LITHUANIA'S NATIONAL INVENTORY REPORT 2018

GREENHOUSE GAS EMISSIONS 1990-2016

ANNEXES

VILNIUS, 2018

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 eqv.*	*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***	***4,169.59***	***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***	***0.57***
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***	***0.70***
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	***CO_2***	***1,475.67***	***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***	***0.80***
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***	***566.18***	***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***	***0.88***
3.D.2.2 Indirect N_2O Emissions from Managed Soils - Nitrogen leaching and run-off	***N_2O***	***432.67***	***0.01***	***0.88***
3.D.1.3 Direct N_2O Emissions from Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***420.61***	***0.01***	***0.89***
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	***CO_2***	***-413.03***	***0.01***	***0.90***
4.A Forest land, Emissions and removals from	***CO_2***	***404.61***	***0.01***	***0.90***

IPCC Category	***Greenhouse gas***	***GHG emissions, kt CO_2 eqv.***	***Level assessment***	***Cumulative total***
drainage and rewetting and other management of organic and mineral soils				
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***	***345.11***	***0.01***	***0.93***
3.B.1.3 Manure Management - Swine	***CH_4***	***329.25***	***0.01***	***0.93***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***268.06***	***0.00***	***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***	***251.74***	***0.00***	***0.95***
2.A.4 Other process use of carbonates	***CO_2***	***239.70***	***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	206.14	0.00	0.96
3.D.2.1 Indirect N_2O Emissions from Managed Soils - Atmospheric deposition	N_2O	175.35	0.00	0.96
1.A.1 Energy industries - Solid fuels	CO_2	174.05	0.00	0.97
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	144.72	0.00	0.98
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Total		***42,968.91***		

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

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eqv.*	*Level assessment*	*Cumulative total*
1.A.1.a Public electricity and heat production - Liquid Fuels	***CO_2***	***6,021.25***	***0.13***	***0.13***
1.A.1.a Public electricity and heat production - Gaseous Fuels	***CO_2***	***5,796.59***	***0.12***	***0.25***
1.A.3.b Road transportation	***CO_2***	***5,247.15***	***0.11***	***0.35***
3.A.1 Enteric Fermentation - Cattle	***CH_4***	***4,169.59***	***0.09***	***0.44***
1.A.2 Manufacturing industries and construction-Liquid fuels	***CO_2***	***3,873.72***	***0.08***	***0.52***
1.A.4 Other sectors - Solid fuels	***CO_2***	***2,760.55***	***0.06***	***0.58***
1.A.4 Other sectors - Liquid fuels	***CO_2***	***2,736.38***	***0.06***	***0.64***
1.A.2 Manufacturing industries and construction-Gaseous fuels	***CO_2***	***2,045.42***	***0.04***	***0.68***
2.A.1 Cement Production	***CO_2***	***1,668.07***	***0.03***	***0.71***
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***	***566.18***	***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***	***432.67***	***0.01***	***0.89***
3.D.1.3 Direct N_2O Emissions from Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***420.61***	***0.01***	***0.90***
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***	***0.91***
3.D.1.2 Direct N_2O Emissions from Managed Soils - Organic N Fertilizers	***N_2O***	***345.11***	***0.01***	***0.92***
3.B.1.3 Manure Management - Swine	***CH_4***	***329.25***	***0.01***	***0.93***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***268.06***	***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***	***251.74***	***0.01***	***0.94***
2.A.4 Other process use of carbonates	***CO_2***	***239.70***	***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	206.14	0.00	0.96
3.D.2.1 Indirect N_2O Emissions from Managed Soils - Atmospheric deposition	N_2O	175.35	0.00	0.96
1.A.1 Energy industries - Solid fuels	CO_2	174.05	0.00	0.97
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Total		***48,104.59***		

Approach 1 Level Assessment for 2016

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eqv.*	*Level assessment*	*Cumulative total*
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO_2	-9,907.76	0.26	0.26
1.A.3.b Road transportation	CO_2	5,186.13	0.14	0.40
2.B.1 Ammonia Production	CO_2	1,827.63	0.05	0.44
3.A.1 Enteric Fermentation - Cattle	CH_4	1,504.20	0.04	0.48
1.A.1.b Petroleum refining - Liquid Fuels	CO_2	1,420.50	0.04	0.52
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO_2	1,187.58	0.03	0.55
4.G Harvested wood products	CO_2	-1,043.37	0.03	0.58
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO_2	987.59	0.03	0.61
4.B.2 Land converted to cropland- carbon stock change in biomass	CO_2	870.42	0.02	0.63
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	CO_2	-774.61	0.02	0.65
5.A Solid Waste Disposal	CH_4	755.65	0.02	0.67
3.D.1.1 Direct N_2O Emissions from Managed Soils - Inorganic N Fertilizers	N_2O	750.37	0.02	0.69
4.A.2 Land converted to forest land - carbon stock change in biomass	CO_2	-718.75	0.02	0.71
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO_2	715.28	0.02	0.73
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO_2	695.79	0.02	0.74
4.E.2 Land converted to settlements	CO_2	667.52	0.02	0.76
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	CO_2	634.71	0.02	0.78
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	625.53	0.02	0.79
1.A.4 Other sectors - Gaseous fuels	CO_2	542.25	0.01	0.81
3.D.1.6 Direct N_2O Emissions from Managed Soils - Cultivation of organic soils	N_2O	518.22	0.01	0.82
2.A.1 Cement Production	CO_2	452.40	0.01	0.83
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO_2	433.87	0.01	0.85
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	CO_2	-432.55	0.01	0.86
3.D.1.4 Direct N_2O Emissions from Managed Soils - Crop Residues	N_2O	368.02	0.01	0.87
1.A.2 Manufacturing industries and construction-Solid fuels	CO_2	353.59	0.01	0.88
3.D.2.2 Indirect N_2O Emissions from Managed Soils - Nitrogen leaching and run-off	N_2O	306.49	0.01	0.88
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH_4	299.75	0.01	0.89
1.A.4 Other sectors - Liquid fuels	CO_2	289.39	0.01	0.90

IPCC Category	Greenhouse gas	GHG emissions, kt CO_2 eqv.	Level assessment	Cumulative total
1.A.4 Other sectors - Solid fuels	***CO_2***	***279.33***	***0.01***	***0.91***
1.A.1 Energy industries - Other fossil fuels	***CO_2***	***265.59***	***0.01***	***0.91***
4.A.2 Land converted to forest land - net carbon stock change in mineral soils	***CO_2***	***-229.85***	***0.01***	***0.92***
2.B.2 Nitric Acid Production	***N_2O***	***209.51***	***0.01***	***0.93***
3.D.1.3 Direct N_2O Emissions from Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***177.35***	***0.00***	***0.93***
1.A.3.c Railways	***CO_2***	***158.33***	***0.00***	***0.93***
3.D.1.2 Direct N_2O Emissions from Managed Soils - Organic N Fertilizers	***N_2O***	***151.43***	***0.00***	***0.94***
1.A.4 Other sectors - Biomass	***CH_4***	***143.68***	***0.00***	***0.94***
3.B.1.1 Manure Management - Cattle	***CH_4***	***137.96***	***0.00***	***0.95***
5.D Wastewater Treatment and Discharge	***CH_4***	***137.63***	***0.00***	***0.95***
1.A.1.a Public electricity and heat production - Liquid Fuels	***CO_2***	***130.93***	***0.00***	***0.95***
1.A.2 Manufacturing industries and construction-Liquid fuels	CO_2	107.65	0.00	0.96
3.D.2.1 Indirect N_2O Emissions from Managed Soils - Atmospheric deposition	N_2O	100.68	0.00	0.96
3.B.2 Manure Management - Indirect N_2O Emissions	N_2O	94.00	0.00	0.96
1.A.4 Other sectors - Peat	CO_2	90.46	0.00	0.96
3.A. Enteric Fermentation - Others	CH_4	82.14	0.00	0.97
3.B.2 Manure Management - Cattle	N_2O	77.22	0.00	0.97
1.A.3.e Other transportation	CO_2	72.62	0.00	0.97
3.B.1.3 Manure Management - Swine	CH_4	69.96	0.00	0.97
1.A.1.c Manufacture of solid fuels and other energy industries - Gaseous fuels	CO_2	58.24	0.00	0.97
4.C Grassland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO_2	57.24	0.00	0.97
4.B Cropland	N_2O	57.00	0.00	0.98
4.E Settlements	N_2O	54.37	0.00	0.98
4.F Other land	CO_2	53.00	0.00	0.98
2. D Non-energy products from fuels and solvent use	CO_2	50.87	0.00	0.98
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Total		***11,574.91***		

Approach 1 Level Assessment for 2016 using a subset (LULUCF was excluded from analysis)

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eqv.*	*Level assessment*	*Cumulative total*
1.A.3.b Road transportation	CO_2	***5,186.13***	***0.26***	***0.26***
2.B.1 Ammonia Production	CO_2	***1,827.63***	***0.09***	***0.35***
3.A.1 Enteric Fermentation - Cattle	CH_4	***1,504.20***	***0.08***	***0.42***
1.A.1.b Petroleum refining - Liquid Fuels	CO_2	***1,420.50***	***0.07***	***0.50***
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO_2	***987.59***	***0.05***	***0.54***
5.A Solid Waste Disposal	CH_4	***755.65***	***0.04***	***0.58***
3.D.1.1 Direct N_2O Emissions from Managed Soils - Inorganic N Fertilizers	N_2O	***750.37***	***0.04***	***0.62***
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO_2	***695.79***	***0.03***	***0.65***
2.F.1 Refrigeration and Air Conditioning Equipment	***HFCs***	***625.53***	***0.03***	***0.69***
1.A.4 Other sectors - Gaseous fuels	CO_2	***542.25***	***0.03***	***0.71***
3.D.1.6 Direct N_2O Emissions from Managed Soils - Cultivation of organic soils	N_2O	***518.22***	***0.03***	***0.74***
2.A.1 Cement Production	CO_2	***452.40***	***0.02***	***0.76***
3.D.1.4 Direct N_2O Emissions from Managed Soils - Crop Residues	N_2O	***368.02***	***0.02***	***0.78***
1.A.2 Manufacturing industries and construction-Solid fuels	CO_2	***353.59***	***0.02***	***0.80***
3.D.2.2 Indirect N_2O Emissions from Managed Soils - Nitrogen leaching and run-off	N_2O	***306.49***	***0.02***	***0.81***
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH_4	***299.75***	***0.01***	***0.83***
1.A.4 Other sectors - Liquid fuels	CO_2	***289.39***	***0.01***	***0.84***
1.A.4 Other sectors - Solid fuels	CO_2	***279.33***	***0.01***	***0.86***
1.A.1 Energy industries - Other fossil fuels	CO_2	***265.59***	***0.01***	***0.87***
2.B.2 Nitric Acid Production	N_2O	***209.51***	***0.01***	***0.88***
3.D.1.3 Direct N_2O Emissions from Managed Soils - Urine and dung deposited by grazing animals	N_2O	***177.35***	***0.01***	***0.89***
1.A.3.c Railways	CO_2	***158.33***	***0.01***	***0.90***
3.D.1.2 Direct N_2O Emissions from Managed Soils - Organic N Fertilizers	N_2O	***151.43***	***0.01***	***0.90***
1.A.4 Other sectors - Biomass	CH_4	***143.68***	***0.01***	***0.91***
3.B.1.1 Manure Management - Cattle	CH_4	***137.96***	***0.01***	***0.92***
5.D Wastewater Treatment and Discharge	CH_4	***137.63***	***0.01***	***0.92***
1.A.1.a Public electricity and heat production - Liquid Fuels	CO_2	***130.93***	***0.01***	***0.93***
1.A.2 Manufacturing industries and construction-Liquid fuels	CO_2	***107.65***	***0.01***	***0.94***
3.D.2.1 Indirect N_2O Emissions from Managed Soils - Atmospheric deposition	N_2O	***100.68***	***0.01***	***0.94***
3.B.2 Manure Management - Indirect N_2O Emissions	N_2O	***94.00***	***0.00***	***0.95***

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eqv.*	*Level assessment*	*Cumulative total*
1.A.4 Other sectors - Peat	***CO_2***	***90.46***	***0.00***	***0.95***
3.A. Enteric Fermentation - Others	CH_4	82.14	0.00	0.95
3.B.2 Manure Management - Cattle	N_2O	77.22	0.00	0.96
1.A.3.e Other transportation	CO_2	72.62	0.00	0.96
3.B.1.3 Manure Management - Swine	CH_4	69.96	0.00	0.97
1.A.1.c Manufacture of solid fuels and other energy industries - Gaseous fuels	CO_2	58.24	0.00	0.97
2. D Non-energy products from fuels and solvent use	CO_2	50.87	0.00	0.97
3.B.1 Manure Management - Other	CH_4	47.02	0.00	0.97
5.D Wastewater Treatment and Discharge	N_2O	44.28	0.00	0.98
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Total		***20,054.42***		

Approach 1 Trend Assessment for 2016

IPCC Category	*Greenhouse gas*	*1990 kt CO_2 eqv.*	*2016 kt CO_2 eqv.*	*Trend assessment*	*% Contribution to Trend*	*Cumulative total*
1.A.1.a Public electricity and heat production - Liquid Fuels	CO_2	6,021.25	130.93	0.05	0.12	0.12
1.A.3.b Road transportation	CO_2	5,247.15	5,186.13	0.04	0.11	0.23
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO_2	5,796.59	987.59	0.03	0.08	0.31
1.A.2 Manufacturing industries and construction-Liquid fuels	CO_2	3,873.72	107.65	0.03	0.08	0.38
2.B.1 Ammonia Production	CO_2	1,253.68	1,827.63	0.02	0.05	0.43
1.A.4 Other sectors - Solid fuels	CO_2	2,760.55	279.33	0.02	0.05	0.48
1.A.4 Other sectors - Liquid fuels	CO_2	2,736.38	289.39	0.02	0.04	0.52
1.A.1.b Petroleum refining - Liquid Fuels	CO_2	1,509.64	1,420.50	0.01	0.03	0.55
4.G Harvested wood products	CO_2	-252.55	-1,043.37	0.01	0.03	0.58
4.E.2 Land converted to settlements	CO_2	15.30	667.52	0.01	0.03	0.61
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	0.00	625.53	0.01	0.03	0.63
4.B.2 Land converted to cropland- carbon stock change in biomass	CO_2	524.11	870.42	0.01	0.03	0.66
4.C.2 Land converted to grassland - carbon stock change in biomass	CO_2	-374.09	-22.30	0.01	0.02	0.68
3.A.1 Enteric Fermentation - Cattle	CH_4	4,169.59	1,504.20	0.01	0.02	0.70
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO_2	-6,892.07	-9,907.76	0.01	0.02	0.73
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO_2	1,475.67	1,187.58	0.01	0.02	0.74
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO_2	517.32	715.28	0.01	0.02	0.76
2.A.1 Cement Production	CO_2	1,668.07	452.40	0.01	0.02	0.78
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO_2	2,045.42	695.79	0.00	0.01	0.79
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	CO_2	-474.03	-432.55	0.00	0.01	0.80
1.A.2 Manufacturing industries and construction-Solid fuels	CO_2	171.63	353.59	0.00	0.01	0.82
1.A.1 Energy industries - Other fossil fuels	CO_2	0.00	265.59	0.00	0.01	0.83
3.D.1.1 Direct N_2O Emissions from Managed Soils - Inorganic N Fertilizers	N_2O	992.77	750.37	0.00	0.01	0.84
5.A Solid Waste Disposal	CH_4	1,028.83	755.65	0.00	0.01	0.85
3.D.1.6 Direct N_2O Emissions from Managed Soils - Cultivation of organic soils	N_2O	566.18	518.22	0.00	0.01	0.86
4.A Forest land, Emissions and removals from drainage and rewetting and other	CO_2	404.61	433.87	0.00	0.01	0.87

IPCC Category	Greenhouse gas	1990 kt CO_2 eqv.	2016 kt CO_2 eqv.	Trend assessment	% Contribution to Trend	Cumulative total
management of organic and mineral soils						
2.B.2 Nitric Acid Production	***N_2O***	***893.01***	***209.51***	***0.00***	***0.01***	***0.88***
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	***CO_2***	***853.90***	***634.71***	***0.00***	***0.01***	***0.89***
3.D.1.4 Direct N_2O Emissions from Managed Soils - Crop Residues	***N_2O***	***361.31***	***368.02***	***0.00***	***0.01***	***0.90***
4.A.2 Land converted to forest land - carbon stock change in biomass	***CO_2***	***-600.66***	***-718.75***	***0.00***	***0.01***	***0.90***
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	***CH_4***	***260.55***	***299.75***	***0.00***	***0.01***	***0.91***
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	***CO_2***	***-413.03***	***-774.61***	***0.00***	***0.01***	***0.92***
1.A.4 Other sectors - Gaseous fuels	***CO_2***	***1,379.27***	***542.25***	***0.00***	***0.01***	***0.92***
1.A.4 Other sectors - Biomass	***CH_4***	***70.28***	***143.68***	***0.00***	***0.00***	***0.93***
2.A.4 Other process use of carbonates	***CO_2***	***239.66***	***17.73***	***0.00***	***0.00***	***0.93***
3.D.2.2 Indirect N_2O Emissions from Managed Soils - Nitrogen leaching and run-off	***N_2O***	***432.67***	***306.49***	***0.00***	***0.00***	***0.94***
5.D Wastewater Treatment and Discharge	***CH_4***	***471.00***	***137.63***	***0.00***	***0.00***	***0.94***
3.B.1.3 Manure Management - Swine	***CH_4***	***329.25***	***69.96***	***0.00***	***0.00***	***0.94***
1.A.4 Other sectors - Peat	***CO_2***	***27.13***	***90.46***	***0.00***	***0.00***	***0.95***
1.A.1. Energy industries-Solid fuels	***CO_2***	***174.05***	***7.89***	***0.00***	***0.00***	***0.95***
2.A.2 Lime Production	***CO_2***	***222.68***	***37.06***	***0.00***	***0.00***	***0.95***
4.B.1 Cropland remaining cropland - carbon stock change in biomass	CO_2	77.39	-28.59	0.00	0.00	0.96
1.A.4 Other sectors - Liquid fuels	N_2O	159.35	13.44	0.00	0.00	0.96
4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils	CO_2	22.94	-48.23	0.00	0.00	0.96
1.A.1.c Manufacture of solid fuels and other energy industries - Gaseous fuels	CO_2	0.00	58.24	0.00	0.00	0.96
4.E Settlements	N_2O	0.50	54.37	0.00	0.00	0.97
4.F Other land	CO_2	0.00	53.00	0.00	0.00	0.97
1.A.4 Other sectors - Solid fuels	CH_4	128.56	12.40	0.00	0.00	0.97
……………………………………						
Total		***42,968.87***	***11,574.91***	***0.39***	***1.00***	

Approach 1 Trend Assessment for 2016 using a subset (LULUCF was excluded from analysis)

IPCC Category	*Greenhouse gas*	*1990 kt CO_2 eqv.*	*2016 kt CO_2 eqv.*	*Trend assessment*	*% Contribution to Trend*	*Cumulative total*
1.A.3.b Road transportation	***CO_2***	***5,247.15***	***5,186.13***	***0.06***	***0.18***	***0.18***
1.A.1.a Public electricity and heat production - Liquid Fuels	***CO_2***	***6,021.25***	***130.93***	***0.05***	***0.14***	***0.32***
1.A.2 Manufacturing industries and construction-Liquid fuels	***CO_2***	***3,873.72***	***107.65***	***0.03***	***0.09***	***0.41***
1.A.1.a Public electricity and heat production - Gaseous Fuels	***CO_2***	***5,796.59***	***987.59***	***0.03***	***0.08***	***0.49***
2.B.1 Ammonia Production	***CO_2***	***1,253.68***	***1,827.63***	***0.03***	***0.08***	***0.57***
1.A.4 Other sectors -Solid fuels	***CO_2***	***2,760.55***	***279.33***	***0.02***	***0.05***	***0.62***
1.A.4 Other sectors - Liquid fuels	***CO_2***	***2,736.38***	***289.39***	***0.02***	***0.05***	***0.67***
1.A.1.b Petroleum refining - Liquid Fuels	***CO_2***	***1,509.64***	***1,420.50***	***0.02***	***0.05***	***0.72***
2.F.1 Refrigeration and Air Conditioning Equipment	***HFCs***	***0.00***	***625.53***	***0.01***	***0.04***	***0.76***
3.D.1.1 Direct N_2O Emissions from Managed Soils - Inorganic N Fertilizers	***N_2O***	***992.77***	***750.37***	***0.01***	***0.02***	***0.78***
5.A Solid Waste Disposal	***CH_4***	***1,028.83***	***755.65***	***0.01***	***0.02***	***0.79***
3.D.1.6 Direct N_2O Emissions from Managed Soils - Cultivation of organic soils	***N_2O***	***566.18***	***518.22***	***0.01***	***0.02***	***0.81***
1.A.2 Manufacturing industries and construction-Solid fuels	***CO_2***	***171.63***	***353.59***	***0.01***	***0.02***	***0.83***
1.A.1 Energy industries - Other fossil fuels	***CO_2***	***0.00***	***265.59***	***0.01***	***0.02***	***0.84***
2.A.1 Cement Production	***CO_2***	***1,668.07***	***452.40***	***0.01***	***0.01***	***0.86***
3.A.1 Enteric Fermentation - Cattle	***CH_4***	***4,169.59***	***1,504.20***	***0.00***	***0.01***	***0.87***
3.D.1.4 Direct N_2O Emissions from Managed Soils - Crop Residues	***N_2O***	***361.31***	***368.02***	***0.00***	***0.01***	***0.89***
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	***CH_4***	***260.55***	***299.75***	***0.00***	***0.01***	***0.90***
2.B.2 Nitric Acid Production	***N_2O***	***893.01***	***209.51***	***0.00***	***0.01***	***0.91***
1.A.2 Manufacturing industries and construction-Gaseous fuels	***CO_2***	***2,045.42***	***695.79***	***0.00***	***0.01***	***0.92***
3.D.2.2 Indirect N_2O Emissions from Managed Soils - Nitrogen leaching and run-off	***N_2O***	***432.67***	***306.49***	***0.00***	***0.01***	***0.92***
1.A.4 Other sectors - Biomass	***CH_4***	***70.28***	***143.68***	***0.00***	***0.01***	***0.93***
2.A.4 Other process use of carbonates	***CO_2***	***239.66***	***17.73***	***0.00***	***0.00***	***0.93***

IPCC Category	*Greenhouse gas*	*1990 kt CO_2 eqv.*	*2016 kt CO_2 eqv.*	*Trend assessment*	*% Contribution to Trend*	*Cumulative total*
1.A.4 Other sectors - Peat	***CO_2***	***27.13***	***90.46***	***0.00***	***0.00***	***0.94***
3.B.1.3 Manure Management - Swine	***CH_4***	***329.25***	***69.96***	***0.00***	***0.00***	***0.94***
1.A.1. Energy industries-Solid fuels	***CO_2***	***174.05***	***7.89***	***0.00***	***0.00***	***0.95***
5.D Wastewater Treatment and Discharge	***CH_4***	***471.00***	***137.63***	***0.00***	***0.00***	***0.95***
1.A.1.c Manufacture of solid fuels and other energy industries - Gaseous fuels	***CO_2***	***0.00***	***58.24***	***0.00***	***0.00***	***0.95***
2.A.2 Lime Production	CO_2	222.68	37.06	0.00	0.00	0.96
1.A.4 Other sectors - Liquid fuels	N_2O	159.35	13.44	0.00	0.00	0.96
1.A.4 Other sectors - Solid fuels	CH_4	128.56	12.40	0.00	0.00	0.96
5.B Biological Treatment of Solid Waste	CH_4	0.20	37.77	0.00	0.00	0.96
1.A.3.e Other transportation	CO_2	85.36	72.62	0.00	0.00	0.97
2.G Other product manufacture and use	N_2O	96.05	4.68	0.00	0.00	0.97
3.B.1.1 Manure Management - Cattle	CH_4	251.74	137.96	0.00	0.00	0.97
1.A.4 Other sectors - Gaseous fuels	CO_2	1,379.27	542.25	0.00	0.00	0.97
1.A.1 Energy industries - Biomass	N_2O	0.63	30.21	0.00	0.00	0.97
2. D Non-energy products from fuels and solvent use	CO_2	50.31	50.87	0.00	0.00	0.98
3.B.1 Manure Management - Other	N_2O	127.18	24.52	0.00	0.00	0.98
3.D.2.1 Indirect N_2O Emissions from Managed Soils - Atmospheric deposition	N_2O	175.35	100.68	0.00	0.00	0.98
3.A. Enteric Fermentation - Others	CH_4	144.72	82.14	0.00	0.00	0.98
5.B Biological Treatment of Solid Waste	N_2O	0.15	21.36	0.00	0.00	0.98
1.A.4 Other sectors - Biomass	N_2O	12.97	26.41	0.00	0.00	0.98
....						
Total		***48,104.54***	***20,054.42***	***0.35***	***1.00***	

Approach 2 Level Assessment for 1990

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eqv.*	*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***	***0.21***
5.A Solid Waste Disposal	***CH_4***	***1,028.83***	***0.02***	***0.29***
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	***CO_2***	***1,475.67***	***0.02***	***0.36***
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	***CO_2***	***517.32***	***0.02***	***0.43***
3.D.1.1 Direct N_2O Emissions from Managed Soils - Inorganic N Fertilizers	***N_2O***	***992.77***	***0.01***	***0.49***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***268.06***	***0.01***	***0.53***
3.D.2.2 Indirect N_2O Emissions from Managed Soils - Nitrogen leaching and run-off	***N_2O***	***432.67***	***0.01***	***0.57***
3.D.1.6 Direct N_2O Emissions from Managed Soils - Cultivation of organic soils	***N_2O***	***566.18***	***0.01***	***0.60***
5.D Wastewater Treatment and Discharge	***CH_4***	***471.00***	***0.01***	***0.63***
3.A.1 Enteric Fermentation - Cattle	***CH_4***	***4,169.59***	***0.01***	***0.65***
3.D.1.3 Direct N_2O Emissions from Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***420.61***	***0.01***	***0.68***
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	***CO_2***	***853.90***	***0.01***	***0.70***
3.D.1.4 Direct N_2O Emissions from Managed Soils - Crop Residues	***N_2O***	***361.31***	***0.01***	***0.72***
3.D.1.2 Direct N_2O Emissions from Managed Soils - Organic N Fertilizers	***N_2O***	***345.11***	***0.00***	***0.74***
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	***CO_2***	***404.61***	***0.00***	***0.76***
4.A.2 Land converted to forest land - carbon stock change in biomass	***CO_2***	***-600.66***	***0.00***	***0.78***
3.D.2.1 Indirect N_2O Emissions from Managed Soils - Atmospheric deposition	***N_2O***	***175.35***	***0.00***	***0.79***
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	***CO_2***	***-474.03***	***0.00***	***0.81***
4.B.2 Land converted to cropland- carbon stock change in biomass	***CO_2***	***524.11***	***0.00***	***0.82***
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	***CO_2***	***-413.03***	***0.00***	***0.83***
1.A.1.a Public electricity and heat production - Liquid Fuels	***CO_2***	***6,021.25***	***0.00***	***0.85***
1.A.1.a Public electricity and heat production - Gaseous Fuels	***CO_2***	***5,796.59***	***0.00***	***0.86***
4.C.2 Land converted to grassland - carbon stock change in biomass	***CO_2***	***-374.09***	***0.00***	***0.87***
1.A.4 Other sectors - Solid fuels	***CO_2***	***2,760.55***	***0.00***	***0.88***
4.G Harvested wood products	***CO_2***	***-252.55***	***0.00***	***0.89***

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eqv.*	*Level assessment with uncertainty*	*Cumulative total*
1.A.3.b Road transportation	***CO_2***	***5,247.15***	***0.00***	***0.90***
1.A.4 Other sectors - Biomass	***CH_4***	***70.28***	***0.00***	***0.90***
1.A.2 Manufacturing industries and construction-Liquid fuels	CO_2	3,873.72	0.00	0.91
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	0.92
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	0.93
4.A.2 Land converted to forest land - net carbon stock change in mineral soils	CO_2	-151.67	0.00	0.94
2.A.2 Lime Production	CO_2	222.68	0.00	0.94
1.A.4 Other sectors - Solid fuels	CH_4	128.56	0.00	0.95
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Total		***42,968.91***		

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

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eqv.*	*Level assessment with uncertainty*	*Cumulative total*
5.A Solid Waste Disposal	***CH_4***	***1,028.83***	***0.03***	***0.16***
3.D.1.1 Direct N_2O Emissions from Managed Soils - Inorganic N Fertilizers	***N_2O***	***992.77***	***0.02***	***0.27***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***268.06***	***0.01***	***0.36***
3.D.2.2 Indirect N_2O Emissions from Managed Soils - Nitrogen leaching and run-off	***N_2O***	***432.67***	***0.01***	***0.43***
3.D.1.6 Direct N_2O Emissions from Managed Soils - Cultivation of organic soils	***N_2O***	***566.18***	***0.01***	***0.50***
5.D Wastewater Treatment and Discharge	***CH_4***	***471.00***	***0.01***	***0.55***
3.A.1 Enteric Fermentation - Cattle	***CH_4***	***4,169.59***	***0.01***	***0.60***
3.D.1.3 Direct N_2O Emissions from Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***420.61***	***0.01***	***0.64***
3.D.1.4 Direct N_2O Emissions from Managed Soils - Crop Residues	***N_2O***	***361.31***	***0.01***	***0.68***
3.D.1.2 Direct N_2O Emissions from Managed Soils - Organic N Fertilizers	***N_2O***	***345.11***	***0.01***	***0.72***
3.D.2.1 Indirect N_2O Emissions from Managed Soils - Atmospheric deposition	***N_2O***	***175.35***	***0.00***	***0.75***
1.A.1.a Public electricity and heat production - Liquid Fuels	***CO_2***	***6,021.25***	***0.00***	***0.77***
1.A.1.a Public electricity and heat production - Gaseous Fuels	***CO_2***	***5,796.59***	***0.00***	***0.79***
1.A.4 Other sectors - Solid fuels	***CO_2***	***2,760.55***	***0.00***	***0.81***
1.A.3.b Road transportation	***CO_2***	***5,247.15***	***0.00***	***0.83***
1.A.4 Other sectors - Biomass	***CH_4***	***70.28***	***0.00***	***0.84***
1.A.2 Manufacturing industries and construction-Liquid fuels	***CO_2***	***3,873.72***	***0.00***	***0.86***
1.A.4 Other sectors - Liquid fuels	***CO_2***	***2,736.38***	***0.00***	***0.87***
2.B.2 Nitric Acid Production	***N_2O***	***893.01***	***0.00***	***0.88***
2.A.1 Cement Production	***CO_2***	***1,668.07***	***0.00***	***0.89***
1.A.4 Other sectors - Liquid fuels	***N_2O***	***159.35***	***0.00***	***0.90***
2.A.2 Lime Production	CO_2	222.68	0.00	0.91
1.A.4 Other sectors - Solid fuels	CH_4	128.56	0.00	0.92
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO_2	2,045.42	0.00	0.93
1.A.4 Other sectors - Gaseous fuels	CO_2	1,379.27	0.00	0.93
1.A.1.b Petroleum refining - Liquid Fuels	CO_2	1,509.64	0.00	0.94
2.G Other product manufacture and use	N_2O	96.05	0.00	0.94
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Total		***48,104.6***		

Approach 2 Level Assessment for 2016

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eqv.*	*Level assessment with uncertainty*	*Cumulative total*
4.A.1 Forest land remaining forest land - carbon stock change in biomass	***CO_2***	***-9,907.76***	***0.12***	***0.31***
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	***CO_2***	***715.28***	***0.04***	***0.41***
5.A Solid Waste Disposal	***CH_4***	***755.65***	***0.03***	***0.47***
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	***CO_2***	***1,187.58***	***0.02***	***0.53***
3.D.1.1 Direct N_2O Emissions from Managed Soils - Inorganic N Fertilizers	***N_2O***	***750.37***	***0.02***	***0.58***
4.G Harvested wood products	***CO_2***	***-1,043.37***	***0.02***	***0.62***
3.D.1.6 Direct N_2O Emissions from Managed Soils - Cultivation of organic soils	***N_2O***	***518.22***	***0.01***	***0.65***
3.D.2.2 Indirect N_2O Emissions from Managed Soils - Nitrogen leaching and run-off	***N_2O***	***306.49***	***0.01***	***0.68***
4.B.2 Land converted to cropland- carbon stock change in biomass	***CO_2***	***870.42***	***0.01***	***0.70***
4.A.2 Land converted to forest land - carbon stock change in biomass	***CO_2***	***-718.75***	***0.01***	***0.72***
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	***CO_2***	***-774.61***	***0.01***	***0.75***
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	***CO_2***	***433.87***	***0.01***	***0.77***
3.D.1.4 Direct N_2O Emissions from Managed Soils - Crop Residues	***N_2O***	***368.02***	***0.01***	***0.79***
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	***CO_2***	***634.71***	***0.01***	***0.81***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***94.00***	***0.01***	***0.82***
1.A.4 Other sectors - Biomass	***CH_4***	***143.68***	***0.01***	***0.84***
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	***CO_2***	***-432.55***	***0.01***	***0.85***
2.F.1 Refrigeration and Air Conditioning Equipment	***HFCs***	***625.53***	***0.00***	***0.86***
3.D.1.3 Direct N_2O Emissions from Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***177.35***	***0.00***	***0.87***
1.A.3.b Road transportation	***CO_2***	***5,186.13***	***0.00***	***0.88***
3.D.2.1 Indirect N_2O Emissions from Managed Soils - Atmospheric deposition	***N_2O***	***100.68***	***0.00***	***0.89***
3.A.1 Enteric Fermentation - Cattle	***CH_4***	***1,504.20***	***0.00***	***0.90***
3.D.1.2 Direct N_2O Emissions from Managed Soils - Organic N Fertilizers	N_2O	151.43	0.00	0.91
5.D Wastewater Treatment and Discharge	CH_4	137.63	0.00	0.92
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Total		***11,574.91***		

Approach 2 Level Assessment for 2016 using a subset (LULUCF was excluded from analysis)

IPCC Category	*Greenhouse gas*	*GHG emissions, kt CO_2 eqv.*	*Level assessment with uncertainty*	*Cumulative total*
5.A Solid Waste Disposal	***CH_4***	***755.65***	***0.05***	***0.19***
3.D.1.1 Direct N_2O Emissions from Managed Soils - Inorganic N Fertilizers	***N_2O***	***750.37***	***0.03***	***0.32***
3.D.1.6 Direct N_2O Emissions from Managed Soils - Cultivation of organic soils	***N_2O***	***518.22***	***0.02***	***0.41***
3.D.2.2 Indirect N_2O Emissions from Managed Soils - Nitrogen leaching and run-off	***N_2O***	***306.49***	***0.02***	***0.50***
3.D.1.4 Direct N_2O Emissions from Managed Soils - Crop Residues	***N_2O***	***368.02***	***0.02***	***0.56***
3.B.2 Manure Management - Indirect N_2O Emissions	***N_2O***	***94.00***	***0.01***	***0.61***
1.A.4 Other sectors - Biomass	***CH_4***	***143.68***	***0.01***	***0.66***
2.F.1 Refrigeration and Air Conditioning Equipment	***HFCs***	***625.53***	***0.01***	***0.69***
3.D.1.3 Direct N_2O Emissions from Managed Soils - Urine and dung deposited by grazing animals	***N_2O***	***177.35***	***0.01***	***0.72***
1.A.3.b Road transportation	***CO_2***	***5,186.13***	***0.01***	***0.75***
3.D.2.1 Indirect N_2O Emissions from Managed Soils - Atmospheric deposition	***N_2O***	***100.68***	***0.01***	***0.78***
3.A.1 Enteric Fermentation - Cattle	***CH_4***	***1,504.20***	***0.01***	***0.81***
3.D.1.2 Direct N_2O Emissions from Managed Soils - Organic N Fertilizers	***N_2O***	***151.43***	***0.01***	***0.83***
5.D Wastewater Treatment and Discharge	***CH_4***	***137.63***	***0.01***	***0.86***
2.B.1 Ammonia Production	***CO_2***	***1,827.63***	***0.00***	***0.87***
1.A.1 Energy industries - Biomass	***N_2O***	***30.21***	***0.00***	***0.88***
1.A.4 Other sectors - Biomass	***N_2O***	***26.41***	***0.00***	***0.89***
5.B Biological Treatment of Solid Waste	***CH_4***	***37.77***	***0.00***	***0.90***
1.A.1.b Petroleum refining - Liquid Fuels	***CO_2***	***1,420.50***	***0.00***	***0.90***
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH_4	299.75	0.00	0.91
1.A.1 Energy industries - Biomass	CH_4	19.01	0.00	0.92
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO_2	987.59	0.00	0.92
5.D Wastewater Treatment and Discharge	N_2O	44.28	0.00	0.93
2.A.1 Cement Production	CO_2	452.40	0.00	0.93
5.B Biological Treatment of Solid Waste	N_2O	21.36	0.00	0.94
2.B.2 Nitric Acid Production	N_2O	209.51	0.00	0.94
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO_2	695.79	0.00	0.95
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Total		***20,054.42***		

Approach 2 Trend Assessment for 2016

IPCC Category	*Greenhouse gas*	*1990 kt CO_2 eqv.*	*2016 kt CO_2 eqv.*	*Trend assessment with uncertainty*	*% Contribution to Trend*	*Cumulative total*
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO_2	517.32	715.28	0.02	0.16	0.16
4.G Harvested wood products	CO_2	-252.55	-1,043.37	0.01	0.07	0.23
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO_2	1,475.67	1,187.58	0.01	0.06	0.29
5.A Solid Waste Disposal	CH_4	1,028.83	755.65	0.01	0.05	0.34
4.B.2 Land converted to cropland- carbon stock change in biomass	CO_2	524.11	870.42	0.00	0.04	0.38
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO_2	-6,892.07	-9,907.76	0.00	0.04	0.42
4.C.2 Land converted to grassland - carbon stock change in biomass	CO_2	-374.09	-22.30	0.00	0.04	0.46
3.D.1.1 Direct N_2O Emissions from Managed Soils - Inorganic N Fertilizers	N_2O	992.77	750.37	0.00	0.04	0.50
3.D.1.6 Direct N_2O Emissions from Managed Soils - Cultivation of organic soils	N_2O	566.18	518.22	0.00	0.04	0.54
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO_2	404.61	433.87	0.00	0.03	0.57
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	0.00	625.53	0.00	0.03	0.60
1.A.4 Other sectors - Biomass	CH_4	70.28	143.68	0.00	0.03	0.63
3.D.1.4 Direct N_2O Emissions from Managed Soils - Crop Residues	N_2O	361.31	368.02	0.00	0.03	0.66
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	CO_2	-474.03	-432.55	0.00	0.02	0.68
3.D.2.2 Indirect N_2O Emissions from Managed Soils - Nitrogen leaching and run-off	N_2O	432.67	306.49	0.00	0.02	0.70
4.E.2 Land converted to settlements	CO_2	15.30	667.52	0.00	0.02	0.72
3.B.2 Manure Management - Indirect N_2O Emissions	N_2O	268.06	94.00	0.00	0.02	0.74
4.A.2 Land converted to forest land - carbon stock change in biomass	CO_2	-600.66	-718.75	0.00	0.02	0.75
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	CO_2	853.90	634.71	0.00	0.02	0.77
5.D Wastewater Treatment and Discharge	CH_4	471.00	137.63	0.00	0.01	0.78
4.E Settlements	N_2O	0.50	54.37	0.00	0.01	0.80
1.A.1.a Public electricity and heat production - Liquid Fuels	CO_2	6,021.25	130.93	0.00	0.01	0.81

IPCC Category	Greenhouse gas	1990 kt CO_2 eqv.	2016 kt CO_2 eqv.	Trend assessment with uncertainty	% Contribution to Trend	Cumulative total
1.A.3.b Road transportation	***CO_2***	***5,247.15***	***5,186.13***	***0.00***	***0.01***	***0.82***
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	***CO_2***	***-413.03***	***-774.61***	***0.00***	***0.01***	***0.83***
1.A.4 Other sectors - Solid fuels	***CO_2***	***2,760.55***	***279.33***	***0.00***	***0.01***	***0.84***
1.A.1.a Public electricity and heat production - Gaseous Fuels	***CO_2***	***5,796.59***	***987.59***	***0.00***	***0.01***	***0.85***
1.A.2 Manufacturing industries and construction-Liquid fuels	***CO_2***	***3,873.72***	***107.65***	***0.00***	***0.01***	***0.86***
3.A.1 Enteric Fermentation - Cattle	***CH_4***	***4,169.59***	***1,504.20***	***0.00***	***0.01***	***0.87***
1.A.1 Energy industries - Biomass	***N_2O***	***0.63***	***30.21***	***0.00***	***0.01***	***0.88***
5.B Biological Treatment of Solid Waste	***CH_4***	***0.20***	***37.77***	***0.00***	***0.01***	***0.88***
1.A.4 Other sectors - Liquid fuels	***CO_2***	***2,736.38***	***289.39***	***0.00***	***0.01***	***0.89***
2.B.1 Ammonia Production	***CO_2***	***1,253.68***	***1,827.63***	***0.00***	***0.01***	***0.90***
1.A.4 Other sectors - Liquid fuels	***N_2O***	***159.35***	***13.44***	***0.00***	***0.01***	***0.90***
1.A.4 Other sectors - Biomass	N_2O	12.97	26.41	0.00	0.01	0.91
1.A.1 Energy industries - Biomass	CH_4	0.40	19.01	0.00	0.00	0.91
4.B.1 Cropland remaining cropland - carbon stock change in biomass	CO_2	77.39	-28.59	0.00	0.00	0.92
1.A.4 Other sectors - Solid fuels	CH_4	128.56	12.40	0.00	0.00	0.92
4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils	CO_2	22.94	-48.23	0.00	0.00	0.92
3.D.1.3 Direct N_2O Emissions from Managed Soils - Urine and dung deposited by grazing animals	N_2O	420.61	177.35	0.00	0.00	0.93
4.C Grassland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO_2	52.94	57.24	0.00	0.00	0.93
2.B.2 Nitric Acid Production	N_2O	893.01	209.51	0.00	0.00	0.94
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Total		***42,968.87***	***11,574.91***	***0.10***	***1.00***	

Approach 2 Trend Assessment for 2016 using a subset (LULUCF was excluded from analysis)

IPCC Category	*Greenhouse gas*	*1990 kt CO_2 eqv.*	*2016 kt CO_2 eqv.*	*Trend assessment with uncertainty*	*% Contribution to Trend*	*Cumulative total*
5.A Solid Waste Disposal	CH_4	***1,028.83***	***755.65***	***0.01***	***0.15***	***0.15***
3.D.1.1 Direct N_2O Emissions from Managed Soils - Inorganic N Fertilizers	N_2O	***992.77***	***750.37***	***0.01***	***0.11***	***0.27***
3.D.1.6 Direct N_2O Emissions from Managed Soils - Cultivation of organic soils	N_2O	***566.18***	***518.22***	***0.01***	***0.09***	***0.36***
3.D.1.4 Direct N_2O Emissions from Managed Soils - Crop Residues	N_2O	***361.31***	***368.02***	***0.00***	***0.07***	***0.43***
1.A.4 Other sectors - Biomass	CH_4	***70.28***	***143.68***	***0.00***	***0.07***	***0.50***
2.F.1 Refrigeration and Air Conditioning Equipment	***HFCs***	***0.00***	***625.53***	***0.00***	***0.07***	***0.56***
3.D.2.2 Indirect N_2O Emissions from Managed Soils - Nitrogen leaching and run-off	N_2O	***432.67***	***306.49***	***0.00***	***0.06***	***0.63***
1.A.3.b Road transportation	CO_2	***5,247.15***	***5,186.13***	***0.00***	***0.03***	***0.66***
1.A.1.a Public electricity and heat production - Liquid Fuels	CO_2	***6,021.25***	***130.93***	***0.00***	***0.03***	***0.68***
5.D Wastewater Treatment and Discharge	CH_4	***471.00***	***137.63***	***0.00***	***0.02***	***0.70***
1.A.4 Other sectors - Solid fuels	CO_2	***2,760.55***	***279.33***	***0.00***	***0.02***	***0.72***
3.B.2 Manure Management - Indirect N_2O Emissions	N_2O	***268.06***	***94.00***	***0.00***	***0.02***	***0.74***
1.A.1 Energy industries - Biomass	N_2O	***0.63***	***30.21***	***0.00***	***0.02***	***0.76***
1.A.2 Manufacturing industries and construction-Liquid fuels	CO_2	***3,873.72***	***107.65***	***0.00***	***0.02***	***0.77***
5.B Biological Treatment of Solid Waste	CH_4	***0.20***	***37.77***	***0.00***	***0.02***	***0.79***
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO_2	***5,796.59***	***987.59***	***0.00***	***0.02***	***0.80***
3.D.2.1 Indirect N_2O Emissions from Managed Soils - Atmospheric deposition	N_2O	***175.35***	***100.68***	***0.00***	***0.01***	***0.82***
2.B.1 Ammonia Production	CO_2	***1,253.68***	***1,827.63***	***0.00***	***0.01***	***0.83***
1.A.4 Other sectors - Biomass	N_2O	***12.97***	***26.41***	***0.00***	***0.01***	***0.84***
1.A.4 Other sectors - Liquid fuels	CO_2	***2,736.38***	***289.39***	***0.00***	***0.01***	***0.86***

IPCC Category	Greenhouse gas	1990 kt CO_2 eqv.	2016 kt CO_2 eqv.	Trend assessment with uncertainty	% Contribution to Trend	Cumulative total
1.A.1 Energy industries - Biomass	***CH_4***	***0.40***	***19.01***	***0.00***	***0.01***	***0.87***
1.A.4 Other sectors - Liquid fuels	***N_2O***	***159.35***	***13.44***	***0.00***	***0.01***	***0.88***
5.B Biological Treatment of Solid Waste	***N_2O***	***0.15***	***21.36***	***0.00***	***0.01***	***0.89***
1.A.1.b Petroleum refining - Liquid Fuels	***CO_2***	***1,509.64***	***1,420.50***	***0.00***	***0.01***	***0.89***
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	***CH_4***	***260.55***	***299.75***	***0.00***	***0.01***	***0.90***
3.A.1 Enteric Fermentation - Cattle	CH_4	4,169.59	1,504.20	0.00	0.01	0.91
1.A.4 Other sectors - Solid fuels	CH_4	128.56	12.40	0.00	0.01	0.92
2.A.2 Lime Production	CO_2	222.68	37.06	0.00	0.01	0.92
2.B.2 Nitric Acid Production	N_2O	893.01	209.51	0.00	0.01	0.93
2.G Other product manufacture and use	N_2O	96.05	4.68	0.00	0.01	0.94
1.A.2 Manufacturing industries and construction-Solid fuels	CO_2	171.63	353.59	0.00	0.01	0.94
1.A.1 Energy industries - Other fossil fuels	CO_2	0.00	265.59	0.00	0.00	0.95
2.A.1 Cement Production	CO_2	1,668.07	452.40	0.00	0.00	0.95
5.D Wastewater Treatment and Discharge	N_2O	67.21	44.28	0.00	0.00	0.95
2. D Non-energy products from fuels and solvent use	CO_2	50.31	50.87	0.00	0.00	0.96
1.A.3.b Road transportation	N_2O	39.09	32.07	0.00	0.00	0.96
…………						
Total		***48,104.54***	***20,054.42***	***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 2016*	*Activity data uncertainty*	*Emission factor uncertainty*	*Combined uncertainty*	*Combined uncertainty as % of total national emissions in 2016*	*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 eqv.	***kt CO_2 eqv.***	***%***	***%***	***%***	***%***	***%***	***%***	***%***	***%***	***%***
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CO_2	7,540.22	1,565.03	2%	2%	3%	0.000	0.011	0.036	0.000	0.001	0.000
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CH_4	6.90	0.95	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	1.81	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	7.89	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	0.04	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	1,049.06	2%	2%	3%	0.000	0.012	0.024	0.000	0.001	0.000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CH_4	2.63	0.47	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	0.56	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	265.59	2%	5%	5%	0.000	0.006	0.006	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CH_4	0.00	1.65	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	2.63	2%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000

1.A.1 Fuel combustion - Energy Industries - Peat	CO_2	11.06	10.64	2%	5%	5%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Peat	CH_4	0.00	0.00	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	0.05	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			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	19.01	30%	150%	153%	0.000	0.000	0.000	0.001	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Biomass	N_2O	0.63	30.21	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	107.65	2%	2%	3%	0.000	0.022	0.003	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	CH_4	4.46	0.14	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	4.76	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	353.59	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	0.91	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	1.63	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	695.79	2%	2%	3%	0.000	0.003	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	0.37	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	5.43	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	0.02	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			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	2.91	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	4.63	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	1.42	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	5,186.13	2%	2%	3%	0.000	0.088	0.121	0.002	0.003	0.000
1.A.3.b Road Transportation	CH_4	50.93	12.82	2%	40%	40%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b Road Transportation	N_2O	39.09	32.07	2%	50%	50%	0.000	0.001	0.001	0.000	0.000	0.000
1.A.3.c Railways	CO_2	349.97	158.33	5%	2%	5%	0.000	0.001	0.004	0.000	0.000	0.000
1.A.3.c Railways	CH_4	0.50	0.23	5%	75%	75%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.c Railways	N_2O	40.92	18.55	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	13.16	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	0.03	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	0.11	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	72.62	5%	2%	5%	0.000	0.001	0.002	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 - Pipeline Transportation	N_2O	0.05	0.04	5%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Liquid Fuels	CO_2	2,736.38	289.39	3%	2%	4%	0.000	0.010	0.007	0.000	0.000	0.000
1.A.4 Other Sectors - Liquid Fuels	CH_4	7.04	0.64	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	13.44	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	279.33	3%	5%	6%	0.000	0.011	0.006	0.001	0.000	0.000
1.A.4 Other Sectors - Solid Fuels	CH_4	128.56	12.40	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	1.31	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	542.25	3%	2%	4%	0.000	0.004	0.013	0.000	0.001	0.000
1.A.4 Other Sectors - Gaseous Fuels	CH_4	3.13	1.22	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	0.29	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	90.46	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	4.65	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	0.36	3%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors- Biomass	CO_2			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	143.68	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	26.41	50%	150%	158%	0.000	0.001	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	0.69	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	3.12	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	299.75	5%	10%	11%	0.000	0.005	0.007	0.001	0.000	0.000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	CO_2	0.58	3.06	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	1.39	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	452.40	2%	5%	5%	0.000	0.000	0.011	0.000	0.000	0.000
2.A.2 Lime Production	CO_2	222.68	37.06	5%	30%	30%	0.000	0.001	0.001	0.000	0.000	0.000
2.A.3 Glass Production	CO_2	11.74	6.97	7%	5%	9%	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4.a Ceramics	CO_2	227.92	4.96	5%	5%	7%	0.000	0.001	0.000	0.000	0.000	0.000
2.A.4.b Other use of soda ash	CO_2	5.32	0.81	5%	5%	7%	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4.d Mineral wool production	CO_2	6.41	11.96	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	1,827.63	2%	2%	3%	0.000	0.035	0.042	0.001	0.001	0.000
2.B.2 Nitric Acid Production	N_2O	893.01	209.51	2%	10%	10%	0.000	0.001	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	1.46	10%	10%	14%	0.000	0.000	0.000	0.000	0.000	0.000
2.D.1 Lubricant use	CO_2	6.06	10.93	5%	50%	50%	0.000	0.000	0.000	0.000	0.000	0.000
2.D.2 Paraffin wax use	CO_2	0.88	2.68	5%	100%	100%	0.000	0.000	0.000	0.000	0.000	0.000
2.D.3 Solvent use	CO_2	43.35	35.19	30%	20%	36%	0.000	0.001	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	2.06	10%	2%	10%	0.000	0.000	0.000	0.000	0.000	0.000
2.E.1 Semiconductor	SF_6	0.00	3.97	5%	5%	7%	0.000	0.000	0.000	0.000	0.000	0.000
2.E.3 Photovoltaics	NF_3	0.00	0.20	5%	20%	21%	0.000	0.000	0.000	0.000	0.000	0.000

2.F.1.a Domestic Refrigeration	HFCs	0.00	1.67	20%	50%	54%	0.000	0.000	0.000	0.000	0.000	0.000
2.F.1.a Commercial Refrigeration	HFCs	0.00	379.74	20%	50%	54%	0.000	0.009	0.009	0.004	0.002	0.000
2.F.1.a Transport Refrigeration	HFCs	0.00	48.60	20%	50%	54%	0.000	0.001	0.001	0.001	0.000	0.000
2.F.1.a Industrial Refrigeration	HFCs	0.00	47.76	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	22.78	20%	50%	54%	0.000	0.001	0.001	0.000	0.000	0.000
2.F.1.b Mobile Air-Conditioning	HFCs	0.00	124.99	20%	50%	54%	0.000	0.003	0.003	0.001	0.001	0.000
2.F.2 Foam Blowing Agents	HFCs	0.00	17.83	30%	30%	42%	0.000	0.000	0.000	0.000	0.000	0.000
2.F.3 Fire Protection	HFCs	0.00	3.24	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	7.62	5%	5%	7%	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1 Manufacture of electrical equipments	SF_6	0.00	0.46	5%	5%	7%	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.b Accelerators	SF_6	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	2.58	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	2.09	5%	100%	100%	0.000	0.000	0.000	0.000	0.000	0.000
3.A Enteric Fermentation	CH_4	4,314.32	1,586.34	3%	9%	9%	0.000	0.010	0.037	0.001	0.001	0.000
3.B Manure Management	CH_4	665.75	254.95	4%	2%	4%	0.000	0.002	0.006	0.000	0.000	0.000
3.B Manure Management	N_2O	601.39	195.75	5%	100%	100%	0.000	0.001	0.005	0.001	0.000	0.000
3.D.1 Direct N_2O Emissions From Managed Soils	N_2O	2,688.91	1,965.39	8%	87%	88%	0.022	0.029	0.046	0.025	0.005	0.001
3.D.2 Indirect N_2O Emissions From Managed Soils	N_2O	608.02	407.17	16%	136%	137%	0.002	0.006	0.009	0.008	0.002	0.000
3.G Liming	CO_2	20.59	15.86	10%	50%	51%	0.000	0.000	0.000	0.000	0.000	0.000
3.H Urea Application	CO_2	35.71	17.17	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	-10,340.07	3%	47%	47%	0.179	0.195	0.240	0.092	0.011	0.009
4.A.1 Forest Land Remaining Forest Land	CH_4	0.47	0.03	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	0.02	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	-995.01	15%	46%	49%	0.002	0.018	0.023	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	1,933.22	1,678.70	7%	74%	75%	0.012	0.027	0.039	0.020	0.004	0.000
4(II) Emissions and removals from drainage and rewetting and other management of	N_2O	39.17	40.52	11%	105%	105%	0.000	0.001	0.001	0.001	0.000	0.000

organic and mineral soils												
4.B Cropland	CO_2	1,478.33	1,428.30	6%	42%	42%	0.003	0.024	0.033	0.010	0.003	0.000
4.B Cropland	CH_4	0.05	0.00	6%	85%	86%	0.000	0.000	0.000	0.000	0.000	0.000
4.B Cropland	N_2O	72.72	57.00	6%	76%	76%	0.000	0.001	0.001	0.001	0.000	0.000
4.C Grassland	CO_2	-787.13	-796.91	8%	42%	43%	0.001	0.014	0.019	0.006	0.002	0.000
4.C Grassland	CH_4	2.46	0.65	6%	85%	86%	0.000	0.000	0.000	0.000	0.000	0.000
4.C Grassland	N_2O	2.68	0.71	6%	76%	76%	0.000	0.000	0.000	0.000	0.000	0.000
4.D Wetlands	CO_2	573.47	724.66	6%	205%	205%	0.016	0.013	0.017	0.027	0.001	0.001
4.D Wetlands	N_2O	0.00	0.00	6%	64%	64%	0.000	0.000	0.000	0.000	0.000	0.000
4.E Settlements	CO_2	15.30	667.52	10%	15%	18%	0.000	0.015	0.016	0.002	0.002	0.000
4.E Settlements	N_2O	0.50	54.37	18%	151%	152%	0.000	0.001	0.001	0.002	0.000	0.000
4.F Other Land	CO_2	0.00	53.00	33%	17%	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	-1,043.37	15%	59%	61%	0.003	0.023	0.024	0.013	0.005	0.000
5.A Solid Waste Disposal	CH_4	1,028.83	755.65	30%	123%	126%	0.007	0.011	0.018	0.014	0.007	0.000
5.B Biological Treatment of Solid Waste	CH_4	0.20	37.77	40%	100%	108%	0.000	0.001	0.001	0.001	0.000	0.000
5.B Biological Treatment of Solid Waste	N_2O	0.15	21.36	40%	100%	108%	0.000	0.000	0.000	0.000	0.000	0.000
5.C Incineration and Open Burning of Waste	CO_2	2.66	0.95	25%	39%	46%	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	0.03	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	137.63	59%	73%	93%	0.000	0.000	0.003	0.000	0.003	0.000
5.D Wastewater Treatment and Discharge	N_2O	67.21	44.28	30%	50%	58%	0.000	0.001	0.001	0.000	0.000	0.000
Total emission		***43,029.38***	***11,585.40***	***Overall uncertainty (%)***			***49.9***	***Trend uncertainty (%)***				***10.6***

Table 1b. Uncertainty evaluation excluding LULUCF

IPCC Source category	*Gas*	*Base year (1990) emissions*	*Emissions in 2016*	*Activity data uncertainty*	*Emission factor uncertainty*	*Combined uncertainty*	*Combined uncertainty as % of total national emissions in 2016*	*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 eqv.	*kt CO_2 eqv.*	*%*	*%*	*%*	*%*	*%*	*%*	*%*	*%*	*%*
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CO_2	7,540.22	1,565.03	2%	2%	3%	0.0000	0.033	0.0325	0.0007	0.0009	0.0000
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CH_4	6.90	0.95	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	1.81	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	7.89	2%	5%	5%	0.0000	0.001	0.0002	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	0.04	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CO_2	5,796.59	1,049.06	2%	2%	3%	0.0000	0.028	0.0218	0.0006	0.0006	0.0000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CH_4	2.63	0.47	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	0.56	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	265.59	2%	5%	5%	0.0000	0.006	0.0055	0.0003	0.0002	0.0000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CH_4	0.00	1.65	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	2.63	2%	50%	50%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Peat	CO_2	11.06	10.64	2%	5%	5%	0.0000	0.000	0.0002	0.0000	0.0000	0.0000
1.A.1 Fuel combustion - Energy Industries - Peat	CH_4	0.00	0.00	2%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000

1.A.1 Fuel combustion - Energy Industries - Peat	N_2O	0.05	0.05	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			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	19.01	30%	150%	153%	0.0000	0.000	0.0004	0.0006	0.0002	0.0000
1.A.1 Fuel combustion - Energy Industries - Biomass	N_2O	0.63	30.21	30%	150%	153%	0.0000	0.001	0.0006	0.0009	0.0003	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	CO_2	3,873.72	107.65	2%	2%	3%	0.0000	0.031	0.0022	0.0006	0.0001	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	CH_4	4.46	0.14	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	4.76	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	353.59	2%	5%	5%	0.0000	0.006	0.0074	0.0003	0.0002	0.0000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	CH_4	0.45	0.91	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	1.63	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	695.79	2%	2%	3%	0.0000	0.003	0.0145	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	0.37	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	5.43	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	0.02	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			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	2.91	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	4.63	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	1.42	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	5,186.13	2%	2%	3%	0.0001	0.062	0.1078	0.0012	0.0030	0.0000
1.A.3.b Road Transportation	CH_4	50.93	12.82	2%	40%	40%	0.0000	0.000	0.0003	0.0001	0.0000	0.0000
1.A.3.b Road Transportation	N_2O	39.09	32.07	2%	50%	50%	0.0000	0.000	0.0007	0.0002	0.0000	0.0000
1.A.3.c Railways	CO_2	349.97	158.33	5%	2%	5%	0.0000	0.000	0.0033	0.0000	0.0002	0.0000
1.A.3.c Railways	CH_4	0.50	0.23	5%	75%	75%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.3.c Railways	N_2O	40.92	18.55	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	13.16	5%	3%	6%	0.0000	0.000	0.0003	0.0000	0.0000	0.0000
1.A.3.d Domestic Navigation - Liquid Fuels	CH_4	0.04	0.03	5%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.3.d Domestic Navigation - Liquid Fuels	N_2O	0.13	0.11	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	72.62	5%	2%	5%	0.0000	0.001	0.0015	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	0.04	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	289.39	3%	2%	4%	0.0000	0.018	0.0060	0.0004	0.0003	0.0000
1.A.4 Other Sectors - Liquid Fuels	CH_4	7.04	0.64	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	13.44	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	279.33	3%	5%	6%	0.0000	0.018	0.0058	0.0009	0.0002	0.0000
1.A.4 Other Sectors - Solid Fuels	CH_4	128.56	12.40	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	1.31	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	542.25	3%	2%	4%	0.0000	0.001	0.0113	0.0000	0.0005	0.0000
1.A.4 Other Sectors - Gaseous Fuels	CH_4	3.13	1.22	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	0.29	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	90.46	3%	5%	6%	0.0000	0.002	0.0019	0.0001	0.0001	0.0000
1.A.4 Other Sectors - Peat	CH_4	1.12	4.65	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	0.36	3%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
1.A.4 Other Sectors- Biomass	CO_2			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	143.68	50%	150%	158%	0.0001	0.002	0.0030	0.0036	0.0021	0.0000
1.A.4 Other Sectors- Biomass	N_2O	12.97	26.41	50%	150%	158%	0.0000	0.000	0.0005	0.0007	0.0004	0.0000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CO_2	0.14	0.69	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	3.12	5%	50%	50%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
1.B.2.a Fugitive Emissions from Fuels - Oil	N_2O	0.00	0.00	5%	50%	50%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000

and Natural Gas - Oil												
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	299.75	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	3.06	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	1.39	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	452.40	2%	5%	5%	0.0000	0.005	0.0094	0.0003	0.0003	0.0000
2.A.2 Lime Production	CO_2	222.68	37.06	5%	30%	30%	0.0000	0.001	0.0008	0.0003	0.0001	0.0000
2.A.3 Glass Production	CO_2	11.74	6.97	7%	5%	9%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
2.A.4.a Ceramics	CO_2	227.92	4.96	5%	5%	7%	0.0000	0.002	0.0000	0.0001	0.0000	0.0000
2.A.4.b Other use of soda ash	CO_2	5.32	0.81	5%	5%	7%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.A.4.d Mineral wool production	CO_2	6.41	11.96	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	1,827.63	2%	2%	3%	0.0000	0.027	0.0380	0.0005	0.0011	0.0000
2.B.2 Nitric Acid Production	N_2O	893.01	209.51	2%	10%	10%	0.0000	0.003	0.0044	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	1.46	10%	10%	14%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.D.1 Lubricant use	CO_2	6.06	10.93	5%	50%	50%	0.0000	0.000	0.0002	0.0001	0.0000	0.0000
2.D.2 Parafin wax use	CO_2	0.88	2.68	5%	100%	100%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
2.D.3 Solvent use	CO_2	43.35	35.19	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	2.06	10%	2%	10%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.E.1 Semiconductor	SF_6	0.00	3.97	5%	5%	7%	0.0000	0.000	0.0001	0.0000	0.0000	0.0000
2.E.3 Photovoltaics	NF_3	0.00	0.20	5%	20%	21%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.F.1.a Domestic Refrigeration	HFCs	0.00	1.67	20%	50%	54%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
2.F.1.a Commercial Refrigeration	HFCs	0.00	379.74	20%	50%	54%	0.0001	0.008	0.0079	0.0039	0.0022	0.0000
2.F.1.a Transport Refrigeration	HFCs	0.00	48.60	20%	50%	54%	0.0000	0.001	0.0010	0.0005	0.0003	0.0000
2.F.1.a Industrial Refrigeration	HFCs	0.00	47.76	20%	50%	54%	0.0000	0.001	0.0010	0.0005	0.0003	0.0000
2.F.1.a Stationary Air-Conditioning	HFCs	0.00	22.78	20%	50%	54%	0.0000	0.000	0.0005	0.0002	0.0001	0.0000
2.F.1.b Mobile Air-Conditioning	HFCs	0.00	124.99	20%	50%	54%	0.0000	0.003	0.0026	0.0013	0.0007	0.0000
2.F.2 Foam Blowing Agents	HFCs	0.00	17.83	30%	30%	42%	0.0000	0.000	0.0004	0.0001	0.0002	0.0000
2.F.3 Fire Protection	HFCs	0.00	3.24	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	7.62	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	2.58	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	2.09	5%	100%	100%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
3.A Enteric Fermentation	CH_4	4,314.32	1,586.34	3%	9%	9%	0.0000	0.004	0.0330	0.0004	0.0012	0.0000
3.B Manure Management	CH_4	665.75	254.95	4%	2%	4%	0.0000	0.000	0.0053	0.0000	0.0003	0.0000
3.B Manure Management	N_2O	601.39	195.75	5%	100%	100%	0.0001	0.001	0.0041	0.0011	0.0003	0.0000
3.D.1 Direct N_2O Emissions From Managed Soils	N_2O	2,688.91	1,965.39	8%	87%	88%	0.0074	0.018	0.0409	0.0153	0.0046	0.0003
3.D.2 Indirect N_2O Emissions From Managed Soils	N_2O	608.02	407.17	16%	136%	137%	0.0008	0.003	0.0085	0.0043	0.0019	0.0000
3.G Liming	CO_2	20.59	15.86	10%	50%	51%	0.0000	0.000	0.0003	0.0001	0.0000	0.0000
3.H Urea Application	CO_2	35.71	17.17	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	755.65	30%	123%	126%	0.0023	0.007	0.0157	0.0083	0.0067	0.0001
5.B Biological Treatment of Solid Waste	CH_4	0.20	37.77	40%	100%	108%	0.0000	0.001	0.0008	0.0008	0.0004	0.0000
5.B Biological Treatment of Solid Waste	N_2O	0.15	21.36	40%	100%	108%	0.0000	0.000	0.0004	0.0004	0.0003	0.0000
5.C Incineration and Open Burning of Waste	CO_2	2.66	0.95	25%	40%	47%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
5.C Incineration and Open Burning of Waste	CH_4	0.00	0.00	25%	60%	65%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
5.C Incineration and Open Burning of Waste	N_2O	0.08	0.03	25%	60%	65%	0.0000	0.000	0.0000	0.0000	0.0000	0.0000
5.D Wastewater Treatment and Discharge	CH_4	471.00	137.63	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	44.28	30%	50%	58%	0.0000	0.000	0.0009	0.0002	0.0004	0.0000
Total emission		***48,107.51***	***20,050.77***	***Overall uncertainty (%)***			***10.5***	***Trend uncertainty (%)***				***2.2***

ANNEX III. Lithuanian energy balance according to the fuel type

Table 3-1. Balance of crude oil, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production	502	5,358	13,491	9,217	4,909	4,892	4,379	3,560	3,514	3,065	2,691
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
Export		335	13,254	6,312	4,736	3,438	3,408	2,863	2,677	2,067	2,185
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
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**
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
- 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
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
Production	87,988	37,709	68,838	112,699	123,626	124,021	115,648	116,610	96,781	107,664	117,465
Biofuel blended				26	445	610	528	433	293	600	337
Import	220	14,328	736	1,115	2,616	1,141	996	667	1,004	2,881	2,906
Export	42,104	23,601	50,765	95,698	114,237	114,611	105,566	110,591	89,539	101,063	111,419
International marine bunkers											
Changes in stocks	-2,725	-1,758	-2,012	-3,193	506	151	-1,479	1,999	353	-1,256	62
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**
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
- in peat extraction enterprises				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
Non-energy use											
Distribution and transmission losses	308	176	68	61	22	17	17	10	8	5	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**
- in industry	44	88	48	31	15	17	14	13	13	8	9
- in construction	439	176	101	69	28	29	24	17	16	16	15
- in transport	41,840	25,887	16,337	14,711	12,841	11,201	10,025	9,033	8,809	8,761	9,301
- in agriculture	440	307	170	53	43	38	33	32	35	28	17
- in fishing											
- in commercial / public services	308	44	58	19	7	10	11	10	7	6	4
- in households											

Table 3-3. Balance of aviation gasoline, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production											
Biofuel blended											
Import			14	20	18	18	18	16	19	19	16
Export											
International marine bunkers											
Changes in stocks											
Gross inland consumption			**14**	**20**	**18**	**18**	**18**	**16**	**19**	**19**	**16**
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**
- in industry											
- in construction											
- in transport			14	20	18	18	18	16	19	19	16
- 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
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
Production	28,125	9,088	18,566	24,705	10,352	11,862	10,874	12,168	9,267	7,780	10,012
Biofuel blended											
Import	387	948	846		837	303	7,263	2,078	1,255	2,244	2,943
Export	22,956	8,442	16,673	21,406	9,062	9,882	14,527	11,876	6,587	6,113	8,645
International marine bunkers											
Changes in stocks	86	129	-1,651	-1,185	115	222	-846	799	-203	10	40
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**
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**
- 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
- 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
Production	107,712	42,490	56,232	127,985	150,168	156,497	150,528	161,248	136,670	156,249	165,004
Biofuel blended				119	1,478	1,600	2,142	2,174	2,383	2,393	1,931
Import	8,923	9,475	1,670	2,840	7,882	15,451	19,016	31,433	42,930	68,750	48,563
Export	49,416	27,364	28,516	92,877	116,251	128,505	128,727	146,569	129,039	169,375	153,347
International marine bunkers			942								
Changes in stocks	-1,997	1,573	-4,819	-2,586	31	178	1,961	-2,156	217	-768	-274
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**
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
- in peat extraction enterprises	128	43	60	125	109	107	99	144	156	153	160
- in crude oil extraction enterprises			22	49	23	27	23	25	21	13	
- in refineries			5						4	2	1
- in electricity, gas, steam and air conditioning enterprises			49	20	12	16	11	12	11	6	7
Non-energy use			6								
Distribution and transmission losses	297	128	55	122	73	81	70	28	19	22	14
Final consumption:	**57,276**	**24,474**	**24,245**	**35,165**	**43,091**	**44,990**	**44,717**	**45,921**	**52,950**	**57,053**	**61,695**
- in industry	2,124	1,827	510	499	190	191	174	223	237	248	235
- in construction	2,507	935	613	589	382	425	472	406	390	320	309
- in transport	34,289	14,489	21,476	32,515	41,030	42,814	42,412	43,719	50,702	55,021	59,595
- in agriculture	14,277	4,207	1,327	1,362	1,444	1,472	1,587	1,503	1,562	1,438	1,516
- in fishing				14	5	9	10	10	10	6	7
- in commercial / public services	2,889	2,804	319	186	40	79	62	60	49	20	33
- 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
Production				2,125	1,130	1,216	4,020	3,397	3,930	4,777	5,068
Biofuel blended					2		104	89	98	73	68
Import		717		915	854	934	874	674	538	701	1231
Export				985		6			90	206	2
International marine bunkers				770	756	867	850	577	347	1738	2858
Changes in stocks		-717	65	-225	-7	-59	-150	79	-119	-61	63
Gross inland consumption			**65**	**1,060**	**1,223**	**1,218**	**3,998**	**3,662**	**4,010**	**3,546**	**3,570**
Statistical difference											
Transformed in power, heat and other plants:			22	102	55	40	51	58	38	38	43
- 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
-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
- in peat extraction enterprises					5	3	3	3	3	4	1
- in crude oil extraction enterprises											
- in refineries											
- in electricity, gas, steam and air conditioning enterprises											17
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**
- in industry			7	405	220	214	240	200	286	228	138
- in construction			7	25	47	49	63	60	80	67	39
- in transport				226	235	179	2,686	2,478	2,588	2,413	2,358
- in agriculture			23	137	230	237	287	268	346	264	287
- in fishing				59	73	65	72	73	78	76	37
- in commercial / public services			6	55	69	72	87	97	118	48	24
- in households				51	289	359	509	425	473	408	626

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production	12,006	7,636	11,026	21,046	12,720	11,507	10,235	11,742	10,116	12,155	13,388
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
Export	7,038	4,646	5,793	11,596	8,114	7,526	6,647	8,303	7,256	9,662	9,730
International marine bunkers											
Changes in stocks	46	230	-420	163	-111	-27	100	-34	-47	31	8
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**
Statistical difference											
Transformed in power, heat and other plants:	46		51	90	90	79	80	79	75	81	90
- 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
-in public heat plant	46		31	71	69	49	49	47	48	45	49
- 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
Final consumption:	**6,302**	**4,046**	**8,595**	**12,580**	**9,403**	**9,062**	**8,795**	**8,236**	**7,906**	**7,311**	**7,174**
- in industry			201	229	273	259	320	325	269	326	329
- in construction	92	46	74	77	122	48	32	35	43	38	55
- in transport	920	1,058	5,032	9,593	7,275	6,790	6,400	6,147	5,966	5,573	5,254
- in agriculture	230	46	19	38	41	63	68	65	105	54	94
- in fishing											
- in commercial / public services	460	92	62	23	6	25	14	23	26	20	42
- in households	4,600	2,804	3,207	2,620	1,686	1,877	1,961	1,641	1,497	1,300	1,400

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production	133,867	33,356	39,422	71,994	65,373	67,961	66,546	72,862	57,935	60,871	72,114
Biofuel blended											
Import	293,464	47,887	4,110	5,056	7,883	1,707	813	315	167	1,377	3504
Export	277,769	8,148	16,608	56,627	60,139	64,685	63,173	68,752	56,058	57,774	68,493
International marine bunkers	3,894	5,780	2,857	4,712	2,801	1,281	812	46		1255	3409
Changes in stocks	-8,951	-11,159	-4,689	-1,824	-3,450	1,270	5,997	543	1420	926	-693
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**
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
- in public CHP plant	44,195	20,511	7,233	3,837	4,157	942	5,284	1,349	346	493	77
- in auto-producer heat plant	642	201	27			405	279	418	383	1115	930
- in auto-producer CHP plant	20,190	16,618	6,813	1,659	491	217	248	171	128	26	102
-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
- 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
- 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**
- in industry	43,993	11,520	5,202	1,486	148	79	155	115	91	67	49
- 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
Production					4,306	2,413	1,563	382	343	267	256
Biofuel blended											
Import			1,407	1,191	2,779	4,630	5,339	3,589	333	516	701
Export				23	40	46	55	15	15	10	33
International marine bunkers			29	451	2,224	3,735	3,344	3,003	130	203	475
Changes in stocks			56	-60	-308	-338	-1,515	637	685	196	62
Gross inland consumption			**1,434**	**657**	**4,513**	**2,924**	**1,988**	**1,590**	**1,216**	**766**	**511**
Statistical difference											
Transformed in power, heat and other plants:			755	328	1,232	818	727	1,040	920	436	178
- in public CHP plant					18		262	819	624	348	16
- in auto-producer heat plant					1,017	602	181	37			
- in auto-producer CHP plant			713	318	197	213	282	183	296	87	162
-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**
- in industry			363	220	147	210	237	213	244	275	278
- in construction			47	93	75	72	35	37	31	35	30
- in transport											
- in agriculture			15	2	5	22	19	15	18	17	16
- in fishing				9							
- in commercial / public services			254	5	12	15	22	5	3	3	9
- in households											

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production	11,032	5,318	8,253	15,250	14,127	13,324	13,300	14,875	13,065	14,007	15,353
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**
Statistical difference											
Transformed in power, heat and other plants:					109	101	172	121	99	175	358
- in public CHP plant											
- in auto-producer heat plant							172	121	99	175	358
- 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
- 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
- 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
Production	9,534	1,108	3,117	6,804	4,938	5,158	4,288	4,904	3,555	5,449	6,588
Biofuel blended											
Import	40	791	474	1,150	1,814	2,208	1,623	1,792	1,567	1,812	1,371
Export	1,662	356	839	2,587	2,896	3,736	2,757	3,444	2,164	3,506	3,824
International marine bunkers											
Changes in stocks	40	39	71	28	-165	162	-286	164	40	-143	71
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**
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
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
Production			1,226	847	1,504	1,675	1,790	1,755	1,886	1,931	2,350
Biofuel blended											
Import	413	620	602	1,121	1,709	2,181	2,891	1,641	1,268	1,655	1,411
Export			924	843	2,350	2,950	3,795	2,555	2,358	2,781	2,970
International marine bunkers											
Changes in stocks			129	-14	-17	-34	-53	33	11	3	-46
Gross inland consumption	**413**	**620**	**1,033**	**1,111**	**846**	**872**	**833**	**874**	**807**	**808**	**745**
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
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
Production	1,962	1,393	2,740	3,940	3,856	3,883	3,433	3,738	3,528	3,745	4,146
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**
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
- 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
- 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
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
Export							9	6	11	33	15
International marine bunkers											
Changes in stocks	-1,220	-8,470	213	-1,121	614	673	-352	-434	709	-1420	322
Gross inland consumption	**84**	**17,252**	**14,565**	**4,274**	**12,785**	**19,604**	**22,726**	**25,059**	**22,708**	**24,002**	**24,551**
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
- 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
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
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
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
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
Production											
Biofuel blended											
Import	31,752	6,506	176	53	4,343	8,929	8,010	10,427	8,326	5,701	5,624
Export		50			438	464	575	865	817		
International marine bunkers											
Changes in stocks	980	2,889			-275	-970	-4	-730	178	640	536
Gross inland consumption	**32,732**	**9,345**	**176**	**53**	**3,630**	**7,495**	**7,431**	**8,832**	**7,687**	**6,341**	**6,160**
Statistical difference											
Transformed in power, heat and other plants:	1,834	452	25	53	55	51	71	81	67	88	83
- 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
-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**
- in industry	1,583	703	137		2,860	3,750	4,353	5,083	4,418	3,602	3,141
- in construction	226	25	14		0	11	7	7	4	6	11
- in transport											
- in agriculture	1,557	50			3	23	16	35	80	86	94
- in fishing											
- in commercial / public services	12,359	6,632			406	2,105	1,302	1,583	1,352	1,089	1,323
- in households	15,173	1,433			305	1,547	1,673	2,033	1,761	1,460	1,506

Table 3-20. Balance of anthracite, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
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		
Gross inland consumption			**100**		**15**	**91**	**24**	**42**	**26**		**24**
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**
- in industry					5	91	24	42	22		24
- 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
Production											
Biofuel blended											
Import			2,698	6,618	3,248	857	24	58	30		
Export				37	406	127		2	31		
International marine bunkers											
Changes in stocks			11	-168	672	-46	346	10	21	1	13
Gross inland consumption			**2,709**	**6,413**	**3,514**	**684**	**370**	**66**	**20**	**1**	**13**
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**
- in industry			5	3,059	207	16	19	4	3		
- 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
- in households			651	1,048	1,772	557	293	30	11		9

Table 3-22. Balance of coke, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production											
Biofuel blended											
Import			445	440	466	517	543	551	499	391	456
Export											
International marine bunkers											
Changes in stocks			-52	96	7	5	11	10	-21	8	14
Gross inland consumption			**393**	**536**	**473**	**522**	**554**	**561**	**478**	**399**	**470**
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**
- in industry			346	534	473	522	554	561	478	399	470
- 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
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
Production	580	600	494	825	364	492	709	985	1,181	872	200
Biofuel blended											
Import						2					
Export			76	1	104	142	153	137	109	94	13
International marine bunkers											
Changes in stocks	116	222	51	-235	94	140	-68	-44	-565	-510	153
Gross inland consumption	**696**	**822**	**469**	**589**	**354**	**492**	**488**	**804**	**507**	**268**	**340**
Statistical difference											
Transformed in power, heat and other plants:	445	357	258	299	202	248	188	551	163	67	101
- 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
-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
Consumed in energy sector, total:		126	36	11		13	25	6	6	3	1
- in peat extraction enterprises			20	11				6	6	3	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							
Final consumption:	**242**	**329**	**170**	**272**	**152**	**231**	**275**	**247**	**242**	**124**	**148**
- in industry	155	174	43	7	9	37	40	40	38	33	34
- in construction											
- in transport											
- in agriculture											
- in fishing											
- in commercial / public services	87	58		21	44	85	112	99	97	51	66
- in households		97	127	244	99	109	123	108	107	40	48

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production	239	186	138	147	84	101	73	96	81	63	77
Biofuel blended											
Import		119	2	143	696	899	1,009	1,150	762	604	797
Export						22	168	116	159	26	70
International marine bunkers											
Changes in stocks	-53	-13	-1	-35	-44	-160	64	-120	184	9	-26
Gross inland consumption	**186**	**292**	**139**	**255**	**736**	**818**	**978**	**1,010**	**868**	**650**	**778**
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**
- in industry	13	53		8	27	27	34	28	27	16	18
- in construction											
- in transport											
- in agriculture				3	16	17	18	21	19	13	15
- in fishing											
- in commercial / public services	27	53	1	28	193	238	295	325	307	173	190
- in households	146	186	136	207	497	536	628	633	515	448	548

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production											
Biofuel blended											
Import				176	520	857	1,139	1,264	1,328	1,776	1,166
Export				106	384	647	906	1,161	1,167	1,427	1,017
International marine bunkers											
Changes in stocks					3	-46	-61	38	-13	-202	34
Gross inland consumption				**70**	**139**	**164**	**172**	**141**	**148**	**147**	**183**
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
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
Production											
Biofuel blended											
Import	201,957	84,929	86,453	104,363	104,017	114,115	111,200	90,670	89,759	89,642	79,544
Export	6,102								13	3335	1536
International marine bunkers											
Changes in stocks			-37	-671	304	-298	-68	-62	-3296	255	-466
Gross inland consumption	**195,855**	**84,929**	**86,416**	**103,692**	**104,321**	**113,817**	**111,132**	**90,608**	**86,450**	**86,562**	**77,542**
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
- 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
- in auto-producer heat plant	1,787	473	324	1,160	1,003	954	1,881	1,045	1,896	1,970	1,675
- 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
-in public heat plant	6,265	1,391	688	667	558	568	470	391	372	327	483
- in geothermal plants				819	345	270	268	124	144	96	100
- in other industries			307	538							
Consumed in energy sector, total:			140	130	65	199	130	72	58	1298	1103
- in peat extraction enterprises											
- in crude oil extraction enterprises			3	3	3	3	3	2	3	2	2
- in refineries			28	28	4	2	19	20	18	15	58
- in electricity, gas, steam and air conditioning enterprises			109	99	58	194	108	50	37	1281	1043
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
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**
- in industry	36,065	8,916	8,285	14,573	13,670	14,099	14,579	12,470	12,024	11,417	11,966
- in construction	1,030	219	266	513	501	459	490	509	457	477	519
- in transport				647	1,028	862	1,330	1,250	1,232	1,250	1,303
- in agriculture	2,946	1,197	991	1,192	1,309	1,273	1,156	1,058	869	872	899
- 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
- in households	9,237	7,696	4,356	5,630	6,625	6,070	5,670	5,156	5,029	5,137	6,090

Table 3-28. Balance of charcoal, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production				18	24	19	19	19	28	26	15
Biofuel blended											
Import				14	61	58	43	58	126	210	215
Export				15	38	36	34	36	93	163	180
International marine bunkers											
Changes in stocks				3	1			-3	-17	-7	-10
Gross inland consumption				**20**	**48**	**41**	**28**	**38**	**44**	**66**	**40**
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**
- in industry											
- in construction											
- in transport											
- in agriculture											
- in fishing											
- in commercial / public services				20	48	41	28	38	44	66	40
- in households											

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production	11,930	19,632	27,324	35,293	41,734	40,955	41,291	43,355	46,292	49,852	49,647
Biofuel blended											
Import		61	4	727	2,008	4,603	4,623	4,949	5,185	5,628	6,203
Export			255	710	5,102	5,431	4,871	5,427	5,761	5,725	5,669
International marine bunkers											
Changes in stocks	-14	-381	-54	-498	444	-2,044	722	-188	-530	457	85
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**
Statistical difference				457							
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
- in public CHP plant				191	2,472	2,359	3,785	6,073	6,058	6,365	5,771
- 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
-in public heat plant	253	402	580	1,128	772	706	1,149	1,002	2,627	980	990
- in geothermal plants											
- in other industries				48	43	36	42	43	44	39	41
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**
- in industry	453	756	1,218	4,007	2,920	3,027	3,400	3,380	3,313	3,520	3,776
- in construction	51	105	100	185	143	145	157	125	99	62	73
- in transport											
- in agriculture	187	211	272	253	399	463	437	400	436	383	434
- 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
- in households	8,999	16,578	22,049	23,256	24,017	23,368	23,464	22,591	21,281	20,542	20,256

Table 3-30. Balance of agricultural waste, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production				96	228	212	242	238	457	585	591
Biofuel blended											
Import									8	10	2
Export									269	386	401
International marine bunkers											
Changes in stocks				16	11	-9	-34	24	6	-31	14
Gross inland consumption				**112**	**239**	**203**	**208**	**262**	**202**	**178**	**206**
Statistical difference											
Transformed in power, heat and other plants:				64	144	113	112	99	105	68	85
- 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
-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**
- in industry				41	11	7	6	13	5	16	28
- in construction											
- in transport											
- in agriculture				2	56	56	59	88	63	73	57
- in fishing											
- in commercial / public services					18	25	28	58	29	20	32
- in households				5	7	1	3	4		1	4

Table 3-31. Balance of bioethanol, TJ

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production				195	1,060	565	656	730	407	470	381
Biofuel blended											
Import					106	234	286	214	32	269	111
Export				162	649	320	483	562	120	308	184
International marine bunkers											
Changes in stocks				-7	-3	-14	6	19	41	11	-39
Gross inland consumption				**26**	**514**	**465**	**465**	**401**	**360**	**442**	**269**
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**
- in industry											
- in construction											
- in transport				26	436	397	365	284	232	405	269
- 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
Production				260	3,299	2,956	3,948	4,340	4429	4353	3816
Biofuel blended											
Import					527	1,273	1,413	1,406	1502	2035	1323
Export				168	2,538	2,726	3,131	3,571	3434	3865	3027
International marine bunkers											
Changes in stocks				27	166	-22	-62	-2	-88	-101	-15
Gross inland consumption				**119**	**1,454**	**1,481**	**2,168**	**2,173**	**2409**	**2422**	**2097**
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**	**2409**	**2422**	**2097**
- in industry											
- in construction											
- in transport				119	1,454	1,481	2,168	2,173	2409	2422	2097
- 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
Production				57	125	129	130	150	290	294	316
Biofuel blended											
Import											
Export											
International marine bunkers											
Changes in stocks											
Gross inland consumption				**57**	**125**	**129**	**130**	**150**	**290**	**294**	**316**
Statistical difference											
Transformed in power, heat and other plants:				36	55	56	52	67	105	106	109
- 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
- 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**
- in industry											
- in construction											
- in transport											
- in agriculture											
- in fishing											
- in commercial / public services				21	70	73	78	83	185	188	207
- in households											

Table 3-34. Balance of landfill biogas, TJ

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

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
Production				20	210	89	97	200	263	344	669
Biofuel blended											
Import											
Export											
International marine bunkers											
Changes in stocks											
Gross inland consumption				**20**	**210**	**89**	**97**	**200**	**263**	**344**	**669**
Statistical difference											
Transformed in power, heat and other plants:				7	91	42	45	114	178	225	545
- in public CHP plant											495
- in auto-producer heat plant				7	91	42	45	114	178	225	50
- 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**
- in industry					104	41	52	86	85	119	124
- 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
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
Production	960	400	1,228	2,971	2,939	3,068	2,922	3,258	3,064	3,337	3,779
Biofuel blended											
Import										2	
Export			14	154	49		19		1456	332	744
International marine bunkers											
Changes in stocks		-280	-101	-75	6	3	-65	87	11	-324	302
Gross inland consumption	**960**	**120**	**1,113**	**2,742**	**2,896**	**3,071**	**2,838**	**3,345**	**1,619**	**2,683**	**3,337**
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
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
Production								155	258	303	626
Biofuel blended											
Import											
Export											
International marine bunkers											
Changes in stocks										-13	
Gross inland consumption								**155**	**258**	**290**	**626**
Statistical difference											
Transformed in power, heat and other plants:								155	258	290	626
- in public CHP plant								155	258	290	626
- 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
Production								475	495	661	1583
Biofuel blended											
Import											
Export											
International marine bunkers											
Changes in stocks								-7	3	-8	-6
Gross inland consumption								**468**	**498**	**653**	**1577**
Statistical difference											
Transformed in power, heat and other plants:								468	498	653	1577
- in public CHP plant								468	498	653	1577
- 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
Production								468	475	676	912
Biofuel blended											
Import											
Export											
International marine bunkers											
Changes in stocks								-7	2	-17	-9
Gross inland consumption								**461**	**477**	**659**	**903**
Statistical difference											
Transformed in power, heat and other plants:								461	477	659	903
- in public CHP plant								461	477	659	903
- 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. Summary of study "Update of country specific GHG emission factors for energy sector" performed by Lithuanian Energy Institute in 2016

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						
Coking 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						

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
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 coking 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.

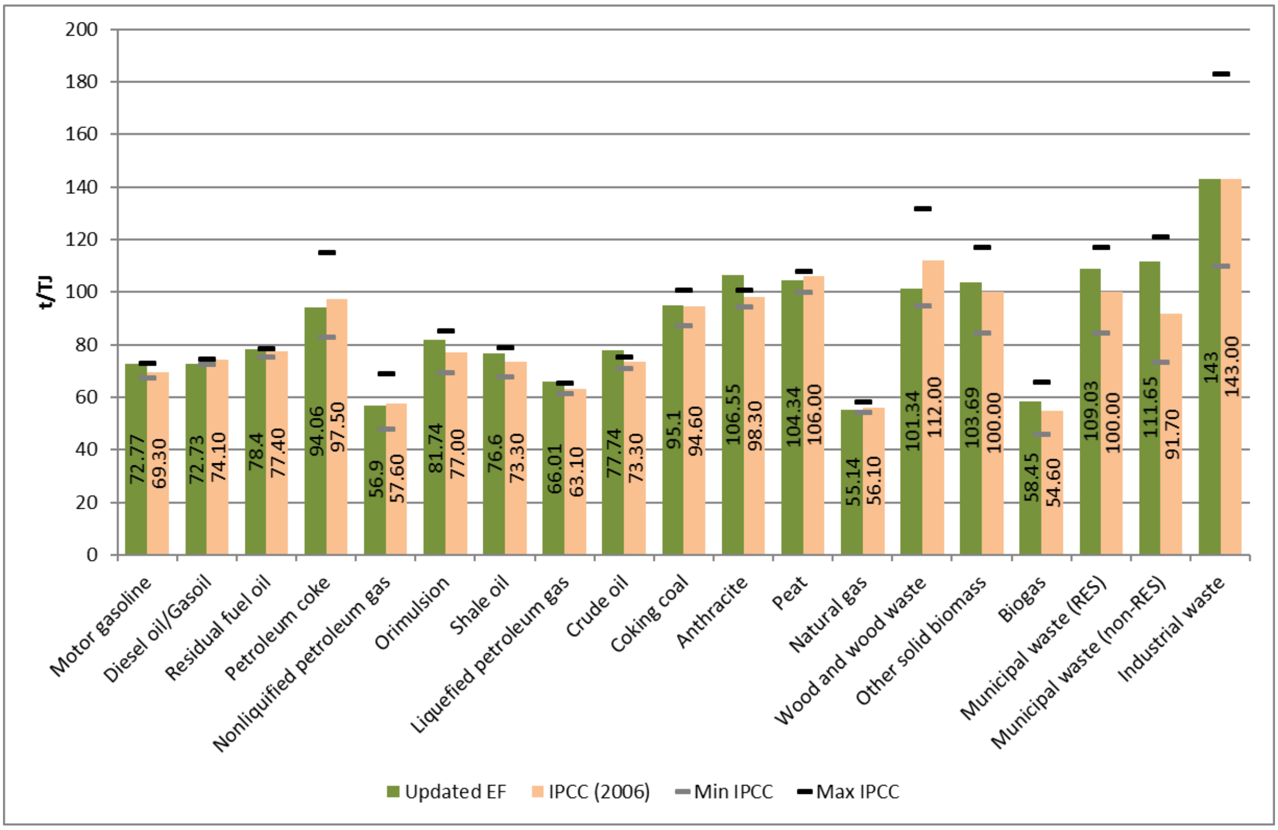


Figure 4-1. Comparison of updated country specific **CO_2** emission factors and default *2006 IPCC Guidelines* emission factors: energy industries

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						

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
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 *2006 IPCC Guidelines*.

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]	-	-	-

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
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.

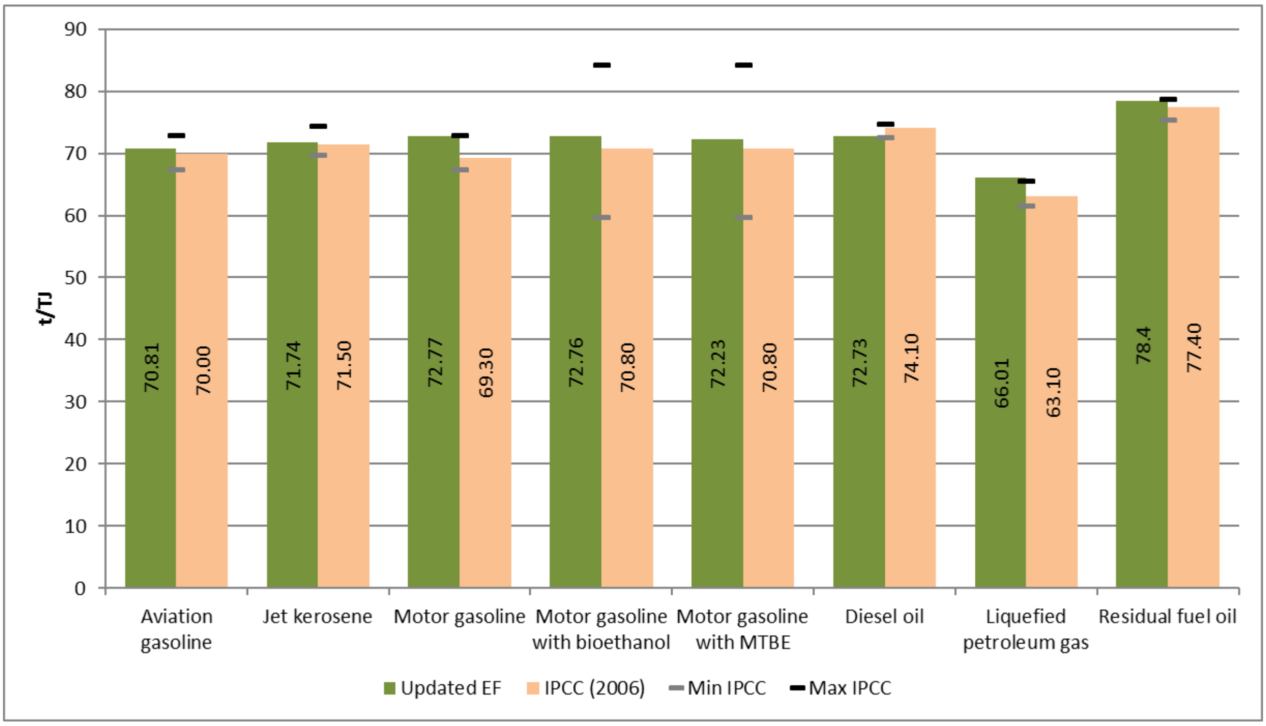


Figure 4-2. Comparison of updated country specific $\mathbf{CO_2}$ emission factors with default *2006 IPCC Guidelines* emission factors: transport sector

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	Coking 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	-	-	-

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
	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	Coking 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	Coking 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 (2006).

ANNEX V. CO_2 emissions from the installations registered in the National GHG registry, 2016

Table 5-1. CO_2 emissions from the installations registered in the GHG Emission Allowance Registry, 2016

No	*Company*	*Name of the Installation*	*Allocated EUA*	*Verified Emissions, t CO_2*
1	AB "Akmenės cementas"	Boiler house, cement production furnace	603,079	741,381
2	AB "Naujasis kalcitas"	Whitewash production furnace	43,651	45,637
3	UAB "Švenčionėlių keramika"	Furnace for ceramics	5,185	916
4	UAB "Rokų keramika"	Ceramics combustion furnace	7,879	1,700
5	AB "Palemono keramika"	Ceramics combustion furnace	7,811	3,097
6	AB "Dvarčionių keramika"	Ceramics combustion furnace	0	77
7	UAB "Alytaus keramika"	Ceramics combustion furnace	0	0
8	UAB "Kauno stiklas"	Glass melting furnace	5,491	15,641
9	AB "Panevėžio stiklas"	Glass melting furnace	10,464	21,659
10	AB "ORLEN Lietuva"	Oil refining factory	1,333,141	1,830,717
11	AB "Klaipėdos kartonas"	Boiler house	23,335	9,104
12	AB "Grigiškės"	Boiler house	33,589	9,487
13	AB "Simega"	Boiler house	2,672	0
14	AB "Achema"	Boiler house	1,938,496	2,440,359
15	AB "Nordic Sugar Kėdainiai"	Boiler house, oilcake desiccation	27,931	27,140
16	AB "Lifosa"	Boiler house	161,642	266
17	AB "Klaipėdos nafta"	Boiler house	12,766	17,526
18	UAB "Arvi cukrus"	Boiler house	12,385	14,686
19	UAB "Idavang Pasodėlė"	Boiler house	1,255	0
20	AB "Klaipėdos mediena"	Boiler house	14,242	71
21	UAB "Matuizų plytinė"	Boiler house	5,467	0
22	AB "Jonavos šilumos tinklai"	Jonava boiler house	15,230	6,856
23	AB "Jonavos šilumos tinklai"	Girele boiler house	3,580	0
24	UAB "Mažeikių šilumos tinklai"	Mazeikiai boiler house	16,197	359
25	UAB "Raseinių šilumos tinklai"	Raseiniai boiler house No 4	3,985	2,903
26	UAB "Molėtų šiluma"	Moletai boiler house	2,827	27
27	UAB "Šilutės šilumos tinklai"	Šilute boiler house	7,770	1,527

No	*Company*	*Name of the Installation*	*Allocated EUA*	*Verified Emissions, t CO_2*
28	UAB "Vilniaus energija"	Vilnius power plant No 2 (E-2)	0	317,515
29	UAB "Vilniaus energija"	Vilnius power plant No 3 (E-3)	0	2,562
30	UAB "Vilniaus energija"	Vilnius boiler house No 2	0	4,917
31	UAB "Vilniaus energija"	Vilnius boiler house No 8	0	4,901
32	UAB "Širvintų šiluma"	Širvintu boiler house No 3	3,066	0
33	AB "Šiaulių energija"	Šiauliai southern boiler house	51,207	14,555
34	AB "Klaipėdos energija"	Power plant	39,474	16,913
35	UAB "Radviliškio šiluma"	Radviliškis city boiler house	6,354	318
36	UAB "Utenos šilumos tinklai"	Utena boiler house	20,505	1,320
37	UAB "Tauragės šilumos tinklai"	Taurage - Berže boiler house	6,182	406
38	UAB "Šalčininkų šilumos tiklai"	Šalcininkai boiler house	2,634	224
39	Pravieniškių pataisos namai-atviroji kolonija	Boiler house	1,974	2,574
40	UAB "Varėnos šiluma"	Varena boiler house	5,229	0
41	AB "Panevėžio energija"	Panevežys boiler house No 2	21,883	21,203
42	AB "Panevėžio energija"	Rokiškis region boiler house	13,104	23
43	AB "Panevėžio energija"	Panevežys region boiler house No 1	24,512	4,518
44	AB "Panevėžio energija"	Pasvalys region boiler house	3,668	664
45	AB "Panevėžio energija"	Zarasai boiler house No 4	3,370	0
46	UAB "GEOTERMA"	Klaipeda geothermal PP	14,522	5,215
47	AB "Kauno energija"	Petrašiunai PP	3,648	1,855
48	AB "Kauno energija"	Pergale boiler house	790	417
49	AB "Kauno energija"	Šilkas boiler house	1,540	668
50	AB "Kauno energija"	Noreikiškes region boiler house	2,877	762
51	AB "Kauno energija"	Garliava region boiler house	3,271	185
52	AB "Kauno energija"	Jurbarkas region boiler house	4,764	4,593
53	UAB "Plungės šilumos tinklai"	Plunge boiler house No 1	6,088	338
54	UAB "Birštono šiluma"	Birštonas region boiler house	2,289	837
55	UAB "Litesko"	Druskininkai industry boiler house	13,698	1,321
56	UAB "Litesko"	Boiler house of Biržai city hall	1,373	266
57	UAB "Litesko"	Vilkaviškis boiler house	3,606	405

No	*Company*	*Name of the Installation*	*Allocated EUA*	*Verified Emissions, t CO_2*
58	UAB "Litesko"	Luoke boiler house	5,645	255
59	UAB "Litesko"	Mackevicius boiler house	2,588	150
60	UAB "Palangos šilumos tinklai"	Palanga boiler house	8,857	4,302
61	UAB "Litesko"	Marijampole region boiler house	18,676	7,069
62	UAB "Litesko"	Alytus region boiler house	32,468	9,288
63	AB "Lietuvos energijos gamyba"	Lietuvos PP	18,630	200,670
64	UAB "Kauno termofikacijos elektrinė"	Kaunas PP	171,368	61,614
65	UAB "Kaišiadorių šiluma"	Kaišiadoriai boiler house	4,242	0
66	UAB "Kretingos šilumos tinklai"	Kretinga boiler house No 3	3,928	0
67	AB "Klaipėdos energija"	Klaipeda region boiler house	34,510	14,121
68	AB "Klaipėdos energija"	Lypkiai regiopn boiler house	19,730	7,901
69	AB "Pagirių šiltnamiai"	Boiler house	0	31
70	UAB "Pramonės energija"	Boiler house	9,840	0
71	VĮ "Ignalinos atominė elektrinė"	Boiler house	4,168	4,585
72	UAB "Trakų energija"	Lentvaris boiler house	1,535	0
73	UAB "Gargždų plytų gamykla"	Boiler house	2,270	0
74	UAB "Akmenės energija"	Zalgiris boiler house	3,752	1,508
75	AB "Panevėžio energija"	Panevežys thermal PP	19,125	43,778
76	UAB "IKEA Industry Lietuva"	Fuel combustion plants	38,258	18,486
77	UAB "NEO Group"	Boiler house	33,296	12,398
78	AB "Panevėžio energija"	Kėdainiai region boiler house	71	222
79	UAB "Paroc"	Plants producing stone-wool	32,875	59,369
80	UAB "Vilniaus energija"	Boiler house	0	0
81	AB "Vilniaus GKG-3"	Boiler house	690	363
82	UAB "Agro Neveronys"	Boiler house	0	0
83	UAB "Pramonės energija"	Boiler house	14,873	0
84	VĮ "Visagino energija"	Thermal boiler house	44,547	28,847
85	AB "Amilina"	Boiler house and driers	0	2,126
86	UAB "Lignoterma"	Boiler house	0	0
87	AB "Amber Grid"	Jauniūnų gas compressor station	0	582

No	*Company*	*Name of the Installation*	*Allocated EUA*	*Verified Emissions, t* CO_2
88	UAB "Hoegh DLNG Klaipėda"	LNG ship	0	51,340
89	UAB "Fortum Klaipėda"	Power plant	0	29,957
		Total	**5,087,640**	**6,159,573**

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**	**0**

1991

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,054,154	399	3,993	2,396	399	0	2,061,342	7,188
Cropland	0	2,353,252	22,362	0	799	399	2,376,813	-38,735
Grassland	0	60,299	1,252,299	3,195	799	4,393	1,320,984	39,534
Wetlands	0	399	1,597	376,169	0	0	378,166	-3,594
Settlements	0	1,198	1,198	0	349,813	799	353,008	1,198
Other land	0	0	0	0	0	38,336	38,336	-5,590
Initial	**2,054,154**	**2,415,548**	**1,281,450**	**381,760**	**351,810**	**43,926**	**6,528,648**	**0**

1992

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,061,342	399	3,195	1,997	0	399	2,067,332	5,990
Cropland	0	2,312,920	25,158	0	0	799	2,338,877	-37,936
Grassland	0	59,900	1,291,833	799	1,198	4,792	1,358,521	37,537
Wetlands	0	399	0	375,370	0	2,396	378,166	0
Settlements	0	2,396	799	0	351,810	399	355,404	2,396
Other land	0	799	0	0	0	29,550	30,349	-7,987
Initial	**2,061,342**	**2,376,813**	**1,320,984**	**378,166**	**353,008**	**38,336**	**6,528,648**	**0**

1993

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,067,332	1,198	3,993	0	0	0	2,072,523	5,191
Cropland	0	2,276,581	22,762	1,198	799	1,597	2,302,937	-35,940
Grassland	0	58,702	1,331,367	1,198	799	5,191	1,397,256	38,735
Wetlands	0	799	0	375,770	0	399	376,968	-1,198
Settlements	0	799	399	0	353,806	0	355,004	-400
Other land	0	799	0	0	0	23,161	23,960	-6,389
Initial	**2,067,332**	**2,338,877**	**1,358,521**	**378,166**	**355,404**	**30,349**	**6,528,648**	**0**

1994

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,072,124	0	2,396	399	399	0	2,075,319	2,796
Cropland	0	2,232,655	28,352	0	0	799	2,261,806	-41,131
Grassland	0	66,688	1,364,910	799	799	4,792	1,437,988	40,732
Wetlands	0	399	0	375,770	0	399	376,568	-400
Settlements	0	2,795	1,597	0	353,806	0	358,199	3,195
Other land	399	399	0	0	0	17,970	18,769	-5,191
Initial	**2,072,523**	**2,302,937**	**1,397,256**	**376,968**	**355,004**	**23,960**	**6,528,648**	**0**

1995

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,075,319	0	1,597	799	0	0	2,077,715	2,396
Cropland	0	2,199,510	24,758	0	0	399	2,224,668	-37,138
Grassland	0	59,500	1,411,233	1,198	3,195	4,393	1,479,518	41,530
Wetlands	0	399	399	374,572	0	1,198	376,568	0
Settlements	0	1,997	0	0	355,004	399	357,400	-799
Other land	0	399	0	0	0	12,379	12,779	-5,990
Initial	**2,075,319**	**2,261,806**	**1,437,988**	**376,568**	**358,199**	**18,769**	**6,528,648**	**0**

1996

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,077,715	399	2,795	799	0	0	2,081,708	3,993
Cropland	0	2,198,312	8,386	0	0	0	2,206,698	-17,970
Grassland	0	25,956	1,468,337	399	0	399	1,495,092	15,574
Wetlands	0	0	0	375,370	0	0	375,370	-1,198
Settlements	0	0	0	0	357,400	0	357,400	0
Other land	0	0	0	0	0	12,379	12,379	-400
Initial	**2,077,715**	**2,224,668**	**1,479,518**	**376,568**	**357,400**	**12,779**	**6,528,648**	**0**

1997

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,081,708	799	2,396	399	0	0	2,085,302	3,594
Cropland	0	2,154,386	19,567	0	0	399	2,174,353	-32,345
Grassland	0	51,114	1,472,330	0	0	0	1,523,444	28,352
Wetlands	0	0	399	374,971	0	0	375,370	0
Settlements	0	399	399	0	357,001	0	357,800	400
Other land	0	0	0	0	399	11,980	12,379	0
Initial	**2,081,708**	**2,206,698**	**1,495,092**	**375,370**	**357,400**	**12,379**	**6,528,648**	**0**

1998

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,085,302	0	2,795	0	0	399	2,088,497	3,195
Cropland	0	2,089,295	37,138	0	0	0	2,126,433	-47,920
Grassland	0	84,259	1,483,112	0	0	0	1,567,371	43,927
Wetlands	0	0	0	375,370	0	0	375,370	0
Settlements	0	399	399	0	357,800	0	358,598	798
Other land	0	399	0	0	0	11,980	12,379	0
Initial	**2,085,302**	**2,174,353**	**1,523,444**	**375,370**	**357,800**	**12,379**	**6,528,648**	**0**

1999

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,088,097	399	1,597	1,198	0	0	2,091,292	2,795
Cropland	0	2,029,396	51,913	0	0	0	2,081,309	-45,124
Grassland	0	96,239	1,513,062	0	0	0	1,609,300	41,929
Wetlands	399	0	0	374,172	0	0	374,572	-798
Settlements	0	399	799	0	358,598	0	359,796	1,198
Other land	0	0	0	0	0	12,379	12,379	0
Initial	**2,088,497**	**2,126,433**	**1,567,371**	**375,370**	**358,598**	**12,379**	**6,528,648**	**0**

2000

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,091,292	0	2,396	2,396	0	399	2,096,483	5,191
Cropland	0	1,971,094	50,715	0	0	0	2,021,808	-59,501
Grassland	0	108,218	1,552,995	399	1,198	0	1,662,811	53,511
Wetlands	0	0	799	371,776	0	0	372,575	-1,997
Settlements	0	1,997	2,396	0	358,598	0	362,991	3,195
Other land	0	0	0	0	0	11,980	11,980	-399
Initial	**2,091,292**	**2,081,309**	**1,609,300**	**374,572**	**359,796**	**12,379**	**6,528,648**	**0**

2001

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,096,483	399	1,997	0	0	0	2,098,879	2,396
Cropland	0	1,920,379	43,128	0	0	0	1,963,506	-58,302
Grassland	0	100,631	1,616,888	399	399	399	1,718,717	55,906
Wetlands	0	0	0	372,176	0	0	372,176	-399
Settlements	0	399	399	0	362,592	0	363,390	399
Other land	0	0	399	0	0	11,581	11,980	0
Initial	**2,096,483**	**2,021,808**	**1,662,811**	**372,575**	**362,991**	**11,980**	**6,528,648**	**0**

2002

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,098,879	0	3,993	399	0	0	2,103,272	4,393
Cropland	0	1,873,657	40,332	0	0	0	1,913,989	-49,517
Grassland	0	89,051	1,673,992	0	0	0	1,763,043	44,326
Wetlands	0	0	399	371,776	0	799	372,974	798
Settlements	0	799	0	0	363,390	0	364,189	799
Other land	0	0	0	0	0	11,181	11,181	-799
Initial	**2,098,879**	**1,963,506**	**1,718,717**	**372,176**	**363,390**	**11,980**	**6,528,648**	**0**

2003

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,102,872	799	3,195	799	399	0	2,108,064	4,792
Cropland	0	1,848,499	23,560	0	0	0	1,872,060	-41,929
Grassland	0	64,691	1,735,089	0	0	399	1,800,180	37,137
Wetlands	399	0	399	372,176	0	0	372,974	0
Settlements	0	0	399	0	363,790	0	364,189	0
Other land	0	0	399	0	0	10,782	11,181	0
Initial	**2,103,272**	**1,913,989**	**1,763,043**	**372,974**	**364,189**	**11,181**	**6,528,648**	**0**

2004

Land	Forest	Cropland	Grassland	Wetlands	Settlements	Other	Final	Net

category	land					land		change
Forest land	2,107,265	399	6,389	1,597	0	0	2,115,651	7,587
Cropland	0	1,821,744	29,151	0	0	0	1,850,895	-21,165
Grassland	0	49,517	1,763,841	399	0	0	1,813,757	13,577
Wetlands	799	0	399	370,978	0	399	372,575	-399
Settlements	0	399	399	0	364,189	0	364,988	799
Other land	0	0	0	0	0	10,782	10,782	-399
Initial	**2,108,064**	**1,872,060**	**1,800,180**	**372,974**	**364,189**	**11,181**	**6,528,648**	**0**

2005

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,115,252	799	5,191	1,597	0	399	2,123,238	7,587
Cropland	0	1,810,163	22,762	0	0	0	1,832,925	-17,970
Grassland	0	39,134	1,783,408	0	0	0	1,822,543	8,786
Wetlands	0	0	799	370,978	0	399	372,176	-399
Settlements	399	799	1,597	0	364,988	0	367,783	2,795
Other land	0	0	0	0	0	9,983	9,983	-799
Initial	**2,115,651**	**1,850,895**	**1,813,757**	**372,575**	**364,988**	**10,782**	**6,528,648**	**0**

2006

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,122,839	799	5,591	1,597	0	0	2,130,826	7,588
Cropland	0	1,796,986	91,047	0	0	0	1,888,033	55,108
Grassland	0	34,742	1,723,509	399	0	0	1,758,650	-63,893
Wetlands	0	399	399	370,179	0	0	370,978	-1,198
Settlements	399	0	1,597	0	367,783	0	369,780	1,997
Other land	0	0	399	0	0	9,983	10,383	400
Initial	**2,123,238**	**1,832,925**	**1,822,543**	**372,176**	**367,783**	**9,983**	**6,528,648**	**0**

2007

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,130,826	2,396	2,795	1,997	0	399	2,138,413	7,587
Cropland	0	1,861,278	85,856	0	0	0	1,947,134	59,101
Grassland	0	24,359	1,667,603	0	399	0	1,692,361	-66,289
Wetlands	0	0	1,198	368,981	0	0	370,179	-799
Settlements	0	0	1,198	0	369,380	0	370,578	798
Other land	0	0	0	0	0	9,983	9,983	-400
Initial	**2,130,826**	**1,888,033**	**1,758,650**	**370,978**	**369,780**	**10,383**	**6,528,648**	**0**

2008

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,138,413	1,597	4,792	399	0	0	2,145,201	6,788
Cropland	0	1,919,580	85,057	0	399	0	2,005,037	57,903
Grassland	0	25,557	1,599,317	399	0	0	1,625,274	-67,087
Wetlands	0	0	799	369,380	0	0	370,179	0
Settlements	0	399	1,597	0	370,179	0	372,176	1,598
Other land	0	0	799	0	0	9,983	10,782	799
Initial	**2,138,413**	**1,947,134**	**1,692,361**	**370,179**	**370,578**	**9,983**	**6,528,648**	**0**

2009

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change

Forest land	2,144,802	0	3,594	0	0	0	2,148,396	3,195
Cropland	0	1,989,463	57,504	0	0	0	2,046,966	41,929
Grassland	0	15,175	1,559,783	0	1,198	399	1,576,555	-48,719
Wetlands	399	0	0	370,179	0	0	370,578	399
Settlements	0	399	3,594	0	370,978	0	374,971	2,795
Other land	0	0	799	0	0	10,383	11,181	399
Initial	**2,145,201**	**2,005,037**	**1,625,274**	**370,179**	**372,176**	**10,782**	**6,528,648**	**0**

2010

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,148,396	399	5,990	0	0	0	2,154,785	6,389
Cropland	0	2,019,412	4,393	0	0	0	2,023,805	-23,161
Grassland	0	27,154	1,562,579	399	1,198	0	1,591,331	14,776
Wetlands	0	0	0	370,179	0	0	370,179	-399
Settlements	0	0	3,594	0	373,773	0	377,367	2,396
Other land	0	0	0	0	0	11,181	11,181	0
Initial	**2,148,396**	**2,046,966**	**1,576,555**	**370,578**	**374,971**	**11,181**	**6,528,648**	**0**

2011

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,154,785	2,396	5,990	0	0	0	2,163,171	8,386
Cropland	0	1,956,718	47,920	0	0	0	2,004,637	-19,168
Grassland	0	64,691	1,537,022	0	399	0	1,602,112	10,781
Wetlands	0	0	0	370,179	0	399	370,578	399
Settlements	0	0	399	0	376,968	0	377,367	0
Other land	0	0	0	0	0	10,782	10,782	-399
Initial	**2,154,785**	**2,023,805**	**1,591,331**	**370,179**	**377,367**	**11,181**	**6,528,648**	**0**

2012

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,163,171	1,198	8,785	1,597	0	0	2,174,752	11,581
Cropland	0	1,935,154	49,118	0	0	0	1,984,271	-20,366
Grassland	0	68,285	1,543,810	799	799	0	1,613,693	11,581
Wetlands	0	0	0	368,182	0	0	368,182	-2,396
Settlements	0	0	399	0	376,568	0	376,968	-399
Other land	0	0	0	0	0	10,782	10,782	0
Initial	**2,163,171**	**2,004,637**	**1,602,112**	**370,578**	**377,367**	**10,782**	**6,528,648**	**0**

2013

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,174,752	799	4,792	0	0	0	2,180,343	5,591
Cropland	0	1,916,785	59,900	0	399	0	1,977,083	-7,188
Grassland	0	66,289	1,544,210	0	799	0	1,611,297	-2,396
Wetlands	0	0	0	368,182	0	0	368,182	0
Settlements	0	399	4,393	0	375,770	0	380,562	3,594
Other land	0	0	399	0	0	10,782	11,181	399
Initial	**2,174,752**	**1,984,271**	**1,613,693**	**368,182**	**376,968**	**10,782**	**6,528,648**	**0**

2014

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,180,343	1,997	3,594	2,396	0	0	2,188,329	7,986
Cropland	0	1,921,577	74,275	0	0	0	1,995,852	18,769
Grassland	0	53,111	1,529,834	799	399	799	1,584,941	-26,356
Wetlands	0	0	1,198	364,988	0	0	366,186	-1,996
Settlements	0	399	1,997	0	380,162	0	382,558	1,996
Other land	0	0	399	0	0	10,383	10,782	-399
Initial	**2,180,343**	**1,977,083**	**1,611,297**	**368,182**	**380,562**	**11,181**	**6,528,648**	**0**

2015

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,188,329	799	8,386	799	0	0	2,198,312	9,983
Cropland	0	1,985,070	50,715	0	399	0	2,036,184	40,332
Grassland	0	9,584	1,523,444	0	0	1,198	1,534,226	-50,715
Wetlands	0	0	399	365,387	0	399	366,186	0
Settlements	0	399	1,997	0	382,159	0	384,555	1,997
Other land	0	0	0	0	0	9,185	9,185	-1,597
Initial	**2,188,329**	**1,995,852**	**1,584,941**	**366,186**	**382,558**	**10,782**	**6,528,648**	**0**

2016

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,197,913	399	3,594	799	0	0	2,202,705	4,393
Cropland	0	2,032,191	37,138	0	799	0	2,070,127	33,943
Grassland	0	3,594	1,492,297	799	399	799	1,497,887	-36,339
Wetlands	0	0	799	364,588	0	0	365,387	-799
Settlements	399	0	399	0	383,357	0	384,156	-399
Other land	0	0	0	0	0	8,386	8,386	-799
Initial	**2,198,312**	**2,036,184**	**1,534,226**	**366,186**	**384,555**	**9,185**	**6,528,648**	**0**

ANNEX VII. Additional information of Agriculture sector

Other relavant information

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

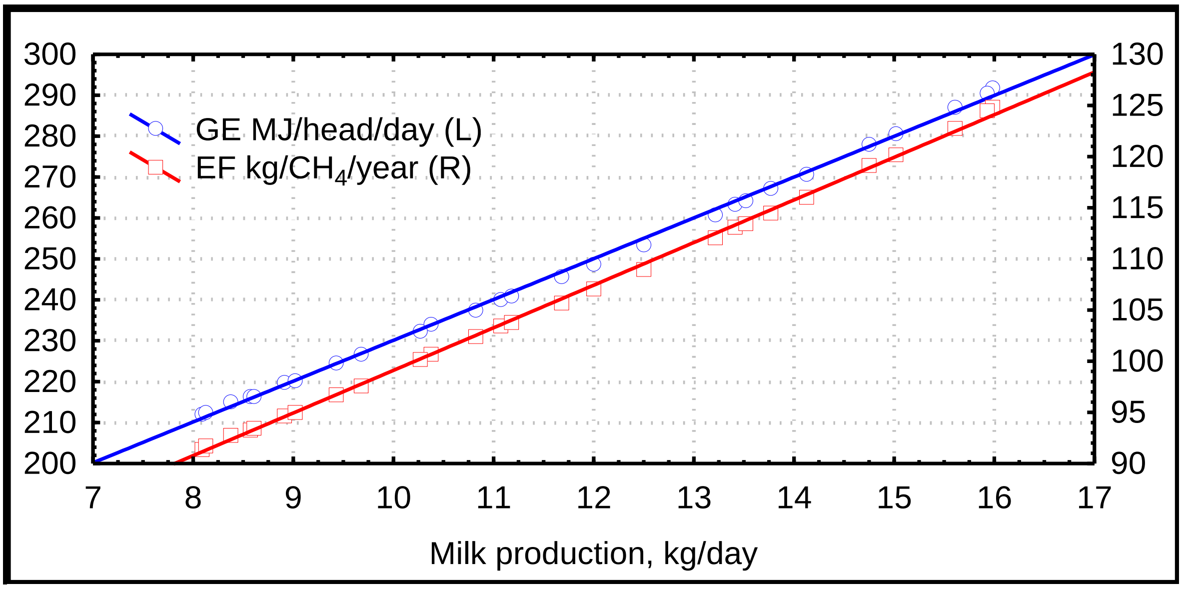


Figure A.5-1. Impact of milk yeld on GE and EF's

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 2016.

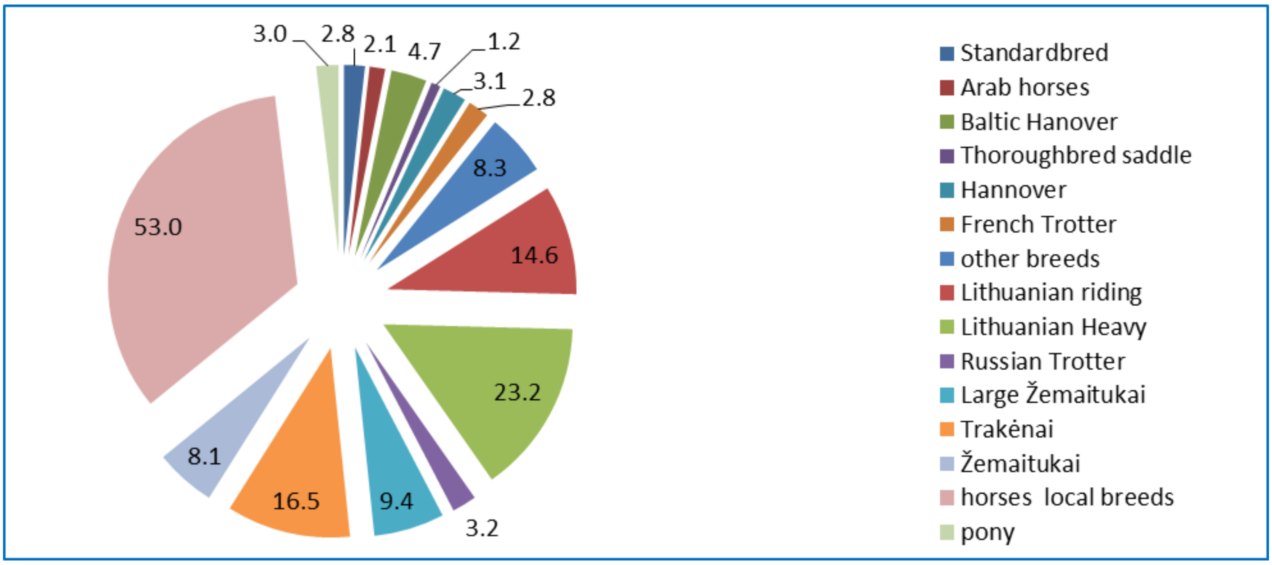


Figure A.5-2. Distribution by breeds of horses, %

Local breeds horses constitute more than half (53%) of grown horses breeds in Lithuania. Lithuanian Heavy (23%) and Trakėnai (17%) breeds are also wildly grown.

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	6.56	6.45	5.98	0.60
1995	6.58	6.44	5.98	0.60
2000	6.58	6.45	5.98	0.60
2005	6.56	6.45	5.98	0.60
2010	6.54	6.50	5.98	0.60
2011	6.53	6.51	5.98	0.60
2012	6.53	6.52	5.98	0.60
2013	6.53	6.54	5.98	0.60
2014	6.52	6.57	5.99	0.60
2015	6.53	6.59	6.00	0.60
2016	6.52	6.61	5.99	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	99	100	55
2005	50	116	106	106	54
2010	43	133	114	114	49
2011	42	136	116	115	48
2012	40	142	119	118	48
2013	38	145	120	119	46
2014	37	154	125	124	46
2015	36	153	124	124	45
2016	35	150	123	122	42

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**	
	Swine, thous. heads	701.2	692.7	677.2	600.1	569.8	439.9	
	Liquid manure, %	81.6	86.7	86.7	81.7	81.3	65.1	
Anaerobi cdigester	**Year**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
	Swine, thous.	0	0	0	0	0	0	0

s	heads							
	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**	
	Swine, thous. heads	16.6	0.0	0.0	41.9	43.0	154.0	
	Liquid manure, %	1.9	0.0	0.0	5.7	6.1	22.8	

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

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

Table A. 5 - 6. Composition of diet for Suckling cows

Feedstuff	Crude	Crude	Crude	Nitrogen-	DM	GE	Fooder

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

	protein	fat	fibre	free extract			
	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	0.9
Silage	114.1	32.5	298.4	390	279	16.84	4.5
Green fodder – grass	182.9	37.6	250.1	432.7	213.1	18.47	9
Milk substitutes	275	301	0	368.8	125	25.01	1.02
Concentrates	173.5	26.4	52.6	719.2	866	18.84	1.01

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	kg/day

						DM	
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	1,722	313	3,179	6,648
1995	1,495	272	3,003	6,173
2000	1,703	310	3,164	6,607
2005	1,908	345	3,317	7,024
2010	2,115	384	3,430	7,560
2011	2,155	392	3,449	7,672
2012	2,238	409	3,485	7,898
2013	2,269	415	3,499	7,982
2014	2,391	440	3,553	8,317
2015	2,380	438	3,549	8,288
2016	2,341	430	3,531	8,180

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	0.769	0.193	1.138	2.361	4.94
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 protein	Crude fat	Crude fiber	Nitrogen-free extracts	DM 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

Recalculations made in Agriculture

Table A.5-41. Reported in previous submission and recalculated GE (MJ/head/day) and CH_4 EF (kg CH_4/head/year) from enteric fermentation of swine

Year	2017 submission		2018 submission		Absolute difference		Relative difference	
	Gross energy (MJ/head/day)	CH_4 EF (kg CH_4/head/year)	Gross energy (MJ/head/day)	CH_4 EF(kg CH_4/head/year)	Gross energy (MJ/head/day)	CH_4 emission factors (CH_4/head/year)	Gross energy, %	CH_4 emission factors, %
1990	30.28	1.19	34.69	1.36	4.41	0.17	14.57	13.95
1991	30.17	1.19	34.77	1.36	4.60	0.17	15.24	14.63
1992	30.15	1.19	34.98	1.37	4.82	0.18	16.00	15.40
1993	30.14	1.18	35.30	1.38	5.16	0.20	17.13	16.56
1994	30.12	1.18	35.30	1.38	5.18	0.20	17.18	16.61
1995	30.11	1.18	35.19	1.38	5.08	0.19	16.87	16.29

1996	30.09	1.18	35.21	1.38	5.11	0.19	16.99	16.41
1997	30.17	1.19	35.09	1.37	4.92	0.19	16.32	15.72
1998	30.01	1.18	34.69	1.36	4.68	0.18	15.59	14.95
1999	29.96	1.18	34.86	1.36	4.90	0.19	16.37	15.74
2000	30.08	1.18	35.03	1.37	4.95	0.19	16.45	15.85
2001	29.98	1.18	34.54	1.35	4.56	0.17	15.20	14.57
2002	30.00	1.18	34.69	1.36	4.69	0.18	15.64	15.04
2003	29.98	1.18	34.74	1.36	4.76	0.18	15.88	15.29
2004	29.95	1.18	34.47	1.35	4.52	0.17	15.08	14.46
2005	29.82	1.17	34.15	1.33	4.34	0.16	14.54	13.89
2006	29.52	1.16	33.65	1.31	4.13	0.15	13.99	13.27
2007	29.39	1.16	33.51	1.31	4.11	0.15	14.00	13.25
2008	29.68	1.17	33.85	1.32	4.17	0.16	14.06	13.39
2009	29.39	1.15	33.32	1.30	3.93	0.15	13.38	12.64
2010	29.35	1.15	33.26	1.30	3.91	0.14	13.31	12.56
2011	29.83	1.17	33.95	1.33	4.12	0.15	13.83	13.21
2012	29.83	1.17	34.00	1.33	4.17	0.16	13.98	13.38
2013	29.84	1.17	34.04	1.33	4.21	0.16	14.10	13.52
2014	29.83	1.17	34.14	1.34	4.31	0.16	14.44	13.86
2015	29.77	1.17	34.09	1.33	4.32	0.16	14.49	13.90

Table A.5-42. Reported in previous submission and recalculated GE (MJ/head/day) and CH_4 EF (kg CH_4/head/year) from enteric fermentation of non-dairy cattle

Year	**2017 submission**		**2018 submission**		**Absolute difference**		**Relative difference**	
	Gross energy (MJ/head/day)	**CH_4 EF (kg CH_4/head /year)**	**Gross energy (MJ/head /day)**	**CH_4 EF(kg CH_4/head/year)**	**Gross energy (MJ/head /day)**	**CH_4 emission factors (CH_4/head/ year)**	**Gross energy, %**	**CH_4 emission factors, %**
1990	124.96	52.82	125.47	53.04	0.51	0.22	0.41	0.42
1991	124.8	52.75	125.91	53.23	1.11	0.48	0.89	0.91
1992	124.41	52.58	125.06	52.86	0.65	0.28	0.52	0.53
1993	123.65	52.24	123.59	52.22	-0.06	-0.02	-0.05	-0.04
1994	122.83	51.89	122.77	51.86	-0.06	-0.03	-0.05	-0.06
1995	122.25	51.63	122.18	51.6	-0.07	-0.03	-0.06	-0.06
1996	121.98	51.51	121.9	51.48	-0.08	-0.03	-0.07	-0.06
1997	121.84	51.45	122.52	51.86	0.68	0.41	0.56	0.80
1998	119.45	50.4	120.96	51.28	1.51	0.88	1.26	1.75
1999	117.71	49.64	119.11	50.46	1.40	0.82	1.19	1.65
2000	117.9	49.73	118.57	50.13	0.67	0.40	0.57	0.80
2001	116.66	49.21	116.57	49.17	-0.09	-0.04	-0.08	-0.08
2002	116.75	49.27	116.68	49.24	-0.07	-0.03	-0.06	-0.06
2003	117.08	49.43	117.02	49.41	-0.06	-0.02	-0.05	-0.04
2004	116.76	49.32	116.7	49.29	-0.06	-0.03	-0.05	-0.06
2005	117.04	49.49	116.98	49.46	-0.06	-0.03	-0.05	-0.06
2006	118.98	50.44	118.94	50.42	-0.04	-0.02	-0.03	-0.04
2007	120.41	51.13	120.38	51.11	-0.03	-0.02	-0.02	-0.04
2008	120.64	51.29	120.61	51.28	-0.03	-0.01	-0.02	-0.02
2009	121.12	51.6	121.09	51.59	-0.03	-0.01	-0.02	-0.02
2010	122.32	52.19	122.3	52.18	-0.02	-0.01	-0.02	-0.02
2011	121.74	51.97	121.73	51.97	-0.01	0.00	-0.01	0.00
2012	121.2	51.79	121.21	51.79	0.01	0.00	0.01	0
2013	123.35	52.92	123.36	52.92	0.01	0.00	0.01	0

2014	126.11	54.34	126.11	54.34	0	0	0	0
2015	128.47	5554	128.47	55.54	0	0	0	0

Table A.5-43. Reported in previous submission and recalculated number of livestock population per year, thous. heads

Year	Non-dairy cattle		Swine		Horses	
	2017 submission	2018 submission	2017 submission	2018 submission	2017 submission	2018 submission
1990	1531.20	1540.99	2574.63	2577.35	78.85	78.85
1991	1431.66	1450.92	2307.85	2303.87	81.25	81.24
1992	1182.92	1192.39	1769.80	1769.16	81.15	81.15
1993	-	-	1277.95	1280.16	80.50	80.53
1994	-	-	1227.98	1230.15	79.75	79.75
1995	-	-	1264.91	1266.28	77.90	77.86
1996	-	-	1198.79	1200.28	79.50	79.45
1997	497.13	500.97	1163.86	1167.35	79.95	81.55
1998	456.26	463.55	1179.56	1186.46	76.40	78.25
1999	426.98	433.27	1047.59	1051.92	74.60	74.81
2000	385.94	388.79	901.86	895.89	71.65	71.65
2001	339.14	339.19	939.19	933.22	66.45	66.46
2002	351.71	351.74	1035.91	1035.91	62.60	62.58
2003	377.68	377.67	1059.21	1059.19	62.15	62.12
2004	387.50	387.49	1065.37	1065.35	63.60	63.61
2005	-	-	-	-	63.10	63.12
2006	-	-	-	-	61.75	61.73
2007	-	-	-	-	58.40	58.38
2008	-	-	-	-	55.15	55.16
2009	-	-	-	-	51.69	51.70

Table A.5-44. Reported in previous submission and recalculated CH_4 EF (kg CH_4/head/year) and methane emission (kt) from manure management for non-dairy cattle

Year	2017 submission		2018 submission		Relative difference, %	
	CH_4 EF (kg CH_4/head/year)	CH_4 emission (kt)	CH_4 EF (kg CH_4/head/year)	CH_4 emission (kt)	CH_4 EF	CH_4 emission
1990	3.24	4.96	3.26	5.02	0.60	1.23
1991	3.29	4.71	3.33	4.83	1.28	2.59
1992	3.34	3.95	3.36	4.01	0.75	1.54
1993	3.37	2.91	3.37	2.91	-0.06	-0.06
1994	3.41	2.24	3.40	2.24	-0.07	-0.07
1995	3.45	1.88	3.44	1.88	-0.07	-0.07
1996	3.49	1.78	3.49	1.78	-0.07	-0.07
1997	3.55	1.76	3.70	1.85	4.04	4.78
1998	3.53	1.61	3.84	1.78	8.05	9.49
1999	3.55	1.52	3.83	1.66	7.44	8.79
2000	3.61	1.39	3.75	1.46	3.78	4.49
2001	3.62	1.23	3.61	1.23	-0.12	-0.10
2002	3.67	1.29	3.67	1.29	-0.06	-0.05
2003	3.73	1.41	3.73	1.41	-0.02	-0.02
2004	3.78	1.46	3.77	1.46	-0.05	-0.05
2005	3.89	1.54	3.89	1.54	-0.07	-0.07
2006	4.13	1.78	4.12	1.78	-0.06	-0.06
2007	4.28	1.85	4.28	1.85	-0.05	-0.05

2008	4.39	1.77	4.39	1.77	-0.05	-0.05
2009	4.55	1.83	4.54	1.83	-0.05	-0.05
2010	4.70	1.91	4.70	1.91	-0.04	-0.04
2011	4.76	1.97	4.76	1.96	-0.03	-0.03
2012	4.83	2.01	4.83	2.01	-0.02	-0.02
2013	5.18	2.14	5.18	2.14	-0.03	-0.03
2014	5.60	2.37	5.59	2.37	-0.03	-0.03
2015	5.93	2.57	5.93	2.57	-0.04	-0.04

Table A.5-45. Reported in previous submission and recalculated CH_4 EF (kg CH_4/head/year) and methane emission (kt) from manure management for swine

Year	2017 submission		2018 submission		Absolute difference	
	CH_4 EF (kg CH_4/head/year)	CH_4 emission (kt)	CH_4 EF (kg CH_4/head/year)	CH_4 emission (kt)	CH_4 EF CH_4/head/year)	CH_4 Emission (kt)
1990	4.46	11.48	5.11	13.17	0.65	1.69
1991	4.46	10.30	5.14	11.85	0.68	1.55
1992	4.48	7.93	5.20	9.19	0.72	1.26
1993	4.50	5.75	5.27	6.74	0.77	1.00
1994	4.51	5.54	5.29	6.51	0.78	0.96
1995	4.53	5.73	5.30	6.71	0.76	0.97
1996	4.55	5.45	5.32	6.39	0.77	0.93
1997	4.58	5.33	5.33	6.22	0.75	0.89
1998	4.57	5.39	5.29	6.27	0.71	0.88
1999	4.59	4.80	5.34	5.61	0.75	0.81
2000	4.62	4.17	5.38	4.82	0.76	0.65
2001	4.63	4.35	5.33	4.97	0.70	0.63
2002	4.65	4.82	5.38	5.57	0.73	0.75
2003	4.66	4.94	5.41	5.73	0.74	0.78
2004	4.50	4.80	5.18	5.52	0.68	0.72
2005	4.51	4.93	5.17	5.65	0.66	0.72
2006	4.48	5.03	5.11	5.73	0.63	0.70
2007	4.45	4.56	5.07	5.20	0.62	0.64
2008	4.50	4.10	5.13	4.67	0.63	0.58
2009	4.48	4.09	5.08	4.64	0.60	0.55
2010	4.50	4.18	5.10	4.73	0.60	0.56
2011	4.69	4.03	5.34	4.59	0.65	0.56
2012	4.81	3.85	5.49	4.38	0.67	0.54
2013	4.81	3.76	5.49	4.29	0.68	0.53
2014	4.54	3.33	5.19	3.81	0.66	0.48
2015	4.50	3.16	5.16	3.62	0.65	0.46

Table A.5-46. Reported in previous submission and recalculated N excretion of animal population (except Pasture range and paddock), kt

Year	2017 submission	2018 submission	Absolute difference	Relative difference, %
1990	131.27	132.82	1.55	1.18
1991	122.70	124.96	2.27	1.85
1992	100.37	102.34	1.97	1.96
1993	78.95	80.53	1.58	2.00
1994	69.00	70.47	1.47	2.13
1995	64.09	65.35	1.25	1.95
1996	61.61	62.83	1.23	1.99
1997	61.37	62.33	0.96	1.56

1998	58.54	59.13	0.59	1.00
1999	51.90	52.34	0.44	0.85
2000	48.03	48.12	0.09	0.19
2001	46.96	46.87	-0.08	-0.18
2002	49.21	49.18	-0.03	-0.05
2003	51.52	51.51	0.00	-0.01
2004	53.19	53.23	0.04	0.08
2005	53.99	54.05	0.06	0.11
2006	55.62	55.73	0.11	0.20
2007	54.88	55.02	0.15	0.27
2008	52.97	53.13	0.16	0.31
2009	51.98	52.18	0.20	0.38
2010	52.05	52.27	0.23	0.44
2011	51.39	51.64	0.25	0.49
2012	51.39	51.69	0.29	0.57
2013	51.71	52.06	0.35	0.68
2014	53.62	54.04	0.42	0.79
2015	54.71	55.08	0.37	0.69

Agriculture 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.5-47. Harvested annual dry matter yield

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
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
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
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
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
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
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
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
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
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
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
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
Flax	434.1	450.6	287.3	425.6	457.5	610.0	610.0	610.0	915.0	915.0	915.0
Buckwheat	574.1	516.7	762.6	476.1	619.8	812.5	767.3	788.7	809.1	845.4	972.8
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
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
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
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
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
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
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
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
Soya beans	772.6	772.6	772.6	772.6	772.6	772.6	611.3	946.1	714.8	588.7	1471.7
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
Lupines	110.1	176.7	133.9	159.1	103.0	162.5	150.0	132.6	140.9	204.2	181.6
Vetches	551.0	427.0	386.0	398.0	340.0	368.0	350.0	526.0	495.0	495.0	427.0
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
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
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
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
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
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
Perennial grasses hay	2,805.6	3,149.8	2,682.1	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
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
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
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
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

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
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

Table A.5-48. Total annual area harvested

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
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
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
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
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
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
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
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
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
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
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
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
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
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
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
Other cereals	100.0	100.0	200.0	200.0	700.0	700.0	600.0	800.0	900.0	200.0	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
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
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
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
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
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
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
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
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
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
Lucerne hay	951.6	600.0	700.0	700.0	900.0	1,300.0	1,700.0	1,800.0	951.6	600.0	700.0
Lucerne haylage	3,384.4	3,000.0	2,900.0	3,300.0	3,100.0	3,000.0	5,500.0	6,300.0	3,384.4	3,000.0	2,900.0
Clover and their mixture hay	60,278.0	15,700.0	15,400.0	17,100.0	17,400.0	17,400.0	14,100.0	11,100.0	60,278.0	15,700.0	15,400.0
Clover and their mixture haylage	100,502.2	18,300.0	26,900.0	27,800.0	28,200.0	29,900.0	28,000.0	20,300.0	100,502.2	18,300.0	26,900.0
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
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
Perennial grasses hay	257,946.1	168,269.3	109,981.8	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
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
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
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	385700.0
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	307200.0

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
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

Table A.5-49. Ratio of above-ground residues dry matter to harvested yield

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016
$R_{AG(T)}$	**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
Spring Wheat	1.63	1.64	1.62	1.56	1.58	1.54	1.52	1.53	1.49	1.50	1.55
Triticale	1.50	1.58	1.49	1.47	1.53	1.50	1.37	1.42	1.40	1.36	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
Barley	1.21	1.40	1.26	1.23	1.27	1.21	1.18	1.19	1.16	1.15	1.20
Oats	1.31	1.63	1.45	1.44	1.55	1.42	1.36	1.38	1.34	1.32	1.39
Grain maize	1.27	1.27	1.27	1.26	1.14	1.13	1.15	1.13	1.15	1.18	1.13
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
Winter Rape	1.52	1.78	1.52	1.47	1.57	1.63	1.37	1.48	1.44	1.36	1.43
Spring Rape	2.04	1.79	1.78	1.68	1.74	1.58	1.57	1.62	1.58	1.58	1.66
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
Flax	3.12	3.04	4.15	3.16	3.01	2.53	2.53	2.53	2.05	2.05	2.05
Buckwheat	2.62	2.79	2.24	2.94	2.51	2.17	2.24	2.21	2.18	2.13	1.99
Mixed cereals	1.47	1.76	1.66	1.65	1.68	1.61	1.55	1.55	1.49	1.51	1.54
Other cereals	1.61	1.61	1.35	1.78	1.90	1.61	1.50	1.73	1.87	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
Potatoes	0.44	0.47	0.39	0.49	0.47	0.41	0.38	0.42	0.38	0.38	0.40
Sugar beet	0.26	0.26	0.24	0.22	0.20	0.19	0.19	0.18	0.18	0.19	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
Peas	1.49	1.67	1.63	1.70	1.78	1.69	1.63	1.61	1.54	1.48	1.51
Beans	0.90	0.70	0.76	0.88	0.83	0.78	0.72	0.68	0.63	0.61	0.61
Soya beans	2.68	2.68	2.68	2.68	2.68	2.68	3.14	2.36	2.82	3.22	1.85
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
Lupines	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
Lucerne hay	IE	IE	IE	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
Clover and their mixture hay	IE	IE	IE	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
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
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
Perennial grasses hay	0.30	0.30	0.30	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
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
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
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

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
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
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

Table A.5-50. Ratio of below-ground residues to harvested yield

	1990	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
$R_{BG(T)}$	**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
Spring Wheat	0.74	0.74	0.73	0.72	0.72	0.71	0.70	0.71	0.70	0.70	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
Rye	0.54	0.59	0.56	0.57	0.59	0.57	0.54	0.58	0.56	0.54	0.56
Barley	0.49	0.53	0.50	0.49	0.50	0.49	0.48	0.48	0.48	0.47	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
Grain maize	0.50	0.50	0.50	0.50	0.47	0.47	0.47	0.47	0.47	0.48	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
Winter Rape	0.55	0.61	0.55	0.54	0.57	0.58	0.52	0.54	0.54	0.52	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
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
Flax	0.91	0.89	1.13	0.91	0.88	0.78	0.78	0.78	0.67	0.67	0.67
Buckwheat	0.80	0.83	0.71	0.87	0.77	0.70	0.71	0.71	0.70	0.69	0.66
Mixed cereals	0.54	0.61	0.58	0.58	0.59	0.58	0.56	0.56	0.55	0.55	0.56
Other cereals	0.57	0.57	0.52	0.61	0.64	0.57	0.55	0.60	0.63	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
Potatoes	0.29	0.29	0.28	0.30	0.29	0.28	0.28	0.28	0.28	0.28	0.28
Sugar beet	0.25	0.25	0.25	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
Peas	0.47	0.51	0.50	0.51	0.53	0.51	0.50	0.50	0.48	0.47	0.48
Beans	0.36	0.32	0.33	0.36	0.35	0.34	0.33	0.32	0.31	0.31	0.31
Soya beans	0.70	0.70	0.70	0.70	0.70	0.70	0.79	0.64	0.73	0.80	0.54
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
Lupines	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
Lucerne hay	IE	IE	IE	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
Clover and their mixture hay	IE	IE	IE	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
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
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
Perennial grasses hay	1.04	1.04	1.04	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
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
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

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
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
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
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

Table A.5-51. Other relavant parameters used for annual N in crop residues

	DRY	$N_{AG(T)}$	$N_{BG(T)}$	$R_{BG-BIO(T)}$	$Frac_{REMOVE}$	$Frac_{RENEW}$	Area burnt	Slope	Intercept	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. Additional information of LULUCF sector

Recalculation made in LULUCF

1. Forest land

Recalculations were done as a result of internal land use and land-use change database review in State Forest Service. Database review was done taking into account NFI field measurement data, National Paying Agency data of declared agricultural land and the initial data from studies (Study 1 and Study 2) conducted in 2012, in order to improve accuracy in land-use matrix preparation. Another recalculations are related to national carbon stock factors' implementation for GHG inventory: carbon stock in forest litter (for forest land remaining forest land and land converted to forest land separately), adjusted carbon stock in forest land remaining forest land mineral soils, carbon stock in land converted to forest land mineral soils. Use of national carbon stock value in forest litter resulted in recalculation of carbon stock change in forest wildfires and dead organic matter carbon stock change in land converted to forest land. National value of carbon stock in litter in forest land remaining forest land equals to 7.389 t C ha^{-1}, whereas carbon stock in litter in land converted to forest land equals to 1.2 t C ha-1 in forests of 1 – 10 years and 2.5 in forests of 101 – 20 years. Average adjusted national carbon stock in mineral soils in forest land remaining forest land equals to 81.4 t C ha^{-1} and 55.3 t C ha^{-1} for forests in age group of 0 to 10 years and 58.8 t C ha^{-1} for forests in age group of 11 to 20 years. As a consequence of determination of national carbon stock value in mineral soils in land converted to forest land, carbon stock changes in mineral soils in land converted to forest land were estimated for the first time this year. Use of national carbon stock value in mineral soils has resulted in recalculations if carbon stock change in mineral soils in land converted to forest land and deforested areas.

Table A. 6-1. Forest area changes due to the revision of land use, land-use change matrix, ha

Year	2017 submission	2018 submission	Absolute difference	Relative difference, %
1990	2,061,369.00	2,054,154.00	-7,215.00	-0.35
1991	2,068,559.00	2,061,342.00	-7,217.00	-0.35
1992	2,074,549.00	2,067,332.00	-7,217.00	-0.35
1993	2,079,742.00	2,072,523.00	-7,219.00	-0.35
1994	2,082,539.00	2,075,319.00	-7,220.00	-0.35
1995	2,084,935.00	2,077,714.00	-7,221.00	-0.35
1996	2,090,128.00	2,081,708.00	-8,420.00	-0.40
1997	2,093,722.00	2,085,301.00	-8,421.00	-0.40
1998	2,097,317.00	2,088,497.00	-8,820.00	-0.42
1999	2,100,113.00	2,091,292.00	-8,821.00	-0.42
2000	2,105,704.00	2,096,483.00	-9,221.00	-0.44
2001	2,108,899.00	2,098,879.00	-10,020.00	-0.48
2002	2,113,293.00	2,103,273.00	-10,020.00	-0.47
2003	2,118,884.00	2,108,064.00	-10,820.00	-0.51
2004	2,126,873.00	2,115,651.00	-11,222.00	-0.53
2005	2,134,860.00	2,123,238.00	-11,622.00	-0.54
2006	2,142,050.00	2,130,826.00	-11,224.00	-0.52
2007	2,150,438.00	2,138,413.00	-12,025.00	-0.56
2008	2,157,227.00	2,145,201.00	-12,026.00	-0.56
2009	2,160,023.00	2,148,395.00	-11,628.00	-0.54
2010	2,166,415.00	2,154,786.00	-11,629.00	-0.54
2011	2,173,206.00	2,163,172.00	-10,034.00	-0.46

2012	2,184,788.00	2,174,752.00	-10,036.00	-0.46
2013	2,189,182.00	2,180,342.00	-8,840.00	-0.40
2014	2,197,170.00	2,188,328.00	-8,842.00	-0.40
2015	2,205,957.00	2,198,311.00	-7,646.00	-0.35

Table A. 6-2. Submitted and recalculated emissions due to forest wildfires, kt CO_2

Years	2017 submission	2018 submission	Absolute difference	Relative difference, %
1990	4.50	1.42	-3.08	-68.34
1991	2.15	0.68	-1.47	-68.34
1992	32.60	10.32	-22.28	-68.34
1993	11.92	3.77	-8.15	-68.34
1994	11.92	3.77	-8.15	-68.34
1995	11.92	3.77	-8.15	-68.34
1996	11.92	3.77	-8.15	-68.34
1997	11.92	3.77	-8.15	-68.34
1998	1.81	0.57	-1.24	-68.34
1999	11.51	3.64	-7.87	-68.34
2000	10.98	3.48	-7.51	-68.34
2001	3.73	1.18	-2.55	-68.34
2002	25.06	7.93	-17.13	-68.34
2003	14.65	4.64	-10.01	-68.34
2004	8.50	2.69	-5.81	-68.34
2005	1.71	0.54	-1.17	-68.34
2006	40.27	12.75	-27.52	-68.34
2007	1.28	0.40	-0.87	-68.34
2008	3.77	1.19	-2.58	-68.34
2009	10.59	3.35	-7.24	-68.34
2010	0.72	0.23	-0.49	-68.34
2011	9.83	3.11	-6.72	-68.34
2012	0.68	0.22	-0.47	-68.34
2013	0.58	0.19	-0.39	-67.12
2014	5.67	1.79	-3.88	-68.44
2015	1.78	0.61	-1.18	-66.03

Table A. 6-3. Submitted and recalculated emissions due to forest wildfires, kt CH_4

Year	2017 submission	2018 submission	Absolute difference	Relative difference, %
1990	0.029	0.02	-0.01	-32.00
1991	0.014	0.01	0.00	-32.00
1992	0.209	0.14	-0.07	-32.00
1993	0.076	0.05	-0.02	-32.00
1994	0.076	0.05	-0.02	-32.00
1995	0.076	0.05	-0.02	-32.00
1996	0.076	0.05	-0.02	-32.00
1997	0.076	0.05	-0.02	-32.00
1998	0.012	0.01	0.00	-32.00
1999	0.074	0.05	-0.02	-32.00
2000	0.070	0.05	-0.02	-32.00
2001	0.024	0.02	-0.01	-32.00

2002	0.160	0.11	-0.05	-32.00
2003	0.094	0.06	-0.03	-32.00
2004	0.054	0.04	-0.02	-32.00
2005	0.011	0.01	0.00	-32.00
2006	0.258	0.18	-0.08	-32.00
2007	0.008	0.01	0.00	-32.00
2008	0.024	0.02	-0.01	-32.00
2009	0.068	0.05	-0.02	-32.00
2010	0.005	0.00	0.00	-32.00
2011	0.063	0.04	-0.02	-32.00
2012	0.004	0.00	0.00	-32.00
2013	0.002	0.00	0.00	-56.14
2014	0.038	0.03	-0.01	-30.30
2015	0.008	0.00	0.00	-44.48

Table A. 6-4. Submitted and recalculated emissions due to forest wildfires, kt N_2O

Year	2017 submission	2018 submission	Absolute difference	Relative difference, %
1990	0.0016	0.0011	-0.0005	-32.00
1991	0.0008	0.0005	-0.0002	-32.00
1992	0.0115	0.0078	-0.0037	-32.00
1993	0.0042	0.0029	-0.0013	-32.00
1994	0.0042	0.0029	-0.0013	-32.00
1995	0.0042	0.0029	-0.0013	-32.00
1996	0.0042	0.0029	-0.0013	-32.00
1997	0.0042	0.0029	-0.0013	-32.00
1998	0.0006	0.0004	-0.0002	-32.00
1999	0.0041	0.0028	-0.0013	-32.00
2000	0.0039	0.0026	-0.0012	-32.00
2001	0.0013	0.0009	-0.0004	-32.00
2002	0.0089	0.0060	-0.0028	-32.00
2003	0.0052	0.0035	-0.0017	-32.00
2004	0.0030	0.0020	-0.0010	-32.00
2005	0.0006	0.0004	-0.0002	-32.00
2006	0.0143	0.0097	-0.0046	-32.00
2007	0.0005	0.0003	-0.0001	-32.00
2008	0.0013	0.0009	-0.0004	-32.00
2009	0.0037	0.0025	-0.0012	-32.00
2010	0.0003	0.0002	-0.0001	-32.00
2011	0.0035	0.0024	-0.0011	-32.00
2012	0.0002	0.0002	-0.0001	-32.00
2013	0.0001	0.0001	-0.0001	-56.14
2014	0.0021	0.0015	-0.0006	-30.30
2015	0.0004	0.0002	-0.0002	-44.48

Table A. 6-5. Submitted and recalculated litter carbon stock changes in land converted to forest land, kt C

Year	2017 submission	2018 submission	Absolute difference	Relative difference, %
1990	122.22	10.94	-111.28	-91.05

1991	127.97	10.95	-117.02	-91.44
1992	132.29	11.43	-120.85	-91.36
1993	132.76	11.57	-121.20	-91.29
1994	131.81	11.48	-120.33	-91.29
1995	130.85	11.50	-119.35	-91.21
1996	131.81	11.57	-120.23	-91.22
1997	131.81	11.70	-120.10	-91.12
1998	129.89	11.53	-118.36	-91.13
1999	128.45	11.59	-116.86	-90.98
2000	124.14	11.40	-112.74	-90.82
2001	122.70	11.43	-111.27	-90.69
2002	121.26	11.36	-109.90	-90.63
2003	120.78	11.20	-109.59	-90.73
2004	126.53	11.53	-115.00	-90.89
2005	131.33	11.67	-119.66	-91.11
2006	133.72	11.69	-122.03	-91.26
2007	137.08	11.71	-125.37	-91.46
2008	139.47	11.75	-127.72	-91.57
2009	134.68	11.28	-123.40	-91.62
2010	129.89	10.59	-119.30	-91.85
2011	129.41	10.37	-119.04	-91.99
2012	136.12	10.68	-125.44	-92.15
2013	135.16	10.71	-124.45	-92.07
2014	140.91	11.41	-129.50	-91.90
2015	139.95	12.34	-127.61	-91.18

Table A. 6-6. Submitted and recalculated carbon stock changes in mineral soils in deforested land, kt CO_2

Year	2017 submission	2018 submission	Absolute difference	Relative difference, %
1994	140.45	130.29	-10.16	-7.23
1999	140.45	130.29	-10.16	-7.23
2003	140.45	130.29	-10.16	-7.23
2004	140.45	260.90	120.46	85.77
2005	140.45	130.29	-10.16	-7.23
2006	280.90	130.29	-150.61	-53.62
2009	140.45	11.19	-129.26	-92.03

Table A. 6-7. Submitted and recalculated total emissions/removals in forest land category, kt CO_2 eqv.

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	-7,743.23	-7,718.63	24.60	-0.32
1991	-7,682.04	-7,620.37	61.67	-0.80
1992	-7,542.12	-7,290.68	251.44	-3.33
1993	-8,136.33	-7,866.79	269.54	-3.31
1994	-7,603.71	-7,344.19	259.51	-3.41
1995	-5,430.44	-5,172.79	257.65	-4.74
1996	406.79	630.54	223.75	55.00
1997	-1,008.73	-748.47	260.27	-25.80

1998	-8,331.84	-8,090.19	241.65	-2.90
1999	-8,137.64	-7,895.33	242.31	-2.98
2000	-9,494.91	-9,263.74	231.17	-2.43
2001	-7,054.34	-6,801.51	252.83	-3.58
2002	-6,276.81	-6,037.88	238.93	-3.81
2003	-5,125.40	-4,884.81	240.58	-4.69
2004	-4,971.90	-4,709.55	262.35	-5.28
2005	-4,516.13	-4,250.81	265.32	-5.87
2006	-4,643.53	-4,406.35	237.19	-5.11
2007	-5,894.96	-5,631.42	263.54	-4.47
2008	-7,497.35	-7,231.86	265.49	-3.54
2009	-8,728.82	-8,484.37	244.45	-2.80
2010	-9,845.85	-9,605.82	240.02	-2.44
2011	-10,366.56	-10,150.66	215.90	-2.08
2012	-10,068.86	-9,839.11	229.75	-2.28
2013	-9,873.84	-9,641.96	231.89	-2.35
2014	-9,225.28	-8,950.75	274.53	-2.98
2015	-8,861.81	-8,638.30	223.50	-2.52

2 Cropland

Recalculations were done as a result of internal land use and land-use change database review in State Forest Service. Database review was done taking into account NFI field measurement data, National Paying Agency data of declared agricultural land and the initial data from studies (Study 1 and Study 2) conducted in 2012, in order to improve accuracy in land-use matrix preparation. Another recalculations are related to national carbon stock factors' implementation for GHG inventory - carbon stock in cropland (76.1 t C ha^{-1}) and grassland (81.0 t C ha^{-1}) mineral soils, which not only resulted in recalculations of carbon stock changes in mineral soils in cropland remaining cropland mineral soils, land converted to cropland mineral soils, but also direct N_2O emissions due to the recalculated carbon loss in mineral soils. Recalculations, in addition, were performed due to the adjusted organic soils proportion in total land use area in cropland after the NFI cycle on non-forest land was completed, recalculation of organic soil proportion in turn resulted in recalculations of carbon stock changes in mineral soils. Adjusted share of organic soils in cropland is equal to 1 % of total cropland area, whereas organic soils share in grassland category is equal to 7.2 % of total grassland area (drained organic soils in grassland category constitute 6.5 % of total grassland area). Another recalculation was done in order to correct errors of misinterpretation of the formula for GHG emission calculation from fires (value of C_F was not needed in the formula as it is already included in the value of M_B). Another type of recalculations includes correction of errors due to the incorrect biomass values for cropland (10 t d. m. ha^{-1}) and grassland (13.6 t d. m. ha^{-1}) used for biomass carbon stock change calculation, which were corrected for this submission.

Table A. 6-8. Cropland area changes due to the revised land use, land-use change matrix, kha

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	2,426.03	2,415.55	-10.49	-0.43
1991	2,386.49	2,376.81	-9.68	-0.41
1992	2,346.55	2,338.88	-7.67	-0.33
1993	2,311.00	2,302.94	-8.07	-0.35
1994	2,269.46	2,261.81	-7.66	-0.34

1995	2,233.12	2,224.67	-8.45	-0.38
1996	2,215.94	2,206.70	-9.24	-0.42
1997	2,183.59	2,174.35	-9.24	-0.42
1998	2,134.46	2,126.43	-8.03	-0.38
1999	2,088.53	2,081.31	-7.22	-0.35
2000	2,029.42	2,021.81	-7.61	-0.37
2001	1,967.51	1,963.51	-4.00	-0.20
2002	1,918.78	1,913.99	-4.79	-0.25
2003	1,876.84	1,872.06	-4.78	-0.25
2004	1,854.87	1,850.90	-3.98	-0.21
2005	1,835.30	1,832.93	-2.38	-0.13
2006	1,893.22	1,888.03	-5.18	-0.27
2007	1,952.73	1,947.13	-5.60	-0.29
2008	2,026.62	2,005.04	-21.58	-1.07
2009	2,080.54	2,046.97	-33.58	-1.61
2010	2,084.93	2,023.81	-61.13	-2.93
2011	2,090.53	2,004.64	-85.89	-4.11
2012	2,113.69	1,984.27	-129.42	-6.12
2013	2,131.27	1,977.08	-154.18	-7.23
2014	2,154.83	1,995.85	-158.98	-7.38
2015	2,138.86	2,036.18	-102.67	-4.80

Table A. 6-9. Submitted and recalculated biomass carbon stock changes in land converted to cropland, kt C

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	-26.84	-142.94	-116.10	432.55
1991	-26.84	-142.94	-116.10	432.55
1992	-30.67	-160.81	-130.14	424.25
1993	-28.28	-145.49	-117.22	414.52
1994	-34.99	-181.23	-146.24	417.96
1995	-31.15	-158.25	-127.10	407.96
1996	-10.07	-53.60	-43.54	432.54
1997	-23.49	-125.07	-101.59	432.56
1998	-45.53	-237.39	-191.85	421.35
1999	-62.31	-331.83	-269.52	432.55
2000	-61.35	-324.17	-262.82	428.39
2001	-50.81	-275.67	-224.87	442.61
2002	-48.41	-257.80	-209.39	432.55
2003	-28.28	-150.60	-122.32	432.55
2004	-34.99	-186.33	-151.34	432.56
2005	-23.97	-145.49	-121.53	507.11
2006	-108.32	-581.97	-473.65	437.27
2007	-104.01	-548.79	-444.78	427.65
2008	-120.30	-543.68	-423.38	351.93
2009	-85.79	-367.57	-281.77	328.43
2010	-7.19	-28.08	-20.89	290.59
2011	-16.77	-306.30	-289.53	1,725.98
2012	-36.43	-313.96	-277.54	761.92

2013	-69.50	-382.88	-313.38	450.92
2014	-95.38	-474.77	-379.39	397.76
2015	-99.69	-324.17	-224.48	225.17

Table A. 6-10. Submitted and recalculated carbon stock changes in cropland remaining cropland mineral soils, kt C

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	-53.35	-6.26	47.09	-88.27
1991	-53.35	-6.26	47.09	-88.27
1992	-53.35	-11.45	41.90	-78.54
1993	-53.35	-10.41	42.94	-80.49
1994	-53.35	-10.41	42.94	-80.49
1995	-53.35	-9.37	43.98	-82.44
1996	-53.35	-3.15	50.20	-94.10
1997	-53.35	-4.14	49.21	-92.24
1998	-53.35	-3.11	50.24	-94.18
1999	-53.35	-5.18	48.17	-90.29
2000	-53.35	-8.52	44.83	-84.03
2001	-53.35	-3.22	50.13	-93.96
2002	-53.35	-5.53	47.82	-89.63
2003	14.70	-1.57	-16.27	-110.71
2004	14.70	0.62	-14.08	-95.75
2005	14.70	-7.93	-22.63	-153.91
2006	14.70	-8.91	-23.61	-160.62
2007	14.70	-5.10	-19.80	-134.67
2008	14.70	-7.01	-21.71	-147.69
2009	14.70	-0.68	-15.38	-104.65
2010	14.70	-51.14	-65.84	-447.88
2011	14.70	-51.35	-66.05	-449.32
2012	14.70	-48.43	-63.13	-429.46
2013	14.70	-43.59	-58.29	-396.54
2014	14.70	-58.48	-73.18	-497.84
2015	14.70	22.98	8.28	56.32

Table A. 6-11. Submitted and recalculated carbon stock changes in land converted to cropland mineral soils, kt C

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	-1,258.76	-232.88	1,025.87	-81.50
1991	-1,208.50	-219.70	988.80	-81.82
1992	-1,161.75	-208.76	953.00	-82.03
1993	-1,111.63	-191.47	920.16	-82.78
1994	-1,062.95	-179.72	883.23	-83.09
1995	-1,021.16	-170.39	850.77	-83.31
1996	-1,000.81	-166.49	834.32	-83.36
1997	-963.02	-159.41	803.61	-83.45
1998	-904.39	-148.69	755.70	-83.56
1999	-851.22	-140.40	710.81	-83.51
2000	-781.93	-127.51	654.42	-83.69

2001	-711.43	-117.75	593.68	-83.45
2002	-654.86	-108.46	546.39	-83.44
2003	-604.95	-99.20	505.75	-83.60
2004	-579.76	-94.57	485.18	-83.69
2005	-560.01	-92.82	467.19	-83.42
2006	-631.72	-107.69	524.03	-82.95
2007	-707.30	-121.67	585.63	-82.80
2008	-797.79	-133.95	663.83	-83.21
2009	-863.68	-143.58	720.10	-83.38
2010	-869.49	-142.76	726.73	-83.58
2011	-869.73	-149.29	720.44	-82.83
2012	-889.34	-148.93	740.41	-83.25
2013	-918.28	-154.60	763.68	-83.16
2014	-961.40	-164.04	797.36	-82.94
2015	-971.69	-169.97	801.72	-82.51

Table A. 6-12. Submitted and recalculated emissions from drainage of organic soils, kt CO_2 eqv.

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	266.06	1,387.78	1,121.72	421.60
1991	262.38	1,430.24	1,167.86	445.10
1992	257.90	1,388.11	1,130.21	438.23
1993	275.56	1,366.73	1,091.17	395.98
1994	270.91	1,320.39	1,049.48	387.40
1995	266.86	1,278.88	1,012.01	379.23
1996	264.97	1,258.27	993.30	374.86
1997	261.42	1,220.93	959.52	367.05
1998	256.01	1,164.63	908.62	354.91
1999	251.00	1,112.95	861.94	343.40
2000	244.50	1,044.86	800.36	327.34
2001	237.78	977.47	739.69	311.08
2002	232.46	920.55	688.09	296.00
2003	227.85	871.79	643.94	282.62
2004	218.15	840.13	621.98	285.11
2005	216.05	822.42	606.37	280.67
2006	222.42	891.78	669.37	300.95
2007	228.96	964.63	735.67	321.30
2008	237.05	1,036.45	799.40	337.23
2009	242.98	1,086.82	843.84	347.29
2010	243.46	1,078.95	835.48	343.17
2011	244.16	1,077.59	833.43	341.34
2012	246.80	1,072.25	825.44	334.45
2013	234.31	1,068.32	834.02	355.95
2014	236.90	1,113.64	876.74	370.09
2015	235.19	1,154.20	919.01	390.76

Table A. 6-13. Submitted and recalculated CH_4 emissions from fires, kt CH_4

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	0.0020	0.0021	0.0001	3.05

1991	0.0020	0.0021	0.0001	3.05
1992	0.0020	0.0021	0.0001	3.05
1993	0.0020	0.0021	0.0001	3.05
1994	0.0020	0.0021	0.0001	3.05
1995	0.0020	0.0021	0.0001	3.05
1996	0.0020	0.0021	0.0001	3.05
1997	0.0020	0.0021	0.0001	3.05
1998	0.0020	0.0021	0.0001	3.05
1999	0.0020	0.0021	0.0001	3.05
2000	0.0020	0.0021	0.0001	3.05
2001	0.0020	0.0021	0.0001	3.05
2002	0.0020	0.0021	0.0001	3.05
2003	0.0020	0.0021	0.0001	3.05
2004	0.0020	0.0019	-0.0001	-6.21
2005	0.0050	0.0057	0.0007	13.33
2006	0.0010	0.0011	0.0001	14.00
2007	0.0019	0.0011	-0.0008	-42.22
2008	0.0010	0.0011	0.0001	11.20
2009	0.0020	0.0024	0.0004	20.18
2010	0.0010	0.0012	0.0002	15.69
2011	0.0010	0.0012	0.0002	15.69
2012	0.0010	0.0007	-0.0003	-28.68
2013	0.0010	0.0014	0.0004	38.25
2014	0.0002	0.0002	0.0000	11.11
2015	0.0004	0.0005	0.0000	11.11

Table A. 6-14. Submitted and recalculated N_2O emissions from fires, kt N_2O

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
1991	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
1992	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
1993	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
1994	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
1995	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
1996	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
1997	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
1998	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
1999	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
2000	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
2001	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
2002	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
2003	0.00005	5.34×10^{5}	3.44×10^{6}	6.87
2004	0.00004	4.86×10^{5}	8.63×10^{6}	21.576
2005	0.00013	0.00014691	1.69×10^{5}	13.008
2006	0.00003	2.96×10^{5}	-4.43×10^{7}	-1.4773
2007	0.00003	2.80×10^{5}	-2.05×10^{6}	-6.8160
2008	0.00003	2.88×10^{5}	-1.17×10^{6}	-3.9040
2009	0.00006	6.23×10^{5}	2.32×10^{6}	3.8613

2010	0.00003	3.00×10^5	-6.4E-09	-0.0213
2011	0.00003	3.00×10^5	-6.4E-09	-0.0213
2012	0.00002	1.85×10^5	-1.51×10^6	-7.5440
2013	0.00003	3.58×10^5	5.84×10^6	19.4745
2014	4.73×10^6	5.26×10^6	5.26×10^7	11.1111
2015	1.10×10^5	1.22×10^5	1.222×10^6	11.1111

Table A. 6-15. Submitted and recalculated direct N_2O emissions in cropland category, kt N_2O eqv.

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	1.32	0.24	-1.07	-81.50
1991	1.27	0.23	-1.03	-81.49
1992	1.22	0.23	-1.00	-81.46
1993	1.18	0.22	-0.96	-81.47
1994	1.13	0.21	-0.92	-81.48
1995	1.09	0.20	-0.88	-81.51
1996	1.06	0.20	-0.87	-81.52
1997	1.02	0.19	-0.84	-81.53
1998	0.96	0.18	-0.79	-81.52
1999	0.91	0.17	-0.74	-81.49
2000	0.83	0.15	-0.68	-81.50
2001	0.76	0.14	-0.62	-81.41
2002	0.70	0.13	-0.57	-81.42
2003	0.65	0.12	-0.53	-81.42
2004	0.62	0.11	-0.50	-81.41
2005	0.60	0.11	-0.49	-81.31
2006	0.67	0.13	-0.55	-81.32
2007	0.75	0.14	-0.61	-81.34
2008	0.85	0.15	-0.69	-81.74
2009	0.92	0.16	-0.75	-82.02
2010	0.92	0.16	-0.76	-82.23
2011	0.92	0.16	-0.76	-82.14
2012	0.94	0.16	-0.77	-82.53
2013	0.97	0.17	-0.80	-82.73
2014	1.01	0.18	-0.83	-82.52
2015	1.02	0.18	-0.84	-81.92

Table A. 6-16. Submitted and recalculated total emissions/removals in cropland category, kt CO_2 eqv.

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	5,645.97	2,938.88	-2,707.08	-47.95
1991	5,446.86	2,930.31	-2,516.55	-46.20
1992	5,267.60	2,930.17	-2,337.43	-44.37
1993	5,087.87	2,782.90	-2,304.97	-45.30
1994	4,905.99	2,821.74	-2,084.25	-42.48
1995	4,721.98	2,655.55	-2,066.42	-43.76
1996	4,561.79	2,212.87	-2,348.92	-51.49

1997	4,454.19	2,410.18	-2,044.01	-45.89
1998	4,296.36	2,719.27	-1,577.09	-36.71
1999	4,140.93	2,988.02	-1,152.91	-27.84
2000	3,871.69	2,869.27	-1,002.43	-25.89
2001	3,461.94	2,481.66	-980.28	-28.32
2002	3,314.37	2,422.23	-892.14	-26.92
2003	2,681.33	1,822.50	-858.83	-32.03
2004	2,589.38	1,888.78	-700.60	-27.06
2005	2,467.68	1,744.99	-722.68	-29.29
2006	3,162.99	3,571.37	408.38	12.91
2007	3,359.58	3,469.29	109.71	3.27
2008	3,798.18	3,589.16	-209.02	-5.50
2009	3,956.84	3,025.95	-930.89	-23.53
2010	3,672.41	1,935.22	-1,737.20	-47.30
2011	3,711.78	2,982.14	-729.64	-19.66
2012	3,860.68	2,989.56	-871.12	-22.56
2013	4,075.75	3,234.42	-841.34	-20.64
2014	4,345.66	3,709.65	-636.01	-14.64
2015	4,388.66	2,911.67	-1,476.99	-33.65

1.3 Grassland

Recalculations were done as a result of internal land use and land-use change database review in State Forest Service. Database review was done taking into account NFI field measurement data, National Paying Agency data of declared agricultural land and the initial data from studies (Study 1 and Study 2) conducted in 2012, in order to improve accuracy in land-use matrix preparation. Another recalculations are related to national carbon stock factors' implementation for GHG inventory - carbon stock in grassland (81.0 t C ha^{-1}) and cropland (76.1 t C ha^{-1}) mineral soils. Recalculations, in addition, were performed due to the adjusted organic soils proportion in total land use area in grassland after the NFI cycle on non-forest land was completed, recalculation of organic soil proportion in turn resulted in recalculations of carbon stock changes in mineral soils. Adjusted share of organic soils in cropland is equal to 1 % of total cropland area, whereas organic soils share in grassland category is equal to 7.2 % of total grassland area (drained organic soils in grassland category constitute 6.5 % of total grassland area). Another recalculation was done in order to correct errors of misinterpretation of the formula for GHG emission calculation from fires (value of C_F was not needed in the formula as it is already included in the value of M_B). Another type of recalculations includes correction of errors due to the incorrect biomass values for grassland (13.6 t d. m. ha^{-1}) and cropland (10 t d. m. ha^{-1}) used for biomass carbon stock change calculation, which were corrected for this submission.

Table A. 6-17. Grassland area changes due to the revised land use, land-use change matrix, kha

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	1,307.68	1,281.45	-26.23	-2.01
1991	1,350.02	1,320.98	-29.03	-2.15
1992	1,391.95	1,358.52	-33.43	-2.40
1993	1,431.50	1,397.26	-34.24	-2.39
1994	1,473.03	1,437.99	-35.05	-2.38
1995	1,513.38	1,479.52	-33.86	-2.24

1996	1,527.35	1,495.09	-32.26	-2.11
1997	1,555.71	1,523.44	-32.27	-2.07
1998	1,600.45	1,567.37	-33.08	-2.07
1999	1,643.18	1,609.30	-33.88	-2.06
2000	1,697.11	1,662.81	-34.29	-2.02
2001	1,755.82	1,718.72	-37.10	-2.11
2002	1,799.35	1,763.04	-36.31	-2.02
2003	1,836.50	1,800.18	-36.32	-1.98
2004	1,850.88	1,813.76	-37.12	-2.01
2005	1,862.46	1,822.54	-39.92	-2.14
2006	1,796.16	1,758.65	-37.51	-2.09
2007	1,729.46	1,692.36	-37.10	-2.14
2008	1,647.18	1,625.27	-21.90	-1.33
2009	1,589.26	1,576.56	-12.71	-0.80
2010	1,579.68	1,591.33	11.65	0.74
2011	1,567.70	1,602.11	34.42	2.20
2012	1,532.54	1,613.69	81.15	5.30
2013	1,506.99	1,611.30	104.31	6.92
2014	1,471.04	1,584.94	113.90	7.74
2015	1,477.83	1,534.23	56.40	3.82

Table A. 6-18. Submitted and recalculated biomass carbon stock changes in land converted to grassland, kt C

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	NO	102.03	102.03	100.00
1991	5.75	102.03	96.27	1,673.75
1992	5.75	101.35	95.60	1,662.01
1993	6.23	99.32	93.09	1,494.28
1994	6.71	112.84	106.13	1,581.61
1995	5.27	100.67	95.40	1,809.24
1996	NO	43.92	43.92	100.00
1997	NO	86.48	86.48	100.00
1998	NO	142.57	142.57	100.00
1999	NO	162.84	162.84	100.00
2000	NO	183.10	183.10	100.00
2001	0.48	170.27	169.79	35,446.48
2002	NO	150.67	150.67	100.00
2003	0.48	109.46	108.98	22,751.18
2004	NO	83.78	83.78	100.00
2005	NO	66.21	66.21	100.00
2006	NO	58.78	58.78	100.00
2007	NO	41.22	41.22	100.00
2008	NO	43.24	43.24	100.00
2009	0.48	25.68	25.20	5,260.35
2010	NO	45.94	45.94	100.00
2011	NO	109.46	109.46	100.00
2012	NO	115.54	115.54	100.00
2013	NO	112.16	112.16	100.00

2014	0.96	89.86	88.90	9,270.57
2015	1.44	16.22	14.78	1,028.47

Table A. 6-19. Submitted and recalculated carbon stock changes in land converted to grassland mineral soils, kt C

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	511.80	112.65	-399.16	-77.99
1991	576.20	142.87	-433.33	-75.20
1992	641.56	175.56	-466.00	-72.64
1993	707.62	208.53	-499.09	-70.53
1994	774.72	240.38	-534.34	-68.97
1995	839.74	279.44	-560.30	-66.72
1996	858.08	285.22	-572.86	-66.76
1997	892.58	292.87	-599.71	-67.19
1998	945.42	304.30	-641.12	-67.81
1999	994.33	314.95	-679.37	-68.33
2000	1,057.04	332.98	-724.06	-68.50
2001	1,122.98	346.83	-776.15	-69.12
2002	1,173.81	357.03	-816.78	-69.58
2003	1,219.49	368.52	-850.96	-69.78
2004	1,241.32	373.17	-868.15	-69.94
2005	1,260.10	376.85	-883.25	-70.09
2006	1,193.89	361.67	-832.22	-69.71
2007	1,124.90	347.60	-777.30	-69.10
2008	1,039.48	331.17	-708.31	-68.14
2009	982.80	323.84	-658.95	-67.05
2010	974.94	332.47	-642.46	-65.90
2011	905.83	312.16	-593.67	-65.54
2012	811.81	290.37	-521.45	-64.23
2013	755.73	271.06	-484.67	-64.13
2014	699.89	248.88	-451.02	-64.44
2015	701.00	213.48	-487.53	-69.55

Table A. 6-20. Submitted and recalculated emissions from drainage of organic soils, kt CO_2 eqv.

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	98.29	52.94	-45.36	-46.14
1991	104.08	55.86	-48.22	-46.33
1992	108.77	56.74	-52.03	-47.83
1993	112.58	57.96	-54.62	-48.52
1994	115.89	58.87	-57.02	-49.20
1995	120.40	60.38	-60.02	-49.85
1996	121.79	60.76	-61.03	-50.11
1997	123.92	60.86	-63.06	-50.89
1998	127.28	61.10	-66.18	-52.00
1999	130.49	61.38	-69.11	-52.96
2000	134.85	62.52	-72.34	-53.64
2001	139.60	63.31	-76.29	-54.65
2002	142.90	63.50	-79.41	-55.57

2003	145.66	63.63	-82.03	-56.32
2004	147.08	63.82	-83.27	-56.61
2005	147.95	63.57	-84.38	-57.03
2006	143.00	62.27	-80.73	-56.46
2007	137.99	61.58	-76.41	-55.37
2008	132.17	61.00	-71.16	-53.84
2009	127.42	59.93	-67.49	-52.96
2010	127.37	60.37	-67.00	-52.60
2011	124.14	59.06	-65.08	-52.43
2012	119.99	60.17	-59.82	-49.85
2013	117.48	59.27	-58.22	-49.55
2014	115.17	59.18	-55.99	-48.61
2015	114.76	57.64	-57.12	-49.77

Table A. 6-21. Submitted and recalculated CH_4 emissions from fires, kt CH_4

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	0.0848	0.0986	0.0138	16.28
1991	0.0848	0.0986	0.0138	16.28
1992	0.0848	0.0986	0.0138	16.28
1993	0.0848	0.0986	0.0138	16.28
1994	0.0848	0.0986	0.0138	16.28
1995	0.0848	0.0986	0.0138	16.28
1996	0.0848	0.0986	0.0138	16.28
1997	0.0848	0.0986	0.0138	16.28
1998	0.0848	0.0986	0.0138	16.28
1999	0.0848	0.0986	0.0138	16.28
2000	0.0848	0.0986	0.0138	16.28
2001	0.0848	0.0986	0.0138	16.28
2002	0.0848	0.0986	0.0138	16.28
2003	0.0848	0.0986	0.0138	16.28
2004	0.1024	0.1190	0.0167	16.28
2005	0.0229	0.0267	0.0037	16.28
2006	0.2646	0.3076	0.0431	16.28
2007	0.0242	0.0281	0.0039	16.28
2008	0.0403	0.0469	0.0066	16.28
2009	0.0946	0.1100	0.0154	16.28
2010	0.0443	0.0515	0.0072	16.28
2011	0.0443	0.0515	0.0072	16.28
2012	0.0341	0.0396	0.0055	16.28
2013	0.0290	0.0332	0.0042	14.45
2014	0.0759	0.0882	0.0123	16.28
2015	0.0406	0.0472	0.0066	16.28

Table A. 6-22. Submitted and recalculated N_2O emissions from fires, kt N_2O

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	0.0077	0.0090	0.0013	16.28
1991	0.0077	0.0090	0.0013	16.28
1992	0.0077	0.0090	0.0013	16.28

1993	0.0077	0.0090	0.0013	16.28
1994	0.0077	0.0090	0.0013	16.28
1995	0.0077	0.0090	0.0013	16.28
1996	0.0077	0.0090	0.0013	16.28
1997	0.0077	0.0090	0.0013	16.28
1998	0.0077	0.0090	0.0013	16.28
1999	0.0077	0.0090	0.0013	16.28
2000	0.0077	0.0090	0.0013	16.28
2001	0.0077	0.0090	0.0013	16.28
2002	0.0077	0.0090	0.0013	16.28
2003	0.0077	0.0090	0.0013	16.28
2004	0.0093	0.0109	0.0015	16.28
2005	0.0021	0.0024	0.0003	16.28
2006	0.0242	0.0281	0.0039	16.28
2007	0.0022	0.0026	0.0004	16.28
2008	0.0037	0.0043	0.0006	16.28
2009	0.0086	0.0100	0.0014	16.28
2010	0.0040	0.0047	0.0007	16.28
2011	0.0040	0.0047	0.0007	16.28
2012	0.0031	0.0036	0.0005	16.28
2013	0.0026	0.0030	0.0004	16.55
2014	0.0069	0.0081	0.0011	16.28
2015	0.0037	0.0043	0.0006	16.28

Table A. 6-23. Submitted and recalculated total emissions/removals in grassland category, kt CO_2 eqv.

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	-1,773.90	-729.04	1,044.85	-58.90
1991	-2,025.31	-836.95	1,188.36	-58.68
1992	-2,260.27	-953.45	1,306.82	-57.82
1993	-2,500.44	-1,065.69	1,434.75	-57.38
1994	-2,744.94	-1,231.10	1,513.83	-55.15
1995	-2,973.54	-1,328.21	1,645.33	-55.33
1996	-3,020.07	-1,140.92	1,879.15	-62.22
1997	-3,144.44	-1,324.96	1,819.48	-57.86
1998	-3,334.82	-1,572.26	1,762.56	-52.85
1999	-3,510.94	-1,685.36	1,825.58	-52.00
2000	-3,736.52	-1,824.63	1,911.89	-51.17
2001	-3,975.31	-1,827.56	2,147.76	-54.03
2002	-4,156.63	-1,792.93	2,363.70	-56.87
2003	-4,323.11	-1,683.82	2,639.30	-61.05
2004	-4,399.08	-1,605.47	2,793.61	-63.50
2005	-4,471.21	-1,559.61	2,911.60	-65.12
2006	-4,220.80	-1,463.34	2,757.46	-65.33
2007	-3,985.37	-1,362.61	2,622.76	-65.81
2008	-3,677.15	-1,309.38	2,367.77	-64.39
2009	-3,472.99	-1,215.90	2,257.09	-64.99
2010	-3,445.09	-1,324.48	2,120.61	-61.55

2011	-3,194.93	-1,484.20	1,710.73	-53.55
2012	-2,854.88	-1,426.07	1,428.81	-50.05
2013	-2,652.02	-1,344.14	1,307.88	-49.32
2014	-2,450.66	-1,178.27	1,272.39	-51.92
2015	-2,458.73	-782.10	1,676.63	-68.19

1.4 Wetlands

Recalculations were done as a result of internal land use and land-use change database review in State Forest Service. Database review was done taking into account NFI field measurement data, National Paying Agency data of declared agricultural land and the initial data from studies (Study 1 and Study 2) conducted in 2012, in order to improve accuracy in land-use matrix preparation. Another type of recalculations includes correction of errors due to the incorrect biomass values for grassland (13.6 t d. m. ha^{-1}) and cropland (10 t d. m. ha^{-1}) used for biomass carbon stock change calculation, which were corrected for this submission. Another improvement in national GHG inventory is related to national carbon stock factors' implementation for GHG inventory - adjusted national carbon stock value in forest land (81.4 t C ha^{-1}) mineral soils, whereas direct N_2O emissions due to the recalculated carbon loss in mineral soils were calculated for the first time in this submission.

Table A. 6-24. Total wetland area changes due to the revised land use, land-use change matrix, kha

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	363.07	381.76	18.69	5.15
1991	357.87	378.17	20.29	5.67
1992	356.28	378.17	21.89	6.14
1993	354.68	376.97	22.29	6.28
1994	354.68	376.57	21.89	6.17
1995	354.68	376.57	21.89	6.17
1996	352.68	375.37	22.69	6.43
1997	352.68	375.37	22.69	6.43
1998	352.28	375.37	23.09	6.55
1999	351.48	374.57	23.09	6.57
2000	348.69	372.58	23.89	6.85
2001	348.29	372.18	23.89	6.86
2002	349.09	372.97	23.89	6.84
2003	348.29	372.97	24.69	7.09
2004	347.89	372.58	24.69	7.10
2005	347.09	372.18	25.09	7.23
2006	345.49	370.98	25.49	7.38
2007	343.89	370.18	26.29	7.64
2008	343.89	370.18	26.29	7.64
2009	344.69	370.58	25.89	7.51
2010	343.50	370.18	26.68	7.77
2011	343.10	370.58	27.48	8.01
2012	342.30	368.18	25.89	7.56
2013	342.30	368.18	25.89	7.56
2014	341.90	366.19	24.29	7.10

2015	341.09	366.19	25.09	7.36

Table A. 6-25. Submitted and recalculated biomass carbon stock changes in land converted to flooded land, kt C

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	NO	-15.32	-15.32	100.00
1991	-0.96	-5.11	-4.15	433.33
1992	-0.48	-2.55	-2.07	432.67
1993	-0.96	0.00	0.96	-100.00
1994	-0.96	0.00	0.96	-100.00
1995	-2.40	0.00	2.40	-100.00
1996	NO	-2.55	-2.55	100.00
1997	-0.48	NO	0.48	-100.00
1998	NO,NA	NO	0	0
1999	NE,NA,NO,IE	NO	0	0
2000	NO,NA	NO	0	0
2001	NO,NA	NO	0	0
2002	-0.48	NO	0.48	-100.00
2003	NE,NA,NO,IE	NO	0	0
2004	-0.96	-2.56	-1.60	166.67
2005	-0.48	-2.56	-2.08	434.00
2006	-0.96	-2.55	-1.59	166.33
2007	-0.48	-2.55	-2.07	432.67
2008	-0.96	-5.11	-4.15	432.67
2009	-0.48	NO	0.48	-100.00
2010	NO,NA	NO	0	0
2011	NO,NA	NO	0	0
2012	NO,NA	NO	0	0
2013	-0.48	NO	0.48	-100.00
2014	-3.36	NO	3.36	-100.00
2015	NA,NO	NO	0	0

Table A. 6-26. Submitted and recalculated total emissions/removals in wetland category, kt CO_2 eqv.

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	523.40	579.55	56.16	10.73
1991	556.37	578.46	22.09	3.97
1992	584.08	598.55	14.47	2.48
1993	340.60	350.86	10.26	3.01
1994	737.13	733.61	-3.52	-0.48
1995	446.53	444.62	-1.91	-0.43
1996	463.66	473.02	9.35	2.02
1997	488.81	487.06	-1.76	-0.36
1998	348.67	348.67	0.00	0.00
1999	791.64	782.66	-8.98	-1.13
2000	466.29	466.29	0.00	0.00
2001	472.73	472.73	0.00	0.00
2002	845.06	843.30	-1.76	-0.21

2003	761.20	752.22	-8.98	-1.18
2004	768.20	909.17	140.97	18.35
2005	879.91	887.53	7.62	0.87
2006	780.31	793.02	12.72	1.63
2007	519.26	526.86	7.60	1.46
2008	858.19	873.40	15.21	1.77
2009	1,042.04	1,036.23	-5.81	-0.56
2010	548.67	548.67	0.00	0.00
2011	639.54	639.54	0.00	0.00
2012	641.84	641.84	0.00	0.00
2013	883.06	881.31	-1.76	-0.20
2014	892.36	880.06	-12.30	-1.38
2015	965.10	965.10	0.00	0.00

1.5 Settlements

Recalculations were done as a result of internal land use and land-use change database review in State Forest Service. Database review was done taking into account NFI field measurement data, National Paying Agency data of declared agricultural land and the initial data from studies (Study 1 and Study 2) conducted in 2012, in order to improve accuracy in land-use matrix preparation. Another recalculations are related to national carbon stock factors' implementation for GHG inventory - carbon stock in grassland (81.0 t C ha^{-1}) and cropland (76.1 t C ha^{-1}) mineral soils, which not only resulted in recalculations of carbon stock changes in mineral soils in land converted to settlements mineral soils, but also direct N_2O emissions due to the recalculated carbon loss in mineral soils. Another type of recalculations includes correction of errors due to the incorrect biomass values for grassland (13.6 t d. m. ha^{-1}) and cropland (10 t d. m. ha^{-1}) used for biomass carbon stock change calculation, which were corrected for this submission.

Table A. 6-27. Settlements area changes due to the revised land use, land-use change matrix, kha

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	324.32	351.81	27.49	8.48
1991	325.53	353.01	27.48	8.44
1992	327.12	355.40	28.28	8.65
1993	325.92	355.00	29.09	8.92
1994	329.11	358.20	29.09	8.84
1995	328.72	357.40	28.68	8.73
1996	327.52	357.40	29.88	9.12
1997	329.12	357.80	28.68	8.71
1998	330.32	358.60	28.28	8.56
1999	331.51	359.80	28.28	8.53
2000	334.31	362.99	28.68	8.58
2001	335.11	363.39	28.28	8.44
2002	335.91	364.19	28.28	8.42
2003	335.91	364.19	28.28	8.42
2004	336.30	364.99	28.68	8.53
2005	337.90	367.78	29.88	8.84
2006	339.90	369.78	29.88	8.79
2007	340.70	370.58	29.88	8.77
2008	341.50	372.18	30.68	8.98

2009	341.90	374.97	33.08	9.67
2010	341.90	377.37	35.47	10.38
2011	341.90	377.37	35.47	10.37
2012	342.69	376.97	34.27	10.00
2013	346.29	380.56	34.27	9.90
2014	351.88	382.56	30.68	8.72
2015	354.28	384.56	30.28	8.55

Table A. 6-28. Submitted and recalculated biomass carbon stock changes in land converted to settlements, kt C

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	NO	-2.55	-2.55	100.00
1991	-2.88	-13.29	-10.41	362.17
1992	-3.35	-16.37	-13.01	388.03
1993	-1.44	-6.31	-4.87	338.63
1994	-5.27	-23.34	-18.07	342.73
1995	-2.40	-9.39	-6.99	291.67
1996	NO	NO	0.00	0.00
1997	-0.96	-4.43	-3.47	362.17
1998	-1.44	-4.43	-2.99	207.85
1999	-1.44	-6.98	-5.54	385.71
2000	-3.83	-24.70	-20.87	544.27
2001	-0.96	-4.43	-3.47	362.17
2002	-0.96	-3.76	-2.80	291.67
2003	-0.48	-2.55	-2.07	432.67
2004	-0.48	-4.43	-3.95	824.33
2005	-1.44	-13.96	-12.53	871.29
2006	-1.92	-10.21	-8.29	432.33
2007	-0.96	-7.66	-6.70	698.67
2008	-1.44	-12.08	-10.65	740.52
2009	-1.44	-24.85	-23.41	1,628.45
2010	NO	-22.97	-22.97	100.00
2011	NO	-2.55	-2.55	100.00
2012	-0.96	-2.55	-1.59	166.00
2013	-4.79	-29.96	-25.16	525.01
2014	-7.19	-14.64	-7.45	103.61
2015	-5.75	-14.64	-8.89	154.59

Table A. 6-29. Submitted and recalculated carbon stock changes in land converted to settlements mineral soils, kt C

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	NO	-1.62	-1.62	100.00
1991	-7.98	-10.98	-3.00	37.60
1992	-16.07	-23.24	-7.17	44.61
1993	-19.82	-27.86	-8.05	40.61
1994	-33.71	-44.86	-11.15	33.07
1995	-39.14	-50.77	-11.63	29.70
1996	-39.14	-50.77	-11.63	29.70

1997	-41.80	-53.89	-12.09	28.91
1998	-44.46	-57.01	-12.55	28.22
1999	-48.70	-61.75	-13.05	26.81
2000	-58.85	-78.97	-20.12	34.20
2001	-61.51	-82.10	-20.59	33.48
2002	-63.68	-85.11	-21.43	33.64
2003	-65.26	-86.72	-21.47	32.90
2004	-66.34	-89.85	-23.50	35.43
2005	-98.33	-99.32	-1.00	1.01
2006	-104.62	-105.79	-1.17	1.12
2007	-79.04	-110.64	-31.60	39.98
2008	-83.28	-118.62	-35.34	42.44
2009	-87.51	-134.57	-47.06	53.77
2010	-87.51	-149.13	-61.62	70.41
2011	-79.53	-141.38	-61.85	77.76
2012	-74.59	-130.73	-56.14	75.26
2013	-86.09	-145.40	-59.31	68.89
2014	-94.34	-137.99	-43.65	46.27
2015	-98.36	-140.06	-41.70	42.40

Table A. 6-30. Submitted and recalculated direct N_2O emissions in settlements category, kt N_2O

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	NO	0.002	0.002	100.00
1991	0.01	0.012	0.003	37.60
1992	0.02	0.024	0.008	44.61
1993	0.02	0.029	0.008	40.61
1994	0.04	0.047	0.012	33.07
1995	0.04	0.053	0.012	29.70
1996	0.04	0.053	0.012	29.70
1997	0.04	0.056	0.013	28.91
1998	0.05	0.060	0.013	28.22
1999	0.05	0.065	0.014	26.81
2000	0.06	0.083	0.021	34.20
2001	0.06	0.086	0.022	33.48
2002	0.07	0.089	0.022	33.64
2003	0.07	0.091	0.022	32.90
2004	0.07	0.094	0.025	35.43
2005	0.10	0.138	0.035	34.17
2006	0.11	0.145	0.035	32.28
2007	0.08	0.116	0.033	39.98
2008	0.09	0.124	0.037	42.44
2009	0.09	0.141	0.049	53.77
2010	0.09	0.156	0.065	70.41
2011	0.08	0.148	0.065	77.76
2012	0.08	0.137	0.059	75.26
2013	0.09	0.152	0.062	68.89
2014	0.10	0.145	0.046	46.27
2015	0.10	0.147	0.044	42.40

Table A. 6-31. Submitted and recalculated total emissions/removals in settlements category, kt CO_2 eqv.

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	NO	15.80	15.80	100.00
1991	42.29	92.73	50.44	119.25
1992	76.24	153.28	77.04	101.05
1993	84.12	134.96	50.84	60.44
1994	153.48	265.69	112.21	73.11
1995	164.54	238.35	73.81	44.86
1996	155.75	203.93	48.18	30.94
1997	169.84	232.67	62.82	36.99
1998	182.55	245.19	62.64	34.31
1999	199.40	273.54	74.14	37.18
2000	248.58	407.54	158.97	63.95
2001	248.61	345.74	97.13	39.07
2002	257.26	355.39	98.13	38.14
2003	261.76	357.42	95.66	36.54
2004	266.08	376.82	110.74	41.62
2005	431.95	593.77	161.82	37.46
2006	458.76	606.21	147.44	32.14
2007	318.38	471.83	153.45	48.20
2008	336.98	519.96	182.97	54.30
2009	353.83	630.56	276.73	78.21
2010	348.56	681.83	333.27	95.61
2011	316.81	575.85	259.04	81.77
2012	300.67	533.01	232.35	77.28
2013	360.49	692.04	331.55	91.97
2014	402.10	605.99	203.89	50.71
2015	412.80	614.04	201.24	48.75

1.6 Other Land

Recalculations were done as a result of internal land use and land-use change database review in State Forest Service. Database review was done taking into account NFI field measurement data, National Paying Agency data of declared agricultural land and the initial data from studies (Study 1 and Study 2) conducted in 2012, in order to improve accuracy in land-use matrix preparation. Another recalculations are related to national carbon stock factors' implementation for GHG inventory - carbon stock in grassland (81.0 t C ha^{-1}) and cropland (76.1 t C ha^{-1}) mineral soils, which not only resulted in recalculations of carbon stock changes in mineral soils in land converted to other land mineral soils, but also direct N_2O emissions due to the recalculated carbon loss in mineral soils. Another type of recalculations includes correction of errors due to the incorrect biomass values for grassland (13.6 t d. m. ha^{-1}) and cropland (10 t d. m. ha^{-1}) used for biomass carbon stock change calculation, which were corrected for this submission.

Table A. 6-32. Other land area changes due to the revised land use, land-use change matrix, kha

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	47.53	47.53	0.0005	0.0010
1991	41.54	41.54	0.0005	0.0011

1992	33.55	33.55	-0.0002	-0.0005
1993	27.16	27.16	-0.0002	-0.0006
1994	21.17	21.17	0.0002	0.0011
1995	15.18	15.18	0.0004	0.0027
1996	15.18	15.18	0.0004	0.0027
1997	15.18	15.18	0.0004	0.0027
1998	15.18	15.18	0.0004	0.0027
1999	15.18	15.18	0.0004	0.0027
2000	14.78	14.78	0.0004	0.0028
2001	14.38	14.38	0.0004	0.0029
2002	13.58	13.58	0.0004	0.0030
2003	13.58	13.58	0.0004	0.0030
2004	13.18	13.18	0.0004	0.0031
2005	12.38	12.38	0.0004	0.0033
2006	13.18	13.18	-0.0002	-0.0013
2007	12.78	12.78	-0.0002	-0.0014
2008	13.58	13.58	-0.0002	-0.0013
2009	13.58	13.58	-0.0002	-0.0013
2010	13.58	13.58	-0.0002	-0.0013
2011	13.58	13.58	-0.0002	-0.0013
2012	13.98	13.98	0.0000	0.0000
2013	13.98	11.18	-2.7970	-20.0100
2014	13.18	10.78	-2.4000	-18.2094
2015	11.98	9.18	-2.7970	-23.3453

Table A. 6-33. Submitted and recalculated biomass carbon stock changes in land converted to other land, kt C

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1992	-0.96	-3.76	-2.80	291.67
1993	-0.96	-3.76	-2.80	291.67
1994	-0.48	-1.88	-1.40	291.67
1995	-0.48	-1.88	-1.40	291.67
1998	-0.48	-1.88	-1.40	291.67
2015	-0.48	0.00	0.48	-100.00

Table A. 6-34. Submitted and recalculated carbon stock changes in land converted to other land mineral soils, kt C

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1992	-2.17	-3.04	-0.87	39.97
1993	-4.34	-6.08	-1.73	39.88
1994	-34.16	-7.60	26.56	-77.75
1995	-6.52	-9.12	-2.60	39.91
1996	-6.52	-9.12	-2.60	39.91
1997	-6.52	-9.12	-2.60	39.91
1998	-7.60	-10.63	-3.03	39.89
1999	-7.60	-10.63	-3.03	39.89

2000	-7.60	-10.63	-3.03	39.89
2001	-9.18	-12.25	-3.07	33.51
2002	-9.18	-12.25	-3.07	33.51
2003	-10.75	-13.87	-3.12	29.03
2004	-9.66	-12.35	-2.69	27.82
2005	-9.66	-12.35	-2.69	27.82
2006	-39.97	-13.97	26.00	-65.05
2007	-11.24	-13.97	-2.73	24.30
2008	-14.39	-17.20	-2.81	19.57
2009	-15.96	-20.44	-4.48	28.07
2010	-15.96	-20.44	-4.48	28.07
2011	-15.96	-20.44	-4.48	28.07
2012	-15.36	-17.40	-2.04	13.31
2013	-13.19	-15.98	-2.79	21.15
2014	-13.19	-15.97	-2.79	21.12
2015	-13.68	-14.45	-0.78	5.69

Table A. 6-35. Submitted and recalculated direct N_2O emissions in other land category, kt N_2O

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	NO	NO	0.00	0.00
1991	NO	NO	0.00	0.00
1992	0.00	0.00	0.00	39.97
1993	0.00	0.01	0.00	39.88
1994	0.04	0.04	0.01	17.34
1995	0.01	0.01	0.00	39.91
1996	0.01	0.01	0.00	39.91
1997	0.01	0.01	0.00	39.91
1998	0.01	0.01	0.00	39.89
1999	0.01	0.01	0.00	39.89
2000	0.01	0.01	0.00	39.89
2001	0.01	0.01	0.00	33.51
2002	0.01	0.01	0.00	33.51
2003	0.01	0.01	0.00	29.03
2004	0.01	0.01	0.00	27.82
2005	0.01	0.01	0.00	27.82
2006	0.04	0.01	-0.03	-65.05
2007	0.01	0.01	0.00	24.30
2008	0.02	0.02	0.00	19.57
2009	0.02	0.02	0.00	28.07
2010	0.02	0.02	0.00	28.07
2011	0.02	0.02	0.00	28.07
2012	0.02	0.02	0.00	13.31
2013	0.01	0.02	0.00	21.15
2014	0.01	0.02	0.00	21.12
2015	0.01	0.02	0.00	5.69

Table A. 6-36. Submitted and recalculated total emissions/removals in other land category, kt CO_2 eqv.

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	NO,NE	NO, NE	0.00	0.00
1991	NO,NE	NO, NE	0.00	0.00
1992	12.84	25.87	13.03	101.51
1993	22.16	37.95	15.79	71.27
1994	183.44	180.60	-2.84	-1.55
1995	29.72	43.15	13.43	45.21
1996	27.96	36.27	8.31	29.73
1997	27.96	36.27	8.31	29.73
1998	34.38	49.19	14.81	43.09
1999	32.62	42.32	9.69	29.72
2000	32.62	42.32	9.69	29.72
2001	41.13	58.10	16.97	41.25
2002	39.38	48.74	9.37	23.80
2003	47.88	64.54	16.66	34.79
2004	41.47	49.15	7.68	18.52
2005	41.47	49.15	7.68	18.52
2006	208.36	64.93	-143.43	-68.84
2007	48.22	55.58	7.36	15.26
2008	65.25	87.17	21.92	33.59
2009	70.24	100.06	29.82	42.45
2010	68.48	81.33	12.85	18.76
2011	68.48	81.33	12.85	18.76
2012	67.65	69.23	1.58	2.34
2013	56.58	72.92	16.33	28.87
2014	58.34	72.90	14.56	24.96
2015	62.19	57.51	-4.68	-7.53

Table A. 6-37. Submitted and recalculated indirect N_2O emissions from LULUCF sector, kt N_2O

Year	2017 submission	2018 submission	Absolute difference	Relative difference %
1990	0.30	0.06	-0.24	-81.37
1991	0.29	0.06	-0.23	-80.71
1992	0.28	0.06	-0.22	-79.53
1993	0.27	0.06	-0.21	-78.90
1994	0.27	0.07	-0.20	-75.16
1995	0.26	0.06	-0.20	-76.75
1996	0.25	0.06	-0.19	-76.67
1997	0.24	0.06	-0.18	-76.26
1998	0.23	0.06	-0.17	-75.55
1999	0.22	0.06	-0.16	-72.11
2000	0.20	0.06	-0.15	-72.54
2001	0.19	0.05	-0.13	-71.18
2002	0.17	0.05	-0.12	-70.08
2003	0.17	0.06	-0.11	-65.65

2004	0.16	0.07	-0.10	-60.16
2005	0.16	0.06	-0.10	-63.02
2006	0.19	0.06	-0.12	-65.39
2007	0.19	0.06	-0.13	-67.99
2008	0.21	0.07	-0.15	-68.73
2009	0.24	0.08	-0.16	-65.76
2010	0.23	0.08	-0.16	-66.86
2011	0.23	0.08	-0.15	-67.28
2012	0.23	0.07	-0.16	-69.10
2013	0.24	0.08	-0.17	-68.60
2014	0.25	0.08	-0.18	-69.92
2015	0.26	0.08	-0.18	-69.56

Table A. 6-38. Submitted and recalculated total emissions/removals from LULUCF sector, kt CO_2 eqv.

Year	**2017 submission**	**2018 submission**	**Absolute difference**	**Relative difference %**
1990	-3,511.89	-5,149.51	-1,637.62	46.63
1991	-3,839.98	-5,103.13	-1,263.15	32.89
1992	-4,009.18	-4,750.03	-740.85	18.48
1993	-5,143.00	-5,730.41	-587.41	11.42
1994	-4,921.31	-5,186.82	-265.50	5.39
1995	-3,795.28	-3,931.72	-136.45	3.60
1996	1,516.04	1,278.69	-237.35	-15.66
1997	142.77	192.90	50.12	35.11
1998	-7,613.46	-7,160.45	453.01	-5.95
1999	-7,232.32	-6,290.62	941.70	-13.02
2000	-9,820.50	-8,555.16	1,265.34	-12.88
2001	-7,981.63	-6,486.94	1,494.69	-18.73
2002	-7,262.42	-5,482.55	1,779.87	-24.51
2003	-7,164.14	-5,072.98	2,091.16	-29.19
2004	-6,991.17	-4,405.81	2,585.37	-36.98
2005	-6,328.26	-3,726.90	2,601.35	-41.11
2006	-5,372.91	-1,989.26	3,383.65	-62.98
2007	-6,974.73	-3,848.88	3,125.85	-44.82
2008	-7,045.53	-4,444.94	2,600.59	-36.91
2009	-7,472.11	-5,647.23	1,824.88	-24.42
2010	-9,901.15	-8,977.80	923.34	-9.33
2011	-10,227.95	-8,805.10	1,422.85	-13.91
2012	-9,217.12	-8,243.59	973.53	-10.56
2013	-8,504.46	-7,509.09	995.37	-11.70
2014	-7,331.99	-6,267.59	1,064.40	-14.52
2015	-6,705.03	-6,138.38	566.65	-8.45

ANNEX IX. 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.*

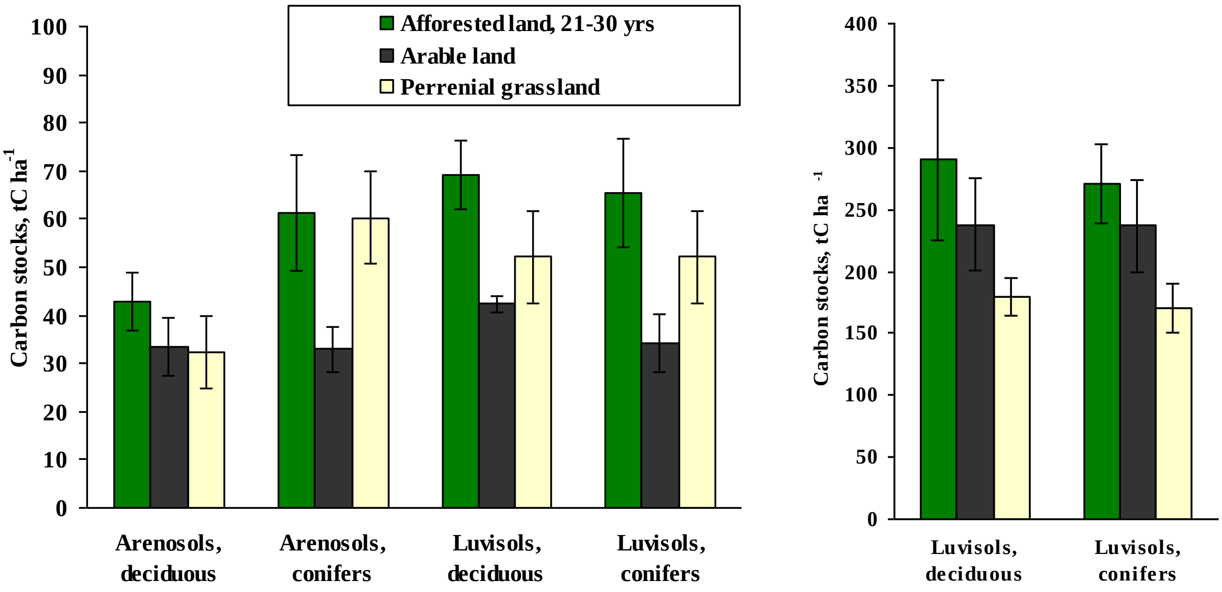


Fig.1. Stocks (t ha^{-1}) of organic carbon in 0–30 cm mineral soil/peat layer in the afforested land in the 21-30-year old coniferous and deciduous forest plantations and the control (arable land and grassland).

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

LITHUANIAN RESEARCH CENTRE FOR AGRICULTURE AND FORESTRY

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**).

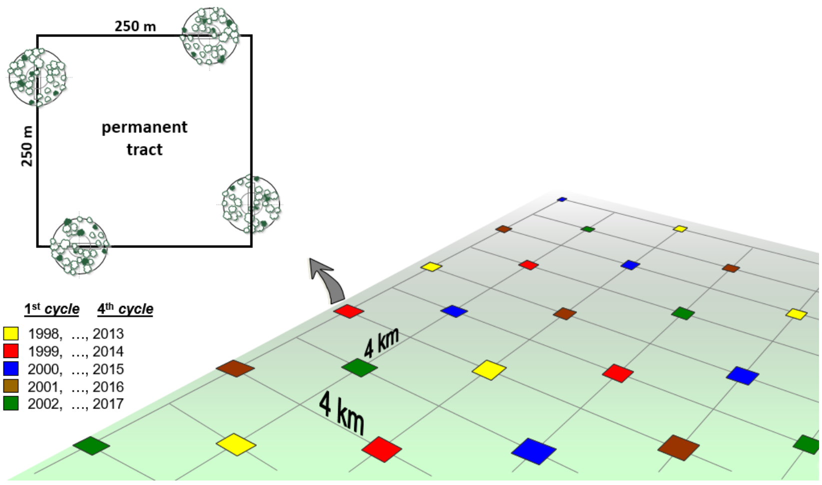


Fig. 1. National Forest Inventory permanent sample plots grid in Lithuania

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

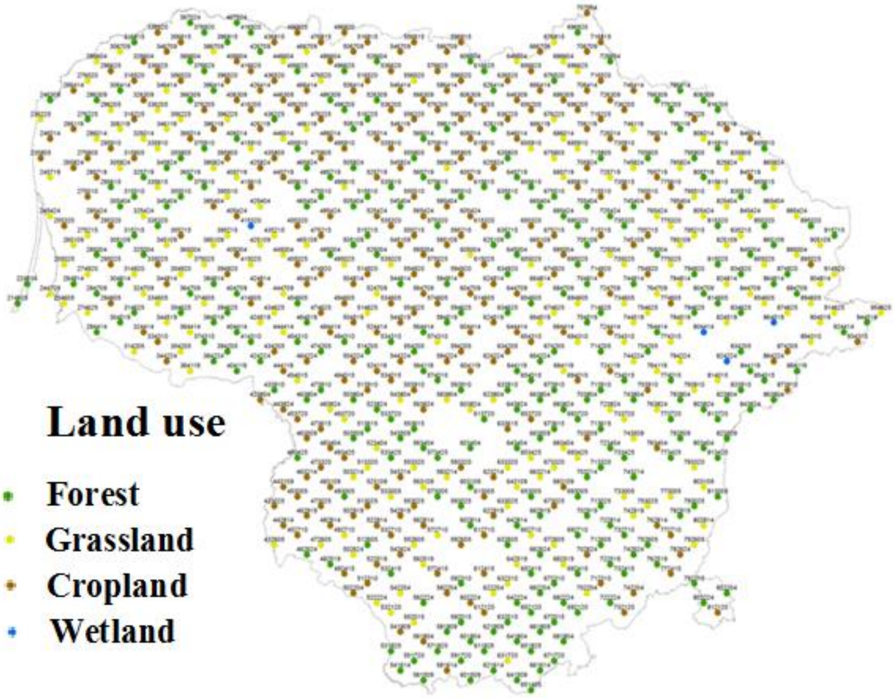


Fig. 2. Sample plots in the grid (9x9 km) of Lithuanian National Forest Inventory (NFI) (Total N=752; forest land – 298; grassland – 206; cropland – 244; wetland – 4)

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):

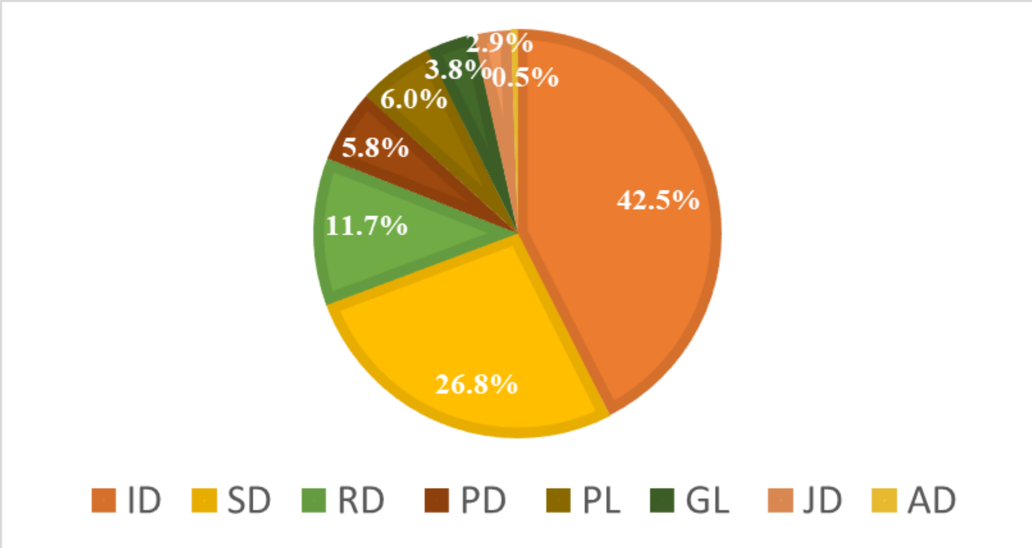
$$\mathrm{SOC_i} = \mathrm{p_i}\left(1 - \left(\frac{Qi,2mm}{100}\right)\right) d_i C_i * 10^{-1}$$

where p_i is the bulk density of the <2 mm fraction in g cm^{-3}, $Q_{i,\,2\,mm}$ 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.

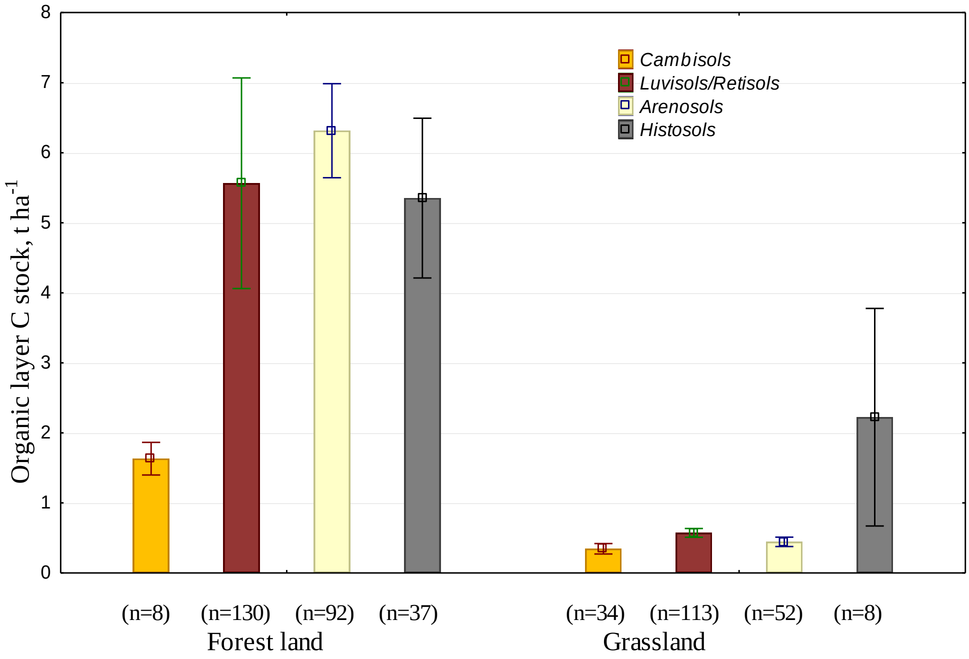


Fig. 4. Mean organic layer stocks of carbon in organic layer of different mineral soils in forest land and grassland (the bars represent SE)

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%)	**-**	**-**

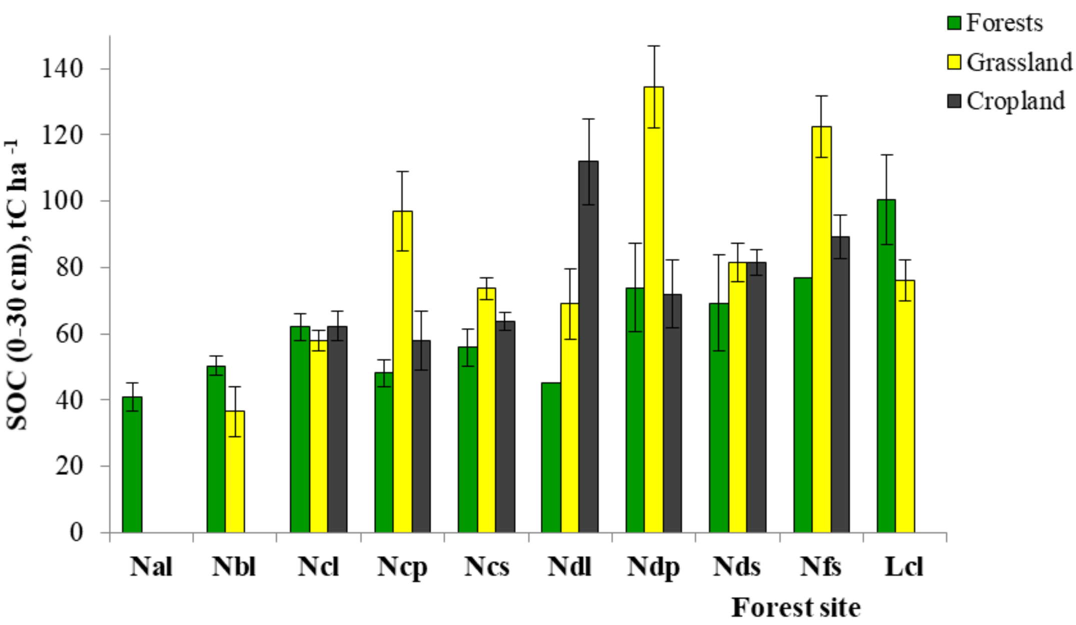


Fig. 5. Mean sotcks of soil organic carbon (SOC) in surface 0-30 cm layer of different forest sites (according Lithuanian classification, Vaičys et al., 2006)

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 X. Improvements in response to recommendations/encouragements provided in the DRAFT ARR 2017

Review recommendation	*Paragraph No*	*Response/ status of implementation*	*Chapter/section in the NIR*
The ERT recommends that the Party review the use of notation keys for CO_2, CH_4 and N_2O emissions from category 1.A.5.a (stationary (other)) (reported as blank instead of “NO”); in CRF table 1.A(a)s4, AD and emissions from biomass consumption for light duty trucks, for heavy duty trucks and buses and for motorcycles (AD are reported as “IE” but emissions as “NO” in CRF table 1.A(a)s3; i.e. for emissions, “NO” should be corrected to “IE”); in CRF table 1.B.2, AD and emissions of distribution of oil products are reported as “NO” instead of “NA”.	E.8	All mentioned errors were corrected.	
The ERT recommends that the Party explain in the NIR the trend in peat consumption, including the peak consumption for 2007 and 2013.	E.9	The peaks of 2007 and 2013 in the trend of peat consumption are explained in the NIR.	Chapters 3.2.6.3.1 Combined Heat and Power Generation (CRF 1.A.1.a.ii) and 3.2.6.4.1 Heat plants (CRF 1.A.1.a.iii)
The ERT recommends that the Party review the differences between jet kerosene consumption reported to the IEA and estimates in the CRF tables in 2000–2008 and make the data consistent or explain the reasons for these differences in the NIR.	E.10	Information on differences in IEA and Lithuanian Statistics data of fuel consumption by domestic aviation is provided in the NIR.	Chapter 3.4.1.3 Civil aviation (CRF 1.A.3.a)
The ERT recommends that the Party explain the trend of the CH_4 IEF for gasoline consumption in the NIR, including the impact of national legislation on the trend and the low value reported for the CH_4 IEF for 2014.	E.11	All the mileages of motorcycles and mopeds and CH4 emissions were recalculated using COPERT V (COPERT IV was used previously). Implied emission factors from 56 to 110 kg/TJ were obtained, and the IEF difference between years 2013 and 2014 is now lower (-10 %). Information on the impact of national legislation on the trend is provided in the NIR.	Chapter 3.4.2.5 Road transportation (CRF 1.A.3.b)

Review recommendation	*Paragraph No*	*Response/ status of implementation*	*Chapter/section in the NIR*
The ERT recommends that the Party review the differences between gas/diesel oil consumption reported to the IEA and estimates in the CRF tables from 1998 onward and make the data consistent or explain the reasons for these differences in the NIR.	E.12	Information on differences in IEA and Lithuanian Statistics data of fuel consumption by domestic navigation is provided in the NIR.	Chapter 3.4.5.2 Water borne navigation (CRF 1.A.3.d)
The ERT recommends that the Party estimate and report CO_2, CH_4 and N_2O emissions for 1990–2004 or, if the Party considers these emissions insignificant, report them as “NE” and justify that the likely level of emissions is below the significance threshold indicated in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	E.13	The data on consumption of Gas/Diesel Oil from category 1.A.4.C.iii Fishing for period 1990-2004 has been extrapolated and emissions have been estimated.	Chapter 3.4.5.5 Water borne navigation (CRF 1.A.4.C.iii)
The ERT encourages the Party to report fugitive CO_2 and CH_4 emissions from the LNG terminal, including associated liquefaction and gasification facilities.	E.14	The activity data was obtained (throughput - 14771 TJ in 2015, 16.5% of imported gas, total import 89642 TJ) and the calculation of fugitive emissions for LNG plant (liquefaction/regasification) for 2015 and 2016 based on 2006 IPCC yearly emission factors presented in Table 4.2.8 (low) is included.	Chapter 3.5.3.2 Fugitive emissions from natural gas (CRF 1.B.2.b)
The ERT recommends that Lithuania correct the errors found in the NIR by removing the reference to NIR table 4-45 in chapter 4.8.3.1, adding a reference to chapter 3.2.6.5 (CO_2 emission from carbonates use in flue gas desulphurization) in NIR chapter 4.9.3 (Consumption of carbonates use in flue gas desulphurization) and ensuring consistent number formatting is used in NIR table 3-18.	I.3	The reference to Table 4-45 in Chapter 4.8.3.1 was removed; a reference in Chapter 4.9.3 was added (Consumption of carbonates use in flue gas desulphurisation) to Chapter 3.2.6.5 (CO_2 emission from carbonates use in flue gas desulphurisation); a consistent number formatting is used in Table 3-18 “CO_2 emission from limestone use in flue gas desulphurisation”.	Chapter 4.8.3.1 Category Description (CRF 2.G.3); Chapter 4.9.3 Consumption of carbonates use in flue gas desulphurisation; Chapter 4.6.3 Consumption of carbonates use in flue gas desulphurisation (CRF 2.H.3)
The ERT recommends that the Party explain in its NIR the decrease in clinker production in 2014 compared to 2013 and 2015.	I.4	The explanation of decrease in clinker production is included in the NIR.	Chapter 4.2.1.1 Category Description

Review recommendation	*Paragraph No*	*Response/ status of implementation*	*Chapter/section in the NIR*
			(CRF 2.A.1)
The ERT recommends that Lithuania report the correct the AD for 2010–2015 in CRF table 2(I).A-Hs1.	I.5	Activity data reported in the CRF table (CRF Table2(I).A-Hs1) is corrected.	CRF Table2(I).A-Hs1
The ERT encourages Lithuania to provide the outcomes of the category-specific QA/QC activities in its NIR.	I.6	Explanation of QA/QC procedures performed for the 2.B.1 Ammonia production category is included.	Chapter 4.3.1.4 Category-specific QA/QC and verification (CRF 2.B.1)
The ERT recommends that Lithuania include an explanation in the NIR that there is only information in the country available on urea produced, exported, used in the agriculture sector and used in urea-based catalysts and that CO_2 emissions from all other uses of urea have been allocated to ammonia production. The ERT encourages Lithuania to contact the urea production plant to identify all uses of downstream urea and allocate CO_2 emissions to the appropriate inventory categories.	I.7	Explanation about CO_2 recovery for downstream use in urea production is included.	Chapter 4.3.1.2 Methodological issues (CRF 2.B.1)
The ERT recommends that Lithuania explain the increase in ammonia production between 2006 and 2007 in its NIR.	I.8	Explanatory information about the launch of the second ammonia production unit is included in the NIR.	Chapter 4.3.1.1 Category Description (CRF 2.B.1)
The ERT recommends that Lithuania clarify in the NIR whether all emissions from natural gas consumption in ammonia production are allocated to category 2.B.1 (ammonia production).	I.9	Emissions from natural gas consumption used for heat production are reported under 1.A.2.c Chemicals and natural gas consumption as feedstock for ammonia production (non-energy use) is reported in the IPPU sector under category 2.B.1.	Chapter 3.3.3.2 Methodological issues (CRF 1.A.2.c); Chapter 4.3.1.2 Methodological issues (CRF 2.B.1)
The ERT recommends that Lithuania use the most updated country-specific CO_2 EFs for natural gas.	I.10	Corrected EFs for CO_2 emissions from natural gas for 2013 and 2014 are used in the NIR.	Chapter 4.3.1.5 Category-specific recalculations (CRF 2.B.1)

Review recommendation	*Paragraph No*	*Response/ status of implementation*	*Chapter/section in the NIR*
The ERT commends Lithuania for obtaining and using this information in its 2017 submission and recommends that the Party clearly explain the CO_2 EF applied for natural gas for ammonia production and the differences with the CO_2 EF for natural gas used in other categories in the NIR, particularly for the year 2015. The ERT encourages Lithuania to continue to take into consideration the natural gas mix used by the plant when choosing the EF for this category, for example considering the LNG contract that the ammonia production plant has from 2016 onward.	I.11	An explanation of country-specific emission factors for CO_2 emissions from natural gas is included.	Chapter 4.3.1.2 Methodological issues (CRF 2.B.1)
The ERT encourages Lithuania to run annual QA/QC activities comparing the SO_2 estimates from this category in the submission to the UNFCCC and the submission to Convention on Long-range Transboundary Air Pollution to ensure consistency. The ERT also encourages Lithuania to include the missing SO_2 emissions for ammonia production in 2015.	I.12	The missing SO_2 emissions for ammonia production in 2015 are included.	CRF Table2(I)s1
Annex I inventory reporting guidelines (preliminary estimates indicate emissions of 0.88 kt CO_2, below the significance threshold for the Party (10.05 kt CO2 eq)). The ERT recommends that Lithuania report AD and CO_2 emissions from this category for 1990–2000.	I.13	The AD and CO_2 emissions for Paraffin wax use category for the period 1990-2000 are reported.	Chapter 4.5.2.1 Category Description (CRF 2.D.2)
The ERT recommends that Lithuania address the time series inconsistency between 1990–2004 and 2005 onward by applying an appropriate technique in accordance with the *2006 IPCC Guidelines* (volume 1, chapter 5.3.3) for the years 1990–2004.	I.14	Recalculated NMVOC emissions from Coating applications applying extrapolation for the years 1990-2004 are included in the NIR.	Chapter 4.5.3.2 Methodological issues (CRF 2.D.3)

Review recommendation	*Paragraph No*	*Response/ status of implementation*	*Chapter/section in the NIR*
The ERT recommends that the Party explain in the NIR that no PFCs and NF_3 emissions occur during the production of semiconductors and report the entire time series as “NO” in the CRF tables.	I.15	Lithuania has included explanation that PFCs and NF_3 were not used during the production of semiconductors.	Chapter 4.6.1.1 Category Description (CRF 2.E.1)
The ERT encourages Lithuania to include details of the category-specific QA/QC activities in the NIR and continue to perform such activities considering whether indicators such as gross value added may be more appropriate than per capita for these subcategories.	I.16	Explanation of QA/QC procedures performed for the 2.F.1 Refrigeration and air conditioning category is added.	Chapter 4.7.1.4 Category-specific QA/QC and verification (CRF 2.F.1)
The ERT recommends that Lithuania estimate HFC emissions from the disposal of imported refrigerators. or justify that the likely level of emissions is below the significance threshold indicated in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	I.17	Emissions from Domestic refrigerators disposal are included.	Chapter 4.7.1.2 Methodological issues (CRF 2.F.1)
The ERT recommends that Lithuania include the explanation for the decrease in the amount of HFC-143a for the amount of gas “filled into new manufactured products” between 2013 and 2014 (from 3.53 t to 2.18 t) for subcategory 2.F.1.a (commercial refrigeration).	I.18	The explanation of decrease in the amount of HFC-143a for "filled into new manufactured products" between 2013 and 2014 is included in the NIR.	Chapter 4.7.1.2 Methodological issues (CRF 2.F.1)
The ERT recommends that Lithuania estimate emissions or, if the Party considers the emissions insignificant, report them as “NE” and justify that the likely level of emissions is below the significance threshold indicated in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	I.19	Emissions of HFC-23 in 2.F.3 Fire Protection are included.	Chapter 4.7.3.2 Methodological issues (CRF 2.F.3)

Review recommendation	*Paragraph No*	*Response/ status of implementation*	*Chapter/section in the NIR*
The ERT recommends that Lithuania include in the NIR a brief explanation of the reason for the fluctuating trend of CO_2 emissions from flue gas desulphurization and report all emissions from limestone used in flue gas desulphurization under category 2.A.4.d other (other process uses of carbonates). The ERT encourages Lithuania to include the liquid fuel consumption for the power plant in NIR table 3-18 of the NIR.	I.20	An explanation of the reason for the fluctuating trend is included and the data on fuel consumption for the power plant is added in the Table 3-18 of the NIR. Emissions from limestone used in flue gas desulphurisation will be reported under category 2.A.4.d Other process uses of carbonates in the next submission.	Chapter 3.2.6.5 CO_2 emission from carbonates use in flue gas desulphurisation (CRF 2.H.3)
The ERT recommends that the Party use the same subcategory names for non-dairy cattle, sheep and swine when reporting the AD, parameters, GE and EF calculations in its NIR.	A.17	Lithuania has used same subcategory names for non-dairy cattle, sheep and swine in the NIR submission.	Non-dairy cattle: NIR Tables: 5-2, 5-9, 5-16, 5-19; 5-31;
The ERT recommends that the Party report the correct average diet nutrition indicators for dairy cattle in its NIR for all years in the time series.	A.18	Average diet nutrition indicators for dairy cattle were corrected.	NIR Annexes VII Table A.5-5
The ERT recommends that the Party correct the values of nutrition indicators for non-dairy cattle reported in NIR table 5-17.	A.19	The values of nutrition indicators for non-dairy cattle were corrected.	NIR Annexes VII Table A.5-38
The ERT recommends that the Party report consistent CH_4 EFs for non-dairy cattle in the NIR and in CRF table 3.As1.	A.20	General QC procedures were implemented to make sure that data provided in the NIR and CRF are consistent.	
The ERT recommends that the Party correct the inconsistencies in the sheep population (e.g. 154,500 heads for 2015 reported in NIR table 5-3 but 169,300 heads (the sum of all categories) in NIR table 5-12) and report consistent and correct sheep populations in all NIR tables.	A.21	The inconsistencies of sheep population within the NIR throughout the whole time series were corrected in the NIR submission.	NIR Tables: 5-5; 5-16; 5-21;

Review recommendation	*Paragraph No*	*Response/ status of implementation*	*Chapter/section in the NIR*
The ERT recommends that the Party correct the inconsistencies for average diet nutrition indicators (NIR p.315, table 5-24), GE and EF of sheep (NIR p.315, table 5-25) so that the calculations can be replicated and report, in its NIR, correct and consistent values for the average diet nutrition indicators (crude protein, crude fat, crude fibre, nitrogen-free extracts and dm), GE and food consumption of each feedstuff for all sheep subcategories.	A.22	The values of crude protein, crude fat, crude fibre, and nitrogen-free extraction, DM, GE and fooder consumption of each feedstuff for all sheep sub-categories has been checked.	NIR Chapter 5.2.2.2, Tables 5-21; NIR Annexes VII Tables A.5-31 - A.5-36, A.5-40
The ERT recommends that the Party correct the inconsistency identified for the swine population in NIR table 5-3 and table 5-10 (e.g. sow (replacement) population of 88,000 heads in 2013 reported in NIR table 5-10 was much higher than other years (e.g. 9,800 heads for 2012 and 8,000 heads for 2014); total swine population in 2013 reported in NIR table 5-10 was 10.2 per cent higher than that in table 5-3) and ensure the consistency of swine populations in different NIR tables.	A.23	General QC procedures were implemented to make sure that all data provided in the NIR are consistent.	NIR Tables: 5-4, 5-16, 5-20;
The ERT recommends that the Party correct the values in NIR tables A.5-15, A.5-17 to A.5-20, A.5-22 and A.5-23 for crude protein, crude fat, crude fibre, and N-free extraction, dm, GE and fodder consumption of each feedstuff for all swine subcategories (e.g. NIR tables A.5-17 to A.5-20 and tables A.5-22 to A.5-23 reported a value of 999 g/kg for dm of oil but the correct value is 0 g/kg, and NIR table A.5-20 reported a value of 0.47 kg/day, 0.09 kg/day, 0.59 kg/day, 0.28 kg/day, 0.12 kg/day, 0.06 kg/day and 0.02 kg/day for consumption of barley, wheat, triticale, leguminous plans, rapeseed cake, soybean meal and milk substitutes, respectively, but the correct values are 0.58 kg/day, 0.34 kg/day, 0.45 kg/day, 0.27 kg/day, 0.11 kg/day, 0.11 kg/day and 0.03 kg/day for barley, wheat, triticale, leguminous plans, rapeseed cake, soybean meal and milk substitutes, respectively).	A.24	The values of crude protein, crude fat, crude fibre, and nitrogen-free extraction, DM, GE and fooder consumption of each feedstuff for all swine sub-categories has been checked.	NIR Tables 5-20; NIR Annexes VII Tables A.5-19 - A.5-30; A.5-39
The ERT recommends that the Party report the source of the Ym for swine in its NIR.	A.25	Ym for Swine and its reference was included in the NIR submission.	NIR Chapter 5.2.2 Methodological issues

Review recommendation	***Paragraph No***	***Response/ status of implementation***	***Chapter/section in the NIR***
The ERT recommends that the Party, in the NIR, remove all reference to the N_2O EF reported for dry lot and explain that management of manure in dry lots does not occur in the country.	A.26	Reference to the N_2O EF reported for dry lot was removed.	NIR Tables: 5.28; 5-37; 5-38; 5-42; 5-44, 5-45; 5-46
The ERT recommends that the Party conduct a survey to obtain data on N in bedding to improve the allocation of the estimates reported under categories 3.D.a.2 and 3.D.a.3.	A.27	In the 2016 NIR Lithuania have included default values (as no country specific data are available) of N bedding per animal species as provided in 2006 IPCC GL, however GL provides default values only for cattle and swine categories. During the EU review ESD experts asked to crosscheck the amounts of N in bedding between 3.D.1.2.a Animal manure applied to soils and 3.D.1.4 Crop residue categories in order to ensure that there is no double counting or underestimation of emissions. For the estimation of N_2O emissions from 3.D.1.4 Crop residue category $Frac_{REMOVE}$ of 45% was used (country specific data). The results of crosscheck showed that calculated N in above-ground crop residues removed annually as bedding material is not consistent with calculated N amount of bedding material in Animal manure applied to soils. In order to keep amounts of N consistent and not to double count emissions of N2O from agriculture soils no removal was assumed in 3.D.1.4 Crop residue category ($Frac_{REMOVE}$=0) and the amounts of N in bedding per animal species were excluded from the calculation of N_20 emissions from Animal manure applied to soils. Lithuania has initiated a survey to obtain data on N in bedding per animal species. This survey should be completed in the 2019.	
The ERT recommends that Lithuania provide the AD used for calculating FCR.	A.28	AD used for calculating FCR is provided in the NIR Annexes	NIR Annex VII A.5-47 - A.5-51
The ERT recommends that the Party include the ratio of below-ground residues to harvested yield of crop (T) (RBG(T)) in the	A.29	All activity data used for calculation of FCR were provided in the 2018 NIR submission. Lithuania also has	NIR Annex VII A.5-47 - A.5-51

Review recommendation	Paragraph No	Response/ status of implementation	Chapter/section in the NIR
calculation for annual, perennial grasses and meadows and correct the value of $Frac_{RENEW}$ for mixed dried pulses (1), provide revised estimates in the next annual submission and report the correct parameters in the NIR.		checked equation and $Frac_{RENEW}$ applied for the FRC calculation.	Chapter 5.6.1.4 Category-specific QA/QC and verification Chapter 5.6.1.5 Category-specific recalculation
The ERT recommends that Lithuania justify the modification to equation 2.8 from the 2006 IPCC Guidelines and, when modifying any equation from the 2006 IPCC Guidelines, provide transparent information regarding the reasons for doing so.	L.10	Lithuania is using activity data as requested in the equation 2.8 from 2006 IPCC Guidelines, however, we are calculating separately above and below-ground biomass carbon stock changes. As a consequence, below-ground biomass carbon stock change is directly calculated from above-ground biomass carbon stock change using root-to-shoot-ratio, as explained in the modified equation in NIR.	Chapter 6.2.2.1 Forest land remaining forest land
The ERT recommends that the Party ensure that the NIR and the CRF tables reflect the same total area throughout the time series (in the 2017 submission, the Party reported 6,530.00 kha for 2012 in CRF table NIR 2 but the NIR (p.373) indicates 6,528.65 kha) and recalculate the estimates of emissions and removals where necessary.	L.12	Land-use and land-use change matrix was revised after the first NFI cycle on non-forest land was completed in order to improve accuracy of land use and land use change reporting. Area, represented by single sampling plot was recalculated due to the updated total country area by National Land Service.	NIR Chapter 6.1.2.
The ERT recommends that the Party report net CSCs in mineral soils as “NA” and explain, in the NIR that “NA” is used because the Party is using a tier 1 method that assumes that carbon stocks do not change.	L.13	Notation keys were changed from NO to NE for carbon stock changes in mineral soils in forest land remaining forest land.	
The ERT recommends that the Party explain, in the NIR, that the annual increment of carbon stock due to biomass growth is applied to all perennial croplands except for the area where perennial crops are harvested (i.e. they have reached 30 years) and carbon loss is reported (63 t C/ha).	L.14	Notation keys were changed from NO to IE for carbon stock changes in living biomass in grassland converted to cropland.	NIR Chapter 6.3.2.2.
The ERT recommends that the Party apply the correct values of carbon stock for cropland (for cropland containing annual crops, the 2006 IPCC Guidelines indicates a default of 4.7 t C/ha	L.15	Estimation of living biomass carbon stock changes in land converted to grassland was corrected for this submission, using the correct default values of carbon stock in living	NIR Chapter 6.4.2.2, 6.4.5, Annex VIII

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or 10 t dm/ha (p.6.27, section 6.3.1.2) and, for croplands containing perennial crops, the suggested default value is 63 t C/ha (p.5.9, table 5.1)) before the conversion to other land uses to avoid underestimating the net emissions.		biomass.	(recalculations).
The ERT recommends that the Party revise the calculations of the changes in carbon stock in living biomass from land converted to grassland to ensure that the total carbon stock in living biomass per hectare does not exceed the peak values for grassland provided in table 6.4 of the 2006 IPCC Guidelines (2.4 t dm/ha).	L.16	Estimation of carbon stock changes in living biomass was corrected for this submission and does not exceed the peak value provided in the 2006 IPCC Guidelines.	
The ERT recommends that Lithuania correct the fraction of organic soils in land converted to cropland (0.7 per cent instead of 10.5 per cent) in its NIR.	L.17	Figures, presented in the NIR were updated for this submission in order to better represent carbon stock changes reporter in CRF.	
The ERT recommends that the Party use aboveground biomass and/or living biomass carbon stocks in accordance with the 2006 IPCC Guidelines when estimating CSCs for biomass in conversions from croplands, grasslands, wetlands and other land to settlements.	L.18	Estimation of living biomass carbon stock changes in land converted to settlements was corrected for this submission, using the correct default values of carbon stock in living biomass (for conversions from cropland and grassland to settlements).	NIR Chapter 6.6.2.2, 6.6.5, Annex VIII (recalculations).
The ERT recommends that the Party review and if necessary revise the values of the carbon stocks assumed in the land-use categories cropland and grassland prior to conversion in all conversions from cropland and grassland reported to ensure that the estimates of the changes in carbon stock are not underestimated and are in accordance with the 2006 IPCC Guidelines.	L.19	Lithuania has reviewed and corrected the values of biomass carbon stocks in cropland and grassland categories used to estimate carbon stock changes due to the land-use conversion.	NIR Chapters 6.3.2.2 Land converted to cropland; 6.4.2.2 Land converted to grassland
The ERT recommends that the Party ensures consistency of the values for emissions and removals from HWP presented in the NIR and in CRF table 10s1, as this might reflect problems with the QA/QC system.	L.20	Values of HWP in the NIR and CRF has been cross-checked and corrected.	

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The ERT recommends that the Party correct the information about the equation, parameters and units to estimate N_2O emissions for this category and explain in the NIR any change introduced in the equation provided in the 2006 IPCC Guidelines.	L.21	Estimation of living biomass carbon stock changes in land converted to settlements was corrected for this submission, using the correct default values of carbon stock in living biomass (for conversions from cropland and grassland to settlements).	NIR Chapter 6.6.2.2, 6.6.5, Annex VIII (recalculations).
The ERT recommends that the Party presents in the NIR the correct EF for temperate, organic, nutrient-poor forest soil (0.1 kg N_2O-N/kg N from the 2006 IPCC Guidelines (volume 4, chapter 11, table 11.1) instead of 0.6 kg N_2O-N/kg N as is currently reported in the NIR (p.412).	L.22	Description of the equation and parameters used to calculate N_2O emissions from drainage of organic soils in forest land was corrected for this submission, as well as value of emission factor for temperate organic nutrient poor forest soil was corrected in the NIR.	NIR Chapter 6.2.2.1 (Non-CO_2 emissions from drainage of forest soils).
The ERT recommends that the Party estimate and report carbon stocks in organic soils in forest land, cropland and grassland in CRF tables 4.A, 4.B and 4.C, respectively. If the Party reports net CSC in organic soils as "IE" in CRF tables 4.A, 4.B and 4.C, the ERT recommends that the Party explains in the NIR where the changes in carbon stocks in drained organic soils in forest land, cropland and grassland are reported.	L.23	Information on where emissions/removals from drainage of organic soils are reported, when notation key IE is used in CRF Tables 4.A.1, 4.A.2, 4.B.1, 4.B.2 etc., is provided in the NIR and relevant CRF Tables Documentation boxes.	NIR Chapters 6.2.2.1, 6.2.2.2, 6.3.2.1, 6.3.2.2, 6.4.2.1, 6.4.2.2.
The ERT recommends that the Party use the appropriate values in equation 2.27 (2006 IPCC Guidelines, volume 4, chapter 4) to estimate CH_4 and N_2O emissions from wildfires.	L.24	Estimation of GHG (CH_4, N_2O) emissions from wildfires was corrected for this submission.	NIR Chapter 6.4.5, Annex VIII (recalculations).
The ERT encourages the Party to adopt, or include in the inventory improvement plan, procedures or methodologies that can lead to lower uncertainties and increase accuracy of estimations, such as surveys at plants to obtain more specific data on waste composition being incinerated, as suggested in the 2006 IPCC Guidelines (volume 5, chapters 5.71 and 5.7.2).	W.2	The activity data uncertainty has been updated as more reliable data are available.	NIR Chapter 7.4.3
The ERT recommends that the Party correct in the NIR (chapter 7.4.2) the error in the equation to estimate N_2O emissions from waste incinerated by correcting the reference from CH_4 to N_2O emissions.	W.3	The error in the formula has been corrected.	NIR Chapter 7.4.2

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The ERT encourages the Party to increase the transparency of the NIR by documenting the calculation of the emissions in Chapter 9 of the NIR or providing a link to other documentation (e.g. the informative inventory report, available at http://oras.gamta.lt/files/NIR_20170317.pdf).	W.4	All necessary information is provided in NIR chapter 9.	NIR Chapter 9
The ERT encourages the Party to explore the possibility of estimating emissions from the three to four most significant industry sectors separately and including a short paragraph in the NIR on the percentage of emissions from industrial wastewater in the total emissions from domestic wastewater.	W.5	Lithuania provided to ERT comments on this recommendation in the draft ARR 2017.	
The ERT recommends that the Party ensures the use of correct values of B_{BEFORE} by using values for biomass stocks immediately before conversion, in accordance with the 2006 IPCC Guidelines, since the values used in the 2017 submission could lead to an underestimation of CO2 emissions from AR. The ERT also recommends that the Party use values for B_{AFTER} in accordance with the country-specific curve for growing stock volumes.	KL.1	Biomass carbon stock changes estimation in afforestation/reforestation were recalculated, taking into account B_{BEFORE} value of 13.6 t d. m. ha-1 in grassland converted to forest land.	
The ERT recommends that the Party report correct areas for AR for 2014 and 2015 in the NIR and ensure the consistency between the areas for AR provided in the NIR and in the CRF tables.	KL.2	Area estimates in CRF and NIR Tables have been checked for this submission.	
The ERT recommends that the Party revise the estimates for CSC in dead organic matter to include the CSC in litter and the information thereon in the NIR.	KL.3	Estimation of carbon stock changes in dead organic matter in Forest Management category has been updated, including carbon stock changes in litter in the events of natural forest expansion.	