



LITHUANIA'S NATIONAL INVENTORY REPORT 2022

GREENHOUSE GAS EMISSIONS 1990-2020

ANNEXES

VILNIUS, 2022

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ANNEX I. Approach 1 and Approach 2 key categories analysis

Approach 1 Level Assessment for 1990

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment</i>	<i>Cumulative total</i>
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO ₂	-6,889.99	0.11	0.11
1.A.1.a Public electricity and heat production - Liquid Fuels	CO ₂	6,021.25	0.10	0.21
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO ₂	5,796.59	0.10	0.31
1.A.3.b Road transportation	CO ₂	5,247.15	0.09	0.39
3.A.1 Enteric Fermentation - Cattle	CH ₄	4,146.14	0.07	0.46
1.A.2 Manufacturing industries and construction-Liquid fuels	CO ₂	3,873.72	0.06	0.53
1.A.4 Other sectors-Solid fuels	CO ₂	2,760.55	0.05	0.57
1.A.4 Other sectors-Liquid fuels	CO ₂	2,736.38	0.04	0.62
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO ₂	2,045.42	0.03	0.65
2.A.1 Cement Production	CO ₂	1,668.07	0.03	0.68
1.A.1.b Petroleum refining - Liquid Fuels	CO ₂	1,509.64	0.02	0.70
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	1,443.18	0.02	0.73
1.A.4 Other sectors-Gaseous fuels	CO ₂	1,379.27	0.02	0.75
2.B.1 Ammonia Production	CO ₂	1,253.68	0.02	0.77
5.A Solid Waste Disposal	CH ₄	1,028.83	0.02	0.79
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	992.77	0.02	0.80
2.B.2 Nitric Acid Production	N ₂ O	893.01	0.01	0.82
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	CO ₂	858.08	0.01	0.83
4.A.2 Land converted to forest land - carbon stock change in biomass	CO ₂	-600.70	0.01	0.84
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	532.76	0.01	0.85
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO ₂	517.32	0.01	0.86
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	CO ₂	-474.03	0.01	0.87
5.D Wastewater Treatment and Discharge	CH ₄	422.99	0.01	0.87
3.D.1.3 Direct N ₂ O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	419.85	0.01	0.88
3.D.2.2 Indirect N ₂ O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	414.68	0.01	0.89
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	CO ₂	-412.62	0.01	0.89
4.C.2 Land converted to grassland - carbon stock change in biomass	CO ₂	-388.52	0.01	0.90
3.D.1.2 Direct N ₂ O Emissions From Managed Soils - Organic N Fertilizers	N ₂ O	361.60	0.01	0.91

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment</i>	<i>Cumulative total</i>
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	353.40	0.01	0.91
1.A.3.c Railways	CO ₂	349.97	0.01	0.92
3.B.1.3 Manure Management - Swine	CH ₄	329.25	0.01	0.92
3.D.1.4 Direct N ₂ O Emissions From Managed Soils - Crop Residues	N ₂ O	268.18	0.00	0.93
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH ₄	260.55	0.00	0.93
4.G Harvested wood products	CO ₂	-252.55	0.00	0.94
3.B.1.1 Manure Management - Cattle	CH ₄	251.55	0.00	0.94
3.B.2 Manure Management - Indirect N ₂ O Emissions	N ₂ O	247.61	0.00	0.94
2.A.4 Other process use of carbonates	CO ₂	239.53	0.00	0.95
2.A.2 Lime Production	CO ₂	210.27	0.00	0.95
3.B.2 Manure Management - Cattle	N ₂ O	205.85	0.00	0.95
1.A.1. Energy industries-Solid fuels	CO ₂	174.05	0.00	0.96
3.D.2.1 Indirect N ₂ O Emissions From Managed Soils - Atmospheric deposition	N ₂ O	172.11	0.00	0.96
1.A.2 Manufacturing industries and construction-Solid fuels	CO ₂	171.63	0.00	0.96
1.A.4 Other sectors-Liquid fuels	N ₂ O	159.35	0.00	0.97
4.A.2 Land converted to forest land - net carbon stock change in mineral soils	CO ₂	-150.57	0.00	0.97
.....				
Total		42,311.3		

Approach 1 Level Assessment for 1990 using a subset (LULUCF was excluded from analysis)

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment</i>	<i>Cumulative total</i>
1.A.1.a Public electricity and heat production - Liquid Fuels	CO ₂	6,021.25	0.13	0.13
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO ₂	5,796.59	0.12	0.25
1.A.3.b Road transportation	CO ₂	5,247.15	0.11	0.36
3.A.1 Enteric Fermentation - Cattle	CH ₄	4,146.14	0.09	0.44
1.A.2 Manufacturing industries and construction- Liquid fuels	CO ₂	3,873.72	0.08	0.52
1.A.4 Other sectors-Solid fuels	CO ₂	2,760.55	0.06	0.58
1.A.4 Other sectors-Liquid fuels	CO ₂	2,736.38	0.06	0.64
1.A.2 Manufacturing industries and construction- Gaseous fuels	CO ₂	2,045.42	0.04	0.68
2.A.1 Cement Production	CO ₂	1,668.07	0.03	0.72
1.A.1.b Petroleum refining - Liquid Fuels	CO ₂	1,509.64	0.03	0.75
1.A.4 Other sectors-Gaseous fuels	CO ₂	1,379.27	0.03	0.78
2.B.1 Ammonia Production	CO ₂	1,253.68	0.03	0.80
5.A Solid Waste Disposal	CH ₄	1,028.83	0.02	0.82
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	992.77	0.02	0.85
2.B.2 Nitric Acid Production	N ₂ O	893.01	0.02	0.86
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	532.76	0.01	0.88
5.D Wastewater Treatment and Discharge	CH ₄	422.99	0.01	0.88
3.D.1.3 Direct N ₂ O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	419.85	0.01	0.89
3.D.2.2 Indirect N ₂ O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	414.68	0.01	0.90
3.D.1.2 Direct N ₂ O Emissions From Managed Soils - Organic N Fertilizers	N ₂ O	361.60	0.01	0.91
1.A.3.c Railways	CO ₂	349.97	0.01	0.92
3.B.1.3 Manure Management - Swine	CH ₄	329.25	0.01	0.92
3.D.1.4 Direct N ₂ O Emissions From Managed Soils - Crop Residues	N ₂ O	268.18	0.01	0.93
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH ₄	260.55	0.01	0.93
3.B.1.1 Manure Management - Cattle	CH ₄	251.55	0.01	0.94
3.B.2 Manure Management - Indirect N ₂ O Emissions	N ₂ O	247.61	0.01	0.94
2.A.4 Other process use of carbonates	CO ₂	239.53	0.01	0.95
2.A.2 Lime Production	CO ₂	210.27	0.00	0.95
3.B.2 Manure Management - Cattle	N ₂ O	205.85	0.00	0.96
1.A.1. Energy industries-Solid fuels	CO ₂	174.05	0.00	0.96
3.D.2.1 Indirect N ₂ O Emissions From Managed Soils - Atmospheric deposition	N ₂ O	172.11	0.00	0.97
.....				
Total		47,860.5		

Approach 1 Level Assessment for 2020

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment</i>	<i>Cumulative total</i>
1.A.3.b Road transportation	CO ₂	5,854.41	0.17	0.17
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO ₂	-4,998.73	0.15	0.32
2.B.1 Ammonia Production	CO ₂	1,783.05	0.05	0.37
3.A.1 Enteric Fermentation - Cattle	CH ₄	1,374.69	0.04	0.41
4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils	CO ₂	-1,114.70	0.03	0.45
1.A.1.b Petroleum refining - Liquid Fuels	CO ₂	1,063.51	0.03	0.48
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	1,042.08	0.03	0.51
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	931.89	0.03	0.54
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO ₂	908.52	0.03	0.56
4.A.2 Land converted to forest land - carbon stock change in biomass	CO ₂	-829.88	0.02	0.59
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO ₂	809.77	0.02	0.61
4.G Harvested wood products	CO ₂	-783.96	0.02	0.63
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	CO ₂	-770.71	0.02	0.66
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	CO ₂	-679.28	0.02	0.68
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO ₂	672.44	0.02	0.70
1.A.4 Other sectors-Gaseous fuels	CO ₂	611.67	0.02	0.71
5.A Solid Waste Disposal	CH ₄	563.04	0.02	0.73
2.A.1 Cement Production	CO ₂	556.68	0.02	0.75
4.E.2 Land converted to settlements	CO ₂	548.01	0.02	0.76
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	CO ₂	532.70	0.02	0.78
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	495.22	0.01	0.79
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	454.27	0.01	0.81
3.D.1.4 Direct N ₂ O Emissions From Managed Soils - Crop Residues	N ₂ O	406.39	0.01	0.82
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	382.32	0.01	0.83
1.A.2 Manufacturing industries and construction-Solid fuels	CO ₂	360.03	0.01	0.84
3.D.2.2 Indirect N ₂ O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	351.38	0.01	0.85
1.A.4 Other sectors-Liquid fuels	CO ₂	331.48	0.01	0.86
1.A.1 Energy industries-Other fossil fuels	CO ₂	294.57	0.01	0.87
4.B.2 Land converted to cropland- carbon stock change in biomass	CO ₂	260.13	0.01	0.88
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH ₄	248.55	0.01	0.88

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment</i>	<i>Cumulative total</i>
4.A.2 Land converted to forest land - net carbon stock change in mineral soils	CO ₂	-236.09	0.01	0.89
1.B.2 Oil, natural gas and other emissions from energy production	CO ₂	181.61	0.01	0.90
4.D.2 Land converted to wetlands	CO ₂	179.20	0.01	0.90
1.A.4 Other sectors-Solid fuels	CO ₂	177.84	0.01	0.91
1.A.3.c Railways	CO ₂	161.80	0.00	0.91
1.A.1.b Petroleum refining - Gaseous Fuels	CO ₂	158.77	0.00	0.92
3.B.1.1 Manure Management - Cattle	CH ₄	155.29	0.00	0.92
2.B.2 Nitric Acid Production	N ₂ O	154.88	0.00	0.93
3.D.1.2 Direct N ₂ O Emissions From Managed Soils - Organic N Fertilizers	N ₂ O	151.83	0.00	0.93
1.A.4 Other sectors-Biomass	CH ₄	138.51	0.00	0.93
3.D.1.3 Direct N ₂ O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	136.20	0.00	0.94
4.B.2 Land converted to cropland- net carbon stock change in dead organic matter	CO ₂	123.40	0.00	0.94
1.A.2 Manufacturing industries and construction-Liquid fuels	CO ₂	118.46	0.00	0.95
5.D Wastewater Treatment and Discharge	CH ₄	118.00	0.00	0.95
3.D.2.1 Indirect N ₂ O Emissions From Managed Soils - Atmospheric deposition	N ₂ O	98.21	0.00	0.95
3.B.2 Manure Management - Indirect N ₂ O Emissions	N ₂ O	83.92	0.00	0.95
3.B.2 Manure Management - Cattle	N ₂ O	79.42	0.00	0.96
4.C.2 Land converted to grassland - net carbon stock change in dead organic matter	CO ₂	-79.03	0.00	0.96
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Total		14,698.9		

Approach 1 Level Assessment for 2020 using a subset (LULUCF was excluded from analysis)

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment</i>	<i>Cumulative total</i>
1.A.3.b Road transportation	CO ₂	5,854.41	0.29	0.29
2.B.1 Ammonia Production	CO ₂	1,783.05	0.09	0.38
3.A.1 Enteric Fermentation - Cattle	CH ₄	1,374.69	0.07	0.45
1.A.1.b Petroleum refining - Liquid Fuels	CO ₂	1,063.51	0.05	0.50
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	931.89	0.05	0.55
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO ₂	908.52	0.05	0.59
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO ₂	672.44	0.03	0.62
1.A.4 Other sectors-Gaseous fuels	CO ₂	611.67	0.03	0.65
5.A Solid Waste Disposal	CH ₄	563.04	0.03	0.68
2.A.1 Cement Production	CO ₂	556.68	0.03	0.71
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	495.22	0.02	0.74
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	454.27	0.02	0.76
3.D.1.4 Direct N ₂ O Emissions From Managed Soils - Crop Residues	N ₂ O	406.39	0.02	0.78
1.A.2 Manufacturing industries and construction-Solid fuels	CO ₂	360.03	0.02	0.80
3.D.2.2 Indirect N ₂ O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	351.38	0.02	0.81
1.A.4 Other sectors-Liquid fuels	CO ₂	331.48	0.02	0.83
1.A.1 Energy industries-Other fossil fuels	CO ₂	294.57	0.01	0.84
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH ₄	248.55	0.01	0.86
1.B.2 Oil, natural gas and other emissions from energy production	CO ₂	181.61	0.01	0.87
1.A.4 Other sectors-Solid fuels	CO ₂	177.84	0.01	0.87
1.A.3.c Railways	CO ₂	161.80	0.01	0.88
1.A.1.b Petroleum refining - Gaseous Fuels	CO ₂	158.77	0.01	0.89
3.B.1.1 Manure Management - Cattle	CH ₄	155.29	0.01	0.90
2.B.2 Nitric Acid Production	N ₂ O	154.88	0.01	0.91
3.D.1.2 Direct N ₂ O Emissions From Managed Soils - Organic N Fertilizers	N ₂ O	151.83	0.01	0.91
1.A.4 Other sectors-Biomass	CH ₄	138.51	0.01	0.92
3.D.1.3 Direct N ₂ O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	136.20	0.01	0.93
1.A.2 Manufacturing industries and construction-Liquid fuels	CO ₂	118.46	0.01	0.93
5.D Wastewater Treatment and Discharge	CH ₄	118.00	0.01	0.94
3.D.2.1 Indirect N ₂ O Emissions From Managed Soils - Atmospheric deposition	N ₂ O	98.21	0.00	0.94
3.B.2 Manure Management - Indirect N ₂ O Emissions	N ₂ O	83.92	0.00	0.95
3.B.2 Manure Management - Cattle	N ₂ O	79.42	0.00	0.95
1.A.1.a Public electricity and heat production - Liquid Fuels	CO ₂	73.07	0.00	0.96
3.A. Enteric Fermentation - Others	CH ₄	70.71	0.00	0.96

5.B Biological Treatment of Solid Waste	CH ₄	65.04	0.00	0.96
1.A.4 Other sectors-Peat	CO ₂	63.02	0.00	0.96
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Total		20,155.8		

Approach 1 Trend Assessment for 2020

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2020 kt CO₂ eq.</i>	<i>Trend assessment</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO ₂	-6,889.99	-4,998.73	0.08	0.17	0.17
1.A.1.a Public electricity and heat production - Liquid Fuels	CO ₂	6,021.25	73.07	0.05	0.11	0.27
1.A.3.b Road transportation	CO ₂	5,247.15	5,854.41	0.05	0.10	0.37
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO ₂	5,796.59	908.52	0.04	0.08	0.45
1.A.2 Manufacturing industries and construction-Liquid fuels	CO ₂	3,873.72	118.46	0.03	0.07	0.51
1.A.4 Other sectors-Solid fuels	CO ₂	2,760.55	177.84	0.02	0.04	0.56
1.A.4 Other sectors-Liquid fuels	CO ₂	2,736.38	331.48	0.02	0.04	0.60
4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils	CO ₂	0.00	-1,114.70	0.02	0.04	0.63
2.B.1 Ammonia Production	CO ₂	1,253.68	1,783.05	0.02	0.04	0.67
3.A.1 Enteric Fermentation - Cattle	CH ₄	4,146.14	1,374.69	0.01	0.03	0.70
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO ₂	517.32	809.77	0.01	0.02	0.72
4.E.2 Land converted to settlements	CO ₂	38.49	548.01	0.01	0.02	0.74
4.C.2 Land converted to grassland - carbon stock change in biomass	CO ₂	-388.52	-57.95	0.01	0.02	0.75
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	0.00	454.27	0.01	0.02	0.77
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO ₂	2,045.42	672.44	0.01	0.01	0.78
4.G Harvested wood products	CO ₂	-252.55	-783.96	0.01	0.01	0.80
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	992.77	931.89	0.01	0.01	0.81
2.A.1 Cement Production	CO ₂	1,668.07	556.68	0.01	0.01	0.82
2.B.2 Nitric Acid Production	N ₂ O	893.01	154.88	0.01	0.01	0.83
1.A.1 Energy industries-Other fossil fuels	CO ₂	0.00	294.57	0.00	0.01	0.84
1.A.2 Manufacturing industries and construction-Solid fuels	CO ₂	171.63	360.03	0.00	0.01	0.85
3.D.1.4 Direct N ₂ O Emissions From Managed Soils - Crop Residues	N ₂ O	268.18	406.39	0.00	0.01	0.86
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	1,443.18	1,042.08	0.00	0.01	0.87
1.A.1.b Petroleum refining - Liquid Fuels	CO ₂	1,509.64	1,063.51	0.00	0.01	0.88
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	532.76	495.22	0.00	0.01	0.88
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	353.40	382.32	0.00	0.01	0.89
4.B.2 Land converted to cropland- carbon stock change in biomass	CO ₂	138.74	260.13	0.00	0.01	0.89
1.B.2 Oil, natural gas and other emissions from energy production	CO ₂	23.88	181.61	0.00	0.01	0.90
1.A.1.b Petroleum refining - Gaseous Fuels	CO ₂	0.00	158.77	0.00	0.01	0.91
4.D.2 Land converted to wetlands	CO ₂	63.13	179.20	0.00	0.00	0.91

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2020 kt CO₂ eq.</i>	<i>Trend assessment</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
1.A.4 Other sectors-Gaseous fuels	CO ₂	1,379.27	611.67	0.00	0.00	0.91
3.B.1.3 Manure Management - Swine	CH ₄	329.25	49.46	0.00	0.00	0.92
3.D.2.2 Indirect N ₂ O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	414.68	351.38	0.00	0.00	0.92
2.A.4 Other process use of carbonates	CO ₂	239.53	13.38	0.00	0.00	0.93
5.D Wastewater Treatment and Discharge	CH ₄	422.99	118.00	0.00	0.00	0.93
2.A.2 Lime Production	CO ₂	210.27	1.92	0.00	0.00	0.93
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH ₄	260.55	248.55	0.00	0.00	0.94
1.A.4 Other sectors-Biomass	CH ₄	70.28	138.51	0.00	0.00	0.94
3.D.1.3 Direct N ₂ O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	419.85	136.20	0.00	0.00	0.94
1.A.1. Energy industries-Solid fuels	CO ₂	174.05	5.33	0.00	0.00	0.95
4.B.2 Land converted to cropland- net carbon stock change in dead organic matter	CO ₂	65.28	123.40	0.00	0.00	0.95
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	CO ₂	-474.03	-770.71	0.00	0.00	0.95
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	CO ₂	-412.62	-679.28	0.00	0.00	0.96
1.A.4 Other sectors-Liquid fuels	N ₂ O	159.35	12.99	0.00	0.00	0.96
5.B Biological Treatment of Solid Waste	CH ₄	0.20	65.04	0.00	0.00	0.96
.....						
Total		42,311.3	14,698.94	0.49	1.00	

Approach 1 Trend Assessment for 2020 using a subset (LULUCF was excluded from analysis)

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2020 kt CO₂ eq.</i>	<i>Trend assessment</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
1.A.3.b Road transportation	CO ₂	5,247.15	5854.41	0.08	0.20	0.20
1.A.1.a Public electricity and heat production - Liquid Fuels	CO ₂	6,021.25	73.07	0.05	0.14	0.34
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO ₂	5,796.59	908.52	0.03	0.09	0.43
1.A.2 Manufacturing industries and construction-Liquid fuels	CO ₂	3,873.72	118.46	0.03	0.08	0.51
2.B.1 Ammonia Production	CO ₂	1,253.68	1783.05	0.03	0.07	0.58
1.A.4 Other sectors-Solid fuels	CO ₂	2,760.55	177.84	0.02	0.05	0.64
1.A.4 Other sectors-Liquid fuels	CO ₂	2,736.38	331.48	0.02	0.05	0.68
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	992.77	931.89	0.01	0.03	0.71
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	0.00	454.27	0.01	0.03	0.74
1.A.1.b Petroleum refining - Liquid Fuels	CO ₂	1,509.64	1063.51	0.01	0.02	0.76
3.A.1 Enteric Fermentation - Cattle	CH ₄	4,146.14	1374.69	0.01	0.02	0.78
1.A.1 Energy industries-Other fossil fuels	CO ₂	0.00	294.57	0.01	0.02	0.80
3.D.1.4 Direct N ₂ O Emissions From Managed Soils - Crop Residues	N ₂ O	268.18	406.39	0.01	0.02	0.81
1.A.2 Manufacturing industries and construction-Solid fuels	CO ₂	171.63	360.03	0.01	0.02	0.83
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	532.76	495.22	0.01	0.02	0.84
2.B.2 Nitric Acid Production	N ₂ O	893.01	154.88	0.00	0.01	0.86
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO ₂	2,045.42	672.44	0.00	0.01	0.87
3.D.2.2 Indirect N ₂ O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	414.68	351.38	0.00	0.01	0.88
1.B.2 Oil, natural gas and other emissions from energy production	CO ₂	23.88	181.61	0.00	0.01	0.89
1.A.1.b Petroleum refining - Gaseous Fuels	CO ₂	0.00	158.77	0.00	0.01	0.90
2.A.1 Cement Production	CO ₂	1,668.07	556.68	0.00	0.01	0.90
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH ₄	260.55	248.55	0.00	0.01	0.91
5.A Solid Waste Disposal	CH ₄	1,028.83	563.04	0.00	0.01	0.92
1.A.4 Other sectors-Biomass	CH ₄	70.28	138.51	0.00	0.01	0.92
3.B.1.3 Manure Management - Swine	CH ₄	329.25	49.46	0.00	0.00	0.93
2.A.4 Other process use of carbonates	CO ₂	239.53	13.38	0.00	0.00	0.93
2.A.2 Lime Production	CO ₂	210.27	1.92	0.00	0.00	0.94
1.A.1. Energy industries-Solid fuels	CO ₂	174.05	5.33	0.00	0.00	0.94
5.B Biological Treatment of Solid Waste	CH ₄	0.20	65.04	0.00	0.00	0.95
5.D Wastewater Treatment and Discharge	CH ₄	422.99	118.00	0.00	0.00	0.95
1.A.4 Other sectors-Liquid fuels	N ₂ O	159.35	12.99	0.00	0.00	0.95
1.A.1.c Manufacture of solid fuels and other energy industries - Gaseous fuels	CO ₂	0.00	52.79	0.00	0.00	0.96

1.A.4 Other sectors-Peat	CO ₂	27.13	63.02	0.00	0.00	0.96
3.B.1.1 Manure Management - Cattle	CH ₄	251.55	155.29	0.00	0.00	0.96
1.A.4 Other sectors-Solid fuels	CH ₄	128.56	8.30	0.00	0.00	0.96
.....						
Total		47,860.5	20,155.8	0.37	1.00	

Approach 2 Level Assessment for 1990

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment with uncertainty</i>	<i>Cumulative total</i>
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO ₂	-6,889.99	0.05	0.21
5.A Solid Waste Disposal	CH ₄	1,028.83	0.02	0.29
3.A.1 Enteric Fermentation - Cattle	CH ₄	4,146.14	0.02	0.36
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO ₂	517.32	0.02	0.42
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	1,443.18	0.01	0.48
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	992.77	0.01	0.53
3.D.2.2 Indirect N ₂ O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	414.68	0.01	0.56
3.B.2 Manure Management - Indirect N ₂ O Emissions	N ₂ O	247.61	0.01	0.60
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	532.76	0.01	0.62
5.D Wastewater Treatment and Discharge	CH ₄	422.99	0.01	0.65
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	CO ₂	858.08	0.01	0.67
3.D.1.3 Direct N ₂ O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	419.85	0.01	0.69
3.D.1.2 Direct N ₂ O Emissions From Managed Soils - Organic N Fertilizers	N ₂ O	361.60	0.00	0.71
4.A.2 Land converted to forest land - carbon stock change in biomass	CO ₂	-600.70	0.00	0.73
3.D.2.1 Indirect N ₂ O Emissions From Managed Soils - Atmospheric deposition	N ₂ O	172.11	0.00	0.75
3.B.2 Manure Management - Cattle	N ₂ O	205.85	0.00	0.76
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	CO ₂	-474.03	0.00	0.78
3.D.1.4 Direct N ₂ O Emissions From Managed Soils - Crop Residues	N ₂ O	268.18	0.00	0.79
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	353.40	0.00	0.80
1.A.1.a Public electricity and heat production - Liquid Fuels	CO ₂	6,021.25	0.00	0.81
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO ₂	5,796.59	0.00	0.82
1.A.4 Other sectors-Solid fuels	CO ₂	2,760.55	0.00	0.83
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	CO ₂	-412.62	0.00	0.84
4.G Harvested wood products	CO ₂	-252.55	0.00	0.85
4.C.2 Land converted to grassland - carbon stock change in biomass	CO ₂	-388.52	0.00	0.86

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment with uncertainty</i>	<i>Cumulative total</i>
1.A.3.b Road transportation	CO ₂	5,247.15	0.00	0.87
3.B.2 Manure Management - Other	N ₂ O	127.49	0.00	0.88
4.D.2 Land converted to wetlands	CO ₂	63.13	0.00	0.89
1.A.4 Other sectors-Biomass	CH ₄	70.28	0.00	0.90
1.A.2 Manufacturing industries and construction-Liquid fuels	CO ₂	3,873.72	0.00	0.90
1.A.4 Other sectors-Liquid fuels	CO ₂	2,736.38	0.00	0.91
2.B.2 Nitric Acid Production	N ₂ O	893.01	0.00	0.91
.....				
<i>Total</i>		42,311.3		

Approach 2 Level Assessment for 1990 using a subset (LULUCF was excluded from analysis)

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment with uncertainty</i>	<i>Cumulative total</i>
5.A Solid Waste Disposal	CH ₄	1,028.83	0.03	0.15
3.A.1 Enteric Fermentation - Cattle	CH ₄	4,146.14	0.02	0.28
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	992.77	0.02	0.37
3.D.2.2 Indirect N ₂ O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	414.68	0.01	0.44
3.B.2 Manure Management - Indirect N ₂ O Emissions	N ₂ O	247.61	0.01	0.50
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	532.76	0.01	0.55
5.D Wastewater Treatment and Discharge	CH ₄	422.99	0.01	0.59
3.D.1.3 Direct N ₂ O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	419.85	0.01	0.63
3.D.1.2 Direct N ₂ O Emissions From Managed Soils - Organic N Fertilizers	N ₂ O	361.60	0.01	0.67
3.D.2.1 Indirect N ₂ O Emissions From Managed Soils - Atmospheric deposition	N ₂ O	172.11	0.01	0.70
3.B.2 Manure Management - Cattle	N ₂ O	205.85	0.00	0.72
3.D.1.4 Direct N ₂ O Emissions From Managed Soils - Crop Residues	N ₂ O	268.18	0.00	0.75
1.A.1.a Public electricity and heat production - Liquid Fuels	CO ₂	6,021.25	0.00	0.77
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO ₂	5,796.59	0.00	0.79
1.A.4 Other sectors-Solid fuels	CO ₂	2,760.55	0.00	0.81
1.A.3.b Road transportation	CO ₂	5,247.15	0.00	0.82
3.B.2 Manure Management - Other	N ₂ O	127.49	0.00	0.84
1.A.4 Other sectors-Biomass	CH ₄	70.28	0.00	0.85
1.A.2 Manufacturing industries and construction-Liquid fuels	CO ₂	3,873.72	0.00	0.86
1.A.4 Other sectors-Liquid fuels	CO ₂	2,736.38	0.00	0.87
2.B.2 Nitric Acid Production	N ₂ O	893.01	0.00	0.89
2.A.1 Cement Production	CO ₂	1,668.07	0.00	0.90
1.A.4 Other sectors-Liquid fuels	N ₂ O	159.35	0.00	0.90
1.A.4 Other sectors-Solid fuels	CH ₄	128.56	0.00	0.91
3.B.1.3 Manure Management - Swine	CH ₄	329.25	0.00	0.92
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO ₂	2,045.42	0.00	0.93
.....				
Total		47,860.5		

Approach 2 Level Assessment for 2020

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment with uncertainty</i>	<i>Cumulative total</i>
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO ₂	-4,998.73	0.07	0.18
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO ₂	809.77	0.05	0.30
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	931.89	0.02	0.36
5.A Solid Waste Disposal	CH ₄	563.04	0.02	0.41
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	1,042.08	0.02	0.46
3.D.2.2 Indirect N ₂ O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	351.38	0.01	0.49
4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils	CO ₂	-1,114.70	0.01	0.53
4.G Harvested wood products	CO ₂	-783.96	0.01	0.57
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	495.22	0.01	0.60
4.A.2 Land converted to forest land - carbon stock change in biomass	CO ₂	-829.88	0.01	0.63
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	CO ₂	-770.71	0.01	0.66
4.D.2 Land converted to wetlands	CO ₂	179.20	0.01	0.68
3.A.1 Enteric Fermentation - Cattle	CH ₄	1,374.69	0.01	0.71
3.D.1.4 Direct N ₂ O Emissions From Managed Soils - Crop Residues	N ₂ O	406.39	0.01	0.74
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	CO ₂	-679.28	0.01	0.76
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	CO ₂	532.70	0.01	0.77
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	382.32	0.01	0.79
1.A.4 Other sectors-Biomass	CH ₄	138.51	0.01	0.81
3.B.2 Manure Management - Indirect N ₂ O Emissions	N ₂ O	83.92	0.01	0.82
1.A.3.b Road transportation	CO ₂	5,854.41	0.00	0.83
3.D.2.1 Indirect N ₂ O Emissions From Managed Soils - Atmospheric deposition	N ₂ O	98.21	0.00	0.84
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	454.27	0.00	0.85
3.D.1.2 Direct N ₂ O Emissions From Managed Soils - Organic N Fertilizers	N ₂ O	151.83	0.00	0.86
4.B.2 Land converted to cropland- carbon stock change in biomass	CO ₂	260.13	0.00	0.87
4.A.2 Land converted to forest land - net carbon stock change in mineral soils	CO ₂	-236.09	0.00	0.88
3.D.1.3 Direct N ₂ O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	136.20	0.00	0.89

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment with uncertainty</i>	<i>Cumulative total</i>
1.B.2 Oil, natural gas and other emissions from energy production	CO ₂	181.61	0.00	0.89
5.D Wastewater Treatment and Discharge	CH ₄	118.00	0.00	0.90
4.E.2 Land converted to settlements	CO ₂	548.01	0.00	0.91
3.B.2 Manure Management - Cattle	N ₂ O	79.42	0.00	0.92
.....				
<i>Total</i>		14,698.9		

Approach 2 Level Assessment for 2020 using a subset (LULUCF was excluded from analysis)

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment with uncertainty</i>	<i>Cumulative total</i>
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	931.89	0.04	0.15
5.A Solid Waste Disposal	CH ₄	563.04	0.04	0.28
3.D.2.2 Indirect N ₂ O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	351.38	0.02	0.38
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	495.22	0.02	0.46
3.A.1 Enteric Fermentation - Cattle	CH ₄	1,374.69	0.02	0.53
3.D.1.4 Direct N ₂ O Emissions From Managed Soils - Crop Residues	N ₂ O	406.39	0.02	0.59
1.A.4 Other sectors-Biomass	CH ₄	138.51	0.01	0.63
3.B.2 Manure Management - Indirect N ₂ O Emissions	N ₂ O	83.92	0.01	0.67
1.A.3.b Road transportation	CO ₂	5,854.41	0.01	0.70
3.D.2.1 Indirect N ₂ O Emissions From Managed Soils - Atmospheric deposition	N ₂ O	98.21	0.01	0.72
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	454.27	0.01	0.75
3.D.1.2 Direct N ₂ O Emissions From Managed Soils - Organic N Fertilizers	N ₂ O	151.83	0.01	0.77
3.D.1.3 Direct N ₂ O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	136.20	0.01	0.79
1.B.2 Oil, natural gas and other emissions from energy production	CO ₂	181.61	0.01	0.82
5.D Wastewater Treatment and Discharge	CH ₄	118.00	0.01	0.84
3.B.2 Manure Management - Cattle	N ₂ O	79.42	0.00	0.85
5.B Biological Treatment of Solid Waste	CH ₄	65.04	0.00	0.87
1.A.1 Energy industries-Biomass	N ₂ O	33.97	0.00	0.88
2.B.1 Ammonia Production	CO ₂	1,783.05	0.00	0.89
1.A.4 Other sectors-Biomass	N ₂ O	25.41	0.00	0.89
1.A.1 Energy industries-Biomass	CH ₄	21.38	0.00	0.90
1.A.1.b Petroleum refining - Liquid Fuels	CO ₂	1,063.51	0.00	0.91
2.A.1 Cement Production	CO ₂	556.68	0.00	0.91
.....				
Total		20,155.8		

Approach 2 Trend Assessment for 2020

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2020 kt CO₂ eq.</i>	<i>Trend assessment with uncertainty</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO ₂	-6,889.99	-4,998.73	0.04	0.28	0.28
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO ₂	517.32	809.77	0.02	0.13	0.41
4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils	CO ₂	0.00	-1,114.70	0.01	0.06	0.46
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	992.77	931.89	0.01	0.04	0.50
4.D.2 Land converted to wetlands	CO ₂	63.13	179.20	0.00	0.03	0.54
4.G Harvested wood products	CO ₂	-252.55	-783.96	0.00	0.03	0.57
3.A.1 Enteric Fermentation - Cattle	CH ₄	4,146.14	1,374.69	0.00	0.03	0.59
3.D.1.4 Direct N ₂ O Emissions From Managed Soils - Crop Residues	N ₂ O	268.18	406.39	0.00	0.03	0.62
4.C.2 Land converted to grassland - carbon stock change in biomass	CO ₂	-388.52	-57.95	0.00	0.02	0.64
3.D.2.2 Indirect N ₂ O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	414.68	351.38	0.00	0.02	0.66
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	532.76	495.22	0.00	0.02	0.68
1.A.4 Other sectors-Biomass	CH ₄	70.28	138.51	0.00	0.02	0.70
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	1,443.18	1,042.08	0.00	0.02	0.72
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	0.00	454.27	0.00	0.01	0.73
3.D.1.2 Direct N ₂ O Emissions From Managed Soils - Organic N Fertilizers	N ₂ O	361.60	151.83	0.00	0.01	0.75
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	353.40	382.32	0.00	0.01	0.76
3.B.2 Manure Management - Indirect N ₂ O Emissions	N ₂ O	247.61	83.92	0.00	0.01	0.77
1.B.2 Oil, natural gas and other emissions from energy production	CO ₂	23.88	181.61	0.00	0.01	0.79
5.D Wastewater Treatment and Discharge	CH ₄	422.99	118.00	0.00	0.01	0.80
4.E.2 Land converted to settlements	CO ₂	38.49	548.01	0.00	0.01	0.81
1.A.1.a Public electricity and heat production - Liquid Fuels	CO ₂	6,021.25	73.07	0.00	0.01	0.82
1.A.3.b Road transportation	CO ₂	5,247.15	5,854.41	0.00	0.01	0.83

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2020 kt CO₂ eq.</i>	<i>Trend assessment with uncertainty</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
4.B.2 Land converted to cropland- carbon stock change in biomass	CO ₂	138.74	260.13	0.00	0.01	0.84
1.A.4 Other sectors-Solid fuels	CO ₂	2,760.55	177.84	0.00	0.01	0.85
3.D.1.3 Direct N ₂ O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	419.85	136.20	0.00	0.01	0.86
4.E Settlements	N ₂ O	0.47	50.85	0.00	0.01	0.87
5.B Biological Treatment of Solid Waste	CH ₄	0.20	65.04	0.00	0.01	0.88
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO ₂	5,796.59	908.52	0.00	0.01	0.88
3.B.2 Manure Management - Other	N ₂ O	127.49	16.26	0.00	0.01	0.89
1.A.2 Manufacturing industries and construction-Liquid fuels	CO ₂	3,873.72	118.46	0.00	0.01	0.90
1.A.1 Energy industries-Biomass	N ₂ O	0.63	33.97	0.00	0.01	0.90
1.A.4 Other sectors-Liquid fuels	CO ₂	2,736.38	331.48	0.00	0.00	0.91
4.B.2 Land converted to cropland- net carbon stock change in dead organic matter	CO ₂	65.28	123.40	0.00	0.00	0.91
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	CO ₂	-474.03	-770.71	0.00	0.00	0.92
.....						
Total		42,311.3	14,698.9	0.14	1.00	

Approach 2 Trend Assessment for 2020 using a subset (LULUCF was excluded from analysis)

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2020 kt CO₂ eq.</i>	<i>Trend assessment with uncertainty</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	992.77	931.89	0.01	0.14	0.14
3.D.2.2 Indirect N ₂ O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	414.68	351.38	0.01	0.08	0.23
3.D.1.4 Direct N ₂ O Emissions From Managed Soils - Crop Residues	N ₂ O	268.18	406.39	0.01	0.08	0.31
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	532.76	495.22	0.00	0.08	0.39
1.A.4 Other sectors-Biomass	CH ₄	70.28	138.51	0.00	0.06	0.45
5.A Solid Waste Disposal	CH ₄	1,028.83	563.04	0.00	0.06	0.50
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	0.00	454.27	0.00	0.04	0.55
1.B.2 Oil, natural gas and other emissions from energy production	CO ₂	23.88	181.61	0.00	0.04	0.58
1.A.3.b Road transportation	CO ₂	5,247.15	5854.41	0.00	0.03	0.62
3.A.1 Enteric Fermentation - Cattle	CH ₄	4,146.14	1374.69	0.00	0.03	0.65
5.B Biological Treatment of Solid Waste	CH ₄	0.20	65.04	0.00	0.02	0.67
1.A.1.a Public electricity and heat production - Liquid Fuels	CO ₂	6,021.25	73.07	0.00	0.02	0.70
1.A.4 Other sectors-Solid fuels	CO ₂	2,760.55	177.84	0.00	0.02	0.72
5.D Wastewater Treatment and Discharge	CH ₄	422.99	118.00	0.00	0.02	0.74
1.A.1 Energy industries-Biomass	N ₂ O	0.63	33.97	0.00	0.02	0.75
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO ₂	5,796.59	908.52	0.00	0.01	0.77
1.A.2 Manufacturing industries and construction-Liquid fuels	CO ₂	3,873.72	118.46	0.00	0.01	0.78
3.B.2 Manure Management - Indirect N ₂ O Emissions	N ₂ O	247.61	83.92	0.00	0.01	0.80
3.B.2 Manure Management - Other	N ₂ O	127.49	16.26	0.00	0.01	0.81
3.D.2.1 Indirect N ₂ O Emissions From Managed Soils - Atmospheric deposition	N ₂ O	172.11	98.21	0.00	0.01	0.82

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2020 kt CO₂ eq.</i>	<i>Trend assessment with uncertainty</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
2.B.1 Ammonia Production	CO ₂	1,253.68	1783.05	0.00	0.01	0.83
3.D.1.3 Direct N ₂ O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	419.85	136.20	0.00	0.01	0.85
1.A.1 Energy industries-Biomass	CH ₄	0.40	21.38	0.00	0.01	0.86
1.A.4 Other sectors-Biomass	N ₂ O	12.97	25.41	0.00	0.01	0.87
1.A.4 Other sectors-Liquid fuels	CO ₂	2,736.38	331.48	0.00	0.01	0.88
5.B Biological Treatment of Solid Waste	N ₂ O	0.15	26.42	0.00	0.01	0.89
1.A.4 Other sectors-Liquid fuels	N ₂ O	159.35	12.99	0.00	0.01	0.90
1.A.4 Other sectors-Solid fuels	CH ₄	128.56	8.30	0.00	0.01	0.90
2.B.2 Nitric Acid Production	N ₂ O	893.01	154.88	0.00	0.01	0.91
2.F.2 Foam Blowing Agents	HFCs	0.00	40.22	0.00	0.01	0.92
3.B.1.3 Manure Management - Swine	CH ₄	329.25	49.46	0.00	0.01	0.92
.....						
Total		47,860.5	20,155.8	0.06	1.00	

ANNEX II. Tier 1 Uncertainty assessment

Table 1a. Uncertainty evaluation including LULUCF

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CO ₂	7,540.22	1,149.54	0.02	0.02	0.03	0.00	0.04	0.03	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CH ₄	6.90	0.72	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	N ₂ O	16.11	1.38	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	CO ₂	174.05	5.33	0.02	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	CH ₄	0.05	0.00	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	N ₂ O	0.82	0.03	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CO ₂	5,796.59	1,120.08	0.02	0.02	0.03	0.00	0.02	0.03	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CH ₄	2.63	0.51	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	N ₂ O	3.13	0.60	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CO ₂	0.00	294.57	0.02	0.05	0.05	0.00	0.01	0.01	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CH ₄	0.00	1.78	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	N ₂ O	0.00	2.83	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
1.A.1 Fuel combustion - Energy Industries - Peat	CO ₂	11.06	14.92	0.02	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Peat	CH ₄	0.00	0.00	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Peat	N ₂ O	0.05	0.06	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Biomass	CO ₂	0.00	0.00	0.05	0.15	0.16	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Biomass	CH ₄	0.40	21.38	0.05	1.50	1.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.1 Fuel combustion - Energy Industries - Biomass	N ₂ O	0.63	33.97	0.05	1.50	1.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	CO ₂	3,873.72	118.46	0.02	0.02	0.03	0.00	0.03	0.00	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	CH ₄	4.46	0.15	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	N ₂ O	47.81	5.05	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	CO ₂	171.63	360.03	0.02	0.05	0.05	0.00	0.01	0.01	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	CH ₄	0.45	0.93	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	N ₂ O	0.81	1.66	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	CO ₂	2,045.42	672.44	0.02	0.02	0.03	0.00	0.00	0.02	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	CH ₄	0.93	0.30	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	N ₂ O	1.11	0.36	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	CO ₂	17.53	0.42	0.02	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	CH ₄	0.01	0.00	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	N ₂ O	0.08	0.00	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	CO ₂	0.00	0.00	0.05	0.15	0.16	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	CH ₄	0.38	3.85	0.05	1.50	1.50	0.00	0.00	0.00	0.00	0.00	0.00

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	N ₂ O	0.60	6.08	0.05	1.50	1.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a Domestic Aviation	CO ₂	8.16	1.92	0.10	0.02	0.10	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a Domestic Aviation	CH ₄	0.00	0.00	0.10	0.79	0.79	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a Domestic Aviation	N ₂ O	0.07	0.02	0.10	1.10	1.10	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b Road Transportation	CO ₂	5,247.15	5,854.41	0.02	0.02	0.03	0.00	0.10	0.14	0.00	0.00	0.00
1.A.3.b Road Transportation	CH ₄	39.42	6.74	0.02	0.40	0.40	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b Road Transportation	N ₂ O	49.78	52.35	0.02	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.c Railways	CO ₂	349.97	161.80	0.05	0.02	0.05	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.c Railways	CH ₄	0.50	0.24	0.05	0.75	0.75	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.c Railways	N ₂ O	40.92	18.93	0.05	0.75	0.75	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.d Domestic Navigation - Liquid Fuels	CO ₂	15.49	11.58	0.05	0.03	0.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.d Domestic Navigation - Liquid Fuels	CH ₄	0.04	0.03	0.05	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.d Domestic Navigation - Liquid Fuels	N ₂ O	0.13	0.09	0.05	0.90	0.90	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.e.i Other Transportation - Pipeline Transportation	CO ₂	64.28	19.53	0.05	0.02	0.05	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.e.i Other Transportation - Pipeline Transportation	CH ₄	0.03	0.01	0.05	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.e.i Other Transportation - Pipeline Transportation	N ₂ O	0.03	0.01	0.05	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4 Other Sectors - Liquid Fuels	CO ₂	2,736.38	331.48	0.03	0.02	0.04	0.00	0.02	0.01	0.00	0.00	0.00
1.A.4 Other Sectors - Liquid Fuels	CH ₄	7.04	0.79	0.03	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4 Other Sectors - Liquid Fuels	N ₂ O	159.35	12.99	0.03	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4 Other Sectors - Solid Fuels	CO ₂	2,760.55	177.84	0.03	0.05	0.06	0.00	0.02	0.00	0.00	0.00	0.00

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
1.A.4 Other Sectors - Solid Fuels	CH ₄	128.56	8.30	0.03	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4 Other Sectors - Solid Fuels	N ₂ O	13.00	0.84	0.03	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4 Other Sectors - Gaseous Fuels	CO ₂	1,379.27	611.67	0.03	0.02	0.04	0.00	0.00	0.01	0.00	0.00	0.00
1.A.4 Other Sectors - Gaseous Fuels	CH ₄	3.13	1.38	0.03	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4 Other Sectors - Gaseous Fuels	N ₂ O	0.75	0.33	0.03	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4 Other Sectors - Peat	CO ₂	27.13	63.02	0.03	0.05	0.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4 Other Sectors - Peat	CH ₄	1.12	3.32	0.03	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4 Other Sectors - Peat	N ₂ O	0.11	0.25	0.03	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4 Other Sectors- Biomass	CO ₂	0.00	0.00	0.10	0.15	0.18	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4 Other Sectors- Biomass	CH ₄	70.28	138.51	0.10	1.50	1.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4 Other Sectors- Biomass	N ₂ O	12.97	25.41	0.10	1.50	1.50	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CO ₂	23.30	180.11	0.05	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CH ₄	4.25	2.26	0.05	0.75	0.75	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	N ₂ O	0.00	0.00	0.05	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CO ₂	0.01	0.01	0.05	0.10	0.11	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH ₄	260.55	248.55	0.05	0.10	0.11	0.00	0.00	0.01	0.00	0.00	0.00
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	CO ₂	0.58	1.50	0.05	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	CH ₄	0.26	0.68	0.05	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	N ₂ O	0.00	0.01	0.05	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
2.A.1 Cement Production	CO ₂	1,668.07	556.68	0.02	0.05	0.05	0.00	0.00	0.01	0.00	0.00	0.00
2.A.2 Lime Production	CO ₂	210.27	1.92	0.05	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.00
2.A.3 Glass Production	CO ₂	11.74	7.49	0.07	0.05	0.09	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.a Ceramics	CO ₂	227.92	0.71	0.05	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.b Other use of soda ash	CO ₂	5.20	1.02	0.15	0.05	0.16	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.d Mineral wool production	CO ₂	6.41	11.64	0.07	0.05	0.09	0.00	0.00	0.00	0.00	0.00	0.00
2.B.1 Ammonia Production	CO ₂	1,253.68	1,783.05	0.02	0.02	0.03	0.00	0.03	0.04	0.00	0.00	0.00
2.B.2 Nitric Acid Production	N ₂ O	893.01	154.88	0.02	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.a Methanol	CO ₂	24.35	0.00	0.05	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.a Methanol	CH ₄	5.24	0.00	0.05	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00
2.C.1 Iron and Steel Production	CO ₂	16.98	0.04	0.10	0.10	0.14	0.00	0.00	0.00	0.00	0.00	0.00
2.D.1 Lubricant use	CO ₂	6.06	13.87	0.05	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00
2.D.2 Paraffin wax use	CO ₂	0.88	2.13	0.05	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D.3 Solvent use	CO ₂	34.33	37.75	0.30	0.20	0.36	0.00	0.00	0.00	0.00	0.00	0.00
2.D.3 Asphalt roofing	CO ₂	0.02	0.02	0.05	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00
2.D.3 Road paving with asphalt	CO ₂	0.00	0.00	0.20	0.50	0.54	0.00	0.00	0.00	0.00	0.00	0.00
2.D.3 Urea-based catalyst	CO ₂	0.00	1.06	0.10	0.02	0.10	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 Semiconductor	SF ₆	0.00	9.54	0.05	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.00
2.E.3 Photovoltaics	NF ₃	0.00	0.00	0.05	0.20	0.21	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a Domestic Refrigeration	HFCs	0.00	1.84	0.20	0.50	0.54	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a Commercial Refrigeration	HFCs	0.00	166.27	0.20	0.50	0.54	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a Transport Refrigeration	HFCs	0.00	71.93	0.20	0.50	0.54	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a Industrial Refrigeration	HFCs	0.00	40.11	0.20	0.50	0.54	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a Stationary Air-Conditioning	HFCs	0.00	20.77	0.20	0.50	0.54	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.b Mobile Air-Conditioning	HFCs	0.00	153.35	0.20	0.50	0.54	0.00	0.00	0.00	0.00	0.00	0.00
2.F.2 Foam Blowing Agents	HFCs	0.00	40.22	0.30	0.30	0.42	0.00	0.00	0.00	0.00	0.00	0.00

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
2.F.3 Fire Protection	HFCs	0.00	4.10	0.20	0.20	0.28	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 Aerosols/metered dose inhalers	HFCs	0.00	9.51	0.05	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1 Manufacture of electrical equipments	SF ₆	0.00	0.14	0.05	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b Accelerators	SF ₆	0.00	0.07	0.05	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.a Medical applications	N ₂ O	93.35	1.34	0.05	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.b Propellant for pressure and aerosol products	N ₂ O	2.70	2.04	0.20	1.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00
3.A Enteric Fermentation	CH ₄	4,290.91	1,445.40	0.05	0.26	0.27	0.00	0.00	0.03	0.00	0.00	0.00
3.B Manure Management	CH ₄	665.91	231.64	0.14	0.12	0.19	0.00	0.00	0.01	0.00	0.00	0.00
3.B Manure Management	N ₂ O	580.96	179.61	0.21	2.37	2.38	0.00	0.00	0.00	0.00	0.00	0.00
3.D.1 Direct N ₂ O Emissions From Managed Soils	N ₂ O	2,575.16	2,121.53	0.07	0.83	0.84	0.02	0.03	0.05	0.02	0.01	0.00
3.D.2 Indirect N ₂ O Emissions From Managed Soils	N ₂ O	586.79	449.58	0.40	1.37	1.42	0.00	0.01	0.01	0.01	0.01	0.00
3.G Liming	CO ₂	20.59	7.02	0.10	0.50	0.51	0.00	0.00	0.00	0.00	0.00	0.00
3.H Urea Application	CO ₂	35.71	15.94	0.10	0.50	0.51	0.00	0.00	0.00	0.00	0.00	0.00
4.A.1 Forest Land Remaining Forest Land	CO ₂	-7,362.67	-5,768.36	0.03	0.46	0.46	0.03	0.08	0.14	0.04	0.01	0.00
4.A.1 Forest Land Remaining Forest Land	CH ₄	0.47	0.14	0.32	0.40	0.51	0.00	0.00	0.00	0.00	0.00	0.00
4.A.1 Forest Land Remaining Forest Land	N ₂ O	0.31	0.10	0.32	0.27	0.42	0.00	0.00	0.00	0.00	0.00	0.00
4.A.2 Land Converted to Forest Land	CO ₂	-783.26	-1,129.35	0.15	0.46	0.48	0.00	0.02	0.03	0.01	0.01	0.00
4.A.2 Land Converted to Forest Land	CH ₄	0.02	0.01	0.32	0.40	0.51	0.00	0.00	0.00	0.00	0.00	0.00
4.A.2 Land Converted to Forest Land	N ₂ O	0.02	0.01	0.32	0.27	0.42	0.00	0.00	0.00	0.00	0.00	0.00

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
4(II) Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	1,847.99	1,487.37	0.07	0.56	0.57	0.00	0.02	0.04	0.01	0.00	0.00
4(II) Emissions and removals from drainage and rewetting and other management of organic and mineral soils	N ₂ O	35.32	34.41	0.09	0.86	0.87	0.00	0.00	0.00	0.00	0.00	0.00
4.B Cropland	CO ₂	1,139.64	-155.78	0.05	0.31	0.31	0.00	0.01	0.00	0.00	0.00	0.00
4.B Cropland	CH ₄	0.05	0.01	0.06	0.85	0.85	0.00	0.00	0.00	0.00	0.00	0.00
4.B Cropland	N ₂ O	73.08	48.64	0.15	1.51	1.51	0.00	0.00	0.00	0.00	0.00	0.00
4.C Grassland	CO ₂	-869.39	-816.26	0.07	0.42	0.42	0.00	0.01	0.02	0.01	0.00	0.00
4.C Grassland	CH ₄	2.46	0.19	0.06	0.85	0.85	0.00	0.00	0.00	0.00	0.00	0.00
4.C Grassland	N ₂ O	2.68	0.21	0.06	0.76	0.76	0.00	0.00	0.00	0.00	0.00	0.00
4.D Wetlands	CO ₂	580.45	988.97	0.06	2.05	2.05	0.02	0.02	0.02	0.04	0.00	0.00
4.D Wetlands	N ₂ O	6.08	4.66	0.15	1.51	1.51	0.00	0.00	0.00	0.00	0.00	0.00
4.E Settlements	CO ₂	38.49	548.01	0.10	0.15	0.18	0.00	0.01	0.01	0.00	0.00	0.00
4.E Settlements	N ₂ O	0.47	50.85	0.18	1.51	1.52	0.00	0.00	0.00	0.00	0.00	0.00
4.F Other Land	CO ₂	0.00	38.93	0.17	0.15	0.23	0.00	0.00	0.00	0.00	0.00	0.00
4.F Other Land	N ₂ O	0.00	21.12	0.23	1.51	1.52	0.00	0.00	0.00	0.00	0.00	0.00
4.G Harvested Wood Products	CO ₂	-252.55	-783.96	0.15	0.59	0.61	0.00	0.02	0.02	0.01	0.00	0.00
5.A Solid Waste Disposal	CH ₄	1,028.83	563.04	0.30	1.24	1.28	0.00	0.01	0.01	0.01	0.01	0.00
5.B Biological Treatment of Solid Waste	CH ₄	0.20	65.04	0.40	1.00	1.08	0.00	0.00	0.00	0.00	0.00	0.00
5.B Biological Treatment of Solid Waste	N ₂ O	0.15	26.42	0.40	1.00	1.08	0.00	0.00	0.00	0.00	0.00	0.00
5.C Incineration and Open Burning of Waste	CO ₂	2.66	2.11	0.25	0.43	0.50	0.00	0.00	0.00	0.00	0.00	0.00

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
5.C Incineration and Open Burning of Waste	CH ₄	0.00	0.00	0.25	0.60	0.65	0.00	0.00	0.00	0.00	0.00	0.00
5.C Incineration and Open Burning of Waste	N ₂ O	0.08	0.07	0.25	0.60	0.65	0.00	0.00	0.00	0.00	0.00	0.00
5.D Wastewater Treatment and Discharge	CH ₄	422.99	118.00	0.59	0.73	0.93	0.00	0.00	0.00	0.00	0.00	0.00
5.D Wastewater Treatment and Discharge	N ₂ O	67.21	46.90	0.30	0.46	0.55	0.00	0.00	0.00	0.00	0.00	0.00
Total emission		42,320.17	14,690.03	Overall uncertainty (%)			28.1	Trend uncertainty (%)				6.3

Table 1b. Uncertainty evaluation excluding LULUCF

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in 2019	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CO ₂	7,540.22	1,149.54	2%	2%	3%	0.0000	0.042	0.0240	0.0008	0.0007	0.0000
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CH ₄	6.90	0.72	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	N ₂ O	16.11	1.38	2%	50%	50%	0.0000	0.000	0.0000	0.0001	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	CO ₂	174.05	5.33	2%	5%	5%	0.0000	0.001	0.0001	0.0001	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	CH ₄	0.05	0.00	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	N ₂ O	0.82	0.03	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CO ₂	5,796.59	1,120.08	2%	2%	3%	0.0000	0.027	0.0234	0.0005	0.0007	0.0000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CH ₄	2.63	0.51	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	N ₂ O	3.13	0.60	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CO ₂	0.00	294.57	2%	5%	5%	0.0000	0.006	0.0062	0.0003	0.0002	0.0000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CH ₄	0.00	1.78	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	N ₂ O	0.00	2.83	2%	50%	50%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in 2019	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
1.A.1 Fuel combustion - Energy Industries - Peat	CO ₂	11.06	14.92	2%	5%	5%	0.0000	0.000	0.0003	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Peat	CH ₄	0.00	0.00	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Peat	N ₂ O	0.05	0.06	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Biomass	CO ₂	0.00	0.00	5%	15%	16%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Biomass	CH ₄	0.40	21.38	5%	150%	150%	0.0000	0.000	0.0004	0.0007	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Biomass	N ₂ O	0.63	33.97	5%	150%	150%	0.0000	0.001	0.0007	0.0011	0.0001	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	CO ₂	3,873.72	118.46	2%	2%	3%	0.0000	0.032	0.0025	0.0006	0.0001	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	CH ₄	4.46	0.15	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	N ₂ O	47.81	5.05	2%	50%	50%	0.0000	0.000	0.0001	0.0002	0.0000	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	CO ₂	171.63	360.03	2%	5%	5%	0.0000	0.006	0.0075	0.0003	0.0002	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	CH ₄	0.45	0.93	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	N ₂ O	0.81	1.66	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in 2019	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	CO ₂	2,045.42	672.44	2%	2%	3%	0.0000	0.004	0.0140	0.0001	0.0004	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	CH ₄	0.93	0.30	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	N ₂ O	1.11	0.36	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	CO ₂	17.53	0.42	2%	5%	5%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	CH ₄	0.01	0.00	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	N ₂ O	0.08	0.00	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	CO ₂	0.00	0.00	5%	15%	16%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	CH ₄	0.38	3.85	5%	150%	150%	0.0000	0.000	0.0001	0.0001	0.0000	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	N ₂ O	0.60	6.08	5%	150%	150%	0.0000	0.000	0.0001	0.0002	0.0000	0.0000
1.A.3.a Domestic Aviation	CO ₂	8.16	1.92	10%	2%	10%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.3.a Domestic Aviation	CH ₄	0.00	0.00	10%	79%	79%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.3.a Domestic Aviation	N ₂ O	0.07	0.02	10%	110%	110%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.3.b Road Transportation	CO ₂	5,247.15	5,854.41	2%	2%	3%	0.0001	0.076	0.1223	0.0015	0.0035	0.0000
1.A.3.b Road Transportation	CH ₄	39.42	6.74	2%	40%	40%	0.0000	0.000	0.0001	0.0001	0.0000	0.0000

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in 2019	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
1.A.3.b Road Transportation	N ₂ O	49.78	52.35	2%	50%	50%	0.0000	0.001	0.0011	0.0003	0.0000	0.0000
1.A.3.c Railways	CO ₂	349.97	161.80	5%	2%	5%	0.0000	0.000	0.0034	0.0000	0.0002	0.0000
1.A.3.c Railways	CH ₄	0.50	0.24	5%	75%	75%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.3.c Railways	N ₂ O	40.92	18.93	5%	75%	75%	0.0000	0.000	0.0004	0.0000	0.0000	0.0000
1.A.3.d Domestic Navigation - Liquid Fuels	CO ₂	15.49	11.58	5%	3%	6%	0.0000	0.000	0.0002	0.0000	0.0000	0.0000
1.A.3.d Domestic Navigation - Liquid Fuels	CH ₄	0.04	0.03	5%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.3.d Domestic Navigation - Liquid Fuels	N ₂ O	0.13	0.09	5%	90%	90%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.3.e.i Other Transportation - Pipeline Transportation	CO ₂	64.28	19.53	5%	2%	5%	0.0000	0.000	0.0004	0.0000	0.0000	0.0000
1.A.3.e.i Other Transportation - Pipeline Transportation	CH ₄	0.03	0.01	5%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.3.e.i Other Transportation - Pipeline Transportation	N ₂ O	0.03	0.01	5%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.4 Other Sectors - Liquid Fuels	CO ₂	2,736.38	331.48	3%	2%	4%	0.0000	0.017	0.0069	0.0003	0.0003	0.0000
1.A.4 Other Sectors - Liquid Fuels	CH ₄	7.04	0.79	3%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.4 Other Sectors - Liquid Fuels	N ₂ O	159.35	12.99	3%	50%	50%	0.0000	0.001	0.0003	0.0006	0.0000	0.0000
1.A.4 Other Sectors - Solid Fuels	CO ₂	2,760.55	177.84	3%	5%	6%	0.0000	0.021	0.0037	0.0010	0.0002	0.0000
1.A.4 Other Sectors - Solid Fuels	CH ₄	128.56	8.30	3%	50%	50%	0.0000	0.001	0.0002	0.0005	0.0000	0.0000
1.A.4 Other Sectors - Solid Fuels	N ₂ O	13.00	0.84	3%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.4 Other Sectors - Gaseous Fuels	CO ₂	1,379.27	611.67	3%	2%	4%	0.0000	0.001	0.0128	0.0000	0.0005	0.0000
1.A.4 Other Sectors - Gaseous Fuels	CH ₄	3.13	1.38	3%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.4 Other Sectors - Gaseous Fuels	N ₂ O	0.75	0.33	3%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.4 Other Sectors - Peat	CO ₂	27.13	63.02	3%	5%	6%	0.0000	0.001	0.0013	0.0001	0.0001	0.0000
1.A.4 Other Sectors - Peat	CH ₄	1.12	3.32	3%	50%	50%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
1.A.4 Other Sectors - Peat	N ₂ O	0.11	0.25	3%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.4 Other Sectors- Biomass	CO ₂	0.00	0.00	10%	15%	18%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in 2019	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
1.A.4 Other Sectors- Biomass	CH ₄	70.28	138.51	10%	150%	150%	0.0001	0.002	0.0029	0.0034	0.0004	0.0000
1.A.4 Other Sectors- Biomass	N ₂ O	12.97	25.41	10%	150%	150%	0.0000	0.000	0.0005	0.0006	0.0001	0.0000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CO ₂	23.30	180.11	5%	50%	50%	0.0000	0.004	0.0038	0.0018	0.0003	0.0000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CH ₄	4.25	2.26	5%	75%	75%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	N ₂ O	0.00	0.00	5%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CO ₂	0.01	0.01	5%	10%	11%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH ₄	260.55	248.55	5%	10%	11%	0.0000	0.003	0.0052	0.0003	0.0004	0.0000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	CO ₂	0.58	1.50	5%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	CH ₄	0.26	0.68	5%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	N ₂ O	0.00	0.01	5%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.A.1 Cement Production	CO ₂	1,668.07	556.68	2%	5%	5%	0.0000	0.003	0.0116	0.0002	0.0003	0.0000
2.A.2 Lime Production	CO ₂	210.27	1.92	5%	5%	7%	0.0000	0.002	0.0000	0.0001	0.0000	0.0000
2.A.3 Glass Production	CO ₂	11.74	7.49	7%	5%	9%	0.0000	0.000	0.0002	0.0000	0.0000	0.0000
2.A.4.a Ceramics	CO ₂	227.92	0.71	5%	5%	7%	0.0000	0.002	0.0000	0.0001	0.0000	0.0000
2.A.4.b Other use of soda ash	CO ₂	5.20	1.02	15%	5%	16%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.A.4.d Mineral wool production	CO ₂	6.41	11.64	7%	5%	9%	0.0000	0.000	0.0002	0.0000	0.0000	0.0000
2.B.1 Ammonia Production	CO ₂	1,253.68	1,783.05	2%	2%	3%	0.0000	0.026	0.0373	0.0005	0.0011	0.0000
2.B.2 Nitric Acid Production	N ₂ O	893.01	154.88	2%	10%	10%	0.0000	0.005	0.0032	0.0005	0.0001	0.0000

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in 2019	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
2.B.8.a Methanol	CO ₂	24.35	0.00	5%	30%	30%	0.0000	0.000	0.0000	0.0001	0.0000	0.0000
2.B.8.a Methanol	CH ₄	5.24	0.00	5%	30%	30%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.C.1 Iron and Steel Production	CO ₂	16.98	0.04	10%	10%	14%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.D.1 Lubricant use	CO ₂	6.06	13.87	5%	50%	50%	0.0000	0.000	0.0003	0.0001	0.0000	0.0000
2.D.2 Parafin wax use	CO ₂	0.88	2.13	5%	100%	100%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.D.3 Solvent use	CO ₂	34.33	37.75	30%	20%	36%	0.0000	0.000	0.0008	0.0001	0.0003	0.0000
2.D.3 Asphalt roofing	CO ₂	0.02	0.02	5%	25%	25%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.D.3 Road paving with asphalt	CO ₂	0.00	0.00	20%	50%	54%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.D.3 Urea-based catalyst	CO ₂	0.00	1.06	10%	2%	10%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.E.1 Semiconductor	SF ₆	0.00	9.54	5%	5%	7%	0.0000	0.000	0.0002	0.0000	0.0000	0.0000
2.E.3 Photovoltaics	NF ₃	0.00	0.00	5%	20%	21%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.F.1.a Domestic Refrigeration	HFCs	0.00	1.84	20%	50%	54%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.F.1.a Commercial Refrigeration	HFCs	0.00	166.27	20%	50%	54%	0.0000	0.003	0.0035	0.0017	0.0010	0.0000
2.F.1.a Transport Refrigeration	HFCs	0.00	71.93	20%	50%	54%	0.0000	0.002	0.0015	0.0008	0.0004	0.0000
2.F.1.a Industrial Refrigeration	HFCs	0.00	40.11	20%	50%	54%	0.0000	0.001	0.0008	0.0004	0.0002	0.0000
2.F.1.a Stationary Air-Conditioning	HFCs	0.00	20.77	20%	50%	54%	0.0000	0.000	0.0004	0.0002	0.0001	0.0000
2.F.1.b Mobile Air-Conditioning	HFCs	0.00	153.35	20%	50%	54%	0.0000	0.003	0.0032	0.0016	0.0009	0.0000
2.F.2 Foam Blowing Agents	HFCs	0.00	40.22	30%	30%	42%	0.0000	0.001	0.0008	0.0003	0.0004	0.0000
2.F.3 Fire Protection	HFCs	0.00	4.10	20%	20%	28%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
2.F.4 Aerosols/metered dose inhalers	HFCs	0.00	9.51	5%	5%	7%	0.0000	0.000	0.0002	0.0000	0.0000	0.0000
2.G.1 Manufacture of electrical equipments	SF ₆	0.00	0.14	5%	5%	7%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.G.2.b Accelerators	SF ₆	0.00	0.07	5%	5%	7%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.G.3.a Medical applications	N ₂ O	93.35	1.34	5%	5%	7%	0.0000	0.001	0.0000	0.0000	0.0000	0.0000
2.G.3.b Propellant for pressure and aerosol products	N ₂ O	2.70	2.04	20%	100%	102%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2020	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in 2019	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty in trend in national emissions introduced by emission factor	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
3.A Enteric Fermentation	CH ₄	4,290.91	1,445.40	5%	26%	27%	0.0004	0.007	0.0302	0.0020	0.0020	0.0000
3.B Manure Management	CH ₄	665.91	231.64	14%	12%	19%	0.0000	0.001	0.0048	0.0001	0.0010	0.0000
3.B Manure Management	N ₂ O	580.96	179.61	21%	237%	238%	0.0005	0.001	0.0038	0.0032	0.0011	0.0000
3.D.1 Direct N ₂ O Emissions From Managed Soils	N ₂ O	2,575.16	2,121.53	7%	83%	84%	0.0078	0.022	0.0443	0.0180	0.0046	0.0003
3.D.2 Indirect N ₂ O Emissions From Managed Soils	N ₂ O	586.79	449.58	40%	137%	142%	0.0010	0.004	0.0094	0.0058	0.0054	0.0001
3.G Liming	CO ₂	20.59	7.02	10%	50%	51%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
3.H Urea Application	CO ₂	35.71	15.94	10%	50%	51%	0.0000	0.000	0.0003	0.0000	0.0000	0.0000
5.A Solid Waste Disposal	CH ₄	1,028.83	563.04	30%	124%	128%	0.0013	0.003	0.0118	0.0034	0.0050	0.0000
5.B Biological Treatment of Solid Waste	CH ₄	0.20	65.04	40%	100%	108%	0.0000	0.001	0.0014	0.0014	0.0008	0.0000
5.B Biological Treatment of Solid Waste	N ₂ O	0.15	26.42	40%	100%	108%	0.0000	0.001	0.0006	0.0006	0.0003	0.0000
5.C Incineration and Open Burning of Waste	CO ₂	2.66	2.11	25%	43%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
5.C Incineration and Open Burning of Waste	CH ₄	0.00	0.00	25%	60%	65%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
5.C Incineration and Open Burning of Waste	N ₂ O	0.08	0.07	25%	60%	65%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
5.D Wastewater Treatment and Discharge	CH ₄	422.99	118.00	59%	73%	93%	0.0000	0.001	0.0025	0.0009	0.0020	0.0000
5.D Wastewater Treatment and Discharge	N ₂ O	67.21	46.90	30%	46%	55%	0.0000	0.000	0.0010	0.0002	0.0004	0.0000
Total emission		47,860.51	20,121.24	Overall uncertainty (%)			10.6	Trend uncertainty (%)				2.3

ANNEX III. Lithuanian energy balance

Table 3-1. Balance of crude oil, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production		502	5358	13491	9217	4909	3065	2691	2336	1948	1675	1304
Liquid biofuels for blending												
Import		396707	131189	199709	380035	385276	356108	394439	415437	408513	404744	329509
Export			335	13254	6312	4736	2067	2185	1773	1914	1588	1549
International marine bunkers												
Changes in stocks		2093	-4730	-1169	9169	-1081	-1194	-372	-424	1500	-4893	564
Gross consumption		399302	131482	198777	392109	384368	355912	394573	415576	410047	399938	329828
Statistical difference			-42									
Transformed in power, heat and other plants:		399302	131440	198777	392101	384357	355912	394573	415576	410047	399938	329828
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants	1.A.1.a iii	84	167	99								
- in geothermal plants												
- in other industries		399218	131273	198678	392101	384357	355912	394573	415576	410047	399938	329828
Consumed in energy sector:					3							
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries	1.A.1.b				3							
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses*					5	11						
Final consumption:												
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-2. Balance of motor gasoline, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production		87988	37709	68838	112699	123626	107664	117465	122611	114204	110125	95230
Liquid biofuels for blending					26	445	600	337	375	557	637	931
Import		220	14328	736	1115	2616	2881	2906	2811	2016	1996	2125
Export		42104	23601	50765	95698	114237	101063	111419	117451	107056	102035	87753
International marine bunkers												
Changes in stocks		-2725	-1758	-2012	-3193	506	-1256	62	937	406	-109	96
Gross consumption		43379	26678	16797	14949	12956	8826	9351	9283	10127	10614	10629
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:				15	5		2	2	3	3	1	1
- in peat extraction enterprises	1.A.1.c.i				1		1	1	1	1	1	1
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises	1.A.1.c.iii			15	4		1	1	2	2		
Non energy use												
Distribution and transmission losses*		308	176	68	61	22	5	3	3	5	6	4
Final consumption:		43071	26502	16714	14883	12934	8819	9346	9277	10119	10607	10624
- in industry	1.A.2.g.vii	44	88	48	31	15	8	9	6	17	7	13
- in construction	1.A.2.g.vii	439	176	101	69	28	16	15	14	17	16	14
- in transport	1.A.3	41840	25887	16337	14711	12841	8761	9301	9234	10063	10557	10581
- in agriculture	1.A.4.c.ii	440	307	170	53	43	28	17	18	17	19	12
- in fishing												
- in commercial / public services	1.A.4.a.ii	308	44	58	19	7	6	4	5	5	8	4
- in households												

Table 3-3. Balance of aviation gasoline, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production												
Liquid biofuels for blending												
Import				14	20	18	19	16	19	22	20	18
Export												
International marine bunkers												
Changes in stocks												
Gross consumption				14	20	18	19	16	19	22	20	18
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:				14	20	18	19	16	19	22	20	18
- in industry												
- in construction												
- in transport	1.A.3			14	20	18	19	16	19	22	20	18
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-4. Balance of gasoline type jet fuel, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production												
Liquid biofuels for blending												
Import				65	3							
Export												
International marine bunkers												
Changes in stocks				-65								
Gross consumption					3							
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:					3							
- in industry												
- in construction												
- in transport	1.A.3				3							
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-5. Balance of kerosene type jet fuel, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production		28125	9088	18566	24705	10352	7780	10012	12264	14565	15166	6732
Liquid biofuels for blending												
Import		387	948	846		837	2244	2943	2233	1622	1938	
Export		22956	8442	16673	21406	9062	6113	8645	9229	10964	11436	4455
International marine bunkers												
Changes in stocks		86	129	-1651	-1185	115	10	40	-476	340	-120	386
Gross consumption		5642	1723	1088	2114	2242	3921	4350	4792	5563	5578	2663
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses*					14	5						
Final consumption:		5642	1723	1088	2100	2237	3921	4350	4792	5563	5578	2663
- in industry												
- in construction												
- in transport	1.A.3	5642	1723	1088	2100	2237	3921	4350	4792	5563	5578	2663
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-6. Balance of transport diesel, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production		107712	42490	56232	127985	150168	156249	165004	170006	164846	159469	135526
Liquid biofuels for blending					119	1478	2393	1931	2151	3308	3233	3777
Import		8923	9475	1670	2840	7882	68750	48563	27342	21096	21815	23206
Export		49416	27364	28516	92877	116251	169375	153347	135819	116666	111813	85924
International marine bunkers				942								
Changes in stocks		-1997	1573	-4819	-2586	31	-768	-274	2379	-1918	834	-3894
Gross consumption		65222	26174	23625	35481	43308	57249	61877	66059	70666	73538	72691
Statistical difference			213	853								
Transformed in power, heat and other plants:		7521	1742	36								
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants	1.A.1.a iii	7521	1615	28								
- in autoproducer heat plants	1.A.1.a iii		127	8								
- in geothermal plants												
- in other industries												
Consumed in energy sector:		128	43	136	194	144	174	168	175	185	161	177
- in peat extraction enterprises	1.A.1.c.i	128	43	60	125	109	153	160	159	175	155	172
- in crude oil extraction enterprises	1.A.1.c.ii			22	49	23	13		8	1		
- in refineries	1.A.1.b			5			2	1				
- in electricity, gas, steam and air conditioning enterprises	1.A.1.c.ii			49	20	12	6	7	8	9	6	5
Non energy use	1.AD			6								
Distribution and transmission losses*		297	128	55	122	73	22	14	13	13	19	13
Final consumption:		57276	24474	24245	35165	43091	57053	61695	65871	70468	73358	72501
- in industry	1.A.2.g.vii	2124	1827	510	499	190	248	235	247	299	297	309
- in construction	1.A.2.g.vii	2507	935	613	589	382	320	309	360	355	377	266
- in transport	1.A.3	34289	14489	21476	32515	41030	55021	59595	63677	68233	71055	70436
- in agriculture	1.A.4.c.ii	14277	4207	1327	1362	1444	1438	1516	1548	1544	1578	1437
- in fishing	1.A.4.c.iii				14	5	6	7	7	7	8	7
- in commercial / public services	1.A.4.a.ii	2889	2804	319	186	40	20	33	32	30	43	46
- in households	1.A.4.b.ii	1190	212									

Table 3-7. Balance of heating and other gasoil, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production					2125	1130	4777	5068	6107	6884	7064	6740
Liquid biofuels for blending						2	73	68	76	79	76	99
Import			717		915	854	701	1231	1107	1169	711	848
Export					985		206	2	114	9	318	35
International marine bunkers					770	756	1738	2858	3133	3567	3381	3206
Changes in stocks			-717	65	-225	-7	-61	63	-24	-126	138	92
Gross consumption				65	1060	1223	3546	3570	4019	4430	4290	4538
Statistical difference												
Transformed in power, heat and other plants:				22	102	55	38	43	42	44	26	26
- in public CHP plants	1.A.1.a ii					1						
- in autoproducer CHP plants												2
- in public heat plants	1.A.1.a iii			22	64	52	37	43	41	44	26	24
- in autoproducer heat plants	1.A.1.a iii				38	2	1		1			
- in geothermal plants												
- in other industries												
Consumed in energy sector:						5	4	18	12	2		
- in peat extraction enterprises	1.A.1.c.i					5	4	1	1	1		
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises	1.A.1.c.ii							17	11	1		
Non energy use												
Distribution and transmission losses												
Final consumption:				43	958	1163	3504	3509	3965	4384	4264	4512
- in industry	1.A.2			7	405	220	228	138	193	232	264	328
- in construction	1.A.2.g.v			7	25	47	67	39	44	54	57	64
- in transport	1.A.3				226	235	2413	2358	2571	2839	2615	2475
- in agriculture	1.A.4.c.i			23	137	230	264	287	301	283	377	672
- in fishing	1.A.4.c.i				59	73	76	37	25	33	36	21
- in commercial / public services	1.A.4.a			6	55	69	48	24	35	98	22	29
- in households	1.A.4.b				51	289	408	626	796	845	893	923

Table 3-8. Balance of liquefied petroleum gases (LPG), TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production		12006	7636	11026	21046	12720	12155	13388	14350	13723	16377	13767
Liquid biofuels for blending												
Import		2208	1056	3972	3110	5024	4882	3612	3767	3770	3513	2387
Export		7038	4646	5793	11596	8114	9662	9730	11099	10830	13053	10111
International marine bunkers												
Changes in stocks		46	230	-420	163	-111	31	8	88		-111	-8
Gross consumption		7222	4276	8785	12723	9519	7406	7278	7106	6663	6726	6035
Statistical difference												
Transformed in power, heat and other plants:		46		51	90	90	81	90	81	79	78	83
- in public CHP plants	1.A.1.a ii					3						
- in autoproducer CHP plants												
- in public heat plants	1.A.1.a iii			21	19	18	36	41	35	35	35	43
- in autoproducer heat plants	1.A.1.a iii	46		31	71	69	45	49	46	44	43	40
- in geothermal plants												
- in other industries												
Consumed in energy sector:		552	138	36	4							
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries	1.A.1.b	552	138	22								
- in electricity, gas, steam and air conditioning enterprises	1.A.1.c.ii			14	4							
Non energy use												
Distribution and transmission losses*		322	92	103	47	26	14	14	20	14	23	24
Final consumption:		6302	4046	8595	12580	9403	7311	7174	7005	6570	6625	5928
- in industry	1.A.2			201	229	273	326	329	355	355	396	281
- in construction	1.A.2.g.v	92	46	74	77	122	38	55	58	50	49	72
- in transport	1.A.3	920	1058	5032	9593	7275	5573	5254	4878	4572	4405	4058
- in agriculture	1.A.4.c.i	230	46	19	38	41	54	94	142	100	149	150
- in fishing												
- in commercial / public services	1.A.4.a	460	92	62	23	6	20	42	57	27	29	30
- in households	1.A.4.b	4600	2804	3207	2620	1686	1300	1400	1515	1466	1597	1337

Table 3-9. Balance of residual fuel oil (RFO) – high sulphur (>1%), TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production		133867	33356	39422	71994	65373	60871	72114	66347	65761	60218	44554
Liquid biofuels for blending												
Import		293464	47887	4110	5056	7883	1377	3504	3391	3495	3112	2707
Export		277769	8148	16608	56627	60139	57774	68493	65099	64036	60363	41314
International marine bunkers		3894	5780	2857	4712	2801	1255	3409	3270	3416	3132	2700
Changes in stocks		-8951	-11159	-4689	-1824	-3450	926	-693	995	147	927	-1074
Gross consumption		136717	56156	19378	13887	6866	4145	3023	2364	1951	762	2173
Statistical difference			40	5592							438	
Transformed in power, heat and other plants:		70406	39377	14650	5536	4648	1634	1109	651	474	231	516
- in public CHP plants	1.A.1.a ii	44195	20511	7233	3837	4157	493	77	59			
- in autoproducer CHP plants	1.A.1.a ii	642	201	27			1115	930	522	420	215	495
- in public heat plants	1.A.1.a iii	20190	16618	6813	1659	491	26	102	70	54	16	21
- in autoproducer heat plants	1.A.1.a iii	5379	2047	577	40							
- in geothermal plants												
- in other industries												
Consumed in energy sector:		8068	3693	4899	6716	2005	2444	1865	1624	1462	946	1630
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries	1.A.1.b	8068	3693	4899	6716	2005	2444	1865	1624	1462	943	1628
- in electricity, gas, steam and air conditioning enterprises											3	2
Non energy use												
Distribution and transmission losses*		361			38							
Final consumption:		57882	13126	5421	1597	213	67	49	89	15	23	27
- in industry	1.A.2	43993	11520	5202	1486	148	67	49	89	15	23	27
- in construction	1.A.2.g.v	1044	201	11	17							
- in transport	1.A.3			3	4							
- in agriculture	1.A.4.c.i	1084	201	114	80	41						
- in fishing												
- in commercial / public services	1.A.4.a	11641	1204	91	10	24						
- in households	1.A.4.b	120										

Table 3-10. Balance of residual fuel oil (RFO) – low sulphur (<1%), TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production						4306	267	256	340	182	416	217
Liquid biofuels for blending												
Import				1407	1191	2779	516	701	1068	1565	1747	1728
Export					23	40	10	33	160	68	274	27
International marine bunkers				29	451	2224	203	475	890	1386	1587	1738
Changes in stocks				56	-60	-308	196	62	156	264	80	250
Gross consumption				1434	657	4513	766	511	514	557	382	430
Statistical difference												
Transformed in power, heat and other plants:				755	328	1232	436	178	161	357	120	159
- in public CHP plants	1.A.1.a ii					18	348	16	41	170	39	136
- in autoproducer CHP plants	1.A.1.a ii					1017						
- in public heat plants	1.A.1.a iii			713	318	197	87	162	120	187	81	23
- in autoproducer heat plants	1.A.1.a iii			42	10		1					
- in geothermal plants												
- in other industries												
Consumed in energy sector:						3042						
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries	1.A.1.b					3042						
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:				679	329	239	330	333	353	200	262	271
- in industry	1.A.2			363	220	147	275	278	298	187	248	253
- in construction	1.A.2.g.v			47	93	75	35	30	33	6	7	8
- in transport												
- in agriculture	1.A.4.c.i			15	2	5	17	16	17	5	7	10
- in fishing	1.A.4.c.i				9							
- in commercial / public services	1.A.4.a			254	5	12	3	9	5	2		
- in households												

Table 3-11. Balance of refinery gas, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production		11032	5318	8253	15250	14127	14007	15353	15518	14638	13549	11148
Liquid biofuels for blending												
Import												
Export												
International marine bunkers												
Changes in stocks												
Gross consumption		11032	5318	8253	15250	14127	14007	15353	15518	14638	13549	11148
Statistical difference												
Transformed in power, heat and other plants:						109	175	358	250	326	182	228
- in public CHP plants												
- in autoproducer CHP plants	1.A.1.a ii						175	358	250	326	182	228
- in public heat plants												
- in autoproducer heat plants	1.A.1.a iii					109						
- in geothermal plants												
- in other industries												
Consumed in energy sector:		11032	5318	8253	15250	14018	13832	14995	15268	14312	13367	10920
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries	1.A.1.b	11032	5318	8253	15250	14018	13832	14995	15268	14312	13367	10920
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:												
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-12. Balance of bitumen, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production		9534	1108	3117	6804	4938	5449	6588	8417	9776	14893	14574
Liquid biofuels for blending												
Import		40	791	474	1150	1814	1812	1371	1793	2174	2722	3730
Export		1662	356	839	2587	2896	3506	3824	5049	4655	12264	11677
International marine bunkers												
Changes in stocks		40	39	71	28	-165	-143	71	16	-274	196	-113
Gross consumption		7952	1582	2823	5395	3691	3612	4206	5177	7021	5547	6514
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use	1.AD	7952	1582	2823	5395	3691	3612	4206	5177	7021	5547	6514
Distribution and transmission losses												
Final consumption:												
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-13. Balance of lubricants, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production				1226	847	1504	1931	2350	2757	3006	3597	3506
Liquid biofuels for blending												
Import		413	620	602	1121	1709	1655	1411	1386	1393	1459	1489
Export				924	843	2350	2781	2970	3203	3355	3889	4053
International marine bunkers												
Changes in stocks				129	-14	-17	3	-46	-44	-3	-104	4
Gross consumption		413	620	1033	1111	846	808	745	896	1041	1063	946
Statistical difference				-84								
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use	1.AD	413	620	949	1111	846	808	745	896	1041	1063	946
Distribution and transmission losses												
Final consumption:												
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-14. Balance of petroleum coke, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production		1962	1393	2740	3940	3856	3745	4146	3890	3964	3972	3340
Liquid biofuels for blending												
Import					1100	9						
Export												
International marine bunkers												
Changes in stocks					-1054	102						
Gross consumption		1962	1393	2740	3986	3967	3745	4146	3890	3964	3972	3340
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:		1962	1393	2740	3940	3856	3745	4146	3890	3964	3972	3340
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries	1.A.1.b	1962	1393	2740	3940	3856	3745	4146	3890	3964	3972	3340
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:					46	111						
- in industry	1.A.2				46	111						
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-15. Balance of refinery feedstock, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production			8513	418	1827		640	77		505	246	
Liquid biofuels for blending												
Import		1304	17209	13934	3568	12171	24815	24167	12907	9043	8725	7894
Export							33	15	31	14	4	
International marine bunkers												
Changes in stocks		-1220	-8470	213	-1121	614	-1420	322	230	-507	-90	-1592
Gross consumption		84	17252	14565	4274	12785	24002	24551	13106	9027	8877	7676
Statistical difference			-43									
Transformed in power, heat and other plants:		84	17209	14565	4274	12785	24002	24551	13106	9027	8877	7676
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries		84	17209	14565	4274	12785	24002	24551	13106	9027	8877	7676
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:												
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-16. Balance of naphtha, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production					3477							
Liquid biofuels for blending												
Import												
Export					3257							
International marine bunkers												
Changes in stocks					-220							
Gross consumption												
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:												
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-17. Balance of orimulsion, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production												
Liquid biofuels for blending												
Import			729	1383	1681							
Export												
International marine bunkers												
Changes in stocks				-734	700							
Gross consumption			729	649	2381							
Statistical difference												
Transformed in power, heat and other plants:			729	649	2381							
- in public CHP plants	1.A.1.a ii		729	649	2381							
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:												
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-18. Balance of shale oil, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production												
Liquid biofuels for blending												
Import					73	19						
Export						18						
International marine bunkers												
Changes in stocks					-7	31						
Gross consumption					66	32						
Statistical difference												
Transformed in power, heat and other plants:					9	10						
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants	1.A.1.a iii				9	1						
- in autoproducer heat plants	1.A.1.a iii					9						
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:					57	22						
- in industry	1.A.2				13							
- in construction												
- in transport												
- in agriculture	1.A.4.c.i				23	4						
- in fishing												
- in commercial / public services	1.A.4.a				21	18						
- in households												

Table 3-19. Balance of other bituminous coal, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production												
Liquid biofuels for blending												
Import		31752	6506	176	53	4343	5701	5624	6833	6585	7161	4420
Export			50			438						
International marine bunkers												
Changes in stocks		980	2889			-275	640	536	-567	79	-595	674
Gross consumption		32732	9345	176	53	3630	6341	6160	6266	6664	6566	5094
Statistical difference												
Transformed in power, heat and other plants:		1834	452	25	53	55	88	83	69	69	78	56
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants	1.A.1.a iii	904	126	25	53	32	88	83	69	69	78	56
- in autoproducer heat plants	1.A.1.a iii	930	326			23						
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use	1.AD		25									
Distribution and transmission losses			25			0	10	2				
Final consumption:		30898	8843	151		3575	6243	6075	6197	6595	6488	5038
- in industry	1.A.2	1583	703	137		2860	3602	3141	2975	3373	3889	3169
- in construction	1.A.2.g.v	226	25	14		0	6	11	12	12	8	3
- in transport												
- in agriculture	1.A.4.c.i	1557	50			3	86	94	90	92	74	48
- in fishing												
- in commercial / public services	1.A.4.a	12359	6632			406	1089	1323	1377	1535	1190	786
- in households	1.A.4.b	15173	1433			305	1460	1506	1743	1583	1327	1032

Table 3-20. Balance of anthracite, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production												
Liquid biofuels for blending												
Import				100		90		24				
Export						1						
International marine bunkers												
Changes in stocks						-74			5			
Gross consumption				100		15		24	5			
Statistical difference												
Transformed in power, heat and other plants:				100								
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants	1.A.1.a iii			100								
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:						15		24	5			
- in industry	1.A.2					5		24	5			
- in construction	1.A.2.g.v					2						
- in transport												
- in agriculture	1.A.4.c.i					3						
- in fishing												
- in commercial / public services	1.A.4.a					4						
- in households	1.A.4.b					1						

Table 3-21. Balance of sub-bituminous coal, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production												
Liquid biofuels for blending												
Import				2698	6618	3248			60	35		
Export					37	406						
International marine bunkers												
Changes in stocks				11	-168	672	1	13	10	-9	29	4
Gross consumption				2709	6413	3514	1	13	70	26	29	4
Statistical difference												
Transformed in power, heat and other plants:				154	207	100	1					
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants	1.A.1.a iii			85	147	66	1					
- in autoproducer heat plants	1.A.1.a iii			69	60	34						
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use				7	3							
Distribution and transmission losses				11	6	8						
Final consumption:				2537	6197	3406		13	70	26	29	4
- in industry	1.A.2			5	3059	207			57	22	27	
- in construction	1.A.2.g.v				18	2						
- in transport												
- in agriculture	1.A.4.c.i			14	36	8						
- in fishing												
- in commercial / public services	1.A.4.a			1867	2036	1417		4	7	4	2	4
- in households	1.A.4.b			651	1048	1772		9	6			

Table 3-22. Balance of coke, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production												
Liquid biofuels for blending												
Import				445	440	466	391	456	474	546	505	533
Export												
International marine bunkers												
Changes in stocks				-52	96	7	8	14	21	2	-10	2
Gross consumption				393	536	473	399	470	495	548	495	535
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use	A.AD			47	2							
Distribution and transmission losses												
Final consumption:				346	534	473	399	470	495	548	495	535
- in industry	1.A.2			346	534	473	399	470	495	548	495	535
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-23. Balance of lignite, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production												
Liquid biofuels for blending												
Import				15	40	14						
Export												
International marine bunkers												
Changes in stocks				1	2	-6	1	1				
Gross consumption				16	42	8	1	1				
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:				16	42	8	1	1				
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services	1.A.4.a			16	25			1				
- in households	1.A.4.b				17	8	1					

Table 3-24. Balance of peat, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production		580	600	494	825	364	872	200	284	332	353	207
Liquid biofuels for blending												
Import												
Export				76	1	104	94	13	15	36	20	12
International marine bunkers												
Changes in stocks		116	222	51	-235	94	-510	153	341	307	30	40
Gross consumption		696	822	469	589	354	268	340	610	603	363	235
Statistical difference												
Transformed in power, heat and other plants:		445	357	258	299	202	141	191	418	423	246	185
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants	1.A.1.a iii	67	96	80	128	102	67	101	343	364	203	139
- in autoproducer heat plants	1.A.1.a iii	39	10	14								
- in geothermal plants												
- in other industries		339	251	163	171	100	74	90	75	59	43	46
Consumed in energy sector:			126	36	11		3	1	1			1
- in peat extraction enterprises	1.A.c.i			20	11		3	1	1			1
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises	1.A.c.ii		126	15								
Non energy use												
Distribution and transmission losses**		9	10	5	7				36			2
Final consumption:		242	329	170	272	152	124	148	155	180	117	47
- in industry	1.A.2	155	174	43	7	9	33	34	36	41	23	
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services	1.A.4.a	87	58		21	44	51	66	68	69	44	31
- in households	1.A.4.b		97	127	244	99	40	48	51	70	50	16

Table 3-25. Balance of peat briquettes and peat pellets, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production		239	186	138	147	84	63	77	64	50	37	39
Liquid biofuels for blending												
Import			119	2	143	696	604	797	786	976	769	513
Export							26	70	52	9	7	4
International marine bunkers												
Changes in stocks		-53	-13	-1	-35	-44	9	-26	62	-18	13	16
Gross consumption		186	292	139	255	736	650	778	860	999	812	564
Statistical difference												
Transformed in power, heat and other plants:					9	3				3	8	3
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants	1.A.1.a iii				2	1				3	8	3
- in autoproducer heat plants	1.A.1.a iii				7	2						
- in geothermal plants												
- in other industries												
Consumed in energy sector:				2							3	
- in peat extraction enterprises	1.A.c.i			2							3	
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses**								7				
Final consumption:		186	293	137	246	733	650	771	860	996	801	561
- in industry	1.A.2	13	53		8	27	16	18	23	28	20	4
- in construction												
- in transport												
- in agriculture	1.A.4.c.i				3	16	13	15	20	27	19	7
- in fishing												
- in commercial / public services	1.A.4.a	27	53	1	28	193	173	190	216	261	210	136
- in households	1.A.4.b	146	186	136	207	497	448	548	601	680	552	414

Table 3-26. Balance of paraffin and waxes, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production												
Liquid biofuels for blending												
Import					176	520	1776	1166	1356	1173	781	608
Export					106	384	1427	1017	1171	1103	660	538
International marine bunkers												
Changes in stocks						3	-202	34	68	71	-24	75
Gross consumption					70	139	147	183	253	141	97	145
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use	1.AD				70	139	147	183	253	141	97	145
Distribution and transmission losses												
Final consumption:												
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-27. Balance of natural gas, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production												
Liquid biofuels for blending												
Import		201957	84929	86453	104363	104017	89642	79106	87082	79844	96189	99751
Export		6102					3335	1536	7182	6301	18158	18080
International marine bunkers												
Changes in stocks				-37	-671	304	255	-466	547	803	27	884
Gross consumption		195855	84929	86416	103692	104321	86562	77104	80447	74346	78058	82555
Statistical difference												
Transformed in power, heat and other plants:		105124	41480	47241	57134	58186	24104	17721	14138	12662	10657	16417
- in public CHP plants	1.A.1.a ii	62825	17664	29650	42536	45755	17354	11413	8230	7084	5236	11960
- in autoproducer CHP plants	1.A.1.a ii	1787	473	324	1160	1003	1970	1675	1831	1056	2269	2072
- in public heat plants	1.A.1.a iii	34248	21952	16272	11414	10525	4357	4050	3708	4203	2744	2052
- in autoproducer heat plants	1.A.1.a iii	6265	1391	688	667	558	327	483	336	319	408	333
- in geothermal plants	1.A.1.a iii				819	345	96	100	33			
- in other industries	1.AD			307	538							
Consumed in energy sector:				140	130	65	1298	1103	773	778	2812	3823
- in peat extraction enterprises												
- in crude oil extraction enterprises	1.A.1.c.ii			3	3	3	2	2	2	1	1	1
- in refineries	1.A.1.b			28	28	4	15	58	63	46	2146	2869
- in electricity, gas, steam and air conditioning enterprises	1.A.1.c.ii			109	99	58	1281	1043	708	731	665	953
Non energy use	1.AD	26934	20167	22716	21335	20139	39432	35200	41679	35913	40136	37913
Distribution and transmission losses***		1688	1935	1119	420	5						
Final consumption:		62109	21347	15200	24673	25926	21728	23080	23857	24993	24453	24402
- in industry	1.A.2	36065	8916	8285	14573	13670	11417	11528	11601	12412	12104	11439
- in construction	1.A.2.g.v	1030	219	266	513	501	477	519	612	616	604	712
- in transport	1.A.3				647	1028	1250	1303	1412	1132	1106	1198
- in agriculture	1.A.4.c.i	2946	1197	991	1192	1309	872	899	911	876	866	849
- in fishing												
- in commercial / public services	1.A.4.a	12831	3319	1302	2118	2793	2575	2741	2883	3060	3039	2904
- in households	1.A.4.b	9237	7696	4356	5630	6625	5137	6090	6438	6897	6734	7300

Table 3-28. Balance of charcoal, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production					18	24	26	15	11	15	15	15
Liquid biofuels for blending												
Import					14	61	210	215	201	171	199	198
Export					15	38	163	180	126	110	77	98
International marine bunkers												
Changes in stocks					3	1	-7	-10	-13	5	-30	-7
Gross consumption					20	48	66	40	73	81	107	108
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:					20	48	66	40	73	81	107	108
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services	1.A.4.a				20	48	66	40	73	81	107	108
- in households												

Table 3-29. Balance of wood and wood waste, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production		11930	19632	27324	35293	41734	49852	49647	53960	52657	50969	51852
Liquid biofuels for blending												
Import			61	4	727	2008	5628	6203	4554	5637	5711	6214
Export				255	710	5102	5725	5669	6835	5482	5787	5751
International marine bunkers												
Changes in stocks		-14	-381	-54	-498	444	457	85	815	224	1140	420
Gross consumption		11916	19312	27019	34812	39084	50212	50266	52494	53036	52033	52735
Statistical difference					457				574	736		
Transformed in power, heat and other plants:		527	558	1640	6273	10408	24371	24324	27576	26689	26522	26456
- in public CHP plants	1.A.1.a ii				191	2472	6365	5771	7009	7327	7268	7665
- in autoproducer CHP plants												
- in public heat plants	1.A.1.a iii	274	156	1060	4906	7121	16987	17563	19341	17932	17415	16041
- in autoproducer heat plants	1.A.1.a iii	253	402	580	1128	772	980	990	1205	1404	1839	2750
- in geothermal plants												
- in other industries					48	43	39	41	21	26	33	27
Consumed in energy sector:				25	13	19	2	3				
- in peat extraction enterprises	1.A.1.c.i				13	4						
- in crude oil extraction enterprises												
- in refineries	1.A.1.b					1						
- in electricity, gas, steam and air conditioning enterprises	1.A.1.c.ii			25		14	2	3				
Non energy use												
Distribution and transmission losses				12	4							
Final consumption:		11389	18754	25342	28979	28657	25839	25898	25492	26347	25478	26252
- in industry	1.A.2	453	756	1218	4007	2920	3520	3776	3981	4373	4349	4944
- in construction	1.A.2.g.v	51	105	100	185	143	62	73	72	76	70	91
- in transport												
- in agriculture	1.A.4.c.i	187	211	272	253	399	383	434	568	588	566	674
- in fishing												
- in commercial / public services	1.A.4.a	1699	1104	1703	1278	1178	1332	1359	1191	1230	1178	1273
- in households	1.A.4.b	8999	16578	22049	23256	24017	20542	20256	19680	20 080	19315	19270

Table 3-30. Balance of agricultural waste, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production					96	228	585	591	535	603	672	608
Liquid biofuels for blending												
Import							10	2	28	4	1	10
Export							386	401	371	382	432	423
International marine bunkers												
Changes in stocks					16	11	-31	14	9	-25	-12	2
Gross consumption					112	239	178	206	201	200	229	197
Statistical difference												
Transformed in power, heat and other plants:					64	144	68	85	90	107	94	66
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants	1.A.1.a iii				55	131	68	85	90	107	94	66
- in autoproducer heat plants	1.A.1.a iii				9	13						
- in geothermal plants												
- in other industries												
Consumed in energy sector:						3						
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises	1.A.1.c.ii					3						
Non energy use												
Distribution and transmission losses												
Final consumption:					48	92	110	121	111	93	135	131
- in industry	1.A.2				41	11	16	28	30	24	43	61
- in construction												
- in transport												
- in agriculture	1.A.4.c.i				2	56	73	57	49	45	65	47
- in fishing												
- in commercial / public services	1.A.4.a					18	20	32	26	21	25	23
- in households	1.A.4.b				5	7	1	4	6	3	2	

Table 3-31. Balance of bioethanol, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production					195	1060	470	381	362	463	460	854
Liquid biofuels for blending												
Import						106	269	111	155	216	282	257
Export					162	649	308	184	189	342	333	445
International marine bunkers												
Changes in stocks					-7	-3	11	-39	16	-3		-7
Gross consumption					26	514	442	269	344	334	409	659
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use						78	37					
Distribution and transmission losses												
Final consumption:					26	436	405	269	344	334	409	659
- in industry												
- in construction												
- in transport	1.A.3				26	436	405	269	344	334	409	659
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-32. Balance of biodiesel, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production					260	3299	4353	3816	4372	5706	6179	6020
Liquid biofuels for blending												
Import						527	2035	1323	2171	2214	1826	3355
Export					168	2538	3865	3027	3953	5151	4998	5588
International marine bunkers												
Changes in stocks					27	166	-101	-15	68	153	-266	-137
Gross consumption					119	1454	2422	2097	2658	2922	2741	3650
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plants												
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:					119	1454	2422	2097	2658	2922	2741	3650
- in industry												
- in construction												
- in transport	1.A.3				119	1454	2422	2097	2658	2922	2741	3650
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-33. Balance of sludge biogas, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production					57	125	294	316	303	289	286	300
Liquid biofuels for blending												
Import												
Export												
International marine bunkers												
Changes in stocks												
Gross consumption					57	125	294	316	303	289	286	300
Statistical difference												
Transformed in power, heat and other plants:					36	55	106	109	118	112	112	116
- in public CHP plants	1.A.1.a ii				17	8	21	4				
- in autoproducer CHP plants	1.A.1.a ii				3	47	85	105	118	112	112	116
- in public heat plants	1.A.1.a iii				16							
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:					21	70	188	207	185	177	174	184
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services	1.A.4.a				21	70	188	207	185	177	174	184
- in households												

Table 3-34. Balance of landfill biogas, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production						83	343	356	213	418	366	274
Liquid biofuels for blending												
Import												
Export												
International marine bunkers												
Changes in stocks												
Gross consumption						83	343	356	213	418	366	274
Statistical difference												
Transformed in power, heat and other plants:						83	338	342	197	391	344	262
- in public CHP plants	1.A.1.a ii					35	266	264	115	305	258	180
- in autoproducer CHP plants	1.A.1.a ii					48	72	78	82	86	86	82
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:							5	14	16	27	22	12
- in industry	1.A.2						2	1	1	1		1
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services	1.A.4.a						3	13	15	26	22	11
- in households												

Table 3-35. Balance of other biogas from agricultural waste, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production					20	210	344	669	834	847	980	1043
Liquid biofuels for blending												
Import												
Export												
International marine bunkers												
Changes in stocks												
Gross consumption					20	210	344	669	834	847	980	1043
Statistical difference												
Transformed in power, heat and other plants:					7	91	225	545	689	706	808	858
- in public CHP plants	1.A.1.a ii							50	211	494	590	604
- in autoproducer CHP plants	1.A.1.a ii				7	91	225	495	478	212	218	254
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses												
Final consumption:					13	119	119	124	145	141	172	185
- in industry	1.A.2					104	119	124	145	141	172	185
- in construction												
- in transport												
- in agriculture	1.A.4.c.i				13	15						
- in fishing												
- in commercial / public services												
- in households												

Table 3-36. Balance of emulsified vacuum residue, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Production						19		40							
Liquid biofuels for blending															
Import															
Export						19		40							
International marine bunkers															
Changes in stocks															
Gross consumption															
Statistical difference															
Transformed in power, heat and other plants:															
- in public CHP plants															
- in autoproducer CHP plants															
- in public heat plants															
- in autoproducer heat plants															
- in geothermal plants															
- in other industries															
Consumed in energy sector:															
- in peat extraction enterprises															
- in crude oil extraction enterprises															
- in refineries															
- in electricity, gas, steam and air conditioning enterprises															
Non energy use															
Distribution and transmission losses															
Final consumption:															
- in industry															
- in construction															
- in transport															
- in agriculture															
- in fishing															
- in commercial / public services															
- in households															

Table 3-37. Balance of industrial waste, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production							303	626	183	644	744	1010
Liquid biofuels for blending												
Import												
Export												
International marine bunkers												
Changes in stocks							-13		-1	-13	8	-12
Gross consumption							290	626	182	631	752	998
Statistical difference												
Transformed in power, heat and other plants:							290	626	181	584	665	927
- in public CHP plants	1.A.1.a ii						290	626	181	584	578	831
- in autoproducer CHP plants											87	96
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses****									1	3	3	4
Final consumption:										44	84	67
- in industry	1.A.2.f									44	84	67
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-38. Balance of industrial waste (biomass fraction), TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production								140	186	572	593	823
Liquid biofuels for blending												
Import												
Export												
International marine bunkers												
Changes in stocks									-2	-9	8	-12
Gross consumption								140	184	563	601	811
Statistical difference												
Transformed in power, heat and other plants:								140	183	560	567	782
- in public CHP plants	1.A.1.a ii							140	183	560	567	782
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses****									1	3	3	4
Final consumption:											31	25
- in industry											31	25
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-39. Balance of municipal waste (non-biomass fraction), TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production							661	1583	1246	865	751	1511
Liquid biofuels for blending												
Import												
Export												
International marine bunkers												
Changes in stocks							-8	-6	-19	1	4	-56
Gross consumption							653	1577	1227	866	755	1455
Statistical difference												
Transformed in power, heat and other plants:							653	1577	1220	861	751	1451
- in public CHP plants	1.A.1.a ii						653	1577	1220	861	751	1451
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses****									7	5	4	4
Final consumption:												
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-40. Balance of municipal waste (biomass fraction), TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production							676	912	1230	827	747	1182
Liquid biofuels for blending												
Import												
Export												
International marine bunkers												
Changes in stocks							-17	-9	-2	-5	8	-17
Gross consumption							659	903	1228	822	755	1165
Statistical difference												
Transformed in power, heat and other plants:							659	903	1223	817	752	1161
- in public CHP plants	1.A.1.a ii						659	903	1223	817	752	1161
- in autoproducer CHP plants												
- in public heat plants												
- in autoproducer heat plants												
- in geothermal plants												
- in other industries												
Consumed in energy sector:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non energy use												
Distribution and transmission losses****									5	5	3	4
Final consumption:												
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

*According to Lithuania Statistics, transmission losses of liquid fuels arise during the primary refining of oil, but fugitive emissions from oil refining are calculated using Tier 1, on the basis of crude oil refined.

**Losses of peat are not related to fugitive emissions.

*** Part of natural gas losses is natural gas combustion for technological needs, therefore not all the losses are treated as fugitive emissions.

****Waste losses occur from delivery to a landfill up to the moment of utilization. Waste loses humidity, evaporate, rot and decompose during that time. These losses are not accounted in fugitive emissions.

ANNEX IV. Lithuanian energy consumption in manufacturing industries

Table 4-1. Energy consumption by fuel type in Chemicals industries, TJ

Fuel type	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Heating and other gasoil	0	0	0	0	0	0	0	0	1	0	2
Residual fuel oil (RFO)	883	281	20	0	47	0	0	0	0	0	0
Liquefied petroleum gases (LPG)	0	0	0	7	17	31	23	41	39	54	55
Other bituminous coal	0	0	0	0	0	0	0	1	0	0	0
Sub-bituminous coal	0	0	0	0	0	0	0	0	0	0	0
Natural gas	6001	1563	191	4972	5476	5489	4781	4876	5136	5577	4992
Wood and wood waste	0	0	3	0	0	66	113	607	459	451	445
Biogas	0	0	0	0	94	84	92	96	99	126	124
Total	6884	1844	214	4980	5634	5670	5009	5621	5734	6208	5618

Table 4-2. Energy consumption by fuel type in Pulp, paper and print industries, TJ

Fuel type	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Heating and other gasoil	0	0	4	0	0	0	2	5	6	6	8
Residual fuel oil (RFO)	883	401	64	0	0	0	0	0	0	0	0
Liquefied petroleum gases (LPG)	0	0	42	4	3	6	5	4	47	58	3
Coke	0	0	0	0	0	0	0	0	0	0	0
Other bituminous coal	0	75	18	0	0	0	0	0	0	0	0
Sub-bituminous coal	0	0	0	0	0	0	0	0	0	0	0
Natural gas	3388	749	1162	448	1172	384	510	587	707	618	556
Wood and wood waste	3	5	1	0	128	161	195	258	779	794	766
Peat	0	0	0	0	0	0	0	0	2	1	2
Total	4274	1231	1291	453	1303	551	712	854	1541	1477	1335

Table 4-3. Energy consumption by fuel type in Food Processing, Beverages and Tobacco industries, TJ

Fuel type	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Heating and other gasoil	0	0	3	148	94	99	53	71	84	95	112
Residual fuel oil (RFO)	2248	1606	1567	334	212	271	273	289	180	239	249
Liquefied petroleum gases (LPG)	0	0	121	158	192	209	219	217	168	156	124
Shale oil	0	0	0	13	0	0	0	0	0	0	0
Coke	0	0	105	64	54	45	60	38	60	52	82
Other bituminous coal	352	151	68	0	3	36	33	61	24	15	16
Anthracite	0	0	0	0	0	0	0	5	0	0	0
Sub-bituminous coal	0	0	0	50	38	0	0	0	0	0	0
Natural gas	8498	2077	2890	3695	4005	3379	3515	3477	3815	3412	3536
Wood and wood waste	36	57	77	297	93	668	640	624	491	406	545
Other solid biomass	0	0	0	0	0	16	24	25	16	16	41
Biogas	0	0	0	0	10	35	32	49	42	46	61
Peat	0	0	0	6	15	7	8	8	10	6	0
Total	11134	3890	4831	4765	4716	4765	4857	4864	4890	4443	4766

Table 4-4. Energy consumption by fuel type in Non-Metallic Minerals industries, TJ

Fuel type	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Heating and other gasoil	0	0	0	148	65	75	43	70	83	100	109
Residual fuel oil (RFO)	35444	7787	3522	1180	1	57	45	86	13	23	24
Liquefied petroleum gases (LPG)	0	0	5	5	2	3	3	3	3	11	4
Petroleum coke	0	0	0	46	111	0	0	0	0	0	0
Coke	0	0	190	402	387	336	394	439	471	429	453
Other bituminous coal	628	327	8	0	2847	3545	3088	2890	3332	3861	3138
Anthracite	0	0	0	0	0	0	24	0	0	0	0
Sub-bituminous coal	0	0	0	2924	153	0	0	57	22	23	0
Natural gas	6934	1833	1775	1615	909	945	1055	986	1001	947	901
Wood and wood waste	19	63	152	566	345	266	302	166	471	449	436
Other solid biomass	0	0	0	0	0	0	0	0	0	0	3
Peat	168	227	43	7	11	33	34	36	38	23	1
Industrial waste (used tires)	0	0	0	0	209	0	0	45	44	84	67
Industrial waste (biomass)	0	0	0	0	0	0	0	0	0	31	25
Total	43193	10237	5695	6894	5040	5260	4988	4778	5478	5981	5161

Table 4-5. Energy consumption by fuel type in Transport Equipment industries, TJ

Fuel type	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Heating and other gasoil	0	0	0	1	1	1	2	3	5	5	7
Residual fuel oil (RFO)	0	0	0	0	0	0	0	0	0	0	0
Liquefied petroleum gases (LPG)	0	0	9	8	1	2	0	0	3	2	0
Other bituminous coal	0	0	0	0	1	4	2	1	1	0	1
Sub-bituminous coal	0	0	0	4	1	0	0	0	0	1	0
Natural gas	189	102	171	238	105	47	54	61	73	60	71
Wood and wood waste	0	0	0	1	1	0	0	1	3	5	4
Other solid biomass	0	0	0	0	0	0	0	0	1	0	0
Total	189	102	180	252	110	54	58	66	86	73	83

Table 4-6. Energy consumption by fuel type in Machinery industries, TJ

Fuel type	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Heating and other gasoil	0	0	0	4	8	2	2	2	4	5	7
Residual fuel oil (RFO)	1565	482	48	0	0	3	4	8	0	0	0
Liquefied petroleum gases (LPG)	0	0	5	15	9	7	9	10	13	22	9
Coke	0	0	23	17	3	0	0	0	0	0	0
Other bituminous coal	50	0	8	0	0	5	4	8	4	3	3
Anthracite	0	0	0	0	3	0	0	0	0	0	0
Sub-bituminous coal	0	0	0	13	2	0	0	0	0	0	0
Natural gas	2923	1036	924	1099	262	238	327	362	417	406	372
Wood and wood waste	14	68	108	373	36	14	18	4	25	17	12
Other solid biomass	0	0	0	0	9	0	0	5	7	27	17
Peat	0	0	0	1	3	1	2	3	3	3	0
Total	4553	1586	1116	1522	335	270	366	402	473	483	420

Table 4-7. Energy consumption by fuel type in Mining and Quarrying industries, TJ

Fuel type	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Heating and other gasoil	0	0	0	5	0	1	1	1	2	1	2
Residual fuel oil (RFO)	80	40	56	0	0	0	0	0	0	0	3
Liquefied petroleum gases (LPG)	0	0	0	0	0	0	0	0	2	2	5
Other bituminous coal	0	0	3	0	0	1	1	1	0	0	1
Anthracite	0	0	0	0	0	0	0	0	0	0	0
Sub-bituminous coal	0	0	0	2	0	0	0	0	0	0	0
Natural gas	270	264	20	41	17	11	9	9	11	10	44
Wood and wood waste	0	0	2	5	4	18	25	16	14	6	12
Peat	0	0	0	0	1	0	0	0	1	0	1
Total	350	304	80	53	22	31	36	27	30	19	68

Table 4-8. Energy consumption by fuel type in Wood and Wood Products industries, TJ

Fuel type	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Heating and other gasoil	0	0	0	3	0	0	1	1	1	1	7
Residual fuel oil (RFO)	1204	321	148	147	31	0	0	0	0	0	0
Liquefied petroleum gases (LPG)	0	0	5	3	19	7	8	7	9	17	8
Other bituminous coal	0	0	0	0	0	0	0	0	0	0	0
Anthracite	0	0	0	0	0	0	0	0	0	0	0
Sub-bituminous coal	0	0	0	12	0	0	0	0	0	3	0
Natural gas	1167	451	288	1046	944	131	445	472	394	279	315
Wood and wood waste	240	284	466	2081	1905	1670	1995	1775	1673	1704	2213
Other solid biomass	0	0	0	0	0	0	4	0	0	0	0
Peat	0	0	0	1	1	1	2	3	4	3	0
Total	2611	1056	906	3294	2900	1809	2455	2258	2081	2007	2543

Table 4-9. Energy consumption by fuel type in Construction industries, TJ

Fuel type	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Heating and other gasoil	0	0	7	25	47	67	39	44	54	57	64
Residual fuel oil (RFO)	1044	201	58	110	75	35	30	33	6	7	8
Liquefied petroleum gases (LPG)	92	46	74	77	122	38	55	58	50	49	72
Other bituminous coal	226	25	14	0	0	6	11	12	12	8	3
Anthracite	0	0	0	0	2	0	0	0	0	0	0
Sub-bituminous coal	0	0	0	18	2	0	0	0	0	0	0
Natural gas	1030	219	266	513	501	477	519	612	616	604	712
Wood and wood waste	51	105	100	185	143	62	73	72	76	70	91
Peat	0	0	0	0	0	0	0	0	0	0	0
Total	2443	596	519	928	892	685	727	831	814	795	950

Table 4-10. Energy consumption by fuel type in Textile and Leather industries, TJ

Fuel type	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Heating and other gasoil	0	0	0	76	41	26	17	18	24	26	37
Residual fuel oil (RFO)	1365	442	140	40	4	11	5	4	9	9	4
Liquefied petroleum gases (LPG)	0	0	5	2	12	14	13	18	18	19	12
Other bituminous coal	528	100	35	0	7	10	10	8	9	7	6
Anthracite	0	0	0	0	2	0	0	0	0	0	0
Sub-bituminous coal	0	0	0	49	8	0	0	0	0	0	0
Natural gas	2467	646	810	1228	591	568	647	555	638	564	397
Wood and wood waste	20	50	109	37	18	35	28	29	29	25	26
Other solid biomass	0	0	0	41	2	0	0	0	0	0	0
Peat	0	0	0	1	1	0	0	1	0	0	0
Total	4379	1238	1099	1474	686	664	720	633	727	650	482

Table 4-11. Energy consumption by fuel type in Non-Specified Industry, TJ

Fuel type	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Heating and other gasoil	0	0	0	20	11	24	17	22	22	25	37
Residual fuel oil (RFO)	321	161	0	3	0	0	0	0	0	0	0
Liquefied petroleum gases (LPG)	0	0	9	26	18	47	49	55	53	55	61
Coke	0	0	28	52	29	18	16	18	17	14	0
Other bituminous coal	25	50	0	0	2	1	3	5	3	3	4
Anthracite	0	0	0	0	0	0	0	0	0	0	0
Sub-bituminous coal	0	0	5	5	5	0	0	0	0	0	0
Natural gas	4228	195	54	189	189	225	185	216	220	231	255
Wood and wood waste	121	229	300	646	390	622	460	501	429	492	485
Other solid biomass	0	0	0	0	0	0	0	0	0	0	0
Biogas	0	0	0	0	0	2	1	1	1	0	1
Peat	0	0	0	1	4	7	6	8	11	7	0
Industrial waste	0	0	0	0	0	9	48	57	67	69	75
Total	4695	635	396	943	648	955	785	883	823	896	918

ANNEX V. Energy sector country specific CO₂ emission factors

Country specific CO₂ emission factors have been derived in study “Determination of national GHG emission factors for energy sector” (performed in 2012 by Lithuanian Energy Institute) and study “Update of country specific GHG emission factors for energy sector” (performed in 2016 by Lithuanian Energy Institute). Results of 2012 study are presented in scientific publication “Assessment of national carbon dioxide emission factors for the Lithuanian fuel combustion sector” published in journal “Greenhouse Gas Measurement and Management”, Volume 4, 2014 – Issue 1 <https://www.tandfonline.com/doi/full/10.1080/20430779.2014.905243>. Summary of study "Update of country specific GHG emission factors for energy sector" is presented in Annex IX.

According to the agreement with Ministry of Environment the accredited Laboratory of Quality Research Centre of AB “ORLEN Lietuva” (petroleum refining company) performed measurements for CO₂ emission factors for all oil products produced at this refinery in 2017. Refinery provided measurements’ protocols for all samples of their products. AB “ORLEN Lietuva” performed measurements for 6 samples of diesel, jet fuel, gasoline (A-95), LPG (summer and winter types), 4 samples of gasoline (A-98) and 6 samples of liquefied petroleum gas for residential sector (BT and SPBT types). Standard practise for sampling petroleum products has been used as presented in Table 5-1.

Table 5-1. Sampling and test methods used by AB „ORLEN Lietuva“

Product	Sampling method	Test method for CO ₂ emission factor evaluation
Diesel	LST EN ISO 3170:2004 ASTM D5291-16 D	Thermo Fisher Scientific method No. 85
Gasoline	LST EN ISO 3170:2004 PIANO method	Thermo Fisher Scientific method No. 85
Jet fuel	ASTM D4057-12 ASTM D5291-16 D	Thermo Fisher Scientific method No. 85
Liquefied petroleum gas	LST EN ISO 4257:2002 LST EN SIO 4257:2002/AC:2007	Thermo Fisher Scientific method No. 85

Country specific CO₂ emission factors for all fuel types are presented in Table 5-2 and Table 5-3.

Table 5-2. Country specific CO₂ emission factors, t/TJ

Fuel type	1990-2014	2015	2016	2017	2018	2019	2020
Liquid fuel							
Heating and other gasoil	72.89	72.73	72.73	72.80	72.80	72.80	72.80
Residual fuel oil (RFO)	77.60	78.40	78.40	78.40	78.40	78.40	78.40
Liquefied petroleum gases (LPG)	65.42	66.34	66.34	66.81	66.81	66.81	66.81
Shale oil	77.40	76.60	76.60	76.60	76.60	76.60	76.60
Crude oil	77.74	77.74	77.74	77.74	77.74	77.74	77.74
Petroleum coke	94.06	94.06	94.06	94.06	94.06	94.06	94.06
Diesel oil	72.89	72.73	72.73	72.80	72.80	72.80	72.80
Motor gasoline	72.97	72.77	72.77	70.13	70.13	70.13	70.13
Aviation gasoline and gasoline type jet fuel	71.62	70.81	70.81	70.81	70.81	70.81	70.81
Jet kerosene	72.24	71.74	71.74	71.67	71.67	71.67	71.67
Solid fuel							
Coke	109.11	109.11	109.11	109.11	109.11	109.11	109.11
Other bituminous coal	94.90	95.10	95.10	95.10	95.10	95.10	95.10
Anthracite	106.55	106.55	106.55	106.55	106.55	106.55	106.55
Sub-bituminous coal	96.10	96.10	96.10	96.10	96.10	96.10	96.10
Lignite	101.2	101.0	101.0	101.0	101.0	101.0	101.0
Peat	104.34	104.34	104.34	104.34	104.34	104.34	104.34
Biomass							
Wood and wood waste	101.34	101.34	101.34	101.34	101.34	101.34	101.34
Other solid biomass	103.69	103.69	103.69	103.69	103.69	103.69	103.69
Biogas	58.45	58.45	58.45	58.45	58.45	58.45	58.45
Charcoal	109.9	109.9	109.9	109.9	109.9	109.9	109.9
Waste							
Municipal waste (non-biomass fraction)	111.65	111.65	111.65	111.65	111.65	111.65	111.65
Municipal and industrial waste (biomass fraction)	109.03	109.03	109.03	109.03	109.03	109.03	109.03
Industrial waste – used tires (rubber)	85.00	-	-	84.40	88.70	88.70	88.70

Table 5-3. Country specific CO₂ emission factors of natural gas, t/TJ

Fuel type	1990-2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Natural gas	55.14	55.09	55.09	55.12	55.11	55.11	55.16	55.12	55.12	55.16	55.21	55.24	55.53	55.73	55.57	55.54	55.59	55.34

ANNEX VI. Summary of study "Update of country specific GHG emission factors for energy sector" (2016)

During combustion a great share of carbon is removed immediately as CO₂, therefore conditions of combustion process practically have not influence on CO₂ emission factors. CO₂ emission factors depend on type of fuel, i.e. on the amount of carbon content in this fuel. After the summarization of performed comparative analysis of applied emission factors in other EU countries, summarization of data provided by the operators under the EU ETS system and aggregation of results provided by the accredited research laboratories, the study determined country specific CO₂ emission factors for energy sector (fuel combustion). Updated values of country specific CO₂ emission factors are set considering to the results of analysis performed. Besides, determined values of emission factors assure low as possible uncertainty of emission factors.

CH₄ and N₂O emission factors are influenced by type of technology, operating conditions, age of equipment and other combustion conditions, therefore values of these emission factors significantly differ between the individual technologies. Seeking to precisely set country specific CH₄ and N₂O emission factors of energy technologies used in Lithuania, it is essential to perform comprehensive and multiplex measurements of emissions by differencing in accordance to the group of equipment and fuel type. However, the measurements have to be long-lasting, therefore in this study recommended values of CH₄ and N₂O emission factors are based on the default IPCC (2006) values.

Updated CO₂ emission factors and previously applied CO₂ emission factors (presented in the study on "Determination of national GHG emission factors for energy sector", 2012) for energy sector are provided in Tables 6-1.

Table 6-1. GHG emission factors for energy industries

1.A.1 Energy industries	CO₂ emission factors in the study of 2016, t/TJ	CO₂ emission factors in the study of 2012, t/TJ
Liquid fuel		
Motor gasoline	72.77	72.97
Diesel	72.73	72.89
Gasoil	72.73	72.89
Residual fuel oil (RFO)	78.4	77.6
Petroleum coke	94.06	94.06
Refinery gas	56.9	55.82
Orimulsion	81.74	81.74
Shale oil	76.6	77.4
Liquified petroleum gas (LPG)	66.34	65.42
Crude oil	77.74	77.74
Solid fuel		
Other bituminous coal	95.1	94.9
Anthracite	106.55	-
Sub-bituminous coal	96.1	-
Peat	104.34	104.34
Natural gas		
Natural gas	55.14*	55.23
Biomass		
Wood and wood waste	101.34	109.9
Other solid biomass	103.69	-
Biogas	58.45	58.45
Waste		
Municipality waste (RES)	109.03	-
Municipality waste (non-RES)	111.65	-
Industrial waste	143	-

Remark: * Seeking to ensure higher accuracy of GHG emissions accounting, it is valuable to apply time series of CO₂ emission factor for a period 2004-2014, but an average value of 55,14 t/TJ for a period 1990-2003. Since 2015, country will have to calculate CO₂ emission factor for natural gas considering to the chemical composition of natural gas imported through the pipeline and the liquefied natural gas terminal by applying the method of weighted average.

Updated country specific CO₂ emission factor for natural gas is determined considering to the chemical composition of natural gas during 2004-2014 that was provided by Central Calibration and Test Laboratory of AB “Lietuvos dujos”. Seeking to ensure higher accuracy of GHG inventory, it is valuable to apply time series of CO₂ emission factor for a period 2004-2014, but an average value of 55.14 t/TJ – for a period 1990-2003. Since 2015, country specific CO₂ emission factor for natural gas should be estimated considering chemical composition of natural gas imported through the pipeline and the liquefied natural gas terminal. The CO₂ emission factor for natural gas since 2015 should be calculated applying the method of weighted average and considering to the import structure and chemical composition of natural gas.

Values of country specific CO₂ emission factors for gasoline, diesel, gasoil, jet kerosene, residual fuel oil and liquefied petroleum gas are updated considering the results of measurements of petroleum products that were performed by the accredited Laboratory of Quality Research Centre of AB „ORLEN Lietuva“. When accounting GHG emissions, it is valuable to apply the updated CO₂ emission factors for a specified in this paragraph fuels for a period after 2015 and for a period 1990-2014 to use the emission factors determined in the study of 2012.

Values of country specific CO₂ emission factors for other bituminous coal, petroleum coke, orimulsion, refinery gas and coke are updated on the basis of data provided by the operators under EU ETS and considering to the Tier 3 reliability that ensures the lowest uncertainty of emission factor. Sustaining to data base of EU ETS, in some cases it is possible to apply emission factors set at the plant-specific level. For example, this can be applied for orimulsion or residual fuel oil combusted in CHP of the AB “ORLEN Lietuva”. The application of plant-specific emission factors enables to use higher Tiers in the national GHG inventory.

Value of CO₂ emission factor for shale oil is based on national Estonian emission factor considering the fact that shale oil is imported to Lithuania from Estonia. When preparing the inventory of GHG emissions, it is recommended to apply the updated CO₂ emission factor for shale oil after 2015.

Country specific CO₂ emission factors for wood, wood waste, agricultural waste and municipality waste (renewable and non-renewable) are specified by performed measurements in the Laboratory of Heat Equipment Research and Testing (Lithuanian Energy Institute). The Laboratory of Heat Equipment Research and Testing performed measurements for 17 samples of municipal waste (non-biomass fraction); 6 samples of municipal waste (biomass fraction); 21 samples of agricultural waste and 4 samples of wood/wood waste. It is recommended to apply the updated CO₂ emission factors for the specified in this paragraph fuels when recalculating GHG emissions from 1990. This will ensure higher reliability of accounting, considering to the significantly lower uncertainties of the updated CO₂ emission factors.

Value of CO₂ emission factor for biogas and industrial waste is updated in accordance to the results of analysis on applied emission factors in other EU countries and considering the results of long-lasting research analysis performed in other countries. However, seeking to ensure low uncertainty of emission factor for biogas, it is essential to perform long-lasting measurements for different types of biogas in Lithuania.

The reliability of the updated CO₂ emission factors is assessed considering default values given in 2006 *IPCC Guidelines* and results of performed comparative analysis, where the updated CO₂ emission factors were compared with the emission factors applied in EU countries. The comparison of updated CO₂ emission factors with default values of 2006 *IPCC Guidelines* is presented in Figure 6-1.

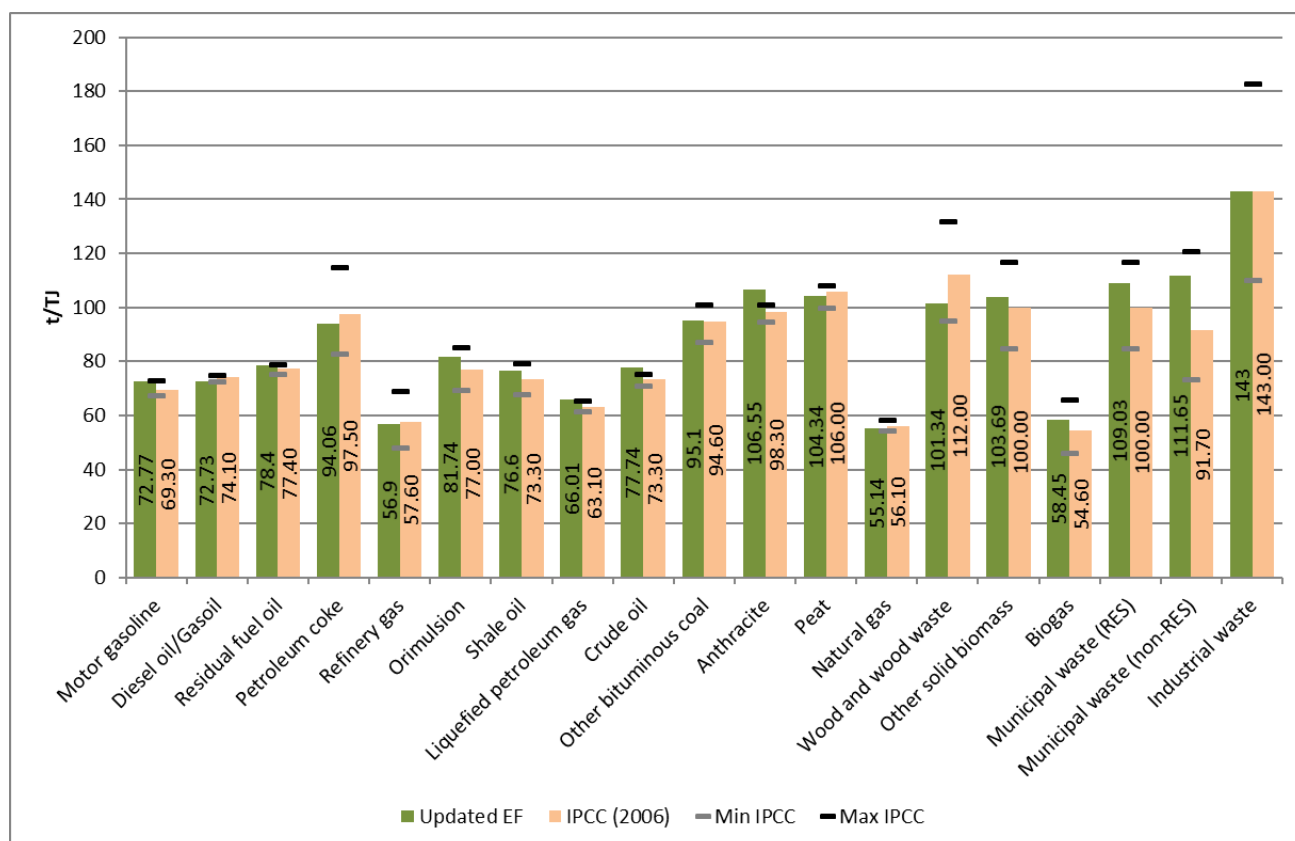


Figure 6-1. Comparison of updated country specific CO₂ emission factors and default 2006 IPCC Guidelines emission factors: energy industries

As it is seen from Figure 6-1, the updated values of country specific CO₂ emission factors for fuels fall into the uncertainty ranges of default 2006 IPCC Guidelines, except for crude oil and anthracite. The updated values of country specific CO₂ emission factors for crude oil and anthracite are by 5.71% and 7.74% higher than default 2006 IPCC Guidelines values, respectively.

CO₂ emission factors for manufacturing industries and construction are recommended the same as for energy industries sector (Table 6-2).

Table 6-2. GHG emission factors for manufacturing industries and construction

1.A.2 Manufacturing industries and construction	CO ₂ emission factors in the study of 2016, t/TJ	CO ₂ emission factors in the study of 2012, t/TJ
Liquid fuel		
Gasoil	72.73	72.89
Residual fuel oil	78.4	77.60
Petroleum coke	94.06	94.06
Shale oil	76.6	77.40
Liquified petroleum gas	66.34	65.42
Jet kerosene	71.74	72.24
Solid fuel		
Other bituminous coal	95.1	94.90
Anthracite	106.55	-
Sub-bituminous coal	96.1	-
Peat	104.34	104.34
Coke	109.11	109.11
Natural gas		
Natural gas	55.14*	55.23
Biomass		
Wood and wood waste	101.34	109.9
Other solid biomass	103.69	-
Biogas	58.45	58.45

Waste		
Industrial waste (used tires)	85.00	-

Remark: * Seeking to ensure higher accuracy of GHG emissions accounting, it is valuable to apply time series of CO₂ emission factor for a period 2004-2014, but an average value of 55,14 t/TJ for a period 1990-2003. Since 2015, country will have to calculate CO₂ emission factor for natural gas considering to the chemical composition of natural gas imported through the pipeline and the liquefied natural gas terminal by applying the method of weighted average.

Updated values of CO₂ emission factors for transport sector are presented in Table 6-3. CO₂ emission factors of fuels (except aviation gasoline) used in transport sector are updated on the basis of measurement performed by the accredited Laboratory of Quality Research Centre of AB „ORLEN Lietuva“. AB ORLEN Lietuva performed measurements for 1 sample of diesel, jet fuel, RFO, gasoil; 3 samples of gasoline and 2 samples of liquefied petroleum gas. Aviation gasoline is not produced in Lithuania. Minor volume of this fuel is imported from Sweden and other EU countries; therefore, it is recommended for aviation gasoline to apply average value of emission factors applied in EU countries.

Table 6-3. GHG emission factors for transport sector

1.A.3 Transport	CO₂ emission factors in the study of 2016, t/TJ	CO₂ emission factors in the study of 2012, t/TJ
Aviation gasoline	70.81	71.62
Jet kerosene	71.74	72.24
Motor gasoline	72.77	72.97
Gasoline with bioethanol	72.76	-
Gasoline with MTBE	72.23	-
Diesel	72.73	72.89
Liquefied petroleum gas (LPG)	66.01	65.42
Residual fuel oil	78.4	77.60

The comparison of updated country specific CO₂ emission factors with default 2006 IPCC Guidelines emission factors are presented in Figure 6-2.

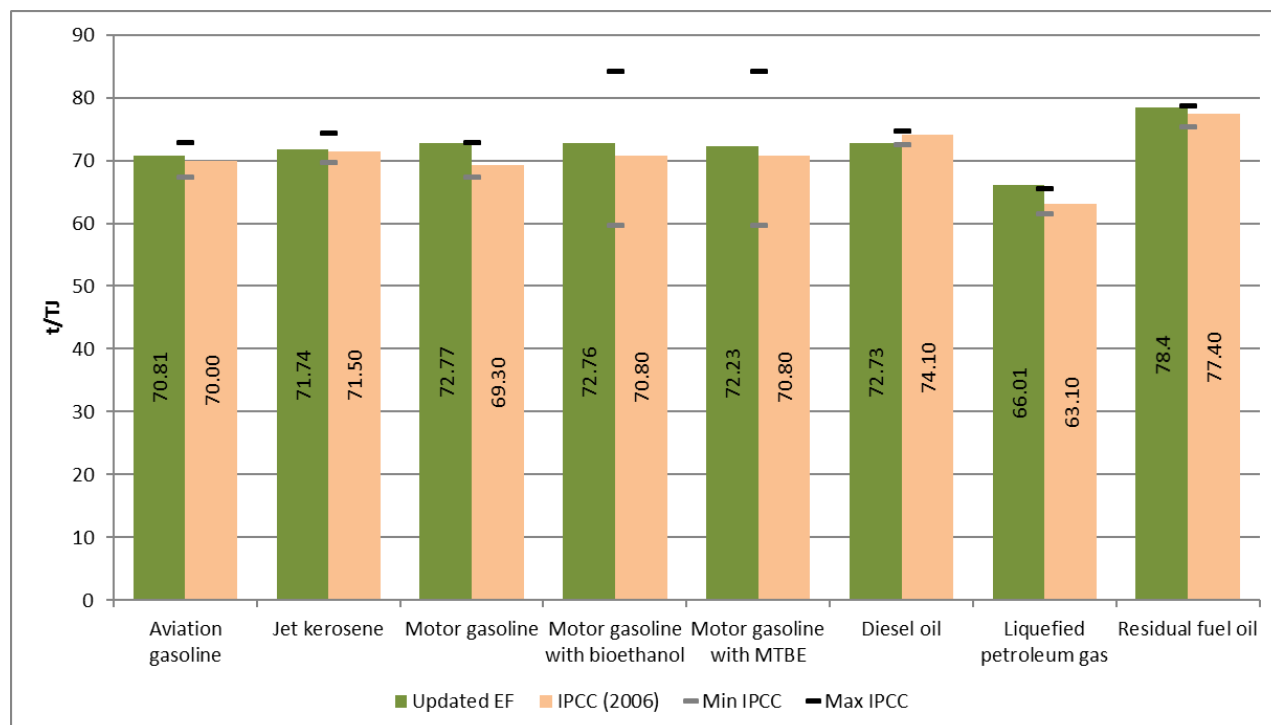


Figure 6-2. Comparison of updated country specific CO₂ emission factors with default 2006 IPCC Guidelines emission factors: transport sector

As it is seen from Figure 6-2, updated values of country specific CO₂ emission factors for fuels in transport sector fall into the uncertainty ranges of 2006 IPCC Guidelines, except for liquefied petroleum

gas. The updated value of CO₂ emission factor for liquefied petroleum gas is by 4.41% higher than its default value.

Recommended values of CO₂ emission factors for commercial/institutional, household, agriculture/forestry/fishing sector are presented in Table 6-4.

Table 6-4. GHG emission factors for *commercial/institutional, household, agriculture/forestry and fishing sectors*

1.A.4 Other sectors	CO₂ emission factors in the study of 2016, t/TJ	CO₂ emission factors in the study of 2012, t/TJ
Commercial/ institutional sector		
Other bituminous coal	95.1	94.9
Anthracite	106.55	-
Sub-bituminous coal	96.1	-
Biogas	58.45	58.45
Peat	104.34	104.34
Natural gas	55.14*	55.23
Gasoil	72.73	72.89
Lignite	101	101.2
Wood and wood waste	101.34	109.9
Other solid biomass	103.69	-
Residual fuel oil	78.4	77.6
Charcoal	109.9	109.9
Shale oil	76.6	77.4
Liquified petroleum gas	66.34	65.42
Household sector		
Other bituminous coal	95.1	94.9
Anthracite	106.55	-
Sub-bituminous coal	96.1	-
Peat	104.34	104.34
Natural gas	55.14*	55.23
Gasoil	72.73	72.89
Lignite	101	101.2
Wood and wood waste	101.34	109.9
Other solid biomass	103.69	-
Residual fuel oil	78.4	77.6
Liquified petroleum gas	66.34	65.42
Agriculture/forestry and fishing sector		
Other bituminous coal	95.1	94.9
Anthracite	106.55	-
Sub-bituminous coal	96.1	-
Biogas	58.45	58.45
Peat	104.34	104.34
Natural gas	55.14*	55.23
Gasoil	72.73	72.89
Wood and wood waste	101.34	109.9
Other solid biomass	103.69	-
Residual fuel oil	78.4	77.6
Shale oil	76.6	77.4
Liquified petroleum gas	66.34	65.42

Remark: * Seeking to ensure higher accuracy of GHG emissions accounting, it is valuable to apply time series of CO₂ emission factor for a period 2004-2014, but an average value of 55.14 t/TJ for a period 1990-2003. Since 2015, country will have to calculate CO₂ emission factor for natural gas considering to the chemical composition of natural gas imported through the pipeline and the liquefied natural gas terminal by applying the method of weighted average.

Preparing the national GHG inventory, it is essential to evaluate the overall inventory uncertainty. For this purpose, it is needed to have uncertainty estimates of emission factors, therefore in this study expert valuations of determined national emission factors uncertainties are performed.

Considering international practice, uncertainty assessment of CO₂, CH₄ and N₂O emission factors is performed at aggregated sector-specific and fuel type-specific (liquid, solid, gaseous fuel and biomass) levels. Uncertainty estimations of recommended GHG emission factors are presented in Table 6-5.

Table 6-5. Uncertainties of recommended GHG emission factors

<i>IPCC source category</i>	<i>Fuel type</i>	<i>CO₂, %</i>
1.A.1 Energy industries	Liquid fuel	± 2.0
	Solid fuel	± 5.0
	Natural gas	± 2.0
	Biomass	± 15.0
1.A.2 Manufacturing industry and construction	Liquid fuel	± 2.0
	Solid fuel	± 5.0
	Natural gas	± 2.0
	Biomass	± 15.0
1.A.3 Transport	Liquid fuel	± 2.0
1.A.4 Other sectors: commercial/institutional, household, agriculture and fishing	Liquid fuel	± 2.0
	Solid fuel	± 5.0
	Natural gas	± 2.0
	Biomass	± 15.0

Assessment of uncertainty of CO₂ emission factors is performed considering the fact that carbon share of some types of fuels is relatively stable. Emission factors for liquid fuels mainly are identified at the accredited laboratory that satisfies the requirements of LST EN ISO/IEC 17025:2005 standard or are based on data provided by EU ETS applying the Tier 3. Chemical composition of natural gas is determined in the laboratory, which is accredited by the National Accreditation Bureau, too. This has an influence on low uncertainties of emission factors for liquid fuels and natural gas (±2,0%). Uncertainties of emission factors for solid fuels are remarkably higher, because, for example, carbon share in peat is variable, therefore uncertainties of emission factors for solid fuels are estimated considering the recommendations provided in *2006 IPCC Guidelines*. Uncertainty of CO₂ emission factor for biomass is the highest and reaches ±15%.

ANNEX VII. CO₂ emissions from the installations, participating in the EU ETS, 2020

Table 7-1. CO₂ emissions from the installations registered in the GHG Emission Allowance Registry, 2020

No	Company	Name of the Installation	Verified Emissions, t CO ₂	Corresponding CRF Sector (Fuel combustion)
1	AB "Akmenės cementas"	Boiler house, cement production furnace	875,536	1.A.2.F Non-Metallic Minerals
2	AB "Naujasis kalcitas"	Whitewash production furnace	0	1.A.2.F Non-Metallic Minerals
3	UAB "Švenčionėlių keramika"	Furnace for ceramics	0	1.A.2.F Non-Metallic Minerals
4	UAB "Rokų keramika"	Ceramics combustion furnace	0	1.A.2.F Non-Metallic Minerals
5	AB "Palemono keramikos gamykla"	Boiler house, ceramics combustion furnace	1,378	1.A.2.F Non-Metallic Minerals
6	UAB "Kauno stiklas"	Glass melting furnace	13,052	1.A.2.F Non-Metallic Minerals
7	AB "Panevėžio stiklas"	Glass melting furnace	18,052	1.A.2.F Non-Metallic Minerals
8	AB "ORLEN Lietuva"	Oil refining factory	1,478,463	1.A.1.B Petroleum Refining / 1.A.1.A Public electricity and heat production
9	AB "Grigeo Klaipėda"	Boiler house	13,937	1.A.2.D Pulp, Paper and Print
10	AB "Grigeo"	Boiler house	6,534	1.A.2.D Pulp, Paper and Print
11	AB "Simega"	Boiler house	0	1.A.1.A Public electricity and heat production
12	AB "Achema"	Boiler houses, CHP	2,523,262	1.A.2.C Chemicals / 1.A.1.A Public electricity and heat production
13	AB "Nordic Sugar Kėdainiai"	Boiler house, oilcake desiccation	40,074	1.A.2.E Food processing, Beverages and Tobacco
14	AB "Lifosa"	Boiler house	447	1.A.2.C Chemicals
15	AB "Klaipėdos nafta"	Boiler house	14,024	1.A.1.A Public electricity and heat production
16	UAB "Lietuvos cukrus"	Boiler house	13,106	1.A.2.E Food processing, Beverages and Tobacco
17	UAB "Idavang"	Boiler house	0	1.A.4.C Agriculture/ Forestry/ Fisheries
18	AB "Klaipėdos mediena"	Boiler house	34	1.A.2.G.iv Wood and Wood Products
19	UAB "Matuizų plytinė"	Boiler house	0	1.A.2.F Non-Metallic Minerals
20	AB "Jonavos šilumos tinklai"	Jonava boiler house	0	1.A.1.A Public electricity and heat production
21	AB "Jonavos šilumos tinklai"	Girele boiler house	1,056	1.A.1.A Public electricity and heat production
22	UAB "Mažeikių šilumos tinklai"	Mazeikiai boiler house	9	1.A.1.A Public electricity and heat production
23	UAB "Raseinių šilumos tinklai"	Raseiniai boiler house No 4	136	1.A.1.A Public electricity and heat production

No	Company	Name of the Installation	Verified Emissions, t CO ₂	Corresponding CRF Sector (Fuel combustion)
24	UAB "Molėtų šiluma"	Moletai boiler house	0	1.A.1.A Public electricity and heat production
25	UAB "Šilutės šilumos tinklai"	Šilute boiler house	1	1.A.1.A Public electricity and heat production
26	UAB "Vilniaus šilumos tinklai"	Vilnius power plant No 2 (E-2)	218,218	1.A.1.A Public electricity and heat production
27	AB "Ignitis gamyba"	Vilnius power plant No 3 (E-3)	1,055	1.A.1.A Public electricity and heat production
28	UAB "Vilniaus šilumos tinklai"	Vilnius boiler house No 2	3,455	1.A.1.A Public electricity and heat production
29	UAB "Vilniaus šilumos tinklai"	Vilnius boiler house No 8	27	1.A.1.A Public electricity and heat production
30	UAB "Širvintų šiluma"	Širvintu boiler house No 3	17	1.A.1.A Public electricity and heat production
31	AB "Šiaulių energija"	Šiauliai southern boiler house	10,498	1.A.1.A Public electricity and heat production
32	AB "Klaipėdos energija"	Power plant	1,094	1.A.1.A Public electricity and heat production
33	UAB "Radviliškio šiluma"	Radviliškis city boiler house	285	1.A.1.A Public electricity and heat production
34	UAB "Utenos šilumos tinklai"	Utena boiler house	702	1.A.1.A Public electricity and heat production
35	UAB "Tauragės šilumos tinklai"	Taurage - Beržė boiler house	0	1.A.1.A Public electricity and heat production
36	UAB "Šalčininkų šilumos tinklai"	Šalčininkai boiler house	56	1.A.1.A Public electricity and heat production
37	Pravieniškų pataisos namai-atviroji kolonija	Boiler house	3,472	1.A.1.A Public electricity and heat production
38	UAB "Varėnos šiluma"	Varena boiler house	0	1.A.1.A Public electricity and heat production
39	AB "Panevėžio energija"	Panevezio boiler house No 2	4,079	1.A.1.A Public electricity and heat production
40	AB "Panevėžio energija"	Rokiškio boiler house	0	1.A.1.A Public electricity and heat production
41	AB "Panevėžio energija"	Panevezio boiler house No 1	5	1.A.1.A Public electricity and heat production
42	AB "Panevėžio energija"	Pasvalio boiler house	21	1.A.1.A Public electricity and heat production
43	AB "Panevėžio energija"	Zarasai boiler house No 4	0	1.A.1.A Public electricity and heat production
44	UAB "GEOTERMA"	Klaipėda geothermal PP	0	1.A.1.A Public electricity and heat production
45	AB "Kauno energija"	Petrašiunai PP	1,620	1.A.1.A Public electricity and heat production
46	AB "Kauno energija"	Pergalė boiler house	1,268	1.A.1.A Public electricity and heat production
47	AB "Kauno energija"	Šilkas boiler house	2,436	1.A.1.A Public electricity and heat production
48	AB "Kauno energija"	Garliava boiler house	199	1.A.1.A Public electricity and heat production
49	AB "Kauno energija"	Jurbarkas boiler house	1,757	1.A.1.A Public electricity and heat production
50	UAB "Plungės šilumos tinklai"	Plunge boiler house No 1	1,747	1.A.1.A Public electricity and heat production

No	Company	Name of the Installation	Verified Emissions, t CO ₂	Corresponding CRF Sector (Fuel combustion)
51	UAB "Birštono šiluma"	Birštonas region boiler house	830	1.A.1.A Public electricity and heat production
52	UAB "Litesko"	Druskininkai industry boiler house	472	1.A.1.A Public electricity and heat production
53	UAB "Litesko"	Boiler house of Biržai city hall	370	1.A.1.A Public electricity and heat production
54	UAB "Litesko"	Vilkaviškis boiler house	39	1.A.1.A Public electricity and heat production
55	UAB "Litesko"	Luoke boiler house	47	1.A.1.A Public electricity and heat production
56	UAB "Litesko"	Mackevicius boiler house	37	1.A.1.A Public electricity and heat production
57	UAB "Palangos šilumos tinklai"	Palanga boiler house	2,881	1.A.1.A Public electricity and heat production
58	UAB "Litesko"	Marijampole region boiler house	3,262	1.A.1.A Public electricity and heat production
59	UAB "Litesko"	Alytus boiler house	6,063	1.A.1.A Public electricity and heat production
60	AB "Ignitis gamyba"	Lietuvos PP	450,611	1.A.1.A Public electricity and heat production
61	UAB "Kauno termofikacijos elektrinė"	Kaunas PP	1,853	1.A.1.A Public electricity and heat production
62	UAB "Kaišiadorių šiluma"	Kaišiadoriai boiler house	0	1.A.1.A Public electricity and heat production
63	UAB "Kretingos šilumos tinklai"	Kretinga boiler house No 3	0	1.A.1.A Public electricity and heat production
64	AB "Klaipėdos energija"	Klaipėda region boiler house	3,382	1.A.1.A Public electricity and heat production
65	AB "Klaipėdos energija"	Lypkiai regiopn boiler house	3,037	1.A.1.A Public electricity and heat production
66	UAB "Pramonės energija"	Boiler house	0	1.A.1.A Public electricity and heat production
67	VĮ "Ignalinos atominė elektrinė"	Boiler house	3,942	1.A.4.A Commercial/institutional
68	UAB "Trakų energija"	Lentvaris boiler house	0	1.A.1.A Public electricity and heat production
69	UAB "Akmenės energija"	Zalgiris boiler house	501	1.A.1.A Public electricity and heat production
70	AB "Panevėžio energija"	Panevėžys thermal PP	1,307	1.A.1.A Public electricity and heat production
71	UAB "IKEA Industry Lietuva"	Fuel combustion plants	11,098	1.A.2.G.iv Wood and wood products
72	UAB "NEO Group"	Boiler house	27,204	1.A.2.C Chemicals
73	AB "Panevėžio energija"	Kėdainiai region boiler house	388	1.A.1.A Public electricity and heat production
74	UAB "Paroc"	Plants producing stone-wool	63,745	1.A.2.F Non-Metallic Minerals
75	AB "Vilniaus GKG-3"	Boiler house	386	1.A.2.G.v Construction
76	AB "Vilniaus šilumos tinklai"	Boiler house No 7	0	1.A.1.A Public electricity and heat production
77	UAB "Pramonės energija"	Boiler house	0	1.A.1.A Public electricity and heat production

No	Company	Name of the Installation	Verified Emissions, t CO ₂	Corresponding CRF Sector (Fuel combustion)
78	VĮ "Visagino energija"	Thermal boiler house	3,383	1.A.1.A Public electricity and heat production
79	AB "Roquette Amilina"	Boiler house and driers	2,242	1.A.2.E Food processing, Beverages and Tobacco
80	AB "Roquette Amilina"	Boiler house	0	1.A.2.E Food processing, Beverages and Tobacco
81	AB "Amber Grid"	Jauniūnų gas compressor station	265	1.A.3.E.i Pipeline transport
82	UAB "Hoegh LNG Klaipėda"	LNG ship	62,047	1.A.1.C.iii Other energy industries
83	UAB "Fortum Klaipėda"	Power plant	146,184	1.A.1.A Public electricity and heat production
84	UAB "Idex Biruliškių"	Boiler house	0	1.A.1.A Public electricity and heat production
85	UAB "Idex Paneriškių"	Boiler house	146	1.A.1.A Public electricity and heat production
86	UAB "Kauno kogeneracinė jėgainė"	Power plant	86,628	1.A.1.A Public electricity and heat production
87	AB "Klaipėdos mediena" (Akmenės raj.)	Boiler house and dryer	4,200	1.A.2.G.iv Wood and Wood Products
		Total	6,137,662	

Sources: <https://www.apva.lt/wp-content/uploads/2021/05/Atsiskaitymas-uz-2020-m-2.pdf>

ANNEX VIII. Additional information of Agriculture sector

Other relevant information

Figure below shows impact of milk yield on GE and EFs.

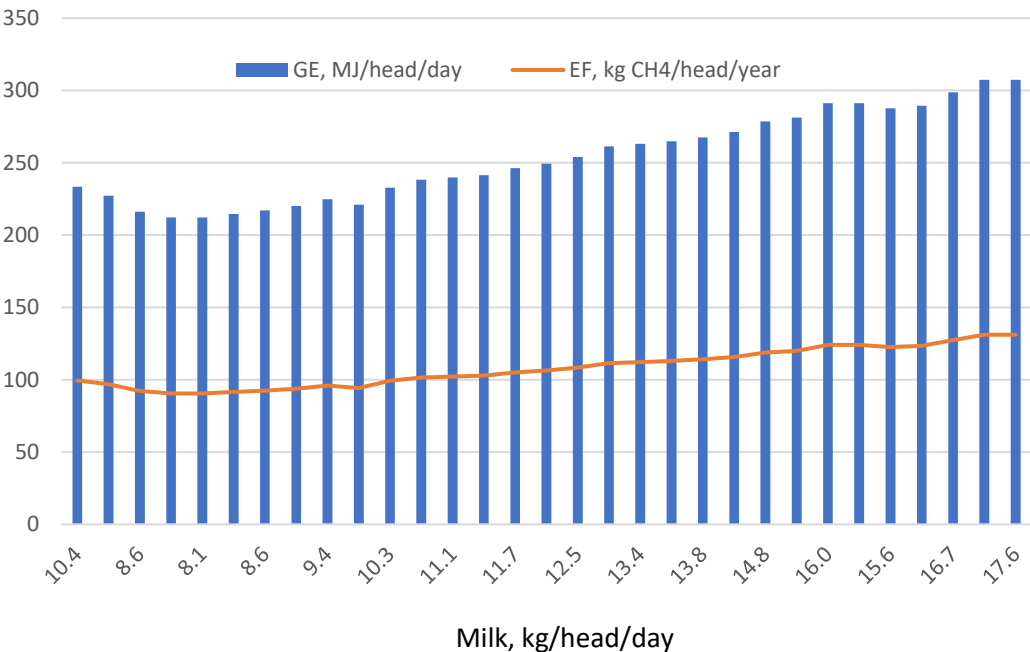


Figure A.5-1. Impact of milk yield on GE and EF's

Milk yield, gross energy, and emission factors are closely related. Positive relationships between milk production and gross energy as well as between milk yield and emission factors.

Figure below shows distribution of horses by breeds in 2020.

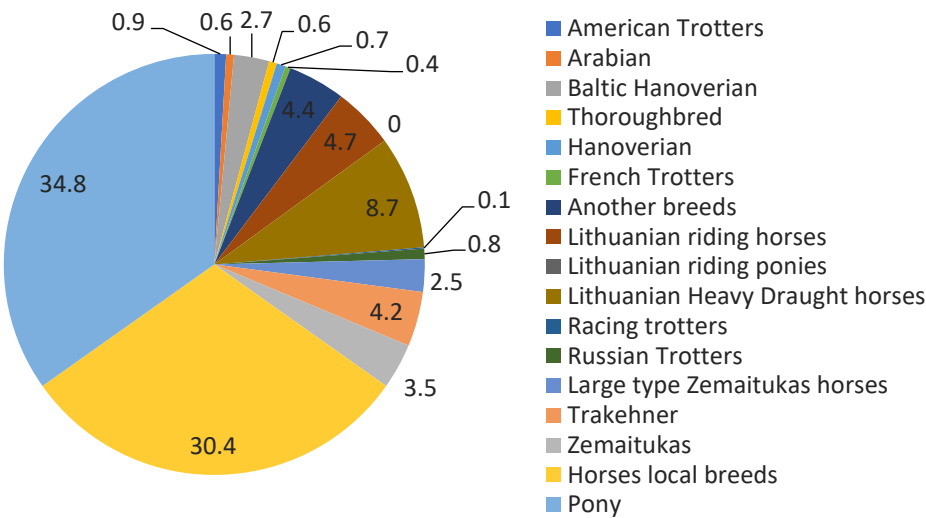


Figure A.5-2. Distribution by breeds of horses, %

Local breeds horses with no known origins constitute about 34% of grown horses breeds in Lithuania.

Table A. 5-1. Methane conversion factors values estimated in enteric fermentation category

Year	Methane conversion factor, %			
	Dairy cattle	Non-dairy cattle	Sheep	Swine
1990	6.50	6.45	5.98	0.60
1995	6.50	6.44	5.98	0.60
2000	6.50	6.45	5.98	0.60
2005	6.50	6.45	5.98	0.60
2010	6.50	6.50	5.98	0.60
2015	6.50	6.59	6.00	0.60
2016	6.50	6.61	5.99	0.60
2017	6.50	6.63	5.97	0.60
2018	6.50	6.65	5.96	0.60
2019	6.50	6.67	5.97	0.60
2020	6.50	6.69	5.97	0.60

Table A. 5-2. Changes in dairy cattle population, milk yield, GE, CH₄ EF per cow and methane emission, % (1990=100%)

Year	Population of Dairy cattle	Milk production	GE	CH ₄ EF	Emissions
1990	100	100	100	100	100
1995	71	81	92	92	65
2000	55	99	100	100	55
2005	50	116	107	107	54
2010	43	133	115	115	50
2015	36	153	125	125	45
2016	35	150	123	123	43
2017	33	152	124	124	41
2018	31	160	128	128	40
2019	29	167	132	132	39
2020	28	168	132	132	37

Table A. 5-3. The number of swine and fraction of swine manure managed in liquid MMS

Year	Swine, thous. heads	Manure Management System	
		Liquid manure, %	Liquid manure, % (Anaerobic digesters)
1990	2,577.35	16.0	0
1995	1,266.28	32.07	0
2000	895.89	48.13	0
2005	1,094.00	61.05	3.15
2010	928.79	76.47	3.8
2015	700.99	81.29	6.13
2016	675.87	65.09	22.78
2017	637.92	59.11	29.21
2018	591.97	56.06	32.71
2019	561.43	53.97	35.25
2020	565.61	55.51	34.16

Table A. 5-4. The number of breeding and market swine in the population, thous. head

Year	Breeding swine	Marked swine	Weight, kg
1990	257.5	2319.9	64.8
1995	171.8	1094.4	70.1
2000	84.2	811.7	63.9
2005	99.3	994.7	63.4

2010	84.1	844.7	63.4
2015	55.5	645.4	61.7
2016	51.7	624.2	61.3
2017	49.6	588.3	61.5
2018	47.7	544.3	61.9
2019	44.3	517.1	61.7
2020	44.3	521.3	61.6

Diet composition parameters are provided in the tables below for different livestock (non-dairy, swine and sheep subcategories). All data provided in the tables were taken from Livestock manual¹.

Diet composition for cattle subcategories

Table A. 5 - 5. Nutrition standards for dairy cattle

Item	Quantity of milk/4% of milk fat/day		
	10	15	20
Dry matter, kg	12.7	15.1	17.0
Crude protein, g	1,524	2,038	2,550
Crude fat, g	279	362	459
Crude fiber, g	3,048	3,473	3,740
Nitrogen-free extract (in accordance by used feeds, identified based on the study data)	6,350	7,420	8,990

Intermediate values were interpolated

Table A. 5 - 6. Composition of diet for Non-dairy cattle suckling cows

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	112.84	23.54	321.36	469.1	844.8	18.30	1.0
Straw	49.4	16.3	434.4	451.5	820.9	18.46	2.0
Silage	120	38.4	349	412	232	18.62	14.0
Green fodder - grass	183.75	39.2	243	431.9	215.05	18.39	25.0
Concentrates	134.8	19.5	42.2	781.9	869.3	18.53	1.0

Non-dairy cattle less than 1 year old

Table A. 5 - 7. Composition of diet for Calves for slaughter

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	115	23.7	310.7	476.3	851.3	18.27	0.82
Silage	114.1	32.5	298.4	390	279	16.84	4
Green fodder – grass	182.9	37.6	250.1	432.7	213.1	18.47	8
Milk substitutes	275	301	0	368.8	125	25.01	1.51
Concentrates	173.5	26.4	52.6	719.2	866	18.84	0.92

Table A. 5 - 8. Composition of diet for Bulls for breeding

¹ Gyvulininkystės žinybas. Baisogala (en. Livestock manual. Institute of Animal Science of LVA), 2007.

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	115	23.7	310.7	476.3	851.3	18.27	1
Silage	114.1	32.5	298.4	390	279	16.84	4
Green fodder – grass	182.9	37.6	250.1	432.7	213.1	18.47	11.8
Milk substitutes	275	301	0	368.8	125	25.01	1.1
Concentrates	173.5	26.4	52.6	719.2	866	18.84	1

Table A. 5 – 9. Composition of diet for Heifers for breeding

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	115	23.7	310.7	476.3	851.3	18.27	0.7
Silage	114.1	32.5	298.4	390	279	16.84	2.2
Green fodder – grass	182.9	37.6	250.1	432.7	213.1	18.47	10.9
Milk substitutes	275	301	0	368.8	125	25.01	1.1
Concentrates	173.5	26.4	52.6	719.2	866	18.84	0.7

Non-dairy cattle from 1 to 2 years old

Table A. 5 - 10. Composition of diet for Bulls

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	115	23.7	310.7	476.3	851.3	18.27	1.8
Silage	114.1	32.5	298.4	390	279	16.84	13.6
Green fodder - grass	182.9	37.6	250.1	432.7	213.1	18.47	15.1
Concentrates	173.5	26.4	52.6	719.2	866	18.84	1.85

Table A. 5 – 11. Composition of diet for Heifers for slaughter

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	115	23.7	310.7	476.3	860	18.27	0.6
Straw	49.4	16.25	434.4	451.45	820.9	18.46	0.5
Silage	109.3	33.8	297.3	343.8	232	15.95	12.2
Green fodder - grass	175	40	258	422	220	18.35	18.1
Concentrates	173.5	26.4	52.6	719.2	866	18.84	1

Table A. 5 – 12. Composition of diet for Heifers for breeding

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	115	23.7	310.7	476.3	851.3	18.27	1.8

Straw	49.4	16.25	434.4	451.45	820.9	18.46	0.5
Silage	114.1	32.5	298.4	390	279	16.84	8.4
Green fodder - grass	182.9	37.6	250.1	432.7	213.1	18.47	15
Concentrates	173.5	26.4	52.6	719.2	866	18.84	0.2

Non-dairy cattle 2 years old and older

Table A. 5 – 13. Composition of diet for Dairy cattle sires bulls

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	121.75	23.8	304.05	473.4	847.5	18.25	1.7
Silage	123.6	29.9	300.6	482.4	373	18.63	16
Green fodder - grass	183.75	39.2	243	431.9	215.1	18.39	16.9
Concentrates	173.5	26.4	52.6	719.2	866	18.84	1.1

Table A. 5 – 14. Composition of diet for Non-dairy cattle sires bulls

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	112.84	23.54	321.36	469.1	844.8	18.3	1.7
Straw	49.4	16.25	434.4	451.45	820.9	18.46	0.8
Silage	120	38.4	349	412	232	18.62	15
Green fodder - grass	183.75	39.2	243	431.9	215.1	18.39	24
Concentrates	173.5	26.4	52.6	719.2	866	18.84	0.3

Table A. 5 – 15. Composition of diet for Other Bulls

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	115	23.7	310.7	476.3	851.3	18.27	2
Silage	114.1	32.5	298.4	390	279	16.84	12
Green fodder - grass	182.9	37.6	250.1	432.7	213.1	18.47	17
Concentrates	173.5	26.4	52.6	719.2	866	18.84	1.4

Table A. 5 – 16. Composition of diet for Heifers for slaughter

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	115	23.7	310.7	476.3	851.3	18.27	1.8
Silage	121.8	34.2	324.8	447.2	302.5	18.63	9.1
Green fodder - grass	182.9	37.6	250.1	432.7	213.1	18.47	18
Concentrates	170.3	25.7	49.3	726.9	869.9	18.8	1.3

Table A. 5 – 17. Composition of diet Heifers for breeding

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	115	23.7	310.7	476.3	851.3	18.27	2.1
Silage	121.8	34.2	324.8	447.2	302.5	18.63	9.6
Green fodder - grass	182.9	37.6	250.1	432.7	213.1	18.47	17.7
Concentrates	173.5	26.4	52.6	719.2	866	18.84	0.9

Table A. 5 – 18. Composition of diet for Non-dairy cattle Other cow

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	115	23.7	310.7	476.3	851.3	18.27	1.1
Straw	49.4	16.25	434.4	451.45	820.9	18.46	0.81
Silage	114.1	32.5	298.4	390	279	16.84	16.3
Green fodder - grass	182.9	37.6	250.1	432.7	213.1	18.47	24
Concentrates	173.5	26.4	52.6	719.2	866	18.84	0.7

Diet composition for Swine subcategories

Breeding Sows

Table A. 5- 19. Composition of diet for Mated

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.4	23.3	60.4	764.5	853	18.61	0.898
Oats	123	38.8	108.2	704.8	860	18.99	0.705
Wheat bran	145.1	42.2	82.3	693.3	867.5	18.93	0.08
Legumes	245	20.4	76	628.4	840	19.19	0.2
Rape cake	313.2	190.6	101.5	335.5	902	22.98	0.116
Soy Meal	500.3	16.4	78.1	337.3	880.6	20.08	0.017
Fish Meal	695	102	8	18	910	21.15	0.013
Premix	0	0	0	0	950	0	0.067

Table A. 5- 20. Composition of diet for Nursing young

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.4	23.3	60.4	764.5	853	18.61	2.64
Oats	123	38.8	108.2	704.8	860	18.99	0.807
Wheat bran	145.1	42.2	82.3	693.3	867.5	18.93	0.233
Legumes	245	20.4	76	628.4	840	19.19	0.714
Rape cake	313.2	190.6	101.5	335.5	902	22.98	0.295
Soy meal	500.3	16.4	78.1	337.3	880.6	20.08	0.419
Fish meal	695	102	8	18	910	21.15	0.155
Oil	0	998	0	0	0	39.72	0.171

Premix	0	0	0	0	950	0	0.155
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Replacement Sows

Table A. 5- 21. Composition of diet for Mated

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.4	23.3	60.4	764.5	853	18.61	0.8
Oats	123	38.8	108.2	704.8	860	18.99	0.7
Wheat bran	145.1	42.2	82.3	693.3	867.5	18.93	0.164
Legumes	245	20.4	76	628.4	840	19.19	0.244
Rape cake	313.2	190.6	101.5	335.5	902	22.98	0.153
Soy meal	500.3	16.4	78.1	337.3	880.6	20.08	0.038
Fish Meal	695	102	8	18	910	21.15	0.019
Premix	0	0	0	0	950	0	0.076

Table A. 5- 22. Composition of diet for Nursing young

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.4	23.3	60.4	764.5	853	18.61	3.059
Oats	123	38.8	108.2	704.8	860	18.99	0.978
Wheat bran	145.1	42.2	82.3	693.3	867.5	18.93	0.311
Legumes	245	20.4	76	628.4	840	19.19	0.795
Rape cake	313.2	190.6	101.5	335.5	902	22.98	0.311
Soy meal	500.3	16.4	78.1	337.3	880.6	20.08	0.469
Fish meal	695	102	8	18	910	21.15	0.186
Oil	0	998	0	0	0	39.72	0.202
Premix	0	0	0	0	950	0	0.186

Table A. 5- 23. Composition of diet for Swine Piglets < 2 month (< 20 kg)

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.41	23.3	60.4	764.5	853	18.61	0.208
Wheat	137.51	19.4	30.8	793.1	850	18.56	0.282
Legumes	245	20.4	76	628.4	840	19.19	0.032
Soy meal	500.3	16.4	78.1	337.3	880.6	20.08	0.08
Milk substitutes	366	11.2	0	549.3	960	18.81	0.118
Fish meal	695	102	8	18	910	21.15	0.027
Oil	0	998	0	0	0	39.72	0.027
Premix	0	0	0	0	950	0	0.027

Table A. 5- 24. Composition of diet for Swine Growing pigs (20-50 kg)

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day

Barley	129.41	23.3	60.4	764.5	853	18.61	0.48
Wheat	137.51	19.4	30.8	793.1	850	18.56	0.23
Triticale	135.31	17	29.9	797	880	18.46	0.49
Legumes	245	20.4	76	628.4	840	19.19	0.19
Rape cake	313.2	190.6	101.5	335.5	902	22.98	0.13
Soybean meal	500.3	16.4	78.1	337.3	880.6	20.08	0.15
Fish meal	695	102	8	18	910	21.15	0.04
Oil	0	998	0	0	0	39.72	0.04
Premix	0	0	0	0	950	0	0.05

Table A. 5- 25. Composition of diet for Swine Growing pigs (50-80 kg)

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.41	23.3	60.4	764.5	853	18.61	0.66
Wheat	137.51	19.4	30.8	793.1	850	18.56	0.28
Triticale	135.31	17	29.9	797	880	18.46	0.95
Legumes	245	20.4	76	628.4	840	19.19	0.42
Rape cake	313.2	190.6	101.5	335.5	902	22.98	0.19
Soybean meal	500.3	16.4	78.1	337.3	880.6	20.08	0.06
Oil	0	998	0	0	0	39.72	0.01
Premix	0	0	0	0	950	0	0.07

Table A. 5- 26. Composition of diet for Swine growing pigs 80-110 kg

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.41	23.3	60.4	764.5	853	18.61	0.73
Wheat	137.51	19.4	30.8	793.1	850	18.56	0.31
Triticale	135.31	17	29.9	797	880	18.46	1.04
Legumes	245	20.4	76	628.4	840	19.19	0.46
Rape cake	313.2	190.6	101.5	335.5	902	22.98	0.2
Soybean meal	500.3	16.4	78.1	337.3	880.6	20.08	0.06
Oil	0	998	0	0	0	39.72	0.01
Premix	0	0	0	0	950	0	0.08

Table A. 5-27. Composition of diet for Swine pigs >110 kg (8 month and more)

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.41	23.3	60.4	764.5	853	18.61	0.7
Wheat	137.51	19.4	30.8	793.1	850	18.56	0.3
Triticale	135.31	17	29.9	797	880	18.46	1.01
Legumes	245	20.4	76	628.4	840	19.19	0.45
Rape cake	313.2	190.6	101.5	335.5	902	22.98	0.2
Soybean meal	500.3	16.4	78.1	337.3	880.6	20.08	0.06
Oil	0	998	0	0	0	39.72	0.01
Premix	0	0	0	0	950	0	0.08

Table A. 5- 28. Composition of diet for Swine Gilts for breed

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.4	23.3	60.4	764.5	853	18.61	0.73
Wheat	137.51	19.4	30.8	793.1	850	18.56	0.11
Triticale	135.31	17	29.9	797	880	18.46	0.16
Oats	123	38.8	108.2	704.8	860	18.99	0.44
Wheat bran	145.1	42.2	82.3	693.3	867.5	18.93	0.14
Soybean meal	500.3	16.4	78.1	628.4	880.6	25.18	0.11
Legumes	245	20.4	76	335.5	840	14.07	0.31
Rapeseed cake	313.2	190.6	101.5	337.3	902	23.01	0.16
Milk substitutes	366	11.2	0	549.3	960	18.81	0.02
Oil	0	998	0	0	0	39.72	0.01
Premix	0	0	0	0	950	0	0.06

Boars

Table A. 5- 29. Composition of diet for Mature

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.4	23.3	60.4	764.5	853	18.61	0.86
Oats	123	38.8	108.2	704.8	860	18.99	0.79
Wheat bran	145.1	42.2	82.3	693.3	867.5	18.93	0.17
Legumes	245	20.4	76	628.4	840	19.19	0.25
Rape cake	313.2	190.6	101.5	335.5	902	22.98	0.1
Soy meal	500.3	16.4	78.1	337.3	880.6	20.08	0.15
Fish meal	695	102	8	18	910	21.15	0.07
Premix	0	0	0	0	950	0	0.07

Table A. 5- 30. Composition of diet for Young for breed

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.4	23.3	60.4	764.5	853	18.61	0.75
Wheat	137.51	19.4	30.8	793.1	850	18.56	0.09
Triticale	135.31	17	29.9	797	880	18.46	0.14
Oats	123	38.8	108.2	704.8	860	18.99	0.55
Wheat bran	145.1	42.2	82.3	693.3	867.5	18.93	0.2
Soybean meal	500.3	16.4	78.1	628.4	880.6	25.18	0.15
Legumes	245	20.4	76	335.5	840	14.07	0.37
Rapeseed cake	313.2	190.6	101.5	337.3	902	23.01	0.19
Fish Meal	695	102	8	18	910	21.15	0.004
Oil	0	998	0	0	0	39.72	0.007
Premix	0	0	0	0	950	0	0.08

Diet composition for Sheep subcategories

Table A. 5- 31. Composition of diet for Mature ewes

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	113.4	23.05	313.6	478.4	847.30	18.30	0.60
Silage	123.6	29.9	300.6	482.4	373	18.63	1.27
Green fodder - grass	187.3	37.5	225.5	454.7	186.5	18.46	3.31
Concentrates	123	38.8	108.2	704.8	880	18.99	0.21

Table A. 5- 32. Composition of diet for Ewe over 1 years

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	113.4	23.05	313.6	478.4	847.3	18.25	0.5
Silage	123.6	29.9	300.6	482.4	373	18.63	0.91
Green fodder - grass	187.3	37.5	225.5	454.7	186.5	18.46	2.8
Concentrates	123	38.8	108.2	704.8	880	18.99	0.26

Table A. 5-33. Composition of diet for Mature Rams

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	113.4	23.05	313.6	478.4	847.3	18.3	0.70
Silage	123.6	29.9	300.6	482.4	373	18.63	1.22
Green fodder - grass	187.3	37.5	225.5	454.7	186.5	18.46	3.2
Concentrates	123	38.8	108.2	704.8	880	18.99	0.36

Table A. 5- 34. Composition of diet for Rams over 1 years

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	113.4	23.05	313.6	478.4	847.3	18.3	0.5
Silage	123.6	29.9	300.6	482.4	373	18.63	1.35
Green fodder - grass	187.3	37.5	225.5	454.7	186.5	18.46	3
Concentrates	123	38.8	108.2	704.8	880	18.99	0.30

Table A. 5- 35. Composition of diet for Ewe to 1 years

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	119.8	23.6	313.9	465	853.8	18.25	0.32
Silage	123.6	29.9	300.6	482.4	373	18.63	0.5
Milk and milk substitutes	275	301	0	368.8	125	25.01	0.198
Green fodder - grass	168.5	36.2	263	440.7	185.5	18.47	1.22
Concentrates	171.7	29.6	64.3	705.3	869.2	18.92	0.22

Table A. 5-36. Composition of diet for Lambs to 1 years

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	119.8	23.6	313.9	465	853.8	18.25	0.22
Silage	123.6	29.9	300.6	482.4	373	18.63	0.35
Milk and milk substitutes	275	301	0	368.8	125	25.01	0.198
Green fodder - grass	168.5	36.2	263	440.7	185.5	18.47	1.07
Concentrates	171.7	29.6	64.3	705.3	869.2	18.92	0.26

Average diet nutrition indicators for different livestock categories

Average diet nutrition indicators that were used to estimate gross energy for different livestock categories (dairy cattle, non-dairy cattle, swine and sheep)

Table A. 5-37. Average diet nutrition indicators for dairy cattle, g/kg DM

Year	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract
1990	1,718	312	3,176	6,639
1995	1,491	272	3,000	6,164
2000	1,709	311	3,169	6,619
2005	1,913	346	3,321	7,034
2010	2,119	385	3,433	7,574
2015	2,386	439	3,551	8,305
2016	2,345	431	3,533	8,192
2017	2,366	435	3,542	8,248
2018	2,467	456	3,589	8,540
2019	2,549	485	3,638	8,804
2020	2,549	485	3,638	8,804

Table A.5-38. Average diet nutrition indicators for non-dairy cattle, g/kg DM

Sub-category			Crude protein	Crude fat	Crude fiber	Nitrogen free extracts	DM kg/day
Suckling cows			1,671	399	3,461	5,477	11.98
Less than 1 year old	Calves for slaughter		709	195	1,018	2,148	4.50
	For breeding	Bulls	873	215	1,272	2,602	5.49
		Heifers	706	179	981	2,015	4.28
From 1 to 2 years old	Bulls		1,476	323	2,497	4,754	10.15
	Heifers	For slaughter	1,236	297	2,253	3,707	8.60
		For breeding	1,079	244	2,162	3,337	7.66
2 years old and older	Bulls	Dairy cattle sires	1,746	380	3,165	5,816	12.00
		Non-dairy cattle sires	1,606	387	3,229	4,820	11.00
		Other bulls	1,451	317	2,498	4,556	9.89
	Heifers	For slaughter	1,406	304	2,385	4,443	9.25
		For breeding	1,384	304	2,483	4,342	9.24
Other cows			1,700	389	3,248	5,169	11.87

Table A.5-39. Average diet nutrition indicators for swine, g/kg DM

Sub-category			Crude protein	Crude fat	Crude fibre	Nitrogen-free extracts	DM kg/day
Breeding	Sows	Mated	273.4	69.1	142.2	1,207	1.805
		Nursing young	918.9	171.5	330.3	2,944	4.671

Replacement	Sows	Mated	305.2	78.1	150.4	1,231.3	1.893
		Nursing young	1,055.9	196.1	383.6	3,430.8	5.427
Piglets < 2 months (< 20 kg)			156.2	14.3	25.8	429.1	0.678
Growing pigs (20-50 kg)			305.4	52.2	78.3	996.6	1.529
Growing pigs (50-80 kg)			385.2	72.7	114.7	1,582.5	2.280
Growing pigs (80-110 kg)			418.3	78.3	124.9	1,735.6	2.497
Pigs > 110 kg (8 months and >)			408.1	76.9	121.7	1,682.9	2.428
Gilts for breeds			341.1	73.2	137.6	1,220.8	1.935
Boars		Mature	389.9	79.8	165.9	1,349.8	2.123
		Young for breed	391.8	85.7	161.5	1,346.8	2.180

Table A.5-40. Average diet nutrition indicators for sheep, g/kg DM

Sub-category	Crude protein	Crude fat	Crude fiber	Nitrogen-free extracts	DM kg/day
Mature ewes	255	56	461	883	1.784
Ewe over 1 years	216	48	377	765	1.514
Ewe to 1 years	134	33	214	461	0.902
Lambs to 1 years	118	30	165	406	0.768
Mature Rams	274	62	492	998	1.962
Rams over 1 years	248	56	439	886	1.751

Table A.5-41. Coefficients of group size of fur-bearing animals

Livestock	Coefficients of group size		
	Female	Male	Young
Minks	1.0	0.2	5.0
Foxes	1.0	0.07-0.2	4.8

Agricultural soils

All activity data used to estimate annual amount of N in crop residues (above and below ground), including N-fixing crops, and from forage/pasture renewal, returned to soils are provided in the tables below.

Table A.5-42. Harvested annual dry matter yield

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
CROP (T)	kg d.m. ha ⁻¹														
Winter Wheat	2,943	2,117	3,083	3,338	2,927	2,851	4,450	3,921	4,137	4,910	4,081	4,497	3,701	3,897	4,857
Spring Wheat	2,208	2,193	2,265	2,803	2,634	2,983	3,344	3,189	3,710	3,622	2,943	3,021	2,349	2,709	3,475
Triticale	2,169	1,806	2,247	2,332	2,046	2,159	3,140	2,693	2,830	3,303	2,825	2,808	2,309	2,831	3,270
Rye	2,450	1,554	2,047	1,861	1,512	1,740	2,409	1,680	1,936	2,389	2,044	2,095	1,777	2,262	2,557
Barley	2,607	1,427	2,121	2,365	2,041	2,586	2,936	2,821	3,281	3,448	2,718	3,156	2,359	2,895	3,684
Oats	2,232	1,242	1,652	1,690	1,397	1,749	1,986	1,924	2,083	2,192	1,884	2,217	1,523	1,777	2,259
Grain maize	2,543	2,543	2,543	2,721	5,754	6,441	5,253	6,360	5,205	4,146	5,978	4,952	5,622	6,584	6,033
Winter Rape	2,060	1,267	2,051	2,338	1,820	1,642	3,110	2,281	2,507	3,223	2,578	2,866	2,125	2,715	3,168
Spring Rape	931	1,265	1,284	1,487	1,345	1,784	1,842	1,670	1,782	1,780	1,554	1,963	1,484	1,420	1,960
Flax	408	423	270	400	430	573	573	573	860	860	860	1,505	1,032	645	645
Buckwheat	581	523	772	482	627	822	776	798	819	855	984	943	871	957	8,18
Mixed cereals	2,335	1,338	1,573	1,600	1,510	1,698	1,937	1,949	2,207	2,130	1,998	1,781	1,594	2,046	2,041
Other cereals	1,720	1,720	3,440	1,290	1,106	1,720	2,150	1,398	1,147	860	860	860	860	860	1,147
Peas	2,389	1,625	1,752	1,524	1,349	1,542	1,734	1,813	2,126	2,477	2,302	2,504	1,731	1,782	2,103
Beans	1,251	1,959	1,679	1,295	1,433	1,591	1,845	2,094	2,477	2,696	2,667	2,945	1,842	1,988	3,224
Soya beans	753	753	753	753	753	753	595	921	696	573	1,433	1,066	1,505	1,099	1,065
Lupines	631	1,013	768	912	591	932	860	760	808	1,171	1,041	1,097	827	812	902
Vetches	2,061	1,597	1,445	1,488	1,270	1,376	1,310	1,966	1,849	1,852	1,597	1,032	430	1,147	1,003
Mixed dried pulses	1,618	1,618	1,618	1,609	1,437	1,670	1,733	1,635	1,891	1,964	1750	1,810	1,319	1,807	1,850
Potatoes	3,114	2,850	3,650	2,692	2,867	3,430	3,757	3,269	3,775	3,737	3,499	2,688	3,394	3,966	3,449
Sugar beet	6,564	6,580	7,350	8,781	10,624	11,471	12,015	12,567	13,724	11,679	14,125	12,871	13,186	16,338	15,583
Fodder beet	6,175	4,249	4,488	4,026	3264	3,565	4,166	3,712	4,003	3,785	3,213	1,980	2,370	2,606	2,760
Field vegetables (carrot, beetroot)	2,615	2,615	2,615	2,195	2,089	3,482	3,861	3,183	3,942	3,011	2,977	2,614	3,025	3,052	3,111
Alfalfa (for hay)	IE	IE	IE	3	2	3	3	3	3	2	5	4	5	6	4
Alfalfa (for green fodder, silage)	IE	IE	IE	6	7	7	6	6	5	4	6	6	4	5	6
Clover and their mixture (for hay)	IE	IE	IE	4	3	3	2	2	2	3	3	4	3	2	2
Clover and their mixture (for green fodder, silage)	IE	IE	IE	2	6	5	5	5	5	4	5	4	4	4	4
Silage crops	5	4	5	5	3	4	4	4	4	4	3	3	4	4	4
Maize for silage and green fodder	8,372	7,693	8,403	7,338	8,758	9,904	9,198	8,877	8,812	7,923	9,786	7,947	8,480	9,231	8,539
Annual grasses (for hay)	611	1,068	878	620	2,550	2,550	2,928	2,739	3,627	2,550	1,700	2,267	2,444	4,675	3,168

Annual grasses (for haylage)	5,411	7,587	6,648	3,708	4,190	4,033	4,562	3,208	3,568	2,975	3,213	3,432	2,672	2,965	3,313
Perennial grasses (for hey)	2,773	3,113	2,651	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses heylage harvested	3,726	4,183	3,562	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses (excl. alfalfa and clovers and their mixtures) (for hay)	IE	IE	IE	2,774	2,330	2,216	2,492	2,312	2,356	2,246	2,392	2,777	3,244	2,953	2,730
Perennial grasses (excl. alfalfa and clovers and their mixtures) (for green fodder and silage)	IE	IE	IE	1,716	4,047	3,671	3,951	3,723	3,453	2,964	3,138	2,843	3,196	2,439	3,695
Perennial pastures (for hay)	975	2,675	2,312	2,215	1,951	1,948	2,013	1,818	1,920	2,031	2,083	2,360	1,967	1,839	2,268
Perennial pastures (for silage and green fodder)	828	2,272	1,964	1,109	3,288	2,761	2,597	2,435	2,361	2,232	2,045	1,982	2,000	1,550	2,847
Meadows and natural pastures (for hey)	3,320	3,320	3,320	2,098	1,769	1,754	2,009	1,977	1,983	1,977	1,978	2,646	1,107	1,807	2,154
Meadows and natural pastures (for silage and green fodder)	3,489	3,489	3,489	1,352	2,766	2,434	2,280	2,019	1,963	2,172	2,322	2,698	1,731	2,216	2,508

Table A.5-43. Total annual area harvested

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
AREA (T)	ha yr ⁻¹														
Winter Wheat	34,3728	248,496	283,216	295,914	367,400	275,200	436,200	466,000	355,000	573,000	628,600	620,600	463,100	739,600	751,900
Spring Wheat	2,883	10,039	84,391	70,773	150,200	275,900	190,800	201,400	353,000	263,200	251,900	191,300	309,700	156,200	141,700
Triticale	13,357	22,185	50,089	74,147	108,600	94,400	119,100	144,900	120,100	122,000	100,900	75,800	57,100	105,400	115,000
Rye	165,046	132,410	130,837	50,035	49,500	42,000	55,900	49,400	37,900	38,800	32,600	25,900	21,300	41,100	37,000
Barley	394,701	537,422	348,608	344,858	231,800	252,700	217,300	209,300	267,000	202,400	172,500	141,600	225,900	174,800	164,800
Oats	75,388	46,168	43,148	58,050	57,800	63,200	70,800	73,600	75,900	64,100	70,800	76,000	103,000	86,100	104,900
Grain maize	2,807	2,807	2,807	1,549	7,100	9,600	12,900	17,200	19,000	11,700	12,400	9,900	13,400	12,800	20,200
Winter Rape	10,616	3,539	5,308	28,409	89,300	23,400	77,900	116,600	104,200	123,100	123,800	157,500	143,400	221,600	272,300
Spring Rape	393	10,125	49,248	79,132	162,600	226,800	182,900	142,400	110,900	40,400	29,800	23,400	61,900	20,100	11,300
Flax	21,500	13,200	8,600	4,300	400	600	300	300	300	300	200	400	500	400	800
Buckwheat	296	987	16,384	28,031	19,200	27,200	33,900	30,500	37,400	36,700	43,600	48,500	52,700	27,600	39,100
Mixed cereals	6,888	15,744	10,824	20,959	19,700	23,800	22,200	20,300	22,600	17,000	13,300	9,800	10,900	5,800	7,500
Other cereals	100	100	200	200	700	700	600	800	900	200	100	100	100	200	300
Peas	40,850	11,326	24,394	11,906	27,100	26,500	24,000	24,000	40,900	79,400	148,700	154,200	106,200	75,200	61,800
Beans	3,162	1,186	1,383	3,853	3,000	4,000	4,800	6,900	21,700	61,400	67,500	67,100	69,900	55,100	58,400
Soya beans	800	800	800	800	800	800	2,600	1,400	2,100	2700	1,800	2,500	2,000	1,800	2,100
Lupines	2,452	849	1,792	4,621	9,900	6,000	5,100	4,300	3,300	3,600	3,800	2,900	2,600	3,600	4,100

Vetches	27,200	9,800	10,000	2,600	2,100	2,000	2,100	2,100	2,000	1,300	700	500	400	300	600
Mixed dried pulses	8,184	8,184	8,184	12,076	7,600	6,900	6,400	7,100	13,600	11,300	11,300	11,500	9,000	6,900	7,300
Potatoes	111,150	123,006	107,988	73,112	36,600	37,700	32,200	28,700	27,300	23,500	22,100	19,400	19,200	18,700	19,300
Sugar beet	31,972	24,203	27,589	20,916	15,300	17,600	19,200	17,700	17,000	12,200	15,200	17,100	15,500	14,100	14,000
Fodder beet	52,061	61,822	37,419	11,197	1,500	1,700	1,400	1,500	1,400	1,300	900	800	800	700	200
Field vegetables (carrot, beetroot)	12,300	12,300	12,300	8,800	4,200	4,600	4,000	4,100	4,000	3,700	4,100	3,700	4,100	4,400	4,200
Alfalfa (for hay)	IE	IE	IE	952	600	700	700	900	1,300	1,700	1,800	1,300	1,900	2,700	3,700
Alfalfa (for green fodder, silage)	IE	IE	IE	3,384	3,000	2,900	3,300	3,100	3,000	5,500	6,300	4,300	6,800	8,000	8,700
Clover and their mixture (for hay)	IE	IE	IE	60,278	15,700	15,400	17,100	17,400	17,400	14,100	11,100	9,900	13,600	15,200	15,400
Clover and their mixture (for green fodder, silage)	IE	IE	IE	100,502	18,300	26,900	27,800	28,200	29,900	28,000	20,300	20,800	29,900	32,400	25,800
Silage crops	82,700	13,600	5,500	7,300	1,100	1,000	1,200	1,400	2,100	4,000	3,900	4,300	5,100	5,600	4,200
Maize for silage and green fodder	77,800	4,200	10,300	13,900	17,600	21,000	21,800	22,700	28,500	29,200	26,600	24,300	28,300	32,900	29,900
Annual grasses (for hay)	9,328	3,898	2,226	5,755	500	700	900	900	1,500	300	400	600	800	1,000	1,100
Annual grasses (for haylage)	93,131	38,922	22,228	57,460	6,700	6,500	5,800	7,300	9,200	7,600	7,800	5,700	10,400	10,800	9,000
Perennial grasses (for hay)	257,946	168,269	109,982	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses haylage harvested	212,602	138,689	90,648	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses (excl. alfalfa and clovers and their mixtures) (for hay)	IE	IE	IE	122,448	232,900	246,400	220,900	228,200	228,400	158,700	107,300	71,300	64,500	72,700	72,300
Perennial grasses (excl. alfalfa and clovers and their mixtures) (for green	IE	IE	IE	90,512	150,100	169,400	173,000	143,800	154,100	120,500	101,800	82,800	70,400	115,000	72,700

fodder and silage)															
Perennial pastures (for hay)	373,977	322,985	394,777	367,822	209,600	201,300	166,200	183,800	181,100	273,100	385,700	348,100	366,100	261,800	227,200
Perennial pastures (for silage and green fodder)	185,565	160,263	195,886	182,511	68,400	61,200	51,700	66,700	76,300	237,500	307,200	305,700	245,200	298,400	158,500
Meadows and natural pastures (for hay)	244,747	150,721	86,925	82,510	99,400	88,900	66,400	77,200	79,700	95,500	37,000	34,400	25,500	42,800	23,600
Meadows and natural pastures (for silage and green fodder)	81,850	50,405	29,070	27,594	21,700	25,500	19,400	28,100	34,700	30,200	16,100	14,400	9,300	13,300	13,200

Table A.5-44. Ratio of above-ground residues dry matter to harvested yield

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
R _{AG(T)}	kg d.m.														
Winter Wheat	0.80	0.65	0.81	0.84	0.79	0.78	0.92	0.89	0.90	0.95	0.90	0.93	0.87	0.89	0.94
Spring Wheat	1.16	1.16	1.15	1.12	1.13	1.11	1.09	1.10	1.08	1.08	1.11	1.11	1.15	1.12	1.09
Triticale	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Rye	1.67	1.70	1.68	1.69	1.71	1.69	1.67	1.70	1.68	1.67	1.68	1.68	1.69	1.67	1.66
Barley	0.99	1.10	1.02	1.00	1.03	0.99	0.98	0.98	0.96	0.96	0.99	0.97	1.00	0.98	0.95
Oats	1.50	1.07	1.31	1.33	1.18	1.35	1.44	1.42	1.46	1.49	1.40	1.50	1.25	1.36	1.51
Grain maize	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14	1.14
Winter Rape	1.81	1.21	1.81	1.93	1.69	1.57	2.14	1.91	1.99	2.16	2.01	2.09	1.84	2.05	2.15
Spring Rape	0.64	1.21	1.23	1.44	1.30	1.66	1.70	1.59	1.66	1.66	1.50	1.77	1.44	1.38	1.76
Flax	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Buckwheat	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Mixed cereals	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Other cereals	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30
Peas	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Beans	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20
Soya beans	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
Lupines	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
Vetches	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
Mixed dried pulses	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
Potatoes	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
Sugar beet	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Fodder beet	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Field vegetables (carrot, beetroot)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Alfalfa (for hay)	IE	IE	IE	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29

Alfalfa (for green fodder, silage)	IE	IE	IE	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Clover and their mixture (for hay)	IE	IE	IE	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Clover and their mixture (for green fodder, silage)	IE	IE	IE	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Silage crops	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Maize for silage and green fodder	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Annual grasses (for hay)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Annual grasses (for haylage)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Perennial grasses (for hey)	0.30	0.30	0.30	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses heylage harvested	0.30	0.30	0.30	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial (excl. alfalfa and clovers and their mixtures) (for hay)	IE	IE	IE	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.3	0.3
Perennial (excl. alfalfa and clovers and their mixtures) (for green fodder and silage)	IE	IE	IE	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Perennial pastures (for hay)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Perennial pastures (for silage and green fodder)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Meadows and natural pastures (for hey)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Meadows and natural pastures (for silage and green fodder)	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30

Table A.5-45. Ratio of below-ground residues to harvested yield

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
R _{BG(T)}	kg d.m.														
Winter Wheat	0.41	0.38	0.42	0.42	0.41	0.41	0.44	0.43	0.44	0.45	0.44	0.44	0.43	0.43	0.45
Spring Wheat	0.60	0.60	0.60	0.59	0.60	0.59	0.59	0.59	0.58	0.58	0.59	0.59	0.60	0.59	0.58
Triticale	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Rye	0.59	0.59	0.59	0.59	0.60	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
Barley	0.44	0.46	0.44	0.44	0.45	0.44	0.43	0.44	0.43	0.43	0.44	0.43	0.44	0.44	0.43

Oats	0.63	0.52	0.58	0.58	0.54	0.59	0.61	0.60	0.62	0.62	0.60	0.62	0.56	0.59	0.63
Grain maize	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
Winter Rape	0.84	0.66	0.84	0.88	0.81	0.77	0.94	0.87	0.90	0.95	0.90	0.93	0.85	0.91	0.95
Spring Rape	0.49	0.66	0.67	0.73	0.69	0.80	0.81	0.78	0.80	0.80	0.75	0.83	0.73	0.71	0.83
Flax	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Buckwheat	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Mixed cereals	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Other cereals	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Peas	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Beans	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
Soya beans	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Lupines	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
Vetches	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49
Mixed dried pulses	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Potatoes	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Sugar beet	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Fodder beet	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Field vegetables (carrot, beetroot)	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Alfalfa (for hay)	IE	IE	IE	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
Alfalfa (for green fodder, silage)	IE	IE	IE	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
Clover and their mixture (for hay)	IE	IE	IE	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Clover and their mixture (for green fodder, silage)	IE	IE	IE	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Silage crops	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Maize for silage and green fodder	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Annual grasses (for hay)	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Annual grasses (for haylage)	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Perennial grasses (for hey)	2.00	2.00	2.00	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses heylage harvested	2.00	2.00	2.00	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses (excl. alfalfa and clovers and their mixtures) (for hay)	IE	IE	IE	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Perennial (excl. alfalfa and clovers and their mixtures) (for green fodder and silage)	IE	IE	IE	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

Perennial pastures (for hay)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Perennial pastures (for silage and green fodder)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Meadows and natural pastures (for hay)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Meadows and natural pastures (for silage and green fodder)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

Table A.5-46. Other relevant parameters used for annual N in crop residues

	DRY	N _{AG(T)}	N _{BG(T)}	R _{BG-BIO(T)}	Frac _{REMOVE}	Frac _{RENEW}	Area burnt	Slope	Intercept	R _{AG(T)}	R _{BG(T)}	Emission factor
	kg d.m.	kg N	kg N	kg d.m.	kg N	-	-	-	-	Kg d.m.	Kg d.m.	kg N ₂ O-N
Non-N-fixing grain crops												
Winter Wheat	0.86	0.005	0.004	0.23	*	1	0	1.17	-1.1	Calculated	Calculated	0.01
Spring Wheat	0.86	0.008	0.005	0.28	*	1	0	0.96	0.44	Calculated	Calculated	0.01
Triticale	0.86	0.006	0.005	0.22	*	1	0	-	-	1.3	Calculated	0.01
Rye	0.86	0.006	0.005	0.22	*	1	0	1.6	0.16	Calculated	Calculated	0.01
Barley	0.86	0.006	0.005	0.22	*	1	0	0.86	0.34	Calculated	Calculated	0.01
Oats	0.86	0.007	0.005	0.25	0	1	0	2.05	-1.22	Calculated	Calculated	0.01
Grain maize	0.86	0.008	0.005	0.22	0	1	0	-	-	1.14	Calculated	0.01
Winter Rape	0.915	0.007	0.006	0.3	0	1	0	2.78	-1.99	Calculated	Calculated	0.01
Spring Rape	0.915	0.008	0.006	0.3	0	1	0	2.78	-1.99	Calculated	Calculated	0.01
Flax	0.86	0.006	0.005	0.22	0	1	0	-	-	1.3	Calculated	0.01
Buckwheat	0.86	0.007	0.005	0.22	0	1	0	-	-	2.3	Calculated	0.01
Mixed cereals	0.86	0.006	0.005	0.22	0	1	0	-	-	1.3	Calculated	0.01
Other cereals	0.86	0.006	0.005	0.22	0	1	0	-	-	1.3	Calculated	0.01
N fixing grains and pulses												
Peas	0.86	0.0167	0.0243	0.19	0	1	0	-	-	1.4	Calculated	0.01
Beans	0.86	0.012	0.016	0.19	0	1	0	-	-	2.2	Calculated	0.01
Soya beans	0.86	0.014	0.02	0.19	0	1	0	-	-	1.75	Calculated	0.01
Lupines	0.86	0.0136	0.0227	0.19	0	1	0	-	-	1.6	Calculated	0.01
Vetches	0.06	0.0129	0.02	0.19	0	1	0	-	-	1.6	Calculated	0.01
Mixed dried pulses	0.86	0.014	0.02	0.19	0	1	0	-	-	1.7	Calculated	0.01
Root/tuber crops												
Potatoes	0.22	0.014	0.0125	0.2	0	1	0	-	-	0.2	Calculated	0.01
Sugar beet	0.23	0.03	0.014	0.2	0	1	0	-	-	0.5	Calculated	0.01
Fodder beet	0.12	0.03	0.014	0.2	0	1	0	-	-	0.3	Calculated	0.01
Field vegetables	0.13	0.022	0.014	0.2	0	1	0	-	-	0.3	Calculated	0.01
N fixing forage crops												
Alfalfa hay	0.85	0.025	0.017	-	0	0.25	0	0.29	0	Calculated	1.7	0.01
Alfalfa haylage	0.35	0.025	0.017	-	0	0.25	0	0.29	0	Calculated	1.7	0.01
Clover and their mixture hay	0.85	0.025	0.016	-	0	0.3	0	0.3	0	Calculated	0.9	0.01

Clover and their mixture haylage	0.35	0.025	0.016	-	0	0.3	0	0.3	0	Calculated	0.9	0.01
Silage crops	0.3	0.008	0.022	0.4	0	1	0	0.3	0	Calculated	Calculated	0.01
Other industrial and forage crops, including annual and perennial pastures and meadows												
Maize for silage and green fodder	0.3	0.008	0.012	0.54	0	1	0	0.3	0	Calculated	Calculated	0.01
Annual grasses hay	0.85	0.015	0.012	-	0	1	0	0.3	0	Calculated	0.6	0.01
Annual grasses haylage	0.35	0.015	0.012	-	0	1	0	0.3	0	Calculated	0.6	0.01
Perennial grasses (excl. alfalfa, clover and their mixture) hay	0.85	0.02	0.015	-	0	0.2	0	0.3	0	Calculated	2	0.01
Perennial grasses (excl. alfalfa, clover and their mixture) haylage	0.35	0.02	0.015	-	0	0.2	0	0.3	0	Calculated	2	0.01
Perennial pasutes hay	0.85	0.02	0.015	-	0	0.07	0	0.3	0	Calculated	2	0.01
Perennial pastures haylage	0.35	0.02	0.015	-	0	0.07	0	0.3	0	Calculated	2	0.01
Meadows and natural pastures hay	0.85	0.02	0.015	-	0	0.07	0	0.3	0	Calculated	2	0.01
Meadows and natural pastures haylage	0.35	0.02	0.015	-	0	0.07	0	0.3	0	Calculated	2	0.01

*Data provided in the Table A.5-46

Table A.5-47. N content in above-ground residues and in bedding material

Year	N content in above-ground residues of grain crops used for bedding (from wheat, barley, triticale and rye), kg N yr	N input from bedding material, kg N yr	Fra _{CREMOVE} (from wheat, barley, triticale and rye), %
1990	14,467,259	7,106,929	49
1995	9,382,984	4,513,520	48
2000	13,415,910	3,334,998	25
2005	13,127,255	3,043,114	23
2010	13,249,666	2,610,443	20
2011	16,587,058	2,442,192	15
2012	22,526,166	2,285,012	10
2013	21,128,355	2,168,193	10
2014	26,395,789	2,107,523	8
2015	29,640,919	2,072,139	7
2016	23,792,972	2,082,122	9
2017	22,827,399	2,050,373	9
2018	18,779,141	1,995,505	11
2019	22,821,930	1,886,235	8
2020	39,292,375	1,828,892	5

ANNEX IX. Summary of the study on estimation of nitrous oxide (N₂O) emissions from the crop residues category

Following the requirements of the United Nations Framework Convention on Climate Change (UNFCCC), Kyoto protocol, Regulation (EU) No 525/2013 of the European Parliament and of the Council, Member States have to submit their annual national greenhouse gas inventory reports to UNFCCC secretariat and European Commission (EC). GHG inventory agriculture sector must include N₂O emissions from crop residues estimated following 2006 IPCC Guidelines. The default methodology presented in the 2006 IPCC Guidelines for the assessment of N₂O emissions is based on the application of standard coefficients and values, thus it has a rather limited ability to represent country specific conditions in Lithuania and properly describe nitrogen amounts introduced to soil with crop residues. To follow the country's GHG emissions reduction progress, it is crucially important that GHG emissions are accounted for with the adequate accuracy. For this reason, countries are encouraged to develop their own methodologies, ensuring that calculation parameters represent country specific conditions.

In Lithuania, to quantify N₂O emissions from the crop residues two methodologies have been employed so far: by 2015, methodology provided in 2006 IPCC Guidelines was used for the assessment and later, for compilation of inventories for 2015, 2016, and 2017, alternative methodology was elaborated for better and more precise N₂O emissions accounting. The alternative methodology anticipated a modified way of N₂O emission assessment and was partly based on the nationally derived coefficients and parameters.

Lithuanian Environmental Protection Agency (EPA) experts however observe that these two methodologies come out with significantly different results. The assessment based on the 2006 IPCC Guidelines provides N₂O emission estimate which is by around 100 kt CO₂ eq larger if compared with the alternative methodology calculation results.

In relation to this, the main objective of the study was to identify the reasons and sources for errors and inconsistencies in previously used N₂O accounting methodologies and to elaborate revised national methodology for the assessment of N₂O emissions from the sub-category of crop residues in Lithuania that would cover main crops under the following crop groups 1. Non-N-fixing grain crops; 2. N-fixing grains and pulses; 3. Root and tuber crops; 4. N-fixing forage crops; 5. Other forages including perennial grasses and grass/clover pastures.

The initial stage of the study covered an extensive review and analysis of Lithuanian research studies and field experiments to retrieve national parameters for the assessment of N₂O emissions from crop residues. The analysis focused on available national data about crop above ground and below ground biomass, biomass nitrogen contents, residue management practices. The overview has covered all main crops under 5 groups of crops as suggested by the 2006 IPCC Guidelines.

In the next stage, a detailed analysis of methodologies used in Lithuania for N₂O emission assessment so far (i.e. methodology based on 2006 IPCC Guidelines and the alternative methodology) was conducted where input data and parameters of these methodologies were validated against available national data. This analysis has reveal that both methodologies possess some inconsistencies and shortcomings that may consequently lead to inaccurate and biased calculation results.

Some essential differences were observed when comparing parameter values recommended by 2006 IPCC Guidelines and those defined in the national studies. The largest difference was detected for above ground biomass parameters of the most popular crops (wheat, triticale, rye, barley, oat). The main reason for such inconsistency could be the fact that 2006 IPCC Guidelines rely on rather old and USA research based coefficients that eventually revealed as not suitable to describe nowadays crop production trends in Lithuania.

The alternative methodology which was developed to improve N₂O calculations by integrating more national parameters has demonstrated poor performance because of mistakes in the assessment of below ground biomass.

Taking into account shortcomings and gaps of both tested methodologies the study proposes revised national parameters for the assessment of N₂O emissions from crop residues in Lithuania. Emissions are developed according 2006 IPCC Guidelines; Equation 11.2 of the Guidelines which is simplified accounting for no burning of crop residues in Lithuania:

$$F_{CR} = \sum_T \{Crop_{(T)} * Frac_{Renew(T)} * Area_{(T)} [R_{AG(T)} * N_{AG(T)} * (1 - Frac_{Remove(T)}) + R_{BG(T)} * N_{BG(T)}]\}$$

here:

F_{CR} -	annual amount of N in crop residues (above and below ground), including N-fixing crops, and from forage/ pasture renewal, returned to soils annually, kg N/ year
T -	crop or forage type
$Crop_{(T)}$ -	harvested annual dry matter yield for crop T, kg d.m. / ha
$Area_{(T)}$ -	total annual area harvested of crop T, ha / year
$Frac_{Renew(T)}$ -	fraction of total area under crop T that is renewed annually. For countries where pastures are renewed on average every X years, $Frac_{Renew} = 1/X$. For annual crops $Frac_{Renew} = 1$
$R_{AG(T)}$ -	ratio of above-ground residues dry matter ($AG_{DM(T)}$) to harvested yield for crop T ($Crop_{(T)}$), $kg\ d.m. / kg\ d.m. = AG_{DM(T)} * 1000 / Crop_{(T)}$; $AG_{DM(T)} = (Crop_{(T)} / 1000) * a_{(T)} + b_{(T)}$
$N_{AG(T)}$ -	N content of above-ground residues for crop T, kg N / kg d.m.
$Frac_{Remove(T)}$ -	fraction of above-ground residues of crop T removed annually for purposes such as feed, bedding and construction, kg N / kg crop-N
$R_{BG(T)}$ -	ratio of belowground residues to harvest yield for crop T, kg d.m. / kg d. If alternative data is not available, $R_{BG(T)}$ can be calculated as $= R_{BG-BIO} * ((AG_{DM(T)} * 1000 / Crop_{(T)}) / Crop_{(T)})$
$N_{BG(T)}$ -	N content of below-ground residues for crop T, kg N / kg d.m.

Methodology integrates all available national data in order to ensure better assessment accuracy under the local conditions. Only in calculation stages for which national data is not available, it is recommended to use parameters from 2006 IPCC Guidelines.

Crops which are included into accounting and proposed calculation parameters are listed in the Table below.

In future, when new data is obtained, proposed parameters will need to be further revised by putting special emphasis on parameters which, according to sensitivity analysis, mostly affect accuracy of the N₂O emission assessment. Results of the latest investigations will need to be considered to revise linear regression coefficients describing ratios between above-ground residue biomass and harvested crop yields.

To improve assessment accuracy it would be useful to conduct representative field measurements of above-ground and below-ground biomass under different farming practices and crop productivity conditions. Today, no reliable information is available on usage of straw. Survey of farmers would help to answer the question which part of the residue is left on the fields after the harvest and which factors have impact on straw usage patterns in the country.

The study reveals that national data on grassland contribution to soil nitrogen pool is still rather poor. For better assessment of N₂O emissions from grasslands and meadows a representative study investigating composition and usage of grasslands, root biomass of grasslands of different age and productivity or ratios between root biomass and hay, silage or green fodder production would be very useful. In future Crop structure changes should be considered and new crops included into account, if needed.

Crops	DRY	$Frac_{Renew(T)}$	$R_{AG(T)}$	$a_{(T)}$	$b_{(T)}$	$Frac_{Remove(T)}$	$R_{BG(T)}$	R_{BG-BIO}	$N_{AG(T)}$	$N_{BG(T)}$
1. Non-N-fixing grain crops										
Winter Wheat	0.86	1	to be calculated	1.17	-1.1	0.3	to be calculated	0.23	0.005	0.004
Spring Wheat	0.86	1	to be calculated	0.96	0.44	0.3	to be calculated	0.28	0.008	0.005
Triticale	0.86	1	1.3	-	-	0.3	to be calculated	0.22	0.006	0.005
Rye	0.86	1	to be calculated	1.6	0.16	0.3	to be calculated	0.22	0.006	0.005
Barley	0.86	1	to be calculated	0.86	0.34	0.3	to be calculated	0.22	0.006	0.005
Oats	0.86	1	to be calculated	2.05	-1.22	0.3	to be calculated	0.25	0.007	0.005
Grain maize	0.86	1	1.14	-	-	0.3	to be calculated	0.22	0.008	0.005
Winter Rape	0.915	1	to be calculated	2.78	-1.99	0.3	to be calculated	0.3	0.007	0.006
Spring Rape	0.915	1	to be calculated	2.78	-1.99	0.3	to be calculated	0.3	0.008	0.006
Flax	0.86	1	1.3	-	-	0.3	to be calculated	0.22	0.006	0.005
Buckwheat	0.86	1	2.3	-	-	0.3	to be calculated	0.22	0.007	0.005
Mixed cereals	0.86	1	1.3	-	-	0.3	to be calculated	0.22	0.006	0.005
Other cereals	0.86	1	1.3	-	-	0.3	to be calculated	0.22	0.006	0.005
2. N fixing grains and pulses										
Peas	0.86	1	1.4	-	-	0	to be calculated	0.19	0.0167	0.0243
Beans	0.86	1	2.2	-	-	0	to be calculated	0.19	0.012	0.016
Soya beans	0.86	1	1.75	-	-	0	to be calculated	0.19	0.014	0.02
Lupines	0.86	1	1.6	-	-	0	to be calculated	0.19	0.0136	0.0227
Vetches	0.86	1	1.6	-	-	0	to be calculated	0.19	0.0129	0.02
Mixed dried pulses	0.86	1	1.7	-	-	0	to be calculated	0.19	0.014	0.02
3. Root/tuber crops										
Potatoes	0.22	1	0.2	-	-	0	to be calculated	0.2	0.014	0.0125
Sugar beet	0.23	1	0.5	-	-	0	to be calculated	0.2	0.03	0.014
Fodder beet	0.12	1	0.3	-	-	0	to be calculated	0.2	0.03	0.014
Field vegetables	0.13	1	0.3	-	-	0	to be calculated	0.2	0.022	0.014
4. N fixing forage crops										
Alfalfa (for hay)	0.85	0.25	to be calculated	0.29	0	0	1.7	-	0.025	0.017
Alfalfa (for green fodder, silage)	0.35	0.25	to be calculated	0.29	0	0	1.7	-	0.025	0.017
Clover and their mixtures (for hay)	0.85	0.3	to be calculated	0.3	0	0	0.9	-	0.025	0.016
Clover and their mixtures (for green fodder and silage)	0.35	0.3	to be calculated	0.3	0	0	0.9	-	0.025	0.016
Silage crops	0.3	1	to be calculated	0.3	0	0	to be calculated	0.4	0.008	0.022
5. Other industrial and forage crops, including annual and perennial pastures and meadows										

Crops	DRY	$Frac_{Renew(T)}$	$R_{AG(T)}$	$a_{(T)}$	$b_{(T)}$	$Frac_{Remove(T)}$	$R_{BG(T)}$	R_{BG-BIO}	$N_{AG(T)}$	$N_{BG(T)}$
Maize for silage and green fodder	0.3	1	to be calculated	0.3	0	0	to be calculated	0.54	0.008	0.012
Annual grasses (for hay)	0.85	1	to be calculated	0.3	0	0	0.6	-	0.015	0.012
Annual grasses (for hay)	0.35	1	to be calculated	0.3	0	0	0.6	-	0.015	0.012
Perennial grasses up to 5 years (apart from alfalfa and clovers and their mixtures) (for hay)	0.85	0.2	to be calculated	0.3	0	0	2	-	0.02	0.015
Perennial grasses up to 5 years (apart from alfalfa and clovers and their mixtures) (for green fodder and silage)	0.35	0.2	to be calculated	0.3	0	0	2	-	0.02	0.015
Perennial pastures (for hay)	0.85	0.07	to be calculated	0.3	0	0	2	-	0.02	0.015
Perennial pastures (for silage and green fodder)	0.35	0.07	to be calculated	0.3	0	0	2	-	0.02	0.015
Meadows and natural pastures (for hay)	0.85	0.07	to be calculated	0.3	0	0	2	-	0.02	0.015
Meadows and natural pastures (for silage and green fodder)	0.35	0.07	to be calculated	0.3	0	0	2	-	0.02	0.015

ANNEX X. LULUCF area matrices

1990

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,042,574	0	6,389	3,594	799	799	2,054,154	11,581
Cropland	0	2,391,988	22,362	0	799	399	2,414,749	-38,336
Grassland	0	60,299	1,218,355	3,195	799	4,393	1,287,041	37,139
Wetlands	0	399	1,597	379,364	0	0	381,360	-4,793
Settlements	0	1,198	1,198	0	344,223	799	347,417	0,799
Other land	0	0	0	0	0	43,926	43,926	-6,399
Initial	2,041,375	2,453,884	1,248,304	387,751	347,018	50,316	6,528,648	

1991

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,054,154	399	3,993	2,396	399	0	2,061,342	7,188
Cropland	0	2,352,454	22,362	0	799	399	2,376,014	-38,735
Grassland	0	60,698	1,257,890	3,195	799	4,393	1,326,974	39,933
Wetlands	0	399	1,597	375,770	0	0	377,766	-3,594
Settlements	0	799	1,198	0	345,421	799	348,216	0,799
Other land	0	0	0	0	0	38,336	38,336	-5,591
Initial	2,054,154	2,414,749	1,287,041	381,360	347,417	43,926	6,528,648	

1992

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,061,342	399	2,795	1,997	0	399	2,066,933	5,591
Cropland	0	2,311,722	25,158	0	0	799	2,337,679	-38,336
Grassland	0	60,299	1,298,222	799	1,198	4,792	1,365,310	38,336
Wetlands	0	399	0	374,971	0	2,396	377,766	0
Settlements	0	2,396	799	0	347,018	399	350,612	2,396
Other land	0	799	0	0	0	29,550	30,349	-7,987
Initial	2,061,342	2,376,014	1,326,974	377,766	348,216	38,336	6,528,648	

1993

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,066,933	1,198	3,993	0	0	0	2,072,124	5,191
Cropland	0	2,275,383	22,762	1,198	799	1,597	2,301,739	-35,940
Grassland	0	58,702	1,338,155	1,198	1,198	5,191	1,404,444	39,134
Wetlands	0	799	0	375,370	0	399	376,568	-1,198
Settlements	0	799	399	0	348,615	0	349,813	-799
Other land	0	799	0	0	0	23,161	23,960	-6,389
Initial	2,066,933	2,337,679	1,365,310	377,766	350,612	30,349	6,528,648	

1994

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,071,725	0	2,396	399	399	0	2,074,919	2,795
Cropland	0	2,231,457	27,953	0	0	799	2,260,209	-41,530
Grassland	0	66,688	1,372,498	799	799	4,792	1,445,575	41,131
Wetlands	0	399	0	375,370	0	399	376,169	-399
Settlements	0	2,795	1,597	0	348,615	0	353,008	3,195
Other land	399	399	0	0	0	17,970	18,769	-5,191
Initial	2,072,124	2,301,739	1,404,444	376,568	349,813	23,960	6,528,648	

1995

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,074,919	0	1,597	799	0	0	2,077,315	2,396
Cropland	0	2,197,913	24,758	0	0	399	2,223,071	-37,138
Grassland	0	59,500	1,418,820	1,198	3,195	4,792	1,487,505	41,930
Wetlands	0	399	399	374,172	0	1,198	376,169	0
Settlements	0	1,997	0	0	349,813	0	351,810	-1,198
Other land	0	399	0	0	0	12,379	12,779	-5,990
Initial	2,074,919	2,260,209	1,445,575	376,169	353,008	18,769	6,528,648	

1996

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,077,315	399	2,795	799	0	0	2,081,309	3,993
Cropland	0	2,196,715	8,386	0	0	0	2,205,101	-17,970
Grassland	0	25,956	1,476,323	399	0	399	1,503,079	15,574
Wetlands	0	0	0	374,971	0	0	374,971	-1,198
Settlements	0	0	0	0	351,810	0	351,810	0
Other land	0	0	0	0	0	12,379	12,379	-399
Initial	2,077,315	2,223,071	1,487,505	376,169	351,810	12,779	6,528,648	

1997

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,081,309	799	2,396	399	0	0	2,084,903	3,594
Cropland	0	2,153,188	19,567	0	0	399	2,173,155	-31,946
Grassland	0	50,715	1,480,317	0	0	0	1,531,032	27,953
Wetlands	0	0	399	374,572	0	0	374,971	0
Settlements	0	399	399	0	351,411	0	352,209	399
Other land	0	0	0	0	399	11,980	12,379	0
Initial	2,081,309	2,205,101	1,503,079	374,971	351,810	12,379	6,528,648	

1998

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,084,903	0	2,795	0	0	399	2,088,097	3,195
Cropland	0	2,088,497	37,138	0	0	0	2,125,634	-47,520
Grassland	0	83,859	1,490,699	0	0	0	1,574,559	43,527
Wetlands	0	0	0	374,971	0	0	374,971	0
Settlements	0	399	399	0	352,209	0	353,008	799
Other land	0	399	0	0	0	11,980	12,379	0
Initial	2,084,903	2,173,155	1,531,032	374,971	352,209	12,379	6,528,648	

1999

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,087,698	399	1,597	1,198	0	0	2,090,893	2,795
Cropland	0	2,028,597	51,913	0	0	0	2,080,510	-45,124
Grassland	0	96,239	1,520,250	0	0	0	1,616,488	41,930
Wetlands	399	0	0	373,773	0	0	374,172	-799
Settlements	0	399	799	0	353,008	0	354,206	1,198
Other land	0	0	0	0	0	12,379	12,379	0
Initial	2,088,097	2,125,634	1,574,559	374,971	353,008	12,379	6,528,648	

2000

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,090,893	0	2,396	2,396	0	399	2,096,084	5,191
Cropland	0	1,969,896	50,715	0	0	0	2,020,610	-59,900
Grassland	0	108,618	1,559,783	399	1,198	0	1,669,999	53,510
Wetlands	0	0	1,198	371,377	0	0	372,575	-1,597
Settlements	0	1,997	2,396	0	353,008	0	357,400	3,195
Other land	0	0	0	0	0	11,980	11,980	-399
Initial	2,090,893	2,080,510	1,616,488	374,172	354,206	12,379	6,528,648	

2001

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,096,084	399	1,997	0	0	0	2,098,480	2,396
Cropland	0	1,918,382	43,128	0	0	0	1,961,510	-59,101
Grassland	0	101,430	1,624,076	399	399	399	1,726,703	56,705
Wetlands	0	0	0	372,176	0	0	372,176	-399
Settlements	0	399	399	0	357,001	0	357,800	399
Other land	0	0	399	0	0	11,581	11,980	0
Initial	2,096,084	2,020,610	1,669,999	372,575	357,400	11,980	6,528,648	

2002

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,098,480	0	3,993	399	0	0	2,102,872	4,393
Cropland	0	1,872,858	40,332	0	0	0	1,913,191	-48,319
Grassland	0	87,853	1,681,979	0	0	0	1,769,831	43,128
Wetlands	0	0	399	371,776	0	799	372,974	799
Settlements	0	799	0	0	357,800	0	358,598	799
Other land	0	0	0	0	0	11,181	11,181	-799
Initial	2,098,480	1,961,510	1,726,703	372,176	357,800	11,980	6,528,648	

2003

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,102,473	799	3,195	799	399	0	2,107,664	4,792
Cropland	0	1,848,100	23,560	0	0	0	1,871,660	-41,530
Grassland	0	64,292	1,741,878	0	0	0	1,806,170	36,339
Wetlands	399	0	399	372,176	0	399	373,374	399
Settlements	0	0	399	0	358,199	0	358,598	0
Other land	0	0	399	0	0	10,782	11,181	0
Initial	2,102,872	1,913,191	1,769,831	372,974	358,598	11,181	6,528,648	

2004

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,106,866	399	6,389	1,198	0	0	2,114,852	7,188
Cropland	0	1,821,744	29,151	0	0	0	1,850,895	-20,765
Grassland	0	49,118	1,769,831	399	0	0	1,819,348	13,178
Wetlands	799	0	399	371,776	0	399	373,374	0
Settlements	0	399	399	0	358,598	0	359,397	799
Other land	0	0	0	0	0	10,782	10,782	-399
Initial	2,107,664	1,871,660	1,806,170	373,374	358,598	11,181	6,528,648	

2005

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,114,453	799	5,191	1,597	0	399	2,122,440	7,587
Cropland	0	1,810,563	23,560	0	0	0	1,834,123	-16,772
Grassland	0	38,735	1,788,200	0	0	0	1,826,935	7,587
Wetlands	0	0	799	371,776	0	399	372,974	-399
Settlements	399	799	1,597	0	359,397	0	362,192	2,795
Other land	0	0	0	0	0	9,983	9,983	-799
Initial	2,114,852	1,850,895	1,819,348	373,374	359,397	10,782	6,528,648	

2006

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,122,040	799	5,591	1,597	0	0	2,130,027	7,587
Cropland	0	1,798,184	81,863	0	0	0	1,880,046	45,923
Grassland	0	34,742	1,737,485	399	0	0	1,772,626	-54,309
Wetlands	0	399	399	370,978	0	0	371,776	-1,198
Settlements	399	0	1,597	0	362,192	0	364,189	1,997
Other land	0	0	0	0	0	9,983	9,983	0
Initial	2,122,440	1,834,123	1,826,935	372,974	362,192	9,983	6,528,648	

2007

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,130,027	2,396	2,795	1,997	0	399	2,137,614	7,587
Cropland	0	1,853,291	78,668	0	0	0	1,931,959	51,913
Grassland	0	24,359	1,688,767	0	399	0	1,713,526	-59,101
Wetlands	0	0	1,198	369,780	0	0	370,978	-799
Settlements	0	0	1,198	0	363,790	0	364,988	799
Other land	0	0	0	0	0	9,584	9,584	-399
Initial	2,130,027	1,880,046	1,772,626	371,776	364,189	9,983	6,528,648	

2008

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,137,614	1,597	4,792	399	0	0	2,144,403	6,789
Cropland	0	1,904,405	76,272	0	399	0	1,981,077	49,118
Grassland	0	25,557	1,629,267	399	0	0	1,655,223	-58,302
Wetlands	0	0	799	370,179	0	0	370,978	0
Settlements	0	399	1,597	0	364,588	0	366,585	1,597
Other land	0	0	799	0	0	9,584	10,383	799
Initial	2,137,614	1,931,959	1,713,526	370,978	364,988	9,584	6,528,648	

2009

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,144,003	0	3,594	0	0	0	2,147,597	3,195
Cropland	0	1,965,902	50,316	0	0	0	2,016,218	35,141
Grassland	0	14,775	1,596,921	0	399	399	1,612,495	-42,728
Wetlands	399	0	0	370,978	0	0	371,377	399
Settlements	0	399	3,594	0	366,186	0	370,179	3,594
Other land	0	0	799	0	0	9,983	10,782	399
Initial	2,144,403	1,981,077	1,655,223	370,978	366,585	10,383	6,528,648	

2010

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,147,597	399	5,990	0	0	0	2,153,987	6,389
Cropland	0	1,933,556	4,792	0	0	0	1,938,348	-77,869
Grassland	0	82,262	1,597,720	399	1,198	0	1,681,579	69,084
Wetlands	0	0	0	370,978	0	0	370,978	-399
Settlements	0	0	3,993	0	368,981	0	372,974	2,795
Other land	0	0	0	0	0	10,782	10,782	0
Initial	2,147,597	2,016,218	1,612,495	371,377	370,179	10,782	6,528,648	

2011

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,153,987	2,396	5,990	0	0	0	2,162,373	8,386
Cropland	0	1,883,241	39,534	0	0	0	1,922,775	-15,574
Grassland	0	52,712	1,635,656	0	399	0	1,688,767	7,188
Wetlands	0	0	0	370,978	0	399	371,377	399
Settlements	0	0	399	0	372,575	0	372,974	0
Other land	0	0	0	0	0	10,383	10,383	-399
Initial	2,153,987	1,938,348	1,681,579	370,978	372,974	10,782	6,528,648	

2012

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,162,373	1,198	8,785	1,597	0	0	2,173,953	11,581
Cropland	0	1,870,462	39,534	0	0	0	1,909,996	-12,779
Grassland	0	51,114	1,639,650	399	1,198	0	1,692,361	3,594
Wetlands	0	0	0	369,380	0	0	369,380	-1,997
Settlements	0	0	799	0	371,776	0	372,575	-399
Other land	0	0	0	0	0	10,383	10,383	0
Initial	2,162,373	1,922,775	1,688,767	371,377	372,974	10,383	6,528,648	

2013

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,173,953	799	4,393	0	799	0	2,179,943	5,990
Cropland	0	1,885,637	39,534	0	399	0	1,925,570	15,574
Grassland	0	23,161	1,643,643	0	799	0	1,667,603	-24,758
Wetlands	0	0	0	369,380	0	399	369,780	399
Settlements	0	399	4,393	0	370,578	0	375,370	2,795
Other land	0	0	399	0	0	9,983	10,383	0
Initial	2,173,953	1,909,996	1,692,361	369,380	372,575	10,383	6,528,648	

2014

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,179,943	1,997	3,594	2,396	0	0	2,187,930	7,987
Cropland	0	1,900,412	45,124	0	0	0	1,945,536	19,967
Grassland	0	22,362	1,615,690	399	399	399	1,639,250	-28,352
Wetlands	0	0	1,198	366,984	0	0	368,182	-1,597
Settlements	0	799	1,597	0	374,971	0	377,367	1,997
Other land	0	0	399	0	0	9,983	10,383	0
Initial	2,179,943	1,925,570	1,667,603	369,780	375,370	10,383	6,528,648	

2015

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,187,930	799	7,587	799	0	0	2,197,114	9,185
Cropland	0	1,932,359	19,567	0	399	0	1,952,325	6,789
Grassland	0	11,980	1,609,700	0	0	1,198	1,622,878	-16,373
Wetlands	0	0	399	367,384	0	0	367,783	-399
Settlements	0	399	1,997	0	376,968	0	379,364	1,997
Other land	0	0	0	0	0	9,185	9,185	-1,198
Initial	2,187,930	1,945,536	1,639,250	368,182	377,367	10,383	6,528,648	

2016

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,196,715	399	3,993	1,198	0	0	2,202,306	5,191
Cropland	0	1,927,966	15,973	0	799	0	1,944,738	-7,587
Grassland	0	23,960	1,602,112	399	0	799	1,627,270	4,393
Wetlands	0	0	799	366,186	0	0	366,984	-799
Settlements	399	0	0	0	378,565	0	378,964	-399
Other land	0	0	0	0	0	8,386	8,386	-799
Initial	2,197,114	1,952,325	1,622,878	367,783	379,364	9,185	6,528,648	

2017

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,201,507	399	5,990	2,396	0	0	2,210,292	7,987
Cropland	0	1,917,184	45,524	0	0	0	1,962,708	17,970
Grassland	0	26,755	1,574,958	399	1,198	399	1,603,710	-23,560
Wetlands	799	0	0	364,189	0	0	364,988	-1,997
Settlements	0	399	799	0	377,766	0	378,964	0
Other land	0	0	0	0	0	7,987	7,987	-399
Initial	2,202,306	1,944,738	1,627,270	366,984	378,964	8,386	6,528,648	

2018

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,208,296	0	3,594	399	0	0	2,212,289	1,997
Cropland	0	1,931,959	38,336	0	0	0	1,970,295	7,587
Grassland	1,198	30,748	1,560,981	799	399	399	1,594,525	-9,185
Wetlands	0	0	0	363,790	0	0	363,790	-1,198
Settlements	799	0	799	0	378,565	0	380,162	1,198
Other land	0	0	0	0	0	7,587	7,587	-399
Initial	2,210,292	1,962,708	1,603,710	364,988	378,964	7,987	6,528,648	

2019

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,211,091	0	3,594	399	0	0	2,215,084	2,795
Cropland	0	1,951,127	33,544	0	399	0	1,985,070	14,775
Grassland	399	19,168	1,555,391	399	0	0	1,575,357	-19,168
Wetlands	0	0	0	362,991	0	0	362,991	-799
Settlements	0	0	1,997	0	379,763	0	381,760	1,597
Other land	799	0	0	0	0	7,587	8,386	799
Initial	2,212,289	1,970,295	1,594,525	363,790	380,162	7,587	6,528,648	

2020

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,213,886	399	5,990	1,997	0	0	2,222,272	7,188
Cropland	0	1,968,298	41,930	0	399	0	2,010,627	25,557
Grassland	799	16,373	1,524,243	0	399	399	1,542,213	-33,144
Wetlands	399	0	0	360,994	0	0	361,394	-1,597
Settlements	0	0	3,195	0	380,961	0	384,156	2,396
Other land	0	0	0	0	0	7,987	7,987	-399
Initial	2,215,084	1,985,070	1,575,357	362,991	381,760	8,386	6,528,648	

ANNEX XI. Summary of the studies on carbon stock values in forest and non-forest land

In this annex the summaries of two studies performed by Lithuanian Centre of Agriculture and Forestry, Institute of Forestry under the partnership project between Lithuania and Norway.

Summaries do not provide all the studies' results (estimates of each sampling plot estimated carbon stock value) which were used to calculate average national values of carbon stocks in mineral soils of forest land, cropland and grassland as well as afforested/reforested lands mineral soils and carbon stocks in litter in forest remaining forest and land converted to forest land. Summaries are provided here as information item on the methodology used to estimate national carbon stock values in soil and litter.

OF THE STUDY “ASSESSMENT OF CARBON STOCKS IN MINERAL AND ORGANIC SOILS, AND ESTIMATION OF NATIONAL CARBON VALUES IN THE SOILS AFTER AFFORESTATION OF ABANDONED AGRICULTURAL LAND/REFORESTATION”

SHORT REPORT

(Supervised by dr. I.Varnagirytė-Kabašinskienė. Kaunas-Girionys, 2016)

Introduction

The afforestation (conversion to forest land actively promoted through planting of trees) is recognized as an eligible measure to achieve climate change mitigation, biodiversity protection and enhancement goals promoted by recent environmental policies. Generally, the mitigation policies aim to reduce greenhouse gas emissions from individual countries in order to prevent climate change. In accordance with various commitments, Lithuania aims to develop methodically reasonable estimates of national carbon stocks in mineral and organic soils.

This study aims to give an overview of soil organic carbon estimates in *Arenosols*, *Luvisols* and *Histosols* after afforestation of abandoned agricultural land/reforestation in Lithuania. Carbon concentrations and stocks in the coniferous and deciduous forest plantations of different 1–10, 11–20 and 21–30 years age are analysed. Recently obtained data of soil carbon estimates on conversion to forest land or plantations at Lithuanian level are presented.

Conversion to forest land is generally associated with positive effects on the carbon balance, particularly if former agricultural land with low soil organic matter content is afforested. The carbon benefits are produced by biomass accumulation during the conversion and by a potential increase of organic carbon in the soil. However, the carbon dynamics in the conversion to forest can vary a lot. While forest stands always contain more biomass above-ground compared to grassland or agricultural crops, this is not always true for below-ground biomass and soil organic matter.

Materials and methods

The study describes the method used for estimating carbon stocks for managed forest plantations (different tree species, different age classes) and the control – crops and/or grasslands. The effect of land-use change was investigated by applying the paired-site design, i.e. by comparing soil organic carbon in the forest plantation (afforested plot) with identical soil type but different land-use type (control – grassland or crop) at the same moment in time. The soil organic carbon stocks are derived from field measurements up to a depth of 30 cm (forest litter/organic horizon/Ao; mineral soil of 0–10, 10–30 and 0–30 cm depths). A comprehensive soil survey was undertaken in March–September, 2016. The study objectives were selected in Dubrava, Kaunas, Kretinga, Kazlų Rūda, Jonava, Marijampolė, Alytus, Prienai, Varėna, Veisiejai, Ukmergė, Kėdainiai and Valkininkai Forest Enterprises.

Totally soil samples were collected from 383 plots, of which 188 plots were selected in afforested sites (deciduous or conifers), other plots were selected as controls in permanent grassland or arable land.

In the field, the plot characteristics were given: ground vegetation assessment – species composition and projection area (%); projection area of forest litter, especially in young forest plantations; land-use type was described – natural or agricultural grasslands, arable land, etc. The litter layer was collected

from five places within 0.25×0.25 m frame. Mineral soil was sampled with a gauge from 10 places. Subsamples were combined both forest litter and mineral soil.

In the laboratory, collected composite samples were analysed: dry mass of forest or grassland litter, bulk density of mineral soil and dry mass of organic soil were determined according ISO 11272:1998. Samples were prepared for the chemical analyses according to the ISO 11464:1994. According to the requirements of LST EN ISO/IEC 17025:2005, total organic carbon was determined by ISO 10694:1995 (total concentrations of organic carbon were given for dry mass according ISO 11465:1993) in the accredited Agrochemical Research laboratory of Lithuanian Research Centre for Agriculture and Forestry.

Main findings and conclusions

1. The study results showed that mean mass of soil organic layer (forest litter) in the studied *Arenosols*, *Luvisols* and *Histosols* of afforested/reforested land (0–30-year-old coniferous and deciduous plantations) in all cases was higher than soil organic layer (mainly annual litter of grasses) of perennial grassland. The mass of soil organic layer in coniferous stands was 1.6 to 2.6 times higher than in deciduous stands.

2. The bulk density (of fine soil fraction, <2 mm) in the 0–10 cm layer of forest soil was $1.15 \pm 0.02 \text{ g cm}^{-3}$ in *Arenosols*, $1.24 \pm 0.02 \text{ g cm}^{-3}$ in *Luvisols*, and $0.33 \pm 0.02 \text{ g cm}^{-3}$ in *Histosols*. Deeper, in the 10–30 cm layer, the bulk density was 1.30 ± 0.02 (*Arenosols*); 1.43 ± 0.02 (*Luvisols*) and $0.35 \pm 0.03 \text{ g cm}^{-3}$ (*Histosols*). In all studied soils of afforested land the bulk density slightly differed from the bulk density in the perennial grasslands or arable land. Also, in many cases, the bulk density was lower in older forest plantations compared to the arable land. However, it did not significantly differ between forests and perennial grasslands.

The mean soil organic carbon concentrations in the soil organic layer (forest litter) of *Arenosols* and *Luvisols* varied in a range of $340\text{--}360 \text{ g kg}^{-1}$, while in the *Histosols* the carbon concentration was about 420 g kg^{-1} . However, in all cases C concentration in the soil organic layer of afforested land did not much differ from the C concentration in the perennial grasslands.

The stocks of organic carbon in the soils at 0–30 depths of afforested land exceeded the organic carbon values in the similar soils of the perennial grasslands. The carbon stocks in the soil of afforested land were by 1.3 times higher in the nutrient poor *Arenosols* and by 1.4 times higher in the *Histosols* compared to the similar grassland soils. The carbon stocks in more fertile *Luvisols* of afforested land were quite similar to the carbon stocks in the perennial grasslands. In the afforested land, the carbon stocks at 0–30 cm soil depth were significantly higher compared to the arable soils: they were about 1.3 times higher in *Arenosols*, by 1.7 times – in *Luvisols*, and by 1.2 times higher – in *Histosols*.

Our study showed that organic carbon more intensively accumulated in the deciduous forest compared to the coniferous forest in the nutrient poor *Arenosols*. In the deciduous forest organic carbon stocks were about 1.4 times lower than in the coniferous forest (Fig.1). However, no significant difference between conifers and deciduous forest were obtained in more fertile *Luvisols* and organic *Histosols*.

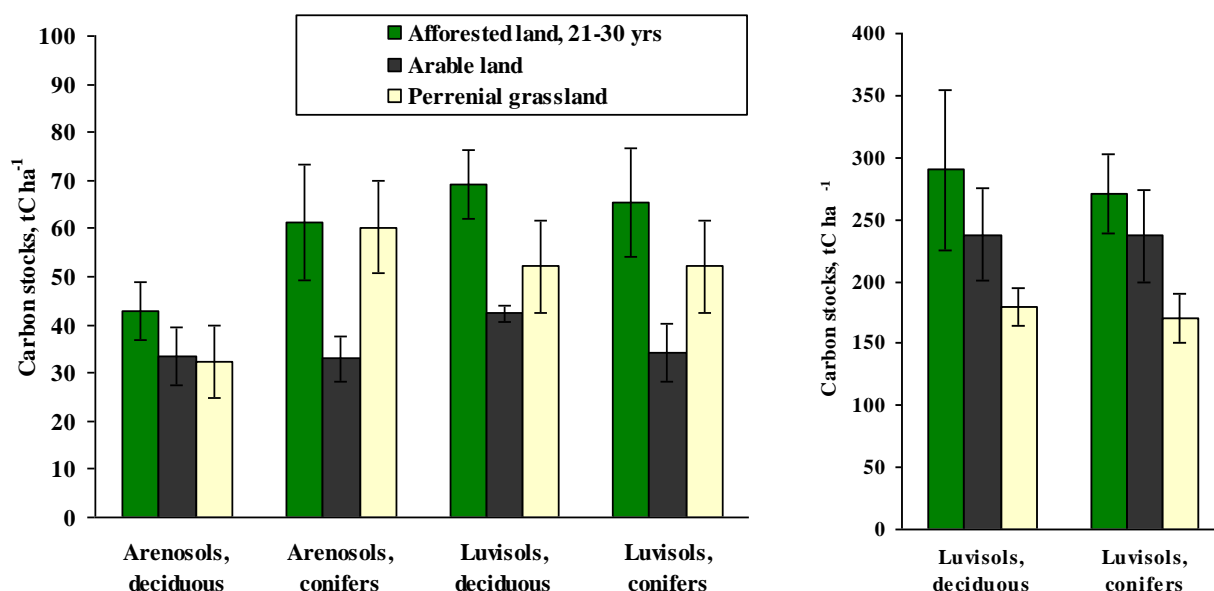


Fig.1. Stocks (t ha⁻¹) of organic carbon in 0–30 cm mineral soil/peat layer in the afforested land in the 21-30-year old coniferous and deciduous forest plantations and the control (arable land and grassland).

Detailed estimates of national carbon stocks in mineral and organic soils in Lithuania are given in a summary Table 1 and Tables 2–4.

This study confirmed the results obtained in the similar surveys of foreign countries stating that the significant increase of organic carbon stocks up to 30–40 years after the afforestation/reforestation is not recorded. For this aim, older afforested sites should be studied.

Table 1. Organic carbon stocks (t ha⁻¹) in the 0–30 cm mineral soil/peat layer of afforested/reforested sites of different age groups and the control (arable land and permanent grasslands). The values are given as the means and standard errors (data of 2016 soil survey in Lithuania)

Land-use	Soil group (WRB, 2015)					
	Arenosols		Luvisols		Histosols	
	<i>n</i>	tC ha ⁻¹	<i>n</i>	tC ha ⁻¹	<i>n</i>	tC ha ⁻¹
Afforested land* (0-10 years old)	23	51.9±5.2	22	59.1±4.0	15	283.9±15.8
Arable land	10	44.9±7.1	13	33.6±3.9	7	227.7±47.0
Grassland	9	39.4±4.5	9	63.6±13.9	7	221.0±14.7

Afforested land (11-20 years old)	22	57.5±4.8	21	60.3±4.8	22	243.9±26.5
Arable land	12	40.4±4.1	12	40.1±5.4	6	171.6±18.5
Grassland	11	46.3±5.8	10	61.9±13.0	15	168.4±13.5

Afforested land (21-30 years old)	22	49.3±6.0	18	66.9±7.2	23	277.6±29.9
Arable land	11	33.3±3.9	14	36.9±4.2	7	199.7±32.3
Grassland	9	36.9±7.7	8	52.1±9.7	16	174.3±12.9

Afforested land (0-30 years old)	67	53.3±3.1	61	61.8±3.1	60	266.8±15.5
Arable land	33	40.0±2.8	39	36.9±2.2	22	221.3±23.2
Grassland	29	42.5±3.1	26	58.0±6.1	38	191.2±8.7

* Afforested land – conifers and deciduous plantations

Table 2. Soil organic carbon stocks (t ha⁻¹) in Arenosols (data of 2016 soil survey in Lithuania)

Land-use	Stock of soil organic carbon, tC ha ⁻¹			
	Soil organic layer / litter of grasses	Mineral soil 0–10 cm	Mineral soil 10–30 cm	Mineral soil 0–30 cm
Afforested land (0-10 yrs old)	1.2±0.2	19.2±2.0	32.7±3.5	51.9±5.2
Control	0.9±0.1	21.8±2.1	20.1±2.6	41.9±4.0
Conifers (0-10 yrs old)	0.8±0.3	17.4±2.7	29.0±4.9	46.4±7.5
Arable land	-	15.3±3.6	22.5±7.3	37.8±10.9
Grassland	0.9	18.0±3.3	15.1±3.6	33.1±6.9
Deciduous (0-10 yrs old)	1.5±0.3	20.7±2.8	35.7±5.0	56.4±7.3
Arable land	-	25.0±3.4	27.1±6.9	52.1±9.3
Grassland	0.8±0.2	28.5±4.1	17.1±2.4	45.7±5.3

Afforested land (11-20 yrs old)	2.9±0.3	20.3±1.4	37.2±3.8	57.5±4.8
Control	0.7±0.1	22.3±1.8	20.8±1.9	43.1±3.4
Conifers (11-20 yrs old)	3.3±0.4	22.6±1.5	36.8±3.8	59.4±5.2
Arable land	-	23.1±2.5	23.0±3.8	46.1±5.7
Grassland	0.7±0.2	29.9±3.6	24.6±3.5	54.5±6.8
Deciduous (11-20 yrs old)	2.3±0.3	17.3±2.5	37.7±7.6	55.0±9.2
Arable land	-	16.3±1.9	16.1±2.0	32.4±3.7
Grassland	-	19.4±3.9	18.7±4.9	38.1±8.6

Afforested land (21-30 yrs old)	4.1±0.4	19.2±2.4	30.2±4.0	49.3±6.0
Control	0.5	18.7±2.1	15.7±1.8	34.4±3.5
Conifers (21-30 yrs old)	4.8±0.5	17.8±3.0	25.0±3.9	42.8±6.1
Arable land	-	15.5±2.8	18.1±3.4	33.5±6.1
Grassland	-	20.3±4.3	12.0±3.6	32.2±7.5
Deciduous (21-30 yrs old)	2.9±0.4	21.7±4.1	39.6±8.1	61.3±12.1
Arable land	-	19.2±4.4	13.7±0.7	32.9±4.7
Grassland	0.5	32.7	27.7	60.3

Afforested land (0-30 yrs old)	2.6±0.2	19.6±1.1	33.7±2.2	53.3±3.1
Control	0.7±0.1	21.5±1.1	19.7±1.2	41.2±2.1
Conifers (0-30 yrs old)	3.1±0.4	19.6±1.4	30.8±2.5	50.3±3.7
Arable land	-	18.1±1.8	20.9±2.5	39.0±4.1
Grassland	0.7±0.1	22.4±2.4	17.1±2.4	39.5±4.6
Deciduous (0-30 yrs old)	2.1±0.2	19.7±1.7	37.3±3.8	56.9±5.1
Arable land	-	20.1±2.1	18.6±2.6	38.7±4.1
Grassland	0.7±0.1	25.1±2.9	18.7±2.4	43.7±4.6

Table 3. Soil organic carbon stocks (t ha⁻¹) in Luvisols (data of 2016 soil survey in Lithuania)

Land-use	Stock of soil organic carbon, tC ha ⁻¹			
	Soil organic layer / litter of grasses	Mineral soil 0–10 cm	Mineral soil 10–30 cm	Mineral soil 0–30 cm
Afforested land (0-10 yrs old)	1.0±0.2	22.8±1.8	36.3±2.6	59.1±4.0
Control	-	26.4±4.4	21.5±3.5	47.8±7.5
Conifers (0-10 yrs old)	1.4±0.3	22.6±2.9	34.6±4.1	57.2±6.4
Arable land	-	16.3±3.4	17.0±2.3	33.4±5.2
Grassland	-	41.3±14.3	32.5±16.5	73.8±30.7
Deciduous (0-10 yrs old)	0.7±0.2	23.0±2.3	37.6±3.5	60.6±5.3
Arable land	-	15.7±3.5	18.0±2.4	33.7±5.9
Grassland	-	35.3±7.6	20.2±2.7	55.5±9.4

Afforested land (11-20 yrs old)	2.1±0.3	23.7±1.9	36.7±3.0	60.3±4.8
Control	1.1±0.1	29.8±4.3	21.8±3.7	51.6±7.6
Conifers (11-20 yrs old)	2.2±0.5	25.0±3.0	38.1±5.0	63.0±7.8
Arable land	-	18.7±2.1	14.3±2.0	33.0±3.4
Grassland	1.2	39.7±11.8	17.8±3.5	57.5±14.8
Deciduous (11-20 yrs old)	1.9±0.3	22.4±2.6	35.3±3.6	57.7±5.9
Arable land	-	26.2±6.8	22.8±4.0	49.0±10.4
Grassland	1.0±0.1	34.8±9.7	30.0±10.8	64.8±20.4

Afforested land (21-30 yrs old)	2.5±0.3	26.7±2.5	40.2±5.1	66.9±7.2
Control	-	23.7±3.4	17.9±2.3	41.6±4.4
Conifers (21-30 yrs old)	3.4±0.5	28.0±4.1	41.1±4.2	69.1±7.1
Arable land	-	16.2±1.7	26.2±2.9	42.4±1.7
Grassland	-	30.7±7.7	21.4±2.7	52.1±9.7
Deciduous (21-30 yrs old)	1.9±0.4	25.8±3.3	39.7±8.1	65.4±11.2
Arable land	-	22.8±4.9	11.4±2.2	34.2±6.0
Grassland	-	-	-	-

Afforested land (0-30 yrs old)	1.8±0.2	24.2±1.2	37.6±2.0	61.8±3.1
Control	0.9±0.1	25.6±1.7	26.9±2.1	46.1±3.1
Conifers (0-30 yrs old)	2.2±0.3	25.1±1.8	37.6±2.5	62.7±4.0
Arable land	-	17.3±1.4	18.2±1.9	35.5±2.4
Grassland	1.2	37.2±6.2	23.9±5.5	61.1±11.0
Deciduous (0-30 yrs old)	1.5±0.2	23.7±1.6	37.6±3.1	61.3±4.5
Arable land	-	21.0±2.8	16.7±1.9	37.7±4.1
Grassland	1.0±0.1	35.0±6.0	25.6±6.0	60.6±11.5

Table 4. Soil organic carbon stocks (t ha⁻¹) in *Histosols* (data of 2016 soil survey in Lithuania)

Land-use	Stock of soil organic carbon, tC ha ⁻¹			
	Organic layer / litter of grasses	Peat layer 0– 10 cm	Peat layer 10–30 cm	Peat layer 0–30 cm
Afforested land (0-10 yrs old)	1.4±0.2	88.3±4.5	195.6±12.4	283.9±15.8
Control	-	113.4±12.3	110.9±12.7	224.3±22.8
Conifers (0-10 yrs old)	1.0±0.2	90.9±8.0	192.2±20.3	283.1±26.9
Arable land	-	110.7±31.0	131.4±35.7	242.1±66.6
Grassland	-	125.2±3.5	96.5±9.5	221.7±6.0
Deciduous (0-10 yrs old)	1.9±0.2	85.4±3.7	199.4±14.7	284.8±16.9
Arable land	-	90.9±2.4	100.7±14.9	191.6±12.5
Grassland	-	120.5±20.9	100.2±10.5	220.7±21.2

Afforested land (11-20 yrs old)	2.7±0.2	75.0±7.2	168.9±22.3	243.9±26.5
Control	2.1	81.2±4.9	87.7±7.3	168.9±11.5
Conifers (11-20 yrs old)	3.0±0.4	90.4±9.6	199.7±38.3	290.1±41.3
Arable land	-	71.3±12.3	84.6±4.8	155.9±17.1
Grassland	-	78.7±5.6	77.2±12.0	155.9±16.9
Deciduous (11-20 yrs old)	2.4±0.2	59.6±8.9	138.1±20.5	197.7±28.5
Arable land	-	71.3±12.3	84.6±4.8	155.9±17.1
Grassland	2.1	84.5±11.3	102.7±10.9	187.2±21.7

Afforested land (21-30 yrs old)	4.8±0.5	87.5±9.7	190.2±24.2	277.6±29.9
Control	-	112.8±11.5	90.3±10.2	206.0±19.0
Conifers (21-30 yrs old)	7.3±0.5	95.9±15.1	194.0±50.0	289.9±64.8
Arable land	-	121.2±21.4	116.3±16.0	237.5±37.2
Grassland	-	104.8±15.2	74.5±5.9	179.3±15.5
Deciduous (21-30 yrs old)	3.4±0.4	83.0±12.8	188.1±27.4	271.1±32.0
Arable land	-	121.2±21.4	116.3±16.0	237.0±37.0
Grassland	-	100.3±18.5	70.0±8.6	170.3±20.2

Afforested land (0-30 yrs old)	3.2±0.3	83.1±4.7	183.7±12.7	266.8±15.5
Control	2.1	98.3±5.6	104.0±6.4	202.2±10.2
Conifers (0-30 yrs old)	3.7±0.5	92.2±6.1	195.8±21.5	288.0±25.7
Arable land	-	128.1±28.2	144.2±31.1	272.4±59.1
Grassland	-	94.0±7.4	78.3±6.5	172.3±11.2
Deciduous (0-30 yrs old)	2.7±0.2	75.7±6.7	173.8±14.9	249.5±18.5
Arable land	-	103.4±13.7	105.8±9.9	209.2±23.3
Grassland	2.1	104.1±10.3	90.4±6.1	194.5±11.4

**EVALUATION OF NATIONAL ORGANIC CARBON STOCKS AND THE DETERMINATION OF STOCK
VALUES IN ORGANIC AND MINERAL SOILS
IN FOREST AND NON-FOREST LAND**

Short report

(LRCAF, Institute of Forestry in 2016. Supervisor - prof. dr. Kęstutis Armolaitis)

Introduction

It is essential in order to meet the requirements of the Land Use Land Use Change and Forestry (*LULUCF*) reporting under UNFCCC. At the moment Lithuania is using Tier 1 methodology and default values for carbon stock estimations in soil and forest litter in forest and non-forest land. Annual UNFCCC Expert Review Teams revisions encourage countries to follow guidelines of Intergovernmental Panel on Climate Change (IPCC) and to move to higher Tiers for estimation of carbon stock changes in soils and forest litter.

The aim of study was to estimate soil organic carbon (SOC) stocks in Lithuanian forests, croplands and grasslands. These specific national SOC values in forest floor and mineral or peat topsoil in the land of different use for Land Use, Land Use Change and Forestry (*LULUCF*) reporting under UNFCCC.

The study was funded by Ministry of Environment of the Republic of Lithuania in the frame of 2009-2014 European Economic Area or Norwegian Financial Mechanisms and Co-financing.

Materials and Methods

The study was performed in 2015 at National Forest Inventory (NFI) permanent sample plots grid that covers the whole territory of Lithuania (**Fig. 1**).

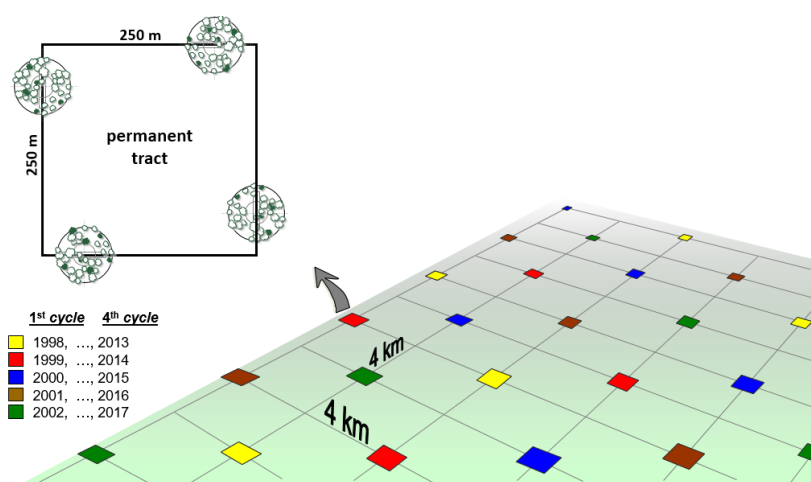


Fig. 1. National Forest Inventory permanent sample plots grid in Lithuania

The data were collected in 752 sample plots (**Fig. 2**).

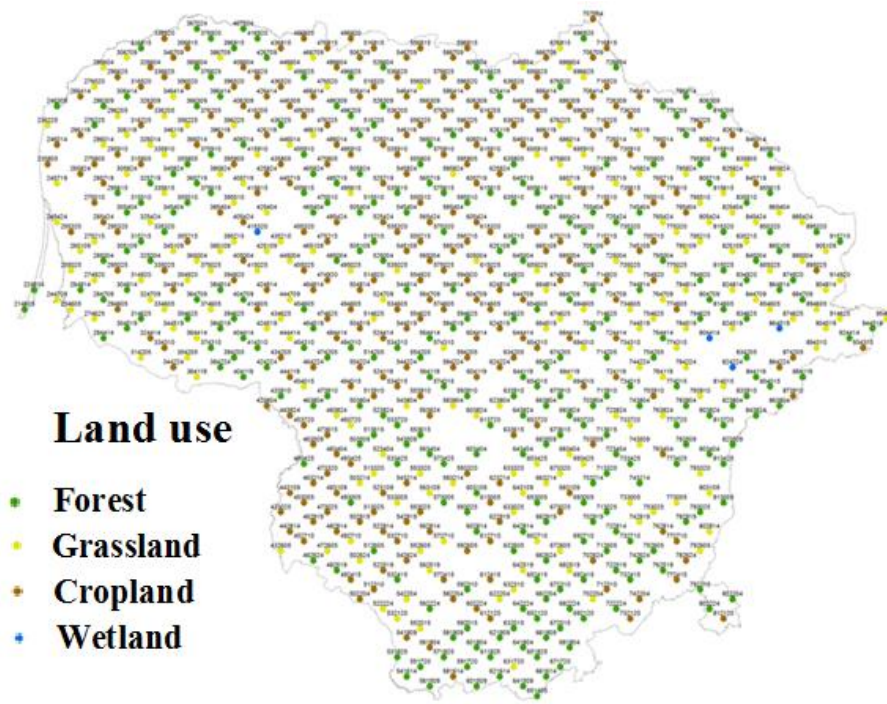


Fig. 2. Sample plots in the grid (9x9 km) of Lithuanian National Forest Inventory (NFI) (Total N=752; forest land – 298; grassland – 206; cropland – 244; wetland – 4)

Forest floor combined (from n=5) samples were collected for the determination of mass and carbon content, whereas mineral topsoil combined samples (from 0-10 cm and 10-30 cm surface layers, from n=10) – for bulk density (ISO 11272:1998) and soil organic carbon (SOC) concentrations (ISO 10694:1995) determination. The SOC stocks in 0-30 cm layer were calculated according following equation (Vesterdal et al., 2008):

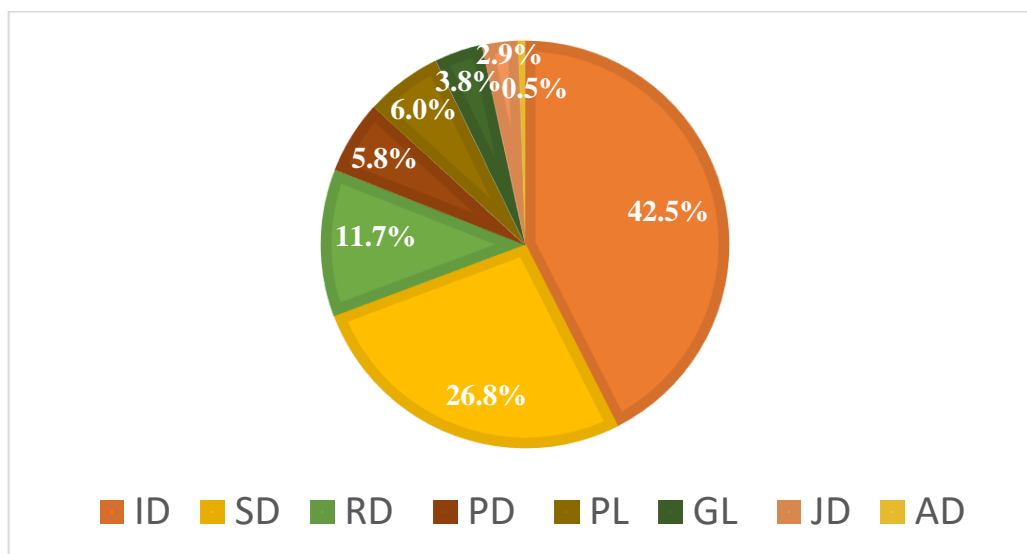
$$SOC_i = p_i \left(1 - \left(\frac{Q_{i,2mm}}{100}\right)\right) d_i C_i * 10^{-1}$$

where p_i is the bulk density of the <2 mm fraction in $g\ cm^{-3}$, $Q_{i,2mm}$ is the relative volume of the fraction $\geq 2\ mm$ (%), d_i denotes the thickness of layer i in cm, C_i denotes the C concentration of layer i ($mg\ g^{-1}$), and 10^{-1} is a unit factor ($10^{-9}\ mg\ Mg^{-1} \times 10^8\ cm^2\ ha^{-1}$)

Microsoft Excel2016 and Statistica12 were used to analyse the collected data. Mean values $\pm SE$ are presented in the report.

Results and Discussion

In total 9 major soil groups were found in sample plots (**Fig. 3**).



ID – *Luvisols/Retisols*; SD – *Arenosols*; RD – *Cambisols*; PD – *Histosols*; PL – *Planosols*;
GL – *Gleysols*; JD – *Podzols*; AD – *Fluvisols*

Fig.3. Distribution of major soil groups (WRB, 2014) in sample plots

Mean mass of forest floor (total mass of forest litter (OL) + fragmented (OF) + humified (OH) litters) of major soil groups is presented in **Table 1**).

Table.1. Mean mass of forest floor (OL+OF+OH) and mean organic carbon (OC) stocks in major soil groups

Major soil groups: LTK-99 (WRB, 2014)	Number of sample plots (n)	Mean mass, t ha ⁻¹	Mean OC stocks (tC ha ⁻¹)
Rudžemiai (<i>Cambisols</i>)	8	4,1±0,6	1,6±0,2
Išplautžemiai ir balkšvažemiai (<i>Luvisols + Retisols</i>)	130	13,6±2,8	5,6±1,2
Palvažemiai (<i>Planosols</i>)	26	22,9±8,7	9,5±3,7
Smėlžemiai (<i>Arenosols</i>)	92	15,7±1,6	6,3±0,7
Jaurėžemiai (<i>Podzols</i>)	21	58,1±15,5	25,0±6,7
Šlynžemiai (<i>Gleysols</i>)	20	14,4±6,7	6,3±3,2
Durpžemiai (<i>Histosols</i>)	37	12,7±2,5	5,3±1,1
Salpžemiai (<i>Fluvisols</i>)	3	2,3±1,0	0,9±0,4

As could be seen from **Fig 4**, from 2.5 time (*Histosols*) to 9 folds (*Arenosols*) mean OC stocks were found for organic layer of grassland as well.

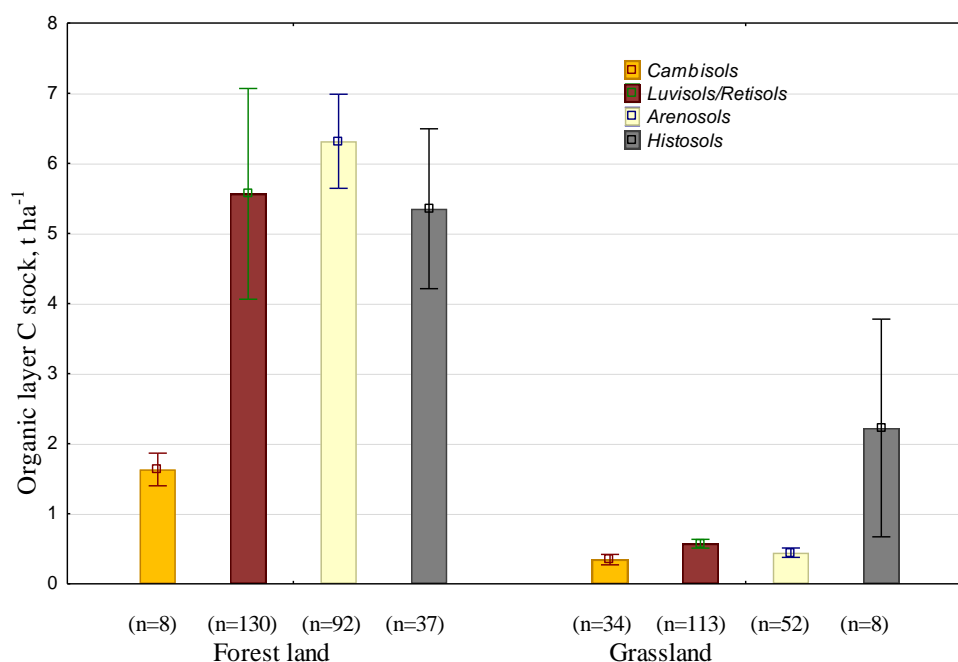


Fig. 4. Mean organic layer stocks of carbon in organic layer of different mineral soils in forest land and grassland (the bars represent SE)

It was found that mean stocks of soil organic carbon (SOC) in surface 0-30 cm layer of some major soil groups (*Cambisols*, *Arenosols*, *Podzols*, *Gleysols*, *Planosols*) are specific in Lithuanian forests (**Table 2**).

Table 2. Mean stocks of soil organic carbon (SOC) in surface 0-30 cm layer of major soil groups in forests

Major soil groups: LTK-99 (WRB, 2014)	Average in Europe, (de Vos et al., 2015)	LULUCF default values* (IPCC, 2006)	Average in Lithuania (2016 m., number of plots, n)
Rudžemiai (<i>Cambisols</i>)	75	95	118 (n=8)
Išplautžemiai/balkšvažemiai (<i>Luvisols+Retisols</i>)	73	95	96 (n=130)
Palvažemiai (<i>Planosols</i>)	45	95 (?)	81 (n=26)
Smėlžemiai (<i>Arenosols</i>)	50	71	58 (n=92)
Jauržemiai (<i>Podzols</i>)	63	115	100 (n=21)
Šlynžemiai (<i>Gleysols</i>)	94	87	106 (n=20)
Durpžemiai (<i>Histosols</i>)	181	-	154 (n=37)
Salpžemiai (<i>Fluvisols</i>)	64	-	80 (n=3)

*Cold temperate, moist region

National values of soil organic carbon (SOC) stocks in surface 0-30 cm layer of major soil groups in forests, grassland and cropland are presented in **Table 3**. The most valuable values were determined for *Luvisols/Retisols* (number of sample plots in different land use – 81-130), *Arenosols* (n= 26-92) and *Cambisols* (n=18-81).

Table 3. National values of soil organic carbon (SOC) stocks in surface 0-30 cm layer of major soil groups in forests, grassland and cropland

Major soil groups: LTKD-99 (WRB, 2014)	Forests		Grassland		Cropland	
	n	DOC, tC ha ⁻¹	n	DOC, tC ha ⁻¹	n	DOC, tC ha ⁻¹
Rudžemiai (<i>Cambisols</i>)	18	118±8 (100%)	34	92±7 (78%)	81	91±4 (69%)
Išplautžemiai/balkšvažemiai (<i>Luvissols+Retissols</i>)	130	96±3 (100%)	113	79±3 (82%)	81	71±4 (74%)
Palvažemiai (<i>Planossols</i>)	26	81±8 (100%)	7	95±13 (117%)	9	61±7 (75%)
Smėlžemiai (<i>Arenossols</i>)	92	58±3 (100%)	52	56±3 (97%)	26	62±4 (107%)
Jaurazemiai (<i>Podzols</i>)	21	100±12 (100%)	1	83 (83%)	-	-
Šlynžemiai (<i>Gleysols</i>)	20	105±8 (100%)	2	106±1 (101%)	1	109 (104%)
Durpžemiai (<i>Histosols</i>)	37	154±11 (100%)	8	200±23 (130%)	2	243±131 (158%)
Salpžemiai (<i>Fluvisols</i>)	3	80±5 (100%)	1	65 (83%)	-	-

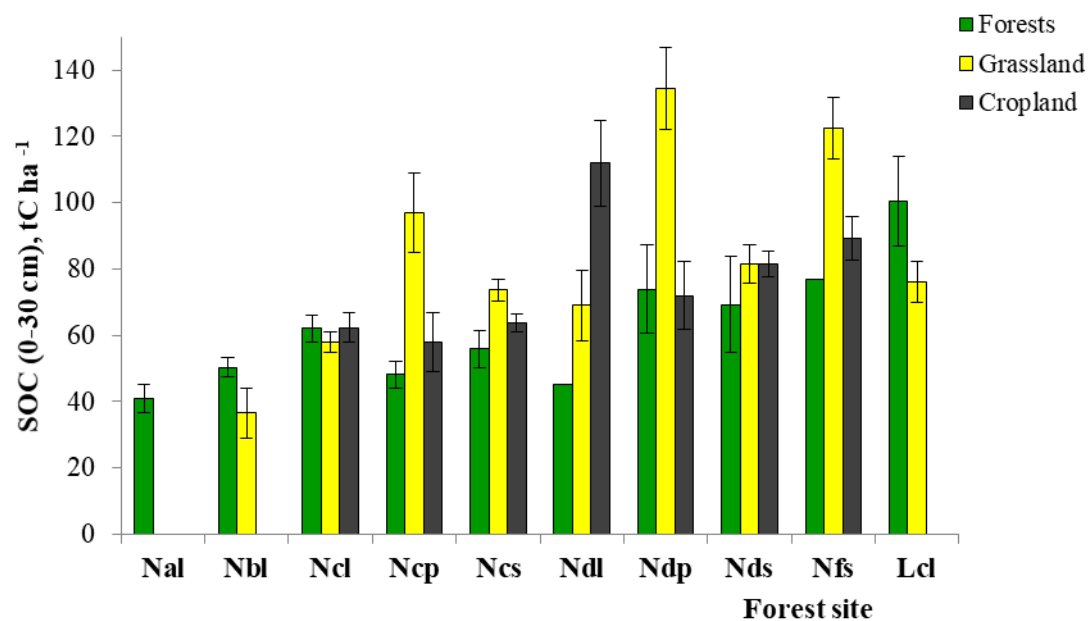


Fig. 5. Mean stocks of soil organic carbon (SOC) in surface 0-30 cm layer of different forest sites (according Lithuanian classification, Vaičys et al., 2006)

Mean stocks of soil organic carbon (SOC) in surface 0-30 cm layer of different forest sites according Lithuanian classification (Vaičys et al., 2006) were presented in **Fig. 5**.

Table 4. Mean stocks of soil organic carbon (SOC) in soil organic layer and surface 0-30 cm mineral layer in forest stands of different age at Luvisol/Retissols

Age, years	N	Mass of organic layer, t ha ⁻¹	SOC in organic layer, tC ha ⁻¹	SOC (0-30 cm), tC ha ⁻¹
1-20	11	2,6±0,5	1,1±0,2	120,7±10,0
21-40	16	4,6±0,8	1,8±0,3	107,6±9,7
41-60	14	3,3±0,6	1,2±0,2	93,2±8,4
61-80	12	4,8±0,6	1,9±0,2	94,9±7,8

In average	53	3,9±0,3	1,5±0,1	103,6±4,7
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It was found that the mean stocks of soil organic carbon (SOC) in soil organic layer and surface 0-30 cm mineral layer did not depend directly on forest stands of different age at *Luvisol/Retisols*.

ANNEX XII. Improvements in response to UN reviews recommendations (draft ARR 2021)

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
Lithuania provided in its NIR (chap. 15, p.558) some updated information on its funding for projects to minimize the adverse social, environmental and economic impacts on developing countries. During the review Lithuania indicated that newest data and follow-up activities initiated in past years are provided in the NIR. However, the ERT considers that the recommendation has not yet been fully addressed because Lithuania has not included a follow-up to activities initiated in the past years. Although some changes since previous submissions have been highlighted, Lithuania has not elaborated on how its national policy-making processes continue to minimize adverse impacts on developing countries.	G.1	It is planned to provide more information on how Lithuania's national policy-making processes continue to minimize adverse impacts on developing countries in the 2023 submission.	

<p>Reallocate the AD on and emissions from waste tyres used in the cement industry to subcategory 1.A.2.f non-metallic minerals in the next annual submission. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet confirmed that tyres were not used in the cement industry prior to 2018. The Party is encouraged to make efforts to explore, with the cement industry, if tyres were used prior to 2018 and, if so, report in NIR Annex III the quantities that may have been used in those years.</p>	<p>E.7</p>	<p>Recommendation to reallocate AD and emissions is fully implemented.</p> <p>All AD and emissions from waste tyres used in the cement industry were reallocated to category 1.A.2.f non-metallic minerals in the 2020 submission. The tyres were used in the cement industry from 2006, all emissions and AD since 2006 are reported in the CRF Reporting tables and can be recognized, as waste tyres is the only Other fossil fuel used in category 1.A.2.f Non-metallic minerals. AD on waste tyres used in the cement industry were taken from cement plant EU ETS reports up to 2017, as Statistic Lithuania includes waste tyres in the fuel balance only from 2018. Annex III (p. 73) of the NIR contains the official fuel balance obtained from Statistics Lithuania, that's why waste tyres data 2006-2017 is not included in this Annex, but only in Annex IV. In 2020 we have contacted Statistics Lithuania informing about waste tyres used as fuel data availability since 2006, however use of industrial waste in the industry sector was included in the official fuel balance only from 2018, due to Statistics Lithuania internal procedures and methodologies.</p>	<p>Chapter 3.4.2 Methodological issues. ANNEX IV. Lithuanian energy consumption in manufacturing industries, table 4-4.</p>
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Continue reporting N2O emissions from diesel oil use in cars and light-duty trucks using default N2O EFs and a tier 1 approach until estimates calculated by the COPERT V model can be fully justified. If using the COPERT V model, investigate and document in the NIR the reasons for the very low N2O emissions calculated by the COPERT V model for cars and light-duty trucks. Aim to improve the input parameters to allow the COPERT V model to provide more accurate and reliable estimates of N2O emissions from these subcategories. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet explained in the NIR either the impact of the changes in these N2O EFs (i.e. departure from the range of IEFs for UNFCCC Parties) or the discrepancies in the trend for 2000–2014, or how the COPERT V model might best be adjusted to address the low N2O EFs for more recent years.	E.8	The impact of the changes of N2O emission factors from diesel oil use in cars and light-duty trucks (i.e., difference from the range of IEFs for UNFCCC Parties) and the reasons for the differences in trend in the 2000 to 2014 period are provided in the NIR.	Chapter 3.5.2.2 Methodological issues, IEF value estimation (CRF 1.A.3.b.i and 1.A.3.b.ii).
The ERT recommends that the Party include in future NIRs the detailed explanation and charts provided to the ERT during the review on the trends in IEFs and the differences in emission levels from previous submissions, to support the change from the tier 1 method to the COPERT V-derived emission factors to increase the transparency of its reporting.	E.12	The detailed explanation and charts are included in the NIR.	Chapter 3.5.2.2 Methodological issues, IEF value estimation; Chapter 3.5.2.3 Uncertainties and time-series consistency (CRF 1.A.3.b).
The ERT recommends that the Party explain in detail in the NIR of its next annual submission how the changes made to the COPERT V model have affected the N2O and CH4 EFs between the 2019 and 2021 annual submissions, and also explain how these changes do not lead to an underestimation of these emissions for the transport category.	E.13	CH4 and N2O emissions were recalculated using Tier 3 method between submission LTU 2019 and LTU 2021 and COPERT V input parameters were improved (sold fuel share by vehicle categories and fluctuations of fleet for every Euro standard were updated due to different data provided before) for 1990-2018. Explanation how the changes made to the COPERT V model have affected the N2O and CH4 EFs between the 2019 and 2021 annual submissions is included in the NIR.	Chapter 3.5.2.2 Methodological issues, IEF value estimation (CRF 1.A.3.b)

<p>Correct the uncertainty estimate of the CO2 EFs, correct the related calculations and present the estimation method and uncertainty values used in the NIR of the next annual submission.</p> <p>The ERT considers that the recommendation has not yet been fully addressed because the Party did not report in the NIR the correct uncertainty values used.</p>	I.1	Uncertainty estimate of the CO2 EFs was corrected.	Chapter 4.2.2.3 Uncertainties and time-series consistency
<p>Report all CO2 emissions from fuel consumption (used as feedstock and fuel) under category 2.B.1 ammonia production in accordance with the 2006 IPCC Guidelines.</p> <p>The ERT considers that the recommendation has not yet been addressed because the Party did not report all CO2 emissions from fuel consumption (used as feedstock and fuel) under category 2.B.1 ammonia production in accordance with the 2006 IPCC Guidelines.</p>	I.7	This recommendation will be addressed in 2023 submission.	
<p>The ERT recommends that the Party report national totals with and without indirect CO2 emissions, in line with paragraph 29 of the UNFCCC Annex 1 inventory reporting guidelines. To enable the reporting of national totals with and without indirect emissions, the ERT recommends that the Party report indirect CO2 emissions separately from direct CO2 emissions (i.e. in CRF table 6, and in sectoral CRF tables as such).</p>	I.16	<p>Not implemented. Lithuania does not agree with this recommendation provided in the draft ARR.</p> <p>Countries that reported indirect CO2 emissions in inventory submissions before 2015 (CP 1) in previous CRF table 3 (Sectoral report for solvents and other products use) should continue reporting these emissions. For this reason, it was recommended and agreed to report these indirect CO2 emissions in CRF table 2(l) under “2D Non-energy products from fuels and solvent use” which includes a predefined drop down list in the CRF reporter under 2D3 Other for “solvent use” and for “asphalt roofing” and “road paving with asphalt”. The rationale was then to ensure the highest consistency with 2006 IPCC Guidelines and with the previous inventory submissions.</p>	

The ERT recommends that the Party include detailed information in the NIR regarding HFC emissions from subcategory 2.F.1.b domestic refrigeration on the calculations performed to obtain the volume of gases in operation, describing the differences by time span and including equations for the calculations performed.	I.17	The information is updated based on the report of "Analysis and verification of the inventory of fluorinated greenhouse gases" (2021 study) results.	Chapter 4.7.1.2 Methodological issues Domestic Refrigeration (CRF 2.F.1.b)
The ERT recommends that the Party obtain data on the volume of gases incorporated into the bank of gases in operation (new products being installed (production plus imports minus exports)) and, in calculating the bank of gases in operation, consider all inputs and outputs of gases, such as annual leakages and gases contained in products at end of life. The ERT also recommends the Party recalculate the emissions across the time series considering the new information, when available, and report accordingly in the relevant CRF tables and the NIR. The ERT further recommends that the Party provide in the NIR the mathematical equation used to calculate the bank of gases in operation and the methodology used to calculate the emissions across the time series to further enhance the transparency of the reporting.	I.18	So far Lithuania calculates the bank of gases in operation on the basis of data on the volume of gases refilled, taken from the EPA database. According to the recently completed study on F-gases use in Lithuania, currently available data collected from companies on F-gases in equipment is not sufficient and suitable to use for GHG estimates. Emissions estimation method will be updated when new complete and reliable information on the quantity of F-gases contained in the equipment will be available. Mathematical equation used to calculate the bank of gases in operation is provided in the NIR.	Chapter 4.7.1.2 Methodological issues Commercial Refrigeration (CRF 2.F.1.a) and Industrial Refrigeration (CRF 2.F.1.c)
The ERT recommends that the Party review the EF for HFC-134a used for freight wagons in light of the new study on F-gases was carried out in 2021. The ERT also recommends that the Party document in the NIR the sources for this EF, describing its nature and coverage, ensuring that no underestimation of emissions occur.	I.19	EF was revised and information provided in the NIR.	Chapter 4.7.1.2 Methodological issues Transport Refrigeration (CRF 2.F.1.d)
The ERT recommends that the Party enhance the description in the NIR regarding the estimation of HFC-227ea emissions for category 2.F.3 fire protection equipment by including information on the method and approaches followed, the data used, and how the different intermediate variables and assumptions were considered in the estimation.	I.20	The explanation is provided in the NIR.	Chapter 4.7.3.2 Methodological issues (CRF 2.F.3)

<p>The ERT recommends that the Party update the uncertainty values used for SF6 emissions from category 2.G.1 electrical equipment, considering specifically the uncertainty values of the measurements made by operating plants that underpin the emissions reported for this category and report the results in the NIR. It also recommends that the Party provide a qualitative discussion in the NIR on the reasons for the uncertainty of the category.</p>	I.21	<p>Emission uncertainty was based on expert judgement provided in the study “Analysis of the use of fluorinated greenhouse gases in Lithuania in 1990-2011” (2012). The same values are identified in the report of “Analysis and verification of the inventory of fluorinated greenhouse gases” (2021 study).</p>	<p>Chapter 4.8.1.3 Uncertainties and time-series consistency</p>
<p>Include a description of the improvements of the estimates of CH4 emissions from enteric fermentation, firstly on the refining of the number of suckling cows that affects the GE estimate, and secondly in the calculation of the annual average fur-bearing population.</p> <p>The ERT considers that the recommendation has not yet been fully addressed because although the Party provided clear information on improvements made to the estimates during the review, it did not include a sufficient explanation in the NIR for how it refined the number of suckling cows (for which years or why only for 1997–1999, etc.) and how this affected GE estimates. Likewise, the information provided in the NIR still does not clearly demonstrate how the annual average fur-bearing population was calculated</p>	A.2	<p>The information on suckling cows population and its GE changes, also parameters on calculation of fur-bearing animals annual average population are provided in the NIR.</p>	<p>Regarding to suckling cows – NIR Chapter 5.2 Enteric fermentation 5.2.2. Methodological issues Regarding to fur-bearing animals – NIR Chapter 5.2 Enteric fermentation 5.2.2. Methodological issues; NIR Annex VIII, Table A. 5-41</p>
<p>Conduct a study to develop country-specific data on feed digestibility, and when available, apply these data for estimating CH4 and N2O emissions, and update the information reported on the manure management category in the NIR.</p> <p>The NIR does not include information on whether a study to develop country-specific data on feed digestibility has been conducted. The Party reported the same manure management system category as in NIR 2019.</p>	A.7	<p>The information on the feed digestibility study is provided in the NIR.</p>	<p>NIR Chapter 5.3.6. Category-specific planned improvements</p>

<p>Include data on the amount of N in bedding per animal species in the NIR, with an appropriate reference to the 2006 IPCC Guidelines.</p> <p>The ERT considers that the recommendation has not been addressed because the Party has not yet included in the NIR transparent information on amount of N in bedding material per animal species.</p>	A.12	The table with amount of N in bedding per animal species are provided in the NIR.	NIR Chapter 5.1 Overview of sector (Nitrogen in bedding per animal species)
<p>Report in the NIR that N₂O emissions from subcategory 3.D.a.5 have not occurred since 2015, and provide documented explanations as to why emissions ceased in 2015.</p> <p>The ERT considers that the recommendation has not yet been fully addressed because the Party has not provided sufficient explanation on why N₂O emissions from mineralization/immobilization associated with loss/gain of soil organic matter is reported as NO for the 2002-2019 period.</p>	A.14	The explanation is provided in the NIR.	NIR Chapter 5.2.1.2.1 Methodological issues (Mineralization/Immobilization associated with the loss/gain of soil organic matter)
<p>During the review, the Party clarified that the minor differences in direct N₂O emissions for 2000, 2015 and 2016, as reported in NIR tables 5-30 and 5-37, were attributable to the rounding of the figures concerned.</p> <p>The ERT encourages the Party to ensure that the figures reported in the NIR for N₂O emissions from manure management are accurate and consistent in the next annual submission.</p>	A.2 (A.15?)	No recalculations (Table 5-37) for the direct N ₂ O emissions were made in the 2022 NIR submission. However, in the future Lithuania will check if numbers in the tables 5-30 and 5-37 are accurate and consistent.	
<p>The ERT recommends that the Party provide clear and sufficient information in its next submission on changes of MMS and transparently report its justification for any recalculations, including discussion of the impact of the recalculations on the trends in emissions at the category, sector and national level.</p>	A.3 (A.16?)	The explanation on cattle MMS changes is provided in the NIR.	NIR Chapter 5.1 Sector overview (Livestock housing and grazing period)

<p>Conduct an analysis of significance at the pool level to determine whether the DOM pool is significant under category 4.A.1 forest land remaining forest land and, if so, adopt a higher tier to estimate the litter (and DOM) CSCs.</p> <p>The ERT considers that the recommendation has not been addressed as the planned improvement of DOM CSCs estimates through scientific studies has not yet been implemented.</p>	L.12	Not yet conducted. It is planned to implement this recommendation for the 2023 submission.	
<p>Report the CSC in litter from the conversion of grassland to cropland (perennial crops) and, if applying a value different from 0.4 t C/ha, explain in the NIR the reason for using a different value.</p> <p>During the review, Lithuania noted that litter carbon stock was not estimated for cropland, and that it is considering conducting a literature analysis and/or obtaining expert judgment with a view to developing a national carbon stock value for litter occurring on cropland</p>	L.19	It is planned to implement this recommendation for the 2023 submission. We do not calculate carbon stock changes for grassland converted to perennial cropland, only for grassland converted to arable cropland.	
<p>Provide a justification for simplifying equation 11.1 from the 2006 IPCC Guidelines (vol. 4, chap. 11, section 11.2.1.1, p.11.7) and excluding certain N sources included in equation 11.1 and specify those reported under the agriculture sector or those that do not occur. Provide the corresponding information in the NIR and CRF table 4(I).</p> <p>Lithuania provided the required justification in the NIR (p.382) for land converted to cropland, grassland, flooded land, settlements and other land but did not include this information in CRF table 4(I).</p>	L.24	Relevant information was included also in CRF table 4(I).	CRF table 4(I)

<p>Provide in the NIR the justification for simplifying equation 11.1 from the 2006 IPCC Guidelines (vol. 4, chap. 11, section 11.2.1.1, p.11.7), which excludes synthetic N fertilizers; managed animal manure, compost, sewage sludge and other organic N additions applied to soils; urine and dung N deposited by grazing animals; and N in crop residues (above- and belowground), including N-fixing crops and N from forage/pasture renewal, returned to soils annually from the calculation of indirect N₂O emissions from leaching/run-off from managed soils, and include a related explanation in the documentation box of CRF table 4(IV).</p> <p>The ERT commends Lithuania for providing this explanation in the NIR but requests that it also include the same information in CRF table 4(IV), as recommended by the previous ERT.</p>	L.25	Relevant information was included also in CRF table 4(IV).	CRF table 4(IV)
<p>Correct the inconsistencies between the data in the NIR and CRF table 4.G (sheet 2), and provide updated production, export and import data in the next annual submission, as well as additional information on the factors used to convert product units to carbon units in CRF table 4.G (sheet 2).</p> <p>During the review, Lithuania acknowledged the inconsistencies and indicated that it intends to include the data on imported HWP for sawnwood, wood panels and paper, and paper and paper board in table 6-44 of the NIR of its next annual submission.</p>	L.26	Data about imported HWP products for sawnwood, wood-based panels and paper and paper boards was included in NIR table 6-44.	NIR Chapter 6.8.1 Table 6-44. Activity data used for estimations
<p>The ERT recommends that the Party provide an accurate reporting of GSV for overall total, total deciduous, other species unaccounted, and total coniferous to ensure that GSV is accurately and fully reported.</p>	L.27	Growing stock volume of other deciduous species included in table 6-14.	NIR Chapter 1.2.2.1 Table 6-14 Total growing stock volume (NFI, 2020) and average basic wood density values
<p>The ERT recommends that Lithuania correct the inconsistencies in the land transition matrix in its next annual submission.</p>	KL.4	Land use matrix presented as NIR table 11-7 shows area sizes that sum up as total land area of the country.	NIR Chapter 11.2.2 Table 11-7 Land transition matrix for 2020, thous. ha

The ERT recommends that Lithuania, in its next NIR, report the accounted quantity (the difference in net emissions between reporting of FM during the second commitment period and the FMRL), the main factors generating the accounted quantity for FM and state whether the accounted quantity is consistent with those factors and the guidance given in the 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (p.2.97).	KL.5	Accounted quantity and its factors are described in the NIR.	Added NIR Chapter 11.5.3.5. Comparison of historical data between Forest Management under KP and Forest Management Reference Level (FMRL)
The ERT recommends that, in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, Lithuania include in the next annual submission, the explanation provided during the review regarding the insignificance of the CO2 emissions or removals in the deadwood pool under afforestation activities and clarify the use of the notation key “NE” in the documentation box of the relevant CRF table and the NIR.	KL.6	Explanation for using notation key “NO” for dead wood pool in afforestation/reforestation activities was included in NIR.	NIR Chapters 11.3.1.1 Description of the methodologies and the underlying assumptions used and 2.3.1.2 Justification when omitting any carbon pool or GHG emissions/removals from activities under Article 3.3 and elected activities under Article 3.4
The ERT recommends that Lithuania include in the NIR the explanation provided during the review regarding that under the Lithuanian forestry law, where afforestation follows deforestation, the afforested area has to be at least three times larger than the deforested area in protected ecosystems and recreational forests (functional group II) and at least two times larger in protected forests (functional group III), or an appropriate level of government compensation must be provided for those deforested lands.	KL.7	Afforestation after deforestation is described more accurately in NIR.	NIR Chapter 11.1.3 Description on how the definitions of each activity under Article 3.3 and each elected activity under Article 3.4 have been implemented and applied consistently over time
The ERT recommends that Lithuania ensure all areas deforested under the Kyoto Protocol are correctly accounted and correct the inconsistencies between the areas reported as forest land converted to other land-use categories in the CRF tables and that reported as deforested under the Kyoto Protocol in its next annual submission.	KL.8	Inconsistencies were corrected.	NIR Chapter 11.2.2 Methodology used to develop the land transition matrix Table 11-8

The ERT recommends that Lithuania include in the NIR the detailed explanation provided during the review regarding the adjustment of rotation lengths of FM regimes incorporated into the FMRL correction calculations and any other detailed information required for subsequent FMRL corrections.	KL.9	Explanation about updated rotation lengths not affecting FM policy was added in NIR.	NIR Chapter 11.5.3.4 Technical Corrections of FMRL
The ERT recommends that Lithuania provide detailed information in chapter 11 of the NIR on the consistency between the FMRL and FM reporting during the second commitment period of the Kyoto Protocol in accordance with paragraph 5(e) of annex II to decision 2/CMP.8.	KL.10	GHG removals from FM activities under KP-LULUCF were compared to model outputs for FMRL and FMRLcorr itself.	Added NIR Chapter 11.5.3.5. Comparison of historical data between Forest Management under KP and Forest Management Reference Level (FMRL)