1. List of Calculation Methods and Emissions Factors

# **Energy-related carbon dioxide (CO2)**

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| --- | --- | --- | --- | --- |
| **Targeted emissions activities** | **Calculation method** | **Emissions per unit of production, etc. (emission factor)** | | |
| **Category** | **Unit** | **Value** |
| Use of fuel | Fuel used (per fuel type) × Calorific value emitted per unit of use × Carbon emissions per unit calorific value × 44/12 | Attached Tables 1 and 2 | | |
| Use of electricity supplied from others | Amount of electricity used × Emissions per unit of use | (Check on the Systems for Calculation, Reporting and Public Disclosure of Greenhouse Gas Emissions website.) | | |
| Use of heat supplied from others | Heat used (per heat type) × Emissions per unit of use | Industrial steam | tCO2/GJ | 0.060 |
| Steam (excluding industrial use steam), hot water, cold water | tCO2/GJ | 0.057 |

[Grounds] Item 1, Paragraph 1, Article 6 of the Cabinet Order, Article 2 of the ministerial ordinance on calculation

# **Non-energy-related carbon dioxide (CO2)**

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| --- | --- | --- | --- | --- |
| **Targeted emissions activities** | **Calculation method** | **Emissions per unit of production, etc. (emission factor)** | | |
| **Category** | **Unit** | **Value** |
| Exploratory drilling for crude oil or natural gas | Number of drilled test wells x Emissions per drilled well | - | tCO2/No. of wells | 0.000028 |
| Implementation of examinations related to the properties of the crude oil or natural gas | Number of wells where property examinations were carried out x Emissions per well | - | tCO2/No. of wells | 5.7 |
| Production of crude oil or natural gas | Crude oil (not including condensate) production volume x Emissions per unit of production | Vent valves during production | tCO2/kl | 0.000012 |
| Equipment other than vent valves during production | tCO2/kl | 0.00027 |
| When burning off associated gases | tCO2/kl | 0.067 |
| Natural gas production volume x Emissions per unit of production | Production well facilities during production | tCO2/Nm3 | 0.000000095 |
| Processing facilities such as for quality governing during production | tCO2/Nm3 | 0.000000027 |
| If combustion of associated gases only occurs during collection of natural gas | tCO2/Nm3 | 0.0000018 |
| If combustion of associated gases only occurs during processing of natural gas | tCO2/Nm3 | 0.0000021 |
| If combustion of associated gases occurs during collection and processing of natural gas | tCO2/Nm3 | 0.0000039 |
|  | Number of drilled production wells x Emissions from inspections per drilled well | - | tCO2/No. of wells | 0.00048 |
| Cement production | Production volume of cement clinker x Emissions per unit of production | - | tCO2/t | 0.502 |
| Production of quicklime | Amount used (per ingredient type) × Emissions per unit of use | Limestone | tCO2/t | 0.428 |
| Dolomite | tCO2/t | 0.449 |
| Production of soda-lime glass or steel | Amount used (per ingredient type) × Emissions per unit of use | Limestone | tCO2/t | 0.440 |
| Dolomite | tCO2/t | 0.471 |
| Production of soda ash | Amount of CO2 used in the production of soda ash | - | - | - |
| Use of soda ash | Amount of soda ash used × Emissions per unit of use | - | tCO2/t | 0.415 |
| Production of ammonia | Amount used (per ingredient type) × Emissions per unit of use | Attached Table 3 | | |
| Production of silicon carbide | Amount of petroleum coke used × Emissions per unit of use | - | tCO2/t | 2.3 |
| Production of calcium carbide | Production volume of calcium carbide x Emissions per unit of production | Production of quicklime | tCO2/t | 0.76 |
| Reduction of quicklime | tCO2/t | 1.1 |
| Production of ethylene | Production volume of ethylene x Emissions per unit of production | - | tCO2/t | 0.014 |
| Use of acetylene made from calcium carbide | Amount of acetylene used × Emissions per unit of use | - | tCO2/t | 3.4 |
| Production of crude steel using an electric furnace | Production volume of crude steel using an electric furnace x Emissions per unit of production | - | tCO2/t | 0.0050 |
| Use of dry ice | Use of CO2 as dry ice | - | - | - |
| Use of a sprayer | Use of CO2 through use of a sprayer | - | - | - |
| Combustion of waste materials, etc. or use for purposes of production of products/waste material fuel | Combustion/use amount (per furnace/waste material type) × Emissions per unit of use/combustion | Attached Table 4 | | |

[Grounds] Item 2, Paragraph 1, Article 6 of the Cabinet Order and Attached Table 7, Article 3 of the ministerial ordinance on calculation

# **Methane (CH4)**

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| --- | --- | --- | --- | --- |
| **Targeted emissions activities** | **Calculation method** | **Emissions per unit of production, etc. (emission factor)** | | |
|  |  | **Category** | **Unit** | **Value** |
| Use of fuel in machinery or facilities provided for the combustion of fuel | Fuel used (per fuel/furnace type) × Calorific value emitted per unit of use × Carbon emissions per unit calorific value | Attached Tables 1 and 5 | | |
| Use of electricity in electric furnaces (For pig iron making, steel making, alloy steel production, or carbide production) | Amount of electricity used × Emissions per unit of use | - | tCH4/kWh | 0.000000020 |
| Mining of coal | Amount produced by underground mining x Emissions per unit of production (for each emitted period) | During mining | tCH4/t | 0.0014 |
| During processing following mining | tCH4/t | 0.0016 |
| Amount produced by open-air mining x Emissions per unit of production (for each emitted period) | During mining | tCH4/t | 0.00077 |
| During processing following mining | tCH4/t | 0.000067 |
| Exploratory drilling for crude oil or natural gas | Number of drilled test wells x Emissions per drilled well | - | tCH4/No. of wells | 0.00043 |
| Implementation of examinations related to the properties of the crude oil or natural gas | Number of wells where property examinations were carried out x Emissions per well | - | tCH4/No. of wells | 0.27 |
| Production of crude oil or natural gas | Crude oil (not including condensate) production volume x Emissions per unit of production | Vent valve during production | tCH4/kl | 0.0014 |
| Equipment other than vent valves during production | tCH4/kl | 0.0015 |
| When burning off associated gases | tCH4/kl | 0.00014 |
| Natural gas production volume x Emissions per unit of production | Production well facilities during production | tCH4/Nm3 | 0.0000028 |
| Processing facilities such as for quality governing during production | tCH4/Nm3 | 0.00000088 |
| If combustion of associated gases only occurs during collection of natural gas | tCH4/Nm3 | 0.000000011 |
| If combustion of associated gases only occurs during processing of natural gas | tCH4/Nm3 | 0.000000013 |
| If combustion of associated gases occurs during collection and processing of natural gas | tCH4/Nm3 | 0.000000024 |
| Number of drilled production wells x Emissions from inspections per drilled well | - | tCH4/No. of wells | 0.064 |
| Refining of oil | Condensate refining volume x Emissions per refining volume unit | During storage | tCH4/kl | 0.000000025 |
| During refining | tCH4/kl | 0.0000030 |
| Crude oil (not including condensate) refining volume x Emissions per refining volume unit | During storage | tCH4/kl | 0.000000027 |
| During refining | tCH4/kl | 0.0000033 |
| Production of city gas | Amount used (per ingredient type) × Emissions per unit of use | Liquefied natural gas (LNG) | tCH4/PJ | 0.26 |
| Natural gas (excluding liquefied natural gas (LNG)) | tCH4/PJ | 0.26 |
| Production of chemical products such as carbon black | Amount produced (per product type) × Emissions per unit of production | Attached Table 6 | | |
| Raising of livestock | Average herd size (per type of livestock) x Bodily emissions per head of livestock unit | Attached Table 7 | | |
| Management of livestock waste products | Organic matter in manure (per livestock manure management method) x Emissions from management per organic matter unit | Attached Table 8 | | |
| Average herd size (per type of livestock) x Manure emissions per head of livestock unit |
| Average herd size of range cattle x Manure emissions per head of range cattle |
| Rice-growing | Area of rice paddies (per paddy type) x Emissions per area unit | Intermittent irrigation paddy fields | tCH4/m2 | 0.000016 |
| Permanent irrigation paddy fields | tCH4/m2 | 0.000028 |
| Combustion of agricultural waste | Volume of agricultural waste combusted outdoors (per type of agricultural waste) x Emissions per unit of combustion volume | Attached Table 9 | | |
| Landfill disposal of waste material | Volume of waste material buried in landfills in final disposal sites (per type of waste) x Emissions per unit of waste material | Attached Table 10 | | |
| Processing of industrial effluent | Pollution loading amount shown by the biochemical oxygen demand included in the influent of treatment facilities for industrial effluent x Emissions accompanying the treatment of industrial effluent per unit of biochemical oxygen demand | - | tCH4/kgBOD | 0.0000049 |
| Treatment of raw sewage, drainage, etc. | Volume of sewage treated at final treatment plant x Emissions per treatment unit | Attached Table 11 | | |
| Volume of septic tank sludge and raw sewage treated (per raw sewage treatment method) x Emissions per treatment unit |
| Number of treatment personnel (per facility type) x Emissions per unit of personnel |
| Combustion of waste materials, etc. or use for purposes of production of products/waste material fuel | Combustion /use amount (per furnace/waste material type) × Emissions per unit of use/combustion | Attached Table 12 | | |

[Grounds] Item 3, Paragraph 1, Article 6 of the Cabinet Order and Attached Table 8, Article 4 of the ministerial ordinance on calculation and Attached Table 6

# **Nitrogen monoxide (N2O)**

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| **Targeted emissions activities** | **Calculation method** | **Emissions per unit of production, etc. (emission factor)** | | |
| **Category** | **Unit** | **Value** |
| Use of fuel in machinery or facilities provided for the combustion of fuel | Fuel used (per fuel/furnace type) × Calorific value emitted per unit of use × Carbon emissions per unit calorific value | Attached Tables 1 and 13 | | |
| Implementation of examinations related to the properties of the crude oil or natural gas | Number of wells where property examinations were carried out x Emissions per well | - | tN2O/No. of wells | 0.000068 |
| Production of crude oil or natural gas | Crude oil (not including condensate) production volume x Emissions from flaring per unit of production | When burning off associated gases | tN2O/kl | 0.00000064 |
| Natural gas production volume x Emissions from flaring per unit of production | If combustion of associated gases only occurs during collection of natural gas | tN2O/Nm3 | 0.000000000021 |
| If combustion of associated gases only occurs during processing of natural gas | tN2O/Nm3 | 0.000000000025 |
| If combustion of associated gases occurs during collection and processing of natural gas | tN2O/Nm3 | 0.000000000046 |
| Production of chemical products such as adipic acid | Amount produced (per product type) × Emissions per unit of production | Adipic acid | tN2O/t | 0.28 |
| Nitric acid | tN2O/t | 0.0032 |
| Use of anesthetics | Amount of N2O as anesthetics | - | - | - |
| Management of livestock waste products | Nitrogen in manure (per livestock manure management method) x Emissions from management per nitrogen unit | Attached Table 14 | | |
| Average herd size (per type of livestock manure management) x Manure emissions per head of livestock unit |
| Average herd size of range cattle x Manure emissions per head of range cattle |
| Use of fuels in cultivation | Volume of nitrogen included in fertilizers used (per crop type) x Emissions per nitrogen volume unit | Attached Table 15 | | |
| Use of crop residue as fertilizer in cultivation | Volume of dried crop residue tilled back into the soil x Emissions per unit of volume for dried crop residue | Attached Table 16 | | |
| Combustion of agricultural waste | Volume of agricultural waste combusted outdoors (per type of agricultural waste) x Emissions per unit of combustion volume | Attached Table 17 | | |
| Processing of industrial waste water | Volume of nitrogen in influent for treatment facilities for industrial effluent x Emissions from treatment per nitrogen volume unit | - | tN2O/tN | 0.0043 |
| Treatment of raw sewage, etc. | Volume of sewage treated at final treatment plant x Emissions per treatment unit | Attached Table 18 | | |
| Volume of nitrogen in septic tank sludge and raw sewage treated (per raw sewage treatment method) x Emissions from treatment per nitrogen volume unit |
| Number of treatment personnel (per facility type) x Emissions per unit of personnel |
| Combustion of waste materials, etc. or use for purposes of production of products/waste material fuel | Combustion/use amount (per furnace/waste material type) × Emissions per unit of use/combustion | Attached Table 19 |  |  |

[Grounds] Item 4, Paragraph 1, Article 6 of the Cabinet Order and Attached Table 9, Article 5 of the ministerial ordinance on calculation

# Attached Table 1 Calorific values per fuel type

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| --- | --- | --- | --- |
| **Fuel type** | | **Unit** | **Value** |
| Solid fuels | Coking coal | GJ/t | 29.0 |
| Steam coal | GJ/t | 25.7 |
| Anthracite coal | GJ/t | 26.9 |
| Coke | GJ/t | 29.4 |
| Petroleum coke | GJ/t | 29.9 |
| Briquettes | GJ/t | 23.9 |
| Lumber | GJ/t | 14.4 |
| Charcoal | GJ/t | 30.5 |
| Other solid fuels | GJ/t | 33.1 |
| Liquid fuels | Coke tar | GJ/t | 37.3 |
| Petroleum asphalt | GJ/t | 40.9 |
| Condensate (NGL) | GJ/kl | 35.3 |
| Crude oil (excluding condensate [NGL]) | GJ/kl | 38.2 |
| Gasoline | GJ/kl | 34.6 |
| Naphtha | GJ/kl | 33.6 |
| Jet fuel oil | GJ/kl | 36.7 |
| Kerosene | GJ/kl | 36.7 |
| Light oil | GJ/kl | 37.7 |
| Heavy oil A | GJ/kl | 39.1 |
| Heavy oil B, C | GJ/kl | 41.9 |
| Lubricating oil | GJ/kl | 40.2 |
| Other liquid fuels | GJ/kl | 37.9 |
| Gaseous fuels | Liquefied petroleum gas (LPG) | GJ/t | 50.8 |
| Petroleum hydrocarbon gas | GJ/1,000 Nm3 | 44.9 |
| Liquefied natural gas (LNG） | GJ/t | 54.6 |
| Natural gas (excluding liquefied natural gas [LNG]) | GJ/1,000 Nm3 | 43.5 |
| Coke oven gas | GJ/1,000 Nm3 | 21.1 |
| Blast furnace gas | GJ/1,000 Nm3 | 3.41 |
| Converter gas | GJ/1,000 Nm3 | 8.41 |
| City gas | GJ/1,000 Nm3 | 44.8 (\*) |
| Other gaseous fuels | GJ/1,000 Nm3 | 28.5 |
| Pulp waste liquid | | GJ/t | 13.9 |

\*The calorific value used in the periodical report in accordance with the provisions of the Act on Rationalizing Energy Use may be used for the calorific value used in the calculation of energy-related CO2 emissions.

[Grounds] Paragraph 3, Article 2 and Paragraph 1, Article 4 of the ministerial ordinance on calculation and Attached Tables 1 and 5

# Attached Table 2 Emissions factors related to the use of fuel

|  |  |  |  |
| --- | --- | --- | --- |
| **Targeted emissions activities** | **Category** | **Unit** | **Value** |
| Use of fuel | Coking coal | tC/GJ | 0.0245 |
| Steam coal | tC/GJ | 0.0247 |
| Anthracite coal | tC/GJ | 0.0255 |
| Coke | tC/GJ | 0.0294 |
| Petroleum coke | tC/GJ | 0.0254 |
| Coke tar | tC/GJ | 0.0209 |
| Petroleum asphalt | tC/GJ | 0.0208 |
| Condensate (NGL) | tC/GJ | 0.0184 |
| Crude oil (excluding condensate [NGL]) | tC/GJ | 0.0187 |
| Gasoline | tC/GJ | 0.0183 |
| Naphtha | tC/GJ | 0.0182 |
| Jet fuel oil | tC/GJ | 0.0183 |
| Kerosene | tC/GJ | 0.0185 |
| Light oil | tC/GJ | 0.0187 |
| Heavy oil A | tC/GJ | 0.0189 |
| Heavy oil B, C | tC/GJ | 0.0195 |
| Liquefied petroleum gas (LPG) | tC/GJ | 0.0161 |
| Petroleum hydrocarbon gas | tC/GJ | 0.0142 |
| Liquefied natural gas (LNG） | tC/GJ | 0.0135 |
| Natural gas (excluding liquefied natural gas [LNG]) | tC/GJ | 0.0139 |
| Coke oven gas | tC/GJ | 0.0110 |
| Blast furnace gas | tC/GJ | 0.0263 |
| Converter gas | tC/GJ | 0.0384 |
| City gas | tC/GJ | 0.0136 |

\* See Attached Table 1 for calorific values per fuel type

[Grounds] Paragraph 3, Article 2 of the ministerial ordinance on calculation and Attached Table 1

# REFERENCE: Emission factors related to the use of fuel (Attached Table 1 x Attached Table 2 x (44/12)

|  |  |  |  |
| --- | --- | --- | --- |
| **Targeted emissions activities** | **Category** | **Unit** | **Value** |
| Use of fuel | Coking coal | tCO2/t | 2.61 |
| Steam coal | tCO2/t | 2.33 |
| Anthracite coal | tCO2/t | 2.52 |
| Coke | tCO2/t | 3.17 |
| Petroleum coke | tCO2/t | 2.78 |
| Coke tar | tCO2/t | 2.86 |
| Petroleum asphalt | tCO2/t | 3.12 |
| Condensate (NGL) | tCO2/kl | 2.38 |
| Crude oil (excluding condensate [NGL]) | tCO2/kl | 2.62 |
| Gasoline | tCO2/kl | 2.32 |
| Naphtha | tCO2/kl | 2.24 |
| Jet fuel oil | tCO2/kl | 2.46 |
| Kerosene | tCO2/kl | 2.49 |
| Light oil | tCO2/kl | 2.58 |
| Heavy oil A | tCO2/kl | 2.71 |
| Heavy oil B, C | tCO2/kl | 3.00 |
| Liquefied petroleum gas (LPG) | tCO2/t | 3.00 |
| Petroleum hydrocarbon gas | tCO/1,000 Nm3 | 2.34 |
| Liquefied natural gas (LNG） | tCO2/t | 2.70 |
| Natural gas (excluding liquefied natural gas [LNG]) | tCO/1,000 Nm3 | 2.22 |
| Coke oven gas | tCO/1,000 Nm3 | 0.85 |
| Blast furnace gas | tCO/1,000 Nm3 | 0.33 |
| Converter gas | tCO/1,000 Nm3 | 1.18 |
| City gas | tCO/1,000 Nm3 | 2.23 |

\* The emission factor for city gas is the value when 44.8 GJ/1,000 Nm3 is used, and the calorific value used in the periodical report in accordance with the provisions of the Act on Rationalizing Energy Use may be used.

[Grounds] Paragraph 3, Article 2 and Paragraph 1, Article 4 of the ministerial ordinance on calculation and Attached Tables 1 and 5

# Attached Table 3 Emission factors related to the production of ammonia

|  |  |  |  |
| --- | --- | --- | --- |
| **Targeted emissions activities** | **Category** | **Unit** | **Value** |
| Production of ammonia | Coal | tCO2/t | 2.3 |
| Petroleum coke | tCO2/t | 2.8 |
| Naphtha | tCO2/kl | 2.2 |
| Liquefied petroleum gas (LPG) | tCO2/t | 3.0 |
| Petroleum hydrocarbon gas | tCO2/1,000 Nm3 | 2.3 |
| Liquefied natural gas (LNG） | tCO2/t | 2.7 |
| Natural gas (excluding liquefied natural gas [LNG]) | tCO2/1,000 Nm3 | 2.2 |
| Coke oven gas | tCO2/1,000 Nm3 | 0.85 |

[Grounds] Paragraph 9, Article 3 of the ministerial ordinance on calculation and Attached Table 2

# Attached Table 4 Emission factors related to the combustion of waste materials or their use as raw fuel

|  |  |  |  |
| --- | --- | --- | --- |
| **Targeted emissions activities** | **Category** | **Unit** | **Value** |
| Combustion of waste material or use in the manufacture of products | Waste oil (excluding vegetable or animal oils) | tCO2/t | 2.92 |
| Synthetic fibers | tCO2/t | 2.29 |
| Waste tire rubber | tCO2/t | 1.72 |
| Waste plastics other than synthetic fibers or tire rubber (limited to industrial waste) | tCO2/t | 2.55 |
| Other waste plastics | tCO2/t | 2.77 |
| Refuse paper & plastic fuel (RPF) | tCO2/t | 1.57 |
| Refuse-derived fuel (RDF) | tCO2/t | 0.775 |
| Use of waste material fuel | Fuel oil produced from waste oil (excluding vegetable or animal oils) | tCO2/kl | 2.63 |
| Fuel oil produced from waste plastics (excluding self-manufactured oil) | tCO2/kl | 2.62 |
| Refuse paper & plastic fuel (RPF) | tCO2/t | 1.57 |
| Refuse-derived fuel (RDF) | tCO2/t | 0.775 |

[Grounds] Paragraph 12, 14 and 15, Article 3 of the ministerial ordinance on calculation and Attached Table 3

# Attached Table 6 Emission factors related to the production of chemical products such as carbon black

|  |  |  |  |
| --- | --- | --- | --- |
| **Targeted emissions activities** | **Category** | **Unit** | **Value** |
| Production of chemical products such as carbon black | Carbon black | tCH4/t | 0.00035 |
| Coke | tCH4/t | 0.00013 |
| Ethylene | tCH4/t | 0.000015 |
| 1,2-dichloroethane | tCH4/t | 0.0000050 |
| Styrene | tCH4/t | 0.000031 |
| Methanol | tCH4/t | 0.0020 |

[Grounds] Paragraph 10, Article 4 of the ministerial ordinance on calculation

# Attached Table 12 Emission factors related to the combustion of waste materials or their use as raw fuel

|  |  |  |  |
| --- | --- | --- | --- |
| **Targeted emissions activities** | **Category** | **Unit** | **Value** |
| Combustion of general waste | Continuous-type incineration plant | tCH4/t | 0.00000095 |
| Quasi-continuous-type incineration plant | tCH4/t | 0.000077 |
| Batch-type incineration plant | tCH4/t | 0.000076 |
| Combustion of industrial waste | Sludge | tCH4/t | 0.0000097 |
| Waste oil | tCH4/t | 0.00000056 |
| Combustion of waste material in industrial furnaces, etc. or use in the manufacture of products | Combustion of waste tire rubber in cement firing kilns or use in the manufacture of products | tCH4/t | 0.00025 |
| Combustion of waste plastics (excluding waste tire rubber) in cement firing kilns or use in the manufacture of products | tCH4/t | 0.00036 |
| Combustion of waste tire rubber in other industrial furnaces (excluding boilers) or use in the manufacture of products | tCH4/t | 0.00025 |
| Combustion of waste plastics (excluding waste tire rubber) in other industrial furnaces (excluding boilers) or use in the manufacture of products | tCH4/t | 0.00036 |
| Use of waste material fuel in industrial furnaces, etc. | Use of refuse paper & plastic fuel (RPF) in cement firing kilns | tCH4/t | 0.00035 |
| Use of refuse-derived fuel (RDF) in cement firing kilns | tCH4/t | 0.00022 |
| Use of refuse paper & plastic fuel (RPF) in other industrial furnaces (excluding boilers) | tCH4/t | 0.00035 |
| Use of refuse-derived fuel (RDF) in other industrial furnaces (excluding boilers) | tCH4/t | 0.00022 |

[Grounds] Paragraph 24 to 28, Article 4 of the ministerial ordinance on calculation and Attached Tables 12 to 14

# Attached Table 19 Emission factors related to the combustion of waste materials or their use as raw fuel

|  |  |  |  |
| --- | --- | --- | --- |
| **Targeted emissions activities** | **Category** | **Unit** | **Value** |
| Combustion of general waste | Continuous-type incineration plant | tN2O/t | 0.0000567 |
| Quasi-continuous-type incineration plant | tN2O/t | 0.0000539 |
| Batch-type incineration plant | tN2O/t | 0.0000724 |
| Combustion of waste material in industrial furnaces, etc. or use in the manufacture of products | Combustion of waste tire rubber in normal pressure fluidized-bed boilers or use in the manufacture of products | tN2O/t | 0.0011 |
| Combustion of waste plastics (excluding waste tire rubber) in normal pressure fluidized-bed boilers or use in the manufacture of products | tN2O/t | 0.0016 |
| Combustion of waste tire rubber in boilers or use in the manufacture of products | tN2O/t | 0.000012 |
| Combustion of waste plastics (excluding waste tire rubber) in boilers or use in the manufacture of products | tN2O/t | 0.000017 |
| Combustion of waste oil in cement firing kilns or use in the manufacture of products | tN2O/t | 0.000046 |
| Combustion of waste tire rubber in cement firing kilns or use in the manufacture of products | tN2O/t | 0.000014 |
| Combustion of waste plastics (excluding waste tire rubber) in cement firing kilns or use in the manufacture of products | tN2O/t | 0.000019 |
| Combustion of waste oil in other industrial furnaces or use in the manufacture of products | tN2O/t | 0.000046 |
| Combustion of waste tire rubber in other industrial furnaces or use in the manufacture of products | tN2O/t | 0.000014 |
| Combustion of waste plastics (excluding waste tire rubber) in other industrial furnaces or use in the manufacture of products | tN2O/t | 0.000019 |
| Combustion of waste | Combustion of sewage sludge (with added polymer coagulant and dewaterized) in fluidized-bed furnaces (normal combustion) | tN2O/t | 0.00151 |
| Combustion of sewage sludge (with added polymer coagulant and dewaterized) in fluidized-bed furnaces (high-temperature combustion) | tN2O/t | 0.000645 |
| Combustion of sewage sludge (with added polymer coagulant and dewaterized) in multi-hearth furnaces | tN2O/t | 0.000882 |
| Combustion of sewage sludge (with added lime-based coagulant and dewaterized) | tN2O/t | 0.000294 |
| Combustion of other sewage sludge | tN2O/t | 0.000882 |
| Combustion of sludge (excluding sewage sludge) | tN2O/t | 0.00045 |
| Combustion of waste oil | tN2O/t | 0.0000098 |
| Combustion of waste tire rubber | tN2O/t | 0.00017 |
| Combustion of waste plastics (excluding waste tire rubber) | tN2O/t | 0.00017 |
| Combustion of paper or timber scraps | tN2O/t | 0.000010 |
| Combustion of textile scraps | tN2O/t | 0.000010 |
| Combustion of animal and plant residue or dead livestock | tN2O/t | 0.000010 |
| Combustion of refuse-derived fuel (RDF) | tN2O/t | 0.00017 |
| Combustion of refuse paper & plastic fuel (RPF) | tN2O/t | 0.00017 |
| Use of waste material as fuel in industrial furnaces, etc. | Use of refuse paper & plastic fuel (RPF) in normal pressure fluidized-bed boilers | tN2O/t | 0.0016 |
| Use of refuse-derived fuel (RDF) in normal pressure fluidized-bed boilers | tN2O/t | 0.00097 |
| Use of refuse paper & plastic fuel (RPF) in boilers | tN2O/t | 0.000017 |
| Use of refuse-derived fuel (RDF) in boilers | tN2O/t | 0.000010 |
| Use of Refuse Paper & Plastic Fuel (RPF) in cement firing kilns | tN2O/t | 0.000019 |
| Use of refuse-derived fuel (RDF) in cement firing kilns | tN2O/t | 0.000012 |
| Use of refuse paper & plastic fuel (RPF) in other industrial furnaces | tN2O/t | 0.000019 |
| Use of refuse-derived fuel (RDF) in other industrial furnaces | tN2O/t | 0.000012 |

[Grounds] Paragraph 17 to 20, Article 5 of the ministerial ordinance on calculation and Attached Tables 12, 16 and 17

# REFERENCE 2 Global Warming Factors

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Greenhouse gases** | | | | **Global warming factors** |
| 1 | Carbon dioxide | | CO2 | 1 |
| 2 | Methane | | CH4 | 25 |
| 3 | Nitrogen monoxide | | N2O | 298 |
| 4 | Hydrofluorocarbon | | HFC | - |
|  |  | Trifluoromethane | HFC-23 | 14,800 |
| Difluoromethane | HFC-32 | 675 |
| Fluoromethane | HFC-41 | 92 |
| 1,1,1,2,2-Pentafluoroethane | HFC-125 | 3,500 |
| 1,1,2,2-Tetrafluoroethane | HFC-134 | 1,100 |
| 1,1,1,2-Tetrafluoroethane | HFC-134a | 1,430 |
| 1,1,2-Trifluoroethane | HFC-143 | 353 |
| 1,1,1-Trifluoroethane | HFC-143a | 4,470 |
| 1,2-Difluoroethane | HFC-152 | 53 |
| 1,1-Difluoroethane | HFC-152a | 124 |
| Fluoroethane | HFC-161 | 12 |
| 1,1,1,2,3,3,3-Heptafluoropropane | HFC-227ea | 3,220 |
| 1,1,1,3,3,3-Hexafluoropropane | HFC-236fa | 9,810 |
| 1,1,1,2,3,3-Hexafluoropropane | HFC-236ea | 1,370 |
| 1,1,1,2,3,3-Hexafluoropropane | HFC-236cb | 1,340 |
| 1,1,2,2,3-Pentafluoropropane | HFC-245ca | 693 |
| 1,1,1,3,3-Pentafluoropropane | HFC-245fa | 1,030 |
| 1,1,1,3,3-Pentafluorobutane | HFC-365mfc | 794 |
| 1,1,1,2,3,4,4,5,5,5-Decafluoropentane | HFC-43-10mee | 1,640 |
| 5 | Perfluorocarbon | | PFC | - |
|  |  | Perfluoromethane | PFC-14 | 7,390 |
| Perfluoroethane | PFC-116 | 12,200 |
| Perfluoropropane | PFC-218 | 8,830 |
| Perfluorocyclopropane |  | 17,340 |
| Perfluorobutane | PFC-31-10 | 8,860 |
| Perfluorocyclobutane | PFC-c318 | 10,300 |
| Perfluoropentane | PFC-41-12 | 9,160 |
| Perfluorohexane | PFC-51-14 | 9,300 |
| Perfluorodecalin | PFC-91-18 | 7,500 |
| 6 | 6 Sulfur Hydrofluoride | | SF6 | 22,800 |
| 7 | Nitrogen trifluoride | | NF3 | 17,200 |

[Grounds] Article 4, Cabinet Order