4
2010	2 1087.9	31 487.3	8 340.4	183.3
2011	8 830.3	11 696.5	4 095.1	92.8
2012	15 673.1	0	15 673.1	182.0
2013	13 780.7	0	13 780.7	88.5
2014	18 394.1	0	18 394.1	1 156.5
2015	18 014.0	0	18 014.0	2 342.0
2016	29 137.0	0	29 137.0	2 481.0
2017	34 887.0	0	34 887.0	1 996.0
2018	38 194.0	0	38 194.0	5 178.0
2019	32 534.0	0	32 534.0	2 410.0
2020				

### A.3.2\_IX. AMOUNTS OF UREA FERTILIZERS USED IN ESTONIA

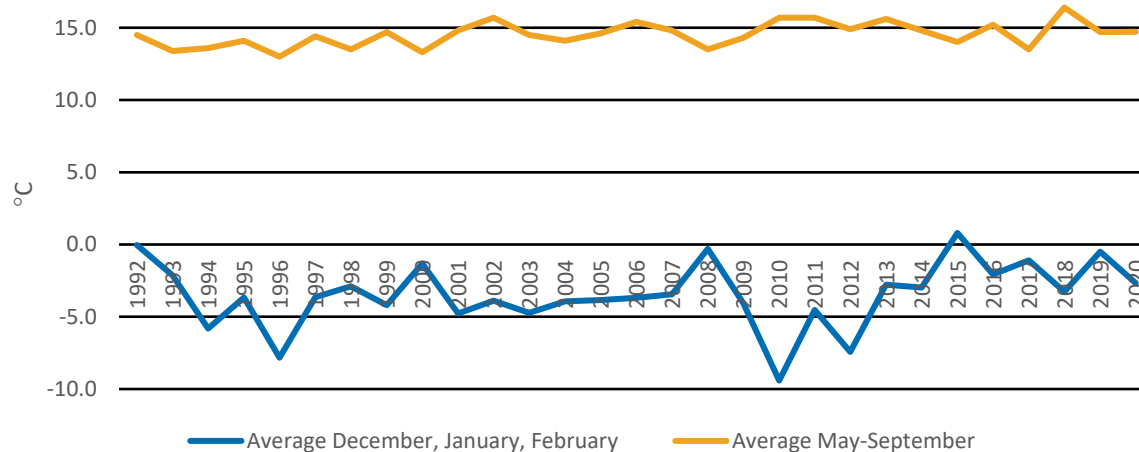
**Table A.3.2\_IX.1.** Amounts of urea fertilizers applied to soils in 1990–2020, tonnes

Year	Annual amount of used urea fertilizers (t/yr)
1990	1 360.2
1991	1 265.4
1992	663.9
1993	269.0
1994	895.0
1995	873.0
1996	807.4
1997	653.9
1998	489.7
1999	631.7
2000	592.9
2001	612.1
2002	378.5
2003	527.5
2004	884.1
2005	1 919.7
2006	1 041.1
2007	2 117.5
2008	251.7
2009	304.0
2010	10.3
2011	14.6
2012	35.4
2013	498.9
2014	31.7
2015	37.9
2016	34.5
2017	139.5
2018	181.2
2019	181.2
2020	181.2

### A.3.2\_X. AVERAGE MONTHLY TEMPERATURE AND PRECIPITATION IN ESTONIA IN 1992–2020



**Figure A.3.2\_X.1.** Total precipitation from May to September in Estonia in 1992–2020, mm (SE, 2015; EstEA, 2021)



**Figure A.3.2\_X.2.** Average yearly temperatures in Estonia in 1992–2020, °C (SE, 2015; EstEA, 2021)

## Annex 4. Any additional information

### A.4.1 Assessment of completeness

Completeness of the Estonia's inventory submissions is evaluated here by sectors in tables below. The completeness has been estimated by gases (CO<sub>2</sub>, N<sub>2</sub>O CH<sub>4</sub>, F-gases and also NO<sub>x</sub>, CO, NMVOC and SO<sub>2</sub>) and emission sources according to the detailed CRF Reporter classification.

#### Abbreviations used in tables:

X	-	Included in to the inventory
NO	-	Not occurring in Estonia
NA	-	Not available
NE	-	Not estimated
IE	-	Included elsewhere.

#### \* Notes,

if category reporting includes some national specific emission source, which is not required in IPCC guidelines and other relevant issues.

### Energy, Fuel combustion (CRF 1.A)

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NMVOC	SO <sub>2</sub>	Notes*
<b>1. A. Fuel combustion activities</b>								
<b>1.A.A. Sectoral Approach</b>								
<b>1.AA.1.A. Energy industries</b>								
1.AA.1.A. Public Electricity and Heat Production	X	X	X	X	X	X	X	
1.AA.1.B. Petroleum Refining	NO	NO	NO	NO	NO	NO	NO	
1.AA.1.C. Manufacture of Solid Fuels and Other Energy Industries	X	X	X	X	X	X	X	
<b>1.AA.2. Manufacturing Industries and Construction</b>								
1.AA.2.A. Iron and Steel*	X	X	X	X	X	X	X	There was no production of iron and steel products in 1990-1994, 1997-1999 and 2008.
1.AA.2.B. Non-Ferrous Metals*	X	X	X	X	X	X	X	There was no production of non-ferrous metals products in 1990-2000.
1.AA.2.C. Chemicals	X	X	X	X	X	X	X	
1.AA.2.D. Pulp, Paper and Print*	X	X	X	X	X	X	X	
1.AA.2.E. Food Processing, Beverages and Tobacco	X	X	X	X	X	X	X	
1.AA.2.F. Non-metallic Minerals	X	X	X	X	X	X	X	
1.AA.2.G Other manufacturing industries and construction	X	X	X	X	X	X	X	
<b>1.AA.3. Transport</b>								
1.AA.3.A. Civil Aviation	X	X	X	X	X	X	X	
1.AA.3.B. Road Transportation	X	X	X	X	X	X	X	
1.AA.3.C. Railways	X	X	X	X	X	X	X	
1.AA.3.D. Navigation	X	X	X	X	X	X	X	
1.AA.3.E. Other Transportation-other fuels from the Civil Aviation sub-sector	NO	NO	NO	NO	NO	NO	NO	
<b>1.AA.4. Other Sectors</b>								

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NM VOC	SO <sub>2</sub>	Notes*
1.AA.4.A. Commercial/Institutional	X	X	X	X	X	X	X	
1.AA.4.B. Residential	X	X	X	X	X	X	X	
1.AA.4.C. Agriculture/Forestry/Fisheries	X	X	X	X	X	X	X	

### **Energy, Fugitive emissions (CRF 1.B)**

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NM VOC	SO <sub>2</sub>	Notes*
<b>1.B Fugitive emissions from fuels</b>								
<b>1.B.1. Solid fuels</b>								
1.B.1.A. Coal Mining and Handling	NO	NO	NO	NO	NO	NO	NO	
1.B.1.B. Solid Fuel Transformation	NO	NO	NO	NO	NO	NO	NO	
1.B.1.C. Other (please specify)	NO	NO	NO	NO	NO	NO	NO	
<b>1.B.2. Oil and Natural Gas</b>								
1.B.2.A.1 Exploration	NO	NO	NO	NO	NO	NO	NO	
1.B.2.A.2 Production	NO	NO	NO	NO	NO	NO	NO	
1.B.2.A.3 Transport	NO	NO	NO	NO	NO	NO	NO	
1.B.2.A.4 Refining/Storage	NO	NO	NO	NO	NO	NO	NO	
1.B.2.A.5 Distribution of Oil Products	NE	NE	NE	NE	NE	NE	NE	
1.B.2.A.6 Other	NO	NO	NO	NO	NO	NO	NO	
1.B.2.B.1 Exploration	NO	NO	NO	NO	NO	NO	NO	
1.B.2.B.2 Production	NO	NO	NO	NO	NO	NO	NO	
1.B.2.B.3 Processing	NO	NO	NO	NO	NO	NO	NO	
1.B.2.B.4 Natural Gas/Transmission and storage	X	X	NO	NO	NO	NO	NO	
1.B.2.B.5 Natural Gas/Distribution	X	X	NO	NO	NO	NO	NO	
1.B.2.B.6 Other	NO	NO	NO	NO	NO	NO	NO	
1.B.2.C. Venting and Flaring	X	X	NO	NO	NO	NO	NO	
1.B.2.D. Other (please specify)	NO	NO	NO	NO	NO	NO	NO	

### **Industrial processes and product use (CRF 2)**

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NM VOC	SO <sub>2</sub>	Notes*
<b>2. Industrial processes and Product Use</b>								
<b>2.A. Mineral Industry</b>								
2.A.1. Cement Production	X	NO	NO	NO	NO	NO	X	
2.A.2. Lime Production	X	NO	NO	NO	NO	NO	NO	
2.A.3. Glass Production	X	NO	NO	NO	NO	NO	NO	
2.A.4.a Ceramics	X	NO	NO	NO	NO	NO	NO	
2.A.4.b. Other uses of Soda Ash	IE	NO	NO	NO	NO	NO	IE	Emissions from soda ash use were relocated to 2.C.5 Lead production in 2019 year's submission
2.A.4.c Non-metallurgical Magnesium Production	NO	NO	NO	NO	NO	NO	NO	
2.A.4.d Other – Limestone use for flue gas desulphurisation	NO	NO	NO	NO	NO	NO	NO	In 2018 no activity occurred
<b>2.B. Chemical Industry</b>								
2.B.1. Ammonia Production	X	NO	NO	X	X	X	NO	Historical activity and emissions are reported from 1990 to 2013.

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NM VOC	SO <sub>2</sub>	Notes*
2.B.2.Nitric Acid Production	NO	NO	NO	NO	NO	NO	NO	
2.B.3. Adipic Acid Production	NO	NO	NO	NO	NO	NO	NO	
2.B.4. Caprolactam, Glyoxal and Glyoxylic Acid Production	NO	NO	NO	NO	NO	NO	NO	
2.B.5. Carbide Production	NO	NO	NO	NO	NO	NO	NO	
2.B.6. Titanium Dioxide Production	NO	NO	NO	NO	NO	NO	NO	
2.B.7. Soda Ash Production	NO	NO	NO	NO	NO	NO	NO	
2.B.8. Petrochemical and Carbon Black Production	NO	NO	NO	NO	NO	NO	NO	
2.B.10 Other	NO	NO	NO	NO	NO	NO	NO	
	HFC	PFC	SF <sub>6</sub>	NF <sub>3</sub>	Unspecified mix of HFC and PFC			
2.B.9. Fluorochemical Production	NO	NO	NO	NO	NO			
2.D. Non-energy Products from fuels and Solvent use								
Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NM VOC	SO <sub>2</sub>	Notes*
2.D.1. Lubricant Use	X	NO	NO	NO	NO	NO	NO	
2.D.2. Paraffin Wax use	X	NO	NO	NO	NO	NO	NO	
2.D.3. Other – Solvent Use	X	NO	NO	NO	X	X	NO	Indirect CO <sub>2</sub> emissions from NMVOC emissions are reported.
2.D.3. Other – Road paving with asphalt	X	NO	NO	NO	NO	X	NO	Indirect CO <sub>2</sub> emissions from NMVOC emissions are reported.
2.D.3 Other; Other – Urea based catalysts for motor vehicles	X	NO	NO	NO	NO	NO	NO	

<b>2.C. Metal Production</b>													
Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NM VOC	SO <sub>2</sub>	HFCs	PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Unspecified mix of HFC and PFC	Notes*
2.C.1. Iron and Steel Production	NO	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA	NA	
2.C.2. Ferroalloys Production	NO	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA	NA	
2.C.3. Aluminium Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2.C.4. Magnesium Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2.C.5. Lead Production	X	NO	NO	NO	NO	NO	X	NA	NA	NA	NA	NA	For confidentiality reasons emissions from rare earth metal industry are aggregated with lead industry's emissions.
2.C.6 Zinc Production	NO	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA	NA	
2.C.7 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	

Greenhouse gas source and sink categories	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF <sub>6</sub>	NF <sub>3</sub>	Notes*
<b>2.E. Electronics Industry</b>						
2.E.1. Integrated Circuit or Semiconductor	NO	NO	NO	NO	NO	
2.E.2. TFT Flat Panel Display	NO	NO	NO	NO	NO	
2.E.3. Photovoltaics	NO	NO	NO	NO	NO	
2.E.4. Heat Transfer Fluid	NO	NO	NO	NO	NO	
2.E.5. Other	NO	NO	NO	NO	NO	
<b>2.F. Product Uses and Substitutes for ODS</b>						
2.F.1. Refrigeration and Air Conditioning	X	NO	NO	NO	NO	
2.F.2. Foam Blowing Agents	X	NO	NO	NO	NO	
2.F.3. Fire Protection	X	NO	NO	NO	NO	
2.F.4. Aerosols	X	NO	NO	NO	NO	
2.F.5. Solvents	NO	NO	NO	NO	NO	
2.F.6. Other applications using ODS Substitutes	NO	NO	NO	NO	NO	

Greenhouse gas source and sink categories	HFCs	PFCs	SF <sub>6</sub>	N <sub>2</sub> O	Notes*
<b>2.G. Other Product Manufacture and Use</b>					
2.G.1 Electrical Equipment	NO	NO	X	NO	
2.G.2. Other - Particle accelerators	NO	NO	X	NO	
2.G.2. Other – Sport Shoes	NO	NO	NO	NO	PFC emissions from sport shoes with gas cushion occurred in Estonia from 2006 to 2008 and SF <sub>6</sub> emissions from 1995 to 2006.
2.G.2. Other – Car tyres	NO	NO	NO	NO	SF <sub>6</sub> emissions from car tyres occurred in 1993–2003.
2.G.3.a N <sub>2</sub> O from Medical Applications	NO	NO	NO	X	
2.G.3.b Other – Propellant for pressure and aerosol products	NO	NO	NO	NO	In 2018 no activity occurred.

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NMVOC	SO <sub>2</sub>	Notes*
<b>2.H. Other Production</b>								
2.H.1. Pulp and Paper	NO	NO	NO	X	X	X	X	
2.H.2. Food and beverages	NO	NO	NO	NO	NO	X	NO	

### **Agriculture (CRF 4)**

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NMVOC	SO <sub>2</sub>	Notes*
3.A. Enteric Fermentation	NO	X	NO	NO	NO	NO	NO	CO <sub>2</sub> emissions from livestock are not estimated because annual net CO <sub>2</sub> emissions are assumed to be zero – the CO <sub>2</sub> photosynthesized by plants is returned to the atmosphere as respired CO <sub>2</sub> .
3.B. Manure Management	NO	X	X	NO	NO	X	NO	
3.C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	
3.D. Agricultural soils	NO	NO	X	X	NO	NO	NO	
3.D.1. Direct Soil Emissions	NO	NO	X	NO	NO	NO	NO	
3.D.1.1. Synthetic Fertilizers	NO	NO	X	NO	NO	NO	NO	

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NMVOC	SO <sub>2</sub>	Notes*
3.D.1.2. Organic N Fertilizers	NO	NO	X	NO	NO	NO	NO	
3.D.1.3. Urine and Dung Deposited by Grazing Animals	NO	NO	X	NO	NO	NO	NO	
3.D.1.4. Crop Residues	NO	NO	X	NO	NO	NO	NO	
3.D.1.5. Mineralization/Immobilization Associated with Loss/Gain of Soil Organic Matter	NO	NO	X	NO	NO	NO	NO	According to 2021 submission calculations, annual net emissions from mineralization/immobilization associated with loss/gain of soil organic matter have occurred only in years 1991 and 1992.
3.D.1.6. Cultivation of Organic Soils	NO	NO	X	NO	NO	NO	NO	
3.D.2. Indirect Emissions	NO	NO	X	NO	NO	NO	NO	
3.D.2.1. Atmospheric Deposition	NO	NO	X	NO	NO	NO	NO	
3.D.2.2. Nitrogen Leaching and Run-off	NO	NO	X	NO	NO	NO	NO	
3.E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	There are no savannas in Estonia.
3.F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	Burning of agricultural residues is not a common practice in Estonia.
3.G. Liming	X	NO	NO	NO	NO	NO	NO	
3.H. Urea Application	X	NO	NO	NO	NO	NO	NO	

## **LULUCF (CRF 4)**

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NMVOC	Notes*
<b>4.A. Forest Land</b>							
4.A.1. Forest Land remaining Forest Land	X	X	X	NE	NE	NE	NE: IPCC 2006 does not provide default method for estimating these emissions.
Carbon stock change	X						Estonia does not have sufficient data regarding litter stock
4(I) Direct N <sub>2</sub> O emissions from N inputs to managed soils			NO				According to Estonian Forest Act, application of mineral fertilizers is prohibited in forests.
4(III) Direct N <sub>2</sub> O Emissions from N Mineralization/Immobilization			NO				
4(V) Biomass burning	IE, NO	X	X				IE: CO <sub>2</sub> emission estimates are included in FL remaining FL living biomass emission estimates due to stock-difference method used.
4.A.2. Land converted to Forest Land	X	IE, NO	X	NE	NE	NE	
Carbon stock change							
4.A.2.1. Cropland to Forest Land	X						
4.A.2.2. Grassland to Forest Land	X						



Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NM VOC	Notes*
4.A.2.3. Wetlands to Forest Land	X						
4.A.2.4. Settlements to Forest Land	X						
4.A.2.5. Other Land to Forest Land	X						
4(I) Direct N <sub>2</sub> O emissions from N inputs to managed soils			NO				
4(III) Direct N <sub>2</sub> O Emissions from N Mineralization/Immobilization			X				
4(V) Biomass burning	IE, NO	IE, NO	IE, NO				IE: Emissions are reported under category 4.A.1 FL remaining FL.
4(II) Emissions and removals from drainage and rewetting and other management of organic and mineral soils	IE, NA	X	X				IE: CO <sub>2</sub> emissions are included in 4.A.1 and 4.A.2.
<b>4.B. Cropland</b>							
4.B.1. Cropland remaining Cropland	X	NO	NO	NE	NE	NE	
Carbon stock change	X						
4(V) Biomass Burning	NO	NO	NO				
4.B.2. Land converted to Cropland	X	NO	X	NE	NE	NE	
Carbon stock change							
4.B.2.1. Forest Land to Cropland	X						
4.B.2.2. Grassland to Cropland	X						
4.B.2.3. Wetlands to Cropland	X						
4.B.2.4. Settlements to Cropland	NO						
4.B.2.5. Other land to Cropland	NO						
4(III) Direct N <sub>2</sub> O Emissions from N Mineralization/Immobilization			X				
4(V) Biomass Burning	NO	NO	NO				
4(II) Emissions and removals from drainage and rewetting and other management of organic and mineral soils	NA	NA	NA				According to 2006 IPCC it is not mandatory to report this category.
<b>4.C. Grassland</b>							
4.C.1. Grassland remaining Grassland	X	X	X	NE	NE	NE	
Carbon stock change	X						
4(III) Direct N <sub>2</sub> O Emissions from N Mineralization/Immobilization			NO				
4 (V) Biomass Burning	IE, NO	X	X				IE: CO <sub>2</sub> emission estimates are included in GL remaining GL living biomass emission estimates due to stock-difference method used.
4.C.2. Land converted to Grassland	X	IE, NO	IE, NO	NE	NE	NE	
Carbon stock change							
4.C.2.1. Forest Land to Grassland	X						

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NMVOC	Notes*
4.C.2.2. Cropland to Grassland	X						
4.C.2.3. Wetlands to Grassland	X						
4.C.2.4. Settlements to Grassland	X						
4.C.2.5. Other land to Grassland	X						
4(III) Direct N <sub>2</sub> O Emissions from N Mineralization/Immobilization			NO				
4(V) Biomass Burning	IE, NO	IE, NO	IE, NO				IE: Emissions are reported under category 4.C.1 GL remaining GL
4(II) Emissions and removals from drainage and rewetting and other management of organic and mineral soils	NA	NA	NA				According to 2006 IPCC it is not mandatory to report this category.
<b>4.D. Wetlands</b>							
4.D.1. Wetlands remaining Wetlands	X	IE	IE, NO	NE	NE	NE	
Carbon stock change							
4.D.1.1 Peat Extraction remaining Peat Extraction	X						
4.D.1.2 Flooded Land Remaining Flooded Land	NA						According to IPCC 2006 no methodologies are provided for Flooded Land Remaining Flooded Land.
4.D.1.3 Other Wetlands remaining Other Wetlands	NO, NA						NA: IPCC 2006 Guidelines do not provide default methods for this category
4(I) Direct N <sub>2</sub> O emissions from N inputs to managed soils			NO				
4(III) Direct N <sub>2</sub> O Emissions from N Mineralization/Immobilization			NO				
4(V) Biomass Burning	IE, NO	IE, NO	IE, NO				IE: Emissions are reported under category 4.C.1 Grassland remaining Grassland due to unified statistical data about burned areas.
4.D.2. Land converted to Wetlands	X	IE, NO	IE, NO	NE	NE	NE	
Carbon stock change							
4.D.2.1. Land converted for Peat Extraction	X						
4.D.2.2. Land converted to Flooded Land	NA						
4.D.2.3. Land converted to Other Wetlands	X						
4(I) Direct N <sub>2</sub> O emissions from N inputs to managed soils			NO				
4(III) Direct N <sub>2</sub> O Emissions from N Mineralization/Immobilization			NO				

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NM VOC	Notes*
4(V) Biomass Burning	IE, NO	IE, NO	IE, NO				IE: Emissions are reported under category 4.C.1 Grassland remaining Grassland due to unified statistical data about burned areas.
4(II) Emissions and removals from drainage and rewetting and other management of organic and mineral soils	IE, NA	X	X				Only emissions from Peat Extraction Lands, Drained organic soils are estimated. IE: CO <sub>2</sub> emissions are included in 4.D.1.1 and 4.D.2.1.
<b>4.E. Settlements</b>							
4.E.1. Settlements remaining Settlements	NO	NO	NO, NA	NE	NE	NE	
Carbon stock change	NO						Lack of activity data, it is assumed that C stocks are at equilibrium
4(I) Direct N <sub>2</sub> O emissions from N inputs to managed soils			NA				
4(III) Direct N <sub>2</sub> O Emissions from N Mineralization/Immobilization			NO				
4.E.2. Land converted to Settlements	X	NO	X	NE	NE	NE	
Carbon stock change							
4.E.2.1. Forest Land to Settlements	X						
4.E.2.2. Cropland to Settlements	X						
4.E.2.3. Grassland to Settlements	X						
4.E.2.4. Wetlands to Settlements	X						
4.E.2.5. Other land to Settlements	X						
4(I) Direct N <sub>2</sub> O emissions from N inputs to managed soils			NA				
4(III) Direct N <sub>2</sub> O Emissions from N Mineralization/Immobilization			X				
4(V) Biomass Burning	NO	NO	NO				
<b>4.F. Other Land</b>							
4.F.2. Land converted to Other Land	X	NO	IE	NE	NE	NE	IE: Emissions are reported in 4.F. Other Land 4(III)
Carbon stock change							
4.F.2.1. Forest Land to Other Land	X						
4.F.2.2. Cropland to Other Land	X						
4.F.2.3. Grassland to Other Land	X						
4.F.2.4. Wetlands to Other Land	NO						
4.F.2.5. Settlements to Other Land	NO						
4(III) Direct N <sub>2</sub> O Emissions from N Mineralization/Immobilization			X				

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NMVOC	Notes*
4(V) Biomass Burning	NO	NO	NO				
<b>4.G. Harvested Wood Products</b>							
HWP from domestic harvest	X						
<b>4.H. Other</b>	NO	NO	NO	NO	NO	NO	
<b>4(IV) Indirect N<sub>2</sub>O emissions from managed soils</b>							
Atmospheric Deposition			NO				
Nitrogen Leaching and Run-off			X				

## **Waste (CRF 5)**

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NMVOC	SO <sub>2</sub>	Notes*
<b>5.A. Solid waste disposal on land</b>								
5.A.1. Managed waste disposal on land								Based on the 2006 IPCC Guidelines, CO <sub>2</sub> emissions from Solid Waste Disposal is not included in national total emission estimates, because the carbon is of biogenic origin and net emissions are accounted for under AFOLU Sector. N <sub>2</sub> O emissions from Solid Waste Disposal on Land are not significant and there is no methodology provided to calculate the emissions.
5.A.1.a. Aerobic	NA	X	NE	NA	NE	X	NA	
5.A.1.b. Semi- aerobic	NO	NO	NO	NO	NO	NO	NO	
5.A.2. Unmanaged waste disposal sites	NO	NO	NO	NO	NO	NO	NO	
5.A.3. Uncategorized waste disposal on land	NO	NE	NO	NO	NO	NO	NO	
<b>5.B. Biological treatment of solid waste</b>								
5.B.1. Composting	NO	X	X	NE	NE	X	NE	
5.B.2. Anaerobic digestion at biogas facility	NE	NE	NE	NE	NE	NE	NE	The emission from anaerobic digestion with energy recovery has been reported under Energy sector (CRF 1.A.1.A) as an aggregated total biogas production in Estonia. There is currently no anaerobic digestion taking place without energy recovery. Estonia has estimated unintentional leakages during process disturbance or other unexpected events which resulted with insignificant emission based on the National Inventory reporting guidance provided in the National Inventory reporting guidance, paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.
<b>5.C. Incineration and open burning of waste</b>								
5.C.1. Waste incineration								
5.C.1.1. Biogenic	X	X	X	NE	NE	NE	NE	Based on the 2006 IPCC Guidelines, CO <sub>2</sub> emissions from Incineration of biogenic material is not included in national total emission estimates.

Greenhouse gas source and sink categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	NO <sub>x</sub>	CO	NMVOC	SO <sub>2</sub>	Notes*
5.C.1.2. Non-biogenic	X	X	X	NE	NE	NE	NE	
5.C.2. Open Burning of Waste				X	X	X	X	NO <sub>x</sub> , CO and NMVOC from Open Burning of waste from both biogenic and non-biogenic sources is reported as a sum under 5.C.2 Open burning of Waste
5.C.2.1. Biogenic	X	X	X	IE	IE	IE	IE	Based on the 2006 IPCC Guidelines, CO <sub>2</sub> emissions from Open Burning of biogenic material is not included in national total emission estimates.
5.C.2.2. Non-biogenic	X	X	X	IE	IE	IE	IE	
<b>5.D. Wastewater Treatment and Discharge</b>								
5.D.1. Domestic wastewater	NO	X	X	NA	NA	X	NA	
5.D.2. Industrial wastewater	NO	X	NO	X	NA	X	NE	
<b>5.F. Memo items</b>	NO	NO	NO	NO	NO	NO	NO	

**Annex 5. Standard Independent Assessment Report**

NATIONAL REGISTRY OF ESTONIA

**STANDARD INDEPENDENT ASSESSMENT REPORT**

Submission to the UNFCCC secretariat

2021

**Tallinn 2022**

## **PREFACE**

Standard Independent Assessment Report of National Registry (hereinafter as NR) of Estonia under the United Nations Framework Convention on Climate Change (hereinafter as UNFCCC) contains the following parts:

Part I. Description Kyoto Protocol Units

Part II. Changes to National Registry

Part III Appendixes

Annika Konovalov (Registry System Administrator (hereinafter as RSA) of National Registry of Estonia from Climate and Ambient Air Bureau of the Estonian Environmental Board (hereinafter as EEB)) has compiled the Standard Independent Assessment Report 2021 (hereinafter as SIAR) and other information included in this report.

In this document, 2021 refers to the year for which the data is submitted, and not to the year of submission (publication).

## ABBREVIATIONS

UNFCCC – United Nations Framework on Climate Change Convention

EE – Estonia

CDM – Clean Development Mechanism

EEB – Estonian Environmental Board

MoE – Ministry of the Environment

NR – National Registry

CPR – Commitment Period Reserve

RSA – Registry System Administrator

SEF – Standard Electronic Format

ITL – International Transaction Log

CITL – Community Transaction Log

KP – Kyoto Protocol

CR – Community Registry

ERT – Expert Review Team

IAR – Independent Assessment Report

SIAR – Standard Independent Assessment Report

EU ETS – European Union Emission Trading System

NIR – National Inventory Report

CITL – Community Independent Transaction Log

EUTL – European Union Transaction Log

ERU – Emission Reduction Unit

CER – Certified Emission Reduction Unit

lCER – Long-term Certified Emission Reduction Unit

tCER – Temporary Certified Emission Reduction Unit

RMU – Removal Unit



## **1. PART I. KYOTO PROTOCOL UNITS**

### **1.2 Information on Accounting of the Kyoto Protocol Units (Chapter 12 of NIR)**

The following reports are described in this document and correspond to the requirements of decisions 14/CMP.1 and 15/CMP.1. Information required under Decision 15/CMP.1 paragraph 11 is displayed as required by UNFCCC ITL Administrators' "Standard Independent Assessment Report. Reporting Requirements and Guidance for Registries v4.7" in "RREG1\_EE\_2021\_2\_3.xls". The Standard Electronic Format (hereinafter as SEF) reporting tables relevant for the second commitment period for 2021 have been submitted to the UNFCCC Secretariat electronically and the contents of the report can also be found as Appendix 1 of this document. The SEF tables include information about AAU, ERU, CER, t-CER, l-CER and RMU in Estonian National Registry (hereinafter as NR) standing 31st of December 2021. Also, the SEF includes information on transfers of the units during the year 2021.

The total amount of AAUs in the party holding account at the end 2021 was 51 056 976.

SEF report will be also included in Estonian Standard Independent Assessment Report (hereinafter as SIAR) 2021 report as Appendix 1 (as SIAR Report R-1).

<b>Annual Submission Item</b>	<b>Reporting Guidance</b>
15/CMP.1 annex I.E paragraph 11: Standard electronic format (SEF)	<p>The Standard Electronic Format report for 2021 has been submitted to the UNFCCC Secretariat electronically. SEF, containing the information required in paragraph 11 of the annex to decision 15/CMP.1, is included in the “Greenhouse Gas emissions in Estonia 1990–2020. National Inventory Report under the UNFCCC and the Kyoto Protocol. Common Reporting Formats (CRF) 1990–2020. Tallinn 2022” (hereinafter as NIR) in Chapter 12.2 "Summary of information reported in the SEF tables" and the report is a part of NIR as Annex 5.</p> <p>This SEF report is referenced as report R-1 in this document. See Appendix 1 for more details related to the SEF report.</p>
15/CMP.1 annex I.E paragraph 12: List of discrepant transactions	<p>Information of discrepant transactions is included in the NIR in Chapter 12.3 "Discrepancies and notifications" and the report is a part of NIR as Annex 5.</p> <p>The report of discrepant transactions is referenced as report R-2 in this document. See Appendix 2 for more details related to the discrepant transactions.</p> <p>No discrepancies and no notifications occurred in 2021.</p>
15/CMP.1 annex I.E paragraph 13 & 14: List of CDM notifications	<p>Information on CDM notifications is included in the NIR in Chapter 12.3 "Discrepancies and notifications" and report is a part of NIR as Annex 5.</p> <p>The report of CDM notifications is referenced as report R-3 in this document. See Appendix 3 for more details related to the discrepant transactions.</p> <p>No CDM notifications occurred in 2021.</p>
15/CMP.1 annex I.E paragraph 15: List of non-replacements	<p>Information on non-replacements is included in the NIR as Chapter 12.3 "Discrepancies and notifications" and report is a part of NIR as Annex 5.</p> <p>The report on non-replacements is referenced as report R-4 in this document. See Appendix 3 for more details related to the non-replacements.</p> <p>No non-replacements occurred in 2021.</p>

Annual Submission Item	Reporting Guidance
15/CMP.1 annex I.E paragraph 16: List of invalid units	<p>Information of invalid units is included in the NIR as Chapter 12.3 "Discrepancies and notifications" and report is a part of NIR as Annex 5.</p> <p>The report of invalid units is referenced as report R-5 of this document. See Appendix 3 for more details related to the list of invalid units.</p> <p>No invalid units exist as at 31.12.2021.</p>
15/CMP.1 annex I.E paragraph 17 Actions and changes to address discrepancies	<p>No actions were taken or changes made to address discrepancies for the period under review.</p> <p>No change occurred during the reported period.</p>
15/CMP.1 annex I.E Publicly accessible information	<p>Information regarding the NR is publicly available to users via MoE web page <a href="https://envir.ee/kliima/kliima/rahvusvaheline-aruanne#kyoto-protokoli-ala">https://envir.ee/kliima/kliima/rahvusvaheline-aruanne#kyoto-protokoli-ala</a> and via EEB web page <a href="https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid">https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid</a>.</p> <p>Due to the updates on the publicly available information web page in year 2011, information referred in Decision 13/CMP.1; II Registry requirements; E. Publicly accessible information in paragraphs 45-48 are as following:</p> <ol style="list-style-type: none"> <li>1. account information (information on paragraph 45 of annex to the decision 13/CMP.1);</li> <li>2. JI projects in Estonia (information on paragraph 46 of annex to the decision 13/CMP.1);</li> <li>3. information about unit holdings and transactions (information on paragraph 47 of annex to the decision 13/CMP.1);</li> <li>4. information about Entities Authorized to hold units (information on paragraph 48 of annex to the decision 13/CMP.1).</li> </ol> <p>This information is currently available at:</p> <p>1) <b>Paragraph 45 of annex to the decision 13/CMP.1 (account information)</b>. This information is available to users via user interface of the MoE <a href="https://envir.ee/kliima/kliima/rahvusvaheline-aruanne#kyoto-protokoli-ala">https://envir.ee/kliima/kliima/rahvusvaheline-aruanne#kyoto-protokoli-ala</a> and via EUTL <a href="http://ec.europa.eu/environment/ets/">http://ec.europa.eu/environment/ets/</a> (selecting from left hand menu "ETS" – "Accounts" – "select Estonia" – "Search");</p>

Annual Submission Item	Reporting Guidance
	<p>2) <b>Paragraph 46 of annex to the decision 13/CMP.1</b> (<u>information of JI projects in Estonia</u>). This information is available to users via user interface of the web page of the Ministry of the Environment <a href="https://envir.ee/kliima/kliima/rahvusvaheline-aruandlus#kyoto-protokolli-ala">https://envir.ee/kliima/kliima/rahvusvaheline-aruandlus#kyoto-protokolli-ala</a> (selecting the headline “<u>Ühisrakendusprojektide ülevaade / JI projects overview</u>”);</p> <p>3) <b>Paragraph 47 of annex to the decision 13/CMP.1</b> (<u>information about unit holdings and transactions</u>). Following information is publicly accessible via user interface of the EUTL <a href="http://ec.europa.eu/environment/ets/">http://ec.europa.eu/environment/ets/</a> (selecting from left hand menu “Transactions” - “Selecting Estonia and other relevant parameters displayed in the search field” – “Search”). In accordance with the annex XVI of the EC regulation (No 2216/2004 of 21 Dec. 2004) "the information for each completed transaction relevant for the registries system for year X shall be displayed from 15 January onwards of year X+5".</p> <p>4) <b>Paragraph 48 of annex to the decision 13/CMP.1</b> (<u>information about Entities Authorised to hold units under its responsibility</u>). The Decision 280/2004/EC of the European Parliament and of the Council requires EU Member States to provide information on the legal entities authorized to participate in the mechanism under Articles 6, 12 and 17 of the Kyoto Protocol in the NIR. According to the Estonian national legislation (Atmospheric Air Protection Act § 143) the Ministry of the Environment as competent authority is authorized to trade with AAUs, RMUs, ERUs and CERs. Installations falling under the scope of the Directive 2003/87/EC are authorised to use ERUs and CERs for compliance according to the percentage set out in National Allocation Plan for 2008–2012. This information is available to users via user interface of the web page of the Estonian Environmental Board: <a href="https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid#teine-kauplemisperio">https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid#teine-kauplemisperio</a>. Public information required by Commission regulation (EC) No 389/2013 (in addition to the above-mentioned public information):</p> <p>1) Installation and permit details – information about installations and permit details is available to users via user interface of EEB <a href="https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid">https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid</a> and via EUTL <a href="http://ec.europa.eu/environment/ets/welcome.do?languageCode=en">http://ec.europa.eu/environment/ets/welcome.do?languageCode=en</a></p>

Annual Submission Item	Reporting Guidance
	<p>selecting from left hand menu “ETS” – “Operator Holding Accounts” - “Search” – “selecting Estonia”;</p> <p>2) Information about verified emissions, surrenders and compliance status of installations – information about verified emissions, surrenders and compliance status of installations is available to users via user interface of the EEB web page at:  <a href="https://www.keskkonnaamet.ee/et/eesmargid-tegevused/kliima/eli-hksi-aruandlus">https://www.keskkonnaamet.ee/et/eesmargid-tegevused/kliima/eli-hksi-aruandlus</a> and from the interface of the EUTL  <a href="http://ec.europa.eu/environment/ets/">http://ec.europa.eu/environment/ets/</a> selecting from left hand menu “ETS” – “Allocation/Compliance” - “Search” - selecting Estonia;</p> <p>3) National allocation plan for Estonia (NAP) – information on national allocation plan for Estonia (NAP) is available via user interface of the EEB web page at  <a href="https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid#kolmas-kauplemisperi">https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid#kolmas-kauplemisperi</a> and via EUTL web page <a href="http://ec.europa.eu/environment/ets/">http://ec.europa.eu/environment/ets/</a> selecting from left hand menu “NAP-info” - “Search” - selecting Estonia.</p>
15/CMP.1 annex I.E paragraph 18 CPR Calculation	<p>Parties are required by decision 11/CMP.1 under the Kyoto Protocol and paragraph 18 of Decision 1/CMP.8 to establish and maintain a commitment period reserve as part of their responsibility to manage and account for their assigned amount. The commitment period reserve equals the lower of either 90% of a Party’s assigned amount pursuant to Article 3(7bis), (8) and (8bis) or 100% of its most recently reviewed inventory, multiplied by 8.</p> <p>For the purposes of the joint fulfilment, the commitment period reserve applies to the EU, its Member States and Iceland individually. Both methods to calculate Estonia’s commitment period reserve are presented hereinafter:</p> <ol style="list-style-type: none"> <li>1. 90% of a Party’s assigned amount  90% from 51 056 976 = 45 951 278.4 tonnes of CO<sub>2</sub> equivalent.</li> <li>1. 100% of most recently reviewed inventory multiplied by 8  (Estonia has interpreted the ‘most recently reviewed inventory’ as the 2020 inventory submission<sup>12</sup>)  19 974 140*8 = 159 793 120 tonnes of CO<sub>2</sub> equivalent. Consequently, the commitment period reserve for Estonia is  <b>45 951 279 tonnes of CO<sub>2</sub> equivalent.</b></li> </ol>

<sup>12</sup> FCCC/ARR/2020/EST- No recalculations made during the Review, 2020 inventory GHG emissions were used.

## **2. PART II. CHANGES IN THE NATIONAL REGISTRY**

### **2.1 Information on Changes in National Registry (Chapter 14 of NIR)**

Directive 2009/29/EC adopted in 2009, provides for the centralization of the EU ETS operations into a single European Union registry operated by the European Commission as well as for the inclusion of the aviation sector. At the same time, and with a view to increasing efficiency in the operations of their respective national registries, the EU Member States who are also Parties to the Kyoto Protocol (25) plus Iceland, Liechtenstein and Norway decided to operate their registries in a consolidated manner in accordance with all relevant decisions applicable to the establishment of Party registries - in particular Decision 13/CMP.1 and decision 24/CP.8.

With a view to complying with the new requirements of Commission Regulation 389/2013 and Commission Regulation 1193/2011, in addition to implementing the platform shared by the consolidating Parties, the registry of EU has undergone a major re-development. The consolidated platform which implements the national registries in a consolidated manner (including the registry of EU) is called Consolidated System of EU registries (CSEUR) and was developed together with the new EU registry on the basis the following modalities:

- (1) Each Party retains its organization designated as its registry administrator to maintain the national registry of that Party and remains responsible for all the obligations of Parties that are to be fulfilled through registries;
- (2) Each Kyoto unit issued by the Parties in such a consolidated system is issued by one of the constituent Parties and continues to carry the Party of origin identifier in its unique serial number;
- (3) Each Party retains its own set of national accounts as required by paragraph 21 of the Annex to Decision 15/CMP.1. Each account within a national registry keeps a unique account number comprising the identifier of the Party and a unique number within the Party where the account is maintained;
- (4) Kyoto transactions continue to be forwarded to and checked by the UNFCCC Independent Transaction Log (ITL), which remains responsible for verifying the accuracy and validity of those transactions;

- (5) The transaction log and registries continue to reconcile their data with each other in order to ensure data consistency and facilitate the automated checks of the ITL;
- (6) The requirements of paragraphs 44 to 48 of the Annex to Decision 13/CMP.1 concerning making non-confidential information accessible to the public would be fulfilled by each Party individually;
- (7) All registries reside on a consolidated IT platform sharing the same infrastructure technologies. The chosen architecture implements modalities to ensure that the consolidated national registries are uniquely identifiable, protected and distinguishable from each other, notably:
  - (a) With regards to the data exchange, each national registry connects to the ITL directly and establishes a distinct and secure communication link through a consolidated communication channel (VPN tunnel);
  - (b) The ITL remains responsible for authenticating the national registries and takes the full and final record of all transactions involving Kyoto units and other administrative processes such that those actions cannot be disputed or repudiated;
  - (c) With regards to the data storage, the consolidated platform continues to guarantee that data is kept confidential and protected against unauthorized manipulation;
  - (d) The data storage architecture also ensures that the data pertaining to a national registry are distinguishable and uniquely identifiable from the data pertaining to other consolidated national registries;
  - (e) In addition, each consolidated national registry keeps a distinct user access entry point (URL) and a distinct set of authorisation and configuration rules.

Following the successful implementation of the CSEUR platform, the 28 national registries concerned were re-certified in June 2012 and switched over to their new national registry on 20 June 2012. During the go-live process, all relevant transaction and holdings data were migrated

to the CSEUR platform and the individual connections to and from the ITL were re-established for each Party.

The following changes to the national registry of Estonia have occurred in 2021:

Reporting Item	Description
15/CMP.1 annex II.E paragraph 32.(a) Change of name or contact	No change of name or contact occurred during the reporting period. National administrator is: Ms. Annika Konovalov <a href="mailto:khgregister@keskkonnaamet.ee">khgregister@keskkonnaamet.ee</a> tel. +372 5694 4935
15/CMP.1 annex II.E paragraph 32.(b) Change regarding cooperation arrangement	There was a change in the cooperation arrangement during the reported period as the United Kingdom of Great Britain and Northern Ireland no longer operate their registry in a consolidated manner within the Consolidated System of EU registries, CS EUR.
15/CMP.1 annex II.E paragraph 32.(c) Change to database structure or the capacity of national registry	There has been 6 new EUCR releases (versions 12.4, 13.0.2, 13.2.1, 13.3.3, 13.5.1 and 13.5.2) after version 11.5 (the production version at the time of the last Chapter 14 submission). No changes were applied to the database, whose model is provided in Annex A. No change was required to the application backup plan or to the disaster recovery plan. No change to the capacity of the national registry occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(d) Change regarding conformance to technical standards	The changes that have been introduced with versions 12.4, 13.0.2, 13.2.1, 13.3.3, 13.5.1 and 13.5.2 compared with version 11.5 of the national registry are presented in Annex B. It is to be noted that each release of the registry is subject to both regression testing and tests related to new functionality. These tests also include thorough testing against the DES and are carried out prior to the relevant major release of the version to Production (see Annex B). No other change in the registry's conformance to the technical standards occurred for the reported period.
15/CMP.1 annex II.E paragraph 32.(e) Change to discrepancies procedures	No change of discrepancies procedures occurred during the reported period.



Reporting Item	Description
15/CMP.1 annex II.E paragraph 32.(f) Change regarding security	No changes regarding security were introduced.
15/CMP.1 annex II.E paragraph 32.(g) Change to list of publicly available information	No change to the list of publicly available information occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(h) Change of Internet address	No change to the registry internet address during the reported period.
15/CMP.1 annex II.E paragraph 32.(i) Change regarding data integrity measures	No change of data integrity measures occurred during the reported period.
15/CMP.1 annex II.E paragraph 32.(j) Change regarding test results	No change during the reported period.

### 3. PART III. APPENDIXES

#### Appendix 1 – Report R-1: SEF\_2021

Party  
 Submission year  
 Reported year  
 Commitment period

Estonia  
 2022  
 2021  
 2

Table 1. Total quantities of Kyoto Protocol units by account type at beginning of reported year

	Account type	Unit type					
		AAUs	ERUs	RMUs	CERs	tCERs	ICERs
1	Party holding accounts	NO	NO	NO	NO	NO	NO
2	Entity holding accounts	NO	NO	NO	NO	NO	NO
3	Retirement account	NO	NO	NO	NO	NO	NO
4	Previous period surplus reserve account	NO					
5	Article 3.3/3.4 net source cancellation accounts	NO	NO	NO	NO		
6	Non-compliance cancellation account	NO	NO	NO	NO		
7	Voluntary cancellation account	NO	NO	NO	NO	NO	NO
8	Cancellation account for remaining units after carry-over	NO	NO	NO	NO	NO	NO
9	Article 3.1 ter and quater ambition increase cancellation account	NO					
10	Article 3.7 ter cancellation account	NO					
11	tCER cancellation account for expiry					NO	
12	ICER cancellation account for expiry						NO
13	ICER cancellation account for reversal of storage						NO
14	ICER cancellation account for non-submission of certification report						NO
15	tCER replacement account for expiry	NO	NO	NO	NO	NO	
16	ICER replacement account for expiry	NO	NO	NO	NO		
17	ICER replacement account for reversal of storage	NO	NO	NO	NO		NO
18	ICER replacement account for non-submission of certification report	NO	NO	NO	NO		NO
	<b>Total</b>	NO	NO	NO	NO	NO	NO

Party Estonia  
 Submission year 2022  
 Reported year 2021  
 Commitment period 2

Table 2 (a). Annual internal transactions

Transaction type		Additions						Subtractions					
		Unit type						Unit type					
		AAUs	ERUs	RMUs	CERs	tCERs	ICERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs
<b>Article 6 issuance and conversion</b>													
1	Party-verified projects		NO					NO		NO			
2	Independently verified projects		NO					NO		NO			
<b>Article 3.3 and 3.4 issuance or cancellation</b>													
3	3.3 Afforestation and reforestation			NO				NO	NO	NO	NO		
4	3.3 Deforestation			NO				NO	NO	NO	NO		
5	3.4 Forest management			NO				NO	NO	NO	NO		
6	3.4 Cropland management			NO				NO	NO	NO	NO		
7	3.4 Grazing land management			NO				NO	NO	NO	NO		
8	3.4 Revegetation			NO				NO	NO	NO	NO		
9	3.4 Wetlands drainage and management			NO				NO	NO	NO	NO		
<b>Article 12 afforestation and reforestation</b>													
10	Replacement of expired tCERs							NO	NO	NO	NO	NO	
11	Replacement of expired ICERs							NO	NO	NO	NO		
12	Replacement for reversal of storage							NO	NO	NO	NO		NO
13	Cancellation for reversal of storage												NO
14	Replacement for non-submission of certification report							NO	NO	NO	NO		NO
15	Cancellation for non-submission of certification report												NO
<b>Other cancelation</b>													
16	Voluntary cancellation							NO	NO	NO	NO	NO	NO
17	Article 3.1 ter and quater ambition increase cancellation							NO					
<b>Sub-total</b>			NO	NO				NO	NO	NO	NO	NO	NO

Transaction type		Retirement					
		Unit type					
		AAUs	ERUs	RMUs	CERs	tCERs	ICERs
1	Retirement	NO	NO	NO	NO	NO	NO
2	Retirement from PPSR	NO					
<b>Total</b>		NO	NO	NO	NO	NO	NO

Party Estonia  
 Submission year 2022  
 Reported year 2021  
 Commitment period 2

**Table 2 (b). Total annual external transactions**

	Additions						Subtractions					
	Unit type						Unit type					
	AAUs	ERUs	RMUs	CERs	tCERs	ICERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs
Total transfers and acquisitions												
Sub-total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

**Table 2 (c). Annual transactions between PPSR accounts**

	Additions						Subtractions					
	Unit type						Unit type					
	AAUs	ERUs	RMUs	CERs	tCERs	ICERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs
Transfers and acquisitions between PPSR accounts												
Sub-total	NO						NO					

**Table 2 (d). Share of proceeds transactions under decision 1/CMP.8, paragraph 21 - Adaptation fund**

	Amount transferred or converted						Amount contributed as SoP to the adaptation fund					
	AAUs	ERUs	RMUs	CERs	tCERs	ICERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs
1 First international transfers of AAUs	NO						NO					
2 Issuance of ERU from party-verified projects		NO						NO				
3 Issuance of independently verified ERUs		NO						NO				

**Table 2 (e). Total annual transactions**

1 Total (Sum of sub-totals in table 2a and table 2b)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
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Party Estonia  
 Submission year 2022  
 Reported year 2021  
 Commitment period 2

Table 3. Annual expiry, cancellation and replacement

Transaction or event type		Requirement to replace or cancel			Replacement						Cancellation					
		Unit type			Unit type						Unit type					
		tCERs	ICERs	CERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs
<b>Temporary CERs</b>																
1	Expired in retirement and replacement accounts	NO			NO	NO	NO	NO	NO							
2	Expired in holding accounts	NO													NO	
<b>Long-term CERs</b>																
3	Expired in retirement and replacement accounts		NO		NO	NO	NO	NO								
4	Expired in holding accounts		NO													NO
5	Subject to reversal of storage		NO		NO	NO	NO	NO		NO						NO
6	Subject to non-submission of certification Report		NO		NO	NO	NO	NO		NO						NO
<b>Carbon Capture and Storage CERs</b>																
7	Subject to net reversal of storage			NO							NO	NO	NO	NO		
8	Subject to non-submission of certification report			NO							NO	NO	NO	NO		
<b>Total</b>		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

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**Table 4. Total quantities of Kyoto Protocol units by account type at end of reported year**

	Account type	Unit type					
		AAUs	ERUs	RMUs	CERs	tCERs	ICERs
1	Party holding accounts	51,056,976	NO	NO	NO	NO	NO
2	Entity holding accounts	NO	NO	NO	NO	NO	NO
3	Retirement account	NO	NO	NO	NO	NO	NO
4	Previous period surplus reserve account	NO					
5	Article 3.3/3.4 net source cancellation accounts	NO	NO	NO	NO		
6	Non-compliance cancellation account	NO	NO	NO	NO		
7	Voluntary cancellation account	NO	NO	NO	NO	NO	NO
8	Cancellation account for remaining units after carry-over	NO	NO	NO	NO	NO	NO
9	Article 3.1 ter and quater ambition increase cancellation account	NO					
10	Article 3.7 ter cancellation account	NO					
11	tCER cancellation account for expiry					NO	
12	ICER cancellation account for expiry						NO
13	ICER cancellation account for reversal of storage						NO
14	ICER cancellation account for non-submission of certification report						NO
15	tCER replacement account for expiry	NO	NO	NO	NO	NO	
16	ICER replacement account for expiry	NO	NO	NO	NO		
17	ICER replacement account for reversal of storage	NO	NO	NO	NO		NO
18	ICER replacement account for non-submission of certification report	NO	NO	NO	NO		NO
	<b>Total</b>	51,056,976	NO	NO	NO	NO	NO

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Table 5 (a). Summary information on additions and subtractions

		Additions						Subtractions					
		Unit type						Unit type					
		AAUs	ERUs	RMUs	CERs	tCERs	ICERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs
1	Assigned amount units issued	51,056,976											
2	Article 3 paragraph 7 ter cancellations							NO					
3	Cancellation following increase in ambition							NO					
4	Cancellation of remaining units after carry over							NO	NO	NO	NO	NO	NO
5	Non-compliance cancellation							NO	NO	NO	NO		
6	Carry-over		NO		NO				NO		NO		
7	Carry-over to PPSR	NO						NO					
	<b>Total</b>	51,056,976	NO		NO			NO	NO	NO	NO	NO	NO

Table 5 (b). Summary information on annual transactions

		Additions						Subtractions					
		Unit type						Unit type					
		AAUs	ERUs	RMUs	CERs	tCERs	ICERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs
1	Year 1 (2013)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2	Year 2 (2014)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3	Year 3 (2015)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4	Year 4 (2016)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5	Year 5 (2017)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6	Year 6 (2018)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7	Year 7 (2019)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
8	Year 8 (2020)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
9	Year 2021	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
10	Year 2022	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
11	Year 2023	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	<b>Total</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Table 5 (c). Summary information on annual transactions between PPSR accounts

		Additions						Subtractions					
		Unit type						Unit type					
		AAUs	ERUs	RMUs	CERs	tCERs	ICERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs
1	Year 1 (2013)	NO						NO					
2	Year 2 (2014)	NO						NO					
3	Year 3 (2015)	NO						NO					
4	Year 4 (2016)	NO						NO					
5	Year 5 (2017)	NO						NO					
6	Year 6 (2018)	NO						NO					
7	Year 7 (2019)	NO						NO					
8	Year 8 (2020)	NO						NO					
9	Year 2021	NO						NO					
10	Year 2022	NO						NO					
11	Year 2023	NO						NO					
	<b>Total</b>	NO						NO					

Table 5 (d). Summary information on expiry, cancellation and replacement

		Requirement to replace or cancel			Replacement						Cancellation					
		Unit type			Unit type						Unit type					
		tCERs	ICERs	CERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs
1	Year 1 (2013)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2	Year 2 (2014)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3	Year 3 (2015)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4	Year 4 (2016)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5	Year 5 (2017)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6	Year 6 (2018)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7	Year 7 (2019)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
8	Year 8 (2020)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
9	Year 2021	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
10	Year 2022	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
11	Year 2023	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	<b>Total</b>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO



**Table 5 (e). Summary information on retirement**

Year		Retirement					
		Unit type					
		AAUs	ERUs	RMUs	CERs	tCERs	ICERs
1	Year 1 (2013)	NO	NO	NO	NO	NO	NO
2	Year 2 (2014)	NO	NO	NO	NO	NO	NO
3	Year 3 (2015)	NO	NO	NO	NO	NO	NO
4	Year 4 (2016)	NO	NO	NO	NO	NO	NO
5	Year 5 (2017)	NO	NO	NO	NO	NO	NO
6	Year 6 (2018)	NO	NO	NO	NO	NO	NO
7	Year 7 (2019)	NO	NO	NO	NO	NO	NO
8	Year 8 (2020)	NO	NO	NO	NO	NO	NO
9	Year 2021	NO	NO	NO	NO	NO	NO
10	Year 2022	NO	NO	NO	NO	NO	NO
11	Year 2023	NO	NO	NO	NO	NO	NO
<b>Total</b>		NO	NO	NO	NO	NO	NO

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**Table 6 (a). Memo item: Corrective transactions relating to additions and subtractions**

	Additions						Subtractions					
	Unit type						Unit type					
	AAUs	ERUs	RMUs	CERs	tCERs	ICERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs

**Table 6 (b). Memo item: Corrective transactions relating to replacement**

	Requirement for replacement		Replacement					
	Unit type		Unit type					
	tCERs	ICERs	AAUs	ERUs	RMUs	CERs	tCERs	ICERs

**Table 6 (c). Memo item: Corrective transactions relating to retirement**

	Retirement					
	Unit type					
	AAUs	ERUs	RMUs	CERs	tCERs	ICERs

## **Appendix 2 – Report R-2: List of Discrepant Transactions**

No discrepant transactions to list for the reporting period.

### **Appendix 3 – Report R-3, Report R-4 and Report R-5**

List of CDM Notifications - No CDM notifications were received during the reporting period.

List of Non-replacements - No non-replacements occurred during the reporting period.

List of Invalid Units - No invalid units to list for the reporting period.

## **Appendix 4 – Further Detailed Information about Reporting Changes to National Registry**

A complete description of the consolidated registry was provided in the common readiness documentation and specific readiness documentation for the national registry of EU and all consolidating national registries. This description includes:

- **Readiness questionnaire**
- **Application logging**
- **Change management procedure**
- **Disaster recovery**
- **Manual Intervention**
- **Operational Plan**
- **Roles and responsibilities**
- **Security Plan**
- **Time Validation Plan**
- **Version change Management**

The documents above are provided as an appendix to this document.