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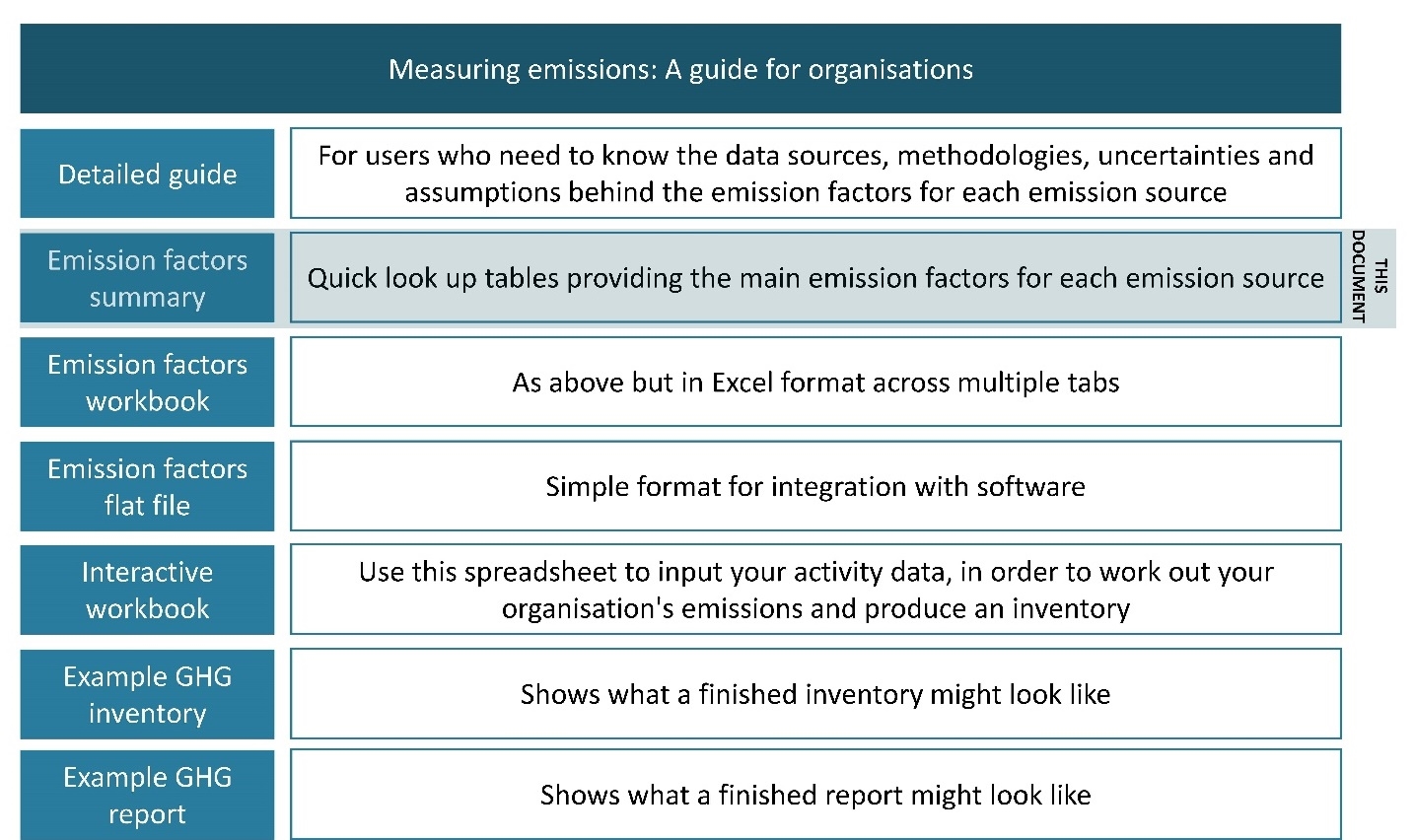
# Introduction

Organisations wishing to voluntarily 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 2021 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*



For further guidance on how to measure and report your organisation’s GHG emissions, and for understanding how these emission factors were derived, see the [*Detailed Guide*](https://environment.govt.nz/publications/measuring-emissions-a-guide-for-organisations-2023-detailed-guide).

# Fuel emission factors

Table 1: Stationary combustion of fuels: Residential use

|  |  |  |
| --- | --- | --- |
| **Residential fuel emission Source** | **Unit** | **kg CO₂-e/unit** |
| Coal - Default | kg | 2.12 |
| Coal - Bituminous | kg | 2.88 |
| Coal - Sub-Bituminous | kg | 2.17 |
| Coal - Lignite | kg | 1.55 |

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 | 2.00 |
| Coal - Lignite | kg | 1.43 |
| Diesel | litre | 2.69 |
| LPG | kg | 2.97 |
| Heavy Fuel Oil | litre | 3.00 |
| Light Fuel Oil | litre | 2.97 |
| Natural Gas | kWh | 0.194 |
|  | GJ | 53.8 |

Table 3: Stationary combustion of fuels: Industrial use

|  |  |  |
| --- | --- | --- |
| **Industrial fuel emission source** | **Unit** | **kg CO₂-e/unit** |
| Coal - Default | kg | 1.96 |
| Coal - Bituminous | kg | 2.66 |
| Coal - Sub-Bituminous | kg | 2.00 |
| Coal - Lignite | kg | 1.43 |
| Diesel | litre | 2.68 |
| LPG | kg | 2.97 |
| Heavy Fuel Oil | litre | 3.00 |
| Light Fuel Oil | litre | 2.96 |
| Natural Gas | kWh | 0.193 |
|  | GJ | 53.7 |

Table 4: Transport fuels

|  |  |  |
| --- | --- | --- |
| **Transport fuel type** | **Unit** | **kg CO₂-e/unit** |
| Regular Petrol | litre | 2.46 |
| Premium Petrol | litre | 2.46 |
| Diesel | litre | 2.71 |
| LPG | litre | 1.62 |
| Heavy Fuel Oil | litre | 3.02 |
| Light Fuel Oil | litre | 2.98 |
| Aviation fuel (Kerosene) | GJ | 68.8 |
|  | litre | 2.56 |
| Aviation gas | GJ | 66.4 |
|  | litre | 2.25 |

Table 5: Biofuels

|  |  |  |
| --- | --- | --- |
| **Biofuel type** | **Unit** | **Fossil (kg CO₂-e/unit)** |
| Bioethanol | GJ | 3.89 |
|  | litre | 0.0917 |
| Biodiesel | GJ | 0.963 |
|  | litre | 0.0351 |
| Wood - Residential | kg | 0.0729 |
| Wood - Industrial | kg | 0.0146 |

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 | 0.00713 |
|  | GJ | 1.98 |

# Refrigerant use emission factors

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

| **Industrial designation or common name** | **Chemical formula** | **Unit** | **AR5 GWP100** |
| --- | --- | --- | --- |
| **Industrial designation or common name** |  |  |  |
| Carbon dioxide (R-744) | CO₂ | kg | 1 |
| Methane | CH₄ | kg | 28 |
| Propane (R-290) | C₃H₈ | kg | 0.02\* |
| Nitrous oxide (R-744a) | N₂O | kg | 265 |
| Butane | C4H10 | kg | 0.006\* |
| **Substances controlled by the Montreal Protocol** |  |  |  |
| CFC-11  (R-11) | CCl₃F | kg | 4660 |
| CFC-12  (R-12) | CCl₂F₂ | kg | 10200 |
| CFC-13  (R-13) | CClF₃ | kg | 13900 |
| CFC-113  (R-113) | CCl₂FCClF₂ | kg | 5820 |
| CFC-114  (R-114) | CClF₂CClF₂ | kg | 8590 |
| CFC-115  (R-115) | CClF₂CF₃ | kg | 7670 |
| Halon-1301  (R-1301) | CBrF₃ | kg | 6290 |
| Halon-1211  (R-1211) | CBrClF₂ | kg | 1750 |
| Halon-2402  (R-2402) | CBrF₂CBrF₂ | kg | 1470 |
| Carbon tetrachloride  (R-10) | CCl₄ | kg | 1730 |
| Methyl bromide | CH₃Br | kg | 2 |
| Methyl chloroform | CH₃CCl₃ | kg | 160 |
| HCFC-21 | CHCl₂F | kg | 148 |
| HCFC-22  (R-22) | CHClF₂ | kg | 1760 |
| HCFC-123  (R-123) | CHCl₂CF₃ | kg | 79 |
| HCFC-124  (R-124) | CHClFCF₃ | kg | 527 |
| HCFC-141b  (R-141b) | CH₃CCl₂F | kg | 782 |
| HCFC-142b  (R-142b) | CH₃CClF₂ | kg | 1980 |
| HCFC-225ca  (R-225ca) | CHCl₂CF₂CF₃ | kg | 127 |
| HCFC-225cb  (R- 225cb) | CHClFCF₂CClF₂ | kg | 525 |
| **Hydrofluorocarbons** |  |  |  |
| HFC-23  (R-23) | CHF₃ | kg | 12400 |
| HFC-32  (R-32) | CH₂F₂ | kg | 677 |
| HFC-41 | CH₃F | kg | 116 |
| HFC-125  (R-125) | CHF₂CF₃ | kg | 3170 |
| HFC-134 | CHF₂CHF₂ | kg | 1120 |
| HFC-134a  (R-134a) | CH₂FCF₃ | kg | 1300 |
| HFC-143 | CH₂FCHF₂ | kg | 328 |
| HFC-143a  (R-143a) | CH₃CF₃ | kg | 4800 |
| HFC-152 | CH₂FCH₂F | kg | 16 |
| HFC-152a  (R-152a) | CH₃CHF₂ | kg | 138 |
| HFC-161 | CH₃CH₂F | kg | 4 |
| HFC-227ea  (R-227ea) | CF₃CHFCF₃ | kg | 3350 |
| HFC-236cb | CH₂FCF₂CF₃ | kg | 1210 |
| HFC-236ea | CHF₂CHFCF₃ | kg | 1330 |
| HFC-236fa  (R-236fa) | CF₃CH₂CF₃ | kg | 8060 |
| HFC-245ca | CH₂FCF₂CHF₂ | kg | 716 |
| HFC-245fa  (R - 245fa) | CHF₂CH₂CF₃ | kg | 858 |
| HFC-365mfc  (R- 365mfc) | CH₃CF₂CH₂CF₃ | kg | 804 |
| HFC-43-10mee | CF₃CHFCHFCF₂CF₃ | kg | 1650 |
| **Perfluorinated compounds** |  |  |  |
| Sulphur hexafluoride | SF₆ | kg | 23500 |
| Nitrogen trifluoride | NF₃ | kg | 16100 |
| PFC-14 | CF₄ | kg | 6630 |
| PFC-116 | C₂F₆ | kg | 11100 |
| PFC-218 | C₃F₈ | kg | 8900 |
| PFC-318 | c-C₄F₈ | kg | 9540 |
| PFC-31-10 | C₄F₁₀ | kg | 9200 |
| PFC-41-12 | C₅F₁₂ | kg | 8550 |
| PFC-51-14 | C₆F₁₄ | kg | 7910 |
| PFC-91-18 | C₁₀F₁₈ | kg | 7190 |
| Trifluoromethyl sulphur pentafluoride | SF₅CF₃ | kg | 17400 |
| Perfluorocyclopropane | c-C₃F₆ | kg | 9200 |
| **Fluorinated ethers** |  |  |  |
| HFE-125 | CHF₂OCF₃ | kg | 12400 |
| HFE-134 | CHF₂OCHF₂ | kg | 5560 |
| HFE-143a | CH₃OCF₃ | kg | 523 |
| HFE-227ea | CF₃CHFOCF₃ | kg | 6450 |
| HCFE-235da2 (Isoflurane) | CHF₂OCHClCF₃ | kg | 491 |
| HFE-236ea2 | CHF₂OCHFCF₃ | kg | 1790 |
| HFE-236fa | CF₃CH₂OCF₃ | kg | 979 |
| HFE-245cb2 | CH₃OCF₂CF₃ | kg | 654 |
| HFE-245fa1 | CHF₂CH₂OCF₃ | kg | 828 |
| HFE-245fa2 | CHF₂OCH₂CF₃ | kg | 812 |
| HFE-254cb2 | CH₃OCF₂CHF₂ | kg | 301 |
| HFE-263fb2 | CF₃CH₂OCH₃ | kg | 1 |
| HFE-329mcc2 | CHF₂CF₂OCF₂CF₃ | kg | 3070 |
| HFE-338mcf2 | CF₃CH₂OCF₂CF₃ | kg | 929 |
| HFE-347mcc3 | CH₃OCF₂CF₂CF₃ | kg | 530 |
| HFE-347mcf2 | CHF₂CH₂OCF₂CF₃ | kg | 854 |
| HFE-347pcf2 | CHF₂CF₂OCH₂CF₃ | kg | 889 |
| HFE-356mec3 | CH₃OCF₂CHFCF₃ | kg | 387 |
| HFE-356pcc3 | CH₃OCF₂CF₂CHF₂ | kg | 413 |
| HFE-356pcf2 | CHF₂CH₂OCF₂CHF₂ | kg | 719 |
| HFE-356pcf3 | CHF₂OCH₂CF₂CHF₂ | kg | 446 |
| HFE-365mcf3 | CF₃CF₂CH₂OCH₃ | kg | 1 |
| HFE-374pc2 | CHF₂CF₂OCH₂CH₃ | kg | 627 |
| HFE-449sl (HFE-7100) | C₄F₉OCH₃ | kg | 421 |
| HFE-569sf2 (HFE-7200) | C₄F₉OC₂H₅ | kg | 57 |
| HFE-43-10pccc124 (H-Galden 1040x) | CHF₂OCF₂OC₂F₄OCHF₂ | kg | 2820 |
| HFE-236ca12 (HG-10) | CHF₂OCF₂OCHF₂ | kg | 5350 |
| HFE-338pcc13 (HG-01) | CHF₂OCF₂CF₂OCHF₂ | kg | 2910 |
| **Perfluoropolyethers** |  |  |  |
| PFPMIE | CF₃OCF(CF₃)CF₂OCF₂OCF₃ | kg | 9710 |
| **Hydrocarbons and other compounds – Direct Effects** |  |  |  |
| Chloroform | CHCl₃ | kg | 16 |
| Dimethylether | CH₃OCH₃ | kg | 1 |
| Methylene chloride | CH₂Cl₂ | kg | 9 |
| Halon-1201 | CHBrF₂ | kg | 376 |
| Methyl chloride | CH₃Cl | kg | 12 |

Table 8: Global warming potentials of medical gases

|  |  |  |  |
| --- | --- | --- | --- |
| **Industrial designation or common name** | **Chemical formula** | **Unit** | **AR5 GWP100** |
| **Medical gases** |  |  |  |
| HFE-347mmz1 (Sevoflurane)\* | (CF₃)₂CHOCH₂F | kg | 216 |
| HCFE-235da2 (Isoflurane) | CHF₂OCHClCF₃ | kg | 491 |
| HFE-236ea2 (Desflurane)\* | CHF₂OCHFCF₃ | kg | 1790 |

**\*** AR6 values

# Purchased electricity, heat and steam emission factors

Table 9: Purchased electricity – annual average

|  |  |  |
| --- | --- | --- |
| **Emission source** | **Unit** | **Purchased grid-average electricity kg CO₂-e/unit** |
| 2022 | kWh | 0.0742 |
| 2021 | kWh | 0.115 |
| 2020 | kWh | 0.120 |
| 2019 | kWh | 0.110 |
| 2018 | kWh | 0.0947 |
| 2017 | kWh | 0.0996 |
| 2016 | kWh | 0.0885 |
| 2015 | kWh | 0.112 |
| 2014 | kWh | 0.118 |
| 2013 | kWh | 0.141 |
| 2012 | kWh | 0.167 |
| 2011 | kWh | 0.135 |
| 2010 | kWh | 0.1457 |

Table 10: Purchased electricity – calendar quarters

| **Emission source – Quarter** | **Unit** | **Purchased grid-average electricity kg CO₂-e/unit** |
| --- | --- | --- |
| Dec-2022 | kWh | 0.0353 |
| Sep-2022 | kWh | 0.0554 |
| Jun-2022 | kWh | 0.108 |
| Mar-2022 | kWh | 0.0991 |
| Dec-2021 | kWh | 0.0496 |
| Sep-2021 | kWh | 0.0931 |
| Jun-2021 | kWh | 0.170 |
| Mar-2021 | kWh | 0.147 |
| Dec-2020 | kWh | 0.103 |
| Sep-2020 | kWh | 0.147 |
| Jun-2020 | kWh | 0.111 |
| Mar-2020 | kWh | 0.117 |

Table 11: Transmission and distribution losses for electricity consumption

|  |  |  |
| --- | --- | --- |
| **Emission source** | **Unit** | **kg CO₂-e/unit** |
| 2022 | kWh | 0.00860 |
| 2021 | kWh | 0.0108 |
| 2020 | kWh | 0.0109 |
| 2019 | kWh | 0.00993 |
| 2018 | kWh | 0.00797 |
| 2017 | kWh | 0.00879 |
| 2016 | kWh | 0.00593 |
| 2015 | kWh | 0.00671 |
| 2014 | kWh | 0.00693 |
| 2013 | kWh | 0.0102 |
| 2012 | kWh | 0.0137 |
| 2011 | kWh | 0.00976 |
| 2010 | kWh | 0.0103 |

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 days | 0.365 |
| Without heating | employee days | 0.054 |
| With heating | employee days | 0.799 |

# 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 | 0.195 | 0.172 | 0.159 |
|  | 1350–<1600 cc | km | 0.201 | 0.178 | 0.165 |
|  | 1600–<2000 cc | km | 0.227 | 0.201 | 0.186 |
|  | 2000–3000 cc | km | 0.252 | 0.223 | 0.206 |
|  | ≥3000 cc | km | 0.301 | 0.267 | 0.247 |
| Diesel vehicle | <1350 cc | km | 0.214 | 0.190 | 0.178 |
|  | 1350–<1600 cc | km | 0.206 | 0.183 | 0.171 |
|  | 1600–<2000 cc | km | 0.218 | 0.194 | 0.181 |
|  | 2000–<3000 cc | km | 0.268 | 0.238 | 0.223 |
|  | ≥3000 cc | km | 0.298 | 0.264 | 0.247 |
| Petrol hybrid vehicle | <1350 cc | km | 0.154 | 0.136 | 0.126 |
|  | 1350–<1600 cc | km | 0.159 | 0.141 | 0.130 |
|  | 1600–<2000 cc | km | 0.179 | 0.159 | 0.147 |
|  | 2000–<3000 cc | km | 0.199 | 0.176 | 0.163 |
|  | ≥3000 cc | km | 0.238 | 0.211 | 0.195 |
| Diesel Hybrid vehicle | <1350 cc | km | 0.192 | 0.170 | 0.157 |
|  | 1350–<1600 cc | km | 0.185 | 0.164 | 0.151 |
|  | 1600–<2000 cc | km | 0.196 | 0.173 | 0.160 |
|  | 2000–<3000 cc | km | 0.241 | 0.213 | 0.197 |
|  | ≥3000 cc | km | 0.267 | 0.237 | 0.219 |
| Motorcycle | <60cc, petrol | km | 0.0683 | 0.0605 | 0.0565 |
|  | ≥ 60cc, petrol | km | 0.137 | 0.121 | 0.113 |
| PHEV (Petrol) - | <1350 cc | km | n/a | 0.0712 | 0.0658 |
| Petrol consumption | 1350–<1600 cc | km | n/a | 0.0737 | 0.0681 |
|  | 1600–<2000 cc | km | n/a | 0.0830 | 0.0767 |
|  | 2000–<3000 cc | km | n/a | 0.0922 | 0.0852 |
|  | ≥3000 cc | km | n/a | 0.110 | 0.102 |
| PHEV (Petrol) - | <1350 cc | km | n/a | 0.00736 | 0.00695 |
| Electricity consumption | 1350–<1600 cc | km | n/a | 0.00762 | 0.00719 |
|  | 1600–<2000 cc | km | n/a | 0.00858 | 0.00810 |
|  | 2000–<3000 cc | km | n/a | 0.00953 | 0.00899 |
|  | ≥3000 cc | km | n/a | 0.0114 | 0.0108 |
| PHEV (Diesel) - | <1350 cc | km | n/a | 0.0890 | 0.0823 |
| Diesel consumption | 1350–<1600 cc | km | n/a | 0.0856 | 0.0792 |
|  | 1600–<2000 cc | km | n/a | 0.0908 | 0.0839 |
|  | 2000–<3000 cc | km | n/a | 0.112 | 0.103 |
|  | ≥3000 cc | km | n/a | 0.124 | 0.114 |
| PHEV (Diesel) - | <1350 cc | km | n/a | 0.00803 | 0.00758 |
| Electricity consumption | 1350–<1600 cc | km | n/a | 0.00771 | 0.00728 |
|  | 1600–<2000 cc | km | n/a | 0.00845 | 0.00798 |
|  | 2000–<3000 cc | km | n/a | 0.00957 | 0.00903 |
|  | ≥3000 cc | km | n/a | 0.0113 | 0.0107 |
| Electric vehicle | <1350 cc | km | n/a | 0.0154 | 0.0146 |
|  | 1350–<1600 cc | km | n/a | 0.0160 | 0.0151 |
|  | 1600–<2000 cc | km | n/a | 0.0180 | 0.0170 |
|  | 2000–<3000 cc | km | n/a | 0.0200 | 0.0189 |
|  | ≥3000 cc | km | n/a | 0.0239 | 0.0226 |
| Motorcycle | <60cc, electricity | km | n/a | 0.00380 | 0.00372 |
|  | ≥ 60cc, electricity | km | n/a | 0.00760 | 0.00743 |

Table 14: Default private car emission factors

|  |  |  |
| --- | --- | --- |
| **Default private car travel emission source** | **Unit** | **kg CO₂-e/unit** |
| Petrol | km | 0.252 |
| Diesel | km | 0.268 |
| Petrol hybrid | km | 0.199 |
| Diesel hybrid | km | 0.241 |
| PHEV (Petrol) - Petrol consumption | km | 0.0922 |
| PHEV (Petrol) - Electricity consumption | km | 0.00953 |
| PHEV (Diesel) - Diesel consumption | km | 0.112 |
| PHEV (Diesel) - Electricity consumption | km | 0.00957 |
| Electric | km | 0.0200 |

Table 15: Default rental car emission factors

|  |  |  |
| --- | --- | --- |
| **Default rental car travel emission source** | **Unit** | **kg CO₂-e/unit** |
| Petrol | km | 0.186 |
| Diesel | km | 0.181 |
| Petrol hybrid | km | 0.147 |
| Diesel hybrid | km | 0.160 |
| PHEV (Petrol) - Petrol consumption | km | 0.0767 |
| PHEV (Petrol) - Electricity consumption | km | 0.00810 |
| PHEV (Diesel) - Diesel consumption | km | 0.0839 |
| PHEV (Diesel) - Electricity consumption | km | 0.00798 |
| Electric | km | 0.0170 |

Table 16: Taxi travel

|  |  |  |
| --- | --- | --- |
| **Taxi travel emission source** | **Unit** | **kg CO₂-e/unit** |
| Regular | km | 0.164 |
| Regular - dollars spent | $ | 0.0514 |
| Petrol hybrid | km | 0.176 |
| Petrol hybrid - dollars spent | $ | 0.0550 |
| Electric | km | 0.0200 |
| Electric - dollars spent | $ | 0.00625 |

Table 17: Public transport passenger

|  |  |  |  |
| --- | --- | --- | --- |
| **Emission source** |  | **Unit** | **kg CO₂-e/unit** |
| Bus | National Average for Bus | pkm | 0.155 |
|  | Electric Bus | pkm | 0.0124 |
|  | Diesel Bus | pkm | 0.0600 |
|  | Average Bus | pkm | 0.0363 |
| Rail | Metropolitan Electric | pkm | 0.0130 |
|  | Metropolitan Diesel | pkm | 0.0460 |
|  | Metropolitan Average | pkm | 0.0190 |

Table 18: Public transport vehicles

|  |  |  |  |
| --- | --- | --- | --- |
| **Emission source** |  | **Unit** | **kg CO₂-e/unit** |
| Diesel Bus | < 7500 kg | km | 0.567 |
|  | 7500 - 12000 kg | km | 0.785 |
|  | ≥ 12000 kg | km | 1.09 |
| Diesel hybrid bus | < 7500 kg | km | 0.401 |
|  | 7500 - 12000 kg | km | 0.556 |
|  | ≥ 12000 kg | km | 0.770 |
| Electric bus | < 7500 kg | km | 0.0552 |
|  | 7500 - 12000 kg | km | 0.0765 |
|  | ≥ 12000 kg | km | 0.106 |

Table 19: Air travel (domestic)

|  |  |  |  |
| --- | --- | --- | --- |
| **Emission source** | **Unit** | **With radiative forcing kg CO₂-e/unit** | **Without radiative forcing kg CO₂-e/unit** |

|  |  |  |  |
| --- | --- | --- | --- |
| National average | pkm | 0.306 | 0.164 |
| Large aircraft | pkm | 0.180 | 0.097 |
| Medium aircraft | pkm | 0.239 | 0.128 |
| Small aircraft | pkm | 0.670 | 0.352 |

**For calculating international air travel emissions**, use the [International Civil Aviation Organisation calculator](http://www.icao.int/environmental-protection/CarbonOffset/Pages/default.aspx). If you prefer not to use this, emission factors for international travel can be found in the [*Emission Factors Workbook*](https://environment.govt.nz/assets/publications/Measuring-Emissions-2023/3bffeb2623/Measuring-Emissions-Guidance_EmissionFactors_InteractiveWorkbook_2023.xlsx).

Table 20: Air travel (international)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Emission source** | **Travel class** | **Unit** | **With radiative forcing kg CO₂-e/unit** | **Without radiative forcing kg CO₂-e/unit** |
| Short-haul (<3700km) | Average passenger | pkm | 0.154 | 0.0812 |
|  | Economy class | pkm | 0.151 | 0.0798 |
|  | Business class | pkm | 0.227 | 0.120 |
| Long-haul (>3700km) | Average passenger | pkm | 0.193 | 0.102 |
|  | Economy class | pkm | 0.148 | 0.0782 |
|  | Premium economy class | pkm | 0.237 | 0.125 |
|  | Business class | pkm | 0.429 | 0.227 |
|  | First class | pkm | 0.591 | 0.313 |

Table 21: Helicopter emission factors

|  |  |  |
| --- | --- | --- |
| **Emission source** | **Unit** | **kg CO₂-e/unit** |
| Eurocopter AS 350B Squirrel | hours | 467 |
| Eurocopter AS 350B3 Squirrel | hours | 483 |
| Robinson R44 | hours | 186 |
| Robinson R22 Beta | hours | 129 |
| Bell 206B | hours | 322 |

Table 22: Accommodation

| **Country stayed in** | **kg CO₂-e/unit** |
| --- | --- |
| Argentina | 50.0 |
| Australia | 38.9 |
| Austria | 11.9 |
| Belgium | 11.6 |
| Brazil | 14.9 |
| Canada | 17.1 |
| Caribbean Region | 61.1 |
| Chile | 30.8 |
| China | 60.7 |
| Colombia | 11.0 |
| Costa Rica | 7.00 |
| Czech Republic | 31.8 |
| Egypt | 54.0 |
| Fiji | 54.8 |
| Finland | 11.1 |
| France | 7.50 |
| Germany | 18.2 |
| Greece | 42.8 |
| Hong Kong | 66.2 |
| Hungary | 22.0 |
| India | 66.0 |
| Indonesia | 88.2 |
| Ireland | 23.9 |
| Israel | 51.8 |
| Italy | 23.9 |
| Japan | 54.7 |
| Jordan | 64.5 |
| Kazakhstan | 106 |
| Macau | 68.1 |
| Malaysia | 80.3 |
| Maldives | 176 |
| Mexico | 27.0 |
| Morocco | 104 |
| Netherlands | 21.2 |
| New Zealand | 9.40 |
| Oman | 117 |
| Panama | 23.7 |
| Peru | 29.9 |
| Philippines | 62.9 |
| Poland | 35.8 |
| Portugal | 27.2 |
| Qatar | 105 |
| Romania | 25.5 |
| Russian Federation | 30.9 |
| Saudi Arabia | 112 |
| Singapore | 28.5 |
| South Africa | 56.6 |
| South Korea | 56.5 |
| Spain | 16.3 |
| Switzerland | 7.40 |
| Thailand | 55.9 |
| Turkey | 38.0 |
| United Arab Emirates | 95.9 |
| United Kingdom | 13.4 |
| United States | 19.8 |
| Vietnam | 49.2 |

# Freight transport emission factors

Table 23: Road freight: Light commercial vehicles

| **Light commercial vehicle travel emission source** |  | **Unit** | **Pre-2010 fleet kg CO₂-e/unit** | **2010–2015**  **kg CO₂-e/unit** | **Post-2015 fleet**  **kg CO₂-e/unit** |
| --- | --- | --- | --- | --- | --- |
| Petrol | <1350 cc | km | 0.207 | 0.195 | 0.184 |
|  | 1350 - <1600 cc | km | 0.222 | 0.209 | 0.197 |
|  | 1600 -<2000 cc | km | 0.300 | 0.283 | 0.266 |
|  | 2000 - <3000 cc | km | 0.317 | 0.299 | 0.281 |
|  | ≥3000 cc | km | 0.362 | 0.341 | 0.321 |
| Diesel | <1350 cc | km | 0.217 | 0.200 | 0.190 |
|  | 1350 - <1600 cc | km | 0.209 | 0.193 | 0.183 |
|  | 1600 -<2000 cc | km | 0.278 | 0.256 | 0.244 |
|  | 2000 - <3000 cc | km | 0.298 | 0.275 | 0.261 |
|  | ≥3000 cc | km | 0.302 | 0.278 | 0.264 |
| 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 | 0.237 | 0.223 | 0.209 |
|  | 2000 - <3000 cc | km | 0.250 | 0.236 | 0.221 |
|  | ≥3000 cc | km | 0.286 | 0.269 | 0.252 |
| Diesel hybrid | <1350 cc | km | 0.195 | 0.179 | 0.171 |
|  | 1350 - <1600 cc | km | 0.187 | 0.173 | 0.165 |
|  | 1600 -<2000 cc | km | 0.249 | 0.230 | 0.219 |
|  | 2000 - <3000 cc | km | 0.267 | 0.247 | 0.235 |
|  | ≥3000 cc | km | 0.271 | 0.250 | 0.238 |
| PHEV (Petrol) - | <1350 cc | km | n/a | 0.0806 | 0.0754 |
| Petrol consumption | 1350 - <1600 cc | km | n/a | 0.0865 | 0.0810 |
|  | 1600 -<2000 cc | km | n/a | 0.117 | 0.109 |
|  | 2000 - <3000 cc | km | n/a | 0.123 | 0.116 |
|  | ≥3000 cc | km | n/a | 0.141 | 0.132 |
| PHEV (Petrol) - | <1350 cc | km | n/a | 0.00835 | 0.00808 |
| Electricity consumption | 1350 - <1600 cc | km | n/a | 0.00897 | 0.00868 |
|  | 1600 -<2000 cc | km | n/a | 0.0101 | 0.00982 |
|  | 2000 - <3000 cc | km | n/a | 0.0125 | 0.0121 |
|  | ≥3000 cc | km | n/a | 0.0146 | 0.0141 |
| PHEV (Diesel) - | <1350 cc | km | n/a | 0.0939 | 0.0895 |
| Diesel consumption | 1350 - <1600 cc | km | n/a | 0.0904 | 0.0861 |
|  | 1600 -<2000 cc | km | n/a | 0.120 | 0.115 |
|  | 2000 - <3000 cc | km | n/a | 0.129 | 0.123 |
|  | ≥3000 cc | km | n/a | 0.131 | 0.124 |
| PHEV (Diesel) - | <1350 cc | km | n/a | 0.00848 | 0.00820 |
| Electricity consumption | 1350 - <1600 cc | km | n/a | 0.00814 | 0.00787 |
|  | 1600 -<2000 cc | km | n/a | 0.00892 | 0.00863 |
|  | 2000 - <3000 cc | km | n/a | 0.0101 | 0.00976 |
|  | ≥3000 cc | km | n/a | 0.0119 | 0.0115 |
| Electric vehicle | <1350 cc | km | n/a | 0.0175 | 0.0170 |
|  | 1350 - <1600 cc | km | n/a | 0.0188 | 0.0182 |
|  | 1600 -<2000 cc | km | n/a | 0.0213 | 0.0206 |
|  | 2000 - <3000 cc | km | n/a | 0.0262 | 0.0254 |
|  | ≥3000 cc | km | n/a | 0.0306 | 0.0297 |

Table 24: Road freight: Default light commercial vehicles

|  |  |  |
| --- | --- | --- |
| **Emission source** | **Unit** | **kg CO₂-e/unit** |
| Petrol | km | 0.317 |
| Diesel | km | 0.298 |
| Petrol Hybrid | km | 0.250 |
| Diesel Hybrid | km | 0.267 |

Table 25: 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 | 0.450 | 0.427 | 0.425 |
|  | 5,000 - 7,500 kg | km | 0.515 | 0.489 | 0.481 |
|  | 7,500 - 10,000 kg | km | 0.630 | 0.598 | 0.589 |
|  | 10,000 - 12,000 kg | km | 0.747 | 0.706 | 0.698 |
|  | 12,000 - 15,000 kg | km | 0.849 | 0.805 | 0.793 |
|  | 15,000 - 20,000 kg | km | 0.991 | 0.966 | 0.964 |
|  | 20,000 - 25,000 kg | km | 1.32 | 1.29 | 1.28 |
|  | 25,000 - 30,000 kg | km | 1.56 | 1.44 | 1.43 |
|  | ≥ 30,000 kg | km | 1.56 | 1.51 | 1.51 |
| HGV diesel hybrid | < 5,000 kg | km | 0.362 | 0.343 | 0.335 |
|  | 5,000 - 7,500 kg | km | 0.415 | 0.394 | 0.384 |
|  | 7,500 - 10,000 kg | km | 0.508 | 0.481 | 0.469 |
|  | 10,000 - 12,000 kg | km | 0.602 | 0.570 | 0.557 |
|  | 12,000 - 15,000 kg | km | 0.684 | 0.648 | 0.633 |
|  | 15,000 - 20,000 kg | km | 0.901 | 0.878 | 0.876 |
|  | 20,000 - 25,000 kg | km | 1.20 | 1.17 | 1.17 |
|  | 25,000 - 30,000 kg | km | 1.39 | 1.35 | 1.35 |
|  | ≥ 30,000 kg | km | 1.46 | 1.42 | 1.42 |
| HGV BEV | < 5,000 kg | km | n/a | 0.0367 | 0.0359 |
|  | 5,000 - 7,500 kg | km | n/a | 0.0421 | 0.0412 |
|  | 7,500 - 10,000 kg | km | n/a | 0.0515 | 0.0503 |
|  | 10,000 - 12,000 kg | km | n/a | 0.0610 | 0.0678 |
|  | 12,000 - 15,000 kg | km | n/a | 0.0693 | 0.0761 |

Table 26: Road freight: Default emission factors for heavy goods vehicles

|  |  |  |
| --- | --- | --- |
| **Emission source** | **Unit** | **kg CO₂-e** |
| HGV Diesel | km | 0.482 |
| HGV Diesel Hybrid | km | 0.389 |

Table 27: 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 28: Freighting goods in New Zealand

|  |  |  |
| --- | --- | --- |
| **Emission source** | **Unit** | **kg CO₂-e** |
| Oil products | tkm | 0.0160 |
| Other bulk | tkm | 0.0300 |
| Container freight | tkm | 0.0460 |
| Rail Freight | tkm | 0.0270 |

Table 29: Air freight

|  |  |  |  |
| --- | --- | --- | --- |
| **Emission source** | **Unit** | **With radiative forcing kg CO₂-e/unit** | **Without radiative forcing kg CO₂-e/unit** |
| Domestic | tkm | 4.49 | 2.38 |
| Short haul | tkm | 2.30 | 1.22 |
| Long haul | tkm | 1.02 | 0.539 |

Table 30: International shipping

| **Emission source** |  | **Unit** | **kg CO₂-e** |
| --- | --- | --- | --- |
| Bulk carrier | 200,000+ dwt | tkm | 0.00253 |
|  | 100,000–199,999 dwt | tkm | 0.00304 |
|  | 60,000–99,999 dwt | tkm | 0.00416 |
|  | 35,000–59,999 dwt | tkm | 0.00578 |
|  | 10,000–34,999 dwt | tkm | 0.00801 |
|  | 0–9999 dwt | tkm | 0.0296 |
|  | Average | tkm | 0.00355 |
| General cargo | 10,000+ dwt | tkm | 0.0121 |
|  | 5000–9999 dwt | tkm | 0.0160 |
|  | 0–4999 dwt | tkm | 0.0141 |
|  | 10,000+ dwt 100+ TEU | tkm | 0.0112 |
|  | 5000–9999 dwt 100+ TEU | tkm | 0.0177 |
|  | 0–4999 dwt 100+ TEU | tkm | 0.0201 |
|  | Average | tkm | 0.0133 |
| Container ship | 8000+ TEU | tkm | 0.0127 |
|  | 5000–7999 TEU | tkm | 0.0168 |
|  | 3000–4999 TEU | tkm | 0.0168 |
|  | 2000–2999 TEU | tkm | 0.0203 |
|  | 1000–1999 TEU | tkm | 0.0325 |
|  | 0–999 TEU | tkm | 0.0368 |
|  | Average | tkm | 0.0161 |
| Vehicle transport | 4000+ CEU | tkm | 0.0324 |
|  | 0–3999 CEU | tkm | 0.0584 |
|  | Average | tkm | 0.0386 |
| RoRo-Ferry | 2000+ LM | tkm | 0.0502 |
|  | 0–1999 LM | tkm | 0.0611 |
|  | Average | tkm | 0.0517 |
|  | Large RoPax ferry | tkm | 0.377 |
| Refrigerated cargo | All dwt | tkm | 0.0131 |

# Water supply and wastewater treatment emission factors

Table 31: Water supply

|  |  |  |
| --- | --- | --- |
| **Emission source** | **Unit** | **kg CO₂-e** |
| Water supply emission factors | m3 | 0.0369 |
|  | per capita | 4.302 |

Table 32: Wastewater treatment

|  |  |  |  |
| --- | --- | --- | --- |
| **Emission source** |  | **Unit** | **kg CO₂-e/unit** |
| Domestic wastewater | Average for wastewater treatment plants | m3 of water supplied | 0.508 |
|  |  | per capita | 48.5 |
|  | Septic tanks | per capita | 190 |
| Industrial Wastewater | Meat (excl. poultry) | tonne of kills | 52.6 |
|  | Poultry | tonne of kills | 51.7 |
|  | Pulp & paper | tonne of product | 11.8 |
|  | Wine | tonne of crushed grapes | 5.79 |
|  | Dairy processing | m3 of milk | 0.102 |

# Materials and waste emission factors

Table 33: 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) | Waste - Food | kg | 0.674 | 2.11 |
|  | Waste - Garden | kg | 0.552 | 1.72 |
|  | Waste - Paper | kg | 0.981 | 3.06 |
|  | Waste - Wood (combined) | kg | 0.380 | 1.19 |
|  | Wood (treated) | kg | 0.0613 | 0.192 |
|  | Wood (untreated) | kg | 0.858 | 2.68 |
|  | Waste - Textile | kg | 0.490 | 1.53 |
|  | Waste - Nappies | kg | 0.245 | 0.766 |
|  | Waste - Sludge | kg | 0.153 | 0.479 |
|  | Waste - Other (Inert) | kg | n/a | n/a |
| Waste (unknown composition) | General waste | kg | 0.232 | 0.724 |
|  | Office waste | kg | 0.666 | 2.08 |

Table 34: Composting

|  |  |  |
| --- | --- | --- |
| **Emission source** | **Unit** | **kg CO₂-e/unit** |
| Composting | kg | 0.176 |
| Anaerobic digestion | Kg | 0.0224 |

# Agriculture, forestry and other land-use emission factors

Table 35: Forest growth removal source

|  |  |  |
| --- | --- | --- |
| **Emission source** | **Unit** | **kg CO₂-e/unit** |
| **Planted forests: Approach one - Stock change accounting** |  |  |
| All planted forests | ha | -35,503 |
| *Pinus radiata* | ha | -36,655 |
| Other softwoods | ha | -29,414 |
| All hardwoods | ha | -16,102 |
| **Planted forests: Approach two - Averaging accounting** |  |  |
| All planted forests – First rotation (age 22 years and under) | ha | -35,503 |
| *Pinus radiata* – First rotation (age 22 years and under) | ha | -36,655 |
| Other softwoods – First rotation (age 28 years and under) | ha | -29,414 |
| All hardwoods – First rotation (age 13 years and under) | ha | -16,102 |
| All planted forest above the long-term average age | ha | 0000 |
| **Natural forests** |  |  |
| Post-1989 Regenerating natural forest | ha | -7,973 |
| Pre-1990 Regenerating natural forest | ha | -1,567 |
| Pre-1990 Tall natural forest | ha | 0000 |

Table 36: Land-use change

|  |  |  |  |
| --- | --- | --- | --- |
| **Emission source** |  | **Unit** | **kg CO₂-e/unit** |
| **Planted forests: Approach one - Stock change accounting** |  |  |  |
| All planted forests | Harvest or deforestation | ha | 994,095 |
| *Pinus radiata* | Harvest or deforestation | ha | 1,026,353 |
| Other softwoods | Harvest or deforestation | ha | 1,176,533 |
| All hardwoods | Harvest or deforestation | ha | 241,536 |
| **Planted forests: Approach two - Averaging accounting** |  |  |  |
| All planted forests | Harvest | ha | n/a |
|  | Deforestation | ha | 994,095 |
| *Pinus radiata* | Harvest | ha | n/a |
|  | Deforestation | ha | 1,026,353 |
| Other softwoods | Harvest | ha | n/a |
|  | Deforestation | ha | 1,176,533 |
| All hardwoods | Harvest | ha | n/a |
|  | Deforestation | ha | 241,536 |
| **Natural forests** |  |  |  |
| Post-1989 Regenerating natural forest | Deforestation | ha | 141,350 |
| Pre-1990 Regenerating natural forest | Deforestation | ha | 898,662 |
| Pre-1990 Tall natural forest | Deforestation | ha | 277,161 |

Table 37: Agriculture

|  |  |  |  |
| --- | --- | --- | --- |
| **Emission source** |  | **Unit** | **kg CO₂-e/unit** |
| Enteric Fermentation | Dairy cattle | per head | 2,423 |
|  | Non-dairy cattle | per head | 1,679 |
|  | Sheep | per head | 349 |
|  | Deer | per head | 644 |
|  | Swine | per head | 29.7 |
|  | Goats | per head | 251 |
|  | Horses | per head | 504 |
|  | Alpaca and llama | per head | 224 |
|  | Mules and asses | per head | 280 |
|  | Poultry | per head | 0000 |
| Manure management | Dairy cattle | per head | 255 |
|  | Non-dairy cattle | per head | 23.3 |
|  | Sheep | per head | 3.81 |
|  | Deer | per head | 8.33 |
|  | Swine | per head | 218 |
|  | Goats | per head | 5.60 |
|  | Horses | per head | 65.5 |
|  | Alpaca and llama | per head | 2.84 |
|  | Mules and asses | per head | 30.8 |
|  | Poultry | per head | 1.43 |
| Fertiliser Use | Nitrogen content of non-urea nitrogen fertiliser | kg N | 4.80 |
|  | Nitrogen content of urea nitrogen fertiliser not coated with urease inhibitor | kg N | 4.69 |
|  | Nitrogen content of urea nitrogen fertiliser coated with urease inhibitor | kg N | 4.50 |
|  | Limestone | kg | 0.440 |
|  | Dolomite | kg | 0.477 |
| Agricultural soils | Dairy cattle | per head | 377.2 |
| (live stock) | Non-dairy cattle | per head | 226.6 |
|  | Sheep | per head | 31.5 |
|  | Deer | per head | 72.5 |
|  | Swine | per head | 42.0 |
|  | Goats | per head | 61.5 |
|  | Horses | per head | 290.9 |
|  | Alpaca and llama | per head | 66.3 |
|  | Mules and asses | per head | 129.6 |
|  | Poultry | per head | 1.54 |