Ministry of Environment Republic of Lithuania

ENVIRONMENTAL PROTECTION AGENCY

State Forest Service

# LITHUANIA'S NATIONAL INVENTORY DOCUMENT 2026

GREENHOUSE GAS EMISSIONS 1990-2024

# ANNEXES

VILNIUS, 2026

# ANNEX I. Approach 1 and Approach 2 key categories analysis

## Approach 1 Level Assessment for 1990

| *IPCC Category* | *Greenhouse gas* | *GHG emissions, kt $CO_2$ eq.* | *Level assessment* | *Cumulative total* |
|---|---|---|---|---|
| 4.A.1 Forest land remaining forest land - carbon stock change in biomass | CO2 | -6,892.19 | 0.12 | 0.12 |
| 1.A.1.a Public electricity and heat production - Liquid Fuels | CO2 | 6,021.25 | 0.10 | 0.22 |
| 1.A.1.a Public electricity and heat production - Gaseous Fuels | CO2 | 5,796.59 | 0.10 | 0.31 |
| 1.A.3.b Road transportation | CO2 | 5,247.15 | 0.09 | 0.40 |
| 3.A.1 Enteric Fermentation - Cattle | CH4 | 4,717.44 | 0.08 | 0.48 |
| 1.A.2 Manufacturing industries and construction-Liquid fuels | CO2 | 3,873.72 | 0.06 | 0.55 |
| 1.A.4 Other sectors-Solid fuels | CO2 | 2,760.55 | 0.05 | 0.59 |
| 1.A.4 Other sectors-Liquid fuels | CO2 | 2,736.38 | 0.05 | 0.64 |
| 1.A.2 Manufacturing industries and construction-Gaseous fuels | CO2 | 2,042.93 | 0.03 | 0.67 |
| 2.A.1 Cement Production | CO2 | 1,668.07 | 0.03 | 0.70 |
| 1.A.1.b Petroleum refining - Liquid Fuels | CO2 | 1,509.64 | 0.03 | 0.73 |
| 1.A.4 Other sectors-Gaseous fuels | CO2 | 1,379.27 | 0.02 | 0.75 |
| 2.B.1 Ammonia Production | CO2 | 1,236.56 | 0.02 | 0.77 |
| 5.A Solid Waste Disposal | CH4 | 1,152.29 | 0.02 | 0.79 |
| 4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils | CO2 | 1,129.39 | 0.02 | 0.81 |
| 4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 1,087.18 | 0.02 | 0.83 |
| 3.D.1.1 Direct N2O Emissions From Managed Soils - Inorganic N Fertilizers | N2O | 882.83 | 0.01 | 0.84 |
| 2.B.2 Nitric Acid Production | N2O | 794.12 | 0.01 | 0.85 |
| 4.C.2 Land converted to grassland - carbon stock change in biomass | CO2 | -611.19 | 0.01 | 0.86 |
| 4.B.2 Land converted to cropland- carbon stock change in biomass | CO2 | 439.13 | 0.01 | 0.87 |
| 4.A.2 Land converted to forest land - carbon stock change in biomass | CO2 | -410.94 | 0.01 | 0.88 |
| 3.D.1.3 Direct N2O Emissions From Managed Soils - Urine and dung deposited by grazing animals | N2O | 377.12 | 0.01 | 0.88 |
| 3.B.1.3 Manure Management - Swine | CH4 | 368.76 | 0.01 | 0.89 |
| 3.D.1.2 Direct N2O Emissions From Managed Soils - Organic N Fertilizers | N2O | 353.68 | 0.01 | 0.90 |
| 1.A.3.c Railways | CO2 | 349.97 | 0.01 | 0.90 |
| 4.A.1 Forest land remaining forest land - net carbon stock change in dead wood | CO2 | -306.59 | 0.01 | 0.91 |
| 1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas | CH4 | 291.81 | 0.00 | 0.91 |
| 3.D.1.4 Direct N2O Emissions From Managed Soils - Crop Residues | N2O | 290.77 | 0.00 | 0.92 |
| 3.B.1.1 Manure Management - Cattle | CH4 | 286.33 | 0.00 | 0.92 |
| 4.C Grassland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 279.81 | 0.00 | 0.93 |

| ***IPCC Category*** | ***Greenhouse gas*** | ***GHG emissions, kt $CO_2$ eq.*** | ***Level assessment*** | ***Cumulative total*** |
|---|---|---|---|---|
| 4.A Forest land | N2O | 270.93 | 0.00 | 0.93 |
| 4.G Harvested wood products | CO2 | -240.15 | 0.00 | 0.94 |
| 2.A.4 Other process use of carbonates | CO2 | 239.53 | 0.00 | 0.94 |
| 3.D.2.2 Indirect N2O Emissions From Managed Soils - Nitrogen leaching and run-off | N2O | 225.62 | 0.00 | 0.94 |
| 2.A.2 Lime Production | CO2 | 210.27 | 0.00 | 0.95 |
| 3.B.2 Manure Management - Indirect N2O Emissions | N2O | 198.51 | 0.00 | 0.95 |
| 3.B.2 Manure Management - Cattle | N2O | 186.05 | 0.00 | 0.95 |
| 1.A.1. Energy industries-Solid fuels | CO2 | 174.05 | 0.00 | 0.96 |
| 1.A.2 Manufacturing industries and construction-Solid fuels | CO2 | 171.63 | 0.00 | 0.96 |
| 3.D.2.1 Indirect N2O Emissions From Managed Soils - Atmospheric deposition | N2O | 171.05 | 0.00 | 0.96 |
| 3.D.1.6 Direct N2O Emissions From Managed Soils - Cultivation of organic soils | N2O | 165.66 | 0.00 | 0.96 |
| 3.A. Enteric Fermentation - Others | CH4 | 162.14 | 0.00 | 0.97 |
| 5.D Wastewater Treatment and Discharge | CH4 | 161.97 | 0.00 | 0.97 |
| 1.A.4 Other sectors-Solid fuels | CH4 | 143.99 | 0.00 | 0.97 |
| ………… | | | | |
| ***Total*** | | ***43,618.4*** | | |

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

| *IPCC Category* | *Greenhouse gas* | *GHG emissions, kt $CO_2$ eq.* | *Level assessment* | *Cumulative total* |
|---|---|---|---|---|
| 1.A.1.a Public electricity and heat production - Liquid Fuels | CO2 | 6,021.25 | 0.13 | 0.13 |
| 1.A.1.a Public electricity and heat production - Gaseous Fuels | CO2 | 5,796.59 | 0.12 | 0.25 |
| 1.A.3.b Road transportation | CO2 | 5,247.15 | 0.11 | 0.36 |
| 3.A.1 Enteric Fermentation - Cattle | CH4 | 4,717.44 | 0.10 | 0.46 |
| 1.A.2 Manufacturing industries and construction-Liquid fuels | CO2 | 3,873.72 | 0.08 | 0.54 |
| 1.A.4 Other sectors-Solid fuels | CO2 | 2,760.55 | 0.06 | 0.60 |
| 1.A.4 Other sectors-Liquid fuels | CO2 | 2,736.38 | 0.06 | 0.66 |
| 1.A.2 Manufacturing industries and construction-Gaseous fuels | CO2 | 2,042.93 | 0.04 | 0.70 |
| 2.A.1 Cement Production | CO2 | 1,668.07 | 0.04 | 0.73 |
| 1.A.1.b Petroleum refining - Liquid Fuels | CO2 | 1,509.64 | 0.03 | 0.77 |
| 1.A.4 Other sectors-Gaseous fuels | CO2 | 1,379.27 | 0.03 | 0.79 |
| 2.B.1 Ammonia Production | CO2 | 1,236.56 | 0.03 | 0.82 |
| 5.A Solid Waste Disposal | CH4 | 1,152.29 | 0.02 | 0.85 |
| 3.D.1.1 Direct N2O Emissions From Managed Soils - Inorganic N Fertilizers | N2O | 882.83 | 0.02 | 0.86 |
| 2.B.2 Nitric Acid Production | N2O | 794.12 | 0.02 | 0.88 |
| 3.D.1.3 Direct N2O Emissions From Managed Soils - Urine and dung deposited by grazing animals | N2O | 377.12 | 0.01 | 0.89 |
| 3.B.1.3 Manure Management - Swine | CH4 | 368.76 | 0.01 | 0.90 |
| 3.D.1.2 Direct N2O Emissions From Managed Soils - Organic N Fertilizers | N2O | 353.68 | 0.01 | 0.90 |
| 1.A.3.c Railways | CO2 | 349.97 | 0.01 | 0.91 |
| 1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas | CH4 | 291.81 | 0.01 | 0.92 |
| 3.D.1.4 Direct N2O Emissions From Managed Soils - Crop Residues | N2O | 290.77 | 0.01 | 0.92 |
| 3.B.1.1 Manure Management - Cattle | CH4 | 286.33 | 0.01 | 0.93 |
| 2.A.4 Other process use of carbonates | CO2 | 239.53 | 0.01 | 0.93 |
| 3.D.2.2 Indirect N2O Emissions From Managed Soils - Nitrogen leaching and run-off | N2O | 225.62 | 0.00 | 0.94 |
| 2.A.2 Lime Production | CO2 | 210.27 | 0.00 | 0.94 |
| 3.B.2 Manure Management - Indirect N2O Emissions | N2O | 198.51 | 0.00 | 0.95 |
| 3.B.2 Manure Management - Cattle | N2O | 186.05 | 0.00 | 0.95 |
| 1.A.1. Energy industries-Solid fuels | CO2 | 174.05 | 0.00 | 0.96 |
| 1.A.2 Manufacturing industries and construction-Solid fuels | CO2 | 171.63 | 0.00 | 0.96 |
| 3.D.2.1 Indirect N2O Emissions From Managed Soils - Atmospheric deposition | N2O | 171.05 | 0.00 | 0.96 |
| 3.D.1.6 Direct N2O Emissions From Managed Soils - Cultivation of organic soils | N2O | 165.66 | 0.00 | 0.97 |
| ………………………………………… | | | | |
| ***Total*** | | ***47,494.5*** | | |

***Approach 1 Level Assessment for 2024***

| ***IPCC Category*** | ***Greenhouse gas*** | ***GHG emissions, kt $CO_2$ eq.*** | ***Level assessment*** | ***Cumulative total*** |
|---|---|---|---|---|
| 1.A.3.b Road transportation | CO2 | 5,694.18 | 0.16 | 0.16 |
| 4.A.1 Forest land remaining forest land - carbon stock change in biomass | CO2 | -4,889.74 | 0.13 | 0.29 |
| 4.G Harvested wood products | CO2 | -2,105.85 | 0.06 | 0.35 |
| 4.A.2 Land converted to forest land - carbon stock change in biomass | CO2 | -1,833.38 | 0.05 | 0.40 |
| 4.C Grassland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 1,714.74 | 0.05 | 0.45 |
| 3.A.1 Enteric Fermentation - Cattle | CH4 | 1,646.58 | 0.05 | 0.49 |
| 4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils | CO2 | -1,616.97 | 0.04 | 0.54 |
| 4.A.1 Forest land remaining forest land - net carbon stock change in dead wood | CO2 | -1,412.70 | 0.04 | 0.57 |
| 1.A.1.b Petroleum refining - Liquid Fuels | CO2 | 1,320.20 | 0.04 | 0.61 |
| 4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 1,245.31 | 0.03 | 0.64 |
| 2.B.1 Ammonia Production | CO2 | 1,088.73 | 0.03 | 0.67 |
| 1.A.4 Other sectors-Liquid fuels | CO2 | 927.96 | 0.03 | 0.70 |
| 4.B.2 Land converted to cropland- carbon stock change in biomass | CO2 | 813.49 | 0.02 | 0.72 |
| 4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils | CO2 | 719.86 | 0.02 | 0.74 |
| 1.A.4 Other sectors-Gaseous fuels | CO2 | 682.57 | 0.02 | 0.76 |
| 1.A.2 Manufacturing industries and construction-Gaseous fuels | CO2 | 605.93 | 0.02 | 0.78 |
| 2.A.1 Cement Production | CO2 | 575.74 | 0.02 | 0.79 |
| 5.A Solid Waste Disposal | CH4 | 538.28 | 0.01 | 0.81 |
| 3.D.1.1 Direct N2O Emissions From Managed Soils - Inorganic N Fertilizers | N2O | 519.96 | 0.01 | 0.82 |
| 1.A.1.a Public electricity and heat production - Gaseous Fuels | CO2 | 507.40 | 0.01 | 0.84 |
| 2.F.1 Refrigeration and Air Conditioning Equipment | HFCs | 454.60 | 0.01 | 0.85 |
| 4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 452.00 | 0.01 | 0.86 |
| 4.C.2 Land converted to grassland - carbon stock change in biomass | CO2 | -353.22 | 0.01 | 0.87 |
| 3.D.1.4 Direct N2O Emissions From Managed Soils - Crop Residues | N2O | 350.73 | 0.01 | 0.88 |
| 4.A Forest land | N2O | 310.14 | 0.01 | 0.89 |
| 1.A.2 Manufacturing industries and construction-Solid fuels | CO2 | 265.17 | 0.01 | 0.90 |
| 1.A.1 Energy industries-Other fossil fuels | CO2 | 230.19 | 0.01 | 0.90 |
| 4.A.2 Land converted to forest land - net carbon stock change in mineral soils | CO2 | -216.50 | 0.01 | 0.91 |
| 1.B.2 Oil, natural gas and other emissions from energy production | CO2 | 200.81 | 0.01 | 0.91 |
| 3.B.1.1 Manure Management - Cattle | CH4 | 189.85 | 0.01 | 0.92 |
| 3.D.1.6 Direct N2O Emissions From Managed Soils - Cultivation of organic soils | N2O | 169.39 | 0.00 | 0.92 |

| *IPCC Category* | *Greenhouse gas* | *GHG emissions, kt $CO_2$ eq.* | *Level assessment* | *Cumulative total* |
|---|---|---|---|---|
| 3.D.1.2 Direct N2O Emissions From Managed Soils - Organic N Fertilizers | N2O | 147.73 | 0.00 | 0.93 |
| 1.A.2 Manufacturing industries and construction-Liquid fuels | CO2 | 144.90 | 0.00 | 0.93 |
| 2.B.2 Nitric Acid Production | N2O | 144.83 | 0.00 | 0.94 |
| 3.D.2.2 Indirect N2O Emissions From Managed Soils - Nitrogen leaching and run-off | N2O | 137.48 | 0.00 | 0.94 |
| 4.B.2 Land converted to cropland- net carbon stock change in dead organic matter | CO2 | 129.09 | 0.00 | 0.94 |
| 3.D.1.3 Direct N2O Emissions From Managed Soils - Urine and dung deposited by grazing animals | N2O | 111.46 | 0.00 | 0.95 |
| 1.A.4 Other sectors-Biomass | CH4 | 93.05 | 0.00 | 0.95 |
| 4.F Other land | CO2 | 88.55 | 0.00 | 0.95 |
| 1.A.4 Other sectors-Solid fuels | CO2 | 86.79 | 0.00 | 0.95 |
| 1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas | CH4 | 86.06 | 0.00 | 0.96 |
| 1.A.2 Manufacturing industries and construction-Other fossil fuels | CO2 | 85.35 | 0.00 | 0.96 |
| 1.A.3.c Railways | CO2 | 82.30 | 0.00 | 0.96 |
| 3.D.2.1 Indirect N2O Emissions From Managed Soils - Atmospheric deposition | N2O | 73.10 | 0.00 | 0.96 |
| ………………………………………………………………………………………… | | | | |
| ***Total*** | | ***10,578.3*** | | |

**Approach 1 Level Assessment for 2024 using a subset** (LULUCF was excluded from analysis)

| *IPCC Category* | *Greenhouse gas* | *GHG emissions, kt $CO_2$ eq.* | *Level assessment* | *Cumulative total* |
|---|---|---|---|---|
| 1.A.3.b Road transportation | CO2 | 5,694.18 | 0.31 | 0.31 |
| 3.A.1 Enteric Fermentation - Cattle | CH4 | 1,646.58 | 0.09 | 0.40 |
| 1.A.1.b Petroleum refining - Liquid Fuels | CO2 | 1,320.16 | 0.07 | 0.47 |
| 2.B.1 Ammonia Production | CO2 | 1,088.73 | 0.06 | 0.53 |
| 1.A.4 Other sectors-Liquid fuels | CO2 | 927.96 | 0.05 | 0.58 |
| 1.A.4 Other sectors-Gaseous fuels | CO2 | 682.57 | 0.04 | 0.62 |
| 1.A.2 Manufacturing industries and construction-Gaseous fuels | CO2 | 605.93 | 0.03 | 0.66 |
| 2.A.1 Cement Production | CO2 | 575.74 | 0.03 | 0.69 |
| 5.A Solid Waste Disposal | CH4 | 538.28 | 0.03 | 0.72 |
| 3.D.1.1 Direct N2O Emissions From Managed Soils - Inorganic N Fertilizers | N2O | 519.96 | 0.03 | 0.74 |
| 1.A.1.a Public electricity and heat production - Gaseous Fuels | CO2 | 507.37 | 0.03 | 0.77 |
| 2.F.1 Refrigeration and Air Conditioning Equipment | HFCs | 454.60 | 0.02 | 0.80 |
| 3.D.1.4 Direct N2O Emissions From Managed Soils - Crop Residues | N2O | 350.73 | 0.02 | 0.82 |
| 1.A.2 Manufacturing industries and construction-Solid fuels | CO2 | 265.17 | 0.01 | 0.83 |
| 1.A.1 Energy industries-Other fossil fuels | CO2 | 230.19 | 0.01 | 0.84 |
| 1.B.2 Oil, natural gas and other emissions from energy production | CO2 | 200.81 | 0.01 | 0.85 |
| 3.B.1.1 Manure Management - Cattle | CH4 | 189.85 | 0.01 | 0.87 |
| 3.D.1.6 Direct N2O Emissions From Managed Soils - Cultivation of organic soils | N2O | 169.39 | 0.01 | 0.87 |
| 3.D.1.2 Direct N2O Emissions From Managed Soils - Organic N Fertilizers | N2O | 147.73 | 0.01 | 0.88 |
| 1.A.2 Manufacturing industries and construction-Liquid fuels | CO2 | 144.90 | 0.01 | 0.89 |
| 2.B.2 Nitric Acid Production | N2O | 144.83 | 0.01 | 0.90 |
| 3.D.2.2 Indirect N2O Emissions From Managed Soils - Nitrogen leaching and run-off | N2O | 137.48 | 0.01 | 0.91 |
| 3.D.1.3 Direct N2O Emissions From Managed Soils - Urine and dung deposited by grazing animals | N2O | 111.46 | 0.01 | 0.91 |
| 1.A.4 Other sectors-Biomass | CH4 | 93.05 | 0.01 | 0.92 |
| 1.A.4 Other sectors-Solid fuels | CO2 | 86.79 | 0.00 | 0.92 |
| 1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas | CH4 | 86.06 | 0.00 | 0.93 |
| 1.A.2 Manufacturing industries and construction-Other fossil fuels | CO2 | 85.35 | 0.00 | 0.93 |
| 1.A.3.c Railways | CO2 | 82.30 | 0.00 | 0.94 |
| 3.D.2.1 Indirect N2O Emissions From Managed Soils - Atmospheric deposition | N2O | 73.10 | 0.00 | 0.94 |
| 1.A.1.a Public electricity and heat production - Liquid Fuels | CO2 | 72.99 | 0.00 | 0.94 |
| 3.A. Enteric Fermentation - Others | CH4 | 72.24 | 0.00 | 0.95 |
| 5.B Biological Treatment of Solid Waste | CH4 | 71.93 | 0.00 | 0.95 |
| 3.B.2 Manure Management - Cattle | N2O | 70.79 | 0.00 | 0.96 |
| …………………………………… | | | | |
| ***Total*** | | ***18,307.1*** | | |

## Approach 1 Trend Assessment for 2024

| ***IPCC Category*** | ***Greenhouse gas*** | ***1990 kt $CO_2$ eq.*** | ***2024 kt $CO_2$ eq.*** | ***Trend assessment*** | ***% Contribution to Trend*** | ***Cumulative total*** |
|---|---|---|---|---|---|---|
| 4.A.1 Forest land remaining forest land - carbon stock change in biomass | CO2 | -6,892.19 | -4,889.74 | 0.09 | 0.17 | 0.17 |
| 1.A.3.b Road transportation | CO2 | 5,247.15 | 5,694.18 | 0.05 | 0.10 | 0.26 |
| 1.A.1.a Public electricity and heat production - Liquid Fuels | CO2 | 6,021.25 | 72.99 | 0.05 | 0.08 | 0.35 |
| 1.A.1.a Public electricity and heat production - Gaseous Fuels | CO2 | 5,796.59 | 507.37 | 0.04 | 0.07 | 0.42 |
| 4.G Harvested wood products | CO2 | -240.15 | -2,105.85 | 0.03 | 0.05 | 0.47 |
| 1.A.2 Manufacturing industries and construction-Liquid fuels | CO2 | 3,873.72 | 144.90 | 0.03 | 0.05 | 0.52 |
| 4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils | CO2 | 0.00 | -1,616.97 | 0.03 | 0.05 | 0.57 |
| 4.C Grassland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 279.81 | 1,714.74 | 0.03 | 0.05 | 0.62 |
| 1.A.4 Other sectors-Solid fuels | CO2 | 2,760.55 | 86.79 | 0.02 | 0.04 | 0.66 |
| 4.A.2 Land converted to forest land - carbon stock change in biomass | CO2 | -410.94 | -1,833.38 | 0.02 | 0.04 | 0.69 |
| 4.A.1 Forest land remaining forest land - net carbon stock change in dead wood | CO2 | -306.59 | -1,412.70 | 0.02 | 0.03 | 0.72 |
| 4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 1,087.18 | 1,245.31 | 0.01 | 0.02 | 0.74 |
| 3.A.1 Enteric Fermentation - Cattle | CH4 | 4,717.44 | 1,646.58 | 0.01 | 0.02 | 0.76 |
| 4.B.2 Land converted to cropland- carbon stock change in biomass | CO2 | 439.13 | 813.49 | 0.01 | 0.02 | 0.78 |
| 1.A.1.b Petroleum refining - Liquid Fuels | CO2 | 1,509.64 | 1,320.16 | 0.01 | 0.02 | 0.80 |
| 4.C.2 Land converted to grassland - carbon stock change in biomass | CO2 | -611.19 | -353.22 | 0.01 | 0.02 | 0.81 |
| 2.B.1 Ammonia Production | CO2 | 1,236.56 | 1,088.73 | 0.01 | 0.01 | 0.83 |
| 2.F.1 Refrigeration and Air Conditioning Equipment | HFCs | 0.00 | 454.60 | 0.01 | 0.01 | 0.84 |
| 4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 79.07 | 452.00 | 0.01 | 0.01 | 0.85 |
| 1.A.4 Other sectors-Liquid fuels | CO2 | 2,736.38 | 927.96 | 0.01 | 0.01 | 0.87 |
| 1.A.2 Manufacturing industries and construction-Gaseous fuels | CO2 | 2,042.93 | 605.93 | 0.01 | 0.01 | 0.88 |
| 2.B.2 Nitric Acid Production | N2O | 794.12 | 144.83 | 0.00 | 0.01 | 0.88 |
| 1.A.1 Energy industries-Other fossil fuels | CO2 | 0.00 | 230.19 | 0.00 | 0.01 | 0.89 |
| 2.A.1 Cement Production | CO2 | 1,668.07 | 575.74 | 0.00 | 0.01 | 0.90 |
| 3.D.1.4 Direct N2O Emissions From Managed Soils - Crop Residues | N2O | 290.77 | 350.73 | 0.00 | 0.01 | 0.91 |
| 1.B.2 Oil, natural gas and other emissions from energy production | CO2 | 23.88 | 200.81 | 0.00 | 0.01 | 0.91 |
| 1.A.2 Manufacturing industries and construction-Solid fuels | CO2 | 171.63 | 265.17 | 0.00 | 0.01 | 0.92 |
| 4.A Forest land | N2O | 270.93 | 310.14 | 0.00 | 0.01 | 0.92 |
| 4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils | CO2 | 1,129.39 | 719.86 | 0.00 | 0.01 | 0.93 |

| *IPCC Category* | *Greenhouse gas* | *1990 kt $CO_2$ eq.* | *2024 kt $CO_2$ eq.* | *Trend assessment* | *% Contribution to Trend* | *Cumulative total* |
|---|---|---|---|---|---|---|
| 3.B.1.3 Manure Management - Swine | CH4 | 368.76 | 28.79 | 0.00 | 0.00 | 0.93 |
| 2.A.4 Other process use of carbonates | CO2 | 239.53 | 10.05 | 0.00 | 0.00 | 0.93 |
| 2.A.2 Lime Production | CO2 | 210.27 | 1.75 | 0.00 | 0.00 | 0.94 |
| 4.B.2 Land converted to cropland- net carbon stock change in dead organic matter | CO2 | 63.62 | 129.09 | 0.00 | 0.00 | 0.94 |
| 3.D.1.1 Direct N2O Emissions From Managed Soils - Inorganic N Fertilizers | N2O | 882.83 | 519.96 | 0.00 | 0.00 | 0.94 |
| 3.D.1.6 Direct N2O Emissions From Managed Soils - Cultivation of organic soils | N2O | 165.66 | 169.39 | 0.00 | 0.00 | 0.95 |
| 4.F Other land | CO2 | 0.00 | 88.55 | 0.00 | 0.00 | 0.95 |
| 1.A.2 Manufacturing industries and construction-Other fossil fuels | CO2 | 0.00 | 85.35 | 0.00 | 0.00 | 0.95 |
| 1.A.3.c Railways | CO2 | 349.97 | 82.30 | 0.00 | 0.00 | 0.95 |
| 4.B.1 Cropland remaining cropland - carbon stock change in biomass | CO2 | -85.47 | -45.01 | 0.00 | 0.00 | 0.96 |
| 1.A.1. Energy industries-Solid fuels | CO2 | 174.05 | 1.62 | 0.00 | 0.00 | 0.96 |
| 5.B Biological Treatment of Solid Waste | CH4 | 0.23 | 71.93 | 0.00 | 0.00 | 0.96 |
| ……………………………………………………………………………………… | | | | | | |
| ***Total*** | | ***43,618.4*** | ***10,578.3*** | ***0.56*** | ***1.00*** | |

**Approach 1 Trend Assessment for 2024 using a subset** (LULUCF was excluded from analysis)

| *IPCC Category* | *Greenhouse gas* | *1990 kt $CO_2$ eq.* | *2024 kt $CO_2$ eq.* | *Trend assessment* | *% Contribution to Trend* | *Cumulative total* |
|---|---|---|---|---|---|---|
| 1.A.3.b Road transportation | CO2 | 5,247.15 | 5,694.18 | 0.08 | 0.24 | 0.24 |
| 1.A.1.a Public electricity and heat production - Liquid Fuels | CO2 | 6,021.25 | 72.99 | 0.05 | 0.15 | 0.39 |
| 1.A.1.a Public electricity and heat production - Gaseous Fuels | CO2 | 5,796.59 | 507.37 | 0.04 | 0.11 | 0.50 |
| 1.A.2 Manufacturing industries and construction-Liquid fuels | CO2 | 3,873.72 | 144.90 | 0.03 | 0.09 | 0.59 |
| 1.A.4 Other sectors-Solid fuels | CO2 | 2,760.55 | 86.79 | 0.02 | 0.06 | 0.65 |
| 1.A.1.b Petroleum refining - Liquid Fuels | CO2 | 1,509.64 | 1,320.16 | 0.02 | 0.05 | 0.70 |
| 2.B.1 Ammonia Production | CO2 | 1,236.56 | 1,088.73 | 0.01 | 0.04 | 0.74 |
| 2.F.1 Refrigeration and Air Conditioning Equipment | HFCs | 0.00 | 454.60 | 0.01 | 0.03 | 0.77 |
| 3.D.1.4 Direct N2O Emissions From Managed Soils - Crop Residues | N2O | 290.77 | 350.73 | 0.01 | 0.02 | 0.78 |
| 1.A.1 Energy industries-Other fossil fuels | CO2 | 0.00 | 230.19 | 0.00 | 0.02 | 0.80 |
| 1.A.2 Manufacturing industries and construction-Solid fuels | CO2 | 171.63 | 265.17 | 0.00 | 0.01 | 0.81 |
| 1.B.2 Oil, natural gas and other emissions from energy production | CO2 | 23.88 | 200.81 | 0.00 | 0.01 | 0.82 |
| 3.D.1.1 Direct N2O Emissions From Managed Soils - Inorganic N Fertilizers | N2O | 882.83 | 519.96 | 0.00 | 0.01 | 0.84 |
| 1.A.2 Manufacturing industries and construction-Gaseous fuels | CO2 | 2,042.93 | 605.93 | 0.00 | 0.01 | 0.85 |
| 3.A.1 Enteric Fermentation - Cattle | CH4 | 4,717.44 | 1,646.58 | 0.00 | 0.01 | 0.86 |
| 2.B.2 Nitric Acid Production | N2O | 794.12 | 144.83 | 0.00 | 0.01 | 0.87 |
| 1.A.4 Other sectors-Gaseous fuels | CO2 | 1,379.27 | 682.57 | 0.00 | 0.01 | 0.88 |
| 1.A.4 Other sectors-Liquid fuels | CO2 | 2,736.38 | 927.96 | 0.00 | 0.01 | 0.89 |
| 3.B.1.3 Manure Management - Swine | CH4 | 368.76 | 28.79 | 0.00 | 0.01 | 0.89 |
| 3.D.1.6 Direct N2O Emissions From Managed Soils - Cultivation of organic soils | N2O | 165.66 | 169.39 | 0.00 | 0.01 | 0.90 |
| 5.A Solid Waste Disposal | CH4 | 1,152.29 | 538.28 | 0.00 | 0.01 | 0.91 |
| 1.A.2 Manufacturing industries and construction-Other fossil fuels | CO2 | 0.00 | 85.35 | 0.00 | 0.01 | 0.91 |
| 2.A.4 Other process use of carbonates | CO2 | 239.53 | 10.05 | 0.00 | 0.01 | 0.92 |
| 3.B.1.1 Manure Management - Cattle | CH4 | 286.33 | 189.85 | 0.00 | 0.01 | 0.92 |
| 2.A.2 Lime Production | CO2 | 210.27 | 1.75 | 0.00 | 0.01 | 0.93 |
| 5.B Biological Treatment of Solid Waste | CH4 | 0.23 | 71.93 | 0.00 | 0.00 | 0.93 |
| 2.A.1 Cement Production | CO2 | 1,668.07 | 575.74 | 0.00 | 0.00 | 0.94 |
| 1.A.1. Energy industries-Solid fuels | CO2 | 174.05 | 1.62 | 0.00 | 0.00 | 0.94 |
| 1.A.4 Other sectors-Biomass | CH4 | 78.71 | 93.05 | 0.00 | 0.00 | 0.95 |
| 3.G Liming | CO2 | 20.59 | 61.84 | 0.00 | 0.00 | 0.95 |
| 1.A.3.c Railways | CO2 | 349.97 | 82.30 | 0.00 | 0.00 | 0.95 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3.D.2.2 Indirect N2O Emissions From Managed Soils - Nitrogen leaching and run-off | N2O | 225.62 | 137.48 | 0.00 | 0.00 | 0.96 |
| 1.A.4 Other sectors-Solid fuels | CH4 | 143.99 | 6.06 | 0.00 | 0.00 | 0.96 |
| 1.A.3.b Road transportation | N2O | 44.27 | 61.28 | 0.00 | 0.00 | 0.96 |
| 1.A.1 Energy industries-Biomass | N2O | 0.56 | 37.10 | 0.00 | 0.00 | 0.96 |
| 3.D.1.3 Direct N2O Emissions From Managed Soils - Urine and dung deposited by grazing animals | N2O | 377.12 | 111.46 | 0.00 | 0.00 | 0.97 |
| 3.B.2 Manure Management - Other | N2O | 113.37 | 12.52 | 0.00 | 0.00 | 0.97 |
| ………………………………………… | | | | | | |
| ***Total*** | | ***47,519.9*** | ***18,307.1*** | ***0.33*** | ***1.00*** | |

## Approach 2 Level Assessment for 1990

| *IPCC Category* | *Greenhouse gas* | *GHG emissions, kt $CO_2$ eq.* | *Level assessment with uncertainty* | *Cumulative total* |
|---|---|---|---|---|
| 4.A.1 Forest land remaining forest land - carbon stock change in biomass | CO2 | -6,892.19 | 0.05 | 0.20 |
| 4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils | CO2 | 1,129.39 | 0.04 | 0.35 |
| 5.A Solid Waste Disposal | CH4 | 1,152.29 | 0.02 | 0.45 |
| 3.A.1 Enteric Fermentation - Cattle | CH4 | 4,717.44 | 0.02 | 0.53 |
| 3.D.1.1 Direct N2O Emissions From Managed Soils - Inorganic N Fertilizers | N2O | 882.83 | 0.01 | 0.58 |
| 4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 1,087.18 | 0.01 | 0.61 |
| 3.B.2 Manure Management - Indirect N2O Emissions | N2O | 198.51 | 0.01 | 0.64 |
| 3.D.2.2 Indirect N2O Emissions From Managed Soils - Nitrogen leaching and run-off | N2O | 225.62 | 0.01 | 0.66 |
| 3.D.1.3 Direct N2O Emissions From Managed Soils - Urine and dung deposited by grazing animals | N2O | 377.12 | 0.01 | 0.68 |
| 3.D.1.2 Direct N2O Emissions From Managed Soils - Organic N Fertilizers | N2O | 353.68 | 0.00 | 0.70 |
| 4.C.2 Land converted to grassland - carbon stock change in biomass | CO2 | -611.19 | 0.00 | 0.72 |
| 3.D.2.1 Indirect N2O Emissions From Managed Soils - Atmospheric deposition | N2O | 171.05 | 0.00 | 0.73 |
| 3.D.1.4 Direct N2O Emissions From Managed Soils - Crop Residues | N2O | 290.77 | 0.00 | 0.75 |
| 3.B.2 Manure Management - Cattle | N2O | 186.05 | 0.00 | 0.76 |
| 4.A.2 Land converted to forest land - carbon stock change in biomass | CO2 | -410.94 | 0.00 | 0.78 |
| 1.A.1.a Public electricity and heat production - Liquid Fuels | CO2 | 6,021.25 | 0.00 | 0.79 |
| 1.A.1.a Public electricity and heat production - Gaseous Fuels | CO2 | 5,796.59 | 0.00 | 0.80 |
| 1.A.4 Other sectors-Solid fuels | CO2 | 2,760.55 | 0.00 | 0.81 |
| 4.C Grassland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 279.81 | 0.00 | 0.82 |
| 5.D Wastewater Treatment and Discharge | CH4 | 161.97 | 0.00 | 0.83 |
| 1.A.3.b Road transportation | CO2 | 5,247.15 | 0.00 | 0.84 |
| 4.G Harvested wood products | CO2 | -240.15 | 0.00 | 0.85 |
| 4.A.1 Forest land remaining forest land - net carbon stock change in dead wood | CO2 | -306.59 | 0.00 | 0.86 |
| 3.D.1.6 Direct N2O Emissions From Managed Soils - Cultivation of organic soils | N2O | 165.66 | 0.00 | 0.86 |
| 4.B.2 Land converted to cropland- carbon stock change in biomass | CO2 | 439.13 | 0.00 | 0.87 |
| 3.B.2 Manure Management - Other | N2O | 113.37 | 0.00 | 0.88 |

| ***IPCC Category*** | ***Greenhouse gas*** | ***GHG emissions, kt $CO_2$ eq.*** | ***Level assessment with uncertainty*** | ***Cumulative total*** |
|---|---|---|---|---|
| 1.A.4 Other sectors-Biomass | CH4 | 78.71 | 0.00 | 0.89 |
| 4.A Forest land | N2O | 270.93 | 0.00 | 0.90 |
| 1.A.2 Manufacturing industries and construction-Liquid fuels | CO2 | 3,873.72 | 0.00 | 0.90 |
| 1.A.4 Other sectors-Liquid fuels | CO2 | 2,736.38 | 0.00 | 0.91 |
| 2.G Other product manufacture and use | N2O | 85.41 | 0.00 | 0.92 |
| 2.A.1 Cement Production | CO2 | 1,668.07 | 0.00 | 0.92 |
| …………………………………………………………………………… | | | | |
| ***Total*** | | ***43,618.4*** | | |

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

| *IPCC Category* | *Greenhouse gas* | *GHG emissions, kt $CO_2$ eq.* | *Level assessment with uncertainty* | *Cumulative total* |
|---|---|---|---|---|
| 5.A Solid Waste Disposal | CH4 | 1,152.29 | 0.03 | 0.18 |
| 3.A.1 Enteric Fermentation - Cattle | CH4 | 4,717.44 | 0.03 | 0.34 |
| 3.D.1.1 Direct N2O Emissions From Managed Soils - Inorganic N Fertilizers | N2O | 882.83 | 0.02 | 0.43 |
| 3.B.2 Manure Management - Indirect N2O Emissions | N2O | 198.51 | 0.01 | 0.49 |
| 3.D.2.2 Indirect N2O Emissions From Managed Soils - Nitrogen leaching and run-off | N2O | 225.62 | 0.01 | 0.53 |
| 3.D.1.3 Direct N2O Emissions From Managed Soils - Urine and dung deposited by grazing animals | N2O | 377.12 | 0.01 | 0.56 |
| 3.D.1.2 Direct N2O Emissions From Managed Soils - Organic N Fertilizers | N2O | 353.68 | 0.01 | 0.60 |
| 3.D.2.1 Indirect N2O Emissions From Managed Soils - Atmospheric deposition | N2O | 171.05 | 0.01 | 0.63 |
| 3.D.1.4 Direct N2O Emissions From Managed Soils - Crop Residues | N2O | 290.77 | 0.01 | 0.66 |
| 3.B.2 Manure Management - Cattle | N2O | 186.05 | 0.00 | 0.68 |
| 1.A.1.a Public electricity and heat production - Liquid Fuels | CO2 | 6,021.25 | 0.00 | 0.71 |
| 1.A.1.a Public electricity and heat production - Gaseous Fuels | CO2 | 5,796.59 | 0.00 | 0.73 |
| 1.A.4 Other sectors-Solid fuels | CO2 | 2,760.55 | 0.00 | 0.75 |
| 5.D Wastewater Treatment and Discharge | CH4 | 161.97 | 0.00 | 0.77 |
| 1.A.3.b Road transportation | CO2 | 5,247.15 | 0.00 | 0.78 |
| 3.D.1.6 Direct N2O Emissions From Managed Soils - Cultivation of organic soils | N2O | 165.66 | 0.00 | 0.80 |
| 3.B.2 Manure Management - Other | N2O | 113.37 | 0.00 | 0.82 |
| 1.A.4 Other sectors-Biomass | CH4 | 78.71 | 0.00 | 0.83 |
| 1.A.2 Manufacturing industries and construction-Liquid fuels | CO2 | 3,873.72 | 0.00 | 0.85 |
| 1.A.4 Other sectors-Liquid fuels | CO2 | 2,736.38 | 0.00 | 0.86 |
| 2.A.1 Cement Production | CO2 | 1,668.07 | 0.00 | 0.87 |
| 2.B.2 Nitric Acid Production | N2O | 794.12 | 0.00 | 0.88 |
| 1.A.4 Other sectors-Solid fuels | CH4 | 143.99 | 0.00 | 0.89 |
| 1.A.4 Other sectors-Liquid fuels | N2O | 141.71 | 0.00 | 0.90 |
| 3.B.1.3 Manure Management - Swine | CH4 | 368.76 | 0.00 | 0.91 |
| 1.A.2 Manufacturing industries and construction-Gaseous fuels | CO2 | 2,042.93 | 0.00 | 0.92 |
| ………………………………………………………………………… | | | | |
| ***Total*** | | ***47,519.9*** | | |

## Approach 2 Level Assessment for 2024

| *IPCC Category* | *Greenhouse gas* | *GHG emissions, kt $CO_2$ eq.* | *Level assessment with uncertainty* | *Cumulative total* |
|---|---|---|---|---|
| 4.A.1 Forest land remaining forest land - carbon stock change in biomass | CO2 | -4,889.74 | 0.06 | 0.16 |
| 4.D.1 Wetlands remaining wetlands -net carbon stock change in organic soils | CO2 | 719.86 | 0.04 | 0.27 |
| 4.G Harvested wood products | CO2 | -2,105.85 | 0.04 | 0.36 |
| 4.C Grassland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 1,714.74 | 0.03 | 0.43 |
| 4.A.2 Land converted to forest land - carbon stock change in biomass | CO2 | -1,833.38 | 0.02 | 0.49 |
| 4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 1,245.31 | 0.02 | 0.55 |
| 5.A Solid Waste Disposal | CH4 | 538.28 | 0.02 | 0.60 |
| 4.A.1 Forest land remaining forest land - net carbon stock change in dead wood | CO2 | -1,412.70 | 0.02 | 0.64 |
| 4.B.1 Cropland remaining cropland - net carbon stock change in mineral soils | CO2 | -1,616.97 | 0.01 | 0.68 |
| 3.A.1 Enteric Fermentation - Cattle | CH4 | 1,646.58 | 0.01 | 0.71 |
| 3.D.1.1 Direct N2O Emissions From Managed Soils - Inorganic N Fertilizers | N2O | 519.96 | 0.01 | 0.74 |
| 3.D.1.4 Direct N2O Emissions From Managed Soils - Crop Residues | N2O | 350.73 | 0.01 | 0.76 |
| 4.B Cropland, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 452.00 | 0.01 | 0.78 |
| 4.B.2 Land converted to cropland- carbon stock change in biomass | CO2 | 813.49 | 0.01 | 0.80 |
| 3.D.2.2 Indirect N2O Emissions From Managed Soils - Nitrogen leaching and run-off | N2O | 137.48 | 0.01 | 0.81 |
| 1.A.3.b Road transportation | CO2 | 5,694.18 | 0.00 | 0.82 |
| 4.C.2 Land converted to grassland - carbon stock change in biomass | CO2 | -353.22 | 0.00 | 0.84 |
| 3.D.1.6 Direct N2O Emissions From Managed Soils - Cultivation of organic soils | N2O | 169.39 | 0.00 | 0.85 |
| 1.A.4 Other sectors-Biomass | CH4 | 93.05 | 0.00 | 0.86 |
| 4.A Forest land | N2O | 310.14 | 0.00 | 0.86 |
| 2.F.1 Refrigeration and Air Conditioning Equipment | HFCs | 454.60 | 0.00 | 0.87 |
| 3.D.1.2 Direct N2O Emissions From Managed Soils - Organic N Fertilizers | N2O | 147.73 | 0.00 | 0.88 |
| 3.B.2 Manure Management - Indirect N2O Emissions | N2O | 57.21 | 0.00 | 0.89 |
| 4.A.2 Land converted to forest land - net carbon stock change in mineral soils | CO2 | -216.50 | 0.00 | 0.90 |
| 3.D.2.1 Indirect N2O Emissions From Managed Soils - Atmospheric deposition | N2O | 73.10 | 0.00 | 0.91 |
| 3.D.1.3 Direct N2O Emissions From Managed Soils - Urine and dung deposited by grazing animals | N2O | 111.46 | 0.00 | 0.91 |

| ***IPCC Category*** | ***Greenhouse gas*** | ***GHG emissions, kt $CO_2$ eq.*** | ***Level assessment with uncertainty*** | ***Cumulative total*** |
|---|---|---|---|---|
| 1.B.2 Oil, natural gas and other emissions from energy production | CO2 | 200.81 | 0.00 | 0.92 |
| 3.B.2 Manure Management - Cattle | N2O | 70.79 | 0.00 | 0.93 |
| 5.B Biological Treatment of Solid Waste | CH4 | 71.93 | 0.00 | 0.93 |
| ……………………………………………………………………………………………………………………………………………………………… | | | | |
| ***Total*** | | ***10,578.3*** | | |

**Approach 2 Level Assessment for 2024 using a subset** (LULUCF was excluded from analysis)

| *IPCC Category* | *Greenhouse gas* | *GHG emissions, kt $CO_2$ eq.* | *Level assessment with uncertainty* | *Cumulative total* |
|---|---|---|---|---|
| 5.A Solid Waste Disposal | CH4 | 538.28 | 0.17 | 0.17 |
| 3.A.1 Enteric Fermentation - Cattle | CH4 | 1,646.58 | 0.11 | 0.28 |
| 3.D.1.1 Direct N2O Emissions From Managed Soils - Inorganic N Fertilizers | N2O | 519.96 | 0.11 | 0.39 |
| 3.D.1.4 Direct N2O Emissions From Managed Soils - Crop Residues | N2O | 350.73 | 0.07 | 0.46 |
| 3.D.2.2 Indirect N2O Emissions From Managed Soils - Nitrogen leaching and run-off | N2O | 137.48 | 0.05 | 0.51 |
| 1.A.3.b Road transportation | CO2 | 5,694.18 | 0.04 | 0.55 |
| 3.D.1.6 Direct N2O Emissions From Managed Soils - Cultivation of organic soils | N2O | 169.39 | 0.04 | 0.58 |
| 1.A.4 Other sectors-Biomass | CH4 | 93.05 | 0.03 | 0.62 |
| 2.F.1 Refrigeration and Air Conditioning Equipment | HFCs | 454.60 | 0.03 | 0.65 |
| 3.D.1.2 Direct N2O Emissions From Managed Soils - Organic N Fertilizers | N2O | 147.73 | 0.03 | 0.68 |
| 3.B.2 Manure Management - Indirect N2O Emissions | N2O | 57.21 | 0.03 | 0.71 |
| 3.D.2.1 Indirect N2O Emissions From Managed Soils - Atmospheric deposition | N2O | 73.10 | 0.03 | 0.73 |
| 3.D.1.3 Direct N2O Emissions From Managed Soils - Urine and dung deposited by grazing animals | N2O | 111.46 | 0.02 | 0.76 |
| 1.B.2 Oil, natural gas and other emissions from energy production | CO2 | 200.81 | 0.02 | 0.78 |
| 3.B.2 Manure Management - Cattle | N2O | 70.79 | 0.02 | 0.80 |
| 5.B Biological Treatment of Solid Waste | CH4 | 71.93 | 0.02 | 0.82 |
| 1.A.1 Energy industries-Biomass | N2O | 37.10 | 0.01 | 0.83 |
| 1.A.1 Energy industries-Biomass | CH4 | 29.12 | 0.01 | 0.84 |
| 1.A.1.b Petroleum refining - Liquid Fuels | CO2 | 1,320.16 | 0.01 | 0.85 |
| 3.B.1.1 Manure Management - Cattle | CH4 | 189.85 | 0.01 | 0.86 |
| 1.A.4 Other sectors-Liquid fuels | N2O | 68.17 | 0.01 | 0.87 |
| 1.A.4 Other sectors-Biomass | N2O | 22.51 | 0.01 | 0.88 |
| 1.A.4 Other sectors-Liquid fuels | CO2 | 927.96 | 0.01 | 0.89 |
| 3.G Liming | CO2 | 61.84 | 0.01 | 0.89 |
| 5.D Wastewater Treatment and Discharge | CH4 | 33.24 | 0.01 | 0.90 |
| …………………………………………………… | | | | |
| ***Total*** | | ***18,307.1*** | | |

## Approach 2 Trend Assessment for 2024

| *IPCC Category* | *Greenhouse gas* | *1990 kt $CO_2$ eq.* | *2024 kt $CO_2$ eq.* | *Trend assessment with uncertainty* | *% Contribution to Trend* | *Cumulative total* |
|---|---|---|---|---|---|---|
| 4.A.1 Forest land remaining forest land - carbon stock change in biomass | CO2 | -6,892.19 | -4,889.74 | 0.04 | 0.39 | 0.39 |
| 4.A.2 Land converted to forest land - carbon stock change in biomass | CO2 | -410.94 | -1,833.38 | 0.01 | 0.09 | 0.48 |
| 4.A Forest land, Emissions and removals from drainage and rewetting and other management of organic and mineral soils | CO2 | 1,087.18 | 1,245.31 | 0.01 | 0.12 | 0.60 |
| 4.A.1 Forest land remaining forest land - net carbon stock change in dead wood | CO2 | -306.59 | -1,412.70 | 0.01 | 0.07 | 0.67 |
| 4.A Forest land | N2O | 270.93 | 310.14 | 0.00 | 0.03 | 0.70 |
| 3.D.1.4 Direct N2O Emissions From Managed Soils - Crop Residues | N2O | 290.77 | 350.73 | 0.00 | 0.03 | 0.72 |
| 3.A.1 Enteric Fermentation - Cattle | CH4 | 4,717.44 | 1,646.58 | 0.00 | 0.02 | 0.75 |
| 2.F.1 Refrigeration and Air Conditioning Equipment | HFCs | 0.00 | 454.60 | 0.00 | 0.02 | 0.77 |
| 1.A.3.b Road transportation | CO2 | 5,247.15 | 5,694.18 | 0.00 | 0.01 | 0.78 |
| 1.A.4 Other sectors-Biomass | CH4 | 78.71 | 93.05 | 0.00 | 0.01 | 0.79 |
| 3.D.1.1 Direct N2O Emissions From Managed Soils - Inorganic N Fertilizers | N2O | 882.83 | 519.96 | 0.00 | 0.01 | 0.81 |
| 3.B.2 Manure Management - Indirect N2O Emissions | N2O | 198.51 | 57.21 | 0.00 | 0.01 | 0.82 |
| 1.A.1.a Public electricity and heat production - Liquid Fuels | CO2 | 6,021.25 | 72.99 | 0.00 | 0.01 | 0.83 |
| 1.B.2 Oil, natural gas and other emissions from energy production | CO2 | 23.88 | 200.81 | 0.00 | 0.01 | 0.84 |
| 3.D.1.6 Direct N2O Emissions From Managed Soils - Cultivation of organic soils | N2O | 165.66 | 169.39 | 0.00 | 0.01 | 0.85 |
| 1.A.4 Other sectors-Solid fuels | CO2 | 2,760.55 | 86.79 | 0.00 | 0.01 | 0.87 |
| 1.A.1.a Public electricity and heat production - Gaseous Fuels | CO2 | 5,796.59 | 507.37 | 0.00 | 0.01 | 0.88 |
| 3.D.1.3 Direct N2O Emissions From Managed Soils - Urine and dung deposited by grazing animals | N2O | 377.12 | 111.46 | 0.00 | 0.01 | 0.88 |
| 1.A.1 Energy industries-Biomass | N2O | 0.56 | 37.10 | 0.00 | 0.01 | 0.89 |
| 1.A.2 Manufacturing industries and construction-Liquid fuels | CO2 | 3,873.72 | 144.90 | 0.00 | 0.01 | 0.90 |
| 3.B.2 Manure Management - Other | N2O | 113.37 | 12.52 | 0.00 | 0.01 | 0.91 |
| 1.A.1 Energy industries-Biomass | CH4 | 0.44 | 29.12 | 0.00 | 0.01 | 0.91 |

| *IPCC Category* | *Greenhouse gas* | *1990 kt $CO_2$ eq.* | *2024 kt $CO_2$ eq.* | *Trend assessment with uncertainty* | *% Contribution to Trend* | *Cumulative total* |
|---|---|---|---|---|---|---|
| 2.G Other product manufacture and use | N2O | 85.41 | 3.59 | 0.00 | 0.01 | 0.92 |
| 3.D.2.2 Indirect N2O Emissions From Managed Soils - Nitrogen leaching and run-off | N2O | 225.62 | 137.48 | 0.00 | 0.01 | 0.93 |
| 4.A.2 Land converted to forest land - net carbon stock change in mineral soils | CO2 | -100.81 | -216.50 | 0.00 | 0.01 | 0.93 |
| 1.A.4 Other sectors-Solid fuels | CH4 | 143.99 | 6.06 | 0.00 | 0.00 | 0.94 |
| 3.B.1.3 Manure Management - Swine | CH4 | 368.76 | 28.79 | 0.00 | 0.00 | 0.94 |
| 3.G Liming | CO2 | 20.59 | 61.84 | 0.00 | 0.00 | 0.95 |
| 1.A.4 Other sectors-Biomass | N2O | 11.54 | 22.51 | 0.00 | 0.00 | 0.95 |
| 2.B.2 Nitric Acid Production | N2O | 794.12 | 144.83 | 0.00 | 0.00 | 0.95 |
| 3.B.2 Manure Management - Cattle | N2O | 186.05 | 70.79 | 0.00 | 0.00 | 0.96 |
| 1.A.3.b Road transportation | N2O | 44.27 | 61.28 | 0.00 | 0.00 | 0.96 |
| 3.D.1.2 Direct N2O Emissions From Managed Soils - Organic N Fertilizers | N2O | 353.68 | 147.73 | 0.00 | 0.00 | 0.96 |
| …………………………………………………………………………………………… | | | | | | |
| ***Total*** | | ***43,618.4*** | ***10,578.3*** | ***0.11*** | ***1.00*** | |

**Approach 2 Trend Assessment for 2024 using a subset** (LULUCF was excluded from analysis)

| *IPCC Category* | *Greenhouse gas* | *1990 kt $CO_2$ eq.* | *2024 kt $CO_2$ eq.* | *Trend assessment with uncertainty* | *% Contribution to Trend* | *Cumulative total* |
|---|---|---|---|---|---|---|
| 3.D.1.4 Direct N2O Emissions From Managed Soils - Crop Residues | N2O | 238.47 | 296.57 | 0.00 | 0.08 | 0.08 |
| 3.D.1.1 Direct N2O Emissions From Managed Soils - Inorganic N Fertilizers | N2O | 882.83 | 530.45 | 0.00 | 0.08 | 0.16 |
| 5.A Solid Waste Disposal | CH4 | 1152.29 | 563.15 | 0.00 | 0.08 | 0.24 |
| 2.F.1 Refrigeration and Air Conditioning Equipment | HFCs | 0.00 | 448.46 | 0.00 | 0.06 | 0.30 |
| 1.A.3.b Road transportation | CO2 | 5,247.15 | 5,933.78 | 0.00 | 0.05 | 0.35 |
| 3.D.1.6 Direct N2O Emissions From Managed Soils - Cultivation of organic soils | N2O | 188.21 | 199.01 | 0.00 | 0.05 | 0.40 |
| 1.A.4 Other sectors-Biomass | CH4 | 78.71 | 100.34 | 0.00 | 0.05 | 0.45 |
| 5.B Biological Treatment of Solid Waste | CH4 | 0.23 | 90.51 | 0.00 | 0.05 | 0.50 |
| 1.B.2 Oil, natural gas and other emissions from energy production | CO2 | 23.88 | 197.84 | 0.00 | 0.04 | 0.54 |
| 3.D.2.2 Indirect N2O Emissions From Managed Soils - Nitrogen leaching and run-off | N2O | 218.05 | 132.74 | 0.00 | 0.03 | 0.57 |
| 1.A.1.a Public electricity and heat production - Liquid Fuels | CO2 | 6,021.25 | 242.65 | 0.00 | 0.03 | 0.60 |
| 1.A.4 Other sectors-Solid fuels | CO2 | 2,760.55 | 104.94 | 0.00 | 0.03 | 0.63 |
| 1.A.1 Energy industries-Biomass | N2O | 0.56 | 34.71 | 0.00 | 0.02 | 0.65 |
| 1.A.1.a Public electricity and heat production - Gaseous Fuels | CO2 | 5,796.59 | 437.27 | 0.00 | 0.02 | 0.67 |
| 1.A.1 Energy industries-Biomass | CH4 | 0.44 | 27.51 | 0.00 | 0.02 | 0.69 |
| 1.A.2 Manufacturing industries and construction-Liquid fuels | CO2 | 3,873.72 | 150.60 | 0.00 | 0.02 | 0.71 |
| 5.D Wastewater Treatment and Discharge | CH4 | 161.97 | 22.44 | 0.00 | 0.02 | 0.73 |
| 3.B.2 Manure Management - Other | N2O | 113.37 | 13.53 | 0.00 | 0.02 | 0.74 |
| 2.G Other product manufacture and use | N2O | 85.41 | 3.48 | 0.00 | 0.02 | 0.76 |
| 3.A.1 Enteric Fermentation - Cattle | CH4 | 4,717.44 | 1,668.64 | 0.00 | 0.01 | 0.77 |

| *IPCC Category* | *Greenhouse gas* | *1990 kt $CO_2$ eq.* | *2024 kt $CO_2$ eq.* | *Trend assessment with uncertainty* | *% Contribution to Trend* | *Cumulative total* |
|---|---|---|---|---|---|---|
| 5.B Biological Treatment of Solid Waste | N2O | 0.13 | 26.60 | 0.00 | 0.01 | 0.79 |
| 1.A.4 Other sectors-Solid fuels | CH4 | 143.99 | 5.11 | 0.00 | 0.01 | 0.80 |
| 3.D.1.3 Direct N2O Emissions From Managed Soils - Urine and dung deposited by grazing animals | N2O | 377.12 | 113.25 | 0.00 | 0.01 | 0.81 |
| 2.F.2 Foam Blowing Agents | HFCs | 0.00 | 56.58 | 0.00 | 0.01 | 0.82 |
| 3.B.2 Manure Management - Indirect N2O Emissions | N2O | 222.89 | 72.82 | 0.00 | 0.01 | 0.83 |
| 1.A.4 Other sectors-Biomass | N2O | 11.54 | 19.56 | 0.00 | 0.01 | 0.84 |
| 1.A.1.b Petroleum refining - Liquid Fuels | CO2 | 1,509.64 | 1,360.87 | 0.00 | 0.01 | 0.85 |
| 1.A.4 Other sectors-Liquid fuels | CO2 | 2,736.38 | 413.92 | 0.00 | 0.01 | 0.86 |
| 1.A.4 Other sectors-Liquid fuels | N2O | 141.71 | 11.04 | 0.00 | 0.01 | 0.87 |
| 3.B.1.3 Manure Management - Swine | CH4 | 368.76 | 29.98 | 0.00 | 0.01 | 0.88 |
| 2.B.2 Nitric Acid Production | N2O | 794.12 | 107.82 | 0.00 | 0.01 | 0.89 |
| 3.G Liming | CO2 | 20.59 | 41.84 | 0.00 | 0.01 | 0.90 |
| 1.A.3.b Road transportation | N2O | 44.27 | 49.39 | 0.00 | 0.01 | 0.91 |
| …… | | | | | | |
| ***Total*** | | ***47,519.9*** | ***18,307.1*** | ***0.04*** | ***1.00*** | |

# ANNEX II. Tier 1 Uncertainty assessment

## Table 1a. Uncertainty evaluation including LULUCF

| *IPCC Source category* | *Gas* | *Base year (1990) emissions* | *Emissions in 2024* | *Activity data uncertainty* | *Emission factor uncertainty* | *Combined uncertainty* | *Combined uncertainty as % of total national* | *Type A sensitivity* | *Type B sensitivity* | *Uncertainty in trend in national emissions introduced by emission factor* | *Uncertainty in trend in national emissions introduced by* | *Uncertainty introduced into the trend in total national emissions* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ***kt $CO_2$ eq.*** | ***kt $CO_2$ eq.*** | **%** | **%** | **%** | **%** | **%** | **%** | **%** | **%** | **%** |
| 1.A.1 Fuel combustion - Energy Industries - Liquid Fuels | $CO_2$ | 7 540.2 | 1 401.2 | 2% | 2% | 3% | 0.000 | 0.009 | 0.032 | 0.000 | 0.001 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Liquid Fuels | $CH_4$ | 7.7 | 0.9 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Liquid Fuels | $N_2O$ | 14.3 | 1.4 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Solid Fuels | $CO_2$ | 174.0 | 1.6 | 2% | 5% | 5% | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Solid Fuels | $CH_4$ | 0.1 | 0.0 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Solid Fuels | $N_2O$ | 0.7 | 0.0 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels | $CO_2$ | 5,796.6 | 544.4 | 2% | 2% | 3% | 0.000 | 0.019 | 0.012 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels | $CH_4$ | 2.9 | 0.3 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels | $N_2O$ | 2.8 | 0.3 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels | $CO_2$ | 0.0 | 230.2 | 2% | 5% | 5% | 0.000 | 0.005 | 0.005 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels | $CH_4$ | 0.0 | 2.1 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels | $N_2O$ | 0.0 | 2.6 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| IPCC Source category | Gas | Base year (1990) emissions | Emissions in 2024 | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor | Uncertainty in trend in national emissions introduced by | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | kt $CO_2$ eq. | kt $CO_2$ eq. | % | % | % | % | % | % | % | % | % |
| 1.A.1 Fuel combustion - Energy Industries - Peat | $CO_2$ | 11.1 | 8.7 | 2% | 5% | 5% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Peat | $CH_4$ | 0.0 | 0.0 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Peat | $N_2O$ | 0.0 | 0.0 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Biomass | $CO_2$ | 0.0 | 0.0 | 5% | 15% | 16% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Biomass | $CH_4$ | 0.4 | 29.0 | 5% | 150% | 150% | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Biomass | $N_2O$ | 0.6 | 36.6 | 5% | 150% | 150% | 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 | 144.9 | 2% | 2% | 3% | 0.000 | 0.018 | 0.003 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels | $CH_4$ | 5.0 | 0.2 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels | $N_2O$ | 42.5 | 5.8 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels | $CO_2$ | 171.6 | 265.2 | 2% | 5% | 5% | 0.000 | 0.005 | 0.006 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels | $CH_4$ | 0.5 | 0.8 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| *IPCC Source category* | *Gas* | *Base year (1990) emissions* | *Emissions in 2024* | *Activity data uncertainty* | *Emission factor uncertainty* | *Combined uncertainty* | *Combined uncertainty as % of total national* | *Type A sensitivity* | *Type B sensitivity* | *Uncertainty in trend in national emissions introduced by emission factor* | *Uncertainty in trend in national emissions introduced by* | *Uncertainty introduced into the trend in total national emissions* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ***kt $CO_2$ eq.*** | ***kt $CO_2$ eq.*** | **%** | **%** | **%** | **%** | **%** | **%** | **%** | **%** | **%** |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels | $N_2O$ | 0.7 | 1.1 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels | $CO_2$ | 2,042.9 | 605.9 | 2% | 2% | 3% | 0.000 | 0.003 | 0.014 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels | $CH_4$ | 1.0 | 0.3 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels | $N_2O$ | 1.0 | 0.3 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction -Other fossil fuels | $CO_2$ | 0.0 | 85.3 | 2% | 2% | 3% | 0.000 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction -Other fossil fuels | $CH_4$ | 0.0 | 0.8 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction -Other fossil fuels | $N_2O$ | 0.0 | 1.1 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat | $CO_2$ | 17.5 | 0.0 | 2% | 5% | 5% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat | $CH_4$ | 0.0 | 0.0 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| IPCC Source category | Gas | Base year (1990) emissions | Emissions in 2024 | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor | Uncertainty in trend in national emissions introduced by | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | kt $CO_2$ eq. | kt $CO_2$ eq. | % | % | % | % | % | % | % | % | % |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat | $N_2O$ | 0.0 | 0.0 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass | $CO_2$ | 0.0 | 0.0 | 5% | 15% | 16% | 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 | 5.3 | 5% | 150% | 150% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass | $N_2O$ | 0.5 | 6.7 | 5% | 150% | 150% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.a Domestic Aviation | $CO_2$ | 8.2 | 1.5 | 10% | 2% | 10% | 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% | 79% | 79% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.a Domestic Aviation | $N_2O$ | 0.1 | 0.0 | 10% | 110% | 110% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.b Road Transportation | $CO_2$ | 5,247.2 | 5,694.2 | 2% | 2% | 3% | 0.000 | 0.101 | 0.130 | 0.002 | 0.004 | 0.000 |
| 1.A.3.b Road Transportation | $CH_4$ | 44.2 | 7.7 | 2% | 40% | 40% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.b Road Transportation | $N_2O$ | 44.3 | 61.3 | 2% | 50% | 50% | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 |
| 1.A.3.c Railways | $CO_2$ | 350.0 | 82.3 | 5% | 2% | 5% | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 |
| 1.A.3.c Railways | $CH_4$ | 0.6 | 0.1 | 5% | 75% | 75% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.c Railways | $N_2O$ | 36.4 | 8.5 | 5% | 75% | 75% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.d Domestic Navigation - Liquid Fuels | $CO_2$ | 15.5 | 0.3 | 5% | 3% | 6% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.d Domestic Navigation - Liquid Fuels | $CH_4$ | 0.0 | 0.0 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.d Domestic Navigation - Liquid Fuels | $N_2O$ | 0.1 | 0.0 | 5% | 90% | 90% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.e.i Other Transportation | $CO_2$ | 64.3 | 42.5 | 5% | 2% | 5% | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |

| IPCC Source category | Gas | Base year (1990) emissions | Emissions in 2024 | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor | Uncertainty in trend in national emissions introduced by | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | kt $CO_2$ eq. | kt $CO_2$ eq. | % | % | % | % | % | % | % | % | % |
| 1.A.3.e.i Other Transportation | $CH_4$ | 0.0 | 0.0 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.e.i Other Transportation | $N_2O$ | 0.0 | 1.9 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Liquid Fuels | $CO_2$ | 2,736.4 | 928.0 | 3% | 2% | 4% | 0.000 | 0.006 | 0.021 | 0.000 | 0.001 | 0.000 |
| 1.A.4 Other Sectors - Liquid Fuels | $CH_4$ | 7.9 | 1.9 | 3% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Liquid Fuels | $N_2O$ | 141.7 | 68.2 | 3% | 50% | 50% | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Solid Fuels | $CO_2$ | 2,760.5 | 86.8 | 3% | 5% | 6% | 0.000 | 0.013 | 0.002 | 0.001 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Solid Fuels | $CH_4$ | 144.0 | 6.1 | 3% | 50% | 50% | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Solid Fuels | $N_2O$ | 11.6 | 0.4 | 3% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Gaseous Fuels | $CO_2$ | 1,379.3 | 682.6 | 3% | 2% | 4% | 0.000 | 0.008 | 0.016 | 0.000 | 0.001 | 0.000 |
| 1.A.4 Other Sectors - Gaseous Fuels | $CH_4$ | 3.5 | 1.7 | 3% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Gaseous Fuels | $N_2O$ | 0.7 | 0.3 | 3% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Peat | $CO_2$ | 27.1 | 33.4 | 3% | 5% | 6% | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Peat | $CH_4$ | 1.3 | 1.6 | 3% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Peat | $N_2O$ | 0.1 | 0.1 | 3% | 50% | 50% | 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% | 15% | 18% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors- Biomass | $CH_4$ | 78.7 | 93.1 | 10% | 150% | 150% | 0.000 | 0.002 | 0.002 | 0.003 | 0.000 | 0.000 |
| 1.A.4 Other Sectors- Biomass | $N_2O$ | 11.5 | 22.5 | 10% | 150% | 150% | 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 | 199.9 | 5% | 50% | 50% | 0.000 | 0.004 | 0.005 | 0.002 | 0.000 | 0.000 |
| 1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil | $CH_4$ | 4.8 | 2.5 | 5% | 75% | 75% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil | $N_2O$ | 0.0 | 0.0 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas | $CO_2$ | 0.0 | 0.0 | 5% | 10% | 11% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| IPCC Source category | Gas | Base year (1990) emissions | Emissions in 2024 | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor | Uncertainty in trend in national emissions introduced by | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | kt $CO_2$ eq. | kt $CO_2$ eq. | % | % | % | % | % | % | % | % | % |
| 1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas | $CH_4$ | 291.8 | 86.1 | 5% | 10% | 11% | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 |
| 1.B.2.c Fugitive Emissions from Fuels - Venting and flaring | $CO_2$ | 0.6 | 0.9 | 5% | 50% | 50% | 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 | 0.5 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.B.2.c Fugitive Emissions from Fuels - Venting and flaring | $N_2O$ | 0.0 | 0.0 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.A.1 Cement Production | $CO_2$ | 1,668.1 | 575.7 | 2% | 5% | 5% | 0.000 | 0.004 | 0.013 | 0.000 | 0.000 | 0.000 |
| 2.A.2 Lime Production | $CO_2$ | 210.3 | 1.8 | 5% | 5% | 7% | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.A.3 Glass Production | $CO_2$ | 11.7 | 7.0 | 7% | 5% | 9% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.A.4.a Ceramics | $CO_2$ | 227.9 | 0.0 | 5% | 5% | 7% | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.A.4.b Other use of soda ash | $CO_2$ | 5.2 | 0.6 | 15% | 5% | 16% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.A.4.d Mineral wool production | $CO_2$ | 6.4 | 9.4 | 7% | 5% | 9% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.B.1 Ammonia Production | $CO_2$ | 1,236.6 | 1,088.7 | 2% | 2% | 3% | 0.000 | 0.018 | 0.025 | 0.000 | 0.001 | 0.000 |
| 2.B.2 Nitric Acid Production | $N_2O$ | 794.1 | 144.8 | 2% | 10% | 10% | 0.000 | 0.001 | 0.003 | 0.000 | 0.000 | 0.000 |
| 2.B.8.a Methanol | $CO_2$ | 24.4 | 0.0 | 5% | 30% | 30% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.B.8.a Methanol | $CH_4$ | 5.9 | 0.0 | 5% | 30% | 30% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.C.1 Iron and Steel Production | $CO_2$ | 17.0 | 0.0 | 10% | 10% | 14% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.D.1 Lubricant use | $CO_2$ | 0.0 | 0.0 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.D.2 Parafin wax use | $CO_2$ | 6.9 | 19.9 | 5% | 100% | 100% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.D.3 Urea-based catalyst | $CO_2$ | 0.0 | 3.3 | 10% | 2% | 10% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.E.1 Semiconductor | $SF_6$ | 0.0 | 3.0 | 5% | 5% | 7% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.E.3 Photovoltaics | $NF_3$ | 0.0 | 0.0 | 5% | 20% | 21% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.F.1.a Commercial Refrigeration | HFCs | 0.0 | 147.3 | 20% | 50% | 54% | 0.000 | 0.003 | 0.003 | 0.002 | 0.001 | 0.000 |
| 2.F.1.b Domestic Refrigeration | HFCs | 0.0 | 2.3 | 20% | 50% | 54% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| IPCC Source category | Gas | Base year (1990) emissions | Emissions in 2024 | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor | Uncertainty in trend in national emissions introduced by | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | kt $CO_2$ eq. | kt $CO_2$ eq. | % | % | % | % | % | % | % | % | % |
| 2.F.1.c. Industrial Refrigeration | HFCs | 0.0 | 42.0 | 20% | 50% | 54% | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| 2.F.1.d. Transport Refrigeration | HFCs | 0.0 | 76.3 | 20% | 50% | 54% | 0.000 | 0.002 | 0.002 | 0.001 | 0.000 | 0.000 |
| 2.F.1.e. Mobile air-conditioning | HFCs | 0.0 | 152.7 | 20% | 50% | 54% | 0.000 | 0.003 | 0.003 | 0.002 | 0.001 | 0.000 |
| 2.F.1.f. Stationary Air Conditioning | HFCs | 0.0 | 34.1 | 20% | 50% | 54% | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| 2.F.2 Foam Blowing Agents | HFCs | 0.0 | 14.9 | 30% | 30% | 42% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.F.3 Fire Protection | HFCs | 0.0 | 4.0 | 20% | 20% | 28% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.F.4 Aerosols/metered dose inhalers | HFCs | 0.0 | 8.3 | 5% | 5% | 7% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.G.1 Manufacture of electrical equipments | $SF_6$ | 0.0 | 0.4 | 5% | 5% | 7% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.G.2.b Accelerators | $SF_6$ | 0.0 | 0.1 | 5% | 5% | 7% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.G.3.a Medical applications | $N_2O$ | 85.4 | 3.6 | 5% | 5% | 7% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.G.3.b Propellant for pressure and aerosol products | $N_2O$ | 83.0 | 1.7 | 20% | 100% | 102% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 3.A Enteric Fermentation | $CH_4$ | 4,879.6 | 1,718.8 | 4% | 25% | 26% | 0.002 | 0.012 | 0.039 | 0.003 | 0.002 | 0.000 |
| 3.B Manure Management | $CH_4$ | 750.4 | 246.1 | 14% | 11% | 18% | 0.000 | 0.001 | 0.006 | 0.000 | 0.001 | 0.000 |
| 3.B Manure Management | $N_2O$ | 497.9 | 140.5 | 27% | 203% | 204% | 0.001 | 0.000 | 0.003 | 0.001 | 0.001 | 0.000 |
| 3.D.1 Direct $N_2O$ Emissions From Managed Soils | $N_2O$ | 2,070.1 | 1,299.3 | 11% | 69% | 70% | 0.007 | 0.018 | 0.030 | 0.013 | 0.004 | 0.000 |
| 3.D.2 Indirect $N_2O$ Emissions From Managed Soils | $N_2O$ | 396.7 | 210.6 | 37% | 135% | 140% | 0.001 | 0.003 | 0.005 | 0.004 | 0.003 | 0.000 |
| 3.G Liming | $CO_2$ | 20.6 | 61.8 | 10% | 50% | 51% | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 |
| 3.H Urea Application | $CO_2$ | 59.6 | 21.7 | 10% | 50% | 51% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4.A.1 Forest Land Remaining Forest Land | $CO_2$ | -6,205.1 | -5,151.4 | 3% | 46% | 46% | 0.051 | 0.084 | 0.118 | 0.038 | 0.005 | 0.001 |
| 4.A.1 Forest Land Remaining Forest Land | $CH_4$ | 0.5 | 0.2 | 32% | 40% | 51% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| IPCC Source category | Gas | Base year (1990) emissions | Emissions in 2024 | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor | Uncertainty in trend in national emissions introduced by | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | kt $CO_2$ eq. | kt $CO_2$ eq. | % | % | % | % | % | % | % | % | % |
| 4.A.1 Forest Land Remaining Forest Land | $N_2O$ | 247.3 | 286.5 | 32% | 27% | 42% | 0.000 | 0.005 | 0.007 | 0.001 | 0.003 | 0.000 |
| 4.A.2 Land Converted to Forest Land | $CO_2$ | -448.9 | -2,018.7 | 15% | 46% | 48% | 0.009 | 0.044 | 0.046 | 0.020 | 0.010 | 0.000 |
| 4.A.2 Land Converted to Forest Land | $CH_4$ | 0.0 | 0.0 | 32% | 40% | 51% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4.A.2 Land Converted to Forest Land | $N_2O$ | 23.6 | 23.6 | 32% | 27% | 42% | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| 4.B Cropland | $CO_2$ | 804.7 | -267.4 | 5% | 31% | 31% | 0.000 | 0.011 | 0.006 | 0.003 | 0.000 | 0.000 |
| 4.B Cropland | $CH_4$ | 0.5 | 0.5 | 6% | 85% | 85% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4.B Cropland | $N_2O$ | 21.5 | 26.4 | 15% | 151% | 151% | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 |
| 4.C Grassland | $CO_2$ | 746.4 | 825.3 | 7% | 42% | 42% | 0.001 | 0.015 | 0.019 | 0.006 | 0.002 | 0.000 |
| 4.C Grassland | $CH_4$ | 4.8 | 1.9 | 6% | 85% | 85% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4.C Grassland | $N_2O$ | 24.9 | 16.4 | 6% | 76% | 76% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4.D Wetlands | $CO_2$ | 1,129.1 | 704.8 | 6% | 205% | 205% | 0.019 | 0.010 | 0.016 | 0.020 | 0.001 | 0.000 |
| 4.D Wetlands | $N_2O$ | 5.4 | 0.1 | 15% | 151% | 151% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4.E Settlements | $CO_2$ | -189.1 | -170.5 | 10% | 15% | 18% | 0.000 | 0.003 | 0.004 | 0.000 | 0.001 | 0.000 |
| 4.E Settlements | $N_2O$ | 0.0 | 5.5 | 18% | 151% | 152% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4.F Other Land | $CO_2$ | 195.7 | 88.6 | 17% | 15% | 23% | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 |
| 4.F Other Land | $N_2O$ | 2.7 | 5.2 | 23% | 151% | 152% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4.G Harvested Wood Products | $CO_2$ | -240.2 | -2,105.9 | 15% | 59% | 61% | 0.015 | 0.047 | 0.048 | 0.028 | 0.010 | 0.001 |
| 5.A Solid Waste Disposal | $CH_4$ | 1,152.3 | 538.3 | 10% | 125% | 125% | 0.004 | 0.006 | 0.012 | 0.007 | 0.002 | 0.000 |
| 5.B Biological Treatment of Solid Waste | $CH_4$ | 0.2 | 71.9 | 10% | 100% | 100% | 0.000 | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 |
| 5.B Biological Treatment of Solid Waste | $N_2O$ | 0.1 | 28.6 | 10% | 100% | 100% | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 |

| *IPCC Source category* | *Gas* | *Base year (1990) emissions* | *Emissions in 2024* | *Activity data uncertainty* | *Emission factor uncertainty* | *Combined uncertainty* | *Combined uncertainty as % of total national* | *Type A sensitivity* | *Type B sensitivity* | *Uncertainty in trend in national emissions introduced by emission factor* | *Uncertainty in trend in national emissions introduced by* | *Uncertainty introduced into the trend in total national emissions* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **kt $CO_2$ eq.** | **kt $CO_2$ eq.** | **%** | **%** | **%** | **%** | **%** | **%** | **%** | **%** | **%** |
| 5.C Incineration and Open Burning of Waste | $CO_2$ | 2.7 | 2.2 | 10% | 33% | 34% | 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 | 10% | 60% | 61% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5.C Incineration and Open Burning of Waste | $N_2O$ | 0.1 | 0.1 | 10% | 60% | 61% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5.D Wastewater Treatment and Discharge | $CH_4$ | 162.0 | 33.2 | 54% | 73% | 91% | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 |
| 5.D Wastewater Treatment and Discharge | $N_2O$ | 22.9 | 6.5 | 20% | 50% | 54% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Indirect emissions (2. Industrial processes and product use) | Indirect $CO_2$ | 34.3 | 36.8 | 30% | 20% | 36% | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| **Total emission** | | **43,700.9** | **10,529.0** | **Overall uncertainty (%)** | | | **33.2** | **Trend uncertainty (%)** | | | | **6.1** |

**Table 1b. Uncertainty evaluation excluding LULUCF**

| *IPCC Source category* | *Gas* | *Base year (1990) emissions* | *Emissions in 2024* | *Activity data uncertainty* | *Emission factor uncertainty* | *Combined uncertainty* | *Combined uncertainty as % of total national emissions in 2019* | *Type A sensitivity* | *Type B sensitivity* | *Uncertainty in trend in national emissions introduced by emission factor* | *Uncertainty in trend in national emissions introduced by* | *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 | 1,401.2 | 2% | 2% | 3% | 0.000 | 0.031 | 0.029 | 0.001 | 0.001 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Liquid Fuels | $CH_4$ | 7.7 | 0.9 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Liquid Fuels | $N_2O$ | 14.3 | 1.4 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Solid Fuels | $CO_2$ | 174.0 | 1.6 | 2% | 5% | 5% | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Solid Fuels | $CH_4$ | 0.1 | 0.0 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Solid Fuels | $N_2O$ | 0.7 | 0.0 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels | $CO_2$ | 5,796.6 | 544.4 | 2% | 2% | 3% | 0.000 | 0.035 | 0.011 | 0.001 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels | $CH_4$ | 2.9 | 0.3 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Gaseous Fuels | $N_2O$ | 2.8 | 0.3 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels | $CO_2$ | 0.0 | 230.2 | 2% | 5% | 5% | 0.000 | 0.005 | 0.005 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels | $CH_4$ | 0.0 | 2.1 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Other Fossil Fuels | $N_2O$ | 0.0 | 2.6 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| IPCC Source category | Gas | Base year (1990) emissions | Emissions in 2024 | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in 2019 | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor | Uncertainty in trend in national emissions introduced by | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | kt $CO_2$ eq. | kt $CO_2$ eq. | % | % | % | % | % | % | % | % | % |
| 1.A.1 Fuel combustion - Energy Industries - Peat | $CO_2$ | 11.1 | 8.7 | 2% | 5% | 5% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Peat | $CH_4$ | 0.0 | 0.0 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Peat | $N_2O$ | 0.0 | 0.0 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Biomass | $CO_2$ | 0.0 | 0.0 | 5% | 15% | 16% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Biomass | $CH_4$ | 0.4 | 29.0 | 5% | 150% | 150% | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 |
| 1.A.1 Fuel combustion - Energy Industries - Biomass | $N_2O$ | 0.6 | 36.6 | 5% | 150% | 150% | 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 | 144.9 | 2% | 2% | 3% | 0.000 | 0.028 | 0.003 | 0.001 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels | $CH_4$ | 5.0 | 0.2 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Liquid Fuels | $N_2O$ | 42.5 | 5.8 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels | $CO_2$ | 171.6 | 265.2 | 2% | 5% | 5% | 0.000 | 0.004 | 0.006 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels | $CH_4$ | 0.5 | 0.8 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Solid Fuels | $N_2O$ | 0.7 | 1.1 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| *IPCC Source category* | *Gas* | *Base year (1990) emissions* | *Emissions in 2024* | *Activity data uncertainty* | *Emission factor uncertainty* | *Combined uncertainty* | *Combined uncertainty as % of total national emissions in 2019* | *Type A sensitivity* | *Type B sensitivity* | *Uncertainty in trend in national emissions introduced by emission factor* | *Uncertainty in trend in national emissions introduced by* | *Uncertainty introduced into the trend in total national emissions* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ***kt $CO_2$ eq.*** | ***kt $CO_2$ eq.*** | *%* | *%* | *%* | *%* | *%* | *%* | *%* | *%* | *%* |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels | $CO_2$ | 2,042.9 | 605.9 | 2% | 2% | 3% | 0.000 | 0.004 | 0.013 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels | $CH_4$ | 1.0 | 0.3 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Gaseous Fuels | $N_2O$ | 1.0 | 0.3 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction -Other fossil fuels | $CO_2$ | 0.0 | 85.3 | 2% | 2% | 3% | 0.000 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction -Other fossil fuels | $CH_4$ | 0.0 | 0.8 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction -Other fossil fuels | $N_2O$ | 0.0 | 1.1 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat | $CO_2$ | 17.5 | 0.0 | 2% | 5% | 5% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat | $CH_4$ | 0.0 | 0.0 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Peat | $N_2O$ | 0.0 | 0.0 | 2% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass | $CO_2$ | 0.0 | 0.0 | 5% | 15% | 16% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| *IPCC Source category* | *Gas* | *Base year (1990) emissions* | *Emissions in 2024* | *Activity data uncertainty* | *Emission factor uncertainty* | *Combined uncertainty* | *Combined uncertainty as % of total national emissions in 2019* | *Type A sensitivity* | *Type B sensitivity* | *Uncertainty in trend in national emissions introduced by emission factor* | *Uncertainty in trend in national emissions introduced by* | *Uncertainty introduced into the trend in total national emissions* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ***kt $CO_2$ eq.*** | ***kt $CO_2$ eq.*** | *%* | *%* | *%* | *%* | *%* | *%* | *%* | *%* | *%* |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass | $CH_4$ | 0.4 | 5.3 | 5% | 150% | 150% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.2 Fuel combustion - Manufacturing Industries and Construction - Biomass | $N_2O$ | 0.5 | 6.7 | 5% | 150% | 150% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.a Domestic Aviation | $CO_2$ | 8.2 | 1.5 | 10% | 2% | 10% | 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% | 79% | 79% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.a Domestic Aviation | $N_2O$ | 0.1 | 0.0 | 10% | 110% | 110% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.b Road Transportation | $CO_2$ | 5,247.2 | 5,694.2 | 2% | 2% | 3% | 0.000 | 0.077 | 0.120 | 0.002 | 0.003 | 0.000 |
| 1.A.3.b Road Transportation | $CH_4$ | 44.2 | 7.7 | 2% | 40% | 40% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.b Road Transportation | $N_2O$ | 44.3 | 61.3 | 2% | 50% | 50% | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| 1.A.3.c Railways | $CO_2$ | 350.0 | 82.3 | 5% | 2% | 5% | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 |
| 1.A.3.c Railways | $CH_4$ | 0.6 | 0.1 | 5% | 75% | 75% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.c Railways | $N_2O$ | 36.4 | 8.5 | 5% | 75% | 75% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.d Domestic Navigation - Liquid Fuels | $CO_2$ | 15.5 | 0.3 | 5% | 3% | 6% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.d Domestic Navigation - Liquid Fuels | $CH_4$ | 0.0 | 0.0 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.d Domestic Navigation - Liquid Fuels | $N_2O$ | 0.1 | 0.0 | 5% | 90% | 90% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.e.i Other Transportation - Pipeline Transportation | $CO_2$ | 64.3 | 42.5 | 5% | 2% | 5% | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| 1.A.3.e.i Other Transportation - Pipeline Transportation | $CH_4$ | 0.0 | 0.0 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.3.e.i Other Transportation - Pipeline Transportation | $N_2O$ | 0.0 | 1.9 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Liquid Fuels | $CO_2$ | 2,736.4 | 928.0 | 3% | 2% | 4% | 0.000 | 0.003 | 0.020 | 0.000 | 0.001 | 0.000 |
| 1.A.4 Other Sectors - Liquid Fuels | $CH_4$ | 7.9 | 1.9 | 3% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Liquid Fuels | $N_2O$ | 141.7 | 68.2 | 3% | 50% | 50% | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Solid Fuels | $CO_2$ | 2,760.5 | 86.8 | 3% | 5% | 6% | 0.000 | 0.020 | 0.002 | 0.001 | 0.000 | 0.000 |

| IPCC Source category | Gas | Base year (1990) emissions | Emissions in 2024 | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in 2019 | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor | Uncertainty in trend in national emissions introduced by | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | kt $CO_2$ eq. | kt $CO_2$ eq. | % | % | % | % | % | % | % | % | % |
| 1.A.4 Other Sectors - Solid Fuels | $CH_4$ | 144.0 | 6.1 | 3% | 50% | 50% | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Solid Fuels | $N_2O$ | 11.6 | 0.4 | 3% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Gaseous Fuels | $CO_2$ | 1,379.3 | 682.6 | 3% | 2% | 4% | 0.000 | 0.003 | 0.014 | 0.000 | 0.001 | 0.000 |
| 1.A.4 Other Sectors - Gaseous Fuels | $CH_4$ | 3.5 | 1.7 | 3% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Gaseous Fuels | $N_2O$ | 0.7 | 0.3 | 3% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Peat | $CO_2$ | 27.1 | 33.4 | 3% | 5% | 6% | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Peat | $CH_4$ | 1.3 | 1.6 | 3% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors - Peat | $N_2O$ | 0.1 | 0.1 | 3% | 50% | 50% | 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% | 15% | 18% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.A.4 Other Sectors- Biomass | $CH_4$ | 78.7 | 93.1 | 10% | 150% | 150% | 0.000 | 0.001 | 0.002 | 0.002 | 0.000 | 0.000 |
| 1.A.4 Other Sectors- Biomass | $N_2O$ | 11.5 | 22.5 | 10% | 150% | 150% | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| 1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil | $CO_2$ | 23.3 | 199.9 | 5% | 50% | 50% | 0.000 | 0.004 | 0.004 | 0.002 | 0.000 | 0.000 |
| 1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil | $CH_4$ | 4.8 | 2.5 | 5% | 75% | 75% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.B.2.a Fugitive Emissions from Fuels - Oil and Natural Gas - Oil | $N_2O$ | 0.0 | 0.0 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas | $CO_2$ | 0.0 | 0.0 | 5% | 10% | 11% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 1.B.2.b Fugitive Emissions from Fuels - Oil and Natural Gas - Natural Gas | $CH_4$ | 291.8 | 86.1 | 5% | 10% | 11% | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 |
| 1.B.2.c Fugitive Emissions from Fuels - Venting and flaring | $CO_2$ | 0.6 | 0.9 | 5% | 50% | 50% | 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 | 0.5 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| *IPCC Source category* | *Gas* | *Base year (1990) emissions* | *Emissions in 2024* | *Activity data uncertainty* | *Emission factor uncertainty* | *Combined uncertainty* | *Combined uncertainty as % of total national emissions in 2019* | *Type A sensitivity* | *Type B sensitivity* | *Uncertainty in trend in national emissions introduced by emission factor* | *Uncertainty in trend in national emissions introduced by* | *Uncertainty introduced into the trend in total* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *kt $CO_2$ eq.* | *kt $CO_2$ eq.* | *%* | *%* | *%* | *%* | *%* | *%* | *%* | *%* | *%* |
| 1.B.2.c Fugitive Emissions from Fuels - Venting and flaring | $N_2O$ | 0.0 | 0.0 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.A.1 Cement Production | $CO_2$ | 1,668.1 | 575.7 | 2% | 5% | 5% | 0.000 | 0.001 | 0.012 | 0.000 | 0.000 | 0.000 |
| 2.A.2 Lime Production | $CO_2$ | 210.3 | 1.8 | 5% | 5% | 7% | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.A.3 Glass Production | $CO_2$ | 11.7 | 7.0 | 7% | 5% | 9% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.A.4.a Ceramics | $CO_2$ | 227.9 | 0.0 | 5% | 5% | 7% | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.A.4.b Other use of soda ash | $CO_2$ | 5.2 | 0.6 | 15% | 5% | 16% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.A.4.d Mineral wool production | $CO_2$ | 6.4 | 9.4 | 7% | 5% | 9% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.B.1 Ammonia Production | $CO_2$ | 1,236.6 | 1,088.7 | 2% | 2% | 3% | 0.000 | 0.013 | 0.023 | 0.000 | 0.001 | 0.000 |
| 2.B.2 Nitric Acid Production | $N_2O$ | 794.1 | 144.8 | 2% | 10% | 10% | 0.000 | 0.003 | 0.003 | 0.000 | 0.000 | 0.000 |
| 2.B.8.a Methanol | $CO_2$ | 24.4 | 0.0 | 5% | 30% | 30% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.B.8.a Methanol | $CH_4$ | 5.9 | 0.0 | 5% | 30% | 30% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.C.1 Iron and Steel Production | $CO_2$ | 17.0 | 0.0 | 10% | 10% | 14% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.D.1 Lubricant use | $CO_2$ | 0.0 | 0.0 | 5% | 50% | 50% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.D.2 Parafin wax use | $CO_2$ | 6.9 | 19.9 | 5% | 100% | 100% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.D.3 Urea-based catalyst | $CO_2$ | 0.0 | 3.3 | 10% | 2% | 10% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.E.1 Semiconductor | SF6 | 0.0 | 3.0 | 5% | 5% | 7% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.E.3 Photovoltaics | NF3 | 0.0 | 0.0 | 5% | 20% | 21% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.F.1.a Commercial Refrigeration | HFCs | 0.0 | 147.3 | 20% | 50% | 54% | 0.000 | 0.003 | 0.003 | 0.002 | 0.001 | 0.000 |
| 2.F.1.b Domestic Refrigeration | HFCs | 0.0 | 2.3 | 20% | 50% | 54% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.F.1.c. Industrial Refrigeration | HFCs | 0.0 | 42.0 | 20% | 50% | 54% | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| 2.F.1.d. Transport Refrigeration | HFCs | 0.0 | 76.3 | 20% | 50% | 54% | 0.000 | 0.002 | 0.002 | 0.001 | 0.000 | 0.000 |
| 2.F.1.e. Mobile air-conditioning | HFCs | 0.0 | 152.7 | 20% | 50% | 54% | 0.000 | 0.003 | 0.003 | 0.002 | 0.001 | 0.000 |
| 2.F.1.f. Stationary Air Conditioning | HFCs | 0.0 | 34.1 | 20% | 50% | 54% | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| 2.F.2 Foam Blowing Agents | HFCs | 0.0 | 14.9 | 30% | 30% | 42% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.F.3 Fire Protection | HFCs | 0.0 | 4.0 | 20% | 20% | 28% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| IPCC Source category | Gas | Base year (1990) emissions | Emissions in 2024 | Activity data uncertainty | Emission factor uncertainty | Combined uncertainty | Combined uncertainty as % of total national emissions in 2019 | Type A sensitivity | Type B sensitivity | Uncertainty in trend in national emissions introduced by emission factor | Uncertainty in trend in national emissions introduced by | Uncertainty introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | kt $CO_2$ eq. | kt $CO_2$ eq. | % | % | % | % | % | % | % | % | % |
| 2.F.4 Aerosols/metered dose inhalers | HFCs | 0.0 | 8.3 | 5% | 5% | 7% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.G.1 Manufacture of electrical equipments | SF6 | 0.0 | 0.4 | 5% | 5% | 7% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.G.2.b Accelerators | SF6 | 0.0 | 0.1 | 5% | 5% | 7% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.G.3.a Medical applications | $N_2O$ | 85.4 | 3.6 | 5% | 5% | 7% | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2.G.3.b Propellant for pressure and aerosol products | $N_2O$ | 83.0 | 1.7 | 20% | 100% | 102% | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 |
| 3.A Enteric Fermentation | $CH_4$ | 4,879.6 | 1,718.8 | 4% | 25% | 26% | 0.001 | 0.003 | 0.036 | 0.001 | 0.002 | 0.000 |
| 3.B Manure Management | $CH_4$ | 750.4 | 246.1 | 14% | 11% | 18% | 0.000 | 0.001 | 0.005 | 0.000 | 0.001 | 0.000 |
| 3.B Manure Management | $N_2O$ | 497.9 | 140.5 | 27% | 203% | 204% | 0.000 | 0.001 | 0.003 | 0.002 | 0.001 | 0.000 |
| 3.D.1 Direct $N_2O$ Emissions From Managed Soils | $N_2O$ | 2,070.1 | 1,299.3 | 11% | 69% | 70% | 0.002 | 0.011 | 0.027 | 0.007 | 0.004 | 0.000 |
| 3.D.2 Indirect $N_2O$ Emissions From Managed Soils | $N_2O$ | 396.7 | 210.6 | 37% | 135% | 140% | 0.000 | 0.001 | 0.004 | 0.002 | 0.002 | 0.000 |
| 3.G Liming | $CO_2$ | 20.6 | 61.8 | 10% | 50% | 51% | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 |
| 3.H Urea Application | $CO_2$ | 59.6 | 21.7 | 10% | 50% | 51% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5.A Solid Waste Disposal | $CH_4$ | 1,152.3 | 538.3 | 10% | 125% | 125% | 0.001 | 0.002 | 0.011 | 0.003 | 0.002 | 0.000 |
| 5.B Biological Treatment of Solid Waste | $CH_4$ | 0.2 | 71.9 | 10% | 100% | 100% | 0.000 | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 |
| 5.B Biological Treatment of Solid Waste | $N_2O$ | 0.1 | 28.6 | 10% | 100% | 100% | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 |
| 5.C Incineration and Open Burning of Waste | $CO_2$ | 2.7 | 2.2 | 10% | 33% | 34% | 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 | 10% | 60% | 61% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5.C Incineration and Open Burning of Waste | $N_2O$ | 0.1 | 0.1 | 10% | 60% | 61% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5.D Wastewater Treatment and Discharge | $CH_4$ | 162.0 | 33.2 | 54% | 73% | 91% | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 |

| *IPCC Source category* | *Gas* | *Base year (1990) emissions* | *Emissions in 2024* | *Activity data uncertainty* | *Emission factor uncertainty* | *Combined uncertainty* | *Combined uncertainty as % of total national emissions in 2019* | *Type A sensitivity* | *Type B sensitivity* | *Uncertainty in trend in national emissions introduced by emission factor* | *Uncertainty in trend in national emissions introduced by* | *Uncertainty introduced into the trend in total national emissions* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ***kt $CO_2$ eq.*** | ***kt $CO_2$ eq.*** | ***%*** | ***%*** | ***%*** | ***%*** | ***%*** | ***%*** | ***%*** | ***%*** | ***%*** |
| 5.D Wastewater Treatment and Discharge | $N_2O$ | 22.9 | 6.5 | 20% | 50% | 54% | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Indirect emissions (2. Industrial processes and product use) | Indirect $CO_2$ | 34.3 | 36.8 | 30% | 20% | 36% | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| **Total emission** | | **47,577.1** | **18,257.8** | **Overall uncertainty (%)** | | | **7.2** | **Trend uncertainty (%)** | | | | **1.2** |

# ANNEX III. Lithuanian energy balance

**Table 3-1. Balance of crude oil, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | 502 | 5358 | 13491 | 9217 | 4909 | 3065 | 1313 | 1165 | 967 | 484 | 789 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | 396707 | 131189 | 199709 | 380035 | 385276 | 356108 | 331780 | 338910 | 347889 | 383804 | 378083 |
| Export | | | 335 | 13254 | 6312 | 4736 | 2067 | 1556 | 1131 | 965 | 1387 | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | 2093 | -4730 | -1169 | 9169 | -1081 | -1194 | 567 | -2332 | 1533 | 5464 | -1187 |
| **Gross consumption** | | **399302** | **131482** | **198777** | **392109** | **384368** | **355912** | **332104** | **336612** | **349424** | **388365** | **377685** |
| Statistical difference | | | -42 | | | | | | | | | |
| Transformed in power, heat and other plants: | | 399302 | 131440 | 198777 | 392101 | 384357 | 355912 | 332104 | 336612 | 349424 | 388365 | 377685 |
| - 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 | 332104 | 336612 | 349424 | 388365 | 377685 |
| 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | 87988 | 37709 | 68838 | 112699 | 123626 | 107664 | 95230 | 106842 | 107706 | 127730 | 123991 |
| Liquid biofuels for blending | | | | | 26 | 445 | 600 | 931 | 844 | 797 | 764 | 1085 |
| Import | | 220 | 14328 | 736 | 1115 | 2616 | 2881 | 2125 | 4375 | 1811 | 2106 | 1625 |
| Export | | 42104 | 23601 | 50765 | 95698 | 114237 | 101063 | 87753 | 101157 | 97886 | 115504 | 112344 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | -2725 | -1758 | -2012 | -3193 | 506 | -1256 | 96 | -226 | -572 | -1975 | -268 |
| **Gross consumption** | | **43379** | **26678** | **16797** | **14949** | **12956** | **8826** | **10629** | **10678** | **11856** | **13121** | **14089** |
| 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 | 1 | | | | |
| - in peat extraction enterprises | 1.A.1.c.i | | | | 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 | | | | | |
| Non energy use | | | | | | | | | | | | |
| Distribution and transmission losses* | | 308 | 176 | 68 | 61 | 22 | 5 | 4 | 2 | 4 | 3 | 2 |
| **Final consumption:** | | **43071** | **26502** | **16714** | **14883** | **12934** | **8819** | **10624** | **10676** | **11852** | **13118** | **14087** |
| - in industry | 1.A.2.g.vii | 44 | 88 | 48 | 31 | 15 | 8 | 13 | 8 | 14 | 14 | 14 |
| - in construction | 1.A.2.g.vii | 439 | 176 | 101 | 69 | 28 | 16 | 14 | 17 | 16 | 15 | 13 |
| - in transport***** | 1.A.3 | 41840 | 25887 | 16337 | 14711 | 12841 | 8761 | 10581 | 10629 | 11805 | 13064 | 14044 |
| - in agriculture | 1.A.4.c.ii | 440 | 307 | 170 | 53 | 43 | 28 | 12 | 18 | 14 | 22 | 14 |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | 1.A.4.a.ii | 308 | 44 | 58 | 19 | 7 | 6 | 4 | 4 | 3 | 3 | 2 |
| - in households | | | | | | | | | | | | |

**Table 3-3. Balance of aviation gasoline, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | | | | | | | |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | 14 | 20 | 18 | 19 | 18 | 18 | 17 | 22 | 9 |
| Export | | | | | | | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | | | | | | | | |
| **Gross consumption** | | | | **14** | **20** | **18** | **19** | **18** | **18** | **17** | **22** | **9** |
| 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** | **18** | **18** | **17** | **22** | **9** |
| - in industry | | | | | | | | | | | | |
| - in construction | | | | | | | | | | | | |
| - in transport | 1.A.3 | | | 14 | 20 | 18 | 19 | 18 | 18 | 17 | 22 | 9 |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | | | | | | | | | | | | |
| - in households | | | | | | | | | | | | |

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

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | 28125 | 9088 | 18566 | 24705 | 10352 | 7780 | 6732 | 9304 | 7689 | 9568 | 9766 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | 387 | 948 | 846 | | 837 | 2244 | | 5 | 141 | | |
| Export | | 22956 | 8442 | 16673 | 21406 | 9062 | 6113 | 4455 | 5959 | 3310 | 4515 | 4701 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | 86 | 129 | -1651 | -1185 | 115 | 10 | 386 | -371 | 152 | -21 | 158 |
| **Gross consumption** | | **5642** | **1723** | **1088** | **2114** | **2242** | **3921** | **2663** | **2979** | **4672** | **5032** | **5223** |
| 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** | **2663** | **2979** | **4672** | **5032** | **5223** |
| - in industry | | | | | | | | | | | | |
| - in construction | | | | | | | | | | | | |
| - in transport | 1.A.3 | 5642 | 1723 | 1088 | 2100 | 2237 | 3921 | 2663 | 2979 | 4672 | 5032 | 5223 |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | | | | | | | | | | | | |
| - in households | | | | | | | | | | | | |

**Table 3-6. Balance of transport diesel, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | 107712 | 42490 | 56232 | 127985 | 150168 | 156249 | 135526 | 126772 | 137435 | 153053 | 146751 |
| Liquid biofuels for blending | | | | | 119 | 1478 | 2393 | 3777 | 4122 | 3626 | 3430 | 4336 |
| Import | | 8923 | 9475 | 1670 | 2840 | 7882 | 68750 | 23206 | 26570 | 30109 | 19262 | 13002 |
| Export | | 49416 | 27364 | 28516 | 92877 | 116251 | 169375 | 85924 | 83679 | 99680 | 103851 | 88408 |
| International marine bunkers | | | | 942 | | | | | | | | |
| Changes in stocks | | -1997 | 1573 | -4819 | -2586 | 31 | -768 | -3894 | -243 | 141 | -24 | 390 |
| **Gross consumption** | | **65222** | **26174** | **23625** | **35481** | **43308** | **57249** | **72691** | **73542** | **71631** | **71327** | **76071** |
| 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 | 177 | 140 | 95 | 107 | 111 |
| - in peat extraction enterprises | 1.A.1.c.i | 128 | 43 | 60 | 125 | 109 | 153 | 172 | 136 | 91 | 103 | 106 |
| - in crude oil extraction enterprises | 1.A.1.c.ii | | | 22 | 49 | 23 | 13 | | | | | |
| - 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 | 5 | 4 | 4 | 4 | 4 |
| Non energy use | 1.AD | | | 6 | | | | | | | | |
| Distribution and transmission losses* | | 297 | 128 | 55 | 122 | 73 | 22 | 13 | 9 | 12 | 10 | 11 |
| **Final consumption:** | | **57276** | **24474** | **24245** | **35165** | **43091** | **57053** | **72501** | **73393** | **71524** | **71753** | **75949** |
| - in industry | 1.A.2.g.vii | 2124 | 1827 | 510 | 499 | 190 | 248 | 309 | 305 | 323 | 369 | 502 |
| - in construction | 1.A.2.g.vii | 2507 | 935 | 613 | 589 | 382 | 320 | 266 | 217 | 212 | 224 | 250 |
| - in transport***** | 1.A.3 | 34289 | 14489 | 21476 | 32515 | 41030 | 55021 | 70436 | 71274 | 69452 | 69751 | 66247 |
| - in agriculture | 1.A.4.c.ii | 14277 | 4207 | 1327 | 1362 | 1444 | 1438 | 1437 | 1530 | 1485 | 1350 | 8848 |
| - in fishing | 1.A.4.c.iii | | | | 14 | 5 | 6 | 7 | 8 | 6 | 5 | 5 |
| - in commercial / public services | 1.A.4.a.ii | 2889 | 2804 | 319 | 186 | 40 | 20 | 46 | 59 | 46 | 54 | 97 |
| - in households | 1.A.4.b.ii | 1190 | 212 | | | | | | | | | |

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

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | 2125 | 1130 | 4777 | 6740 | 8357 | 8141 | 6545 | 6146 |
| Liquid biofuels for blending | | | | | | 2 | 73 | 99 | 179 | 78 | 72 | 74 |
| Import | | | 717 | | 915 | 854 | 701 | 848 | 1214 | 731 | 261 | 111 |
| Export | | | | | 985 | | 206 | 35 | 523 | 703 | 790 | 774 |
| International marine bunkers | | | | | 770 | 756 | 1738 | 3206 | 4480 | 3200 | 1935 | 1637 |
| Changes in stocks | | | -717 | 65 | -225 | -7 | -61 | 92 | 51 | -240 | 76 | -8 |
| **Gross consumption** | | | | **65** | **1060** | **1223** | **3546** | **4538** | **4798** | **4807** | **4229** | **3912** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | | | 22 | 102 | 55 | 38 | 26 | 107 | 344 | 274 | 141 |
| - in public CHP plants | 1.A.1.a ii | | | | | 1 | | | | 15 | | 3 |
| - in autoproducer CHP plants | | | | | | | | 2 | | 16 | | |
| - in public heat plants | 1.A.1.a iii | | | 22 | 64 | 52 | 37 | 24 | 107 | 275 | 264 | 138 |
| - in autoproducer heat plants | 1.A.1.a iii | | | | 38 | 2 | 1 | | | 38 | 10 | |
| - in geothermal plants | | | | | | | | | | | | |
| - in other industries | | | | | | | | | | | | |
| Consumed in energy sector: | | | | | | 5 | 4 | | | | | |
| - in peat extraction enterprises | 1.A.1.c.i | | | | | 5 | 4 | | | | | |
| - in crude oil extraction enterprises | | | | | | | | | | | | |
| - in refineries | | | | | | | | | | | | |
| - in electricity, gas, steam and air conditioning enterprises | 1.A.1.c.ii | | | | | | | | | | | |
| Non energy use | | | | | | | | | | | | |
| Distribution and transmission losses | | | | | | | | | | | | |
| **Final consumption:** | | | | **43** | **958** | **1163** | **3504** | **4512** | **4691** | **4463** | **3955** | **3771** |
| - in industry | 1.A.2 | | | 7 | 405 | 220 | 228 | 328 | 378 | 483 | 433 | 399 |
| - in construction | 1.A.2.g.v | | | 7 | 25 | 47 | 67 | 64 | 75 | 216 | 149 | 123 |
| - in transport***** | 1.A.3 | | | | 226 | 235 | 2413 | 2475 | 2438 | 1352 | 1350 | 1300 |
| - in agriculture | 1.A.4.c.i | | | 23 | 137 | 230 | 264 | 672 | 671 | 1085 | 739 | 774 |
| - in fishing | 1.A.4.c.i | | | | 59 | 73 | 76 | 21 | 26 | 23 | 18 | 9 |
| - in commercial / public services | 1.A.4.a | | | 6 | 55 | 69 | 48 | 29 | 33 | 35 | 37 | 22 |
| - in households | 1.A.4.b | | | | 51 | 289 | 408 | 923 | 1070 | 1269 | 1229 | 1144 |

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

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | 12006 | 7636 | 11026 | 21046 | 12720 | 12155 | 13767 | 13422 | 10617 | 12877 | 13354 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | 2208 | 1056 | 3972 | 3110 | 5024 | 4882 | 2387 | 2553 | 5979 | 6557 | 5705 |
| Export | | 7038 | 4646 | 5793 | 11596 | 8114 | 9662 | 10111 | 10268 | 9915 | 12587 | 12135 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | 46 | 230 | -420 | 163 | -111 | 31 | -8 | 31 | -585 | 568 | -55 |
| **Gross consumption** | | **7222** | **4276** | **8785** | **12723** | **9519** | **7406** | **6035** | **5738** | **6096** | **7415** | **6869** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | 46 | | 51 | 90 | 90 | 81 | 83 | 100 | 92 | 108 | 50 |
| - 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 | 43 | 45 | 78 | 91 | 47 |
| - in autoproducer heat plants | 1.A.1.a iii | 46 | | 31 | 71 | 69 | 45 | 40 | 55 | 14 | 17 | 3 |
| - 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 | 24 | 21 | 30 | 19 | 17 |
| **Final consumption:** | | **6302** | **4046** | **8595** | **12580** | **9403** | **7311** | **5928** | **5617** | **5974** | **7288** | **6802** |
| - in industry | 1.A.2 | | | 201 | 229 | 273 | 326 | 281 | 335 | 529 | 841 | 650 |
| - in construction | 1.A.2.g.v | 92 | 46 | 74 | 77 | 122 | 38 | 72 | 58 | 62 | 80 | 82 |
| - in transport | 1.A.3 | 920 | 1058 | 5032 | 9593 | 7275 | 5573 | 4058 | 3867 | 3872 | 3944 | 4097 |
| - in agriculture | 1.A.4.c.i | 230 | 46 | 19 | 38 | 41 | 54 | 150 | 202 | 196 | 194 | 136 |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | 1.A.4.a | 460 | 92 | 62 | 23 | 6 | 20 | 30 | 35 | 18 | 36 | 17 |
| - in households | 1.A.4.b | 4600 | 2804 | 3207 | 2620 | 1686 | 1300 | 1337 | 1120 | 1297 | 2193 | 1820 |

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

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | 133867 | 33356 | 39422 | 71994 | 65373 | 60871 | 44554 | 45303 | 43460 | 36393 | 38111 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | 293464 | 47887 | 4110 | 5056 | 7883 | 1377 | 2707 | 2795 | 3272 | 3190 | 1654 |
| Export | | 277769 | 8148 | 16608 | 56627 | 60139 | 57774 | 41314 | 42681 | 41872 | 34684 | 38447 |
| International marine bunkers | | 3894 | 5780 | 2857 | 4712 | 2801 | 1255 | 2700 | 2697 | 2779 | 2673 | |
| Changes in stocks | | -8951 | -11159 | -4689 | -1824 | -3450 | 926 | -1074 | -1446 | 882 | -439 | 714 |
| **Gross consumption** | | **136717** | **56156** | **19378** | **13887** | **6866** | **4145** | **2173** | **1274** | **2963** | **1787** | **2032** |
| Statistical difference | | | 40 | 5592 | | | | | | | | |
| Transformed in power, heat and other plants: | | 70406 | 39377 | 14650 | 5536 | 4648 | 1634 | 516 | 1249 | 1100 | 428 | 311 |
| - in public CHP plants | 1.A.1.a ii | 44195 | 20511 | 7233 | 3837 | 4157 | 493 | | | | | |
| - in autoproducer CHP plants | 1.A.1.a ii | 642 | 201 | 27 | | | 1115 | 495 | 185 | 1100 | 410 | 283 |
| - in public heat plants | 1.A.1.a iii | 20190 | 16618 | 6813 | 1659 | 491 | 26 | 21 | 18 | | 18 | 28 |
| - 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 | 1630 | 1046 | 1847 | 1352 | 1706 |
| - in peat extraction enterprises | | | | | | | | | | | | |
| - in crude oil extraction enterprises | | | | | | | | | | | | |
| - in refineries | 1.A.1.b | 8068 | 3693 | 4899 | 6716 | 2005 | 2444 | 1628 | 1046 | 1847 | 1352 | 1706 |
| - in electricity, gas, steam and air conditioning enterprises | | | | | | | | 2 | | | | |
| Non energy use | | | | | | | | | | | | |
| Distribution and transmission losses* | | 361 | | | 38 | | | | | | | |
| **Final consumption:** | | **57882** | **13126** | **5421** | **1597** | **213** | **67** | **27** | **25** | **16** | **7** | **15** |
| - in industry | 1.A.2 | 43993 | 11520 | 5202 | 1486 | 148 | 67 | 27 | 25 | 16 | 7 | 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | 4306 | 267 | 217 | 255 | 249 | 79 | -2 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | 1407 | 1191 | 2779 | 516 | 1728 | 715 | 1709 | 1783 | |
| Export | | | | | 23 | 40 | 10 | 27 | 59 | 89 | 50 | 1 |
| International marine bunkers | | | | 29 | 451 | 2224 | 203 | 1738 | 709 | 440 | 400 | |
| Changes in stocks | | | | 56 | -60 | -308 | 196 | 250 | 420 | -202 | 283 | 76 |
| **Gross consumption** | | | | **1434** | **657** | **4513** | **766** | **430** | **622** | **1227** | **1695** | **73** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | | | 755 | 328 | 1232 | 436 | 159 | 426 | 1213 | 1685 | 73 |
| - in public CHP plants | 1.A.1.a ii | | | | | 18 | 348 | 136 | 212 | 989 | 1598 | |
| - in autoproducer CHP plants | 1.A.1.a ii | | | | | 1017 | | | | | | |
| - in public heat plants | 1.A.1.a iii | | | 713 | 318 | 197 | 87 | 23 | 214 | 224 | 87 | 73 |
| - 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 | | | | | | | | | 12 | | | |
| **Final consumption:** | | | | **679** | **329** | **239** | **330** | **271** | **184** | **14** | **10** | |
| - in industry | 1.A.2 | | | 363 | 220 | 147 | 275 | 253 | 174 | 14 | 10 | |
| - in construction | 1.A.2.g.v | | | 47 | 93 | 75 | 35 | 8 | 6 | | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | 1.A.4.c.i | | | 15 | 2 | 5 | 17 | 10 | 4 | | | |
| - in fishing | 1.A.4.c.i | | | | 9 | | | | | | | |
| - in commercial / public services | 1.A.4.a | | | 254 | 5 | 12 | 3 | | | | | |
| - in households | | | | | | | | | | | | |

**Table 3-11. Balance of refinery gas, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | 11032 | 5318 | 8253 | 15250 | 14127 | 14007 | 11148 | 12763 | 13979 | 17008 | 15804 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | | | | | | | |
| Export | | | | | | | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | | | | | | | | |
| **Gross consumption** | | **11032** | **5318** | **8253** | **15250** | **14127** | **14007** | **11148** | **12763** | **13979** | **17008** | **15804** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | | | | | 109 | 175 | 228 | 364 | 1041 | 869 | 524 |
| - in public CHP plants | | | | | | | | | | | | |
| - in autoproducer CHP plants | 1.A.1.a ii | | | | | | 175 | 228 | 364 | 1041 | 869 | 524 |
| - 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 | 10920 | 12399 | 12938 | 16139 | 15280 |
| - in peat extraction enterprises | | | | | | | | | | | | |
| - in crude oil extraction enterprises | | | | | | | | | | | | |
| - in refineries | 1.A.1.b | 11032 | 5318 | 8253 | 15250 | 14018 | 13832 | 10920 | 12399 | 12938 | 16139 | 15280 |
| - 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | 9534 | 1108 | 3117 | 6804 | 4938 | 5449 | 14289 | 11618 | 11843 | 19034 | 18288 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | 40 | 791 | 474 | 1150 | 1814 | 1812 | 3658 | 2442 | 1888 | 1403 | 1466 |
| Export | | 1662 | 356 | 839 | 2587 | 2896 | 3506 | 11449 | 8236 | 10102 | 14567 | 13435 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | 40 | 39 | 71 | 28 | -165 | -143 | -112 | -153 | 165 | 55 | -35 |
| **Gross consumption** | | **7952** | **1582** | **2823** | **5395** | **3691** | **3612** | **6386** | **5671** | **3794** | **5925** | **6284** |
| 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 | 6386 | 5671 | 3794 | 5925 | 6284 |
| 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | 1226 | 847 | 1504 | 1931 | 3506 | 4246 | 4150 | 4176 | 4148 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | 413 | 620 | 602 | 1121 | 1709 | 1655 | 1489 | 1616 | 2177 | 1951 | 1583 |
| Export | | | | 924 | 843 | 2350 | 2781 | 4053 | 4884 | 5548 | 5162 | 4950 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | 129 | -14 | -17 | 3 | 4 | 53 | -88 | -167 | 273 |
| **Gross consumption** | | **413** | **620** | **1033** | **1111** | **846** | **808** | **946** | **1031** | **691** | **798** | **1054** |
| 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 | 946 | 1031 | 691 | 798 | 1054 |
| 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | 1962 | 1393 | 2740 | 3940 | 3856 | 3745 | 3340 | 3626 | 3423 | 3750 | 3556 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | 1100 | 9 | | | | | | |
| Export | | | | | | | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | -1054 | 102 | | | | | | |
| **Gross consumption** | | **1962** | **1393** | **2740** | **3986** | **3967** | **3745** | **3340** | **3626** | **3423** | **3750** | **3556** |
| 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 | 3340 | 3626 | 3423 | 3750 | 3556 |
| - in peat extraction enterprises | | | | | | | | | | | | |
| - in crude oil extraction enterprises | | | | | | | | | | | | |
| - in refineries | 1.A.1.b | 1962 | 1393 | 2740 | 3940 | 3856 | 3745 | 3340 | 3626 | 3423 | 3750 | 3556 |
| - 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | 8513 | 418 | 1827 | | 640 | 1374 | | | | |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | 1304 | 17209 | 13934 | 3568 | 12171 | 24815 | 7923 | 9439 | 9712 | 5724 | 5459 |
| Export | | | | | | | 33 | | | 57 | 25 | 3 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | -1220 | -8470 | 213 | -1121 | 614 | -1420 | -1592 | 762 | -947 | 454 | 1576 |
| **Gross consumption** | | **84** | **17252** | **14565** | **4274** | **12785** | **24002** | **7705** | **9340** | **9450** | **5806** | **5603** |
| Statistical difference | | | -43 | | | | | | | | | |
| Transformed in power, heat and other plants: | | 84 | 17209 | 14565 | 4274 | 12785 | 24002 | 7705 | 9340 | 9450 | 5806 | 5603 |
| - 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 | 7705 | 9340 | 9450 | 5806 | 5603 |
| 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | 3477 | | | | 31 | 5110 | 644 | 286 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | | | | | | | |
| Export | | | | | 3257 | | | | 31 | 5099 | 655 | 300 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | -220 | | | | | -11 | 11 | 14 |
| **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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | | | | | | | |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | 31752 | 6506 | 176 | 53 | 4343 | 5701 | 4420 | 5653 | 7400 | 2902 | 3265 |
| Export | | | 50 | | | 438 | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | 980 | 2889 | | | -275 | 640 | 674 | 545 | -1799 | 434 | -101 |
| **Gross consumption** | | **32732** | **9345** | **176** | **53** | **3630** | **6341** | **5094** | **6198** | **5601** | **3336** | **3164** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | 1834 | 452 | 25 | 53 | 55 | 88 | 56 | 61 | 54 | 36 | 17 |
| - in public CHP plants | | | | | | | | | | | | |
| - in autoproducer CHP plants | | | | | | | | | | | | |
| - in public heat plants | 1.A.1.a iii | 904 | 126 | 25 | 53 | 32 | 88 | 56 | 61 | 54 | 36 | 17 |
| - 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 | | | | 10 | | | | | |
| **Final consumption:** | | **30898** | **8843** | **151** | | **3575** | **6243** | **5038** | **6137** | **5547** | **3300** | **3147** |
| - in industry | 1.A.2 | 1583 | 703 | 137 | | 2860 | 3602 | 3169 | 3859 | 4011 | 2608 | 2269 |
| - in construction | 1.A.2.g.v | 226 | 25 | 14 | | | 6 | 3 | 3 | 2 | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | 1.A.4.c.i | 1557 | 50 | | | 3 | 86 | 48 | 35 | 72 | 15 | 24 |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | 1.A.4.a | 12359 | 6632 | | | 406 | 1089 | 786 | 973 | 358 | 101 | 163 |
| - in households | 1.A.4.b | 15173 | 1433 | | | 305 | 1460 | 1032 | 1267 | 1104 | 576 | 691 |

**Table 3-20. Balance of anthracite, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | | | | | | | |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | 100 | | 90 | | | | | | |
| Export | | | | | | 1 | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | | -74 | | | | | | |
| **Gross consumption** | | | | **100** | | **15** | | | | | | |
| 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** | | | | | | |
| - in industry | 1.A.2 | | | | | 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | | | | | | | |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | 2698 | 6618 | 3248 | | | | 575 | 394 | |
| Export | | | | | 37 | 406 | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | 11 | -168 | 672 | 1 | 4 | | -47 | 13 | 34 |
| **Gross consumption** | | | | **2709** | **6413** | **3514** | **1** | **4** | | **528** | **407** | **34** |
| 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** | | **4** | | **528** | **407** | **34** |
| - in industry | 1.A.2 | | | 5 | 3059 | 207 | | | | | | |
| - 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 | | 528 | 407 | 34 |
| - in households | 1.A.4.b | | | 651 | 1048 | 1772 | | | | | | |

**Table 3-22. Balance of coke, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | | | | | | | |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | 445 | 440 | 466 | 391 | 533 | 504 | 446 | 416 | 438 |
| Export | | | | | | | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | -52 | 96 | 7 | 8 | 2 | -1 | 12 | -27 | 14 |
| **Gross consumption** | | | | **393** | **536** | **473** | **399** | **535** | **503** | **458** | **389** | **452** |
| 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** | **535** | **503** | **458** | **389** | **452** |
| - in industry | 1.A.2 | | | 346 | 534 | 473 | 399 | 535 | 503 | 458 | 389 | 452 |
| - in construction | | | | | | | | | | | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | | | | | | | | | | | | |
| - in households | | | | | | | | | | | | |

**Table 3-23. Balance of lignite, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | | | | | | | |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | 15 | 40 | 14 | | | | 25 | 26 | 19 |
| Export | | | | | | | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | 1 | 2 | -6 | 1 | | | | | |
| **Gross consumption** | | | | **16** | **42** | **8** | **1** | | | **25** | **26** | **19** |
| 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 | | | | | | | | | | 25 | 26 | 19 |
| Distribution and transmission losses | | | | | | | | | | | | |
| **Final consumption:** | | | | **16** | **42** | **8** | **1** | | | | | |
| - in industry | | | | | | | | | | | | |
| - in construction | | | | | | | | | | | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | 1.A.4.a | | | 16 | 25 | | | | | | | |
| - in households | 1.A.4.b | | | | 17 | 8 | 1 | | | | | |

**Table 3-24. Balance of peat, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | 580 | 600 | 494 | 825 | 364 | 872 | 207 | 197 | 141 | 204 | 53 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | | | | | 5 | | |
| Export | | | | 76 | 1 | 104 | 94 | 12 | 21 | 14 | 8 | 3 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | 116 | 222 | 51 | -235 | 94 | -510 | 40 | 96 | 170 | 13 | 85 |
| **Gross consumption** | | **696** | **822** | **469** | **589** | **354** | **268** | **235** | **272** | **302** | **209** | **135** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | 445 | 357 | 258 | 299 | 202 | 141 | 185 | 229 | 275 | 172 | 121 |
| - in public CHP plants | | | | | | | | | | | | |
| - in autoproducer CHP plants | | | | | | | | | | | | |
| - in public heat plants | 1.A.1.a iii | 67 | 96 | 80 | 128 | 102 | 67 | 139 | 179 | 118 | 76 | 83 |
| - in autoproducer heat plants | 1.A.1.a iii | 39 | 10 | 14 | | | | | | | | |
| - in geothermal plants | | | | | | | | | | | | |
| - in other industries | | 339 | 251 | 163 | 171 | 100 | 74 | 46 | 50 | 157 | 96 | 38 |
| Consumed in energy sector: | | | 126 | 36 | 11 | | 3 | 1 | 3 | 1 | 2 | |
| - in peat extraction enterprises | 1.A.c.i | | | 20 | 11 | | 3 | 1 | 3 | 1 | 2 | |
| - 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 | | | 2 | | | | |
| **Final consumption:** | | **242** | **329** | **170** | **272** | **152** | **124** | **47** | **40** | **26** | **35** | **14** |
| - in industry | 1.A.2 | 155 | 174 | 43 | 7 | 9 | 33 | | | | | |
| - in construction | | | | | | | | | | | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | 1.A.4.a | 87 | 58 | | 21 | 44 | 51 | 31 | 28 | 17 | 23 | 8 |
| - in households | 1.A.4.b | | 97 | 127 | 244 | 99 | 40 | 16 | 12 | 9 | 12 | 6 |

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

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | 239 | 186 | 138 | 147 | 84 | 63 | 39 | 43 | 135 | 80 | 34 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | 119 | 2 | 143 | 696 | 604 | 513 | 681 | 768 | 480 | 265 |
| Export | | | | | | | 26 | 4 | 8 | 93 | 35 | 17 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | -53 | -13 | -1 | -35 | -44 | 9 | 16 | -27 | 5 | -1 | 24 |
| **Gross consumption** | | **186** | **292** | **139** | **255** | **736** | **650** | **564** | **689** | **815** | **524** | **306** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | | | | 9 | 3 | | 3 | 2 | 3 | | |
| - in public CHP plants | | | | | | | | | | | | |
| - in autoproducer CHP plants | | | | | | | | | | | | |
| - in public heat plants | 1.A.1.a iii | | | | 2 | 1 | | 3 | 2 | 3 | | |
| - in autoproducer heat plants | 1.A.1.a iii | | | | 7 | 2 | | | | | | |
| - in geothermal plants | | | | | | | | | | | | |
| - in other industries | | | | | | | | | | | | |
| Consumed in energy sector: | | | | 2 | | | | | 3 | 1 | 1 | |
| - in peat extraction enterprises | 1.A.c.i | | | 2 | | | | | 3 | 1 | 1 | |
| - in crude oil extraction enterprises | | | | | | | | | | | | |
| - in refineries | | | | | | | | | | | | |
| - in electricity, gas, steam and air conditioning enterprises | | | | | | | | | | | | |
| Non energy use | | | | | | | | | | | | |
| Distribution and transmission losses** | | | | | | | | | | | | |
| **Final consumption:** | | **186** | **293** | **137** | **246** | **733** | **650** | **561** | **684** | **811** | **523** | **306** |
| - in industry | 1.A.2 | 13 | 53 | | 8 | 27 | 16 | 4 | 3 | 1 | | |
| - in construction | | | | | | | | | | | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | 1.A.4.c.i | | | | 3 | 16 | 13 | 7 | 12 | 19 | 8 | 4 |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | 1.A.4.a | 27 | 53 | 1 | 28 | 193 | 173 | 136 | 170 | 235 | 206 | 132 |
| - in households | 1.A.4.b | 146 | 186 | 136 | 207 | 497 | 448 | 414 | 499 | 556 | 309 | 170 |

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

| | **CRT** | **1990** | **1995** | **2000** | **2005** | **2010** | **2015** | **2020** | **2021** | **2022** | **2023** | **2024** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | | | | | | | |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | 176 | 520 | 1776 | 608 | 607 | 674 | 485 | 126 |
| Export | | | | | 106 | 384 | 1427 | 538 | 394 | 491 | 208 | 112 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | | 3 | -202 | 75 | 17 | 4 | -61 | 62 |
| **Gross consumption** | | | | | **70** | **139** | **147** | **145** | **230** | **187** | **216** | **76** |
| 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 | 145 | 230 | 187 | 216 | 76 |
| 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | | | | | | | |
| Injected to the natural gas network | | | | | | | | | | | 152 | 411 |
| Import | | 201957 | 84929 | 86453 | 104363 | 104017 | 89642 | 99751 | 83854 | 123951 | 116239 | 94859 |
| Export | | 6102 | | | | | 3335 | 18080 | 4651 | 69647 | 66105 | 38024 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | -37 | -671 | 304 | 255 | 884 | -647 | -652 | 2113 | 464 |
| **Gross consumption** | | **195855** | **84929** | **86416** | **103692** | **104321** | **86562** | **82555** | **78556** | **53652** | **52399** | **57710** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | 105124 | 41480 | 47241 | 57134 | 58186 | 24104 | 16417 | 16209 | 7945 | 7866 | 9122 |
| - in public CHP plants | 1.A.1.a ii | 62825 | 17664 | 29650 | 42536 | 45755 | 17354 | 11960 | 10694 | 4474 | 4197 | 5578 |
| - in autoproducer CHP plants | 1.A.1.a ii | 1787 | 473 | 324 | 1160 | 1003 | 1970 | 2072 | 1572 | 986 | 1114 | 1019 |
| - in public heat plants | 1.A.1.a iii | 34248 | 21952 | 16272 | 11414 | 10525 | 4357 | 2052 | 3631 | 2232 | 2286 | 2136 |
| - in autoproducer heat plants | 1.A.1.a iii | 6265 | 1391 | 688 | 667 | 558 | 327 | 333 | 312 | 253 | 269 | 389 |
| - in geothermal plants | 1.A.1.a iii | | | | 819 | 345 | 96 | | | | | |
| - in other industries | 1.AD | | | 307 | 538 | | | | | | | |
| Consumed in energy sector: | | | | 140 | 130 | 65 | 1298 | 3823 | 2160 | 1167 | 770 | 665 |
| - in peat extraction enterprises | | | | | | | | | | | | |
| - in crude oil extraction enterprises | 1.A.1.c.ii | | | 3 | 3 | 3 | 2 | 1 | | | | |
| - in refineries | 1.A.1.b | | | 28 | 28 | 4 | 15 | 2869 | 1577 | 359 | 212 | 211 |
| - in electricity, gas, steam and air conditioning enterprises | 1.A.1.c.ii | | | 109 | 99 | 58 | 1281 | 953 | 583 | 808 | 558 | 454 |
| Non energy use | 1.AD | 26934 | 20167 | 22716 | 21335 | 20139 | 39432 | 37913 | 33059 | 20012 | 19792 | 23556 |
| Distribution and transmission losses*** | | 1688 | 1935 | 1119 | 420 | 5 | | | | | 3 | 32 |
| **Final consumption:** | | **62109** | **21347** | **15200** | **24673** | **25926** | **21728** | **24402** | **27128** | **24528** | **23968** | **24335** |
| - in industry | 1.A.2 | 36065 | 8916 | 8285 | 14573 | 13670 | 11417 | 11439 | 11887 | 10507 | 9811 | 10261 |
| - in construction | 1.A.2.g.v | 1030 | 219 | 266 | 513 | 501 | 477 | 712 | 725 | 665 | 639 | 638 |
| - in transport | 1.A.3 | | | | 647 | 1028 | 1250 | 1198 | 1286 | 1226 | 1221 | 1164 |
| - in agriculture | 1.A.4.c.i | 2946 | 1197 | 991 | 1192 | 1309 | 872 | 849 | 989 | 850 | 845 | 837 |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | 1.A.4.a | 12831 | 3319 | 1302 | 2118 | 2793 | 2575 | 2904 | 3034 | 3009 | 3842 | 3832 |
| - in households | 1.A.4.b | 9237 | 7696 | 4356 | 5630 | 6625 | 5137 | 7300 | 9207 | 8271 | 7610 | 7603 |

**Table 3-28. Balance of charcoal, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | 18 | 24 | 26 | 15 | 8 | | | |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | 14 | 61 | 210 | 198 | 200 | 156 | 188 | 182 |
| Export | | | | | 15 | 38 | 163 | 98 | 86 | 40 | 40 | 57 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | 3 | 1 | -7 | -7 | 39 | -5 | | 10 |
| **Gross consumption** | | | | | **20** | **48** | **66** | **108** | **161** | **111** | **148** | **135** |
| 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** | **108** | **161** | **111** | **148** | **135** |
| - in industry | | | | | | | | | | | | |
| - in construction | | | | | | | | | | | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | 1.A.4.a | | | | 20 | 48 | 66 | 108 | 161 | 111 | 148 | 135 |
| - in households | | | | | | | | | | | | |

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

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | 11930 | 19632 | 27324 | 35293 | 41734 | 49852 | 51852 | 56892 | 52650 | 52081 | 56000 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | 61 | 4 | 727 | 2008 | 5628 | 6214 | 6502 | 5227 | 5589 | 4509 |
| Export | | | | 255 | 710 | 5102 | 5725 | 5751 | 5795 | 5321 | 5456 | 4534 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | -14 | -381 | -54 | -498 | 444 | 457 | 420 | 673 | 164 | 287 | 328 |
| **Gross consumption** | | **11916** | **19312** | **27019** | **34812** | **39084** | **50212** | **52735** | **58272** | **52720** | **52501** | **56303** |
| Statistical difference | | | | | 457 | | | | | | | |
| Transformed in power, heat and other plants: | | 527 | 558 | 1640 | 6273 | 10408 | 24371 | 26456 | 31739 | 27356 | 27753 | 28809 |
| - in public CHP plants | 1.A.1.a ii | | | | 191 | 2472 | 6365 | 7665 | 7881 | 7629 | 8047 | 11526 |
| - in autoproducer CHP plants | | | | | | | | | | | | |
| - in public heat plants | 1.A.1.a iii | 274 | 156 | 1060 | 4906 | 7121 | 16987 | 16041 | 21496 | 17340 | 18053 | 16289 |
| - in autoproducer heat plants | 1.A.1.a iii | 253 | 402 | 580 | 1128 | 772 | 980 | 2750 | 2351 | 2387 | 1653 | 994 |
| - in geothermal plants | | | | | | | | | | | | |
| - in other industries | | | | | 48 | 43 | 39 | 27 | 11 | | | |
| Consumed in energy sector: | | | | 25 | 13 | 19 | 2 | | | | | |
| - 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 | | | | | |
| Non energy use | | | | | | | | | | | | |
| Distribution and transmission losses | | | | 12 | 4 | | | | | | | |
| **Final consumption:** | | **11389** | **18754** | **25342** | **28979** | **28657** | **25839** | **26252** | **26533** | **25364** | **24748** | **27494** |
| - in industry | 1.A.2 | 453 | 756 | 1218 | 4007 | 2920 | 3520 | 4944 | 5138 | 4921 | 5086 | 5331 |
| - in construction | 1.A.2.g.v | 51 | 105 | 100 | 185 | 143 | 62 | 91 | 88 | 84 | 90 | 103 |
| - in transport | | | | | | | | | | | | |
| - in agriculture | 1.A.4.c.i | 187 | 211 | 272 | 253 | 399 | 383 | 674 | 724 | 714 | 699 | 739 |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | 1.A.4.a | 1699 | 1104 | 1703 | 1278 | 1178 | 1332 | 1273 | 1230 | 1195 | 1243 | 1231 |
| - in households | 1.A.4.b | 8999 | 16578 | 22049 | 23256 | 24017 | 20542 | 19270 | 19353 | 18450 | 17630 | 20090 |

**Table 3-30. Balance of agricultural waste, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | 96 | 228 | 585 | 608 | 577 | 528 | 479 | 395 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | | 10 | 10 | | 3 | 2 | 12 |
| Export | | | | | | | 386 | 423 | 417 | 323 | 276 | 186 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | 16 | 11 | -31 | 2 | 23 | 15 | -35 | -19 |
| **Gross consumption** | | | | | **112** | **239** | **178** | **197** | **183** | **223** | **170** | **202** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | | | | 64 | 144 | 68 | 66 | 64 | 88 | 52 | 70 |
| - in public CHP plants | | | | | | | | | | | | |
| - in autoproducer CHP plants | | | | | | | | | | | | |
| - in public heat plants | 1.A.1.a iii | | | | 55 | 131 | 68 | 66 | 64 | 88 | 52 | 70 |
| - 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** | **131** | **119** | **135** | **118** | **132** |
| - in industry | 1.A.2 | | | | 41 | 11 | 16 | 61 | 71 | 75 | 69 | 76 |
| - in construction | | | | | | | | | | | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | 1.A.4.c.i | | | | 2 | 56 | 73 | 47 | 25 | 31 | 29 | 33 |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | 1.A.4.a | | | | | 18 | 20 | 23 | 23 | 29 | 20 | 23 |
| - in households | 1.A.4.b | | | | 5 | 7 | 1 | | | | | |

**Table 3-31. Balance of bioethanol, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | 195 | 1060 | 470 | 854 | 597 | 475 | 379 | 525 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | 106 | 269 | 257 | 438 | 458 | 619 | 748 |
| Export | | | | | 162 | 649 | 308 | 445 | 338 | 140 | 140 | 323 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | -7 | -3 | 11 | -7 | -5 | 32 | -1 | |
| **Gross consumption** | | | | | **26** | **514** | **442** | **659** | **692** | **825** | **857** | **950** |
| 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** | **659** | **692** | **825** | **857** | **950** |
| - in industry | | | | | | | | | | | | |
| - in construction | | | | | | | | | | | | |
| - in transport | 1.A.3 | | | | 26 | 436 | 405 | 659 | 692 | 825 | 857 | 950 |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | | | | | | | | | | | | |
| - in households | | | | | | | | | | | | |

**Table 3-32. Balance of biodiesel, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | 260 | 3299 | 4353 | 6020 | 5772 | 5885 | 5861 | 5839 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | 527 | 2035 | 3355 | 5101 | 5401 | 4715 | 5290 |
| Export | | | | | 168 | 2538 | 3865 | 5588 | 6379 | 7159 | 6626 | 5842 |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | 27 | 166 | -101 | -137 | 122 | 61 | 139 | -348 |
| **Gross consumption** | | | | | **119** | **1454** | **2422** | **3650** | **4616** | **4188** | **4089** | **4939** |
| 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** | **3650** | **4616** | **4188** | **4089** | **4939** |
| - in industry | | | | | | | | | | | | |
| - in construction | | | | | | | | | | | | |
| - in transport | 1.A.3 | | | | 119 | 1454 | 2422 | 3650 | 4616 | 4188 | 4089 | 4939 |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | | | | | | | | | | | | |
| - in households | | | | | | | | | | | | |

**Table 3-33. Balance of sludge biogas, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | 57 | 125 | 294 | 300 | 340 | 344 | 338 | 508 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | | | | | | | |
| Export | | | | | | | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | | | | | | | | |
| **Gross consumption** | | | | | **57** | **125** | **294** | **300** | **340** | **344** | **338** | **508** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | | | | 36 | 55 | 106 | 116 | 106 | 113 | 111 | 203 |
| - in public CHP plants | 1.A.1.a ii | | | | 17 | 8 | 21 | | | | | |
| - in autoproducer CHP plants | 1.A.1.a ii | | | | 3 | 47 | 85 | 116 | 106 | 113 | 111 | 203 |
| - 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** | **184** | **234** | **231** | **227** | **305** |
| - in industry | | | | | | | | | | | | |
| - in construction | | | | | | | | | | | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | 1.A.4.a | | | | 21 | 70 | 188 | 184 | 234 | 231 | 227 | 305 |
| - in households | | | | | | | | | | | | |

**Table 3-34. Balance of landfill biogas, TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | 83 | 343 | 274 | 231 | 230 | 137 | 143 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | | | | | | | |
| Export | | | | | | | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | | | | | | | | |
| **Gross consumption** | | | | | | **83** | **343** | **274** | **231** | **230** | **137** | **143** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | | | | | 83 | 338 | 262 | 224 | 220 | 127 | 108 |
| - in public CHP plants | 1.A.1.a ii | | | | | 35 | 266 | 180 | 148 | 140 | 116 | 100 |
| - in autoproducer CHP plants | 1.A.1.a ii | | | | | 48 | 72 | 82 | 76 | 80 | 11 | 8 |
| - 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** | **12** | **7** | **10** | **10** | **35** |
| - in industry | 1.A.2 | | | | | | 2 | 1 | | | | |
| - in construction | | | | | | | | | | | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | 1.A.4.a | | | | | | 3 | 11 | 7 | 10 | 10 | 35 |
| - in households | | | | | | | | | | | | |

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

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | 20 | 210 | 344 | 1043 | 1111 | 1176 | 1002 | 498 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | | | | | | | |
| Export | | | | | | | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | | | | | | | | |
| **Gross consumption** | | | | | **20** | **210** | **344** | **1043** | **1111** | **1176** | **1002** | **498** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | | | | 7 | 91 | 225 | 858 | 924 | 960 | 811 | 460 |
| - in public CHP plants | 1.A.1.a ii | | | | | | | 604 | 690 | 724 | 484 | 368 |
| - in autoproducer CHP plants | 1.A.1.a ii | | | | 7 | 91 | 225 | 254 | 234 | 236 | 327 | 92 |
| - in public heat plants | | | | | | | | | | | | |
| - in autoproducer heat plants | | | | | | | | | | | | |
| - in geothermal plants | | | | | | | | | | | | |
| - in other industries | | | | | | | | | | | 161 | |
| 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** | **185** | **187** | **216** | **191** | **38** |
| - in industry | 1.A.2 | | | | | 104 | 119 | 185 | 187 | 216 | 191 | 38 |
| - 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 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 (non-biomass fraction), TJ**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | | 303 | 1010 | 1312 | 1279 | 1265 | 1348 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | | | | | | | |
| Export | | | | | | | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | | | -13 | -12 | -3 | 12 | -3 | 4 |
| **Gross consumption** | | | | | | | **290** | **998** | **1309** | **1291** | **1262** | **1352** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | | | | | | 290 | 927 | 1196 | 1180 | 1205 | 1288 |
| - in public CHP plants | 1.A.1.a ii | | | | | | 290 | 831 | 1059 | 1055 | 1082 | 1086 |
| - in autoproducer CHP plants | | | | | | | | 96 | 137 | 125 | 123 | 202 |
| - 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**** | | | | | | | | 4 | 4 | 3 | | |
| **Final consumption:** | | | | | | | | **67** | **109** | **108** | **57** | **64** |
| - in industry | 1.A.2.f | | | | | | | 67 | 109 | 108 | 57 | 64 |
| - in construction | | | | | | | | | | | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | | | | | | | | | | | | |
| - in households | | | | | | | | | | | | |

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

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | | | 823 | 965 | 1129 | 1182 | 1488 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | | | | | | | |
| Export | | | | | | | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | | | | -12 | 2 | 3 | 2 | -10 |
| **Gross consumption** | | | | | | | | **811** | **967** | **1132** | **1184** | **1478** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | | | | | | | 782 | 930 | 1092 | 1166 | 1458 |
| - in public CHP plants | 1.A.1.a ii | | | | | | | 782 | 930 | 1092 | 1166 | 1458 |
| - 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**** | | | | | | | | 4 | 3 | 6 | | |
| **Final consumption:** | | | | | | | | **25** | **34** | **34** | **18** | **20** |
| - in industry | | | | | | | | 25 | 34 | 34 | 18 | 20 |
| - 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**

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | | 661 | 1511 | 2465 | 2396 | 1674 | 2136 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | | | | | | | |
| Export | | | | | | | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | | | -8 | -56 | 24 | 18 | 5 | 2 |
| **Gross consumption** | | | | | | | **653** | **1455** | **2489** | **2414** | **1679** | **2138** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | | | | | | 653 | 1451 | 2484 | 2410 | 1214 | 1208 |
| - in public CHP plants | 1.A.1.a ii | | | | | | 653 | 1451 | 2484 | 2410 | 1214 | 1208 |
| - 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**** | | | | | | | | 4 | 5 | 4 | | |
| **Final consumption:** | | | | | | | | | | | **465** | **930** |
| - in industry | | | | | | | | | | | 465 | 930 |
| - in construction | | | | | | | | | | | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | | | | | | | | | | | | |
| - in households | | | | | | | | | | | | |

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

| | CRT | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Production | | | | | | | 676 | 1182 | 2268 | 2214 | 4172 | 4928 |
| Liquid biofuels for blending | | | | | | | | | | | | |
| Import | | | | | | | | | | | | |
| Export | | | | | | | | | | | | |
| International marine bunkers | | | | | | | | | | | | |
| Changes in stocks | | | | | | | -17 | -17 | 16 | -1 | -3 | -11 |
| **Gross consumption** | | | | | | | **659** | **1165** | **2284** | **2213** | **4169** | **4917** |
| Statistical difference | | | | | | | | | | | | |
| Transformed in power, heat and other plants: | | | | | | | 659 | 1161 | 2280 | 2207 | 3749 | 4168 |
| - in public CHP plants | 1.A.1.a ii | | | | | | 659 | 1161 | 2280 | 2207 | 3749 | 4168 |
| - 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**** | | | | | | | | 4 | 4 | 6 | | |
| **Final consumption:** | | | | | | | | | | | **420** | **749** |
| - in industry | | | | | | | | | | | 420 | 749 |
| - in construction | | | | | | | | | | | | |
| - in transport | | | | | | | | | | | | |
| - in agriculture | | | | | | | | | | | | |
| - in fishing | | | | | | | | | | | | |
| - in commercial / public services | | | | | | | | | | | | |
| - in households | | | | | | | | | | | | |

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

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

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

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

*****Fossil fuels are provided together with mixed biofuels in transport, in line with data provided in Official statistics portal of Lithuania. On the contrary, only fossil parts of transport fuels are provided in CRT as fossil fuel.

# 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 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heating and other gasoil | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 39 | 9 | 4 |
| Residual fuel oil (RFO) | 883 | 281 | 20 | 0 | 47 | 0 | 0 | 0 | 0 | 0 | 0 |
| Liquefied petroleum gases (LPG) | 0 | 0 | 0 | 7 | 17 | 31 | 55 | 69 | 73 | 256 | 192 |
| Other bituminous coal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-bituminous coal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural gas | 6001 | 1563 | 191 | 4972 | 5476 | 5489 | 4992 | 5003 | 4264 | 3447 | 3765 |
| Wood and wood waste | 0 | 0 | 3 | 0 | 0 | 66 | 445 | 454 | 447 | 462 | 445 |
| Biogas | 0 | 0 | 0 | 0 | 94 | 84 | 124 | 142 | 170 | 150 | 0 |
| **Total** | **6884** | **1844** | **214** | **4980** | **5634** | **5670** | **5618** | **5668** | **4993** | **4324** | **4406** |

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

| Fuel type | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heating and other gasoil | 0 | 0 | 4 | 0 | 0 | 0 | 8 | 9 | 9 | 4 | 0 |
| Residual fuel oil (RFO) | 883 | 401 | 64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Liquefied petroleum gases (LPG) | 0 | 0 | 42 | 4 | 3 | 6 | 3 | 6 | 5 | 5 | 5 |
| Coke | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other bituminous coal | 0 | 75 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-bituminous coal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural gas | 3388 | 749 | 1162 | 448 | 1172 | 384 | 556 | 520 | 492 | 415 | 425 |
| Wood and wood waste | 3 | 5 | 1 | 0 | 128 | 161 | 766 | 762 | 804 | 829 | 845 |
| Peat | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 1 | 0 | 0 |
| **Total** | **4274** | **1231** | **1291** | **453** | **1303** | **551** | **1335** | **1300** | **1311** | **1253** | **1275** |

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

| Fuel type | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heating and other gasoil | 0 | 0 | 3 | 148 | 94 | 99 | 112 | 129 | 228 | 249 | 232 |
| Residual fuel oil (RFO) | 2248 | 1606 | 1567 | 334 | 212 | 271 | 249 | 169 | 14 | 17 | 15 |
| Liquefied petroleum gases (LPG) | 0 | 0 | 121 | 158 | 192 | 209 | 124 | 140 | 162 | 247 | 212 |
| Shale oil | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Coke | 0 | 0 | 105 | 64 | 54 | 45 | 82 | 58 | 49 | 64 | 77 |
| Other bituminous coal | 352 | 151 | 68 | 0 | 3 | 36 | 16 | 17 | 5 | 10 | 8 |
| Anthracite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-bituminous coal | 0 | 0 | 0 | 50 | 38 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural gas | 8498 | 2077 | 2890 | 3695 | 4005 | 3379 | 3536 | 3535 | 3166 | 3973 | 4126 |
| Wood and wood waste | 36 | 57 | 77 | 297 | 93 | 668 | 545 | 610 | 552 | 568 | 617 |
| Other solid biomass | 0 | 0 | 0 | 0 | 0 | 16 | 41 | 46 | 50 | 46 | 69 |
| Biogas | 0 | 0 | 0 | 0 | 10 | 35 | 61 | 45 | 46 | 41 | 38 |
| Peat | 0 | 0 | 0 | 6 | 15 | 7 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **11134** | **3890** | **4831** | **4765** | **4716** | **4765** | **4766** | **4749** | **4272** | **5215** | **5394** |

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

| Fuel type | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heating and other gasoil | 0 | 0 | 0 | 4 | 8 | 2 | 7 | 16 | 17 | 22 | 17 |
| Residual fuel oil (RFO) | 1565 | 482 | 48 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| Liquefied petroleum gases (LPG) | 0 | 0 | 5 | 15 | 9 | 7 | 9 | 12 | 10 | 9 | 9 |
| Coke | 0 | 0 | 23 | 17 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other bituminous coal | 50 | 0 | 8 | 0 | 0 | 5 | 3 | 2 | 5 | 2 | 0 |
| Anthracite | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-bituminous coal | 0 | 0 | 0 | 13 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural gas | 2923 | 1036 | 924 | 1099 | 262 | 238 | 372 | 373 | 431 | 296 | 328 |
| Wood and wood waste | 14 | 68 | 108 | 373 | 36 | 14 | 12 | 10 | 18 | 19 | 30 |
| Other solid biomass | 0 | 0 | 0 | 0 | 9 | 0 | 17 | 25 | 25 | 23 | 7 |
| Peat | 0 | 0 | 0 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **4553** | **1586** | **1116** | **1522** | **335** | **270** | **420** | **438** | **506** | **371** | **391** |

**Table 4-5. Energy consumption by fuel type in Non-Metallic Minerals industries, TJ**

| Fuel type | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heating and other gasoil | 0 | 0 | 0 | 148 | 65 | 75 | 109 | 135 | 129 | 90 | 94 |
| Residual fuel oil (RFO) | 35444 | 7787 | 3522 | 1180 | 1 | 57 | 24 | 25 | 16 | 0 | 0 |
| Liquefied petroleum gases (LPG) | 0 | 0 | 5 | 5 | 2 | 3 | 4 | 8 | 128 | 182 | 134 |
| Petroleum coke | 0 | 0 | 0 | 46 | 111 | 0 | 0 | 0 | 0 | 0 | 0 |
| Coke | 0 | 0 | 190 | 402 | 387 | 336 | 453 | 445 | 409 | 325 | 375 |
| Other bituminous coal | 628 | 327 | 8 | 0 | 2847 | 3545 | 3138 | 3829 | 3999 | 2580 | 2250 |
| Anthracite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-bituminous coal | 0 | 0 | 0 | 2924 | 153 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural gas | 6934 | 1833 | 1775 | 1615 | 909 | 945 | 901 | 933 | 678 | 487 | 483 |
| Wood and wood waste | 19 | 63 | 152 | 566 | 345 | 266 | 436 | 457 | 336 | 345 | 365 |
| Other solid biomass | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| Peat | 168 | 227 | 43 | 7 | 11 | 33 | 1 | 0 | 0 | 0 | 0 |
| Industrial waste (used tires) | 0 | 0 | 0 | 0 | 209 | 0 | 67 | 109 | 108 | 57 | 64 |
| Industrial waste (biomass) | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 34 | 34 | 18 | 20 |
| Municipal waste (non-RES) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 465 | 930 |
| Municipal waste (RES) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 420 | 749 |
| **Total** | **43193** | **10237** | **5695** | **6894** | **5040** | **5260** | **5161** | **5975** | **5837** | **4969** | **5464** |

**Table 4-6. Energy consumption by fuel type in Transport Equipment industries, TJ**

| Fuel type | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heating and other gasoil | 0 | 0 | 0 | 1 | 1 | 1 | 7 | 5 | 4 | 8 | 8 |
| Residual fuel oil (RFO) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Liquefied petroleum gases (LPG) | 0 | 0 | 9 | 8 | 1 | 2 | 0 | 0 | 0 | 9 | 0 |
| Other bituminous coal | 0 | 0 | 0 | 0 | 1 | 4 | 1 | 0 | 0 | 0 | 0 |
| Sub-bituminous coal | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural gas | 189 | 102 | 171 | 238 | 105 | 47 | 71 | 86 | 89 | 71 | 53 |
| Wood and wood waste | 0 | 0 | 0 | 1 | 1 | 0 | 4 | 0 | 1 | 1 | 2 |
| Other solid biomass | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **189** | **102** | **180** | **252** | **110** | **54** | **83** | **91** | **94** | **89** | **63** |

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

| **Fuel type** | **1990** | **1995** | **2000** | **2005** | **2010** | **2015** | **2020** | **2021** | **2022** | **2023** | **2024** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heating and other gasoil | 0 | 0 | 0 | 5 | 0 | 1 | 2 | 2 | 0 | 0 | 0 |
| Residual fuel oil (RFO) | 80 | 40 | 56 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| Liquefied petroleum gases (LPG) | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 19 | 55 | 28 |
| Other bituminous coal | 0 | 0 | 3 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Anthracite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-bituminous coal | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural gas | 270 | 264 | 20 | 41 | 17 | 11 | 44 | 48 | 33 | 5 | 7 |
| Wood and wood waste | 0 | 0 | 2 | 5 | 4 | 18 | 12 | 25 | 43 | 42 | 34 |
| Peat | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| **Total** | **350** | **304** | **80** | **53** | **22** | **31** | **68** | **80** | **95** | **102** | **69** |

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

| **Fuel type** | **1990** | **1995** | **2000** | **2005** | **2010** | **2015** | **2020** | **2021** | **2022** | **2023** | **2024** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heating and other gasoil | 0 | 0 | 0 | 3 | 0 | 0 | 7 | 11 | 9 | 13 | 9 |
| Residual fuel oil (RFO) | 1204 | 321 | 148 | 147 | 31 | 0 | 0 | 0 | 0 | 0 | 0 |
| Liquefied petroleum gases (LPG) | 0 | 0 | 5 | 3 | 19 | 7 | 8 | 10 | 55 | 5 | 6 |
| Other bituminous coal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Anthracite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-bituminous coal | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural gas | 1167 | 451 | 288 | 1046 | 944 | 131 | 315 | 397 | 397 | 333 | 376 |
| Wood and wood waste | 240 | 284 | 466 | 2081 | 1905 | 1670 | 2213 | 2316 | 2128 | 2226 | 2371 |
| Other solid biomass | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Peat | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **2611** | **1056** | **906** | **3294** | **2900** | **1809** | **2543** | **2734** | **2589** | **2577** | **2762** |

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

| Fuel type | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heating and other gasoil | 0 | 0 | 7 | 25 | 47 | 67 | 64 | 75 | 216 | 149 | 123 |
| Residual fuel oil (RFO) | 1044 | 201 | 58 | 110 | 75 | 35 | 8 | 6 | 0 | 0 | 0 |
| Liquefied petroleum gases (LPG) | 92 | 46 | 74 | 77 | 122 | 38 | 72 | 58 | 62 | 80 | 82 |
| Other bituminous coal | 226 | 25 | 14 | 0 | 0 | 6 | 3 | 3 | 2 | 0 | 0 |
| Anthracite | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-bituminous coal | 0 | 0 | 0 | 18 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural gas | 1030 | 219 | 266 | 513 | 501 | 477 | 712 | 725 | 665 | 639 | 638 |
| Wood and wood waste | 51 | 105 | 100 | 185 | 143 | 62 | 91 | 88 | 84 | 90 | 103 |
| Peat | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **2443** | **596** | **519** | **928** | **892** | **685** | **950** | **955** | **1029** | **958** | **946** |

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

| Fuel type | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heating and other gasoil | 0 | 0 | 0 | 76 | 41 | 26 | 37 | 32 | 22 | 16 | 13 |
| Residual fuel oil (RFO) | 1365 | 442 | 140 | 40 | 4 | 11 | 4 | 5 | 0 | 0 | 0 |
| Liquefied petroleum gases (LPG) | 0 | 0 | 5 | 2 | 12 | 14 | 12 | 17 | 18 | 14 | 14 |
| Other bituminous coal | 528 | 100 | 35 | 0 | 7 | 10 | 6 | 7 | 2 | 16 | 11 |
| Anthracite | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-bituminous coal | 0 | 0 | 0 | 49 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural gas | 2467 | 646 | 810 | 1228 | 591 | 568 | 397 | 580 | 579 | 444 | 425 |
| Wood and wood waste | 20 | 50 | 109 | 37 | 18 | 35 | 26 | 21 | 26 | 19 | 36 |
| Other solid biomass | 0 | 0 | 0 | 41 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Peat | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **4379** | **1238** | **1099** | **1474** | **686** | **664** | **482** | **662** | **647** | **509** | **499** |

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

| Fuel type | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heating and other gasoil | 0 | 0 | 0 | 20 | 11 | 24 | 37 | 39 | 26 | 22 | 22 |
| Residual fuel oil (RFO) | 321 | 161 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Liquefied petroleum gases (LPG) | 0 | 0 | 9 | 26 | 18 | 47 | 61 | 68 | 59 | 59 | 50 |
| Coke | 0 | 0 | 28 | 52 | 29 | 18 | 0 | 0 | 0 | 0 | 0 |
| Other bituminous coal | 25 | 50 | 0 | 0 | 2 | 1 | 4 | 4 | 0 | 0 | 0 |
| Anthracite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-bituminous coal | 0 | 0 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural gas | 4228 | 195 | 54 | 189 | 189 | 225 | 255 | 412 | 378 | 340 | 268 |
| Wood and wood waste | 121 | 229 | 300 | 646 | 390 | 622 | 485 | 483 | 566 | 575 | 586 |
| Other solid biomass | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Biogas | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| Peat | 0 | 0 | 0 | 1 | 4 | 7 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **4695** | **635** | **396** | **943** | **648** | **946** | **843** | **1006** | **1029** | **996** | **926** |

# ANNEX V. Energy sector country specific $CO_2$ emission factors

Country specific $CO_2$ emission factors have been derived in studies to determine and update national GHG emission factors for energy sector performed in 2012, 2016 and 2023 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 2016 study "Update of country specific GHG emission factors for energy sector" is presented in Annex VI.

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 $CO_2$ 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 practice 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<br>ASTM D5291-16 D | Thermo Fisher Scientific method No. 85 |
| Gasoline | LST EN ISO 3170:2004<br>PIANO method | Thermo Fisher Scientific method No. 85 |
| Jet fuel | ASTM D4057-12<br>ASTM D5291-16 D | Thermo Fisher Scientific method No. 85 |
| Liquefied petroleum gas | LST EN ISO 4257:2002<br>LST EN SIO 4257:2002/AC:2007 | Thermo Fisher Scientific method No. 85 |

In 2023, new study “Update of country specific GHG emission factors for energy sector” was performed by Lithuanian Energy Institute. The summary of this 2023 study "Update of country specific GHG emission factors for energy sector" is presented in Annex VII.

Country specific $CO_2$ emission factors for all fuel types are presented in Table 5-2 and Table 5-3.

**Table 5-2. Country specific $CO_2$ emission factors, t/TJ**

| Fuel type | 1990-2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Liquid fuel** | | | | | | | | | | | |
| Heating and other gasoil | 72.89 | 72.73 | 72.73 | 72.80 | 72.80 | 72.80 | 72.80 | 72.80 | 72.80 | 72.95 | 72.95 |
| Residual fuel oil (RFO) | 77.60 | 78.40 | 78.40 | 78.40 | 78.40 | 78.40 | 78.40 | 78.40 | 78.40 | 79.15 | 79.15 |
| Liquefied petroleum gases (LPG) – 1.A.1, 1.A.2, 1.A.4 | 65.42 | 66.34 | 66.34 | 66.81 | 66.81 | 66.81 | 66.81 | 66.81 | 66.81 | 66.78 | 66.78 |
| Liquefied petroleum gases (LPG) – 1.A.3 | 65.42 | 66.34 | 66.34 | 66.81 | 66.81 | 66.81 | 66.81 | 66.81 | 66.81 | 66.44 | 66.44 |
| Shale oil | 77.40 | 76.60 | 76.60 | 76.60 | 76.60 | 76.60 | 76.60 | 76.60 | 76.60 | 76.60 | 76.60 |
| Crude oil | 77.74 | 77.74 | 77.74 | 77.74 | 77.74 | 77.74 | 77.74 | 77.74 | 77.74 | 77.74 | 77.74 |
| Petroleum coke | 94.06 | 94.06 | 94.06 | 94.06 | 94.06 | 94.06 | 94.06 | 94.06 | 94.06 | 94.06 | 94.06 |
| Diesel oil | 72.89 | 72.73 | 72.73 | 72.80 | 72.80 | 72.80 | 72.80 | 72.80 | 72.80 | 72.95 | 72.95 |
| Motor gasoline | 72.97 | 72.77 | 72.77 | 70.13 | 70.13 | 70.13 | 70.13 | 70.13 | 70.13 | 70.03 | 70.03 |
| Aviation gasoline and gasoline type jet fuel | 71.62 | 70.81 | 70.81 | 70.81 | 70.81 | 70.81 | 70.81 | 70.81 | 70.81 | 70.81 | 70.81 |
| Jet kerosene | 72.24 | 71.74 | 71.74 | 71.67 | 71.67 | 71.67 | 71.67 | 71.67 | 71.67 | 72.00 | 72.00 |
| **Solid fuel** | | | | | | | | | | | |
| Coke | 109.11 | 109.11 | 109.11 | 109.11 | 109.11 | 109.11 | 109.11 | 109.11 | 109.11 | 109.11 | 109.11 |
| Other bituminous coal | 94.90 | 95.10 | 95.10 | 95.10 | 95.10 | 95.10 | 95.10 | 95.10 | 95.10 | 95.10 | 95.10 |
| Anthracite | 106.55 | 106.55 | 106.55 | 106.55 | 106.55 | 106.55 | 106.55 | 106.55 | 106.55 | 106.55 | 106.55 |
| Sub-bituminous coal | 96.10 | 96.10 | 96.10 | 96.10 | 96.10 | 96.10 | 96.10 | 96.10 | 96.10 | 96.10 | 96.10 |
| Lignite | 101.2 | 101.0 | 101.0 | 101.0 | 101.0 | 101.0 | 101.0 | 101.0 | 101.0 | 101.0 | 101.0 |
| Peat | 104.34 | 104.34 | 104.34 | 104.34 | 104.34 | 104.34 | 104.34 | 104.34 | 104.34 | 104.34 | 104.34 |
| **Biomass** | | | | | | | | | | | |
| Wood and wood waste | 101.34 | 101.34 | 101.34 | 101.34 | 101.34 | 101.34 | 101.34 | 101.34 | 101.34 | 104.1 | 104.1 |
| Other solid biomass | 103.69 | 103.69 | 103.69 | 103.69 | 103.69 | 103.69 | 103.69 | 103.69 | 103.69 | 88.50 | 88.50 |
| Biogas | 58.45 | 58.45 | 58.45 | 58.45 | 58.45 | 58.45 | 58.45 | 58.45 | 58.45 | 58.45 | 58.45 |
| Charcoal | 109.9 | 109.9 | 109.9 | 109.9 | 109.9 | 109.9 | 109.9 | 109.9 | 109.9 | 109.9 | 109.9 |
| **Waste** | | | | | | | | | | | |
| Municipal waste (non-biomass fraction) | 111.65 | 111.65 | 111.65 | 111.65 | 111.65 | 111.65 | 111.65 | 111.65 | 111.65 | 115.63 | 115.63 |
| Municipal and industrial waste (biomass fraction) | 109.03 | 109.03 | 109.03 | 109.03 | 109.03 | 109.03 | 109.03 | 109.03 | 109.03 | 115.63 | 115.63 |
| Industrial waste – used tires (rubber) | 85.00 | - | - | 84.40 | 88.70 | 88.70 | 88.70 | 66.40 | 66.40 | 66.40 | 66.40 |

**Table 5-3. Country specific $CO_2$ emission factors of natural gas, t/TJ**

| Fuel type | 1990-2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

| Fuel type | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|
| Natural gas | 55.73 | 55.57 | 55.54 | 55.59 | 55.34 | 55.34 | 55.40 | 55.59 | 55.62 |

# 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 $CO_2$, therefore conditions of combustion process practically have no influence on $CO_2$ emission factors. $CO_2$ emission factors depend on the type of fuel, i.e. on the amount of carbon content in this fuel. After the summarization of performed comparative analysis of applied emission factors in other EU countries, summarization of data provided by the operators under the EU ETS system and aggregation of results provided by the accredited research laboratories, the study determined country specific $CO_2$ emission factors for energy sector (fuel combustion). Updated values of country specific $CO_2$ emission factors are set considering the results of analysis performed. Besides, determined values of emission factors assure low as possible uncertainty of emission factors.

$CH_4$ and $N_2O$ emission factors are influenced by type of technology, operating conditions, age of equipment and other combustion conditions, therefore values of these emission factors significantly differ between the individual technologies. Seeking to precisely set country specific $CH_4$ and $N_2O$ emission factors of energy technologies used in Lithuania, it is essential to perform comprehensive and multiplex measurements of emissions by differencing in accordance with the group of equipment and fuel type. However, the measurements should be long-lasting, therefore in this study recommended values of $CH_4$ and $N_2O$ emission factors are based on the default IPCC (2006) values.

Updated $CO_2$ emission factors and previously applied $CO_2$ 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* | $CO_2$ *emission factors in the study of 2016, t/TJ* | $CO_2$ *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 $CO_2$ emission factor for a period 2004-2014, but an average value of 55,14 t/TJ for a period 1990-2003. Since 2015, country will have to calculate $CO_2$ emission factor for natural gas considering to the chemical composition of natural gas imported through the pipeline and the liquefied natural gas terminal by applying the method of weighted average.

Updated country specific $CO_2$ emission factor for natural gas is determined considering to the chemical composition of natural gas during 2004-2014 that was provided by Central Calibration and Test Laboratory of AB “Lietuvos dujos”. Seeking to ensure higher accuracy of GHG inventory, it is valuable to apply time series of $CO_2$ emission factor for a period 2004-2014, but an average value of 55.14 t/TJ – for a period 1990-2003. Since 2015, country specific $CO_2$ emission factor for natural gas should be estimated considering chemical composition of natural gas imported through the pipeline and the liquefied natural gas terminal. The $CO_2$ emission factor for natural gas since 2015 should be calculated applying the method of weighted average and considering the import structure and chemical composition of natural gas.

Values of country specific $CO_2$ emission factors for gasoline, diesel, gasoil, jet kerosene, residual fuel oil and liquefied petroleum gas are updated considering the results of measurements of petroleum products that were performed by the accredited Laboratory of Quality Research Centre of AB „ORLEN Lietuva“. When accounting GHG emissions, it is valuable to apply the updated $CO_2$ emission factors for a specified in this paragraph fuels for a period after 2015 and for a period 1990-2014 to use the emission factors determined in the study of 2012.

Values of country specific $CO_2$ emission factors for other bituminous coal, petroleum coke, orimulsion, 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 $CO_2$ emission factor for shale oil is based on national Estonian emission factor, considering the fact that shale oil is imported to Lithuania from Estonia. When preparing the inventory of GHG emissions, it is recommended to apply the updated $CO_2$ emission factor for shale oil after 2015.

Country specific $CO_2$ emission factors for wood, wood waste, agricultural waste and municipality waste (renewable and non-renewable) are specified by performed measurements in the Laboratory of Heat Equipment Research and Testing (Lithuanian Energy Institute). 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 $CO_2$ emission factors for the specified in this paragraph fuels when recalculating GHG emissions from 1990. This will ensure higher reliability of accounting, considering the significantly lower uncertainties of the updated $CO_2$ emission factors.

The Value of $CO_2$ emission factor for biogas and industrial waste is updated in accordance with the results of analysis on applied emission factors in other EU countries and considering the results of long-lasting research analysis performed in other countries. However, seeking to ensure low uncertainty of emission factor for biogas, it is essential to perform long-lasting measurements for different types of biogas in Lithuania.

The reliability of the updated $CO_2$ emission factors is assessed considering default values given in *2006 IPCC Guidelines* and results of performed comparative analysis, where the updated $CO_2$ emission factors were compared with the emission factors applied in EU countries. The comparison of updated $CO_2$ emission factors with default values of *2006 IPCC Guidelines* is presented in Figure 6-1.

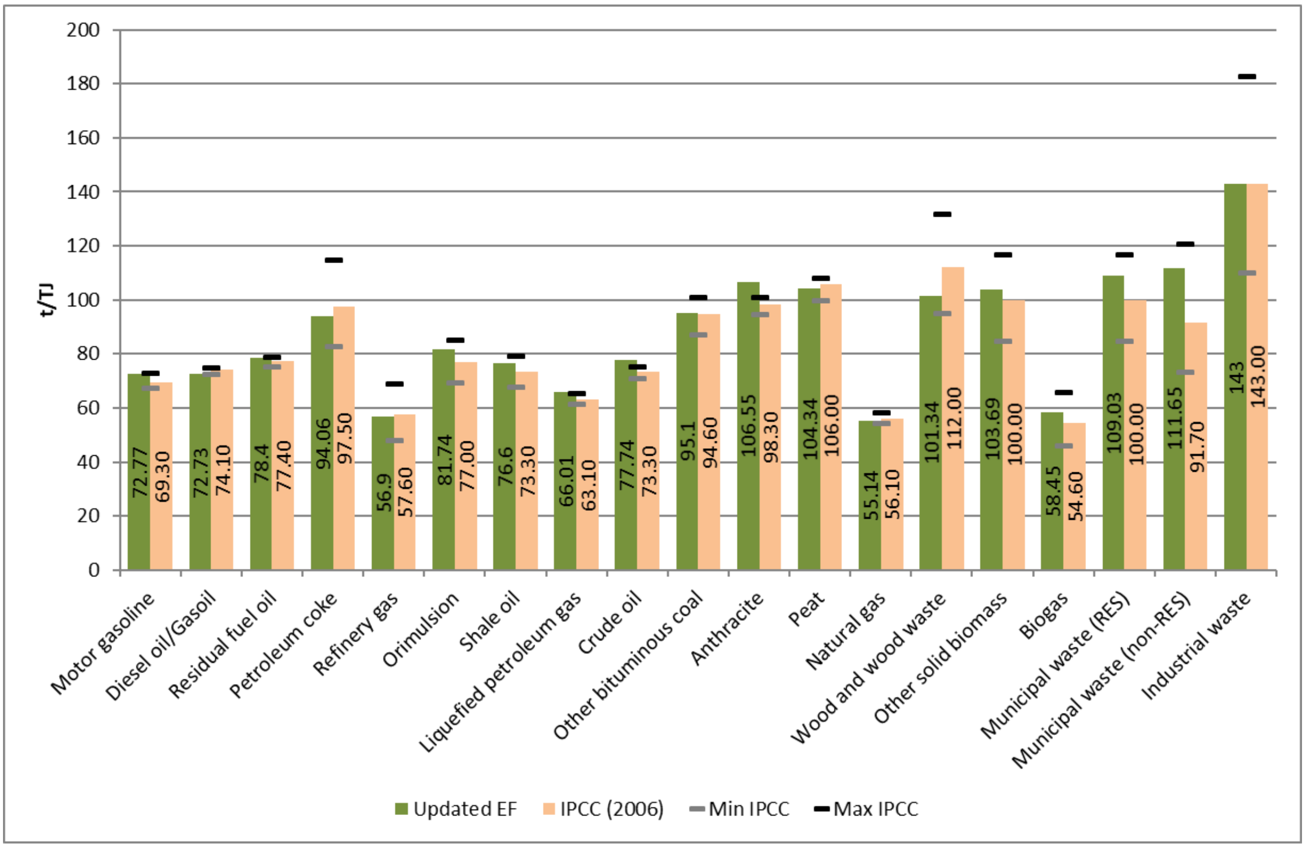



**Figure 6-1.** Comparison of updated country specific $CO_2$ emission factors and default *2006 IPCC Guidelines* emission factors: energy industries

As it is seen from Figure 6-1, the updated values of country specific $CO_2$ emission factors for fuels fall into the uncertainty ranges of default *2006 IPCC Guidelines*, except for crude oil and anthracite. The updated values of country specific $CO_2$ emission factors for crude oil and anthracite are by 5.71% and 7.74% higher than default *2006 IPCC Guidelines* values, respectively.

$CO_2$ emission factors for manufacturing industries and construction are recommended the same as for energy industries sector (Table 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 $CO_2$ emission factor for a period 2004-2014, but an average value of 55,14 t/TJ for a period 1990-2003. Since 2015, country will have to calculate $CO_2$ emission factor for natural gas considering to the chemical composition of natural gas imported through the pipeline and the liquefied natural gas terminal by applying the method of weighted average.

Updated values of $CO_2$ emission factors for transport sector are presented in Table 6-3. $CO_2$ emission factors of fuels (except aviation gasoline) used in transport sector are updated on the basis of measurement performed by the accredited Laboratory of Quality Research Centre of 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* | $CO_2$ *emission factors in the study of 2016, t/TJ* | $CO_2$ *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 $CO_2$ emission factors with default *2006 IPCC Guidelines* emission factors are presented in Figure 6-2.

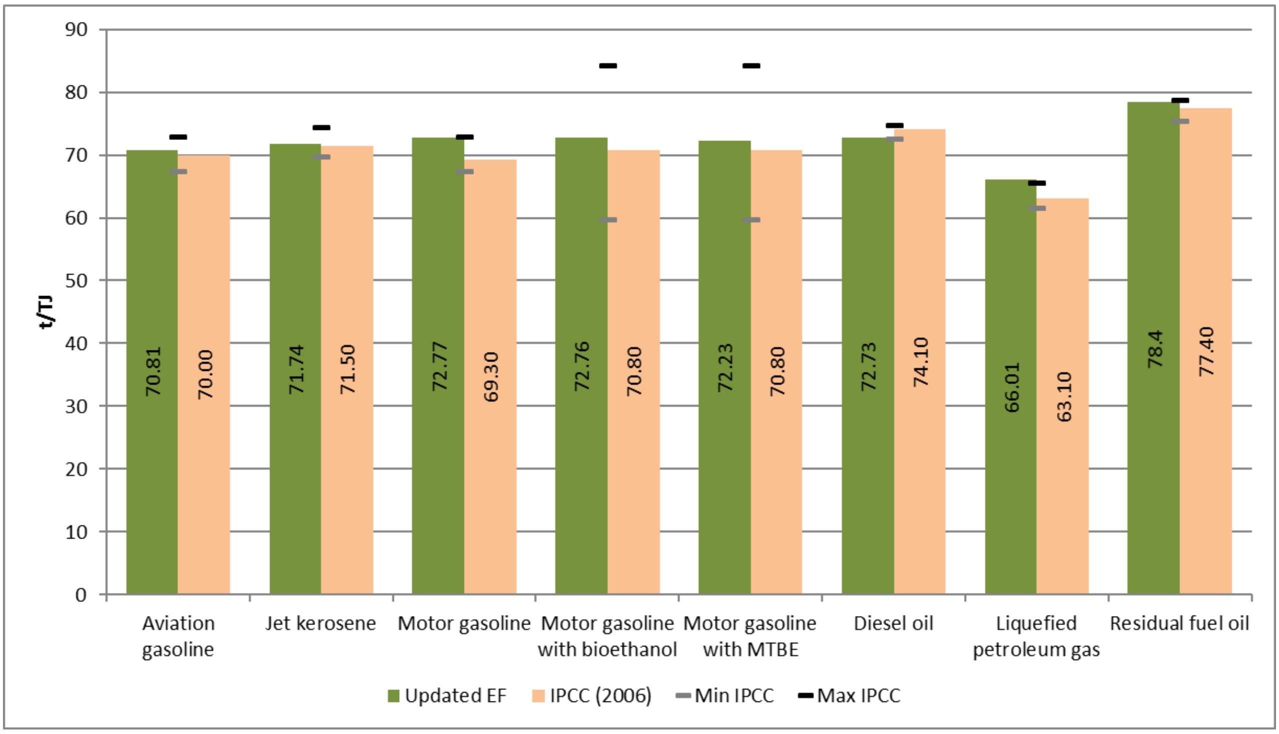


**Figure 6-2.** Comparison of updated country specific $CO_2$ emission factors with default *2006 IPCC Guidelines* emission factors: transport sector

As it is seen from Figure 6-2, updated values of country specific $CO_2$ emission factors for fuels in transport sector fall into the uncertainty ranges of *2006 IPCC Guidelines*, except for liquefied petroleum gas. The updated value of $CO_2$ emission factor for liquefied petroleum gas is by 4.41% higher than its default value.

Recommended values of $CO_2$ 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* | $CO_2$ *emission factors in the study of 2016, t/TJ* | $CO_2$ *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 $CO_2$ emission factor for a period 2004-2014, but an average value of 55.14 t/TJ for a period 1990-2003. Since 2015, country will have to calculate $CO_2$ emission factor for natural gas considering to the chemical composition of natural gas imported through the pipeline and the liquefied natural gas terminal by applying the method of weighted average.

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

Considering international practice, uncertainty assessment of $CO_2$, $CH_4$ and $N_2O$ emission factors is performed at aggregated sector-specific and fuel type-specific (liquid, solid, gaseous fuel and biomass) levels. Uncertainty estimations of recommended GHG emission factors are presented in Table 6-5.

**Table 6-5. Uncertainties of recommended GHG emission factors**

| ***IPCC source category*** | ***Fuel type*** | ***$CO_2$, %*** |
|---|---|---|
| 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 $CO_2$ emission factors is performed considering the fact that carbon share of some types of fuels is relatively stable. Emission factors for liquid fuels mainly are identified at the accredited laboratory that satisfies the requirements of LST EN ISO/IEC 17025:2005 standard or are based on data provided by EU ETS applying the Tier 3. Chemical composition of natural gas is determined in the laboratory, which is accredited by the National Accreditation Bureau, too. This has an influence on low uncertainties of emission factors for liquid fuels and natural gas (±2,0%). Uncertainties of emission factors for solid fuels are remarkably higher, because, for example, carbon share in peat is variable, therefore uncertainties of emission factors for solid fuels are estimated considering the recommendations provided in *2006 IPCC Guidelines*. The Uncertainty of $CO_2$ emission factor for biomass is the highest and reaches ±15%.

# ANNEX VII. Summary of study “Update of country specific GHG emission factors for energy sector” (2023)

Updated $CO_2$ EFs for energy sector and $CH_4$ and $N_2O$ EFs of biomass for residential and commercial/institutional sectors are provided in Table 7-1 and Table 7-2.

**Table 7-1. $CO_2$ emission factors for energy sector**

| ***Fuel type*** | ***$CO_2$ emission factors in the study of 2023, t/TJ*** |
|---|---|
| **Liquid fuel** | |
| Motor gasoline | 70.03 |
| Diesel / gasoil | 72.95 |
| Jet kerosene | 72.00 |
| Residual fuel oil (RFO) | 79.15 |
| Petroleum coke | 94.06 |
| Refinery gas | 57.11 |
| Liquified petroleum gas (LPG) | 66.44 (1.A.3) / 66.78 (1.A.1, 1.A.2, 1.A.4) |
| **Solid fuel** | |
| Other bituminous coal | 95.13 |
| **Biomass** | |
| Wood and wood waste | 104.10 |
| Other solid biomass | 88.50 |
| **Waste** | |
| Municipality waste (non-RES) | 115.63 |
| Municipality waste (RES) | |
| Industrial waste (non-RES) | |
| Industrial waste (RES) | |

**Table 7-2. $CH_4$ and $N_2O$ EFs of biomass for residential and commercial/institutional sectors**

| ***IPCC category*** | ***Fuel type*** | ***Emission factors, kg/TJ*** | | ***IPCC (2006), kg/TJ*** | |
|---|---|---|---|---|---|
| | | **$CH_4$** | **$N_2O$** | **$CH_4$** | **$N_2O$** |
| Residential | Wood logs | 206.60 | 4.12 | 300 | 4 |
| | Wood waste | 19.80 | 6.10 | | |
| | Wood pellets | 3.84 | 0.33 | | |
| Commercial/institutional | Wood logs | 11.10 | 0.00 | | |
| | Wood waste | 16.90 | 1.67 | | |
| | Wood pellets | 0.24 | 0.06 | | |

The national $CO_2$ EFs for petroleum products (gasoline, diesel, gasoil, jet kerosene fuel, residual fuel oil and liquefied petroleum gas) have been revised considering the results of measurements of petroleum products that were performed by the accredited Laboratory of the Quality Research Centre of AB "ORLEN Lietuva" in 2023. Refinery provided measurements’ protocols for all samples of their products. Standard practice for sampling petroleum products has been used as presented in Table 7-3.

**Table 7-3. Sampling and test methods used by AB „ORLEN Lietuva“**

| **Product** | **Sampling method** | **Test method for $CO_2$ EFs evaluation** | **Number of samples** |
|---|---|---|---|
| Gasoline | LST EN ISO 3170 | Thermo Fisher Scientific | 12 |
| Diesel | LST EN ISO 3170 | Thermo Fisher Scientific | 8 |

| | | | |
|---|---|---|---|
| Jet kerosene | ASTM D 4057 | Thermo Fisher Scientific | 6 |
| Residual fuel oil | LST EN ISO 3170 | Thermo Fisher Scientific | 6 |
| Liquefied petroleum gas (transport) | LST EN ISO 4257 | Thermo Fisher Scientific | 12 |
| Liquefied petroleum gas (other) | GOST 14921 | Thermo Fisher Scientific | 12 |

The comparison of updated country specific $CO_2$ EFs of petroleum products with default *2006 IPCC Guidelines* emission factors are presented in Figure 7-1.

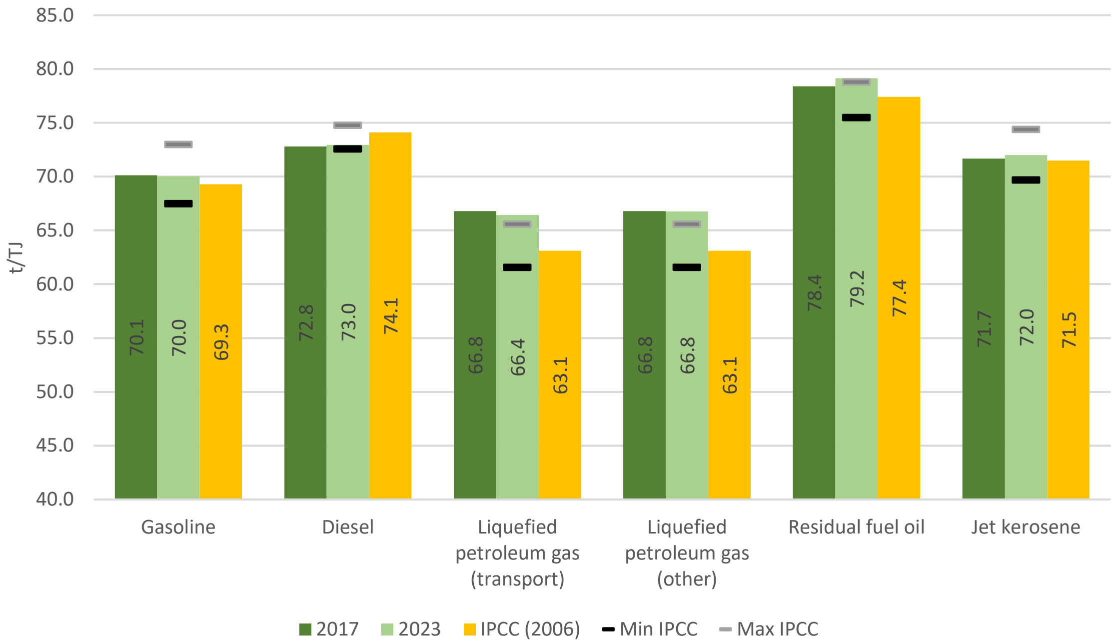



**Figure 7-1.** Comparison of updated CS $CO_2$ EFs of petroleum products with default *2006 IPCC Guidelines* emission factors

As it seen from Figure 7-1, updated values of CS $CO_2$ EFs of petroleum products fall into the uncertainty ranges of *2006 IPCC Guidelines*, except for liquefied petroleum gas and residual fuel oil. When accounting GHG emissions, it is appropriate to apply these revised $CO_2$ EFs for petroleum products from 2023.

Country specific $CO_2$ EFs for wood, wood waste, agricultural waste, municipal and industrial waste (renewable and non-renewable) have been updated at the Laboratory of Heat Equipment Research and Testing (Lithuanian Energy Institute). $CO_2$ EFs for wood and wood waste, wood pellets and agricultural waste have been updated by direct measurement. The following equipment was used for measurements: S type Pito tube for the determination of the combustion products flow; a moisture meter and a pressure sensor with secondary instruments; a portable gas analyser Testo 350XL for the measurement of the concentrations of the combustion products ($CO_2$, $CH_4$, $N_2O$) and a portable FTIR analyser Gasmet DX-4000.

The concentration of combustion products ($CO_2$ %, $CH_4$ and $N_2O$ mg/m$^3$) was directly measured using combustion product analysers. Then, taking into account the flue gas volume flow (Nm$^3$/h) from the boiler and the fuel consumption (kg/h) and calorific value (TJ/kg), the amount of emissions (mg/h) were calculated.

$CO_2$ emissions concentration was measured from the combustion of different fuels: biomass (wood logs, wood chips, wood pellets) and agricultural waste. In order to update the national $CO_2$ EFs for biomass, the concentration of emissions and other parameters were measured at:

- 11 wood logs burning equipment with a capacity ranging from 5 kW to 1200 kW;
- 8 wood waste (chips) burning equipment with a capacity ranging from 5 kW to 24 MW;

- 29 wood pellet burning equipment with a capacity ranging from 4 kW to 500 kW;
- 5 agricultural waste burning equipment with a capacity ranging from 5 kW to 32 kW.

$CH_4$ and $N_2O$ emissions concentration from the combustion of biomass (wood logs, wood chips and pellets) were also measured at the stationary combustion equipment: residential sector and commercial/institutional sector. In order to determine the national $CH_4$ and $N_2O$ EFs for biomass, the concentrations of $CH_4$ and $N_2O$ emissions and other parameters were measured at 15 biomass burning equipment in residential sector with a capacity ranging from 4 to 24 kW and 11 biomass burning equipment in commercial/institutional sector with a capacity ranging from 30 to 1200 kW. Direct measurements of $CH_4$ and $N_2O$ emissions from wood, wood waste and wood pellets combusted in equipment of residential and commercial/institutional sectors have shown that modern biofuel (especially wood pellets) boilers are characterised by low $CH_4$ and $N_2O$ emission factors (Table 7-2).

The comparison of country specific $CH_4$ and $N_2O$ EFs of biomass for residential sector and commercial/institutional sector with default *2006 IPCC Guidelines* emission factors are presented in Figure 7-2 and Figure 7-3.

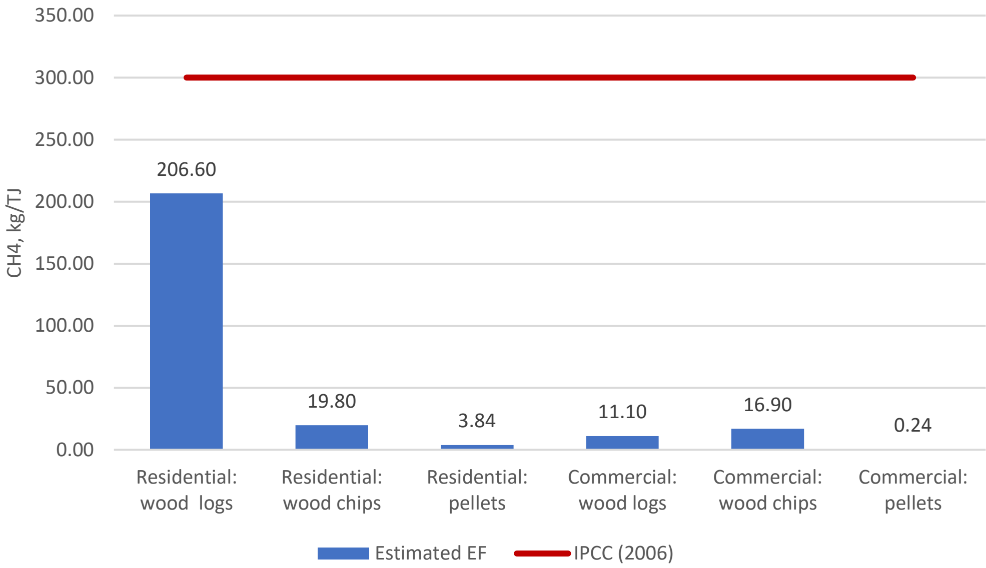



**Figure 7-2.** Comparison of country specific $CH_4$ EFs of biomass for residential sector and commercial/institutional sector with default *2006 IPCC Guidelines* emission factors

As it seen from Figure 7-2, estimated CS $CH_4$ EFs for wood, wood chips and wood pellets burned in residential and commercial/institutional sector have been found to be well below the default (300 kg/TJ) *2006 IPCC Guidelines* emission factors. Only CS $CH_4$ EF for wood logs burned in residential sector falls into the uncertainty ranges of default *2006 IPCC Guidelines* (100-900 kg/TJ) emission factors.

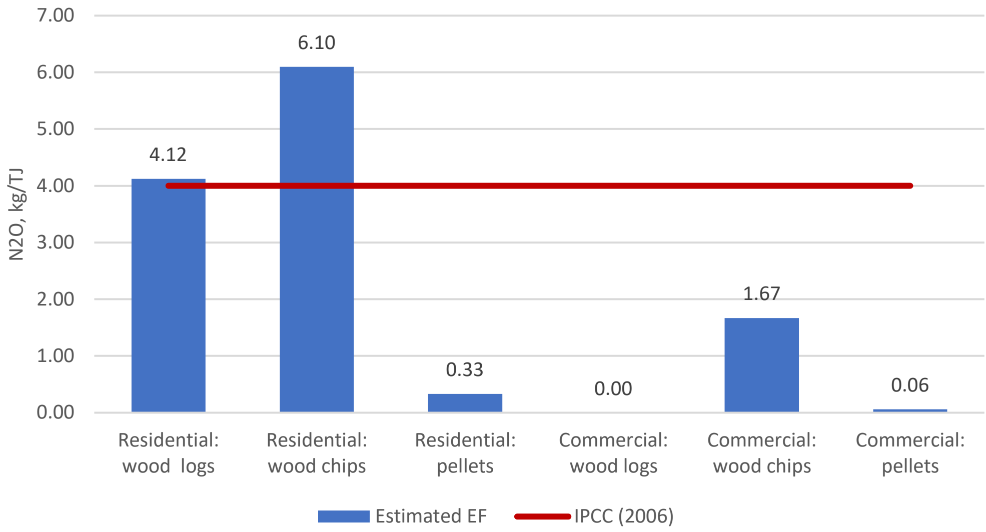



**Figure 7-3.** Comparison of country specific $N_2O$ EFs of biomass for residential sector and commercial/institutional sector with default *2006 IPCC Guidelines* emission factors

As it seen from Figure 7-3, estimated CS $N_2O$ EFs for wood and wood chips burned in residential and commercial/institutional sector fall within the uncertainty range of *2006 IPCC Guidelines* default values (1,5-15 kg/TJ), except wood pellets. CS $N_2O$ EFs for wood pellets burned in residential and commercial/institutional sector are below the lower limit of *2006 IPCC Guidelines* emission factor uncertainty range.

It is recommended to apply the updated $CO_2$ EFs and $CH_4$ and $N_2O$ EFs for wood, wood waste and agricultural waste when accounting GHG emissions from 2023.

$CO_2$ EFs for municipal and industrial waste (renewable and non-renewable) have been determined on the basis of chemical composition of the fuel obtained from the waste. For the update of $CO_2$ EFs of municipal and industrial (non-renewable and renewable) waste, a drying oven (for moisture content), a calorimeter (for calorific value), an incinerator (for ash content) and an analyser for the main elements (C, H, N, S) were used.

It should be noted that the waste samples from Lithuanian incinerators were unsorted or only partially sorted during the study, resulting in a mix of municipal and industrial waste, as well as renewable and non-renewable wastes. The study analysed two groups of waste samples: 30 samples in I group and 13 samples in II group. Measurements of municipal and industrial waste (renewable and non-renewable) have shown that the results for the experimental sample of fuels derived from waste are scattered over a wide range due to the wide variation in the samples (Table 7-4).

**Table 7-4. $CO_2$ EFs of municipal and industrial (RES and non-RES) waste**

| Fuel types | $CO_2$ emission factor, t/TJ | | | Number of samples |
|---|---|---|---|---|
| | Min | Average | Max | |
| **Municipal and industrial (RES and non-RES) waste** | **65.03** | **115.63** | **182.30** | **43** |
| I group of samples | 74.78 | 115.17 | 182.30 | 30 |
| II group of samples | 65.03 | 116.70 | 162.78 | 13 |

The comparison of updated country specific $CO_2$ EFs of biomass, municipal and industrial (RES and non-RES) waste with default *2006 IPCC Guidelines* emission factors are presented in Figure 7-4.

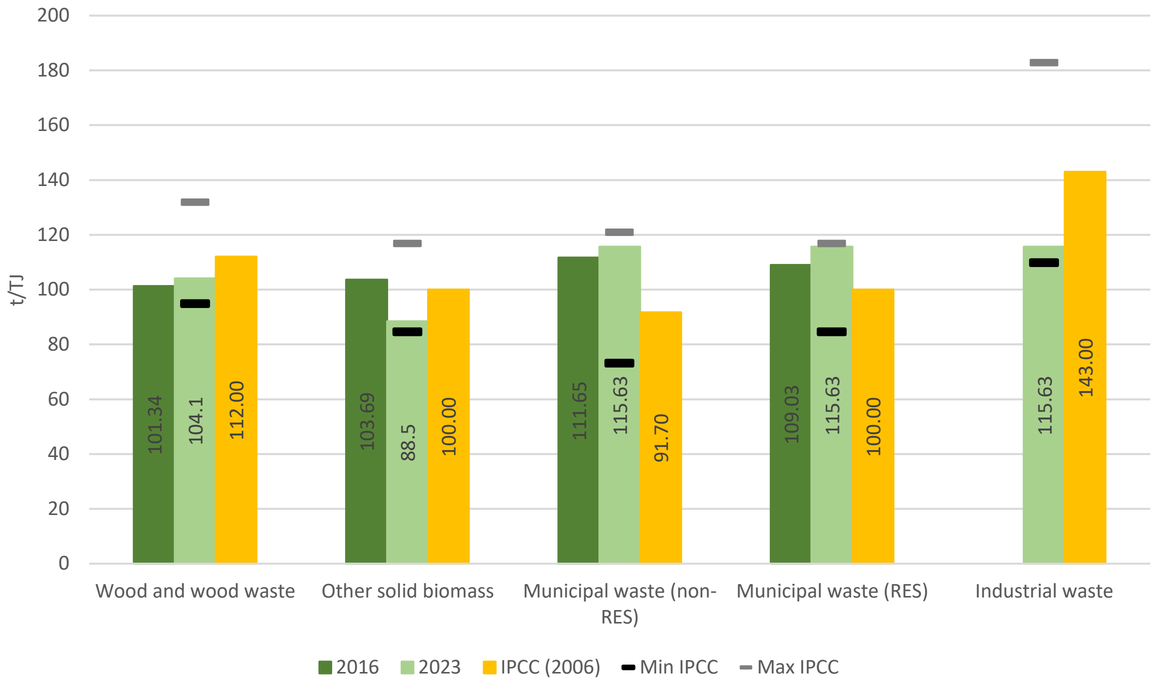



**Figure 7-4.** Comparison of updated CS $CO_2$ EFs of biomass, municipal and industrial (RES and non-RES) and default *2006 IPCC Guidelines* emission factors

As it seen from Figure 7-4, updated values of CS $CO_2$ EFs of biomass, municipal and industrial (RES and non-RES) fall into the uncertainty ranges of *2006 IPCC Guidelines.*

Values of country specific $CO_2$ EFs for other bituminous coal, petroleum coke and coke are updated on the basis of data provide by the operators under EU ETS and considering to the Tier 3 reliability that ensures the lowest uncertainty of emission factor. Sustaining to the data base of EU ETS, in some cases it is possible to apply EFs set at the plant-specific level. When accounting GHG emissions, it is appropriate to continue apply PS EFs based on the EU ETS Tier 3.

CHPs incinerating municipal and industrial waste use the instrumental measurement method (Tier 4) under EU ETS. Analysis of EU ETS reports of waste-fired CHPs for the period 2016-2022 showed that $CO_2$ emission factor for municipal and industrial waste varied between 72.46 and 106.76 t/TJ. The average value of $CO_2$ EF for municipal and industrial waste for the period 2016-2022 was 92.37 t/TJ. The average value of $CO_2$ EF for municipal and industrial waste is 0.7% higher than the default *2006 IPCC Guidelines* emission factor for municipal waste and 35.4% lower than the default *2006 IPCC Guidelines* emission factor for industrial waste. The instrumental measurement method (Tier 4) used under EU ETS ensures a low uncertainty ±2.5% through continuous monitoring of emissions, therefore it is appropriate to use these measured and verified emissions for the national GHG emissions accounting.

Country specific $CO_2$ EF for natural gas have not been analysed in this study, as in preparation of the national GHG inventory is applied CS $CO_2$ EF that varies from year to year, depending on the chemical composition of natural gas.

Preparing the national GHG inventory, it is necessary to evaluate the overall inventory uncertainty, therefore for this purpose, uncertainty estimates of updated EFs have been revised. Considering international practice, uncertainty assessment of $CO_2$, $CH_4$ and $N_2O$ emission factors is performed at aggregated sector-specific and fuel type-specific (liquid, solid, gaseous fuel and biomass) levels. Uncertainty estimations of recommended GHG emission factors are presented in Table 7-5.

**Table 7-5. Uncertainties of recommended GHG emission factors**

| ***IPCC source category*** | ***Fuel type*** | **$CO_2$, %** |
|---|---|---|
| 1.A.1 Energy industries | Liquid fuel | ± 2.0 |
| | Solid fuel | ± 5.0 |
| | Natural gas | ± 2.0 |
| | Waste | ± 2.5 |
| | Biomass | ± 8.1 |
| 1.A.2 Manufacturing industry and construction | Liquid fuel | ± 2.0 |
| | Solid fuel | ± 5.0 |
| | Natural gas | ± 2.0 |
| | Waste | ± 4.0 |
| | Biomass | ± 8.1 |
| 1.A.3 Transport | Liquid fuel | ± 2.0 |
| 1.A.4 Other sectors | Liquid fuel | ± 2.0 |
| | Solid fuel | ± 5.0 |
| | Natural gas | ± 2.0 |
| | Biomass | ± 8.1 |

The uncertainties of the aggregated $CH_4$ and $N_2O$ EFs are very high, as these emission factors are highly dependent on specific combustion technologies. Uncertainties of $CH_4$ and $N_2O$ EFs for biomass are based on measurements results: $CH_4$ – ±60%, $N_2O$ – ±40%.

# ANNEX VIII. $CO_2$ emissions from the installations of the GHG registry, 2024

**Table 8-1. $CO_2$ emissions from the installations registered in the GHG Emission Allowance Registry, 2024**

| *No* | *Company* | *Name of the Installation* | *Verified emissions, t $CO_2$* | *Corresponding CRT Sector (Fuel combustion)* |
|---|---|---|---|---|
| 1 | AB "Akmenės cementas" | Boiler house, cement production furnace | 869,485 | 1.A.2.F Non-Metallic Minerals |
| 2 | AB "Palemono keramikos gamykla" | Boiler house, ceramics combustion furnace | 370 | 1.A.2.F Non-Metallic Minerals |
| 3 | UAB "Kauno stiklas" | Glass melting furnace | 13,991 | 1.A.2.F Non-Metallic Minerals |
| 4 | AB "Panevėžio stiklas" | Glass melting furnace | 18,047 | 1.A.2.F Non-Metallic Minerals |
| 5 | AB "ORLEN Lietuva" | Oil refining factory | 1,605,458 | 1.A.1.B Petroleum Refining / 1.A.1.A Public electricity and heat production |
| 6 | AB "Grigeo Klaipėda" | Boiler house | 11,134 | 1.A.2.D Pulp, Paper and Print |
| 7 | AB "Grigeo Tissue" | Boiler house | 7,104 | 1.A.2.D Pulp, Paper and Print |
| 8 | AB "Achema" | Boiler houses, CHP | 1,584,285 | 1.A.2.C Chemicals / 1.A.1.A Public electricity and heat production |
| 9 | AB "Nordic Sugar Kėdainiai" | Boiler house, oilcake desiccation | 36,265 | 1.A.2.E Food processing, Beverages and Tobacco |
| 10 | AB "Lifosa" | Boiler house | 7,334 | 1.A.2.C Chemicals |
| 11 | AB "KN Energies" | Boiler house | 4,561 | 1.A.1.A Public electricity and heat production |
| 12 | UAB "Lietuvos cukraus fabrikas" | Boiler house | 15,996 | 1.A.2.E Food processing, Beverages and Tobacco |
| 13 | AB "Jonavos šilumos tinklai" | Jonava boiler house | 388 | 1.A.1.A Public electricity and heat production |
| 14 | UAB "Mažeikių šilumos tinklai" | Mazeikiai boiler house | 307 | 1.A.1.A Public electricity and heat production |
| 15 | UAB "Raseinių šilumos tinklai" | Raseiniai boiler house No 4 | 12 | 1.A.1.A Public electricity and heat production |
| 16 | UAB "Šilutės šilumos tinklai" | Šilute boiler house | 1 | 1.A.1.A Public electricity and heat production |
| 17 | UAB "Vilniaus šilumos tinklai" | Vilnius power plant No 2 (E-2) | 106,209 | 1.A.1.A Public electricity and heat production |
| 18 | AB "Ignitis gamyba" | Vilnius power plant No 3 (E-3) | 0 | 1.A.1.A Public electricity and heat production |
| 19 | UAB "Vilniaus šilumos tinklai" | Vilnius boiler house No 2 | 4,245 | 1.A.1.A Public electricity and heat production |
| 20 | UAB "Vilniaus šilumos tinklai" | Vilnius boiler house No 8 | 114 | 1.A.1.A Public electricity and heat production |
| 21 | UAB "Širvintų šiluma" | Širvintu boiler house No 3 | 0 | 1.A.1.A Public electricity and heat production |

| No | Company | Name of the Installation | Verified emissions, t $CO_2$ | Corresponding CRT Sector (Fuel combustion) |
|---|---|---|---|---|
| 22 | AB "Šiaulių energija" | Šiauliai southern boiler house | 12,546 | 1.A.1.A Public electricity and heat production |
| 23 | AB "Klaipėdos energija" | Power plant | 0 | 1.A.1.A Public electricity and heat production |
| 24 | UAB "Radviliškio šiluma" | Radviliškis city boiler house | 2 | 1.A.1.A Public electricity and heat production |
| 25 | UAB "Utenos šilumos tinklai" | Utena boiler house | 1,287 | 1.A.1.A Public electricity and heat production |
| 26 | UAB "Tauragės šilumos tinklai" | Taurage - Berže boiler house | 21 | 1.A.1.A Public electricity and heat production |
| 27 | UAB "Šalčininkų šilumos tiklai" | Šalcininkai boiler house | 89 | 1.A.1.A Public electricity and heat production |
| 28 | UAB "Varėnos šiluma" | Varena boiler house | 0 | 1.A.1.A Public electricity and heat production |
| 29 | AB "Panevėžio energija" | Panevezio boiler house No 2 | 5,823 | 1.A.1.A Public electricity and heat production |
| 30 | AB "Panevėžio energija" | Rokiškio boiler house | 0 | 1.A.1.A Public electricity and heat production |
| 31 | AB "Panevėžio energija" | Panevezio boiler house No 1 | 1 | 1.A.1.A Public electricity and heat production |
| 32 | AB "Panevėžio energija" | Pasvalio boiler house | 83 | 1.A.1.A Public electricity and heat production |
| 33 | AB "Kauno energija" | Petrašiunai PP | 1,821 | 1.A.1.A Public electricity and heat production |
| 34 | AB "Kauno energija" | Pergale boiler house | 4,683 | 1.A.1.A Public electricity and heat production |
| 35 | AB "Kauno energija" | Šilkas boiler house | 1,843 | 1.A.1.A Public electricity and heat production |
| 36 | AB "Kauno energija" | Garliava boiler house | 220 | 1.A.1.A Public electricity and heat production |
| 37 | AB "Kauno energija" | Jurbarkas boiler house | 1,277 | 1.A.1.A Public electricity and heat production |
| 38 | UAB "Plungės šilumos tinklai" | Plunge boiler house No 1 | 288 | 1.A.1.A Public electricity and heat production |
| 39 | UAB "Litesko" | Druskininkai industry boiler house | 1,257 | 1.A.1.A Public electricity and heat production |
| 40 | UAB "Vilkaviškio šilumos tinklai" | Vilkaviškis boiler house | 119 | 1.A.1.A Public electricity and heat production |
| 41 | UAB "Litesko" | Luoke boiler house | 20 | 1.A.1.A Public electricity and heat production |
| 42 | UAB "Palangos šilumos tinklai" | Palanga boiler house | 860 | 1.A.1.A Public electricity and heat production |
| 43 | UAB "Litesko" | Marijampole region boiler house | 2,885 | 1.A.1.A Public electricity and heat production |
| 44 | UAB "Alytaus šilumos tinklai" | Alytus boiler house | 3,079 | 1.A.1.A Public electricity and heat production |
| 45 | AB "Ignitis gamyba" | Lietuvos PP | 207,414 | 1.A.1.A Public electricity and heat production |

| No | Company | Name of the Installation | Verified emissions, t $CO_2$ | Corresponding CRT Sector (Fuel combustion) |
|---|---|---|---|---|
| 46 | UAB "Kauno termofikacijos elektrinė" | Kaunas PP | 402 | 1.A.1.A Public electricity and heat production |
| 47 | UAB "Kaišiadorių šiluma" | Kaišiadoriai boiler house | 0 | 1.A.1.A Public electricity and heat production |
| 48 | UAB "Kretingos šilumos tinklai" | Kretinga boiler house No 3 | 0 | 1.A.1.A Public electricity and heat production |
| 49 | AB "Klaipėdos energija" | Klaipeda region boiler house | 9,584 | 1.A.1.A Public electricity and heat production |
| 50 | AB "Klaipėdos energija" | Lypkiai regiopn boiler house | 551 | 1.A.1.A Public electricity and heat production |
| 51 | VĮ "Ignalinos atominė elektrinė" | Boiler house | 3.895 | 1.A.4.A Commercial/institutional |
| 52 | UAB "Gren Trakai" | Lentvaris boiler house | 0 | 1.A.1.A Public electricity and heat production |
| 53 | UAB "Gren Akmenė" | Zalgiris boiler house | 1,036 | 1.A.1.A Public electricity and heat production |
| 54 | AB "Panevėžio energija" | Panevežys thermal PP | 5,519 | 1.A.1.A Public electricity and heat production |
| 55 | UAB "IKEA Industry Lietuva" | Fuel combustion plants | 14,834 | 1.A.2.G.iv Wood and wood products |
| 56 | UAB "NEO Group" | Boiler house | 25,534 | 1.A.2.C Chemicals |
| 57 | AB "Panevėžio energija" | Kėdainiai region boiler house | 10,592 | 1.A.1.A Public electricity and heat production |
| 58 | UAB "Paroc" | Plants producing stone-wool | 55,530 | 1.A.2.F Non-Metallic Minerals |
| 59 | AB "Vilniaus GKG-3" | Boiler house | 11 | 1.A.2.G.v Construction |
| 60 | AB “Vilniaus šilumos tinklai” | Boiler house No 7 | 0 | 1.A.1.A Public electricity and heat production |
| 61 | VĮ "Visagino energija" | Thermal boiler house | 6,229 | 1.A.1.A Public electricity and heat production |
| 62 | AB "Roquette Amilina" | Boiler house and driers | 649 | 1.A.2.E Food processing, Beverages and Tobacco |
| 63 | AB "Amber Grid" | Jauniūnų gas compressor station | 9,396 | 1.A.3.E.i Pipeline transport |
| 64 | UAB "Hoegh LNG Klaipėda" | LNG ship | 79,262 | 1.A.1.C.iii Other energy industries / 1.A.4.A Commercial/institutional |
| 65 | UAB “Gren Klaipėda” | Power plant | 121,182 | 1.A.1.A Public electricity and heat production |
| 66 | UAB “Idex Biruliškių” | Boiler house | 146 | 1.A.1.A Public electricity and heat production |
| 67 | UAB “Idex Paneriškių” | Boiler house | 143 | 1.A.1.A Public electricity and heat production |
| 68 | UAB “Kauno kogeneracine jėgainė” | Power plant | 85,650 | 1.A.1.A Public electricity and heat production |
| 69 | UAB “VMG Wood Solutions” | Boiler house and dryer | 825 | 1.A.2.G.iv Wood and Wood Products |

| *No* | *Company* | *Name of the Installation* | *Verified emissions, t $CO_2$* | *Corresponding CRT Sector (Fuel combustion)* |
|---|---|---|---|---|
| | | **Total** | **4,961,894** | |

Source: https://apva.lrv.lt/lt/veiklos-sritys/sesd-registras/naujienos/

# ANNEX IX. Additional information of Agriculture sector

***Other relevant information***

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

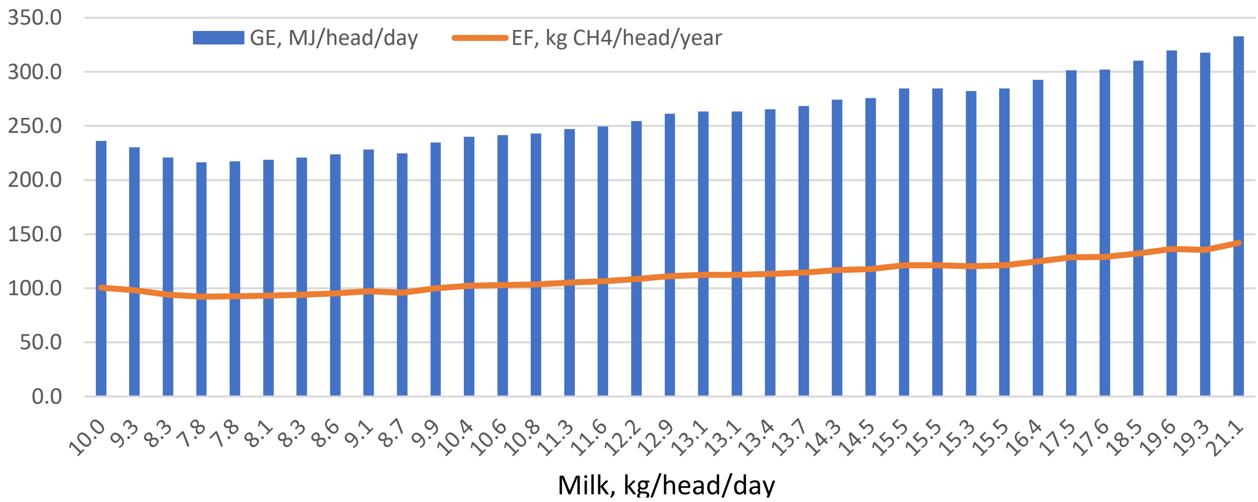



Figure A.5-1. Impact of milk yield on GE and EF's

Milk yield, gross energy, and emission factors are indeed closely related. There are positive relationships between milk production and gross energy, meaning that higher milk yield is often associated with higher levels of gross energy. Similarly, there are positive relationships between milk yield and emission factors, indicating that higher milk production can result in increased emission factors.

Figure below shows distribution of horses by breeds in 2024.

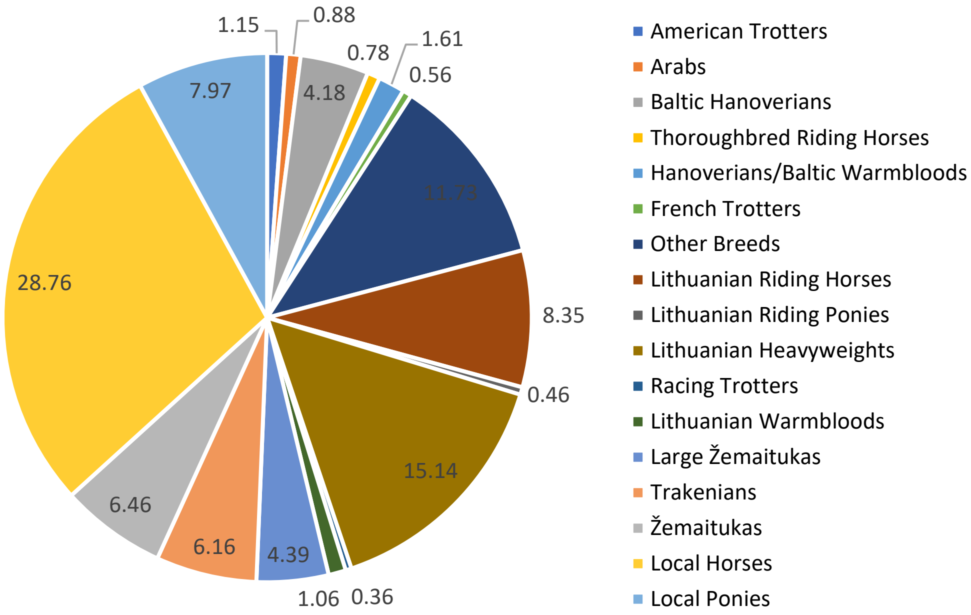



Figure A.5-2. Distribution by breeds of horses, %

Local breeds horses with no known origins constitute about 28.8% 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 | 6.44 | 5.98 | 0.596 |
| **1995** | 6.50 | 6.44 | 5.98 | 0.596 |
| **2000** | 6.50 | 6.43 | 5.98 | 0.597 |
| **2005** | 6.50 | 6.42 | 5.98 | 0.597 |
| **2010** | 6.50 | 6.43 | 5.98 | 0.596 |
| **2015** | 6.50 | 6.44 | 6.00 | 0.597 |
| **2020** | 6.50 | 6.44 | 5.97 | 0.597 |
| **2021** | 6.50 | 6.45 | 5.97 | 0.597 |
| **2022** | 6.50 | 6.45 | 5.97 | 0.597 |
| **2023** | 6.50 | 6.45 | 5.98 | 0.597 |
| **2024** | 6.50 | 6.45 | 5.99 | 0.597 |

Table A. 5-2. Changes in dairy cattle population, milk yield, GE, $CH_4$ EF per cow and methane emission, % (1990=100%)

| Year | Population of Dairy cattle | Milk production (4% of milk fat, 3.4% of milk protein) | GE | $CH_4$ EF | Emissions |
|---|---|---|---|---|---|
| **1990** | 100 | 100 | 100 | 100 | 100 |
| **1995** | 71 | 81 | 93 | 93 | 66 |
| **2000** | 55 | 99 | 99 | 99 | 55 |
| **2005** | 50 | 116 | 106 | 106 | 53 |
| **2010** | 43 | 134 | 112 | 112 | 49 |
| **2015** | 36 | 155 | 120 | 120 | 44 |
| **2020** | 28 | 176 | 128 | 128 | 36 |
| **2021** | 27 | 185 | 131 | 131 | 36 |
| **2022** | 27 | 196 | 135 | 135 | 36 |
| **2023** | 26 | 193 | 134 | 134 | 35 |
| **2024** | 24 | 211 | 141 | 141 | 34 |

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

| | Liquid manure, % | | Liquid manure, % (Anaerobic digesters) | |
|---|---|---|---|---|
| | Swine | Dairy cattle | Swine | Dairy cattle |
| **1990** | 16.00 | 12.00 | - | - |
| **1995** | 32.07 | 15.68 | - | - |
| **2000** | 48.13 | 19.35 | - | - |
| **2005** | 61.05 | 23.03 | 3.15 | - |
| **2010** | 76.47 | 26.71 | 3.80 | - |
| **2015** | 81.29 | 30.38 | 6.13 | - |
| **2020** | 55.51 | 34.21 | 34.16 | - |
| **2021** | 57.54 | 35.60 | 32.58 | - |
| **2022** | 56.53 | 36.74 | 34.04 | 0.05 |
| **2023** | 53.47 | 38.08 | 37.55 | - |
| **2024** | 52.95 | 38.82 | 38.52 | 0.45 |

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 | 2,319.9 | 64.8 |
| **1995** | 171.8 | 1,094.4 | 70.1 |
| **2000** | 84.2 | 811.7 | 63.9 |
| **2005** | 99.3 | 994.7 | 63.4 |

| | | | |
|---|---|---|---|
| **2010** | 84.1 | 844.7 | 63.4 |
| **2015** | 55.5 | 645.4 | 61.7 |
| **2020** | 44.3 | 521.3 | 61.6 |
| **2021** | 45.2 | 531.9 | 61.6 |
| **2022** | 42.2 | 503.4 | 61.5 |
| **2023** | 39.9 | 467.4 | 61.6 |
| **2024** | 39.9 | 457.1 | 61.9 |

## *Nutritional value of diet for cattle subcategories*

Table A. 5 – 5. Nutritional standards for dairy cattle (Livestock manual[1])

| Item | Quantity of milk/day (4% of milk fat, 3.4% of milk protein) | | |
|---|---|---|---|
| | **10** | **15** | **20** |
| Dry matter, kg | 12.7 | 15.1 | 17.0 |
| Crude protein, g | 1,524.0 | 2,038.0 | 2,550.0 |
| Crude fat, g | 279.0 | 362.0 | 459.0 |
| Crude fiber, g | 3,048.0 | 3,473.0 | 3,740.0 |
| Nitrogen-free extract, g (in accordance by used feeds, identified based on the study data) | 6,350.0 | 7,420.0 | 8,990.0 |

Table A. 5 – 6. Nutritional value of diet for dairy cattle (The study data[2])

| Item | Quantity of milk/day (4% of milk fat, 3.4% of milk protein) | | |
|---|---|---|---|
| | **25** | **15** | **25** |
| Dry matter, kg | 18.8 | Dry matter, kg | 18.8 |
| Crude protein, g | 2,914.0 | Crude protein, g | 2,914.0 |
| Crude fat, g | 602.0 | Crude fat, g | 602.0 |
| Crude fiber, g | 3,948.0 | Crude fiber, g | 3,948.0 |
| Nitrogen-free extract, g | 10,186.0 | Nitrogen-free extract, g | 10,186.0 |

Table A. 5 - 7. Nutritional value of diet for dairy cattle in 1990-2024

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 13.35 | 1,717.13 | 314.33 | 3,035.51 | 6,955.10 |
| **1995** | 12.53 | 1,529.95 | 271.15 | 2,915.18 | 6,442.19 |
| **2000** | 13.28 | 1,701.53 | 310.73 | 3,025.48 | 6,912.36 |
| **2005** | 13.96 | 1,857.52 | 346.72 | 3,125.75 | 7,339.79 |
| **2010** | 14.71 | 2,029.10 | 386.30 | 3,236.05 | 7,809.96 |
| **2015** | 15.59 | 2,231.87 | 433.09 | 3,366.41 | 8,365.61 |
| **2020** | 16.41 | 2,419.05 | 476.27 | 3,486.74 | 8,878.53 |
| **2021** | 16.78 | 2,504.84 | 496.07 | 3,541.89 | 9,113.61 |
| **2022** | 17.22 | 2,606.23 | 519.46 | 3,607.07 | 9,391.44 |
| **2023** | 17.12 | 2,582.83 | 514.06 | 3,592.03 | 9,327.33 |
| **2024** | 17.83 | 2,752.00 | 554,28 | 3,693.64 | 9,764.27 |

Table A. 5 - 8. Nutritional value of diet for Non-dairy cattle suckler cows

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|

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

[2] Studija „Pašarų virškinamumo nacionalinių verčių nustatymas klasikiniu in vivo metodu, tobulinant Lietuvos šiltnamio efektą sukeliančių dujų apskaitos metodologiją“ (en. The study "Determination of national values of feed digestibility by the classic in vivo method, improving the Lithuanian greenhouse gas accounting methodology"), Baisogala, 2022

| | | | | | |
|---|---|---|---|---|---|
| **1997**[3] | 11.98 | 1,671.26 | 399.07 | 3,461.35 | 5,477.45 |
| **2000** | 12.28 | 1,701.23 | 402.45 | 3,442.22 | 5,774.96 |
| **2005** | 12.79 | 1,751.17 | 408.08 | 3,410.33 | 6,270.80 |
| **2010** | 13.29 | 1,801.12 | 413.71 | 3,378.45 | 6,766.64 |
| **2015** | 13.80 | 1,851.06 | 419.34 | 3,346.56 | 7,262.49 |
| **2020** | 14.30 | 1,901.01 | 424.97 | 3,314.68 | 7,758.33 |
| **2021-2024** | 14.40 | 1,911.00 | 426.10 | 3,308.30 | 7,857.50 |

## *Non-dairy cattle less than 1 year old*

Table A. 5 - 9. Nutritional value of diet for Calves for slaughter

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 4.98 | 777.76 | 194.24 | 1,143.80 | 2,374.46 |
| **1995** | 5.05 | 751.20 | 190.47 | 1,181.96 | 2,462.73 |
| **2000** | 5.26 | 744.10 | 185.91 | 1,261.38 | 2,621.39 |
| **2005** | 5.49 | 739.16 | 181.54 | 1,344.56 | 2,787.37 |
| **2010** | 5.69 | 731.87 | 177.54 | 1,420.86 | 2,941.69 |
| **2015** | 5.93 | 727.20 | 172.76 | 1,508.78 | 3,115.66 |
| **2020** | 6.16 | 720.12 | 167.57 | 1,592.34 | 3,281.00 |
| **2021** | 6.19 | 717.67 | 166.75 | 1,605.07 | 3,307.14 |
| **2022** | 6.21 | 719.50 | 166.78 | 1,610.42 | 3,317.11 |
| **2023** | 6.20 | 719.16 | 166.79 | 1,609.37 | 3,315.18 |
| **2024** | 6.21 | 719.41 | 166.77 | 1,610.20 | 3,316.68 |

Table A. 5 – 10. Nutritional value of diet for Bulls for breeding

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 5.49 | 873.22 | 215.24 | 1,271.96 | 2,602.31 |
| **1995** | 5.62 | 849.73 | 207.12 | 1,331.40 | 2,726.03 |
| **2000** | 5.75 | 826.24 | 199.00 | 1,390.84 | 2,849.76 |
| **2005** | 5.88 | 802.76 | 190.88 | 1,450.29 | 2,973.48 |
| **2010** | 6.01 | 779.27 | 182.76 | 1,509.73 | 3,097.21 |
| **2015** | 6.14 | 755.78 | 174.64 | 1,569.17 | 3,220.93 |
| **2020** | 6.27 | 732.30 | 166.52 | 1,628.61 | 3,344.66 |
| **2021-2024** | 6.30 | 727.60 | 164.90 | 1,640.50 | 3,369.40 |

Table A. 5 – 11. Nutritional value of diet for Heifers for breeding

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 4.28 | 706.39 | 178.80 | 981.12 | 2,014.97 |
| **1995** | 4.60 | 709.81 | 176.56 | 1,087.47 | 2,233.43 |
| **2000** | 4.93 | 713.23 | 174.32 | 1,193.83 | 2,451.89 |
| **2005** | 5.26 | 716.65 | 172.07 | 1,300.18 | 2,670.34 |
| **2010** | 5.58 | 720.07 | 169.83 | 1,406.53 | 2,888.80 |
| **2015** | 5.91 | 723.49 | 167.59 | 1,512.88 | 3,107.25 |
| **2020** | 6.23 | 726.92 | 165.35 | 1,619.23 | 3,325.71 |
| **2021-2024** | 6.30 | 727.60 | 164.90 | 1,640.50 | 3,369.40 |

## *Non-dairy cattle from 1 to 2 years old*

Table A. 5 - 12. Nutritional value of diet for Bulls

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|

[3] Jukna Č., Jukna V. Mėsinių galvijų auginimas (en. Beef cattle rearing), 2004, Kaunas

| | | | | | |
|---|---|---|---|---|---|
| **1990** | 10.15 | 1475.66 | 322.92 | 2,497.39 | 4,754.25 |
| **1995** | 10.01 | 1410.23 | 309.95 | 2,483.70 | 4,786.63 |
| **2000** | 9.86 | 1344.80 | 296.98 | 2,470.01 | 4,819.01 |
| **2005** | 9.72 | 1279.37 | 284.01 | 2,456.32 | 4,851.39 |
| **2010** | 9.58 | 1213.94 | 271.04 | 2,442.62 | 4,883.76 |
| **2015** | 9.44 | 1148.52 | 258.07 | 2,428.93 | 4,916.14 |
| **2020** | 9.30 | 1083.09 | 245.09 | 2,415.24 | 4,948.52 |
| **2021-2024** | 9.27 | 1070.00 | 242.50 | 2,412.50 | 4,955.00 |

Table A. 5 – 13. Nutritional value of diet for Heifers for slaughter

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 8.60 | 1,236.08 | 296.71 | 2,253.01 | 3,707.39 |
| **1995** | 8.71 | 1,209.29 | 287.97 | 2,278.73 | 3,908.62 |
| **2000** | 8.82 | 1,182.51 | 279.22 | 2,304.46 | 4,109.85 |
| **2005** | 8.93 | 1,155.72 | 270.48 | 2,330.18 | 4,311.07 |
| **2010** | 9.03 | 1,128.93 | 261.74 | 2,355.91 | 4,512.30 |
| **2015** | 9.14 | 1,102.14 | 252.99 | 2,381.63 | 4,713.53 |
| **2020** | 9.25 | 1,075.36 | 244.25 | 2,407.36 | 4,914.75 |
| **2021-2024** | 9.27 | 1,070.00 | 242.50 | 2,412.50 | 4,955.00 |

Table A. 5 – 14. Nutritional value of diet for Heifers for breeding

| Year | | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|---|
| **1990** | | 7.66 | 1,078.59 | 243.91 | 2,162.28 | 3,336.85 |
| **1995** | | 7.92 | 1,077.20 | 243.69 | 2,202.64 | 3,597.84 |
| **2000** | | 8.18 | 1,075.82 | 243.46 | 2,243.00 | 3,858.83 |
| **2005** | | 8.44 | 1,074.43 | 243.23 | 2,283.36 | 4,119.82 |
| **2010** | | 8.70 | 1,073.05 | 243.00 | 2,323.71 | 4,380.82 |
| **2015** | | 8.96 | 1,071.66 | 242.77 | 2,364.07 | 4,641.81 |
| **2020** | | 9.22 | 1,070.28 | 242.55 | 2,404.43 | 4,902.80 |
| **2021-2024** | | 9.27 | 1,070.00 | 242.50 | 2,412.50 | 4,955.00 |

## *Non-dairy cattle 2 years old and older*

Table A. 5 – 15. Nutritional value of diet for Dairy and non-dairy cattle sires bulls

| Item | Dairy cattle sires bulls | Non-dairy cattle sires bulls |
|---|---|---|
| | Accounting year | |
| | 1990 - 2024 | 1990 - 2024 |
| Dry matter, kg | 12.00 | 11.00 |
| Crude protein, g | 1,746.30 | 1,605.76 |
| Crude fat, g | 380.38 | 387.34 |
| Crude fiber, g | 3,165.50 | 3,229.45 |
| Nitrogen-free extract, g | 5,816.16 | 4,820.43 |

Table A. 5 – 16. Nutritional value of diet for other bulls

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 9.89 | 1,450.75 | 317.38 | 2,497.85 | 4,556.17 |
| **1995** | 10.08 | 1,423.85 | 313.13 | 2,561.91 | 4,780.34 |
| **2000** | 10.28 | 1,396.96 | 308.87 | 2,625.96 | 5,004.50 |
| **2005** | 10.47 | 1,370.06 | 304.62 | 2,690.02 | 5,228.67 |
| **2010** | 10.67 | 1,343.17 | 300.36 | 2,754.08 | 5,452.83 |
| **2015** | 10.86 | 1,316.27 | 296.11 | 2,818.13 | 5,677.00 |
| **2020** | 11.06 | 1,289.38 | 291.85 | 2,882.19 | 5,901.17 |
| **2021-2024** | 11.10 | 1,284.00 | 291.00 | 2,895.00 | 5,946.00 |

Table A. 5 – 17. Nutritional value of heifer diet for slaughter

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 9.25 | 1,405.66 | 303.75 | 2,385.28 | 4,442.66 |
| **1995** | 9.55 | 1,386.04 | 301.69 | 2,467.49 | 4,685.14 |
| **2000** | 9.85 | 1,366.41 | 299.64 | 2,549.70 | 4,927.61 |
| **2005** | 10.15 | 1,346.79 | 297.58 | 2,631.92 | 5,170.08 |
| **2010** | 10.44 | 1,327.17 | 295.52 | 2,714.13 | 5,412.56 |
| **2015** | 10.74 | 1,307.55 | 293.47 | 2,796.34 | 5,655.03 |
| **2020** | 11.04 | 1,287.92 | 291.41 | 2,878.56 | 5,897.51 |
| **2021-2024** | 11.10 | 1,284.00 | 291.00 | 2,895.00 | 5,946.00 |

Table A. 5 – 18. Nutritional value of diet for breeding heifers

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 9.24 | 1,384.40 | 304.08 | 2,483.01 | 4,342.80 |
| **1995** | 9.54 | 1,368.20 | 301.97 | 2,549.46 | 4,601.38 |
| **2000** | 9.84 | 1,352.01 | 299.86 | 2,615.91 | 4,859.96 |
| **2005** | 10.14 | 1,335.82 | 297.75 | 2,682.36 | 5,118.54 |
| **2010** | 10.44 | 1,319.62 | 295.64 | 2,748.81 | 5,377.12 |
| **2015** | 10.74 | 1,303.43 | 293.53 | 2,815.26 | 5,635.70 |
| **2020** | 11.04 | 1,287.24 | 291.42 | 2,881.71 | 5,894.28 |
| **2021-2024** | 11.10 | 1,284.00 | 291.00 | 2,895.00 | 5,946.00 |

Table A. 5 – 19. Nutritional value of diet for non-dairy cattle other cow

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 11.87 | 1,700.03 | 389.10 | 3,247.83 | 5,168.79 |
| **1995** | 11.94 | 1,690.02 | 384.89 | 3,181.24 | 5,418.98 |
| **2000** | 12.01 | 1,680.02 | 380.68 | 3,114.66 | 5,669.18 |
| 2005 | 12.08 | 1,670.01 | 376.47 | 3,048.07 | 5,919.37 |
| **2010** | 12.15 | 1,660.01 | 372.26 | 2,981.49 | 6,169.57 |
| **2015** | 12.22 | 1,650.01 | 368.05 | 2,914.90 | 6,419.77 |
| **2020** | 12.29 | 1,640.00 | 363.84 | 2,848.32 | 6,669.96 |
| **2021-2024** | 12.30 | 1,638.00 | 363.00 | 2,835.00 | 6,720.00 |

## *Nutritional value of diet for swine subcategories*

### *Breeding Sows*

Table A. 5- 20. Nutritional value of diet for Mated

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 1.80 | 273.41 | 69.12 | 142.23 | 1,206.98 |
| **1995** | 1.82 | 285.30 | 68.37 | 131.11 | 1,229.57 |
| **2000** | 1.84 | 297.20 | 67.62 | 119.98 | 1,252.16 |
| **2005** | 1.86 | 309.09 | 66.87 | 108.86 | 1,274.76 |
| **2010** | 1.88 | 320.99 | 66.11 | 97.73 | 1,297.35 |
| **2015** | 1.90 | 332.89 | 65.36 | 86.61 | 1,319.95 |
| **2020** | 1.92 | 344.78 | 64.61 | 75.48 | 1,342.54 |
| **2021-2024** | 1.92 | 347.16 | 64.46 | 73.26 | 1,347.06 |

Table A. 5- 21. Nutritional value of diet for Nursing young

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 4.67 | 919.00 | 171.49 | 330.28 | 2,944.03 |

| | | | | | |
|---|---|---|---|---|---|
| **1995** | 4.70 | 918.47 | 182.05 | 311.02 | 2,979.34 |
| **2000** | 4.73 | 917.95 | 192.62 | 291.77 | 3,014.65 |
| **2005** | 4.75 | 917.43 | 203.18 | 272.51 | 3,049.96 |
| **2010** | 4.78 | 916.90 | 213.75 | 253.26 | 3,085.27 |
| **2015** | 4.81 | 916.38 | 224.31 | 234.01 | 3,120.58 |
| **2020** | 4.83 | 915.85 | 234.88 | 214.75 | 3,155.89 |
| **2021-2024** | 4.84 | 915.75 | 236.99 | 210.90 | 3,162.95 |

## *Replacement Sows*

Table A. 5- 22. Nutritional value of diet for mated

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 1.89 | 305.19 | 78.06 | 150.40 | 1,231.32 |
| **1995** | 1.92 | 315.78 | 76.58 | 138.76 | 1,264.80 |
| **2000** | 1.94 | 326.36 | 75.09 | 127.13 | 1,298.28 |
| **2009** | 1.99 | 345.42 | 72.42 | 106.18 | 1,358.55 |
| **2010** | 1.99 | 347.54 | 72.12 | 103.86 | 1,365.25 |
| **2015** | 2.02 | 358.13 | 70.64 | 92.22 | 1,398.73 |
| **2020** | 2.04 | 368.71 | 69.16 | 80.59 | 1,432.21 |
| **2021-2024** | 2.05 | 370.83 | 68.86 | 78.26 | 1,438.91 |

Table A. 5- 23. Nutritional value of diet for Nursing young

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 5.43 | 1,055.98 | 196.15 | 383.65 | 3,430.78 |
| **1995** | 5.39 | 1,044.01 | 205.49 | 358.24 | 3,424.35 |
| **2000** | 5.35 | 1,032.03 | 214.83 | 332.83 | 3,417.92 |
| **2005** | 5.31 | 1,020.06 | 224.17 | 307.41 | 3,411.49 |
| **2010** | 5.27 | 1,008.09 | 233.52 | 282.00 | 3,405.06 |
| **2015** | 5.24 | 996.12 | 242.86 | 256.59 | 3,398.63 |
| **2020** | 5.20 | 984.14 | 252.20 | 231.18 | 3,392.20 |
| **2021-2024** | 5.19 | 981.75 | 254.07 | 226.10 | 3,390.91 |

## *Growing swine*

Table A. 5- 24. Nutritional value of diet for piglets till 20 kg

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 0.68 | 156.29 | 14.29 | 25.84 | 429.07 |
| **1995** | 0.64 | 147.84 | 15.70 | 23.40 | 408.47 |
| **2000** | 0.61 | 139.38 | 17.12 | 20.96 | 387.87 |
| **2005** | 0.58 | 130.93 | 18.53 | 18.52 | 367.27 |
| **2010** | 0.54 | 122.48 | 19.95 | 16.08 | 346.68 |
| **2015** | 0.51 | 114.02 | 21.36 | 13.64 | 326.08 |
| **2020** | 0.48 | 105.57 | 22.78 | 11.20 | 305.48 |
| **2021-2024** | 0.47 | 103.88 | 23.06 | 10.71 | 301.36 |

Table A. 5- 25. Nutritional value of diet for growing pigs (20-50 kg)

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 1.53 | 305.42 | 52.19 | 78.28 | 996.58 |
| **1995** | 1.56 | 315.3 | 52.17 | 75.00 | 1,021.91 |
| **2000** | 1.59 | 325.1 | 52.15 | 71.71 | 1,047.24 |
| **2005** | 1.62 | 334.9 | 52.14 | 68.43 | 1,072.57 |
| **2010** | 1.65 | 344.8 | 52.12 | 65.15 | 1,097.90 |

| | | | | | |
|---|---|---|---|---|---|
| **2015** | 1.67 | 354.6 | 52.10 | 61.86 | 1,123.23 |
| **2020** | 1.70 | 364.5 | 52.08 | 58.58 | 1,148.56 |
| **2021-2024** | 1.71 | 366.42 | 52.08 | 57.92 | 1,153.63 |

Table A. 5- 26. Nutritional value of diet for growing pigs (50-80 kg)

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 2.28 | 385.25 | 72.69 | 114.67 | 1,582.47 |
| **1995** | 2.30 | 399.93 | 72.20 | 111.91 | 1,599.27 |
| **2000** | 2.33 | 414.62 | 71.71 | 109.15 | 1,616.07 |
| **2005** | 2.35 | 429.31 | 71.22 | 106.39 | 1,632.87 |
| **2010** | 2.38 | 443.99 | 70.73 | 103.64 | 1,649.68 |
| **2015** | 2.40 | 458.68 | 70.24 | 100.88 | 1,666.48 |
| **2020** | 2.43 | 473.36 | 69.75 | 98.12 | 1,683.28 |
| **2021-2024** | 2.43 | 476.30 | 69.65 | 97.57 | 1,686.64 |

Table A. 5- 27. Nutritional value of diet for growing pigs 80-110 kg

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 2.50 | 418.26 | 78.32 | 124.89 | 1,735.60 |
| **1995** | 2.52 | 434.15 | 77.88 | 121.83 | 1,750.86 |
| **2000** | 2.54 | 450.05 | 77.44 | 118.76 | 1,766.11 |
| **2005** | 2.57 | 465.95 | 77.00 | 115.69 | 1,781.37 |
| **2010** | 2.59 | 481.85 | 76.55 | 112.63 | 1,796.63 |
| **2015** | 2.61 | 497.75 | 76.11 | 109.56 | 1,811.88 |
| **2020** | 2.64 | 513.65 | 75.67 | 106.49 | 1,827.14 |
| **2021-2024** | 2.64 | 516.83 | 75.58 | 105.88 | 1,830.19 |

Table A. 5-28. Nutritional value of diet for pigs >110 kg (8 month and more)

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 2.43 | 408.14 | 76.94 | 121.66 | 1,682.98 |
| **1995** | 2.46 | 425.67 | 76.72 | 119.11 | 1,706.72 |
| **2000** | 2.50 | 443.20 | 76.50 | 116.57 | 1,730.47 |
| **2005** | 2.53 | 460.73 | 76.28 | 114.02 | 1,754.21 |
| **2010** | 2.56 | 478.26 | 76.06 | 111.48 | 1,777.95 |
| **2015** | 2.60 | 495.79 | 75.84 | 108.93 | 1,801.70 |
| **2020** | 2.63 | 513.32 | 75.62 | 106.39 | 1,825.44 |
| **2021-2024** | 2.64 | 516.83 | 75.58 | 105.88 | 1,830.19 |

Table A. 5- 29. Nutritional value of diet for gilts for breed

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 1.93 | 341.14 | 73.16 | 137.64 | 1,220.78 |
| **1995** | 2.00 | 353.82 | 73.93 | 129.73 | 1,286.57 |
| **2000** | 2.06 | 366.50 | 74.70 | 121.82 | 1,352.37 |
| **2005** | 2.12 | 379.18 | 75.47 | 113.90 | 1,418.17 |
| **2010** | 2.18 | 391.86 | 76.24 | 105.99 | 1,483.97 |
| **2015** | 2.25 | 404.53 | 77.01 | 98.08 | 1,549.76 |
| **2020** | 2.31 | 417.21 | 77.79 | 90.16 | 1,615.56 |
| **2021-2024** | 2.32 | 419.75 | 77.94 | 88.58 | 1,628.72 |

## *Boars*

Table A. 5- 30. Nutritional value of diet for mature

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 2.12 | 389.95 | 79.82 | 165.90 | 1,349.83 |
| **1995** | 2.20 | 408.37 | 81.22 | 158.84 | 1,409.54 |
| **2000** | 2.27 | 426.79 | 82.62 | 151.78 | 1,469.24 |
| **2005** | 2.34 | 445.21 | 84.02 | 144.72 | 1,528.95 |
| **2010** | 2.42 | 463.63 | 85.42 | 137.66 | 1,588.65 |
| **2015** | 2.49 | 482.05 | 86.82 | 130.60 | 1,648.35 |
| **2020** | 2.57 | 500.48 | 88.22 | 123.54 | 1,708.06 |
| **2021-2024** | 2.58 | 504.16 | 88.50 | 122.13 | 1,720.00 |

Table A. 5- 31. Nutritional value of diet for young for breed

| Year | Dry matter, kg | Crude protein, g | Crude fat, g | Crude fibre, g | Nitrogen-free extract, g |
|---|---|---|---|---|---|
| **1990** | 2.18 | 391.76 | 85.71 | 161.50 | 1,346.76 |
| **1995** | 2.21 | 403.00 | 84.95 | 153.48 | 1,382.86 |
| **2000** | 2.24 | 414.24 | 84.19 | 145.46 | 1,418.96 |
| **2005** | 2.27 | 425.47 | 83.43 | 137.44 | 1,455.06 |
| **2010** | 2.30 | 436.71 | 82.67 | 129.42 | 1,491.17 |
| **2015** | 2.33 | 447.95 | 81.91 | 121.40 | 1,527.27 |
| **2020** | 2.35 | 459.18 | 81.15 | 113.38 | 1,563.37 |
| **2021-2024** | 2.36 | 461.43 | 81.00 | 111.78 | 1,570.59 |

## *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. 5-32. Digestibility coefficients for cattle diet, %

| Item | Cattle less 1 year | Cattle from 1 to 2 years | Cattle 2 years and older | Dairy cows | Suckling cows | Other cows |
|---|---|---|---|---|---|---|
| Dry matter | 63.97 | 65.13 | 65.13 | 67.68 | 66.51 | 66.51 |
| Crude protein | 53.97 | 55.84 | 55.84 | 65.21 | 64.95 | 64.95 |
| Crude fat | 59.85 | 62.70 | 62.70 | 60.57 | 60.06 | 60.06 |
| Crude fiber | 60.39 | 63.65 | 63.65 | 63.94 | 61.97 | 61.97 |
| Nitrogen-free extract | 71.51 | 72.45 | 72.45 | 73.20 | 72.50 | 72.50 |
| Organic matter | 66.20 | 67.79 | 67.79 | 69.59 | 67.64 | 67.64 |

Table A.5-33. Digestibility coefficients for swine diet, %

| Sub-category of swine | Dry matter | Crude protein | Crude fat | Crude fiber | Nitrogen-free extract | Organic matter |
|---|---|---|---|---|---|---|
| Piglets till 20 kg | 83.62 | 85.92 | 68.04 | 25.14 | 87.65 | 86.27 |
| Growing pigs 20-50 kg | 83.62 | 85.92 | 68.04 | 25.14 | 87.65 | 86.27 |
| Growing pigs 50-80 kg | 83.27 | 85.18 | 67.99 | 22.24 | 89.55 | 85.08 |
| Growing pigs 80-110 kg | 83.50 | 87.15 | 68.75 | 23.66 | 88.96 | 85.32 |
| Pigs >8 month | 83.50 | 87.15 | 68.75 | 23.66 | 88.96 | 85.32 |
| Sows main mated | 81.15 | 82.55 | 70.59 | 22.32 | 87.17 | 83.12 |
| Sows main nursing young | 81.15 | 82.55 | 70.59 | 22.32 | 87.17 | 83.12 |
| Sows replacement mated | 81.15 | 82.55 | 70.59 | 22.32 | 87.17 | 83.12 |
| Sows replacement nursing young | 81.15 | 82.55 | 70.59 | 22.32 | 87.17 | 83.12 |
| Gilts for breeding | 81.15 | 82.55 | 70.59 | 22.32 | 87.17 | 83.12 |
| Boars Young for breeding | 81.15 | 82.55 | 70.59 | 22.32 | 87.17 | 83.12 |
| Boars mature | 81.15 | 82.55 | 70.59 | 22.32 | 87.17 | 83.12 |

Table A. 5- 34. Nutritional value of diet for sheep subcategories in 1990-2024

| Sub-category | Crude protein g/day | Crude fat g/day | Crude fiber g/day | Nitrogen-free Extracts g/day | DM kg/day |
|---|---|---|---|---|---|
| Mature ewes | 254.55 | 56.20 | 461.03 | 882.67 | 1.78 |
| Ewe over 1 years | 215.95 | 48.37 | 377.40 | 765.12 | 1.51 |
| Ewe to 1 years | 133.56 | 33.33 | 213.64 | 460.75 | 0.90 |
| Lambs to 1 years | 117.69 | 29.66 | 164.94 | 406.31 | 0.77 |
| Mature Rams | 274.25 | 61.95 | 491.65 | 997.91 | 1.96 |
| Rams over 1 years | 247.55 | 56.05 | 438.96 | 886.06 | 1.75 |

## Agricultural soils

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

Table A.5-35. Harvested annual dry matter yield

| | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CROP(T)** | kg d.m. $ha^{-1}$ | | | | | | | | | | |
| Winter Wheat | 2,943 | 2,117 | 3,083 | 3,338 | 2,927 | 4,910 | 4,857 | 4,132 | 4,213 | 4,274 | 4,613 |
| Spring Wheat | 2,208 | 2,193 | 2,265 | 2,803 | 2,634 | 3,622 | 3,475 | 2557 | 2,943 | 2,522 | 2,713 |
| Triticale | 2,169 | 1,806 | 2,247 | 2,332 | 2,046 | 3,303 | 3,270 | 2,379 | 2,789 | 2,653 | 2,956 |
| Rye | 2,450 | 1,554 | 2,047 | 1,861 | 1,512 | 2,389 | 2,557 | 2,092 | 2,075 | 2,029 | 2,045 |
| Barley | 2,607 | 1,427 | 2,121 | 2,365 | 2,041 | 3,448 | 3,684 | 2,974 | 3,372 | 3,058 | 3,358 |
| Oats | 2,232 | 1,242 | 1,652 | 1,690 | 1,397 | 2,192 | 2,259 | 1,584 | 1,992 | 1,825 | 1,887 |
| Grain maize | 2,543 | 2,543 | 2,543 | 2,721 | 5,754 | 4,146 | 6,033 | 5,030 | 4,565 | 6978 | 6,772 |
| Winter Rape | 2,060 | 1,267 | 2,051 | 2,338 | 1,820 | 3,223 | 3,168 | 2,738 | 2,397 | 2,473 | 2,429 |
| Spring Rape | 931 | 1,265 | 1,284 | 1,487 | 1,345 | 1,780 | 1,960 | 1,433 | 1,392 | 1,259 | 1,311 |
| Flax | 408 | 423 | 270 | 400 | 430 | 860 | 645 | 753 | 645 | 773 | 703 |
| Buckwheat | 581 | 523 | 772 | 482 | 627 | 855 | 818 | 570 | 644 | 742 | 847 |
| Mixed cereals | 2,335 | 1,338 | 1,573 | 1,600 | 1,510 | 2,130 | 2,023 | 1,579 | 1,956 | 2,220 | 2,056 |
| Other cereals | 1,720 | 1,720 | 3,440 | 1,290 | 1,106 | 860 | 1,147 | 1,023 | 938 | 1,060 | 1,018 |
| Peas | 2,389 | 1,625 | 1,752 | 1,524 | 1,349 | 2,477 | 2,103 | 1,693 | 1,831 | 1,806 | 1,907 |
| Beans | 1,251 | 1,959 | 1,679 | 1,295 | 1,433 | 2,696 | 3,224 | 1,539 | 3,277 | 2,042 | 2,228 |
| Soya beans | 753 | 753 | 753 | 753 | 753 | 573 | 1,082 | 1,228 | 970 | 1,190 | 1,660 |
| Lupines | 631 | 1,013 | 768 | 912 | 591 | 1,171 | 902 | 785 | 880 | 1,076 | 1,006 |
| Vetches | 2,061 | 1,597 | 1,445 | 1,488 | 1,270 | 1,852 | 1,003 | 860 | 1,107 | 873 | 725 |
| Mixed dried pulses | 1,618 | 1,618 | 1,618 | 1,609 | 1,437 | 1,964 | 1,864 | 1,728 | 1,895 | 1,629 | 1,711 |
| Potatoes | 3,114 | 2,850 | 3,650 | 2,692 | 2,867 | 3,737 | 3,449 | 2,867 | 3,269 | 3,981 | 3,953 |
| Sugar beet | 6,564 | 6,580 | 7,350 | 8,781 | 10,624 | 11,679 | 15,583 | 13,401 | 14,436 | 16,604 | 16,073 |
| Fodder beet | 6,175 | 4,249 | 4,488 | 4,026 | 3,264 | 3,785 | 2,788 | 2,563 | 2,688 | 4,295 | 4,684 |
| Field vegetables (carrot, beetroot) | 2,615 | 2,615 | 2,615 | 2,195 | 2,089 | 3,011 | 3,111 | 3,890 | 3,856 | 3,101 | 4,100 |
| Alfalfa (for hay) | IE | IE | IE | 3 | 2 | 2 | 4 | 2 | 3 | 4 | 3 |
| Alfalfa (for green fodder, silage) | IE | IE | IE | 6 | 7 | 4 | 6 | 5 | 5 | 5 | 5 |
| Clover and their mixture (for hay) | IE | IE | IE | 4 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| Clover and their mixture (for green fodder, silage) | IE | IE | IE | 2 | 6 | 4 | 4 | 4 | 5 | 4 | 4 |
| Silage crops | 5 | 4 | 5 | 5 | 3 | 4 | 4 | 3 | 4 | 3 | 5 |
| Maize for silage and green fodder | 8,372 | 7,693 | 8,403 | 7,338 | 8,758 | 7,923 | 8,539 | 8,292 | 7,978 | 8,660 | 9,576 |
| Annual grasses (for hay) | 611 | 1,068 | 878 | 620 | 2,550 | 2,550 | 3,168 | 1,983 | 4,144 | 1,549 | 2,441 |
| Annual grasses (for haylage) | 5,411 | 7,587 | 6,648 | 3,708 | 4,190 | 2,975 | 3,313 | 3,232 | 3,492 | 2,254 | 3,087 |
| Perennial grasses (for hey) | 2,773 | 3,113 | 2,651 | IE | IE | IE | IE | IE | IE | IE | IE |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Perennial grasses heylage harvested | 3,726 | 4,183 | 3,562 | IE | IE | IE | IE | IE | IE | IE | IE |
| Perennial grasses (excl. alfalfa and clovers and their mixtures) (for hay) | IE | IE | IE | 2,774 | 2,330 | 2,246 | 2,730 | 2,604 | 2,853 | 1,617 | 1,970 |
| Perennial grasses (excl. alfaalfa and clovers and their mixtures) (for green fodder and silage) | IE | IE | IE | 1,716 | 4,047 | 2,964 | 3,695 | 3,311 | 4,220 | 2,309 | 2,931 |
| Perennial pastures (for hay) | 975 | 2,675 | 2,312 | 2,215 | 1,951 | 2,031 | 2,268 | 2,192 | 2,548 | 1,532 | 1,728 |
| Perennial pastures (for silage and green fodder) | 828 | 2,272 | 1,964 | 1,109 | 3,288 | 2,232 | 2,847 | 2,727 | 2,597 | 1,425 | 1,787 |
| Meadows and natural pastures (for hey) | 3,320 | 3,320 | 3,320 | 2,098 | 1,769 | 1,977 | 2,154 | 2,167 | 1,897 | 1,715 | 1,734 |
| Meadows and natural pastures (for silage and green fodder) | 3,489 | 3,489 | 3,489 | 1,352 | 2,766 | 2,172 | 2,508 | 2,024 | 2,106 | 1,709 | 1,999 |

## Table A.5-36. Total annual area harvested

| | **1990** | **1995** | **2000** | **2005** | **2010** | **2015** | **2020** | **2021** | **2022** | **2023** | **2024** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **AREA (T)** | **ha yr$^{-1}$** | | | | | | | | | | |
| Winter Wheat | 34,3728 | 248,496 | 283,216 | 295,914 | 367,400 | 573,000 | 751,900 | 787,400 | 842,000 | 833,242 | 714,502 |
| Spring Wheat | 2,883 | 10,039 | 84,391 | 70,773 | 150,200 | 263,200 | 141,700 | 156,700 | 104,700 | 107,052 | 122,468 |
| Triticale | 13,357 | 22,185 | 50,089 | 74,147 | 108,600 | 122,000 | 115,000 | 74,500 | 63,098 | 67,215 | 81,878 |
| Rye | 165,046 | 132,410 | 130,837 | 50,035 | 49,500 | 38,800 | 37,000 | 26,100 | 29,471 | 28,088 | 25,434 |
| Barley | 394,701 | 537,422 | 348,608 | 344,858 | 231,800 | 202,400 | 164,800 | 144,700 | 133,124 | 159,430 | 191,720 |
| Oats | 75,388 | 46,168 | 43,148 | 58,050 | 57,800 | 64,100 | 104,900 | 92,400 | 80,361 | 91,749 | 107,880 |
| Grain maize | 2,807 | 2,807 | 2,807 | 1,549 | 7,100 | 11,700 | 20,200 | 17,900 | 18,800 | 11,255 | 14,190 |
| Winter Rape | 10,616 | 3,539 | 5,308 | 28,409 | 89,300 | 123,100 | 272,300 | 293,200 | 333,239 | 298,097 | 321,278 |
| Spring Rape | 393 | 10,125 | 49,248 | 79,132 | 162,600 | 40,400 | 11,300 | 17,300 | 15,185 | 6,844 | 7,320 |
| Flax | 21,500 | 13,200 | 8,600 | 4,300 | 400 | 300 | 800 | 800 | 800 | 789 | 779 |
| Buckwheat | 296 | 987 | 16,384 | 28,031 | 19,200 | 36,700 | 39,100 | 48,600 | 57,300 | 41,589 | 37,137 |
| Mixed cereals | 6,888 | 15,744 | 10,824 | 20,959 | 19,700 | 17,000 | 7,500 | 7,844 | 5,891 | 4,392 | 5,094 |
| Other cereals | 100 | 100 | 200 | 200 | 700 | 200 | 300 | 365 | 953 | 473 | 664 |
| Peas | 40,850 | 11,326 | 24,394 | 11,906 | 27,100 | 79,400 | 61,800 | 61,500 | 71,500 | 71,148 | 97,479 |
| Beans | 3,162 | 1,186 | 1,383 | 3,853 | 3,000 | 61,400 | 58,400 | 76,200 | 55,300 | 80,260 | 90,333 |
| Soya beans | 800 | 800 | 800 | 800 | 800 | 2,700 | 2,100 | 1,541 | 2,040 | 1,234 | 1,057 |
| Lupines | 2,452 | 849 | 1,792 | 4,621 | 9,900 | 3,600 | 4,100 | 4,600 | 4,300 | 3,665 | 5,015 |
| Vetches | 27,200 | 9,800 | 10,000 | 2,600 | 2,100 | 1,300 | 600 | 800 | 1,243 | 1,090 | 3,194 |
| Mixed dried pulses | 8,184 | 8,184 | 8,184 | 12,076 | 7,600 | 11,300 | 7,300 | 8,958 | 9,714 | 11,423 | 15,350 |
| Potatoes | 111,150 | 123,006 | 107,988 | 73,112 | 36,600 | 23,500 | 19,300 | 15,700 | 15,600 | 15,168 | 15,105 |
| Sugar beet | 31,972 | 24,203 | 27,589 | 20,916 | 15,300 | 12,200 | 14,000 | 14,700 | 11,600 | 14,423 | 16,025 |
| Fodder beet | 52,061 | 61,822 | 37,419 | 11,197 | 1,500 | 1,300 | 200 | 323 | 192 | 127 | 115 |
| Field vegetables (carrot, beetroot) | 12,300 | 12,300 | 12,300 | 8,800 | 4,200 | 3,700 | 4,200 | 3,900 | 4,063 | 3,576 | 4,197 |
| Alfalfa (for hay) | IE | IE | IE | 952 | 600 | 1,700 | 3,700 | 3,732 | 3,146 | 2,717 | 1,832 |
| Alfalfa (for green fodder, silage) | IE | IE | IE | 3,384 | 3,000 | 5,500 | 8,700 | 11,352 | 12,520 | 12,423 | 18,088 |
| Clover and their mixture (for hay) | IE | IE | IE | 60,278 | 15,700 | 14,100 | 15,400 | 15,900 | 13,500 | 12,089 | 13,038 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Clover and their mixture (for green fodder, silage) | IE | IE | IE | 100,502 | 18,300 | 28,000 | 25,800 | 34,325 | 33,041 | 31,329 | 42,811 |
| Silage crops | 82,700 | 13,600 | 5,500 | 7,300 | 1,100 | 4,000 | 4,200 | 4,200 | 3,800 | 3,603 | 3,462 |
| Maize for silage and green fodder | 77,800 | 4,200 | 10,300 | 13,900 | 17,600 | 29,200 | 29,900 | 29,400 | 32,900 | 39,567 | 42,514 |
| Annual grasses (for hay) | 9,328 | 3,898 | 2,226 | 5,755 | 5,00 | 300 | 1100 | 300 | 800 | 1,433 | 743 |
| Annual grasses (for haylage) | 93,131 | 38,922 | 22,228 | 57,460 | 6,700 | 7,600 | 9,000 | 9,000 | 8,400 | 8,248 | 12,959 |
| Perennial grasses (for hey) | 257,946 | 168,269 | 109,982 | IE | IE | IE | IE | IE | IE | IE | IE |
| Perennial grasses heylage harvested | 212,602 | 138,689 | 90,648 | IE | IE | IE | IE | IE | IE | IE | IE |
| Perennial grasses (excl. alfalfa and clovers and their mixtures) (for hay) | IE | IE | IE | 122,448 | 232,900 | 158,700 | 72,300 | 36,500 | 44,900 | 61,978 | 66,611 |
| Perennial grasses (excl. alfaalfa and clovers and their mixtures) (for green fodder and silage) | IE | IE | IE | 90,512 | 150,100 | 120,500 | 72,700 | 74,000 | 74,400 | 64,514 | 79,254 |
| Perennial pastures (for hay) | 373,977 | 322,985 | 394,777 | 367,822 | 209,600 | 273,100 | 227,200 | 300,500 | 273,200 | 22,0662 | 214,811 |
| Perennial pastures (for silage and green fodder) | 185,565 | 160,263 | 195,886 | 182,511 | 68,400 | 237,500 | 158,500 | 125,200 | 133,200 | 14,1340 | 129,882 |
| Meadows and natural pastures (for hey) | 244,747 | 150,721 | 86,925 | 82,510 | 99,400 | 95,500 | 23,600 | 38,800 | 44,400 | 20,030 | 27,192 |
| Meadows and natural pastures (for silage and green fodder) | 81,850 | 50,405 | 29,070 | 27,594 | 21,700 | 30,200 | 13,200 | 12,400 | 17,800 | 12,569 | 12,569 |

Table A.5-37. Ratio of above-ground residues dry matter to harvested yield

| | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **$R_{AG(T)}$** | **kg d.m.** | | | | | | | | | | |
| Winter Wheat | 0.80 | 0.65 | 0.81 | 0.84 | 0.79 | 0.95 | 0.94 | 0.90 | 0.91 | 0.91 | 0.93 |
| Spring Wheat | 1.16 | 1.16 | 1.15 | 1.12 | 1.13 | 1.08 | 1.09 | 1.13 | 1.11 | 1.13 | 1.12 |
| Triticale | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 |
| Rye | 1.67 | 1.70 | 1.68 | 1.69 | 1.71 | 1.67 | 1.66 | 1.68 | 1.68 | 1.68 | 1.68 |
| Barley | 0.99 | 1.10 | 1.02 | 1.00 | 1.03 | 0.96 | 0.95 | 0.97 | 0.96 | 0.97 | 0.96 |
| Oats | 1.50 | 1.07 | 1.31 | 1.33 | 1.18 | 1.49 | 1.51 | 1.28 | 1.44 | 1.38 | 1.40 |
| Grain maize | 1.14 | 1.14 | 1.14 | 1.14 | 1.14 | 1.14 | 1.14 | 1.14 | 1.14 | 1.14 | 1.14 |
| Winter Rape | 1.81 | 1.21 | 1.81 | 1.93 | 1.69 | 2.16 | 2.15 | 2.05 | 1.95 | 1.98 | 1.96 |
| Spring Rape | 0.64 | 1.21 | 1.23 | 1.44 | 1.30 | 1.66 | 1.76 | 1.39 | 1.35 | 1.20 | 1.26 |
| Flax | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Buckwheat | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 | 2.30 |
| Mixed cereals | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 |
| Other cereals | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 | 1.30 |
| Peas | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 |
| Beans | 2.20 | 2.20 | 2.20 | 2.20 | 2.20 | 2.20 | 2.20 | 2.20 | 2.20 | 2.20 | 2.20 |
| Soya beans | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 |
| Lupines | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 |
| Vetches | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 | 1.60 |
| Mixed dried pulses | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 |
| Potatoes | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Sugar beet | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Fodder beet | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Field vegetables (carrot, beetroot) | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Alfalfa (for hay) | IE | IE | IE | 0.29 | 0.29 | 0.29 | 0.29 | 0.29 | 0.29 | 0.29 | 0.29 |
| Alfalfa (for green fodder, silage) | IE | IE | IE | 0.29 | 0.29 | 0.29 | 0.29 | 0.29 | 0.29 | 0.29 | 0.29 |
| Clover and their mixture (for hay) | IE | IE | IE | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Clover and their mixture (for green fodder, silage) | IE | IE | IE | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Silage crops | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Maize for silage and green fodder | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Annual grasses (for hay) | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Annual grasses (for haylage) | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Perennial grasses (for hey) | 0.30 | 0.30 | 0.30 | IE | IE | IE | IE | IE | IE | IE | IE |
| Perennial grasses heylage harvested | 0.30 | 0.30 | 0.30 | IE | IE | IE | IE | IE | IE | IE | IE |
| Perennial (excl. alfalfa and clovers and their mixtures) (for hay) | IE | IE | IE | 0.30 | 0.30 | 0.30 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Perennial (excl. alfaalfa and clovers and their mixtures) (for green fodder and silage) | IE | IE | IE | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Perennial pastures (for hay) | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Perennial pastures (for silage and green fodder) | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Meadows and natural pastures (for hey) | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| Meadows and natural pastures (for silage and green fodder) | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |

Table A.5-38. Ratio of below-ground residues to harvested yield

| | **1990** | **1995** | **2000** | **2005** | **2010** | **2015** | **2020** | **2021** | **2022** | **2023** | **2024** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **$R_{BG(T)}$** | **kg d.m.** | | | | | | | | | | |
| Winter Wheat | 0.41 | 0.38 | 0.42 | 0.42 | 0.41 | 0.45 | 0.45 | 0.44 | 0.44 | 0.44 | 0.44 |
| Spring Wheat | 0.60 | 0.60 | 0.60 | 0.59 | 0.60 | 0.58 | 0.58 | 0.60 | 0.59 | 0.60 | 0.59 |
| Triticale | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rye | 0.59 | 0.59 | 0.59 | 0.59 | 0.60 | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 |
| Barley | 0.44 | 0.46 | 0.44 | 0.44 | 0.45 | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 |
| Oats | 0.63 | 0.52 | 0.58 | 0.58 | 0.54 | 0.62 | 0.63 | 0.57 | 0.61 | 0.60 | 0.60 |
| Grain maize | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 |
| Winter Rape | 0.84 | 0.66 | 0.84 | 0.88 | 0.81 | 0.95 | 0.95 | 0.92 | 0.88 | 0.89 | 0.89 |
| Spring Rape | 0.49 | 0.66 | 0.67 | 0.73 | 0.69 | 0.80 | 0.83 | 0.72 | 0.71 | 0.66 | 0.68 |
| Flax | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 |
| Buckwheat | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 |
| Mixed cereals | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 |
| Other cereals | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 |
| Peas | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 | 0.46 |
| Beans | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 |
| Soya beans | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 |
| Lupines | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 |
| Vetches | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 |
| Mixed dried pulses | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 |
| Potatoes | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| Sugar beet | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Fodder beet | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| Field vegetables (carrot, beetroot) | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 |
| Alfalfa (for hay) | IE | IE | IE | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 |
| Alfalfa (for green fodder, silage) | IE | IE | IE | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 | 1.70 |
| Clover and their mixture (for hay) | IE | IE | IE | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Clover and their mixture (for green fodder, silage) | IE | IE | IE | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Silage crops | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 |
| Maize for silage and green fodder | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |
| Annual grasses (for hay) | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 |
| Annual grasses (for haylage) | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 | 0.60 |
| Perennial grasses (for hey) | 2.00 | 2.00 | 2.00 | IE | IE | IE | IE | IE | IE | IE | IE |
| Perennial grasses heylage harvested | 2.00 | 2.00 | 2.00 | IE | IE | IE | IE | IE | IE | IE | IE |
| Perennial grasses (excl. alfalfa and clovers and their mixtures) (for hay) | IE | IE | IE | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Perennial (excl. alfaalfa and clovers and their mixtures) (for green fodder and silage) | IE | IE | IE | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Perennial pastures (for hay) | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Perennial pastures (for silage and green fodder) | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Meadows and natural pastures (for hey) | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Meadows and natural pastures (for silage and green fodder) | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |

Table A.5-39. Other relevant parameters used for annual N in crop residues

| | DRY | $N_{AG(T)}$ | $N_{BG(T)}$ | $R_{BG-BIO(T)}$ | $Frac_{REMOVE}$ | $Frac_{RENEW}$ | Area burnt | Slope | Intercept | $R_{AG(T)}$ | $R_{BG(T)}$ | Emission factor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | kg d.m. | kg N | kg N | kg d.m. | kg N | - | - | - | - | kg d.m. | kg d.m. | kg $N_2O$-N |
| **Non-N-fixing grain crops** | | | | | | | | | | | | |
| Winter Wheat | 0.86 | 0.005 | 0.004 | 0.23 | * | 1 | 0 | 1.17 | -1.1 | Calculated | Calculated | 0.01 |
| Spring Wheat | 0.86 | 0.008 | 0.005 | 0.28 | * | 1 | 0 | 0.96 | 0.44 | Calculated | Calculated | 0.01 |
| Triticale | 0.86 | 0.006 | 0.005 | 0.22 | * | 1 | 0 | - | - | 1.3 | Calculated | 0.01 |
| Rye | 0.86 | 0.006 | 0.005 | 0.22 | * | 1 | 0 | 1.6 | 0.16 | Calculated | Calculated | 0.01 |
| Barley | 0.86 | 0.006 | 0.005 | 0.22 | * | 1 | 0 | 0.86 | 0.34 | Calculated | Calculated | 0.01 |
| Oats | 0.86 | 0.007 | 0.005 | 0.25 | * | 1 | 0 | 2.05 | -1.22 | Calculated | Calculated | 0.01 |
| Grain maize | 0.86 | 0.008 | 0.005 | 0.22 | 0 | 1 | 0 | - | - | 1.14 | Calculated | 0.01 |
| Winter Rape | 0.915 | 0.007 | 0.006 | 0.3 | 0 | 1 | 0 | 2.78 | -1.99 | Calculated | Calculated | 0.01 |
| Spring Rape | 0.915 | 0.008 | 0.006 | 0.3 | 0 | 1 | 0 | 2.78 | -1.99 | Calculated | Calculated | 0.01 |
| Flax | 0.86 | 0.006 | 0.005 | 0.22 | 0 | 1 | 0 | - | - | 1.3 | Calculated | 0.01 |
| Buckwheat | 0.86 | 0.007 | 0.005 | 0.22 | 0 | 1 | 0 | - | - | 2.3 | Calculated | 0.01 |
| Mixed cereals | 0.86 | 0.006 | 0.005 | 0.22 | 0 | 1 | 0 | - | - | 1.3 | Calculated | 0.01 |
| Other cereals | 0.86 | 0.006 | 0.005 | 0.22 | 0 | 1 | 0 | - | - | 1.3 | Calculated | 0.01 |
| **N fixing grains and pulses** | | | | | | | | | | | | |
| Peas | 0.86 | 0.0167 | 0.0243 | 0.19 | 0 | 1 | 0 | - | - | 1.4 | Calculated | 0.01 |
| Beans | 0.86 | 0.012 | 0.016 | 0.19 | 0 | 1 | 0 | - | - | 2.2 | Calculated | 0.01 |
| Soya beans | 0.86 | 0.014 | 0.02 | 0.19 | 0 | 1 | 0 | - | - | 1.75 | Calculated | 0.01 |
| Lupines | 0.86 | 0.0136 | 0.0227 | 0.19 | 0 | 1 | 0 | - | - | 1.6 | Calculated | 0.01 |
| Vetches | 0.06 | 0.0129 | 0.02 | 0.19 | 0 | 1 | 0 | - | - | 1.6 | Calculated | 0.01 |
| Mixed dried pulses | 0.86 | 0.014 | 0.02 | 0.19 | 0 | 1 | 0 | - | - | 1.7 | Calculated | 0.01 |
| **Root/tumber crops** | | | | | | | | | | | | |
| Potatoes | 0.22 | 0.014 | 0.0125 | 0.2 | 0 | 1 | 0 | - | - | 0.2 | Calculated | 0.01 |
| Sugar beet | 0.23 | 0.03 | 0.014 | 0.2 | 0 | 1 | 0 | - | - | 0.5 | Calculated | 0.01 |
| Fodder beet | 0.12 | 0.03 | 0.014 | 0.2 | 0 | 1 | 0 | - | - | 0.3 | Calculated | 0.01 |
| Field vegetables | 0.13 | 0.022 | 0.014 | 0.2 | 0 | 1 | 0 | - | - | 0.3 | Calculated | 0.01 |
| **N fixing forage crops** | | | | | | | | | | | | |
| Alfalafa hay | 0.85 | 0.025 | 0.017 | - | 0 | 0.25 | 0 | 0.29 | 0 | Calculated | 1.7 | 0.01 |
| Alfalafa haylage | 0.35 | 0.025 | 0.017 | - | 0 | 0.25 | 0 | 0.29 | 0 | Calculated | 1.7 | 0.01 |
| Clover and their mixture hay | 0.85 | 0.025 | 0.016 | - | 0 | 0.3 | 0 | 0.3 | 0 | Calculated | 0.9 | 0.01 |
| Clover and their mixture haylage | 0.35 | 0.025 | 0.016 | - | 0 | 0.3 | 0 | 0.3 | 0 | Calculated | 0.9 | 0.01 |
| Silage crops | 0.3 | 0.008 | 0.022 | 0.4 | 0 | 1 | 0 | 0.3 | 0 | Calculated | Calculated | 0.01 |
| **Other industrial and forage crops, including annual and perennial pastures and meadows** | | | | | | | | | | | | |
| Maize for silage and green fodder | 0.3 | 0.008 | 0.012 | 0.54 | 0 | 1 | 0 | 0.3 | 0 | Calculated | Calculated | 0.01 |
| Annual grasses hay | 0.85 | 0.015 | 0.012 | - | 0 | 1 | 0 | 0.3 | 0 | Calculated | 0.6 | 0.01 |
| Annual grasses haylage | 0.35 | 0.015 | 0.012 | - | 0 | 1 | 0 | 0.3 | 0 | Calculated | 0.6 | 0.01 |
| Perennial grasses (excl. alfalafa, clover and their mixture) hay | 0.85 | 0.02 | 0.015 | - | 0 | 0.2 | 0 | 0.3 | 0 | Calculated | 2 | 0.01 |
| Perennial grasses (excl. alfalafa, clover and their mixture) haylage | 0.35 | 0.02 | 0.015 | - | 0 | 0.2 | 0 | 0.3 | 0 | Calculated | 2 | 0.01 |
| Perennial pasutes hay | 0.85 | 0.02 | 0.015 | - | 0 | 0.07 | 0 | 0.3 | 0 | Calculated | 2 | 0.01 |
| Perennial pastures haylage | 0.35 | 0.02 | 0.015 | - | 0 | 0.07 | 0 | 0.3 | 0 | Calculated | 2 | 0.01 |
| Meadows and natural pastures hay | 0.85 | 0.02 | 0.015 | - | 0 | 0.07 | 0 | 0.3 | 0 | Calculated | 2 | 0.01 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Meadows and natural pastures haylage | 0.35 | 0.02 | 0.015 | - | 0 | 0.07 | 0 | 0.3 | 0 | Calculated | 2 | 0.01 |

*Data provided in the Table A.5-40

Table A.5-40. N content in above-ground residues and N content in residues removed from fields

| Year | N content in total amount of above ground residue, kg N yr | N content in total amount of above ground residues removed from field, kg N yr | $Frac_{REMOVE}$ (from wheat, barley, triticale, oats and rye), % |
|---|---|---|---|
| **1990** | 16,238,583 | 10,807,885 | 67% |
| **1995** | 9,11,857 | 6,453,882 | 66% |
| **2000** | 14,070,493 | 4,713,117 | 33% |
| **2005** | 14,039,613 | 4,398,563 | 31% |
| **2010** | 13,914,874 | 3,942,874 | 28% |
| **2015** | 31,110,025 | 3,532,137 | 11% |
| **2020** | 31,358,833 | 3,140,129 | 10% |
| **2021** | 24,088,924 | 3,012,599 | 13% |
| **2022** | 25,040,531 | 2,984,917 | 12% |
| **2023** | 25,128,267 | 2,945,847 | 12% |
| **2024** | 26,460,915 | 2,857,596 | 11% |

# ANNEX X. Summary of the study on estimation of nitrous oxide ($N_2O$) emissions from the crop residues category

Following the requirements of the United Nations Framework Convention on Climate Change (UNFCCC), Kyoto protocol, Regulation (EU) No 525/2013 of the European Parliament and of the Council, Member States have to submit their annual national greenhouse gas inventory reports to UNFCCC secretariat and European Commission (EC). GHG inventory agriculture sector must include $N_2O$ emissions from crop residues estimated following 2006 IPCC Guidelines. The default methodology presented in the 2006 IPCC Guidelines for the assessment of $N_2O$ emissions is based on the application of standard coefficients and values, thus it has a rather limited ability to represent country specific conditions in Lithuania and properly describe nitrogen amounts introduced to soil with crop residues. To follow the country's GHG emissions reduction progress, it is crucially important that GHG emissions are accounted for with the adequate accuracy. For this reason, countries are encouraged to develop their own methodologies, ensuring that calculation parameters represent country specific conditions.

In Lithuania, to quantify $N_2O$ emissions from the crop residues two methodologies have been employed so far: by 2015, methodology provided in 2006 IPCC Guidelines was used for the assessment and later, for compilation of inventories for 2015, 2016, and 2017, alternative methodology was elaborated for better and more precise $N_2O$ emissions accounting. The alternative methodology anticipated a modified way of $N_2O$ emission assessment and was partly based on the nationally derived coefficients and parameters.

Lithuanian Environmental Protection Agency (EPA) experts however observe that these two methodologies come out with significantly different results. The assessment based on the 2006 IPCC Guidelines provides $N_2O$ emission estimate which is by around 100 kt $CO_2$ eq larger if compared with the alternative methodology calculation results.

***In relation to this, the main objective of the study*** was to identify the reasons and sources for errors and inconsistencies in previously used $N_2O$ accounting methodologies and to elaborate revised national methodology for the assessment of $N_2O$ emissions from the sub-category of crop residues in Lithuania that would cover main crops under the following crop groups 1. Non-N-fixing grain crops; 2. N-fixing grains and pulses; 3. Root and tuber crops; 4. N-fixing forage crops; 5. Other forages including perennial grasses and grass/clover pastures.

The initial stage of the study covered an extensive review and analysis of Lithuanian research studies and field experiments to retrieve national parameters for the assessment of $N_2O$ emissions from crop residues. The analysis focused on available national data about crop above ground and below ground biomass, biomass nitrogen contents, residue management practices. The overview has covered all main crops under 5 groups of crops as suggested by the 2006 IPCC Guidelines.

In the next stage, a detailed analysis of methodologies used in Lithuania for $N_2O$ emission assessment so far (i.e. methodology based on 2006 IPCC Guidelines and the alternative methodology) was conducted where input data and parameters of these methodologies were validated against available national data. This analysis has reveal that both methodologies possess some inconsistencies and shortcomings that may consequently lead to inaccurate and biased calculation results.

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

The alternative methodology which was developed to improve $N_2O$ calculations by integrating more national parameters has demonstrated poor performance because of mistakes in the assessment of below ground biomass.

Taking into account shortcomings and gaps of both tested methodologies the study proposes revised national parameters for the assessment of $N_2O$ emissions from crop residues in Lithuania. Emissions are developed according 2006 IPCC Guidelines; Equation 11.2 of the Guidelines which is simplified accounting for no burning of crop residues in Lithuania:

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

here:

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

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

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

In future, when new data is obtained, proposed parameters will need to be further revised by putting special emphasis on parameters which, according to sensitivity analysis, mostly affect accuracy of the $N_2O$ emission assessment. Results of the latest investigations will need to be considered to revise linear regression coefficients describing ratios between above-ground residue biomass and harvested crop yields.

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

The study reveals that national data on grassland contribution to soil nitrogen pool is still rather poor. For better assessment of $N_2O$ emissions from grasslands and meadows a representative study investigating composition and usage of grasslands, root biomass of grasslands of different age and productivity or ratios between root biomass and hay, silage or green fodder production would be very useful. In future Crop structure changes should be considered and new crops included into account, if needed.

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

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

# ANNEX XI. Summary of the study on determination of national values of feed digestibility by the classic in vivo method for the Lithuania GHG inventory methodology improvement

Food digestibility is the main parameter to evaluate the amounts of volatile solids methane ($CH_4$) and nitrous oxide ($N_2O$) emitted at manure handling. Lithuania has been recommended by UNFCCC secretariat experts to carry out a study and collect the national data on food digestibility that would help to estimate the amounts of $CH_4$ and $N_2O$ emitted in manure management and included in the national inventory report. Therefore, the aim of this study was to analyze the structure, chemical composition and nutritive value of the rations used for fattening bulls, dairy cows and fattening pigs in Lithuania and, consequently, to estimate nutrient digestibility in vivo and nutrient digestibility coefficients of the average ration for each technological animal group.

Information about feedstuffs and ration structures applied to the animals of different technological groups has been collected in different regions of the country from randomly chosen farms. In 2021, the regions under investigation contained 81.22 % fattening bulls, 95.28 % dairy cows (2 years and older), 90.39 % suckler cows (2 years and older) and 83,74 % fattening pigs. The samples of standard rations collected from farms were analyzed at the Chemical laboratory of the Animal Science Institute of the Lithuanian University of Health Sciences (LUHS). The samples were analyzed for dry matter, crude protein, crude fat, crude fibre and energy (metabolizable, netto energy lactation) contents.

Nutrient digestibility in vivo studies were carried out at the Animal feed nutrient digestibility laboratory of Animal Science Institute of the LUHS with 6 Lithuanian Black-and-White fattening cattle, 6 dairy cows and 12 fattening pigs of different age and condition score according to methodical recommendations for balance-digestibility trials.

**Fattening cattle**

The study indicated that two different fattening cattle feeding technologies are used on Lithuanian farms, i. e. animals are fed on separate feeds or separate feeds are mixed to make a total mix ration (TMR). TMR was used to feed animals in 16 farms out of 23 (almost 70 %) investigated. Most farms use perennial grass and maize silages, compound feeds or grain mixtures for the production of TMR. In case of fibre shortage, meadow grass straw is added. A similar ration structure is applied on the farms where fattening cattle is given ration feeds separately. We have estimated the amounts of feeds given to different cattle groups, i.e. those up to one and up to 2 years old and older. Up to one year of age animals were fed on the average 14.5 kg feeds and received daily 4.70 – 8.04 kg dry matter (DM), 526 – 1114 g crude protein (CP), 1114 – 2354 g crude fibre (CF) and from 43.95 to 79.32 MJ of metabolizable energy (ME). Up to 2 years of age and older animals were given on the average 23.4 kg feeds of natural moisture and received daily 7.02 – 13.83 kg DM, 598 -2550 g CP, 1796 – 4185 g CF and 61.0 – 138.30 MJ ME. Estimation of the amounts of feeds as fed and the nutritive and energy value of rations indicated that the average rations should amount to 15.0 – 18.0 kg for the fattening cattle up to 12 month of age and for the bulls up to 2 years and old, the average rations should amount to 23 – 25 kg of TMR of natural moisture consisting of perennial grass and maize silages and compound feed. On this basis, we have formulated the average ration for cattle feeding comprising TMR made from maize and perennial grass silages and compound feed (37.1 % DM, 4.28 % CP, 0.9 7% crude fat, 9.65 % CF, 19.82 % NFE, 2.38 % crude ash (CA), 3.38 MJ/kg ME). It is recommended to give 17 and 25 kg of feed for cattle up to 12 month of age and up to 2 years and older, respectively.

The animals of the first age group digested on the average 63.97 % DM, 53.97 % CP, 59.85 % crude fat, 60.39 % CF, 51.24 % ADF, 68.69 % NDF, 71.51 % nitrogen free extracts (NFE) and 66.20 % organic matter

(OM) of total ration digestibility. The animals of the second age group digested on the average 65.13 % DM, 55.84 % CP, 62.70 % crude fat, 63.65 % CF, 52.85 % ADF, 71.27 % NDF, 72.45 % NFE and 67.79 % OM. The daily weight gain of the treated animals was 1.27 – 1.73 and 1.73 – 1.87 kg in, respectively, Group 1 and Group 2.

**Dairy cattle**

Two different technologies are used for feeding dairy cows in Lithuania, i. e. animals are given ration feeds separately or separate feeds are mixed to make a complete TMR. TMR technology was applied in 19 farms out of 31 under investigation (almost 61.2 %). Most farms use perennial grass and maize silages, compound feeds or grain mixtures for the production of TMR.

A similar ration structure is applied on the farms where cows are given separate ration feedstuffs. The analysis of feeding amounts showed that the average ration of milking cows was composed of 40 – 50 kg natural moisture feeds comprising perennial grass and maize silages and compound feed. In case of dry matter or fibre deficiency, straw or hay was added. The cows fed this type of ration received 18.1 – 28.2 kg DM, 102 – 178 MJ netto energy lactation (NEL), 2115 – 4131 g CP, 314 – 765 g crude fat, 3433 – 7608 g CF, 112 – 288 calcium and 53 – 152 g phosphorus. Dry and suckler cows are fed on the average 30 – 35 kg natural moisture feeds and receive 11.2 – 19.5 kg DM, 59 – 114 MJ NEL, 1383 – 2421 g CP, 290 – 515 g crude fat, 2376 – 5340 g CF, 53 – 226 g calcium and 21 – 76 g phosphorus. On this basis, we have formulated the average ration for cow feeding comprising TMR manufactured from maize and perennial grass silages and compound feed (41 – 47 % DM, 5.46 – 6.45 % CP, 1.21 – 1.39 % crude fat, 9.45 – 9.71 % CF, 22.45 – 25.97 % NFE, 2.43 – 3.48 % CA, 2.46 – 2.87 MJ/kg NEL). It is recommended to feed 50 kg for milking cows and 35 kg for dry and suckler cows. The cows of the first technological group digested on the average 67.68 % DM, 65.21 % CP, 60.57 % crude fat, 63.94 % CF, 57.68 % ADF, 66.49 % NDF, 73.20 % NFE and 69.59 % OM of total ration. The animals of the second technological group digested on the average 66.51 % DM, 64.95 % CP, 60.06 % crude fat, 61.97 % CF, 56.70 % ADF, 62.62 % NDF, 72.50 % NFE and 67.64 % OM. During the trial, the cows of Group 1 yielded daily 19.6 – 30.1 kg whole milk, whereas the cows of Group 2 8.71 – 12.9 kg milk daily.

**Swine**

On large scale of pig farms in Lithuania pigs are fed complete compound feeds. Three feeding technologies are being applied: feeding dry feeds, moistened feeds or slop feeds. On some farms that apply slop feeding the rations are additionally supplied with whey. Small individual farms with up to 10 – 20 pigs can also use mash feeding rations containing, besides grain feeds, also potatoes, feedroots and other feeds. However, such farms are not numerous and important.

All the 14 studied farms composed their pig rations using the feeds of their own production or purchased compound feeds. Besides, one farm also used whey together with compound feed. For the production of compound feeds, most farms use barley, wheat, triticale. Maize (for piglets and fattening pigs) and oats (for gilts and sows). As protein feeds, the farms use soybean oilmeal, rapeseed cake or meal, sunflower meal, leguminous seeds (peas or beans), also soya or potato protein concentrate (for piglets), fish meal (for piglets and lactating sows), protein-vitamin-mineral premix (for piglets and sows). Components with higher content of crude fiber for sows and gilts comprise wheat bran, dried sugarbeet pulp and soybean hulls. Fodder lime or limestone, monocalcium phosphate, common salt, premixes, aminoacid, trace element, vitamin, enzyme, etc. supplements, also mycotoxin binders are used as minerals and other additives. As an energy source, the farms use vegetable oil, sugarbeet molasses. It should be noted that there was a farm which used dry mixture made from only on farm grown feeds (barley, wheat, peas) and mineral-vitamin supplement. This farm fattens pigs from 45 kg weight.

Dry feeds are given to weaned pigs, fattening pigs and sows on, respectively, 7, 5 and 4 farms. Moistened feeds are given to fattening pigs and sows on, respectively, one and two farms. Weaned pigs, fattening pigs and sows were given slop feeds on, respectively four, eight and three farms. We have estimated the amounts of feeds given to separate groups of pigs, namely, weaned 20-30 kg pigs, fattening pigs, gilts, farrowing and lactating sows.

Weaned 20 to 30 kg pigs are given on the average 1.37-1.44 kg compound feed and get daily 1.20-1.25 kg DM, 18.34-19.48 MJ ME, 246.60-252.42 g CP, 15.98-18.20 g lysine (Lys), 7.73-10.92 g methionine + cystine (Met+Cys), 9.01-11.30 g threonine (Thr), 30.38-69.86 g crude fat, 38.50-53.71 g CF, 10.08-11.52 g calcium (Ca) and 5.96-9.01 g phosphorus (P).

Pigs in the first growing phase (30-60 kg) are offered on the average 2.22-2.45 kg compound feed and get daily 1.96-2.09 kg DM, 29.05-31.19 MJ ME, 343.74-391.08 g CP, 20.34-25.99 g Lys, 9.8-15.64 g Met+Cys, 12.74-17.02 g Thr, 57.56-115.00 g crude fat, 70.67-117.53 g CF, 15.44-18.86 g Ca and 9.59-12.19 g P.

Pigs in the second fattening phase (over 60 kg) are given on the average 2.85-3.10 kg compound feed and get daily 2.47-2.64 kg DM, 36.18-39.62 MJ ME, 434.93-456.00 g CP, 25.61-29.27 g Lys, 12.40-17.23 g Met+Cys, 16.12-19.49 g Thr, 58.98-97.03 g crude fat, 91.98-162.10 g CF, 18.81-21.08 g Ca and 11.39-15.30 g P.

Gilts of more than 50-60 kg weight are given on the average 2.50-2.70 kg compound feed and get daily 2.18-2.36 kg DM, 29.74-33.23 MJ ME, 359.84-401.50 g CP, 16.88-30.00 g Lys, 10.09-18.25 g Met+Cys, 11.26-14.75 g Thr, 51.74-101.00 g crude fat, 96.12-257.14 g CF, 17.85-20.80 g Ca and 11.48-14.56 g P.

Bred sows up to 85 farrowing days are given on the average 2.12-2.26 kg compound feed and get daily 1.87-1.98 kg DM, 25.17-28.16 MJ ME, 304.19-311.88 g CP, 13.67-17.79 g Lys, 8.54-11.07 g Met+Cys, 9.11-11.50 g Thr, 42.20-98.30 g crude fat, 76.32-217.58 g CF, 15.26-17.60 g Ca and 9.12-12.37 g P.

Bred sows having 30 days prior to farrowing days are offered on the average 2.62-2.90 kg compound feed and get daily 2.29-2.52 kg DM, 32.60-35.80 MJ ME, 393.82-435.66 g CP, 17.89-24.10 g Lys, 11.06-15.11 g Met+Cys, 11.93-16.96 g Thr, 56.00-129.11 g crude fat, 99.56-281.87 g CF, 20.16-22.80 g Ca and 12.04-16.25 g P.

Lactating sows are fed on the average 5.61-5.70 kg compound feeds and get daily 4.91-5.06 kg DM, 71.36-76.47 MJ ME, 929.10-935.37 g CP, 50.29-67.83 g Lys, 25.94-41.51 g Met+Cys, 32.77-41.51 g Thr, 216.03-456.65 g crude fat, 196.75-307.80 g CF, 45.20-56.10 g Ca and 27.22-35.34 g P.

Some farms also use whey for pig feeding (on average 1.5 kg for 20-30 kg weaned pigs, 3-4 kg for fattening pigs, gilts) In that case, the pigs are fed compound feeds: on average 1.25 kg for 20-30 kg weaned pigs, 2.15-2.90 kg for fattening pigs in, respectively, growing and finishing fattening phase, 2,50 kg for gilts.

Estimation of daily feed allowance, also nutritive and energy value of rations indicated that complete compound feeds in the average ration should amount to 1.37-1.44 kg for weaned 20-30 kg pigs, 2.22-2.45 kg for 30-65 kg pigs in the first fattening phase, 2.85-3.10 kg for over 60 kg weight pigs in the second fattening phase, 2.50-2.70 kg for over 50-60 kg weight gilts, 2.12-2.26 kg for bred sows up to 85 farrowing days, 2.62-2.90 kg for bred sows with 30 farrowing days left and 5.61-5.70 kg for lactating sows.

Complete compound feeds for fattening pigs and sows were used for nutrient digestibility in vivo studies. The pigs of first technological group were given compound feeds (86.67 % DM, 18.60 % CP, 2.68 % crude fat, 2.94 % CF, 9.80 g/kg Lys, 6.20 g/kg Met+Cys, 6.50 g/kg Thr, 12.96 MJ/kg ME) formulated for the first fattening phase (30-60 kg weight) and composed of barley, wheat, triticale, soybean meal, rapeseed cake, sunflower meal, vegetable oil, fodder lime, monocalcium phosphate, common salt, vitamins, trace elements, aminoacids and enzyme additives. The pigs of the second and third technological groups (60-85 kg and ower 85 kg weight) were given compound feeds (86.31 % DM, 16.89 % CP, 2.47 % crude fat, 3.46 % CF, 8.65 g/kg Lys, 5.05 g/kg Met+Cys, 5.90 g/kg Thr, 12.84 MJ/kg ME) formulated for the second fattening phase (over 60 kg weight) and composed of barley, wheat, wheat bran, soybean meal, rapeseed cake, sunflower meal, vegetable oil, fodder lime, monocalcium phosphate, common salt, vitamins, trace elements, aminoacids and enzyme additives. The pigs of the fourth technological group (sows) were given compound feeds (87.31 % DM, 15.78 % CP, 2.93 % crude fat, 3.33 % CF, 7.20 g/kg Lys, 4.50 g/kg Met+Cys, 4.70 g/kg Thr, 12.35 MJ/kg ME) formulated for farrowing sows and composed of barley, oats, triticale, wheat, wheat bran, soybean meal, rapeseed cake, sunflower meal, vegetable oil, fodder lime, monocalcium phosphate, common salt, vitamins, trace elements, aminoacids and enzyme additives. The chemical composition and nutritive value of the compound feeds used in the study were in agreement with the average values of compound feeds used in the country farms and the average ration which was formulated on the basis of the collected and systematized information about the feeds used for feeding fattening pigs and sows. The average ration used in the study is a reflection of the ration for fattening pigs and sows used in most of the farms in Lithuania and accounts for feeding 83.74 % of the animals of the above technological groups. The pigs of the first technological group digested on the average 83.62 % DM, 85.92 % CP, 68.04 % crude fat, 25.14 % CF, 32.70 % ADF, 52.54 % NDF, 87.65 % NFE and 86.27 % OM of total ration. The animals of the second technological group digested on the average 83.27 % DM, 85.18 % CP, 67.99 % crude fat, 22.24 % CF, 34.28 % ADF, 52.88 % NDF, 89.55 % NFE and 85.08 % OM. The animals of the third technological group digested on the average 83.50 % DM, 87.15 % CP, 68.75 % crude fat, 23.66 % CF, 38.58 % ADF, 51.82 % NDF, 88.96 % NFE and 85.32 % OM. The pigs of the fourth technological group digested on the average 81.15 % DM, 82.55 % CP, 70.59 % crude fat, 22.32 % CF, 33.29 % ADF, 50.62 % NDF, 87.17 % NFE and 83.12 % OM. The daily weight gain of the treated animals was 893-1057 g, 839-1314 g, 739-907 g and 432-604 g in, respectively, Group 1, Group 2, Group 3 and Group 4.

# ANNEX XII. LULUCF area matrices

**1990**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | v | NO | 6,389 | 4,393 | NO | NO | 2,053,755 | 10,782 |
| Cropland | NO | 2,392,387 | 22,362 | NO | NO | NO | 2,414,749 | -6,789 |
| Grassland | NO | 29,151 | 1,257,091 | NO | NO | NO | 1,286,242 | 399 |
| Wetlands | NO | NO | NO | 384,156 | NO | NO | 384,156 | -4,393 |
| Settlements | NO | NO | NO | NO | 347,018 | NO | 347,018 | NO |
| Other land | NO | NO | NO | NO | NO | 42,728 | 42,728 | NO |
| **Initial** | 2,042,973 | 2,421,538 | 1,285,843 | 388,548 | 347,018 | 42,728 | 6,528,648 | |

**1991**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,053,755 | 399 | 3,993 | 2,396 | 399 | NO | 2,060,943 | 7,188 |
| Cropland | NO | 2,352,454 | 22,362 | NO | 799 | 399 | 2,376,014 | -38,735 |
| Grassland | NO | 60,698 | 1,257,091 | 2,795 | 799 | 4,393 | 1,325,776 | 39,534 |
| Wetlands | NO | 399 | 1,597 | 378,166 | NO | NO | 380,162 | -3,195 |
| Settlements | NO | 799 | 1,198 | NO | 346,219 | 799 | 349,015 | 799 |
| Other land | NO | NO | NO | NO | NO | 36,738 | 36,738 | -5,591 |
| **Initial** | 2,053,755 | 2,414,749 | 1,286,242 | 383,357 | 348,216 | 42,329 | 6,528,648 | |

**1992**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,060,943 | 399 | 2,795 | 1,997 | NO | 399 | 2,066,533 | 5,591 |
| Cropland | NO | 2,311,722 | 25,158 | NO | NO | 799 | 2,337,679 | -38,336 |
| Grassland | NO | 60,299 | 1,297,024 | 799 | 1,198 | 4,792 | 1,364,112 | 38,336 |
| Wetlands | NO | 399 | NO | 377,367 | NO | 1,997 | 379,763 | NO |
| Settlements | NO | 2,396 | 799 | NO | 347,817 | 399 | 351,411 | 2,396 |
| Other land | NO | 799 | NO | NO | NO | 28,352 | 29,151 | -7,587 |
| **Initial** | 2,060,943 | 2,376,014 | 1,325,776 | 380,162 | 349,015 | 36,738 | 6,528,648 | |

**1993**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,066,533 | 1,198 | 3,993 | NO | NO | NO | 2,071,725 | 5,191 |
| Cropland | NO | 2,275,383 | 22,762 | 1,198 | 399 | 1,597 | 2,301,340 | -36,339 |
| Grassland | NO | 58,702 | 1,336,558 | 1,198 | 1,198 | 5,191 | 1,402,847 | 39,134 |
| Wetlands | NO | 799 | NO | 378,166 | NO | NO | 378,964 | -1,597 |
| Settlements | NO | 799 | 399.33013 | NO | 349,015 | NO | 350,213 | -399 |
| Other land | NO | 799 | NO | NO | NO | 22,762 | 23,560 | -5,990 |
| **Initial** | 2,066,533 | 2,337,679 | 1,363,712 | 380,562 | 350,612 | 29,550 | 6,528,648 | |

**1994**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,071,325 | NO | 2,396 | 399 | NO | 399 | 2,074,520 | 2,795 |
| Cropland | NO | 2,231,057 | 27,953 | NO | NO | 799 | 2,259,809 | -41,530 |
| Grassland | NO | 66,688 | 1,370,900 | 799 | 799 | 4,792 | 1,443,978 | 41,131 |
| Wetlands | NO | 399 | NO | 377,766 | NO | NO | 378,166 | -799 |
| Settlements | NO | 2,795 | 1,597 | NO | 349,414 | NO | 353,806 | 3,594 |
| Other land | 399 | 399 | NO | NO | NO | 17,571 | 18,369 | -5,191 |
| **Initial** | 2,071,725 | 2,301,340 | 1,402,847 | 378,964 | 350,213 | 23,560 | 6,528,648 | |

**1995**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,074,520 | NO | 1,597 | 799 | NO | NO | 2,076,916 | 2,396 |
| Cropland | NO | 2,197,514 | 24,758 | NO | NO | 399 | 2,222,672 | -37,138 |
| Grassland | NO | 59,500 | 1,417,223 | 1,198 | 3,195 | 4,792 | 1,485,907 | 41,930 |
| Wetlands | NO | 399 | 399 | 376,169 | NO | 799 | 377,766 | -399 |
| Settlements | NO | 1,997 | NO | NO | 350,612 | NO | 352,609 | -1,198 |
| Other land | NO | 399 | NO | NO | NO | 12,379 | 12,779 | -5,591 |
| **Initial** | 2,074,520 | 2,259,809 | 1,443,978 | 378,166 | 353,806 | 18,369 | 6,528,648 | |

**1996**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,076,916 | 399 | 2,795 | 799 | NO | NO | 2,080,909 | 3,993 |
| Cropland | NO | 2,196,316 | 8,386 | NO | NO | NO | 2,204,702 | -17,970 |
| Grassland | NO | 25,956 | 1,474,726 | 399 | NO | 399 | 1,501,481 | 15,574 |
| Wetlands | NO | NO | NO | 376,568 | NO | NO | 376,568 | -1,198 |
| Settlements | NO | NO | NO | NO | 352,609 | NO | 352,609 | NO |
| Other land | NO | NO | NO | NO | NO | 12,379 | 12,379 | -399 |
| **Initial** | 2,076,916 | 2,222,672 | 1,485,907 | 377,766 | 352,609 | 12,779 | 6,528,648 | |

**1997**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,080,909 | 799 | 2,396 | 399 | NO | NO | 2,084,503 | 3,594 |
| Cropland | NO | 2,152,789 | 19,567 | NO | NO | 399 | 2,172,755 | -31,946 |
| Grassland | NO | 50,715 | 1,478,719 | NO | NO | NO | 1,529,434 | 27,953 |
| Wetlands | NO | NO | 399 | 376,169 | NO | NO | 376,568 | NO |
| Settlements | NO | 399 | 399 | NO | 352,209 | NO | 353,008 | 399 |
| Other land | NO | NO | NO | NO | 399 | 11,980 | 12,379 | NO |
| **Initial** | 2,080,909 | 2,204,702 | 1,501,481 | 376,568 | 352,609 | 12,379 | 6,528,648 | |

**1998**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,084,503 | NO | 2,795 | NO | NO | 399 | 2,087,698 | 3,195 |
| Cropland | NO | 2,088,097 | 37,138 | NO | NO | NO | 2,125,235 | -47,520 |
| Grassland | NO | 83,859 | 1,489,102 | NO | NO | NO | 1,572,961 | 43,527 |
| Wetlands | NO | NO | NO | 376,568 | NO | NO | 376,568 | NO |
| Settlements | NO | 399 | 399 | NO | 353,008 | NO | 353,806 | 799 |
| Other land | NO | 399 | NO | NO | NO | 11,980 | 12,379 | NO |
| **Initial** | 2,084,503 | 2,172,755 | 1,529,434 | 376,568 | 353,008 | 12,379 | 6,528,648 | |

**1999**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,087,299 | 399.33013 | 1,597 | 1,198 | NO | NO | 2,090,493 | 2,795 |
| Cropland | NO | 2,028,198 | 51,913 | NO | NO | NO | 2,080,111 | -45,124 |
| Grassland | NO | 96,239 | 1,518,652 | NO | NO | NO | 1,614,891 | 41,930 |
| Wetlands | 399 | NO | NO | 375,370 | NO | NO | 375,770 | -799 |
| Settlements | NO | 399 | 799 | NO | 353,806 | NO | 355,004 | 1,198 |
| Other land | NO | NO | NO | NO | NO | 12,379 | 12,379 | NO |
| **Initial** | 2,087,698 | 2,125,235 | 1,572,961 | 376,568 | 353,806 | 12,379 | 6,528,648 | |

**2000**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,090,493 | NO | 2,396 | 1,997 | NO | 399 | 2,095,285 | 4,792 |
| Cropland | NO | 1,969,496 | 50,715 | NO | NO | NO | 2,020,211 | -59,900 |
| Grassland | NO | 108,618 | 1,558,186 | 399 | 1,198 | NO | 1,668,401 | 53,510 |
| Wetlands | NO | NO | 1,198 | 373,374 | NO | NO | 374,572 | -1,198 |
| Settlements | NO | 1,997 | 2,396 | NO | 353,806 | NO | 358,199 | 3,195 |
| Other land | NO | NO | NO | NO | NO | 11,980 | 11,980 | -399 |
| **Initial** | 2,090,493 | 2,080,111 | 1,614,891 | 375,770 | 355,004 | 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 | NO | NO | NO | 2,097,681 | 2,396 |
| Cropland | NO | 1,917,583 | 43,128 | NO | NO | NO | 1,960,711 | -59,500 |
| Grassland | NO | 101,829 | 1,622,478 | 399 | 399 | 399 | 1,725,505 | 57,104 |
| Wetlands | NO | NO | NO | 374,172 | NO | NO | 374,172 | -399 |
| Settlements | NO | 399 | 399 | NO | 357,800 | NO | 358,598 | 399 |
| Other land | NO | NO | 399 | NO | NO | 11,581 | 11,980 | NO |
| **Initial** | 2,095,285 | 2,020,211 | 1,668,401 | 374,572 | 358,199 | 11,980 | 6,528,648 | |

**2002**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,097,681 | NO | 3,993 | 399 | NO | NO | 2,102,074 | 4,393 |
| Cropland | NO | 1,872,459 | 40,332 | NO | NO | NO | 1,912,791 | -47,920 |
| Grassland | NO | 87,453 | 1,680,781 | NO | NO | NO | 1,768,234 | 42,728 |
| Wetlands | NO | NO | 399 | 373,773 | NO | 799 | 374,971 | 799 |
| Settlements | NO | 799 | NO | NO | 358,598 | NO | 359,397 | 799 |
| Other land | NO | NO | NO | NO | NO | 11,181 | 11,181 | -799 |
| **Initial** | 2,097,681 | 1,960,711 | 1,725,505 | 374,172 | 358,598 | 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 | NO | 2,106,866 | 4,792 |
| Cropland | NO | 1,848,499 | 23,560 | NO | NO | NO | 1,872,060 | -40,732 |
| Grassland | NO | 63,493 | 1,740,680 | NO | NO | NO | 1,804,174 | 35,940 |
| Wetlands | 399 | NO | NO | 374,172 | NO | 399 | 374,971 | NO |
| Settlements | NO | NO | 399 | NO | 358,998 | NO | 359,397 | NO |
| Other land | NO | NO | 399 | NO | NO | 10,782 | 11,181 | NO |
| **Initial** | 2,102,074 | 1,912,791 | 1,768,234 | 374,971 | 359,397 | 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 | 1,198 | NO | NO | 2,114,054 | 7,188 |
| Cropland | NO | 1,821,744 | 29,151 | NO | NO | NO | 1,850,895 | -21,164 |
| Grassland | NO | 49,517 | 1,768,234 | 399 | NO | NO | 1,818,150 | 13,977 |
| Wetlands | 799 | NO | NO | 373,374 | NO | 399 | 374,572 | -399 |
| Settlements | NO | 399 | 399 | NO | 359,397 | NO | 360,196 | 799 |
| Other land | NO | NO | NO | NO | NO | 10,782 | 10,782 | -399 |
| **Initial** | 2,106,866 | 1,872,060 | 1,804,174 | 374,971 | 359,397 | 11,181 | 6,528,648 | |

**2005**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,113,654 | 799 | 5,191 | 1,597 | NO | 399 | 2,121,641 | 7,587 |
| Cropland | NO | 1,810,962 | 23,161 | NO | NO | NO | 1,834,123 | -16,772 |
| Grassland | NO | 38,336 | 1,787,402 | NO | NO | NO | 1,825,737 | 7,587 |
| Wetlands | NO | NO | 799 | 372,974 | NO | 399 | 374,172 | -399 |
| Settlements | 399 | 799 | 1,597 | NO | 360,196 | NO | 362,991 | 2,795 |
| Other land | NO | NO | NO | NO | NO | 9,983 | 9,983 | -799 |
| **Initial** | 2,114,054 | 1,850,895 | 1,818,150 | 374,572 | 360,196 | 10,782 | 6,528,648 | |

**2006**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,121,242 | 799 | 5,591 | 1,597 | NO | NO | 2,129,228 | 7,587 |
| Cropland | NO | 1,798,184 | 76,272 | NO | NO | NO | 1,874,456 | 40,332 |
| Grassland | NO | 34,742 | 1,741,878 | 399 | NO | NO | 1,777,019 | -48,718 |
| Wetlands | NO | 399 | 399 | 372,176 | NO | NO | 372,974 | -1,198 |
| Settlements | 399 | NO | 1,597 | NO | 362,991 | NO | 364,988 | 1,997 |
| Other land | NO | NO | NO | NO | NO | 9,983 | 9,983 | NO |
| **Initial** | 2,121,641 | 1,834,123 | 1,825,737 | 374,172 | 362,991 | 9,983 | 6,528,648 | |

**2007**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,129,228 | 2,396 | 2,795 | 1,997 | NO | 399 | 2,136,816 | 7,587 |
| Cropland | NO | 1,847,701 | 71,879 | NO | NO | NO | 1,919,580 | 45,124 |
| Grassland | NO | 24,359 | 1,699,948 | NO | 399 | NO | 1,724,707 | -52,312 |
| Wetlands | NO | NO | 1,198 | 370,978 | NO | NO | 372,176 | -799 |
| Settlements | NO | NO | 1,198 | NO | 364,588 | NO | 365,786 | 799 |
| Other land | NO | NO | NO | NO | NO | 9,584 | 9,584 | -399 |
| **Initial** | 2,129,228 | 1,874,456 | 1,777,019 | 372,974 | 364,988 | 9,983 | 6,528,648 | |

**2008**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,136,816 | 1,597 | 4,792 | 399 | NO | NO | 2,143,604 | 6,789 |
| Cropland | NO | 1,892,825 | 73,077 | NO | 399 | NO | 1,966,302 | 46,722 |
| Grassland | NO | 24,758 | 1,643,643 | 399 | NO | NO | 1,668,801 | -55,906 |
| Wetlands | NO | NO | 799 | 371,377 | NO | NO | 372,176 | NO |
| Settlements | NO | 399 | 1,597 | NO | 365,387 | NO | 367,384 | 1,597 |
| Other land | NO | NO | NO | NO | NO | 9,584 | 10,383 | 799 |
| **Initial** | 2,136,816 | 1,919,580 | 1,724,707 | 372,176 | 365,786 | 9,584 | 6,528,648 | |

**2009**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,143,205 | NO | 3,594 | NO | NO | NO | 2,146,799 | 3,195 |
| Cropland | NO | 1,949,929 | 50,316 | NO | NO | NO | 2,000,245 | 33,943 |
| Grassland | NO | 15,973 | 1,610,498 | NO | 399 | 399 | 1,627,270 | -41,530 |
| Wetlands | 399 | NO | NO | 372,176 | NO | NO | 372,575 | 399 |
| Settlements | NO | 399 | 3,594 | NO | 366,984 | NO | 370,978 | 3,594 |
| Other land | NO | NO | 799 | NO | NO | 9,983 | 10,782 | 399 |
| **Initial** | 2,143,604 | 1,966,302 | 1,668,801 | 372,176 | 367,384 | 10,383 | 6,528,648 | |

**2010**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,146,799 | 399 | 5,990 | NO | NO | NO | 2,153,188 | 6,389 |
| Cropland | NO | 1,896,818 | 5,191 | NO | NO | NO | 1,902,009 | -98,235 |
| Grassland | NO | 103,027 | 1,612,096 | 399 | 1,198 | NO | 1,716,720 | 89,450 |
| Wetlands | NO | NO | NO | 372,176 | NO | NO | 372,176 | -399 |
| Settlements | NO | NO | 3,993 | NO | 369,780 | NO | 373,773 | 2,795 |
| Other land | NO | NO | NO | NO | NO | 10,782 | 10,782 | NO |
| **Initial** | 2,146,799 | 2,000,245 | 1,627,270 | 372,575 | 370,978 | 10,782 | 6,528,648 | |

**2011**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,153,188 | 2,396 | 5,591 | NO | NO | NO | 2,161,175 | 7,987 |
| Cropland | NO | 1,858,882 | 39,933 | NO | NO | NO | 1,898,815 | -3,195 |
| Grassland | NO | 40,732 | 1,670,797 | NO | 399 | NO | 1,711,928 | -4,792 |
| Wetlands | NO | NO | NO | 372,176 | NO | 399 | 372,575 | 399 |
| Settlements | NO | NO | 399 | NO | 373,374 | NO | 373,773 | NO |
| Other land | NO | NO | NO | NO | NO | 10,383 | 10,383 | -399 |
| **Initial** | 2,153,188 | 1,902,009 | 1,716,720 | 372,176 | 373,773 | 10,782 | 6,528,648 | |

**2012**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,161,175 | 1,198 | 8,386 | 1,597 | NO | NO | 2,172,356 | 11,181 |
| Cropland | NO | 1,863,674 | 37,138 | NO | NO | NO | 1,900,811 | 1,997 |
| Grassland | NO | 33,943 | 1,665,606 | 399 | 1,198 | NO | 1,701,146 | -10,782 |
| Wetlands | NO | NO | NO | 370,578 | NO | NO | 370,578 | -1,997 |
| Settlements | NO | NO | 799 | NO | 372,575 | NO | 373,374 | -399 |
| Other land | NO | NO | NO | NO | NO | 10,383 | 10,383 | NO |
| **Initial** | 2,161,175 | 1,898,815 | 1,711,928 | 372,575 | 373,773 | 10,383 | 6,528,648 | |

**2013**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,172,356 | 799 | 4,393 | NO | 799 | NO | 2,178,346 | 5,990 |
| Cropland | NO | 1,879,647 | 37,138 | NO | NO | NO | 1,916,785 | 15,973 |
| Grassland | NO | 19,967 | 1,654,824 | NO | 1198 | NO | 1,675,989 | -25,158 |
| Wetlands | NO | NO | NO | 370,578 | NO | 399 | 370,978 | 399 |
| Settlements | NO | 399 | 4,393 | NO | 371,377 | NO | 376,169 | 2,795 |
| Other land | NO | NO | 399 | NO | 0 | 9,983 | 10,383 | NO |
| **Initial** | 2,172,356 | 1,900,811 | 1,701,146 | 370,578 | 373,374 | 10,383 | 6,528,648 | |

**2014**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,178,346 | 1,997 | 3,594 | 2,396 | NO | NO | 2,186,332 | 7,987 |
| Cropland | NO | 1,892,825 | 42,728 | NO | NO | NO | 1,935,553 | 18,769 |
| Grassland | NO | 21,164 | 1,626,472 | 399 | 399 | 399 | 1,648,834 | -27,154 |
| Wetlands | NO | NO | 1,198 | 368,182 | NO | NO | 369,380 | -1,597 |
| Settlements | NO | 799 | 1,597 | NO | 375,770 | NO | 378,166 | 1,997 |
| Other land | NO | NO | 399 | NO | NO | 9,983 | 10,383 | NO |
| **Initial** | 2,178,346 | 1,916,785 | 1,675,989 | 370,978 | 376,169 | 10,383 | 6,528,648 | |

**2015**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,186,332 | 799 | 7,587 | 799 | NO | NO | 2,195,517 | 9,185 |
| Cropland | NO | 1,924,771 | 15,973 | NO | 399 | NO | 1,941,144 | 5,591 |
| Grassland | NO | 9,584 | 1,622,878 | NO | NO | 1,198 | 1,633,660 | -15,175 |
| Wetlands | NO | NO | 399 | 368,582 | NO | NO | 368,981 | -399 |
| Settlements | NO | 399 | 1,997 | NO | 377,766 | NO | 380,162 | 1,997 |
| Other land | NO | NO | NO | NO | NO | 9,185 | 9,185 | -1,198 |
| **Initial** | 2,186,332 | 1,935,553 | 1,648,834 | 369,380 | 378,166 | 10,383 | 6,528,648 | |

**2016**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,195,118 | 399 | 3,993 | 1,198 | NO | NO | 2,200,708 | 5,191 |
| Cropland | NO | 1,930,761 | 11,980 | NO | 798.66026 | NO | 1,943,540 | 2,396 |
| Grassland | NO | 9,983 | 1,617,686 | 399 | NO | 799 | 1,628,868 | -4,792 |
| Wetlands | NO | NO | NO | 367,384 | NO | NO | 367,384 | -1,597 |
| Settlements | 399 | NO | NO | NO | 379,364 | NO | 379,763 | -399 |
| Other land | NO | NO | NO | NO | NO | 8,386 | 8,386 | -799 |
| **Initial** | 2,195,517 | 1,941,144 | 1,633,660 | 368,981 | 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 | NO | NO | 2,209,094 | 8,386 |
| Cropland | NO | 1,931,959 | 34,342 | NO | NO | NO | 1,966,302 | 22,762 |
| Grassland | NO | 10,782 | 1,587,737 | 399 | 1,198 | 399 | 1,600,515 | -28,352 |
| Wetlands | 399 | NO | NO | 364,588 | NO | NO | 364,988 | -2,396 |
| Settlements | NO | 399 | 799 | NO | 378,565 | NO | 379,763 | NO |
| Other land | NO | NO | NO | NO | NO | 7,987 | 7,987 | -399 |
| **Initial** | 2,200,708 | 1,943,540 | 1,628,868 | 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 | 2,205,900 | NO | 3,594 | 399 | NO | NO | 2,209,893 | 799 |
| Cropland | NO | 1,955,520 | 33,144 | NO | 399 | NO | 1,989,063 | 22,762 |
| Grassland | 1,198 | 10,782 | 1,562,978 | 799 | 799 | 399 | 1,576,955 | -23,560 |
| Wetlands | NO | NO | NO | 363,790 | NO | NO | 363,790 | -1,198 |
| Settlements | 799 | NO | 799 | NO | 378,565 | 399 | 380,562 | 799 |
| Other land | 1,198 | NO | NO | NO | NO | 7,188 | 8,386 | 399 |
| **Initial** | 2,209,094 | 1,966,302 | 1,600,515 | 364,988 | 379,763 | 7,987 | 6,528,648 | |

**2019**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,209,494 | NO | 3,594 | 399 | NO | NO | 2,213,487 | 3,594 |
| Cropland | NO | 1,975,486 | 30,748 | NO | 399 | NO | 2,006,634 | 17,571 |
| Grassland | 399 | 13,577 | 1,540,216 | 399 | NO | NO | 1,554,592 | -22,362 |
| Wetlands | NO | NO | NO | 362,991 | NO | NO | 362,991 | -799 |
| Settlements | NO | NO | 2,396 | NO | 380,162 | NO | 382,558 | 1,997 |
| Other land | NO | NO | NO | NO | NO | 8,386 | 8,386 | NO |
| **Initial** | 2,209,893 | 1,989,063 | 1,576,955 | 363,790 | 380,562 | 8,386 | 6,528,648 | |

**2020**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,212,688 | 399 | 5,990 | 1,997 | NO | NO | 2,221,074 | 7,587 |
| Cropland | NO | 1,989,862 | 41,930 | NO | 399 | NO | 2,032,191 | 25,557 |
| Grassland | 799 | 16,373 | 1,503,478 | NO | 399 | 399 | 1,521,448 | -33,144 |
| Wetlands | NO | NO | NO | 360,994 | NO | NO | 360,994 | -1,997 |
| Settlements | NO | NO | 3,195 | NO | 381,760 | NO | 384,954 | 2,396 |
| Other land | NO | NO | NO | NO | NO | 7,987 | 7,987 | -399 |
| **Initial** | 2,213,487 | 2,006,634 | 1,554,592 | 362,991 | 382,558 | 8,386 | 6,528,648 | |

**2021**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,220,276 | NO | 9,185 | 399 | 399 | NO | 2,230,259 | 9,185 |
| Cropland | NO | 2,010,228 | 45,923 | NO | NO | NO | 2,056,151 | 23,960 |
| Grassland | 399 | 21,564 | 1,464,743 | NO | 399 | NO | 1,487,105 | -34,342 |
| Wetlands | NO | NO | NO | 360,595 | NO | NO | 360,595 | -399 |
| Settlements | 399 | 399 | 1,198 | NO | 384,156 | NO | 386,152 | 1,198 |
| Other land | NO | NO | 399 | NO | NO | 7,987 | 8,386 | 399 |
| **Initial** | 2,221,074 | 2,032,191 | 1,521,448 | 360,994 | 384,954 | 7,987 | 6,528,648 | |

**2022**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,229,859 | 399 | 7,987 | 2,396 | NO | NO | 2,240,641 | 10,383 |
| Cropland | 399 | 2,041,376 | 60,299 | NO | 399 | NO | 2,102,473 | 46,322 |
| Grassland | NO | 13,977 | 1,417,223 | NO | 399 | NO | 1,431,599 | -55,507 |
| Wetlands | NO | NO | NO | 358,199 | 399 | NO | 358,598 | -1,997 |
| Settlements | NO | 399 | 1,198 | NO | 384,954 | NO | 386,552 | 399 |
| Other land | NO | NO | 399 | NO | NO | 8,386 | 8,785 | 399 |
| **Initial** | 2,230,259 | 2,056,151 | 1,487,105 | 360,595 | 386,152 | 8,386 | 6,528,648 | |

**2023**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,240,242 | 399 | 6,789 | 399 | NO | NO | 2,247,829 | 7,188 |
| Cropland | NO | 2,086,500 | 58,302 | NO | 399 | NO | 2,145,201 | 42,728 |
| Grassland | NO | 15,175 | 1,363,313 | NO | 399 | NO | 1,378,887 | -52,712 |
| Wetlands | NO | NO | NO | 358,199 | NO | NO | 358,199 | -399 |
| Settlements | 399 | 399 | 3,195 | NO | 385,753 | NO | 389,746 | 3,195 |
| Other land | NO | NO | NO | NO | NO | 8,785 | 8,785 | NO |
| **Initial** | 2,240,641 | 2,102,473 | 1,431,599 | 358,598 | 386,552 | 8,785 | 6,528,648 | |

**2024**

| Land category | Forest land | Cropland | Grassland | Wetlands | Settlements | Other land | Final | Net change |
|---|---|---|---|---|---|---|---|---|
| Forest land | 2,247,031 | NO | 4,393 | 1,198 | NO | NO | 2,252,621 | 4,792 |
| Cropland | 0 | 2,126,832 | 44,725 | NO | NO | NO | 2,171,557 | 26,356 |
| Grassland | 399.33013 | 17,571 | 1,325,776 | NO | NO | NO | 1,343,746 | -35,141 |
| Wetlands | NO | NO | 1197.9904 | 357,001 | 399.33013 | NO | 358,598 | 399 |
| Settlements | 399 | 799 | 2,396 | NO | 389,347 | NO | 392,941 | 3,195 |
| Other land | NO | NO | 399.33013 | NO | NO | 8,785 | 9,185 | 399 |
| **Initial** | 2,247,829 | 2,145,201 | 1,378,887 | 358,199 | 389,746 | 8,785 | 6,528,648 | |

# ANNEX XIII. 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.

LITHUANIAN RESEARCH CENTRE FOR AGRICULTURE AND FORESTRY

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

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

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

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

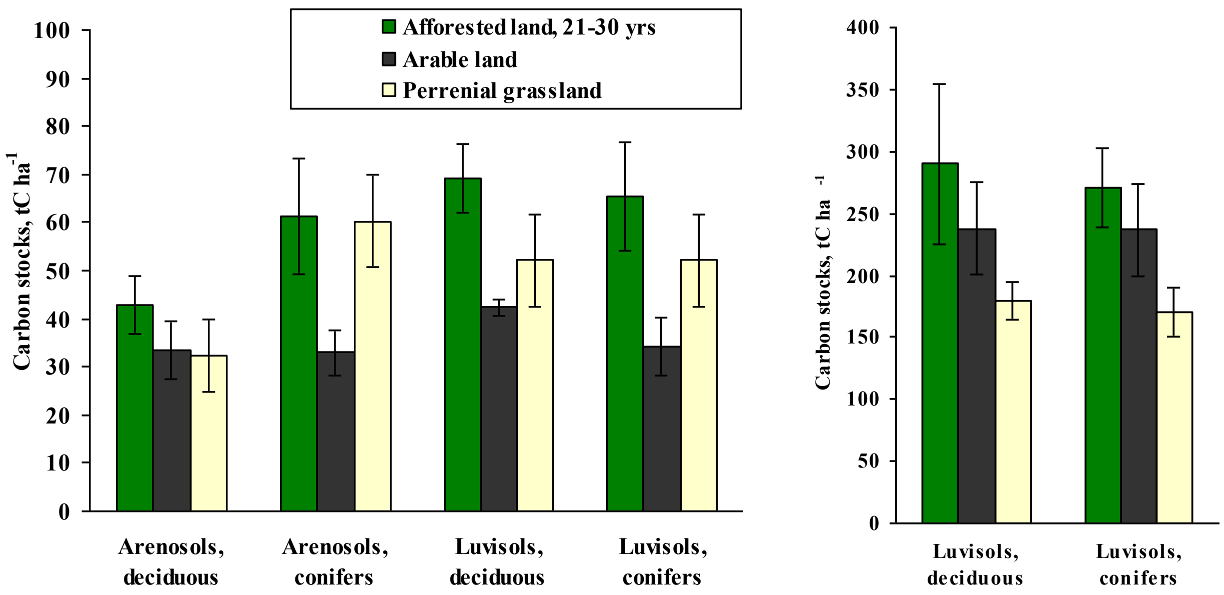



Fig.1. Stocks (t $ha^{-1}$) of organic carbon in 0–30 cm mineral soil/peat layer in the afforested land in the 21-30-year old coniferous and deciduous forest plantations and the control (arable land and grassland).

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

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

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

| **Land-use** | **Soil group (WRB, 2015)** | | | | | |
|---|---|---|---|---|---|---|
| | ***Arenosols*** | | ***Luvisols*** | | ***Histosols*** | |
| | ***n*** | **tC ha$^{-1}$** | ***n*** | **tC ha$^{-1}$** | ***n*** | **tC ha$^{-1}$** |
| **Afforested land*** (0-10 years old) | 23 | **51.9±5.2** | 22 | **59.1±4.0** | 15 | **283.9±15.8** |
| Arable land | 10 | 44.9±7.1 | 13 | 33.6±3.9 | 7 | 227.7±47.0 |
| Grassland | 9 | 39.4±4.5 | 9 | 63.6±13.9 | 7 | 221.0±14.7 |
| **Afforested land** (11-20 years old) | 22 | **57.5±4.8** | 21 | **60.3±4.8** | 22 | **243.9±26.5** |
| Arable land | 12 | 40.4±4.1 | 12 | 40.1±5.4 | 6 | 171.6±18.5 |
| Grassland | 11 | 46.3±5.8 | 10 | 61.9±13.0 | 15 | 168.4±13.5 |
| **Afforested land** (21-30 years old) | 22 | **49.3±6.0** | 18 | **66.9±7.2** | 23 | **277.6±29.9** |
| Arable land | 11 | 33.3±3.9 | 14 | 36.9±4.2 | 7 | 199.7±32.3 |
| Grassland | 9 | 36.9±7.7 | 8 | 52.1±9.7 | 16 | 174.3±12.9 |
| **Afforested land** (0-30 years old) | 67 | **53.3±3.1** | 61 | **61.8±3.1** | 60 | **266.8±15.5** |
| Arable land | 33 | 40.0±2.8 | 39 | 36.9±2.2 | 22 | 221.3±23.2 |
| Grassland | 29 | 42.5±3.1 | 26 | 58.0±6.1 | 38 | 191.2±8.7 |

* Afforested land – conifers and deciduous plantations

Table 2. Soil organic carbon stocks (t ha$^{-1}$) in Arenosols (data of 2016 soil survey in Lithuania)

| **Land-use** | **Stock of soil organic carbon, tC ha$^{-1}$** | | | |
|---|---|---|---|---|
| | **Soil organic layer / litter of grasses** | **Mineral soil 0–10 cm** | **Mineral soil 10–30 cm** | **Mineral soil 0–30 cm** |
| **Afforested land** (0-10 yrs old) | 1.2±0.2 | 19.2±2.0 | 32.7±3.5 | 51.9±5.2 |
| Control | 0.9±0.1 | 21.8±2.1 | 20.1±2.6 | 41.9±4.0 |
| **Conifers** (0-10 yrs old) | 0.8±0.3 | 17.4±2.7 | 29.0±4.9 | 46.4±7.5 |
| Arable land | - | 15.3±3.6 | 22.5±7.3 | 37.8±10.9 |
| Grassland | 0.9 | 18.0±3.3 | 15.1±3.6 | 33.1±6.9 |
| **Deciduous** (0-10 yrs old) | 1.5±0.3 | 20.7±2.8 | 35.7±5.0 | 56.4±7.3 |
| Arable land | - | 25.0±3.4 | 27.1±6.9 | 52.1±9.3 |
| Grassland | 0.8±0.2 | 28.5±4.1 | 17.1±2.4 | 45.7±5.3 |
| **Afforested land** (11-20 yrs old) | 2.9±0.3 | 20.3±1.4 | 37.2±3.8 | 57.5±4.8 |
| Control | 0.7±0.1 | 22.3±1.8 | 20.8±1.9 | 43.1±3.4 |
| **Conifers** (11-20 yrs old) | 3.3±0.4 | 22.6±1.5 | 36.8±3.8 | 59.4±5.2 |
| Arable land | - | 23.1±2.5 | 23.0±3.8 | 46.1±5.7 |
| Grassland | 0.7±0.2 | 29.9±3.6 | 24.6±3.5 | 54.5±6.8 |
| **Deciduous** (11-20 yrs old) | 2.3±0.3 | 17.3±2.5 | 37.7±7.6 | 55.0±9.2 |
| Arable land | - | 16.3±1.9 | 16.1±2.0 | 32.4±3.7 |
| Grassland | - | 19.4±3.9 | 18.7±4.9 | 38.1±8.6 |

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

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

Table 3. Soil organic carbon stocks (t $ha^{-1}$) in Luvisols (data of 2016 soil survey in Lithuania)

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

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

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

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

Table 4. Soil organic carbon stocks (t $ha^{-1}$) in *Histosols* (data of 2016 soil survey in Lithuania)

| Land-use | Stock of soil organic carbon, tC $ha^{-1}$ | | | |
|---|---|---|---|---|
| | Organic layer / litter of grasses | Peat layer 0–10 cm | Peat layer 10–30 cm | Peat layer 0–30 cm |
| **Afforested land** (0-10 yrs old) | 1.4±0.2 | 88.3±4.5 | 195.6±12.4 | 283.9±15.8 |
| Control | - | 113.4±12.3 | 110.9±12.7 | 224.3±22.8 |
| **Conifers** (0-10 yrs old) | 1.0±0.2 | 90.9±8.0 | 192.2±20.3 | 283.1±26.9 |
| Arable land | - | 110.7±31.0 | 131.4±35.7 | 242.1±66.6 |
| Grassland | - | 125.2±3.5 | 96.5±9.5 | 221.7±6.0 |
| **Deciduous** (0-10 yrs old) | 1.9±0.2 | 85.4±3.7 | 199.4±14.7 | 284.8±16.9 |
| Arable land | - | 90.9±2.4 | 100.7±14.9 | 191.6±12.5 |
| Grassland | - | 120.5±20.9 | 100.2±10.5 | 220.7±21.2 |
| **Afforested land** (11-20 yrs old) | 2.7±0.2 | 75.0±7.2 | 168.9±22.3 | 243.9±26.5 |
| Control | 2.1 | 81.2±4.9 | 87.7±7.3 | 168.9±11.5 |
| **Conifers** (11-20 yrs old) | 3.0±0.4 | 90.4±9.6 | 199.7±38.3 | 290.1±41.3 |
| Arable land | - | 71.3±12.3 | 84.6±4.8 | 155.9±17.1 |
| Grassland | - | 78.7±5.6 | 77.2±12.0 | 155.9±16.9 |
| **Deciduous** (11-20 yrs old) | 2.4±0.2 | 59.6±8.9 | 138.1±20.5 | 197.7±28.5 |
| Arable land | - | 71.3±12.3 | 84.6±4.8 | 155.9±17.1 |
| Grassland | 2.1 | 84.5±11.3 | 102.7±10.9 | 187.2±21.7 |
| **Afforested land** (21-30 yrs old) | 4.8±0.5 | 87.5±9.7 | 190.2±24.2 | 277.6±29.9 |
| Control | - | 112.8±11.5 | 90.3±10.2 | 206.0±19.0 |
| **Conifers** (21-30 yrs old) | 7.3±0.5 | 95.9±15.1 | 194.0±50.0 | 289.9±64.8 |
| Arable land | - | 121.2±21.4 | 116.3±16.0 | 237.5±37.2 |
| Grassland | - | 104.8±15.2 | 74.5±5.9 | 179.3±15.5 |
| **Deciduous** (21-30 yrs old) | 3.4±0.4 | 83.0±12.8 | 188.1±27.4 | 271.1±32.0 |
| Arable land | - | 121.2±21.4 | 116.3±16.0 | 237.0±37.0 |
| Grassland | - | 100.3±18.5 | 70.0±8.6 | 170.3±20.2 |
| **Afforested land** (0-30 yrs old) | 3.2±0.3 | 83.1±4.7 | 183.7±12.7 | 266.8±15.5 |
| Control | 2.1 | 98.3±5.6 | 104.0±6.4 | 202.2±10.2 |
| **Conifers** (0-30 yrs old) | 3.7±0.5 | 92.2±6.1 | 195.8±21.5 | 288.0±25.7 |
| Arable land | - | 128.1±28.2 | 144.2±31.1 | 272.4±59.1 |
| Grassland | - | 94.0±7.4 | 78.3±6.5 | 172.3±11.2 |
| **Deciduous** (0-30 yrs old) | 2.7±0.2 | 75.7±6.7 | 173.8±14.9 | 249.5±18.5 |
| Arable land | - | 103.4±13.7 | 105.8±9.9 | 209.2±23.3 |
| Grassland | 2.1 | 104.1±10.3 | 90.4±6.1 | 194.5±11.4 |

LITHUANIAN RESEARCH CENTRE FOR AGRICULTURE AND FORESTRY

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

**Short report**

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

## Introduction

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

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

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

## Materials and Methods

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

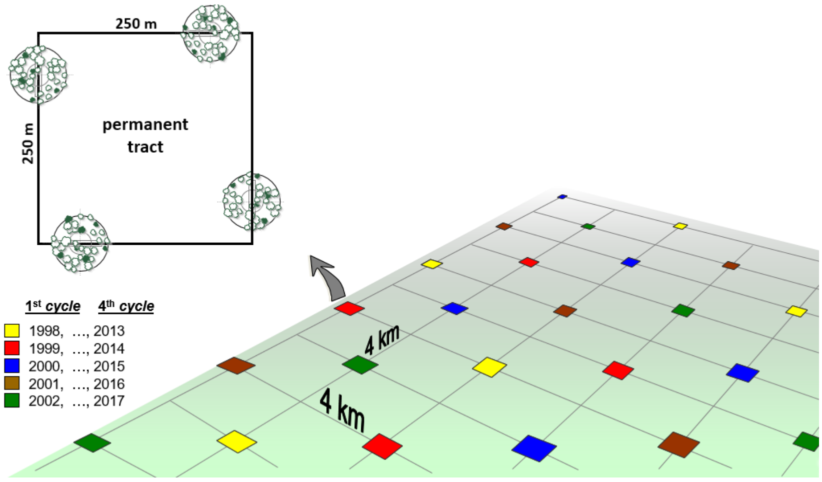



Fig. 1. National Forest Inventory permanent sample plots grid in Lithuania

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

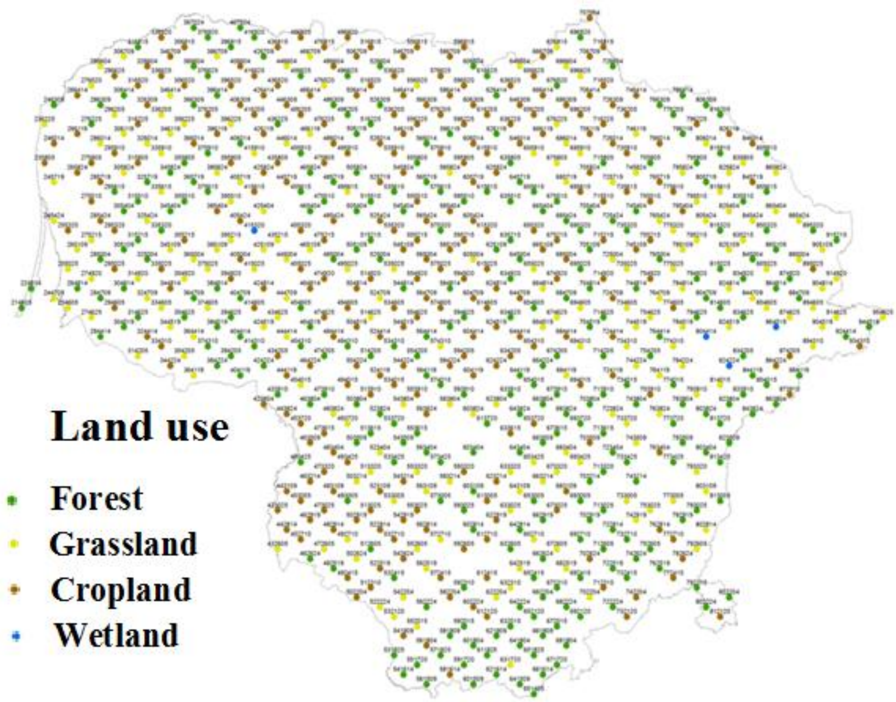



*Fig. 2*. Sample plots in the grid (9x9 km) of Lithuanian National Forest Inventory (NFI) (Total N=752; forest land – 298; grassland – 206; cropland – 244; wetland – 4)

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

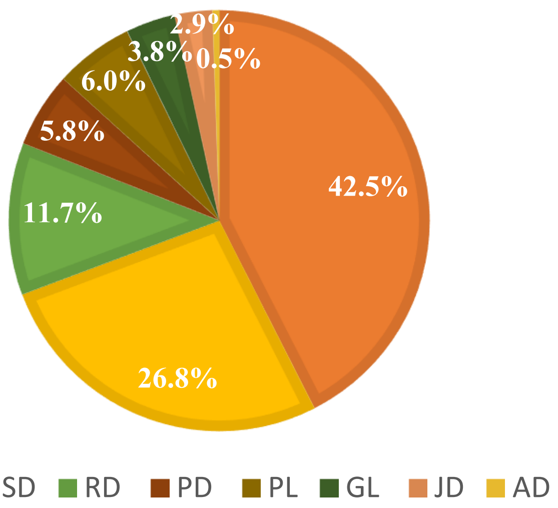
$$\mathrm{SOC_i} = \mathrm{p_i}(1 - (\frac{Qi{,}2mm}{100}))d_\mathrm{i}C_\mathrm{i} * 10^{-1}$$

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

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

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

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

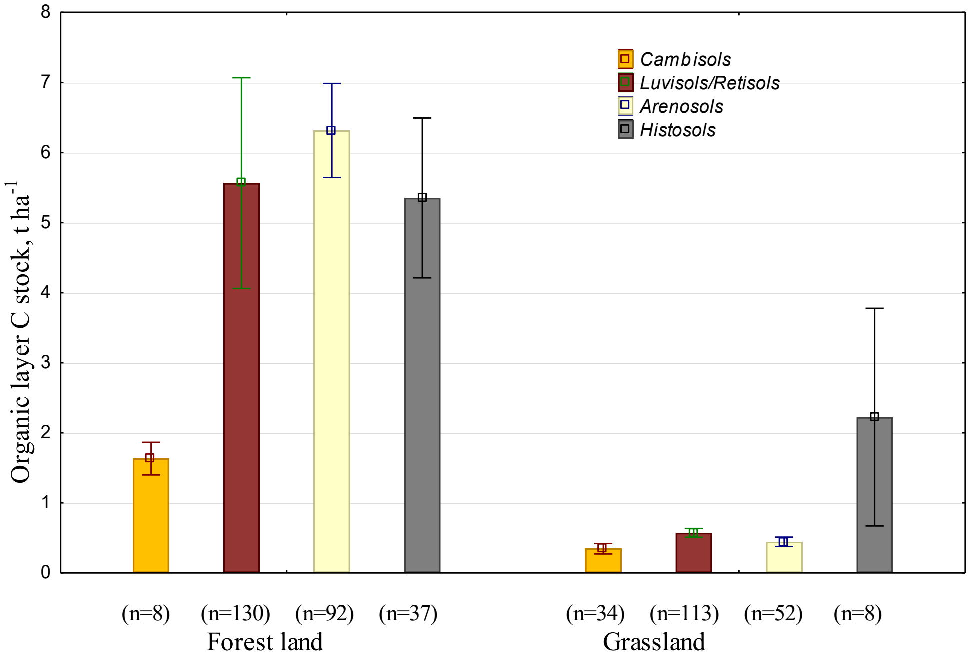



Fig. 4. Mean organic layer stocks of carbon in organic layer of different mineral soils in forest land and grassland (the bars represent SE)

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

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

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

***Cold temperate, moist region***

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

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

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

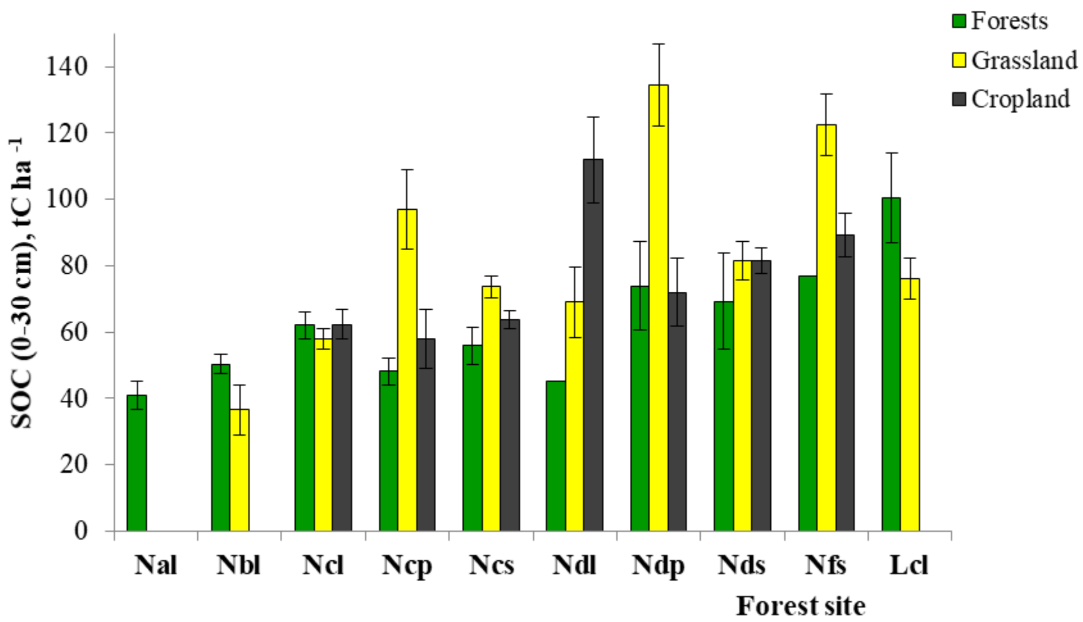



*Fig. 5.* Mean stocks of soil organic carbon (SOC) in surface 0-30 cm layer of different forest sites (according Lithuanian classification, Vaičys et al., 2006)

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/Retisols

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

| | | | | |
|---|---|---|---|---|
| **In average** | 53 | 3,9±0,3 | 1,5±0,1 | 103,6±4,7 |

It was found that the mean stocks of soil organic carbon (SOC) in soil organic layer and surface 0-30 cm mineral layer did not depend directly on forest stands of different age at *Luvisol/Retisols.*

# ANNEX XIV. Improvements in response to UN reviews recommendations (ARR 2025)

| ***Review recommendation*** | ***Paragraph No*** | ***Response/status of implementation*** | ***Chapter/section in the NID*** |
|---|---|---|---|
| The TERT recommends that Lithuania implement robust, comprehensive general and sector-level QC procedures for its NID in accordance with its QA/QC plan and the 2006 IPCC Guidelines and encourages Lithuania to implement QA procedures by conducting a basic expert peer review of its NIR. | 2.G.1 | The recommendation will be implemented for NID 2026 March submission. | |
| The TERT encourages Lithuania to include explanatory text on indirect $N_2O$ emissions in the NID and report consistent information on the indirect emissions between the NID, CRT background tables and CRT 6. | 2.G.2 | The encouragement will be implemented for NID 2026 March submission. | NID Chapter 9 |
| The TERT recommends that Lithuania include in its NID under category 1.A the explanation of the different trends of fuel consumption between oil and natural gas, including the distinction between market-driven fuel consumption changes and those changes resulting from policy or legal obligations. | 3.E.1 | In 2022, the share of oil and oil products increased till 41.6% due to the accumulation of secured stocks of oil products. This stock is ensured by the Law on Oil Products and State Oil Reserves. The purpose of the Law on Oil Products and State Oil Reserves in Lithuania is to ensure the accumulation, management, use, supervision, and regulation of oil products and state oil reserves. This law aims to maintain a strategic reserve of oil products to safeguard against supply disruptions and emergencies, aligning with European Union regulations. The explanation was provided in the NID submission. | NID Chapter 3.1 Overview of the sector and background information |
| The TERT recommends that Lithuania (1) revise the allocation in the CRTs of $CO_2$, $CH_4$ and $N_2O$ emissions from the country's combined-cycle gas turbine unit to ensure alignment with IPCC category definitions and to reflect the actual function of the unit, either by reporting emissions from the unit separately under category 1.A.1.a.i or, if confidentiality concerns prevent this, by clearly indicating that the emissions from the unit are included elsewhere, that is reporting them as "IE" under category 1.A.1.a.i; and (2) | 3.E.2 | The greenhouse gas emissions, which occurred at the combined cycle gas turbine in 2012-2024 were reallocated from the category 1.A.1.a.ii Combined heat and power generation to the category 1.A.1.a.i. Electricity generation based on information provided by the Elektrėnai complex on natural gas consumption. | NID Chapters 3.2.5.1.2 Electricity Generation (CRT 1.A.1.a.i) and 3.2.5.1.3 Combined Heat and Power Generation (CRT 1.A.1.a.ii) |

| ***Review recommendation*** | ***Paragraph No*** | ***Response/status of implementation*** | ***Chapter/section in the NID*** |
|---|---|---|---|
| include a clarification of the allocation in the NID to improve the transparency of the national GHG inventory. | | | |
| The TERT recommends that Lithuania enhance the transparency of its inventory data by clearly reporting the assumptions made and methodologies used for allocating fuel consumption between mobile (off-road vehicles and other machinery) and stationary combustion sources, including, for example, the information provided during the review that petrol and diesel oil are assumed to be used only by mobile sources. | 3.E.3 | Lithuania enhances the transparency of its inventory data by reporting that petrol and diesel oil are currently assumed to be used exclusively by mobile off-road sources. The explanation was provided in the NID submission. | NID Chapter 3.2.7.5.2 Methodological issues |
| The TERT recommends that Lithuania explain in the NID that all biofuel use is attributed solely to the mobile combustion categories and revise the notation keys reported for relevant categories, such as off-road vehicle categories, to ensure the accurate representation of fuel types and that reporting is consistent with actual fuel use. | 3.E.4 | According to State Data Agency, all biofuels use is attributed solely to the mobile combustion categories in transport. The explanation was provided in the NID submission. Notation keys for off-road vehicle and fishing categories were changed from "NO" to "IE" in CRTs, and explanations were included in appropriate cells. | NID Chapter 3.2.7.5.2 Methodological issues |
| The TERT recommends that Lithuania enhance the transparency of the reported data by including in the NID clear and comprehensive explanations for any notable changes or anomalies in AD trends such as the sharp increase in biomass consumption for category 1.A.2.g.iv (wood and wood products) observed from 2002 onward. | 3.E.5 | In 2002, significant increase of biomass consumption is linked to the adoption of Lithuania's Law on Energy from Renewable Energy Sources. This legislation established a legal framework to support the development of renewable energy sources. At that time, support for biomass investment projects become available through interest subsidies and soft-term loans from Lithuanian Environmental Investment Fund. The Lithuanian wood and wood products industry naturally generates large amounts of secondary biomass (sawdust, wood chips). Therefore, the support received has encouraged the development of biomass use in this industry. The explanation was provided in the NID submission. | NID Chapter 3.2.6.1.10 Wood and Wood Products (CRT 1.A.2.g.iv) |
| The TERT recommends that Lithuania explain the allocation of medical and hazardous waste combustion emissions and AD from | 3.E.6 | In 2015, the medical and hazardous waste started to be combusted at the facility operated by | NID Chapter 3.2.5.1.3.1 Category description |

| ***Review recommendation*** | ***Paragraph No*** | ***Response/status of implementation*** | ***Chapter/section in the NID*** |
|---|---|---|---|
| the Toksika facility from category 1.A.2.g.viii (non-specified industry) to category 1.A.1.a.ii (CHP generation), including a brief description of the use of energy generated by the facility (e.g. in district heating, electricity supply) to ensure consistency with the 2006 IPCC Guidelines (vol. 2, chap. 2, p.2.7). | | "Toksika" as a CHP plant recovering energy from this waste combustion. The explanation was provided in the NID submission. | |
| The TERT recommends that Lithuania include in the NID details on gasoline consumption including biofuel blends in category 1.A.3 transport to ensure clarity, as well as consistency between the national energy and fuel balance and the reported emissions. | 3.E.7 | Fossil fuels are provided together with mixed biofuels in transport, in line with data provided in Official statistics portal of Lithuania. On the contrary, only fossil parts of transport fuels are provided in CRT as fossil fuel. This explanation was provided in the NID submission (NID Annexes). | NID Annex III. Lithuanian energy balance |
| The TERT recommends that Lithuania ensure its reporting is consistent between the NID and the CRTs by clearly distinguishing between energy use and non-energy use of fuels and, more specifically, when referencing national energy and fuel balances in the NID, by clarifying the allocation of natural gas between combusted (fuel use) and emitted (fugitive/non-energy) quantities and reconciling these values with those reported in the inventory under categories 1.A (fuel combustion – sectoral approach), 1.A.3 (transport) and 1.B.2.b (fugitive emissions from fuels – natural gas), which will enhance transparency and ensure that reported data can be clearly understood and assessed. | 3.E.8 | The explanation was provided in the NID submission.<br>Consumption of natural gas in pipeline transportation, provided by State Data Agency in Lithuanian energy balance, is allocated between combusted (fuel use) and emitted (fugitive/non-energy) quantities. Fugitive quantities are reported under 1.B.2.b (fugitive emissions from fuels – natural gas) based on data obtained from the natural gas transmission and distribution operators. The remaining (combusted) part of natural gas consumed in pipeline transportation is reported under 1.A.3.e.i (pipeline transport). | NID Chapter 3.2.7.4.3.2 Methodological issues |
| The TERT recommends that Lithuania include in the NID the explanation about the split of 80 per cent fatty acid methyl ester and 20 per cent hydrotreated vegetable oil applied for road transport, specifying that this is a default setting in COPERT and it has not been adjusted to reflect national circumstances, and consider using the available country-specific AD on fatty acid methyl ester and hydrotreated vegetable oil quantities in diesel oil to improve the accuracy of the fuel split used in emission | 3.E.9 | The share of FAME biodiesel from 2004 to 2023 is 80% (default setting in COPERT) and in 2024 it is 69% as determined from the EU ETS for buildings, transport, industry and other sectors (EU ETS 2) GHG reports for year 2024. The explanation was provided in the NID submission, and the available country-specific AD was used for 2024 together with the start of monitoring for EU ETS 2 in 2024. | NID Chapters 3.2.7.2.1 Category description (CO2 emissions associated with the fossil carbon content in biofuels) and 3.2.7.2.2 Methodological issues (Emission factors) |

| ***Review recommendation*** | ***Paragraph No*** | ***Response/status of implementation*** | ***Chapter/section in the NID*** |
|---|---|---|---|
| calculations, particularly where the actual shares may differ significantly from the COPERT default values. | | | |
| The TERT recommends that Lithuania update the methodology description provided in the NID for category 2.A.3 (glass production) to accurately reflect that it uses the tier 3 approach to estimate emissions for this category. | 4.I.1 | Methodology description added in the NID submission. | NID Chapter 5.2.3.3 |
| The TERT recommends that Lithuania include in CRT 2(I)A-H a description of AD for all inventory years for category 2.D.2 (paraffin wax use). | 4.I.2 | Inventory data description added for category 2.D.2 (paraffin wax use) in the current inventory submission. | CRT 2.D.2 |
| The TERT recommends that Lithuania include a complete, transparent description of the methodology used for estimating HFC emissions for categories 2.F.1.a and 2.F.1.c. | 4.I.3 | Methodology description and relevant formulas included in the NID submission | NID Chapter 5.7.1.2 |
| The TERT recommends that Lithuania provide a clear, transparent and detailed methodological justification for the change in assumption for equipment lifetime for category 2.F.1.b from a 20- to a 15-year lifetime for domestic refrigeration equipment, including a reference to the 2021 national study that the lifetime value is based on, the rationale for selecting the revised lifetime value and an assessment of the representativeness of the revised lifetime value in the context of national circumstances. Given that equipment lifetime is a key parameter affecting emission estimations, particularly through its influence on the temporal distribution of refrigerant losses and end-of-life emissions, the TERT also recommends that Lithuania perform recalculations for the entire inventory time series, where applicable, in accordance with the 2006 IPCC Guidelines, providing justification for the recalculations and an indication of relevant changes and their impact on emission trends. | 4.I.4 | Recalculations included with corresponding explanation provided in the NID submission. | NID Chapter 5.7.1.5 |
| The TERT recommends that Lithuania include in the next NID an explanation as to why the nutria population is recorded as “NO” for 2022 and any applicable future years. | 5.A.1 | In the previous NID submission, the State Data Agency reported the nutria population as “NO” for the period 2022–2023. However, in 2025 the State Data Agency revised the nutria population data. Consequently, the annual average population figures for nutria were recalculated, and NO is now | NID Chapter 5.1 Overview of the sector *Livestock population data* |

| *Review recommendation* | *Paragraph No* | *Response/status of implementation* | *Chapter/section in the NID* |
|---|---|---|---|
| | | reported only for 2024. The implementation of legal and regulatory measures aimed at restricting the breeding of this species resulted in the complete cessation of nutria breeding activities in Lithuania in 2024. Further details are provided in the NID submission. | |
| The TERT encourages Lithuania to verify the suitability of the default value of Ym applied in estimating emissions from enteric fermentation of cattle, given that cattle are the most significant species in terms of enteric fermentation emissions in the country and the emission calculation depends highly on Ym, and if resources allow, to develop a country-specific Ym value for cattle and/or for other species for which enteric fermentation emissions may become significant. | 5.A.2 | Explanation provided in the 2026 NID submission. | 5.2.4. Category-specific planned improvements |
| The TERT encourages Lithuania to verify the suitability of the default methane conversion factor values for cool climates for manure management systems that it applies in estimating CH4 emissions from manure management for cattle, swine, sheep and goats on the basis of the deviations from the annual average temperature, and to explore the possibility of conducting research aimed at developing a country-specific value as per the 2006 IPCC Guidelines (vol. 4, chap. 10, p.10.43). | 5.A.3 | Lithuania applies the 2006 IPCC default Methane Conversion Factors (MCF) for estimating emissions from manure management systems, using the values provided in Table 10.17, and uses end-of-range value from column Cool ≤10°C. Regional temperature differences across the country are relatively small, and the national average annual temperature is close to 10°C. In 2022, the average annual temperature was 8°C. However, in line with global climate trends, Lithuania is experiencing a gradual increase in average annual temperatures and according to Lithuanian hydrometeorological service data in 2024 the average annual temperature in Lithuania was 9,5°C. To address the recommendation, in the next NID submission, it is planned to assess the appropriateness of the default MCF values for manure management systems in relation to the country's climatic conditions by analyzing deviations from the average annual temperature, as well as to explore the possibility of conducting research aimed at developing country-specific values. | 5.3.2 Methodological issues<br><br>5.3.6. Category-specific planned improvements |

| ***Review recommendation*** | ***Paragraph No*** | ***Response/status of implementation*** | ***Chapter/section in the NID*** |
|---|---|---|---|
| The TERT encourages that Lithuania employ the tier 2 methodology with country-specific inputs to estimate indirect N2O emissions from manure management, in line with decision tree 10.4 in the 2006 IPCC Guidelines (vol. 4, chap. 10, p.10.55), and make an effort to validate the fraction of nitrogen lost, for example, the fraction lost through leaching, or use values for the fraction of nitrogen lost and EFs from countries with similar environmental conditions and livestock management practices or values from international databases. In case that is not possible, the TERT recommends Lithuania to clearly document why the methodological choice for 3.B.5 category was not in line with the corresponding decision tree of the 2006 IPCC guidelines. | 5.A.4 | Aiming at improvement of the livestock GHG emissions estimation Lithuania has substantially improved quality and accuracy of manure management data (national Nex values for cattle and swine, national MMS data) however transferring to exclusively Tier 2 approach is constrained by missing country-specific emission factors and fractions of N losses, which development requires significant effort and resources, also solid scientific experience, to make such factors representative and reliable and it is hardly affordable to conduct such detailed investigations covering all required pathways in the nearest future. Considering this information, it was decided to use the 2019 IPCC Refinement GHG Guidelines to calculate the amount of nitrogen generated in manure to improve the nitrogen balance between livestock and agricultural soil (Animal manure applied to soil) categories. | 5.4.6.2 Methodological issues |
| The TERT recommends that Lithuania report the area of wetlands as a consistent value between CRTs 4.1 and 4.D and clearly identify the total areas of managed and unmanaged wetlands when reporting land area in the NID. | 6.L.1 | The explanations will be provided in NID 2026 March submission. | |
| The TERT recommends that Lithuania (1) report as "IE" CO2 emissions in CRT 4(II) for mineral soils under categories 4(II).A.2, 4(II).B.2, 4(II).C.2, 4(II).D.1, 4(II).D.2, 4(II).E and 4(II).F where numerical data are not available, together with a clarification on where the emissions have been included; and (2) use appropriate notation keys when CH4 and N2O emissions occur, indicating the reasons why emissions are not reported. | 6.L.2 | The explanations will be provided in NID 2026 March submission. | |
| The TERT recommends that Lithuania clearly document in the NID progress in conducting further scientific studies aimed at collecting additional data for determining CSCs in the litter pool for the forest land remaining forest land category or expand on the information | 6.L.3 | The explanations will be provided in NID 2026 March submission. | |

| *Review recommendation* | *Paragraph No* | *Response/status of implementation* | *Chapter/section in the NID* |
|---|---|---|---|
| provided in the NID on the rationale behind the use of the current reporting method and the assumption that no CSCs are assumed for litter on forest land remaining forest land. | | | |
| The TERT recommends that Lithuania (1) consistently report AD for undrained managed organic soils under the categories 4.A (forest land), 4.B.2.a (forest land converted to cropland), 4.B.2.b (grassland converted to cropland), 4.B.2.d (settlements converted to cropland), 4.C.1 (grassland remaining grassland) and 4.C.2 (land converted to grassland) in CRTs 4.A–4.C and 4(II).A–4(II).C; and (2) report the corresponding CSCs as "NE" in CRTs 4.A–4.C, with a justification for use of the notation key provided in CRT 9. | 6.L.4 | The explanations will be provided in NID 2026 March submission. | |
| The TERT recommends that Lithuania enhance the information provided in the NID on the methods applied for calculating annual SOC changes for mineral soils for categories 4.A.2.5 (other land converted to forest land) and 4.B.2.1 (forest land converted to cropland) for all inventory years. | 6.L.5 | The explanations will be provided in NID 2026 March submission. | |
| The TERT recommends that Lithuania transparently describe in its NID the methods, assumptions, data and/or parameters that provide context for the significant inter-annual changes in the area of organic soils for category 4.B.2.3 (wetlands converted to cropland), the total land conversion area for category 4.C.2.1 (forest land converted to grassland) and the area of mineral soils for category 4.B.2.5 (other land converted to cropland). | 6.L.6 | The explanations will be provided in NID 2026 March submission. | |
| The TERT encourages Lithuania to address the inconsistency in the land conversion area used to calculate CSCs for mineral soils under category 4.C.2.1 (forest land converted to grassland) for 2022 and report emissions/removals for this category if they are occurring. | 6.L.7 | The explanations will be provided in NID 2026 March submission. | |
| The TERT recommends that Lithuania report AD and emission estimates for wetlands that were formerly drained and later abandoned under managed land, in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 1.1), and continue reporting them consistently throughout the time series according to chapter 3.3 of the Guidelines. Additionally, the TERT encourages Lithuania to | 6.L.8 | The explanations will be provided in NID 2026 March submission. | |

| ***Review recommendation*** | ***Paragraph No*** | ***Response/status of implementation*** | ***Chapter/section in the NID*** |
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| consider implementing the methodology provided in the 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands for estimating GHG emissions/removals from drained organic soils. | | | |
| The TERT encourages Lithuania to expand on the information reported in the NID on the assumptions underpinning instant oxidation of forest land converted to settlements and forest land converted to other land and on the method for calculating CSCs for dead organic matter, mineral soils and organic soils for both categories, noting that the Party may consider using methodologies such as the stock difference approach provided in the 2006 IPCC Guidelines (vol. 4, chap. 8, p.8.8) as an alternative to equation 2.25 of the 2006 IPCC Guidelines. | 6.L.9 | The explanations will be provided in NID 2026 March submission. | |
| The TERT recommends that Lithuania correct the information provided in the relevant CRTs and the NID on the EFs and parameters used to estimate CSCs in organic soils for categories 4.E.2.b (cropland converted to settlements), 4.E.2.c (grassland converted to settlements), 4.F.2.b (cropland converted to other land) and 4.F.2.c (grassland converted to other land), and report corrected estimates in CRTs 4.E and 4.F.<br><br>The TERT encourages the Party to consider improving the QC process for categories 4.E.2.b, 4.E.2.c, 4.F.2.b, 4.F.2.c, 4.E and 4.F. | 6.L.10 | The explanations will be provided in NID 2026 March submission. | |
| The TERT recommends that Lithuania increase the transparency of its estimation of CH4 emissions from unmanaged solid waste disposal sites by ensuring that methane correction factor values are consistent between the NID and CRT 5.A. | 7.W.1 | The recommendation was taken into account and additional explanations were included in the NID, together with weighted methane correction factors consistent with those reported in CRT Table 5.A. | NID Chapter 7.2.3, table 7-30 |
| The TERT encourages Lithuania to make all efforts and overcome the lack of resources to developing tier 2 CH4 and N2O emission estimation methods for the key categories 5.B (biological treatment of solid waste) and 5.D (wastewater treatment and discharge), in accordance with the good practices established in the 2006 IPCC Guidelines. In case that is not possible, the TERT | 7.W.2 | Although biological treatment of solid waste and wastewater treatment and discharge are key categories, they comprise a relatively small share of emissions. Currently, due to limited resources and capacities, the main efforts are focused on establishing Tier 2 calculation methods for the | NID Chapter 7.3.2 |

| ***Review recommendation*** | ***Paragraph No*** | ***Response/status of implementation*** | ***Chapter/section in the NID*** |
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| recommends that the Party clearly document why the methodological choice for categories 5.B and 5.D was not in line with the corresponding decision tree of the 2006 IPCC Guidelines. | | largest emission sources. Estimation of $CH_4$ and $N_2O$ emissions from composting and wastewater treatment using a combined Tier 1 and Tier 2 approach is planned in the near future. | |
| The TERT recommends that Lithuania report CH4 and N2O emissions from the incineration of non-biogenic clinical waste at the disaggregated level in CRT 5.C or, if that is not possible, include an explanation as to where these emissions are reported in both the NID and CRT 9. | 7.W.3 | The explanation in CRT 5.C.1 is provided that CH4 and N2O emissions from the incineration of clinical waste are reported under categories 5.C.1.a.ii.2 and 5.C.1.b.ii.2 (hazardous waste). | CRT 5.C.1 |