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# Introduction

Organisations wishing to monitor and report their greenhouse gas (GHG) emissions for their New Zealand operations can use these GHG emission factors.

We present the emission factors in carbon dioxide equivalents (CO2-e) using data and methods from the 2020 calendar year.

This emission factors summary is part of a suite of documents that comprise *Measuring emissions: A guide for organisations*, listed in Figure 1.

Figure 1: Documents in *Measuring emissions: A guide for organisations*

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For further guidance on how to measure and report your organisation’s GHG emissions see the [*Quick Guide*](https://environment.govt.nz/publications/measuring-emissions-2022-quick-guide/)*.* For understanding how these emission factors were derived, see the [*Detailed Guide*.](https://environment.govt.nz/publications/measuring-emissions-detailed-guide-2020/)

# Fuel emission factors

Table 1: Stationary combustion of fuels: Residential use

| **Residential fuel emission Source** | **Unit** | **kg CO2-e/unit** |
| --- | --- | --- |
| Coal – default | kg | 2.10 |
| Coal – bituminous | kg | 2.86 |
| Coal – sub-bituminous | kg | 2.15 |
| Coal – lignite | kg | 1.54 |

Table 2: Stationary combustion of fuels: Commercial use

| **Commercial fuel emission source** | **Unit** | **kg CO2-e/unit** |
| --- | --- | --- |
| Coal – default | kg | 2.01 |
| Coal – bituminous | kg | 2.66 |
| Coal – sub-bituminous | kg | 2.01 |
| Coal – lignite | kg | 1.43 |
| Diesel | litre | 2.67 |
| LPG | kg | 3.03 |
| Heavy fuel oil | litre | 3.02 |
| Light fuel oil | litre | 2.96 |
| Natural gas | kWh | 0.195 |
| GJ | 54.1 |

Table 3: Stationary combustion of fuels: Industrial use

| **Industrial fuel emission source** | **Unit** | **kg CO2-e/unit** |
| --- | --- | --- |
| Coal – default | kg | 1.93 |
| Coal – bituminous | kg | 2.66 |
| Coal – sub-bituminous | kg | 2.01 |
| Coal – lignite | kg | 1.43 |
| Diesel | litre | 2.66 |
| LPG | kg | 3.02 |
| Heavy fuel oil | litre | 3.02 |
| Light fuel oil | litre | 2.92 |
| Natural gas | kWh | 0.194 |
| GJ | 54.0 |

Table 4: Transport fuels

| **Transport fuel type** | **Unit** | **kg CO2-e/unit** |
| --- | --- | --- |
| Regular petrol | litre | 2.46 |
| Premium petrol | litre | 2.48 |
| Diesel | litre | 2.69 |
| LPG | litre | 1.64 |
| Heavy fuel oil | litre | 3.04 |
| Light fuel oil | litre | 2.94 |
| Aviation fuel (Kerosene) / Jet A1 | GJ | 70.6 |
| litre | 2.63 |
| Aviation gasoline | GJ | 68.3 |
| litre | 2.31 |

Table 5: Biofuels

| **Biofuel type** | **Unit** | **kg CO2-e/unit** |
| --- | --- | --- |
| Bioethanol | GJ | 3.42 |
| litre | 0.0000807 |
| Biodiesel | GJ | 3.42 |
| litre | 0.000125 |
| Wood – residential | kg | 0.06696 |
| Wood – industrial | kg | 0.01496 |

Table 6: Transmission and distribution losses for natural gas and electricity

| **Transmission and distribution losses source** | **Unit** | **kg CO2-e/unit** |
| --- | --- | --- |
| Natural gas used | kWh | 0.012 |
| GJ | 3.212 |

# Refrigerant use emission factors

Table 7: Global warming potentials of refrigerants (refrigerant use emission factors)

| **Industrial designation or common name** | **Chemical formula** | **Unit** | **AR4 GWP100** | **AR5 GWP100** |
| --- | --- | --- | --- | --- |
| ***Substances controlled by the Montreal Protocol*** | | | |  |
| CFC-11 | CCl3F | kg | 4,750 | 4,660 |
| CFC-12 | CCl2F2 | kg | 10,900 | 10,200 |
| CFC-13 | CClF3 | kg | 14,400 | 13,900 |
| CFC-113 | CCl2FCClF2 | kg | 6,130 | 5,820 |
| CFC-114 | CClF2CClF2 | kg | 10,000 | 8,590 |
| CFC-115 | CClF2CF3 | kg | 7,370 | 7,670 |
| Halon-1301 | CBrF3 | kg | 7,140 | 6,290 |
| Halon-1211 | CBrClF2 | kg | 1,890 | 1,750 |
| Halon-2402 | CBrF2CBrF2 | kg | 1,640 | 1,470 |
| Carbon tetrachloride | CCl4 | kg | 1,400 | 1,750 |
| Methyl bromide | CH3Br | kg | 5 | 2 |
| Methyl chloroform | CH3CCl3 | kg | 146 | 160 |
| HCFC-21 | CHCl2F | kg | n/a | 148 |
| HCFC-22 | CHClF2 | kg | 1,810 | 1,760 |
| HCFC-123 | CHCl2CF3 | kg | 77 | 79 |
| HCFC-124 | CHClFCF3 | kg | 609 | 527 |
| HCFC-141b | CH3CCl2F | kg | 725 | 782 |
| HCFC-142b | CH3CClF2 | kg | 2,310 | 1,980 |
| HCFC-225ca | CHCl2CF2CF3 | kg | 122 | 127 |
| HCFC-225cb | CHClFCF2CClF2 | kg | 595 | 525 |
| ***Hydrofluorocarbons*** | | | |  |
| HFC-23 | CHF3 | kg | 14,800 | 12,400 |
| HFC-32 | CH2F2 | kg | 675 | 677 |
| HFC-41 | CH3F2 | kg | n/a | 116 |
| HFC-125 | CHF2CF3 | kg | 3,500 | 3,170 |
| HFC-134 | CHF2CHF2 | kg | n/a | 1,120 |
| HFC-134a | CH2FCF3 | kg | 1,430 | 1,300 |
| HFC-143 | CH2FCHF2 | kg | n/a | 328 |
| HFC-143a | CH3CF3 | kg | 4,470 | 4,800 |
| HFC-152 | CH2FCH2F | kg | n/a | 16 |
| HFC-152a | CH3CHF2 | kg | 124 | 138 |
| HFC-161 | CH3CH2F | kg | n/a | 4 |
| HFC-227ea | CF3CHFCF3 | kg | 3,220 | 3,350 |
| HFC-236cb | CH2FCF2CF3 | kg | n/a | 1,210 |
| HFC-236ea | CHF2CHFCF3 | kg | n/a | 1,330 |
| HFC-236fa | CF3CH2CF3 | kg | 9,810 | 8,060 |
| HFC-245ca | CH2FCF2CHF2 | kg | n/a | 716 |
| HFC-245fa | CHF2CH2CF3 | kg | 1030 | 858 |
| HFC-365mfc | CH3CF2CH2CF3 | kg | 794 | 804 |
| HFC-43-10mee | CF3CHFCHFCF2CF3 | kg | 1,640 | 1,650 |
| ***Perfluorinated compounds*** | | | |  |
| Sulphur hexafluoride | SF6 | kg | 22,800 | 23,500 |
| Nitrogen trifluoride | NF3 | kg | 17,200 | 16,100 |
| PFC-14 | CF4 | kg | 7,390 | 6,630 |
| PFC-116 | C2F6 | kg | 12,200 | 11,100 |
| PFC-218 | C3F8 | kg | 8,830 | 8,900 |
| PFC-318 | c-C4F8 | kg | 10,300 | 9,540 |
| PFC-3-1-10 | C4F10 | kg | 8,860 | 9,200 |
| PFC-4-1-12 | C5F12 | kg | 9,160 | 8,550 |
| PFC-5-1-14 | C6F14 | kg | 9,300 | 7,910 |
| PFC-9-1-18 | C10F18 | kg | 7,500 | 7,190 |
| Trifluoromethyl sulphur pentafluoride | SF5CF3 | kg | 17,700 | 17,400 |
| Perfluorocyclopropane | c-C3F6 | kg | n/a | 9,200 |
| ***Fluorinated ethers*** | | | |  |
| HFE-125 | CHF2OCF3 | kg | 14,900 | 12,400 |
| HFE-134 | CHF2OCHF2 | kg | 6,320 | 5,560 |
| HFE-143a | CH3OCF3 | kg | 756 | 523 |
| HFE-227ea | CF3CHFOCF3 | kg | n/a | 6,450 |
| HCFE-235da2 | CHF2OCHClCF3 | kg | 350 | 491 |
| HFE-236ea2 | CHF2OCHFCF3 | kg | n/a | 1,790 |
| HFE-236fa | CF3CH2OCF3 | kg | n/a | 979 |
| HFE-245cb2 | CH3OCF2CF3 | kg | 708 | 654 |
| HFE-245fa1 | CHF2CH2OCF3 | kg | n/a | 828 |
| HFE-245fa2 | CHF2OCH2CF3 | kg | 659 | 812 |
| HFE-245fb2 | CF3CH2OCH3 | kg | n/a | 1 |
| HFE-254cb2 | CH3OCF2CHF2 | kg | 359 | 359\* |
| HFE-329mcc2 | CHF2CF2OCF2CF3 | kg | n/a | 3,070 |
| HFE-338mcf2 | CF3CH2OCF2CF3 | kg | n/a | 929 |
| HFE-347mcc3 | CH3OCF2CF2CF3 | kg | 575 | 530 |
| HFE-347mcf2 | CHF2CH2OCF2CF3 | kg | n/a | 854 |
| HFE-347pcf2 | CHF2CF2OCH2CF3 | kg | 580 | 889 |
| HFE-356mec3 | CH3OCF2CHFCF3 | kg | n/a | 387 |
| HFE-356pcc3 | CHF2OCF2CF2OCHF2  CH3OCF2CF2CHF2 | kg | 110 | 413 |
| HFE-356pcf2 | CHF2CH2OCF2CHF2 | kg | n/a | 719 |
| HFE-356pcf3 | CHF2OCH2CF2CHF2 | kg | n/a | 446 |
| HFE-365mcf3 | CF3CF2CH2OCH3 | kg | n/a | <1 |
| HFE-374pc2 | CHF2CF2OCH2CH3 | kg | n/a | 627 |
| HFE-449sl (HFE-7100) | C4F9OCH3 | kg | 297 | 421 |
| HFE-569sf2 (HFE-7200) | C4F9OC2H5 | kg | 59 | 57 |
| HFE-43-10pccc124 (H-Galden 1040x) | CHF2OCF2OC2F4OCHF2 | kg | 1,870 | 2,820 |
| HFE-236ca12 (HG-10) | CHF2OCF2OCHF2 | kg | 2,800 | 5,350 |
| HFE-338pcc13 (HG-01) | CHF2OCF2CF2OCHF2 | kg | 1,500 | 2,910 |
| ***Perfluoropolyethers*** | | | |  |
| PFPMIE | CF3OCF(CF3)  CF2OCF2OCF3 | kg | 10,300 | 9,710 |
| ***Hydrocarbons and other compounds – Direct Effects*** | | | |  |
| Chloroform | CHCl3 | kg | n/a | 16 |
| Dimethylether | CH3OCH3 | kg | 1 | 1 |
| Halon-1201 | CHBrF2 | kg | n/a | 376 |
| Methylene chloride | CH2Cl2 | kg | 8.7 | 9 |
| Methyl chloride | CH3Cl | kg | 13 | 12 |

Table 8: Global warming potentials of medical gases

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Industrial designation or common name** | **Chemical formula** | **Unit** | **AR4 GWP100** | **AR5 GWP100** |
| ***Medical gases*** | | | |  |
| HFE-347mmz1 (Sevoflurane) | (CF3)2CHOCH2F | kg | Not available | 216 |
| HCFE-235da2 (Isoflurane) | CHF2OCHClCF3 | kg | 350 | 491 |
| HFE-236ea2 (Desflurane) | CHF2OCHFCF3 | kg | Not available | 1,790 |
| ***Medical blends*** | | | | |
| Entonox | N2O/O2 (50.0/50.0) | kg | 173 | 173 |

# Purchased electricity, heat and steam emission factors

Table 9: Purchased electricity – annual average

| **Emission source** | **Unit** | **Purchased grid-average electricity kg CO2-e/unit** |
| --- | --- | --- |
| 2020 | kWh | 0.120 |
| 2019 | kWh | 0.110 |
| 2018 | kWh | 0.094 |
| 2017 | kWh | 0.099 |
| 2016 | kWh | 0.088 |
| 2015 | kWh | 0.112 |
| 2014 | kWh | 0.118 |
| 2013 | kWh | 0.141 |
| 2012 | kWh | 0.167 |
| 2011 | kWh | 0.134 |
| 2010 | kWh | 0.145 |

Table 10: Purchased electricity – calendar quarter

| **Emission source – Quarter** | **Unit** | **Purchased grid-average electricity kg CO2-e/unit** |
| --- | --- | --- |
| December 2020 | kWh | 0.103 |
| September 2020 | kWh | 0.147 |
| June 2020 | kWh | 0.111 |
| March 2020 | kWh | 0.117 |
| December 2019 | kWh | 0.095 |
| September 2019 | kWh | 0.113 |
| June 2019 | kWh | 0.101 |
| March 2019 | kWh | 0.131 |

Table 11: Transmission and distribution losses for electricity consumption

| **Emission source** | **Unit** | **kg CO2-e/unit** |
| --- | --- | --- |
| 2020 | kWh | 0.0110 |
| 2019 | kWh | 0.0119 |
| 2018 | kWh | 0.0092 |
| 2017 | kWh | 0.0094 |
| 2016 | kWh | 0.0075 |
| 2015 | kWh | 0.0107 |
| 2014 | kWh | 0.0092 |
| 2013 | kWh | 0.0100 |
| 2012 | kWh | 0.0152 |
| 2011 | kWh | 0.0126 |
| 2010 | kWh | 0.0148 |

Note: These numbers are rounded to three significant figures.

# Indirect business-related emission factors

Table 12: Working from home emission factors

| **Emission source** | **Unit** | **kg CO2-e/unit** |
| --- | --- | --- |
| Default | employee per day | 0.446 |
| Without heating | employee per day | 0.0665 |
| With heating | employee per day | 0.9791 |

# Travel emission factors

Table 13: Passenger vehicle fleet

| **Passenger vehicle travel emission source** | | **Unit** | **Pre-2010 fleet kg CO2-e/unit** | **2010–2015 fleet kg CO2-e/unit** | **Post-2015 fleet kg CO2-e/unit** |
| --- | --- | --- | --- | --- | --- |
| Petrol vehicle | <1350 cc | km | 0.204 | 0.181 | 0.170 |
| 1350– <1600 cc | km | 0.212 | 0.187 | 0.176 |
| 1600– <2000 cc | km | 0.238 | 0.211 | 0.198 |
| 2000– <3000 cc | km | 0.265 | 0.234 | 0.220 |
| ≥3000 cc | km | 0.317 | 0.280 | 0.263 |
| Diesel vehicle | <1350 cc | km | 0.215 | 0.198 | 0.188 |
| 1350– <1600 cc | km | 0.207 | 0.190 | 0.181 |
| 1600– <2000 cc | km | 0.220 | 0.202 | 0.191 |
| 2000– <3000 cc | km | 0.270 | 0.248 | 0.235 |
| ≥3000 cc | km | 0.300 | 0.275 | 0.261 |
| Petrol hybrid vehicle | <1350 cc | km | 0.156 | 0.141 | 0.128 |
| 1350– <1600 cc | km | 0.161 | 0.146 | 0.133 |
| 1600– <2000 cc | km | 0.181 | 0.165 | 0.149 |
| 2000– <3000 cc | km | 0.201 | 0.183 | 0.166 |
| ≥3000 cc | km | 0.241 | 0.219 | 0.198 |
| Diesel hybrid vehicle | <1350 cc | km | 0.193 | 0.176 | 0.164 |
| 1350– <1600 cc | km | 0.186 | 0.170 | 0.158 |
| 1600– <2000 cc | km | 0.197 | 0.180 | 0.167 |
| 2000– <3000 cc | km | 0.242 | 0.221 | 0.206 |
| ≥3000 cc | km | 0.269 | 0.245 | 0.228 |
| Petrol plug-in hybrid electric vehicle (PHEV) – petrol consumption | <1350 cc | km |  | 0.074 | 0.067 |
| 1350– <1600 cc | km |  | 0.077 | 0.069 |
| 1600– <2000 cc | km |  | 0.086 | 0.078 |
| 2000– <3000 cc | km |  | 0.096 | 0.087 |
| ≥3000 cc | km |  | 0.114 | 0.104 |
| Petrol plug-in hybrid electric vehicle (PHEV) – electricity consumption | <1350 cc | km |  | 0.010 | 0.010 |
| 1350– <1600 cc | km |  | 0.010 | 0.010 |
| 1600– <2000 cc | km |  | 0.012 | 0.011 |
| 2000– <3000 cc | km |  | 0.013 | 0.012 |
| ≥3000 cc | km |  | 0.015 | 0.015 |
| Diesel plug-in hybrid electric vehicle (PHEV) – diesel consumption | <1350 cc | km |  | 0.092 | 0.086 |
| 1350– <1600 cc | km |  | 0.089 | 0.083 |
| 1600– <2000 cc | km |  | 0.094 | 0.088 |
| 2000– <3000 cc | km |  | 0.116 | 0.108 |
| ≥3000 cc | km |  | 0.128 | 0.119 |
| Diesel plug-in hybrid electric vehicle (PHEV) – electricity consumption | <1350 cc | km |  | 0.011 | 0.010 |
| 1350– <1600 cc | km |  | 0.010 | 0.010 |
| 1600– <2000 cc | km |  | 0.011 | 0.011 |
| 2000– <3000 cc | km |  | 0.013 | 0.012 |
| ≥3000 cc | km |  | 0.015 | 0.014 |
| Electric vehicle | Very small | km |  | 0.021 | 0.020 |
| Small | km |  | 0.022 | 0.021 |
| Medium | km |  | 0.024 | 0.023 |
| Large | km |  | 0.026 | 0.026 |
| Very large | km |  | 0.032 | 0.031 |
| Motorcycle | <60 cc, petrol | km | 0.066 | 0.060 | 0.057 |
| ≥60 cc, petrol | km | 0.131 | 0.121 | 0.115 |
| <60 cc, electricity | km |  | 0.005 | 0.005 |
| ≥60 cc, electricity | km |  | 0.009 | 0.009 |

Table 14: Default private car emission factors

| **Default private car travel emission source** | | **Unit** | **kg CO2-e/unit** |
| --- | --- | --- | --- |
| Private car default | Petrol | km | 0.265 |
| Diesel | km | 0.270 |
| Petrol hybrid | km | 0.201 |
| Diesel hybrid | km | 0.242 |
| Petrol plug-in hybrid (petrol consumption) | km | 0.096 |
| Petrol plug-in hybrid (electricity consumption) | kWh | 0.012 |
| Diesel plug-in hybrid (diesel consumption) | km | 0.116 |
| Diesel plug-in hybrid (electricity consumption) | kWh | 0.012 |
| Electric | km | 0.026 |

Table 15: Default rental car emission factors

| **Default rental car travel emission source** | | **Unit** | **kg CO2-e/unit** |
| --- | --- | --- | --- |
| Private car default | Petrol | km | 0.211 |
| Diesel | km | 0.202 |
| Petrol hybrid | km | 0.165 |
| Diesel hybrid | km | 0.180 |
| Petrol plug-in hybrid (petrol consumption) | km | 0.086 |
| Petrol plug-in hybrid (electricity consumption) | kWh | 0.021 |
| Diesel plug-in hybrid (diesel consumption) | km | 0.094 |
| Diesel plug-in hybrid (electricity consumption) | kWh | 0.021 |
| Electric | km | 0.023 |

Table 16: Taxi travel

| **Taxi travel emission source** | | **Unit** | **kg CO2-e/unit** |
| --- | --- | --- | --- |
| Taxi travel | Distance travelled | km | 0.225 |
| Dollars spent | $ | 0.070 |

Table 17: Public transport passenger

|  |  |  |  |
| --- | --- | --- | --- |
| **Emission source** | | **Unit** | **kg CO2-e/unit** |
| Bus | National Average for Bus | pkm | 0.155 |
| Wellington Electric Bus | pkm | 0.012 |
| Wellington Diesel Bus | pkm | 0.060 |
| Wellington Average Bus | pkm | 0.036 |
| Rail | Electric (based on Wellington) | pkm | 0.013 |
| Diesel (based on Wellington) | pkm | 0.046 |
| Average (based on Wellington) | pkm | 0.019 |

Table 18: Public transport vehicles

|  |  |  |  |
| --- | --- | --- | --- |
| **Emission source** | | **Unit** | **kg CO2-e/unit** |
| Diesel bus | <7,500 kg | km | 0.567 |
| <12,000 kg | km | 0.785 |
| ≥12,000 kg | km | 1.088 |
| Diesel hybrid bus | <7,500 kg | km | 0.401 |
| <12,000 kg | km | 0.556 |
| ≥12,000 kg | km | 0.770 |
| Electric bus | <7,500 kg | km | 0.055 |
| <12,000 kg | km | 0.076 |
| ≥12,000 kg | km | 0.106 |

Table 19: Air travel for 2019 (domestic)

|  |  |  |  |
| --- | --- | --- | --- |
| **Emission source** | **Unit** | **Without radiative forcing kg CO2-e/unit** | **With radiative forcing kg CO2-e/unit** |
| National average | pkm | 0.163 | 0.306 |
| Large aircraft | pkm | 0.090 | 0.168 |
| Medium aircraft | pkm | 0.120 | 0.224 |
| Small aircraft | pkm | 0.352 | 0.670 |

Table 20: Air travel for 2020 (domestic)

|  |  |  |  |
| --- | --- | --- | --- |
| **Emission source** | **Unit** | **Without radiative forcing kg CO2-e/unit** | **With radiative forcing kg CO2-e/unit** |
| National average | pkm | 0.164 | 0.306 |
| Large aircraft | pkm | 0.090 | 0.168 |
| Medium aircraft | pkm | 0.120 | 0.224 |
| Small aircraft | pkm | 0.352 | 0.670 |

**For calculating international air travel emissions**, use the International Civil Aviation Organisation calculator (see [*Quick Guide*](https://environment.govt.nz/publications/measuring-emissions-2022-quick-guide/), section 4.5.4). If you prefer not to use this, emission factors for international travel can be found in the [*Emission Factors Workbook*](https://environment.govt.nz/publications/measuring-emissions-a-guide-for-organisations-2022-quick-guide).

Table 21: Air travel (international)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Emission source** | **Travel class** | **Unit** | **Without radiative forcing kg CO2-e/unit** | **With radiative forcing kg CO2-e/unit** |
| Short haul (<3700 km) | Average passenger | pkm | 0.081 | 0.154 |
| Economy | pkm | 0.080 | 0.151 |
| Business | pkm | 0.120 | 0.227 |
| Long haul (>3700 km) | Average passenger | pkm | 0.102 | 0.193 |
| Economy | pkm | 0.078 | 0.148 |
| Premium economy | pkm | 0.125 | 0.237 |
| Business | pkm | 0.227 | 0.429 |
| First | pkm | 0.313 | 0.591 |

Table 22: Helicopter emission factors

|  |  |  |
| --- | --- | --- |
| **Emission source** | **Unit** | **kg CO2-e/unit** |
| Eurocopter AS 350B Squirrel | hours | 480.185 |
| Eurocopter AS 350B3 Squirrel | hours | 496.518 |
| Robinson R44 | hours | 191.016 |
| Robinson R22 Beta | hours | 130.695 |
| Bell 206B | hours | 329.923 |

Table 23: Accommodation

| Country stayed in | Unit | kg CO2-e/unit |
| --- | --- | --- |
| Argentina | Room per night | 50.0 |
| Australia | Room per night | 38.9 |
| Austria | Room per night | 11.9 |
| Belgium | Room per night | 11.6 |
| Brazil | Room per night | 14.9 |
| Canada | Room per night | 17.1 |
| Caribbean Region | Room per night | 61.1 |
| Chile | Room per night | 30.8 |
| China | Room per night | 60.7 |
| Colombia | Room per night | 11.0 |
| Costa Rica | Room per night | 7.0 |
| Czech Republic | Room per night | 31.8 |
| Egypt | Room per night | 54.0 |
| Fiji | Room per night | 54.8 |
| Finland | Room per night | 11.1 |
| France | Room per night | 7.5 |
| French Polynesia | Room per night | 73.0 |
| Germany | Room per night | 18.2 |
| Greece | Room per night | 42.8 |
| Hong Kong | Room per night | 66.2 |
| Hungary | Room per night | 22.0 |
| India | Room per night | 66.0 |
| Indonesia | Room per night | 88.2 |
| Ireland | Room per night | 23.9 |
| Israel | Room per night | 51.8 |
| Italy | Room per night | 23.9 |
| Japan | Room per night | 54.7 |
| Jordan | Room per night | 64.5 |
| Kazakhstan | Room per night | 105.7 |
| Macau | Room per night | 68.1 |
| Malaysia | Room per night | 80.3 |
| Maldives | Room per night | 176.5 |
| Mexico | Room per night | 27.0 |
| Morocco | Room per night | 104.0 |
| Netherlands | Room per night | 21.2 |
| New Zealand | Room per night | 9.4 |
| Oman | Room per night | 117.3 |
| Panama | Room per night | 23.7 |
| Peru | Room per night | 29.9 |
| Philippines | Room per night | 62.9 |
| Poland | Room per night | 35.8 |
| Portugal | Room per night | 27.2 |
| Qatar | Room per night | 104.9 |
| Romania | Room per night | 25.5 |
| Russian Federation | Room per night | 30.9 |
| Saudi Arabia | Room per night | 112.5 |
| Singapore | Room per night | 28.5 |
| South Africa | Room per night | 56.6 |
| South Korea | Room per night | 56.5 |
| Spain | Room per night | 16.3 |
| Switzerland | Room per night | 7.4 |
| Taiwan | Room per night | 86.8 |
| Thailand | Room per night | 55.9 |
| Turkey | Room per night | 38.0 |
| United Arab Emirates | Room per night | 95.9 |
| United Kingdom | Room per night | 13.4 |
| United States | Room per night | 19.8 |
| Vietnam | Room per night | 49.2 |

# Freight transport emission factors

Table 24: Road freight: Light commercial vehicles

| **Light commercial vehicle travel emission source** | | **Unit** | **Pre-2010 kg CO2-e** | **2010–2015  kg CO2-e** | **Post-2015  kg CO2-e** |
| --- | --- | --- | --- | --- | --- |
| Petrol | <1350 cc | km | 0.207 | 0.195 | 0.184 |
| 1350– <1600 cc | km | 0.222 | 0.209 | 0.198 |
| 1600– <2000 cc | km | 0.299 | 0.282 | 0.267 |
| 2000– <3000 cc | km | 0.317 | 0.299 | 0.282 |
| ≥3000 cc | km | 0.362 | 0.341 | 0.322 |
| Diesel | <1350 cc | km | 0.215 | 0.199 | 0.189 |
| 1350– <1600 cc | km | 0.207 | 0.191 | 0.182 |
| 1600– <2000 cc | km | 0.276 | 0.254 | 0.242 |
| 2000– <3000 cc | km | 0.296 | 0.273 | 0.259 |
| ≥3000 cc | km | 0.300 | 0.276 | 0.262 |
| Petrol hybrid | <1350 cc | km | 0.163 | 0.154 | 0.144 |
| 1350– <1600 cc | km | 0.175 | 0.165 | 0.155 |
| 1600– <2000 cc | km | 0.236 | 0.223 | 0.208 |
| 2000– <3000 cc | km | 0.250 | 0.236 | 0.221 |
| ≥3000 cc | km | 0.286 | 0.269 | 0.252 |
| Diesel hybrid | <1350 cc | km | 0.193 | 0.178 | 0.170 |
| 1350– <1600 cc | km | 0.186 | 0.171 | 0.163 |
| 1600– <2000 cc | km | 0.247 | 0.228 | 0.217 |
| 2000– <3000 cc | km | 0.265 | 0.245 | 0.233 |
| ≥3000 cc | km | 0.269 | 0.248 | 0.236 |
| Petrol plug-in hybrid electric vehicle (PHEV) – petrol consumption | <1350 cc | km |  | 0.080 | 0.075 |
| 1350– <1600 cc | km |  | 0.086 | 0.081 |
| 1600– <2000 cc | km |  | 0.117 | 0.109 |
| 2000– <3000 cc | km |  | 0.123 | 0.115 |
| ≥3000 cc | km |  | 0.141 | 0.132 |
| Petrol plug-in hybrid electric vehicle (PHEV) – electricity consumption | <1350 cc | km |  | 0.010 | 0.010 |
| 1350– <1600 cc | km |  | 0.011 | 0.011 |
| 1600– <2000 cc | km |  | 0.012 | 0.012 |
| 2000– <3000 cc | km |  | 0.015 | 0.015 |
| ≥3000 cc | km |  | 0.018 | 0.017 |
| Diesel plug-in hybrid electric vehicle (PHEV) – diesel consumption | <1350 cc | km |  | 0.093 | 0.089 |
| 1350– <1600 cc | km |  | 0.090 | 0.085 |
| 1600– <2000 cc | km |  | 0.119 | 0.114 |
| 2000– <3000 cc | km |  | 0.128 | 0.122 |
| ≥3000 cc | km |  | 0.130 | 0.123 |
| Diesel plug-in hybrid electric vehicle (PHEV) – electricity consumption | <1350 cc | km |  | 0.010 | 0.010 |
| 1350– <1600 cc | km |  | 0.010 | 0.010 |
| 1600– <2000 cc | km |  | 0.011 | 0.011 |
| 2000– <3000 cc | km |  | 0.012 | 0.012 |
| ≥3000 cc | km |  | 0.015 | 0.014 |
| Electricity: BEV (battery electric vehicle) | Very small | km |  | 0.021 | 0.021 |
| Small | km |  | 0.023 | 0.022 |
| Medium | km |  | 0.026 | 0.025 |
| Large | km |  | 0.032 | 0.031 |
| Very large | km |  | 0.038 | 0.036 |

Table 25: Road freight: Default light commercial vehicles

| Emission source | Unit | kg CO2-e/unit |
| --- | --- | --- |
| Petrol | km | 0.317 |
| Diesel | km | 0.296 |
| Petrol hybrid | km | 0.250 |
| Diesel hybrid | km | 0.265 |

Table 26: Road freight: Heavy goods vehicles

| **Emission source** | | **Unit** | **Pre-2010 fleet kg CO2-e** | **2010–2015 fleet  kg CO2-e** | **Post-2015 fleet  kg CO2-e** |
| --- | --- | --- | --- | --- | --- |
| HGV diesel | <5,000 kg | km | 0.446 | 0.423 | 0.421 |
| 5,000– <7,500 kg | km | 0.510 | 0.484 | 0.477 |
| 7,500– <10,000 kg | km | 0.624 | 0.592 | 0.583 |
| 10,000– <12,000 kg | km | 0.740 | 0.702 | 0.692 |
| 12,000– <15,000 kg | km | 0.841 | 0.798 | 0.786 |
| 15,000– <20,000 kg | km | 0.982 | 0.957 | 0.955 |
| 20,000– <25,000 kg | km | 1.308 | 1.274 | 1.271 |
| 25,000– <30,000 kg | km | 1.460 | 1.423 | 1.420 |
| ≥30,000 kg | km | 1.538 | 1.499 | 1.496 |
| HGVdiesel hybrid | <5,000 kg | km | 0.359 | 0.340 | 0.332 |
| 5,000– <7,500 kg | km | 0.411 | 0.390 | 0.380 |
| 7,500– <10,000 kg | km | 0.503 | 0.477 | 0.465 |
| 10,000– <12,000 kg | km | 0.596 | 0.565 | 0.551 |
| 12,000– <15,000 kg | km | 0.678 | 0.642 | 0.627 |
| 15,000– <20,000 kg | km | 0.893 | 0.870 | 0.868 |
| 20,000– <25,000 kg | km | 1.188 | 1.158 | 1.156 |
| 25,000– <30,000 kg | km | 1.372 | 1.338 | 1.334 |
| ≥30,000 kg | km | 1.446 | 1.409 | 1.406 |
| HGVBEV(battery electric vehicle) | <5,000 kg | km |  | 0.045 | 0.044 |
| 5,000– <7,500 kg | km |  | 0.052 | 0.050 |
| 7,500– <10,000 kg | km |  | 0.063 | 0.062 |
| 10,000– <12,000 kg | km |  | 0.075 | 0.083 |
| 12,000– <15,000 kg | km |  | 0.085 | 0.083 |

Table 27: Road freight: Default emission factors for heavy goods vehicles

| Emission source | Unit | kg CO2-e |
| --- | --- | --- |
| HGV diesel | km | 0.480 |
| HGV diesel hybrid | km | 0.387 |

Table 28: Road freight: Emission factors for freighting goods by road

| Emission source | Unit | kg CO2-e |
| --- | --- | --- |
| Long-haul heavy truck | tkm | 0.105 |
| Urban delivery heavy truck | tkm | 0.390 |
| All trucks | tkm | 0.135 |

Table 29: Freighting goods in New Zealand

| Emission source |  | Unit | kg CO2-e |
| --- | --- | --- | --- |
| Rail | Rail freight | tkm | 0.027 |
| Coastal shipping | Container freight | tkm | 0.046 |
| Oil products | tkm | 0.016 |
| Other bulk coastal shipping | tkm | 0.030 |

Table 30: Air freight

| Emission source | Unit | Without radiative forcing kg CO2-e | With radiative forcing kg CO2-e |
| --- | --- | --- | --- |
| Domestic air freight | tkm | 2.377 | 4.494 |
| Short haul air freight | tkm | 1.217 | 2.302 |
| Long haul air freight | tkm | 0.539 | 1.019 |

Table 31: International shipping

| Emission source |  | Unit | kg CO2-e |
| --- | --- | --- | --- |
| Bulk carrier | 200,000+ deadweight tonnes (dwt) | tkm | 0.003 |
| 100,000–199,999 dwt | tkm | 0.003 |
| 60,000–99,999 dwt | tkm | 0.004 |
| 35,000–59,999 dwt | tkm | 0.006 |
| 10,000–34,999 dwt | tkm | 0.008 |
| 0–9,999 dwt | tkm | 0.030 |
| Average | tkm | 0.004 |
| General cargo | 10,000+ dwt | tkm | 0.012 |
| 5,000–9,999 dwt | tkm | 0.016 |
| 0–4,999 dwt | tkm | 0.014 |
| 10,000+ dwt 100+ TEU | tkm | 0.011 |
| 5,000–9,999 dwt 100+ TEU | tkm | 0.018 |
| 0–4,999 dwt 100+ TEU | tkm | 0.020 |
| Average | tkm | 0.013 |
| Container ship | 8,000+ twenty-foot equivalent unit (TEU) | tkm | 0.013 |
| 5,000–7,999 TEU | tkm | 0.017 |
| 3,000–4,999 TEU | tkm | 0.017 |
| 2,000–2,999 TEU | tkm | 0.020 |
| 1,000–1,999 TEU | tkm | 0.033 |
| 0–999 TEU | tkm | 0.037 |
| Average | tkm | 0.016 |
| Vehicle transport | 4,000+ car equivalent unit (CEU) | tkm | 0.032 |
| 0–3,999 CEU | tkm | 0.058 |
| Average | tkm | 0.039 |
| RoRo (Roll-on, Roll-off) ferry | 2,000+ lanemetre (LM) | tkm | 0.050 |
| 0–1,999 LM | tkm | 0.061 |
| Average | tkm | 0.052 |
| Large RoPax ferry | tkm | 0.377 |
| Refrigerated cargo | All dwt | tkm | 0.013 |

# Water supply and wastewater treatment emission factors

Table 32: Water supply

| Emission source | Unit | kg CO2-e |
| --- | --- | --- |
| Water supply | m3 | 0.031 |
| Per capita | 3.785 |

Table 33: Wastewater treatment

| Emission source |  | Unit | kg CO2-e/unit |
| --- | --- | --- | --- |
| Domestic wastewater | Average for wastewater treatment plants | m3 water supplied | 0.48 |
| Per capita | 48.36 |
| Septic tanks | Per capita | 175.2 |
| Industrial wastewater | Meat (excluding poultry) | tonne of kills | 47.528 |
| Poultry | tonne of kills | 47.025 |
| Pulp and paper | tonne of product | 10.530 |
| Wine | tonne of crushed grapes | 5.173 |
| Dairy processing | m3 of milk | 0.115 |

# Materials and waste emission factors

Table 34: Waste disposal with and without landfill gas recovery (LFGR)

| Emission source | | Unit | With LFGR kg CO2-e/unit | Without LFGR kg CO2-e/unit |
| --- | --- | --- | --- | --- |
| Waste (known composition) | Food | kg | 0.602 | 1.881 |
| Garden | kg | 0.492 | 1.539 |
| Paper | kg | 0.876 | 2.736 |
| Wood | kg | 0.339 | 1.060 |
| Textile | kg | 0.438 | 1.368 |
| Nappies | kg | 0.219 | 0.684 |
| Sludge | kg | 0.137 | 0.428 |
| Other (Inert) | kg | n/a | n/a |
| Waste (unknown composition) | General waste | kg | 0.207 | 0.647 |
| Office waste | kg | 0.594 | 1.858 |

Table 35: Composting

| Emission source | Unit | kg CO2-e/unit |
| --- | --- | --- |
| Composting | kg | 0.172 |
| Anaerobic digestion | kg | 0.020 |

# Agriculture, forestry and other land-use emission factors

Table 36: Forest growth removal source

| Emission source | Unit | kg CO2-e/unit |
| --- | --- | --- |
| Planted forests: Approach one – Stock change accounting | | |
| All planted forests | ha | -35,561 |
| *Pinus radiata* | ha | -36,689 |
| Other softwoods | ha | -29,453 |
| All hardwoods | ha | -15,957 |
| Planted forests: Approach two – Averaging accounting | | |
| All planted forests – first rotation (age 23 years and under) | ha | -35,561 |
| *Pinus radiata* – First rotation (age 22 years and under) | ha | -36,689 |
| Other softwoods – First rotation (age 28 years and under) | ha | -29,453 |
| All hardwoods – First rotation (age 13 years and under) | ha | -15,957 |
| All planted forest above the long-term average age | ha | 0 |
| Natural forests | | |
| Post-1989 Regenerating natural forest | ha | -7,973 |
| Pre-1990 Regenerating natural forest | ha | -1,567 |
| Pre-1990 Tall natural forest | ha | 0 |

Table 37: Land-use change

| Emission source |  | Unit | kg CO2-e/unit |
| --- | --- | --- | --- |
| Planted forests: Approach one – Stock change accounting | | | |
| All planted forests | Harvest or deforestation | ha | 995,700 |
| *Pinus radiata* | Harvest or deforestation | ha | 1,027,286 |
| Other softwoods | Harvest or deforestation | ha | 1,178,113 |
| All hardwoods | Harvest or deforestation | ha | 239,354 |
| Planted forests: Approach two – Averaging accounting | | | |
| All planted forests | Harvest | ha | n/a |
| All planted forests | Deforestation | ha | 995,700 |
| *Pinus radiata* | Harvest | ha | n/a |
| *Pinus radiata* | Deforestation | ha | 1,027,286 |
| Other softwoods | Harvest | ha | n/a |
| Other softwoods | Deforestation | ha | 1,178,113 |
| All hardwoods | Harvest | ha | n/a |
| All hardwoods | Deforestation | ha | 239,354 |
| Natural forests | | | |
| Post-1989 Regenerating natural forest | Deforestation | ha | 141,350 |
| Pre-1990 Regenerating natural forest | Deforestation | ha | 898,704 |
| Pre1990 Tall natural forest | Deforestation | ha | 275,595 |

Table 38: Agriculture

|  |  |  |  |
| --- | --- | --- | --- |
| Emission source |  | Unit | kg CO2-e/unit |
| Enteric fermentation | Dairy cattle | per head | 2,264 |
| Non-dairy cattle | per head | 1,540 |
| Sheep | per head | 318 |
| Deer | per head | 597 |
| Swine | per head | 27 |
| Goats | per head | 224 |
| Horses | per head | 450 |
| Alpaca | per head | 200 |
| Mules & asses | per head | 250 |
| Poultry | per head | 0 |
| Manure management | Dairy cattle | per head | 238 |
| Non-dairy cattle | per head | 21.4 |
| Sheep | per head | 3.53 |
| Deer | per head | 7.57 |
| Swine | per head | 206 |
| Goats | per head | 5.0 |
| Horses | per head | 58.5 |
| Alpaca | per head | 2.57 |
| Mules & asses | per head | 27.5 |
| Poultry | per head | 1.44 |
| Fertiliser use | Nitrogen content of non-urea nitrogen fertiliser | kg | 5.40 |
| Nitrogen content of urea nitrogen fertiliser not coated with urease inhibitor | kg | 5.07 |
| Nitrogen content of urea nitrogen fertiliser coated with urease inhibitor | kg | 4.86 |
| Limestone | kg | 0.440 |
| Dolomite | kg | 0.477 |
| Agricultural soils | Dairy cattle | per head | 468 |
| Non-dairy cattle | per head | 267 |
| Sheep | per head | 36.3 |
| Deer | per head | 83.8 |
| Swine | per head | 5.4 |
| Goats | per head | 68.7 |
| Horses | per head | 325 |
| Alpaca | per head | 75.9 |
| Mules & asses | per head | 145 |
| Poultry | per head | 0.11 |