LITHUANIA'S NATIONAL INVENTORY REPORT 2019

GREENHOUSE GAS EMISSIONS 1990-2017

ANNEXES

VILNIUS, 2019

Contents

ANNEX I. Approach 1 and Approach 2 key categories analysis

Approach 1 Level Assessment for 1990

IPCC Category	Greenhouse gas	GHG emissions, kt CO_2 eq.	Level assessment	Cumulative total
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO_2	-6,892.07	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	0.09	0.30
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	0.52
1.A.4 Other sectors-Solid fuels	CO_2	2,760.55	0.04	0.56
1.A.4 Other sectors-Liquid fuels	CO_2	2,736.38	0.04	0.61
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO_2	2,045.42	0.03	0.64
2.A.1 Cement Production	CO_2	1,668.07	0.03	0.67
1.A.1.b Petroleum refining - Liquid Fuels	CO_2	1,509.64	0.02	0.69
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO_2	1,475.59	0.02	0.72
1.A.4 Other sectors-Gaseous fuels	CO_2	1,379.27	0.02	0.74
2.B.1 Ammonia Production	CO_2	1,253.68	0.02	0.76
5.A Solid Waste Disposal	CH_4	1,028.83	0.02	0.78
3.D.1.1 Direct N_2O Emissions From Managed Soils - Inorganic N Fertilizers	N_2O	992.77	0.02	0.79
2.B.2 Nitric Acid Production	N_2O	893.01	0.01	0.81
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	CO_2	853.90	0.01	0.82
4.A.2 Land converted to forest land - carbon stock change in biomass	CO_2	-600.66	0.01	0.83
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	N_2O	566.38	0.01	0.84
4.B.2 Land converted to cropland- carbon stock change in biomass	CO_2	524.11	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	471.00	0.01	0.87
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	N_2O	432.63	0.01	0.88

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eq.*	*Level assessment*	*Cumulative total*
3.D.1.3 Direct N_2O Emissions From Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***419.85***	***0.01***	***0.89***
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	***CO_2***	***-413.03***	***0.01***	***0.89***
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	***CO_2***	***404.46***	***0.01***	***0.90***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***397.01***	***0.01***	***0.91***
4.C.2 Land converted to grassland - carbon stock change in biomass	***CO_2***	***-374.09***	***0.01***	***0.91***
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	***N_2O***	***361.31***	***0.01***	***0.92***
1.A.3.c Railways	***CO_2***	***349.97***	***0.01***	***0.92***
3.D.1.2 Direct N_2O Emissions From Managed Soils - Organic N Fertilizers	***N_2O***	***345.29***	***0.01***	***0.93***
3.B.1.3 Manure Management - Swine	***CH_4***	***329.25***	***0.01***	***0.94***
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	***CH_4***	***260.55***	***0.00***	***0.94***
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***	***0.95***
2.A.4 Other process use of carbonates	***CO_2***	***239.66***	***0.00***	***0.95***
2.A.2 Lime Production	CO_2	222.68	0.00	0.96
3.B.2 Manure Management - Cattle	N_2O	205.85	0.00	0.96
3.D.2.1 Indirect N_2O Emissions From Managed Soils - Atmospheric deposition	N_2O	175.31	0.00	0.96
1.A.1 Energy industries-Solid fuels	CO_2	174.05	0.00	0.96
1.A.2 Manufacturing industries and construction-Solid fuels	CO_2	171.63	0.00	0.97
1.A.4 Other sectors-Liquid fuels	N_2O	159.35	0.00	0.97
4.A.2 Land converted to forest land - net carbon stock change in mineral soils	CO_2	-151.67	0.00	0.97
3.A. Enteric Fermentation - Others	CH_4	144.77	0.00	0.97
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Total		***43,130.45***		

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

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eq.*	*Level assessment*	*Cumulative total*
1.A.1.a Public electricity and heat production - Liquid Fuels	***CO_2***	***6,021.25***	***0.12***	***0.12***
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***	***0.35***
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***	***0.63***
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***	***0.71***
1.A.1.b Petroleum refining - Liquid Fuels	***CO_2***	***1,509.64***	***0.03***	***0.74***
1.A.4 Other sectors-Gaseous fuels	***CO_2***	***1,379.27***	***0.03***	***0.77***
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_2O Emissions From Managed Soils - Inorganic N Fertilizers	***N_2O***	***992.77***	***0.02***	***0.84***
2.B.2 Nitric Acid Production	***N_2O***	***893.01***	***0.02***	***0.86***
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	***N_2O***	***566.38***	***0.01***	***0.87***
5.D Wastewater Treatment and Discharge	***CH_4***	***471.00***	***0.01***	***0.88***
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	***N_2O***	***432.63***	***0.01***	***0.89***
3.D.1.3 Direct N_2O Emissions From Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***419.85***	***0.01***	***0.90***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***397.01***	***0.01***	***0.91***
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	***N_2O***	***361.31***	***0.01***	***0.91***
1.A.3.c Railways	***CO_2***	***349.97***	***0.01***	***0.92***
3.D.1.2 Direct N_2O Emissions From Managed Soils - Organic N Fertilizers	***N_2O***	***345.29***	***0.01***	***0.93***
3.B.1.3 Manure Management - Swine	***CH_4***	***329.25***	***0.01***	***0.93***
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	***CH_4***	***260.55***	***0.01***	***0.94***
3.B.1.1 Manure Management - Cattle	***CH_4***	***251.55***	***0.01***	***0.94***
2.A.4 Other process use of carbonates	***CO_2***	***239.66***	***0.00***	***0.95***
2.A.2 Lime Production	***CO_2***	***222.68***	***0.00***	***0.95***
3.B.2 Manure Management - Cattle	N_2O	205.85	0.00	0.96
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Total		***48,210.15***		

Approach 1 Level Assessment for 2017

IPCC Category	Greenhouse gas	GHG emissions, kt CO_2 eq.	Level assessment	Cumulative total
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO_2	-7,123.24	0.20	0.20
1.A.3.b Road transportation	CO_2	5,444.78	0.15	0.35
2.B.1 Ammonia Production	CO_2	2,137.46	0.06	0.41
3.A.1 Enteric Fermentation - Cattle	CH_4	1,460.84	0.04	0.45
1.A.1.b Petroleum refining - Liquid Fuels	CO_2	1,376.82	0.04	0.49
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO_2	1,167.01	0.03	0.52
4.G Harvested wood products	CO_2	-1,044.78	0.03	0.55
4.B.2 Land converted to cropland- carbon stock change in biomass	CO_2	945.27	0.03	0.58
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO_2	785.65	0.02	0.60
3.D.1.1 Direct N_2O Emissions From Managed Soils - Inorganic N Fertilizers	N_2O	782.74	0.02	0.62
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	CO_2	-782.71	0.02	0.65
5.A Solid Waste Disposal	CH_4	771.84	0.02	0.67
4.A.2 Land converted to forest land - carbon stock change in biomass	CO_2	-748.85	0.02	0.69
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO_2	747.40	0.02	0.71
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO_2	678.68	0.02	0.73
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	667.91	0.02	0.75
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	CO_2	624.97	0.02	0.76
1.A.4 Other sectors-Gaseous fuels	CO_2	568.59	0.02	0.78
4.E.2 Land converted to settlements	CO_2	548.58	0.02	0.79
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	N_2O	519.83	0.01	0.81
2.A.1 Cement Production	CO_2	450.35	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	434.98	0.01	0.83
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	N_2O	368.53	0.01	0.84
1.A.2 Manufacturing industries and construction-Solid fuels	CO_2	343.99	0.01	0.85
1.A.4 Other sectors-Liquid fuels	CO_2	317.53	0.01	0.86
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	N_2O	312.87	0.01	0.87
1.A.4 Other sectors-Solid fuels	CO_2	306.52	0.01	0.88
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH_4	296.66	0.01	0.89

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eq.*	*Level assessment*	*Cumulative total*
4.D.2 Land converted to wetlands	***CO_2***	***271.49***	***0.01***	***0.90***
2.B.2 Nitric Acid Production	***N_2O***	***227.63***	***0.01***	***0.90***
4.A.2 Land converted to forest land - net carbon stock change in mineral soils	***CO_2***	***-221.02***	***0.01***	***0.91***
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	***CO_2***	***-192.79***	***0.01***	***0.91***
3.D.1.3 Direct N_2O Emissions From Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***173.19***	***0.00***	***0.92***
1.A.3.c Railways	***CO_2***	***165.06***	***0.00***	***0.92***
1.A.1 Energy industries-Other fossil fuels	***CO_2***	***162.10***	***0.00***	***0.93***
3.D.1.2 Direct N_2O Emissions From Managed Soils - Organic N Fertilizers	***N_2O***	***148.70***	***0.00***	***0.93***
5.D Wastewater Treatment and Discharge	***CH_4***	***140.00***	***0.00***	***0.94***
1.A.4 Other sectors-Biomass	***CH_4***	***139.81***	***0.00***	***0.94***
3.B.1.1 Manure Management - Cattle	***CH_4***	***137.33***	***0.00***	***0.94***
1.A.2 Manufacturing industries and construction-Liquid fuels	***CO_2***	***123.35***	***0.00***	***0.95***
4.C.2 Land converted to grassland - carbon stock change in biomass	***CO_2***	***-121.39***	***0.00***	***0.95***
3.D.2.1 Indirect N_2O Emissions From Managed Soils - Atmospheric deposition	***N_2O***	***101.61***	***0.00***	***0.95***
1.A.4 Other sectors-Peat	CO_2	99.75	0.00	0.96
3.B.2 Manure Management - Indirect N_2O Emissions	N_2O	91.28	0.00	0.96
1.A.1.a Public electricity and heat production - Liquid Fuels	CO_2	86.50	0.00	0.96
3.A. Enteric Fermentation - Others	CH_4	80.73	0.00	0.96
3.B.2 Manure Management - Cattle	N_2O	75.54	0.00	0.97
3.B.1.3 Manure Management - Swine	CH_4	62.34	0.00	0.97
1.A.3.e Other transportation	CO_2	60.29	0.00	0.97
5.B Biological Treatment of Solid Waste	CH_4	59.22	0.00	0.97
4.C Grassland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO_2	58.62	0.00	0.97
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Total		***15,062.97***		

Approach 1 Level Assessment for 2017 using a subset (LULUCF was excluded from analysis)

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eq.*	*Level assessment*	*Cumulative total*
1.A.3.b Road transportation	*CO_2*	*5,444.78*	*0.27*	*0.27*
2.B.1 Ammonia Production	*CO_2*	*2,137.46*	*0.10*	*0.37*
3.A.1 Enteric Fermentation - Cattle	*CH_4*	*1,460.84*	*0.07*	*0.44*
1.A.1.b Petroleum refining - Liquid Fuels	*CO_2*	*1,376.82*	*0.07*	*0.51*
1.A.1.a Public electricity and heat production - Gaseous Fuels	*CO_2*	*785.65*	*0.04*	*0.55*
3.D.1.1 Direct N_2O Emissions From Managed Soils - Inorganic N Fertilizers	*N_2O*	*782.74*	*0.04*	*0.59*
5.A Solid Waste Disposal	*CH_4*	*771.84*	*0.04*	*0.63*
1.A.2 Manufacturing industries and construction-Gaseous fuels	*CO_2*	*678.68*	*0.03*	*0.66*
2.F.1 Refrigeration and Air Conditioning Equipment	*HFCs*	*667.91*	*0.03*	*0.69*
1.A.4 Other sectors-Gaseous fuels	*CO_2*	*568.59*	*0.03*	*0.72*
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	*N_2O*	*519.83*	*0.03*	*0.75*
2.A.1 Cement Production	*CO_2*	*450.35*	*0.02*	*0.77*
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	*N_2O*	*368.53*	*0.02*	*0.79*
1.A.2 Manufacturing industries and construction-Solid fuels	*CO_2*	*343.99*	*0.02*	*0.80*
1.A.4 Other sectors-Liquid fuels	*CO_2*	*317.53*	*0.02*	*0.82*
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	*N_2O*	*312.87*	*0.02*	*0.83*
1.A.4 Other sectors-Solid fuels	*CO_2*	*306.52*	*0.02*	*0.85*
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	*CH_4*	*296.66*	*0.01*	*0.86*
2.B.2 Nitric Acid Production	*N_2O*	*227.63*	*0.01*	*0.87*
3.D.1.3 Direct N_2O Emissions From Managed Soils - Urine and dung deposited by grazing animals	*N_2O*	*173.19*	*0.01*	*0.88*
1.A.3.c Railways	*CO_2*	*165.06*	*0.01*	*0.89*
1.A.1 Energy industries-Other fossil fuels	*CO_2*	*162.10*	*0.01*	*0.90*
3.D.1.2 Direct N_2O Emissions From Managed Soils - Organic N Fertilizers	*N_2O*	*148.70*	*0.01*	*0.91*
5.D Wastewater Treatment and Discharge	*CH_4*	*140.00*	*0.01*	*0.91*
1.A.4 Other sectors-Biomass	*CH_4*	*139.81*	*0.01*	*0.92*
3.B.1.1 Manure Management - Cattle	*CH_4*	*137.33*	*0.01*	*0.93*
1.A.2 Manufacturing industries and construction-Liquid fuels	*CO_2*	*123.35*	*0.01*	*0.93*
3.D.2.1 Indirect N_2O Emissions From Managed Soils - Atmospheric deposition	*N_2O*	*101.61*	*0.00*	*0.94*
1.A.4 Other sectors-Peat	*CO_2*	*99.75*	*0.00*	*0.94*
3.B.2 Manure Management - Indirect N_2O Emissions	*N_2O*	*91.28*	*0.00*	*0.95*

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eq.*	*Level assessment*	*Cumulative total*
1.A.1.a Public electricity and heat production - Liquid Fuels	***CO_2***	***86.50***	***0.00***	***0.95***
3.A. Enteric Fermentation - Others	***CH_4***	***80.73***	***0.00***	***0.95***
3.B.2 Manure Management - Cattle	N_2O	75.54	0.00	0.96
3.B.1.3 Manure Management - Swine	CH_4	62.34	0.00	0.96
1.A.3.e Other transportation	CO_2	60.29	0.00	0.96
5.B Biological Treatment of Solid Waste	CH_4	59.22	0.00	0.97
2. D Non-energy products from fuels and solvent use	CO_2	53.80	0.00	0.97
5.D Wastewater Treatment and Discharge	N_2O	43.67	0.00	0.97
1.A.1.c Manufacture of solid fuels and other energy industries - Gaseous fuels	CO_2	39.45	0.00	0.97
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Total		***20,387.93***		

Approach 1 Trend Assessment for 2017

IPCC Category	*Greenhouse gas*	*1990 kt CO_2 eq.*	*2017 kt CO_2 eq.*	*Trend assessment*	*% Contribution to Trend*	*Cumulative total*
1.A.1.a Public electricity and heat production - Liquid Fuels	*CO_2*	*6,021.25*	*86.50*	*0.05*	*0.11*	*0.11*
4.A.1 Forest land remaining forest land - carbon stock change in biomass	*CO_2*	*-6,892.07*	*-7,123.24*	*0.05*	*0.10*	*0.22*
1.A.3.b Road transportation	*CO_2*	*5,247.15*	*5,444.78*	*0.04*	*0.09*	*0.31*
1.A.1.a Public electricity and heat production - Gaseous Fuels	*CO_2*	*5,796.59*	*785.65*	*0.04*	*0.08*	*0.39*
1.A.2 Manufacturing industries and construction-Liquid fuels	*CO_2*	*3,873.72*	*123.35*	*0.03*	*0.07*	*0.46*
2.B.1 Ammonia Production	*CO_2*	*1,253.68*	*2,137.46*	*0.02*	*0.05*	*0.51*
1.A.4 Other sectors-Solid fuels	*CO_2*	*2,760.55*	*306.52*	*0.02*	*0.04*	*0.56*
1.A.4 Other sectors-Liquid fuels	*CO_2*	*2,736.38*	*317.53*	*0.02*	*0.04*	*0.60*
3.A.1 Enteric Fermentation - Cattle	*CH_4*	*4,146.14*	*1,460.84*	*0.01*	*0.03*	*0.62*
4.G Harvested wood products	*CO_2*	*-252.55*	*-1,044.78*	*0.01*	*0.02*	*0.65*
2.F.1 Refrigeration and Air Conditioning Equipment	*HFCs*	*0.00*	*667.91*	*0.01*	*0.02*	*0.67*
4.B.2 Land converted to cropland- carbon stock change in biomass	*CO_2*	*524.11*	*945.27*	*0.01*	*0.02*	*0.70*
1.A.1.b Petroleum refining - Liquid Fuels	*CO_2*	*1,509.64*	*1,376.82*	*0.01*	*0.02*	*0.72*
4.E.2 Land converted to settlements	*CO_2*	*15.31*	*548.58*	*0.01*	*0.02*	*0.73*
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	*CO_2*	*-474.03*	*-192.79*	*0.01*	*0.02*	*0.75*
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	*CO_2*	*517.32*	*747.40*	*0.01*	*0.02*	*0.77*
2.A.1 Cement Production	*CO_2*	*1,668.07*	*450.35*	*0.01*	*0.02*	*0.78*
1.A.2 Manufacturing industries and construction-Gaseous fuels	*CO_2*	*2,045.42*	*678.68*	*0.01*	*0.02*	*0.80*
4.C.2 Land converted to grassland - carbon stock change in biomass	*CO_2*	*-374.09*	*-121.39*	*0.01*	*0.01*	*0.81*
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	*CO_2*	*1,475.59*	*1,167.01*	*0.01*	*0.01*	*0.83*
2.B.2 Nitric Acid Production	*N_2O*	*893.01*	*227.63*	*0.00*	*0.01*	*0.84*
1.A.2 Manufacturing industries and construction-Solid fuels	*CO_2*	*171.63*	*343.99*	*0.00*	*0.01*	*0.85*
3.D.1.1 Direct N_2O Emissions From Managed Soils - Inorganic N Fertilizers	*N_2O*	*992.77*	*782.74*	*0.00*	*0.01*	*0.85*
4.D.2 Land converted to wetlands	*CO_2*	*56.16*	*271.49*	*0.00*	*0.01*	*0.86*
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	*CO_2*	*404.46*	*434.98*	*0.00*	*0.01*	*0.87*

IPCC Category	Greenhouse gas	1990 kt CO_2 eq.	2017 kt CO_2 eq.	Trend assessment	% Contribution to Trend	Cumulative total
5.A Solid Waste Disposal	***CH_4***	***1,028.83***	***771.84***	***0.00***	***0.01***	***0.88***
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	***N_2O***	***566.38***	***519.83***	***0.00***	***0.01***	***0.89***
1.A.4 Other sectors-Gaseous fuels	***CO_2***	***1,379.27***	***568.59***	***0.00***	***0.01***	***0.89***
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	***CO_2***	***-413.03***	***-782.71***	***0.00***	***0.01***	***0.90***
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	***N_2O***	***361.31***	***368.53***	***0.00***	***0.01***	***0.90***
1.A.1. Energy industries-Other fossil fuels	***CO_2***	***0.00***	***162.10***	***0.00***	***0.01***	***0.91***
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	***CO_2***	***853.90***	***624.97***	***0.00***	***0.01***	***0.92***
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	***CH_4***	***260.55***	***296.66***	***0.00***	***0.01***	***0.92***
4.A.2 Land converted to forest land - carbon stock change in biomass	***CO_2***	***-600.66***	***-748.85***	***0.00***	***0.00***	***0.93***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***397.01***	***91.28***	***0.00***	***0.00***	***0.93***
3.B.1.3 Manure Management - Swine	***CH_4***	***329.25***	***62.34***	***0.00***	***0.00***	***0.93***
5.D Wastewater Treatment and Discharge	***CH_4***	***471.00***	***140.00***	***0.00***	***0.00***	***0.94***
2.A.4 Other process use of carbonates	***CO_2***	***239.66***	***16.38***	***0.00***	***0.00***	***0.94***
1.A.4 Other sectors-Biomass	***CH_4***	***70.28***	***139.81***	***0.00***	***0.00***	***0.95***
2.A.2 Lime Production	***CO_2***	***222.68***	***20.81***	***0.00***	***0.00***	***0.95***
1.A.1. Energy industries-Solid fuels	***CO_2***	***174.05***	***6.56***	***0.00***	***0.00***	***0.95***
1.A.4 Other sectors-Peat	CO_2	27.13	99.75	0.00	0.00	0.96
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	N_2O	432.63	312.87	0.00	0.00	0.96
1.A.4 Other sectors-Liquid fuels	N_2O	159.35	13.75	0.00	0.00	0.96
4.B.1 Cropland remaining cropland - carbon stock change in biomass	CO_2	77.39	-28.06	0.00	0.00	0.96
5.B Biological Treatment of Solid Waste	CH_4	0.20	59.22	0.00	0.00	0.97
1.A.4 Other sectors-Solid fuels	CH_4	128.56	14.14	0.00	0.00	0.97
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Total		***43,130.45***	***15,062.97***	***0.46***	***1.00***	

Approach 1 Trend Assessment for 2017 using a subset (LULUCF was excluded from analysis)

IPCC Category	*Greenhouse gas*	*1990 kt CO_2 eq.*	*2017 kt CO_2 eq.*	*Trend assessment*	*% Contribution to Trend*	*Cumulative total*
1.A.3.b Road transportation	*CO_2*	*5,247.15*	*5444.78*	*0.07*	*0.18*	*0.18*
1.A.1.a Public electricity and heat production - Liquid Fuels	*CO_2*	*6,021.25*	*86.50*	*0.05*	*0.14*	*0.32*
1.A.1.a Public electricity and heat production - Gaseous Fuels	*CO_2*	*5,796.59*	*785.65*	*0.03*	*0.09*	*0.41*
2.B.1 Ammonia Production	*CO_2*	*1,253.68*	*2137.46*	*0.03*	*0.09*	*0.50*
1.A.2 Manufacturing industries and construction-Liquid fuels	*CO_2*	*3,873.72*	*123.35*	*0.03*	*0.08*	*0.59*
1.A.4 Other sectors-Solid fuels	*CO_2*	*2,760.55*	*306.52*	*0.02*	*0.05*	*0.64*
1.A.4 Other sectors-Liquid fuels	*CO_2*	*2,736.38*	*317.53*	*0.02*	*0.05*	*0.68*
1.A.1.b Petroleum refining - Liquid Fuels	*CO_2*	*1,509.64*	*1376.82*	*0.02*	*0.04*	*0.72*
2.F.1 Refrigeration and Air Conditioning Equipment	*HFCs*	*0.00*	*667.91*	*0.01*	*0.04*	*0.76*
3.D.1.1 Direct N_2O Emissions From Managed Soils - Inorganic N Fertilizers	*N_2O*	*992.77*	*782.74*	*0.01*	*0.02*	*0.78*
5.A Solid Waste Disposal	*CH_4*	*1,028.83*	*771.84*	*0.01*	*0.02*	*0.80*
3.A.1 Enteric Fermentation - Cattle	*CH_4*	*4,146.14*	*1460.84*	*0.01*	*0.02*	*0.82*
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	*N_2O*	*566.38*	*519.83*	*0.01*	*0.02*	*0.83*
1.A.2 Manufacturing industries and construction-Solid fuels	*CO_2*	*171.63*	*343.99*	*0.01*	*0.02*	*0.85*
2.A.1 Cement Production	*CO_2*	*1,668.07*	*450.35*	*0.01*	*0.01*	*0.86*
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	*N_2O*	*361.31*	*368.53*	*0.00*	*0.01*	*0.87*
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	*CH_4*	*260.55*	*296.66*	*0.00*	*0.01*	*0.89*
1.A.2 Manufacturing industries and construction-Gaseous fuels	*CO_2*	*2,045.42*	*678.68*	*0.00*	*0.01*	*0.90*
1.A.1. Energy industries-Other fossil fuels	*CO_2*	*0.00*	*162.10*	*0.00*	*0.01*	*0.90*
2.B.2 Nitric Acid Production	*N_2O*	*893.01*	*227.63*	*0.00*	*0.01*	*0.91*
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	*N_2O*	*432.63*	*312.87*	*0.00*	*0.01*	*0.92*
1.A.4 Other sectors-Biomass	*CH_4*	*70.28*	*139.81*	*0.00*	*0.01*	*0.93*
1.A.4 Other sectors-Peat	*CO_2*	*27.13*	*99.75*	*0.00*	*0.00*	*0.93*

IPCC Category	*Greenhouse gas*	*1990 kt CO_2 eq.*	*2017 kt CO_2 eq.*	*Trend assessment*	*% Contribution to Trend*	*Cumulative total*
2.A.4 Other process use of carbonates	***CO_2***	***239.66***	***16.38***	***0.00***	***0.00***	***0.94***
3.B.1.3 Manure Management - Swine	***CH_4***	***329.25***	***62.34***	***0.00***	***0.00***	***0.94***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***397.01***	***91.28***	***0.00***	***0.00***	***0.95***
2.A.2 Lime Production	***CO_2***	***222.68***	***20.81***	***0.00***	***0.00***	***0.95***
1.A.1. Energy industries-Solid fuels	***CO_2***	***174.05***	***6.56***	***0.00***	***0.00***	***0.95***
5.D Wastewater Treatment and Discharge	CH_4	471.00	140.00	0.00	0.00	0.96
5.B Biological Treatment of Solid Waste	CH_4	0.20	59.22	0.00	0.00	0.96
1.A.4 Other sectors-Liquid fuels	N_2O	159.35	13.75	0.00	0.00	0.96
1.A.4 Other sectors-Solid fuels	CH_4	128.56	14.14	0.00	0.00	0.96
1.A.1.c Manufacture of solid fuels and other energy industries - Gaseous fuels	CO_2	0.00	39.45	0.00	0.00	0.97
2.G Other product manufacture and use	N_2O	96.05	5.08	0.00	0.00	0.97
1.A.1. Energy industries-Biomass	N_2O	0.63	34.44	0.00	0.00	0.97
2. D Non-energy products from fuels and solvent use	CO_2	50.34	53.80	0.00	0.00	0.97
2.F.2 Foam Blowing Agents	HFCs	0.00	32.45	0.00	0.00	0.97
3.B.1 Manure Management - Other	N_2O	127.49	21.47	0.00	0.00	0.98
1.A.1. Energy industries-Peat	CO_2	11.06	35.89	0.00	0.00	0.98
3.B.1.1 Manure Management - Cattle	CH_4	251.55	137.33	0.00	0.00	0.98
3.D.2.1 Indirect N_2O Emissions From Managed Soils - Atmospheric deposition	N_2O	175.31	101.61	0.00	0.00	0.98
1.A.3.e Other transportation	CO_2	85.36	60.29	0.00	0.00	0.98
……						
Total		***48,210.15***	***20,418.19***	***0.37***	***1.00***	

Approach 2 Level Assessment for 1990

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eq.*	*Level assessment with uncertainty*	*Cumulative total*
4.A.1 Forest land remaining forest land - carbon stock change in biomass	*CO_2*	*-6,892.07*	*0.05*	*0.20*
5.A Solid Waste Disposal	*CH_4*	*1,028.83*	*0.02*	*0.28*
3.B.2 Manure Management - Indirect N_2O Emissions	*N_2O*	*397.01*	*0.02*	*0.35*
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	*CO_2*	*517.32*	*0.02*	*0.41*
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	*CO_2*	*1,475.59*	*0.01*	*0.47*
3.D.1.1 Direct N_2O Emissions From Managed Soils - Inorganic N Fertilizers	*N_2O*	*992.77*	*0.01*	*0.52*
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	*N_2O*	*432.63*	*0.01*	*0.55*
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	*N_2O*	*566.38*	*0.01*	*0.58*
5.D Wastewater Treatment and Discharge	*CH_4*	*471.00*	*0.01*	*0.61*
3.B.2 Manure Management - Cattle	*N_2O*	*205.85*	*0.01*	*0.63*
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	*CO_2*	*853.90*	*0.01*	*0.66*
3.A.1 Enteric Fermentation - Cattle	*CH_4*	*4,146.14*	*0.01*	*0.68*
3.D.1.3 Direct N_2O Emissions From Managed Soils - Urine and dung deposited by grazing animals	*N_2O*	*419.85*	*0.01*	*0.70*
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	*N_2O*	*361.31*	*0.00*	*0.72*
4.A.2 Land converted to forest land - carbon stock change in biomass	*CO_2*	*-600.66*	*0.00*	*0.74*
3.D.1.2 Direct N_2O Emissions From Managed Soils - Organic N Fertilizers	*N_2O*	*345.29*	*0.00*	*0.75*
3.D.2.1 Indirect N_2O Emissions From Managed Soils - Atmospheric deposition	*N_2O*	*175.31*	*0.00*	*0.77*
3.B.2 Manure Management - Other	*N_2O*	*127.49*	*0.00*	*0.78*
4.B.2 Land converted to cropland- carbon stock change in biomass	*CO_2*	*524.11*	*0.00*	*0.80*
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	*CO_2*	*404.46*	*0.00*	*0.81*
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	*CO_2*	*-474.03*	*0.00*	*0.83*
1.A.1.a Public electricity and heat production - Liquid Fuels	*CO_2*	*6,021.25*	*0.00*	*0.84*

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eq.*	*Level assessment with uncertainty*	*Cumulative total*
1.A.1.a Public electricity and heat production - Gaseous Fuels	***CO_2***	***5,796.59***	***0.00***	***0.85***
1.A.4 Other sectors-Solid fuels	***CO_2***	***2,760.55***	***0.00***	***0.86***
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	***CO_2***	***-413.03***	***0.00***	***0.87***
4.G Harvested wood products	***CO_2***	***-252.55***	***0.00***	***0.88***
1.A.3.b Road transportation	***CO_2***	***5,247.15***	***0.00***	***0.89***
4.C.2 Land converted to grassland - carbon stock change in biomass	***CO_2***	***-374.09***	***0.00***	***0.89***
4.D.2 Land converted to wetlands	***CO_2***	***56.16***	***0.00***	***0.90***
1.A.4 Other sectors-Biomass	CH_4	70.28	0.00	0.91
1.A.2 Manufacturing industries and construction-Liquid fuels	CO_2	3,873.72	0.00	0.91
1.A.4 Other sectors-Liquid fuels	CO_2	2,736.38	0.00	0.92
2.B.2 Nitric Acid Production	N_2O	893.01	0.00	0.93
2.A.1 Cement Production	CO_2	1,668.07	0.00	0.93
1.A.4 Other sectors-Liquid fuels	N_2O	159.35	0.00	0.94
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Total		***43,130.45***		

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

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eq.*	*Level assessment with uncertainty*	*Cumulative total*
5.A Solid Waste Disposal	***CH_4***	***1,028.83***	***0.03***	***0.15***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***397.01***	***0.02***	***0.27***
3.D.1.1 Direct N_2O Emissions From Managed Soils - Inorganic N Fertilizers	***N_2O***	***992.77***	***0.02***	***0.36***
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	***N_2O***	***432.63***	***0.01***	***0.43***
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	***N_2O***	***566.38***	***0.01***	***0.48***
5.D Wastewater Treatment and Discharge	***CH_4***	***471.00***	***0.01***	***0.53***
3.B.2 Manure Management - Cattle	***N_2O***	***205.85***	***0.01***	***0.57***
3.A.1 Enteric Fermentation - Cattle	***CH_4***	***4,146.14***	***0.01***	***0.62***
3.D.1.3 Direct N_2O Emissions From Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***419.85***	***0.01***	***0.66***
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	***N_2O***	***361.31***	***0.01***	***0.69***
3.D.1.2 Direct N_2O Emissions From Managed Soils - Organic N Fertilizers	***N_2O***	***345.29***	***0.01***	***0.72***
3.D.2.1 Indirect N_2O Emissions From Managed Soils - Atmospheric deposition	***N_2O***	***175.31***	***0.01***	***0.75***
3.B.2 Manure Management - Other	***N_2O***	***127.49***	***0.00***	***0.77***
1.A.1.a Public electricity and heat production - Liquid Fuels	***CO_2***	***6,021.25***	***0.00***	***0.79***
1.A.1.a Public electricity and heat production - Gaseous Fuels	***CO_2***	***5,796.59***	***0.00***	***0.81***
1.A.4 Other sectors-Solid fuels	***CO_2***	***2,760.55***	***0.00***	***0.83***
1.A.3.b Road transportation	***CO_2***	***5,247.15***	***0.00***	***0.85***
1.A.4 Other sectors-Biomass	***CH_4***	***70.28***	***0.00***	***0.86***
1.A.2 Manufacturing industries and construction-Liquid fuels	***CO_2***	***3,873.72***	***0.00***	***0.87***
1.A.4 Other sectors-Liquid fuels	***CO_2***	***2,736.38***	***0.00***	***0.88***
2.B.2 Nitric Acid Production	***N_2O***	***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_2O	159.35	0.00	0.91
2.A.2 Lime Production	CO_2	222.68	0.00	0.92
1.A.4 Other sectors-Solid fuels	CH_4	128.56	0.00	0.93
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Total		***48,210.2***		

Approach 2 Level Assessment for 2017

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eq.*	*Level assessment with uncertainty*	*Cumulative total*
4.A.1 Forest land remaining forest land - carbon stock change in biomass	***CO_2***	***-7,123.24***	***0.10***	***0.24***
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	***CO_2***	***747.40***	***0.04***	***0.35***
5.A Solid Waste Disposal	***CH_4***	***771.84***	***0.03***	***0.42***
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	***CO_2***	***1,167.01***	***0.02***	***0.46***
3.D.1.1 Direct N_2O Emissions From Managed Soils - Inorganic N Fertilizers	***N_2O***	***782.74***	***0.02***	***0.51***
4.G Harvested wood products	***CO_2***	***-1,044.78***	***0.02***	***0.55***
4.D.2 Land converted to wetlands	***CO_2***	***271.49***	***0.02***	***0.59***
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	***N_2O***	***312.87***	***0.01***	***0.62***
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	***N_2O***	***519.83***	***0.01***	***0.65***
4.B.2 Land converted to cropland- carbon stock change in biomass	***CO_2***	***945.27***	***0.01***	***0.68***
4.A.2 Land converted to forest land - carbon stock change in biomass	***CO_2***	***-748.85***	***0.01***	***0.71***
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	***CO_2***	***-782.71***	***0.01***	***0.73***
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	***N_2O***	***368.53***	***0.01***	***0.75***
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	***CO_2***	***624.97***	***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***	***434.98***	***0.01***	***0.79***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***91.28***	***0.01***	***0.81***
1.A.4 Other sectors-Biomass	***CH_4***	***139.81***	***0.01***	***0.82***
2.F.1 Refrigeration and Air Conditioning Equipment	***HFCs***	***667.91***	***0.01***	***0.84***
1.A.3.b Road transportation	***CO_2***	***5,444.78***	***0.00***	***0.85***
3.D.1.3 Direct N_2O Emissions From Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***173.19***	***0.00***	***0.86***
3.B.2 Manure Management - Cattle	***N_2O***	***75.54***	***0.00***	***0.87***
3.D.2.1 Indirect N_2O Emissions From Managed Soils - Atmospheric deposition	***N_2O***	***101.61***	***0.00***	***0.88***
5.D Wastewater Treatment and Discharge	***CH_4***	***140.00***	***0.00***	***0.89***
3.A.1 Enteric Fermentation - Cattle	***CH_4***	***1,460.84***	***0.00***	***0.89***
3.D.1.2 Direct N_2O Emissions From Managed Soils - Organic N Fertilizers	***N_2O***	***148.70***	***0.00***	***0.90***
4.A.2 Land converted to forest land - net carbon stock change in mineral soils	CO_2	-221.02	0.00	0.91
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IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eq.*	*Level assessment with uncertainty*	*Cumulative total*
Total		*15062.97*		

Approach 2 Level Assessment for 2017 using a subset (LULUCF was excluded from analysis)

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eq.*	*Level assessment with uncertainty*	*Cumulative total*
5.A Solid Waste Disposal	***CH_4***	***771.84***	***0.05***	***0.19***
3.D.1.1 Direct N_2O Emissions From Managed Soils - Inorganic N Fertilizers	***N_2O***	***782.74***	***0.03***	***0.31***
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	***N_2O***	***312.87***	***0.02***	***0.40***
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	***N_2O***	***519.83***	***0.02***	***0.48***
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	***N_2O***	***368.53***	***0.01***	***0.54***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***91.28***	***0.01***	***0.59***
1.A.4 Other sectors-Biomass	***CH_4***	***139.81***	***0.01***	***0.63***
2.F.1 Refrigeration and Air Conditioning Equipment	***HFCs***	***667.91***	***0.01***	***0.66***
1.A.3.b Road transportation	***CO_2***	***5,444.78***	***0.01***	***0.69***
3.D.1.3 Direct N_2O Emissions From Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***173.19***	***0.01***	***0.72***
3.B.2 Manure Management - Cattle	***N_2O***	***75.54***	***0.01***	***0.75***
3.D.2.1 Indirect N_2O Emissions From Managed Soils - Atmospheric deposition	***N_2O***	***101.61***	***0.01***	***0.78***
5.D Wastewater Treatment and Discharge	***CH_4***	***140.00***	***0.01***	***0.80***
3.A.1 Enteric Fermentation - Cattle	***CH_4***	***1,460.84***	***0.01***	***0.83***
3.D.1.2 Direct N_2O Emissions From Managed Soils - Organic N Fertilizers	***N_2O***	***148.70***	***0.01***	***0.85***
5.B Biological Treatment of Solid Waste	***CH_4***	***59.22***	***0.00***	***0.86***
2.B.1 Ammonia Production	***CO_2***	***2,137.46***	***0.00***	***0.87***
1.A.1 Energy industries-Biomass	***N_2O***	***34.44***	***0.00***	***0.89***
1.A.4 Other sectors-Biomass	***N_2O***	***25.68***	***0.00***	***0.89***
3.B.2 Manure Management - Other	***N_2O***	***21.47***	***0.00***	***0.90***
1.A.1.b Petroleum refining - Liquid Fuels	*CO_2*	*1,376.82*	*0.00*	*0.91*
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	*CH_4*	*296.66*	*0.00*	*0.91*
1.A.1 Energy industries-Biomass	*CH_4*	*21.68*	*0.00*	*0.92*
5.D Wastewater Treatment and Discharge	*N_2O*	*43.67*	*0.00*	*0.93*
2.A.1 Cement Production	*CO_2*	*450.35*	*0.00*	*0.93*
5.B Biological Treatment of Solid Waste	*N_2O*	*22.03*	*0.00*	*0.94*
……				
Total		***20,387.93***		

Approach 2 Trend Assessment for 2017

IPCC Category	*Greenhouse gas*	*1990 kt CO_2 eq.*	*2017 kt CO_2 eq.*	*Trend assessment with uncertainty*	*% Contribution to Trend*	*Cumulative total*
4.A.1 Forest land remaining forest land - carbon stock change in biomass	*CO_2*	*-6,892.07*	*-7,123.24*	*0.02*	*0.18*	*0.18*
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	*CO_2*	*517.32*	*747.40*	*0.02*	*0.12*	*0.30*
4.D.2 Land converted to wetlands	*CO_2*	*56.16*	*271.49*	*0.01*	*0.06*	*0.37*
4.G Harvested wood products	*CO_2*	*-252.55*	*-1,044.78*	*0.01*	*0.05*	*0.42*
3.B.2 Manure Management - Indirect N_2O Emissions	*N_2O*	*397.01*	*91.28*	*0.01*	*0.04*	*0.46*
4.B.2 Land converted to cropland- carbon stock change in biomass	*CO_2*	*524.11*	*945.27*	*0.00*	*0.04*	*0.50*
5.A Solid Waste Disposal	*CH_4*	*1,028.83*	*771.84*	*0.00*	*0.03*	*0.53*
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	*CO_2*	*-474.03*	*-192.79*	*0.00*	*0.03*	*0.56*
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	*CO_2*	*1,475.59*	*1,167.01*	*0.00*	*0.03*	*0.59*
3.D.1.1 Direct N_2O Emissions From Managed Soils - Inorganic N Fertilizers	*N_2O*	*992.77*	*782.74*	*0.00*	*0.03*	*0.62*
2.F.1 Refrigeration and Air Conditioning Equipment	*HFCs*	*0.00*	*667.91*	*0.00*	*0.02*	*0.64*
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	*N_2O*	*566.38*	*519.83*	*0.00*	*0.02*	*0.66*
4.C.2 Land converted to grassland - carbon stock change in biomass	*CO_2*	*-374.09*	*-121.39*	*0.00*	*0.02*	*0.68*
1.A.4 Other sectors-Biomass	*CH_4*	*70.28*	*139.81*	*0.00*	*0.02*	*0.70*
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	*N_2O*	*361.31*	*368.53*	*0.00*	*0.02*	*0.72*
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	*CO_2*	*404.46*	*434.98*	*0.00*	*0.02*	*0.74*
5.D Wastewater Treatment and Discharge	*CH_4*	*471.00*	*140.00*	*0.00*	*0.01*	*0.75*
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	*N_2O*	*432.63*	*312.87*	*0.00*	*0.01*	*0.77*
4.E.2 Land converted to settlements	*CO_2*	*15.31*	*548.58*	*0.00*	*0.01*	*0.78*
1.A.1.a Public electricity and heat production - Liquid Fuels	*CO_2*	*6,021.25*	*86.50*	*0.00*	*0.01*	*0.79*
3.B.1 Manure Management - Other	*N_2O*	*127.49*	*21.47*	*0.00*	*0.01*	*0.80*
1.A.3.b Road transportation	*CO_2*	*5,247.15*	*5,444.78*	*0.00*	*0.01*	*0.81*

IPCC Category	*Greenhouse gas*	*1990 kt CO_2 eq.*	*2017 kt CO_2 eq.*	*Trend assessment with uncertainty*	*% Contribution to Trend*	*Cumulative total*
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	***CO_2***	***853.90***	***624.97***	***0.00***	***0.01***	***0.82***
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	***CO_2***	***-413.03***	***-782.71***	***0.00***	***0.01***	***0.83***
3.A.1 Enteric Fermentation - Cattle	***CH_4***	***4,146.14***	***1,460.84***	***0.00***	***0.01***	***0.84***
1.A.4 Other sectors-Solid fuels	***CO_2***	***2,760.55***	***306.52***	***0.00***	***0.01***	***0.85***
3.B.2 Manure Management - Cattle	***N_2O***	***205.85***	***75.54***	***0.00***	***0.01***	***0.86***
1.A.1.a Public electricity and heat production - Gaseous Fuels	***CO_2***	***5,796.59***	***785.65***	***0.00***	***0.01***	***0.87***
4.E Settlements	***N_2O***	***0.50***	***44.27***	***0.00***	***0.01***	***0.87***
5.B Biological Treatment of Solid Waste	***CH_4***	***0.20***	***59.22***	***0.00***	***0.01***	***0.88***
4.A.2 Land converted to forest land - carbon stock change in biomass	***CO_2***	***-600.66***	***-748.85***	***0.00***	***0.01***	***0.89***
1.A.2 Manufacturing industries and construction-Liquid fuels	***CO_2***	***3,873.72***	***123.35***	***0.00***	***0.01***	***0.90***
1.A.1. Energy industries-Biomass	***N_2O***	***0.63***	***34.44***	***0.00***	***0.01***	***0.90***
3.D.1.3 Direct N_2O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N_2O	419.85	173.19	0.00	0.01	0.91
1.A.4 Other sectors-Liquid fuels	CO_2	2,736.38	317.53	0.00	0.01	0.92
2.B.1 Ammonia Production	CO_2	1,253.68	2,137.46	0.00	0.01	0.92
1.A.4 Other sectors-Liquid fuels	N_2O	159.35	13.75	0.00	0.00	0.93
……						
Total		***43,130.45***	***15,062.97***	***0.13***	***1.00***	

Approach 2 Trend Assessment for 2017 using a subset (LULUCF was excluded from analysis)

IPCC Category	*Greenhouse gas*	*1990 kt CO_2 eq.*	*2017 kt CO_2 eq.*	*Trend assessment with uncertainty*	*% Contribution to Trend*	*Cumulative total*
5.A Solid Waste Disposal	*CH_4*	*1,028.83*	*771.84*	*0.01*	*0.14*	*0.14*
3.D.1.1 Direct N_2O Emissions From Managed Soils - Inorganic N Fertilizers	*N_2O*	*992.77*	*782.74*	*0.01*	*0.10*	*0.24*
3.D.1.6 Direct N_2O Emissions From Managed Soils - Cultivation of organic soils	*N_2O*	*566.38*	*519.83*	*0.00*	*0.08*	*0.32*
3.B.2 Manure Management - Indirect N_2O Emissions	*N_2O*	*397.01*	*91.28*	*0.00*	*0.07*	*0.39*
2.F.1 Refrigeration and Air Conditioning Equipment	*HFCs*	*0.00*	*667.91*	*0.00*	*0.06*	*0.45*
3.D.2.2 Indirect N_2O Emissions From Managed Soils - Nitrogen leaching and run-off	*N_2O*	*432.63*	*312.87*	*0.00*	*0.06*	*0.51*
3.D.1.4 Direct N_2O Emissions From Managed Soils - Crop Residues	*N_2O*	*361.31*	*368.53*	*0.00*	*0.06*	*0.57*
1.A.4 Other sectors-Biomass	*CH_4*	*70.28*	*139.81*	*0.00*	*0.06*	*0.63*
1.A.3.b Road transportation	*CO_2*	*5,247.15*	*5444.78*	*0.00*	*0.03*	*0.66*
1.A.1.a Public electricity and heat production - Liquid Fuels	*CO_2*	*6,021.25*	*86.50*	*0.00*	*0.02*	*0.69*
5.B Biological Treatment of Solid Waste	*CH_4*	*0.20*	*59.22*	*0.00*	*0.02*	*0.71*
3.B.1 Manure Management - Other	*N_2O*	*127.49*	*21.47*	*0.00*	*0.02*	*0.73*
5.D Wastewater Treatment and Discharge	*CH_4*	*471.00*	*140.00*	*0.00*	*0.02*	*0.75*
1.A.1. Energy industries-Biomass	*N_2O*	*0.63*	*34.44*	*0.00*	*0.02*	*0.77*
1.A.4 Other sectors-Solid fuels	*CO_2*	*2,760.55*	*306.52*	*0.00*	*0.02*	*0.78*
1.A.1.a Public electricity and heat production - Gaseous Fuels	*CO_2*	*5,796.59*	*785.65*	*0.00*	*0.02*	*0.80*
2.B.1 Ammonia Production	*CO_2*	*1,253.68*	*2137.46*	*0.00*	*0.02*	*0.81*
1.A.2 Manufacturing industries and construction-Liquid fuels	*CO_2*	*3,873.72*	*123.35*	*0.00*	*0.01*	*0.83*
3.D.2.1 Indirect N_2O Emissions From Managed Soils - Atmospheric deposition	*N_2O*	*175.31*	*101.61*	*0.00*	*0.01*	*0.84*
1.A.1. Energy industries-Biomass	*CH_4*	*0.40*	*21.68*	*0.00*	*0.01*	*0.85*
1.A.4 Other sectors-Biomass	*N_2O*	*12.97*	*25.68*	*0.00*	*0.01*	*0.86*

IPCC Category	*Greenhouse gas*	*1990 kt CO_2 eq.*	*2017 kt CO_2 eq.*	*Trend assessment with uncertainty*	*% Contribution to Trend*	*Cumulative total*
1.A.4 Other sectors-Liquid fuels	***CO_2***	***2,736.38***	***317.53***	***0.00***	***0.01***	***0.87***
1.A.4 Other sectors-Liquid fuels	***N_2O***	***159.35***	***13.75***	***0.00***	***0.01***	***0.88***
3.A.1 Enteric Fermentation - Cattle	***CH_4***	***4,146.14***	***1460.84***	***0.00***	***0.01***	***0.89***
5.B Biological Treatment of Solid Waste	***N_2O***	***0.15***	***22.03***	***0.00***	***0.01***	***0.90***
2.A.2 Lime Production	CO_2	222.68	20.81	0.00	0.01	0.91
3.B.2 Manure Management - Cattle	N_2O	205.85	75.54	0.00	0.01	0.91
1.A.1.b Petroleum refining - Liquid Fuels	CO_2	1,509.64	1376.82	0.00	0.01	0.92
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH_4	260.55	296.66	0.00	0.01	0.93
1.A.4 Other sectors-Solid fuels	CH_4	128.56	14.14	0.00	0.01	0.93
2.B.2 Nitric Acid Production	N_2O	893.01	227.63	0.00	0.01	0.94
2.G Other product manufacture and use	N_2O	96.05	5.08	0.00	0.01	0.94
……						
Total		***48,210.15***	***20,387.93***	***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 2017*	*Activity data uncertainty*	*Emission factor uncertainty*	*Combined uncertainty*	*Combined uncertainty as % of total national emissions in 2017*	*Type A sensitivity*	*Type B sensitivity*	*Uncertainty in trend in national emissions introduced by emission factor uncertainty*	*Uncertainty in trend in national emissions introduced by activity data uncertainty*	*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	1,477.14	2%	2%	3%	0.000	0.027	0.034	0.001	0.001	0.000
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CH_4	6.90	0.88	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	N_2O	16.11	1.64	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	CO_2	174.05	6.56	2%	5%	5%	0.000	0.001	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	CH_4	0.05	0.00	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	N_2O	0.82	0.03	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CO_2	5,796.59	828.60	2%	2%	3%	0.000	0.028	0.019	0.001	0.001	0.000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CH_4	2.63	0.37	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	N_2O	3.13	0.44	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CO_2	0.00	162.10	2%	5%	5%	0.000	0.004	0.004	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CH_4	0.00	1.05	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	N_2O	0.00	1.67	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy	CO_2	11.06	35.89	2%	5%	5%	0.000	0.001	0.001	0.000	0.000	0.000

Industries - Peat												
1.A.1 Fuel combustion - Energy Industries - Peat	CH_4	0.00	0.01	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Peat	N_2O	0.05	0.15	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Biomass	CO_2	0.00	0.00	30%	15%	34%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Biomass	CH_4	0.40	21.68	30%	150%	153%	0.000	0.000	0.001	0.001	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Biomass	N_2O	0.63	34.44	30%	150%	153%	0.000	0.001	0.001	0.001	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	CO_2	3,873.72	123.35	2%	2%	3%	0.000	0.029	0.003	0.001	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	CH_4	4.46	0.15	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	N_2O	47.81	5.32	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	CO_2	171.63	343.99	2%	5%	5%	0.000	0.007	0.008	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	CH_4	0.45	0.89	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	N_2O	0.81	1.58	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	CO_2	2,045.42	678.68	2%	2%	3%	0.000	0.001	0.016	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	CH_4	0.93	0.31	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	N_2O	1.11	0.36	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000

1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	CO_2	17.53	6.16	2%	5%	5%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	CH_4	0.01	0.00	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	N_2O	0.08	0.03	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	CO_2	0.00	0.00	30%	15%	34%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	CH_4	0.38	3.07	30%	150%	153%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	N_2O	0.60	4.87	30%	150%	153%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.a Domestic Aviation	CO_2	8.16	1.49	10%	2%	10%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.a Domestic Aviation	CH_4	0.00	0.00	10%	79%	79%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.a Domestic Aviation	N_2O	0.07	0.01	10%	110%	110%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b Road Transportation	CO_2	5,247.15	5,444.78	2%	2%	3%	0.000	0.083	0.126	0.002	0.004	0.000
1.A.3.b Road Transportation	CH_4	51.96	18.60	2%	40%	40%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b Road Transportation	N_2O	38.41	27.88	2%	50%	50%	0.000	0.000	0.001	0.000	0.000	0.000
1.A.3.c Railways	CO_2	349.97	165.06	5%	2%	5%	0.000	0.001	0.004	0.000	0.000	0.000
1.A.3.c Railways	CH_4	0.50	0.24	5%	75%	75%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.c Railways	N_2O	40.92	19.30	5%	75%	75%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.d Domestic Navigation - Liquid Fuels	CO_2	15.49	16.89	5%	3%	6%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.d Domestic Navigation - Liquid Fuels	CH_4	0.04	0.04	5%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.d Domestic Navigation - Liquid Fuels	N_2O	0.13	0.14	5%	90%	90%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.i Other Transportation - Pipeline Transportation	CO_2	85.36	60.29	5%	2%	5%	0.000	0.001	0.001	0.000	0.000	0.000
1.A.3.e.i Other Transportation - Pipeline Transportation	CH_4	0.04	0.03	5%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.i Other Transportation -	N_2O	0.05	0.03	5%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000

Pipeline Transportation												
1.A.4 Other Sectors - Liquid Fuels	CO_2	2,736.38	317.53	3%	2%	4%	0.000	0.015	0.007	0.000	0.000	0.000
1.A.4 Other Sectors - Liquid Fuels	CH_4	7.04	0.72	3%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Liquid Fuels	N_2O	159.35	13.75	3%	50%	50%	0.000	0.001	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Solid Fuels	CO_2	2,760.55	306.52	3%	5%	6%	0.000	0.015	0.007	0.001	0.000	0.000
1.A.4 Other Sectors - Solid Fuels	CH_4	128.56	14.14	3%	50%	50%	0.000	0.001	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Solid Fuels	N_2O	13.00	1.44	3%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Gaseous Fuels	CO_2	1,379.27	568.59	3%	2%	4%	0.000	0.002	0.013	0.000	0.001	0.000
1.A.4 Other Sectors - Gaseous Fuels	CH_4	3.13	1.28	3%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Gaseous Fuels	N_2O	0.75	0.30	3%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Peat	CO_2	27.13	99.75	3%	5%	6%	0.000	0.002	0.002	0.000	0.000	0.000
1.A.4 Other Sectors - Peat	CH_4	1.12	5.11	3%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Peat	N_2O	0.11	0.40	3%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors- Biomass	CO_2	0.00	0.00	50%	15%	52%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors- Biomass	CH_4	70.28	139.81	50%	150%	158%	0.000	0.003	0.003	0.004	0.002	0.000
1.A.4 Other Sectors- Biomass	N_2O	12.97	25.68	50%	150%	158%	0.000	0.000	0.001	0.001	0.000	0.000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CO_2	0.14	0.60	5%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CH_4	4.25	3.16	5%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	N_2O	0.00	0.00	5%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CO_2	0.01	0.01	5%	10%	11%	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH_4	260.55	296.66	5%	10%	11%	0.000	0.005	0.007	0.000	0.000	0.000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	CO_2	0.58	2.66	5%	75%	75%	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	CH_4	0.26	1.21	5%	75%	75%	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	N_2O	0.00	0.01	5%	75%	75%	0.000	0.000	0.000	0.000	0.000	0.000
2.A.1 Cement Production	CO_2	1,668.07	450.35	2%	5%	5%	0.000	0.003	0.010	0.000	0.000	0.000
2.A.2 Lime Production	CO_2	222.68	20.81	5%	30%	30%	0.000	0.001	0.000	0.000	0.000	0.000

2.A.3 Glass Production	CO_2	11.74	5.65	7%	5%	9%	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4.a Ceramics	CO_2	227.92	3.08	5%	5%	7%	0.000	0.002	0.000	0.000	0.000	0.000
2.A.4.b Other use of soda ash	CO_2	5.32	0.47	15%	5%	16%	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4.d Mineral wool production	CO_2	6.41	12.83	7%	5%	9%	0.000	0.000	0.000	0.000	0.000	0.000
2.B.1 Ammonia Production	CO_2	1,253.68	2,137.46	2%	2%	3%	0.000	0.039	0.050	0.001	0.001	0.000
2.B.2 Nitric Acid Production	N_2O	893.01	227.63	2%	10%	10%	0.000	0.002	0.005	0.000	0.000	0.000
2.B.8.a Methanol	CO_2	24.35	0.00	5%	30%	30%	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.a Methanol	CH_4	5.24	0.00	5%	30%	30%	0.000	0.000	0.000	0.000	0.000	0.000
2.C.1 Iron and Steel Production	CO_2	16.98	2.07	10%	10%	14%	0.000	0.000	0.000	0.000	0.000	0.000
2.D.1 Lubricant use	CO_2	6.06	13.14	5%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
2.D.2 Parafin wax use	CO_2	0.88	3.71	5%	100%	100%	0.000	0.000	0.000	0.000	0.000	0.000
2.D.3 Solvent use	CO_2	43.38	34.94	30%	20%	36%	0.000	0.000	0.001	0.000	0.000	0.000
2.D.3 Asphalt roofing	CO_2	0.02	0.01	5%	25%	25%	0.000	0.000	0.000	0.000	0.000	0.000
2.D.3 Road paving with asphalt	CO_2	0.00	0.00	20%	50%	54%	0.000	0.000	0.000	0.000	0.000	0.000
2.D.3 Urea-based catalyst	CO_2	0.00	1.99	10%	2%	10%	0.000	0.000	0.000	0.000	0.000	0.000
2.E.1 Semiconductor	SF6	0.00	7.11	5%	5%	7%	0.000	0.000	0.000	0.000	0.000	0.000
2.E.3 Photovoltaics	NF3	0.00	0.01	5%	20%	21%	0.000	0.000	0.000	0.000	0.000	0.000
2.F.1.a Domestic Refrigeration	HFCs	0.00	1.59	20%	50%	54%	0.000	0.000	0.000	0.000	0.000	0.000
2.F.1.a Commercial Refrigeration	HFCs	0.00	367.54	20%	50%	54%	0.000	0.010	0.010	0.005	0.003	0.000
2.F.1.a Transport Refrigeration	HFCs	0.00	86.30	20%	50%	54%	0.000	0.002	0.002	0.001	0.001	0.000
2.F.1.a Industrial Refrigeration	HFCs	0.00	57.07	20%	50%	54%	0.000	0.001	0.001	0.001	0.000	0.000
2.F.1.a Stationary Air-Conditioning	HFCs	0.00	17.56	20%	50%	54%	0.000	0.000	0.000	0.000	0.000	0.000
2.F.1.b Mobile Air-Conditioning	HFCs	0.00	137.84	20%	50%	54%	0.000	0.003	0.003	0.002	0.001	0.000
2.F.2 Foam Blowing Agents	HFCs	0.00	32.45	30%	30%	42%	0.000	0.001	0.001	0.000	0.000	0.000
2.F.3 Fire Protection	HFCs	0.00	3.34	20%	20%	28%	0.000	0.000	0.000	0.000	0.000	0.000
2.F.4 Aerosols/metered dose inhalers	HFCs	0.00	7.56	5%	5%	7%	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1 Manufacture of electrical equipments	SF6	0.00	0.46	5%	5%	7%	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.b Accelerators	SF6	0.00	0.16	5%	5%	7%	0.000	0.000	0.000	0.000	0.000	0.000
2.G.3.a Medical applications	N_2O	93.35	3.01	5%	5%	7%	0.000	0.001	0.000	0.000	0.000	0.000
2.G.3.b Propellant for pressure and aerosol products	N_2O	2.70	2.06	20%	100%	102%	0.000	0.000	0.000	0.000	0.000	0.000
3.A Enteric Fermentation	CH_4	4,290.91	1,541.58	2%	9%	9%	0.000	0.001	0.036	0.000	0.001	0.000
3.B Manure Management	CH_4	665.87	235.18	4%	1%	4%	0.000	0.000	0.005	0.000	0.000	0.000
3.B Manure Management	N_2O	730.36	188.29	5%	187%	187%	0.001	0.002	0.004	0.003	0.000	0.000

3.D.1 Direct N_2O Emissions From Managed Soils	N_2O	2,688.54	1,992.98	9%	81%	82%	0.012	0.024	0.046	0.020	0.006	0.000
3.D.2 Indirect N_2O Emissions From Managed Soils	N_2O	607.93	414.48	16%	137%	138%	0.001	0.005	0.010	0.006	0.002	0.000
3.G Liming	CO_2	20.59	12.23	10%	50%	51%	0.000	0.000	0.000	0.000	0.000	0.000
3.H Urea Application	CO_2	35.71	18.20	30%	50%	58%	0.000	0.000	0.000	0.000	0.000	0.000
4.A.1 Forest Land Remaining Forest Land	CO_2	-7,364.75	-7,315.51	3%	48%	48%	0.054	0.110	0.170	0.052	0.008	0.003
4.A.1 Forest Land Remaining Forest Land	CH_4	0.47	0.05	35%	70%	78%	0.000	0.000	0.000	0.000	0.000	0.000
4.A.1 Forest Land Remaining Forest Land	N_2O	0.31	0.04	35%	70%	78%	0.000	0.000	0.000	0.000	0.000	0.000
4.A.2 Land Converted to Forest Land	CO_2	-792.39	-1,017.88	15%	46%	49%	0.001	0.017	0.024	0.008	0.005	0.000
4.A.2 Land Converted to Forest Land	CH_4	0.02	0.00	35%	70%	78%	0.000	0.000	0.000	0.000	0.000	0.000
4.A.2 Land Converted to Forest Land	N_2O	0.02	0.00	35%	70%	78%	0.000	0.000	0.000	0.000	0.000	0.000
4(II) Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO_2	1,933.04	1,660.61	6%	57%	58%	0.004	0.023	0.038	0.013	0.004	0.000
4(II) Emissions and removals from drainage and rewetting and other management of organic and mineral soils	N_2O	39.16	40.31	9%	87%	87%	0.000	0.001	0.001	0.001	0.000	0.000
4.B Cropland	CO_2	1,478.33	1,515.69	6%	44%	44%	0.002	0.023	0.035	0.010	0.003	0.000
4.B Cropland	CH_4	0.05	0.00	6%	85%	85%	0.000	0.000	0.000	0.000	0.000	0.000
4.B Cropland	N_2O	72.72	55.58	6%	76%	76%	0.000	0.001	0.001	0.001	0.000	0.000
4.C Grassland	CO_2	-787.13	-904.11	7%	38%	39%	0.001	0.015	0.021	0.006	0.002	0.000
4.C Grassland	CH_4	2.46	0.25	6%	85%	85%	0.000	0.000	0.000	0.000	0.000	0.000
4.C Grassland	N_2O	2.68	0.27	6%	76%	76%	0.000	0.000	0.000	0.000	0.000	0.000
4.D Wetlands	CO_2	573.47	1,018.89	6%	205%	205%	0.019	0.019	0.024	0.039	0.002	0.002
4.D Wetlands	N_2O	6.08	25.04	6%	64%	64%	0.000	0.001	0.001	0.000	0.000	0.000
4.E Settlements	CO_2	15.31	548.58	11%	15%	18%	0.000	0.013	0.013	0.002	0.002	0.000
4.E Settlements	N_2O	0.50	44.27	18%	151%	152%	0.000	0.001	0.001	0.002	0.000	0.000
4.F Other Land	CO_2	0.00	53.01	33%	15%	37%	0.000	0.001	0.001	0.000	0.001	0.000

4.F Other Land	N_2O	0.00	4.51	37%	151%	155%	0.000	0.000	0.000	0.000	0.000	0.000
4.G Harvested Wood Products	CO_2	-252.55	-1,044.78	15%	59%	61%	0.002	0.022	0.024	0.013	0.005	0.000
5.A Solid Waste Disposal	CH_4	1,028.83	771.84	30%	124%	127%	0.004	0.010	0.018	0.012	0.008	0.000
5.B Biological Treatment of Solid Waste	CH_4	0.20	59.22	40%	100%	108%	0.000	0.001	0.001	0.001	0.001	0.000
5.B Biological Treatment of Solid Waste	N_2O	0.15	22.03	40%	100%	108%	0.000	0.001	0.001	0.001	0.000	0.000
5.C Incineration and Open Burning of Waste	CO_2	2.66	1.26	25%	43%	50%	0.000	0.000	0.000	0.000	0.000	0.000
5.C Incineration and Open Burning of Waste	CH_4	0.00	0.00	25%	60%	65%	0.000	0.000	0.000	0.000	0.000	0.000
5.C Incineration and Open Burning of Waste	N_2O	0.08	0.04	25%	60%	65%	0.000	0.000	0.000	0.000	0.000	0.000
5.D Wastewater Treatment and Discharge	CH_4	471.00	140.00	59%	73%	93%	0.000	0.001	0.003	0.000	0.003	0.000
5.D Wastewater Treatment and Discharge	N_2O	67.21	43.67	30%	50%	58%	0.000	0.000	0.001	0.000	0.000	0.000
Total emission		**43,140.89**	**15,059.59**	**Overall uncertainty (%)**			**31.8**	**Trend uncertainty (%)**				**7.6**

Table 1b. Uncertainty evaluation excluding LULUCF

IPCC Source category	*Gas*	*Base year (1990) emissions*	*Emissions in 2017*	*Activity data uncertainty*	*Emission factor uncertainty*	*Combined uncertainty*	*Combined uncertainty as % of total national emissions in 2017*	*Type A sensitivity*	*Type B sensitivity*	*Uncertainty in trend in national emissions introduced by emission factor uncertainty*	*Uncertainty in trend in national emissions introduced by activity data uncertainty*	*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	1,477.14	2%	2%	3%	0.0000	0.035	0.0306	0.0007	0.0009	0.0000
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CH_4	6.90	0.88	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_2O	16.11	1.64	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	6.56	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_2O	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	828.60	2%	2%	3%	0.0000	0.034	0.0172	0.0007	0.0005	0.0000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CH_4	2.63	0.37	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_2O	3.13	0.44	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	162.10	2%	5%	5%	0.0000	0.003	0.0034	0.0002	0.0001	0.0000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CH_4	0.00	1.05	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_2O	0.00	1.67	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries	CO_2	11.06	35.89	2%	5%	5%	0.0000	0.001	0.0007	0.0000	0.0000	0.0000

- Peat												
1.A.1 Fuel combustion - Energy Industries - Peat	CH_4	0.00	0.01	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Peat	N_2O	0.05	0.15	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	30%	15%	34%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Biomass	CH_4	0.40	21.68	30%	150%	153%	0.0000	0.000	0.0004	0.0007	0.0002	0.0000
1.A.1 Fuel combustion - Energy Industries - Biomass	N_2O	0.63	34.44	30%	150%	153%	0.0000	0.001	0.0007	0.0011	0.0003	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	CO_2	3,873.72	123.35	2%	2%	3%	0.0000	0.031	0.0026	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_2O	47.81	5.32	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	343.99	2%	5%	5%	0.0000	0.006	0.0071	0.0003	0.0002	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	CH_4	0.45	0.89	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_2O	0.81	1.58	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	CO_2	2,045.42	678.68	2%	2%	3%	0.0000	0.004	0.0141	0.0001	0.0004	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	CH_4	0.93	0.31	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_2O	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	6.16	2%	5%	5%	0.0000	0.000	0.0001	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_2O	0.08	0.03	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	30%	15%	34%	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	3.07	30%	150%	153%	0.0000	0.000	0.0001	0.0001	0.0000	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	N_2O	0.60	4.87	30%	150%	153%	0.0000	0.000	0.0001	0.0001	0.0000	0.0000
1.A.3.a Domestic Aviation	CO_2	8.16	1.49	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_2O	0.07	0.01	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	5,444.78	2%	2%	3%	0.0001	0.067	0.1127	0.0013	0.0032	0.0000
1.A.3.b Road Transportation	CH_4	51.96	18.60	2%	40%	40%	0.0000	0.000	0.0004	0.0000	0.0000	0.0000
1.A.3.b Road Transportation	N_2O	38.41	27.88	2%	50%	50%	0.0000	0.000	0.0006	0.0001	0.0000	0.0000
1.A.3.c Railways	CO_2	349.97	165.06	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_2O	40.92	19.30	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	16.89	5%	3%	6%	0.0000	0.000	0.0004	0.0000	0.0000	0.0000
1.A.3.d Domestic Navigation - Liquid Fuels	CH_4	0.04	0.04	5%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.3.d Domestic Navigation - Liquid Fuels	N_2O	0.13	0.14	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	85.36	60.29	5%	2%	5%	0.0000	0.001	0.0013	0.0000	0.0001	0.0000
1.A.3.e.i Other Transportation - Pipeline Transportation	CH_4	0.04	0.03	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_2O	0.05	0.03	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	317.53	3%	2%	4%	0.0000	0.017	0.0066	0.0003	0.0003	0.0000
1.A.4 Other Sectors - Liquid Fuels	CH_4	7.04	0.72	3%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.4 Other Sectors - Liquid Fuels	N_2O	159.35	13.75	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	306.52	3%	5%	6%	0.0000	0.018	0.0064	0.0009	0.0003	0.0000
1.A.4 Other Sectors - Solid Fuels	CH_4	128.56	14.14	3%	50%	50%	0.0000	0.001	0.0003	0.0004	0.0000	0.0000
1.A.4 Other Sectors - Solid Fuels	N_2O	13.00	1.44	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	568.59	3%	2%	4%	0.0000	0.000	0.0118	0.0000	0.0005	0.0000
1.A.4 Other Sectors - Gaseous Fuels	CH_4	3.13	1.28	3%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.4 Other Sectors - Gaseous Fuels	N_2O	0.75	0.30	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	99.75	3%	5%	6%	0.0000	0.002	0.0021	0.0001	0.0001	0.0000
1.A.4 Other Sectors - Peat	CH_4	1.12	5.11	3%	50%	50%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
1.A.4 Other Sectors - Peat	N_2O	0.11	0.40	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	50%	15%	52%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.4 Other Sectors- Biomass	CH_4	70.28	139.81	50%	150%	158%	0.0001	0.002	0.0029	0.0034	0.0021	0.0000
1.A.4 Other Sectors- Biomass	N_2O	12.97	25.68	50%	150%	158%	0.0000	0.000	0.0005	0.0006	0.0004	0.0000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CO_2	0.14	0.60	5%	50%	50%	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	CH_4	4.25	3.16	5%	50%	50%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	N_2O	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	296.66	5%	10%	11%	0.0000	0.004	0.0062	0.0004	0.0004	0.0000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	CO_2	0.58	2.66	5%	75%	75%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	CH_4	0.26	1.21	5%	75%	75%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	N_2O	0.00	0.01	5%	75%	75%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.A.1 Cement Production	CO_2	1,668.07	450.35	2%	5%	5%	0.0000	0.005	0.0093	0.0003	0.0003	0.0000
2.A.2 Lime Production	CO_2	222.68	20.81	5%	30%	30%	0.0000	0.002	0.0004	0.0005	0.0000	0.0000
2.A.3 Glass Production	CO_2	11.74	5.65	7%	5%	9%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
2.A.4.a Ceramics	CO_2	227.92	3.08	5%	5%	7%	0.0000	0.002	0.0001	0.0001	0.0000	0.0000
2.A.4.b Other use of soda ash	CO_2	5.32	0.47	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	12.83	7%	5%	9%	0.0000	0.000	0.0003	0.0000	0.0000	0.0000
2.B.1 Ammonia Production	CO_2	1,253.68	2,137.46	2%	2%	3%	0.0000	0.033	0.0443	0.0007	0.0013	0.0000
2.B.2 Nitric Acid Production	N_2O	893.01	227.63	2%	10%	10%	0.0000	0.003	0.0047	0.0003	0.0001	0.0000
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	2.07	10%	10%	14%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.D.1 Lubricant use	CO_2	6.06	13.14	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	3.71	5%	100%	100%	0.0000	0.000	0.0001	0.0001	0.0000	0.0000
2.D.3 Solvent use	CO_2	43.38	34.94	30%	20%	36%	0.0000	0.000	0.0007	0.0001	0.0003	0.0000
2.D.3 Asphalt roofing	CO_2	0.02	0.01	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	1.99	10%	2%	10%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.E.1 Semiconductor	SF_6	0.00	7.11	5%	5%	7%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
2.E.3 Photovoltaics	NF_3	0.00	0.01	5%	20%	21%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.F.1.a Domestic Refrigeration	HFCs	0.00	1.59	20%	50%	54%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.F.1.a Commercial Refrigeration	HFCs	0.00	367.54	20%	50%	54%	0.0001	0.009	0.0086	0.0043	0.0024	0.0000
2.F.1.a Transport Refrigeration	HFCs	0.00	86.30	20%	50%	54%	0.0000	0.002	0.0018	0.0009	0.0005	0.0000
2.F.1.a Industrial Refrigeration	HFCs	0.00	57.07	20%	50%	54%	0.0000	0.001	0.0011	0.0005	0.0003	0.0000
2.F.1.a Stationary Air-Conditioning	HFCs	0.00	17.56	20%	50%	54%	0.0000	0.000	0.0003	0.0002	0.0001	0.0000
2.F.1.b Mobile Air-Conditioning	HFCs	0.00	137.84	20%	50%	54%	0.0000	0.003	0.0029	0.0014	0.0008	0.0000
2.F.2 Foam Blowing Agents	HFCs	0.00	32.45	30%	30%	42%	0.0000	0.001	0.0007	0.0002	0.0003	0.0000
2.F.3 Fire Protection	HFCs	0.00	3.34	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	7.56	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	0.46	5%	5%	7%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.G.2.b Accelerators	SF_6	0.00	0.16	5%	5%	7%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.G.3.a Medical applications	N_2O	93.35	3.01	5%	5%	7%	0.0000	0.001	0.0001	0.0000	0.0000	0.0000
2.G.3.b Propellant for pressure and aerosol products	N_2O	2.70	2.06	20%	100%	102%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
3.A Enteric Fermentation	CH_4	4,290.91	1,541.58	2%	9%	9%	0.0000	0.006	0.0320	0.0005	0.0011	0.0000
3.B Manure Management	CH_4	665.87	235.18	4%	1%	4%	0.0000	0.001	0.0049	0.0000	0.0002	0.0000
3.B Manure Management	N_2O	730.36	188.29	5%	187%	187%	0.0003	0.003	0.0039	0.0047	0.0003	0.0000
3.D.1 Direct N_2O Emissions From Managed Soils	N_2O	2,688.54	1,992.98	9%	81%	82%	0.0064	0.018	0.0413	0.0144	0.0051	0.0002
3.D.2 Indirect N_2O Emissions From Managed Soils	N_2O	607.93	414.48	16%	137%	138%	0.0008	0.003	0.0086	0.0045	0.0019	0.0000
3.G Liming	CO_2	20.59	12.23	10%	50%	51%	0.0000	0.000	0.0003	0.0000	0.0000	0.0000
3.H Urea Application	CO_2	35.71	18.20	30%	50%	58%	0.0000	0.000	0.0004	0.0000	0.0002	0.0000
5.A Solid Waste Disposal	CH_4	1,028.83	771.84	30%	124%	127%	0.0023	0.007	0.0160	0.0086	0.0068	0.0001
5.B Biological Treatment of Solid Waste	CH_4	0.20	59.22	40%	100%	108%	0.0000	0.001	0.0012	0.0012	0.0007	0.0000
5.B Biological Treatment of Solid Waste	N_2O	0.15	22.03	40%	100%	108%	0.0000	0.000	0.0005	0.0005	0.0003	0.0000
5.C Incineration and Open Burning of Waste	CO_2	2.66	1.26	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	N_2O	0.08	0.04	25%	60%	65%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000

Waste												
5.D Wastewater Treatment and Discharge	CH_4	471.00	140.00	59%	73%	93%	0.0000	0.001	0.0029	0.0009	0.0024	0.0000
5.D Wastewater Treatment and Discharge	N_2O	67.21	43.67	30%	50%	58%	0.0000	0.000	0.0009	0.0002	0.0004	0.0000
Total emission		**48,213.08**	**20,374.74**	**Overall uncertainty (%)**			**10.1**	**Trend uncertainty (%)**				**2.2**

ANNEX III. Lithuanian energy balance by fuel type

Table 3-1. Balance of crude oil, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	502	5,358	13,491	9,217	4,909	4,892	4,379	3,560	3,514	3,065	2,691	2,336
Biofuel blended												
Import	396,707	131,189	199,709	380,035	385,276	382,015	364,146	383,408	319,455	356,108	394,439	415,437
Export		335	13,254	6,312	4,736	3,438	3,408	2,863	2,677	2,067	2,185	1,773
International marine bunkers												
Changes in stocks	2,093	-4,730	-1,169	9,169	-1,081	1,857	-90	1,345	439	-1,194	-372	-424
Gross inland consumption	**399,302**	**131,482**	**198,777**	**392,109**	**384,368**	**385,326**	**365,027**	**385,450**	**320,731**	**355,912**	**394,573**	**415,576**
Statistical difference		-42										
Transformed in power, heat and other plants:	399,302	131,440	198,777	392,101	384,357	385,326	365,019	385,450	320,731	355,912	394,573	415,576
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant	84	167	99									
- in geothermal plants												
- in other industries	399,218	131,273	198,678	392,101	384,357	385,326	365,019	385,450	320,731	355,912	394,573	415,576
Consumed in energy sector, total:				3								
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries				3								
- in electricity, gas, steam and air conditioning enterprises												
Non-energy use												
Distribution and transmission losses				5	11		8	0				
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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	87,988	37,709	68,838	112,699	123,626	124,021	115,648	116,610	96,781	107,664	117,465	122,611
Biofuel blended				26	445	610	528	433	293	600	337	375
Import	220	14,328	736	1,115	2,616	1,141	996	667	1,004	2,881	2,906	2,833
Export	42,104	23,601	50,765	95,698	114,237	114,611	105,566	110,591	89,539	101,063	111,419	117,451
International marine bunkers												
Changes in stocks	-2,725	-1,758	-2,012	-3,193	506	151	-1,479	1,999	353	-1,256	62	937
Gross inland consumption	**43,379**	**26,678**	**16,797**	**14,949**	**12,956**	**11,312**	**10,127**	**9,118**	**8,892**	**8,826**	**9,351**	**9,305**
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:			15	5			3	3	4	2	2	3
- in peat extraction enterprises				1						1	1	1
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises			15	4			3	3	4	1	1	2
Non-energy use												
Distribution and transmission losses	308	176	68	61	22	17	17	10	8	5	3	3
Final consumption:	**43,071**	**26,502**	**16,714**	**14,883**	**12,934**	**11,295**	**10,107**	**9,105**	**8,880**	**8,819**	**9,346**	**9,299**
- in industry	44	88	48	31	15	17	14	13	13	8	9	6
- in construction	439	176	101	69	28	29	24	17	16	16	15	14
- in transport	41,840	25,887	16,337	14,711	12,841	11,201	10,025	9,033	8,809	8,761	9,301	9,256
- in agriculture	440	307	170	53	43	38	33	32	35	28	17	18
- in fishing												
- in commercial / public services	308	44	58	19	7	10	11	10	7	6	4	5
- in households												

Table 3-3. Balance of aviation gasoline, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production												
Biofuel blended												
Import			14	20	18	18	18	16	19	19	16	19
Export												
International marine bunkers												
Changes in stocks												
Gross inland consumption			**14**	**20**	**18**	**18**	**18**	**16**	**19**	**19**	**16**	**19**
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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**	**18**	**18**	**16**	**19**	**19**	**16**	**19**
- in industry												
- in construction												
- in transport			14	20	18	18	18	16	19	19	16	19
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production												
Biofuel blended												
Import			65	3								
Export												
International marine bunkers												
Changes in stocks			-65									
Gross inland consumption				**3**								
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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				3								
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	28,125	9,088	18,566	24,705	10,352	11,862	10,874	12,168	9,267	7,780	10,012	12,264
Biofuel blended												
Import	387	948	846		837	303	7,263	2,078	1,255	2,244	2,943	2,233
Export	22,956	8,442	16,673	21,406	9,062	9,882	14,527	11,876	6,587	6,113	8,645	9,229
International marine bunkers												
Changes in stocks	86	129	-1,651	-1,185	115	222	-846	799	-203	10	40	-476
Gross inland consumption	**5,642**	**1,723**	**1,088**	**2,114**	**2,242**	**2,505**	**2,764**	**3,169**	**3,732**	**3,921**	**4,350**	**4,792**
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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	9						
Final consumption:	**5,642**	**1,723**	**1,088**	**2,100**	**2,237**	**2,496**	**2,764**	**3,169**	**3,732**	**3,921**	**4,350**	**4,792**
- in industry												
- in construction												
- in transport	5,642	1,723	1,080	2,100	2,237	2,496	2,764	3,169	3,732	3,921	4,350	4,792
- in agriculture												
- in fishing												
- in commercial / public services			5									
- in households			3									

Table 3-6. Balance of transport diesel, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	107,712	42,490	56,232	127,985	150,168	156,497	150,528	161,248	136,670	156,249	165,004	170,006
Biofuel blended				119	1,478	1,600	2,142	2,174	2,383	2,393	1,931	2,151
Import	8,923	9,475	1,670	2,840	7,882	15,451	19,016	31,433	42,930	68,750	48,563	27,408
Export	49,416	27,364	28,516	92,877	116,251	128,505	128,727	146,569	129,039	169,375	153,347	134,101
International marine bunkers			942									
Changes in stocks	-1,997	1,573	-4,819	-2,586	31	178	1,961	-2,156	217	-768	-274	661
Gross inland consumption	**65,222**	**26,174**	**23,625**	**35,481**	**43,308**	**45,221**	**44,920**	**46,130**	**53,161**	**57,249**	**61,877**	**66,125**
Statistical difference		213	853									
Transformed in power, heat and other plants:	7,521	1,742	36									
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant	7,521	1,615	28									
-in public heat plant		127	8									
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:	128	43	136	194	144	150	133	181	192	174	168	175
- in peat extraction enterprises	128	43	60	125	109	107	99	144	156	153	160	159
- in crude oil extraction enterprises			22	49	23	27	23	25	21	13		8
- in refineries			5						4	2	1	
- in electricity, gas, steam and air conditioning enterprises			49	20	12	16	11	12	11	6	7	8
Non-energy use			6									
Distribution and transmission losses	297	128	55	122	73	81	70	28	19	22	14	13
Final consumption:	**57,276**	**24,474**	**24,245**	**35,165**	**43,091**	**44,990**	**44,717**	**45,921**	**52,950**	**57,053**	**61,695**	**65,937**
- in industry	2,124	1,827	510	499	190	191	174	223	237	248	235	247
- in construction	2,507	935	613	589	382	425	472	406	390	320	309	360
- in transport	34,289	14,489	21,476	32,515	41,030	42,814	42,412	43,719	50,702	55,021	59,595	63,743
- in agriculture	14,277	4,207	1,327	1,362	1,444	1,472	1,587	1,503	1,562	1,438	1,516	1,548
- in fishing				14	5	9	10	10	10	6	7	7

- in commercial / public services	2,889	2,804	319	186	40	79	62	60	49	20	33	32
- in households	1,190	212										

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production				2,125	1,130	1,216	4,020	3,397	3,930	4,777	5,068	6,107
Biofuel blended					2		104	89	98	73	68	76
Import		717		915	854	934	874	674	538	701	1,231	1,107
Export				985		6			90	206	2	114
International marine bunkers				770	756	867	850	577	347	1,738	2,858	3,133
Changes in stocks		-717	65	-225	-7	-59	-150	79	-119	-61	63	-24
Gross inland consumption			**65**	**1,060**	**1,223**	**1,218**	**3,998**	**3,662**	**4,010**	**3,546**	**3,570**	**4,019**
Statistical difference												
Transformed in power, heat and other plants:			22	102	55	40	51	58	38	38	43	42
- in public CHP plant					1		9					
- in auto-producer heat plant												
- in auto-producer CHP plant			22	64	52	38	41	56	37	37	43	41
-in public heat plant				38	2	2	1	2	1	1		
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:					5	3	3	3	3	4	18	12
- in peat extraction enterprises					5	3	3	3	3	4	1	1
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises											17	11
Non-energy use												
Distribution and transmission losses												
Final consumption:			**43**	**958**	**1,163**	**1,175**	**3,944**	**3,601**	**3,969**	**3,504**	**3,509**	**3,965**
- in industry			7	405	220	214	240	200	286	228	138	193
- in construction			7	25	47	49	63	60	80	67	39	44
- in transport				226	235	179	2,686	2,478	2,588	2,413	2,358	2,571
- in agriculture			23	137	230	237	287	268	346	264	287	301
- in fishing				59	73	65	72	73	78	76	37	25
- in commercial / public services			6	55	69	72	87	97	118	48	24	35
- in households				51	289	359	509	425	473	408	626	796

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	12,006	7,636	11,026	21,046	12,720	11,507	10,235	11,742	10,116	12,155	13,388	14,350
Biofuel blended												
Import	2,208	1,056	3,972	3,110	5,024	5,202	5,208	4,927	5,184	4,882	3,612	3,767
Export	7,038	4,646	5,793	11,596	8,114	7,526	6,647	8,303	7,256	9,662	9,730	11,099
International marine bunkers												
Changes in stocks	46	230	-420	163	-111	-27	100	-34	-47	31	8	88
Gross inland consumption	**7,222**	**4,276**	**8,785**	**12,723**	**9,519**	**9,156**	**8,896**	**8,332**	**7,997**	**7,406**	**7,278**	**7,106**
Statistical difference												
Transformed in power, heat and other plants:	46		51	90	90	79	80	79	75	81	90	81
- in public CHP plant					3			2				
- in auto-producer heat plant												
- in auto-producer CHP plant			21	19	18	30	31	30	27	36	41	35
-in public heat plant	46		31	71	69	49	49	47	48	45	49	46
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:	552	138	36	4								
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries	552	138	22									
- in electricity, gas, steam and air conditioning enterprises			14	4								
Non-energy use												
Distribution and transmission losses	322	92	103	47	26	15	21	17	16	14	14	20
Final consumption:	**6,302**	**4,046**	**8,595**	**12,580**	**9,403**	**9,062**	**8,795**	**8,236**	**7,906**	**7,311**	**7,174**	**7,005**
- in industry			201	229	273	259	320	325	269	326	329	355
- in construction	92	46	74	77	122	48	32	35	43	38	55	58
- in transport	920	1,058	5,032	9,593	7,275	6,790	6,400	6,147	5,966	5,573	5,254	4,878
- in agriculture	230	46	19	38	41	63	68	65	105	54	94	142
- in fishing												
- in commercial / public services	460	92	62	23	6	25	14	23	26	20	42	57
- in households	4,600	2,804	3,207	2,620	1,686	1,877	1,961	1,641	1,497	1,300	1,400	1,515

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	133,867	33,356	39,422	71,994	65,373	67,961	66,546	72,862	57,935	60,871	72,114	66,347
Biofuel blended												
Import	293,464	47,887	4,110	5,056	7,883	1,707	813	315	167	1,377	3,504	3,391
Export	277,769	8,148	16,608	56,627	60,139	64,685	63,173	68,752	56,058	57,774	68,493	65,099
International marine bunkers	3,894	5,780	2,857	4,712	2,801	1,281	812	46		1,255	3,409	3,270
Changes in stocks	-8,951	-11,159	-4,689	-1,824	-3,450	1,270	5,997	543	1420	926	-693	995
Gross inland consumption	**136,717**	**56,156**	**19,378**	**13,887**	**6,866**	**4,972**	**9,371**	**4,922**	**3,464**	**4,145**	**3,023**	**2,364**
Statistical difference		40	5,592									
Transformed in power, heat and other plants:	70,406	39,377	14,650	5,536	4,648	1,564	5,811	1,938	857	1,634	1,109	651
- in public CHP plant	44,195	20,511	7,233	3,837	4,157	942	5,284	1,349	346	493	77	59
- in auto-producer heat plant	642	201	27			405	279	418	383	1115	930	522
- in auto-producer CHP plant	20,190	16,618	6,813	1,659	491	217	248	171	128	26	102	70
-in public heat plant	5,379	2,047	577	40								
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:	8,068	3,693	4,899	6,716	2,005	3,255	3,396	2,865	2,512	2,444	1,865	1,624
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries	8,068	3,693	4,899	6,716	2,005	3,255	3,392	2,865	2,508	2,444	1,865	1,624
- in electricity, gas, steam and air conditioning enterprises							4		4			
Non-energy use												
Distribution and transmission losses	361			38			3	3	1			
Final consumption:	**57,882**	**13,126**	**5,421**	**1,597**	**213**	**153**	**161**	**116**	**94**	**67**	**49**	**89**
- in industry	43,993	11,520	5,202	1,486	148	79	155	115	91	67	49	89
- in construction	1,044	201	11	17								
- in transport			3	4								
- in agriculture	1,084	201	114	80	41	40						
- in fishing												
- in commercial / public services	11,641	1,204	91	10	24	34	6	1	3			
- in households	120											

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production					4,306	2,413	1,563	382	343	267	256	340
Biofuel blended												
Import			1,407	1,191	2,779	4,630	5,339	3,589	333	516	701	1,068
Export				23	40	46	55	15	15	10	33	160
International marine bunkers			29	451	2,224	3,735	3,344	3,003	130	203	475	890
Changes in stocks			56	-60	-308	-338	-1,515	637	685	196	62	156
Gross inland consumption			**1,434**	**657**	**4,513**	**2,924**	**1,988**	**1,590**	**1,216**	**766**	**511**	**514**
Statistical difference												
Transformed in power, heat and other plants:			755	328	1,232	818	727	1,040	920	436	178	161
- in public CHP plant					18		262	819	624	348	16	41
- in auto-producer heat plant					1,017	602	181	37				
- in auto-producer CHP plant			713	318	197	213	282	183	296	87	162	120
-in public heat plant			42	10		3	2	1	0	1		
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:					3,042	1,787	948	280				
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries					3,042	1,787	948	280				
- in electricity, gas, steam and air conditioning enterprises												
Non-energy use												
Distribution and transmission losses												
Final consumption:			**679**	**329**	**239**	**319**	**313**	**270**	**296**	**330**	**333**	**353**
- in industry			363	220	147	210	237	213	244	275	278	298
- in construction			47	93	75	72	35	37	31	35	30	33
- in transport												
- in agriculture			15	2	5	22	19	15	18	17	16	17
- in fishing				9								
- in commercial / public services			254	5	12	15	22	5	3	3	9	5
- in households												

Table 3-11. Balance of refinery gas (not liquefied), TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	11,032	5,318	8,253	15,250	14,127	13,324	13,300	14,875	13,065	14,007	15,353	15,518
Biofuel blended												
Import												
Export												
International marine bunkers												
Changes in stocks												
Gross inland consumption	**11,032**	**5,318**	**8,253**	**15,250**	**14,127**	**13,324**	**13,300**	**14,875**	**13,065**	**14,007**	**15,353**	**15,518**
Statistical difference												
Transformed in power, heat and other plants:					109	101	172	121	99	175	358	250
- in public CHP plant												
- in auto-producer heat plant							172	121	99	175	358	250
- in auto-producer CHP plant												
-in public heat plant					109	101						
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:	11,032	5,318	8,253	15,250	14,018	13,223	13,128	14,754	12,966	13,832	14,995	15,268
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries	11,032	5,318	8,253	15,250	14,018	13,223	13,128	14,754	12,966	13,832	14,995	15,268
- 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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	9,534	1,108	3,117	6,804	4,938	5,158	4,288	4,904	3,555	5,449	6,588	8,417
Biofuel blended												
Import	40	791	474	1,150	1,814	2,208	1,623	1,792	1,567	1,812	1,371	1,793
Export	1,662	356	839	2,587	2,896	3,736	2,757	3,444	2,164	3,506	3,824	5,049
International marine bunkers												
Changes in stocks	40	39	71	28	-165	162	-286	164	40	-143	71	16
Gross inland consumption	**7,952**	**1,582**	**2,823**	**5,395**	**3,691**	**3,792**	**2,868**	**3,416**	**2,998**	**3,612**	**4,206**	**5,177**
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non-energy use	7,952	1,582	2,823	5,395	3,691	3,792	2,868	3,416	2,998	3,612	4,206	5,177
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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production			1,226	847	1,504	1,675	1,790	1,755	1,886	1,931	2,350	2,757
Biofuel blended												
Import	413	620	602	1,121	1,709	2,181	2,891	1,641	1,268	1,655	1,411	1,386
Export			924	843	2,350	2,950	3,795	2,555	2,358	2,781	2,970	3,203
International marine bunkers												
Changes in stocks			129	-14	-17	-34	-53	33	11	3	-46	-44
Gross inland consumption	**413**	**620**	**1,033**	**1,111**	**846**	**872**	**833**	**874**	**807**	**808**	**745**	**896**
Statistical difference			-84									
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non-energy use	413	620	949	1,111	846	872	833	874	807	808	745	896
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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	1,962	1,393	2,740	3,940	3,856	3,883	3,433	3,738	3,528	3,745	4,146	3,890
Biofuel blended												
Import				1,100	9		13					
Export												
International marine bunkers												
Changes in stocks				-1,054	102							
Gross inland consumption	**1,962**	**1,393**	**2,740**	**3,986**	**3,967**	**3,883**	**3,446**	**3,738**	**3,528**	**3,745**	**4,146**	**3,890**
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:	1,962	1,393	2,740	3,940	3,856	3,883	3,433	3,737	3,528	3,745	4,146	3,890
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries	1,962	1,393	2,740	3,940	3,856	3,883	3,433	3,737	3,528	3,745	4,146	3,890
- in electricity, gas, steam and air conditioning enterprises												
Non-energy use												
Distribution and transmission losses												
Final consumption:				**46**	**111**		**13**	**1**				
- in industry				46	111		13	1				
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-15. Balance of refinery feedstock, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production		8,513	418	1,827				365		640	77	
Biofuel blended												
Import	1,304	17,209	13,934	3,568	12,171	18,931	23,087	25,134	22,010	24,815	24,167	12,907
Export							9	6	11	33	15	31
International marine bunkers												
Changes in stocks	-1,220	-8,470	213	-1,121	614	673	-352	-434	709	-1420	322	230
Gross inland consumption	**84**	**17,252**	**14,565**	**4,274**	**12,785**	**19,604**	**22,726**	**25,059**	**22,708**	**24,002**	**24,551**	**13,106**
Statistical difference		-43										
Transformed in power, heat and other plants:	84	17,209	14,565	4,274	12,785	19,604	22,726	25,059	22,708	24,002	24,551	13,106
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries	84	17,209	14,565	4,274	12,785	19,604	22,726	25,059	22,708	24,002	24,551	13,106
Consumed in energy sector, total:												
- 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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production				3,477								
Biofuel blended												
Import												
Export				3,257								
International marine bunkers												
Changes in stocks				-220								
Gross inland consumption												
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production												
Biofuel blended												
Import		729	1,383	1,681								
Export												
International marine bunkers												
Changes in stocks			-734	700								
Gross inland consumption		**729**	**649**	**2,381**								
Statistical difference												
Transformed in power, heat and other plants:		729	649	2,381								
- in public CHP plant		729	649	2,381								
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production												
Biofuel blended												
Import				73	19							
Export					18							
International marine bunkers												
Changes in stocks				-7	31							
Gross inland consumption				**66**	**32**							
Statistical difference												
Transformed in power, heat and other plants:				9	10							
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant				9	1							
-in public heat plant					9							
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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				13								
- in construction												
- in transport												
- in agriculture				23	4							
- in fishing												
- in commercial / public services				21	18							
- in households												

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production												
Biofuel blended												
Import	31,752	6,506	176	53	4,343	8,929	8,010	10,427	8,326	5,701	5,624	6,833
Export		50			438	464	575	865	817			
International marine bunkers												
Changes in stocks	980	2,889			-275	-970	-4	-730	178	640	536	-567
Gross inland consumption	**32,732**	**9,345**	**176**	**53**	**3,630**	**7,495**	**7,431**	**8,832**	**7,687**	**6,341**	**6,160**	**6,266**
Statistical difference												
Transformed in power, heat and other plants:	1,834	452	25	53	55	51	71	81	67	88	83	69
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant	904	126	25	53	32	44	71	81	67	88	83	69
-in public heat plant	930	326			23	7						
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non-energy use		25										
Distribution and transmission losses		25			0	8	9	10	5	10	2	
Final consumption:	**30,898**	**8,843**	**151**		**3,575**	**7,436**	**7,351**	**8,741**	**7,615**	**6,243**	**6,075**	**6,197**
- in industry	1,583	703	137		2,860	3,750	4,353	5,083	4,418	3,602	3,141	2,975
- in construction	226	25	14		0	11	7	7	4	6	11	12
- in transport												
- in agriculture	1,557	50			3	23	16	35	80	86	94	90
- in fishing												
- in commercial / public services	12,359	6,632			406	2,105	1,302	1,583	1,352	1,089	1,323	1,377
- in households	15,173	1,433			305	1,547	1,673	2,033	1,761	1,460	1,506	1,743

Table 3-20. Balance of anthracite, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production												
Biofuel blended												
Import			100		90	21	33	62	18		24	
Export					1	1	5	5	8			
International marine bunkers												
Changes in stocks					-74	71	-4	-15	16			5
Gross inland consumption			**100**		**15**	**91**	**24**	**42**	**26**		**24**	**5**
Statistical difference												
Transformed in power, heat and other plants:			100									
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant			100									
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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**	**91**	**24**	**42**	**26**		**24**	**5**
- in industry					5	91	24	42	22		24	5
- in construction					2							
- in transport												
- in agriculture					3				2			
- in fishing												
- in commercial / public services					4							
- in households					1				2			

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production												
Biofuel blended												
Import			2,698	6,618	3,248	857	24	58	30			60
Export				37	406	127		2	31			
International marine bunkers												
Changes in stocks			11	-168	672	-46	346	10	21	1	13	10
Gross inland consumption			**2,709**	**6,413**	**3,514**	**684**	**370**	**66**	**20**	**1**	**13**	**70**
Statistical difference												
Transformed in power, heat and other plants:			150	207	100	85	49	27	4	1		
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant			81	147	66	85	49	27	4	1		
-in public heat plant			69	60	34							
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:			4									
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises			4									
Non-energy use			7	3								
Distribution and transmission losses			11	6	8							
Final consumption:			**2,537**	**6,197**	**3,406**	**599**	**321**	**39**	**16**		**13**	**70**
- in industry			5	3,059	207	16	19	4	3			57
- in construction				18	2	1	1					
- in transport												
- in agriculture			14	36	8	3	2					
- in fishing												
- in commercial / public services			1,867	2,036	1,417	22	6	5	2		4	7
- in households			651	1,048	1,772	557	293	30	11		9	6

Table 3-22. Balance of coke, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production												
Biofuel blended												
Import			445	440	466	517	543	551	499	391	456	474
Export												
International marine bunkers												
Changes in stocks			-52	96	7	5	11	10	-21	8	14	21
Gross inland consumption			**393**	**536**	**473**	**522**	**554**	**561**	**478**	**399**	**470**	**495**
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non-energy use			47	2								
Distribution and transmission losses												
Final consumption:			**346**	**534**	**473**	**522**	**554**	**561**	**478**	**399**	**470**	**495**
- in industry			346	534	473	522	554	561	478	399	470	495
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-23. Balance of lignite, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production												
Biofuel blended												
Import			15	40	14	22		22	13			
Export												
International marine bunkers												
Changes in stocks			1	2	-6	-10	2	1	-7	1	1	
Gross inland consumption			**16**	**42**	**8**	**12**	**2**	**23**	**6**	**1**	**1**	
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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**	**12**	**2**	**23**	**6**	**1**	**1**	
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services			16	25		4		6	5		1	
- in households				17	8	8	2	17	1	1		

Table 3-24. Balance of peat, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	580	600	494	825	364	492	709	985	1,181	872	200	284
Biofuel blended												
Import						2						
Export			76	1	104	142	153	137	109	94	13	15
International marine bunkers												
Changes in stocks	116	222	51	-235	94	140	-68	-44	-565	-510	153	341
Gross inland consumption	**696**	**822**	**469**	**589**	**354**	**492**	**488**	**804**	**507**	**268**	**340**	**610**
Statistical difference												
Transformed in power, heat and other plants:	445	357	258	299	202	248	188	551	163	67	101	343
- in public CHP plant							4		36			
- in auto-producer heat plant												
- in auto-producer CHP plant	67	96	80	128	102	132	99	438	127	67	101	343
-in public heat plant	39	10	14			3						
- in geothermal plants												
- in other industries	339	251	163	171	100	113	85	113	96	74	90	75
Consumed in energy sector, total:		126	36	11		13	25	6	6	3	1	1
- in peat extraction enterprises			20	11				6	6	3	1	1
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises		126	15			13	25					
Non-energy use												
Distribution and transmission losses	9	10	5	7								36
Final consumption:	**242**	**329**	**170**	**272**	**152**	**231**	**275**	**247**	**242**	**124**	**148**	**155**
- in industry	155	174	43	7	9	37	40	40	38	33	34	36
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services	87	58		21	44	85	112	99	97	51	66	68
- in households		97	127	244	99	109	123	108	107	40	48	51

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	239	186	138	147	84	101	73	96	81	63	77	64
Biofuel blended												
Import		119	2	143	696	899	1,009	1,150	762	604	797	786
Export						22	168	116	159	26	70	52
International marine bunkers												
Changes in stocks	-53	-13	-1	-35	-44	-160	64	-120	184	9	-26	62
Gross inland consumption	**186**	**292**	**139**	**255**	**736**	**818**	**978**	**1,010**	**868**	**650**	**778**	**860**
Statistical difference												
Transformed in power, heat and other plants:				9	3		3	3				
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant				2	1		2	3				
-in public heat plant				7	2		1					
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:			2									
- in peat extraction enterprises			2									
- 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**	**818**	**975**	**1,007**	**868**	**650**	**771**	**860**
- in industry	13	53		8	27	27	34	28	27	16	18	23
- in construction												
- in transport												
- in agriculture				3	16	17	18	21	19	13	15	20
- in fishing												
- in commercial / public services	27	53	1	28	193	238	295	325	307	173	190	216
- in households	146	186	136	207	497	536	628	633	515	448	548	601

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production												
Biofuel blended												
Import				176	520	857	1,139	1,264	1,328	1,776	1,166	1,356
Export				106	384	647	906	1,161	1,167	1,427	1,017	1,171
International marine bunkers												
Changes in stocks					3	-46	-61	38	-13	-202	34	68
Gross inland consumption				**70**	**139**	**164**	**172**	**141**	**148**	**147**	**183**	**253**
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non-energy use				70	139	164	172	141	148	147	183	253
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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production												
Biofuel blended												
Import	201,957	84,929	86,453	104,363	104,017	114,115	111,200	90,670	89,759	89,642	79,106	87,082
Export	6,102								13	3,335	1,536	7,182
International marine bunkers												
Changes in stocks			-37	-671	304	-298	-68	-62	-3296	255	-466	547
Gross inland consumption	**195,855**	**84,929**	**86,416**	**103,692**	**104,321**	**113,817**	**111,132**	**90,608**	**86,450**	**86,562**	**77,104**	**80,447**
Statistical difference												
Transformed in power, heat and other plants:	105,124	41,480	47,241	57,134	58,186	48,005	43,280	35,499	27,756	24,104	17,721	14,138
- in public CHP plant	62,825	17,664	29,650	42,536	45,755	37,219	31,684	26,622	19,871	17,354	11,413	8,230
- in auto-producer heat plant	1,787	473	324	1,160	1,003	954	1,881	1,045	1,896	1,970	1,675	1,831
- in auto-producer CHP plant	34,248	21,952	16,272	11,414	10,525	8,994	8,977	7,317	5,473	4,357	4,050	3,708
-in public heat plant	6,265	1,391	688	667	558	568	470	391	372	327	483	336
- in geothermal plants				819	345	270	268	124	144	96	100	33
- in other industries			307	538								
Consumed in energy sector, total:			140	130	65	199	130	72	58	1298	665	773
- in peat extraction enterprises												
- in crude oil extraction enterprises			3	3	3	3	3	2	3	2	2	2
- in refineries			28	28	4	2	19	20	18	15	58	63
- in electricity, gas, steam and air conditioning enterprises			109	99	58	194	108	50	37	1281	605	708
Non-energy use	26,934	20,167	22,716	21,335	20,139	40,326	41,842	31,938	36,573	39,432	35,200	41,679
Distribution and transmission losses	1,688	1,935	1,119	420	5	4	3					
Final consumption:	**62,109**	**21,347**	**15,200**	**24,673**	**25,926**	**25,283**	**25,877**	**23,099**	**22,063**	**21,728**	**23,518**	**23,857**
- in industry	36,065	8,916	8,285	14,573	13,670	14,099	14,579	12,470	12,024	11,417	11,966	11,601
- in construction	1,030	219	266	513	501	459	490	509	457	477	519	612
- in transport				647	1,028	862	1,330	1,250	1,232	1,250	1,303	1,412
- in agriculture	2,946	1,197	991	1,192	1,309	1,273	1,156	1,058	869	872	899	911
- in fishing												
- in commercial / public services	12,831	3,319	1,302	2,118	2,793	2,520	2,652	2,656	2,452	2,575	2,741	2,883
- in households	9,237	7,696	4,356	5,630	6,625	6,070	5,670	5,156	5,029	5,137	6,090	6,438

Table 3-28. Balance of charcoal, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production				18	24	19	19	19	28	26	15	11
Biofuel blended												
Import				14	61	58	43	58	126	210	215	201
Export				15	38	36	34	36	93	163	180	126
International marine bunkers												
Changes in stocks				3	1			-3	-17	-7	-10	-13
Gross inland consumption				**20**	**48**	**41**	**28**	**38**	**44**	**66**	**40**	**73**
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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**	**41**	**28**	**38**	**44**	**66**	**40**	**73**
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services				20	48	41	28	38	44	66	40	73
- in households												

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	11,930	19,632	27,324	35,293	41,734	40,955	41,291	43,355	46,292	49,852	49,647	53,960
Biofuel blended												
Import		61	4	727	2,008	4,603	4,623	4,949	5,185	5,628	6,203	4,554
Export			255	710	5,102	5,431	4,871	5,427	5,761	5,725	5,669	6,835
International marine bunkers												
Changes in stocks	-14	-381	-54	-498	444	-2,044	722	-188	-530	457	85	815
Gross inland consumption	**11,916**	**19,312**	**27,019**	**34,812**	**39,084**	**38,083**	**41,765**	**42,689**	**45,186**	**50,212**	**50,266**	**52,494**
Statistical difference				457								574
Transformed in power, heat and other plants:	527	558	1,640	6,273	10,408	9,792	12,952	14,797	18,690	24,371	24,365	27,555
- in public CHP plant				191	2,472	2,359	3,785	6,073	6,058	6,365	5,771	7,009
- in auto-producer heat plant												
- in auto-producer CHP plant	274	156	1,060	4,906	7,121	6,691	7,976	7,679	9,961	16,987	17,563	19,341
-in public heat plant	253	402	580	1,128	772	706	1,149	1,002	2,627	980	990	1,205
- in geothermal plants												
- in other industries				48	43	36	42	43	44	39	41	21
Consumed in energy sector, total:			25	13	19	12	11	6	9	2	3	
- in peat extraction enterprises				13	4	4	6	3	9			
- in crude oil extraction enterprises												
- in refineries					1	2	4	3	0			
- in electricity, gas, steam and air conditioning enterprises			25		14	6	1	0	0	2	3	
Non-energy use												
Distribution and transmission losses			12	4								
Final consumption:	**11,389**	**18,754**	**25,342**	**28,979**	**28,657**	**28,279**	**28,802**	**27,886**	**26,487**	**25,839**	**25,898**	**25,492**
- in industry	453	756	1,218	4,007	2,920	3,027	3,400	3,380	3,313	3,520	3,776	3,981
- in construction	51	105	100	185	143	145	157	125	99	62	73	72
- in transport												
- in agriculture	187	211	272	253	399	463	437	400	436	383	434	568
- in fishing												
- in commercial / public services	1,699	1,104	1,703	1,278	1,178	1,276	1,344	1,390	1,358	1,332	1,359	1,191
- in households	8,999	16,578	22,049	23,256	24,017	23,368	23,464	22,591	21,281	20,542	20,256	19,680

Table 3-30. Balance of agricultural waste, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production				96	228	212	242	238	457	585	591	535
Biofuel blended												
Import									8	10	2	28
Export									269	386	401	371
International marine bunkers												
Changes in stocks				16	11	-9	-34	24	6	-31	14	9
Gross inland consumption				**112**	**239**	**203**	**208**	**262**	**202**	**178**	**206**	**201**
Statistical difference												
Transformed in power, heat and other plants:				64	144	113	112	99	105	68	85	90
- in public CHP plant							1	2	2			
- in auto-producer heat plant												
- in auto-producer CHP plant				55	131	100	101	97	103	68	85	90
-in public heat plant				9	13	13	10					
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:					3	1						
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises					3	1						
Non-energy use												
Distribution and transmission losses												
Final consumption:				**48**	**92**	**89**	**96**	**163**	**97**	**110**	**121**	**111**
- in industry				41	11	7	6	13	5	16	28	30
- in construction												
- in transport												
- in agriculture				2	56	56	59	88	63	73	57	49
- in fishing												
- in commercial / public services					18	25	28	58	29	20	32	26
- in households				5	7	1	3	4		1	4	6

Table 3-31. Balance of bioethanol, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production				195	1,060	565	656	730	407	470	381	362
Biofuel blended												
Import					106	234	286	214	32	269	111	119
Export				162	649	320	483	562	120	308	184	189
International marine bunkers												
Changes in stocks				-7	-3	-14	6	19	41	11	-39	16
Gross inland consumption				**26**	**514**	**465**	**465**	**401**	**360**	**442**	**269**	**308**
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non-energy use					78	68	100	117	128	37		
Distribution and transmission losses												
Final consumption:				**26**	**436**	**397**	**365**	**284**	**232**	**405**	**269**	**308**
- in industry												
- in construction												
- in transport				26	436	397	365	284	232	405	269	308
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-32. Balance of biodiesel, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production				260	3,299	2,956	3,948	4,340	4,429	4,353	3,816	4,372
Biofuel blended												
Import					527	1,273	1,413	1,406	1,502	2,035	1,323	1,757
Export				168	2,538	2,726	3,131	3,571	3,434	3,865	3,027	3,,953
International marine bunkers												
Changes in stocks				27	166	-22	-62	-2	-88	-101	-15	68
Gross inland consumption				**119**	**1,454**	**1,481**	**2,168**	**2,173**	**2,409**	**2,422**	**2,097**	**2,244**
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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**	**1,454**	**1,481**	**2,168**	**2,173**	**2,409**	**2,422**	**2,097**	**2,244**
- in industry												
- in construction												
- in transport				119	1,454	1,481	2,168	2,173	2,409	2,422	2,097	2,244
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-33. Balance of sludge biogas, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production				57	125	129	130	150	290	294	316	303
Biofuel blended												
Import												
Export												
International marine bunkers												
Changes in stocks												
Gross inland consumption				**57**	**125**	**129**	**130**	**150**	**290**	**294**	**316**	**303**
Statistical difference												
Transformed in power, heat and other plants:				36	55	56	52	67	105	106	109	118
- in public CHP plant				17	8	13	10	14	16	21	4	
- in auto-producer heat plant				3	47	43	42	53	89	85	105	118
- in auto-producer CHP plant				16								
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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**	**73**	**78**	**83**	**185**	**188**	**207**	**185**
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services				21	70	73	78	83	185	188	207	185
- in households												

Table 3-34. Balance of landfill biogas, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production					83	245	257	299	323	343	356	213
Biofuel blended												
Import												
Export												
International marine bunkers												
Changes in stocks												
Gross inland consumption					**83**	**245**	**257**	**299**	**323**	**343**	**356**	**213**
Statistical difference												
Transformed in power, heat and other plants:					83	237	256	292	320	338	342	197
- in public CHP plant					35	152	124	226	187	266	264	115
- in auto-producer heat plant					48	85	132	66	133	72	78	82
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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:					**0**	**8**	**1**	**7**	**3**	**5**	**14**	**16**
- in industry								2	1	2	1	1
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services					0	8	1	5	2	3	13	15
- in households												

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production				20	210	89	97	200	263	344	669	834
Biofuel blended												
Import												
Export												
International marine bunkers												
Changes in stocks												
Gross inland consumption				**20**	**210**	**89**	**97**	**200**	**263**	**344**	**669**	**834**
Statistical difference												
Transformed in power, heat and other plants:				7	91	42	45	114	178	225	545	689
- in public CHP plant											495	211
- in auto-producer heat plant				7	91	42	45	114	178	225	50	478
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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**	**47**	**52**	**86**	**85**	**119**	**124**	**145**
- in industry					104	41	52	86	85	119	124	145
- in construction												
- in transport												
- in agriculture				13	15	6						
- 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
Production						19		40				
Biofuel blended												
Import												
Export						19		40				
International marine bunkers												
Changes in stocks												
Gross inland consumption												
Statistical difference												
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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 sulphur (from oil), TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production	960	400	1,228	2,971	2,939	3,068	2,922	3,258	3,064	3,337	3,779	3,757
Biofuel blended												
Import										2		
Export			14	154	49		19		1,456	332	744	1,056
International marine bunkers												
Changes in stocks		-280	-101	-75	6	3	-65	87	11	-324	302	-97
Gross inland consumption	**960**	**120**	**1,113**	**2,742**	**2,896**	**3,071**	**2,838**	**3,345**	**1,619**	**2,683**	**3,337**	**2,604**
Statistical difference		280										
Transformed in power, heat and other plants:												
- in public CHP plant												
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- in peat extraction enterprises												
- in crude oil extraction enterprises												
- in refineries												
- in electricity, gas, steam and air conditioning enterprises												
Non-energy use	960	400	1,113	2,742	2,896	3,071	2,838	3,345	1,619	2,683	3,337	2,604
Distribution and transmission losses												
Final consumption:												
- in industry												
- in construction												
- in transport												
- in agriculture												
- in fishing												
- in commercial / public services												
- in households												

Table 3-38. Balance of industrial waste, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production								155	258	303	626	183
Biofuel blended												
Import												
Export												
International marine bunkers												
Changes in stocks										-13		-1
Gross inland consumption								**155**	**258**	**290**	**626**	**182**
Statistical difference												
Transformed in power, heat and other plants:								155	258	290	626	181
- in public CHP plant								155	258	290	626	181
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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 3-39. Balance of municipal waste (non-biomass fraction), TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production								475	495	661	1,583	1,246
Biofuel blended												
Import												
Export												
International marine bunkers												
Changes in stocks								-7	3	-8	-6	-19
Gross inland consumption								**468**	**498**	**653**	**1,577**	**1,227**
Statistical difference												
Transformed in power, heat and other plants:								468	498	653	1,577	1,220
- in public CHP plant								468	498	653	1,577	1,220
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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 3-40. Balance of municipal waste (biomass fraction), TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
Production								468	475	676	912	1,230
Biofuel blended												
Import												
Export												
International marine bunkers												
Changes in stocks								-7	2	-17	-9	-2
Gross inland consumption								**461**	**477**	**659**	**903**	**1,228**
Statistical difference												
Transformed in power, heat and other plants:								461	477	659	903	1,223
- in public CHP plant								461	477	659	903	1,223
- in auto-producer heat plant												
- in auto-producer CHP plant												
-in public heat plant												
- in geothermal plants												
- in other industries												
Consumed in energy sector, total:												
- 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												

ANNEX IV. Lithuanian energy consumption by fuel type in manufacturing industries

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

Year	RFO	LPG	Gasoil	Sub-bitu-minous coal	Natural gas	Wood/ wood waste	Biogas	Total
1990	883.1	0.0	0.0	0.0	6,001.0	0.0	0.0	6,884.1
1995	281.0	0.0	0.0	0.0	1,563.0	0.0	0.0	1,844.0
2000	20.0	0.0	0.0	0.0	190.9	3.0	0.0	213.9
2005	0.0	6.9	0.0	0.4	4,972.4	0.4	0.0	4,980.1
2010	47.0	17.0	0.0	0.0	5,476.0	0.0	94.0	5,634.0
2011	0.0	4.0	0.0	0.0	5,825.0	0.0	31.0	5,860.0
2012	0.0	27.4	0.0	0.0	6,652.0	0.0	52.0	6,731.4
2013	0.0	26.0	0.0	0.0	5,130.0	0.0	66.0	5,222.0
2014	0.0	26.0	0.0	0.0	5,666.0	0.0	55.0	5,747.0
2015	0.0	31.0	0.0	0.0	5,489.0	66.0	84.0	5,670.0
2016	0.0	23.0	0.0	0.0	4,781.0	113.0	92.0	5,009.0
2017	0.0	41.0	0.0	0.0	4,876.0	607.0	96.0	5,620.0

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

Year	Gasoil	RFO	LPG	Coke	Other bituminous coal	Sub-bitumi-nous coal	Natural gas	Wood/ wood waste	Total
1990	0.0	883.1	0.0	0.0	0.0	0.0	3,388.0	3.0	4,274.1
1995	0.0	401.4	0.0	0.0	75.4	0.0	749.0	5.0	1,230.8
2005	0.0	0.0	3.9	0.0	0.0	0.1	448.3	0.4	452.8
2010	0.0	0.0	3.0	0.0	0.0	0.0	1,172.0	128.0	1,303.0
2011	20.0	0.0	4.0	0.0	0.0	0.0	921.0	140.0	1,085.0
2012	15.0	0.0	4.4	0.0	00	0.0	778.0	86.0	883.4
2013	0.0	0.0	5.0	0.0	0.0	0.0	780.0	217.0	1,002.0
2014	0.0	0.0	6.0	0.0	0.0	0.0	475.0	219.0	700.0
2015	0.0	0.0	6.0	0.0	0.0	0.0	384.0	161.0	551.0
2016	2.0	0.0	5.0	0.0	0.0	0.0	510.0	195.0	712.0
2017	5.0	0.0	4.0	0.0	0.0	0.0	587.0	258.0	854.0

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

Year	Shale oil	RFO	LPG	Gasoil	Peat	Other bituminous coal	An-thra-cite	Sub-bitu-minous coal	Coke	Natural gas	Wood and wood waste	Biogas	Other solid biomass	Total
1990	0.0	2,247.8	0.0	0.0	0.0	351.7	0.0	0.0	0.0	8,498.0	36.0	0.0	0.0	11,133.5
1995	0.0	1,605.6	0.0	0.0	0.0	150.7	0.0	0.0	0.0	2,077.0	57.0	0.0	0.0	3,890.3
2000	0.0	1,567.2	121.0	3.0	0.0	67.5	0.0	0.0	105.0	2,890.2	77.1	0.0	0.0	4,831.0
2005	13.0	334.2	157.5	148.4	5.5	0.0	0.0	49.6	63.5	3,695.4	297.3	0.0	0.0	4,764.5
2010	0.0	212.0	192.0	94.0	15.0	3.0	0.0	38.0	54.0	4,005.0	93.0	10.0	0.0	4,716.0
2011	0.0	268.0	194.0	86.0	9.0	29.0	18.0	9.0	49.0	4,295.0	87.5	10.0	0.0	5,054.5
2012	0.0	243.0	221.0	121.0	11.0	29.0	24.0	2.0	44.0	4,422.0	63.0	0.0	0.0	5,180.0
2013	0.0	213.0	215.0	93.0	9.0	28.5	38.0	0.0	41.0	4,178.0	190.0	20.0	3.0	5,028.5
2014	0.0	243.0	157.0	120.0	10.0	36.0	21.0	0.0	60.0	3,566.0	556.0	30.0	5.0	4,804.0
2015	0.0	271.0	209.0	99.0	7.0	36.0	0.0	0.0	45.0	3,379.0	668.0	35.0	16.0	4,765.0
2016	0.0	273.0	219.0	53.0	8.0	33.0	0.0	0.0	60.0	3,515.0	640.0	32.0	24.0	4,857.0
2017	0.0	289.0	217.0	71.0	8.0	61.0	5.0	0.0	38.0	3,477.0	624.0	49.0	25.0	4.864.0

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

Year	RFO	LPG	Gasoil	Petroleum coke	Peat	Other bitumi-nous coal	Anthracite	Sub-bitumi-nous coal	Coke	Natural gas	Wood /wood waste	Other solid biomass	Total
1990	3,5443.6	0.0	0.0	0.0	168.0	628.0	0.0	0.0	0.0	6,934.0	19.0	0.0	43,192.6
1995	7,787.2	0.0	0.0	0.0	227.0	326.6	0.0	0.0	0.0	1,833.0	63.0	0.0	10,236.7
2000	3,522.2	5.0	0.0	0.0	43.4	7.5	0.0	0.0	190.0	1,775.0	151.7	0.0	5,694.8
2005	1180.3	5.2	148.2	46.2	7.0	0.0	0.0	2,924.1	401.5	1,615.3	565.8	0.0	6,893.6
2010	1.0	2.0	65.0	111.0	11.0	2,847.0	0.0	153.0	387.0	909.0	345.0	0.0	4,831.0
2011	14.0	5.0	69.0	0.0	36.0	3,701.0	73.0	5.0	440.0	1,005.0	501.5	0.0	5,849.5
2012	145.0	3.0	56.0	13.0	38.0	4,307.0	0.0	9.0	481.0	1,007.0	460.0	3.0	6,522.0
2013	112.0	3.0	66.0	1.0	40.0	5,033.5	0.0	0.0	498.0	947.0	451.0	4.0	7,155.5
2014	89.0	2.0	112.0	0.0	38.0	4,337.0	0.0	0.0	395.0	959.0	429.0	0.0	6,361.0
2015	57.0	3.0	75.0	0.0	33.0	3,545.0	0.0	0.0	336.0	945.0	266.0	0.0	5,260.0
2016	45.0	3.0	43.0	0.0	34.0	3,088.0	24.0	0.0	394.0	1,055.0	302.0	0.0	4,988.0
2017	86.0	3.0	70.0	0.0	36.0	2,890.0	0.0	57.0	439.0	986.0	166.0	0.0	4,733.0

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

Year	Gasoil	Residual fuel oil	LPG	Other bituminous coal	Sub-bituminous coal	Natural gas	Wood/ wood waste	Total
1990	0.0	0.0	0.0	0.0	0.0	189.0	0.0	189.0
1995	0.0	0.0	0.0	0.0	0.0	102.0	0.0	102.0
2000	0.0	0.0	9.3	0.0	0.0	170.8	0.0	180.1
2005	0.7	0.0	8.1	0.0	4.1	238.4	0.6	251.9
2010	1.0	0.0	1.0	1.0	1.0	105.0	1.0	110.0
2011	0.0	0.0	2.0	1.0	0.0	48.0	0.0	51.0
2012	1.0	0.0	3.0	1.0	1.0	59.0	0.0	65.0
2013	1.0	0.0	1.0	2.0	0.0	54.0	0.0	58.0
2014	1.0	0.0	1.0	4.0	0.0	50.0	0.0	56.0
2015	1.0	0.0	2.0	4.0	0.0	47.0	0.0	54.0
2016	2.0	0.0	0.0	2.0	0.0	54.0	0.0	58.0
2017	3.0	0.0	0.0	1.0	0.0	61.0	1.0	66.0

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

Year	RFO	LPG	Gasoil	Peat	Other bituminous coal	Anthracite	Sub-bitu-minous coal	Coke	Natural gas	Wood/wood waste	Other solid biomass	Total
1990	1565.5	0.0	0.0	0.0	50.2	0.0	0.0	0.0	2,923.0	14.0	0.0	4,552.7
1995	481.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,036.0	68.0	0.0	1,585.7
2000	48.0	4.6	0.0	0.0	7.5	0.0	0.0	23.0	924.3	108.2	0.0	1,115.7
2005	0.1	15.4	3.6	0.5	0.0	0.0	13.2	17.0	1,098.8	373.1	0.0	1,521.6
2010	0.0	9.0	8.0	3.0	0.0	3.0	2.0	3.0	262.0	36.0	9.0	335.0
2011	0.0	5.0	7.0	3.0	5.0	0.0	1.0	5.0	284.0	35.0	6.0	351.0
2012	0.0	4.0	11.0	5.0	6.0	0.0	0.0	0.0	267.0	99.0	3.0	395.0
2013	0.0	5.0	9.0	3.0	6.0	2.0	0.0	0.0	214.0	48.0	0.0	287.0
2014	0.0	8.0	4.0	3.0	9.0	0.0	0.0	0.0	229.0	13.0	0.0	266.0
2015	3.0	7.0	2.0	1.0	5.0	0.0	0.0	0.0	238.0	14.0	0.0	270.0
2016	4.0	9.0	2.0	2.0	4.0	0.0	0.0	0.0	327.0	18.0	0.0	366.0
2017	8.0	10.0	2.0	3.0	8.0	0.0	0.0	0.0	362.0	4.0	5.0	402.0

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

Year	RFO	Gasoil	Peat	Other bituminous coal	Anthracite	Sub-bituminous coal	Natural gas	Wood/ wood waste	Total
1990	80.3	0.0	0.0	0.0	0.0	0.0	270.0	0.0	350.3
1995	40.1	0.0	0.0	0.0	0.0	0.0	264.0	0.0	304.1
2000	56.0	0.0	0.0	2.5	0.0	0.0	20.1	1.6	80.2
2005	0.0	4.9	0.0	0.0	0.0	2.0	41.1	4.9	52.9
2010	0.0	0.0	1.0	0.0	0.0	0.0	17.0	4.0	22.0
2011	0.0	1.0	0.0	0.0	0.0	0.0	2.0	4.0	7.0
2012	0.0	1.0	0.0	1.0	0.0	0.0	11.0	1.0	14.0
2013	0.0	1.0	0.0	0.0	1.0	0.0	11.0	11.0	24.0
2014	0.0	1.0	0.0	0.0	1.0	0.0	11.0	18.0	31.0
2015	0.0	1.0	0.0	1.0	0.0	0.0	11.0	18.0	31.0
2016	0.0	1.0	0.0	1.0	0.0	0.0	9.0	25.0	36.0
2017	0.0	1.0	0.0	1.0	0.0	0.0	9.0	16.0	27.0

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

Year	Gasoil	RFO	LPG	Anthracite	Sub-bituminous coal	Peat	Natural gas	Other solid biomass	Wood / wood waste	Total
1990	0.0	1,204.2	0.0	0.0	0.0	0.0	1,167.0	0.0	240.0	2,611.2
1995	0.0	321.1	0.0	0.0	0.0	0.0	451.0	0.0	284.0	1,056.1
2000	0.0	147.9	4.6	0.0	0.0	0.0	288.0	0.0	465.8	906.3
2005	2.6	147.5	3.5	0.0	11.8	1.2	1,046.1	0.0	2,081.1	3,293.9
2010	0.0	31.0	19.0	0.0	0.0	1.0	944.0	0.0	1,905.0	2,900.0
2011	0.0	0.0	5.0	0.0	0.0	0.0	650.0	1.0	1,804.0	2,460.0
2012	2.0	0.0	3.0	0.0	0.0	0.0	396.0	0.0	2,252.0	2,653.0
2013	0.0	0.0	5.0	0.0	0.0	0.0	399.0	0.0	2,052.0	2,456.0
2014	0.0	0.0	6.0	0.0	0.0	0.0	270.0	0.0	1,646.0	1,922.0
2015	0.0	0.0	7.0	0.0	0.0	1.0	131.0	0.0	1,670.0	1,809.0
2016	1.0	0.0	8.0	0.0	0.0	2.0	445.0	4.0	1,995.0	2,455.0
2017	1.0	0.0	7.0	0.0	0.0	3.0	472.0	0.0	1,775.0	2,258.0

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

Year	Gasoil	RFO	LPG	Other bituminos coal	Anthracite	Sub-bituminous coal	Peat	Natural gas	Wood/wood waste	Total
1990	0.0	1,044.0	92.0	226.0	0.0	0.0	0.0	1,030.0	51.0	2,443.0
1995	0.0	201.0	46.0	25.0	0.0	0.0	0.0	219.0	105.0	596.0
2000	7.0	58.0	74.0	14.0	0.0	0.0	0.0	266.0	100.0	519.0
2005	25.0	110.0	77.0	0.0	0.0	18.0	0.0	513.0	185.0	928.0
2010	47.0	75.0	122.0	0.0	2.0	2.0	0.0	501.0	143.0	892.0
2011	49.0	72.0	48.0	11.0	0.0	1.0	0.0	459.0	145.0	785.0
2012	63.0	35.0	32.0	7.0	0.0	1.0	0.0	490.0	157.0	785.0
2013	60.0	37.0	35.0	7.0	0.0	0.0	0.0	509.0	125.0	773.0
2014	80.0	31.0	43.0	4.0	0.0	0.0	0.0	457.0	99.0	714.0
2015	67.0	35.0	38.0	6.0	0.0	0.0	0.0	477.0	62.0	685.0
2016	39.0	30.0	55.0	11.0	0.0	0.0	0.0	519.0	73.0	727.0
2017	44.0	33.0	58.0	12.0	0.0	0.0	0.0	612.0	72.0	831.0

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

Year	Gasoil	RFO	LPG	Other bituminous coal	Anthra-cite	Sub-bituminous coal	Peat	Natural gas	Other solid biomass	Wood / wood waste	Total
1990	0.0	1,364.8	0.0	527.5	0.0	0.0	0.0	2,467.0	0.0	20.0	4,379.3
1995	0.0	441.5	0.0	100.5	0.0	0.0	0.0	646.0	0.0	50.0	1,238.0
2000	0.0	139.9	4.6	34.5	0.0	0.0	0.0	810.5	0.0	109.1	1,098.6
2005	76.2	40.5	2.1	0.0	0.0	48.6	0.6	1,228.0	41.0	37.0	1,474.0
2010	41.0	4.0	12.0	7.0	2.0	8.0	1.0	591.0	2.0	18.0	686.0
2011	19.0	6.0	10.0	11.0	0.0	1.0	3.0	608.0	0.0	15.0	673.0
2012	20.0	4.0	13.0	7.0	0.0	7.0	4.0	551.0	0.0	19.0	625.0
2013	19.0	3.0	13.0	9.0	0.0	4.0	4.0	553.0	0.0	6.0	611.0
2014	26.0	3.0	12.0	11.0	0.0	3.0	3.0	548.0	0.0	9.0	615.0
2015	26.0	11.0	14.0	10.0	0.0	0.0	0.0	568.0	0.0	35.0	664.0
2016	17.0	5.0	13.0	10.0	0.0	0.0	0.0	647.0	0.0	28.0	720.0
2017	18.0	4.0	18.0	8.0	0.0	0.0	1.0	555.0	0.0	29.0	633.0

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

Year	RFO	LPG	Gasoil	Peat	Other bituminous coal	Anthracite	Sub-bitumi-nous coal	Coke	Natural gas	Wood/wood waste	Other solid biomass	Biogas	Industrial waste (used tires)	Industrial waste	Total
1990	321.1	0.0	0.0	0.0	25.1	0.0	0.0	0.0	4,228.0	121.0	0.0	0.0	0.0	0.0	4,695.2
1995	160.6	0.0	0.0	0.0	50.2	0.0	0.0	0.0	195.0	229.0	0.0	0.0	0.0	0.0	634.8
2000	0.0	9.3	0.0	0,0	0.0	0.0	5.0	28.0	53.6	300.1	0.0	0.0	0.0	0.0	396.0
2005	3.4	26.4	19.9	0.5	0.0	0.0	5.0	52.0	189.1	646.5	0.0	0.0	0.0	0.0	942.9
2010	0.0	18.0	11.0	4.0	2.0	0.0	5.0	29.0	189.0	390.0	0.0	0.0	209.4	0.0	857.4
2011	1.0	30.0	12.0	1.0	3.0	0.0	0.0	28.0	461.0	440.0	0.0	0.0	248.8	0.0	1,236.8
2012	0.0	41.0	13.0	16.0	2.0	0.0	0.0	29.0	436.0	420.0	0.0	0.0	264.8	0.0	1,221.8
2013	0.0	52.0	11.0	12.0	4.0	1.0	0.0	22.0	204.0	405.0	6.0	2.0	263.8	0.0	982.8
2014	0.0	51.0	22.0	11.0	7.0	0.0	0.0	23.0	250.0	423.0	0.0	1.0	0.0	0.0	788.0
2015	0.0	47.0	24.0	7.0	1.0	0.0	0.0	18.0	225.0	622.0	0.0	2.0	0.0	8.6	954.6
2016	0.0	49.0	17.0	6.0	3.0	0.0	0.0	16.0	185.0	460.0	0.0	1.0	0.0	47.5	737.0
2017	0.0	55.0	22.0	8.0	5.0	0.0	0.0	18.0	216.0	501.0	0.0	1.0	45.0	88.5	959.6

ANNEX V. Summary of study on "Update of country specific GHG emission factors for energy sector", performed by Lithuanian Energy Institute

During combustion a great share of carbon is removed immediately as CO_2, therefore conditions of combustion process practically have not influence on CO_2 emission factors. CO_2 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 CO_2 emission factors for energy sector (fuel combustion). Updated values of country specific CO_2 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.

CH_4 and N_2O 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 CH_4 and N_2O 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 CH_4 and N_2O emission factors are based in accordance to the results of expertual analysis performed and default IPCC (2006) values.

Updated CO_2, CH_4 and N_2O emission factors and previously applied CO_2, CH_4 and N_2O emission factors (presented in the study on "Determination of national GHG emission factors for energy sector", 2012) for energy sector are provided in Tables 4-1.

Table 4-1. GHG emission factors for *energy industries*

1.AA.1 Energy industries	*Emission factors in the study of **2016**, t/TJ*			*Emission factors in the study of **2012**, t/TJ*		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Liquid fuel						
Motor gasoline	72.77	0.003	0.0006	72.97	0.003	0.0006
Diesel	72.73	0.003	0.0006	72.89	0.003	0.0006
Gasoil	72.73	0.003	0.0006	72.89	0.003	0.0006
Residual fuel oil	78.4	0.003	0.0006	77.6	0.003	0.0006
Petroleum coke	94.06	0.003	0.0006	94.06	0.003	0.0006
Nonliquified petroleum gas	56.9	0.001	0.0001	55.82	0.001	0.0001
Orimulsion	81.74	0.003	0.0006	81.74	0.003	0.0006
Shale oil	76.6	0.003	0.0006	77.4	0.003	0.0006
Liquified petroleum gas	66.34	0.001	0.0001	65.42	0.001	0.0001
Crude oil	77.74	0.003	0.0006	77.74	0.003	0.0006

Solid fuel						
Other bituminous coal	95.1	0.001	0.0015	94.9	0.001	0.0014
Anthracite	106.55	0.001	0.0015	-	-	-
Sub-bituminous coal	96.1	0.001	0.0015	-	-	-
Peat	104.34	0.001	0.0015	104.34	0.001	0.0015
Natural gas						
Natural gas	55.14*	0.001	0.0001	55.23	0.001	0.0001
Biomass						
Wood and wood waste	101.34	0.03	0.004	109.9	0.03	0.004
Other solid biomass	103.69	0.03	0.004	-	-	-
Biogas	58.45	0.001	0.0001	58.45	0.001	0.0001
Waste						
Municipality waste (RES)	109.03	0.03	0.004	-	-	-
Municipality waste (non-RES)	111.65	0.03	0.004	-	-	-
Industrial waste	143	0.03	0.004	-	-	-

Remark: * Seeking to ensure higher accuracy of GHG emissions accounting, it is valuable to apply time series of CO_2 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 CO_2 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 CO_2 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 JSC "Lietuvos dujos". Seeking to ensure higher accuracy of GHG inventory, it is valuable to apply time series of CO_2 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 CO_2 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 CO_2 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 CO_2 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 JSC „ORLEN Lietuva". When accounting GHG emissions, it is valuable to apply the updated CO_2 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 CO_2 emission factors for other bituminous coal, petroleum coke, orimulsion, non liquefied petroleum 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 JSC "ORLEN Lietuva". The application of plant-specific emission factors enables to use higher Tiers in the national GHG inventory.

Value of CO_2 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 CO_2 emission factor for shale oil after 2015.

Country specific CO_2 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). It is recommended to apply the updated CO_2 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 CO_2 emission factors.

Value of CO_2 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 CO_2 emission factors is assessed considering default values given in *2006 IPCC Guidelines* and results of performed comparative analysis, where the updated CO_2 emission factors were compared with the emission factors applied in EU countries. The comparison of updated CO_2 emission factors with default values of *2006 IPCC Guidelines* is presented in Figure 4-1.

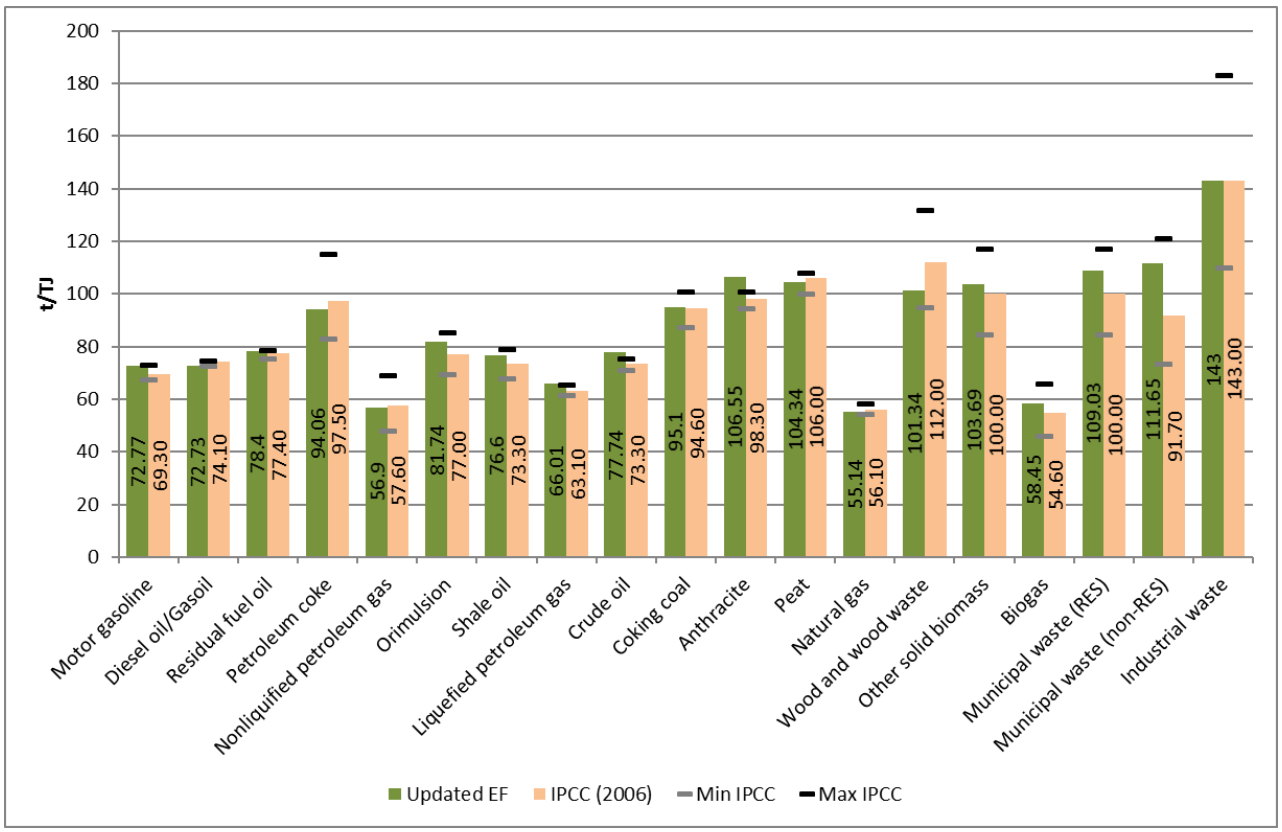


Figure 4-1. Comparison of updated country specific CO_2 emission factors and default *2006 IPCC Guidelines* emission factors: energy industries

As it is seen from Figure 4-1, the updated values of country specific CO_2 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 CO_2 emission factors for crude oil and anthracite are by 5.71% and 7.74% higher than default *2006 IPCC Guidelines* values, respectively.

CO_2 emission factors for manufacturing industries and construction are recommended the same as for energy industries sector (Table 4-2). CH_4 and N_2O emission factors are updated considering the results of expertual analysis performed and default *2006 IPCC Guidelines* values.

Table 4-2. GHG emission factors for *manufacturing industries and construction*

1.AA.2 Manufacturing industries and construction	*Emission factors in the study of **2016**, t/TJ*			*Emission factors in the study of **2012**, t/TJ*		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Liquid fuel						
Gasoil	72.73	0.003	0.0006	72.89	0.002	0.0006
Residual fuel oil	78.4	0.003	0.0006	77.6	0.002	0.0006
Petroleum coke	94.06	0.003	0.0006	94.06	0.002	0.0006
Shale oil	76.6	0.003	0.0006	77.4	0.002	0.0006
Liquified petroleum gas	66.34	0.001	0.0001	65.42	0.002	0.0006
Jet kerosene	71.74	0.003	0.0006	72.24	0.002	0.0006
Solid fuel						
Coaking coal	95.1	0.01	0.0015	94.9	0.01	0.0014
Antracite	106.55	0.01	0.0015	-	-	-
Sub-bituminous coal	96.1	0.01	0.0015	-	-	-
Peat	104.34	0.002	0.0015	104.34	0.002	0.0015
Coke	109.11	0.01	0.0015	109.11	0.01	0.0014
Natural gas						
Natural gas	55.14*	0.001	0.0001	55.23	0.005	0.0001
Biomass						
Biogas	58.45	0.001	0.0001	58.45	0.001	0.0001
Wood and wood waste	101.34	0.03	0.004	109.9	0.03	0.004
Other solid biomass	103.69	0.03	0.004	-	-	-
Waste						
Induastrial waste (used tires)	85.00	0.03	0.004	-	-	-

Remark: * Seeking to ensure higher accuracy of GHG emissions accounting, it is valuable to apply time series of ***CO_2*** 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 ***CO_2*** 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 CO_2, CH_4 and N_2O emission factors for transport sector are presented in Table 4-3. CO_2 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 JSC „ORLEN Lietuva“. 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. CH_4 and N_2O emission factors are significantly impacted by technology type, operational conditions and etc. Table 4-3 provides CH_4 and N_2O emission factors that are updated considering to the recommended values of IPCC (2006).

Table 4-3. GHG emission factors for *transport sector*

1.AA.3 Transport	*Emission factors in the study of **2016**, t/TJ*			*Emission factors in the study of **2012**, t/TJ*		
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
Aviation gasoline	70.81	0.0005[a]	0.002[a]	71.62	0.0005	0.002
Jet kerosene	71.74	0.0005[a]	0.002[a]	72.24	0.0005	0.002
Motor gasoline	72.77	0.003[b]	0.0006[b]	72.97	0.02	0.0006
Gasoline with bioethanol	72.76	0.003[b]	0.0006[b]	-	-	-
Gasoline with MTBE	72.23	0.003[b]	0.0006[b]	-	-	-
Diesel	72.73	0.0039[b]	0.0016[b]	72.89	0.005	0.0006
Liquefied petroleum gas		0.00415[c]	0.0286[c]			
Residual fuel oil		0.007d	0.002[d]			

Remark: a – civil aviation; b – road transportation; c – railways; d - water-borne navigation.

The comparison of updated country specific CO_2 emission factors with default *2006 IPCC Guidelines* emission factors are presented in Figure 4-2.

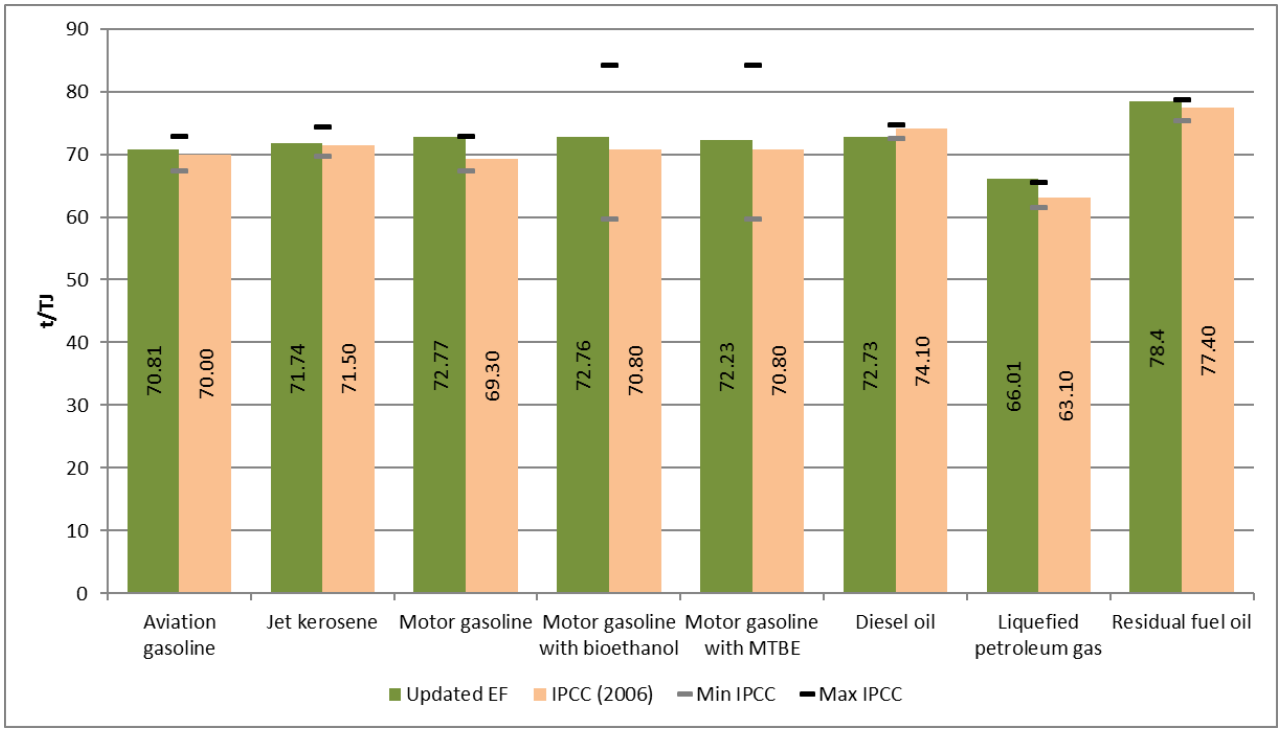


Figure 4-2. Comparison of updated country specific CO_2 emission factors with default *2006 IPCC Guidelines* emission factors: transport sector

As it is seen from Figure 4-2, updated values of country specific CO_2 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 CO_2 emission factor for liquefied petroleum gas is by 4.41% higher than its dafault value.

Recommended values of CO_2, CH_4 and N_2O emission factors for commercial/institutional, household, agriculture/forestry/fishing sector are presented in Table 4-4.

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

1.AA.4 Other sectors	*Fuel type*	*Emission factors in the study of **2016**, t/TJ*			*Emission factors in the study of **2012**, t/TJ*		
		CO_2	CH_4	CO_2	CH_4	CO_2	CH_4
Commercial/ institutional sector	Other bituminous coal	95.1	0.01	0.0015	94.9	0.01	0.0014
	Anthracite	106.55	0.01	0.0015	-	-	-
	Sub-bituminous coal	96.1	0.01	0.0015	-	-	-
	Biogas	58.45	0.005	0.0001	58.45	0.005	0.0001
	Peat	104.34	0.01	0.0014	104.34	0.01	0.0014
	Natural gas	55.14*	0.005	0.0001	55.23	0.005	0.0001
	Gasoil	72.73	0.01	0.0006	72.89	0.01	0.0006
	Lignite	101	0.01	0.0015	101.2	0.01	0.0014
	Wood and wood waste	101.34	0.25	0.004	109.9	0.3	0.004
	Other solid biomass	103.69	0.25	0.004	-	-	-
	Residual fuel oil	78.4	0.01	0.0006	77.6	0.01	0.0006
	Charcoal	109.9	0.2	0.001	109.9	0.2	0.001
	Shale oil	76.6	0.01	0.0006	77.4	0.01	0.0006
	Liquified petroleum gas	66.34	0.005	0.0001	65.42	0.01	0.0006
Household sector	Other bituminous coal	95.1	0.3	0.0015	94.9	0.3	0.0014
	Anthracite	106.55	0.3	0.0015	-	-	-
	Sub-bituminous coal	96.1	0.3	0.0015	-	-	-
	Peat	104.34	0.3	0.0014	104.34	0.3	0.0014
	Natural gas	55.14*	0.005	0.0001	55.23	0.005	0.0001
	Gasoil	72.73	0.01	0.0006	72.89	0.01	0.0006
	Lignite	101	0.3	0.0015	101.2	0.3	0.0014
	Wood and wood waste	101.34	0.26	0.004	109.9	0.3	0.004
	Other solid biomass	103.69	0.26	0.004	-	-	-
	Residual fuel oil	78.4	0.01	0.0006	77.6	0.01	0.0006
	Liquified petroleum gas	66.34	0.005	0.0001	65.42	0.01	0.0006
Agriculture/ forestry and fishing sector	Other bituminous coal	95.1	0.3	0.0015	94.9	0.3	0.0014
	Anthracite	106.55	0.3	0.0015	-	-	-
	Sub-bituminous coal	96.1	0.3	0.0015	-	-	-
	Biogas	58.45	0.005	0.0001	58.45	0.005	0.0001
	Peat	104.34	0.3	0.0014	104.34	0.3	0.0014
	Natural gas	55.14*	0.005	0.0001	55.23	0.005	0.0001
	Gasoil	72.73	0.01	0.0006	72.89	0.01	0.0006
	Wood and wood waste	101.34	0.25	0.004	109.9	0.3	0.004
	Other solid biomass	103.69	0.25	0.004	-	-	-
	Residual fuel oil	78.4	0.01	0.0006	77.6	0.01	0.0006
	Shale oil	76.6	0.01	0.0006	77.4	0.01	0.0006
	Liquified petroleum gas	66.34	0.005	0.0001	65.42	0.01	0.0006

Remark: * Seeking to ensure higher accuracy of GHG emissions accounting, it is valuable to apply time series of CO_2 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 CO_2 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 CO_2, CH_4 and N_2O 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 4-5.

Assessment of uncertainty of CO_2 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 CO_2 emission factor for biomass is the highest and reaches ±15%.

Table 4-5. Uncertainties of recommended GHG emission factors

IPCC source category	*Fuel type*	*CO_2, %*	*CH_4, %*	*N_2O, %*
1.AA.1 Energy industries	Liquid fuel	± 2.0	± 50	± 50
	Solid fuel	± 5.0	± 50	± 50
	Natural gas	± 2.0	± 50	± 50
	Biomass	± 15.0	± 150	± 150
1.AA.2 Manufacturing industry and construction	Liquid fuel	± 2.0	± 50	± 50
	Solid fuel	± 5.0	± 50	± 50
	Natural gas	± 2.0	± 50	± 50
	Biomass	± 15.0	± 150	± 150
1.AA.3 Transport	Liquid fuel	± 2.0	± 100	± 150
1.AA.4 Other sectors: commercial/institutional, household, agriculture and fishing	Liquid fuel	± 2.0	± 50	± 50
	Solid fuel	± 5.0	± 50	± 50
	Natural gas	± 2.0	± 50	± 50
	Biomass	± 15.0	± 100	± 150

Uncertainties of aggregated CH_4 and N_2O emission factors are very high, since these emission factors highly depend on type of combustion technologies. Assessment of uncertainties of these emission factors are performed considering *2006 IPCC Guidelines* for National GHG inventories.

ANNEX VI. LULUCF area matrices, resulted from studies presented in NIR Chapter 6.1.1

1990

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,042,981	399	6,384	3,591	0	799	2,054,154	11,173
Cropland	0	2,391,988	22,362	0	799	399	2,415,548	-38,735
Grassland	0	60,299	1,212,764	3,195	799	4,393	1,281,450	37,145
Wetlands	0	399	1,597	379,764	0	0	381,760	-4,790
Settlements	0	1,198	1,198	0	348,615	799	351,810	1,597
Other land	0	0	0	0	0	43,926	43,926	-6,390
Initial	2,042,981	2,454,283	1,244,305	386,550	350,213	50,316	6,528,648	6,528,648

1991

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,053,356	399	3,993	2,396	399	0	2,060,543	7,187
Cropland	0	2,352,853	22,362	0	799	399	2,376,414	-38,735
Grassland	0	60,299	1,253,098	3,195	799	4,393	1,321,783	39,534
Wetlands	0	399	1,597	377,367	0	0	379,364	-3,594
Settlements	0	1,198	1,198	0	349,015	799	352,209	1,198
Other land	0	0	0	0	0	38,336	38,336	-5,590
Initial	2,053,356	2,415,149	1,282,249	382,958	351,011	43,926	6,528,648	6,528,649

1992

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,060,543	399	3,195	1,997	0	399	2,066,533	5,990
Cropland	0	2,312,521	25,158	0	0	799	2,338,477	-37,937
Grassland	0	59,900	1,292,632	799	1,198	4,792	1,359,320	37,537
Wetlands	0	399	0	376,568	0	2,396	379,364	0
Settlements	0	2,396	799	0	351,011	399	354,605	2,396
Other land	0	799	0	0	0	29,550	30,349	-7,987
Initial	2,060,543	2,376,414	1,321,783	379,364	352,209	38,336	6,528,648	6,528,648

1993

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,066,533	1,198	3,993	0	0	0	2,071,725	5,192
Cropland	0	2,276,182	22,762	1,198	799	1,597	2,302,538	-35,939
Grassland	0	58,702	1,332,165	1,198	1,198	5,191	1,398,454	39,134
Wetlands	0	799	0	376,968	0	399	378,166	-1,198
Settlements	0	799	399	0	352,609	0	353,806	-799
Other land	0	799	0	0	0	23,161	23,960	-6,389
Initial	2,066,533	2,338,477	1,359,320	379,364	354,605	30,349	6,528,648	6,528,649

1994

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,071,325	0	2,396	399	399	0	2,074,520	2,795
Cropland	0	2,232,255	28,352	0	0	799	2,261,407	-41,131
Grassland	0	66,688	1,366,108	799	799	4,792	1,439,186	40,732
Wetlands	0	399	0	376,968	0	399	377,766	-400
Settlements	0	2,795	1,597	0	352,609	0	357,001	3,195
Other land	399	399	0	0	0	17,970	18,769	-5,191
Initial	2,071,725	2,302,538	1,398,454	378,166	353,806	23,960	6,528,648	6,528,649

1995

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,074,520	0	1,597	799	0	0	2,076,916	2,396
Cropland	0	2,199,111	24,758	0	0	399	2,224,269	-37,138
Grassland	0	59,500	1,412,431	1,198	3,195	4,393	1,480,716	41,530
Wetlands	0	399	399	375,770	0	1,198	377,766	0
Settlements	0	1,997	0	0	353,806	399	356,202	-799
Other land	0	399	0	0	0	12,379	12,779	-5,990
Initial	2,074,520	2,261,407	1,439,186	377,766	357,001	18,769	6,528,648	6,528,648

1996

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,076,916	399	2,795	799	0	0	2,080,909	3,993
Cropland	0	2,197,913	8,386	0	0	0	2,206,299	-17,970
Grassland	0	25,956	1,469,535	399	0	399	1,496,290	15,574
Wetlands	0	0	0	376,568	0	0	376,568	-1,198
Settlements	0	0	0	0	356,202	0	356,202	0
Other land	0	0	0	0	0	12,379	12,379	-400
Initial	2,076,916	2,224,269	1,480,716	377,766	356,202	12,779	6,528,648	6,528,647

1997

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,080,909	799	2,396	399	0	0	2,084,503	3,594
Cropland	0	2,153,987	19,567	0	0	399	2,173,953	-32,346
Grassland	0	51,114	1,473,528	0	0	0	1,524,642	28,352
Wetlands	0	0	399	376,169	0	0	376,568	0
Settlements	0	399	399	0	355,803	0	356,602	400
Other land	0	0	0	0	399	11,980	12,379	0
Initial	2,080,909	2,206,299	1,496,290	376,568	356,202	12,379	6,528,648	6,528,647

1998

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,084,503	0	2,795	0	0	399	2,087,698	3,195
Cropland	0	2,088,896	37,138	0	0	0	2,126,034	-47,919
Grassland	0	84,259	1,484,310	0	0	0	1,568,569	43,927
Wetlands	0	0	0	376,568	0	0	376,568	0
Settlements	0	399	399	0	356,602	0	357,400	798
Other land	0	399	0	0	0	11,980	12,379	0
Initial	2,084,503	2,173,953	1,524,642	376,568	356,602	12,379	6,528,648	6,528,648

1999

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,087,299	399	1,597	1,198	0	0	2,090,493	2,795
Cropland	0	2,028,996	51,913	0	0	0	2,080,909	-45,125
Grassland	0	96,239	1,514,260	0	0	0	1,610,498	41,929
Wetlands	399	0	0	375,370	0	0	375,770	-798
Settlements	0	399	799	0	357,400	0	358,598	1,198
Other land	0	0	0	0	0	12,379	12,379	0
Initial	2,087,698	2,126,034	1,568,569	376,568	357,400	12,379	6,528,648	6,528,647

2000

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,090,493	0	2,396	2,396	0	399	2,095,685	5,192
Cropland	0	1,970,694	50,715	0	0	0	2,021,409	-59,500
Grassland	0	108,218	1,554,193	399	1,198	0	1,664,009	53,511
Wetlands	0	0	799	372,974	0	0	373,773	-1,997
Settlements	0	1,997	2,396	0	357,400	0	361,793	3,195
Other land	0	0	0	0	0	11,980	11,980	-399
Initial	2,090,493	2,080,909	1,610,498	375,770	358,598	12,379	6,528,648	6,528,649

2001

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,095,685	399	1,997	0	0	0	2,098,081	2,396
Cropland	0	1,919,979	43,128	0	0	0	1,963,107	-58,302
Grassland	0	100,631	1,618,086	399	399	399	1,719,915	55,906
Wetlands	0	0	0	373,374	0	0	373,374	-399
Settlements	0	399	399	0	361,394	0	362,192	399
Other land	0	0	399	0	0	11,581	11,980	0
Initial	2,095,685	2,021,409	1,664,009	373,773	361,793	11,980	6,528,648	6,528,649

2002

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,098,081	0	3,993	399	0	0	2,102,473	4,392
Cropland	0	1,873,258	40,332	0	0	0	1,913,590	-49,517
Grassland	0	89,051	1,675,190	0	0	0	1,764,241	44,326
Wetlands	0	0	399	372,974	0	799	374,172	798
Settlements	0	799	0	0	362,192	0	362,991	799
Other land	0	0	0	0	0	11,181	11,181	-799
Initial	2,098,081	1,963,107	1,719,915	373,374	362,192	11,980	6,528,648	6,528,648

2003

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,102,074	799	3,195	799	399	0	2,107,265	4,792
Cropland	0	1,848,100	23,560	0	0	0	1,871,660	-41,930
Grassland	0	64,691	1,736,287	0	0	0	1,800,979	36,738
Wetlands	399	0	399	373,374	0	399	374,572	400
Settlements	0	0	399	0	362,592	0	362,991	0
Other land	0	0	399	0	0	10,782	11,181	0
Initial	2,102,473	1,913,590	1,764,241	374,172	362,991	11,181	6,528,648	6,528,648

2004

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,106,466	399	6,389	1,597	0	0	2,114,852	7,587
Cropland	0	1,821,345	29,151	0	0	0	1,850,496	-21,164
Grassland	0	49,517	1,764,640	399	0	0	1,814,556	13,577
Wetlands	799	0	399	372,575	0	399	374,172	-400
Settlements	0	399	399	0	362,991	0	363,790	799
Other land	0	0	0	0	0	10,782	10,782	-399
Initial	2,107,265	1,871,660	1,800,979	374,572	362,991	11,181	6,528,648	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	7,588
Cropland	0	1,809,764	22,762	0	0	0	1,832,526	-17,970
Grassland	0	39,134	1,784,207	0	0	0	1,823,341	8,785
Wetlands	0	0	799	372,575	0	399	373,773	-399
Settlements	399	799	1,597	0	363,790	0	366,585	2,795
Other land	0	0	0	0	0	9,983	9,983	-799
Initial	2,114,852	1,850,496	1,814,556	374,172	363,790	10,782	6,528,648	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	1,796,586	91,047	0	0	0	1,887,634	55,108
Grassland	0	34,742	1,724,308	399	0	0	1,759,449	-63,892
Wetlands	0	399	399	371,776	0	0	372,575	-1,198
Settlements	399	0	1,597	0	366,585	0	368,582	1,997
Other land	0	0	399	0	0	9,983	10,383	400
Initial	2,122,440	1,832,526	1,823,341	373,773	366,585	9,983	6,528,648	6,528,650

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	1,860,878	85,057	0	0	0	1,945,936	58,302
Grassland	0	24,359	1,669,200	0	399	0	1,693,958	-65,491
Wetlands	0	0	1,198	370,578	0	0	371,776	-799
Settlements	0	0	1,198	0	368,182	0	369,380	798
Other land	0	0	0	0	0	9,983	9,983	-400
Initial	2,130,027	1,887,634	1,759,449	372,575	368,582	10,383	6,528,648	6,528,647

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	1,918,382	81,863	0	399	0	2,000,644	54,708
Grassland	0	25,557	1,604,109	399	0	0	1,630,066	-63,892
Wetlands	0	0	799	370,978	0	0	371,776	0
Settlements	0	399	1,597	0	368,981	0	370,978	1,598
Other land	0	0	799	0	0	9,983	10,782	799
Initial	2,137,614	1,945,936	1,693,958	371,776	369,380	9,983	6,528,648	6,528,649

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	3,194
Cropland	0	1,985,070	56,306	0	0	0	2,041,376	40,732
Grassland	0	15,175	1,565,773	0	399	399	1,581,747	-48,319
Wetlands	399	0	0	371,776	0	0	372,176	400
Settlements	0	399	3,594	0	370,578	0	374,572	3,594
Other land	0	0	799	0	0	10,383	11,181	399
Initial	2,144,403	2,000,644	1,630,066	371,776	370,978	10,782	6,528,648	6,528,649

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	6,390
Cropland	0	2,014,221	4,393	0	0	0	2,018,614	-22,762
Grassland	0	26,755	1,567,770	399	1,198	0	1,596,123	14,376
Wetlands	0	0	0	371,776	0	0	371,776	-400
Settlements	0	0	3,594	0	373,374	0	376,968	2,396
Other land	0	0	0	0	0	11,181	11,181	0
Initial	2,147,597	2,041,376	1,581,747	372,176	374,572	11,181	6,528,648	6,528,649

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	1,953,523	47,121	0	0	0	2,000,644	-17,970
Grassland	0	62,695	1,542,612	0	399	0	1,605,706	9,583
Wetlands	0	0	0	371,776	0	399	372,176	400
Settlements	0	0	399	0	376,568	0	376,968	0
Other land	0	0	0	0	0	10,782	10,782	-399
Initial	2,153,987	2,018,614	1,596,123	371,776	376,968	11,181	6,528,648	6,528,649

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	11,580
Cropland	0	1,934,355	45,923	0	0	0	1,980,278	-20,366
Grassland	0	65,091	1,550,200	799	1,597	0	1,617,686	11,980
Wetlands	0	0	0	369,780	0	0	369,780	-2,396
Settlements	0	0	799	0	375,370	0	376,169	-799
Other land	0	0	0	0	0	10,782	10,782	0
Initial	2,162,373	2,000,644	1,605,706	372,176	376,968	10,782	6,528,648	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	399	0	2,179,544	5,591
Cropland	0	1,918,781	47,520	0	399	0	1,966,701	-13,577
Grassland	0	60,299	1,561,381	0	399	0	1,622,079	4,393
Wetlands	0	0	0	369,780	0	0	369,780	0
Settlements	0	399	3,993	0	374,971	0	379,364	3,195
Other land	0	0	399	0	0	10,782	11,181	399
Initial	2,173,953	1,980,278	1,617,686	369,780	376,169	10,782	6,528,648	6,528,649

2014

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,179,544	1,997	3,594	2,396	0	0	2,187,530	8,787
Cropland	0	1,915,986	67,487	0	0	0	1,983,473	-15,976
Grassland	0	48,319	1,547,404	799	399	799	1,597,720	6,790
Wetlands	0	0	1,198	366,585	0	0	367,783	-798
Settlements	0	399	1,997	0	378,964	0	381,360	2,396
Other land	0	0	399	0	0	10,383	10,782	-1,199
Initial	2,179,544	1,966,701	1,622,079	369,780	379,364	11,181	6,528,648	6,528,648

2015

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,187,530	799	7,188	799	0	0	2,196,316	8,787
Cropland	0	1,973,490	41,131	0	399	0	2,015,020	-15,976
Grassland	0	8,785	1,547,005	0	0	1,198	1,556,988	6,790
Wetlands	0	0	399	366,984	0	399	367,783	-798
Settlements	0	399	1,997	0	380,961	0	383,357	2,396
Other land	0	0	0	0	0	9,185	9,185	-1,199
Initial	2,187,530	1,983,473	1,597,720	367,783	381,360	10,782	6,528,648	6,528,649

2016

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,195,916	399	3,993	799	0	0	2,201,108	8,787
Cropland	0	2,012,225	27,554	0	799	0	2,040,577	-15,976
Grassland	0	2,396	1,524,642	799	0	799	1,528,636	6,790
Wetlands	0	0	799	366,186	0	0	366,984	-798
Settlements	399	0	0	0	382,558	0	382,958	2,396
Other land	0	0	0	0	0	8,386	8,386	-1,199
Initial	2,196,316	2,015,020	1,556,988	367,783	383,357	9,185	6,528,648	6,528,649

2017

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,200,309	399	5,191	2,396	0	0	2,208,296	8,787
Cropland	0	2,013,023	45,524	0	0	0	2,058,547	-15,976
Grassland	0	26,755	1,477,122	399	1,198	399	1,505,874	6,790
Wetlands	799	0	0	364,189	0	0	364,988	-798
Settlements	0	399	799	0	381,760	0	382,958	2,396
Other land	0	0	0	0	0	7,987	7,987	-1,199
Initial	2,201,108	2,040,577	1,528,636	366,984	382,958	8,386	6,528,648	6,528,650

ANNEX VII. Additional information of Agriculture sector

Other relavant information

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

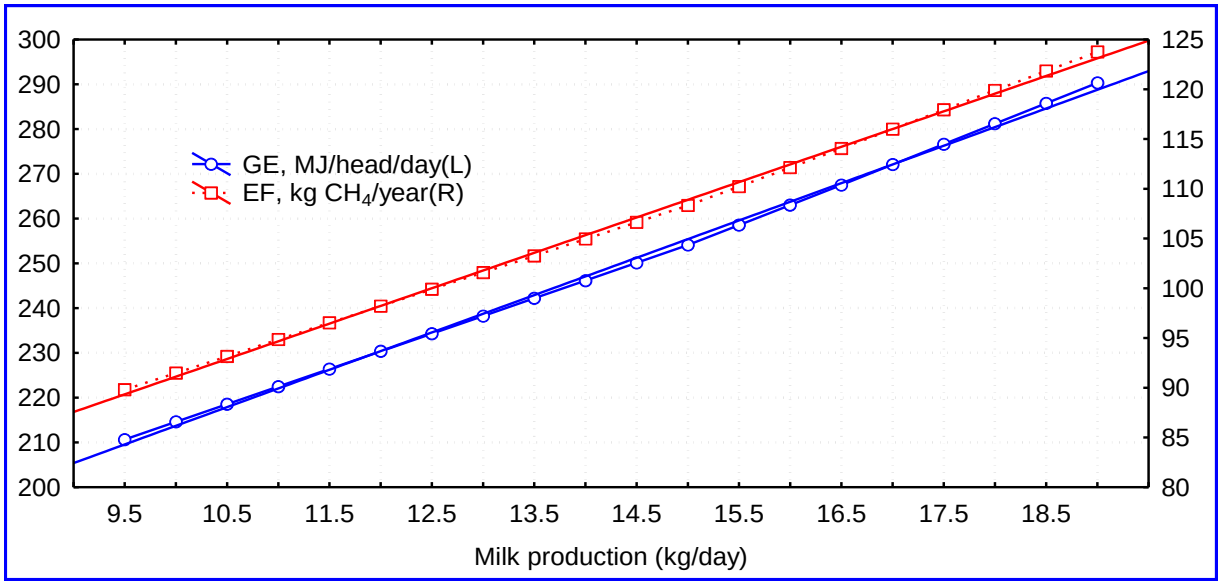


Figure A.5-1. Impact of milk yeld on GE and EF's

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: Pearson r = 0.999 (P<0.0005) were estimated. There is an estimated positive relationship r = 1.0 (P<0.0005) between gross energy and EF.

Figure below shows distribution of horses by breeds in 2017.

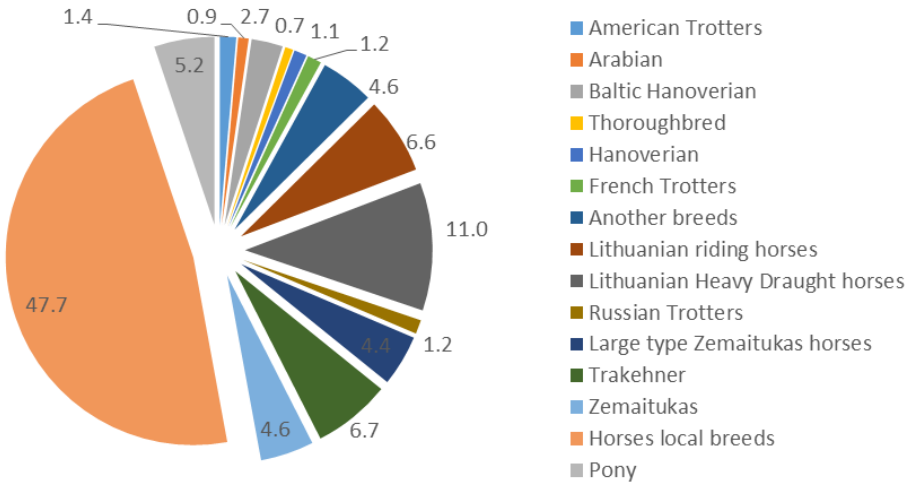


Figure A.5-2. Distribution by breeds of horses, %

Local breeds horses with no known origins constitute more than half (47%) 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
2011	6.50	6.51	5.98	0.60
2012	6.50	6.52	5.98	0.60
2013	6.50	6.54	5.98	0.60
2014	6.50	6.57	5.99	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

Table A. 5-2. Changes in dairy cattle population, milk yield, GE, CH_4 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
2011	42	136	116	116	49
2012	40	142	119	119	48
2013	38	145	120	120	46
2014	37	154	125	125	46
2015	36	153	125	125	45
2016	35	150	123	123	43
2017	33	152	124	124	41

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

MMS	Year	1990	1991	1992	1993	1994	1995	1996
Liquid manure	Swine, thous. heads	412.4	442.6	396.8	328.2	355.0	406.1	423.5
	Liquid manure, %	16.0	19.2	22.4	25.6	28.9	32.1	35.3
	Year	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
	Swine, thous. heads	449.3	494.9	472.5	431.2	479.2	565.2	611.9
	Liquid manure, %	38.5	41.7	44.9	48.1	51.4	54.6	57.8
	Year	**2004**	**2005**	**2006**	**2007**	**208**	**2009**	**2010**
	Swine, thous. heads	615.0	667.9	720.5	684.5	635.7	668.3	710.2
	Liquid manure, %	57.7	61.1	64.3	66.8	69.9	73.2	76.5
	Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
	Swine, thous. heads	701.2	692.7	677.2	600.1	569.8	439.9	469.8
	Liquid manure, %	81.6	86.7	86.7	81.7	81.3	65.1	62.0

Anaerobic digesters	**Year**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
	Swine, thous. heads	0	0	0	0	0	0	0
	Liquid manure, %	0	0	0	0	0	0	0
	Year	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
	Swine, thous. heads	0	0	0	0	0	0	0
	Liquid manure, %	0	0	0	0	0	0	0
	Year	**2004**	**2005**	**2006**	**2007**	**208**	**2009**	**2010**
	Swine, thous. heads	34.7	34.5	35.2	39.6	36.3	35.0	35.3
	Liquid manure, %	3.3	3.2	3.1	3.9	4.0	3.8	3.8
	Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
	Swine, thous. heads	16.6	0.0	0.0	41.9	43.0	154.0	168.1
	Liquid manure, %	1.9	0.0	0.0	5.7	6.1	22.8	26.4

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	2319.8	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
2011	76.4	783.4	63.2
2012	66.9	732.0	62.4
2013	62.2	718.9	61.8
2014	58.5	675.9	61.8
2015	55.5	645.4	61.7
2016	51.7	624.2	61.3
2017	49.6	588.3	61.5

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 manual[1].

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

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

Table A. 5 - 6. Composition of diet for 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

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 Bulls Dairy cattle sires

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 Bulls Non-dairy cattle sires

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 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	0.200
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

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 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

Growing pigs

Table A. 5- 24. Composition of diet for 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 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 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 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 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, kg/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
2011	2,160	393	3,451	7,687
2012	2,243	410	3,487	7,911
2013	2,273	416	3,501	7,996
2014	2,386	439	3,551	8,305
2015	2,386	439	3,551	8,305
2016	2,345	431	3,533	8,192
2017	2,366	435	3,542	8,248

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

Sub-category	**Crude protein**	**Crude fat**	**Crude fiber**	**Nitrogen free extracts**	**DM kg/day**
Suckling cows	1.671	0.399	3.461	5.477	11.98
Cattle to 1 year for slaughter	0.709	0.195	1.018	2.148	4.50
Bulls to 1 year for breed	0.873	0.215	1.272	2.602	5.49
Heifers to 1 year for breed	0.706	0.179	0.981	2.015	4.28
Bulls from 1 to 2 years	1.476	0.323	2.497	4.754	10.15
Heifers from 1 to 2 years for slaughter	1.236	0.297	2.253	3.707	8.60
Heifers from 1 to 2 years for breed	1.079	0.244	2.162	3.337	7.66
Bulls at 2 years	1.451	0.317	2.498	4.556	9.89
Heifers at 2 years for slaughter	1.406	0.304	2.385	4.443	9.25
Heifers at 2 years for breed	1.384	0.304	2.483	4342.80	9.24
Other cows	1.700	0.389	3.248	5.169	11.87
Bulls Dairy cattle sire	1.746	0.380	3.165	5.816	12.00
Bulls Non-dairy cattle sire	1.606	0.387	3.229	4.820	11.00

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

Sub-category		**Crude protein**	**Crude fat**	**Crude fibre**	**Nitrogen-free extracts**	**DM kg/day**
Breeding sows	Mated	0.273	0.069	0.142	1.207	1.805
	Nursing young	0.919	0.171	0.330	2.944	4.671
Replacement sows	Mated	0.305	0.078	0.150	1.231	1.893
	Nursing young	1.056	0.196	0.384	3.431	5.427
Piglets < 2 months (< 20 kg)		0.156	0.014	0.026	0.429	0.678
Growing pigs (20-50 kg)		0.305	0.052	0.078	0.997	1.529
Growing pigs (50-80 kg)		0.385	0.073	0.115	1.582	2.280
Growing pigs (80-110 kg)		0.418	0.078	0.125	1.736	2.497
Pigs > 110 kg (8 months and >)		0.408	0.077	0.122	1.683	2.428
Gilts for breed		0.341	0.073	0.138	1.221	1.935
Boars	Mature	0.390	0.080	0.166	1.350	2.123
	Young for breed	0.392	0.086	0.161	1.347	2.180

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

Sub-category	**Crude**	**Crude**	**Crude fiber**	**Nitrogen-**	**DM**

	protein	fat		free extracts	kg/day
Mature ewes	0.255	0.056	0.461	0.883	1.784
Ewe over 1 years	0.216	0.048	0.377	0.765	1.514
Ewe to 1 years	0.134	0.033	0.214	0.461	0.902
Lambs to 1 years	0.118	0.030	0.165	0.406	0.768
Mature Rams	0.274	0.062	0.492	0.998	1.962
Rams over 1 years	0.248	0.056	0.439	0.886	1.751

Agricultural soils

All activity data used to estimated 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.5-40. Harvested annual dry matter yield

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
CROP (T)	**kg d.m. ha^{-1}**											
Winter Wheat	2,908.9	2,092.4	3,047.2	3,299.6	2,892.9	2,818.1	4,398.3	3,875.2	4,089.1	4,853.3	4,033.1	4,444.9
Spring Wheat	2,182.1	2,167.5	2,239.1	2,770.8	2,603.2	2,948.0	3,304.7	3,151.8	3,666.8	3,580.2	2,908.4	2,986.3
Triticale	2,144.3	1,785.4	2,221.4	2,305.3	2,022.5	2,134.0	3,103.1	2,662.0	2,797.0	3,264.1	2,791.8	2,775.4
Rye	2,421.6	1,536.2	2,023.0	1,839.8	1,493.9	1,720.2	2,381.2	1,660.4	1,913.1	2,361.6	2,020.7	2,070.8
Barley	2,576.5	1,410.0	2,095.9	2,337.4	2,016.8	2,555.7	2,902.0	2,788.0	3,242.4	3,408.0	2,686.5	3,119.7
Oats	2,206.5	1,228.0	1,633.1	1,670.7	1,380.9	1,728.2	1,962.9	1,902.1	2,058.4	2,166.8	1,862.1	2,191.0
Grain maize	2,513.2	2,513.2	2,513.2	2,689.2	5,686.6	6,366.1	5,192.2	6,286.0	5,144.7	4,097.4	5,908.9	4,893.9
Maize for silage	9,767.6	8,975.0	9,803.4	8,561.2	10,102.8	11,500.2	10,305.7	10,311.2	10,280.2	9,212.3	11,417.1	9,271.4
Winter Rape	2,059.9	1,267.0	2,051.3	2,338.3	1,819.8	1,642.3	3,110.3	2,281.2	2,507.0	3,222.9	2,578.0	2,865.8
Spring Rape	930.8	1,265.2	1,283.8	1,487.0	1,345.5	1,784.4	1,841.5	1,670.0	1,782.1	1,780.2	1,553.7	1,962.9
Silage crops excl. maize	5,700.7	4,593.8	5,434.5	5,513.7	3,054.5	4,725.0	4,608.3	4,675.0	5,133.3	4,471.3	3,697.4	3,736.0
Flax	434.1	450.6	287.3	425.6	457.5	610.0	610.0	610.0	915.0	915.0	915.0	1,601.3
Buckwheat	574.1	516.7	762.6	476.1	619.8	812.5	767.3	788.7	809.1	845.4	972.8	932.4
Mixed cereals	2,307.6	1,322.7	1,554.9	1,581.6	1,492.9	1,678.6	1,914.4	1,926.1	2,181.4	2,105.0	1,974.8	1,760.7
Other cereals	1,700.0	1,700.0	3,400.0	1,275.0	1,092.9	1,700.0	2,125.0	1,381.3	1,133.3	850.0	850.0	850.0
Vegetables	4,875.5	4,746.6	4,746.6	4,746.6	2,942.7	4,746.6	5,202.2	4,215.3	4,875.5	4,203.4	4,190.6	3,734.3
Potatoes	3,113.6	2,850.0	3,649.9	2,692.2	2,866.6	3,429.5	3,757.1	3,269.3	3,775.5	3,737.2	3,499.1	2,687.6
Sugar beet	6,563.7	6,579.9	7,349.5	8,780.6	10,623.6	11,471.3	12,015.1	12,566.8	13,724.2	11,679.1	14,125.3	12,870.6
Fodder beet	6,174.6	4,248.8	4,487.8	4,026.5	3,264.0	3,564.7	4,165.7	3,712.0	4,002.9	3,784.6	3,213.3	1,980.0
Peas	2,333.9	1,587.2	1,711.4	1,488.6	1,317.3	1,505.7	1,694.0	1,771.0	2,076.4	2,419.5	2,248.9	2,445.9
Beans	1,265.8	1,981.3	1,698.2	1,309.6	1,450.0	1,609.5	1,866.9	2,118.3	2,505.8	2,727.6	2,697.6	2,979.5
Soya beans	772.6	772.6	772.6	772.6	772.6	772.6	611.3	946.1	714.8	588.7	1471.7	1,094.9
Mixed dried pulses	1,626.5	1,626.5	1,626.5	1,617.6	1,444.3	1,678.6	1,742.2	1,643.5	1,900.3	1,973.4	1,759.3	1,818.9
Lupines	110.1	176.7	133.9	159.1	103.0	162.5	150.0	132.6	140.9	204.2	181.6	191.4
Vetches	551.0	427.0	386.0	398.0	340.0	368.0	350.0	526.0	495.0	495.0	427.0	276.0
Lucerne hay	IE	IE	IE	2,711.3	2,293.3	2,948.6	2,948.6	2,771.1	3,506.2	2,327.1	4,682.2	4,432.3
Lucerne haylage	IE	IE	IE	3,569.0	4,165.0	4,309.0	3,487.0	3,492.0	3,146.0	2,672.0	3,457.0	3,509.8
Clover and their mixture hay	IE	IE	IE	3,861.6	2,698.5	2,523.7	2,287.4	2,104.2	2,190.4	2,780.0	2,795.0	3,799.3
Clover and their mixture haylage	IE	IE	IE	868.2	3,357.7	2,995.6	2,852.3	2,742.0	2,620.4	2,368.2	2,828.9	2,514.4
Annual grasses hay	617.7	1,080.9	888.4	627.6	2,580.0	2,580.0	2,962.2	2,771.1	3,669.3	2,580.0	1,720.0	2.293.3
Annual grasses haylage	3,401.0	4,769.3	4,178.9	2,330.9	2,633.4	2,535.1	2,867.6	2,016.2	2,243.0	1,870.0	2,019.5	2,157.5
Perennial grasses hay	2,805.6	3,149.8	2,682.1	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses haylage	2,342.2	2,629.6	2,239.1	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses (excl. liucerne, clover and their mixture) hay	IE	IE	IE	2,807.0	2,357.0	2,242.0	2,521.0	2,339.0	2,384.0	2,272.0	2,421.0	2,809.2
Perennial grasses (excl. liucerne, clover and their mixture) haylage	IE	IE	IE	1,078.0	2,544.0	2,308.0	2,484.0	2,340.0	2,170.0	1,863.0	1,972.0	1,787.1

Meadows pasture hay	986.9	2,706.3	2,339.4	2,241.5	1,974.0	1,971.2	2,036.7	1,839.3	1,942.7	2,054.4	2,107.5	2,387.3
Meadows pasture haylage	520.7	1,427.9	1,234.4	697.2	2,066.5	1,735.2	1,632.3	1,530.4	1,484.1	1,402.8	1,285.1	1,245.8
Meadows and natural pastures hay	3,261.2	3,261.2	3,261.2	2,061.4	1,738.0	1,722.6	1,973.1	1,942.6	1,947.6	1,941.9	1,943.1	2,599.7
Meadows and natural pastures haylage	2,192.9	2,192.9	21,92.9	849.9	1,738.7	1,529.6	1,433.4	1,269.1	1,233.8	1,365.2	1,459.4	1,695.8

Table A.5-41. Total annual area harvested

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017
AREA (T)	**ha yr^{-1}**											
Winter Wheat	343,728.0	248,496.0	283,216.0	295,913.6	36,7400.0	275,200.0	436,200.0	466,000.0	355,000.0	573,000.0	628,600.0	620,600.0
Spring Wheat	2,882.6	10,039.4	84,390.6	70,772.8	150,200.0	275,900.0	190,800.0	201,400.0	353,000.0	263,200.0	251,900.0	191,300.0
Triticale	13,356.9	22,185.0	50,088.8	74,147.2	108,600.0	94,400.0	119,100.0	144,900.0	120,100.0	122,000.0	100,900.0	75,800.0
Rye	165,045.7	132,410.1	130,837.3	50,034.7	49,500.0	42,000.0	55,900.0	49,400.0	37,900.0	38,800.0	32,600.0	25,900.0
Barley	394,701.3	537,421.5	348,608.4	344,857.8	231,800.0	252,700.0	217,300.0	209,300.0	267,000.0	202,400.0	172,500.0	141,600.0
Oats	75,387.6	46,167.6	43,148.2	58,050.4	57,800.0	63,200.0	70,800.0	73,600.0	75,900.0	64,100.0	70,800.0	76,000.0
Grain maize	2,807.2	2,807.2	2,807.2	1,548.8	7,100.0	9,600.0	12,900.0	17,200.0	19,000.0	11,700.0	12,400.0	9,900.0
Maize for silage	77,800.0	4,200.0	10,300.0	13,900.0	17,800.0	21,100.0	22,700.0	22,800.0	28,500.0	29,300.0	26,600.0	24,300.0
Winter Rape	10,616.4	3,538.8	5,308.2	28,408.7	89,300.0	23,400.0	77,900.0	116,600.0	104,200.0	123,100.0	123,800.0	157,500.0
Spring Rape	393.2	10,124.9	49,248.3	79,131.5	162,600.0	226,800.0	182,900.0	142,400.0	110,900.0	40,400.0	29,800.0	23,400.0
Silage crops excl. maize	82,700.0	13,600.0	5,500.0	7,300.0	1,100.0	1000.0	1,200.0	1,400.0	2,100.0	4,000.0	3,900.0	4,300.0
Flax	21,500.0	13,200.0	8,600.0	4,300.0	400.0	600.0	300.0	300.0	300.0	300.0	200.0	400.0
Buckwheat	296.1	987.0	16,384.2	28,030.8	19,200.0	27,200.0	33,900.0	30,500.0	37,400.0	36,700.0	43,600.0	48,500.0
Mixed cereals	6,888.0	15,744.0	10,824.0	20,959.2	19,700.0	23,800.0	22,200.0	20,300.0	22,600.0	17,000.0	13,300.0	9,800.0
Other cereals	100.0	100.0	200.0	200.0	700.0	700.0	600.0	800.0	900.0	200.0	100.0	100.0
Vegetables	13,311.5	17,089.0	15,267.4	17,112.1	14,100.0	14,600.0	13,000.0	13,100.0	12,400.0	11,300.0	12,400.0	11,500.0
Potatoes	111,150.0	123,006.0	107,988.4	73,112.0	36,600.0	37,700.0	32,200.0	28,700.0	27,300.0	23,500.0	22,100.0	19,400.0
Sugar beet	31,971.6	24,202.8	27,589.2	20,916.0	15,300.0	17,600.0	19,200.0	17,700.0	17,000.0	12,200.0	15,200.0	17,100.0
Fodder beet	52,060.8	61,822.2	37,418.7	11,196.9	1,500.0	1,700.0	1,400.0	1,500.0	1,400.0	1,300.0	900.0	800.0
Peas	40,849.6	11,325.6	24,393.6	11,906.4	27,100.0	26,500.0	24,000.0	24,000.0	40,900.0	79,400.0	148,700.0	154,200.0
Beans	3,161.6	1,185.6	1,383.2	3,853.2	3,000.0	4,000.0	4,800.0	6,900.0	21,700.0	61,400.0	67,500.0	67,100.0
Soya beans	800.0	800.0	800.0	800.0	800.0	800.0	2,600.0	1,400.0	2,100.0	2,700.0	1,800.0	2,500.0
Mixed dried pulses	8,183.6	8,183.6	8,183.6	12,075.8	7,600.0	6,900.0	6,400.0	7,100.0	13,600.0	11,300.0	11,300.0	11,500.0
Lupines	2,451.8	848.7	1,791.7	4,620.7	9,900.0	6,000.0	5,100.0	4,300.0	3,300.0	3,600.0	3,800.0	2,900.0
Vetches	27,200.0	9,800.0	10,000.0	2,600.0	2,100.0	2,000.0	2,100.0	2,100.0	2,000.0	1,300.0	700.0	500.0
Lucerne hay	IE	IE	IE	951.6	600.0	700.0	700.0	900.0	1,300.0	1,700.0	1,800.0	1,300.0
Lucerne haylage	IE	IE	IE	3,384.4	3,000.0	2,900.0	3,300.0	3,100.0	3,000.0	5,500.0	6,300.0	4,300.0
Clover and their mixture hay	IE	IE	IE	60,278.0	15,700.0	15,400.0	17,100.0	17,400.0	17,400.0	14,100.0	11,100.0	9,900.0
Clover and their mixture haylage	IE	IE	IE	100,502.2	18,300.0	26,900.0	27,800.0	28,200.0	29,900.0	28,000.0	20,300.0	20,800.0
Annual grasses hay	9,328.1	3,898.5	2,226.4	5,755.3	500.0	700.0	900.0	900.0	1,500.0	300.0	400.0	600.0
Annual grasses haylage	93,131.0	38,921.7	22,228.4	57,460.0	6,700.0	6,500.0	5,800.0	7,300.0	9,200.0	7,600.0	7,800.0	5,700.0
Perennial grasses hay	257,946.1	168,269.3	109,981.8	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses haylage	212,601.7	138,689.3	90,648.1	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses (excl. liucerne, clover and their mixture) hay	IE	IE	IE	122,448.2	232,900.0	246,400.0	220,900.0	228,200.0	228,400.0	158,700.0	107,300.0	71,300.0

Perennial grasses (excl. liucerne, clover and their mixture) haylage	IE	IE	IE	90,511.9	150,100.0	169,400.0	173,000.0	143,800.0	154,100.0	120,500.0	101,800.0	82,800.0
Meadows pasture hay	373,976.8	322,984.8	394,776.9	36,7821.7	209,600.0	201,300.0	166,200.0	183,800.0	181,100.0	273,100.0	385,700.0	348,100.0
Meadows pasture haylage	185,565.1	160,263.2	195,886.0	18,2511.0	68,400.0	61,200.0	51,700.0	66,700.0	76,300.0	237,500.0	307,200.0	305,700.0
Meadows and natural pastures hay	244,746.8	150,721.1	86,924.9	82,510.0	99,400.0	88,900.0	66,400.0	77,200.0	79,700.0	95,500.0	37,000.0	34,400.0
Meadows and natural pastures haylage	81,850.2	50,405.3	29,070.1	27,593.6	21,700.0	25,500.0	19,400.0	28,100.0	34,700.0	30,200.0	16,100.0	14,400.0

Table A.5-42. Ratio of above-ground residues dry matter to harvested yield

	1990	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
$R_{AG(T)}$	**kg d.m.**											
Winter Wheat	1.75	1.80	1.74	1.73	1.75	1.75	1.70	1.71	1.71	1.69	1.71	1.70
Spring Wheat	1.63	1.64	1.62	1.56	1.58	1.54	1.52	1.53	1.49	1.50	1.55	1.54
Triticale	1.50	1.58	1.49	1.47	1.53	1.50	1.37	1.42	1.40	1.36	1.41	1.41
Rye	1.45	1.66	1.52	1.57	1.68	1.60	1.46	1.62	1.55	1.46	1.53	1.51
Barley	1.21	1.40	1.26	1.23	1.27	1.21	1.18	1.19	1.16	1.15	1.20	1.17
Oats	1.31	1.63	1.45	1.44	1.55	1.42	1.36	1.38	1.34	1.32	1.39	1.32
Grain maize	1.27	1.27	1.27	1.26	1.14	1.13	1.15	1.13	1.15	1.18	1.13	1.15
Maize for silage	1.09	1.10	1.09	1.10	1.09	1.08	1.09	1.09	1.09	1.10	1.08	1.10
Winter Rape	1.52	1.78	1.52	1.47	1.57	1.63	1.37	1.48	1.44	1.36	1.43	1.40
Spring Rape	2.04	1.79	1.78	1.68	1.74	1.58	1.57	1.62	1.58	1.58	1.66	1.54
Silage crops excl. maize	1.24	1.28	1.25	1.25	1.38	1.28	1.28	1.28	1.26	1.29	1.33	1.33
Flax	3.12	3.04	4.15	3.16	3.01	2.53	2.53	2.53	2.05	2.05	2.05	1.64
Buckwheat	2.62	2.79	2.24	2.94	2.51	2.17	2.24	2.21	2.18	2.13	1.99	2.03
Mixed cereals	1.47	1.76	1.66	1.65	1.68	1.61	1.55	1.55	1.49	1.51	1.54	1.59
Other cereals	1.61	1.61	1.35	1.78	1.90	1.61	1.50	1.73	1.87	2.13	2.13	2.13
Vegetables	0.32	0.32	0.32	0.32	0.46	0.32	0.30	0.35	0.32	0.35	0.35	0.38
Potatoes	0.44	0.47	0.39	0.49	0.47	0.41	0.38	0.42	0.38	0.38	0.40	0.49
Sugar beet	0.26	0.26	0.24	0.22	0.20	0.19	0.19	0.18	0.18	0.19	0.18	0.18
Fodder beet	0.27	0.35	0.34	0.36	0.42	0.40	0.35	0.39	0.36	0.38	0.43	0.64
Peas	1.49	1.67	1.63	1.70	1.78	1.69	1.63	1.61	1.54	1.48	1.51	1.48
Beans	0.90	0.70	0.76	0.88	0.83	0.78	0.72	0.68	0.63	0.61	0.61	0.59
Soya beans	2.68	2.68	2.68	2.68	2.68	2.68	3.14	2.36	2.82	3.22	1.85	2.16
Mixed dried pulses	1.65	1.65	1.65	1.66	1.72	1.64	1.62	1.65	1.58	1.56	1.61	1.60
Lupines	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vetches	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Lucerne hay	IE	IE	IE	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Lucerne haylage	IE	IE	IE	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Clover and their mixture hay	IE	IE	IE	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Clover and their mixture haylage	IE	IE	IE	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Annual grasses 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
Annual grasses 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
Perennial grasses hay	0.30	0.30	0.30	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses haylage	0.30	0.30	0.30	IE	IE	IE	IE	IE	IE	IE	IE	IE

Perennial grasses (excl. liucerne, clover and their mixture) hay	IE	IE	IE	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Perennial grasses (excl. liucerne, clover and their mixture) haylage	IE	IE	IE	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Meadows pasture 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
Meadows pasture 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
Meadows and natural pastures 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
Meadows and natural pastures 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

Table A.5-43. Ratio of below-ground residues to harvested yield

	1990	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
$R_{BG(T)}$	**kg d.m.**											
Winter Wheat	0.63	0.64	0.63	0.63	0.63	0.63	0.62	0.62	0.62	0.62	0.62	0.62
Spring Wheat	0.74	0.74	0.73	0.72	0.72	0.71	0.70	0.71	0.70	0.70	0.71	0.71
Triticale	0.55	0.57	0.55	0.54	0.56	0.55	0.52	0.53	0.53	0.52	0.53	0.53
Rye	0.54	0.59	0.56	0.57	0.59	0.57	0.54	0.58	0.56	0.54	0.56	0.55
Barley	0.49	0.53	0.50	0.49	0.50	0.49	0.48	0.48	0.48	0.47	0.48	0.48
Oats	0.58	0.66	0.61	0.61	0.64	0.61	0.59	0.59	0.59	0.58	0.60	0.58
Grain maize	0.50	0.50	0.50	0.50	0.47	0.47	0.47	0.47	0.47	0.48	0.47	0.47
Maize for silage	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Winter Rape	0.55	0.61	0.55	0.54	0.57	0.58	0.52	0.54	0.54	0.52	0.53	0.53
Spring Rape	0.67	0.61	0.61	0.59	0.60	0.57	0.56	0.58	0.57	0.57	0.58	0.56
Silage crops excl. maize	0.49	0.50	0.50	0.49	0.52	0.50	0.50	0.50	0.50	0.50	0.51	0.51
Flax	0.91	0.89	1.13	0.91	0.88	0.78	0.78	0.78	0.67	0.67	0.67	0.58
Buckwheat	0.80	0.83	0.71	0.87	0.77	0.70	0.71	0.71	0.70	0.69	0.66	0.67
Mixed cereals	0.54	0.61	0.58	0.58	0.59	0.58	0.56	0.56	0.55	0.55	0.56	0.57
Other cereals	0.57	0.57	0.52	0.61	0.64	0.57	0.55	0.60	0.63	0.69	0.69	0.69
Vegetables	0.26	0.26	0.26	0.26	0.29	0.26	0.26	0.27	0.26	0.27	0.27	0.28
Potatoes	0.29	0.29	0.28	0.30	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.30
Sugar beet	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Fodder beet	0.25	0.27	0.27	0.27	0.28	0.28	0.27	0.28	0.27	0.28	0.29	0.33
Peas	0.47	0.51	0.50	0.51	0.53	0.51	0.50	0.50	0.48	0.47	0.48	0.47
Beans	0.36	0.32	0.33	0.36	0.35	0.34	0.33	0.32	0.31	0.31	0.31	0.30
Soya beans	0.70	0.70	0.70	0.70	0.70	0.70	0.79	0.64	0.73	0.80	0.54	0.60
Mixed dried pulses	0.50	0.50	0.50	0.50	0.52	0.50	0.50	0.50	0.49	0.49	0.50	0.49
Lupines	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Vetches	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Lucerne hay	IE	IE	IE	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Lucerne haylage	IE	IE	IE	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Clover and their mixture hay	IE	IE	IE	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Clover and their mixture haylage	IE	IE	IE	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Annual grasses hay	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 haylage	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70

Perennial grasses hay	1.04	1.04	1.04	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses haylage	1.04	1.04	1.04	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses (excl. liucerne, clover and their mixture) hay	IE	IE	IE	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Perennial grasses (excl. liucerne, clover and their mixture) haylage	IE	IE	IE	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Meadows pasture hay	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Meadows pasture haylage	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Meadows and natural pastures hay	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Meadows and natural pastures haylage	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04

Table A.5-44. Other relavant parameters used for annual N in crop residues

	DRY	$N_{AG(T)}$	$N_{BG(T)}$	$R_{BG\text{-}BIO(T)}$	$Frac_{REMOVE}$	$Frac_{RENEW}$	Area burnt	Slope	Intercept	Emission factor
	kg d.m.	kg N	kg N	kg d.m.	kg N					kg N_2O-N
Winter Wheat	0.85	0.0051	0.0315	0.23	0	1	0	1.61	0.4	0.01
Spring Wheat	0.85	0.0051	0.0315	0.28	0	1	0	1.29	0.75	0.01
Triticale	0.85	0.0051	0.009	0.22	0	1	0	1.09	0.88	0.01
Rye	0.85	0.0067	0.011	0.22	0	1	0	1.09	0.88	0.01
Barley	0.85	0.0096	0.014	0.22	0	1	0	0.98	0.59	0.01
Oats	0.85	0.0074	0.008	0.25	0	1	0	0.91	0.89	0.01
Grain maize	0.85	0.009	0.007	0.22	0	1	0	1.03	0.61	0.01
Maize for silage	0.35	0.0073	0.007	0.22	0	1	0	1.03	0.61	0.01
Winter Rape	0.915	0.0062	0.0045	0.22	0	1	0	1.09	0.88	0.01
Spring Rape	0.915	0.0086	0.0055	0.22	0	1	0	1.09	0.88	0.01
Silage crops excl. maize	0.35	0.006	0.009	0.22	0	1	0	1.09	0.88	0.01
Flax	0.915	0.0061	0.009	0.22	0	1	0	1.09	0.88	0.01
Buckwheat	0.85	0.0064	0.009	0.22	0	1	0	1.09	0.88	0.01
Mixed cereals	0.85	0.006	0.009	0.22	0	1	0	1.09	0.88	0.01
Other cereals	0.85	0.006	0.009	0.22	0	1	0	1.09	0.88	0.01
Vegetables	0.22	0.014	0.0114	0.2	0	1	0	0.1	1.06	0.01
Potatoes	0.22	0.014	0.0114	0.2	0	1	0	0.1	1.06	0.01
Sugar beet	0.23	0.0253	0.007	0.2	0	1	0	0.1	1.06	0.01
Fodder beet	0.12	0.0312	0.0073	0.2	0	1	0	0.1	1.06	0.01
Peas	0.84	0.0167	0.008	0.19	0	1	0	1.13	0.85	0.01
Beans	0.87	0.0079	0.01	0.19	0	1	0	0.36	0.68	0.01
Soya beans	0.883	0.008	0.008	0.19	0	1	0	0.93	1.35	0.01
Mixed dried pulses	0.864	0.008	0.008	0.19	0	1	0	1.13	0.85	0.01
Lupines	0.15	0.0136	0.022	0.4	0	1	0	0.3	0	0.01
Vetches	0.23	0.0129	0.022	0.4	0	1	0	0.3	0	0.01
Lucerne hay	0.86	0.027	0.019	0.4	0	0.2	0	0.29	0	0.01
Lucerne haylage	0.22	0.027	0.05	0.4	0	0.2	0	0.29	0	0.01
Clover and their mixture hay	0.834	0.025	0.016	0.8	0	0.2	0	0.3	0	0.01

Clover and their mixture haylage	0.201	0.025	0.016	0.8	0	0.2	0	0.3	0	0.01
Annual grasses hay	0.86	0.015	0.012	0.54	0	1	0	0.3	0	0.01
Annual grasses haylage	0.22	0.015	0.012	0.54	0	1	0	0.3	0	0.01
Perennial grasses hay	0.86	0.015	0.012	0.8	0	0.2	0	0.3	0	0.01
Perennial grasses haylage	0.22	0.015	0.012	0.8	0	0.2	0	0.3	0	0.01
Perennial grasses (excl. liucerne, clover and their mixture) hay	0.86	0.015	0.012	0.8	0	0.2	0	0.3	0	0.01
Perennial grasses (excl. liucerne, clover and their mixture) haylage	0.22	0.015	0.012	0.8	0	0.2	0	0.3	0	0.01
Meadows pasture hay	0.86	0.015	0.012	0.8	0	0.125	0	0.3	0	0.01
Meadows pasture haylage	0.22	0.015	0.012	0.8	0	0.125	0	0.3	0	0.01
Meadows and natural pastures hay	0.835	0.015	0.012	0.8	0	0.125	0	0.3	0	0.01
Meadows and natural pastures haylage	0.22	0.015	0.012	0.8	0	0.125	0	0.3	0	0.01

*Country specific values are provided in green

ANNEX VIII. Summary of the reports 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.

LITHUANIAN RESEARCH CENRE FOR AGRICULTURE AND FORESTRY

SHORT REPORT

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"

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 ± 0.02 g cm^{-3} in *Arenosols*, 1.24 ± 0.02 g cm^{-3} in *Luvisols*, and 0.33 ± 0.02 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 ± 0.03 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 340–360 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.*

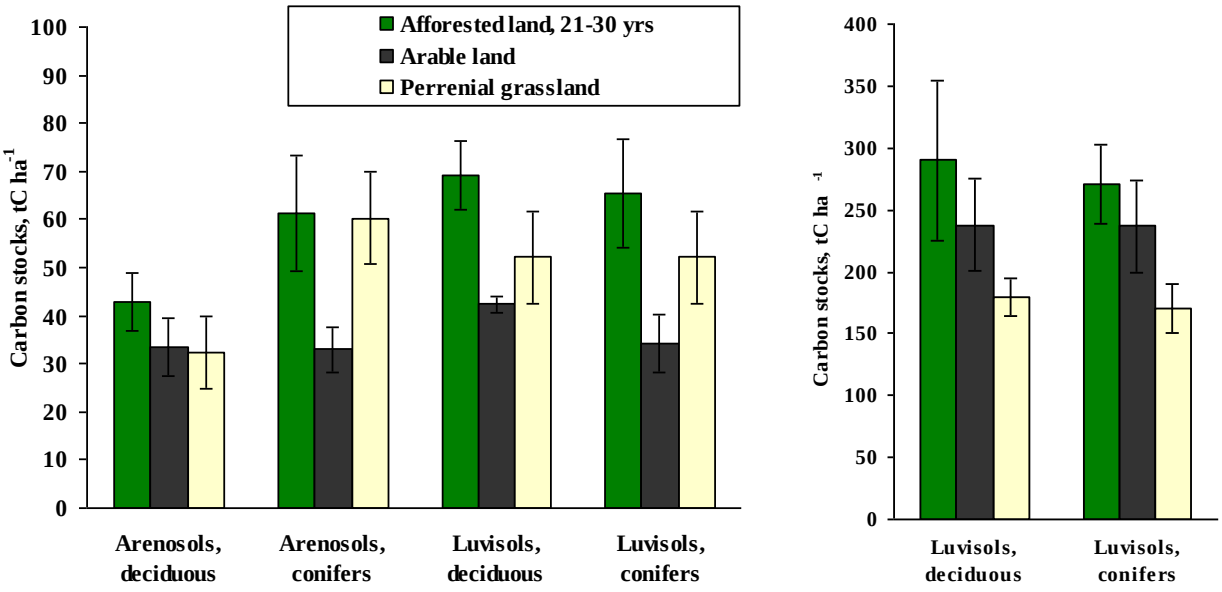


Fig.1. Stocks (t ha^{-1}) of organic carbon in 0–30 cm mineral soil/peat layer in the afforested land in the 21-30-year old coniferous and deciduous forest plantations and the control (arable land and grassland).

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***	
	n	**tC ha^{-1}**	***n***	**tC ha^{-1}**	***n***	**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. Superviser - 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) ant to move to higher Tiers for estimation of carbons 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**).

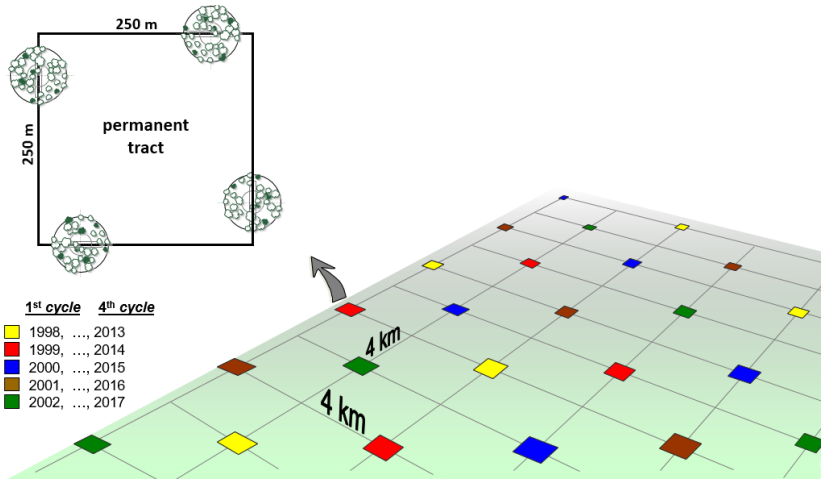


Fig. 1. National Forest Inventory permanent sample plots grid in Lithuania

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

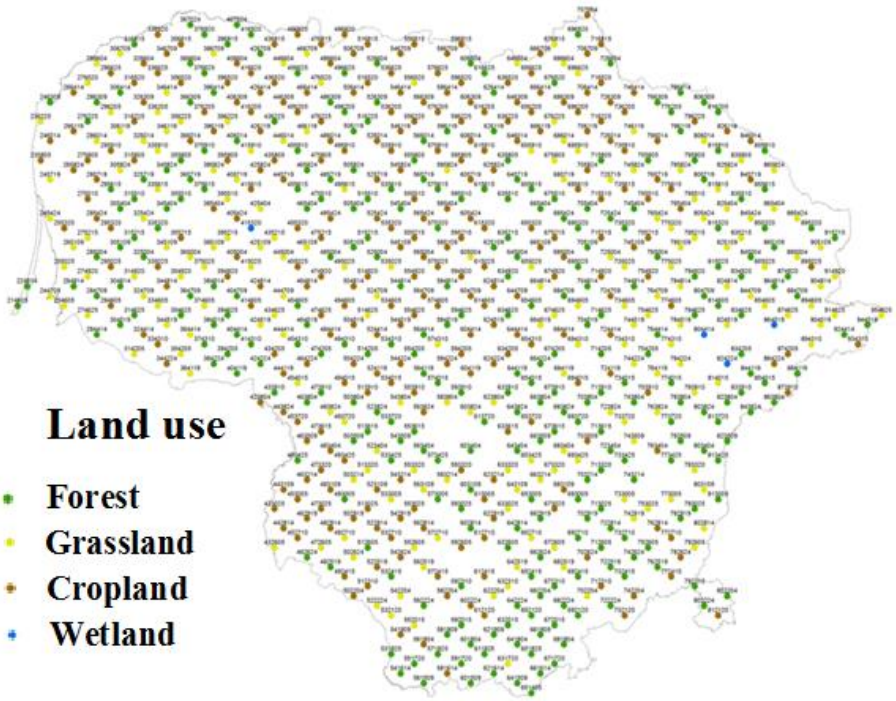


Fig. 2. Sample plots in the grid (9x9 km) of Lithuanian National Forest Inventory (NFI) (Total N=752; forest land – 298; grassland – 206; cropland – 244; wetland – 4)

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):

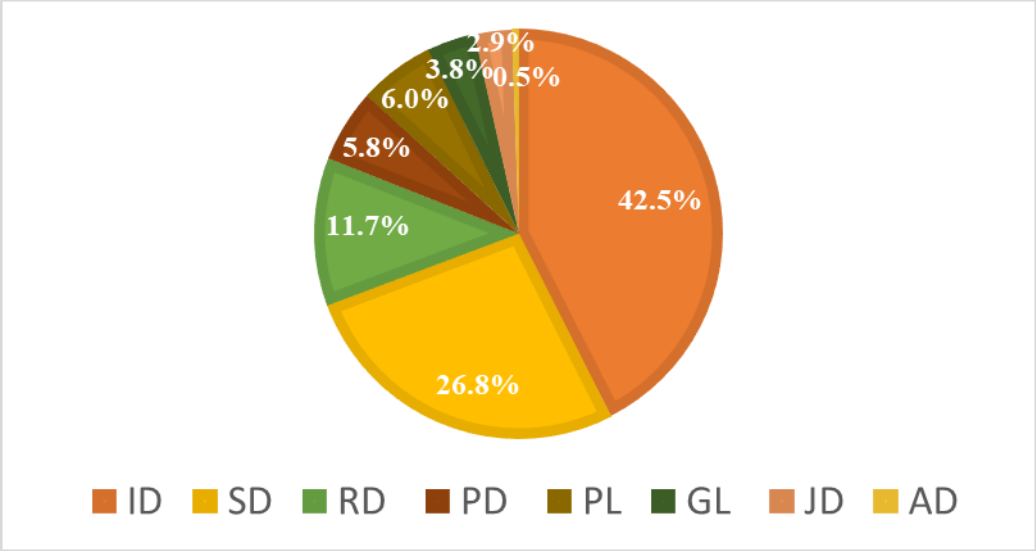
$$\mathrm{SOC_i} = \mathrm{p_i}(1 - (\frac{Qi,2mm}{100}))d_i C_i * 10^{-1}$$

where p_i is the bulk density of the <2 mm fraction in g cm^{-3}, $Q_{i,\ 2\ mm}$ is the relative volume of the fraction ≥ 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} × 10^8 cm^2 ha^{-1})

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

Results and Disscusion

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: LTDK-99 (*WRB, 2014*)	**Number of sample plots (n)**	**Mean mass, t ha^{-1}**	**Mean OC stocks (tC ha^{-1})**
Rudžemiai (*Cambisols*)	8	4,1±0,6	1,6±0,2
Išplautžemiai ir balkšvažemiai (*Luvisols + Retisols*)	130	13,6±2,8	5,6±1,2
Palvažemiai (*Planosols*)	26	22,9±8,7	9,5±3,7
Smėlžemiai (*Arenosols*)	92	15,7±1,6	6,3±0,7
Jauražemiai (*Podzols*)	21	58,1±15,5	25,0±6,7
Šlynžemiai (*Gleysols*)	20	14,4±6,7	6,3±3,2
Durpžemiai (*Histosols*)	37	12,7±2,5	5,3±1,1
Salpžemiai (*Fluvisols*)	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.

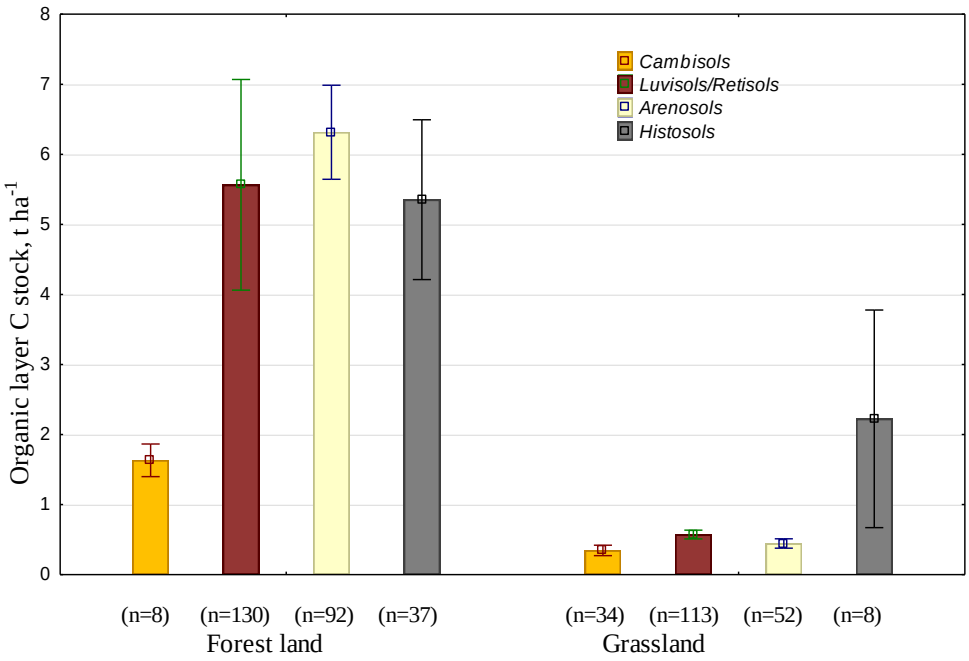


Fig. 4. Mean organic layer stocks of carbon in organic layer of different mineral soils in forest land and grassland (the bars represent SE)

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 sotcks of soil organic carbon (SOC) in surface 0-30 cm layer of major soil groups in forests

Major soil groups: LTDK-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 (*Cambisols*)	**75**	**95**	**118 (n=8)**
Išplautžemiai/balkšvažemiai (*Luvisols+Retisols*)	**73**	**95**	**96 (n=130)**
Palvažemiai (*Planosols*)	**45**	**95 (?)**	**81 (n=26)**
Smėlžemiai (*Arenosols*)	**50**	**71**	**58 (n=92)**
Jauražemiai (*Podzols*)	**63**	**115**	**100 (n=21)**
Šlynžemiai (*Gleysols*)	**94**	**87**	**106 (n=20)**
Durpžemiai (*Histosols*)	**181**	**-**	**154 (n=37)**
Salpžemiai (*Fluvisols*)	**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, grasslan and cropland

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

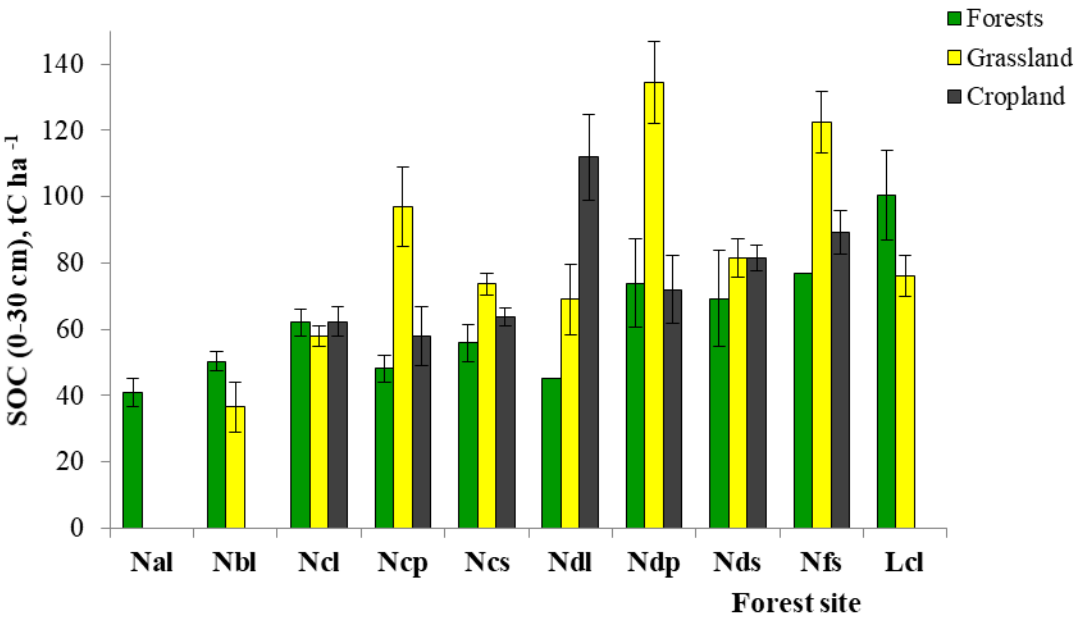


Fig. 5. Mean sotcks of soil organic carbon (SOC) in surface 0-30 cm layer of different forest sites (according Lithuanian classification, Vaičys et al., 2006)

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/Retisols

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

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 IX. CO_2 emissions from the installations registered in the GHG Emission Allowance Registry, 2017

Table 5-1. *CO_2* emissions from the installations registered in the GHG Emission Allowance Registry, 2017

No	*Company*	*Name of the Installation*	*Allocated EUA*	*Verified Emissions, t CO_2*	*Corresponding CRF Sector (Fuel combustion)*
1	AB "Akmenės cementas"	Boiler house, cement production furnace	591,319	734,960	1.A.2.F Non-Metallic Minerals
2	AB "Naujasis kalcitas"	Whitewash production furnace	42,800	25,236	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	7,725	1,910	1.A.2.F Non-Metallic Minerals
5	AB "Palemono keramika"	Boiler house, ceramics combustion furnace	7,604	2,936	1.A.2.F Non-Metallic Minerals
6	AB "Dvarčionių keramika"	Boiler house, ceramics combustion furnace	0	53	1.A.2.F Non-Metallic Minerals
7	UAB "Kauno stiklas"	Glass melting furnace	5,384	14,031	1.A.2.F Non-Metallic Minerals
8	AB "Panevėžio stiklas"	Glass melting furnace	10,202	15,216	1.A.2.F Non-Metallic Minerals
9	AB "ORLEN Lietuva"	Oil refining factory	1,306,788	1,709,530	1.A.1.B Petroleum Refining / 1.A.1.A Public electricity and heat production
10	AB "Grigeo Klaipėda"	Boiler house	22,879	12,115	1.A.2. D Pulp, Paper and Print
11	AB "Grigeo Grigiškės"	Boiler house	32,143	7,344	1.A.2. D Pulp, Paper and Print
12	AB "Simega"	Boiler house	2,257	0	1.A.1.A Public electricity and heat production
13	AB "Achema"	Boiler houses, CHP	1,898,435	2,834,041	1.A.2.C Chemicals / 1.A.1.A Public electricity and heat production
14	AB "Nordic Sugar Kėdainiai"	Boiler house, oilcake desiccation	27,387	27,607	1.A.2.E Food processing, Beverages and Tobacco
15	AB "Lifosa"	Boiler house	157,199	305	1.A.2.C Chemicals
16	AB "Klaipėdos nafta"	Boiler house	10,780	19,228	1.A.1.A Public electricity and heat production
17	UAB "Lietuvos cukrus"	Boiler house	12,143	15,819	1.A.2.E Food processing, Beverages and Tobacco
18	UAB "Idavang Pasodėlė"	Boiler house	1,059	0	1.A.4.C Agriculture/ Forestry/ Fisheries
19	AB "Klaipėdos mediena"	Boiler house	13,964	93	1.A.2.G.iv Wood and Wood Products
20	UAB "Matuizų plytinė"	Boiler house	5,126	0	1.A.2.F Non-Metallic Minerals
21	AB "Jonavos šilumos tinklai"	Jonava boiler house	12,861	4,851	1.A.1.A Public electricity and heat production
22	AB "Jonavos šilumos tinklai"	Girele boiler house	3,022	0	1.A.1.A Public electricity and heat production
23	UAB "Mažeikių šilumos tinklai"	Mazeikiai boiler house	13,676	177	1.A.1.A Public electricity and heat production
24	UAB "Raseinių šilumos tinklai"	Raseiniai boiler house No 4	3,366	2,991	1.A.1.A Public electricity and heat production
25	UAB "Molėtų šiluma"	Moletai boiler house	2,387	0	1.A.1.A Public electricity and heat production

No	Company	Name of the Installation	Allocated EUA	Verified Emissions, t CO_2	Corresponding CRF Sector (Fuel combustion)
26	UAB "Šilutės šilumos tinklai"	Šilute boiler house	6,561	116	1.A.1.A Public electricity and heat production
27	UAB "Vilniaus šilumos tinklai"	Vilnius power plant No 2 (E-2)	-	323,779	1.A.1.A Public electricity and heat production
28	UAB "Vilniaus energija"	Vilnius power plant No 3 (E-3)	-	0	1.A.1.A Public electricity and heat production
29	UAB "Vilniaus šilumos tinklai"	Vilnius boiler house No 2	7,575	4,598	1.A.1.A Public electricity and heat production
30	UAB "Vilniaus šilumos tinklai"	Vilnius boiler house No 8	576	2,101	1.A.1.A Public electricity and heat production
31	UAB "Širvintų šiluma"	Širvintu boiler house No 3	2,589	0	1.A.1.A Public electricity and heat production
32	AB "Šiaulių energija"	Šiauliai southern boiler house	43,273	15,159	1.A.1.A Public electricity and heat production
33	AB "Klaipėdos energija"	Power plant	33,358	14,898	1.A.1.A Public electricity and heat production
34	UAB "Radviliškio šiluma"	Radviliškis city boiler house	5,365	305	1.A.1.A Public electricity and heat production
35	UAB "Utenos šilumos tinklai"	Utena boiler house	18,169	2,328	1.A.1.A Public electricity and heat production
36	UAB "Tauragės šilumos tinklai"	Taurage - Berže boiler house	5,220	86	1.A.1.A Public electricity and heat production
37	UAB "Šalčininkų šilumos tiklai"	Šalcininkai boiler house	2,224	65	1.A.1.A Public electricity and heat production
38	Pravieniškių pataisos namai-atviroji kolonija	Boiler house	1,667	525	1.A.1.A Public electricity and heat production
39	UAB "Varėnos šiluma"	Varena boiler house	4,415	0	1.A.1.A Public electricity and heat production
40	AB "Panevėžio energija"	Panevezio boiler house No 2	18,478	28,308	1.A.1.A Public electricity and heat production
41	AB "Panevėžio energija"	Rokiškio boiler house	11,390	2	1.A.1.A Public electricity and heat production
42	AB "Panevėžio energija"	Panevezio boiler house No 1	20,714	2,643	1.A.1.A Public electricity and heat production
43	AB "Panevėžio energija"	Pasvalio boiler house	3,098	495	1.A.1.A Public electricity and heat production
44	AB "Panevėžio energija"	Zarasai boiler house No 4	2,845	0	1.A.1.A Public electricity and heat production
45	UAB "GEOTERMA"	Klaipeda geothermal PP	12,262	1,728	1.A.1.A Public electricity and heat production
46	AB "Kauno energija"	Petrašiunai PP	3,082	2,487	1.A.1.A Public electricity and heat production
47	AB "Kauno energija"	Pergale boiler house	667	1,060	1.A.1.A Public electricity and heat production
48	AB "Kauno energija"	Šilkas boiler house	1,301	3,765	1.A.1.A Public electricity and heat production
49	AB "Kauno energija"	Noreikiškes region boiler house	0	173	1.A.1.A Public electricity and heat production
50	AB "Kauno energija"	Garliava boiler house	2,762	126	1.A.1.A Public electricity and heat production
51	AB "Kauno energija"	Jurbarkas boiler house	4,023	1,307	1.A.1.A Public electricity and heat production
52	UAB "Plungės šilumos tinklai"	Plunge boiler house No 1	5,145	373	1.A.1.A Public electricity and heat production
53	UAB "Birštono šiluma"	Birštonas region boiler house	1,933	881	1.A.1.A Public electricity and heat production

No	Company	Name of the Installation	Allocated EUA	Verified Emissions, t CO_2	Corresponding CRF Sector (Fuel combustion)
54	UAB "Litesko"	Druskininkai industry boiler house	11,576	1,540	1.A.1.A Public electricity and heat production
55	UAB "Litesko"	Boiler house of Biržai city hall	1,160	104	1.A.1.A Public electricity and heat production
56	UAB "Litesko"	Vilkaviškis boiler house	3,045	171	1.A.1.A Public electricity and heat production
57	UAB "Litesko"	Luoke boiler house	4,767	184	1.A.1.A Public electricity and heat production
58	UAB "Litesko"	Mackevicius boiler house	2,185	33	1.A.1.A Public electricity and heat production
59	UAB "Litesko"	Palanga boiler house	7,479	1,211	1.A.1.A Public electricity and heat production
60	UAB "Litesko"	Marijampole region boiler house	15,782	6,075	1.A.1.A Public electricity and heat production
61	UAB "Litesko"	Alytus boiler house	27,438	7,246	1.A.1.A Public electricity and heat production
62	AB "Lietuvos energijos gamyba"	Lietuvos PP	15,744	65,368	1.A.1.A Public electricity and heat production
63	UAB "Kauno termofikacijos elektrinė"	Kaunas PP	144,816	10,937	1.A.1.A Public electricity and heat production
64	UAB "Kaišiadorių šiluma"	Kaišiadoriai boiler house	3,582	0	1.A.1.A Public electricity and heat production
65	UAB "Kretingos šilumos tinklai"	Kretinga boiler house No 3	3,317	0	1.A.1.A Public electricity and heat production
66	AB "Klaipėdos energija"	Klaipeda region boiler house	29,140	13,905	1.A.1.A Public electricity and heat production
67	AB "Klaipėdos energija"	Lypkiai regiopn boiler house	16,660	2,138	1.A.1.A Public electricity and heat production
68	AB "Pagirių šiltnamiai"	Boiler house	0	10	1.A.4.C Agriculture/ Forestry/ Fisheries
69	UAB "Pramonės energija"	Boiler house	8,309	0	1.A.1.A Public electricity and heat production
70	Vį "Ignalinos atominė elektrinė"	Boiler house	3,519	4,299	1.A.1.A Public electricity and heat production
71	UAB "Trakų energija"	Lentvaris boiler house	1,296	0	1.A.1.A Public electricity and heat production
72	UAB "Gargždų plytų gamykla"	Boiler house	2,226	0	1.A.2.F Non-Metallic Minerals
73	UAB "Akmenės energija"	Zalgiris boiler house	3,168	889	1.A.1.A Public electricity and heat production
74	AB "Panevėžio energija"	Panevežys thermal PP	16,162	29,393	1.A.1.A Public electricity and heat production
75	UAB "IKEA Industry Lietuva"	Fuel combustion plants	37,491	19,056	1.A.2.G.iv Wood and wood products
76	UAB "NEO Group"	Boiler house	32,647	13,530	1.A.2.C Chemicals
77	AB "Panevėžio energija"	Kėdainiai region boiler house	60	332	1.A.1.A Public electricity and heat production
78	UAB "Paroc"	Plants producing stone-wool	32,234	65,867	1.A.2.F Non-Metallic Minerals
79	AB "Vilniaus GKG-3"	Boiler house	583	347	1.A.2.G.v Construction
80	AB "Vilniaus šilumos tinklai"	Boiler house No 7	1	0	
81	UAB "Agro Neveronys"	Boiler house	0	0	1.A.4.C Agriculture/ Forestry/ Fisheries

No	*Company*	*Name of the Installation*	*Allocated EUA*	*Verified Emissions, t* CO_2	*Corresponding CRF Sector (Fuel combustion)*
82	UAB "Pramonės energija"	Boiler house	14,583	0	1.A.1.A Public electricity and heat production
83	Vį "Visagino energija"	Thermal boiler house	37,615	18,809	1.A.1.A Public electricity and heat production
84	AB "Amilina"	Boiler house and driers	0	2,006	1.A.2.E Food processing, Beverages and Tobacco
85	UAB "Lignoterma"	Boiler house	0	0	1.A.2.E Food processing, Beverages and Tobacco
86	AB "Amber Grid"	Jauniūnų gas compressor station	0	2,149	1.A.3.E.i Pipeline transport
87	UAB "Hoegh LNG Klaipėda"	LNG ship	0	44,363	1.A.1.C.iii Other energy industries
88	UAB “Fortum Klaipėda”	Power plant	0	134,653	1.A.1.A Public electricity and heat production
89	UAB “Danpower Baltic Biruliškių”	Boiler house	0	2,970	1.A.1.A Public electricity and heat production
		Total	**4,885,783**	**6,283,339**	

ANNEX X. IMPROVEMENTS IN RESPONSE TO RECOMMENDATIONS/ENCOURAGEMENTS PROVIDED IN THE ARR 2018

Not applicable as Lithuania was not a subject of the UN review in 2018.