REPUBLIC OF ESTONIA
MINISTRY OF THE ENVIRONMENT

GREENHOUSE GAS EMISSIONS IN ESTONIA 1990–2021 NATIONAL INVENTORY REPORT

SUBMISSION TO THE UNFCCC SECRETARIAT

Annexes to the national inventory report

Estonia 2023

Contents

Annex 1. 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
		kt CO_2 eq.	kt CO_2 eq.	%	%	%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CO_2	3518.60	62.49	2%	2%	2.48%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CO_2	22017.06	4880.50	3%	2%	4.07%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	CO_2	1811.98	313.90	1%	4%	3.86%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Peat	CO_2	842.88	21.10	3%	2%	4.07%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	CO_2	0	124.15	5%	60%	60.21%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	CH_4	1.96	0.05	5%	50%	50.25%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	CH_4	0.23	0.36	5%	50%	50.25%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	CH_4	0.28	0.09	5%	50%	50.25%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Peat	CH_4	0.38	0.01	5%	50%	50.25%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	CH_4	0	0.00	5%	50%	50.25%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Biomass	CH_4	0	16.32	5%	50%	50.25%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Liquid Fuels	N_2O	4.72	0.10	5%	60%	60.21%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Solid Fuels	N_2O	1.84	5.53	5%	60%	60.21%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Gaseous Fuels	N_2O	0.99	0.16	5%	60%	60.21%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Peat	N_2O	5.07	0.10	5%	60%	60.21%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Other Fuels (Waste)	N_2O	0	0.03	5%	60%	60.21%
1.A.1.a Energy Industries/Public Electricity and Heat Production - Biomass	N_2O	0	21.16	5%	60%	60.21%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO_2	78.38	1545.47	3%	39%	39.04%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CH_4	0.09	1.62	5%	50%	50.25%
1.A.1.c Energy Industries/Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	N_2O	0.09	1.53	5%	60%	60.21%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Liquid Fuels	CO_2	0	0	2%	2%	2.48%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Solid Fuels	CO_2	0	0	3%	39%	39.04%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Gaseous Fuels	CO_2	0	0.73	1%	4%	3.86%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Peat	CO_2	0	0	3%	39%	39.04%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Liquid Fuels	CH_4	0	0	5%	50%	50.25%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Solid Fuels	CH_4	0	0	5%	50%	50.25%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Gaseous Fuels	CH_4	0	0.00	5%	50%	50.25%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Peat	CH_4	0	0	5%	50%	50.25%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Biomass	CH_4	0	0	5%	50%	50.25%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Liquid Fuels	N_2O	0	0	5%	60%	60.21%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Solid Fuels	N_2O	0	0	5%	60%	60.21%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Gaseous Fuels	N_2O	0	0.00	5%	60%	60.21%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Peat	N_2O	0	0	5%	60%	60.21%
1.A.2.a Manufacturing Industries and Construction/Iron and Steel - Biomass	N_2O	0	0	5%	60%	60.21%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Liquid Fuels	CO_2	0	0	2%	2%	2.48%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Solid Fuels	CO_2	0	0	3%	39%	39.04%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Gaseous Fuels	CO_2	0	0.50	1%	4%	3.86%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Peat	CO_2	0	0	3%	39%	39.04%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Liquid Fuels	CH_4	0	0	5%	50%	50.25%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Solid Fuels	CH_4	0	0	5%	50%	50.25%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Gaseous Fuels	CH_4	0	0.00	5%	50%	50.25%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Peat	CH_4	0	0	5%	50%	50.25%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Biomass	CH_4	0	0	5%	50%	50.25%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Liquid Fuels	N_2O	0	0	5%	60%	60.21%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Solid Fuels	N_2O	0	0	5%	60%	60.21%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Gaseous Fuels	N_2O	0	0.00	5%	60%	60.21%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Peat	N_2O	0	0	5%	60%	60.21%
1.A.2.b Manufacturing Industries and Construction/Non-Ferrous Metals - Biomass	N_2O	0	0	5%	60%	60.21%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Liquid Fuels	CO_2	228.63	2.70	2%	2%	2.48%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Solid Fuels	CO_2	4.88	0	3%	39%	39.04%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Gaseous Fuels	CO_2	156.10	11.94	1%	4%	3.86%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Peat	CO_2	0	0	3%	39%	39.04%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Liquid Fuels	CH_4	0.01	0.00	5%	50%	50.25%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Solid Fuels	CH_4	0.01	0	5%	50%	50.25%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Gaseous Fuels	CH_4	0.00	0.00	5%	50%	50.25%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Peat	CH_4	0	0	5%	50%	50.25%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Biomass	CH_4	0	0	5%	50%	50.25%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Liquid Fuels	N_2O	0.15	0.00	5%	60%	60.21%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Solid Fuels	N_2O	0.02	0	5%	60%	60.21%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Gaseous Fuels	N_2O	0.09	0.01	5%	60%	60.21%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Peat	N_2O	0	0	5%	60%	60.21%
1.A.2.c Manufacturing Industries and Construction/Chemicals - Biomass	N_2O	0	0	5%	60%	60.21%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Liquid Fuels	CO_2	145.24	0.71	2%	2%	2.48%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Solid Fuels	CO_2	0	0	3%	39%	39.04%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Gaseous Fuels	CO_2	0	55.65	1%	4%	3.86%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Peat	CO_2	0	0	3%	39%	39.04%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Liquid Fuels	CH_4	0.01	0.00	5%	50%	50.25%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Solid Fuels	CH_4	0	0	5%	50%	50.25%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Gaseous Fuels	CH_4	0	0.01	5%	50%	50.25%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Peat	CH_4	0	0	5%	50%	50.25%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Biomass	CH_4	0	0.01	5%	50%	50.25%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Liquid Fuels	N_2O	0.10	0.00	5%	60%	60.21%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Solid Fuels	N_2O	0	0	5%	60%	60.21%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Gaseous Fuels	N_2O	0	0.03	5%	60%	60.21%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Peat	N_2O	0	0	5%	60%	60.21%
1.A.2.d Manufacturing Industries and Construction/Pulp, Paper and Print - Biomass	N_2O	0	0.02	5%	60%	60.21%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Liquid Fuels	CO_2	695.49	22.24	2%	2%	2.48%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Solid Fuels	CO_2	0	0	3%	39%	39.04%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Gaseous Fuels	CO_2	0	60.09	1%	4%	3.86%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Peat	CO_2	0	0	3%	39%	39.04%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Liquid Fuels	CH_4	0.46	0.02	5%	50%	50.25%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Solid Fuels	CH_4	0	0	5%	50%	50.25%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Gaseous Fuels	CH_4	0	0.01	5%	50%	50.25%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Peat	CH_4	0	0	5%	50%	50.25%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Biomass	CH_4	0	0.00	5%	50%	50.25%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Liquid Fuels	N_2O	1.05	0.04	5%	60%	60.21%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Solid Fuels	N_2O	0	0	5%	60%	60.21%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Gaseous Fuels	N_2O	0	0.03	5%	60%	60.21%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Peat	N_2O	0	0	5%	60%	60.21%
1.A.2.e Manufacturing Industries and Construction/Food Processing, Beverages and Tobacco - Biomass	N_2O	0	0.00	5%	60%	60.21%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Liquid Fuels	CO_2	448.15	0.09	2%	2%	2.48%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	CO_2	595.12	0	3%	39%	39.04%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Gaseous Fuels	CO_2	0	33.48	1%	4%	3.86%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Peat	CO_2	9.35	0	3%	39%	39.04%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Other Fuels	CO_2	0	51.34	5%	60%	60.21%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Liquid Fuels	CH_4	0.25	0.00	5%	50%	50.25%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	CH_4	1.56	0	5%	50%	50.25%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Gaseous Fuels	CH_4	0	0.00	5%	50%	50.25%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Peat	CH_4	0.00	0	5%	50%	50.25%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Other Fuels	CH_4	0	0.54	5%	60%	60.21%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Biomass	CH_4	0	1.40	5%	50%	50.25%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Liquid Fuels	N_2O	0.61	0.00	5%	60%	60.21%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Solid Fuels	N_2O	2.06	0	5%	60%	60.21%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Gaseous Fuels	N_2O	0	0.02	5%	60%	60.21%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Peat	N_2O	0.05	0	5%	60%	60.21%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Other Fuels	N_2O	0	0.68	5%	60%	60.21%
1.A.2.f Manufacturing Industries and Construction/Non-metallic Minerals - Biomass	N_2O	0	1.77	5%	60%	60.21%
1.A.2.g Manufacturing Industries and Construction/Other - Liquid Fuels	CO_2	702.34	87.77	2%	2%	2.48%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	CO_2	194.01	0.71	3%	39%	39.04%
1.A.2.g Manufacturing Industries and Construction/Other - Gaseous Fuels	CO_2	286.15	65.82	1%	4%	3.86%
1.A.2.g Manufacturing Industries and Construction/Other - Peat	CO_2	0	0	3%	39%	39.04%
1.A.2.g Manufacturing Industries and Construction/Other - Liquid Fuels	CH_4	0.06	0.04	5%	50%	50.25%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	CH_4	0.55	0.00	5%	50%	50.25%
1.A.2.g Manufacturing Industries and Construction/Other - Gaseous Fuels	CH_4	0.01	0.01	5%	50%	50.25%
1.A.2.g Manufacturing Industries and Construction/Other - Peat	CH_4	0	0	5%	50%	50.25%
1.A.2.g Manufacturing Industries and Construction/Other - Biomass	CH_4	0.04	0.02	5%	50%	50.25%
1.A.2.g Manufacturing Industries and Construction/Other - Liquid Fuels	N_2O	0.52	0.31	5%	60%	60.21%
1.A.2.g Manufacturing Industries and Construction/Other - Solid Fuels	N_2O	0.78	0.00	5%	60%	60.21%
1.A.2.g Manufacturing Industries and Construction/Other - Gaseous Fuels	N_2O	0.16	0.04	5%	60%	60.21%
1.A.2.g Manufacturing Industries and Construction/Other - Peat	N_2O	0	0	5%	60%	60.21%
1.A.2.g Manufacturing Industries and Construction/Other - Biomass	N_2O	0.06	0.04	5%	60%	60.21%
1.A.3.a Transport/Domestic Aviation - Liquid Fuels	CO_2	5.52	5.57	1.7%	1.8%	2.5%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty
1.A.3.a Transport/Domestic Aviation - Liquid Fuels	CH_4	0.00	0.00	5.0%	40.0%	40.3%
1.A.3.a Transport/Domestic Aviation - Liquid Fuels	N_2O	0.04	0.04	5.0%	50.0%	50.2%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CO_2	2234.91	2255.93	1.7%	1.8%	2.5%
1.A.3.b Transport/Road Transportation - Liquid Fuels	CH_4	24.25	2.84	5.0%	40.0%	40.3%
1.A.3.b Transport/Road Transportation - Biomass	CH_4	0	0.27	5.0%	100.0%	100.1%
1.A.3.b Transport/Road Transportation - Liquid Fuels	N_2O	19.27	18.53	5.0%	50.0%	50.2%
1.A.3.b Transport/Road Transportation - Biomass	N_2O	0	1.45	5.0%	150.0%	150.1%
1.A.3.c Transport/Railways - Liquid Fuels	CO_2	142.27	43.03	1.7%	1.8%	2.5%
1.A.3.c Transport/Railways - Solid Fuels	CO_2	17.08	0	3.3%	38.9%	39.0%
1.A.3.c Transport/Railways - Liquid Fuels	CH_4	0.23	0.07	5.0%	40.0%	40.3%
1.A.3.c Transport/Railways - Solid Fuels	CH_4	0.01	0	5.0%	40.0%	40.3%
1.A.3.c Transport/Railways - Liquid Fuels	N_2O	14.75	4.45	4.0%	50.0%	50.2%
1.A.3.c Transport/Railways - Solid Fuels	N_2O	0.07	0	5.0%	40.0%	40.3%
1.A.3.d Transport/Domestic Navigation - Liquid Fuels	CO_2	21.65	18.29	5%	50%	50.25%
1.A.3.d Transport/Domestic Navigation - Liquid Fuels	CH_4	0.06	0.05	5%	40%	40.31%
1.A.3.d Transport/Domestic Navigation - Liquid Fuels	N_2O	0.16	0.13	5%	50%	50.25%
1.A.4.a Other Sectors/Commercial/Institutional - Liquid Fuels	CO_2	139.79	64.11	2%	2%	2.48%
1.A.4.a Other Sectors/Commercial/Institutional - Solid Fuels	CO_2	0	4.00	3%	39%	39.04%
1.A.4.a Other Sectors/Commercial/Institutional - Gaseous Fuels	CO_2	18.65	184.10	1%	4%	3.86%
1.A.4.a Other Sectors/Commercial/Institutional - Peat	CO_2	6.21	0	3%	39%	39.04%
1.A.4.a Other Sectors/Commercial/Institutional - Liquid Fuels	CH_4	0.11	0.22	5%	50%	50.25%
1.A.4.a Other Sectors/Commercial/Institutional - Solid Fuels	CH_4	0	0.01	5%	50%	50.25%
1.A.4.a Other Sectors/Commercial/Institutional - Gaseous Fuels	CH_4	0.01	0.12	5%	50%	50.25%
1.A.4.a Other Sectors/Commercial/Institutional - Peat	CH_4	0.01	0	5%	50%	50.25%
1.A.4.a Other Sectors/Commercial/Institutional - Biomass	CH_4	6.49	0.99	10%	150%	150.33%
1.A.4.a Other Sectors/Commercial/Institutional - Liquid Fuels	N_2O	0.14	0.12	5%	75%	75.17%
1.A.4.a Other Sectors/Commercial/Institutional - Solid Fuels	N_2O	0	0.02	5%	50%	50.25%
1.A.4.a Other Sectors/Commercial/Institutional - Gaseous Fuels	N_2O	0.01	0.10	5%	50%	50.25%
1.A.4.a Other Sectors/Commercial/Institutional - Peat	N_2O	0.04	0	5%	50%	50.25%
1.A.4.a Other Sectors/Commercial/Institutional - Biomass	N_2O	0.90	0.15	10%	150%	150.33%
1.A.4.b Other Sectors/Residential - Liquid Fuels	CO_2	246.88	21.87	2%	2%	2.48%
1.A.4.b Other Sectors/Residential - Solid Fuels	CO_2	336.77	2.35	3%	39%	39.04%
1.A.4.b Other Sectors/Residential - Gaseous Fuels	CO_2	131.64	139.51	1%	4%	3.86%
1.A.4.b Other Sectors/Residential - Peat	CO_2	308.79	0	3%	39%	39.04%
1.A.4.b Other Sectors/Residential - Liquid Fuels	CH_4	0.80	0.06	5%	50%	50.25%
1.A.4.b Other Sectors/Residential - Solid Fuels	CH_4	29.56	0.21	5%	50%	50.25%
1.A.4.b Other Sectors/Residential - Gaseous Fuels	CH_4	0.33	0.35	5%	50%	50.25%
1.A.4.b Other Sectors/Residential - Peat	CH_4	26.75	0	5%	50%	50.25%
1.A.4.b Other Sectors/Residential - Biomass	CH_4	6.44	13.68	10%	150%	150.33%
1.A.4.b Other Sectors/Residential - Liquid Fuels	N_2O	0.40	0.10	5%	75%	75.17%
1.A.4.b Other Sectors/Residential - Solid Fuels	N_2O	1.40	0.01	5%	50%	50.25%
1.A.4.b Other Sectors/Residential - Gaseous Fuels	N_2O	0.06	0.07	5%	50%	50.25%
1.A.4.b Other Sectors/Residential - Peat	N_2O	1.18	0	5%	50%	50.25%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty
1.A.4.b Other Sectors/Residential - Biomass	N_2O	1.71	4.84	10%	150%	150.33%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Liquid Fuels	CO_2	487.05	23.14	2%	2%	2.48%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Solid Fuels	CO_2	21.96	1.18	3%	39%	39.04%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Gaseous Fuels	CO_2	3.68	6.86	1%	4%	3.86%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Peat	CO_2	1.55	0	3%	39%	39.04%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Liquid Fuels	CH_4	0.95	0.07	5%	50%	50.25%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Solid Fuels	CH_4	1.93	0.10	5%	50%	50.25%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Gaseous Fuels	CH_4	0.00	0.00	5%	50%	50.25%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Peat	CH_4	0.13	0	5%	50%	50.25%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Biomass	CH_4	2.30	1.14	10%	150%	150.33%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Liquid Fuels	N_2O	0.68	0.04	5%	75%	75.17%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Solid Fuels	N_2O	0.09	0.00	5%	50%	50.25%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Gaseous Fuels	N_2O	0.00	0.00	5%	50%	50.25%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Peat	N_2O	0.01	0	5%	50%	50.25%
1.A.4.c.i Other Sectors/Agriculture/Forestry/Fishing/Stationary - Biomass	N_2O	0.29	0.15	10%	150%	150.33%
1.A.4.c.ii Other Sectors/Agriculture/Forestry/Fishing/Off-road vehicles and other machinery - Liquid Fuels	CO_2	87.08	179.08	2%	2%	2.48%
1.A.4.c.ii Other Sectors/Agriculture/Forestry/Fishing/Off-road vehicles and other machinery - Liquid Fuels	CH_4	0.15	0.20	5%	50%	50.25%
1.A.4.c.ii Other Sectors/Agriculture/Forestry/Fishing/Off-road vehicles and other machinery - Liquid Fuels	N_2O	0.94	1.85	5%	75%	75.17%
1.B.2.b.iv	CO_2	0.00	0.00	10%	25%	26.93%
1.B.2.b.iv	CH_4	8.22	2.65	10%	25%	26.93%
1.B.2.b.v	CO_2	0.09	0.03	10%	25%	26.93%
1.B.2.b.v	CH_4	54.45	17.57	10%	25%	26.93%
1.B.2.c.ii	CO_2	0.01	0.00	10%	25%	26.93%
1.B.2.c.ii	CH_4	9.01	2.91	10%	25%	26.93%
2.A.1 Cement production	CO_2	483.04	0.00	0%	0.00%	0.00%
2.A.2 Lime production	CO_2	129.69	46.75	0%	2.00%	2.02%
2.A.3 Glass production	CO_2	1.23	11.05	0%	1.00%	1.05%
2.A.4.a Ceramics	CO_2	0.00	1.03	0%	2.00%	2.00%
2.A.4.d Other - Limestone use for flue gas desulpurisation	CO_2	0.00	0.00	0%	0.00%	0.00%
2.B.1 Ammonia production	CO_2	307.73	0.00	0%	0.00%	0.00%
2.C.5 Lead production	CO_2	0.76	3.00	3%	5.00%	5.83%
2.D.1 Lubricant use	CO_2	16.11	3.85	5%	50.90%	51.14%
2.D.2 Paraffin wax use	CO_2	1.29	2.62	50%	100.05%	111.84%
2.D.3 Other - Urea based catalysts for motor vehicles	CO_2	0.00	1.38	30%	0.70%	30.01%
2.D.3 Other - Solvent use	indirect CO_2	18.40	30.55	25%	10.00%	26.93%
2.D.3 Other - Road paving with asphalt	indirect CO_2	0.05	0.04	100%	100.50%	141.78%
2.F.1.a Commercial Refrigeration	HFC	0.00	43.89	9%	41.12%	42.06%
2.F.1.b Domestic Refrigeration	HFC	0.00	0.84	20%	10.00%	22.36%
2.F.1.c Industrial Refrigeration	HFC	0.00	36.71	28%	17.71%	32.97%
2.F.1.d Refrigerated Vehicles	HFC	0.00	25.41	9%	5.00%	9.86%
2.F.1.d Reefer Containers	HFC	0.00	1.43	8%	5.00%	9.78%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty
2.F.1.f Heat Pumps	HFC	0.00	12.12	9%	5.00%	10.30%
2.F.1.f Stationary and Room Air-Conditioning	HFC	0.00	27.32	15%	18.00%	23.43%
2.F.1.e Mobile Air-Conditioning - Passenger cars	HFC	0.00	11.91	9%	5.00%	9.86%
2.F.1.e Mobile Air-Conditioning - Trucks	HFC	0.00	5.01	9%	5.00%	9.86%
2.F.1.e Mobile Air-Conditioning - Buses	HFC	0.00	5.44	9%	5.00%	10.03%
2.F.1.e Mobile Air-Conditioning - Ships	HFC	0.00	7.69	3%	4.00%	5.00%
2.F.1.e Mobile Air-Conditioning - Railcars	HFC	0.00	0.00	3%	5.00%	5.83%
2.F.1.e Mobile Air-Conditioning - Wheel tractors and mobile machinery	HFC	0.00	5.49	15%	10.00%	17.61%
2.F.2.a Foam blowing agents; PU Insulation Panels	HFC	0.00	0.09	10%	10.00%	14.14%
2.F.2.a Spray and Injection PU Foam	HFC	0.00	0.74	10%	10.00%	14.14%
2.F.2.a XPS Insulation Foam	HFC	0.00	0.07	20%	10.00%	22.36%
2.F.2.b One Component PU Foam	HFC	0.00	1.30	15%	0.00%	15.00%
2.F.3 Fire protection	HFC	0.00	2.23	10%	10.00%	14.14%
2.F.4 Aerosols; Metered dose inhalers	HFC	0.00	2.52	10%	0.00%	10.00%
2.G.1 Electrical equipment	SF_6	0.00	2.98	3%	10.00%	10.44%
2.G.2 Particle accelerators	SF_6	0.00	0.09	21%	21.00%	29.70%
2.G.3 N2O from product use	N_2O	4.85	2.39	5%	2.00%	5.39%
3.A.1 Enteric Fermentation - Dairy Cattle	CH_4	821.09	367.01	1%	40%	40.01%
3.A.1 Enteric Fermentation - Non-Dairy Cattle	CH_4	533.89	226.38	1%	40%	40.02%
3.A.2 Enteric Fermentation - Sheep	CH_4	35.50	16.73	7%	40%	40.53%
3.A.3 Enteric Fermentation - Swine	CH_4	24.87	9.64	0%	40%	40.00%
3.A.4 Enteric Fermentation - Goats	CH_4	0.29	0.69	10%	40%	41.23%
3.A.4 Enteric Fermentation - Horses	CH_4	4.33	2.71	10%	40%	41.23%
3.A.4 Enteric Fermentation - Fur animals	CH_4	0.65	0.00	10%	40%	41.23%
3.B.1.1 Manure Management - Dairy Cattle	CH_4	39.96	80.62	50%	20%	53.86%
3.B.1.1 Manure Management -Non-Dairy Cattle	CH_4	20.06	53.84	50%	20%	53.86%
3.B.1.2 Manure Management - Sheep	CH_4	0.84	0.40	50%	30%	58.67%
3.B.1.3 Manure Management - Swine	CH_4	115.84	51.05	50%	20%	53.85%
3.B.1.4 Manure Management - Goats	CH_4	0.01	0.02	51%	30%	59.16%
3.B.1.4 Manure Management - Horses	CH_4	0.38	0.24	51%	30%	59.16%
3.B.1.4Manure Management - Poultry	CH_4	4.27	1.83	51%	30%	59.16%
3.B.1.4 Manure Management - Fur animals	CH_4	4.39	0.01	51%	30%	59.16%
3.B.1.4 Manure Management - Rabbits	CH_4	0.19	0.04	51%	30%	59.16%
3.B.2.1 Manure Management - Dairy Cattle	N_2O	35.92	24.49	50%	112%	122.48%
3.B.2.1 Manure Management -Non-Dairy Cattle	N_2O	18.00	20.14	50%	112%	122.48%
3.B.2.2 Manure Management - Sheep	N_2O	2.56	1.21	50%	112%	122.65%
3.B.2.3 Manure Management - Swine	N_2O	2.10	0.51	50%	112%	122.48%
3.B.2.4 Manure Management - Goats	N_2O	0.04	0.10	51%	112%	122.88%
3.B.2.4 Manure Management - Horses	N_2O	0.64	0.40	51%	112%	122.88%
3.B.2.4 Manure Management - Poultry	N_2O	5.68	2.39	51%	112%	122.88%
3.B.2.4 Manure Management - Fur animals	N_2O	3.54	0.00	51%	112%	122.88%
3.B.2.4 Manure Management - Rabbits	N_2O	1.45	0.38	51%	112%	122.88%
3.B.2.5 Indirect N2O Emissions from Manure Management	N_2O	30.54	17.62	51%	400%	403.36%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty
3.D.1.1 Direct Soil Emissions - Inorganic N Fertilizers	N_2O	299.99	194.75	10%	200%	200.25%
3.D.1.2a Direct Soil Emissions - Animal Manure Applied to Soils	N_2O	123.82	72.13	51%	206%	212.37%
3.D.1.2b Direct Soil Emissions - Sewage Sludge Applied to Soils	N_2O	0.15	1.55	20%	200%	201.00%
3.D.1.2c Direct Soil Emissions - Compost Applied to Soils	N_2O	0.21	5.21	20%	200%	201.00%
3.D.1.3 Direct Soil Emissions Urine and Dung Deposited by Grazing Animals	N_2O	66.76	14.65	51%	206%	212.37%
3.D.1.5 Direct Soil Emissions - Mineralization/Immobilization Associated with Loss/Gain of Soil Organic Matter	N_2O	0.00	0.00	33%	30%	44.77%
3.D.1.4 Direct Soil Emissions - Crop Residue	N_2O	168.30	124.12	30%	200%	202.24%
3.D.1.6 Direct Soil Emissions - Cultivation of Organic Soils	N_2O	140.73	135.96	21%	200%	201.14%
3.D.2.1 Indirect Emissions - Atmospheric Deposition	N_2O	62.11	37.03	15%	435%	435.20%
3.D.2.2 Indirect Emissions - Nitrogen Leaching and Run-off	N_2O	141.49	91.49	18%	287%	287.28%
3.G Liming	CO_2	12.11	28.48	29%	50%	57.88%
3.H Urea Application	CO_2	1.00	0.13	2%	50%	50.04%
5.A Solid waste disposal	CH_4	239.36	196.90	17%	87%	88.86%
5.B.1 Biological treatment of waste	CH_4	0.76	19.15	14%	75%	75.95%
5.B.1 Biological treatment of waste	N_2O	0.43	10.88	14%	65%	66.52%
5.C.1 Waste incineration	CH_4	0.06	0.01	5%	50%	50.25%
5.C.1 Waste incineration	N_2O	0.01	0.00	5%	100%	100.12%
5.C.1 Waste incineration	CO_2	0.76	0.17	5%	40%	40.31%
5.C.2 Open Burning of Waste	CH_4	1.30	0.24	32%	50%	59.37%
5.C.2 Open Burning of Waste	N_2O	0.19	0.04	32%	100%	105.00%
5.C.2 Open Burning of Waste	CO_2	1.49	0.44	32%	40%	51.23%
5.D.1 Domestic wastewater	CH_4	126.22	57.15	60%	66%	89.72%
5.D.1 Domestic wastewater	N_2O	34.38	27.92	25%	106%	108.82%
5.D.2 Industrial wastewater	CH_4	0.00	4.26	50%	36%	61.85%
4.A.1. Forest Land remaining Forest Land - living biomass	CO_2	-4025.42	1822.20	2%	50%	50.04%
4.A.1. Forest Land remaining Forest Land - dead wood	CO_2	-463.14	-137.12	1%	20%	19.87%
4.A.1. Forest Land remaining Forest Land - mineral soils	CO_2	-967.94	-981.81	1%	60%	60.02%
4.A.1. Forest Land remaining Forest Land - organic soils	CO_2	696.72	703.64	3%	90%	90.05%
4.A.2.1. Cropland converted to Forest Land - living biomass	CO_2	-1.73	-57.85	11%	50%	51.22%
4.A.2.1. Cropland converted to Forest Land - dead wood	CO_2	-0.01	-0.27	5%	20%	20.50%
4.A.2.1. Cropland converted to Forest Land - litter	CO_2	-0.40	-13.60	14%	50%	52.03%
4.A.2.1. Cropland converted to Forest Land - mineral soil	CO_2	-0.24	-8.07	14%	60%	61.71%
4.A.2.2. Grassland converted to Forest Land - living biomass	CO_2	-3.89	-161.04	12%	50%	51.42%
4.A.2.2. Grassland converted to Forest Land - dead wood	CO_2	-0.02	-0.67	7%	20%	20.98%
4.A.2.2. Grassland converted to Forest Land - litter	CO_2	-0.83	-34.27	12%	50%	51.38%
4.A.2.2. Grassland converted to Forest Land - mineral soils	CO_2	0.31	12.28	12%	60%	61.16%
4.A.2.2. Grassland converted to Forest Land - organic soils	CO_2	0.10	7.19	90%	40%	98.49%
4.A.2.3 Wetlands converted to Forest Land - living biomass	CO_2	-0.28	-34.31	30%	50%	58.26%
4.A.2.3. Wetlands converted to Forest Land - dead wood	CO_2	0.00	-0.16	17%	20%	25.90%
4.A.2.3. Wetlands converted to Forest Land - litter	CO_2	-0.07	-8.03	34%	50%	60.29%
4.A.2.3. Wetlands converted to Forest Land - organic soils	CO_2	0.15	17.76	34%	40%	52.30%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty
4.A.2.4. Settlements converted to Forest Land - living biomass	CO_2	-1.88	-12.62	114%	50%	124.83%
4.A.2.4. Settlements converted to Forest Land - dead wood	CO_2	-0.01	-0.06	15%	20%	24.62%
4.A.2.4. Settlements converted to Forest Land - litter	CO_2	-0.44	-2.97	36%	50%	61.48%
4.A.2.4. Settlements converted to Forest Land - mineral soils	CO_2	-0.20	-1.11	36%	60%	69.86%
4.A.2.4. Settlements converted to Forest Land - organic soils	CO_2	0.10	1.68	90%	40%	98.49%
4.A.2.5. Other Land converted to Forest Land - living biomass	CO_2	-1.01	-20.80	45%	50%	67.50%
4.A.2.5. Other Land converted to Forest Land - dead wood	CO_2	0.00	-0.09	10%	20%	22.20%
4.A.2.5. Other Land converted to Forest Land - litter	CO_2	-0.21	-4.45	27%	50%	57.01%
4.A.2.5. Other Land converted to Forest Land - mineral soil	CO_2	-0.11	-2.22	27%	60%	65.95%
4.D Forest Land 4(II) Emissions and removals from drainage and rewetting	N_2O	236.42	241.51	3%	39%	39.11%
4.D Forest Land 4(II) Emissions and removals from drainage and rewetting	CH_4	72.69	75.13	3%	55%	55.08%
4.A.2. Land converted to Forest land - (4III) direct N2O emissions	N_2O	0.02	0.93	61%	155%	166.67%
4.B.1 Cropland remaining Cropland - living biomass	CO_2	-1.14	1.78	39%	4%	39.50%
4.B.1 Cropland remaining Cropland - mineral soils	CO_2	0.00	-81.71	2%	60%	60.04%
4.B.1 Cropland remaining Cropland - organic soils	CO_2	604.74	536.31	14%	90%	91.11%
4.B.2.1 Forest Land converted to Cropland -litter	CO_2	0.00	9.32	68%	50%	84.37%
4.B.2.1 Forest Land converted to Cropland -mineral soils	CO_2	0.00	5.78	68%	60%	90.66%
4.B.2.2 Grassland converted to Cropland - living biomass	CO_2	0.00	4.47	48%	50%	69.23%
4.B.2.2 Grassland converted to Cropland - dead wood	CO_2	0.00	0.21	40%	20%	44.79%
4.B.2.2 Grassland converted to Cropland - mineral soils	CO_2	0.00	74.40	18%	60%	62.62%
4.B.2.2 Grassland converted to Cropland - organic soils	CO_2	0.00	29.24	77%	90%	118.39%
4.B.2. Land converted to Cropland - (4III) direct N2O emissions	N_2O	0.00	6.07	62%	155%	167.11%
4.C.1 Grassland remaining Grassland – organic soils	CO_2	8.41	8.29	11%	90%	90.64%
4.C.2.1 Forest Land converted to Grassland - living biomass	CO_2	0.00	43.93	53%	50%	73.06%
4.C.2 Land converted to Grassland – living biomass (excl. FL)	CO_2	-0.13	-15.12	46%	50%	68.26%
4.C.2.1 Forest Land converted to Grassland - dead wood	CO_2	0.00	1.72	46%	20%	50.51%
4.C.2.1 Forest Land converted to Grassland - litter	CO_2	0.00	14.34	29%	50%	57.84%
4.C.2 Land converted to Grassland – dead wood (excl. FL)	CO_2	0.00	-0.19	38%	20%	43.27%
4.C.2 Land converted to Grassland – mineral soils	CO_2	-0.32	-81.90	12%	60%	61.16%
4.C.2 Land converted to Grassland – organic soils	CO_2	0.08	1.65	41%	90%	99.08%
4.D.1.1 Peat extraction remaining Peat extraction - organic soils	CO_2	298.50	1437.61	28%	50%	57.54%
4.D.2.1 Land converted for Peat extraction - organic soils	CO_2	0.00	2.39	136%	50%	144.71%
4.D.2.3 Land converted to Other Wetlands - living biomass	CO_2	9.15	1.53	72%	50%	87.69%
4.D.2.3 Land converted to Other Wetlands - dead wood	CO_2	0.19	0.06	72%	20%	74.72%
4.D.2.3 Land converted to Other Wetlands - litter	CO_2	0.08	2.51	72%	50%	87.69%
4.D Wetlands 4(II) Emissions and removals from drainage and rewetting	N_2O	2.08	2.02	28%	100%	103.88%
4.D Wetlands 4(II) Emissions and removals from drainage and rewetting	CH_4	0.12	0.11	28%	100%	103.88%
4.E.2.1 Forest Land converted to Settlements – living biomass	CO_2	0.00	114.47	20%	50%	53.93%
4.E.2.1 Forest Land converted to Settlements – dead wood	CO_2	0.00	4.39	20%	20%	28.26%

IPCC category/Group	Gas	Base year emissions or removals (1990)	Year 2020 emissions or removals	Activity data uncertainty	EF / estimation parameter uncertainty	Combined uncertainty
4.E.2.1 Forest Land converted to Settlements – litter	CO_2	0.00	32.46	20%	50%	53.89%
4.E.2.1 Forest Land converted to Settlements (min+org soils)	CO_2	0.00	92.45	20%	60%	63.28%
4.E.2.2 Cropland converted to Settlements - soils	CO_2	0.00	29.11	29%	65%	71.21%
4.E.2.3 Grassland converted to Settlements – living biomass	CO_2	0.00	4.42	54%	50%	73.60%
4.E.2.3 Grassland converted to Settlements – dead wood	CO_2	0.00	0.21	47%	20%	51.28%
4.E.2.3 Grassland converted to Settlements - soils	CO_2	0.00	28.22	30%	70%	76.32%
4.E.2.4 Wetlands converted to Settlements - soils	CO_2	0.00	3.30	277%	90%	291.53%
4.E.2. Land converted to Settlements - (4III) direct N2O emissions	N_2O	0.00	10.08	72%	145%	161.82%
4.F.2.1 Forest Land converted to Other Land – litter	CO_2	0.00	17.63	51%	50%	71.36%
4.F.2.1 Forest land converted to Other land – soils	CO_2	0.00	63.46	51%	70%	86.56%
4.F.2.2 Cropland converted to Other land - soils	CO_2	0.00	9.21	136%	70%	152.77%
4.F.2.3 Grassland converted to Other land - soils	CO_2	0.00	5.02	277%	70%	285.99%
4.F.2 Land converted to Other land - (4III) direct N2O emissions	N_2O	0.00	6.23	85%	150%	172.36%
4(IV) Indirect N2O Emissions from Managed Soils	N_2O	0.01	5.25	53%	220%	226.32%
4(V) Biomass burning (CH4)	CH_4	0.31	0.06	35%	70%	78.04%
4(V) Biomass burning (N2O)	N_2O	0.03	0.01	35%	70%	78.04%
Wood panels and sawnwood	CO_2	-156.26	-936.12	63%	57%	84.79%
Paper and paperboard	CO_2	-0.01	17.52	45%	57%	72.62%
Semi-Chemical wood pulp	CO_2	0.00	-30.45	44%	57%	72.01%

Annex 2. Detailed methodological description for individual source or sink categories

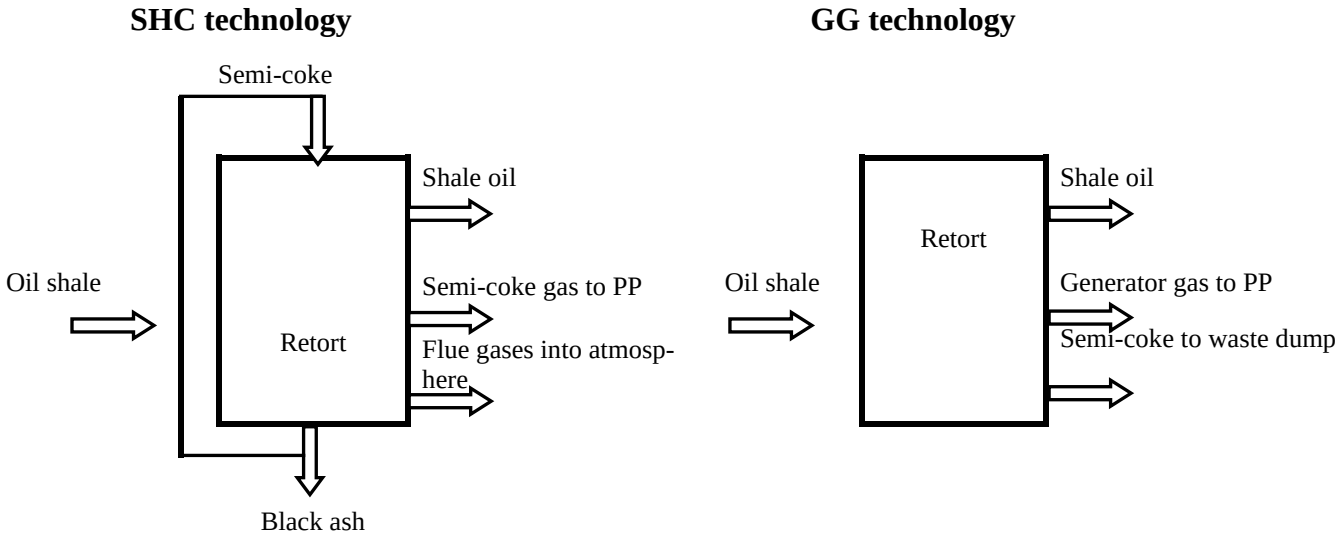
A.2.1. Energy

A.2.1.1. 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 2021 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) 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 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 semi-coke will be delivered for combustion in the aerofountain chamber. Flue gases, which is the product of combustion are used for oil shale draining and after that delivered into the atmosphere. To find the amount of CO_2 emitted with flue gases into the atmosphere a carbon balance method has been developed.

The carbon balance method is very simple: from the amount of carbon delivered with oil shale into the retorting process the amount of carbon of shale oil, semi-coke gas, and black ash is subtracted. The rest of the carbon is emitted into the atmosphere.

For generator gas technology the carbon balance method is used to estimate the amount of carbon delivered with semi-coke to waste dump.

Table A.2.1.1. Composition of semi-coke gas from the Narva Solid Heat Carrier-140 processes in 2021

Composition of semi-coke gas	Content in volume, %	Carbon mole ratio	Density (kg/Nm^3)	Density rate (kg/Nm^3)	Rate of C in gas volume, %	Rate of C in gas weight, %	Heat value of gas Q^r_{scg} (MJ/Nm3)	Rate of Q^r_{scg} (MJ/Nm3)
1	**2**	**3**	**4**	**5=2x4/100**	**6=2x3**	**7=6x4/sum(5)**	**8**	**9=2x8/100**
CO_2	12.099	0.273	1.964	0.238	3.303	4.275		
H_2S	3.865		1.520	0.059			23.384	0.904
N_2	0.337		1.257	0.004				
O_2	4.177		1.428	0.060				
CO	8.835	0.429	1.250	0.110	3.790	3.122	12.636	1.116
H_2	12.165		0.090	0.011			10.798	1.314
CH_4	14.382	0.750	0.720	0.104	10.786	5.119	35.820	5.152
C_2H_6	8.206	0.800	1.340	0.110	6.565	5.798	63.751	5.231
C_2H_4	9.050	0.857	1.250	0.113	7.756	6.390	59.066	5.346
C_3H_4	0.012	0.900	1.787	0.000	0.011	0.013	69.120	0.008
C_3H_8	2.647	0.818	1.970	0.052	2.165	2.811	91.256	2.415
C_3H_6	7.225	0.857	1.880	0.136	6.192	7.672	86.005	6.214
C_4H_6	1.243	0.889	2.330	0.029	1.105	1.697	112.070	1.393
C_4H_{10}	3.832	0.828	2.590	0.099	3.173	5.416	118.651	4.547
C_4H_8+C_4H_6	1.024	0.857	2.500	0.026	0.877	1.446	113.514	1.162
C_5H_{12}	0.367	0.833	3.220	0.012	0.306	0.649	146.087	0.536
C_5H_{10}	5.944	0.857	3.120	0.185	5.094	10.475	140.780	8.368
C_6H_{14}	4.477	0.837	3.791	0.170	3.747	9.363	160.773	7.198
Total	**100.00**			**1.517**		**64.246**		**50.905**

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

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

where

$q_{c\ scg}$ – carbon emission factor of semi-coke gas, tC/TJ,
C_Σ – total carbon content in semi-coke gas, % and
$Q^{r'}_{scg}$ – lower heating value of semi-coke gas, MJ/kg.
Q^r_{scg} – lower heating value of semi-coke gas: = **50.905 MJ/Nm^3**,
ρ_{scg} – density of semi-coke gas **1.517 kg/Nm^3** and
$Q^{r'}_{scg} = Q^r_{sg/}\ \rho_{sg}$ = 50.905/1.517 = **33.556 MJ/kg**

The carbon emission factor of Narva SHC-140 semi-coke gas:

$q_{c\ scg} = 10 \times C_\Sigma / Q^{r'}_{scg}$ = 10 x 64.246/33.556 = **19.146 tC/TJ**

Table A.2.1.2. Composition of semi-coke gas from the Narva Solid Heat Carrier-280 processes in 2021

Composition of semi-coke gas	Content in volume, %	Carbon mole ratio	Density (kg/Nm^3)	Density rate (kg/Nm^3)	Rate of C in gas volume, %	Rate of C in gas weight, %	Heat value of gas Q^r_{scg} (MJ/Nm3)	Rate of Q^r_{scg} (MJ/Nm3)
1	**2**	**3**	**4**	**5=2x4/100**	**6=2x3**	**7=6x4/sum(5)**	**8**	**9=2x8/100**
CO_2	12.042	0.273	1.964	0.237	3.288	4.122		
H_2S	1.570		1.520	0.024			23.384	0.367
N_2	0.419		1.257	0.005				
O_2	20.356		1.428	0.291				
CO	7.308	0.429	1.250	0.091	3.135	2.502	12.636	0.923
H_2	8.916		0.090	0.008			10.798	0.963
CH_4	10.801	0.750	0.720	0.078	8.101	3.723	35.820	3.869
C_2H_6	6.434	0.800	1.340	0.086	5.147	4.403	63.751	4.102
C_2H_4	7.961	0.857	1.250	0.100	6.822	5.444	59.066	4.702
C_3H_4	0.016	0.900	1.787	0.000	0.015	0.017	69.120	0.011
C_3H_8	2.188	0.818	1.970	0.043	1.790	2.251	91.256	1.997
C_3H_6	6.027	0.857	1.880	0.113	5.165	6.199	86.005	5.183
C_4H_6	0.897	0.889	2.330	0.021	0.797	1.186	112.070	1.005
C_4H_{10}	3.143	0.828	2.590	0.081	2.602	4.303	118.651	3.729
C_4H_8+C_4H_6	1.159	0.857	2.500	0.029	0.993	1.585	113.514	1.315
C_5H_{12}	0.288	0.833	3.220	0.009	0.240	0.494	146.087	0.421
C_5H_{10}	7.125	0.857	3.120	0.222	6.106	12.162	140.780	10.031
C_6H_{14}	3.369	0.837	3.791	0.128	2.820	6.824	160.773	5.416
Total	**100.00**			**1.566**		**55.214**		**44.035**

Using the formula 1,

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

where

$q_{c\ scg}$ – carbon emission factor of semi-coke gas, tC/TJ,
C_Σ – total carbon content in semi-coke gas, % and
$Q^{r'}_{scg}$ – lower heating value of semi-coke gas, MJ/kg.
Q^r_{scg} – lower heating value of semi-coke gas: = **44.035 MJ/Nm^3**,
ρ_{scg} – density of semi-coke gas **1.566 kg/Nm^3** and
$Q^{r'}_{scg} = Q^r_{sg}/\ \rho_{sg}$ = 45.429/1.590 = **28.111 MJ/kg**

The carbon emission factor of Narva SHC-2018 semi-coke gas:

$q_{c\ scg} = 10 \times C_\Sigma / Q^{r'}_{scg}$ = 10 x 55.214/28.111 = **19.641 tC/TJ**

Table A.2.1.3. Composition of semi-coke gas from the VKG Solid Heat Carrier (Petroter I) processes in 2021

Composition of semi-coke gas	Content in volume, %	Carbon mole ratio	Density (kg/Nm^3)	Density rate (kg/Nm^3)	Rate of C in gas volume, %	Rate of C in gas weight, %	Heat value of gas Q^r_{scg} (MJ/Nm3)	Rate of Q^r_{scg} (MJ/Nm3)
1	**2**	**3**	**4**	**5=2x4/100**	**6=2x3**	**7=6x4/sum(5)**	**8**	**9=2x8/100**
CO_2	9.256	0.273	1.964	0.197	2.734	3.926		0.000
H_2S	2.584		1.52	0.040	0.000	0.000	23.384	0.618
N_2	2.061		1.257	0.062	0.000	0.000		0.000
O_2	0.199		1.428	0.003	0.000	0.000		0.000
CO	10.027	0.429	1.25	0.124	4.246	3.880	12.636	1.252
H_2	14.684		0.09	0.012	0.000	0.000	10.798	1.464
CH_4	17.878	0.750	0.72	0.113	11.814	6.218	35.82	5.642
C_2H_6	9.429	0.800	1.34	0.112	6.684	6.548	63.751	5.327
C_2H_4	12.207	0.857	1.25	0.144	9.876	9.025	59.066	6.805
C_3H_8	3.155	0.818	1.97	0.063	2.618	3.770	91.256	2.920
C_3H_6	8.180	0.857	1.88	0.142	6.488	8.917	86.005	6.510
C_4H_{10}	1.060	0.828	2.59	0.022	0.700	1.325	118.651	1.003
C_4H_8+C_4H_6	5.394	0.857	2.5	0.130	4.460	8.152	113.514	5.907
C_5H_{12}	3.887	0.833	3.22	0.204	5.273	12.412	146.087	9.243
Total	**100.00**			**1.368**		**64.173**		**46.692**

Using the formula 1,

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

where

$q_{c\ scg}$ – carbon emission factor of semi-coke gas, tC/TJ,
C_Σ – total carbon content in semi-coke gas, % and
$Q^{r'}_{scg}$ – lower heating value of semi-coke gas, MJ/kg.
Q^r_{scg} – lower heating value of semi-coke gas: = **46.692 MJ/Nm^3**,
ρ_{scg} – density of semi-coke gas **1.368 kg/Nm^3** and
$Q^{r'}_{scg} = Q^r_{sg/}\ \rho_{sg}$ = 46.692/1.368 = **34.135 MJ/kg**.

The carbon emission factor of VKG semi-coke gas:

$q_{c\ scg} = 10 \times C_\Sigma / Q^{r'}_{scg} = 10 \times 64.173/34.135 = 18.800$ tC/TJ

Table A.2.1.4. Composition of semi-coke gas from the VKG Solid Heat Carrier (Petroter II and Petroter III) processes in 2021

Compostition of semi-coke gas	Con-tent in volume, %	Carbon mole ratio	Density (kg/Nm^3)	Density rate (kg/Nm^3)	Rate of C in gas vo-lume, %	Rate of C in gas weight, %	Heat va-lue of gas Q^r_{scg} (MJ/Nm3)	Rate of Q^r_{scg} (MJ/Nm3)
1	**2**	**3**	**4**	**5=2x4/100**	**6=2x3**	**7=6x4/sum(5)**	**8**	**9=2x8/100**
CO_2	14.320	0.273	1.964	0.262	3.634	5.044		0.000
H_2S	3.545		1.520	0.055	0.000	0.000	23.384	0.839
N_2	2.626		1.257	0.029	0.000	0.000		0.000
O_2	0.193		1.428	0.002	0.000	0.000		0.000
CO	9.813	0.429	1.250	0.118	4.057	3.584	12.636	1.196
H_2	11.919		0.090	0.011	0.000	0.000	10.798	1.293
CH_4	16.248	0.750	0.720	0.113	11.803	6.006	35.820	5.637
C_2H_6	8.903	0.800	1.340	0.117	6.987	6.616	63.751	5.568
C_2H_4	11.368	0.857	1.250	0.139	9.562	8.447	59.066	6.589
C_3H_8	3.069	0.818	1.970	0.065	2.719	3.785	91.256	3.032
C_3H_6	7.766	0.857	1.880	0.145	6.625	8.802	86.005	6.647
C_4H_{10}	1.043	0.828	2.590	0.024	0.777	1.422	118.651	1.114
C_4H_8+C_4H_6	5.293	0.857	2.500	0.134	4.592	8.114	113.514	6.082
C_5H_{12}	3.896	0.833	3.220	0.199	5.162	11.747	146.087	9.049
Total	**100.00**			**1.415**		**63.567**		**47.047**

Using the formula 1,

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

where

$q_{c\ scg}$ – carbon emission factor of semi-coke gas, tC/TJ,
C_Σ – total carbon content in semi-coke gas, % and
$Q^{r'}_{scg}$ – lower heating value of semi-coke gas, MJ/kg.
Q^r_{scg} – lower heating value of semi-coke gas: = **47.047 MJ/Nm^3**,
ρ_{scg} – density of semi-coke gas **1.415 kg/Nm^3** and
$Q^{r'}_{scg} = Q^r_{sg/}\ \rho_{sg}$ = 47.047/1.415 = **33.248 MJ/kg**.

The carbon emission factor of VKG semi-coke gas:

$q_{c\ scg} = 10 \times C_\Sigma / Q^{r'}_{scg}$ = 10 x 63.567/33.248 = **19.119 tC/TJ**

Table A.2.1.5. Composition of semi-coke gas from the Kiviõli Solid Heat Carrier processes in 2021

Compostition of semi-coke gas	Content in volume, %	Carbon mole ratio	Density (kg/Nm^3)	Density rate (kg/Nm^3)	Rate of C in gas volume, %	Rate of C in gas weight, %	Heat value of gas Q^r_{scg} (MJ/Nm3)	Rate of Q^r_{scg} (MJ/Nm3)
1	**2**	**3**	**4**	**5=2x4/100**	**6=2x3**	**7=6x4/sum(5)**	**8**	**9=2x8/100**
CO_2	1.88	0.273	1.964	0.037	0.513	0.840		
H_2S	0.33		1.520	0.005			23.384	0.077
N_2	3.09		1.257	0.039				
O_2	0.31		1.428	0.004				
CO	8.53	0.429	1.250	0.107	3.659	3.812	12.636	1.078
H_2	20.09		0.090	0.018	0.000	0.000	10.798	2.169
CH_4	19.51	0.750	0.720	0.140	14.633	8.781	35.820	6.988
C_2H_6	9.97	0.800	1.340	0.134	7.976	8.908	63.751	6.356
C_2H_4	12.66	0.857	1.250	0.158	10.850	11.303	59.066	7.478
C_3H_8	3.49	0.818	1.970	0.069	2.855	4.687	91.256	3.185
C_3H_6	8.33	0.857	1.880	0.157	7.139	11.186	86.005	7.164
C_4H_{10}	1.29	1.714	2.590	0.033	2.211	4.773	118.651	1.531
C_4H_8+C_4H_6	5.77	0.857	2.500	0.144	4.945	10.303	113.514	6.550
C_5H_{12}	4.80	0.833	3.220	0.155	3.998	10.731	146.087	7.012
Total	**100.00**			**1.200**		**75.325**		**49.588**

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

$q_{c\ scg}$ – carbon emission factor of semi-coke gas, tC/TJ,
C_Σ – total carbon content in semi-coke gas, % and
$Q^{r'}_{scg}$ – lower heating value of semi-coke gas, MJ/kg.
Q^r_{scg} – lower heating value of semi-coke gas: = **49.588 MJ/Nm^3**,
ρ_{scg} – density of semi-coke gas **1.200 kg/Nm^3** and
$Q^{r'}_{scg} = Q^r_{sg}/\ \rho_{sg}$ = 49.588/1.200 = **41.330 MJ/kg**.

The carbon emission factor of Kiviõli SHC semi-coke gas:

$q_{c\ scg} = 10 \times C_\Sigma / Q^{r'}_{scg}$ = 10 x 75.325/41.330 = **18.225 tC/TJ**

Table A.2.1.6. Composition of the VKG generator gas in 2021

Compostition of semi-coke gas	Content in volume, %	Carbon mole ratio	Density (kg/Nm^3)	Density rate (kg/Nm^3)	Rate of C in gas volume, %	Rate of C in gas weight, %	Heat value of gas Q^r_{scg} (MJ/Nm3)	Rate of Q^r_{scg} (MJ/Nm3)
1	**2**	**3**	**4**	**5=2x4/100**	**6=2x3**	**7=6x4/sum(5)**	**8**	**9=2x8/100**
CO_2	10.767	0.273	1.964	0.201	2.797	4.072		0.000
H_2S	3.040		1.520	0.041	0.000	0.000	23.384	0.623
N_2	2.622		1.257	0.064	0.000	0.000		0.000
O_2	0.251		1.428	0.004	0.000	0.000		0.000
CO	9.491	0.429	1.250	0.124	4.261	3.948	12.636	1.256
H_2	13.746		0.090	0.012	0.000	0.000	10.798	1.467
CH_4	17.779	0.750	0.720	0.119	12.376	6.605	35.820	5.911
C_2H_6	9.448	0.800	1.340	0.115	6.841	6.795	63.751	5.452
C_2H_4	11.072	0.857	1.250	0.139	9.554	8.852	59.066	6.583
C_3H_8	3.327	0.818	1.970	0.059	2.458	3.589	91.256	2.742
C_3H_6	7.779	0.857	1.880	0.138	6.310	8.794	86.005	6.332
C_4H_{10}	1.143	0.828	2.590	0.023	0.742	1.424	118.651	1.063
C_4H_8+C_4H_6	4.019	0.857	2.500	0.126	4.333	8.030	113.514	5.738
C_5H_{12}	1.221	0.833	3.220	0.183	4.738	11.309	146.087	8.306
C_5H_{10}	4.296	0.857	3.120	0.000	0.000	0.000	140.780	0.000
C_6H_{10}		0.878	3.210	0.000	0.000	0.000	141.571	0.000
Total	**100.000**			**1.349**		**63.418**		**45.473**

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_Σ – 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: = **45.473 MJ/Nm^3**,
ρ_{gg} – density of generator gas **1.349 kg/Nm^3** and
$Q^{r'}_{gg} = Q^r_{sg}/\rho_{sg} = 45.473/1.349 =$ **33.708 MJ/kg**.

The carbon emission factor of VKG generator gas:

$q_{c\ gg} = 10 \times C_\Sigma / Q^{r'}_{scg} = 10 \times 63.418/33.708 =$ **18.814 tC/TJ**

Table A.2.1.7. Composition of the Kiviõli generator gas in 2021

Compostition of semi-coke gas	Content in volume, %	Carbon mole ratio	Density (kg/Nm^3)	Density rate (kg/Nm^3)	Rate of C in gas volume, %	Rate of C in gas weight, %	Heat value of gas Q^r_{scg} (MJ/Nm3)	Rate of Q^r_{scg} (MJ/Nm3)
1	**2**	**3**	**4**	**5=2x4/100**	**6=2x3**	**7=6x4/sum(5)**	**8**	**9=2x8/100**
CO_2	15.76	0.273	1.964	0.310	4.302	6.516		
H_2S	0.46		1.520	0.007			23.384	0.108
N_2	65.05		1.257	0.818				
O_2	2.62		1.428	0.037				
CO	4.59	0.429	1.250	0.057	1.969	1.898	12.636	0.580
H_2	6.76		0.090	0.006			10.798	0.730
CH_4	2.34	0.750	0.720	0.017	1.755	0.974	35.820	0.838
C_2H_6	0.44	0.800	1.340	0.006	0.352	0.364	63.751	0.281
C_2H_4	0.87	0.857	1.250	0.011	0.746	0.719	59.066	0.514
C_3H_8	0.15	0.818	1.970	0.003	0.123	0.186	91.256	0.137
C_3H_6	0.33	0.857	1.880	0.006	0.283	0.410	86.005	0.284
C_4H_{10}	0.09	0.828	2.590	0.002	0.075	0.149	118.651	0.107
C_4H_8+C_4H_6	0.24	0.857	2.500	0.006	0.206	0.397	113.514	0.272
C_5H_{12}	0.33	0.833	3.220	0.011	0.275	0.683	146.087	0.482
Total	**100.000**			**1.297**		**12.295**		**4.332**

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_Σ – 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: = **4.332 MJ/Nm^3**,
ρ_{gg} – density of generator gas **1.297 kg/Nm^3** and
$Q^{r'}_{gg} = Q^r_{sg}/\ \rho_{sg} = 4.332/1.297 =$ **3.341 MJ/kg.**

The carbon emission factor of VKG generator gas:

$q_{c\ gg} = 10 \times C_\Sigma / Q^{r'}_{scg} = 10 \times 12.295/3.341 =$ **36.806 tC/TJ**

1918
TALLINNA TEHNIKAÜLIKOOL
MÄEINSTITUUT

Inge Roos, national GHG
inventory energy expert
Department of Thermal
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Kopli 116
TALLINN

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 i
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 min
controlled. Oil shale is a mixture of clay and kerogen matter, and does not emit methan
During the 90-year long period of mining in Estonia there have never been any problem
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. Whil
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 st
and there are no related publications dealing with Estonia.

Sincerely

Prof. Ingo Valgma
Director

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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.

In Table A.2.1.8 the carbon stored with semi-coke by oil plants is presented and in Table A.2.1.9 the total carbon stored with semi-coke is presented.

Table A.2.1.8 Carbon stored with semi-coke

Enefit 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**	**2021**
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	1272
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	39
Enefit 280	**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**	**2021**
Amount of black ash to landfill	TJ	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Carbon stored with black ash	kt	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
VKG GG	**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**	**2021**
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	3784
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	115
VKG SHC	**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**	**2021**
Semi-coke to landfill	TJ	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	101	258	282	302	300	333	344	330	351	439	472	327
Carbon stored with black ash	kt	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	3	8	9	9	9	10	10	10	11	13	14	10
VKG Petroter II	**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**	**2021**
Semi-coke to landfill	TJ	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	93	410	323	391	370	361	394	455
Carbon stored with black ash	kt	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	3	13	10	12	11	11	12	14
VKG Petroter III	**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**	**2021**
Semi-coke to landfill	TJ	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	112	265	361	450	447	480	435
Carbon stored with black ash	kt	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	3	8	11	14	14	15	13
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**	**2021**
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	867
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	26
Kiviõli SHC	**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**	**2021**
Semi-coke to landfill	TJ	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	55	113	63	42	55	143	435	524	527	273	611	547
Carbon stored with black ash	kt	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2	3	2	1	2	4	13	16	16	8	19	17

NO – no oil shale production occurred

Table A.2.1.9 Total carbon stored with semi-coke

Total	**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**	**2021**
Oil Shale	TJ	5269	4700	4354	5298	3570	5167	4851	5124	4012	2345	3657	4978	4095	4259	3841	4479	4149	3954	4015	3972	4588	5062	5263	5408	5632	6438	4478	7585	8054	7574	10072	7687
Carbon stored with semi-coke and black ash	kt	161	143	133	162	109	158	148	156	122	71	111	152	125	130	117	137	126	121	122	121	140	154	160	165	172	196	137	231	246	231	307	234

A.2.1.2. Fuel consumption and emissions by fuel types

In this Annex the fuel consumption and CO_2, CH_4, and N_2O emissions by fuel types are presented. In Table A.2.1.10 the fuel consumption for the whole timeseries is shown. In Table A.2.1.11 CO_2 emissions, in Table A.2.1.12 CH_4 emissions, and in Table A.2.1.13 N_2O emissions are shown.

Table A.2.1.10. Fuel combustion by fuel types, PJ

Fuel type	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	2021
Solid Fuels	**256.3**	**233.1**	**190.8**	**154.9**	**157.6**	**147.5**	**152.8**	**151.4**	**128.4**	**115.9**	**125.0**	**124.7**	**122.3**	**141.5**	**142.1**	**140.9**	**135.3**	**167.1**	**149.8**	**130.4**	**173.0**	**175.8**	**162.5**	**180.1**	**177.3**	**162.5**	**167.2**	**192.7**	**188.0**	**141.2**	**116.5**	**126.3**
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	114.9
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	0.1
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	3.0	3.3	3.7	3.7	4.6	9.4	7.0	7.4	9.0	9.3	9.4	8.7
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	2.6
Gas gasoline	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.2	3.1	0.1	NO	NO	NO
Coke	0.6	0.4	0.1	0.1	0.1	NO	NO	NO	NO	NO	0.1	0.1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.1	NO	NO	NO	NO	NO	NO	NO	NO
Liquid Fuels	**120.8**	**108.5**	**61.0**	**63.2**	**58.9**	**46.3**	**50.3**	**49.0**	**48.5**	**44.3**	**36.8**	**43.0**	**43.2**	**42.4**	**42.0**	**42.9**	**43.3**	**44.7**	**42.7**	**39.2**	**41.0**	**41.6**	**42.6**	**40.8**	**40.8**	**42.7**	**44.0**	**44.1**	**43.8**	**42.4**	**39.5**	**38.2**
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	1.3
Light fuel oil	10.3	9.5	5.5	4.5	2.8	2.9	4.1	3.7	4.5	4.1	4.8	6.6	7.7	9.2	7.4	8.4	7.4	8.5	6.9	6.9	7.5	8.2	8.0	7.2	7.2	7.3	6.4	6.0	5.9	4.9	4.8	2.4
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	8.5
Diesel oil	19.1	17.6	10.4	12.3	12.7	11.3	11.7	12.2	12.7	11.2	10.9	12.7	15.3	14.1	15.7	16.1	17.4	18.4	18.0	15.9	17.6	19.1	20.4	20.7	21.0	22.0	22.5	23.1	23.5	23.2	23.0	25.1
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	0.9
Aviation gasoline	0.08	0.08	0.03	0.05	0.04	0.05	0.04	0.05	0.04	0.04	0.03	0.04	0.03	0.04	0.06	0.07	0.07	0.07	0.08	0.04	0.04	0.07	0.06	0.05	0.06	0.06	0.05	0.05	0.06	0.06	0.05	0.08
Gaseous fuels	**43.6**	**44.4**	**26.4**	**13.5**	**16.7**	**19.5**	**22.0**	**21.3**	**20.0**	**19.4**	**23.6**	**25.3**	**23.8**	**26.0**	**27.9**	**28.6**	**28.9**	**28.9**	**27.4**	**21.4**	**23.6**	**21.1**	**22.4**	**20.4**	**18.2**	**16.3**	**17.9**	**16.5**	**17.2**	**15.9**	**14.3**	**16.1**
Natural Gas	43.6	44.4	26.4	13.5	16.7	19.5	22.0	21.3	20.0	19.4	23.6	25.3	23.8	26.0	27.9	28.6	28.9	28.9	27.4	21.4	23.6	21.1	22.4	20.4	18.2	16.3	17.9	16.5	17.2	15.9	14.3	16.1
Peat	**11.3**	**12.0**	**7.8**	**5.9**	**5.9**	**6.3**	**7.8**	**6.9**	**4.4**	**4.0**	**3.4**	**4.2**	**4.7**	**4.5**	**3.1**	**2.9**	**3.6**	**4.6**	**3.4**	**2.7**	**3.8**	**3.3**	**2.8**	**2.6**	**2.4**	**1.5**	**1.5**	**1.6**	**1.4**	**1.0**	**0.6**	**0.2**
Milled and sod peat	8.0	8.8	5.4	4.1	4.5	4.5	5.8	5.8	3.8	3.5	2.9	3.9	4.4	4.1	2.9	2.7	3.4	4.4	3.1	2.6	3.6	3.1	2.6	2.4	2.2	1.3	1.4	1.6	1.4	1.0	0.6	0.2
Peat Briquette	3.3	3.2	2.4	1.9	1.5	1.8	2.0	1.1	0.5	0.5	0.5	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	NO	NO	NO	NO	NO
Other Fuels	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**0.1**	**0.3**	**0.4**	**0.8**	**0.6**	**0.6**	**0.7**	**0.9**	**0.5**	**0.5**	**1.1**	**1.3**	**2.1**	**2.4**	**1.9**	**2.0**	**2.8**	**2.5**	**1.8**	**1.5**	**1.3**
Waste oils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	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	0.03
Plastics	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.01	0.05	0.02	NO	NO	0.004	0.01	0.001	0.01	0.03	0.01	NO	0.00001	0.01
Other Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.01	0.02	0.1	0.1	0.01	0.03	0.1	0.3	0.2	0.3	1.0	1.2	1.6	1.8	1.2	1.3	2.2	1.9	1.1	0.7	0.6
Municipal Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.5	0.5	0.6	0.6	0.5	0.5	0.5	0.7	0.7
Biomass	**7.9**	**7.8**	**9.1**	**8.6**	**14.8**	**20.6**	**25.4**	**25.2**	**21.2**	**21.8**	**21.5**	**22.6**	**22.9**	**24.1**	**25.1**	**24.4**	**22.1**	**24.9**	**26.8**	**29.4**	**35.0**	**33.7**	**34.4**	**35.4**	**35.6**	**37.3**	**40.5**	**43.2**	**47.6**	**48.1**	**52.5**	**53.7**
Solid biomass	7.9	7.8	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	35.0	35.0	36.7	39.7	42.6	46.1	46.4	50.1	51.1
Liquid biomass	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.01	0.05	0.02	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	1.9
Gaseous biomass	NO	NO	NO	NO	0.02	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	0.7

NO – no consumption occurred

Table A.2.1.11. CO_2 emissions from fuel combustion, Mt

Fuel type	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	2021
Solid Fuels	**23.3**	**21.3**	**17.0**	**13.0**	**13.5**	**12.3**	**12.6**	**12.5**	**11.0**	**10.5**	**10.5**	**10.2**	**9.9**	**11.7**	**11.7**	**11.4**	**10.7**	**13.8**	**12.0**	**9.7**	**13.9**	**13.8**	**12.3**	**14.3**	**13.8**	**11.1**	**12.6**	**13.7**	**12.9**	**7.7**	**5.2**	**6.4**
Oil Shale	21.7	19.9	15.9	12.1	12.7	11.4	11.8	11.6	10.5	10.1	9.8	9.5	9.2	11.0	10.9	10.8	9.9	12.8	11.0	8.9	12.9	12.9	11.4	13.3	12.8	10.1	11.6	12.5	11.7	6.3	4.0	5.3
Coal	0.9	0.9	0.6	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.1	0.2	0.1	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.03	0.01
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	0.72
Oil shale generator gas	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.2	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.2	0.3	0.4	0.5	0.4	0.4
Gas gaso-line	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.09	0.23	NO	NO	NO	NO
Coke	0.06	0.04	0.01	0.01	0.01	0.003	0.003	0.003	0.003	0.003	0.01	0.01	0.003	0.003	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.02	NO	NO	NO	NO	NO	NO	NO	NO
Liquid Fuels	**9.10**	**8.17**	**4.61**	**4.77**	**4.43**	**3.47**	**3.76**	**3.65**	**3.62**	**3.30**	**2.70**	**3.15**	**3.18**	**3.12**	**3.09**	**3.13**	**3.14**	**3.24**	**3.10**	**2.86**	**3.01**	**3.05**	**3.11**	**2.99**	**2.99**	**3.12**	**3.22**	**3.22**	**3.18**	**3.06**	**2.86**	**2.77**
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	0.10
Light fuel oil	0.76	0.70	0.40	0.33	0.21	0.21	0.30	0.27	0.33	0.30	0.35	0.49	0.57	0.68	0.55	0.62	0.55	0.63	0.51	0.51	0.55	0.61	0.59	0.53	0.54	0.54	0.47	0.44	0.43	0.36	0.36	0.17
Motor gasoline	1.64	1.46	0.72	0.74	0.90	0.78	0.88	0.96	0.93	0.89	0.88	1.05	0.98	0.98	0.92	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	0.59
Diesel oil	1.46	1.36	0.80	0.80	0.59	0.39	0.53	0.52	0.54	0.49	0.53	0.64	0.76	0.79	0.69	0.72	0.65	0.72	0.62	0.60	0.65	0.70	0.70	0.66	0.67	0.68	0.63	0.61	0.62	0.56	0.56	0.38
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	0.06
Aviation Gasoline	0.01	0.01	0.002	0.004	0.002	0.003	0.003	0.003	0.002	0.003	0.002	0.003	0.002	0.003	0.005	0.005	0.005	0.01	0.01	0.003	0.003	0.005	0.004	0.004	0.004	0.004	0.003	0.004	0.004	0.004	0.004	0.01
Natural Gas	**2.41**	**2.45**	**1.46**	**0.74**	**0.92**	**1.08**	**1.22**	**1.18**	**1.10**	**1.07**	**1.30**	**1.40**	**1.32**	**1.44**	**1.54**	**1.58**	**1.60**	**1.60**	**1.51**	**1.19**	**1.30**	**1.16**	**1.24**	**1.13**	**1.01**	**0.90**	**0.99**	**0.91**	**0.95**	**0.88**	**0.79**	**0.89**
Peat	**1.17**	**1.24**	**0.80**	**0.61**	**0.62**	**0.65**	**0.81**	**0.72**	**0.46**	**0.42**	**0.36**	**0.44**	**0.50**	**0.47**	**0.33**	**0.31**	**0.38**	**0.48**	**0.36**	**0.29**	**0.40**	**0.34**	**0.29**	**0.27**	**0.25**	**0.16**	**0.16**	**0.17**	**0.15**	**0.10**	**0.07**	**0.02**
Milled and sod peat	0.85	0.93	0.57	0.43	0.47	0.47	0.62	0.62	0.41	0.37	0.31	0.41	0.47	0.44	0.31	0.28	0.36	0.46	0.33	0.27	0.39	0.32	0.27	0.25	0.24	0.14	0.15	0.17	0.15	0.10	0.07	0.02
Peat Bri-quette	0.32	0.31	0.23	0.18	0.14	0.18	0.19	0.10	0.05	0.05	0.05	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	NO	NO	NO	NO	NO
Other fos-sil Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	**0.59**	**10.0**	**25.9**	**29.5**	**57.9**	**45.2**	**44.8**	**53.5**	**70.9**	**40.3**	**36.5**	**89.3**	**105.4**	**223.5**	**264.7**	**232.7**	**242.6**	**311.5**	**286.3**	**213.9**	**197.3**	**178.1**
Waste oils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.001	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	0.002
Plastics	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00003	0.00003	NO	NO	0.0004	0.004	0.001	NO	NO	0.0003	0.001	0.00006	0.0009	0.002	0.0004	NO	0.0009	0.001
Other Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.001	0.001	0.004	0.004	0.001	0.002	0.005	0.03	0.02	0.020	0.08	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.09	0.06	0.05
Municipal Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.13	0.12
Other fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.02	0.15	0.07	0.38	0.22	0.43	0.09	NO	NO	NO	NO	NO	0.02	1.8	2.4	2.8	2.6

NO – no emissions occurred

Table A.2.1.12. CH_4 emissions from fuel combustion, kt CO_2 eq

Fuel type	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	2021
Solid Fuels	**33.94**	**35.92**	**12.69**	**6.44**	**2.35**	**6.73**	**11.50**	**11.21**	**8.53**	**9.55**	**8.17**	**7.15**	**8.06**	**5.47**	**8.54**	**8.12**	**6.51**	**4.56**	**4.16**	**3.08**	**3.33**	**4.05**	**3.74**	**3.65**	**3.48**	**2.80**	**3.56**	**3.58**	**3.00**	**3.11**	**2.52**	**2.31**
Oil Shale	1.65	1.74	1.08	0.84	1.08	1.04	1.04	1.04	1.04	0.72	0.77	0.77	0.70	0.66	0.72	0.96	0.78	1.01	1.05	0.71	0.94	1.12	1.07	1.00	1.15	1.36	1.43	1.70	1.75	1.85	1.68	1.62
Coal	32.03	33.98	11.48	5.47	1.15	5.58	10.33	10.04	7.41	8.76	7.30	6.24	7.25	4.69	7.69	7.01	5.58	3.39	2.95	2.19	2.21	2.74	2.47	2.41	2.11	1.08	1.75	1.32	0.84	0.86	0.46	0.33
Oil Shale Gas	0.11	0.09	0.10	0.12	0.11	0.11	0.12	0.12	0.07	0.06	0.09	0.10	0.11	0.11	0.13	0.14	0.15	0.16	0.16	0.17	0.18	0.19	0.20	0.20	0.22	0.36	0.28	0.30	0.39	0.40	0.38	0.36
Coke	0.16	0.11	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.01	0.01	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.04	NO	NO	NO	NO	NO	NO	NO	NO
Liquid Fuels	**29.32**	**27.37**	**12.80**	**13.87**	**17.02**	**14.98**	**16.44**	**17.21**	**17.08**	**15.48**	**13.80**	**16.15**	**14.61**	**13.23**	**11.90**	**12.16**	**11.76**	**11.35**	**10.14**	**8.72**	**8.03**	**7.58**	**6.90**	**6.17**	**5.70**	**5.76**	**5.53**	**5.36**	**5.02**	**4.78**	**3.87**	**3.54**
Heavy fuel oil	2.27	2.07	1.15	1.37	1.10	0.71	0.76	0.67	0.74	0.65	0.29	0.30	0.24	0.20	0.22	0.15	0.12	0.10	0.12	0.10	0.11	0.10	0.11	0.10	0.09	0.15	0.14	0.10	0.10	0.10	0.07	0.09
Light fuel oil	1.44	1.23	0.67	0.53	0.28	0.27	0.44	0.39	0.47	0.52	0.52	0.88	1.11	1.26	0.95	1.23	1.06	1.21	1.10	1.09	1.12	1.33	1.26	1.17	1.18	1.16	0.95	0.97	0.91	0.68	0.65	0.39
Motor gasoline	22.60	21.30	9.38	10.09	13.55	11.83	13.12	13.98	13.46	12.22	10.97	12.63	10.61	9.31	8.08	8.08	7.97	7.63	6.60	5.74	4.96	4.31	3.81	3.38	3.04	3.14	3.24	3.17	3.03	3.03	2.34	2.21
Diesel oil	2.83	2.57	1.53	1.83	2.03	2.11	2.08	2.12	2.35	2.03	1.96	2.27	2.61	2.42	2.58	2.64	2.54	2.35	2.22	1.70	1.75	1.76	1.61	1.42	1.27	1.17	1.03	0.92	0.79	0.75	0.63	0.68
LPG	0.18	0.19	0.08	0.05	0.05	0.06	0.05	0.05	0.06	0.06	0.06	0.07	0.04	0.05	0.06	0.06	0.07	0.06	0.08	0.08	0.08	0.08	0.10	0.10	0.12	0.14	0.17	0.19	0.19	0.22	0.19	0.17
Aviation Gasoline	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003
Natural Gas	**72.31**	**72.56**	**42.51**	**21.28**	**30.54**	**34.72**	**38.24**	**37.13**	**35.25**	**34.30**	**39.46**	**42.33**	**35.57**	**40.54**	**46.12**	**47.63**	**48.15**	**47.86**	**45.89**	**31.42**	**33.68**	**30.15**	**32.66**	**33.16**	**26.19**	**23.52**	**25.81**	**23.76**	**24.89**	**23.10**	**21.06**	**23.79**
Peat	**27.27**	**25.69**	**20.01**	**16.33**	**12.49**	**14.67**	**16.59**	**9.02**	**4.74**	**4.55**	**3.83**	**2.39**	**2.64**	**2.26**	**1.95**	**1.72**	**1.34**	**1.64**	**2.14**	**1.04**	**1.33**	**1.58**	**1.49**	**1.49**	**1.36**	**0.95**	**0.23**	**0.06**	**0.05**	**0.03**	**0.02**	**0.01**
Milled and sod peat	0.38	0.42	0.26	0.74	0.53	0.28	0.85	0.95	0.70	0.38	0.19	0.24	0.35	0.24	0.20	0.11	0.12	0.16	0.11	0.09	0.12	0.10	0.08	0.08	0.07	0.05	0.22	0.06	0.05	0.03	0.02	0.01
Peat Briquette	26.89	25.28	19.76	15.59	11.97	14.39	15.73	8.07	4.04	4.17	3.63	2.15	2.29	2.02	1.75	1.62	1.21	1.48	2.02	0.95	1.21	1.48	1.41	1.41	1.28	0.90	0.01	NO	NO	NO	NO	NO
Biomass	**15.26**	**15.15**	**13.99**	**13.05**	**18.18**	**20.35**	**23.34**	**25.90**	**20.62**	**20.46**	**19.83**	**20.24**	**19.24**	**19.49**	**19.96**	**17.43**	**18.32**	**19.85**	**20.41**	**23.56**	**26.86**	**25.98**	**26.27**	**22.99**	**23.31**	**22.83**	**23.97**	**25.79**	**26.17**	**27.32**	**29.62**	**33.83**
Solid Biomass	15.26	15.15	13.99	13.05	18.18	20.35	23.34	25.90	20.62	20.46	19.83	20.24	19.24	19.48	19.96	17.42	18.30	19.84	20.35	23.55	26.71	25.87	26.18	22.91	23.19	22.76	23.89	25.75	26.00	27.08	29.36	33.55
Liquid Biomass	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.001	0.008	0.004	0.06	0.01	0.14	0.10	0.09	0.07	0.11	0.06	0.04	0.02	0.11	0.16	0.15	0.11
Gaseous Biomass	NO	NO	NO	NO	0.001	0.002	0.001	0.001	0.002	0.003	0.002	0.002	0.002	0.003	0.002	0.005	0.01	0.01	0.01	0.01	0.01	0.01	0.005	0.01	0.02	0.02	0.04	0.02	0.06	0.08	0.12	0.17
Other Fossil Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	**0.01**	**0.11**	**0.29**	**0.33**	**0.65**	**0.51**	**0.51**	**0.60**	**0.78**	**0.44**	**0.39**	**0.95**	**1.11**	**1.39**	**1.58**	**1.10**	**1.21**	**1.94**	**1.66**	**1.03**	**0.71**	**0.54**
Waste oils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.01	0.11	0.28	0.29	0.61	0.50	0.48	0.55	0.50	0.21	0.17	0.12	0.09	0.07	0.09	0.12	0.11	0.09	0.09	0.12	0.10
Plastics	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.0004	0.0003	NO	NO	0.004	0.04	0.01	NO	NO	0.003	0.009	0.0007	0.01	0.02	0.005	NO	0.00001	0.01
Other Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.01	0.11	0.28	0.29	0.61	0.50	0.48	0.55	0.50	0.21	0.17	0.12	0.09	0.07	0.09	0.12	0.11	0.09	0.09	0.12	0.10	0.02
Municipal Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00005	0.00005	0.00006	0.00006	0.00006	0.00006	0.00006	0.00007	0.00007
Other fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.0001	0.0004	0.0001	0.0008	0.0004	0.0007	0.0001	NO	NO	0.0000001	NO	NO	0.00001	0.001	0.0010	0.001	0.001

NO – no emissions occurred

Table A.2.1.13. N_2O emissions from fuel combustion, kt CO_2 eq

Fuel type	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	2021
Solid Fuels	**6.35**	**6.29**	**3.92**	**2.56**	**2.47**	**2.46**	**2.57**	**2.41**	**2.15**	**1.76**	**2.00**	**2.26**	**1.62**	**1.38**	**4.20**	**7.38**	**7.76**	**8.52**	**9.09**	**6.93**	**7.35**	**7.76**	**6.42**	**8.51**	**8.07**	**8.28**	**9.78**	**10.32**	**10.31**	**7.90**	**6.16**	**7.10**
Oil Shale	2.25	2.37	1.50	1.17	1.48	1.43	1.44	1.44	1.40	0.96	1.04	1.05	0.95	0.90	3.57	6.77	7.00	7.11	7.70	5.99	6.70	7.00	5.73	7.80	7.23	7.97	9.29	9.40	9.86	7.40	6.04	7.06
Coal	3.87	3.76	2.38	1.35	0.96	1.01	1.12	0.95	0.74	0.79	0.93	1.17	0.66	0.47	0.63	0.60	0.76	1.40	1.39	0.94	0.65	0.76	0.69	0.66	0.84	0.31	0.29	0.42	0.44	0.50	0.12	0.03
Oil Shale Gas	0.10	0.09	0.09	0.11	0.11	0.11	0.11	0.11	0.07	0.05	0.09	0.10	0.10	0.11	0.12	0.13	0.15	0.15	0.15	0.16	0.17	0.18	0.19	0.18	0.21	0.34	0.26	0.28	0.37	0.38	0.36	0.34
Coke	0.23	0.16	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.05	0.01	0.01	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.06	NO	NO	NO	NO	NO	NO	NO	NO
Liquid Fuels	**43.53**	**40.42**	**24.19**	**26.30**	**28.72**	**27.66**	**30.43**	**30.14**	**33.52**	**32.97**	**32.29**	**35.03**	**38.18**	**34.66**	**32.90**	**33.66**	**32.15**	**30.39**	**26.22**	**27.39**	**32.31**	**27.92**	**27.49**	**26.35**	**24.64**	**25.87**	**25.19**	**25.94**	**26.03**	**25.97**	**24.81**	**25.68**
Heavy fuel oil	5.89	5.28	2.94	3.33	2.75	1.78	1.87	1.67	1.70	1.51	0.65	0.63	0.50	0.44	0.47	0.41	0.34	0.27	0.27	0.25	0.28	0.22	0.25	0.21	0.18	0.26	0.30	0.22	0.18	0.15	0.13	0.15
Light fuel oil	15.76	14.67	10.75	11.29	11.09	10.78	11.91	10.90	13.83	15.07	14.19	13.47	17.12	15.40	13.27	14.37	14.88	12.83	9.19	12.05	16.84	11.86	10.57	9.22	7.34	7.04	5.63	5.83	5.49	5.75	5.21	4.79
Motor gasoline	13.18	12.49	5.45	6.10	8.75	8.30	9.68	10.40	9.93	9.78	11.22	14.32	13.37	12.45	12.06	11.73	8.95	8.65	7.98	7.03	6.14	5.41	4.79	4.06	3.56	3.62	3.54	3.22	2.87	2.86	2.14	1.65
Diesel oil	8.63	7.90	5.03	5.55	6.10	6.76	6.93	7.11	8.01	6.56	6.18	6.54	7.13	6.29	7.01	7.05	7.86	8.53	8.64	7.93	8.94	10.28	11.75	12.68	13.36	14.73	15.51	16.44	17.19	16.94	17.14	18.90
LPG	0.03	0.04	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.09	0.08	0.10	0.11	0.10	0.11	0.11	0.15	0.16	0.19	0.20	0.22	0.28	0.24	0.17	0.14
Aviation Gasoline	0.04	0.04	0.01	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.04	0.03	0.04	0.04	0.02	0.02	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04
Natural Gas	**1.31**	**1.36**	**0.81**	**0.40**	**0.48**	**0.55**	**0.63**	**0.61**	**0.58**	**0.56**	**0.67**	**0.72**	**0.68**	**0.75**	**0.80**	**0.82**	**0.83**	**0.84**	**0.79**	**0.62**	**0.68**	**0.61**	**0.65**	**0.59**	**0.53**	**0.47**	**0.52**	**0.48**	**0.50**	**0.46**	**0.42**	**0.47**
Peat	**6.35**	**6.85**	**4.33**	**3.23**	**3.38**	**3.47**	**3.89**	**3.72**	**2.26**	**2.05**	**1.69**	**2.27**	**2.82**	**2.29**	**1.74**	**1.52**	**1.77**	**2.27**	**1.67**	**1.29**	**1.72**	**1.45**	**1.22**	**1.19**	**1.10**	**0.69**	**0.70**	**0.81**	**0.66**	**0.44**	**0.34**	**0.10**
Milled and sod peat	5.10	5.61	3.45	2.54	2.84	2.77	3.14	3.29	2.05	1.85	1.50	2.17	2.71	2.16	1.66	1.43	1.69	2.19	1.57	1.22	1.65	1.37	1.14	1.11	1.03	0.63	0.64	0.81	0.66	0.44	0.34	0.10
Peat Bri-quette	1.24	1.24	0.88	0.69	0.55	0.70	0.75	0.42	0.21	0.19	0.19	0.10	0.11	0.13	0.09	0.09	0.08	0.08	0.10	0.06	0.07	0.08	0.08	0.08	0.07	0.05	0.06	NO	NO	NO	NO	NO
Biomass	**2.96**	**2.94**	**3.12**	**2.95**	**4.63**	**6.26**	**7.56**	**7.89**	**6.73**	**6.70**	**6.80**	**6.82**	**6.87**	**6.81**	**7.08**	**6.66**	**6.17**	**6.72**	**7.18**	**10.94**	**14.82**	**16.25**	**17.64**	**13.97**	**14.72**	**14.73**	**16.06**	**18.07**	**19.20**	**21.26**	**23.76**	**29.59**
Solid Bio-mass	2.96	2.94	3.12	2.95	4.63	6.26	7.56	7.89	6.73	6.70	6.80	6.82	6.87	6.81	7.07	6.65	6.14	6.70	7.06	10.90	14.59	16.10	17.53	13.87	14.59	14.66	16.00	18.03	18.69	20.48	22.58	28.13
Liquid Biomass	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.003	0.02	0.01	0.12	0.04	0.23	0.14	0.11	0.08	0.12	0.06	0.04	0.02	0.49	0.77	1.17	1.45
Gaseous Biomass	NO	NO	NO	NO	0.001	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.003	0.003	0.004	0.005	0.005	0.003	0.003	0.004	0.004	0.003	0.008	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.008
Other Fos-sil Fuels	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**0.01**	**0.14**	**0.37**	**0.42**	**0.82**	**0.65**	**0.64**	**0.76**	**0.98**	**0.56**	**0.50**	**1.19**	**1.40**	**1.77**	**2.02**	**1.42**	**1.55**	**2.47**	**2.14**	**1.34**	**0.95**	**0.74**
Waste oils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.01	0.02	0.06	0.05	0.01	0.03	0.07	0.35	0.24	0.27	1.04	1.29	1.65	1.88	1.24	1.37	2.30	1.97	1.14	0.76	0.64
Plastics	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.0004	0.0004	NO	NO	0.005	0.05	0.02	NO	NO	0.004	0.01	0.001	0.01	0.03	0.006	NO	0.00001	0.01
Other Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.01	0.13	0.35	0.36	0.77	0.63	0.61	0.69	0.63	0.26	0.21	0.15	0.12	0.09	0.11	0.15	0.14	0.11	0.12	0.15	0.13	0.03
Municipal Solid Waste	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.03	0.03
Other Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.0001	0.001	0.0005	0.003	0.002	0.003	0.0007	NO	NO	0.0000006	NO	NO	0.0002	0.02	0.02	0.03	0.03

NO – no emissions occurred

A.2.2.3. 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, and oil shale

Activity data on lubricants, bituumen, and natural gas consumption as non-energy use is received from *Joint Questionnaire* dataset by Statistics Estonia and sent to IEA and Eurostat. Activity data on oil shale reported in the CRF 1.AD.10 is calculated. This is oil shale semi-coke which is 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.2.1.14 carbon stored in products is presented.

Table A.2.1.14. Carbon stored 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**	**2021**
Fuel consumption, 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	210
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	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	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	0.8
CO_2 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	3.1
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**	**2021**
Fuel consumption, 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	3666
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	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	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	80.7
CO_2 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	295.7
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**	**2021**
Fuel consumption, 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	NO	NO	443	2 873	NO	NO	NO	NO	NO	NO	NO	NO
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	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	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	NO	NO	6.7	43.3	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 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	NO	NO	24.5	158.7	NO	NO	NO	NO	NO	NO	NO	NO
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**	**2021**
Fuel consumption, 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	10072	7687
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	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	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	307.2	234.5
CO_2 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	1126.4	859.7

NO – no fuel conusmption or emissions occurred

Table A.2.1.15. Emission factors for LTO-cycle (kg/LTO)

	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
Turbofans (Jets)*							
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
Turboprop**							
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
Piston engine***							
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
singe 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
Helicopters****							
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), 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 isrepresented 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.2.2. Agriculture

A.2.2_I. LIVESTOCK POPULATION IN ESTONIA IN 1990–2021

Table A.2.2_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 A.2.2_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.2.2_I.3 Cattle population size in 1999–2021 in Estonia, 1000 heads (SE, 2022)

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	0.7	11.4	7.3	42.0	1.3	40.8	72.1	3.6	49.6	18.9
2021	250.8	83.7	31.3	3.9	12.2	0.7	11.5	7.1	43.7	1.3	42.4	68.8	3.4	48.6	16.7

Table A.2.2_I.4. Swine population size in 1999–2021 in Estonia, 1000 heads (SE, 2022)

	Total	Total of which											
		piglets, live weight less than 20 kg	young pigs, live weight 20–50 kg	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
2021	308	104.1	58.8	119.3	55.4	45.1	18.7	0.2	25.7	21.2	3.1	4.5	3.6

Table A.2.2_I.5. Sheep and goats population quarterly data 2004–2021, 1000 heads (SE, 2022)

Sheep and goats quarterly data				
Year	March 31st	June 30th	September 30th	December 31st
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
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
2021	79.7	88.5	80.2	69.9

Table A.2.2_I.6. Number of poultry in Estonia 1990–2021, 1000 heads (SE, 2022)

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
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
2021	NA	NA	536.0	1 660.4	72.8	405.6	2 674.9

Table A.2.2_I.7. Average number of rabbits in Estonia (calculated) 1990–2021 (SE, 2022)

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
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
2021	1 926.0	214.0	17 808.9	19 948.9

Table A.2.2_I.8. Average number of fur animals in Estonia 1990–2021 (SE, 2022)

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
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	-0.02	0.4	0.4	-0.01	2.7	2.7
2021	-0.06	0.05	0.05	-0.04	0.4	0.3

A.2.2_II. MILK YIELD PER COW, FAT CONTENT OF MILK AND PERCENTAGE OF COW THAT GAVE BIRTH IN ESTONIA IN 1990–2019

Table A.2.2_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.2.2_II.2. Average milk yield per cow in 1994–2021, kg/cow/year (SE 1994–2005; SE, 2022)

County	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
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	6 484	6 781
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	6 019	6 396
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	4 687	4 646
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	5 438	6 053
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	6 812	7 119
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	7 045	7 164
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	5 512	6 295
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	6 823	7 096
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	7 339	7 562
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	6 407	6 651
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	6 325	6 796
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	5 619	5 844
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	7 103	7 880
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	5 870	5 851
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	5 932	6 205
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	6 281	6 319

Table A.2.2_II.2. Average milk yield per cow in 1994–2021, kg/cow/year (continued)

County	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Average yield per cow, kg	6 838	7 021	7 168	7 526	7 990	8 233	8 442	8 878	9 159	9 287	9 633	9 943	9 966
Harju county	6 359	6 402	6 600	6 769	7 377	7 351	7 725	8 386	8 677	9 205	8 667	9 105	9 128
Hiiu county	5 052	4 520	4 667	5 266	4 650	5 468	4 998	5 875	6 559	7 558	7 372	7 274	7 529
Ida-Viru county	6 039	6 334	6 298	6 554	7 250	7 237	7 204	6 668	7 562	7 670	8 175	7 770	8 461
Jõgeva county	7 058	7 230	7 465	7 657	7 807	8 176	8 496	9 651	9 506	9 479	9 887	10 162	9 978
Järva county	7 048	7 254	7 473	7 816	8 338	8 728	8 895	9 532	9 892	10 193	10 178	10 417	10 630
Lääne county	6 281	6 368	6 388	6 802	7 552	7 674	7 944	7 706	8 969	8 568	8 765	9 512	9 183
Lääne-Viru county	7 139	7 390	7 524	7 783	8 186	8 317	8 306	9 031	9 266	9 058	10 141	10 175	10 332
Põlva county	7 581	7 671	7 737	7 980	8 306	9 543	8 983	9 315	9 228	10 054	10 102	10 410	10 743
Pärnu county	6 733	6 948	7 294	7 690	8 054	8 128	8 694	8 941	9 233	9 200	9 708	10 068	9 781
Rapla county	7 078	7 355	7 267	7 784	8 108	7 974	9 005	8 712	9 304	9 020	9 646	9 915	9 765
Saare county	6 008	6 243	6 179	6 633	7 371	7 588	7 476	7 726	8 139	8 336	8 620	8 907	9 166
Tartu county	8 019	7 997	8 237	8 544	9 520	9 463	9 230	9 896	10 127	10 243	10 264	10 696	10 342
Valga county	5 926	6 127	6 470	7 125	7 581	7 894	8 149	8 191	8 527	8 941	9 414	10 109	10 157
Viljandi county	6 530	6 784	6 711	7 220	7 485	7 818	8 344	8 718	9 048	9 210	9 247	9 504	9 532
Võru county	6 493	6 461	6 345	6 948	7 290	7 667	7 586	7 877	8 162	6 803	8 130	8 254	8 280

Table A.2.2_II.3. Average fat content of milk in Estonia in 1990–1997, % (EARC, 2012)[1]

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

[1] EARC. Eesti Jõudluskontrolli aastaraamatud. [www] https://www.jkkeskus.ee/jkk/piimaveised/statistika/j%C3%B5udluskontrolli-aastaraamatud/ (12.12.2022).

Table A.2.2_II.4. Fat content of milk in 1998–2021 by county of Estonia, % (EARC, 2022)[2]

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Average	4.26	4.23	4.29	4.31	4.29	4.31	4.27	4.21	4.17	4.15	4.12	4.14
Harju	4.25	4.23	4.31	4.38	4.32	4.34	4.29	4.27	4.21	4.18	4.14	4.17
Hiiu	4.46	4.4	4.25	4.29	4.38	4.38	4.26	4.19	4.24	4.28	4.34	4.44
Ida-Viru	4.32	4.33	4.31	4.29	4.21	4.25	4.23	4.09	4.06	4.08	4.08	4.09
Jõgeva	4.37	4.32	4.36	4.39	4.46	4.46	4.3	4.28	4.24	4.2	4.18	4.17
Järva	4.18	4.19	4.25	4.25	4.23	4.29	4.27	4.17	4.14	4.11	4.08	4.09
Lääne	4.36	4.24	4.34	4.36	4.28	4.27	4.28	4.25	4.28	4.28	4.24	4.29
Lääne-Viru	4.18	4.14	4.19	4.21	4.19	4.2	4.16	4.11	4.07	4.03	4.02	4.01
Põlva	4.29	4.24	4.28	4.38	4.33	4.3	4.3	4.23	4.14	4.11	4.09	4.08
Pärnu	4.23	4.2	4.36	4.41	4.32	4.35	4.33	4.27	4.2	4.19	4.16	4.17
Rapla	4.23	4.16	4.21	4.27	4.19	4.2	4.21	4.11	4.05	4.06	4.0	4.12
Saare	4.46	4.4	4.38	4.36	4.4	4.4	4.38	4.27	4.26	4.23	4.17	4.22
Tartu	4.3	4.26	4.25	4.28	4.32	4.28	4.28	4.22	4.19	4.13	4.08	4.09
Valga	4.25	4.18	4.27	4.3	4.25	4.26	4.29	4.21	4.19	4.22	4.25	4.29
Viljandi	4.28	4.19	4.32	4.31	4.31	4.39	4.31	4.26	4.27	4.26	4.21	4.22
Võru	4.22	4.25	4.35	4.33	4.34	4.32	4.25	4.26	4.28	4.29	4.21	4.29

[2] EARC. Eesti Jõudluskontrolli aastaaruanded. [www] https://www.epj.ee/jkk/piimaveised/statistika/aastaaruanded/ (12.12.2022)

Table A.2.2_II.4. Fat content of milk in 1998–2021 by county of Estonia, % (EARC, 2022)[1] (continued)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Average	4.11	4.1	4.04	4	4	3.98	4	3.94	3.91	3.89	3.89	3.90
Harju	4.11	4.07	4.03	3.96	4	3.93	4	3.95	3.94	3.92	3.91	3.89
Hiiu	4.41	4.37	4.22	4.27	4.17	4.2	4.17	4.16	4.16	4.20	4.17	4.13
Ida-Viru	4.07	4.11	4.09	4.09	4.01	3.94	4.03	3.93	3.85	3.77	3.86	3.88
Jõgeva	4.14	4.14	4.06	4.05	4.07	3.99	4.1	3.95	3.97	3.89	3.86	3.92
Järva	4.07	4.03	4.03	3.99	3.98	3.93	4.03	3.94	3.84	3.81	3.88	3.86
Lääne	4.2	4.13	4.03	4.03	4.02	4.01	4.01	4.06	4.03	3.96	3.78	3.89
Lääne-Viru	4.01	4.05	4.02	3.95	3.9	3.83	3.82	3.81	3.81	3.77	3.85	3.91
Põlva	4.14	4.12	4.13	4.01	4	3.96	4.03	4.01	3.98	3.98	3.91	3.88
Pärnu	4.12	4.08	3.99	4.01	3.98	3.9	3.94	3.91	3.9	3.91	3.86	3.83
Rapla	4.18	4.21	4.09	4.01	4.03	3.96	3.97	3.99	3.97	3.88	3.86	3.95
Saare	4.15	4.13	3.98	3.96	4.06	4.08	4.11	4.02	3.92	3.92	3.96	3.98
Tartu	4.02	4.03	3.91	3.91	3.89	3.81	3.81	3.79	3.78	3.78	3.73	3.81
Valga	4.17	4.14	4.16	4.08	4.11	4.08	4.13	4.11	4.08	4.03	3.95	3.92
Viljandi	4.12	4.1	4.08	4.05	4.07	3.98	4.12	3.99	4.02	4.06	4.04	3.97
Võru	4.24	4.22	4.16	4.05	4.03	3.95	4	3.97	3.99	4.08	4.04	4.03

Table A.2.2_II.5. Percentage of cows that gave birth in 1990–2021, %

Year	Dairy cows, %	Mature Female Cattle, %
1990	74	80
1991	80	80
1992	86	80
1993	100	80
1994	98	80
1995	100	80
1996	100	80
1997	100	80
1998	100	80
1999	100	80
2000	99	80
2001	100	80
2002	100	80
2003	99	80
2004	100	80
2005	98	80
2006	100	80
2007	100	80
2008	100	80
2009	100	80
2010	100	80
2011	100	80
2012	100	80
2013	100	80
2014	100	80
2015	100	80
2016	100	80
2017	100	80
2018	100	80
2019	100	80
2020	100	80
2021	100	80

A.2.2_III. WEIGHT OF DAIRY CATTLE BY CATTLE BREED IN ESTONIA IN 1990–2021

Table A.2.2_III.1. Average weight of dairy cattle by breed in Estonia in 1990–2021

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[3]	550[2]	460[4]		
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	101 636	577.1
2002	26 726	74 733	507	100 841	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	98 947	591.7
2007	23 842	70 816	514	95 398	594.7
2008	22 357	69 599	517	92 698	597.7
2009	20 578	68 058	475	89 389	600.9
2010	19 724	67 904	461	88 438	604.0
2011	18 917	69 216	493	88 967	607.1
2012	18 294	70 511	479	89 616	610.3
2013	18 175	71 716	441	90 702	613.4
2014	18 356	72 810	459	92 000	616.5
2015	17 247	69 772	484	87 844	619.5
2016	15 899	65 896	466	82 543	622.5
2017	14 742	66 713	520	82 244	625.5
2018	13 682	68 044	518	82 513	629.3
2019	12 321	67 990	567	81 155	632.6
2020	11 297	68 754	601	80 910	635.9
2021	10 325	69 351	637	80 589	636.3

[3] Ling, K., Samarütel, J., Jaakson, H. Ainevahetusalased uurimised põlulas. [www] http://www.eau.ee/~polulakf/ainevahetus.php (12.03.2012).
[4] Kalamees, K. Eesti Maakari. [www] http://www.etll.ee/?Veised:Eesti_maakari (12.03.2012).

Table A.2.2_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[5]:		
Mature females	500	
Mature males	600	
Bovine animals (aged between 1 and 2 years)	300	0.70
Calves (6–12 months)[6]	205	0.55
Calves (0–6 months) [7]	41	0.90

Table A.2.2_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.2.2_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)[8]. As the study covered the years 1990, 1995, 2000, 2005, 2010 and 2015, the values for the distribution of MMS in-between of those years were interpolated. The MMS distribution split values for the year 2020 are based on the new study by A. Kaasik[9] and the years between 2015-2020 were interpolated. The values for 2021 was used as 2020 values as the new data about MMS splits will be available in 2025. The corresponding MMS distributions are shown in tables A.2.2_IV.1. and A.2.2_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[10]. 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.

[5] 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.

[6] The start weight was calculated based on the final weight of calves (0-6 months) and their weight gain. The weigh gain of calves was estimated taking into account the start weigh of mature cattle. Production cycle at 183 days per year was applied.

[7] 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.

[8] Kaasik, A., Möls, M. Loomakasvatusest eralduvate saasteainete heitkoguste inventuurimetoodikate täiendamine ja heite vähendamistehnoloogiate kaardistamine. [www] https://www.envir.ee/sites/default/files/nh3_eriheite_ja_sonnikukaitlustehnoloogiate_ajaloolise_ulevaate_lopparuanne_0.pdf (16.02.2021).

[9] Kaasik, A. Eesti lauda- ja sõnnikukäitlustehnoloogiate ning sõnniku laotamise tehnoloogiate uuring. [www] https://envir.ee/media/1414/download (12.12.2022)

[10] SE. (1991). Eesti statistika 1990. Lk. 445.

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.

Table A.2.2_IV.1. Country-specific MMS of cows in 1990–2021, %

	Dairy cows, %				Bovine animals and bulls,%				Mature non-dairy females,%				Calves,%			
Year	**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
2021	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.2.2_IV.2. Country-specific MMS of swine in 1990–2021, %

	Fattening pigs				Sows and boars				Young pigs			
Year	**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
2021	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.2.2._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.2.2._IV.4).

Table A.2.2_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.2.2_IV.4. Country-specific MMS of poultry in 1990–2021, %

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
2021	99.4	0.6

A.2.2_V. NITROGEN EXCRETION RATES

Table A.2.2_V.1. Nitrogen content of feed, % (Kaasik jt, 2002)[11]

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.2.2_V.2. Content of N in body weight and embryo, g/kg (DIAS, 1997)[12]

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

Table A.2.2_V.3. Average protein content of milk in Estonia in 1990–1997, % of mass (EARC, 2012)[13]

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

[11] Kaasik, A., Leming, R., Remmel, T. (2002). Toitainete (N, P, K) kadu veise- ja seakasvatuses. Agraarteadus, nr 13 (4), lk 201–211.
[12] DIAS. Standard Values for Farm Manure. [www] https://dcapub.au.dk/djfpublikation/djfpdf/djfhd7.pdf (02.11.2020).
[13] 10 Results of animal recording in Estonia in 1997–2012. Annual Reports. [www] https://www.jkkes-kus.ee/jkk/piimaveised/statistika/aastaaruanded/ (02.11.2020).

Table A.2.2_V.4. Protein content of milk in 1998–2021 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**	**2021**
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	3.40
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	3.37
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	3.40
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	3.52
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	3.43
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	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	3.43
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	3.40
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	3.35
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	3.37
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	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	3.49
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	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	3.40
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	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	3.40

A.2.2_VI. SYNTHETIC FERTILIZERS APPLIED ON AGRICULTURAL SOILS IN ESTONIAN IN 1990–2019

Table A.2.2_VI.1. Amounts of synthetic fertilizers applied on agricultural soils in 1990-2021, tonnes (SE, 2022)

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
2021	46 767

A.2.2_VII. PRODUCTION OF CROPS IN ESTONIA IN 1990–2019

Table A.2.2_VII.1. Production of field crops in 1990–2021, 1000 tonnes (SE, 2022)

Year	Cereals	Dry pulses	Rape seed	Open-field vegetab-les	Potatoes	Fodder 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
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
2021	1 256.8	79.2	216.1	43.9	71.2	1.2

Table A.2.2_VII.2. Sown area of field crops in 1990–2021, 1000 ha (SE, 2022)

Year	Cereals	Dry pulses	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

Year	Cereals	Dry pulses	Industrial crops	Open-field vegetables	Potatoes	Fodder roots
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	2.3	3.6	0.3
2021	367.1	49.0	85.3	1.8	3.4	0.3

Table A.2.2_VII.3. Average yields of field crops by field crop in 1990–2021, kg/ha (SE, 2022)

Year	Cereals	Dry pulses	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
2021	3 502	1 617	2 740	21 118	4 124

A.2.2_VIII AMOUNTS OF LIME FERTILIZERS USED IN ESTONIA

Table A.2.2_VIII.1. Amounts of lime fertilizers applied to soils in 1990–2021, tonnes (SE, 2022)

Year	Annual amount of calcic limestone ($CaCO_3$) (t/yr)	Annual amount of clinker dust (t/yr)	Annual amount of limestone and other meliorants (t/yr)	Annual amount of dolomite ($CaMg(CO_3)_2$) (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
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	31 898.0	0	31 898.0	3 558.0
2021	50 848.0	0	50 848.0	12 822.0

A.2.2_IX. AMOUNTS OF UREA FERTILIZERS USED IN ESTONIA

Table A.2.2_IX.1. Amounts of urea fertilizers applied to soils in 1990–2021, 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

Year	Annual amount of used urea fertilizers (t/yr)
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
2021	181.2

A.2.2_X. AVERAGE MONTHLY TEMPERATURE AND PRECIPITATION IN ESTONIA IN 1992–2021

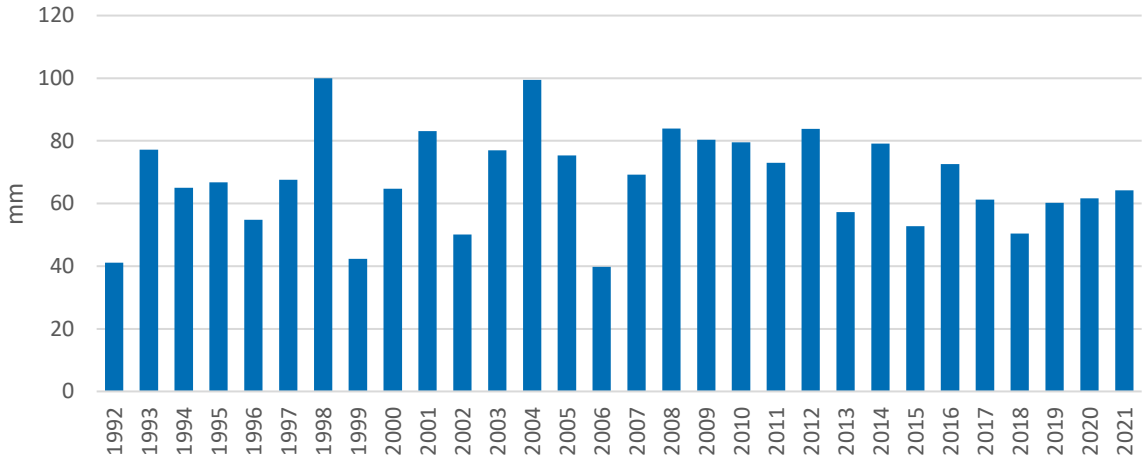

Figure A.2.2_X.1. Total precipitation from May to September in Estonia in 1992–2021, mm (SE, 2015; EstEA, 2023)

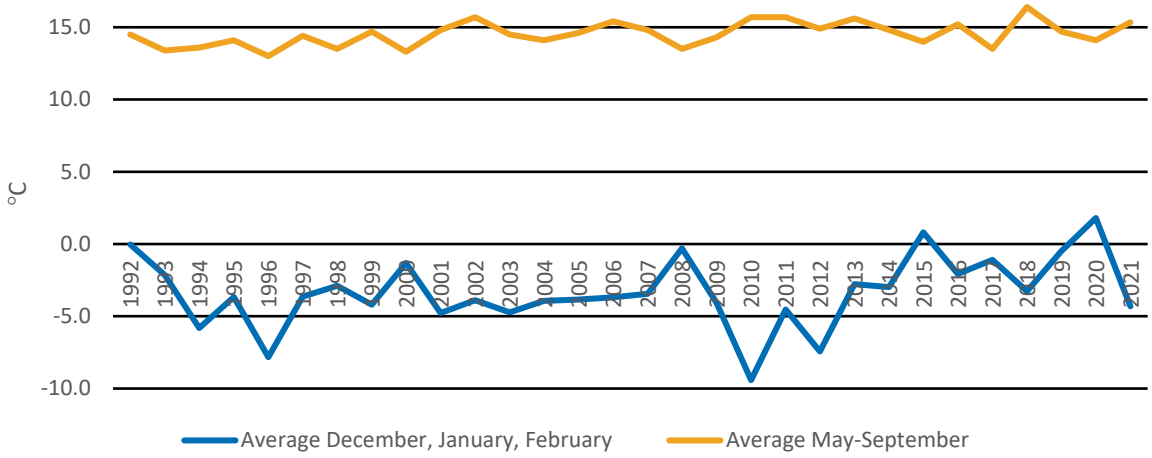

Figure A.2.2_X.2. Average yearly temperatures in Estonia in 1992–2021, ˚C (SE, 2015; EstEA, 2023)

Annex 3. Any additional information

A.3.1. 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_2, N_2O CH_4, F-gases and also NOx, CO, NMVOC and SO_2) 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_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2	Notes*
1. A. Fuel combustion activities								
1.A.A. Sectoral Approach								
1.AA.1.A. Energy industries								
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	
1.AA.2. Manufacturing Industries and Construction								
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, 1997-1999and 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	
1.AA.3. Transport								
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 CivilAviation sub-sector	NO	NO	NO	NO	NO	NO	NO	
1.AA.4. Other Sectors								

Greenhouse gas source and sink categories	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2	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_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2	Notes*
1.B Fugitive emissions from fuels								
1.B.1. Solid fuels								
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	
1.B.2. Oil and Natural Gas								
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_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2	Notes*
2. Industrial processes and Product Use								
2.A. Mineral Industry								
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
2.B. Chemical Industry								
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_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2	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_6**	**NF_3**	**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_2**	**CH_4**	**N_2O**	**NOx**	**CO**	**NMVOC**	**SO_2**	**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_2 emissions from NMVOC emissions are reported.
2.D.3. Other – Road paving with asphalt	X	NO	NO	NO	NO	X	NO	Indirect CO_2 emissions from NMVOC emissions are reported.
2.D.3 Other; Other – Urea based catalysts for motor vehicles	X	NO	NO	NO	NO	NO	NO	

2.C. Metal Production													
Greenhouse gas source and sink categories	**CO_2**	**CH_4**	**N_2O**	**NOx**	**CO**	**NMVOC**	**SO_2**	**HFCs**	**PFCs**	**SF_6**	**NF_3**	**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_6	NF_3	Notes*
2.E. Electronics Industry						
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	
2.F. Product Uses and Substitutes for ODS						
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_6	N_2O	Notes*
2.G. Other Product Manufacture and Use					
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_6 emissions from 1995 to 2006.
2.G.2. Other – Car tyres	NO	NO	NO	NO	SF_6 emissions from car tyres occured in 1993–2003.
2.G.3.a N_2O 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_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2	Notes*
2.H.Other Production								
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_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2	Notes*
3.A. Enteric Fermentation	NO	X	NO	NO	NO	NO	NO	CO_2 emissions from livestock are not estimated because annual net CO_2 emissions are assumed to be zero – the CO_2 photosynthesized by plants is returned to the atmosphere as respired CO_2.
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_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2	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_2	CH_4	N_2O	NO_x	CO	NMVOC	Notes*
4.A. Forest Land							
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_2O 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_2O Emissions from N Mineralization/Immobilization			NO				
4(V) Biomass burning	IE, NO	X	X				IE: CO_2 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_2	CH_4	N_2O	NO_x	CO	NMVOC	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_2O emissions from N inputs to managed soils			NO				
4(III) Direct N_2O 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_2 emissions are included in 4.A.1 and 4.A.2.
4.B. Cropland							
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_2O 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.
4.C. Grassland							
4.C.1. Grassland remaining Grassland	X	X	X	NE	NE	NE	
Carbon stock change	X						
4(III) Direct N_2O Emissions from N Mineralization/Immobilization			NO				
4 (V) Biomass Burning	IE, NO	X	X				IE: CO_2 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_2	CH_4	N_2O	NO_x	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_2O 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.
4.D. Wetlands							
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_2O emissions from N inputs to managed soils			NO				
4(III) Direct N_2O 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_2O emissions from N inputs to managed soils			NO				
4(III) Direct N_2O Emissions from N Mineralization/Immobilization			NO				

Greenhouse gas source and sink categories	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	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_2 emissions are included in 4.D.1.1 and 4.D.2.1.
4.E. Settlements							
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_2O emissions from N inputs to managed soils			NA				
4(III) Direct N_2O 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_2O emissions from N inputs to managed soils			NA				
4(III) Direct N_2O Emissions from N Mineralization/Immobilization			X				
4(V) Biomass Burning	NO	NO	NO				
4.F. Other Land							
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_2O Emissions from N Mineralization/Immobilization			X				

Greenhouse gas source and sink categories	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	Notes*
4(V) Biomass Burning	NO	NO	NO				
4.G. Harvested Wood Products							
HWP from domestic harvest	X						
4.H. Other	NO	NO	NO	NO	NO	NO	
4(IV) Indirect N_2O emissions from managed soils							
Atmospheric Deposition			NO				
Nitrogen Leaching and Run-off			X				

Waste (CRF 5)

Greenhouse gas source and sink categories	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	SO_2	Notes*
5.A. Solid waste disposal on land								
5.A.1. Managed waste disposal on land								Based on the 2006 IPCC Guidelines, CO_2 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_2O emissions from Solid Waste Disposal on Land are not significant and there is no methodology provided to calculate the emissions.
5.A.1.a. Anaerobic	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	
5.B. Biological treatment of solid waste								
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.
5.C. Incineration and open burning of waste								
5.C.1. Waste incineration								
5.C.1.1. Biogenic	X	X	X	NE	NE	NE	NE	Based on the 2006 IPCC Guidelines, CO_2 emissions from Incineration of biogenic material is not included in national total emission estimates.

Greenhouse gas source and sink categories	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	SO_2	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_x, 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_2 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	
5.D. Wastewater Treatment and Discharge								
5.D.1. Domestic wastewater	NO	X	X	NA	NA	X	NA	
5.D.2. Industrial wastewater	NO	X	NO	X	NA	X	NE	
5.F. Memo items	NO	NO	NO	NO	NO	NO	NO	

A.3.2. Joint Questionnaire dataset

The Joint Questionnaire (JQ) dataset made by Statistics Estonia (also sent to IEA and Eusrostat) is added as additional excel files. The JQ dataset contains activity data for gaseous, solid, liquid fuels and biomass used to calculate GHG emissions in the Energy (1.A) sector. The dataset

Annex 4. Description Kyoto Protocol Units and Information on Changes in National Registry

1.1. INFORMATION ON ACCOUNTING OF KYOTO UNITS

1.1.1. Background information

The contents of the Standard Electronic Format report (hereinafter as SEF) for 2022 can be found as Annex 5 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 2022. In addition, the SEF includes information on transfers of the units during the year 2022.

1.1.2. Summary of information reported in the SEF tables

The total amount of AAUs in the party holding account at the end 2022 was 51,056,976.

1.1.3. Discrepancies and notifications

Information about discrepant transactions is included in SIAR report Appendix 2 and 3. Neither discrepancies nor notifications occurred in 2022. No actions were necessary to be taken as no discrepancies occurred during the reported period.

1.1.4. Publicly accessible information

Publicly accessible information is available on the webpage of Ministry of the Environment, under information about Kyoto protocol (https://envir.ee/kliima/kliima/rahvusvaheline-aruandlus#kyoto-protokolli-ala) as well as on the European Union registry webpage (https://ets-registry.webgate.ec.europa.eu/euregistry/EE/public/reports/publicReports.xhtml).

According to Annex to the Decision 13/CMP.1, II Registry requirements, point E the required public information includes:

- account information;
- JI projects in Estonia;
- information about unit holdings and transactions;
- information about entities authorized to hold units.

Public information required by Commission regulation (EC) No 389/2013 (in addition to the above-mentioned public information) is also available on the webpage of Estonian Environmental Board, under information about greenhouse gases (https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid as well as on the European Union Transaction Log webpage (http://ec.europa.eu/environment/ets/).

It includes:

- information about installations and permit details;
- information about verified emissions, surrenders and compliance status of installations;

- National allocation plan for Estonia and NIMs list.

1.1.5. Calculation of the commitment period reserve (CPR)

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.
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:

1. 90% of a Party's assigned amount

90% from 51 056 976 = 45 951 278.4 tonnes of CO_2 equivalent.

2. 100% of most recently reviewed inventory multiplied by 8 (Estonia has interpreted the 'most recently reviewed inventory' as the 2020 inventory submission and has used the the 15th of April 2020 submission in the calculations. FCCC/ARR/2020/EST)

19 974 140*8 = 159 793 120 tonnes of CO_2 equivalent.
Consequently, the commitment period reserve for Estonia is **45 951 278.4** tonnes of CO_2 equivalent.

1.2. INFORMATION ON CHANGES IN NATIONAL REGISTRY

The following changes to the national registry of Estonia have occurred in 2022.

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 khgregister@keskkonnaamet.ee tel. +372 5694 4935
15/CMP.1 annex II.E paragraph 32. (b) Change regarding cooperation arrangement	No change of cooperation arrangement occurred during the reported period.
15/CMP.1 annex II.E paragraph 32. (c) Change to database structure or the capacity of national registry	There has been 3 new EUCR releases (versions 13.6.1, 13.7.1 and 13.8.2) after version 13.5.2 (the production version at the time of the last (previously 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 13.6.1, 13.7.1 and 13.8.2 compared with version 13.5.2 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.
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.

Reporting Item	Description
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.

Annex 5. Standard Independent Assessment Report

NATIONAL REGISTRY OF ESTONIA

STANDARD INDEPENDENT ASSESSMENT REPORT

Submission to the UNFCCC secretariat

2022

Tallinn 2023

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 2022 (hereinafter as SIAR) and other information included in this report.

In this document, 2022 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_2022_2_1.xls". The Standard Electronic Format (hereinafter as SEF) reporting tables relevant for the second commitment period for 2022 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 2022. Also, the SEF includes information on transfers of the units during the year 2022.

The total amount of AAUs in the party holding account at the end 2022 was 51 056 976.

SEF report will be also included in Estonian Standard Independent Assessment Report (hereinafter as SIAR) 2022 report as Appendix 1 (as SIAR Report R-1).

Annual Submission Item	Reporting Guidance
15/CMP.1 annex I.E paragraph 11: Standard electronic format (SEF)	The Standard Electronic Format report for 2022 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 1990–2021. National Inventory Report under the UNFCCC and the Kyoto Protocol. Common Reporting Formats (CRF) 1990–2021. Tallinn 2023" (hereinafter as NIR) in Annex 4 "Summary of information reported in the SEF tables" and the report is a part of NIR as Annex 5. This SEF report is referenced as report R-1 in this document. See Appendix 1 for more details related to the SEF report.
15/CMP.1 annex I.E paragraph 12: List of discrepant transactions	Information of discrepant transactions is included in the NIR in Annex 4 "Discrepancies and notifications" and the report is a part of NIR as Annex 5. 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. No discrepancies and no notifications occurred in 2022.
15/CMP.1 annex I.E paragraph 13 & 14: List of CDM notifications	Information on CDM notifications is included in the NIR in Annex 4 "Discrepancies and notifications" and report is a part of NIR as Annex 5. 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. No CDM notifications occurred in 2022.
15/CMP.1 annex I.E paragraph 15: List of non-replacements	Information on non-replacements is included in the NIR as Annex 4 "Discrepancies and notifications" and report is a part of NIR as Annex 5. 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. No non-replacements occurred in 2022.
15/CMP.1 annex I.E paragraph 16: List of invalid units	Information of invalid units is included in the NIR as Annex 4 "Discrepancies and notifications" and report is a part of NIR as Annex 5. 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. No invalid units exist as at 31.12.2022.
15/CMP.1 annex I.E paragraph 17 Actions and changes to address discrepancies	No actions were taken or changes made to address discrepancies for the period under review. No change occurred during the reported period.

Annual Submission Item	Reporting Guidance
15/CMP.1 annex I.E Publicly accessible information	Information regarding the NR is publicly available to users via MoE web page https://envir.ee/kliima/kliima/rahvusvaheline-aruandlus#kyoto-protokolli-ala and via EEB web page https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid. 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: 1. account information (information on paragraph 45 of annex to the decision 13/CMP.1); 2. JI projects in Estonia (information on paragraph 46 of annex to the decision 13/CMP.1); 3. information about unit holdings and transactions (information on paragraph 47 of annex to the decision 13/CMP.1); 4. information about Entities Authorized to hold units (information on paragraph 48 of annex to the decision 13/CMP.1). This information is currently available at: 1) **Paragraph 45 of annex to the decision 13/CMP.1** (account information). This information is available to users via user interface of the MoE https://envir.ee/kliima/kliima/rahvusvaheline-aruandlus#kyoto-protokolli-ala and via EUTL http://ec.europa.eu/environment/ets/ (selecting from left hand menu "ETS" – "Accounts" – "select Estonia" – "Search"); 2) **Paragraph 46 of annex to the decision 13/CMP.1** (information of JI projects in Estonia). This information is available to users via user interface of the web page of the Ministry of the Environment https://envir.ee/uhisrakendus 3) **Paragraph 47 of annex to the decision 13/CMP.1** (information about unit holdings and transactions). Following information is publicly accessible via user interface of the EUTL http://ec.europa.eu/environment/ets/ (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". 4) **Paragraph 48 of annex to the decision 13/CMP.1** (information about Entities Authorised to hold units under its responsibility). 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

Annual Submission Item	Reporting Guidance
	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: https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid#teine-kauplemisperio. Public information required by Commission regulation (EC) No 389/2013 (in addition to the above-mentioned public information): 1) Installation and permit details – information about installations and permit details is available to users via user interface of EEB https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid and via EUTL http://ec.europa.eu/environment/ets/welcome.do?languageCode=en selecting from left hand menu "ETS" – "Operator Holding Accounts" - "Search" – "selecting Estonia"; 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: https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid and from the interface of the EUTL http://ec.europa.eu/environment/ets/ selecting from left hand menu "ETS" – "Allocation/Compliance" - "Search" - selecting Estonia; 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 https://keskkonnaamet.ee/keskkonnakasutus-keskkonnatasu/ohk-ja-kliima/kasvuhoonegaasid#kolmas-kauplemisperi and via EUTL web page http://ec.europa.eu/environment/ets/ selecting from left hand menu "NAP-info" - "Search" - selecting Estonia.
15/CMP.1 annex I.E paragraph 18 CPR Calculation	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. For the purposes of the joint fulfilment, the commitment period reserve applies to the EU, its Member States and Iceland individually.

Annual Submission Item	Reporting Guidance
	Both methods to calculate Estonia's commitment period reserve are presented hereinafter: 1. 90% of a Party's assigned amount 90% from 51 056 976 = 45 951 278.4 tonnes of CO_2 equivalent. 1. 100% of most recently reviewed inventory multiplied by 8 (Estonia has interpreted the 'most recently reviewed inventory' as the 2020 inventory submission[14]) 19 974 140*8 = 159 793 120 tonnes of CO_2 equivalent. Consequently, the commitment period reserve for Estonia is **45 951 279** tonnes of CO_2 equivalent.

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;

[14] FCCC/ARR/2020/EST- No recalculations made during the Review, 2020 inventory GHG emissions were used.

(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.

Please see NIR Annex 4 chapter 1.2. INFORMATION ON CHANGES IN NATIONAL REGISTRY to see changes to the national registry of Estonia occurred in 2022.

3. PART III. APPENDIXES
Appendix 1 – Report R-1: SEF_2022

Party	Estonia
Submission year	2023
Reported year	2022
Commitment period	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	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	lCER cancellation account for expiry						NO
13	lCER cancellation account for reversal of storage						NO
14	lCER cancellation account for non-submission of certification report						NO
15	tCER replacement account for expiry	NO	NO	NO	NO	NO	
16	lCER replacement account for expiry	NO	NO	NO	NO		
17	lCER replacement account for reversal of storage	NO	NO	NO	NO		NO
18	lCER replacement account for non-submission of certification report	NO	NO	NO	NO		NO
	Total	51 056 976	NO	NO	NO	NO	NO

Party	Estonia
Submission year	2023
Reported year	2022
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
	Article 6 issuance and conversion												
1	Party-verified projects		NO					NO		NO			
2	Independently verified projects		NO					NO		NO			
	Article 3.3 and 3.4 issuance or cancellation												
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		
	Article 12 afforestation and reforestation												
10	Replacement of expired tCERs							NO	NO	NO	NO	NO	
11	Replacement of expired lCERs							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
	Other cancelation												
16	Voluntary cancellation							NO	NO	NO	NO	NO	NO
17	Article 3.1 ter and quater ambition increase cancellation							NO					
	Sub-total		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					
	Total	NO	NO	NO	NO	NO	NO

Party	Estonia
Submission year	2023
Reported year	2022
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

Party	Estonia
Submission year	2023
Reported year	2022
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	lCERs	CERs	AAUs	ERUs	RMUs	CERs	tCERs	lCERs	AAUs	ERUs	RMUs	CERs	tCERs	lCERs
	Temporary CERs															
1	Expired in retirement and replacement accounts	NO			NO	NO	NO	NO	NO							
2	Expired in holding accounts	NO													NO	
	Long-term CERs															
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
	Carbon Capture and Storage CERs															
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		
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Party	Estonia
Submission year	2023
Reported year	2022
Commitment period	2

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	lCERs
1	Party holding accounts	51 056 976	2 127 093	NO	424 474	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	8 862 661					
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	lCER cancellation account for expiry						NO
13	lCER cancellation account for reversal of storage						NO
14	lCER cancellation account for non-submission of certification report						NO
15	tCER replacement account for expiry	NO	NO	NO	NO	NO	
16	lCER replacement account for expiry	NO	NO	NO	NO		
17	lCER replacement account for reversal of storage	NO	NO	NO	NO		NO
18	lCER replacement account for non-submission of certification report	NO	NO	NO	NO		NO
	Total	59 919 637	2 127 093	NO	424 474	NO	NO

Party	Estonia
Submission year	2023
Reported year	2022
Commitment period	2

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

		Additions						Subtractions					
		Unit type						Unit type					
		AAUs	ERUs	RMUs	CERs	tCERs	lCERs	AAUs	ERUs	RMUs	CERs	tCERs	lCERs
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		2 127 093		424 474				NO		NO		
7	Carry-over to PPSR	8 862 661						NO					
	Total	59 919 637	2 127 093		424 474			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	lCERs	AAUs	ERUs	RMUs	CERs	tCERs	lCERs
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
	Total	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					
	Year	AAUs	ERUs	RMUs	CERs	tCERs	lCERs	AAUs	ERUs	RMUs	CERs	tCERs	lCERs
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					
	Total	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					
	Year	tCERs	lCERs	CERs	AAUs	ERUs	RMUs	CERs	tCERs	lCERs	AAUs	ERUs	RMUs	CERs	tCERs	lCERs
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
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Table 5 (e). Summary information on retirement

		Retirement					
		Unit type					
	Year	AAUs	ERUs	RMUs	CERs	tCERs	lCERs
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
	Total	NO	NO	NO	NO	NO	NO

Party	Estonia
Submission year	2023
Reported year	2022
Commitment period	2

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 where 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.