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LITHUANIA'S NATIONAL INVENTORY REPORT 2020

GREENHOUSE GAS EMISSIONS 1990-2018

ANNEXES

VILNIUS, 2020

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ANNEX I. Approach 1 and Approach 2 key categories analysis

Approach 1 Level Assessment for 1990

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment</i>	<i>Cumulative total</i>
<i>4.A.1 Forest land remaining forest land - carbon stock change in biomass</i>	<i>CO₂</i>	<i>-7,007.02</i>	<i>0.11</i>	<i>0.11</i>
<i>1.A.1.a Public electricity and heat production - Liquid Fuels</i>	<i>CO₂</i>	<i>6,021.25</i>	<i>0.10</i>	<i>0.21</i>
<i>1.A.1.a Public electricity and heat production - Gaseous Fuels</i>	<i>CO₂</i>	<i>5,796.59</i>	<i>0.10</i>	<i>0.31</i>
<i>1.A.3.b Road transportation</i>	<i>CO₂</i>	<i>5,247.15</i>	<i>0.09</i>	<i>0.39</i>
<i>3.A.1 Enteric Fermentation - Cattle</i>	<i>CH₄</i>	<i>4,146.14</i>	<i>0.07</i>	<i>0.46</i>
<i>1.A.2 Manufacturing industries and construction-Liquid fuels</i>	<i>CO₂</i>	<i>3,873.72</i>	<i>0.06</i>	<i>0.53</i>
<i>1.A.4 Other sectors-Solid fuels</i>	<i>CO₂</i>	<i>2,760.55</i>	<i>0.05</i>	<i>0.57</i>
<i>1.A.4 Other sectors-Liquid fuels</i>	<i>CO₂</i>	<i>2,736.38</i>	<i>0.04</i>	<i>0.62</i>
<i>1.A.2 Manufacturing industries and construction-Gaseous fuels</i>	<i>CO₂</i>	<i>2,045.42</i>	<i>0.03</i>	<i>0.65</i>
<i>2.A.1 Cement Production</i>	<i>CO₂</i>	<i>1,668.07</i>	<i>0.03</i>	<i>0.68</i>
<i>1.A.1.b Petroleum refining - Liquid Fuels</i>	<i>CO₂</i>	<i>1,509.64</i>	<i>0.02</i>	<i>0.70</i>
<i>4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils</i>	<i>CO₂</i>	<i>1,444.84</i>	<i>0.02</i>	<i>0.73</i>
<i>1.A.4 Other sectors-Gaseous fuels</i>	<i>CO₂</i>	<i>1,379.27</i>	<i>0.02</i>	<i>0.75</i>
<i>2.B.1 Ammonia Production</i>	<i>CO₂</i>	<i>1,253.68</i>	<i>0.02</i>	<i>0.77</i>
<i>5.A Solid Waste Disposal</i>	<i>CH₄</i>	<i>1,028.83</i>	<i>0.02</i>	<i>0.79</i>
<i>3.D.1.1 Direct N₂O Emissions From Managed Soils - Inorganic N Fertilizers</i>	<i>N₂O</i>	<i>992.77</i>	<i>0.02</i>	<i>0.80</i>
<i>2.B.2 Nitric Acid Production</i>	<i>N₂O</i>	<i>893.01</i>	<i>0.01</i>	<i>0.82</i>
<i>4.B.2 Land converted to cropland - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>859.42</i>	<i>0.01</i>	<i>0.83</i>
<i>4.A.2 Land converted to forest land - carbon stock change in biomass</i>	<i>CO₂</i>	<i>-602.56</i>	<i>0.01</i>	<i>0.84</i>
<i>3.D.1.6 Direct N₂O Emissions From Managed Soils - Cultivation of organic soils</i>	<i>N₂O</i>	<i>532.73</i>	<i>0.01</i>	<i>0.85</i>
<i>4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils</i>	<i>CO₂</i>	<i>517.32</i>	<i>0.01</i>	<i>0.86</i>
<i>4.A.1 Forest land remaining forest land - net carbon stock change in dead wood</i>	<i>CO₂</i>	<i>-474.03</i>	<i>0.01</i>	<i>0.87</i>
<i>5.D Wastewater Treatment and Discharge</i>	<i>CH₄</i>	<i>471.00</i>	<i>0.01</i>	<i>0.87</i>
<i>3.D.2.2 Indirect N₂O Emissions From Managed Soils - Nitrogen leaching and run-off</i>	<i>N₂O</i>	<i>431.97</i>	<i>0.01</i>	<i>0.88</i>
<i>3.D.1.3 Direct N₂O Emissions From Managed Soils - Urine and dung deposited by grazing animals</i>	<i>N₂O</i>	<i>419.85</i>	<i>0.01</i>	<i>0.89</i>
<i>4.C.2 Land converted to grassland - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>-412.62</i>	<i>0.01</i>	<i>0.89</i>
<i>3.D.1.4 Direct N₂O Emissions From Managed Soils - Crop Residues</i>	<i>N₂O</i>	<i>361.31</i>	<i>0.01</i>	<i>0.90</i>
<i>4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils</i>	<i>CO₂</i>	<i>353.19</i>	<i>0.01</i>	<i>0.91</i>

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment</i>	<i>Cumulative total</i>
<i>1.A.3.c Railways</i>	<i>CO₂</i>	<i>349.97</i>	<i>0.01</i>	<i>0.91</i>
<i>3.D.1.2 Direct N₂O Emissions From Managed Soils - Organic N Fertilizers</i>	<i>N₂O</i>	<i>345.29</i>	<i>0.01</i>	<i>0.92</i>
<i>3.B.1.3 Manure Management - Swine</i>	<i>CH₄</i>	<i>329.25</i>	<i>0.01</i>	<i>0.92</i>
<i>4.C.2 Land converted to grassland - carbon stock change in biomass</i>	<i>CO₂</i>	<i>-285.50</i>	<i>0.00</i>	<i>0.93</i>
<i>1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas</i>	<i>CH₄</i>	<i>260.55</i>	<i>0.00</i>	<i>0.93</i>
<i>4.G Harvested wood products</i>	<i>CO₂</i>	<i>-252.55</i>	<i>0.00</i>	<i>0.94</i>
<i>3.B.1.1 Manure Management - Cattle</i>	<i>CH₄</i>	<i>251.55</i>	<i>0.00</i>	<i>0.94</i>
<i>3.B.2 Manure Management - Indirect N₂O Emissions</i>	<i>N₂O</i>	<i>247.77</i>	<i>0.00</i>	<i>0.94</i>
<i>2.A.4 Other process use of carbonates</i>	<i>CO₂</i>	<i>239.53</i>	<i>0.00</i>	<i>0.95</i>
<i>2.A.2 Lime Production</i>	<i>CO₂</i>	<i>210.27</i>	<i>0.00</i>	<i>0.95</i>
<i>3.B.2 Manure Management - Cattle</i>	<i>N₂O</i>	<i>205.85</i>	<i>0.00</i>	<i>0.95</i>
<i>3.D.2.1 Indirect N₂O Emissions From Managed Soils - Atmospheric deposition</i>	<i>N₂O</i>	<i>175.31</i>	<i>0.00</i>	<i>0.96</i>
<i>1.A.1. Energy industries-Solid fuels</i>	<i>CO₂</i>	<i>174.05</i>	<i>0.00</i>	<i>0.96</i>
<i>1.A.2 Manufacturing industries and construction-Solid fuels</i>	<i>CO₂</i>	<i>171.63</i>	<i>0.00</i>	<i>0.96</i>
<i>4.A.2 Land converted to forest land - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>-163.88</i>	<i>0.00</i>	<i>0.97</i>
<i>1.A.4 Other sectors-Liquid fuels</i>	<i>N₂O</i>	<i>159.35</i>	<i>0.00</i>	<i>0.97</i>
<i>.....</i>				
<i>Total</i>		<i>42,419.8</i>		

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

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment</i>	<i>Cumulative total</i>
<i>1.A.1.a Public electricity and heat production - Liquid Fuels</i>	<i>CO₂</i>	<i>6,021.25</i>	<i>0.13</i>	<i>0.13</i>
<i>1.A.1.a Public electricity and heat production - Gaseous Fuels</i>	<i>CO₂</i>	<i>5,796.59</i>	<i>0.12</i>	<i>0.25</i>
<i>1.A.3.b Road transportation</i>	<i>CO₂</i>	<i>5,247.15</i>	<i>0.11</i>	<i>0.36</i>
<i>3.A.1 Enteric Fermentation - Cattle</i>	<i>CH₄</i>	<i>4,146.14</i>	<i>0.09</i>	<i>0.44</i>
<i>1.A.2 Manufacturing industries and construction- Liquid fuels</i>	<i>CO₂</i>	<i>3,873.72</i>	<i>0.08</i>	<i>0.52</i>
<i>1.A.4 Other sectors-Solid fuels</i>	<i>CO₂</i>	<i>2,760.55</i>	<i>0.06</i>	<i>0.58</i>
<i>1.A.4 Other sectors-Liquid fuels</i>	<i>CO₂</i>	<i>2,736.38</i>	<i>0.06</i>	<i>0.64</i>
<i>1.A.2 Manufacturing industries and construction- Gaseous fuels</i>	<i>CO₂</i>	<i>2,045.42</i>	<i>0.04</i>	<i>0.68</i>
<i>2.A.1 Cement Production</i>	<i>CO₂</i>	<i>1,668.07</i>	<i>0.03</i>	<i>0.71</i>
<i>1.A.1.b Petroleum refining - Liquid Fuels</i>	<i>CO₂</i>	<i>1,509.64</i>	<i>0.03</i>	<i>0.75</i>
<i>1.A.4 Other sectors-Gaseous fuels</i>	<i>CO₂</i>	<i>1,379.27</i>	<i>0.03</i>	<i>0.77</i>
<i>2.B.1 Ammonia Production</i>	<i>CO₂</i>	<i>1,253.68</i>	<i>0.03</i>	<i>0.80</i>
<i>5.A Solid Waste Disposal</i>	<i>CH₄</i>	<i>1,028.83</i>	<i>0.02</i>	<i>0.82</i>
<i>3.D.1.1 Direct N₂O Emissions From Managed Soils - Inorganic N Fertilizers</i>	<i>N₂O</i>	<i>992.77</i>	<i>0.02</i>	<i>0.84</i>
<i>2.B.2 Nitric Acid Production</i>	<i>N₂O</i>	<i>893.01</i>	<i>0.02</i>	<i>0.86</i>
<i>3.D.1.6 Direct N₂O Emissions From Managed Soils - Cultivation of organic soils</i>	<i>N₂O</i>	<i>532.73</i>	<i>0.01</i>	<i>0.87</i>
<i>5.D Wastewater Treatment and Discharge</i>	<i>CH₄</i>	<i>471.00</i>	<i>0.01</i>	<i>0.88</i>
<i>3.D.2.2 Indirect N₂O Emissions From Managed Soils - Nitrogen leaching and run-off</i>	<i>N₂O</i>	<i>431.97</i>	<i>0.01</i>	<i>0.89</i>
<i>3.D.1.3 Direct N₂O Emissions From Managed Soils - Urine and dung deposited by grazing animals</i>	<i>N₂O</i>	<i>419.85</i>	<i>0.01</i>	<i>0.90</i>
<i>3.D.1.4 Direct N₂O Emissions From Managed Soils - Crop Residues</i>	<i>N₂O</i>	<i>361.31</i>	<i>0.01</i>	<i>0.91</i>
<i>1.A.3.c Railways</i>	<i>CO₂</i>	<i>349.97</i>	<i>0.01</i>	<i>0.91</i>
<i>3.D.1.2 Direct N₂O Emissions From Managed Soils - Organic N Fertilizers</i>	<i>N₂O</i>	<i>345.29</i>	<i>0.01</i>	<i>0.92</i>
<i>3.B.1.3 Manure Management - Swine</i>	<i>CH₄</i>	<i>329.25</i>	<i>0.01</i>	<i>0.93</i>
<i>1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas</i>	<i>CH₄</i>	<i>260.55</i>	<i>0.01</i>	<i>0.93</i>
<i>3.B.1.1 Manure Management - Cattle</i>	<i>CH₄</i>	<i>251.55</i>	<i>0.01</i>	<i>0.94</i>
<i>3.B.2 Manure Management - Indirect N₂O Emissions</i>	<i>N₂O</i>	<i>247.77</i>	<i>0.01</i>	<i>0.94</i>
<i>2.A.4 Other process use of carbonates</i>	<i>CO₂</i>	<i>239.53</i>	<i>0.00</i>	<i>0.95</i>
<i>2.A.2 Lime Production</i>	<i>CO₂</i>	<i>210.27</i>	<i>0.00</i>	<i>0.95</i>
<i>3.B.2 Manure Management - Cattle</i>	<i>N₂O</i>	<i>205.85</i>	<i>0.00</i>	<i>0.96</i>
<i>3.D.2.1 Indirect N₂O Emissions From Managed Soils - Atmospheric deposition</i>	<i>N₂O</i>	<i>175.31</i>	<i>0.00</i>	<i>0.96</i>
<i>1.A.1. Energy industries-Solid fuels</i>	<i>CO₂</i>	<i>174.05</i>	<i>0.00</i>	<i>0.97</i>
<hr/>				
Total		48,016.0		

Approach 1 Level Assessment for 2018

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment</i>	<i>Cumulative total</i>
1.A.3.b Road transportation	CO₂	5,755.81	0.18	0.18
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO₂	-3,781.04	0.12	0.29
2.B.1 Ammonia Production	CO₂	1,828.32	0.06	0.35
3.A.1 Enteric Fermentation - Cattle	CH₄	1,435.85	0.04	0.39
1.A.1.b Petroleum refining - Liquid Fuels	CO₂	1,309.82	0.04	0.43
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO₂	1,117.86	0.03	0.47
4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils	CO₂	-1,019.64	0.03	0.50
4.G Harvested wood products	CO₂	-934.54	0.03	0.53
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO₂	854.64	0.03	0.55
3.D.1.1 Direct N₂O Emissions From Managed Soils - Inorganic N Fertilizers	N₂O	824.72	0.03	0.58
4.A.2 Land converted to forest land - carbon stock change in biomass	CO₂	-783.06	0.02	0.60
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	CO₂	-773.49	0.02	0.62
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO₂	723.58	0.02	0.65
4.E.2 Land converted to settlements	CO₂	717.34	0.02	0.67
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO₂	703.25	0.02	0.69
5.A Solid Waste Disposal	CH₄	661.74	0.02	0.71
1.A.4 Other sectors-Gaseous fuels	CO₂	601.66	0.02	0.73
4.B.2 Land converted to cropland - net carbon stock change in mineral soils	CO₂	600.50	0.02	0.75
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	522.38	0.02	0.76
2.A.1 Cement Production	CO₂	511.33	0.02	0.78
3.D.1.6 Direct N₂O Emissions From Managed Soils - Cultivation of organic soils	N₂O	496.76	0.02	0.79
1.A.2 Manufacturing industries and construction-Solid fuels	CO₂	383.82	0.01	0.81
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO₂	380.46	0.01	0.82
1.A.4 Other sectors-Liquid fuels	CO₂	315.27	0.01	0.83
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	CO₂	-307.05	0.01	0.84
1.A.4 Other sectors-Solid fuels	CO₂	305.66	0.01	0.85
3.D.2.2 Indirect N₂O Emissions From Managed Soils - Nitrogen leaching and run-off	N₂O	304.40	0.01	0.86
3.D.1.4 Direct N₂O Emissions From Managed Soils - Crop Residues	N₂O	300.27	0.01	0.86
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH₄	265.18	0.01	0.87

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment</i>	<i>Cumulative total</i>
<i>1.B.2 Oil, natural gas and other emissions from energy production</i>	<i>CO₂</i>	<i>253.60</i>	<i>0.01</i>	<i>0.88</i>
<i>4.B.2 Land converted to cropland- carbon stock change in biomass</i>	<i>CO₂</i>	<i>240.31</i>	<i>0.01</i>	<i>0.89</i>
<i>4.A.2 Land converted to forest land - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>-229.76</i>	<i>0.01</i>	<i>0.89</i>
<i>1.A.3.c Railways</i>	<i>CO₂</i>	<i>186.55</i>	<i>0.01</i>	<i>0.90</i>
<i>1.A.1 Energy industries-Other fossil fuels</i>	<i>CO₂</i>	<i>179.64</i>	<i>0.01</i>	<i>0.91</i>
<i>2.B.2 Nitric Acid Production</i>	<i>N₂O</i>	<i>175.50</i>	<i>0.01</i>	<i>0.91</i>
<i>3.D.1.3 Direct N₂O Emissions From Managed Soils - Urine and dung deposited by grazing animals</i>	<i>N₂O</i>	<i>170.32</i>	<i>0.01</i>	<i>0.92</i>
<i>4.C.2 Land converted to grassland - carbon stock change in biomass</i>	<i>CO₂</i>	<i>-168.46</i>	<i>0.01</i>	<i>0.92</i>
<i>3.D.1.2 Direct N₂O Emissions From Managed Soils - Organic N Fertilizers</i>	<i>N₂O</i>	<i>138.95</i>	<i>0.00</i>	<i>0.93</i>
<i>3.B.1.1 Manure Management - Cattle</i>	<i>CH₄</i>	<i>138.25</i>	<i>0.00</i>	<i>0.93</i>
<i>1.A.4 Other sectors-Biomass</i>	<i>CH₄</i>	<i>137.56</i>	<i>0.00</i>	<i>0.93</i>
<i>5.D Wastewater Treatment and Discharge</i>	<i>CH₄</i>	<i>128.58</i>	<i>0.00</i>	<i>0.94</i>
<i>1.A.4 Other sectors-Peat</i>	<i>CO₂</i>	<i>115.50</i>	<i>0.00</i>	<i>0.94</i>
<i>1.A.2 Manufacturing industries and construction-Liquid fuels</i>	<i>CO₂</i>	<i>114.18</i>	<i>0.00</i>	<i>0.95</i>
<i>4.B.2 Land converted to cropland- net carbon stock change in dead organic matter</i>	<i>CO₂</i>	<i>112.83</i>	<i>0.00</i>	<i>0.95</i>
<i>3.D.2.1 Indirect N₂O Emissions From Managed Soils - Atmospheric deposition</i>	<i>N₂O</i>	<i>103.97</i>	<i>0.00</i>	<i>0.95</i>
<i>1.A.1.a Public electricity and heat production - Liquid Fuels</i>	<i>CO₂</i>	<i>92.24</i>	<i>0.00</i>	<i>0.95</i>
<i>4.C.2 Land converted to grassland - net carbon stock change in dead organic matter</i>	<i>CO₂</i>	<i>-86.62</i>	<i>0.00</i>	<i>0.96</i>
<i>.....</i>				
<i>Total</i>		<i>16,349.6</i>		

Approach 1 Level Assessment for 2018 using a subset (LULUCF was excluded from analysis)

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment</i>	<i>Cumulative total</i>
1.A.3.b Road transportation	CO ₂	5,755.81	0.28	0.28
2.B.1 Ammonia Production	CO ₂	1,828.32	0.09	0.37
3.A.1 Enteric Fermentation - Cattle	CH ₄	1,435.85	0.07	0.45
1.A.1.b Petroleum refining - Liquid Fuels	CO ₂	1,309.82	0.06	0.51
3.D.1.1 Direct N₂O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	824.72	0.04	0.55
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO ₂	723.58	0.04	0.59
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO ₂	703.25	0.03	0.62
5.A Solid Waste Disposal	CH ₄	661.74	0.03	0.65
1.A.4 Other sectors-Gaseous fuels	CO ₂	601.66	0.03	0.68
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	522.38	0.03	0.71
2.A.1 Cement Production	CO ₂	511.33	0.03	0.73
3.D.1.6 Direct N₂O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	496.76	0.02	0.76
1.A.2 Manufacturing industries and construction-Solid fuels	CO ₂	383.82	0.02	0.78
1.A.4 Other sectors-Liquid fuels	CO ₂	315.27	0.02	0.79
1.A.4 Other sectors-Solid fuels	CO ₂	305.66	0.02	0.81
3.D.2.2 Indirect N₂O Emissions From Managed Soils - Nitrogen leaching and run-off	N ₂ O	304.40	0.02	0.82
3.D.1.4 Direct N₂O Emissions From Managed Soils - Crop Residues	N ₂ O	300.27	0.01	0.84
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH ₄	265.18	0.01	0.85
1.B.2 Oil, natural gas and other emissions from energy production	CO ₂	253.60	0.01	0.86
1.A.3.c Railways	CO ₂	186.55	0.01	0.87
1.A.1 Energy industries-Other fossil fuels	CO ₂	179.64	0.01	0.88
2.B.2 Nitric Acid Production	N ₂ O	175.50	0.01	0.89
3.D.1.3 Direct N₂O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	170.32	0.01	0.90
3.D.1.2 Direct N₂O Emissions From Managed Soils - Organic N Fertilizers	N ₂ O	138.95	0.01	0.91
3.B.1.1 Manure Management - Cattle	CH ₄	138.25	0.01	0.91
1.A.4 Other sectors-Biomass	CH ₄	137.56	0.01	0.92
5.D Wastewater Treatment and Discharge	CH ₄	128.58	0.01	0.93
1.A.4 Other sectors-Peat	CO ₂	115.50	0.01	0.93
1.A.2 Manufacturing industries and construction-Liquid fuels	CO ₂	114.18	0.01	0.94
3.D.2.1 Indirect N₂O Emissions From Managed Soils - Atmospheric deposition	N ₂ O	103.97	0.01	0.94
1.A.1.a Public electricity and heat production - Liquid Fuels	CO ₂	92.24	0.00	0.95
3.B.2 Manure Management - Indirect N₂O Emissions	N ₂ O	84.48	0.00	0.95
3.A. Enteric Fermentation - Others	CH ₄	77.39	0.00	0.96

3.B.2 Manure Management - Cattle	N ₂ O	75.10	0.00	0.96
1.A.3.b Road transportation	N ₂ O	70.90	0.00	0.96
5.B Biological Treatment of Solid Waste	CH ₄	60.67	0.00	0.97
3.B.1.3 Manure Management - Swine	CH ₄	55.14	0.00	0.97
5.D Wastewater Treatment and Discharge	N ₂ O	42.64	0.00	0.97
1.A.1.c Manufacture of solid fuels and other energy industries - Gaseous fuels	CO ₂	40.66	0.00	0.97
1.A.1 Energy industries-Peat	CO ₂	38.29	0.00	0.97
2.F.2 Foam Blowing Agents	HFCs	38.00	0.00	0.98
1.A.3.e Other transportation	CO ₂	37.46	0.00	0.98
1.A.1 Energy industries-Biomass	N ₂ O	33.60	0.00	0.98
.....				
Total		20,243.8		

Approach 1 Trend Assessment for 2018

IPCC Category	Greenhouse gas	1990 kt CO ₂ eq.	2018 kt CO ₂ eq.	Trend assessment	% Contribution to Trend	Cumulative total
4.A.1 Forest land remaining forest land - carbon stock change in biomass	CO ₂	-7,007.02	-3,781.04	0.10	0.19	0.19
1.A.1.a Public electricity and heat production - Liquid Fuels	CO ₂	6,021.25	92.24	0.06	0.10	0.30
1.A.3.b Road transportation	CO ₂	5,247.15	5,755.81	0.05	0.09	0.38
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO ₂	5,796.59	703.25	0.04	0.08	0.46
1.A.2 Manufacturing industries and construction-Liquid fuels	CO ₂	3,873.72	114.18	0.03	0.07	0.53
1.A.4 Other sectors-Solid fuels	CO ₂	2,760.55	305.66	0.02	0.04	0.57
1.A.4 Other sectors-Liquid fuels	CO ₂	2,736.38	315.27	0.02	0.04	0.61
2.B.1 Ammonia Production	CO ₂	1,253.68	1,828.32	0.02	0.03	0.64
4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils	CO ₂	0.00	-1,019.64	0.02	0.03	0.68
3.A.1 Enteric Fermentation - Cattle	CH ₄	4,146.14	1,435.85	0.02	0.03	0.70
4.E.2 Land converted to settlements	CO ₂	16.48	717.34	0.01	0.02	0.73
4.G Harvested wood products	CO ₂	-252.55	-934.54	0.01	0.02	0.74
4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils	CO ₂	517.32	854.64	0.01	0.02	0.76
2.F.1 Refrigeration and Air Conditioning Equipment	HFCs	0.00	522.38	0.01	0.02	0.78
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO ₂	2,045.42	723.58	0.01	0.01	0.79
1.A.1.b Petroleum refining - Liquid Fuels	CO ₂	1,509.64	1,309.82	0.01	0.01	0.81
2.A.1 Cement Production	CO ₂	1,668.07	511.33	0.01	0.01	0.82
4.A.1 Forest land remaining forest land - net carbon stock change in dead wood	CO ₂	-474.03	-307.05	0.01	0.01	0.83
2.B.2 Nitric Acid Production	N ₂ O	893.01	175.50	0.01	0.01	0.84
4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	1,444.84	1,117.86	0.00	0.01	0.85
1.A.2 Manufacturing industries and construction-Solid fuels	CO ₂	171.63	383.82	0.00	0.01	0.86
3.D.1.1 Direct N ₂ O Emissions From Managed Soils - Inorganic N Fertilizers	N ₂ O	992.77	824.72	0.00	0.01	0.87
1.B.2 Oil, natural gas and other emissions from energy production	CO ₂	23.88	253.60	0.00	0.01	0.87
4.C.2 Land converted to grassland - carbon stock change in biomass	CO ₂	-285.50	-168.46	0.00	0.01	0.88
3.D.1.6 Direct N ₂ O Emissions From Managed Soils - Cultivation of organic soils	N ₂ O	532.73	496.76	0.00	0.01	0.89
1.A.4 Other sectors-Gaseous fuels	CO ₂	1,379.27	601.66	0.00	0.01	0.89
4.C.2 Land converted to grassland - net carbon stock change in mineral soils	CO ₂	-412.62	-773.49	0.00	0.01	0.90
1.A.1 Energy industries-Other fossil fuels	CO ₂	0.00	179.64	0.00	0.01	0.91
4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils	CO ₂	353.19	380.46	0.00	0.01	0.91

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2018 kt CO₂ eq.</i>	<i>Trend assessment</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
<i>4.B.2 Land converted to cropland- carbon stock change in biomass</i>	<i>CO₂</i>	<i>138.73</i>	<i>240.31</i>	<i>0.00</i>	<i>0.01</i>	<i>0.92</i>
<i>5.D Wastewater Treatment and Discharge</i>	<i>CH₄</i>	<i>471.00</i>	<i>128.58</i>	<i>0.00</i>	<i>0.00</i>	<i>0.92</i>
<i>3.B.1.3 Manure Management - Swine</i>	<i>CH₄</i>	<i>329.25</i>	<i>55.14</i>	<i>0.00</i>	<i>0.00</i>	<i>0.92</i>
<i>2.A.2 Lime Production</i>	<i>CO₂</i>	<i>210.27</i>	<i>1.53</i>	<i>0.00</i>	<i>0.00</i>	<i>0.93</i>
<i>2.A.4 Other process use of carbonates</i>	<i>CO₂</i>	<i>239.53</i>	<i>19.35</i>	<i>0.00</i>	<i>0.00</i>	<i>0.93</i>
<i>1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas</i>	<i>CH₄</i>	<i>260.55</i>	<i>265.18</i>	<i>0.00</i>	<i>0.00</i>	<i>0.94</i>
<i>4.B.2 Land converted to cropland - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>859.42</i>	<i>600.50</i>	<i>0.00</i>	<i>0.00</i>	<i>0.94</i>
<i>1.A.4 Other sectors-Peat</i>	<i>CO₂</i>	<i>27.13</i>	<i>115.50</i>	<i>0.00</i>	<i>0.00</i>	<i>0.94</i>
<i>1.A.4 Other sectors-Biomass</i>	<i>CH₄</i>	<i>70.28</i>	<i>137.56</i>	<i>0.00</i>	<i>0.00</i>	<i>0.94</i>
<i>3.D.1.4 Direct N₂O Emissions From Managed Soils - Crop Residues</i>	<i>N₂O</i>	<i>361.31</i>	<i>300.27</i>	<i>0.00</i>	<i>0.00</i>	<i>0.95</i>
<i>1.A.1. Energy industries-Solid fuels</i>	<i>CO₂</i>	<i>174.05</i>	<i>6.56</i>	<i>0.00</i>	<i>0.00</i>	<i>0.95</i>
<i>1.A.4 Other sectors-Liquid fuels</i>	<i>N₂O</i>	<i>159.35</i>	<i>13.71</i>	<i>0.00</i>	<i>0.00</i>	<i>0.95</i>
4.A.2 Land converted to forest land - carbon stock change in biomass	CO ₂	-602.56	-783.06	0.00	0.00	0.96
4.B.2 Land converted to cropland- net carbon stock change in dead organic matter	CO ₂	65.14	112.83	0.00	0.00	0.96
5.A Solid Waste Disposal	CH ₄	1,028.83	661.74	0.00	0.00	0.96
4.B.1 Cropland remaining cropland - carbon stock change in biomass	CO ₂	77.39	-27.62	0.00	0.00	0.96
3.D.1.3 Direct N ₂ O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N ₂ O	419.85	170.32	0.00	0.00	0.96
5.B Biological Treatment of Solid Waste	CH ₄	0.20	60.67	0.00	0.00	0.97
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Total		42,419.8	16,349.6	0.53	1.00	

Approach 1 Trend Assessment for 2018 using a subset (LULUCF was excluded from analysis)

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2018 kt CO₂ eq.</i>	<i>Trend assessment</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
<i>1.A.3.b Road transportation</i>	<i>CO₂</i>	<i>5,247.15</i>	<i>5755.81</i>	<i>0.07</i>	<i>0.20</i>	<i>0.20</i>
<i>1.A.1.a Public electricity and heat production - Liquid Fuels</i>	<i>CO₂</i>	<i>6,021.25</i>	<i>92.24</i>	<i>0.05</i>	<i>0.14</i>	<i>0.34</i>
<i>1.A.1.a Public electricity and heat production - Gaseous Fuels</i>	<i>CO₂</i>	<i>5,796.59</i>	<i>703.25</i>	<i>0.04</i>	<i>0.10</i>	<i>0.43</i>
<i>1.A.2 Manufacturing industries and construction-Liquid fuels</i>	<i>CO₂</i>	<i>3,873.72</i>	<i>114.18</i>	<i>0.03</i>	<i>0.09</i>	<i>0.52</i>
<i>2.B.1 Ammonia Production</i>	<i>CO₂</i>	<i>1,253.68</i>	<i>1828.32</i>	<i>0.03</i>	<i>0.07</i>	<i>0.59</i>
<i>1.A.4 Other sectors-Solid fuels</i>	<i>CO₂</i>	<i>2,760.55</i>	<i>305.66</i>	<i>0.02</i>	<i>0.05</i>	<i>0.64</i>
<i>1.A.4 Other sectors-Liquid fuels</i>	<i>CO₂</i>	<i>2,736.38</i>	<i>315.27</i>	<i>0.02</i>	<i>0.05</i>	<i>0.69</i>
<i>1.A.1.b Petroleum refining - Liquid Fuels</i>	<i>CO₂</i>	<i>1,509.64</i>	<i>1309.82</i>	<i>0.01</i>	<i>0.04</i>	<i>0.73</i>
<i>2.F.1 Refrigeration and Air Conditioning Equipment</i>	<i>HFCs</i>	<i>0.00</i>	<i>522.38</i>	<i>0.01</i>	<i>0.03</i>	<i>0.75</i>
<i>3.D.1.1 Direct N₂O Emissions From Managed Soils - Inorganic N Fertilizers</i>	<i>N₂O</i>	<i>992.77</i>	<i>824.72</i>	<i>0.01</i>	<i>0.02</i>	<i>0.78</i>
<i>3.A.1 Enteric Fermentation - Cattle</i>	<i>CH₄</i>	<i>4,146.14</i>	<i>1435.85</i>	<i>0.01</i>	<i>0.02</i>	<i>0.80</i>
<i>1.A.2 Manufacturing industries and construction-Solid fuels</i>	<i>CO₂</i>	<i>171.63</i>	<i>383.82</i>	<i>0.01</i>	<i>0.02</i>	<i>0.81</i>
<i>3.D.1.6 Direct N₂O Emissions From Managed Soils - Cultivation of organic soils</i>	<i>N₂O</i>	<i>532.73</i>	<i>496.76</i>	<i>0.01</i>	<i>0.02</i>	<i>0.83</i>
<i>1.B.2 Oil, natural gas and other emissions from energy production</i>	<i>CO₂</i>	<i>23.88</i>	<i>253.60</i>	<i>0.01</i>	<i>0.01</i>	<i>0.84</i>
<i>5.A Solid Waste Disposal</i>	<i>CH₄</i>	<i>1,028.83</i>	<i>661.74</i>	<i>0.00</i>	<i>0.01</i>	<i>0.85</i>
<i>2.B.2 Nitric Acid Production</i>	<i>N₂O</i>	<i>893.01</i>	<i>175.50</i>	<i>0.00</i>	<i>0.01</i>	<i>0.87</i>
<i>2.A.1 Cement Production</i>	<i>CO₂</i>	<i>1,668.07</i>	<i>511.33</i>	<i>0.00</i>	<i>0.01</i>	<i>0.88</i>
<i>1.A.1 Energy industries-Other fossil fuels</i>	<i>CO₂</i>	<i>0.00</i>	<i>179.64</i>	<i>0.00</i>	<i>0.01</i>	<i>0.89</i>
<i>1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas</i>	<i>CH₄</i>	<i>260.55</i>	<i>265.18</i>	<i>0.00</i>	<i>0.01</i>	<i>0.90</i>
<i>3.D.1.4 Direct N₂O Emissions From Managed Soils - Crop Residues</i>	<i>N₂O</i>	<i>361.31</i>	<i>300.27</i>	<i>0.00</i>	<i>0.01</i>	<i>0.90</i>
<i>1.A.2 Manufacturing industries and construction-Gaseous fuels</i>	<i>CO₂</i>	<i>2,045.42</i>	<i>723.58</i>	<i>0.00</i>	<i>0.01</i>	<i>0.91</i>
<i>3.D.2.2 Indirect N₂O Emissions From Managed Soils - Nitrogen leaching and run-off</i>	<i>N₂O</i>	<i>431.97</i>	<i>304.40</i>	<i>0.00</i>	<i>0.01</i>	<i>0.92</i>
<i>1.A.4 Other sectors-Biomass</i>	<i>CH₄</i>	<i>70.28</i>	<i>137.56</i>	<i>0.00</i>	<i>0.01</i>	<i>0.92</i>
<i>1.A.4 Other sectors-Peat</i>	<i>CO₂</i>	<i>27.13</i>	<i>115.50</i>	<i>0.00</i>	<i>0.01</i>	<i>0.93</i>
<i>2.A.2 Lime Production</i>	<i>CO₂</i>	<i>210.27</i>	<i>1.53</i>	<i>0.00</i>	<i>0.00</i>	<i>0.93</i>
<i>3.B.1.3 Manure Management - Swine</i>	<i>CH₄</i>	<i>329.25</i>	<i>55.14</i>	<i>0.00</i>	<i>0.00</i>	<i>0.94</i>
<i>2.A.4 Other process use of carbonates</i>	<i>CO₂</i>	<i>239.53</i>	<i>19.35</i>	<i>0.00</i>	<i>0.00</i>	<i>0.94</i>
<i>5.D Wastewater Treatment and Discharge</i>	<i>CH₄</i>	<i>471.00</i>	<i>128.58</i>	<i>0.00</i>	<i>0.00</i>	<i>0.95</i>
<i>1.A.1. Energy industries-Solid fuels</i>	<i>CO₂</i>	<i>174.05</i>	<i>6.56</i>	<i>0.00</i>	<i>0.00</i>	<i>0.95</i>
<i>5.B Biological Treatment of Solid Waste</i>	<i>CH₄</i>	<i>0.20</i>	<i>60.67</i>	<i>0.00</i>	<i>0.00</i>	<i>0.96</i>

1.A.4 Other sectors-Liquid fuels	N ₂ O	159.35	13.71	0.00	0.00	0.96
1.A.3.b Road transportation	N ₂ O	43.29	70.90	0.00	0.00	0.96
1.A.1.c Manufacture of solid fuels and other energy industries - Gaseous fuels	CO ₂	0.00	40.66	0.00	0.00	0.96
1.A.4 Other sectors-Solid fuels	CH ₄	128.56	14.03	0.00	0.00	0.97
1.A.3.c Railways	CO ₂	349.97	186.55	0.00	0.00	0.97
2.F.2 Foam Blowing Agents	HFCs	0.00	38.00	0.00	0.00	0.97
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Total		48,016.0	20,243.8	0.37	1.00	

Approach 2 Level Assessment for 1990

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment with uncertainty</i>	<i>Cumulative total</i>
<i>4.A.1 Forest land remaining forest land - carbon stock change in biomass</i>	<i>CO₂</i>	<i>-7,007.02</i>	<i>0.05</i>	<i>0.21</i>
<i>5.A Solid Waste Disposal</i>	<i>CH₄</i>	<i>1,028.83</i>	<i>0.02</i>	<i>0.29</i>
<i>4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils</i>	<i>CO₂</i>	<i>517.32</i>	<i>0.02</i>	<i>0.36</i>
<i>3.A.1 Enteric Fermentation - Cattle</i>	<i>CH₄</i>	<i>4,146.14</i>	<i>0.02</i>	<i>0.41</i>
<i>4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils</i>	<i>CO₂</i>	<i>1,444.84</i>	<i>0.01</i>	<i>0.47</i>
<i>3.D.1.1 Direct N₂O Emissions From Managed Soils - Inorganic N Fertilizers</i>	<i>N₂O</i>	<i>992.77</i>	<i>0.01</i>	<i>0.52</i>
<i>3.B.2 Manure Management - Indirect N₂O Emissions</i>	<i>N₂O</i>	<i>247.77</i>	<i>0.01</i>	<i>0.56</i>
<i>3.D.2.2 Indirect N₂O Emissions From Managed Soils - Nitrogen leaching and run-off</i>	<i>N₂O</i>	<i>431.97</i>	<i>0.01</i>	<i>0.59</i>
<i>3.D.1.6 Direct N₂O Emissions From Managed Soils - Cultivation of organic soils</i>	<i>N₂O</i>	<i>532.73</i>	<i>0.01</i>	<i>0.62</i>
<i>5.D Wastewater Treatment and Discharge</i>	<i>CH₄</i>	<i>471.00</i>	<i>0.01</i>	<i>0.65</i>
<i>4.B.2 Land converted to cropland - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>859.42</i>	<i>0.01</i>	<i>0.67</i>
<i>3.D.1.3 Direct N₂O Emissions From Managed Soils - Urine and dung deposited by grazing animals</i>	<i>N₂O</i>	<i>419.85</i>	<i>0.01</i>	<i>0.69</i>
<i>3.D.1.4 Direct N₂O Emissions From Managed Soils - Crop Residues</i>	<i>N₂O</i>	<i>361.31</i>	<i>0.00</i>	<i>0.71</i>
<i>4.A.2 Land converted to forest land - carbon stock change in biomass</i>	<i>CO₂</i>	<i>-602.56</i>	<i>0.00</i>	<i>0.73</i>
<i>3.D.1.2 Direct N₂O Emissions From Managed Soils - Organic N Fertilizers</i>	<i>N₂O</i>	<i>345.29</i>	<i>0.00</i>	<i>0.75</i>
<i>3.D.2.1 Indirect N₂O Emissions From Managed Soils - Atmospheric deposition</i>	<i>N₂O</i>	<i>175.31</i>	<i>0.00</i>	<i>0.76</i>
<i>3.B.2 Manure Management - Cattle</i>	<i>N₂O</i>	<i>205.85</i>	<i>0.00</i>	<i>0.78</i>
<i>4.A.1 Forest land remaining forest land - net carbon stock change in dead wood</i>	<i>CO₂</i>	<i>-474.03</i>	<i>0.00</i>	<i>0.79</i>
<i>4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils</i>	<i>CO₂</i>	<i>353.19</i>	<i>0.00</i>	<i>0.80</i>
<i>1.A.1.a Public electricity and heat production - Liquid Fuels</i>	<i>CO₂</i>	<i>6,021.25</i>	<i>0.00</i>	<i>0.81</i>
<i>1.A.1.a Public electricity and heat production - Gaseous Fuels</i>	<i>CO₂</i>	<i>5,796.59</i>	<i>0.00</i>	<i>0.82</i>
<i>1.A.4 Other sectors-Solid fuels</i>	<i>CO₂</i>	<i>2,760.55</i>	<i>0.00</i>	<i>0.83</i>
<i>4.C.2 Land converted to grassland - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>-412.62</i>	<i>0.00</i>	<i>0.84</i>
<i>4.G Harvested wood products</i>	<i>CO₂</i>	<i>-252.55</i>	<i>0.00</i>	<i>0.85</i>
<i>1.A.3.b Road transportation</i>	<i>CO₂</i>	<i>5,247.15</i>	<i>0.00</i>	<i>0.86</i>

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment with uncertainty</i>	<i>Cumulative total</i>
3.B.2 Manure Management - Other	N₂O	127.49	0.00	0.87
4.D.2 Land converted to wetlands	CO₂	63.13	0.00	0.88
4.C.2 Land converted to grassland - carbon stock change in biomass	CO₂	-285.50	0.00	0.89
1.A.4 Other sectors-Biomass	CH₄	70.28	0.00	0.89
1.A.2 Manufacturing industries and construction-Liquid fuels	CO₂	3,873.72	0.00	0.90
1.A.4 Other sectors-Liquid fuels	CO ₂	2,736.38	0.00	0.91
2.B.2 Nitric Acid Production	N ₂ O	893.01	0.00	0.91
2.A.1 Cement Production	CO ₂	1,668.07	0.00	0.92
4.A.2 Land converted to forest land - net carbon stock change in mineral soils	CO ₂	-163.88	0.00	0.92
1.A.4 Other sectors-Liquid fuels	N ₂ O	159.35	0.00	0.93
.....				
Total		42,419.8		

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

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment with uncertainty</i>	<i>Cumulative total</i>
5.A Solid Waste Disposal	CH₄	1,028.83	0.03	0.15
3.A.1 Enteric Fermentation - Cattle	CH₄	4,146.14	0.02	0.26
3.D.1.1 Direct N₂O Emissions From Managed Soils - Inorganic N Fertilizers	N₂O	992.77	0.02	0.35
3.B.2 Manure Management - Indirect N₂O Emissions	N₂O	247.77	0.01	0.42
3.D.2.2 Indirect N₂O Emissions From Managed Soils - Nitrogen leaching and run-off	N₂O	431.97	0.01	0.49
3.D.1.6 Direct N₂O Emissions From Managed Soils - Cultivation of organic soils	N₂O	532.73	0.01	0.54
5.D Wastewater Treatment and Discharge	CH₄	471.00	0.01	0.59
3.D.1.3 Direct N₂O Emissions From Managed Soils - Urine and dung deposited by grazing animals	N₂O	419.85	0.01	0.63
3.D.1.4 Direct N₂O Emissions From Managed Soils - Crop Residues	N₂O	361.31	0.01	0.66
3.D.1.2 Direct N₂O Emissions From Managed Soils - Organic N Fertilizers	N₂O	345.29	0.01	0.69
3.D.2.1 Indirect N₂O Emissions From Managed Soils - Atmospheric deposition	N₂O	175.31	0.01	0.72
3.B.2 Manure Management - Cattle	N₂O	205.85	0.00	0.75
1.A.1.a Public electricity and heat production - Liquid Fuels	CO₂	6,021.25	0.00	0.77
1.A.1.a Public electricity and heat production - Gaseous Fuels	CO₂	5,796.59	0.00	0.79
1.A.4 Other sectors-Solid fuels	CO₂	2,760.55	0.00	0.80
1.A.3.b Road transportation	CO₂	5,247.15	0.00	0.82
3.B.2 Manure Management - Other	N₂O	127.49	0.00	0.84
1.A.4 Other sectors-Biomass	CH₄	70.28	0.00	0.85
1.A.2 Manufacturing industries and construction-Liquid fuels	CO₂	3,873.72	0.00	0.86
1.A.4 Other sectors-Liquid fuels	CO₂	2,736.38	0.00	0.87
2.B.2 Nitric Acid Production	N₂O	893.01	0.00	0.88
2.A.1 Cement Production	CO₂	1,668.07	0.00	0.89
1.A.4 Other sectors-Liquid fuels	N₂O	159.35	0.00	0.90
1.A.4 Other sectors-Solid fuels	CH₄	128.56	0.00	0.91
2.A.2 Lime Production	CO₂	210.27	0.00	0.92
1.A.2 Manufacturing industries and construction-Gaseous fuels	CO₂	2,045.42	0.00	0.92
.....				
Total		48,016.0		

Approach 2 Level Assessment for 2018

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment with uncertainty</i>	<i>Cumulative total</i>
<i>4.A.1 Forest land remaining forest land - carbon stock change in biomass</i>	<i>CO₂</i>	<i>-3,781.04</i>	<i>0.06</i>	<i>0.14</i>
<i>4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils</i>	<i>CO₂</i>	<i>854.64</i>	<i>0.05</i>	<i>0.28</i>
<i>5.A Solid Waste Disposal</i>	<i>CH₄</i>	<i>661.74</i>	<i>0.03</i>	<i>0.35</i>
<i>3.D.1.1 Direct N₂O Emissions From Managed Soils - Inorganic N Fertilizers</i>	<i>N₂O</i>	<i>824.72</i>	<i>0.02</i>	<i>0.41</i>
<i>4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils</i>	<i>CO₂</i>	<i>1,117.86</i>	<i>0.02</i>	<i>0.46</i>
<i>4.G Harvested wood products</i>	<i>CO₂</i>	<i>-934.54</i>	<i>0.02</i>	<i>0.50</i>
<i>4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>-1,019.64</i>	<i>0.01</i>	<i>0.54</i>
<i>3.D.2.2 Indirect N₂O Emissions From Managed Soils - Nitrogen leaching and run-off</i>	<i>N₂O</i>	<i>304.40</i>	<i>0.01</i>	<i>0.57</i>
<i>3.D.1.6 Direct N₂O Emissions From Managed Soils - Cultivation of organic soils</i>	<i>N₂O</i>	<i>496.76</i>	<i>0.01</i>	<i>0.61</i>
<i>4.A.2 Land converted to forest land - carbon stock change in biomass</i>	<i>CO₂</i>	<i>-783.06</i>	<i>0.01</i>	<i>0.64</i>
<i>3.A.1 Enteric Fermentation - Cattle</i>	<i>CH₄</i>	<i>1,435.85</i>	<i>0.01</i>	<i>0.66</i>
<i>4.C.2 Land converted to grassland - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>-773.49</i>	<i>0.01</i>	<i>0.69</i>
<i>4.B.2 Land converted to cropland - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>600.50</i>	<i>0.01</i>	<i>0.71</i>
<i>3.D.1.4 Direct N₂O Emissions From Managed Soils - Crop Residues</i>	<i>N₂O</i>	<i>300.27</i>	<i>0.01</i>	<i>0.73</i>
<i>4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils</i>	<i>CO₂</i>	<i>380.46</i>	<i>0.01</i>	<i>0.75</i>
<i>1.A.4 Other sectors-Biomass</i>	<i>CH₄</i>	<i>137.56</i>	<i>0.01</i>	<i>0.76</i>
<i>3.B.2 Manure Management - Indirect N₂O Emissions</i>	<i>N₂O</i>	<i>84.48</i>	<i>0.01</i>	<i>0.78</i>
<i>1.A.3.b Road transportation</i>	<i>CO₂</i>	<i>5,755.81</i>	<i>0.00</i>	<i>0.79</i>
<i>1.B.2 Oil, natural gas and other emissions from energy production</i>	<i>CO₂</i>	<i>253.60</i>	<i>0.00</i>	<i>0.81</i>
<i>4.A.1 Forest land remaining forest land - net carbon stock change in dead wood</i>	<i>CO₂</i>	<i>-307.05</i>	<i>0.00</i>	<i>0.82</i>
<i>2.F.1 Refrigeration and Air Conditioning Equipment</i>	<i>HFCs</i>	<i>522.38</i>	<i>0.00</i>	<i>0.83</i>
<i>3.D.2.1 Indirect N₂O Emissions From Managed Soils - Atmospheric deposition</i>	<i>N₂O</i>	<i>103.97</i>	<i>0.00</i>	<i>0.84</i>
<i>3.D.1.3 Direct N₂O Emissions From Managed Soils - Urine and dung deposited by grazing animals</i>	<i>N₂O</i>	<i>170.32</i>	<i>0.00</i>	<i>0.85</i>
<i>4.E.2 Land converted to settlements</i>	<i>CO₂</i>	<i>717.34</i>	<i>0.00</i>	<i>0.86</i>
<i>5.D Wastewater Treatment and Discharge</i>	<i>CH₄</i>	<i>128.58</i>	<i>0.00</i>	<i>0.87</i>
<i>3.D.1.2 Direct N₂O Emissions From Managed Soils - Organic N Fertilizers</i>	<i>N₂O</i>	<i>138.95</i>	<i>0.00</i>	<i>0.88</i>

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment with uncertainty</i>	<i>Cumulative total</i>
4.A.2 Land converted to forest land - net carbon stock change in mineral soils	CO₂	-229.76	0.00	0.89
4.B.2 Land converted to cropland- carbon stock change in biomass	CO₂	240.31	0.00	0.90
3.B.2 Manure Management - Cattle	N ₂ O	75.10	0.00	0.91
4.E Settlements	N ₂ O	54.17	0.00	0.91
4.C.2 Land converted to grassland - carbon stock change in biomass	CO ₂	-168.46	0.00	0.92
.....				
Total		16,349.6		

Approach 2 Level Assessment for 2018 using a subset (LULUCF was excluded from analysis)

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>GHG emissions, kt CO₂ eq.</i>	<i>Level assessment with uncertainty</i>	<i>Cumulative total</i>
<i>5.A Solid Waste Disposal</i>	<i>CH₄</i>	<i>661.74</i>	<i>0.04</i>	<i>0.16</i>
<i>3.D.1.1 Direct N₂O Emissions From Managed Soils - Inorganic N Fertilizers</i>	<i>N₂O</i>	<i>824.72</i>	<i>0.03</i>	<i>0.29</i>
<i>3.D.2.2 Indirect N₂O Emissions From Managed Soils - Nitrogen leaching and run-off</i>	<i>N₂O</i>	<i>304.40</i>	<i>0.02</i>	<i>0.37</i>
<i>3.D.1.6 Direct N₂O Emissions From Managed Soils - Cultivation of organic soils</i>	<i>N₂O</i>	<i>496.76</i>	<i>0.02</i>	<i>0.45</i>
<i>3.A.1 Enteric Fermentation - Cattle</i>	<i>CH₄</i>	<i>1,435.85</i>	<i>0.02</i>	<i>0.52</i>
<i>3.D.1.4 Direct N₂O Emissions From Managed Soils - Crop Residues</i>	<i>N₂O</i>	<i>300.27</i>	<i>0.01</i>	<i>0.56</i>
<i>1.A.4 Other sectors-Biomass</i>	<i>CH₄</i>	<i>137.56</i>	<i>0.01</i>	<i>0.61</i>
<i>3.B.2 Manure Management - Indirect N₂O Emissions</i>	<i>N₂O</i>	<i>84.48</i>	<i>0.01</i>	<i>0.64</i>
<i>1.A.3.b Road transportation</i>	<i>CO₂</i>	<i>5,755.81</i>	<i>0.01</i>	<i>0.68</i>
<i>1.B.2 Oil, natural gas and other emissions from energy production</i>	<i>CO₂</i>	<i>253.60</i>	<i>0.01</i>	<i>0.71</i>
<i>2.F.1 Refrigeration and Air Conditioning Equipment</i>	<i>HFCs</i>	<i>522.38</i>	<i>0.01</i>	<i>0.73</i>
<i>3.D.2.1 Indirect N₂O Emissions From Managed Soils - Atmospheric deposition</i>	<i>N₂O</i>	<i>103.97</i>	<i>0.01</i>	<i>0.76</i>
<i>3.D.1.3 Direct N₂O Emissions From Managed Soils - Urine and dung deposited by grazing animals</i>	<i>N₂O</i>	<i>170.32</i>	<i>0.01</i>	<i>0.79</i>
<i>5.D Wastewater Treatment and Discharge</i>	<i>CH₄</i>	<i>128.58</i>	<i>0.01</i>	<i>0.81</i>
<i>3.D.1.2 Direct N₂O Emissions From Managed Soils - Organic N Fertilizers</i>	<i>N₂O</i>	<i>138.95</i>	<i>0.01</i>	<i>0.83</i>
<i>3.B.2 Manure Management - Cattle</i>	<i>N₂O</i>	<i>75.10</i>	<i>0.00</i>	<i>0.85</i>
<i>5.B Biological Treatment of Solid Waste</i>	<i>CH₄</i>	<i>60.67</i>	<i>0.00</i>	<i>0.86</i>
<i>2.B.1 Ammonia Production</i>	<i>CO₂</i>	<i>1,828.32</i>	<i>0.00</i>	<i>0.87</i>
<i>1.A.1 Energy industries-Biomass</i>	<i>N₂O</i>	<i>33.60</i>	<i>0.00</i>	<i>0.88</i>
<i>1.A.4 Other sectors-Biomass</i>	<i>N₂O</i>	<i>25.25</i>	<i>0.00</i>	<i>0.89</i>
<i>1.A.1.b Petroleum refining - Liquid Fuels</i>	<i>CO₂</i>	<i>1,309.82</i>	<i>0.00</i>	<i>0.90</i>
<i>1.A.3.b Road transportation</i>	<i>N₂O</i>	<i>70.90</i>	<i>0.00</i>	<i>0.90</i>
<i>1.A.1 Energy industries-Biomass</i>	<i>CH₄</i>	<i>21.15</i>	<i>0.00</i>	<i>0.91</i>
<i>1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas</i>	<i>CH₄</i>	<i>265.18</i>	<i>0.00</i>	<i>0.92</i>
<i>5.B Biological Treatment of Solid Waste</i>	<i>N₂O</i>	<i>26.35</i>	<i>0.00</i>	<i>0.92</i>
<i>2.A.1 Cement Production</i>	<i>CO₂</i>	<i>511.33</i>	<i>0.00</i>	<i>0.93</i>
.....				
Total		20,243.8		

Approach 2 Trend Assessment for 2018

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2018 kt CO₂ eq.</i>	<i>Trend assessment with uncertainty</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
<i>4.A.1 Forest land remaining forest land - carbon stock change in biomass</i>	<i>CO₂</i>	<i>-7,007.02</i>	<i>-3,781.04</i>	<i>0.05</i>	<i>0.33</i>	<i>0.33</i>
<i>4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils</i>	<i>CO₂</i>	<i>517.32</i>	<i>854.64</i>	<i>0.02</i>	<i>0.13</i>	<i>0.46</i>
<i>4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>0.00</i>	<i>-1,019.64</i>	<i>0.01</i>	<i>0.05</i>	<i>0.51</i>
<i>4.G Harvested wood products</i>	<i>CO₂</i>	<i>-252.55</i>	<i>-934.54</i>	<i>0.01</i>	<i>0.04</i>	<i>0.55</i>
<i>3.D.1.1 Direct N₂O Emissions From Managed Soils - Inorganic N Fertilizers</i>	<i>N₂O</i>	<i>992.77</i>	<i>824.72</i>	<i>0.00</i>	<i>0.02</i>	<i>0.57</i>
<i>3.A.1 Enteric Fermentation - Cattle</i>	<i>CH₄</i>	<i>4,146.14</i>	<i>1,435.85</i>	<i>0.00</i>	<i>0.02</i>	<i>0.60</i>
<i>4.A.1 Forest land remaining forest land - net carbon stock change in dead wood</i>	<i>CO₂</i>	<i>-474.03</i>	<i>-307.05</i>	<i>0.00</i>	<i>0.02</i>	<i>0.62</i>
<i>4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils</i>	<i>CO₂</i>	<i>1,444.84</i>	<i>1,117.86</i>	<i>0.00</i>	<i>0.02</i>	<i>0.64</i>
<i>3.D.1.6 Direct N₂O Emissions From Managed Soils - Cultivation of organic soils</i>	<i>N₂O</i>	<i>532.73</i>	<i>496.76</i>	<i>0.00</i>	<i>0.02</i>	<i>0.65</i>
<i>1.A.4 Other sectors-Biomass</i>	<i>CH₄</i>	<i>70.28</i>	<i>137.56</i>	<i>0.00</i>	<i>0.02</i>	<i>0.67</i>
<i>1.B.2 Oil, natural gas and other emissions from energy production</i>	<i>CO₂</i>	<i>23.88</i>	<i>253.60</i>	<i>0.00</i>	<i>0.02</i>	<i>0.69</i>
<i>2.F.1 Refrigeration and Air Conditioning Equipment</i>	<i>HFCs</i>	<i>0.00</i>	<i>522.38</i>	<i>0.00</i>	<i>0.02</i>	<i>0.70</i>
<i>3.B.2 Manure Management - Indirect N₂O Emissions</i>	<i>N₂O</i>	<i>247.77</i>	<i>84.48</i>	<i>0.00</i>	<i>0.02</i>	<i>0.72</i>
<i>5.D Wastewater Treatment and Discharge</i>	<i>CH₄</i>	<i>471.00</i>	<i>128.58</i>	<i>0.00</i>	<i>0.01</i>	<i>0.73</i>
<i>4.E.2 Land converted to settlements</i>	<i>CO₂</i>	<i>16.48</i>	<i>717.34</i>	<i>0.00</i>	<i>0.01</i>	<i>0.75</i>
<i>4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils</i>	<i>CO₂</i>	<i>353.19</i>	<i>380.46</i>	<i>0.00</i>	<i>0.01</i>	<i>0.76</i>
<i>1.A.1.a Public electricity and heat production - Liquid Fuels</i>	<i>CO₂</i>	<i>6,021.25</i>	<i>92.24</i>	<i>0.00</i>	<i>0.01</i>	<i>0.77</i>
<i>4.C.2 Land converted to grassland - carbon stock change in biomass</i>	<i>CO₂</i>	<i>-285.50</i>	<i>-168.46</i>	<i>0.00</i>	<i>0.01</i>	<i>0.78</i>
<i>5.A Solid Waste Disposal</i>	<i>CH₄</i>	<i>1,028.83</i>	<i>661.74</i>	<i>0.00</i>	<i>0.01</i>	<i>0.79</i>
<i>4.E Settlements</i>	<i>N₂O</i>	<i>0.50</i>	<i>54.17</i>	<i>0.00</i>	<i>0.01</i>	<i>0.80</i>
<i>3.D.2.2 Indirect N₂O Emissions From Managed Soils - Nitrogen leaching and run-off</i>	<i>N₂O</i>	<i>431.97</i>	<i>304.40</i>	<i>0.00</i>	<i>0.01</i>	<i>0.81</i>

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2018 kt CO₂ eq.</i>	<i>Trend assessment with uncertainty</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
<i>1.A.3.b Road transportation</i>	<i>CO₂</i>	<i>5,247.15</i>	<i>5,755.81</i>	<i>0.00</i>	<i>0.01</i>	<i>0.82</i>
<i>3.D.1.4 Direct N₂O Emissions From Managed Soils - Crop Residues</i>	<i>N₂O</i>	<i>361.31</i>	<i>300.27</i>	<i>0.00</i>	<i>0.01</i>	<i>0.83</i>
<i>1.A.4 Other sectors-Solid fuels</i>	<i>CO₂</i>	<i>2,760.55</i>	<i>305.66</i>	<i>0.00</i>	<i>0.01</i>	<i>0.83</i>
<i>1.A.1.a Public electricity and heat production - Gaseous Fuels</i>	<i>CO₂</i>	<i>5,796.59</i>	<i>703.25</i>	<i>0.00</i>	<i>0.01</i>	<i>0.84</i>
<i>4.D.2 Land converted to wetlands</i>	<i>CO₂</i>	<i>63.13</i>	<i>0.00</i>	<i>0.00</i>	<i>0.01</i>	<i>0.85</i>
<i>4.C.2 Land converted to grassland - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>-412.62</i>	<i>-773.49</i>	<i>0.00</i>	<i>0.01</i>	<i>0.86</i>
<i>4.B.2 Land converted to cropland- carbon stock change in biomass</i>	<i>CO₂</i>	<i>138.73</i>	<i>240.31</i>	<i>0.00</i>	<i>0.01</i>	<i>0.87</i>
<i>5.B Biological Treatment of Solid Waste</i>	<i>CH₄</i>	<i>0.20</i>	<i>60.67</i>	<i>0.00</i>	<i>0.01</i>	<i>0.87</i>
<i>3.B.2 Manure Management - Other</i>	<i>N₂O</i>	<i>127.49</i>	<i>19.03</i>	<i>0.00</i>	<i>0.01</i>	<i>0.88</i>
<i>1.A.2 Manufacturing industries and construction-Liquid fuels</i>	<i>CO₂</i>	<i>3,873.72</i>	<i>114.18</i>	<i>0.00</i>	<i>0.01</i>	<i>0.89</i>
<i>3.D.1.3 Direct N₂O Emissions From Managed Soils - Urine and dung deposited by grazing animals</i>	<i>N₂O</i>	<i>419.85</i>	<i>170.32</i>	<i>0.00</i>	<i>0.01</i>	<i>0.89</i>
<i>1.A.1 Energy industries-Biomass</i>	<i>N₂O</i>	<i>0.63</i>	<i>33.60</i>	<i>0.00</i>	<i>0.01</i>	<i>0.90</i>
<i>3.B.2 Manure Management - Cattle</i>	<i>N₂O</i>	<i>205.85</i>	<i>75.10</i>	<i>0.00</i>	<i>0.01</i>	<i>0.91</i>
<i>3.D.1.2 Direct N₂O Emissions From Managed Soils - Organic N Fertilizers</i>	<i>N₂O</i>	<i>345.29</i>	<i>138.95</i>	<i>0.00</i>	<i>0.01</i>	<i>0.91</i>
<i>4.B.2 Land converted to cropland - net carbon stock change in mineral soils</i>	<i>CO₂</i>	<i>859.42</i>	<i>600.50</i>	<i>0.00</i>	<i>0.01</i>	<i>0.92</i>
<i>1.A.4 Other sectors-Liquid fuels</i>	<i>CO₂</i>	<i>2,736.38</i>	<i>315.27</i>	<i>0.00</i>	<i>0.01</i>	<i>0.92</i>
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<i>Total</i>		<i>42,419.8</i>	<i>16,349.8</i>	<i>0.15</i>	<i>1.00</i>	

Approach 2 Trend Assessment for 2018 using a subset (LULUCF was excluded from analysis)

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2018 kt CO₂ eq.</i>	<i>Trend assessment with uncertainty</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
<i>3.D.1.1 Direct N₂O Emissions From Managed Soils - Inorganic N Fertilizers</i>	<i>N₂O</i>	<i>992.77</i>	<i>824.72</i>	<i>0.01</i>	<i>0.12</i>	<i>0.12</i>
<i>5.A Solid Waste Disposal</i>	<i>CH₄</i>	<i>1,028.83</i>	<i>661.74</i>	<i>0.01</i>	<i>0.10</i>	<i>0.22</i>
<i>3.D.1.6 Direct N₂O Emissions From Managed Soils - Cultivation of organic soils</i>	<i>N₂O</i>	<i>532.73</i>	<i>496.76</i>	<i>0.00</i>	<i>0.08</i>	<i>0.30</i>
<i>1.A.4 Other sectors-Biomass</i>	<i>CH₄</i>	<i>70.28</i>	<i>137.56</i>	<i>0.00</i>	<i>0.06</i>	<i>0.36</i>
<i>3.D.2.2 Indirect N₂O Emissions From Managed Soils - Nitrogen leaching and run-off</i>	<i>N₂O</i>	<i>431.97</i>	<i>304.40</i>	<i>0.00</i>	<i>0.06</i>	<i>0.42</i>
<i>1.B.2 Oil, natural gas and other emissions from energy production</i>	<i>CO₂</i>	<i>23.88</i>	<i>253.60</i>	<i>0.00</i>	<i>0.05</i>	<i>0.48</i>
<i>2.F.1 Refrigeration and Air Conditioning Equipment</i>	<i>HFCs</i>	<i>0.00</i>	<i>522.38</i>	<i>0.00</i>	<i>0.05</i>	<i>0.53</i>
<i>3.D.1.4 Direct N₂O Emissions From Managed Soils - Crop Residues</i>	<i>N₂O</i>	<i>361.31</i>	<i>300.27</i>	<i>0.00</i>	<i>0.04</i>	<i>0.57</i>
<i>1.A.3.b Road transportation</i>	<i>CO₂</i>	<i>5,247.15</i>	<i>5755.81</i>	<i>0.00</i>	<i>0.04</i>	<i>0.61</i>
<i>3.A.1 Enteric Fermentation - Cattle</i>	<i>CH₄</i>	<i>4,146.14</i>	<i>1435.85</i>	<i>0.00</i>	<i>0.02</i>	<i>0.63</i>
<i>1.A.1.a Public electricity and heat production - Liquid Fuels</i>	<i>CO₂</i>	<i>6,021.25</i>	<i>92.24</i>	<i>0.00</i>	<i>0.02</i>	<i>0.66</i>
<i>5.D Wastewater Treatment and Discharge</i>	<i>CH₄</i>	<i>471.00</i>	<i>128.58</i>	<i>0.00</i>	<i>0.02</i>	<i>0.68</i>
<i>5.B Biological Treatment of Solid Waste</i>	<i>CH₄</i>	<i>0.20</i>	<i>60.67</i>	<i>0.00</i>	<i>0.02</i>	<i>0.70</i>
<i>1.A.4 Other sectors-Solid fuels</i>	<i>CO₂</i>	<i>2,760.55</i>	<i>305.66</i>	<i>0.00</i>	<i>0.02</i>	<i>0.72</i>
<i>1.A.1 Energy industries-Biomass</i>	<i>N₂O</i>	<i>0.63</i>	<i>33.60</i>	<i>0.00</i>	<i>0.02</i>	<i>0.74</i>
<i>1.A.1.a Public electricity and heat production - Gaseous Fuels</i>	<i>CO₂</i>	<i>5,796.59</i>	<i>703.25</i>	<i>0.00</i>	<i>0.02</i>	<i>0.76</i>
<i>3.B.2 Manure Management - Indirect N₂O Emissions</i>	<i>N₂O</i>	<i>247.77</i>	<i>84.48</i>	<i>0.00</i>	<i>0.02</i>	<i>0.77</i>
<i>1.A.2 Manufacturing industries and construction-Liquid fuels</i>	<i>CO₂</i>	<i>3,873.72</i>	<i>114.18</i>	<i>0.00</i>	<i>0.02</i>	<i>0.79</i>
<i>3.D.2.1 Indirect N₂O Emissions From Managed Soils - Atmospheric deposition</i>	<i>N₂O</i>	<i>175.31</i>	<i>103.97</i>	<i>0.00</i>	<i>0.01</i>	<i>0.80</i>

<i>IPCC Category</i>	<i>Greenhouse gas</i>	<i>1990 kt CO₂ eq.</i>	<i>2018 kt CO₂ eq.</i>	<i>Trend assessment with uncertainty</i>	<i>% Contribution to Trend</i>	<i>Cumulative total</i>
3.B.2 Manure Management - Other	N₂O	127.49	19.03	0.00	0.01	0.82
2.B.1 Ammonia Production	CO₂	1,253.68	1828.32	0.00	0.01	0.83
1.A.1 Energy industries-Biomass	CH₄	0.40	21.15	0.00	0.01	0.84
1.A.4 Other sectors-Biomass	N₂O	12.97	25.25	0.00	0.01	0.85
1.A.4 Other sectors-Liquid fuels	CO₂	2,736.38	315.27	0.00	0.01	0.86
5.B Biological Treatment of Solid Waste	N₂O	0.15	26.35	0.00	0.01	0.87
1.A.4 Other sectors-Liquid fuels	N₂O	159.35	13.71	0.00	0.01	0.88
2.A.2 Lime Production	CO₂	210.27	1.53	0.00	0.01	0.89
1.A.3.b Road transportation	N₂O	43.29	70.90	0.00	0.01	0.90
2.B.2 Nitric Acid Production	N ₂ O	893.01	175.50	0.00	0.01	0.91
1.A.4 Other sectors-Solid fuels	CH ₄	128.56	14.03	0.00	0.01	0.92
1.A.1.b Petroleum refining - Liquid Fuels	CO ₂	1,509.64	1309.82	0.00	0.01	0.92
1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas	CH ₄	260.55	265.18	0.00	0.01	0.93
.....						
Total		48,016.0	20,243.8	0.06	1.00	

ANNEX II. Tier 1 Uncertainty assessment

Table 1a. Uncertainty evaluation including LULUCF

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2018	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in 2017	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CO ₂	7,540.2	1,415.9	2.0	2.0	2.8	0.000	0.035	0.033	0.001	0.001	0.000
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CH ₄	6.9	0.9	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	N ₂ O	16.1	1.6	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	CO ₂	174.0	6.6	2.0	5.0	5.4	0.000	0.001	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	CH ₄	0.0	0.0	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	N ₂ O	0.8	0.0	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CO ₂	5,796.6	746.5	2.0	2.0	2.8	0.000	0.035	0.018	0.001	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CH ₄	2.6	0.3	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	N ₂ O	3.1	0.4	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CO ₂	0.0	179.6	2.0	5.0	5.4	0.000	0.004	0.004	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CH ₄	0.0	1.1	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	N ₂ O	0.0	1.7	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000

1.A.1 Fuel combustion - Energy Industries - Peat	CO ₂	11.1	38.3	2.0	5.0	5.4	0.000	0.001	0.001	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Peat	CH ₄	0.0	0.0	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Peat	N ₂ O	0.0	0.2	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Biomass	CO ₂	0.0	0.0	5.0	15.0	15.8	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Biomass	CH ₄	0.4	21.1	5.0	150.0	150.1	0.000	0.000	0.000	0.001	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Biomass	N ₂ O	0.6	33.6	5.0	150.0	150.1	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	3,873.7	114.2	2.0	2.0	2.8	0.000	0.032	0.003	0.001	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	CH ₄	4.5	0.2	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	N ₂ O	47.8	5.7	2.0	50.0	50.0	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	171.6	383.8	2.0	5.0	5.4	0.000	0.007	0.009	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	CH ₄	0.5	1.0	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	N ₂ O	0.8	1.8	2.0	50.0	50.0	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	2,045.4	723.6	2.0	2.0	2.8	0.000	0.001	0.017	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	CH ₄	0.9	0.3	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000

1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	N ₂ O	1.1	0.4	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	CO ₂	17.5	7.2	2.0	5.0	5.4	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	CH ₄	0.0	0.0	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	N ₂ O	0.1	0.0	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	CO ₂	0.0	0.0	5.0	15.0	15.8	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	CH ₄	0.4	3.4	5.0	150.0	150.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	N ₂ O	0.6	5.3	5.0	150.0	150.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.a Domestic Aviation	CO ₂	8.2	2.0	10.0	2.0	10.2	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.a Domestic Aviation	CH ₄	0.0	0.0	10.0	78.5	79.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.a Domestic Aviation	N ₂ O	0.1	0.0	10.0	110.0	110.5	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b Road Transportation	CO ₂	5,247.2	5,755.8	2.0	2.0	2.8	0.000	0.088	0.136	0.002	0.004	0.000
1.A.3.b Road Transportation	CH ₄	52.0	19.1	2.0	40.0	40.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b Road Transportation	N ₂ O	43.3	70.9	2.0	50.0	50.0	0.000	0.001	0.002	0.001	0.000	0.000
1.A.3.c Railways	CO ₂	350.0	186.5	5.0	2.0	5.4	0.000	0.001	0.004	0.000	0.000	0.000
1.A.3.c Railways	CH ₄	0.5	0.3	5.0	75.0	75.2	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.c Railways	N ₂ O	40.9	21.8	5.0	75.0	75.2	0.000	0.000	0.001	0.000	0.000	0.000
1.A.3.d Domestic Navigation - Liquid Fuels	CO ₂	15.5	14.7	5.0	3.0	5.8	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.d Domestic Navigation - Liquid Fuels	CH ₄	0.0	0.0	5.0	50.0	50.2	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.d Domestic Navigation - Liquid Fuels	N ₂ O	0.1	0.1	5.0	90.0	90.1	0.000	0.000	0.000	0.000	0.000	0.000

1.A.3.e.i Other Transportation - Pipeline Transportation	CO ₂	64.3	15.5	5.0	2.0	5.4	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.i Other Transportation - Pipeline Transportation	CH ₄	0.0	0.0	5.0	50.0	50.2	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.i Other Transportation - Pipeline Transportation	N ₂ O	0.0	0.0	5.0	50.0	50.2	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Liquid Fuels	CO ₂	2,736.4	315.3	3.0	2.0	3.6	0.000	0.017	0.007	0.000	0.000	0.000
1.A.4 Other Sectors - Liquid Fuels	CH ₄	7.0	0.7	3.0	50.0	50.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Liquid Fuels	N ₂ O	159.4	13.7	3.0	50.0	50.1	0.000	0.001	0.000	0.001	0.000	0.000
1.A.4 Other Sectors - Solid Fuels	CO ₂	2,760.5	305.7	3.0	5.0	5.8	0.000	0.018	0.007	0.001	0.000	0.000
1.A.4 Other Sectors - Solid Fuels	CH ₄	128.6	14.0	3.0	50.0	50.1	0.000	0.001	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Solid Fuels	N ₂ O	13.0	1.4	3.0	50.0	50.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Gaseous Fuels	CO ₂	1,379.3	601.7	3.0	2.0	3.6	0.000	0.002	0.014	0.000	0.001	0.000
1.A.4 Other Sectors - Gaseous Fuels	CH ₄	3.1	1.4	3.0	50.0	50.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Gaseous Fuels	N ₂ O	0.7	0.3	3.0	50.0	50.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Peat	CO ₂	27.1	115.5	3.0	5.0	5.8	0.000	0.002	0.003	0.000	0.000	0.000
1.A.4 Other Sectors - Peat	CH ₄	1.1	5.8	3.0	50.0	50.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Peat	N ₂ O	0.1	0.5	3.0	50.0	50.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors- Biomass	CO ₂	0.0	0.0	10.0	15.0	18.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors- Biomass	CH ₄	70.3	137.6	10.0	150.0	150.3	0.000	0.003	0.003	0.004	0.000	0.000
1.A.4 Other Sectors- Biomass	N ₂ O	13.0	25.2	10.0	150.0	150.3	0.000	0.000	0.001	0.001	0.000	0.000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CO ₂	23.3	251.4	5.0	50.0	50.2	0.000	0.006	0.006	0.003	0.000	0.000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CH ₄	4.2	3.0	5.0	75.0	75.2	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 ₂ O	0.0	0.0	5.0	50.0	50.2	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	0.0	0.0	5.0	10.0	11.2	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	260.5	265.2	5.0	10.0	11.2	0.000	0.004	0.006	0.000	0.000	0.000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	CO ₂	0.6	2.2	5.0	50.0	50.2	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	0.3	1.0	5.0	50.0	50.2	0.000	0.000	0.000	0.000	0.000	0.000

1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	N ₂ O	0.0	0.0	5.0	50.0	50.2	0.000	0.000	0.000	0.000	0.000	0.000
2.A.1 Cement Production	CO ₂	1,668.1	511.3	2.0	5.0	5.4	0.000	0.003	0.012	0.000	0.000	0.000
2.A.2 Lime Production	CO ₂	210.3	1.5	5.0	5.0	7.1	0.000	0.002	0.000	0.000	0.000	0.000
2.A.3 Glass Production	CO ₂	11.7	7.3	7.0	5.0	8.6	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4.a Ceramics	CO ₂	227.9	3.3	5.0	5.0	7.1	0.000	0.002	0.000	0.000	0.000	0.000
2.A.4.b Other use of soda ash	CO ₂	5.2	2.7	15.0	5.0	15.8	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4.d Mineral wool production	CO ₂	6.4	13.4	7.0	5.0	8.6	0.000	0.000	0.000	0.000	0.000	0.000
2.B.1 Ammonia Production	CO ₂	1,253.7	1,828.3	2.0	2.0	2.8	0.000	0.032	0.043	0.001	0.001	0.000
2.B.2 Nitric Acid Production	N ₂ O	893.0	175.5	2.0	10.0	10.2	0.000	0.004	0.004	0.000	0.000	0.000
2.B.8.a Methanol	CO ₂	24.4	0.0	5.0	30.0	30.4	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.a Methanol	CH ₄	5.2	0.0	5.0	30.0	30.4	0.000	0.000	0.000	0.000	0.000	0.000
2.C.1 Iron and Steel Production	CO ₂	17.0	1.9	10.0	10.0	14.1	0.000	0.000	0.000	0.000	0.000	0.000
2.D.1 Lubricant use	CO ₂	6.1	15.3	5.0	50.1	50.3	0.000	0.000	0.000	0.000	0.000	0.000
2.D.2 Paraffin wax use	CO ₂	0.9	2.1	5.0	100.0	100.1	0.000	0.000	0.000	0.000	0.000	0.000
2.D.3 Solvent use	CO ₂	38.4	11.2	30.0	20.0	36.1	0.000	0.000	0.000	0.000	0.000	0.000
2.D.3 Asphalt roofing	CO ₂	0.0	0.0	5.0	25.0	25.5	0.000	0.000	0.000	0.000	0.000	0.000
2.D.3 Road paving with asphalt	CO ₂	0.0	0.0	20.0	50.0	53.9	0.000	0.000	0.000	0.000	0.000	0.000
2.D.3 Urea-based catalyst	CO ₂	0.0	2.1	10.0	2.0	10.2	0.000	0.000	0.000	0.000	0.000	0.000
2.E.1 Semiconductor	SF ₆	0.0	5.9	5.0	5.0	7.1	0.000	0.000	0.000	0.000	0.000	0.000
2.E.3 Photovoltaics	NF ₃	0.0	0.0	5.0	20.0	20.6	0.000	0.000	0.000	0.000	0.000	0.000
2.F.1.a Domestic Refrigeration	HFCs	0.0	1.6	20.0	50.0	53.9	0.000	0.000	0.000	0.000	0.000	0.000
2.F.1.a Commercial Refrigeration	HFCs	0.0	199.8	20.0	50.0	53.9	0.000	0.005	0.005	0.002	0.001	0.000
2.F.1.a Transport Refrigeration	HFCs	0.0	100.4	20.0	50.0	53.9	0.000	0.002	0.002	0.001	0.001	0.000
2.F.1.a Industrial Refrigeration	HFCs	0.0	56.8	20.0	50.0	53.9	0.000	0.001	0.001	0.001	0.000	0.000
2.F.1.a Stationary Air-Conditioning	HFCs	0.0	17.5	20.0	50.0	53.9	0.000	0.000	0.000	0.000	0.000	0.000
2.F.1.b Mobile Air-Conditioning	HFCs	0.0	146.3	20.0	50.0	53.9	0.000	0.003	0.003	0.002	0.001	0.000
2.F.2 Foam Blowing Agents	HFCs	0.0	38.0	30.0	30.0	42.4	0.000	0.001	0.001	0.000	0.000	0.000
2.F.3 Fire Protection	HFCs	0.0	3.4	20.0	20.0	28.3	0.000	0.000	0.000	0.000	0.000	0.000
2.F.4 Aerosols/metered dose inhalers	HFCs	0.0	7.5	5.0	5.0	7.1	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1 Manufacture of electrical equipments	SF ₆	0.0	0.3	5.0	5.0	7.1	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.b Accelerators	SF ₆	0.0	0.2	5.0	5.0	7.1	0.000	0.000	0.000	0.000	0.000	0.000

2.G.3.a Medical applications	N ₂ O	93.3	3.1	5.0	5.0	7.1	0.000	0.001	0.000	0.000	0.000	0.000
2.G.3.b Propellant for pressure and aerosol products	N ₂ O	2.7	2.0	20.0	100.0	102.0	0.000	0.000	0.000	0.000	0.000	0.000
3.A Enteric Fermentation	CH ₄	4,290.9	1,513.2	4.5	22.1	22.6	0.000	0.003	0.036	0.001	0.002	0.000
3.B Manure Management	CH ₄	665.9	223.6	5.5	12.4	13.6	0.000	0.001	0.005	0.000	0.000	0.000
3.B Manure Management	N ₂ O	581.1	178.6	5.1	210.1	210.2	0.001	0.001	0.004	0.002	0.000	0.000
3.D.1 Direct N ₂ O Emissions From Managed Soils	N ₂ O	2,652.0	1,931.0	6.2	82.7	82.9	0.010	0.021	0.046	0.018	0.004	0.000
3.D.2 Indirect N ₂ O Emissions From Managed Soils	N ₂ O	607.3	408.4	15.8	136.2	137.1	0.001	0.004	0.010	0.006	0.002	0.000
3.G Liming	CO ₂	20.6	11.5	10.0	50.0	51.0	0.000	0.000	0.000	0.000	0.000	0.000
3.H Urea Application	CO ₂	35.7	14.4	10.0	50.0	51.0	0.000	0.000	0.000	0.000	0.000	0.000
4.A.1 Forest Land Remaining Forest Land	CO ₂	-7,479.7	-4,086.9	3.2	45.7	45.8	0.013	0.029	0.096	0.013	0.004	0.000
4.A.1 Forest Land Remaining Forest Land	CH ₄	0.5	0.2	31.8	40.4	51.4	0.000	0.000	0.000	0.000	0.000	0.000
4.A.1 Forest Land Remaining Forest Land	N ₂ O	0.3	0.1	31.8	26.9	41.7	0.000	0.000	0.000	0.000	0.000	0.000
4.A.2 Land Converted to Forest Land	CO ₂	-798.8	-1,069.1	14.8	46.0	48.3	0.001	0.018	0.025	0.008	0.005	0.000
4.A.2 Land Converted to Forest Land	CH ₄	0.0	0.0	31.8	40.4	51.4	0.000	0.000	0.000	0.000	0.000	0.000
4.A.2 Land Converted to Forest Land	N ₂ O	0.0	0.0	31.8	26.9	41.7	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	1,849.4	1,558.0	6.8	56.1	56.5	0.003	0.020	0.037	0.011	0.004	0.000
4(II) Emissions and removals from drainage and rewetting and other management of organic and mineral soils	N ₂ O	35.3	36.2	9.4	86.0	86.5	0.000	0.001	0.001	0.000	0.000	0.000
4.B Cropland	CO ₂	1140.7	-93.6	4.7	30.6	30.95884	0.000	0.013	0.002	0.004	0.000	0.000
4.B Cropland	CH ₄	0.1	0.0	6.1	85.1	85.31835	0.000	0.000	0.000	0.000	0.000	0.000
4.B Cropland	N ₂ O	73.2	54.0	15.2	150.6	151.3651	0.000	0.001	0.001	0.001	0.000	0.000
4.C Grassland	CO ₂	-765.8	-1028.5	6.6	41.7	42.21907	0.001	0.017	0.024	0.007	0.002	0.000
4.C Grassland	CH ₄	2.5	0.4	6.1	85.1	85.31835	0.000	0.000	0.000	0.000	0.000	0.000
4.C Grassland	N ₂ O	2.7	0.5	6.1	75.8	76.04505	0.000	0.000	0.000	0.000	0.000	0.000
4.D Wetlands	CO ₂	580.5	854.6	6.1	204.5	204.591	0.011	0.015	0.020	0.030	0.002	0.001

4.D Wetlands	N ₂ O	6.1	4.7	15.2	150.6	151.3651	0.000	0.000	0.000	0.000	0.000	0.000
4.E Settlements	CO ₂	16.5	717.3	10.4	14.7	18.00694	0.000	0.017	0.017	0.002	0.002	0.000
4.E Settlements	N ₂ O	0.5	54.2	18.3	150.6	151.7078	0.000	0.001	0.001	0.002	0.000	0.000
4.F Other Land	CO ₂	0.0	44.1	17.1	15	22.74665	0.000	0.001	0.001	0.000	0.000	0.000
4.F Other Land	N ₂ O	0.0	3.8	22.8	150.6	152.3161	0.000	0.000	0.000	0.000	0.000	0.000
4.G Harvested Wood Products	CO ₂	-252.5	-934.5	15	59	60.87693	0.001	0.020	0.022	0.012	0.005	0.000
5.A Solid Waste Disposal	CH ₄	1,028.8	661.7	30	124.4	127.9662	0.003	0.006	0.016	0.008	0.007	0.000
5.B Biological Treatment of Solid Waste	CH ₄	0.2	60.7	40	100	107.7033	0.000	0.001	0.001	0.001	0.001	0.000
5.B Biological Treatment of Solid Waste	N ₂ O	0.1	26.3	40	100	107.7033	0.000	0.001	0.001	0.001	0.000	0.000
5.C Incineration and Open Burning of Waste	CO ₂	2.7	0.9	25	42.8	49.56652	0.000	0.000	0.000	0.000	0.000	0.000
5.C Incineration and Open Burning of Waste	CH ₄	0.0	0.0	25	60	65	0.000	0.000	0.000	0.000	0.000	0.000
5.C Incineration and Open Burning of Waste	N ₂ O	0.1	0.0	25	60	65	0.000	0.000	0.000	0.000	0.000	0.000
5.D Wastewater Treatment and Discharge	CH ₄	471.0	128.6	58.5	72.8	93.39213	0.000	0.001	0.003	0.001	0.003	0.000
5.D Wastewater Treatment and Discharge	N ₂ O	67.2	42.6	30	46	54.91812	0.000	0.000	0.001	0.000	0.000	0.000
Total emission		42,427.3	16,318.7	Overall uncertainty (%)			21.4	Trend uncertainty (%)				4.6

Table 1b. Uncertainty evaluation excluding LULUCF

IPCC Source category	Gas	Base year (1990) emissions	Emissions in 2018	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in 2017	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
		kt CO ₂ eq.	kt CO ₂ eq.	%	%	%	%	%	%	%	%	%
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CO ₂	7,540.2	1,415.9	2.0	2.0	2.8	0.000	0.037	0.029	0.001	0.001	0.000
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	CH ₄	6.9	0.9	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Liquid Fuels	N ₂ O	16.1	1.6	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	CO ₂	174.0	6.6	2.0	5.0	5.4	0.000	0.001	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	CH ₄	0.0	0.0	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Solid Fuels	N ₂ O	0.8	0.0	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CO ₂	5,796.6	746.5	2.0	2.0	2.8	0.000	0.035	0.016	0.001	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	CH ₄	2.6	0.3	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels	N ₂ O	3.1	0.4	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CO ₂	0.0	179.6	2.0	5.0	5.4	0.000	0.004	0.004	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	CH ₄	0.0	1.1	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels	N ₂ O	0.0	1.7	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000

1.A.1 Fuel combustion - Energy Industries - Peat	CO ₂	11.1	38.3	2.0	5.0	5.4	0.000	0.001	0.001	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Peat	CH ₄	0.0	0.0	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Peat	N ₂ O	0.0	0.2	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Biomass	CO ₂	0.0	0.0	5.0	15.0	15.8	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Biomass	CH ₄	0.4	21.1	5.0	150.0	150.1	0.000	0.000	0.000	0.001	0.000	0.000
1.A.1 Fuel combustion - Energy Industries - Biomass	N ₂ O	0.6	33.6	5.0	150.0	150.1	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	3,873.7	114.2	2.0	2.0	2.8	0.000	0.032	0.002	0.001	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	CH ₄	4.5	0.2	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels	N ₂ O	47.8	5.7	2.0	50.0	50.0	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	171.6	383.8	2.0	5.0	5.4	0.000	0.006	0.008	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	CH ₄	0.5	1.0	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels	N ₂ O	0.8	1.8	2.0	50.0	50.0	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	2,045.4	723.6	2.0	2.0	2.8	0.000	0.003	0.015	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	CH ₄	0.9	0.3	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels	N ₂ O	1.1	0.4	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	CO ₂	17.5	7.2	2.0	5.0	5.4	0.000	0.000	0.000	0.000	0.000	0.000

1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	CH ₄	0.0	0.0	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat	N ₂ O	0.1	0.0	2.0	50.0	50.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	CO ₂	0.0	0.0	5.0	15.0	15.8	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	CH ₄	0.4	3.4	5.0	150.0	150.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass	N ₂ O	0.6	5.3	5.0	150.0	150.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.a Domestic Aviation	CO ₂	8.2	2.0	10.0	2.0	10.2	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.a Domestic Aviation	CH ₄	0.0	0.0	10.0	78.5	79.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.a Domestic Aviation	N ₂ O	0.1	0.0	10.0	110.0	110.5	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b Road Transportation	CO ₂	5,247.2	5,755.8	2.0	2.0	2.8	0.000	0.074	0.120	0.001	0.003	0.000
1.A.3.b Road Transportation	CH ₄	52.0	19.1	2.0	40.0	40.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b Road Transportation	N ₂ O	43.3	70.9	2.0	50.0	50.0	0.000	0.001	0.001	0.001	0.000	0.000
1.A.3.c Railways	CO ₂	350.0	186.5	5.0	2.0	5.4	0.000	0.001	0.004	0.000	0.000	0.000
1.A.3.c Railways	CH ₄	0.5	0.3	5.0	75.0	75.2	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.c Railways	N ₂ O	40.9	21.8	5.0	75.0	75.2	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.d Domestic Navigation - Liquid Fuels	CO ₂	15.5	14.7	5.0	3.0	5.8	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.d Domestic Navigation - Liquid Fuels	CH ₄	0.0	0.0	5.0	50.0	50.2	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.d Domestic Navigation - Liquid Fuels	N ₂ O	0.1	0.1	5.0	90.0	90.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.i Other Transportation - Pipeline Transportation	CO ₂	64.3	15.5	5.0	2.0	5.4	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.i Other Transportation - Pipeline Transportation	CH ₄	0.0	0.0	5.0	50.0	50.2	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.i Other Transportation - Pipeline Transportation	N ₂ O	0.0	0.0	5.0	50.0	50.2	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Liquid Fuels	CO ₂	2,736.4	315.3	3.0	2.0	3.6	0.000	0.017	0.007	0.000	0.000	0.000
1.A.4 Other Sectors - Liquid Fuels	CH ₄	7.0	0.7	3.0	50.0	50.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Liquid Fuels	N ₂ O	159.4	13.7	3.0	50.0	50.1	0.000	0.001	0.000	0.001	0.000	0.000
1.A.4 Other Sectors - Solid Fuels	CO ₂	2,760.5	305.7	3.0	5.0	5.8	0.000	0.018	0.006	0.001	0.000	0.000
1.A.4 Other Sectors - Solid Fuels	CH ₄	128.6	14.0	3.0	50.0	50.1	0.000	0.001	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Solid Fuels	N ₂ O	13.0	1.4	3.0	50.0	50.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Gaseous Fuels	CO ₂	1,379.3	601.7	3.0	2.0	3.6	0.000	0.000	0.013	0.000	0.001	0.000
1.A.4 Other Sectors - Gaseous Fuels	CH ₄	3.1	1.4	3.0	50.0	50.1	0.000	0.000	0.000	0.000	0.000	0.000

1.A.4 Other Sectors - Gaseous Fuels	N ₂ O	0.7	0.3	3.0	50.0	50.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Peat	CO ₂	27.1	115.5	3.0	5.0	5.8	0.000	0.002	0.002	0.000	0.000	0.000
1.A.4 Other Sectors - Peat	CH ₄	1.1	5.8	3.0	50.0	50.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors - Peat	N ₂ O	0.1	0.5	3.0	50.0	50.1	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors- Biomass	CO ₂	0.0	0.0	10.0	15.0	18.0	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4 Other Sectors- Biomass	CH ₄	70.3	137.6	10.0	150.0	150.3	0.000	0.002	0.003	0.003	0.000	0.000
1.A.4 Other Sectors- Biomass	N ₂ O	13.0	25.2	10.0	150.0	150.3	0.000	0.000	0.001	0.001	0.000	0.000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CO ₂	23.3	251.4	5.0	50.0	50.2	0.000	0.005	0.005	0.003	0.000	0.000
1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil	CH ₄	4.2	3.0	5.0	75.0	75.2	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 ₂ O	0.0	0.0	5.0	50.0	50.2	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	0.0	0.0	5.0	10.0	11.2	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	260.5	265.2	5.0	10.0	11.2	0.000	0.003	0.006	0.000	0.000	0.000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	CO ₂	0.6	2.2	5.0	50.0	50.2	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	0.3	1.0	5.0	50.0	50.2	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.c Fugitive Emissions from Fuels - Venting and flaring	N ₂ O	0.0	0.0	5.0	50.0	50.2	0.000	0.000	0.000	0.000	0.000	0.000
2.A.1 Cement Production	CO ₂	1,668.1	511.3	2.0	5.0	5.4	0.000	0.004	0.011	0.000	0.000	0.000
2.A.2 Lime Production	CO ₂	210.3	1.5	5.0	5.0	7.1	0.000	0.002	0.000	0.000	0.000	0.000
2.A.3 Glass Production	CO ₂	11.7	7.3	7.0	5.0	8.6	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4.a Ceramics	CO ₂	227.9	3.3	5.0	5.0	7.1	0.000	0.002	0.000	0.000	0.000	0.000
2.A.4.b Other use of soda ash	CO ₂	5.2	2.7	15.0	5.0	15.8	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4.d Mineral wool production	CO ₂	6.4	13.4	7.0	5.0	8.6	0.000	0.000	0.000	0.000	0.000	0.000
2.B.1 Ammonia Production	CO ₂	1,253.7	1,828.3	2.0	2.0	2.8	0.000	0.027	0.038	0.001	0.001	0.000
2.B.2 Nitric Acid Production	N ₂ O	893.0	175.5	2.0	10.0	10.2	0.000	0.004	0.004	0.000	0.000	0.000
2.B.8.a Methanol	CO ₂	24.4	0.0	5.0	30.0	30.4	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.a Methanol	CH ₄	5.2	0.0	5.0	30.0	30.4	0.000	0.000	0.000	0.000	0.000	0.000
2.C.1 Iron and Steel Production	CO ₂	17.0	1.9	10.0	10.0	14.1	0.000	0.000	0.000	0.000	0.000	0.000
2.D.1 Lubricant use	CO ₂	6.1	15.3	5.0	50.1	50.3	0.000	0.000	0.000	0.000	0.000	0.000
2.D.2 Parafin wax use	CO ₂	0.9	2.1	5.0	100.0	100.1	0.000	0.000	0.000	0.000	0.000	0.000

2.D.3 Solvent use	CO ₂	43.4	34.8	30.0	20.0	36.1	0.000	0.000	0.001	0.000	0.000	0.000
2.D.3 Asphalt roofing	CO ₂	0.0	0.0	5.0	25.0	25.5	0.000	0.000	0.000	0.000	0.000	0.000
2.D.3 Road paving with asphalt	CO ₂	0.0	0.0	20.0	50.0	53.9	0.000	0.000	0.000	0.000	0.000	0.000
2.D.3 Urea-based catalyst	CO ₂	0.0	2.1	10.0	2.0	10.2	0.000	0.000	0.000	0.000	0.000	0.000
2.E.1 Semiconductor	SF ₆	0.0	5.9	5.0	5.0	7.1	0.000	0.000	0.000	0.000	0.000	0.000
2.E.3 Photovoltaics	NF ₃	0.0	0.0	5.0	20.0	20.6	0.000	0.000	0.000	0.000	0.000	0.000
2.F.1.a Domestic Refrigeration	HFCs	0.0	1.6	20.0	50.0	53.9	0.000	0.000	0.000	0.000	0.000	0.000
2.F.1.a Commercial Refrigeration	HFCs	0.0	199.8	20.0	50.0	53.9	0.000	0.004	0.004	0.002	0.001	0.000
2.F.1.a Transport Refrigeration	HFCs	0.0	100.4	20.0	50.0	53.9	0.000	0.002	0.002	0.001	0.001	0.000
2.F.1.a Industrial Refrigeration	HFCs	0.0	56.8	20.0	50.0	53.9	0.000	0.001	0.001	0.001	0.000	0.000
2.F.1.a Stationary Air-Conditioning	HFCs	0.0	17.5	20.0	50.0	53.9	0.000	0.000	0.000	0.000	0.000	0.000
2.F.1.b Mobile Air-Conditioning	HFCs	0.0	146.3	20.0	50.0	53.9	0.000	0.003	0.003	0.002	0.001	0.000
2.F.2 Foam Blowing Agents	HFCs	0.0	38.0	30.0	30.0	42.4	0.000	0.001	0.001	0.000	0.000	0.000
2.F.3 Fire Protection	HFCs	0.0	3.4	20.0	20.0	28.3	0.000	0.000	0.000	0.000	0.000	0.000
2.F.4 Aerosols/metered dose inhalers	HFCs	0.0	7.5	5.0	5.0	7.1	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1 Manufacture of electrical equipments	SF ₆	0.0	0.3	5.0	5.0	7.1	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.b Accelerators	SF ₆	0.0	0.2	5.0	5.0	7.1	0.000	0.000	0.000	0.000	0.000	0.000
2.G.3.a Medical applications	N ₂ O	93.3	3.1	5.0	5.0	7.1	0.000	0.001	0.000	0.000	0.000	0.000
2.G.3.b Propellant for pressure and aerosol products	N ₂ O	2.7	2.0	20.0	100.0	102.0	0.000	0.000	0.000	0.000	0.000	0.000
3.A Enteric Fermentation	CH ₄	4,290.9	1,513.2	4.5	22.1	22.6	0.000	0.006	0.032	0.001	0.002	0.000
3.B Manure Management	CH ₄	665.9	223.6	5.5	12.4	13.6	0.000	0.001	0.005	0.000	0.000	0.000
3.B Manure Management	N ₂ O	581.1	178.6	5.1	210.1	210.2	0.000	0.001	0.004	0.003	0.000	0.000
3.D.1 Direct N ₂ O Emissions From Managed Soils	N ₂ O	2,652.0	1,931.0	6.2	82.7	82.9	0.006	0.017	0.040	0.014	0.004	0.000
3.D.2 Indirect N ₂ O Emissions From Managed Soils	N ₂ O	607.4	408.4	15.8	136.2	137.1	0.001	0.003	0.009	0.004	0.002	0.000
3.G Liming	CO ₂	20.6	11.5	10.0	50.0	51.0	0.000	0.000	0.000	0.000	0.000	0.000
3.H Urea Application	CO ₂	35.7	14.4	10.0	50.0	51.0	0.000	0.000	0.000	0.000	0.000	0.000
5.A Solid Waste Disposal	CH ₄	1,028.8	661.7	30.0	124.4	128.0	0.002	0.005	0.014	0.006	0.006	0.000
5.B Biological Treatment of Solid Waste	CH ₄	0.2	60.7	40.0	100.0	107.7	0.000	0.001	0.001	0.001	0.001	0.000
5.B Biological Treatment of Solid Waste	N ₂ O	0.1	26.3	40.0	100.0	107.7	0.000	0.001	0.001	0.001	0.000	0.000
5.C Incineration and Open Burning of Waste	CO ₂	2.7	0.9	25.0	42.8	49.6	0.000	0.000	0.000	0.000	0.000	0.000

5.C Incineration and Open Burning of Waste	CH ₄	0.0	0.0	25.0	60.0	65.0	0.000	0.000	0.000	0.000	0.000	0.000
5.C Incineration and Open Burning of Waste	N ₂ O	0.1	0.0	25.0	60.0	65.0	0.000	0.000	0.000	0.000	0.000	0.000
5.D Wastewater Treatment and Discharge	CH ₄	471.0	128.6	58.5	72.8	93.4	0.000	0.001	0.003	0.001	0.002	0.000
5.D Wastewater Treatment and Discharge	N ₂ O	67.2	42.6	30.0	46.0	54.9	0.000	0.000	0.001	0.000	0.000	0.000
Total emission		48,021.1	20,226.7	Overall uncertainty (%)			9.9	Trend uncertainty (%)				1.9

ANNEX III. Lithuanian energy balance

Table 3-1. Balance of crude oil, TJ

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

Table 3-2. Balance of motor gasoline, TJ

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

Table 3-3. Balance of aviation gasoline, TJ

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

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

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

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

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

Table 3-6. Balance of transport diesel, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018
Production		107712	42490	56232	127985	150168	156249	165004	170006	164846
Liquid biofuels for blending					119	1478	2393	1931	2151	3308
Import		8923	9475	1670	2840	7882	68750	48563	27342	21096
Export		49416	27364	28516	92877	116251	169375	153347	134101	116666
International marine bunkers				942						
Changes in stocks		-1997	1573	-4819	-2586	31	-768	-274	661	-1918
Gross consumption		65222	26174	23625	35481	43308	57249	61877	66059	70666
Statistical difference			213	853						
Transformed in power, heat and other plants:		7521	1742	36						
- in public CHP plants										
- in autoproducer CHP plants										
- in public heat plants	1.A.1.a.iii	7521	1615	28						
- in autoproducer heat plants	1.A.1.a.iii		127	8						
- in geothermal plants										
- in other industries										
Consumed in energy sector:		128	43	136	194	144	174	168	175	185
- in peat extraction enterprises	1.A.1.c.i	128	43	60	125	109	153	160	159	175
- in crude oil extraction enterprises	1.A.1.c.ii			22	49	23	13		8	1
- in refineries	1.A.1.b			5			2	1		
- in electricity, gas, steam and air conditioning enterprises	1.A.1.c.ii			49	20	12	6	7	8	9
Non energy use	1.AD			6						
Distribution and transmission losses*		297	128	55	122	73	22	14	13	13
Final consumption:		57276	24474	24245	35165	43091	57053	61695	65871	70468
- in industry	1.A.2.g.vii	2124	1827	510	499	190	248	235	247	299
- in construction	1.A.2.g.vii	2507	935	613	589	382	320	309	360	355
- in transport	1.A.3	34289	14489	21476	32515	41030	55021	59595	63677	68233
- in agriculture	1.A.4.c.ii	14277	4207	1327	1362	1444	1438	1516	1548	1544
- in fishing	1.A.4.c.iii				14	5	6	7	7	7
- in commercial / public services	1.A.4.a.ii	2889	2804	319	186	40	20	33	32	30
- in households	1.A.4.b.ii	1190	212							

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

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018
Production					2125	1130	4777	5068	6107	6884
Liquid biofuels for blending						2	73	68	76	79
Import			717		915	854	701	1231	1107	1169
Export					985		206	2	114	9
International marine bunkers					770	756	1738	2858	3133	3567
Changes in stocks			-717	65	-225	-7	-61	63	-24	-126
Gross consumption				65	1060	1223	3546	3570	4019	4430
Statistical difference										
Transformed in power, heat and other plants:				22	102	55	38	43	42	44
- in public CHP plants	1.A.1.a ii					1				
- in autoproducer CHP plants										
- in public heat plants	1.A.1.a iii			22	64	52	37	43	41	44
- in autoproducer heat plants	1.A.1.a iii				38	2	1		1	
- in geothermal plants										
- in other industries										
Consumed in energy sector:						5	4	18	12	2
- in peat extraction enterprises	1.A.1.c.i					5	4	1	1	1
- in crude oil extraction enterprises										
- in refineries										
- in electricity, gas, steam and air conditioning enterprises	1.A.1.c.ii							17	11	1
Non energy use										
Distribution and transmission losses										
Final consumption:				43	958	1163	3504	3509	3965	4384
- in industry	1.A.2			7	405	220	228	138	193	232
- in construction	1.A.2.g.v			7	25	47	67	39	44	54
- in transport	1.A.3				226	235	2413	2358	2571	2839
- in agriculture	1.A.4.c.i			23	137	230	264	287	301	283
- in fishing	1.A.4.c.i				59	73	76	37	25	33
- in commercial / public services	1.A.4.a			6	55	69	48	24	35	12
- in households	1.A.4.b				51	289	408	626	796	931

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

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

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

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

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

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

Table 3-11. Balance of refinery gas, TJ

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

Table 3-12. Balance of bitumen, TJ

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

Table 3-13. Balance of lubricants, TJ

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

Table 3-14. Balance of petroleum coke, TJ

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

Table 3-15. Balance of refinery feedstock, TJ

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

Table 3-16. Balance of naphtha, TJ

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

Table 3-17. Balance of orimulsion, TJ

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

Table 3-18. Balance of shale oil, TJ

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

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

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018
Production										
Liquid biofuels for blending										
Import		31752	6506	176	53	4343	5701	5624	6833	6585
Export			50			438				
International marine bunkers										
Changes in stocks		980	2889			-275	640	536	-567	79
Gross consumption		32732	9345	176	53	3630	6341	6160	6266	6664
Statistical difference										
Transformed in power, heat and other plants:		1834	452	25	53	55	88	83	69	69
- in public CHP plants										
- in autoproducer CHP plants										
- in public heat plants	1.A.1.a iii	904	126	25	53	32	88	83	69	69
- in autoproducer heat plants	1.A.1.a iii	930	326			23				
- in geothermal plants										
- in other industries										
Consumed in energy sector:										
- in peat extraction enterprises										
- in crude oil extraction enterprises										
- in refineries										
- in electricity, gas, steam and air conditioning enterprises										
Non energy use	1.AD		25							
Distribution and transmission losses			25			0	10	2		
Final consumption:		30898	8843	151		3575	6243	6075	6197	6595
- in industry	1.A.2	1583	703	137		2860	3602	3141	2975	3373
- in construction	1.A.2.g.v	226	25	14		0	6	11	12	12
- in transport										
- in agriculture	1.A.4.c.i	1557	50			3	86	94	90	92
- in fishing										
- in commercial / public services	1.A.4.a	12359	6632			406	1089	1323	1377	1385
- in households	1.A.4.b	15173	1433			305	1460	1506	1743	1733

Table 3-20. Balance of anthracite, TJ

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

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

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

Table 3-22. Balance of coke, TJ

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

Table 3-23. Balance of lignite, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018
Production										
Liquid biofuels for blending										
Import				15	40	14	0	0		
Export										
International marine bunkers										
Changes in stocks				1	2	-6	1	1	0	
Gross consumption				16	42	8	1	1	0	0
Statistical difference										
Transformed in power, heat and other plants:										
- in public CHP plants										
- in autoproducer CHP plants										
- in public heat plants										
- in autoproducer heat plants										
- in geothermal plants										
- in other industries										
Consumed in energy sector:										
- in peat extraction enterprises										
- in crude oil extraction enterprises										
- in refineries										
- in electricity, gas, steam and air conditioning enterprises										
Non energy use										
Distribution and transmission losses										
Final consumption:				16	42	8	1	1	0	0
- in industry										
- in construction										
- in transport										
- in agriculture										
- in fishing										
- in commercial / public services	1.A.4.a			16	25			1		
- in households	1.A.4.b				17	8	1			

Table 3-24. Balance of peat, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018
Production		580	600	494	825	364	872	200	284	332
Liquid biofuels for blending										
Import										
Export				76	1	104	94	13	15	36
International marine bunkers										
Changes in stocks		116	222	51	-235	94	-510	153	341	307
Gross consumption		696	822	469	589	354	268	340	610	603
Statistical difference										
Transformed in power, heat and other plants:		445	357	258	299	202	141	191	418	423
- in public CHP plants										
- in autoproducer CHP plants										
- in public heat plants	1.A.1.a iii	67	96	80	128	102	67	101	343	364
- in autoproducer heat plants	1.A.1.a iii	39	10	14						
- in geothermal plants										
- in other industries		339	251	163	171	100	74	90	75	59
Consumed in energy sector:			126	36	11		3	1	1	
- in peat extraction enterprises	1.A.c.i			20	11		3	1	1	
- in crude oil extraction enterprises										
- in refineries										
- in electricity, gas, steam and air conditioning enterprises	1.A.c.ii		126	15						
Non energy use										
Distribution and transmission losses**		9	10	5	7				36	
Final consumption:		242	329	170	272	152	124	148	155	180
- in industry	1.A.2	155	174	43	7	9	33	34	36	41
- in construction										
- in transport										
- in agriculture										
- in fishing										
- in commercial / public services	1.A.4.a	87	58		21	44	51	66	68	78
- in households	1.A.4.b		97	127	244	99	40	48	51	61

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

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018
Production		239	186	138	147	84	63	77	64	50
Liquid biofuels for blending										
Import			119	2	143	696	604	797	786	1177
Export							26	70	52	210
International marine bunkers										
Changes in stocks		-53	-13	-1	-35	-44	9	-26	62	-18
Gross consumption		186	292	139	255	736	650	778	860	999
Statistical difference										
Transformed in power, heat and other plants:					9	3				3
- in public CHP plants										
- in autoproducer CHP plants										
- in public heat plants	1.A.1.a iii				2	1				3
- in autoproducer heat plants	1.A.1.a iii				7	2				
- in geothermal plants										
- in other industries										
Consumed in energy sector:				2						
- in peat extraction enterprises	1.A.c.i			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	650	771	860	996
- in industry	1.A.2	13	53		8	27	16	18	23	28
- in construction										
- in transport										
- in agriculture	1.A.4.c.i				3	16	13	15	20	27
- in fishing										
- in commercial / public services	1.A.4.a	27	53	1	28	193	173	190	216	261
- in households	1.A.4.b	146	186	136	207	497	448	548	601	680

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

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

Table 3-27. Balance of natural gas, TJ

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

Table 3-28. Balance of charcoal, TJ

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

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

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018
Production		11930	19632	27324	35293	41734	49852	49647	53960	51111
Liquid biofuels for blending										
Import			61	4	727	2008	5628	6203	4554	5637
Export				255	710	5102	5725	5669	6835	5482
International marine bunkers										
Changes in stocks		-14	-381	-54	-498	444	457	85	815	224
Gross consumption		11916	19312	27019	34812	39084	50212	50266	52494	51490
Statistical difference					457				574	736
Transformed in power, heat and other plants:		527	558	1640	6273	10408	24371	24324	27576	26689
- in public CHP plants	1.A.1.a ii				191	2472	6365	5771	7009	7327
- in autoproducer CHP plants										
- in public heat plants	1.A.1.a iii	274	156	1060	4906	7121	16987	17563	19341	17932
- in autoproducer heat plants	1.A.1.a iii	253	402	580	1128	772	980	990	1205	1404
- in geothermal plants										
- in other industries					48	43	39	41	21	26
Consumed in energy sector:				25	13	19	2	3		
- in peat extraction enterprises	1.A.1.c.i				13	4				
- in crude oil extraction enterprises										
- in refineries	1.A.1.b					1				
- in electricity, gas, steam and air conditioning enterprises	1.A.1.c.ii			25		14	2	3		
Non energy use										
Distribution and transmission losses				12	4					
Final consumption:		11389	18754	25342	28979	28657	25839	25898	25492	25537
- in industry	1.A.2	453	756	1218	4007	2920	3520	3776	3981	4373
- in construction	1.A.2.g.v	51	105	100	185	143	62	73	72	76
- in transport										
- in agriculture	1.A.4.c.i	187	211	272	253	399	383	434	568	588
- in fishing										
- in commercial / public services	1.A.4.a	1699	1104	1703	1278	1178	1332	1359	1191	1230
- in households	1.A.4.b	8999	16578	22049	23256	24017	20542	20256	19680	19270

Table 3-30. Balance of agricultural waste, TJ

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

Table 3-31. Balance of bioethanol, TJ

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

Table 3-32. Balance of biodiesel, TJ

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

Table 3-33. Balance of sludge biogas, TJ

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

Table 3-34. Balance of landfill biogas, TJ

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

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

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

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

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

Table 3-37. Balance of industrial waste, TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018
Production							303	626	183	595
Liquid biofuels for blending										
Import										
Export										
International marine bunkers										
Changes in stocks							-13		-1	-8
Gross consumption							290	626	182	587
Statistical difference										
Transformed in power, heat and other plants:							290	626	181	584
- in public CHP plants	1.A.1.a ii						290	626	181	584
- in autoproducer CHP plants										
- in public heat plants										
- in autoproducer heat plants										
- in geothermal plants										
- in other industries										
Consumed in energy sector:										
- in peat extraction enterprises										
- in crude oil extraction enterprises										
- in refineries										
- in electricity, gas, steam and air conditioning enterprises										
Non energy use										
Distribution and transmission losses****									1	3
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 (biomass fraction), TJ

	CRF category	1990	1995	2000	2005	2010	2015	2016	2017	2018
Production								140	186	572
Liquid biofuels for blending										
Import										
Export										
International marine bunkers										
Changes in stocks									-2	-9
Gross consumption								140	184	563
Statistical difference										
Transformed in power, heat and other plants:								140	183	560
- in public CHP plants	1.A.1.a ii							140	183	560
- in autoproducer CHP plants										
- in public heat plants										
- in autoproducer heat plants										
- in geothermal plants										
- in other industries										
Consumed in energy sector:										
- in peat extraction enterprises										
- in crude oil extraction enterprises										
- in refineries										
- in electricity, gas, steam and air conditioning enterprises										
Non energy use										
Distribution and transmission losses****									1	3
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

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

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

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

*According to Lithuania Statistics, transmission losses of liquid fuels arise during the primary refining of oil, but fugitive emissions from oil refining are calculated using Tier1, on the basis of crude oil refined.

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

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

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

ANNEX IV. Lithuanian energy consumption in manufacturing industries

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

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

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

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

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

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

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

Fuel type	1990	1995	2000	2005	2010	2015	2016	2017	2018
Heating and other gasoil	0	0	0	148	65	75	43	70	83
Residual fuel oil (RFO)	35444	7787	3522	1180	1	57	45	86	13
Liquefied petroleum gases (LPG)	0	0	5	5	2	3	3	3	3
Petroleum coke	0	0	0	46	111	0	0	0	0
Coke	0	0	190	402	387	336	394	439	471
Other bituminous coal	628	327	8	0	2847	3545	3088	2890	3332
Anthracite	0	0	0	0	0	0	24	0	0
Sub-bituminous coal	0	0	0	2924	153	0	0	57	22
Natural gas	6934	1833	1775	1615	909	945	1055	986	1001
Wood and wood waste	19	63	152	566	345	266	302	166	471
Other solid biomass	0	0	0	0	0	0	0	0	0
Peat	168	227	43	7	11	33	34	36	38
Waste (used tires)					209	0	0	45	99
Total	43193	10237	5695	6894	5040	5260	4988	4778	5533

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ANNEX V. Energy sector country specific CO₂ emission factors

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 6-1. GHG emission factors for energy industries

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

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

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

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

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

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

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

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

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

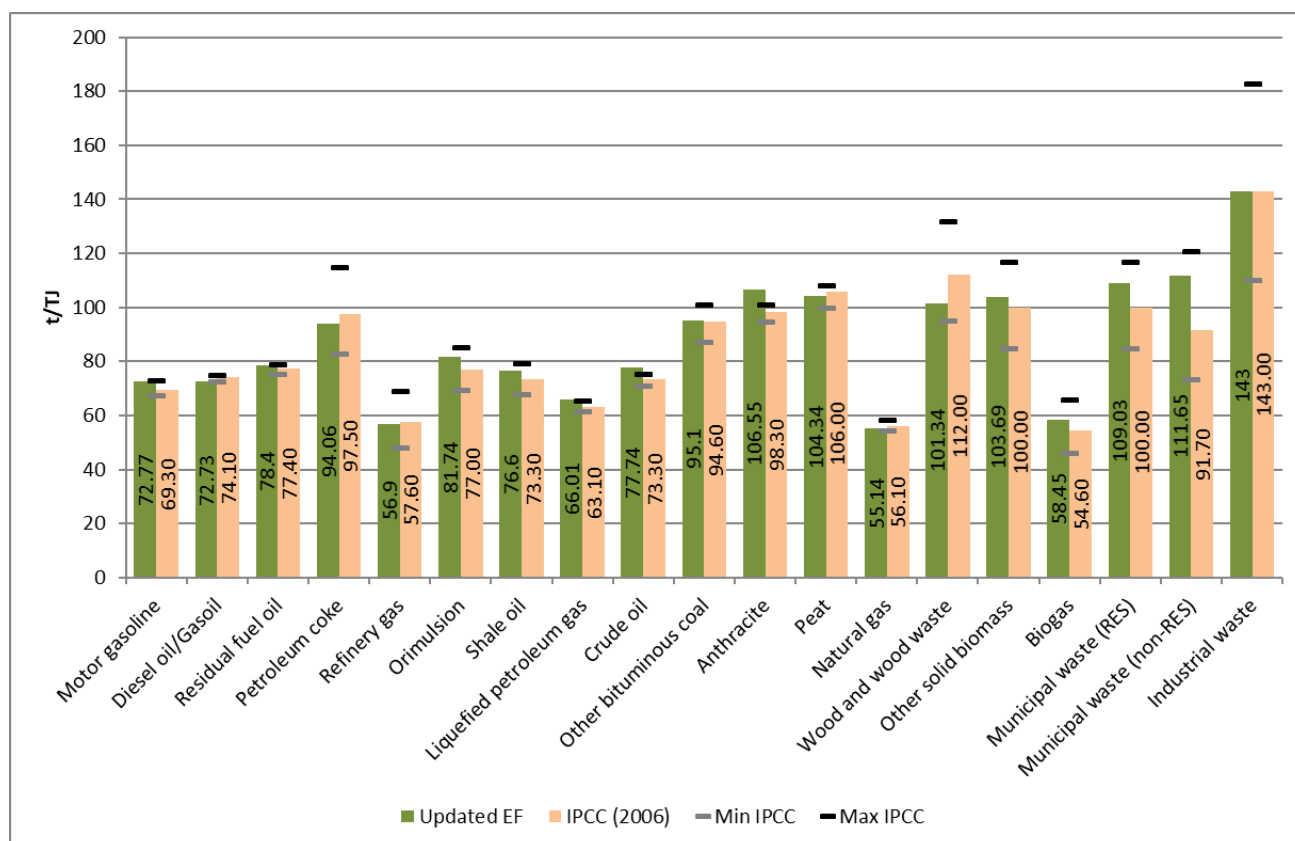


Figure 6-1. Comparison of updated country specific CO₂ emission factors and default 2006 IPCC Guidelines emission factors: energy industries

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

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

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

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

Waste		
Industrial waste (used tires)	85.00	-

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

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

Table 6-3. GHG emission factors for transport sector

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

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

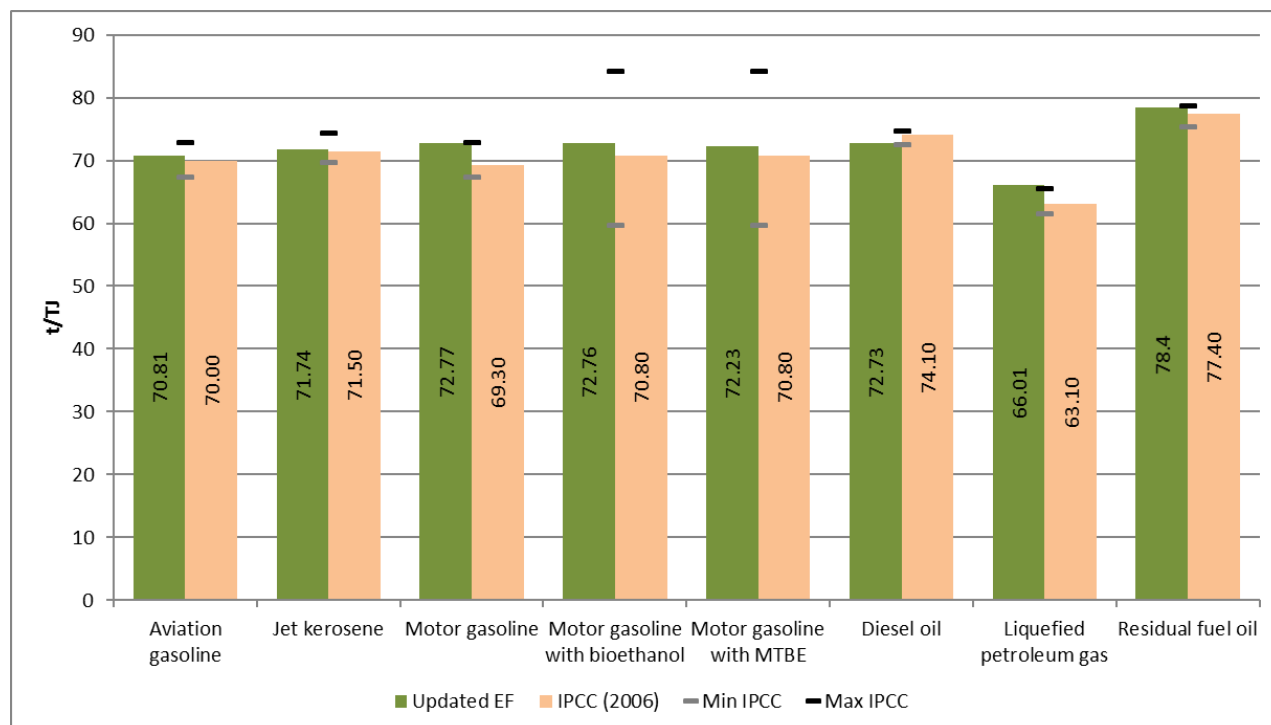


Figure 6-2. Comparison of updated country specific CO₂ emission factors with default 2006 IPCC Guidelines emission factors: transport sector

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

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

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

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

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

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

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

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

Table 6-5. Uncertainties of recommended GHG emission factors

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

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

ANNEX VII. CO₂ emissions from the installations of the GHG registry, 2018

Table 7-1. CO₂ emissions from the installations registered in the GHG Emission Allowance Registry, 2018

No	Company	Name of the Installation	Allocated EUA	Verified Emissions, t CO ₂	Corresponding CRF Sector (Fuel combustion)
1	AB "Akmenės cementas"	Boiler house, cement production furnace	579,412	842,751	1.A.2.F Non-Metallic Minerals
2	AB "Naujasis kalcitas"	Whitewash production furnace	-	0	1.A.2.F Non-Metallic Minerals
3	UAB "Švenčionių keramika"	Furnace for ceramics	-	0	1.A.2.F Non-Metallic Minerals
4	UAB "Rokų keramika"	Ceramics combustion furnace	7,570	1,915	1.A.2.F Non-Metallic Minerals
5	AB "Palemono keramikos gamykla"	Boiler house, ceramics combustion furnace	7,395	3,558	1.A.2.F Non-Metallic Minerals
6	AB "Dvarčionių keramika"	Boiler house, ceramics combustion furnace	0	38	1.A.2.F Non-Metallic Minerals
7	UAB "Kauno stiklas"	Glass melting furnace	5,275	14,240	1.A.2.F Non-Metallic Minerals
8	AB "Panevėžio stiklas"	Glass melting furnace	9,939	16,536	1.A.2.F Non-Metallic Minerals
9	AB "ORLEN Lietuva"	Oil refining factory	1,280,122	1,680,865	1.A.1.B Petroleum Refining / 1.A.1.A Public electricity and heat production
10	AB "Grigeo Klaipėda"	Boiler house	22,419	13,968	1.A.2.D Pulp, Paper and Print
11	AB "Grigeo"	Boiler house	30,720	7,243	1.A.2.D Pulp, Paper and Print
12	AB "Simega"	Boiler house	1,854	0	1.A.1.A Public electricity and heat production
13	AB "Achema"	Boiler houses, CHP	1,857,991	2,405,607	1.A.2.C Chemicals / 1.A.1.A Public electricity and heat production
14	AB "Nordic Sugar Kėdainiai"	Boiler house, oilcake desiccation	26,835	27,086	1.A.2.E Food processing, Beverages and Tobacco
15	AB "Lifosa"	Boiler house	152,808	833	1.A.2.C Chemicals
16	AB "Klaipėdos nafta"	Boiler house	8,858	17,725	1.A.1.A Public electricity and heat production
17	UAB "Lietuvos cukrus"	Boiler house	11,899	14,637	1.A.2.E Food processing, Beverages and Tobacco
18	UAB "Idavang Pasodėlė"	Boiler house	-	0	1.A.4.C Agriculture/ Forestry/ Fisheries
19	AB "Klaipėdos mediena"	Boiler house	13,683	89	1.A.2.G.iv Wood and Wood Products
20	UAB "Matuizų plytinė"	Boiler house	4,793	0	1.A.2.F Non-Metallic Minerals
21	AB "Jonavos šilumos tinklai"	Jonava boiler house	-	5,238	1.A.1.A Public electricity and heat production
22	AB "Jonavos šilumos tinklai"	Girele boiler house	2,483	0	1.A.1.A Public electricity and heat production
23	UAB "Mažeikių šilumos tinklai"	Mazeikiai boiler house	11,237	534	1.A.1.A Public electricity and heat production

No	Company	Name of the Installation	Allocated EUA	Verified Emissions, t CO ₂	Corresponding CRF Sector (Fuel combustion)
24	UAB "Raseinių šilumos tinklai"	Raseiniai boiler house No 4	2,765	3,003	1.A.1.A Public electricity and heat production
25	UAB "Molėtų šiluma"	Moletai boiler house	1,961	65	1.A.1.A Public electricity and heat production
26	UAB "Šilutės šilumos tinklai"	Šilute boiler house	5,391	23	1.A.1.A Public electricity and heat production
27	UAB "Vilniaus šilumos tinklai"	Vilnius power plant No 2 (E-2)	132,594	342,323	1.A.1.A Public electricity and heat production
28	AB "Lietuvos energijos gamyba"	Vilnius power plant No 3 (E-3)	-	0	1.A.1.A Public electricity and heat production
29	UAB "Vilniaus šilumos tinklai"	Vilnius boiler house No 2	6,224	4,364	1.A.1.A Public electricity and heat production
30	UAB "Vilniaus šilumos tinklai"	Vilnius boiler house No 8	473	3,965	1.A.1.A Public electricity and heat production
31	UAB "Širvintų šiluma"	Širvintu boiler house No 3	2,128	0	1.A.1.A Public electricity and heat production
32	AB "Šiaulių energija"	Šiauliai southern boiler house	35,597	21,639	1.A.1.A Public electricity and heat production
33	AB "Klaipėdos energija"	Power plant	-	13,321	1.A.1.A Public electricity and heat production
34	UAB "Radviliškio šiluma"	Radviliškis city boiler house	4,408	336	1.A.1.A Public electricity and heat production
35	UAB "Utenos šilumos tinklai"	Utena boiler house	15,905	2,456	1.A.1.A Public electricity and heat production
36	UAB "Tauragės šilumos tinklai"	Taurage - Beržė boiler house	4,290	464	1.A.1.A Public electricity and heat production
37	UAB "Šalčininkų šilumos tinklai"	Šalčininkai boiler house	1,827	74	1.A.1.A Public electricity and heat production
38	Pravieniškųjų pataisos namai-atviroji kolonija	Boiler house	1,370	1,902	1.A.1.A Public electricity and heat production
39	UAB "Varėnos šiluma"	Varena boiler house	3,628	79	1.A.1.A Public electricity and heat production
40	AB "Panevėžio energija"	Panevezio boiler house No 2	15,182	38,594	1.A.1.A Public electricity and heat production
41	AB "Panevėžio energija"	Rokiškio boiler house	9,729	0	1.A.1.A Public electricity and heat production
42	AB "Panevėžio energija"	Panevezio boiler house No 1	17,040	5,689	1.A.1.A Public electricity and heat production
43	AB "Panevėžio energija"	Pasvalio boiler house	2,545	103	1.A.1.A Public electricity and heat production
44	AB "Panevėžio energija"	Zarasai boiler house No 4	2,338	0	1.A.1.A Public electricity and heat production
45	UAB "GEOTERMA"	Klaipėda geothermal PP	-	0	1.A.1.A Public electricity and heat production
46	AB "Kauno energija"	Petrašiunai PP	2,535	10,906	1.A.1.A Public electricity and heat production
47	AB "Kauno energija"	Pergale boiler house	548	3,096	1.A.1.A Public electricity and heat production
48	AB "Kauno energija"	Šilkas boiler house	1,069	5,299	1.A.1.A Public electricity and heat production
49	AB "Kauno energija"	Garliava boiler house	-	171	1.A.1.A Public electricity and heat production
50	AB "Kauno energija"	Jurbarkas boiler house	3,306	1,536	1.A.1.A Public electricity and heat production

No	Company	Name of the Installation	Allocated EUA	Verified Emissions, t CO ₂	Corresponding CRF Sector (Fuel combustion)
51	UAB "Plungės šilumos tinklai"	Plunge boiler house No 1	4,232	360	1.A.1.A Public electricity and heat production
52	UAB "Birštono šiluma"	Birštonas region boiler house	1,588	1,130	1.A.1.A Public electricity and heat production
53	UAB "Litesko"	Druskininkai industry boiler house	9,522	1,457	1.A.1.A Public electricity and heat production
54	UAB "Litesko"	Boiler house of Biržai city hall	953	143	1.A.1.A Public electricity and heat production
55	UAB "Litesko"	Vilkaviškis boiler house	2,502	313	1.A.1.A Public electricity and heat production
56	UAB "Litesko"	Luohe boiler house	-	211	1.A.1.A Public electricity and heat production
57	UAB "Litesko"	Mackevicius boiler house	1,795	104	1.A.1.A Public electricity and heat production
58	UAB "Palangos šilumos tinklai"	Palanga boiler house	-	2,703	1.A.1.A Public electricity and heat production
59	UAB "Litesko"	Marijampole region boiler house	12,983	6,009	1.A.1.A Public electricity and heat production
60	UAB "Litesko"	Alytus boiler house	22,570	13,160	1.A.1.A Public electricity and heat production
61	AB "Lietuvos energijos gamyba"	Lietuvos PP	12,950	36,301	1.A.1.A Public electricity and heat production
62	UAB "Kauno termofikacijos elektrinė"	Kaunas PP	-	9,811	1.A.1.A Public electricity and heat production
63	UAB "Kaišiadorių šiluma"	Kaišiadoriai boiler house	2,944	0	1.A.1.A Public electricity and heat production
64	UAB "Kretingos šilumos tinklai"	Kretinga boiler house No 3	2,725	0	1.A.1.A Public electricity and heat production
65	AB "Klaipėdos energija"	Klaipėda region boiler house	-	24,917	1.A.1.A Public electricity and heat production
66	AB "Klaipėdos energija"	Lypkiai region boiler house	-	4,514	1.A.1.A Public electricity and heat production
67	UAB "Pramonės energija"	Boiler house	6,827	0	1.A.1.A Public electricity and heat production
68	VĮ "Ignalinos atominė elektrinė"	Boiler house	2,891	4,874	1.A.4.A Commercial/institutional
69	UAB "Trakų energija"	Lentvaris boiler house	1,065	0	1.A.1.A Public electricity and heat production
70	UAB "Gargždų plytų gamykla"	Boiler house	2,181	0	1.A.2.F Non-Metallic Minerals
71	UAB "Akmenės energija"	Zalgiris boiler house	2,603	1,432	1.A.1.A Public electricity and heat production
72	AB "Panevėžio energija"	Panevėžys thermal PP	13,294	559	1.A.1.A Public electricity and heat production
73	UAB "IKEA Industry Lietuva"	Fuel combustion plants	36,716	14,300	1.A.2.G.iv Wood and wood products
74	UAB "NEO Group"	Boiler house	31,989	25,720	1.A.2.C Chemicals
75	AB "Panevėžio energija"	Kėdainiai region boiler house	50	561	1.A.1.A Public electricity and heat production
76	UAB "Paroc"	Plants producing stone-wool	31,585	68,009	1.A.2.F Non-Metallic Minerals
77	AB "Vilniaus GKG-3"	Boiler house	-	334	1.A.2.G.v Construction

No	Company	Name of the Installation	Allocated EUA	Verified Emissions, t CO ₂	Corresponding CRF Sector (Fuel combustion)
78	AB "Vilniaus šilumos tinklai"	Boiler house No 7	0	0	1.A.1.A Public electricity and heat production
79	UAB "Pramonės energija"	Boiler house	-	0	1.A.1.A Public electricity and heat production
80	VĮ "Visagino energija"	Thermal boiler house	-	14,838	1.A.1.A Public electricity and heat production
81	AB "Roquette Amilina"	Boiler house and driers	0	2,947	1.A.2.E Food processing, Beverages and Tobacco
82	UAB "Lignoterma"	Boiler house	0	0	1.A.2.E Food processing, Beverages and Tobacco
83	AB "Amber Grid"	Jauniūnų gas compressor station	0	4,754	1.A.3.E.i Pipeline transport
84	UAB "Hoegh LNG Klaipėda"	LNG ship	0	46,107	1.A.1.C.iii Other energy industries
85	UAB "Fortum Klaipėda"	Power plant	0	145,401	1.A.1.A Public electricity and heat production
86	UAB "Danpower Baltic Biruliškių"	Boiler house	0	9,699	1.A.1.A Public electricity and heat production
		Total	4,512,111	5,952,939	

ANNEX VIII. Additional information of Agriculture sector

Other relevant information

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

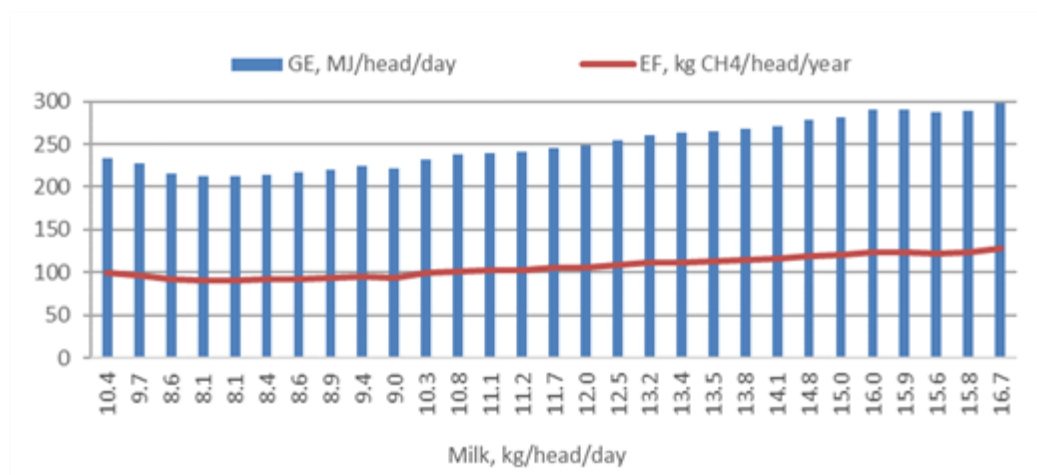


Figure A.5-1. Impact of milk yield on GE and EF's

Milk yield, gross energy, and emission factors are closely related. Positive relationships between milk production and gross energy as well as between milk yield and emission factors: 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 2018.

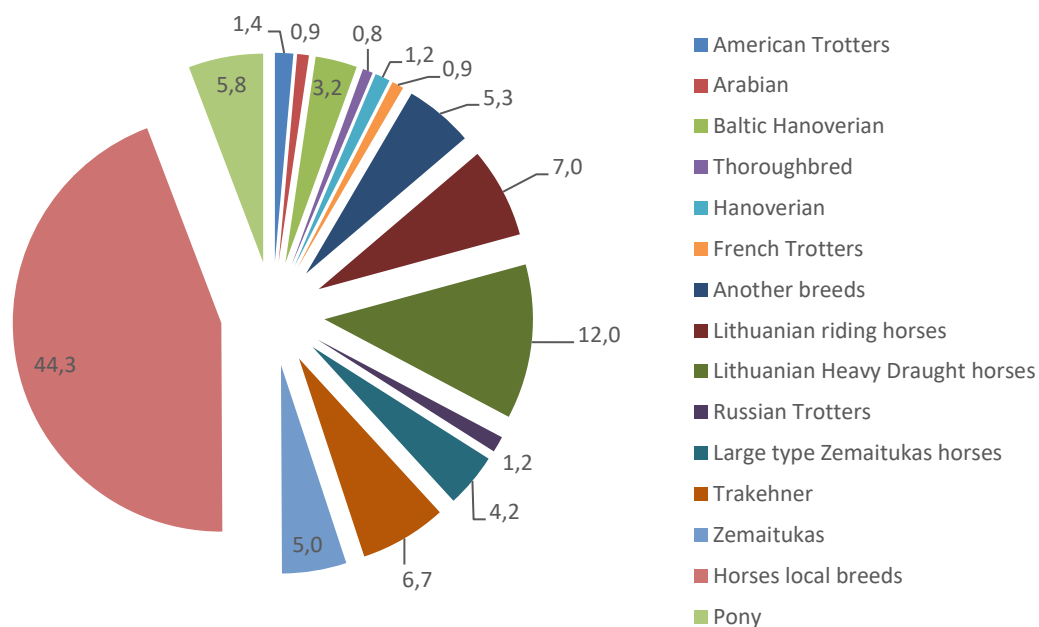


Figure A.5-2. Distribution by breeds of horses, %

Local breeds horses with no known origins constitute more than half (47%) of grown horses breeds in Lithuania.

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

Year	Methane conversion factor, %			
	Dairy cattle	Non-dairy cattle	Sheep	Swine
1990	6.50	6.45	5.98	0.60
1995	6.50	6.44	5.98	0.60
2000	6.50	6.45	5.98	0.60
2005	6.50	6.45	5.98	0.60
2010	6.50	6.50	5.98	0.60
2011	6.50	6.51	5.98	0.60
2012	6.50	6.52	5.98	0.60
2013	6.50	6.54	5.98	0.60
2014	6.50	6.57	5.99	0.60
2015	6.50	6.59	6.00	0.60
2016	6.50	6.61	5.99	0.60
2017	6.50	6.63	5.97	0.60
2018	6.50	6.65	5.96	0.60

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

Year	Population of Dairy cattle	Milk production	GE	CH ₄ EF	Emissions
1990	100	100	100	100	100
1995	71	81	92	92	65
2000	55	99	100	100	55
2005	50	116	107	107	54
2010	43	133	115	115	50
2011	42	136	116	116	49
2012	40	142	119	119	48
2013	38	145	120	120	46
2014	37	154	125	125	46
2015	36	153	125	125	45
2016	35	150	123	123	43
2017	33	152	124	124	41
2018	31	160	128	128	40

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
Liquid manure	Swine, thous. heads	412.4	442.6	396.8	328.2	355.0	406.1
	Liquid manure, %	16.0	19.2	22.4	25.6	28.9	32.1
	Year	1996	1997	1998	1999	2000	2001
	Swine, thous. heads	423.5	449.3	494.9	472.5	431.2	479.2
	Liquid manure, %	35.3	38.5	41.7	44.9	48.1	51.4
	Year	2002	2003	2004	2005	2006	2007
	Swine, thous. heads	565.2	611.9	615.0	667.9	720.5	684.5
	Liquid manure, %	54.6	57.8	57.7	61.1	64.3	66.8
	Year	2018	2009	2010	2011	2012	2013
	Swine, thous. heads	635.7	668.3	710.2	701.2	692.7	677.2
	Liquid manure, %	69.9	73.2	76.5	81.6	86.7	86.7
	Year	2014	2015	2016	2017	2018	
	Swine, thous. heads	600.1	569.8	439.9	395.3	351.1	
	Liquid manure, %	81.7	81.3	65.1	62.0	59.3	
Anaerobic digesters	Year	1990	1991	1992	1993	1994	1995
	Swine, thous. heads	0	0	0	0	0	0
	Liquid manure, %	0	0	0	0	0	0
	Year	1996	1997	1998	1999	2000	2001
	Swine, thous. heads	0	0	0	0	0	0
	Liquid manure, %	0	0	0	0	0	0
	Year	2002	2003	2004	2005	2006	2007
	Swine, thous. heads	0	0	34.7	34.5	35.2	39.6

	Liquid manure, %	0	0	3.3	3.2	3.1	3.9
	Year	208	2009	2010	2011	2012	2013
	Swine, thous. heads	36.3	35.0	35.3	16.6	0.0	0.0
	Liquid manure, %	4.0	3.8	3.8	1.9	0.0	0.0
	Year	2014	2015	2016	2017	2018	
	Swine, thous. heads	41.9	43.0	154.0	168.1	174.4	
	Liquid manure, %	5.7	6.1	22.8	26.4	29.5	

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

Year	Breeding swine	Marked swine	Weight, kg
1990	257.5	2319.8	64.8
1995	171.8	1094.4	70.1
2000	84.2	811.7	63.9
2005	99.3	994.7	63.4
2010	84.1	844.7	63.4
2011	76.4	783.4	63.2
2012	66.9	732.0	62.4
2013	62.2	718.9	61.8
2014	58.5	675.9	61.8
2015	55.5	645.4	61.7
2016	51.7	624.2	61.3
2017	49.6	588.3	61.5
2018	47.7	544.3	61.9

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

Diet composition for cattle subcategories

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

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

Intermediate values were interpolated

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

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

Non-dairy cattle less than 1 year old

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

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

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

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

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

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

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

Non-dairy cattle from 1 to 2 years old

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

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

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

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

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

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	115	23.7	310.7	476.3	851.3	18.27	1.8
Straw	49.4	16.25	434.4	451.45	820.9	18.46	0.5
Silage	114.1	32.5	298.4	390	279	16.84	8.4
Green fodder - grass	182.9	37.6	250.1	432.7	213.1	18.47	15
Concentrates	173.5	26.4	52.6	719.2	866	18.84	0.2

Non-dairy cattle 2 years old and older

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

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

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

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

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

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

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

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

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

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

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

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

Diet composition for Swine subcategories

Breeding Sows

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

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

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

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.4	23.3	60.4	764.5	853	18.61	2.64
Oats	123	38.8	108.2	704.8	860	18.99	0.807
Wheat bran	145.1	42.2	82.3	693.3	867.5	18.93	0.233
Legumes	245	20.4	76	628.4	840	19.19	0.714
Rape cake	313.2	190.6	101.5	335.5	902	22.98	0.295
Soy meal	500.3	16.4	78.1	337.3	880.6	20.08	0.419
Fish meal	695	102	8	18	910	21.15	0.155
Oil	0	998	0	0	0	39.72	0.171
Premix	0	0	0	0	950	0	0.155

Replacement Sows

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

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

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

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.4	23.3	60.4	764.5	853	18.61	3.059

Oats	123	38.8	108.2	704.8	860	18.99	0.978
Wheat bran	145.1	42.2	82.3	693.3	867.5	18.93	0.311
Legumes	245	20.4	76	628.4	840	19.19	0.795
Rape cake	313.2	190.6	101.5	335.5	902	22.98	0.311
Soy meal	500.3	16.4	78.1	337.3	880.6	20.08	0.469
Fish meal	695	102	8	18	910	21.15	0.186
Oil	0	998	0	0	0	39.72	0.202
Premix	0	0	0	0	950	0	0.186

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

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

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

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Barley	129.41	23.3	60.4	764.5	853	18.61	0.48
Wheat	137.51	19.4	30.8	793.1	850	18.56	0.23
Triticale	135.31	17	29.9	797	880	18.46	0.49
Legumes	245	20.4	76	628.4	840	19.19	0.19
Rape cake	313.2	190.6	101.5	335.5	902	22.98	0.13
Soybean meal	500.3	16.4	78.1	337.3	880.6	20.08	0.15
Fish meal	695	102	8	18	910	21.15	0.04
Oil	0	998	0	0	0	39.72	0.04
Premix	0	0	0	0	950	0	0.05

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

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

Oil	0	998	0	0	0	39.72	0.01
Premix	0	0	0	0	950	0	0.07

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

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

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

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

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

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

Boars

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

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

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

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

Diet composition for Sheep subcategories

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

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

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

Feedstuff	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract	DM	GE	Fooder
	g/kg DM				g/kg	MJ/kg DM	kg/day
Hay	113.4	23.05	313.6	478.4	847.3	18.25	0.5

Silage	123.6	29.9	300.6	482.4	373	18.63	0.91
Green fodder - grass	187.3	37.5	225.5	454.7	186.5	18.46	2.8
Concentrates	123	38.8	108.2	704.8	880	18.99	0.26

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

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

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

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

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

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

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

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

Average diet nutrition indicators for different livestock categories

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

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

Year	Crude protein	Crude fat	Crude fibre	Nitrogen-free extract
1990	1,718	312	3,176	6,639
1995	1,491	272	3,000	6,164

2000	1,709	311	3,169	6,619
2005	1,913	346	3,321	7,034
2010	2,119	385	3,433	7,574
2011	2,160	393	3,451	7,687
2012	2,243	410	3,487	7,911
2013	2,273	416	3,501	7,996
2014	2,386	439	3,551	8,305
2015	2,386	439	3,551	8,305
2016	2,345	431	3,533	8,192
2017	2,366	435	3,542	8,248
2018	2,467	456	3,589	8,540

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

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

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

Sub-category			Crude protein	Crude fat	Crude fibre	Nitrogen-free extracts	DM kg/day
Breeding	Sows	Mated	273.4	69.1	142.2	1,207	1.805
		Nursing young	918.9	171.5	330.3	2,944	4.671
Replacement	Sows	Mated	305.2	78.1	150.4	1,231.3	1.893
		Nursing young	1,055.9	196.1	383.6	3,430.8	5.427
Piglets < 2 months (< 20 kg)			156.2	14.3	25.8	429.1	0.678
Growing pigs (20-50 kg)			305.4	52.2	78.3	996.6	1.529
Growing pigs (50-80 kg)			385.2	72.7	114.7	1,582.5	2.280
Growing pigs (80-110 kg)			418.3	78.3	124.9	1,735.6	2.497
Pigs > 110 kg (8 months and >)			408.1	76.9	121.7	1,682.9	2.428
Gilts for breeds			341.1	73.2	137.6	1,220.8	1.935
Boars		Mature	389.9	79.8	165.9	1,349.8	2.123
		Young for breed	391.8	85.7	161.5	1,346.8	2.180

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

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

Agricultural soils

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

Table A.5-40. Harvested annual dry matter yield

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018
CROP (T)	kg d.m. ha ⁻¹												
Winter Wheat	2,908.9	2,092.4	3,047.2	3,299.6	2,892.9	2,818.1	4,398.3	3,875.2	4,089.1	4,853.3	4,033.1	4,444.9	3,658.2
Spring Wheat	2,182.1	2,167.5	2,239.1	2,770.8	2,603.2	2,948.0	3,304.7	3,151.8	3,666.8	3,580.2	2,908.4	2,986.3	2,321.4
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	2,775.4	2,282.0
Rye	2,421.6	1,536.2	2,023.0	1,839.8	1,493.9	1,720.2	2,381.2	1,660.4	1,913.1	2,361.6	2,020.7	2,070.8	1,755.9
Barley	2,576.5	1,410.0	2,095.9	2,337.4	2,016.8	2,555.7	2,902.0	2,788.0	3,242.4	3,408.0	2,686.5	3,119.7	2,331.4
Oats	2,206.5	1,228.0	1,633.1	1,670.7	1,380.9	1,728.2	1,962.9	1,902.1	2,058.4	2,166.8	1,862.1	2,191.0	1,5052.4
Grain maize	2,513.2	2,513.2	2,513.2	2,689.2	5,686.6	6,366.1	5,192.2	6,286.0	5,144.7	4,097.4	5,908.9	4,893.9	5,556.7
Maize for silage	9,767.6	8,975.0	9,803.4	8,561.2	10,102.8	11,500.2	10,305.7	10,311.2	10,280.2	9,212.3	11,417.1	9,271.4	9,892.8
Winter Rape	2,059.9	1,267.0	2,051.3	2,338.3	1,819.8	1,642.3	3,110.3	2,281.2	2,507.0	3,222.9	2,578.0	2,865.8	2,125.4
Spring Rape	930.8	1,265.2	1,283.8	1,487.0	1,345.5	1,784.4	1,841.5	1,670.0	1,782.1	1,780.2	1,553.7	1,962.9	1,484.1
Silage crops excl. maize	5,700.7	4,593.8	5,434.5	5,513.7	3,054.5	4,725.0	4,608.3	4,675.0	5,133.3	4,471.3	3,697.4	3,736.0	4,954.9
Flax	434.1	450.6	287.3	425.6	457.5	610.0	610.0	610.0	915.0	915.0	915.0	1,601.3	1,098.0
Buckwheat	574.1	516.7	762.6	476.1	619.8	812.5	767.3	788.7	809.1	845.4	972.8	932.4	861.3
Mixed cereals	2,307.6	1,322.7	1,554.9	1,581.6	1,492.9	1,678.6	1,914.4	1,926.1	2,181.4	2,105.0	1,974.8	1,760.7	1,575.2
Other cereals	1,700.0	1,700.0	3,400.0	1,275.0	1,092.9	1,700.0	2,125.0	1,381.3	1,133.3	850.0	850.0	850.0	850.0
Vegetables	4,875.5	4,746.6	4,746.6	4,746.6	2,942.7	4,746.6	5,202.2	4,215.3	4,875.5	4,203.4	4,190.6	3,734.3	3,773.7
Potatoes	3,113.6	2,850.0	3,649.9	2,692.2	2,866.6	3,429.5	3,757.1	3,269.3	3,775.5	3,737.2	3,499.1	2,687.6	3,394.0
Sugar beet	6,563.7	6,579.9	7,349.5	8,780.6	10,623.6	11,471.3	12,015.1	12,566.8	13,724.2	11,679.1	14,125.3	12,870.6	13,185.7
Fodder beet	6,174.6	4,248.8	4,487.8	4,026.5	3,264.0	3,564.7	4,165.7	3,712.0	4,002.9	3,784.6	3,213.3	1,980.0	2,370.0
Peas	2,333.9	1,587.2	1,711.4	1,488.6	1,317.3	1,505.7	1,694.0	1,771.0	2,076.4	2,419.5	2,248.9	2,445.9	1,690.3
Beans	1,265.8	1,981.3	1,698.2	1,309.6	1,450.0	1,609.5	1,866.9	2,118.3	2,505.8	2,727.6	2,697.6	2,979.5	1,863.2
Soya beans	772.6	772.6	772.6	772.6	772.6	772.6	611.3	946.1	714.8	588.7	1471.7	1,094.9	1,545.3
Mixed dried pulses	1,626.5	1,626.5	1,626.5	1,617.6	1,444.3	1,678.6	1,742.2	1,643.5	1,900.3	1,973.4	1,759.3	1,818.9	1,325.3
Lupines	110.1	176.7	133.9	159.1	103.0	162.5	150.0	132.6	140.9	204.2	181.6	191.4	144.2
Vetches	551.0	427.0	386.0	398.0	340.0	368.0	350.0	526.0	495.0	495.0	427.0	276.0	155.0
Lucerne hay	IE	IE	IE	2,711.3	2,293.3	2,948.6	2,948.6	2,771.1	3,506.2	2,327.1	4,682.2	4,432.3	5,295.8
Lucerne haylage	IE	IE	IE	3,569.0	4,165.0	4,309.0	3,487.0	3,492.0	3,146.0	2,672.0	3,457.0	3,509.8	2,530.0
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	3,799.3	3,017.1
Clover and their mixture haylage	IE	IE	IE	868.2	3,357.7	2,995.6	2,852.3	2,742.0	2,620.4	2,368.2	2,828.9	2,514.4	2,100.8
Annual grasses hay	617.7	1,080.9	888.4	627.6	2,580.0	2,580.0	2,962.2	2,771.1	3,669.3	2,580.0	1,720.0	2,293.3	2,472.5
Annual grasses haylage	3,401.0	4,769.3	4,178.9	2,330.9	2,633.4	2,535.1	2,867.6	2,016.2	2,243.0	1,870.0	2,019.5	2,157.5	1,679.6
Perennial grasses hay	2,805.6	3,149.8	2,682.1	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses haylage	2,342.2	2,629.6	2,239.1	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses (excl. lucerne, clover and their mixture) hay	IE	IE	IE	2,807.0	2,357.0	2,242.0	2,521.0	2,339.0	2,384.0	2,272.0	2,421.0	2,809.2	3,283.7

Perennial grasses (excl. lucerne, clover and their mixture) haylage	IE	IE	IE	1,078.0	2,544.0	2,308.0	2,484.0	2,340.0	2,170.0	1,863.0	1,972.0	1,787.1	2,008.8
Meadows pasture hay	986.9	2,706.3	2,339.4	2,241.5	1,974.0	1,971.2	2,036.7	1,839.3	1,942.7	2,054.4	2,107.5	2,387.3	2,472.5
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	1,245.8	1,257.2
Meadows and natural pastures hay	3,261.2	3,261.2	3,261.2	2,061.4	1,738.0	1,722.6	1,973.1	1,942.6	1,947.6	1,941.9	1,943.1	2,599.7	1,087.1
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	1,695.8	1,088.2

Table A.5-41. Total annual area harvested

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018
AREA (T)	ha yr ⁻¹												
Winter Wheat	343,728.0	248,496.0	283,216.0	295,913.6	36,7400.0	275,200.0	436,200.0	466,000.0	355,000.0	573,000.0	628,600.0	620,600.0	463,100.0
Spring Wheat	2,882.6	10,039.4	84,390.6	70,772.8	150,200.0	275,900.0	190,800.0	201,400.0	353,000.0	263,200.0	251,900.0	191,300.0	309,700.0
Triticale	13,356.9	22,185.0	50,088.8	74,147.2	108,600.0	94,400.0	119,100.0	144,900.0	120,100.0	122,000.0	100,900.0	75,800.0	57,100.0
Rye	165,045.7	132,410.1	130,837.3	50,034.7	49,500.0	42,000.0	55,900.0	49,400.0	37,900.0	38,800.0	32,600.0	25,900.0	21,300.0
Barley	394,701.3	537,421.5	348,608.4	344,857.8	231,800.0	252,700.0	217,300.0	209,300.0	267,000.0	202,400.0	172,500.0	141,600.0	225,900.0
Oats	75,387.6	46,167.6	43,148.2	58,050.4	57,800.0	63,200.0	70,800.0	73,600.0	75,900.0	64,100.0	70,800.0	76,000.0	10,300.0
Grain maize	2,807.2	2,807.2	2,807.2	1,548.8	7,100.0	9,600.0	12,900.0	17,200.0	19,000.0	11,700.0	12,400.0	9,900.0	13,400.0
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	24,300.0	28,300.0
Winter Rape	10,616.4	3,538.8	5,308.2	28,408.7	89,300.0	23,400.0	77,900.0	116,600.0	104,200.0	123,100.0	123,800.0	157,500.0	143,400.0
Spring Rape	393.2	10,124.9	49,248.3	79,131.5	162,600.0	226,800.0	182,900.0	142,400.0	110,900.0	40,400.0	29,800.0	23,400.0	61,900.0
Silage crops excl. maize	82,700.0	13,600.0	5,500.0	7,300.0	1,100.0	1000.0	1,200.0	1,400.0	2,100.0	4,000.0	3,900.0	4,300.0	5,100.0
Flax	21,500.0	13,200.0	8,600.0	4,300.0	400.0	600.0	300.0	300.0	300.0	300.0	200.0	400.0	500.0
Buckwheat	296.1	987.0	16,384.2	28,030.8	19,200.0	27,200.0	33,900.0	30,500.0	37,400.0	36,700.0	43,600.0	48,500.0	52,700.0
Mixed cereals	6,888.0	15,744.0	10,824.0	20,959.2	19,700.0	23,800.0	22,200.0	20,300.0	22,600.0	17,000.0	13,300.0	9,800.0	10,900.0
Other cereals	100.0	100.0	200.0	200.0	700.0	700.0	600.0	800.0	900.0	200.0	100.0	100.0	100.0
Vegetables	13,311.5	17,089.0	15,267.4	17,112.1	14,100.0	14,600.0	13,000.0	13,100.0	12,400.0	11,300.0	12,400.0	11,500.0	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	19,400.0	19,200.0
Sugar beet	31,971.6	24,202.8	27,589.2	20,916.0	15,300.0	17,600.0	19,200.0	17,700.0	17,000.0	12,200.0	15,200.0	17,100.0	15,500.0
Fodder beet	52,060.8	61,822.2	37,418.7	11,196.9	1,500.0	1,700.0	1,400.0	1,500.0	1,400.0	1,300.0	900.0	800.0	800.0
Peas	40,849.6	11,325.6	24,393.6	11,906.4	27,100.0	26,500.0	24,000.0	24,000.0	40,900.0	79,400.0	148,700.0	154,200.0	106,200.0
Beans	3,161.6	1,185.6	1,383.2	3,853.2	3,000.0	4,000.0	4,800.0	6,900.0	21,700.0	61,400.0	67,500.0	67,100.0	69,900.0
Soya beans	800.0	800.0	800.0	800.0	800.0	800.0	2,600.0	1,400.0	2,100.0	2,700.0	1,800.0	2,500.0	2,000.0
Mixed dried pulses	8,183.6	8,183.6	8,183.6	12,075.8	7,600.0	6,900.0	6,400.0	7,100.0	13,600.0	11,300.0	11,300.0	11,500.0	9,000.0
Lupines	2,451.8	848.7	1,791.7	4,620.7	9,900.0	6,000.0	5,100.0	4,300.0	3,300.0	3,600.0	3,800.0	2,900.0	2,600.0
Vetches	27,200.0	9,800.0	10,000.0	2,600.0	2,100.0	2,000.0	2,100.0	2,100.0	2,000.0	1,300.0	700.0	500.0	400.0
Lucerne hay	IE	IE	IE	951.6	600.0	700.0	700.0	900.0	1,300.0	1,700.0	1,800.0	1,300.0	1,900.0
Lucerne haylage	IE	IE	IE	3,384.4	3,000.0	2,900.0	3,300.0	3,100.0	3,000.0	5,500.0	6,300.0	4,300.0	6,800.0
Clover and their mixture hay	IE	IE	IE	60,278.0	15,700.0	15,400.0	17,100.0	17,400.0	17,400.0	14,100.0	11,100.0	9,900.0	13,600.0
Clover and their mixture haylage	IE	IE	IE	100,502.2	18,300.0	26,900.0	27,800.0	28,200.0	29,900.0	28,000.0	20,300.0	20,800.0	29,900.0
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	600.0	800.0
Annual grasses haylage	93,131.0	38,921.7	22,228.4	57,460.0	6,700.0	6,500.0	5,800.0	7,300.0	9,200.0	7,600.0	7,800.0	5,700.0	10400.0

Perennial grasses hay	257,946.1	168,269.3	109,981.8	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses haylage	212,601.7	138,689.3	90,648.1	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses (excl. lucerne, clover and their mixture) hay	IE	IE	IE	122,448.2	232,900.0	246,400.0	220,900.0	228,200.0	228,400.0	158,700.0	107,300.0	71,300.0	64,500.0
Perennial grasses (excl. lucerne, clover and their mixture) haylage	IE	IE	IE	90,511.9	150,100.0	169,400.0	173,000.0	143,800.0	154,100.0	120,500.0	101,800.0	82,800.0	704,00.0
Meadows pasture hay	373,976.8	322,984.8	394,776.9	36,7821.7	209,600.0	201,300.0	166,200.0	183,800.0	181,100.0	273,100.0	385,700.0	348,100.0	366,100.0
Meadows pasture haylage	185,565.1	160,263.2	195,886.0	18,2511.0	68,400.0	61,200.0	51,700.0	66,700.0	76,300.0	237,500.0	307,200.0	305,700.0	245,200.0
Meadows and natural pastures hay	244,746.8	150,721.1	86,924.9	82,510.0	99,400.0	88,900.0	66,400.0	77,200.0	79,700.0	95,500.0	37,000.0	34,400.0	25,500.0
Meadows and natural pastures haylage	81,850.2	50,405.3	29,070.1	27,593.6	21,700.0	25,500.0	19,400.0	28,100.0	34,700.0	30,200.0	16,100.0	14,400.0	9,300.0

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018
R _{AG(T)}	kg d.m.												
Winter Wheat	1.75	1.80	1.74	1.73	1.75	1.75	1.70	1.71	1.71	1.69	1.71	1.70	1.72
Spring Wheat	1.63	1.64	1.62	1.56	1.58	1.54	1.52	1.53	1.49	1.50	1.55	1.54	1.61
Triticale	1.50	1.58	1.49	1.47	1.53	1.50	1.37	1.42	1.40	1.36	1.41	1.41	1.48
Rye	1.45	1.66	1.52	1.57	1.68	1.60	1.46	1.62	1.55	1.46	1.53	1.51	1.59
Barley	1.21	1.40	1.26	1.23	1.27	1.21	1.18	1.19	1.16	1.15	1.20	1.17	1.23
Oats	1.31	1.63	1.45	1.44	1.55	1.42	1.36	1.38	1.34	1.32	1.39	1.32	0.97
Grain maize	1.27	1.27	1.27	1.26	1.14	1.13	1.15	1.13	1.15	1.18	1.13	1.15	1.14
Maize for silage	1.09	1.10	1.09	1.10	1.09	1.08	1.09	1.09	1.09	1.10	1.08	1.10	1.09
Winter Rape	1.52	1.78	1.52	1.47	1.57	1.63	1.37	1.48	1.44	1.36	1.43	1.40	1.50
Spring Rape	2.04	1.79	1.78	1.68	1.74	1.58	1.57	1.62	1.58	1.58	1.66	1.54	1.68
Silage crops excl. maize	1.24	1.28	1.25	1.25	1.38	1.28	1.28	1.28	1.26	1.29	1.33	1.33	1.27
Flax	3.12	3.04	4.15	3.16	3.01	2.53	2.53	2.53	2.05	2.05	2.05	1.64	1.89
Buckwheat	2.62	2.79	2.24	2.94	2.51	2.17	2.24	2.21	2.18	2.13	1.99	2.03	2.11
Mixed cereals	1.47	1.76	1.66	1.65	1.68	1.61	1.55	1.55	1.49	1.51	1.54	1.59	1.65
Other cereals	1.61	1.61	1.35	1.78	1.90	1.61	1.50	1.73	1.87	2.13	2.13	2.13	2.13
Vegetables	0.32	0.32	0.32	0.32	0.46	0.32	0.30	0.35	0.32	0.35	0.35	0.38	0.38
Potatoes	0.44	0.47	0.39	0.49	0.47	0.41	0.38	0.42	0.38	0.38	0.40	0.49	0.41
Sugar beet	0.26	0.26	0.24	0.22	0.20	0.19	0.19	0.18	0.18	0.19	0.18	0.18	0.18
Fodder beet	0.27	0.35	0.34	0.36	0.42	0.40	0.35	0.39	0.36	0.38	0.43	0.64	0.55
Peas	1.49	1.67	1.63	1.70	1.78	1.69	1.63	1.61	1.54	1.48	1.51	1.48	1.63
Beans	0.90	0.70	0.76	0.88	0.83	0.78	0.72	0.68	0.63	0.61	0.61	0.59	0.72
Soya beans	2.68	2.68	2.68	2.68	2.68	2.68	3.14	2.36	2.82	3.22	1.85	2.16	1.80
Mixed dried pulses	1.65	1.65	1.65	1.66	1.72	1.64	1.62	1.65	1.58	1.56	1.61	1.60	1.77

Lupines	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vetches	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Lucerne hay	IE	IE	IE	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Lucerne haylage	IE	IE	IE	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Clover and their mixture hay	IE	IE	IE	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Clover and their mixture haylage	IE	IE	IE	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Annual grasses hay	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Annual grasses haylage	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Perennial grasses hay	0.30	0.30	0.30	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses haylage	0.30	0.30	0.30	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses (excl. lucerne, clover and their mixture) hay	IE	IE	IE	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Perennial grasses (excl. lucerne, clover and their mixture) haylage	IE	IE	IE	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Meadows pasture hay	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Meadows pasture haylage	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Meadows and natural pastures hay	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Meadows and natural pastures haylage	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30

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

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018
R _{BG(T)}	kg d.m.												
Winter Wheat	0.63	0.64	0.63	0.63	0.63	0.63	0.62	0.62	0.62	0.62	0.62	0.62	0,63
Spring Wheat	0.74	0.74	0.73	0.72	0.72	0.71	0.70	0.71	0.70	0.70	0.71	0.71	0,73
Triticale	0.55	0.57	0.55	0.54	0.56	0.55	0.52	0.53	0.53	0.52	0.53	0.53	0,54
Rye	0.54	0.59	0.56	0.57	0.59	0.57	0.54	0.58	0.56	0.54	0.56	0.55	0,57
Barley	0.49	0.53	0.50	0.49	0.50	0.49	0.48	0.48	0.48	0.47	0.48	0.48	0,49
Oats	0.58	0.66	0.61	0.61	0.64	0.61	0.59	0.59	0.59	0.58	0.60	0.58	0,49
Grain maize	0.50	0.50	0.50	0.50	0.47	0.47	0.47	0.47	0.47	0.48	0.47	0.47	0,47
Maize for silage	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0,46
Winter Rape	0.55	0.61	0.55	0.54	0.57	0.58	0.52	0.54	0.54	0.52	0.53	0.53	0,55
Spring Rape	0.67	0.61	0.61	0.59	0.60	0.57	0.56	0.58	0.57	0.57	0.58	0.56	0,59
Silage crops excl. maize	0.49	0.50	0.50	0.49	0.52	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0,50
Flax	0.91	0.89	1.13	0.91	0.88	0.78	0.78	0.78	0.67	0.67	0.67	0.58	0,64
Buckwheat	0.80	0.83	0.71	0.87	0.77	0.70	0.71	0.71	0.70	0.69	0.66	0.67	0,68
Mixed cereals	0.54	0.61	0.58	0.58	0.59	0.58	0.56	0.56	0.55	0.55	0.56	0.57	0,58
Other cereals	0.57	0.57	0.52	0.61	0.64	0.57	0.55	0.60	0.63	0.69	0.69	0.69	0,69
Vegetables	0.26	0.26	0.26	0.26	0.29	0.26	0.26	0.27	0.26	0.27	0.27	0.28	0,28
Potatoes	0.29	0.29	0.28	0.30	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.30	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	0.24	0,24
Fodder beet	0.25	0.27	0.27	0.27	0.28	0.28	0.27	0.28	0.27	0.28	0.29	0.33	0,31

Peas	0.47	0.51	0.50	0.51	0.53	0.51	0.50	0.50	0.48	0.47	0.48	0.47	0,50
Beans	0.36	0.32	0.33	0.36	0.35	0.34	0.33	0.32	0.31	0.31	0.31	0.30	0,33
Soya beans	0.70	0.70	0.70	0.70	0.70	0.70	0.79	0.64	0.73	0.80	0.54	0.60	0,53
Mixed dried pulses	0.50	0.50	0.50	0.50	0.52	0.50	0.50	0.50	0.49	0.49	0.50	0.49	0,53
Lupines	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Vetches	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Lucerne hay	IE	IE	IE	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Lucerne haylage	IE	IE	IE	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Clover and their mixture hay	IE	IE	IE	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Clover and their mixture haylage	IE	IE	IE	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Annual grasses hay	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Annual grasses haylage	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Perennial grasses hay	1.04	1.04	1.04	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses haylage	1.04	1.04	1.04	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Perennial grasses (excl. lucerne, clover and their mixture) hay	IE	IE	IE	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Perennial grasses (excl. lucerne, clover and their mixture) haylage	IE	IE	IE	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Meadows pasture hay	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Meadows pasture haylage	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Meadows and natural pastures hay	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Meadows and natural pastures haylage	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04

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

	DRY	N _{AG(T)}	N _{BG(T)}	R _{BG-BIO(T)}	Frac _{REMOVE}	Frac _{RENEW}	Area burnt	Slope	Intercept	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. lucerne, 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. lucerne, 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 IX. LULUCF area matrices

1990

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,043,372	0	6,389	3,594	0	799	2,054,154	10,782
Cropland	0	2,393,186	22,362	0	0	0	2,415,548	-37,937
Grassland	0	60,299	1,221,151	0	0	0	1,281,450	26,756
Wetlands	0	0	4,393	377,367	0	0	381,760	799
Settlements	0	0	399	0	351,411	0	351,810	399
Other land	0	0	0	0	0	43,926	43,926	-799
Initial	2,043,372	2,453,485	1,254,694	380,961	351,411	44,725	6,528,648	

1991

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,052,956	399	3,993	2,396	399	0	2,060,144	7,188
Cropland	0	2,353,252	22,362	0	799	399	2,376,813	-38,735
Grassland	0	60,299	1,256,293	3,195	799	4,393	1,324,977	39,533
Wetlands	0	399	1,597	377,367	0	0	379,364	-3,594
Settlements	0	1,198	1,198	0	345,820	799	349,015	1,198
Other land	0	0	0	0	0	38,336	38,336	-5,590
Initial	2,052,956	2,415,548	1,285,444	382,958	347,817	43,926	6,528,648	

1992

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,060,144	399	3,195	1,997	0	399	2,066,134	5,990
Cropland	0	2,312,920	25,158	0	0	799	2,338,877	-37,936
Grassland	0	59,900	1,295,826	799	1,198	4,792	1,362,514	37,537
Wetlands	0	399	0	376,568	0	2,396	379,364	0
Settlements	0	2,396	799	0	347,817	399	351,411	2,396
Other land	0	799	0	0	0	29,550	30,349	-7,987
Initial	2,060,144	2,376,813	1,324,977	379,364	349,015	38,336	6,528,648	

1993

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,066,134	1,198	3,993	0	0	0	2,071,325	5,191
Cropland	0	2,276,581	22,762	1,198	799	1,597	2,302,937	-35,940
Grassland	0	58,702	1,335,360	1,198	1,198	5,191	1,401,649	39,135
Wetlands	0	799	0	376,968	0	399	378,166	-1,198
Settlements	0	799	399	0	349,414	0	350,612	-799
Other land	0	799	0	0	0	23,161	23,960	-6,389
Initial	2,066,134	2,338,877	1,362,514	379,364	351,411	30,349	6,528,648	

1994

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,070,926	0	2,396	399	399	0	2,074,121	2,796
Cropland	0	2,232,655	28,352	0	0	799	2,261,806	-41,131
Grassland	0	66,688	1,369,303	799	799	4,792	1,442,380	40,731
Wetlands	0	399	0	376,968	0	399	377,766	-400
Settlements	0	2,795	1,597	0	349,414	0	353,806	3,194
Other land	399	399	0	0	0	17,970	18,769	-5,191
Initial	2,071,325	2,302,937	1,401,649	378,166	350,612	23,960	6,528,648	

1995

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,074,121	0	1,597	799	0	0	2,076,517	2,396
Cropland	0	2,199,510	24,758	0	0	399	2,224,668	-37,138
Grassland	0	59,500	1,415,625	1,198	3,195	4,393	1,483,911	41,531
Wetlands	0	399	399	375,770	0	1,198	377,766	0
Settlements	0	1,997	0	0	350,612	399	353,008	-798
Other land	0	399	0	0	0	12,379	12,779	-5,990
Initial	2,074,121	2,261,806	1,442,380	37,7766	353,806	18,769	6,528,648	

1996

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,076,517	399	2,795	799	0	0	2,080,510	3,993
Cropland	0	2,198,312	8,386	0	0	0	2,206,698	-17,970
Grassland	0	25,956	1,472,730	399	0	399	1,499,485	15,574
Wetlands	0	0	0	376,568	0	0	376,568	-1,198
Settlements	0	0	0	0	353,008	0	353,008	0
Other land	0	0	0	0	0	12,379	12,379	-400
Initial	2,076,517	2,224,668	1,483,911	377,766	353,008	12,779	6,528,648	

1997

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,080,510	799	2,396	399	0	0	2,084,104	3,594
Cropland	0	2,154,386	19,567	0	0	399	2,174,353	-32,345
Grassland	0	51,114	1,476,723	0	0	0	1,527,837	28,352
Wetlands	0	0	399	376,169	0	0	376,568	0
Settlements	0	399	399	0	352,609	0	353,407	399
Other land	0	0	0	0	399	11,980	12,379	0
Initial	2,080,510	2,206,698	1,499,485	376,568	353,008	12,379	6,528,648	

1998

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,084,104	0	2,795	0	0	399	2,087,299	3,195
Cropland	0	2,089,295	37,138	0	0	0	2,126,433	-47,920
Grassland	0	84,259	1,487,505	0	0	0	1,571,763	43,926
Wetlands	0	0	0	376,568	0	0	376,568	0
Settlements	0	399	399	0	353,407	0	354,206	799
Other land	0	399	0	0	0	11,980	12,379	0
Initial	2,084,104	2,174,353	1,527,837	376,568	353,407	12,379	6,528,648	

1999

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,086,899	399	1,597	1,198	0	0	2,090,094	2,795
Cropland	0	2,029,396	51,913	0	0	0	2,081,309	-45,124
Grassland	0	96,239	1,517,454	0	0	0	1,613,693	41,930
Wetlands	399	0	0	375,370	0	0	375,770	-798
Settlements	0	399	799	0	354,206	0	355,404	1,198
Other land	0	0	0	0	0	12,379	12,379	0
Initial	2,087,299	2,126,433	1,571,763	376,568	354,206	12,379	6,528,648	

2000

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,090,094	0	2,396	2,396	0	399	2,095,285	5,191
Cropland	0	1,970,694	50,715	0	0	0	2,021,409	-59,900
Grassland	0	108,618	1,556,988	399	1,198	0	1,667,203	53,510
Wetlands	0	0	1,198	372,974	0	0	374,172	-1,598
Settlements	0	1,997	2,396	0	354,206	0	358,598	3,194
Other land	0	0	0	0	0	11,980	11,980	-399
Initial	2,090,094	2,081,309	1,613,693	375,770	355,404	12,379	6,528,648	

2001

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,095,285	399	1,997	0	0	0	2,097,681	2,396
Cropland	0	1,919,181	43,128	0	0	0	1,962,308	-59,101
Grassland	0	101,430	1,621,280	399	399	399	1,723,908	56,705
Wetlands	0	0	0	373,773	0	0	373,773	-399
Settlements	0	399	399	0	358,199	0	358,998	400
Other land	0	0	399	0	0	11,581	11,980	0
Initial	2,095,285	2,021,409	1,667,203	374,172	358,598	11,980	6,528,648	

2002

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,097,681	0	3,993	399	0	0	2,102,074	4,393
Cropland	0	1,872,459	40,332	0	0	0	1,912,791	-49,517
Grassland	0	89,051	1,679,183	0	0	0	1,768,234	44,326
Wetlands	0	0	399	373,374	0	799	374,572	799
Settlements	0	799	0	0	358,998	0	359,796	798
Other land	0	0	0	0	0	11,181	11,181	-799
Initial	2,097,681	1,962,308	1,723,908	373,773	358,998	11,980	6,528,648	

2003

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,101,674	799	3,195	799	399	0	2,106,866	4,792
Cropland	0	1,847,701	23,560	0	0	0	1,871,261	-41,530
Grassland	0	64,292	1,740,281	0	0	0	1,804,573	36,339
Wetlands	399	0	399	373,773	0	399	374,971	399
Settlements	0	0	399	0	359,397	0	359,796	0
Other land	0	0	399	0	0	10,782	11,181	0
Initial	2,102,074	1,912,791	1,768,234	374,572	359,796	11,181	6,528,648	

2004

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,106,067	399	6,389	1,597	0	0	2,114,453	7,587
Cropland	0	1,820,945	29,151	0	0	0	1,850,096	-21,165
Grassland	0	49,517	1,768,234	399	0	0	1,818,150	13,577
Wetlands	799	0	399	372,974	0	399	374,572	-399
Settlements	0	399	399	0	359,796	0	360,595	799
Other land	0	0	0	0	0	10,782	10,782	-399
Initial	2,106,866	1,871,261	1,804,573	374,971	359,796	11,181	6,528,648	

2005

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,114,054	799	5,191	1,597	0	399	2,122,040	7,587
Cropland	0	1,809,365	22,762	0	0	0	1,832,127	-17,969
Grassland	0	39,134	1,787,801	0	0	0	1,826,935	8,785
Wetlands	0	0	799	372,974	0	399	374,172	-400
Settlements	399	799	1,597	0	360,595	0	363,390	2,795
Other land	0	0	0	0	0	9,983	9,983	-799
Initial	2,114,453	1,850,096	1,818,150	374,572	360,595	10,782	6,528,648	

2006

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,121,641	799	5,591	1597	0	0	2,129,628	7,588
Cropland	0	1,796,187	8,6655	0	0	0	1,882,842	50,715
Grassland	0	34,742	1,732,294	399	0	0	1,767,435	-59,500
Wetlands	0	399	399	372,176	0	0	372,974	-1,198
Settlements	399	0	1,597	0	363,390	0	365,387	1,997
Other land	0	0	399	0	0	9,983	10,383	400
Initial	2,122,040	1,832,127	1,826,935	374,172	363,390	9,983	6,528,648	

2007

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,129,628	2,396	2,795	1,997	0	399	2,137,215	7,587
Cropland	0	1,856,086	83,859	0	0	0	1,939,946	57,104
Grassland	0	24,359	1,678,385	0	399	0	1,703,143	-64,292
Wetlands	0	0	1,198	370,978	0	0	372,176	-798
Settlements	0	0	1,198	0	364,988	0	366,186	799
Other land	0	0	0	0	0	9,983	9,983	-400
Initial	2,129,628	1,882,842	1,767,435	372,974	365,387	10,383	6,528,648	

2008

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,137,215	1,597	4,792	399	0	0	2,144,003	6,788
Cropland	0	1,912,392	77,470	0	399	0	1,990,261	50,315
Grassland	0	25,557	1,617,686	399	0	0	1,643,643	-59,500
Wetlands	0	0	799	371,377	0	0	372,176	0
Settlements	0	399	1,597	0	365,786	0	367,783	1,597
Other land	0	0	799	0	0	9,983	10,782	799
Initial	2,137,215	1,939,946	1,703,143	372,176	366,186	99,83	6,528,648	

2009

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,143,604	0	3,594	0	0	0	2,147,198	3,195
Cropland	0	1,974,687	51,913	0	0	0	2,026,600	36,339
Grassland	0	15,175	1,583,743	0	399	399	1,599,717	-43,926
Wetlands	399	0	0	372,176	0	0	372,575	399
Settlements	0	399	3,594	0	367,384	0	371,377	3,594
Other land	0	0	799	0	0	10,383	11,181	399
Initial	2,144,003	1,990,261	1,643,643	372,176	367,783	10,782	6,528,648	

2010

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,147,198	399	5,990	0	0	0	2,153,587	6,389
Cropland	0	1,969,496	4,393	0	0	0	1,973,889	-52,711
Grassland	0	56,705	1,585,740	399	1,198	0	1,644,042	44,325
Wetlands	0	0	0	372,176	0	0	372,176	-399
Settlements	0	0	3,594	0	370,179	0	373,773	2,396
Other land	0	0	0	0	0	11,181	11,181	0
Initial	2,147,198	2,026,600	1,599,717	372,575	371,377	11,181	6,528,648	

2011

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,153,587	2,396	5,990	0	0	0	2,161,973	8,386
Cropland	0	1,911,993	46,322	0	0	0	1,958,315	-15,574
Grassland	0	59,500	1,591,331	0	399	0	1,651,230	7,188
Wetlands	0	0	0	372,176	0	399	372,575	399
Settlements	0	0	399	0	373,374	0	373,773	0
Other land	0	0	0	0	0	10,782	10,782	-399
Initial	2,153,587	1,973,889	1,644,042	372,176	373,773	11,181	6,528,648	

2012

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,161,973	1,198	8,785	1,597	0	0	2,173,554	11,581
Cropland	0	1,894,422	45,124	0	0	0	1,939,546	-18,769
Grassland	0	62,695	1,596,522	799	1,597	0	1,661,613	10,383
Wetlands	0	0	0	370,179	0	0	370,179	-2,396
Settlements	0	0	799	0	372,176	0	372,974	-799
Other land	0	0	0	0	0	10,782	10,782	0
Initial	2,161,973	1,958,315	1,651,230	372,575	373,773	10,782	6,528,648	

2013

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,173,554	799	4,393	0	399	0	2,179,145	5,591
Cropland	0	1,912,392	41,530	0	399	0	1,954,322	14,776
Grassland	0	25,956	1,610,498	0	799	0	1,637,254	-24,359
Wetlands	0	0	0	370,179	0	0	370,179	0
Settlements	0	399	4,792	0	371,377	0	376,568	3,594
Other land	0	0	399	0	0	10,782	11,181	399
Initial	2,173,554	1,939,546	1,661,613	370,179	372,974	10,782	6,528,648	

2014

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,179,145	1,997	3,594	2,396	0	0	2,187,131	7,986
Cropland	0	1,905,204	59,101	0	0	0	1,964,305	9,983
Grassland	0	46,722	1,571,364	799	399	799	1,620,082	-17,172
Wetlands	0	0	1,198	366,984	0	0	368,182	-1,997
Settlements	0	399	1,597	0	376,169	0	378,166	1,598
Other land	0	0	399	0	0	10,383	10,782	-399
Initial	2,179,145	1,954,322	1,637,254	370,179	376,568	11,181	6,528,648	

2015

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,187,131	799	7,587	799	0	0	2,196,316	9,185
Cropland	0	1,956,318	32,346	0	399	0	1,989,063	24,758
Grassland	0	6,789	1,577,753	0	0	1,198	1,585,740	-34,342
Wetlands	0	0	399	367,384	0	399	368,182	0
Settlements	0	399	1,997	0	377,766	0	380,162	1,996
Other land	0	0	0	0	0	9,185	9,185	-1,597
Initial	2,187,131	1,964,305	1,620,082	368,182	378,166	10,782	6,528,648	

2016

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,195,916	399	3,993	799	0	0	2,201,108	4,792
Cropland	0	1,986,268	27,554	0	799	0	2,014,621	25,558
Grassland	0	2,396	1,553,394	799	0	799	1,557,388	-28,352
Wetlands	0	0	799	366,585	0	0	367,384	-798
Settlements	399	0	0	0	379,364	0	379,763	-399
Other land	0	0	0	0	0	8,386	8,386	-799
Initial	2,196,316	1,989,063	1,585,740	368,182	380,162	9,185	6,528,648	

2017

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,200,309	399	5,990	2,396	0	0	2,209,094	7,986
Cropland	0	1,987,067	45,524	0	0	0	2,032,590	17,969
Grassland	0	26,755	1,505,075	399	1,198	399	1,533,827	-23,561
Wetlands	799	0	0	364,588	0	0	365,387	-1,997
Settlements	0	399	799	0	378,565	0	379,763	0
Other land	0	0	0	0	0	7,987	7,987	-399
Initial	2,201,108	2,014,621	1,557,388	367,384	379,763	8,386	6,528,648	

2018

Land category	Forest land	Cropland	Grassland	Wetlands	Settlements	Other land	Final	Net change
Forest land	2,207,098	0	3,993	399	0	0	2,211,490	2,396
Cropland	0	2,001,443	38,735	0	0	0	2,040,178	7,588
Grassland	1,198	30,748	1,490,300	799	399	399	1,523,844	-9,983
Wetlands	0	0	0	364,189	0	0	364,189	-1,198
Settlements	799	399	799	0	379,364	0	381,360	1,597
Other land	0	0	0	0	0	7,587	7,587	-400
Initial	2,209,094	2,032,590	1,533,827	365,387	379,763	7,987	6,528,648	

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

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

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

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

SHORT REPORT

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

Introduction

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

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

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

Materials and methods

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

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

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

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

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

Main findings and conclusions

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

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

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

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

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

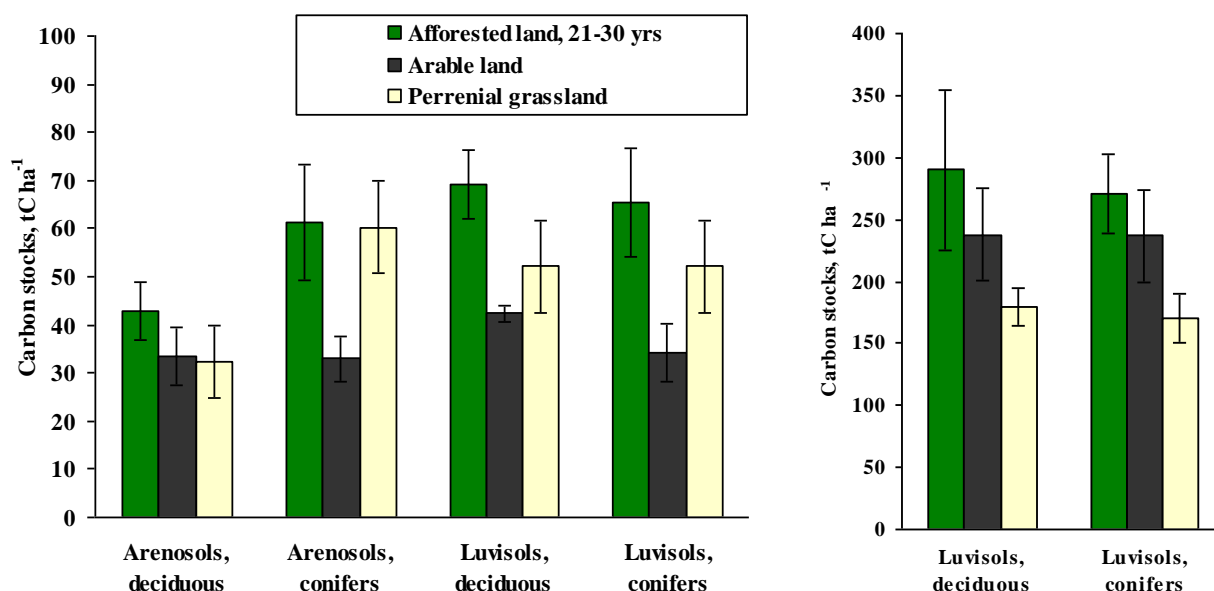


Fig.1. Stocks (t ha⁻¹) of organic carbon in 0–30 cm mineral soil/peat layer in the afforested land in the 21-30-year old coniferous and deciduous forest plantations and the control (arable land and grassland).

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

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

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

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

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

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

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

* Afforested land – conifers and deciduous plantations

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Short report

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

Introduction

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

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

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

Materials and Methods

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

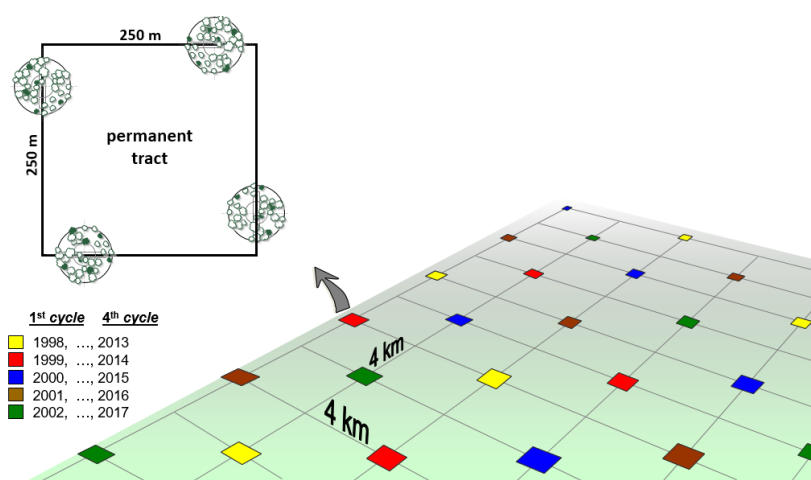


Fig. 1. National Forest Inventory permanent sample plots grid in Lithuania

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

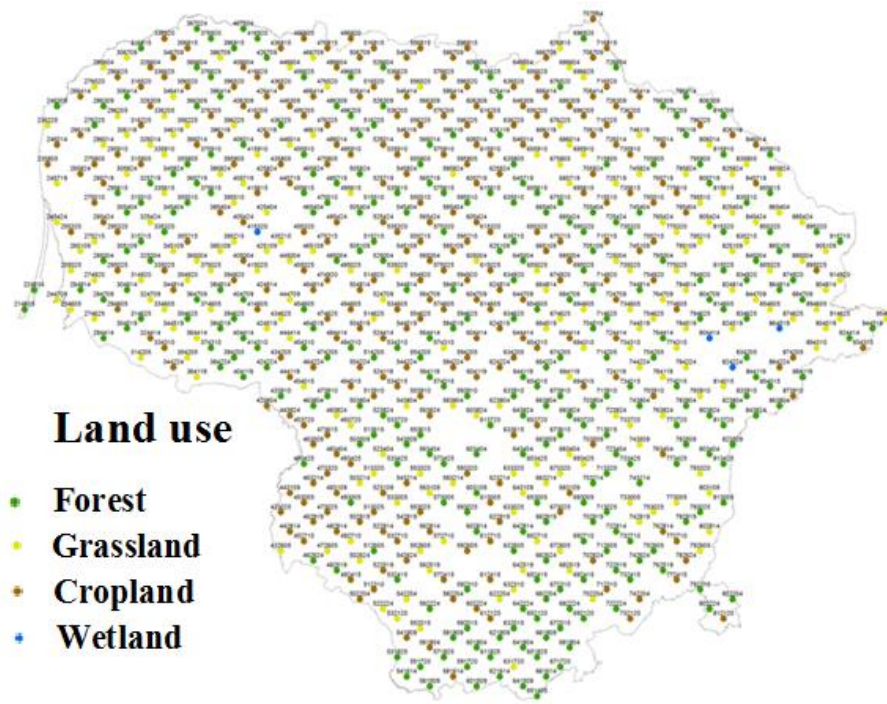


Fig. 2. Sample plots in the grid (9x9 km) of Lithuanian National Forest Inventory (NFI) (Total N=752; forest land – 298; grassland – 206; cropland – 244; wetland – 4)

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

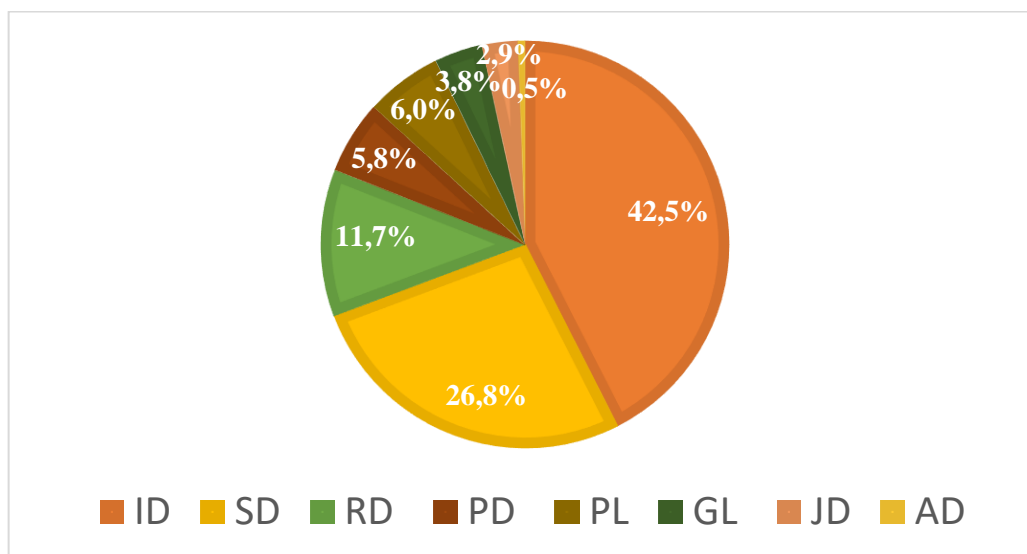
$$SOC_i = p_i \left(1 - \left(\frac{Q_{i,2mm}}{100}\right)\right) d_i C_i * 10^{-1}$$

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

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

Results and Discussion

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



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

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

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

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

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

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

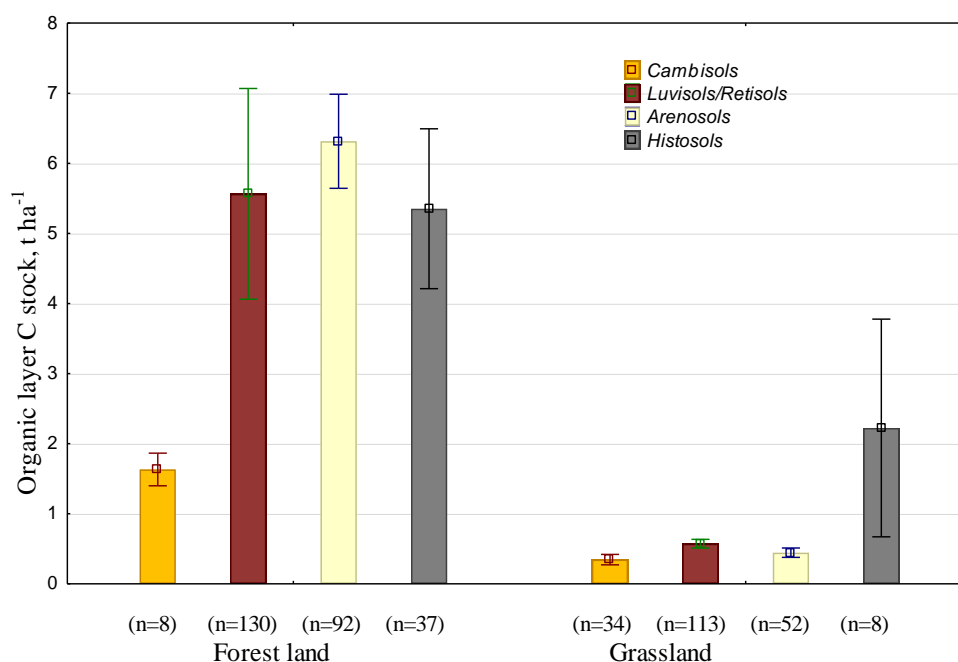


Fig. 4. Mean organic layer stocks of carbon in organic layer of different mineral soils in forest land and grassland (the bars represent SE)

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

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

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

*Cold temperate, moist region

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

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

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

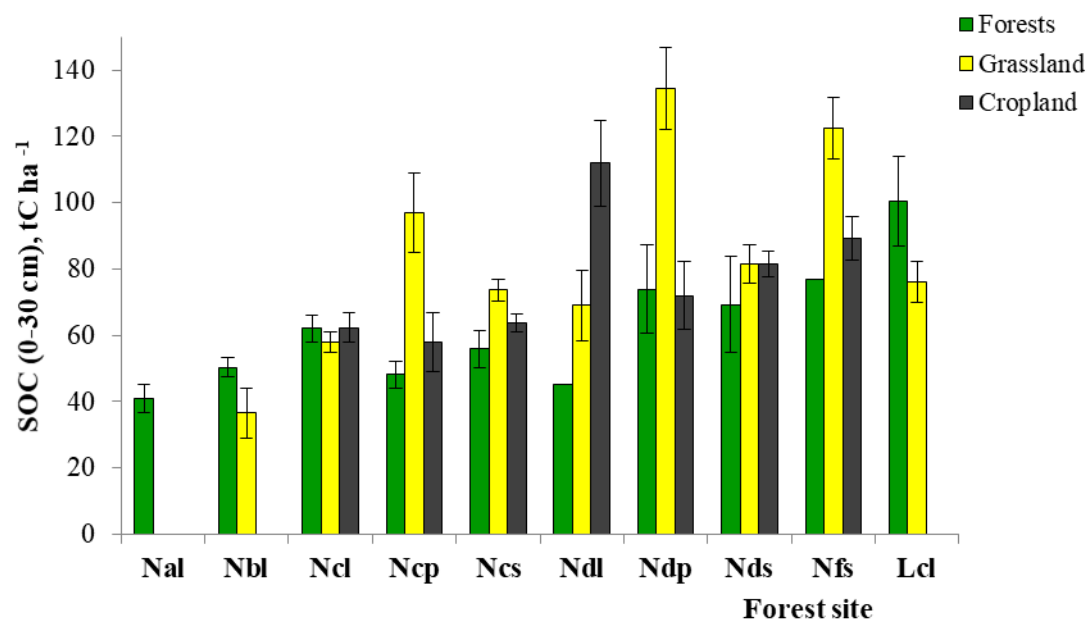


Fig. 5. Mean stocks of soil organic carbon (SOC) in surface 0-30 cm layer of different forest sites (according Lithuanian classification, Vaičys et al., 2006)

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

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

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

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

ANNEX XI. Improvements in response to recommendations/encouragements provided in the ARR 2019

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
The ERT recommends that Lithuania report on changes undertaken or planned in response to the review process in its next annual submissions. The ERT encourages the Party to include in section 10.4 of the NIR a table containing the follow-up to previous review recommendations.	G.3	The description of the previous recommendations status is provided in the NIR Annexes.	NIR Annex XI
The ERT recommends that Lithuania report in the NIR the rationale for its calculation of the CPR, including the comparison of 90 per cent of the Party's assigned amount with 100 per cent of eight times the most recently reviewed inventory.	G.4	Calculation of CPR is provided in the NIR.	NIR Chapter 12.5
The ERT recommends that Lithuania improve the transparency of the information in its NIR by including a follow-up to activities initiated in past years, as reported in previous NIRs, and ensure the reporting of any changes in its activities on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol since the previous annual submission.	G.5	The newest data and follow-up activities initiated in past years, as reported in previous NIRs, any changes in activities on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol since the previous annual submission are provided in Lithuania's 4th biennial report, chapter 5 (https://unfccc.int/sites/default/files/resource/BR4_2020_LT.pdf)	Reference to Lithuania's 4th biennial report is given in the NIR Chapter 15.

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
Lithuania provided a list of the typical constituents considered to form the non-biomass fraction of municipal waste in the NIR (section 3.3.1.3.1, p.75, and annex V, p.92), but not a quantitative assessment of biogenic and non-biogenic waste. During the review, the Party explained that the calorific value and carbon content were measured using 17 samples considered to represent the non-biomass fraction and 6 samples considered to represent the biomass fraction. The ERT noted that this information was not included in the NIR (see ID# E.11).	E.3	Information on measurements of the calorific value and the carbon content factors of waste is provided in the NIR.	Chapter 3.3.1.3.1 Combined Heat and Power Generation (CRF 1.A.1.a.ii)
The ERT recommends that Lithuania investigate the much higher difference in CO ₂ emissions between the reference approach and the sectoral approach compared with the difference in energy consumption for liquid fuels in 2017 and report the relevant quantitative results in the NIR, as well as any actions undertaken to ensure the consistency of the reporting between the two approaches.	E.9	In the SA method for liquid fuels plant-specific and country-specific EFs are used, while in RA method for crude oil default EF is used and for oil products country-specific EFs are used. Performed calculation showed that emission factors of liquid fuels had impact more than 4% in 2017. The much higher difference in CO ₂ emissions compared to the difference in energy consumption for liquid fuels in the year 2017 is explained in the NIR.	Chapter 3.2.2 Comparison of sectoral approach with the reference approach.
The ERT is of the opinion that peat should be treated in analogy to crude oil, as its processing only involves a conversion from a primary fuel into a secondary fuel (peat briquettes), and therefore recommends that Lithuania do not include peat in the feedstock and NEU of fuels in CRF table 1.A(d). For sulfur, the ERT recommends that the Party investigate if and how sulfur is used as a feedstock, how this is related to carbon emissions, if at all, and how an EF could be derived. Depending on the outcome of these	E.10	Peat is not included in the feedstock and non-energy use of fuels table of the CRF in the NIR 2020 submission. Information about sulphur used as a feedstock is provided in the NIR.	Chapter 3.2.4 Feedstocks and non-energy use of fuels

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
investigations, the ERT recommends that Lithuania include appropriate information in the NIR and consider eliminating sulfur from the reporting of feedstocks and NEU of fuels or report any resulting emissions if they do occur.			
The ERT recommends that Lithuania report information on the sampling and analytical procedures used for estimating CO ₂ EFs for each fuel type in an annex to the NIR, including transparent information on changes in the CO ₂ EFs over time, with a reference to the studies on which these changes are based. To improve consistency between different sections of the NIR, the ERT suggests that Lithuania group in one single table the CO ₂ EFs applicable to all categories (e.g. CO ₂ EFs for category 1.A fuel combustion). The ERT further recommends that Lithuania provide in the sections of the NIR for each subcategory, only additional information specific to this subcategory, such as plant-specific CO ₂ EFs and how they were determined, in addition to a reference to the summary table containing the common CO ₂ EFs and to the annex to the NIR.	E.11	All information is provided in the NIR.	Annex V. Country specific CO ₂ emission factors. For plant-specific CO ₂ EFs: chapters 3.3.1.3.2 Combined Heat and Power Generation (CRF 1.A.1.a.ii), 3.3.1.4.2 Heat plants (CRF 1.A.1.a.iii), 3.3.2.2 Petroleum Refining (CRF 1.A.1.b), 3.4.2 Manufacturing Industries and Construction (CRF 1.A.2).
In order to increase transparency and facilitate the assessment of completeness, the ERT recommends that Lithuania provide in the NIR information (e.g. in tabular format) compiling gasoline and diesel oil consumption under the different categories of the energy sector to show where these fuels are used.	E.12	Tables, showing gasoline and diesel oil use in the various categories where the fuels are consumed, are provided in the NIR.	ANNEX III. Lithuanian energy balance, tables 3-2 and 3-6.
In order to increase the transparency of the reporting, the ERT recommends that Lithuania	E.13	Information on subcategories 1.A.1.c.i manufacture of solid fuels and 1.A.1.c.ii other energy industries, including which activities are	Chapter 3.3.3.1 Category description and chapter

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
include detailed information on subcategories 1.A.1.c.i manufacture of solid fuels and 1.A.1.c.ii other energy industries in the corresponding section of the NIR, including which activities are considered under these subcategories, and provide a brief explanation for the large increase in emissions during 2014–2017 and any subsequent changes.		considered under these subcategories, is provided in the NIR. An explanation for the large increase in emissions since 2014 is also provided in the NIR.	3.3.3.1.2 Other Energy Industries (CRF 1.A.1.c.ii).
The ERT recommends that Lithuania reallocate the AD on and emissions from waste tyres used in the cement industry to category 1.A.2.f non-metallic minerals in the next annual submission. While the ERT commends the Party for including additional information on fuel use in the cement industry based on EU ETS information, it encourages the Party to explore whether the information on this additional waste stream used as fuel could also be included in the energy statistics to increase the consistency between the energy statistics and the GHG inventory AD.	E.14	AD and emissions from waste tires are reallocated to 1.A.2.f Non-metallic minerals subcategory in the NIR 2020 submission. Lithuanian Statistics confirmed that consumption of used tires in cement industry will be included in the national fuel and energy balance as industrial waste (non-biomass fraction) for the next submission. Hereby consistency between the energy statistics and GHG inventory activity data will be increased.	Chapters 3.4.2, 3.4.5 and 3.4.6 Manufacturing Industries and Construction (CRF 1.A.2).
The ERT recommends that Lithuania continue reporting N ₂ O emissions from diesel oil use in cars and light-duty trucks using default N ₂ O EFs and a tier 1 approach until estimates calculated by the COPERT V model can be fully justified. If Lithuania decides to use the COPERT V model, the ERT recommends that the Party investigate and document in the NIR the reasons for the very low N ₂ O emissions calculated by the COPERT V model for cars and light-duty trucks. In addition, the ERT recommends that Lithuania aim to improve the input parameters to allow the COPERT V	E.15	N ₂ O emissions from passenger cars and light duty vehicles are continued to report using default N ₂ O emissions factors and tier 1. N ₂ O emissions for diesel PC and LD are planned to be improved and calculated using tier 3 method in the future.	Chapter 3.5.2.2 (table 3-47) and chapter 3.5.2.6 Road transportation (CRF 1.A.3.b)

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
model to provide more accurate and reliable estimates of N ₂ O emissions from these subcategories.			
In order to increase the transparency of reporting, the ERT recommends that Lithuania provide additional information in annex III to the NIR on the nature of distribution and transmission losses reported in the energy balance, why these losses are not considered to cause GHG emissions and how they relate to fugitive emissions in the GHG inventory.	E.16	Lithuanian Statistics confirmed that natural gas leakages into atmosphere until 2000 were reported in energy balance under "Transmission and distribution losses". However, the change in the natural gas transmission and distribution accounting methodologies and the consultation with EUROSTAT have led to the conclusion that natural gas consumption, without which pipelines cannot operate, including releases to the atmosphere, should be considered as "pipeline consumption". Since 2000 natural gas transmission and distribution losses and natural gas consumption in the pipeline are reported under "natural gas consumption in pipeline transport". EUROSTAT did not require perform a recalculation of previous years data therefore natural gas leakages into atmosphere until 2000 are reported in energy balance under "Transmission and distribution losses" and since 2000 - under "natural gas consumption in pipeline transport". Information on the nature of distribution and transmission losses of natural gas, liquid fuels, peat and waste reported in the energy balance as well as how they relate to fugitive emissions in the GHG inventory is provided in the NIR.	Chapter 3.9.3.2 Fugitive emissions from natural gas (CRF 1.B.2.b). ANNEX III. Lithuanian energy balance, asterisks below all tables.
The ERT recommends that Lithuania continue to report emissions from hydrogen production under category 1.B.2.a.6 and provide information on methodologies, AD and EFs in the appropriate section in the NIR. In order to prevent any double counting, the ERT encourages Lithuania to investigate together with Statistics Lithuania whether refinery gas	E.17	Estimates from hydrogen production are continued to report in the NIR 2020 submission. Lithuanian Statistics informed that refinery gas consumption for hydrogen production as intermediate process cannot be reported separately according to the international energy balance preparation principles. AB ORLEN Lietuva confirmed that refinery gas and hydrogen are not final products and not purchased as raw materials. Refinery gas and hydrogen are involved in chemical reactions at various facilities	Chapter 3.9.2.2 Fugitive emissions from oil (CRF 1.B.2.a)

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
consumption for hydrogen production is included in the energy balance for refinery gas and aim to make consistent the reporting of refinery gas consumption in the energy balance and in the GHG inventory.		during the oil refining process therefore they cannot be included separately in national energy balance. This information is provided in the NIR.	
The ERT recommends that Lithuania seek more information from the gas industry regarding the reported CO ₂ and CH ₄ emissions from the gas transmission and distribution network (methodology, AD, EFs and assumptions, etc.) and document this in the NIR.	E.18	Information regarding the reported emissions from the gas industry is provided in the NIR.	Chapter 3.9.3.2 Fugitive emissions from natural gas (CRF 1.B.2.b).
The ERT recommends to include in the NIR 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.13	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)
Include in the NIR a brief explanation of the reason for the fluctuating trend in 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).	I.15	Information about the reasons for changes in CO ₂ emissions from flue gas desulphurization were included in the NIR. All emissions from limestone used in flue gas desulphurization were reported under category 2.A.4.d Other (Other process uses of carbonates).	Chapter 3.3.1.5.1 Methodological issues (CRF 2.A.4.d)
The ERT encourages Lithuania to work together with the secretariat to try to fill in all the necessary cells and resolve the issue of reporting blank cells in the CRF tables.	I.16	All the necessary cells were filled in and the issue of reporting blank cells were resolved.	CRF

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
The ERT recommends that Lithuania correct the uncertainty estimate of the CO ₂ EFs, correct the related calculations and present the estimation method and uncertainty values used in the NIR of the next annual submission.	I.17	CO ₂ EFs uncertainty were corrected and estimation method and values reported in the NIR.	Chapter 4.2.2.3 Uncertainties and time-series consistency (CRF 2.A.2)
The ERT recommends that Lithuania estimate the country-specific correction factor for hydrated lime, apply it in the calculations for the entire time series and report the revised CO ₂ emissions in the next annual submission.	I.18	The country-specific correction factor for hydrated lime were estimated and applied in the calculations for the entire time series and revised emissions were reported in the NIR.	Chapter 4.2.2.2 Methodological issues (CRF 2.A.2) 4.2.2.5 Category-specific recalculations (CRF 2.A.2)
The ERT recommends that Lithuania provide in the NIR clear information concerning the completeness of the AD used and concerning the derivation of the CaO content in lime from the composition of limestone obtained from a single quarry in the country.	I.19	Information regarding AD used and the CaO content in lime from the composition of limestone obtained from a single quarry in the country were reported in the NIR.	Chapter 4.2.2.2 Methodological issues (CRF 2.A.2)
The ERT recommends that Lithuania correct the estimated CO ₂ EF for high-calcium lime production and revise and report the emission estimates in the next annual submission.	I.20	The used CO ₂ EF for the high-calcium lime production were corrected and revised emissions were provided in the NIR.	Chapter 4.2.2.2 Methodological issues (CRF 2.A.2) 4.2.2.5 Category-specific recalculations (CRF 2.A.2)
The ERT recommends that Lithuania report CO ₂ removals from the consumption of carbonates in the sugar production industry under category 2.H.2 food and beverages industry.	I.21	CO ₂ removals from consumption of carbonates in the sugar production industry were reported in category 2.H.2 food and beverages industry.	Chapter 4.9.2 Food and beverages industry (CRF 2.H.2)

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
The ERT recommends that Lithuania include information on the method and time period used for estimating the average plant-specific EFs used for estimating CO ₂ emissions for 1990–1998 for the first plant; 1990–2003 for the second plant; and 1990–2004 for the third plant in the NIR of the next annual submission.	I.22	Information about the method used for estimation of the EF used for extrapolation were included.	4.2.3.2 Methodological issues (CRF 2.A.3)
The ERT recommends that Lithuania report all CO ₂ emissions from fuel consumption (used as feedstock and fuel) under category 2.B.1 ammonia production in accordance with the 2006 IPCC Guidelines.	I.23	The comparison of CO ₂ emissions from ammonia production (process emissions) vs total CO ₂ emissions from ammonia production (process and combustion emissions) and difference in associated IEFs were provided in the NIR.	4.3.1.2 Methodological issues (CRF 2.B.1)
The ERT recommends that Lithuania include in the NIR historical information on imported urea and its uses and explain whether all other uses of urea are allocated to category 2.B.1 ammonia production.	I.24	Information regarding import of urea were included in the NIR.	4.3.1.2 Methodological issues (CRF 2.B.1)
The ERT recommends that Lithuania include in the section of the NIR for category 2.D.3 a clear reference to the section of the NIR where the methodology, AD and EF used for estimating CO ₂ emissions from urea based catalysts are presented.	I.25	In the section of the NIR for category 2.D.3 the information were added that methodology, AD and EF used for CO ₂ emissions estimation from the use of the urea-based catalyst in transport were reported in the energy sector chapter of the NIR under the category 1.A.3 transport (NIR, chapter 3.5.3).	4.5.3.1 Category Description (CRF 2.D.3)
The ERT recommends that Lithuania improve the transparency of the NIR by clearly indicating that CF ₄ and C ₂ F ₆ emissions do not occur under category 2.E.3 photovoltaics.	I.26	Notation keys for CF ₄ and C ₂ F ₆ under category 2.E.3. were added in CRF and relevant information was included in the NIR.	NIR Chapters 4.6.3.1 Category Description and 4.6.3.2 Methodological issues (CRF 2.E.3)

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
The ERT recommends that Lithuania include in the NIR information on the change in the trend of HFC emissions from category 2.F.1 refrigeration and air conditioning in 2017 and any subsequent changes in the trend of HFC emissions.	I.27	Information on the change in the trend of HFC emissions in 2017 were included in the NIR.	Chapter 4.7. Methodological issues (CRF 2.F.)
The ERT recommends that Lithuania include in the NIR a clear description of the method used for estimating the HFC-23 emissions for category 2.F.3 fire protection.	I.28	The description of the method used for estimation of the HFC-23 emissions were included in the NIR.	Chapter 4.7.3.2 Methodological issues (CRF 2.F.3)
The ERT recommends that Lithuania include the revised values for CO ₂ emissions for category 2.H.3 use of carbonates for flue gas desulfurization using the correct assumptions on pure carbonate for AD in the next annual submission.	I.29	The revised values for the CO ₂ emissions for flue gas desulphurization category using the correct assumptions on pure carbonate were included in the NIR.	Chapter 3.3.1.5.2 Methodological issues (2.A.4.d)
The ERT encourages Lithuania to use the tier 2 method for estimating CO ₂ emissions for category 2.H.3 use of carbonates for flue gas desulfurization in order to improve the accuracy of the inventory.	I.30	The tier 2 method for estimating CO ₂ emissions for flue gas desulphurization category was used.	Chapter 3.3.1.5.2 Methodological issues (2.A.4.d)
There are still inconsistencies in the use of subcategory names for non-dairy cattle; for example, in table 5-8 of the NIR, two-yearold bulls and older bulls, and dairy and nondairy cattle sires are grouped in the same subcategory, while in tables 5-12, 5-15 and 5-27 of the NIR and A.5-38 of annex VII to the NIR they are separated into two different subcategories.	A.1	The recommendation was implemented.	NIR Tables 5-8; 5-12; 5-15; 5-27 NIR Annexes Table A.5-38

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
Report consistent CH ₄ EFs for nondairy cattle in the NIR and in CRF table 3.As1.	A.4	Consistent CH ₄ EFs for non-dairy cattle was reported in the NIR and CRF.	NIR Table 5-15 CRF Table 3.As1.
Correct the inconsistencies in the average diet nutrition indicators (NIR, p.315, table 5-24), GE and EFs for 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, N-free extracts and dm), GE and consumption of each feedstuff for all sheep subcategories.	A.6	The recommendation was implemented.	NIR Table 5-17 NIR Annexes Tables A5-31 – A5-36
When using the parameters from table A.5-39 of the annex to the NIR to calculate GE values, the ERT found slightly different values from those reported in table 5-16, except for growing pigs (50–80 kg) and gilts for breed.	A.8	Values of diet nutrition indicators were checked in order to avoid inconsistencies between parameters.	NIR Table 5-16 NIR Annexes Tables A5-19 – A5-36 and Table A5-39
In the NIR, remove all references to the N ₂ O EF reported for dry lot and explain that management of manure in dry lots does not occur in the country.	A.10	Recommendation was implemented and explanation is provided in the NIR.	NIR Chapter 5.1 Overview of sector
The ERT recommends that Lithuania include in the NIR a description of the improvements of the estimates of CH ₄ emissions from enteric fermentation, firstly on the refining of the number of suckling cows that affects the GE estimate, and secondly in the calculation of the annual average fur-bearing population.	A.17	Statistics Lithuania updated data on the number of suckling cows, therefore this data was updated in the NIR. Regarding annual average fur-bearing population explanation is provided in the NIR.	NIR Chapter 5.2.2 Methodological issues

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
Since the digestibility of feed is the key parameter for estimating volatile solids and thus CH ₄ and N ₂ O emissions from manure management, to improve the accuracy of the emission estimates, the ERT recommends that Lithuania conduct a study to develop country-specific data on feed digestibility, and when available, apply these data for estimating CH ₄ and N ₂ O emissions, and update the information reported on the manure management category in the NIR.	A.18	Lithuania has initiated a study to develop country-specific data on feed digestibility. It is foreseen to conduct public procurement procedures during 2020.	
The ERT recommends that Lithuania report under category 3.D.a.2.a animal manure applied to soils the estimated N ₂ O emissions from bedding per animal species using the results from the survey on the amount of N in bedding per animal species. To avoid double counting, the ERT also recommends that Lithuania correct the FracREMOVE value under category 3.D.a.4 crop residues and use a country-specific FracREMOVE value.	A.12 A.14 A.19	During the NIR preparation the survey on the amount of N in bedding per animal species was ongoing therefore, in the next NIR submission Lithuania will report under the category 3.D.a.2.a animal manure applied to soils the estimated N ₂ O emission from bedding per animal species and correct the FracREMOVE value under the category 3.D.a.4 crop residues.	
The ERT recommends that Lithuania correct this explanation in the NIR (in the agriculture sector section), stating explicitly that CH ₄ emissions from anaerobic digesters are included in the waste sector.	A.20	Explanation regarding CH ₄ leakage from anaerobic digestion system is provided in the NIR.	Chapter 5.3.2 Methodological issues
The ERT considers that the explanation and information provided by Lithuania are reasonable, and recommends that Lithuania explain in the NIR that the mean FracleachMS values from the 2018 annual submissions of Estonia and Latvia were used in the 2019	A.21	During the 2019 EU ERT review experts noted that in category 3.B.2. the amount of N applied with animal manure in 3.D.1.2.a is too large as compared to N managed in MMS minus N lost as NH ₃ +NO _x or leaching, this issue occurred due to average FracleachMS values from Estonia and Latvia used. Therefore in the	Chapter 5.4.2.2 Methodological issues

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
annual submission because the 2006 IPCC Guidelines do not provide default values of FracLeachMS, and a justification for the selection of those FracLeachMS values.		2020 NIR Lithuania has used 2019 IPCC Refinement to the 2006 IPCC Guidelines as no national FracLeachMS values are available.	
The ERT recommends that Lithuania determine and evaluate the differences between the IFA and Statistics Lithuania databases when data on N fertilizer consumption are made available in both databases, report the findings and the effects on the estimation of N ₂ O emissions in the NIR and use for the calculations the data from the source that provide a more accurate and consistent estimate of emissions.	A.22	Explanation on differences between IFA and Statistics Lithuania databases is provided in the NIR.	Chapter 5.6.1.4 Category-specific QA/QC and verification
The ERT recommends that Lithuania report in the NIR that N ₂ O emissions from subcategory 3.D.a.5 have not occurred since 2015, and provide documented explanations as to why emissions ceased in 2015.	A.23	Explanation is provided in the NIR.	NIR Chapter 5.6.1.2 Methodological issues (Mineralization/Immobilization associated with loss/gain of soil organic matter (FSOM) (CRF 3.D.1.5))
Report CSC in soils for forest land converted to settlements and other land across the whole 20-year period, or provide a justification for the assumption in the 2016 submission of instantaneous oxidation of soil organic matter in the year of conversion.	L.1	The recommendation was implemented.	NIR Ch. 6.5.2.2, 6.6.2.2, 6.7.2.2.

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
Justify the modification of 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.3	The recommendation was implemented.	NIR Ch. 6.2.2.1 Forest land remaining forest land
The ERT recommends Lithuania to apply the correct values of carbon stock for cropland (for cropland containing annual crops, the 2006 IPCC Guidelines indicate a default of 4.7 t C/ha 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 conversion to other land uses to avoid underestimating the net emissions.	L.8	The recommendation was implemented.	NIR Chapters: 6.4.2.2 Land converted to grassland, 6.5.2.5 Land converted to flooded land, 6.6.2.2 Land converted to settlements, 6.7.2.2 Land converted to other land
The ERT recommends Lithuania to correct the fraction of organic soils in land converted to cropland (0.7 per cent instead of 10.5 per cent) reported in the NIR.	L.10	The recommendation was implemented. Lithuania has updated national fraction of organic soils in forest land, cropland grassland, using the most recent National Forest Inventory data: NFI 2014 – 2018. Organic soils constitute of 13.6 percent in forest land remaining forest land and forest land converted to other land uses, 6.6 percent of grassland remaining grassland and grassland converted to other land uses, 1.1. percent of cropland remaining cropland and cropland converted to other land uses.	NIR Chapters: 6.3.2.2 Land converted to cropland, 6.4.2.2. Land converted to grassland, 6.6.2.2 Land converted to settlements, 6.7.2.2 Land converted to other land.
The ERT recommends Lithuania to use above-ground biomass and/or living biomass carbon stocks in accordance with the 2006 IPCC Guidelines when estimating CSC in biomass for conversions from cropland, grassland, wetlands and other land to settlements.	L.11	The recommendation was implemented.	NIR Chapter 6.6.2.2.

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
The ERT recommends Lithuania to review and, if necessary, revise the values of assumed carbon stocks for the land-use categories cropland and grassland prior to conversion for all conversions from cropland and grassland reported to ensure that the estimates of CSC are not underestimated and are in accordance with the 2006 IPCC Guidelines.	L.12	The recommendation is implemented.	NIR Chapters: 6.3.2.2 Land converted to cropland, 6.4.2.2 Land converted to grassland, 6.5.2.5. Land converted to flooded land, 6.6.2.2. Land converted to settlements, 6.7.2.2 Land converted to other land.
The ERT recommends that Lithuania explain why it assumed that DOM in a previous state before conversion (e.g. cropland) was zero in the NIR and seek to obtain information on the DOM pool, particularly for perennial crops, including information on expert judgment from relevant experts in the country.	L.18	The recommendation was partly implemented. Lithuania has no estimates of the dead wood and litter in the initial land-use systems (except Forest land and Grassland) prior to conversion. Carbon stock gain was estimated in cropland, settlements and other land converted to grassland, while carbon stock loss in litter was estimated in forest land converted to grassland. Lithuania is planning to develop country specific estimates of dead wood in perennial crops in the future, utilising literature analysis or expert judgement.	NIR Chapters: 6.2.2.2 Land converted to forest land, 6.3.2.2 Land converted to Cropland, 6.4.2.2 Land converted to Grassland
The ERT encourages Lithuania to assume that all conversions of settlements to other land-use categories occur in lands with herbaceous vegetation, for which the biomass immediately before conversion (BBEFORE) can be assumed to be equal to zero, and continue not to report any increase in carbon stock in biomass after the conversion of other land-use categories to settlements.	L.19	The recommendation was implemented.	NIR Chapters: 6.3.2.2 Land converted to Cropland and 6.4.2.2 Land converted to Grassland
The ERT recommends that Lithuania use the correct notation key “NA” instead of “NO” when applying the assumption under the tier 1 approach that there is no CSC in a pool, and	L.20	The recommendation was implemented. Notation Keys changed from NO to NA in cropland remaining cropland dead organic matter carbon pool; grassland remaining grassland living biomass, dead organic matter and mineral soil carbon pool; settlements	CRF tables: 4.B.1 Cropland remaining cropland; 4.C.1 Grassland remaining grassland;

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
use “NO” instead of “NE” when a conversion is not observed in a given year.		remaining settlements living biomass, dead organic matter and mineral soil carbon pools.	4.E.1 Settlements remaining settlements
The ERT recommends that Lithuania, when defining the parameters used for estimating the annual CSC in deadwood in forest land remaining forest land, not refer to managed forest land in the NIR to avoid confusion as to the status of the management of forest land, since all forest land in the country is managed.	L.21	The recommendation was implemented.	NIR Chapter 6.2.2.1 Forest land remaining forest land
The ERT recommends that Lithuania include in the NIR an explanation that the below-ground biomass from stumps left on the ground after harvesting is transferred to the dead organic carbon pool and decayed linearly over a five-year period.	L.22	The recommendation was implemented.	NIR Chapter 6.2.2.1 Forest land remaining forest land
The ERT recommends that Lithuania revise the equation presented in the NIR (p.348) and delete the term “ ΔV_{new} (GSV increment)” since it is no longer used or, in case the term is maintained, explain the measures taken to ensure that the annual change in GSV is not overestimated.	L.23	The recommendation was implemented.	NIR Chapter 6.2.2.1 Forest land remaining forest land
The ERT recommends that Lithuania conduct an analysis of significance at the pool level to determine whether the DOM pool is significant under category 4.A.1 forest land remaining forest land and, if so, adopt a higher tier to estimate the litter (and DOM) CSCs.	L.24	Addressing. Lithuania is planning to improve carbon stock changes estimation in forest land carbon pool, performing primary analysis of scientific studies in order to obtain reliable data of carbon stock changes in litter pool in forest land remaining forest land.	NIR Chapter 6.2.7 Category-specific planned improvements.

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
The ERT recommends that Lithuania estimate N2O emissions from drainage of mineral forest soils. In case the Party cannot report these emissions, the ERT recommends that the Party use the notation key “NE” instead of “NO” in CRF table 4(II), since N2O emissions may occur but are not assessed owing to a lack of data, and provide, in the NIR of the next annual submission, information on improvements undertaken to estimate these emissions in case the Party is unable to report these emissions.	L.25	The recommendation was implemented. There is no table for information about drained forest mineral soils available in CRF, only the table for rewetted mineral forest soils is present. There are no rewetted mineral soils in Lithuania, therefore it is reported as NO.	CRF Table 4 (II) Emissions and removals from drainage and rewetting and other management of organic and mineral soils
The ERT recommends that Lithuania specify in the NIR the correct reference to the values used in the comparison with those in table 4.5 of the 2006 IPCC Guidelines (vol. 4, chap. 4, section 4.5, p.4.50) to improve the transparency of the GHG inventory.	L.26	The recommendation was implemented.	NIR Chapters: 6.2.2.1 Forest land remaining forest land, 6.2.2.2 Land converted to forest land
The ERT recommends that Lithuania use separate carbon fraction values of above-ground forest biomass for coniferous and broadleaved stands from the 2006 IPCC Guidelines when calculating CSCs in above-ground biomass in land converted to forest land in its next annual submission.	L.27	The recommendation was implemented.	NIR Chapters: 6.2.2.1 Forest land remaining forest land, 6.2.2.2 Land converted to forest land
The ERT recommends that the Party include information on the country-specific values for MB and Cf used to estimate non-CO2 emissions from biomass burning in the NIR of the next annual submission.	L.28	The recommendation was implemented.	NIR Chapters: 6.2.2.1 Forest land remaining forest land, 6.2.2.2 Land converted to forest land

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
The ERT recommends that Lithuania discount the litter carbon stock accumulated in agricultural land converted to forest land only in the first year after the conversion and ensure a consistent use of methods for estimating CSCs from conversion. The ERT also recommends that, if litter is not a significant pool, Lithuania apply a tier 1 method from the 2006 IPCC Guidelines (vol. 4, chap. 1, section 5.2.2.1, p.5.13), assuming the value for the dead organic carbon pool as zero. If this method is applied, the ERT further recommends that Lithuania apply it consistently to the issues identified in ID#s L.31 and L.34 below.	L.29	The recommendation was implemented.	NIR Chapter 6.2.2.2 Land converted to forest land
The ERT recommends that Lithuania report in the next annual submission emissions from the biomass burning of perennial crops and provide in the NIR information on the MB and Cf used to estimate non-CO2 emissions from biomass burning in cropland remaining cropland by type of crop (annual/perennial).	L.30	The recommendation was implemented.	NIR Chapter 6.3.2.1 Cropland remaining cropland
The ERT recommends that Lithuania report the CSC in litter from the conversion of grassland to cropland (perennial crops) and, if applying a value different from 0.4 t C/ha, explain in the NIR the reason for using a different value.	L.31	0.4 t C ha ⁻¹ was estimated as national value of litter carbon stock in grassland previous to conversion to forest land. Average litter carbon stock in all grassland is estimated to be 0.8 t C ha ⁻¹ (national value). No litter carbon stock was estimated in cropland during the study implemented to obtain national carbon stock values in soils and litter of various land uses, therefore carbon stock change in litter of grassland converted to cropland was estimated as carbon stock losses, applying litter carbon stock value of grassland. However, Lithuania is considering to develop	NIR Chapters: 6.2.2.2 Land converted to forest land, 6.3.2.2 Land converted to cropland and 6.4.2.2 Land converted to grassland

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
		(applying literature analysis and/or expert judgment) national carbon stock value in litter of perennial cropland.	
The ERT recommends that Lithuania apply the value 0.8 t C/ha when estimating DOM in conversions to and from grassland in the next annual submission to enhance the completeness of reporting.	L.32	The recommendation was implemented.	NIR Chapters: 6.2.2.2 Land converted to forest land, 6.3.2.2 Land converted to cropland, 6.4.2.2 Land converted to grassland, 6.5.2.5 Land converted to flooded land, 6.6.2.2 Land converted to settlements and 6.7.2.2 Land converted to other land
The ERT recommends that Lithuania provide the explanation regarding the value used for the annual increase in carbon stocks in biomass due to growth and that grassland achieves its steady-state biomass during the first year following conversion and hence no annual growth is reported thereafter in the NIR of the next annual submission to increase the transparency of the reporting.	L.33	The recommendation was implemented.	NIR Chapter: 6.4.2.2 Land converted to grassland
The ERT recommends that Lithuania report in CRF table 4.C the CSCs in litter from the conversion of perennial crops to grassland and, if applying a value different from 0.4 t C/ha, explain in the NIR the reason for using a different value.	L.34	0.4 t C ha ⁻¹ was estimated as national value of litter carbon stock in grassland previous to conversion to forest land. Average litter carbon stock in all grassland is estimated to be 0.8 t C ha ⁻¹ (national value). No litter carbon stock was estimated in cropland during the study implemented to obtain national carbon stock values in soils and litter of various land uses, therefore carbon stock changes in cropland converted to grassland were estimated only as litter carbon stock gains due to annual cropland converted to grassland, applying litter carbon stock value of grassland.	NIR Chapters: 6.3.2.2 Land converted to cropland and 6.4.2.2 Land converted to grassland

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
		However, Lithuania is considering to develop (applying literature analysis and/or expert judgment) national carbon stock value in litter of perennial cropland.	
The ERT recommends that Lithuania report in the NIR the methodology and values applied to estimate the CSCs from the conversion of forest land to flooded land, if applicable.	L.35	The recommendation was implemented.	NIR Chapter 6.5.2.5 Land converted to flooded land
The ERT recommends that Lithuania provide in the NIR the justification for simplifying equation 11.1 from the 2006 IPCC Guidelines (vol. 4, chap. 11, section 11.2.1.1, p.11.7) and excluding certain N sources included in equation 11.1, and specify those reported under the agriculture sector or those that do not occur. The ERT also recommends that Lithuania provide the corresponding information in the NIR and CRF table 4(I).	L.36	The recommendation was implemented.	NIR Chapters 6.3.2.2 Land converted to cropland, 6.4.2.2 Land converted to grassland, 6.5.2.5 Land converted to flooded land, 6.6.2.2 Land converted to settlements and 6.7.2.2 Land converted to other land
The ERT recommends that Lithuania provide in the NIR the justification for the simplification of equation 11.10 from the 2006 IPCC Guidelines (vol. 4, chap. 11, section 11.2.2.1, p.11.21), which excludes synthetic N fertilizers (known as FSN); managed animal manure, compost, sewage sludge and other organic N additions applied to soils (known as FON); urine and dung N deposited by grazing animals (known as FPRP); and N in crop residues (above- and below-ground), including N-fixing crops and N from forage/pasture renewal, returned to soils annually (known as FCR) from the calculation of indirect N ₂ O emissions from	L.37	The recommendation was implemented.	NIR Chapters 6.3.2.2 Land converted to cropland, 6.4.2.2 Land converted to grassland, 6.5.2.5 Land converted to flooded land, 6.6.2.2 Land converted to settlements and 6.7.2.2 Land converted to other land

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
leaching/runoff from managed soils, and include a related explanation in the documentation box of CRF table 4(IV).			
The ERT recommends that Lithuania correct the inconsistencies between the data in the NIR and CRF table 4.G (sheet 2), and provide updated production, export and import data in the next annual submission, as well as additional information on the factors used to convert product units to carbon units in CRF table 4.G (sheet 2).	L.38	The information was updated and lacking information was filled, inconsistencies between NIR and CRF Table 4.G were corrected.	CRF Table 4.Gs2; NIR Table 6.44
The ERT identified significant inter-annual changes in the CH4 IEF values (an increase of 42.9 per cent from 1992 to 1993) and in the amount of sludge removed (kt DC/year) (an increase of 62.0 per cent from 1991 to 1992 and a decrease of 51.0 per cent from 1992 to 1993) under category 5.D.1 domestic wastewater. Furthermore, the ERT identified that NOX and carbon monoxide emissions from category 5.A solid waste disposal are reported as "NA" for the entire time series, except for 2003, when "NE" is used for NOX emissions from unmanaged solid waste disposal sites under category 5.A.2 unmanaged waste disposal sites. In response to a question raised by the ERT, Lithuania explained that erroneous values for the total organic product and sludge removal were reported in the CRF tables for 1992, but the emissions were reported correctly. The correct value for the total organic product is 113.02 kt	W.2	We believe ERT recommendation should be read as "use appropriate notation key ("NA")" The correct data for total organic product and sludge removal in CRF tables for category 5.D.1 domestic wastewater and appropriate notation key ("NA") for NOx and CO emissions in the CRF tables for category 5.A.2 unmanaged waste disposal sites have been reported.	CRF Tables 5, 5.D

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
<p>DC/year, resulting in a CH₄ IEF of 0.15kg/kg DC for 1992, while the correct value for sludge removal is 17.11 kt DC/year, resulting in inter-annual changes of –9.0 per cent for 1991–1992 and –12.7 per cent for 1992–1993. Furthermore, Lithuania explained that “NE” was erroneously reported for NO_x emissions in 2003, and the notation key “NA” should be applied instead.</p> <p>The ERT recommends that Lithuania report the correct data for the total organic product and sludge removal in CRF table 5.D for category 5.D.1 domestic wastewater in 1992 and use the appropriate notation key (“NE”) for NO_x and CO emissions for the entire time series in CRF table 5 for category 5.A.2 unmanaged waste disposal sites in the next annual submission.</p>			
<p>The ERT recommends that Lithuania correct the misallocation of small town landfills, report them as unmanaged-deep waste disposal sites in CRF table 5.A, and report consistent information on small town landfills in the NIR and CRF tables in the next annual submission.</p>	W.3	<p>The small town landfills has been reported as unmanaged deep waste disposal site in the CRF, the consistent information on small town landfills in the NIR and CRF tables has been reported</p>	CRF Tables 5.A; Chapter 7.2.1
<p>The ERT recommends that Lithuania provide information on the assumptions and parameters used for estimating CH₄ for energy recovery in the NIR.</p>	W.4	<p>The parameters and assumptions are provided in the NIR</p>	Chapter 7.2.1 and 7.3.1

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
The ERT recommends that Lithuania provide clearly documented information in the NIR on any assumptions made for reporting estimates of the amount of CH ₄ flared, which should be reported only if the data are based on metering or substantiated and verified assumptions.	W.5	As information on assumptions used by personnel of the flaring systems for the estimation of the flared landfill gas is not available, the amount of flared CH ₄ was revised during the review week and assumed to be zero, consistent with the default value for flared landfill gas.	Chapter 7.2.1
The ERT recommends that Lithuania use the correct uncertainty values for the methane correction factor (fraction treated anaerobically) in shallow lagoons and untreated systems and latrines when assessing the overall uncertainty of category 5.D wastewater treatment and discharge in the next annual submission.	W.6	The correct uncertainty values have been used	Chapter 7.5.3
The ERT recommends that Lithuania report the correct source of information on protein consumption per capita in the NIR and provide justification of any observed trends as far as possible. In addition, the ERT encourages Lithuania to investigate all possible causes as to why the protein consumption per capita in the country is among the lowest of all reporting Parties, to investigate the significant differences compared with FAOSTAT data and to report the related results in the NIR of its next annual submission.	W.7	The information are reported in the NIR	Chapter 7.5.2
The ERT recommends that Lithuania report consistent information on the factor for industrial and commercial co-discharged protein into the sewage system (known as FIND-COMM) in the NIR and the CRF tables in the next annual submission.	W.8	The FIND-COMM factor was corrected in the CRF	CRF 5.D

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
The ERT recommends Lithuania to ensure the use of correct values of BBEFORE 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.	KL.1	The recommendation was implemented.	NIR Ch. 11.3.1. Methods for carbon stock change and GHG emission and removals estimates
The ERT recommends that Lithuania clarify in the NIR that the plantations were not disaggregated into coniferous or deciduous plantations for the data for AR reported in table 11-10 of the NIR. The ERT further recommends that Lithuania include a table for FM with similar data to those in table 11.10.	KL.5	Recommendation was implemented.	11.3.1.1 Description of the methodologies and the underlying assumptions used
The ERT encourages Lithuania to explore the use of high-resolution satellite data for validating the AR, deforestation and FM area change estimates, for example by using the freely available OpenFORIS – CEEnsure the use of correct values of BBEFORE 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.ollect Earth (see http://www.openforis.org/tools/collect.html), which is a tool that enables data collection through Google Earth that can be used for a wide variety of purposes, including validating existing maps and estimating AR, deforestation and FM areas and area changes.	KL.6	Lithuania will consider application of high resolution satellite imagery data to validate areas and area changes of afforestation/reforestation, deforestation and forest management activities. Satellite images could be important additional data source to verify accuracy of the spatial data (GIS-layers) applied for estimation of areas of afforestation/reforestation and deforestation activities, as provided by national Paying Agency and State Forest Cadaster for annual GHG inventory.	11.2 Land related information

<i>Review recommendation</i>	<i>Paragraph No</i>	<i>Response/ status of implementation</i>	<i>Chapter/section in the NIR</i>
The ERT recommends that Lithuania revise the equation presented in the NIR (p.526) and delete the term “ ΔV_{new} (GSV increment)” since it is no longer used or, in case the term is maintained, explain the measures taken to ensure that the annual change in GSV is not overestimated.	KL.7	Recommendation was implemented.	11.3.1.1 Description of the methodologies and the underlying assumptions used