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Emission Factors for New Zealand

Greenhouse Gas Emission Intensities for Commodities and Industries

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Executive summary

This report provides carbon footprint emission factors per dollar of spend for goods and services purchased in Aotearoa New Zealand

Organisations and individuals are often urged to vote with their wallets – to choose the products and services we buy wisely. However, it can be difficult to determine the potential environmental impacts of a product or service without detailed research.

Emissions factors per dollar spent are an easy way for individuals and businesses to get started with carbon footprinting and Life Cycle Assessment. They allow spending per category – be it investment decisions or supermarket shops – to be multiplied by a corresponding emission factor per dollar to calculate total emissions in that category.

This report provides greenhouse gas (carbon footprint) emissions factors for goods and services purchased in Aotearoa New Zealand. They are reported in kilograms of carbon dioxide equivalent per dollar (kg CO_2e/$). Also known as emission intensities, these values have been calculated at the national level using Input-Output Life Cycle Assessment (IO-LCA), which is also known as Environmentally Extended Input-Output (EEIO) Analysis.

Emissions factors are provided for both wholesale and retail transactions

This report provides three different types of emission factors per dollar spent:

- Industry-level emission factors;
- Commodity-level emission factors in basic prices for purchases direct from a primary producer (for business-to-business transactions); and
- Commodity-level emission factors in purchaser's prices with retail emissions (for business-to-consumer transactions and some business-to-business transactions).

The emission factors in this report include international trade

The emission factors provided in this report include all upstream emissions, including emissions embodied in international trade. The inclusion of international trade is particularly important in cases where New Zealand has little or no domestic industry (e.g., car manufacturing and textile production).

The emission factors in this report are suitable for organisations and individuals

The emission factors in this report can be used in various applications, such as:

- "Scope 3" corporate carbon footprints, particularly for purchased goods and services;
- Calculating the carbon footprint of an investment or lending portfolio (often known as financed emissions); and
- Individuals trying to understand the carbon footprint of their own purchasing decisions.

Table of contents

Executive summary 3

1. Introduction 6

1.1. Background 6

1.2. Purpose 6

2. Literature review 7

2.1. Input-Output Life Cycle Assessment 7

2.2. IO-LCA in New Zealand 7

3. Approach 9

3.1. Industry-level emission factors 9

3.1.1. Emissions embodied in imports 10

3.1.2. Sub-industries 11

3.2. Commodity emission factors 12

3.2.1. Commodity emission factors in basic prices 13

3.2.2. Commodity emission factors in purchaser's prices 14

3.3. GHG emission factors by gas 16

3.4. GHG emissions by scope 16

3.5. Primary data sources 17

3.6. Limitations 19

4. Emission factors 20

4.1. Industry emission factors 21

4.2. Commodity emission factors 26

4.2.1. Commodity emission bactors in basic prices 26

4.2.2. Commodity emission factors in purchaser's prices 40

5. Recommendations 54

5.1. Industry disaggregation 54

5.2. Annual release of IO tables 55

5.3. Import IO table to represent share of imports per country 55

6. References 56

Annex A Industry and commodity emission factors for 2018 59

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Any errors or omissions are those of the current authors.

1. Introduction

1.1. Background

To avoid dangerous warming of global temperatures, the Intergovernmental Panel on Climate Change calls for global reduction of anthropogenic greenhouse gas emissions by about 45% from 2010 levels by 2030, reaching net-zero emissions by 2050 (IPCC, 2018). The first step towards emissions reduction is measuring and reporting emissions, a process often called “carbon footprinting”.

The emission factors of each emission source within an organisation are essential components of carbon footprinting. Emission factors represent the amount of greenhouse gases that are emitted into the atmosphere per unit of emission source. They are usually expressed in carbon dioxide equivalent (CO_2e).

Official, New Zealand-specific emission factors are published by the Ministry for the Environment (MfE) and are expressed in physical units – similar to other internationally published emission factors. For instance, the emission factor for combustion of natural gas for commercial use is 53.8 $kgCO_2e/GJ$. This represents 53.8 kilograms of carbon dioxide equivalent ($kgCO_2e$) emitted into the atmosphere for every 1 gigajoule (GJ) of natural gas combusted (MfE, 2023).

While using emission factors based on physical units is typically possible for energy-related activities, such as purchased electricity, it becomes more difficult for other purchased goods and services where emission factors are typically not readily available. In these cases, it is easier to use emissions factors per dollar spent.

This report provides emission factors (also known as emission intensities) for industries and commodities in New Zealand based on dollars spent, using an Input-Output Life Cycle Assessment (IO-LCA) approach. This approach is also known as Environmentally Extended Input-Output (EEIO) Analysis.

1.2. Purpose

Spend-based emission factors allow organisations and individuals to calculate carbon footprints without access to physical quantities of purchased goods and services, by using monetary spend data. This report enables organisations and individuals to calculate the carbon footprint of goods and services purchased in New Zealand by providing three different types of emission factors per dollar spent:

- Industry-level emission factors;
- Commodity-level emission factors in basic prices (BP) (excluding retail margins and taxes), suitable for business-to-business transactions); and
- Commodity-level emission factors in purchaser’s prices (PP) (including retail margins and taxes), suitable for all business-to-consumer transactions and some business-to-business transactions.

2. Literature review

2.1. Input-Output Life Cycle Assessment

An IO-LCA approach was chosen to calculate the greenhouse gas emissions (carbon footprint) of New Zealand industries and commodities.

Life Cycle Assessment (LCA) has become a popular tool since the 1990s to assess environmental impacts of goods and services throughout their entire life cycle (Guinée, et al., 2011). There are three main approaches for calculating LCA-based carbon footprints:

1. Process-based LCA: 'bottom-up' analysis of the impacts of a product or service, calculated by adding (or subtracting) the greenhouse gas emissions (or removals) of each process stage.
2. IO-LCA: 'top-down' analysis based on calculating an emission factor per dollar based on total greenhouse gas emissions (or removals) from that sector divided by total economic activity in that sector.
3. Hybrid LCA: a combination of process-based LCA and IO-LCA.

IO-LCA, has also been widely used in literature to determine environmental impacts based on economic data.

In carbon footprinting, emissions are usually divided into three 'scopes':

- Scope 1: Direct emissions
- Scope 2: Indirect emissions, from purchased energy
- Scope 3: Other indirect emissions

A major benefit of using the IO-LCA approach for carbon footprinting is that it captures all economic flows within each industry, without the need for complex data collection of entire supply chains of New Zealand's industries. This ensures that both direct (Scope 1) and indirect (Scope 2 and 3) emissions are captured within each emission factor (Sharp, et al., 2016).

2.2. IO-LCA in New Zealand

A limited number of New Zealand-specific studies using IO-LCA approach have been published to date. Andrew and Forgie (2008) presented three perspectives to account for New Zealand emissions: consumption-based, production-based, and shared. In their study, Andrew and Forgie (2008) constructed input-output (IO) tables for the year 2001 by updating the 1996 IO tables which were the latest at the time of the study, and used energy and emissions data for 2001 from government sources. Andrew and Forgie's work was followed by the publication of two other papers also with a focus on the New Zealand economy: Romanos, Kerr, and Will (2014), and Chandrakumar et al. (2020). Since the publication of the draft of this report in January 2022, Auckland Council have also published emission factors for the 2019 calendar year (Market Economics Limited, 2023).

Romanos et al. (2014) used the IO-LCA approach to provide a consumption-based analysis of New Zealand household emissions, based on 2007 IO economic data and greenhouse gas emissions data from governmental sources. Production emissions of New Zealand

industries were calculated and, together with the Stats NZ Household Expenditure Survey, formed the basis of their commodity-level consumption emissions calculations.

Updated IO tables and greenhouse gas emissions data have been made publicly available by Stats NZ since 2007, the base year of the study by Romanos et al. The most up-to-date IO tables for New Zealand were published for the 2019-2020 financial year. Conceptual differences exist between the latest tables and those used by Romanos et al. (2014). Greenhouse gas emissions data have also undergone methodological changes since their publication (MfE, 2020). Furthermore, this report takes a different approach to calculate commodity-level emission factors to those used by Romanos et al. (2014). While both studies base their commodity-level emission factors on those calculated for New Zealand industries, the methodologies used to calculate commodity-level emission factors differ.

The Auckland Council / Market Economics (2023) work uses a similar approach to that applied in this report. Important differences are the choice of reference year (2019 for Auckland Council vs. 2021 in this report) and the handling of imported emissions (assumed to have the same emissions intensity as domestic production for Auckland Council vs. based on the Eora multi-regional input-output database in this report).

3. Approach

This report presents the following New Zealand-specific emission factors per dollar spent, using the IO-LCA approach:

- Industry-level emission factors;
- Commodity-level emission factors in BP; and
- Commodity-level emission factors in PP (for those products that are sold by retailers).

3.1. Industry-level emission factors

Industry-level emission factors represent the emissions caused by an industry to produce one dollar of economic output.

The main data sources used to calculate emission factors for New Zealand industries were the Greenhouse Gas Emissions (industry and household) dataset[1], and National Accounts IO tables, both published by Stats NZ. This report is based on the 2021 and 2020 versions of these datasets, respectively, which are the latest datasets at the time of publication.

A mapping of industries within each dataset mentioned above was required. This was due to differences in the number and aggregation of industries between the two datasets. The industries were ultimately mapped to 118 New Zealand Standard Industrial Output Classification (NZSIOC) categories, which formed the basis for all further calculations.

Industry-level emission factors were calculated as shown in Equation 1.

Equation 1: Equation used to calculate industry-level emission factors (EF)

$$EF_i = EF_{domestic,i} + EF_{embodied\ imports,i} \qquad \forall \text{ industries } i$$

where

$$EF_{domestic,i} = \frac{TDE_{domestic,i}}{GO_{domestic,i}} \bullet (I - A)^{-1}$$

$(I - A)^{-1}$ = Leontief inverse matrix

$TDE_{domestic,i}$ = Total direct emissions from industry i

GO_i = Gross economic output from industry i from Inter-industry transactions table[2]

Domestic emission factors were calculated by multiplying direct emission factors by the Leontief inverse matrix ($(I-A)^{-1}$). The Leontief inverse matrix, represented as the IO 'Total

[1] Stats NZ's New Zealand Greenhouse Gas Emissions (industry and household) is based on the New Zealand's Greenhouse Gas Inventory published by the Ministry for the Environment. The datasets used in this report are representative of the year 2021 (Stats NZ, 2023), and emissions in CO_2e are based on GWP100 following the IPCC's Fourth Assessment Report (AR4). The dataset relates to New Zealand's economic residents only. Emissions from non-residents are excluded, and emissions from residents abroad are included.

[2] Total gross outputs from Stats NZ National Accounts IO table 4 were adjusted for inflation to better represent 2018 economic data.

requirements table' in Stats NZ National Accounts, presents the direct and indirect economic flow required in the production of one million dollar of a particular industry (Stats NZ, 2023). Hence, multiplying direct emission factors by Leontief inverse matrix ensured indirect emissions were accounted for in the final emissions intensities of New Zealand industries.

Calculations used for the emission factors for embodied imports are detailed in section 3.1.1.

3.1.1. Emissions embodied in imports

Emission factors for the calendar year 2015 available commercially through Eora (Lenzen, Kanemoto, Moran, & Geschke, 2012; Lenzen, Moran, Kanemoto, & Geschke, 2013) were used to calculate emission factors embodied in imports used in the production of goods and services by New Zealand domestic industries. An import matrix (M) was constructed to represent the portion of imported commodities used in the production of domestic industry's output. The import matrix was based on Stats NZ's IO 'Import', and 'Inter-industry transactions' table.

Industry-level emission factors for emissions embodied in imports were calculated as shown in Equation 2.

Equation 2: Equation used to calculate emission factors for embodied imports

$$EF_{embodied\ imports,i} = (EF_{imports,i} \bullet M) \bullet (I - A)^{-1}$$

where

$EF_{imports,i}$ = Emission factors from Eora

M = Import matrix, defined below in Equation 3.

Eora-based emission factors ($EF_{imports,i}$) account for the emission of goods and services that are imported into New Zealand. The Eora database provides emission factors for upstream supplier countries into New Zealand, per commodity. Commodities as per IO tables were matched to their respective Eora counterpart. Where one-to-many commodity concordance occurred (IO commodity to Eora commodity), an average of the two Eora commodities was taken.

The original Eora commodity-level emission factors for New Zealand upstream suppliers encompass the emission factors of each upstream supplier country to New Zealand, including New Zealand to New Zealand. The New Zealand to New Zealand portion of the emission factors were removed to subtract the domestic emissions from the overall Eora upstream suppliers' emission factors. The remaining emission factors were adjusted to only represent the proportion of imports from the total gross output of the main New Zealand industries. This process ensured that the emission factors of imported goods and services accounted for the emissions and economic output related to imported goods only. Eora-based emission factors were then converted to New Zealand dollar (NZD), adjusted for inflation, and converted to kilotonnes of carbon dioxide equivalents per million dollars ($ktCO_2e/\$M$).

The import matrix (M) was calculated as per Equation 3 below.

Equation 3: Equation used to calculate the Import matrix (M), per element

$$M = \text{import matrix } c \times i \qquad \forall \text{ commodities } c$$

$$m_{c,i} = \frac{import\ value_{c,i}}{GO_i}$$

The Eora-based emission factors per IO commodity were then multiplied by import matrix, resulting in the direct import emission factors related to the production of $1 million of domestic production.

3.1.2. Sub-industries

To ensure accurate representation of industry sectors within New Zealand, two IO industries needed to be broken down further: “Sheep, beef cattle, and grain farming”, and “Poultry, deer, and other livestock farming”. The resulting sub-industries are as follows:

AA121 Sheep, beef cattle, and grain farming

AA121-1 Sheep

AA121-2 Beef cattle

AA121-3 Grain farming

AA141 Poultry, deer, and other livestock farming

AA141-1 Poultry

AA141-2 Deer

AA141-3 Swine

AA141-4 Other livestock farming

The original equation to calculate final industry-level emission factors remained the same as shown in Equation 1. However, sub-industry domestic emission factors and embodied import emission factors were re-calculated.

Sub-industry domestic emission factors were calculated for by applying weighting factors to the respective industry’s total emissions and gross output as shown in Equation 4. Domestic emissions weightings were calculated based on MfE’s Greenhouse Gas Inventory (MfE, 2024), and economic gross output weightings based on Ministry for Primary Industries’ (MPI) Situation and Outlook for Primary Industries: June 2019 (MPI, 2019).

Equation 4: Equation used to calculate sub-industry emission factors

$$EF_{domestic,s} = (EF_{domestic,i} * \frac{E_s}{\sum_s E_s}) \bullet (I - A)^{-1} \qquad \forall \text{ sub-industries } s \in S$$

where

$E_s =$ Emissions from a sub-industry s

$S =$ Number of sub-industries s in an industry i

Emission factors for embodied imports for the sub-industries were calculated by applying economic gross output weightings, as described above, to the original industry-level emission factors for embodied imports.

3.2. Commodity emission factors

Commodity emission factors were calculated based on the emission factor of their respective industry. Two types of commodity-level emission factors were calculated:

- Commodity-level emission factors in basic prices (BP)
  - Excludes GST
  - Excudes wholesale and retail margins on goods and services
  - Includes imported goods and services sold directly to the consumer
  - Excludes emissions arising from retailer's own operations
  - Excludes exports
- Commodity-level emission factors in purchaser's prices (PP)
  - Includes GST
  - Includes wholesale and retail margins on goods and services
  - Includes imported goods and services sold directly to the consumer
  - Includes emissions arising from retailer's own operations
  - Excludes exports

Industry-commodity concordance was needed to ensure the emission factors related to the domestic production of goods and services is well represented within the commodity-level emission factors. Concordance was largely based on Stats NZ NZSIOC[3]-NA06CC[4] concordance document, which was provided by Stats NZ to thinkstep-anz for internal use.

Commodity matching between NA06CC commodities and IO commodities was based on Concordance 3: Product groupings table found in the National Accounts IO tables published by Stats NZ (Stats NZ, 2021).

In cases of many-to-one matching (industry-to-commodity) occurrences, a conservative approach was used to match commodities with the industry with highest emission factor. This approach did not have a significant impact on the final emission factors for most commodities. However, three commodities were significantly impacted by this conservative

[3] NZSIOC: New Zealand Standard Industrial Output Categories

[4] NA06CC: National Accounts 2006 Commodity Classification

approach, and a manual calculation of their emission factors in BP was necessary. This is explained in more detail in section 3.2.1.

3.2.1. Commodity emission factors in basic prices

Industry-level emission factors were matched to their respective commodities to provide the final commodity emission factors in BP.

As mentioned previously, for IO commodities with many-to-one (industry-to-commodity) matching where the emission factors from the differing industries varied greatly, manual calculation of commodity emission factors in BP was needed. This was true for only two IO commodities: *Living plants, buds, seeds, spice and aromatic crops*, and *Cattle*.

The emission factors in BP for these commodities were calculated as follows:

1. *Living plants, buds, seeds, spice, and aromatic crops*

   This commodity was matched to industries *AA111 Horticulture and fruit growing*, and *AA121-3 Grain farming.* The emission factor in BP for *Living plants, buds, seeds, spice, and aromatic crops* was then calculated by taking a weighted average of the emission factors of *AA111 Horticulture and fruit growing*, and *AA121-3 Grain farming.*

2. *Cattle*

   The same methodology was applied to calculate the emission factor of commodity *Cattle,* which was matched to industries *AA121-2 Beef cattle,* and *AA131 Dairy cattle farming.*

Sub-commodities:

Emission factors for the IO commodity *Meat and offal* is also represented as 5 sub-commodities: *21110-1 Meat and offal of Lamb*, *21110-2 Meat and offal of Beef*, *21110-3 Meat and offal of Venison*, *21110-4 Meat and offal of Pork* and *21120-1 Meat and offal of Poultry.* This was done to ensure the different amount of greenhouse gases that are emitted by each of these commodities are represented correctly.

Emission factors for the sub-industries *AA121-1 Sheep*, *AA121-2 Beef cattle*, *AA141-1 Poultry*, *AA141-2 Deer*, and *AA141-3 Swine* had already been calculated as mentioned in section 3.1.2. The IO commodity *Meat and offal* was matched to industry *CC111 Meat and meat product manufacturing*, rather than industries *AA121 Sheep, beef cattle, and grain farming* and *AA141 Poultry, deer, and other livestock farming*, which were used to calculate the sub-industries *AA121-1 Sheep*, *AA121-2 Beef cattle*, *AA141-1 Poultry*, *AA141-2 Deer*, and *AA141-3 Swine.*

The split of *Meat and offal* into *21110-1 Meat and offal of Lamb*, *21110-2 Meat and offal of Beef*, *21110-3 Meat and offal of Venison*, *21110-4 Meat and offal of Pork* and *21120-1 Meat and offal of Poultry* was done by extracting the final emission factors for *CC111 Meat and meat product manufacturing* that was calculated as part of each Leontief multiplication done to obtain final emission factors for sub-industries *AA121-1 Sheep*, *AA121-2 Beef cattle*, *AA141-1 Poultry*, *AA141-2 Deer*, and *AA141-3 Swine*.

3.2.2. Commodity emission factors in purchaser's prices

Commodity-level emission factors in PP were calculated as per Equation 5.

Equation 5: Equation used to calculate commodity-level emission factors in PP (EF_{PP})

$$EF_{PP,c} = \frac{(E_{domestic,c} + E_{embodied\ imports,c} + E_{retail,c})}{P_c}$$

where

$E_{domestic,c}$ = Emissions from domestic production of commodity

$E_{embodied\ imports,c}$ = Emissions embodied in imports of that commodity sold directly to consumers

$E_{retail,c}$ = Emissions attributable to the sale of that commodity

P_c = Commodity's purchaser's price[5]

Represented in Stats NZ's IO 'Supply' table, commodities' purchasing price (P_c) represent the total economic value of the supply of each commodity to consumers throughout New Zealand. This value includes domestic production, imported goods and services, margins, and taxes (including GST).

Total emissions from commodities ($E_{domestic,c}$) were calculated by multiplying the emission factor of the representative industry, with the total economic value of the commodity's domestic production ('Total industry' column of Stats NZ IO 'Supply' table).

Emissions embodied in imports sold directly to consumer ($E_{embodied\ imports,c}$) were calculated by multiplying the related Eora import emission factor for a commodity (as mapped in section 3.1.1) with the 'Total supply basic prices' column of Stats NZ IO 'supply' table.

Retail emissions attributable to the sale of commodities ($E_{retail,c}$) were calculated as per Equation 6. The authors' note that this equation is not perfect. It disaggregates emissions from an industry into commodities based on the ratio of household spending on a commodity. However, given the small effect of retail emissions, this equation is considered fit-for-purpose for the current report.

Equation 6: Equation used to calculate retail emissions attributable to the sale of a commodity

$$E_{retail,c} = \sum_{i=1}^{I} E_{retail,i} \times \sum_{i=1}^{I} \frac{S_c}{\sum_{i=1}^{I} S_{retail,i}} \qquad \forall \text{ industries } i \in I$$

where

$E_{retail,i}$ = Emissions of retailing industries i where commodity c sold

[5] Total purchaser's price from Stats NZ National Accounts IO table 1 was adjusted for inflation.

$S_c =$	Household expenditure on commodity c
$S_{retail,i} =$	Household expenditure on all commodities sold at retailing industries i
$I =$	Number of industries

Commodities that would need to be purchased from a retailer in order to reach their final user were mapped to relevant retailing IO industries, such as:

- GH111 Motor vehicle and parts retailing
- GH112 Fuel retailing
- GH121 Supermarket and grocery stores
- GH122 Specialised food retailing
- GH131 Furniture, electrical, and hardware retailing
- GH132 Recreational, clothing, footwear and personal accessory retailing
- GH133 Department stores
- GH134 Pharmaceutical and other store based retailing
- GH135 Non-store and commission based retailing
- GH212 Food and beverage services

The *retailing commodities* to *retailing industries* mapping process allowed emissions of retailing industries to be accounted for in $E_{retail,c}$.

Total annual household expenditure data (S_c and $S_{retail,i}$) were sourced from Stats NZ's "Household Expenditure Survey" (Stats NZ, 2020).

Sub-commodities

Retail emission factors for sub-commodities followed the same calculations as shown in Equation 6. However, weighting factors were applied to the total emissions and purchaser's price. Emissions weightings were calculated based on MPI's Situation and Outlook for Primary Industries (MPI, 2019), and purchaser's price weightings for each commodity as per Stats NZ Household Expenditure Survey (Stats NZ, 2024).

3.3. GHG emission factors by gas

New Zealand industry and household emissions are published annually in the dataset "Greenhouse gas emissions (industry and household)" by Stats NZ. The dataset provides emissions in kilotonnes of carbon dioxide equivalent ($ktCO_2e$) for NZSIOC industries.

This following categories of GHGs are considered within our analysis:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulphur hexafluoride (SF_6)
- Nitrogen trifluoride (NF_3)

Domestic EFs New Zealand Industries split by greenhouse gas were calculated following the approach set out in section 3.1, as shown in Equation 7.

Equation 7: Equation used to calculate industry-level domestic EFs split by gas

$$EF_{domestic,i,g} = \frac{TDE_{domestic,i,g}}{GO_{domestic,i}} \bullet (I - A)^{-1} \qquad \forall \text{ industries } i \in I, \; \forall \text{ GHG gases } g \in G$$

For some NZSIOC industries, a detailed breakdown of total domestic GHG emissions per gas ($TDE_{domestic,i,g}$) is available. For others, only aggregated data in kg CO_2e is available. Data for imported emissions were only available in kg CO_2e in the dataset we used. Because disaggregated data was not available for all industries and all imported emissions, a simplified approach has been used where all CO_2e that is not disaggregated is assumed to be carbon dioxide from fossil fuels. While this limitation does not affect the emissions factors pre-calculated as kg CO_2e, it does mean that conversions made between emissions methods (e.g., converting from GWP100 in IPCC AR4 to GWP100 in IPCC AR6) are imperfect.

3.4. GHG emissions by scope

GHG emissions associated with each industry can be broken down into scope 1, 2, 3 emissions as defined by the GHG Protocol.

Scope 1 emissions cover direct emissions from sources directly owned or controlled by the companies within the industry, and are represented by the total emissions per industry provided. The total direct emissions from each industry is collected by Stats NZ in the table "NZ Industries in Greenhouse Gas Emissions (industry and household)". A scope 1 emissions factor for an industry is calculated by dividing the total direct emissions of that industry with its Total Direct Economic Output, represented by the column "Total Economy" in the Stats NZ IO "Transactions" table, as shown in Equation 8.

Equation 8: Equation used to calculate Scope 1 EFs

$$EF_{scope1,i} = \frac{TDE_{domestic,i}}{DEO_i} \qquad \forall \text{ industries } i \in I,$$

Scope 2 emissions are indirect emissions of an industry from the generation of acquired and consumed electricity. To calculate the acquired and consumed electricity of an industry, the direct domestic emissions factor (scope 1 EF) of the "electricity generation and on-selling" industry is multiplied by direct requirements matrix, A.

Equation 9: Equation used to calculate Scope 2 EFs (Kölbl, Beckebanze , Vita, & Wegman, 2024)

$$EF_{scope2,i} = EF_{scope1,electricity} \cdot\bullet A \qquad \forall \text{ industries } i \in I,$$

$$A = Z \bullet \tilde{x}^{-1}$$

A = direct requirements matrix

Z = inter-industry transaction matrix

$\tilde{x}^{-1}$ = diagonalised and inverted Total Economy vector

Scope 3 emissions are all other indirect emissions associated with the industry that do not fall under scope 1 or scope 2 emissions. To calculate scope 3 emissions factor, scope 1 and scope 2 emissions factors are subtracted from the total emissions factor for the industry as calculated in Equation 1.

3.5. Primary data sources

Table 3-1 below provides an overview of main publicly available data sources used when calculating emission factors for New Zealand industries and commodities.

Table 3-1: Overview of main data sources per calculation step

Industry emission factors	
Industry mapping	Stats NZ (2023): NZ Industries in Greenhouse Gas Emissions (industry and household): year ended 2021 Stats NZ (2021): *Concordance 1: Industry groupings* from National Accounts input-output tables: year ended March 2020
Emission factors for domestic production	Stats NZ (2020): NZ Industries in Greenhouse Gas Emissions (industry and household): year ended 2018 Stats NZ (2021): *Table 4: Inter-industry transactions* from National Accounts input-output tables: year ended March 2020 Reserve Bank of New Zealand (2024): Inflation calculator, 2020 Q2 to 2021 Q4 Stats NZ (2021): *Table 5: Industry by industry total requirements (direct & indirect)* from National Accounts input-output tables: year ended March 2020

Industry emission factors	
Emission factors for embodied imports	Lenzen, Kanemoto, Moran, & Geschke (2012) and Lenzen, Moran, Kanemoto, & Geschke (2013): 2015 Eora Multipliers for New Zealand, Upstream Suppliers Stats NZ (2021): *Table 3: Imports into industries and categories of final demand* from National Accounts input-output tables: year ended March 2020 Stats NZ (2021): *Table 4: Inter-industry transactions* from National Accounts input-output tables: year ended March 2020 Stats NZ (2021): *Table 5: Industry by industry total requirements (direct & indirect)* from National Accounts input-output tables: year ended March 2020
Emission factors for sub-industries	MfE (2024): *Tables 3s1 and 3s3: Sectoral Report for Agriculture, Table 3F: Field burning of agricultural residues, and Table 3D: Direct and indirect N_2O emissions from agricultural soils*, from the New Zealand's Greenhouse Gas Inventory: 1990 to 2022 MPI (2019): *Table 21 Gross agricultural revenue and expenditure, year ending March 2015-23* from Situation and Outlook for Primary Industries: June 2019

Commodity emission factors	
Sub-commodity emission factors in BP	Stats NZ (2021): *Table 4: Inter-industry transactions* from National Accounts input-output tables: year ended March 2020 Reserve Bank of New Zealand (2024): Inflation calculator, 2020 Q2 to 2021 Q4 Stats NZ (2021): *Table 5: Industry by industry total requirements (direct & indirect)* from National Accounts input-output tables: year ended March 2020

Commodity emission factors	
Sub-commodity emission factors in PP	Stats NZ (2021): *Table 1: Supply of products in basic prices* from National Accounts input-output tables: year ended March 2020 Stats NZ (2021): *Table 3: Imports into industries and categories of final demand* from National Accounts input-output tables: year ended March 2020 Reserve Bank of New Zealand (2024): Inflation calculator, 2020 Q2 to 2021 Q4 Lenzen, Kanemoto, Moran, & Geschke (2012) and Lenzen, Moran, Kanemoto, & Geschke (2013): 2015 Eora Multipliers for New Zealand, Upstream Suppliers Reserve Bank of New Zealand (2024): Inflation calculator, 2015 Q2 to 2021 Q4 Stats NZ (2024): Detailed household expenditure: Year ended June 2023

3.6. Limitations

The main limitations of the approach used in this report are:

- **Categorisation of data:** Due to differing industry and commodity categorisation within the many sources used in this report, manual mapping was required in some cases. Therefore, it is expected that minor to medium levels of uncertainty may exist within the emission factors provided.
- **Averaged emission factors for imported goods and services:** Stats NZ import IO tables do not differentiate the share of imports by country of origin for each commodity. Therefore, Eora-based commodity emission factors for New Zealand imported goods and services represent an average import emission factor for each IO commodity.
- **Averaged commodity-level emission factors in PP:** Commodity-level emission factors in PP are not split by imported and domestic goods. Instead, a weighted average emission factor for all IO commodities supplied within New Zealand is used.
- **Inflation:** Economic data as per Stats NZ IO tables, and Eora multipliers were adjusted for inflation to 2021 rates using average inflation rates provided by the Reserve Bank of New Zealand. This approach does not account for differing inflation rates between industries, between commodities, or the differing levels of imported goods and services per year.

4. Emission factors

New Zealand-specific industry-level and commodity-level emission factors are provided in Sections 4.1 and 4.2, respectively. Table 4-1 below provides an outline on different uses of the industry-level and commodity-level emission factors.

General notes on the use of emission factors:

1. Emission factors are provided in kg CO_2e/$. This unit is equivalent to $ktCO_2e$/$M when used at the national level.
2. All dollars are in NZD for the year 2021. To calculate total emissions of purchased goods and services for years after 2021, adjustment for inflation is recommended.
3. All emission factors are national averages. They do not reflect the emissions of specific products or specific industries, but rather of all products and services in each industry in New Zealand. As such, they cannot be used to choose between two different products/services produced by the same industry.
4. Domestic emissions are reported by calendar year (1 January to 31 December), and emissions factors in this report should be considered to represent the middle of 2021. Users should adjust the emissions factors in the paper for inflation effects if they have different reporting periods.

Table 4-1: Outline of uses of the different types of emission factors

Industry emission factors and commodity-level emission factors in BP
Industry and commodity emission factors in BP are designed to be used by organisations that purchase goods and service direct from the producer. This is due to the value of these goods not including taxes and margins, and the emissions not including emissions associated with the retailing of goods. While commodity emission factors in BP are more disaggregated than their representative industry emission factors, no additional calculations were done between industry-level and commodity-level emission factors in BP. Use of commodity emission factors in BP are preferred as they represent a more accurate description of goods and services. However, there might be instances in which the good or service that a company is looking for is not catered by the commodity emission factors. In this case, industry emission factors might be more appropriate.

Commodity-level emission factors in PP

Commodity-level emission factors in PP are designed to be used by organisations and individuals that purchase goods from a retailer, such as a supermarket.
These emission factors account for emissions associated with retailing of these commodities, as well as emissions embodied in imports that do not require further transformation by a New Zealand industry. They are also based on the retailing value of those commodities, which include margins and taxes.

4.1. Industry emission factors

Table 4-2 provides a full list of emission factors for New Zealand industries in kg CO_2e/$, based on the New Zealand Standard Industrial Output Classification (NZSIOC)[6].

Notes on the use of industry-level emission factors are as follows:

1. The emission factors provided in this table are at wholesale level, and therefore exclude taxes (and therefore GST), and margins.
2. Industry-level emission factors account for emissions embodied in imported goods and services that are used in the process of production of domestic goods and services. Imported goods and services that are supplied directly to the consumer are excluded in this category.
3. An economic unit is allocated to an industry based on its primary activity. For example, fertiliser could be produced by *AA121 Sheep, beef cattle, and grain farming* as a result of their operations, but will not be allocated to this industry since fertiliser production is not their primary activity.

Table 4-2: Industry-level emission factors, including the direct, direct import and indirect emission factors that make up industries' final emission factors (kg CO_2e/$)

Code	Industry	Emission Factor
AA111	Horticulture and fruit growing	0.304
AA121	Sheep, beef cattle, and grain farming	2.723
AA121-1	Sheep farming	3.151
AA121-2	Beef cattle farming	2.896
AA121-3	Grain farming	0.254
AA131	Dairy cattle farming	1.373
AA141	Poultry, deer, and other livestock farming	0.936
AA141-1	Poultry farming	0.418
AA141-2	Deer farming	1.951

[6] The full NZSIOC classification standard can be found here: https://aria.stats.govt.nz/aria/#ClassificationView:uri=http://stats.govt.nz/cms/ClassificationVersion/CARS5851

Code	Industry	Emission Factor
AA141-3	Swine farming	0.610
AA141-4	Other livestock farming	0.677
AA211	Forestry and logging	0.221
AA311	Aquaculture	0.301
AA312	Fishing	0.301
AA321	Hunting and trapping	0.151
AA322	Agriculture, forestry and fishing support services	0.151
BB111	Coal mining	0.607
BB112	Oil and gas extraction	0.375
BB113	Metal ore and non-metallic mineral mining and quarrying	0.238
BB114	Exploration and other mining support services	0.184
CC111	Meat and meat product manufacturing	1.432
CC121	Seafood processing	0.247
CC131	Dairy product manufacturing	1.031
CC141	Fruit, oil, cereal and other food product manufacturing	0.261
CC151	Beverage and tobacco product manufacturing	0.193
CC211	Textile and leather manufacturing	0.756
CC212	Clothing, knitted products and footwear manufacturing	0.144
CC311	Wood product manufacturing	0.256
CC321	Pulp, paper and converted paper product manufacturing	0.263
CC411	Printing	0.119
CC511	Petroleum and coal product manufacturing	0.175
CC521	Basic chemical and basic polymer manufacturing	1.034
CC522	Fertiliser and pesticide manufacturing	0.285
CC523	Pharmaceutical, cleaning and other chemical manufacturing	0.201
CC531	Polymer product and rubber product manufacturing	0.160
CC611	Non-metallic mineral product manufacturing	0.490
CC711	Primary metal and metal product manufacturing	0.970
CC721	Fabricated metal product manufacturing	0.250
CC811	Transport equipment manufacturing	0.084

Code	Industry	Emission Factor
CC821	Electronic and electrical equipment manufacturing	0.108
CC822	Machinery manufacturing	0.202
CC911	Furniture manufacturing	0.193
CC912	Other manufacturing	0.489
DD111	Electricity generation and on-selling	0.811
DD112	Electricity transmission and distribution	0.142
DD113	Gas supply	0.292
DD121	Water supply	0.209
DD122	Sewerage and drainage services	0.338
DD123	Waste collection, treatment and disposal services	1.744
EE111	Owner-builder construction (national accounts only)	0.149
EE112	Residential building construction	0.149
EE113	Non-residential building construction	0.233
EE121	Heavy and civil engineering construction	0.182
EE131	Construction services	0.140
FF111	Basic material wholesaling	0.148
FF112	Machinery and equipment wholesaling	0.076
FF113	Motor vehicle and motor vehicle parts wholesaling	0.069
FF114	Grocery, liquor and tobacco product wholesaling	0.169
FF115	Other goods wholesaling	0.083
FF116	Commission based wholesaling	0.083
GH111	Motor vehicle and parts retailing	0.061
GH112	Fuel retailing	0.112
GH121	Supermarket and grocery stores	0.134
GH122	Specialised food retailing	0.107
GH131	Furniture, electrical and hardware retailing	0.052
GH132	Recreational, clothing, footwear and personal accessory retailing	0.075
GH133	Department stores	0.056
GH134	Pharmaceutical and other store based retailing	0.068
GH135	Non-store and commission based retailing	0.080

Code	Industry	Emission Factor
GH211	Accommodation	0.160
GH212	Food and beverage services	0.189
II111	Road transport	0.347
II121	Rail transport	0.328
II122	Water transport	0.394
II123	Air and space transport	0.371
II124	Scenic and sightseeing transport	0.253
II125	Other transport	0.253
II131	Postal and courier pick up and delivery services	0.136
II132	Transport support services	0.044
II133	Warehousing and storage services	0.112
JJ111	Publishing (except internet and music publishing)	0.080
JJ112	Motion picture and sound recording activities	0.123
JJ113	Broadcasting and internet publishing	0.072
JJ121	Telecommunications services	0.053
JJ122	Internet service providers, web search portals and data processing services	0.062
JJ123	Library and other information services	0.035
KK111	Banking and financing	0.035
KK112	Financial asset investing	0.035
KK121	Life insurance	0.044
KK122	Health and general insurance	0.037
KK123	Superannuation and individual pension services	0.076
KK131	Auxiliary finance and insurance services	0.034
LL111	Rental and hiring services (except real estate)	0.073
LL112	Non-financial asset leasing	0.054
LL121	Residential property operation	0.038
LL122	Non-residential property operation	0.063
LL123	Real estate services	0.062
LL211	Owner-occupied property operation (national accounts only)	0.027

Code	Industry	Emission Factor
MN111	Scientific, architectural and engineering services	0.060
MN112	Legal and accounting services	0.027
MN113	Advertising, market research and management services	0.067
MN114	Veterinary and other professional services	0.039
MN115	Computer system design and related services	0.039
MN211	Travel agency and tour arrangement services	0.108
MN212	Employment and other administrative services	0.067
MN213	Building cleaning, pest control and other support services	0.120
OO111	Local government administration	0.240
OO211	Central government administration and justice	0.061
OO212	Defence	0.070
OO213	Public order, safety and regulatory services	0.072
PP111	Preschool education	0.038
PP112	School education	0.046
PP113	Tertiary education	0.062
PP114	Adult, community and other education	0.068
QQ111	Hospitals	0.073
QQ112	Medical and other health care services	0.078
QQ113	Residential care services and social assistance	0.072
RS111	Heritage and artistic activities	0.052
RS112	Sport and recreation activities	0.134
RS113	Gambling activities	0.044
RS211	Repair and maintenance	0.089
RS212	Personal care, funeral and other personal services	0.079
RS213	Religious services	0.074
RS214	Civil, professional and other interest groups	0.074
RS215	Private Households Employing Staff	0.079

* Disaggregated industries. The greenhouse gas emissions dataset provides data for each disaggregated industry. However, as Stats NZ IO tables were published in 2013, IO data is only provided for the aggregated level of these industries. For example, IO data for *RS213 Religious Services*, and *RS214 Civil, professional and other interest groups* were provided for the aggregated industry called “Religious services; civil, professional, and other interest groups”. Emission factors for each disaggregated industry were calculated at aggregated-level industry. Therefore, the emission factors for disaggregated industries are the same as their counterpart.

4.2. Commodity emission factors

4.2.1. Commodity emission bactors in basic prices

Table 4-3 provides a list of emission factors for New Zealand commodities in BP in kg CO_2e/$, organised according to the National Accounts Commodity Classification 2006 (NA06CC)[7].

Notes on the use of commodity-level emission factors in BP:

1. The emission factors provided in this table are at wholesale level, and therefore exclude taxes (including GST) and margins.
2. Commodity-level emission factors in BP account for emissions embodied in imported goods and services that are used in the process of production of domestic goods and services. Imported goods and services that are supplied directly to the consumer are excluded in this category.

Table 4-3: Commodity emission factors in BP (kg CO_2e/$)

Code	Commodity	Emission Factor BP
01100	Living plants, cut flowers and flower buds, flower seeds	0.296
01200	Vegetables (excluding processed vegetables; including dried leguminous vegetables)	0.304
01310	Kiwifruit	0.304
01320	Pome Fruit (apples, pears)	0.304
01330	Other fruit and nuts (including oilseeds and oleaginous fruits)	0.304
01400	Forage products, fibres, sugar crops, unmanufactured tobacco, cotton linters and natural rubber	0.254
01500	Stimulant, spice and aromatic crops	0.296
01600	Cereals	0.254
02100	Sheep	3.151
02200	Beef cattle	1.722
02300	Dairy cattle	1.722
02410	Poultry	0.936
02420	Deer	0.936
02430	Pigs	0.936
02440	Other livestock (horses, dogs, ostriches, emus, llama, alpaca, bees and other commercial animals)	0.936

[7] The full NA06CC classification standard can be found here: https://aria.stats.govt.nz/aria/#ClassificationView:uri=http://stats.govt.nz/cms/ClassificationVersion/CARS6712

Code	Commodity	Emission Factor BP
02500	Raw milk	1.373
02610	Raw animal materials used in textile (including wool)	2.723
02620	Other animal products (including fresh eggs, honey, velvet and reproductive materials)	0.936
03100	Non-wood forest products	0.221
03200	Wood in the rough	0.221
03300	Standing timber	0.221
04100	Fishes, live, fresh or chilled	0.301
04200	Other aquatic plants and animals	0.301
05110	Support services to agriculture (including animal husbandry)	2.723
05120	Support services to forestry and logging	0.221
05130	Support services to hunting and fishing	0.151
11000	Coal and lignite; peat; coke, tar and other material derived from coal, lignite and peat	0.607
12100	Crude petroleum oils; bituminous or oil shale and tar sands	0.375
12200	Natural gas	0.375
13100	Iron ores and concentrates, other than roasted iron pyrites; non-ferrous metal ores and concentrates	0.238
13200	Gypsum; anhydrite; limestone flux; limestone and other calcareous stone used for lime or cement manufacturing; Monumental or building stone	0.238
13300	Sands, pebbles, gravel, broken or crushed stone, natural bitumen and asphalt; clays	0.238
13400	Chemical and fertiliser minerals	0.238
13500	Salt and pure sodium chloride; sea water	0.238
13600	Precious and semi-precious stones; pumice stone; emery; natural abrasives; other minerals	0.238
14000	Support services to mining	0.184
21110	Meat and offal of mammals, frozen, fresh or chilled	1.432
21110-1	Lamb meat and offal, frozen, fresh or chilled	1.576
21110-2	Beef meat and offal, frozen, fresh or chilled	1.457
21110-3	Venison meat and offal, frozen, fresh or chilled	1.415
21110-4	Pork meat and offal, frozen, fresh or chilled	1.363

Code	Commodity	Emission Factor BP
21120	Meat and offal of poultry, frozen, fresh or chilled	1.432
21120-1	Poultry meat and offal, frozen, fresh or chilled	1.356
21190	Preserves and preparations of meat, meat offal, or blood; other offal and meat products	1.432
21200	Hide, skins and furskins, raw	1.432
21300	Prepared and preserved fish, crustaceans, molluscs and other aquatic invertebrates	0.247
22110	Processed liquid milk and cream	1.031
22120	Milk and cream, in solid form and concentrates (including milk and buttermilk powder)	1.031
22130	Casein	1.031
22190	Other dairy products	1.031
23110	Prepared and preserved vegetables, pulses, and potatoes	0.261
23120	Fruit juices	0.193
23130	Prepared and preserved fruit and nuts, other than fruit juices	0.261
23200	Animal and vegetable oils and fats; oil-cake and other solid residues of vegetable oils and fats; vegetable and insect waxes; flouts and meals of oil seeds and oleaginous fruits	0.261
23300	Grain mill products	0.261
23400	Starches and starch products; sugars and sugar syrups nec	1.031
23500	Preparations used in animal feeding	0.261
23600	Bakery products	0.261
23700	Sugar	0.261
23800	Cocoa, chocolate and sugar confectionery	0.261
23900	Macaroni, noodles, couscous and similar farinaceous products	0.261
24100	Food products nec	0.261
25100	Soft drinks; bottled mineral waters	0.193
25200	Ethyl alcohol; spirits, liqueurs and other spirituous beverages	0.193
25300	Malt liquors and malt (includes beer made from malt)	0.193
25400	Wines	0.193

Code	Commodity	Emission Factor BP
26000	Tobacco products	0.193
27100	Natural and man-made textile fibres prepared for spinning (including cotton)	0.756
27200	Textile yarn and thread of natural and man-made fibres	0.756
27300	Woven fabrics of natural and man-made fibres (including special fabrics)	0.756
27400	Made-up textile articles	0.756
27500	Tanned or dressed furskins and artificial fur; articles thereof (except headgear)	0.756
27600	Tanned or dressed leather; composition leather	0.756
27700	Luggage, handbags and the like; saddlery and harness; other articles of leather	0.756
27800	Carpets and other textile floor coverings	0.756
27900	Other textile products (including twine, cordage, ropes and cables and articles thereof)	0.756
28100	Wearing apparel, except fur apparel; knitted or crocheted fabrics	0.144
28200	Footwear	0.144
31100	Wood, sawn or chipped lengthwise, sliced or peeled (thickness exceeding 6 mm); wood in the rough, including those treated; railway or tramway sleepers (cross-ties) of wood	0.256
31200	Wood continuously shaped along any of its edges or faces; wood wool; wood flour; wood in chips or particles	0.256
31300	Boards and panels	0.256
31400	Veneer sheets; sheets for plywood; densified wood	0.256
31500	Builders' joinery and carpentry of wood (including cellular wood panels, assembled parquet panels, shingles and shakes)	0.256
31900	Other products of wood (including containers); articles of cork, plaiting materials and straw	0.256
32110	Corrugated paper and paperboard and containers of paper and paperboard	0.263
32120	Pulps of wood and other fibrous cellulosic material	0.263
32190	Other paper and paperboard products (including processed paper, newsprint and paper & paperboard stationery)	0.263

Code	Commodity	Emission Factor BP
32200	Books, maps, music, cards, pictures and plans; excluding advertising material	0.263
32300	Newspapers and periodicals, in print	0.263
32900	Other printed material; composed type and other impressed media used in printing	0.263
33100	Petrol	0.175
33200	Diesel	0.175
33900	Other (non crude) petroleum oils and oils obtained from bituminous materials; other products refined from petroleum (including petroleum gas and petroleum jelly; excluding natural gas); radioactive and nuclear fuel products	0.175
34110	Methanol	1.034
34120	Basic organic chemicals (excluding methanol)	1.034
34200	Basic inorganic chemicals nec	1.034
34300	Miscellaneous basic chemical products	0.160
34410	Fertiliser	0.285
34420	Pesticides	0.285
34500	Plastics in primary forms	1.034
35100	Pharmaceutical products	0.201
35200	Soap, cleaning preparations, perfumes and toilet preparations	0.201
36100	Paints and varnishes and related products; artists' colours; ink	0.160
36200	Rubber tyres and tubes	0.160
36300	Other rubber products (including primary forms or plates, sheets and strips of synthetic rubber and related products)	0.160
36400	Semi-manufactures of plastics	0.160
36500	Packaging products of plastics	0.160
36600	Other plastics products	0.160
36900	Chemical products nec; Man-made fibres	1.034
37100	Glass and glass products	0.490
37200	Non-structural ceramic ware	0.490

Code	Commodity	Emission Factor BP
37300	Refractory products and structural non-refractory clay products	0.490
37400	Plaster, lime and cement	0.490
37500	Articles of concrete, cement and plaster	0.490
37900	Other non-metallic mineral products nec (including articles of monumental or building stone)	0.490
38100	Wastes from food and tobacco industry	1.432
38200	Non-metal wastes and scraps	0.263
38300	Metal wastes or scraps; other non-ferrous metals; cermets and articles thereof	0.970
41100	Basic iron and steel	0.970
41200	Products of steel	0.970
41300	Basic precious metals and metals clad with precious metals	0.970
41400	Copper, nickel, aluminium, alumina, lead, zinc and tin, unwrought	0.970
41500	Semi-finished products of copper, nickel, aluminium, lead, zinc and tin or their alloys	0.970
42100	Structural metal products and parts thereof, including installation services	0.250
42200	Prefabricated buildings	0.250
42300	Metal containers and steam generators and parts thereof; including installation services	0.250
42400	Other fabricated metal products, including installation services	0.250
42500	Weapons and ammunition and parts thereof	0.250
43100	Motor vehicles, trailers and semi-trailers; bodies (coachwork) for motor vehicles, trailers and semi-trailers; parts and accessories thereof	0.084
43200	Ships	0.084
43300	Pleasure and sporting boats	0.084
43400	Railway and tramway locomotives and rolling stock, and parts thereof	0.084
43500	Aircraft and spacecraft, and parts thereof	0.084
43900	Other transport equipment and parts thereof	0.084

Code	Commodity	Emission Factor BP
44100	Domestic appliances and parts thereof; includes installation services	0.108
44200	Office and accounting machinery, and parts and accessories thereof; includes installation services	0.108
44300	Computing machinery and parts and accessories thereof; includes installation services	0.108
44400	Electric motors, generators and transformers, and parts thereof, includes installation services	0.108
44500	Electricity distribution and control apparatus, and parts thereof, includes installation services	0.108
44600	Insulated wire and cable; optical fibre cables, includes installation services	0.108
44700	Accumulators, primary cells and primary batteries, and parts thereof, includes installation services	0.108
44800	Electric filament or discharge lamps; arc lamps; lighting equipment; parts thereof, includes installation services	0.108
44900	Other electrical equipment and parts thereof, includes installation services	0.108
45100	Electronic valves and tubes; electronic components; parts thereof; includes installation services	0.108
45200	Television and radio transmitters; television, video and digital cameras; telephone sets; includes installation services	0.108
45300	Radio broadcast and television receivers; apparatus for sound and video recording and reproducing; microphones, loudspeakers, amplifiers, etc.; includes installation services	0.108
45400	Parts for radio, television, communication and navigation equipment; includes installation services	0.108
45500	Disks, tapes, solid-state non-volatile storage devices and other media (including cards with magnetic strips or chips), not recorded	0.108
45600	Medical and surgical equipment and orthopaedic appliances; includes installation services	0.108
45700	Instruments and appliances for measuring, checking, testing, navigating and other purposes, except optical instruments; industrial process control equipment; parts and accessories thereof; includes installation services	0.108

Code	Commodity	Emission Factor BP
45800	Optical instruments and photographic equipment, and parts and accessories thereof; includes installation services	0.108
45900	Engines and turbines and parts thereof; includes installation services	0.202
46100	Pumps, compressors, hydraulic and pneumatic power engines, and valves, and parts thereof; includes installation services	0.202
46200	Bearings, gears, gearing and driving elements, and parts thereof; includes installation services	0.202
46300	Lifting and handling equipment and parts thereof; includes installation services	0.202
46400	Other general purpose machinery and parts thereof (including ovens and furnace burners); includes installation services	0.202
46500	Agricultural or forestry machinery and parts thereof; includes installation services	0.202
46600	Machine-tools and parts and accessories thereof; includes installation services	0.202
46700	Machinery for metallurgy and parts thereof; includes installation services	0.202
46800	Machinery for mining, quarrying and construction, and parts thereof; includes installation services	0.202
46900	Machinery for food, beverage and tobacco processing, and parts thereof; includes installation services	0.202
47100	Machinery for textile, apparel and leather production, and parts thereof; includes installation services	0.202
47200	Other special-purpose machinery and parts thereof; includes installation services	0.202
48100	Furniture	0.193
49100	Jewellery and related articles	0.489
49200	Sports goods	0.489
49300	Games and toys; roundabouts, swings and other fairground amusements	0.489
49400	Other manufactured articles nec	0.489
49500	Petroleum, chemical & pharmaceutical product manufacturing services, on a fee or contract basis	0.489

Code	Commodity	Emission Factor BP
49600	Fabricated metal product, machinery and equipment manufacturing services, on a fee or contract basis; excluding installation services	0.489
49700	Other manufacturing services, on a fee or contract basis; excluding installation services	0.489
51100	Electrical energy	0.811
51200	Electricity distribution services	0.142
51300	Support services to electricity distribution	0.142
52100	Gas supply	0.292
52200	Gas distribution services	0.292
52300	Support services to gas distribution	0.292
54100	Water, including natural water, ice, steam, and hot water; other non-petroleum gas	0.209
54200	Water distribution services	0.209
54300	Support services to water distribution	0.209
55100	Sewerage, sewage treatment and septic tank cleaning services	0.338
55200	Waste collection services	0.589
55300	Waste treatment and disposal services	3.958
55400	Recycling services	0.589
55500	Environmental protection services	0.240
61100	General construction services of residential buildings, including erection of prefabricated constructions	0.149
61200	General construction services of non-residential buildings, including erection of prefabricated constructions	0.233
61300	General construction services of civil engineering works	0.182
61400	Site preparation services	0.140
61500	Special trade construction services	0.140
61610	Electrical installation services	0.140
61620	Water, plumbing and drain laying services	0.140
61630	Heating, ventilation and air conditioning installation services	0.140
61640	Gas fitting installation services	0.140

Code	Commodity	Emission Factor BP
61650	Other installation services (including insulation and elevator installation services; excluding non-building related installations)	0.140
61700	Building completion and finishing services	0.140
62000	Land improvements	0.182
70000	Commission agents' services	0.083
71000	Wholesale trade services	0.083
73000	Accommodation services	0.160
74100	Meal serving services	0.189
74200	Event catering and other food serving services	0.189
74300	Beverage serving services	0.189
75110	Road transport services of freight; transport services via pipeline	0.347
75120	Road passenger transport	0.347
75210	Railway transport services of freight	0.328
75220	Railway passenger transport	0.328
75310	Water transport services of freight	0.253
75320	Water passenger transport	0.253
75410	Air transport services of freight	0.371
75420	Air passenger transport	0.371
75500	Scenic and sightseeing transportation services	0.253
75600	Postal and courier services	0.136
76710	Cargo handling services	0.112
76720	Supporting services for railway transport	0.044
76730	Supporting services for road transport	0.044
76740	Supporting services for water transport	0.044
76750	Supporting services for air transport	0.044
76800	Freight transport agencies and other supporting transport services	0.044
77100	Storage and warehousing services	0.112
78100	Publishing, printing and reproduction services	0.119
78200	Packaged Software	0.080

Code	Commodity	Emission Factor BP
78300	Audio, video and other disks, tapes and other physical media, recorded	0.123
78400	Audio-visual and related services	0.123
78500	Broadcasting, programming and programme distribution services	0.072
78610	Fixed telecommunications services	0.053
78620	Mobile telecommunications services	0.053
78710	Imports of gaming software and apps	0.080
78720	Imports of software, subscriptions to streaming services & other internet services	0.053
78900	Internet telecommunications services and online content	0.053
79110	News agency services	0.080
79120	Library and archive services	0.035
81110	Financial intermediation services directly measured	0.035
81111	Financial intermediation services indirectly measured	0.035
81210	Life insurance	0.044
81220	Accident and health insurance services	0.037
81230	Other insurance services	0.037
81240	Superannuation and individual pension services	0.076
81300	Services auxiliary to financial services other than to insurance and pensions	0.034
81400	Services auxiliary to insurance and pensions	0.034
82110	Leasing or rental services concerning transport equipment without operator	0.073
82120	Leasing or rental services concerning other machinery and equipment without operator	0.073
82130	Leasing or rental services concerning personal and household goods; leasing or rental services concerning other goods nec	0.073
82210	Licensing services for the right to use computer software and databases	0.073
82220	Licensing services for the right to use mineral exploration and evaluation	0.054
82230	Licensing services for the right to use other intellectual property products (including patents)	0.073

Code	Commodity	Emission Factor BP
82310	Capitalised Oil and Gas Exploration Expenditure	0.184
82320	Capitalised Other Exploration Expenditure	0.238
83110	Real estate services involving own or leased residential property	0.038
83120	Real estate services involving own or leased non-residential property	0.063
83130	Real estate services on a fee or contract basis	0.062
83200	Owner occupied dwellings, imputed rent (NA component)	0.027
91100	Research and development services	0.060
91200	Architectural services, urban and land planning and landscape architectural services; engineering services	0.060
91300	Scientific and other technical services	0.060
91400	Legal services	0.027
91500	Accounting, auditing, bookkeeping, insolvency, receivership and taxation services	0.027
91600	Advertising services and provision of advertising space or time	0.067
91700	Market research and public opinion polling services	0.067
91800	Management consulting and management services	0.067
91900	Veterinary services	0.039
92100	Photographic services and photography processing services	0.039
92200	Other professional, technical and business services nec	0.039
92310	Information technology design and development related services	0.039
92320	Information technology infrastructure provisioning and network management services	0.039
92330	Information technology technical consulting and support services	0.039
92400	Travel arrangement, tour operator and related services	0.108
92500	Employment services	0.067
92600	Cleaning services	0.120
92700	Packaging services	0.120
92800	Other support services (including call centre, secretarial & gardening services)	0.067

Code	Commodity	Emission Factor BP
93110	Local government administration services	0.240
93111	Local Government FCE	0.240
93210	Central government administrative services	0.061
93211	Central government FCE	0.072
93300	Government services to the community as a whole; administrative services of compulsory social security schemes	0.072
93400	Investigation and security services	0.072
94100	Pre-primary education services	0.038
94200	Primary education services	0.046
94300	Secondary education services	0.046
94400	Tertiary education services	0.062
94500	Post-secondary non-tertiary education services	0.068
94600	Other education and training services and educational support services	0.068
95110	Inpatient services	0.073
95120	Medical and dental services	0.078
95130	Other human health services	0.078
95210	Residential care services for the elderly and disabled	0.072
95220	Child care services	0.072
95230	Other social services	0.072
96100	Live entertainment event presentation and promotion services; services of performing and other arts; museum and preservation services	0.052
96210	Sports and recreational sports facility operation services	0.134
96220	Other sports and recreation services; athlete and other related support services	0.134
96310	Casino-based gambling services	0.044
96320	Lottery services	0.044
96330	Racing and sports betting services	0.044
96340	Online gambling services; gaming machines outside of casinos; other gambling services	0.044
96350	Imports of online gambling services	0.044

Code	Commodity	Emission Factor BP
97100	Maintenance and repair services of office and accounting machinery, computers and peripheral equipment	0.089
97200	Maintenance and repair of transport machinery and equipment	0.089
97300	Maintenance and repair services of other fabricated metal products, machinery and equipment	0.089
97400	Repair services of personal and household goods; repair services of other goods nec	0.089
98100	Other miscellaneous services (includes personal care, funeral and other personal services)	0.079
98210	Services furnished by other membership organisations (including religious services)	0.074
98220	Services furnished by business, employers and professional organisations	0.074
98230	Services furnished by trade unions	0.074
98300	Domestic services	0.079

4.2.2. Commodity emission factors in purchaser's prices

Table 4-4 provides a list of emission factors for New Zealand commodities in PP, in kg CO_2e/$.

Notes on the use of commodity-level emission factors in PP:

1. The prices in the commodity-level emission factors in PP are inclusive of taxes (including GST), and margins.
2. Commodity-level emission factors in PP are inclusive of embodied emissions in both imported goods and services used in the domestic production of commodities, and on imports sold directly to the consumer.
3. Commodity-level emission factors in PP include emissions associated with retailing of commodities (distribution, warehousing, and retail).

Table 4-4: Commodity emission factors in PP (kg CO_2e/$)

Code	Commodity	Emission Factor PP
01100	Living plants, cut flowers and flower buds, flower seeds	0.104
01200	Vegetables (excluding processed vegetables; including dried leguminous vegetables)	0.165
01310	Kiwifruit	0.234
01320	Pome Fruit (apples, pears)	0.239
01330	Other fruit and nuts (including oilseeds and oleaginous fruits)	0.163
01400	Forage products, fibres, sugar crops, unmanufactured tobacco, cotton linters and natural rubber	0.236
01500	Stimulant, spice and aromatic crops	0.104
01600	Cereals	0.151
02100	Sheep	3.153
02200	Beef cattle	1.775
02300	Dairy cattle	1.775
02410	Poultry	0.688
02420	Deer	0.924
02430	Pigs	0.752
02440	Other livestock (horses, dogs, ostriches, emus, llama, alpaca, bees and other commercial animals)	0.688
02500	Raw milk	1.384
02610	Raw animal materials used in textile (including wool)	2.630

Code	Commodity	Emission Factor PP
02620	Other animal products (including fresh eggs, honey, velvet and reproductive materials)	0.769
03100	Non-wood forest products	0.200
03200	Wood in the rough	0.200
03300	Standing timber	0.200
04100	Fishes, live, fresh or chilled	0.295
04200	Other aquatic plants and animals	0.254
05110	Support services to agriculture (including animal husbandry)	2.715
05120	Support services to forestry and logging	0.212
05130	Support services to hunting and fishing	0.178
11000	Coal and lignite; peat; coke, tar and other material derived from coal, lignite and peat	0.447
12100	Crude petroleum oils; bituminous or oil shale and tar sands	0.069
12200	Natural gas	0.343
13100	Iron ores and concentrates, other than roasted iron pyrites; non-ferrous metal ores and concentrates	0.119
13200	Gypsum; anhydrite; limestone flux; limestone and other calcareous stone used for lime or cement manufacturing; Monumental or building stone	0.213
13300	Sands, pebbles, gravel, broken or crushed stone, natural bitumen and asphalt; clays	0.242
13400	Chemical and fertiliser minerals	0.105
13500	Salt and pure sodium chloride; sea water	0.105
13600	Precious and semi-precious stones; pumice stone; emery; natural abrasives; other minerals	0.201
14000	Support services to mining	0.207
21110	Meat and offal of mammals, frozen, fresh or chilled	1.207
21110-1	Lamb meat and offal, frozen, fresh or chilled	1.326
21110-2	Beef meat and offal, frozen, fresh or chilled	1.226
21110-3	Venison meat and offal, frozen, fresh or chilled	1.191
21110-4	Pork meat and offal, frozen, fresh or chilled	1.151
21120	Meat and offal of poultry, frozen, fresh or chilled	1.207

Code	Commodity	Emission Factor PP
21120-1	Poultry meat and offal, frozen, fresh or chilled	1.153
21190	Preserves and preparations of meat, meat offal, or blood; other offal and meat products	0.980
21200	Hide, skins and furskins, raw	0.514
21300	Prepared and preserved fish, crustaceans, molluscs and other aquatic invertebrates	0.153
22110	Processed liquid milk and cream	0.947
22120	Milk and cream, in solid form and concentrates (including milk and buttermilk powder)	0.947
22130	Casein	0.979
22190	Other dairy products	0.979
23110	Prepared and preserved vegetables, pulses, and potatoes	0.199
23120	Fruit juices	0.107
23130	Prepared and preserved fruit and nuts, other than fruit juices	0.139
23200	Animal and vegetable oils and fats; oil-cake and other solid residues of vegetable oils and fats; vegetable and insect waxes; flouts and meals of oil seeds and oleaginous fruits	0.115
23300	Grain mill products	0.149
23400	Starches and starch products; sugars and sugar syrups nec	0.442
23500	Preparations used in animal feeding	0.146
23600	Bakery products	0.205
23700	Sugar	0.208
23800	Cocoa, chocolate and sugar confectionery	0.208
23900	Macaroni, noodles, couscous and similar farinaceous products	0.124
24100	Food products nec	0.214
25100	Soft drinks; bottled mineral waters	0.107
25200	Ethyl alcohol; spirits, liqueurs and other spirituous beverages	0.025
25300	Malt liquors and malt (includes beer made from malt)	0.107
25400	Wines	0.115
26000	Tobacco products	0.025

Code	Commodity	Emission Factor PP
27100	Natural and man-made textile fibres prepared for spinning (including cotton)	0.658
27200	Textile yarn and thread of natural and man-made fibres	0.568
27300	Woven fabrics of natural and man-made fibres (including special fabrics)	0.190
27400	Made-up textile articles	0.194
27500	Tanned or dressed furskins and artificial fur; articles thereof (except headgear)	0.224
27600	Tanned or dressed leather; composition leather	0.224
27700	Luggage, handbags and the like; saddlery and harness; other articles of leather	0.224
27800	Carpets and other textile floor coverings	0.391
27900	Other textile products (including twine, cordage, ropes and cables and articles thereof)	0.194
28100	Wearing apparel, except fur apparel; knitted or crocheted fabrics	0.092
28200	Footwear	0.060
31100	Wood, sawn or chipped lengthwise, sliced or peeled (thickness exceeding 6 mm); wood in the rough, including those treated; railway or tramway sleepers (cross-ties) of wood	0.204
31200	Wood continuously shaped along any of its edges or faces; wood wool; wood flour; wood in chips or particles	0.204
31300	Boards and panels	0.211
31400	Veneer sheets; sheets for plywood; densified wood	0.211
31500	Builders' joinery and carpentry of wood (including cellular wood panels, assembled parquet panels, shingles and shakes)	0.195
31900	Other products of wood (including containers); articles of cork, plaiting materials and straw	0.173
32110	Corrugated paper and paperboard and containers of paper and paperboard	0.208
32120	Pulps of wood and other fibrous cellulosic material	0.208
32190	Other paper and paperboard products (including processed paper, newsprint and paper & paperboard stationery)	0.139

Code	Commodity	Emission Factor PP
32200	Books, maps, music, cards, pictures and plans; excluding advertising material	0.083
32300	Newspapers and periodicals, in print	0.104
32900	Other printed material; composed type and other impressed media used in printing	0.083
33100	Petrol	0.067
33200	Diesel	0.106
33900	Other (non crude) petroleum oils and oils obtained from bituminous materials; other products refined from petroleum (including petroleum gas and petroleum jelly; excluding natural gas); radioactive and nuclear fuel products	0.124
34110	Methanol	0.718
34120	Basic organic chemicals (excluding methanol)	0.540
34200	Basic inorganic chemicals nec	0.540
34300	Miscellaneous basic chemical products	0.141
34410	Fertiliser	0.219
34420	Pesticides	0.219
34500	Plastics in primary forms	0.257
35100	Pharmaceutical products	0.090
35200	Soap, cleaning preparations, perfumes and toilet preparations	0.092
36100	Paints and varnishes and related products; artists' colours; ink	0.129
36200	Rubber tyres and tubes	0.117
36300	Other rubber products (including primary forms or plates, sheets and strips of synthetic rubber and related products)	0.160
36400	Semi-manufactures of plastics	0.136
36500	Packaging products of plastics	0.160
36600	Other plastics products	0.125
36900	Chemical products nec; Man-made fibres	0.718
37100	Glass and glass products	0.301
37200	Non-structural ceramic ware	0.182

Code	Commodity	Emission Factor PP
37300	Refractory products and structural non-refractory clay products	0.182
37400	Plaster, lime and cement	0.266
37500	Articles of concrete, cement and plaster	0.373
37900	Other non-metallic mineral products nec (including articles of monumental or building stone)	0.373
38100	Wastes from food and tobacco industry	0.806
38200	Non-metal wastes and scraps	0.193
38300	Metal wastes or scraps; other non-ferrous metals; cermets and articles thereof	0.518
41100	Basic iron and steel	0.599
41200	Products of steel	0.598
41300	Basic precious metals and metals clad with precious metals	0.695
41400	Copper, nickel, aluminium, alumina, lead, zinc and tin, unwrought	0.599
41500	Semi-finished products of copper, nickel, aluminium, lead, zinc and tin or their alloys	0.598
42100	Structural metal products and parts thereof, including installation services	0.165
42200	Prefabricated buildings	0.180
42300	Metal containers and steam generators and parts thereof; including installation services	0.188
42400	Other fabricated metal products, including installation services	0.165
42500	Weapons and ammunition and parts thereof	0.085
43100	Motor vehicles, trailers and semi-trailers; bodies (coachwork) for motor vehicles, trailers and semi-trailers; parts and accessories thereof	0.080
43200	Ships	0.091
43300	Pleasure and sporting boats	0.091
43400	Railway and tramway locomotives and rolling stock, and parts thereof	0.057
43500	Aircraft and spacecraft, and parts thereof	0.118
43900	Other transport equipment and parts thereof	0.057

Code	Commodity	Emission Factor PP
44100	Domestic appliances and parts thereof; includes installation services	0.056
44200	Office and accounting machinery, and parts and accessories thereof; includes installation services	0.072
44300	Computing machinery and parts and accessories thereof; includes installation services	0.072
44400	Electric motors, generators and transformers, and parts thereof, includes installation services	0.108
44500	Electricity distribution and control apparatus, and parts thereof, includes installation services	0.108
44600	Insulated wire and cable; optical fibre cables, includes installation services	0.113
44700	Accumulators, primary cells and primary batteries, and parts thereof, includes installation services	0.085
44800	Electric filament or discharge lamps; arc lamps; lighting equipment; parts thereof, includes installation services	0.113
44900	Other electrical equipment and parts thereof, includes installation services	0.113
45100	Electronic valves and tubes; electronic components; parts thereof; includes installation services	0.113
45200	Television and radio transmitters; television, video and digital cameras; telephone sets; includes installation services	0.056
45300	Radio broadcast and television receivers; apparatus for sound and video recording and reproducing; microphones, loudspeakers, amplifiers, etc.; includes installation services	0.056
45400	Parts for radio, television, communication and navigation equipment; includes installation services	0.056
45500	Disks, tapes, solid-state non-volatile storage devices and other media (including cards with magnetic strips or chips), not recorded	0.072
45600	Medical and surgical equipment and orthopaedic appliances; includes installation services	0.089
45700	Instruments and appliances for measuring, checking, testing, navigating and other purposes, except optical instruments; industrial process control equipment; parts and accessories thereof; includes installation services	0.068

Code	Commodity	Emission Factor PP
45800	Optical instruments and photographic equipment, and parts and accessories thereof; includes installation services	0.068
45900	Engines and turbines and parts thereof; includes installation services	0.061
46100	Pumps, compressors, hydraulic and pneumatic power engines, and valves, and parts thereof; includes installation services	0.115
46200	Bearings, gears, gearing and driving elements, and parts thereof; includes installation services	0.115
46300	Lifting and handling equipment and parts thereof; includes installation services	0.115
46400	Other general purpose machinery and parts thereof (including ovens and furnace burners); includes installation services	0.115
46500	Agricultural or forestry machinery and parts thereof; includes installation services	0.148
46600	Machine-tools and parts and accessories thereof; includes installation services	0.115
46700	Machinery for metallurgy and parts thereof; includes installation services	0.133
46800	Machinery for mining, quarrying and construction, and parts thereof; includes installation services	0.104
46900	Machinery for food, beverage and tobacco processing, and parts thereof; includes installation services	0.164
47100	Machinery for textile, apparel and leather production, and parts thereof; includes installation services	0.133
47200	Other special-purpose machinery and parts thereof; includes installation services	0.133
48100	Furniture	0.090
49100	Jewellery and related articles	0.135
49200	Sports goods	0.120
49300	Games and toys; roundabouts, swings and other fairground amusements	0.137
49400	Other manufactured articles nec	0.137
49500	Petroleum, chemical & pharmaceutical product manufacturing services, on a fee or contract basis	0.505

Code	Commodity	Emission Factor PP
49600	Fabricated metal product, machinery and equipment manufacturing services, on a fee or contract basis; excluding installation services	0.505
49700	Other manufacturing services, on a fee or contract basis; excluding installation services	0.505
51100	Electrical energy	0.757
51200	Electricity distribution services	0.129
51300	Support services to electricity distribution	0.129
52100	Gas supply	0.282
52200	Gas distribution services	0.282
52300	Support services to gas distribution	0.282
54100	Water, including natural water, ice, steam, and hot water; other non-petroleum gas	0.212
54200	Water distribution services	0.212
54300	Support services to water distribution	0.212
55100	Sewerage, sewage treatment and septic tank cleaning services	0.340
55200	Waste collection services	0.602
55300	Waste treatment and disposal services	3.872
55400	Recycling services	0.602
55500	Environmental protection services	0.242
61100	General construction services of residential buildings, including erection of prefabricated constructions	0.146
61200	General construction services of non-residential buildings, including erection of prefabricated constructions	0.233
61300	General construction services of civil engineering works	0.184
61400	Site preparation services	0.153
61500	Special trade construction services	0.153
61610	Electrical installation services	0.179
61620	Water, plumbing and drain laying services	0.174
61630	Heating, ventilation and air conditioning installation services	0.179
61640	Gas fitting installation services	0.174

Code	Commodity	Emission Factor PP
61650	Other installation services (including insulation and elevator installation services; excluding non-building related installations)	0.174
61700	Building completion and finishing services	0.153
62000	Land improvements	0.177
70000	Commission agents' services	0.087
71000	Wholesale trade services	0.087
73000	Accommodation services	0.110
74100	Meal serving services	0.143
74200	Event catering and other food serving services	0.165
74300	Beverage serving services	0.145
75110	Road transport services of freight; transport services via pipeline	0.298
75120	Road passenger transport	0.295
75210	Railway transport services of freight	0.311
75220	Railway passenger transport	0.148
75310	Water transport services of freight	0.302
75320	Water passenger transport	0.194
75410	Air transport services of freight	0.439
75420	Air passenger transport	0.263
75500	Scenic and sightseeing transportation services	0.269
75600	Postal and courier services	0.147
76710	Cargo handling services	0.148
76720	Supporting services for railway transport	0.069
76730	Supporting services for road transport	0.069
76740	Supporting services for water transport	0.089
76750	Supporting services for air transport	0.084
76800	Freight transport agencies and other supporting transport services	0.089
77100	Storage and warehousing services	0.153
78100	Publishing, printing and reproduction services	0.097
78200	Packaged Software	0.106

Code	Commodity	Emission Factor PP
78300	Audio, video and other disks, tapes and other physical media, recorded	0.091
78400	Audio-visual and related services	0.111
78500	Broadcasting, programming and programme distribution services	0.085
78610	Fixed telecommunications services	0.066
78620	Mobile telecommunications services	0.066
78710	Imports of gaming software and apps	0.042
78720	Imports of software, subscriptions to streaming services & other internet services	0.042
78900	Internet telecommunications services and online content	0.073
79110	News agency services	0.119
79120	Library and archive services	0.085
81110	Financial intermediation services directly measured	0.033
81111	Financial intermediation services indirectly measured	0.033
81210	Life insurance	0.036
81220	Accident and health insurance services	0.040
81230	Other insurance services	0.040
81240	Superannuation and individual pension services	0.064
81300	Services auxiliary to financial services other than to insurance and pensions	0.041
81400	Services auxiliary to insurance and pensions	0.041
82110	Leasing or rental services concerning transport equipment without operator	0.080
82120	Leasing or rental services concerning other machinery and equipment without operator	0.080
82130	Leasing or rental services concerning personal and household goods; leasing or rental services concerning other goods nec	0.080
82210	Licensing services for the right to use computer software and databases	0.078
82220	Licensing services for the right to use mineral exploration and evaluation	0.107

Code	Commodity	Emission Factor PP
82230	Licensing services for the right to use other intellectual property products (including patents)	0.047
82310	Capitalised Oil and Gas Exploration Expenditure	0.174
82320	Capitalised Other Exploration Expenditure	0.246
83110	Real estate services involving own or leased residential property	0.059
83120	Real estate services involving own or leased non-residential property	0.059
83130	Real estate services on a fee or contract basis	0.063
83200	Owner occupied dwellings, imputed rent (NA component)	0.032
91100	Research and development services	0.056
91200	Architectural services, urban and land planning and landscape architectural services; engineering services	0.064
91300	Scientific and other technical services	0.080
91400	Legal services	0.027
91500	Accounting, auditing, bookkeeping, insolvency, receivership and taxation services	0.030
91600	Advertising services and provision of advertising space or time	0.088
91700	Market research and public opinion polling services	0.088
91800	Management consulting and management services	0.067
91900	Veterinary services	0.056
92100	Photographic services and photography processing services	0.073
92200	Other professional, technical and business services nec	0.073
92310	Information technology design and development related services	0.061
92320	Information technology infrastructure provisioning and network management services	0.069
92330	Information technology technical consulting and support services	0.069
92400	Travel arrangement, tour operator and related services	0.113
92500	Employment services	0.057
92600	Cleaning services	0.121
92700	Packaging services	0.122

Code	Commodity	Emission Factor PP
92800	Other support services (including call centre, secretarial & gardening services)	0.069
93110	Local government administration services	0.246
93111	Local Government FCE	0.246
93210	Central government administrative services	0.065
93211	Central government FCE	0.082
93300	Government services to the community as a whole; administrative services of compulsory social security schemes	0.082
93400	Investigation and security services	0.069
94100	Pre-primary education services	0.045
94200	Primary education services	0.053
94300	Secondary education services	0.046
94400	Tertiary education services	0.056
94500	Post-secondary non-tertiary education services	0.069
94600	Other education and training services and educational support services	0.069
95110	Inpatient services	0.078
95120	Medical and dental services	0.068
95130	Other human health services	0.068
95210	Residential care services for the elderly and disabled	0.064
95220	Child care services	0.069
95230	Other social services	0.070
96100	Live entertainment event presentation and promotion services; services of performing and other arts; museum and preservation services	0.052
96210	Sports and recreational sports facility operation services	0.127
96220	Other sports and recreation services; athlete and other related support services	0.127
96310	Casino-based gambling services	0.047
96320	Lottery services	0.047
96330	Racing and sports betting services	0.047

Code	Commodity	Emission Factor PP
96340	Online gambling services; gaming machines outside of casinos; other gambling services	0.047
96350	Imports of online gambling services	0.042
97100	Maintenance and repair services of office and accounting machinery, computers and peripheral equipment	0.107
97200	Maintenance and repair of transport machinery and equipment	0.105
97300	Maintenance and repair services of other fabricated metal products, machinery and equipment	0.110
97400	Repair services of personal and household goods; repair services of other goods nec	0.107
98100	Other miscellaneous services (includes personal care, funeral and other personal services)	0.089
98210	Services furnished by other membership organisations (including religious services)	0.067
98220	Services furnished by business, employers and professional organisations	0.067
98230	Services furnished by trade unions	0.067
98300	Domestic services	0.089

5. Recommendations

The use of an Input-Output Life Cycle Assessment approach to carbon footprinting is still in an early phase in New Zealand. This section provides recommendations to improve publicly available data to better facilitate the growth and development of the IO-LCA field in New Zealand.

5.1. Industry disaggregation

The main domestic data sources for IO-LCA in New Zealand are Stats NZ's Greenhouse Gas Emissions (industry and household), and National Accounts IO tables.

Both datasets use NZSIOC industry categorisation and are based on the source of economic production rather than the type of process used by each industry (Stats NZ, 2020). Aggregation of industries by economic production is at times inconsistent with the level greenhouse gases they might emit.

Take for example the category *AA121 Sheep, beef cattle, and grain farming*. thinkstep-anz's calculated domestic emission factors for each element of this industry are as follows:

AA121-1 Sheep: 3.2 kg CO_2e/$

AA121-2 Beef cattle: 2.9 kg CO_2e/$

AA121-3 Grain farming: 0.3 kg CO_2e/$

If not separated, emission factors for *AA121 Sheep, beef cattle, and grain farming* would present an average emission factor of the three sub-industries. Therefore, emissions from sheep, for example, would be artificially low, while emissions for grain farming would be artificially high.

This report separates sub-industries from their overarching industry when possible. For the above three sub-industries, publicly available data enabled the calculation of their own emissions and gross output.

Other industries, where a differing level of emissions might occur, were not able to be separated. An example is 'Primary metal and metal product manufacturing'. This industry includes both ferrous and non-ferrous metals. The total direct emissions of 'Primary metals' is 2445.7 kt CO_2e in 2021 (Stats NZ, 2023). 90% of New Zealand's domestically made aluminium and 24% of New Zealand's domestically made steel are exported. Aluminium has much lower direct (Scope 1) greenhouse gas emissions than steel per dollar, which means that New Zealand exports most of the less carbon intensive portion of this sector and uses the majority of the high emitting portion.

Further desegregation of IO tables, taking account the differing emissions intensities of industries, would greatly increase the quality of IO-LCA studies.

5.2. Annual release of IO tables

The latest IO tables, which were used in this report, were released for 2020. Although it is expected that the New Zealand's economy has not drastically changed since then, some industries have. Hence, more frequent releases of IO tables would improve the representation of imports and the gross outputs of each industry.

5.3. Import IO table to represent share of imports per country

As mentioned in section 3.6, current import IO tables do not differentiate the share of imports by country of origin for each commodity. Therefore, an average import emission factor is needed to be allocated for each IO commodity in order to calculate total emissions from imported goods and services that are consumed directly by final categories. Import data by country of origin would likely increase the accuracy of calculations of total emissions from imported goods and services.

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Applicability and limitations

Restrictions and intended purpose

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Data queries and licencing

If you have questions on these emission factors or would like to purchase a commercial licence, please contact data@thinkstep-anz.com.

Annex A Industry and commodity emission factors for 2018

This annex contains emission factors for 2018. An earlier version of these emission factors was previously released in January 2022 as part of our original consultation document (v1.0 of this report). The classification from the original report has been maintained for comparability, but the values in the tables have been updated to make them consistent with the approach applied in main body of this report.

A.1. Industry emission factors

Table 6-1: Industry-level emission factors (kg CO_2e/$)

Code	Industry	Emission Factor
AA111	Horticulture and fruit growing	0.572
AA121	Sheep, beef cattle, and grain farming	3.696
AA121-1	Sheep	4.815
AA121-2	Beef cattle	3.351
AA121-3	Grain farming	0.223
AA131	Dairy cattle farming	1.823
AA141	Poultry, deer, and other livestock farming	1.287
AA141-1	Poultry	0.564
AA141-2	Deer	2.634
AA141-3	Swine	0.821
AA141-4	Other livestock farming	0.724
AA211	Forestry and logging	0.377
AA311	Aquaculture	0.584
AA312	Fishing	0.584
AA321	Hunting and trapping	0.408
AA322	Agriculture, forestry and fishing support services	0.408
BB111	Coal mining	0.887
BB112	Oil and gas extraction	0.270
BB113	Metal ore and non-metallic mineral mining and quarrying	0.407
BB114	Exploration and other mining support services	0.230

Code	Industry	Emission Factor
CC111	Meat and meat product manufacturing	1.852
CC121	Seafood processing	0.412
CC131	Dairy product manufacturing	1.552
CC141	Fruit, oil, cereal and other food product manufacturing	0.486
CC151	Beverage and tobacco product manufacturing	0.298
CC211	Textile and leather manufacturing	1.095
CC212	Clothing, knitted products and footwear manufacturing	0.405
CC311	Wood product manufacturing	0.334
CC321	Pulp, paper and converted paper product manufacturing	0.411
CC411	Printing	0.456
CC511	Petroleum and coal product manufacturing	1.151
CC521	Basic chemical and basic polymer manufacturing	1.253
CC522	Fertiliser and pesticide manufacturing	0.432
CC523	Pharmaceutical, cleaning and other chemical manufacturing	0.329
CC531	Polymer product and rubber product manufacturing	0.337
CC611	Non-metallic mineral product manufacturing	0.738
CC711	Primary metal and metal product manufacturing	1.171
CC721	Fabricated metal product manufacturing	0.362
CC811	Transport equipment manufacturing	0.250
CC821	Electronic and electrical equipment manufacturing	0.276
CC822	Machinery manufacturing	0.310
CC911	Furniture manufacturing	0.305
CC912	Other manufacturing	0.716
DD111	Electricity generation and on-selling	0.752
DD112	Electricity transmission and distribution	0.219
DD113	Gas supply	0.236
DD122	Sewerage and drainage services	0.484
DD123	Waste collection, treatment and disposal services	2.960
EE111	Owner-builder construction (national accounts only)	0.282
EE112	Residential building construction	0.282

Code	Industry	Emission Factor
EE113	Non-residential building construction	0.405
EE121	Heavy and civil engineering construction	0.291
EE131	Construction services	0.274
FF111	Basic material wholesaling	0.234
FF112	Machinery and equipment wholesaling	0.128
FF113	Motor vehicle and motor vehicle parts wholesaling	0.136
FF114	Grocery, liquor and tobacco product wholesaling	0.258
FF115	Other goods wholesaling	0.154
FF116	Commission based wholesaling	0.154
GH111	Motor vehicle and parts retailing	0.137
GH112	Fuel retailing	0.303
GH121	Supermarket and grocery stores	0.179
GH122	Specialised food retailing	0.233
GH131	Furniture, electrical and hardware retailing	0.110
GH132	Recreational, clothing, footwear and personal accessory retailing	0.141
GH133	Department stores	0.087
GH134	Pharmaceutical and other store based retailing	0.124
GH135	Non-store and commission based retailing	0.124
GH211	Accommodation	0.262
GH212	Food and beverage services	0.288
II11	Road transport	0.429
II121	Rail transport	0.494
II122	Water transport	0.605
II123	Air and space transport	1.152
II124	Scenic and sightseeing transport	0.605
II125	Other transport	0.605
II131	Postal and courier pick up and delivery services	0.247
II132	Transport support services	0.071
II133	Warehousing and storage services	0.164
JJ111	Publishing (except internet and music publishing)	0.209

Code	Industry	Emission Factor
JJ112	Motion picture and sound recording activities	0.167
JJ113	Broadcasting and internet publishing	0.123
JJ121	Telecommunications services	0.117
JJ122	Internet service providers, web search portals and data processing services	0.117
JJ123	Library and other information services	0.087
KK111	Banking and financing	0.071
KK112	Financial asset investing	0.071
KK121	Life insurance	0.065
KK122	Health and general insurance	0.087
KK131	Auxiliary finance and insurance services	0.082
LL111	Rental and hiring services (except real estate)	0.138
LL112	Non-financial asset leasing	0.138
LL122	Non-residential property operation	0.106
LL123	Real estate services	0.177
LL211	Owner-occupied property operation (national accounts only)	0.085
MN111	Scientific, architectural and engineering services	0.118
MN112	Legal and accounting services	0.061
MN113	Advertising, market research and management services	0.157
MN114	Veterinary and other professional services	0.099
MN115	Computer system design and related services	0.083
MN211	Travel agency and tour arrangement services	0.169
MN212	Employment and other administrative services	0.133
MN213	Building cleaning, pest control and other support services	0.225
OO111	Local government administration	0.405
OO211	Central government administration and justice	0.122
OO212	Defence	0.158
OO213	Public order, safety and regulatory services	0.126
PP111	Preschool education	0.092
PP112	School education	0.093
PP113	Tertiary education	0.105

Code	Industry	Emission Factor
PP114	Adult, community and other education	0.161
QQ111	Hospitals	0.141
QQ112	Medical and other health care services	0.137
QQ113	Residential care services and social assistance	0.116
RS111	Heritage and artistic activities	0.112
RS112	Sport and recreation activities	0.241
RS113	Gambling activities	0.087
RS211	Repair and maintenance	0.162
RS212	Personal care, funeral and other personal services	0.168
RS213	Religious services	0.122
RS214	Civil, professional and other interest groups	0.122

* Disaggregated industries. The greenhouse gas emissions dataset provides data for each disaggregated industry. However, as Stats NZ IO tables were published in 2013, IO data is only provided for the aggregated level of these industries. For example, IO data for *RS213 Religious Services*, and *RS214 Civil, professional and other interest groups* were provided for the aggregated industry called "Religious services; civil, professional, and other interest groups". Emission factors for each disaggregated industry were calculated at aggregated-level industry. Therefore, the emission factors for disaggregated industries are the same as their counterpart.

A.2. Commodity emission factors in basic prices

Table 6-2: Wholesale commodity-level emission factors (kg CO_2e/$)

Code	Commodity	Emission Factor
Z3	Living plants, buds, seeds, spice, and aromatic crops	0.507
Z4	Vegetables	0.572
Z5	Kiwifruit	0.572
Z6	Pome fruit (apples, pears)	0.572
Z7	Other fruit and nuts	0.572
Z8	Forage products, fibres, sugar crops, unmanufactured tobacco	3.696
Z9	Cereals	3.696
Z10	Sheep	3.696
Z11	Cattle	2.161
Z12	Other livestock	1.287
Z13	Deer	1.287

Code	Commodity	Emission Factor
Z14	Pigs	1.287
Z15	Raw milk	1.823
Z16	Wool	3.696
Z17	Other animal products	1.287
Z18	Wood and non-wood forest products	0.377
Z19	Standing timber	0.377
Z20	Fish	0.584
Z21	Crustaceans	0.584
Z22	Support services to agriculture (including animal husbandry)	3.696
Z23	Support services to forestry and logging	0.377
Z24	Fishing services	0.408
Z25	Coal, coke, and tar products	0.887
Z26	Crude petroleum	0.270
Z27	Natural gas	0.270
Z28	Iron ores, non-ferrous metal ores, and concentrates	0.407
Z29	Gypsum, limestone, cement, and building stone	0.407
Z30	Sands, pebbles, gravel, clays, stone, and bitumen	0.407
Z31	Chemical and fertilizer minerals and salt	0.407
Z32	Precious metals and stones	0.407
Z33	Services incidental to mining	0.230
Z34	Meat and offal	1.852
Z34-1	Lamb	2.221
Z34-2	Beef	1.592
Z34-3	Poultry	1.696
Z34-4	Venison	1.796
Z34-5	Pork	1.709
Z35	Bacon, ham, and smallgood products	1.852
Z36	Hides and skins	1.852
Z37	Prepared fish	0.412
Z38	Milk and cream in solid or processed liquid form	1.552

Code	Commodity	Emission Factor
Z39	Other dairy products	1.552
Z40	Prepared vegetables	0.486
Z41	Prepared fruit and nuts	0.486
Z42	Animal and vegetable oils and fats	0.486
Z43	Grain products	0.486
Z44	Starches	1.552
Z45	Animal feed	0.486
Z46	Bakery products	0.486
Z47	Sugar and confectionery products	0.486
Z48	Macaroni and noodles	0.486
Z49	Food products	0.486
Z50	Beer, soft drinks, and fruit juices	0.298
Z51	Spirits and tobacco products	0.298
Z52	Wines	0.298
Z53	Natural and man-made textile fibres	1.095
Z54	Yarn and thread	1.095
Z55	Woven fabrics	1.095
Z56	Other textiles	1.095
Z57	Tanned skins and leather; handbags and articles of leather	1.095
Z58	Carpets	1.095
Z59	Clothing and knitted fabrics	0.405
Z60	Footwear	0.405
Z61	Wood	0.334
Z62	Panels, boards, veneer sheets, and plywood	0.334
Z63	Building joinery	0.334
Z64	Wood containers and other wood products	0.334
Z65	Pulp, paper, and paperboard	0.411
Z66	Books and other printed material	0.411
Z67	Newspapers and journals	0.411
Z68	Petrol	1.151

Code	Commodity	Emission Factor
Z69	Diesel	1.151
Z70	Other petroleum products	1.151
Z71	Basic chemicals; other paper and paperboard products	1.253
Z72	Other chemical products and man-made fibres	0.337
Z73	Fertilisers and pesticides	0.432
Z74	Plastics in primary forms	1.253
Z75	Pharmaceutical products	0.329
Z76	Soap and perfumes	0.329
Z77	Paints	0.337
Z78	Rubber tyres and tubes	0.337
Z79	Rubber	0.337
Z80	Semi-manufactures of plastics	0.337
Z81	Packaging products of plastics	0.337
Z82	Other plastics products	0.337
Z83	Glass and glass products	0.738
Z84	Non-structural ceramic ware and clay products	0.738
Z85	Plaster, lime, and cement	0.738
Z86	Articles of concrete and stone	0.738
Z87	Wastes and scraps	0.940
Z88	Basic iron, steel, and other metals	1.171
Z89	Steel products, semi-finished metal products	1.171
Z90	Structural metal products	0.362
Z91	Prefabricated buildings	0.362
Z92	Metal containers and steam generators	0.362
Z93	Other fabricated metal products	0.362
Z94	Weapons and ammunition; accumulators, primary cells, and batteries	0.362
Z95	Motor vehicles, trailers, and semi-trailers; bodies (coachwork)	0.250
Z96	Ships, pleasure, and sporting boats	0.250
Z97	Other transport equipment and parts	0.250
Z98	Aircraft and spacecraft	0.250

Code	Commodity	Emission Factor
Z99	Domestic appliances	0.276
Z100	Computers, parts, and office machinery	0.276
Z101	Electric motors, generators, and transformers	0.276
Z102	Other electrical equipment and parts thereof	0.276
Z103	Television, cameras, and other electronic goods	0.276
Z104	Medical equipment	0.276
Z105	Photographic and scientific equipment	0.276
Z106	Engines	0.310
Z107	General industrial machinery	0.310
Z108	Agricultural and forestry equipment	0.310
Z109	Other special-purpose machinery	0.310
Z110	Machinery for mining	0.310
Z111	Machinery for food production	0.310
Z112	Furniture	0.305
Z113	Jewellery	0.716
Z114	Sports goods	0.716
Z115	Games and toys	0.716
Z116	Services incidental to manufacturing	0.716
Z117	Electricity	0.752
Z118	Gas	0.236
Z119	Water	0.000
Z120	Sewerage services	0.484
Z121	Waste disposal, recycling, and environmental protection services	2.960
Z122	Residential building construction	0.282
Z123	Non-residential building construction	0.405
Z124	Civil engineering services	0.291
Z125	Pre-erection work	0.274
Z126	Other installation work	0.274
Z127	Electrical installation work	0.274
Z128	Plumbing and other installation services	0.274

Code	Commodity	Emission Factor
Z129	Building completion work	0.274
Z130	Land and land improvements	0.291
Z131	Wholesale trade	0.154
Z132	Accommodation	0.262
Z133	Meal services	0.288
Z134	Takeaways	0.288
Z135	Beverage services	0.288
Z136	Road transport freight services	0.429
Z137	Road passenger transport	0.429
Z138	Railway transport freight services	0.494
Z139	Railway passenger transport	0.494
Z140	Sea transport freight services	0.605
Z141	Passenger transportation by waterborne vessels	0.605
Z142	Air transport freight services	1.152
Z143	Air passenger transport	1.152
Z144	Travel arrangement and sightseeing transportation services	0.605
Z145	Postal and courier services	0.247
Z146	Cargo handling services	0.164
Z147	Supporting services for road and rail transport	0.071
Z148	Supporting services for water transport	0.071
Z149	Supporting services for air transport	0.071
Z150	Freight transport agencies and other supporting transport services	0.071
Z151	Storage and warehousing services	0.164
Z152	Publishing, printing, and reproduction services	0.456
Z153	Packaged software, tapes, audio, and video records	0.209
Z154	Motion picture, radio, TV services	0.167
Z155	Broadcasting, programming, and programme distribution services	0.123
Z156	Telecommunications services	0.117
Z157	Internet telecommunications services and online content	0.117
Z158	News agency, library, and archive services	0.209

Code	Commodity	Emission Factor
Z159	Financial intermediation services	0.071
Z160	Life insurance	0.065
Z161	Other insurance services	0.087
Z162	Superannuation and individual pension services	0.000
Z163	Services auxiliary to financial services	0.082
Z164	Equipment hire services	0.138
Z165	Computer software and services	0.138
Z166	Intellectual property licensing services	0.138
Z167	Capitalised exploration	0.230
Z168	Leased residential property services	0.177
Z169	Leased commercial property services	0.106
Z170	Other real estate services	0.177
Z171	Owner - occupied dwellings	0.085
Z172	Research and development	0.118
Z173	Architectural and engineering services	0.118
Z174	Other business services	0.099
Z175	Legal services	0.061
Z176	Accounting and taxation services	0.061
Z177	Advertising and marketing services	0.157
Z178	Management consultancy	0.157
Z179	Placement and supply of personnel	0.133
Z180	Cleaning	0.225
Z181	Other support services	0.133
Z182	Local government administration services	0.405
Z183	Central government administration services	0.122
Z184	Investigation and security services	0.126
Z185	Preschool education	0.092
Z186	Primary education	0.093
Z187	Secondary education	0.093
Z188	Higher education	0.161

Code	Commodity	Emission Factor
Z189	Other education services	0.161
Z190	Hospital and nursing care	0.141
Z191	Medical, dental, and other health services	0.137
Z192	Accommodation for the aged	0.116
Z193	Child care services	0.116
Z194	Other social services	0.116
Z195	Libraries, museums, and art	0.112
Z196	Sport and recreation services	0.241
Z197	Gambling services	0.087
Z198	Maintenance of domestic and office equipment	0.162
Z199	Maintenance of transport machinery and equipment	0.162
Z200	Maintenance of other equipment	0.162
Z201	Other personal and community services	0.168

A.3. Commodity emission factors in purchaser's prices

Table 6-3: Commodity emission factors in purchaser's prices (kg CO_2e/$)

Code	Commodity	Emission Factor
Z3	Living plants, buds, seeds, spice, and aromatic crops	0.164
Z4	Vegetables	0.333
Z5	Kiwifruit	0.476
Z6	Pome fruit (apples, pears)	0.394
Z7	Other fruit and nuts	0.316
Z8	Forage products, fibres, sugar crops, unmanufactured tobacco	3.423
Z9	Cereals	2.254
Z10	Sheep	3.696
Z11	Cattle	2.150
Z12	Other livestock	1.002
Z13	Deer	1.287
Z14	Pigs	1.121
Z15	Raw milk	1.823
Z16	Wool	3.555
Z17	Other animal products	1.086
Z18	Wood and non-wood forest products	0.374
Z19	Standing timber	0.377
Z20	Fish	0.590
Z21	Crustaceans	0.493
Z22	Support services to agriculture (including animal husbandry)	3.674
Z23	Support services to forestry and logging	0.377
Z24	Fishing services	0.373
Z25	Coal, coke, and tar products	0.861
Z26	Crude petroleum	0.067
Z27	Natural gas	0.269
Z28	Iron ores, non-ferrous metal ores, and concentrates	0.400

Code	Commodity	Emission Factor
Z29	Gypsum, limestone, cement, and building stone	0.384
Z30	Sands, pebbles, gravel, clays, stone, and bitumen	0.369
Z31	Chemical and fertilizer minerals and salt	0.193
Z32	Precious metals and stones	0.354
Z33	Services incidental to mining	0.210
Z34	Meat and offal	1.578
Z34-1	Lamb	1.886
Z34-2	Beef	1.359
Z34-3	Poultry	1.461
Z34-4	Venison	1.530
Z34-5	Pork	1.461
Z35	Bacon, ham, and smallgood products	1.195
Z36	Hides and skins	1.834
Z37	Prepared fish	0.335
Z38	Milk and cream in solid or processed liquid form	1.445
Z39	Other dairy products	1.475
Z40	Prepared vegetables	0.366
Z41	Prepared fruit and nuts	0.336
Z42	Animal and vegetable oils and fats	0.266
Z43	Grain products	0.318
Z44	Starches	1.025
Z45	Animal feed	0.272
Z46	Bakery products	0.400
Z47	Sugar and confectionery products	0.412
Z48	Macaroni and noodles	0.401
Z49	Food products	0.372
Z50	Beer, soft drinks, and fruit juices	0.197
Z51	Spirits and tobacco products	0.089
Z52	Wines	0.228
Z53	Natural and man-made textile fibres	0.939

Code	Commodity	Emission Factor
Z54	Yarn and thread	0.771
Z55	Woven fabrics	0.435
Z56	Other textiles	0.449
Z57	Tanned skins and leather; handbags and articles of leather	0.732
Z58	Carpets	0.654
Z59	Clothing and knitted fabrics	0.302
Z60	Footwear	0.226
Z61	Wood	0.319
Z62	Panels, boards, veneer sheets, and plywood	0.311
Z63	Building joinery	0.294
Z64	Wood containers and other wood products	0.261
Z65	Pulp, paper, and paperboard	0.360
Z66	Books and other printed material	0.267
Z67	Newspapers and journals	0.220
Z68	Petrol	0.372
Z69	Diesel	0.745
Z70	Other petroleum products	0.710
Z71	Basic chemicals; other paper and paperboard products	0.568
Z72	Other chemical products and man-made fibres	0.232
Z73	Fertilisers and pesticides	0.254
Z74	Plastics in primary forms	0.262
Z75	Pharmaceutical products	0.167
Z76	Soap and perfumes	0.215
Z77	Paints	0.194
Z78	Rubber tyres and tubes	0.134
Z79	Rubber	0.149
Z80	Semi-manufactures of plastics	0.165
Z81	Packaging products of plastics	0.242
Z82	Other plastics products	0.211
Z83	Glass and glass products	0.423

Code	Commodity	Emission Factor
Z84	Non-structural ceramic ware and clay products	0.289
Z85	Plaster, lime, and cement	0.618
Z86	Articles of concrete and stone	0.576
Z87	Wastes and scraps	0.572
Z88	Basic iron, steel, and other metals	0.766
Z89	Steel products, semi-finished metal products	0.738
Z90	Structural metal products	0.281
Z91	Prefabricated buildings	0.283
Z92	Metal containers and steam generators	0.223
Z93	Other fabricated metal products	0.174
Z94	Weapons and ammunition; accumulators, primary cells, and batteries	0.408
Z95	Motor vehicles, trailers, and semi-trailers; bodies (coachwork)	0.115
Z96	Ships, pleasure, and sporting boats	0.183
Z97	Other transport equipment and parts	0.128
Z98	Aircraft and spacecraft	0.035
Z99	Domestic appliances	0.110
Z100	Computers, parts, and office machinery	0.117
Z101	Electric motors, generators, and transformers	0.121
Z102	Other electrical equipment and parts thereof	0.150
Z103	Television, cameras, and other electronic goods	0.095
Z104	Medical equipment	0.093
Z105	Photographic and scientific equipment	0.069
Z106	Engines	0.034
Z107	General industrial machinery	0.117
Z108	Agricultural and forestry equipment	0.143
Z109	Other special-purpose machinery	0.164
Z110	Machinery for mining	0.069
Z111	Machinery for food production	0.224
Z112	Furniture	0.161
Z113	Jewellery	0.289

Code	Commodity	Emission Factor
Z114	Sports goods	0.287
Z115	Games and toys	0.293
Z116	Services incidental to manufacturing	0.700
Z117	Electricity	0.719
Z118	Gas	0.236
Z119	Water	0.000
Z120	Sewerage services	0.483
Z121	Waste disposal, recycling, and environmental protection services	2.860
Z122	Residential building construction	0.261
Z123	Non-residential building construction	0.398
Z124	Civil engineering services	0.290
Z125	Pre-erection work	0.265
Z126	Other installation work	0.266
Z127	Electrical installation work	0.264
Z128	Plumbing and other installation services	0.263
Z129	Building completion work	0.274
Z130	Land and land improvements	0.291
Z131	Wholesale trade	0.090
Z132	Accommodation	0.256
Z133	Meal services	0.287
Z134	Takeaways	0.296
Z135	Beverage services	0.285
Z136	Road transport freight services	0.390
Z137	Road passenger transport	0.393
Z138	Railway transport freight services	0.494
Z139	Railway passenger transport	0.498
Z140	Sea transport freight services	0.754
Z141	Passenger transportation by waterborne vessels	0.597
Z142	Air transport freight services	1.525
Z143	Air passenger transport	0.925

Code	Commodity	Emission Factor
Z144	Travel arrangement and sightseeing transportation services	0.577
Z145	Postal and courier services	0.233
Z146	Cargo handling services	0.133
Z147	Supporting services for road and rail transport	0.069
Z148	Supporting services for water transport	0.065
Z149	Supporting services for air transport	0.164
Z150	Freight transport agencies and other supporting transport services	0.073
Z151	Storage and warehousing services	0.157
Z152	Publishing, printing, and reproduction services	0.391
Z153	Packaged software, tapes, audio, and video records	0.166
Z154	Motion picture, radio, TV services	0.162
Z155	Broadcasting, programming, and programme distribution services	0.123
Z156	Telecommunications services	0.116
Z157	Internet telecommunications services and online content	0.110
Z158	News agency, library, and archive services	0.229
Z159	Financial intermediation services	0.088
Z160	Life insurance	0.301
Z161	Other insurance services	0.135
Z162	Superannuation and individual pension services	0.027
Z163	Services auxiliary to financial services	0.077
Z164	Equipment hire services	0.130
Z165	Computer software and services	0.111
Z166	Intellectual property licensing services	0.092
Z167	Capitalised exploration	0.230
Z168	Leased residential property services	0.186
Z169	Leased commercial property services	0.105
Z170	Other real estate services	0.165
Z171	Owner - occupied dwellings	0.085
Z172	Research and development	0.117
Z173	Architectural and engineering services	0.110

Code	Commodity	Emission Factor
Z174	Other business services	0.096
Z175	Legal services	0.059
Z176	Accounting and taxation services	0.058
Z177	Advertising and marketing services	0.148
Z178	Management consultancy	0.129
Z179	Placement and supply of personnel	0.132
Z180	Cleaning	0.223
Z181	Other support services	0.130
Z182	Local government administration services	0.405
Z183	Central government administration services	0.122
Z184	Investigation and security services	0.125
Z185	Preschool education	0.091
Z186	Primary education	0.092
Z187	Secondary education	0.095
Z188	Higher education	0.159
Z189	Other education services	0.158
Z190	Hospital and nursing care	0.140
Z191	Medical, dental, and other health services	0.124
Z192	Accommodation for the aged	0.103
Z193	Child care services	0.110
Z194	Other social services	0.110
Z195	Libraries, museums, and art	0.159
Z196	Sport and recreation services	0.234
Z197	Gambling services	0.100
Z198	Maintenance of domestic and office equipment	0.155
Z199	Maintenance of transport machinery and equipment	0.156
Z200	Maintenance of other equipment	0.156
Z201	Other personal and community services	0.160

thinkstep anz

About thinkstep-anz

We're an independent and award winning sustainability firm with offices in Australia and Aotearoa New Zealand - and a global reach.

Our team works with you to put sustainability at the heart of your business, to set you up to succeed and inspire you to keep achieving more.

We focus on what matters and use data to understand organisations and their impact. We provide practical resources and ideas that move you ahead.

We create value for organisations like yours, bringing our technical expertise and business know-how to help you tell your story. It's what we've done for the last 16 years.

Our services cover:

Product

- Life Cycle Assessment (LCA)
- Environmental Product Declarations (EPD)
- Circular Economy (CE)
- Cradle to Cradle (C2C)
- Material Circularity
- Water footprint
- Packaging

Carbon

- Carbon Footprint
- Scope 3 emissions
- Reduction strategy
- Carbon targets
- Science-based targets (SBT)
- Emission factors

Strategy

- Materiality assessment
- Green building
- Sustainable Development Goals (SDGs)
- Regenerative futures
- 3 Horizons
- Roadmaps
- Responsible procurement
- Benchmarking
- Workshops
- Business circularity

Reporting

- Climate risk (TCFD | XRB)
- Global Reporting Initiative (GRI) & Integrated reporting (<IR>)
- B Corp
- CDP

Communications

- Sustainability reports
- Case studies
- Board presentations
- Training
- Copywriting
- Infographics
- Media support

Software

- LCA for experts (GaBi)
- LCA calculator
- Material Circularity Indicator (MCI)
- Corporate sustainability (SoFi)
- MCI tool
- Excel carbon calculator

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