

Climate Action

Carbon Calculation Workshop for Households



wao

Learning Objectives

At the end of this workshop you will:

- Understand how greenhouse gas emissions are calculated
- Understand more about which activities you do produce greenhouse gas emissions
- Know what data you need to collect to estimate your household emissions and how to use a free calculator to do that

Dr Carly Green

- Bachelor Environmental Engineering;
Monash University Melbourne
- PhD – School of Biological Science;
University College Dublin
 - Greenhouse Gas Accounting the Agriculture
and Forestry Sector

Affiliations and Clients

- Founding Director of Environmental Accounting Services
- IPCC Lead Author on the 2019 Refinement to the Good Practice Guidelines for National Greenhouse Gas Inventories
- Methods and Guidance Component Manager for the Global Forest Observations Initiative
- Measurement Reporting and Verification Specialist for the World Banks Forest Carbon Partnership Facility (currently supporting 3 countries)
- UNFCCC; FAO; Govts of Australia, Ghana, Vanuatu, Fiji; Private Clients across 20 countries.....
- Board of Trustees for Wao Wanaka

Around the Room Introductions

- Who are you?
- What are you most interested to understand?
- Have you calculated your emissions before?



TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS

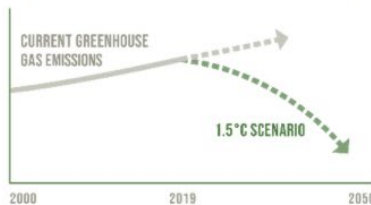
THE CLIMATE CRISIS CONTINUES, LARGELY UNABATED



2020 GLOBAL AVERAGE TEMPERATURE AT 1.2°C ABOVE PRE-INDUSTRIAL BASELINE

WOEFULLY OFF TRACK TO STAY AT OR BELOW 1.5°C AS CALLED FOR IN THE PARIS AGREEMENT

RISING GREENHOUSE GAS EMISSIONS REQUIRE SHIFTING ECONOMIES TOWARDS CARBON NEUTRALITY



CLIMATE FINANCE INCREASED

BY 10%
FROM 2015-2016
TO 2017-2018,
REACHING AN
ANNUAL AVERAGE OF
\$48.7 BILLION

125 OF 154 DEVELOPING COUNTRIES ARE FORMULATING AND IMPLEMENTING NATIONAL CLIMATE ADAPTATION PLANS

HIGHEST PRIORITY AREAS INCLUDE



FOOD SECURITY AND PRODUCTION



TERRESTRIAL AND WETLAND ECOSYSTEMS



FRESHWATER RESOURCES



HUMAN HEALTH



KEY ECONOMIC SECTORS AND SERVICES

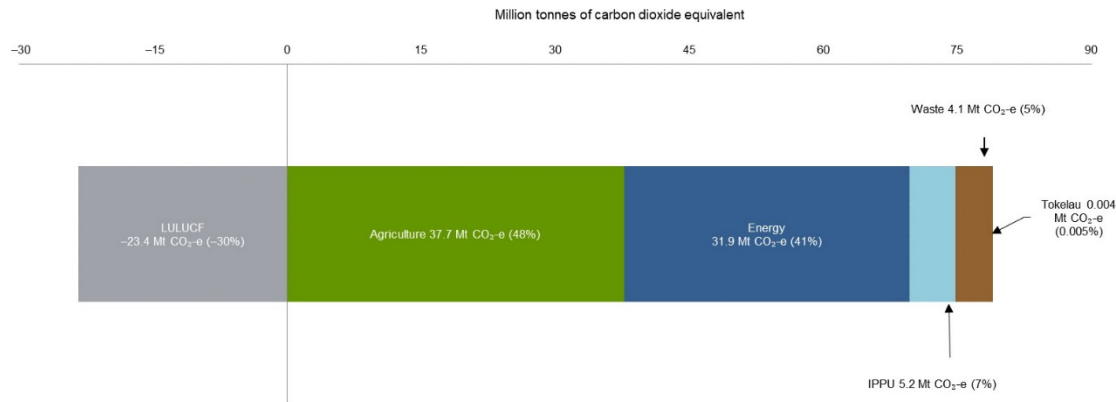
UN Sustainability Goal #13

<https://sdgs.un.org/goals/goal13>

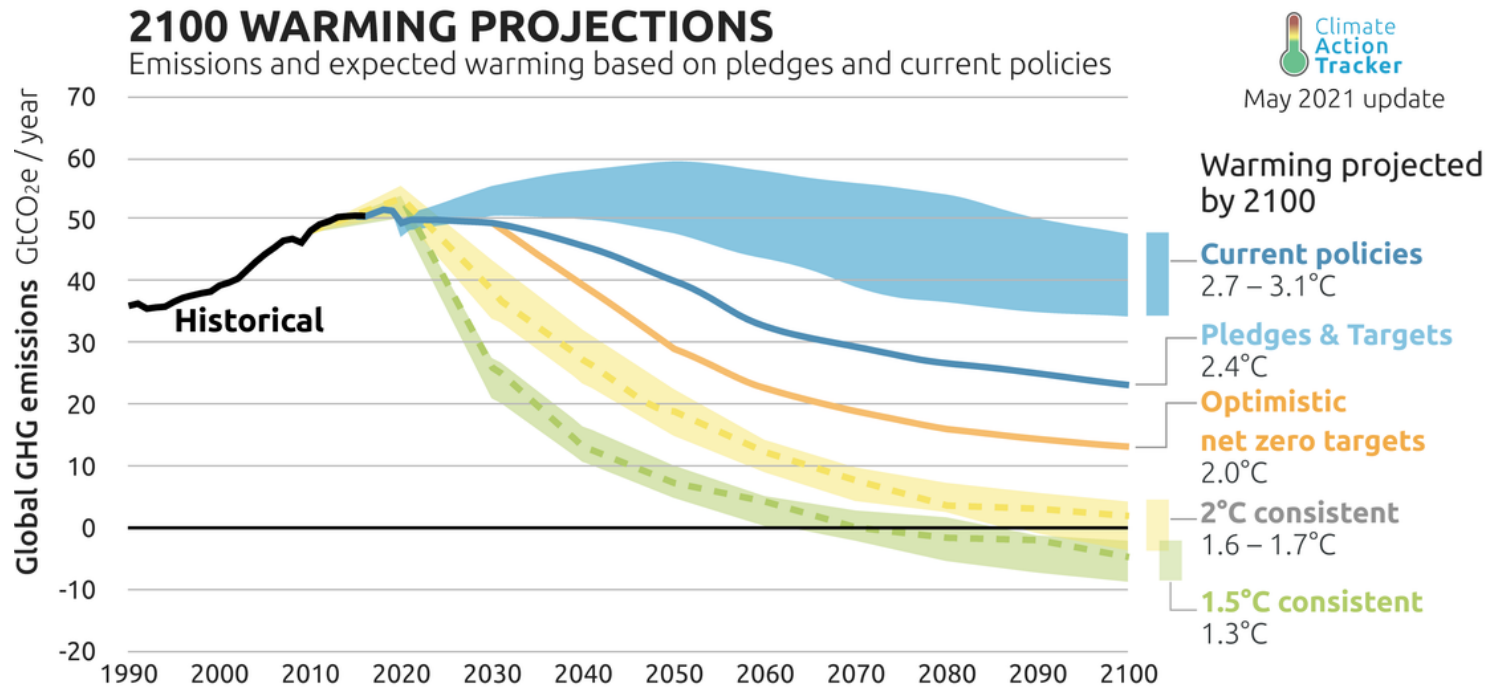
Take urgent action to combat climate change and its impacts*

New Zealand Emission Profile in 2018

- Most emissions come from Agriculture (48%) and Energy (41%)
- The Land Use, Land-Use Change and Forestry (LULUCF) sector offset nearly one third of New Zealand's gross emissions in 2018



Warming Projections



National Context

- **New Zealand commits to reduce greenhouse gas emissions to 30% below 2005 levels by 2030. – NDC to UN**
- New Zealand passed its **Zero Carbon amendment** to the Climate Change Response Act in 2019, which sets a target for all greenhouse gases except for biogenic methane – methane from agriculture and waste – to **reach net zero by 2050**

Greenhouse Gases are Reported as Carbon Dioxide Equivalents

- Emissions are reported most commonly as carbon dioxide, methane and nitrous oxide. Although there are other greenhouse gases such as refrigerants HFC's etc
- When we report greenhouse gas emissions, in order to give a clear and relatable figure, carbon dioxide is used as a reference figure and the other gases are converted into **carbon dioxide equivalent** values.
- A greenhouse gas inventory or footprint is measured and reported as a total in tonnes of Carbon Dioxide Equivalents tCO₂e

Global Warming Potential

Gas	Chemical Formula	Lifetime (years)	Global Warming Potential (100 years)
Carbon dioxide	CO ₂	100	1 (reference value for other gases)
Methane	CH ₄	12	21
Nitrous Oxide	N ₂ O	120	310

Source: <https://unfccc.int/process/transparency-and-reporting/greenhouse-gas-data/greenhouse-gas-data-unfccc/global-warming-potentials>

Greenhouse Gas Emission Calculation

$$\text{Emission (tCO}_2\text{e)} = \text{Activity Data} \times \text{Emissions Factor}$$

Activity Data

- Litres of fuel burnt
- kg of waste sent to land fill
- kWh of electricity purchased

Emission Factors

- Based on historical scientific data
- Published by the Ministry for Environment and updated regularly (every two years).

Emission source	Unit	kg CO ₂ -e/unit	kg CO ₂ /unit	kg CH ₄ (kg CO ₂ -e)/unit	kg N ₂ O (kg CO ₂ -e)/unit
Regular Petrol	Litre	2.453	2.346	0.0276	0.0797

These numbers are the emission factors for data in litres.

Example Calculation

Emission						
Emission source	Unit	Activity Data	kg CO ₂ -e /unit	kg CO ₂ /unit	kg CH ₄ (kg CO ₂ -e)/unit	kg N ₂ O (kg CO ₂ -e)/unit
Regular Petrol	Litre	50	122.65	117.3	1.38	3.985



Sum of other three

Your emissions are likely very large

On a per capita basis, New Zealand has an embarrassingly large carbon footprint, emitting more than **16 tonnes of greenhouse gases per person each year.**

Top 20 in the world - and within the top five in the OECD.

Inspiring Quotes for Encouragement

you're never too small to make a difference

– Greta Thunburg

*How are you going to change the World, if
you don't change yourself*

- Stan Walker

Where to Start?

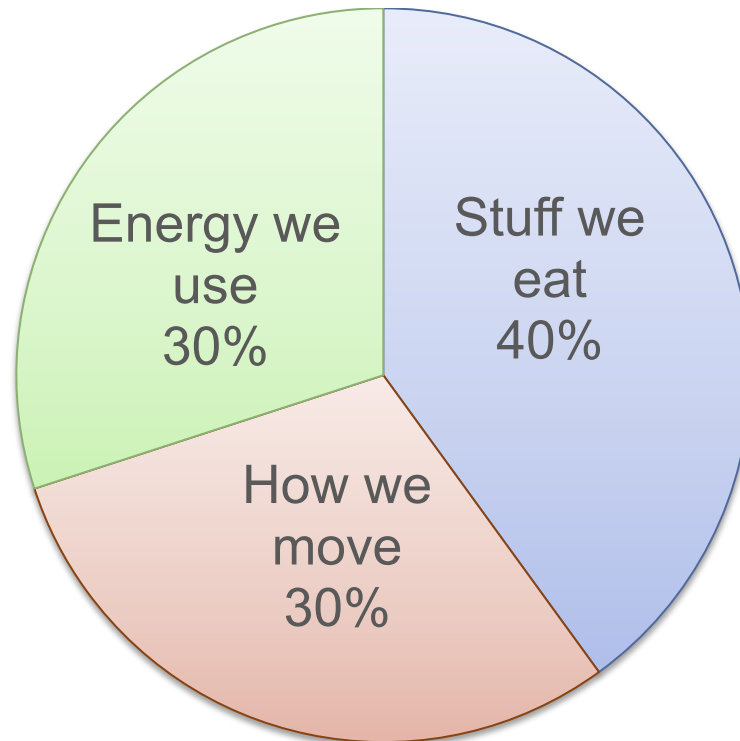
Look no further than **how you move and where you shop.**

Household contribute 71 per cent of New Zealand emissions - because of the goods and services we consume.

That includes **trips in the family cars, food and beverages, and the way we use power and water.**



Proportion of Emissions



What changes have you made?

on average **households HAVE NOT** made a **large systematic shift** in their **climate-change related consumption behaviour.**

The majority of the **change in emissions due to reductions in the emissions intensity of products.**

But its all about US

If every Kiwi

didn't drive one day a week,

switched off their appliances at the wall,

and switched to low-energy lightbulbs,

we could save 386,500 tonnes of CO₂-equivalent greenhouse gases per year – or around a 20th of our total emissions.

What we do matters

Take shorter showers, or outside the peak hours of 4pm and 8pm when there's most demand on the grid for fossil fuelled electricity generation.

Change to an efficient shower head - A person who showers once a day can save the equivalent of a 20kg bag of coal in a year with an efficient shower head

We can **wash our clothes in cold water**

Be a thoughtful consumer

Make goods last like clothes and home appliances

buy second-hand, and repair rather than replace.

Be a thoughtful consumer

Buy food that's sourced as locally as possible – or from New Zealand, rather than overseas fruit.

Avoid products with too much **packaging**

Compost kitchen scraps and garden waste.

Go a step further and **grow what you eat.**

Your Actions Count

Think - Do I need this.

Investigate - What has the lowest impact.

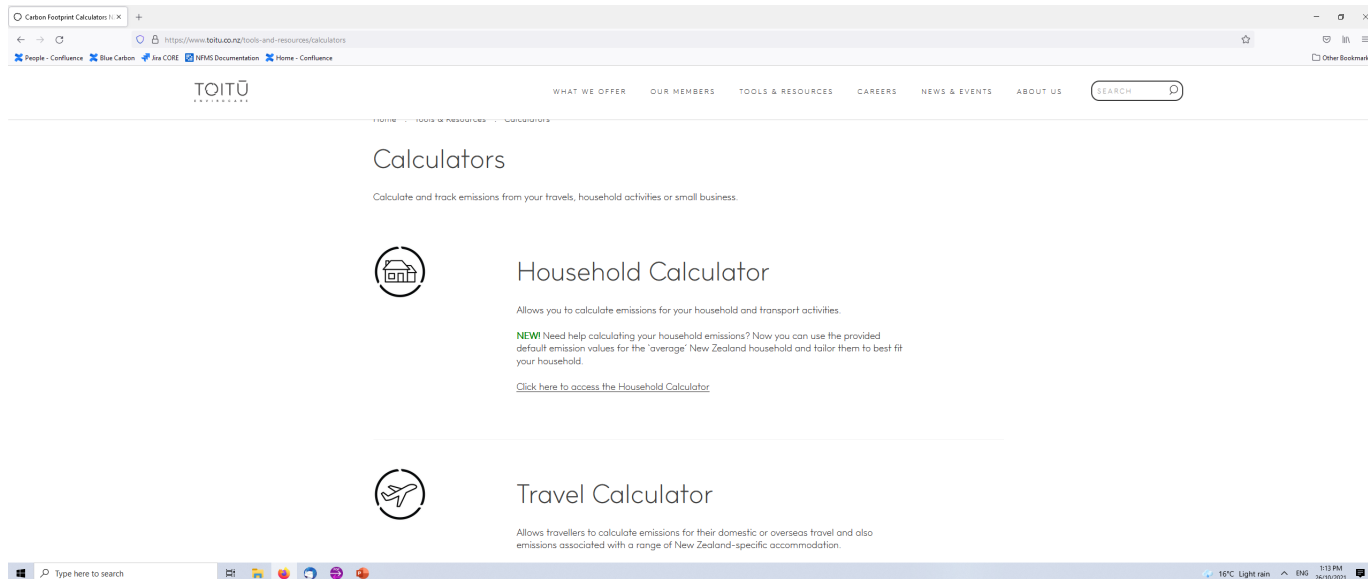
Influence - Tell/show your family and friends.

Calculating your Greenhouse Gas Emissions

Toitu have two online calculators that are useful for individuals to calculate their emissions.

1. Calculator for Households
2. Calculation for Travel Emissions

<https://www.toitu.co.nz/tools-and-resources/calculators>



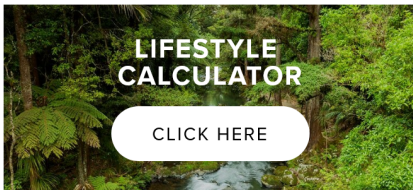
The screenshot shows a web browser window displaying the Toitu website's 'Calculators' page. The page title is 'Calculators' and the subtitle is 'Calculate and track emissions from your travels, household activities or small business.' There are two calculator options listed:

- Household Calculator**: Accompanied by a house icon. It allows users to calculate emissions for household and transport activities. A 'NEW!' notice states: 'Need help calculating your household emissions? Now you can use the provided default emission values for the 'average' New Zealand household and tailor them to best fit your household.' A link below reads 'Click here to access the Household Calculator'.
- Travel Calculator**: Accompanied by a hand holding a suitcase icon. It allows travellers to calculate emissions for their domestic or overseas travel and also emissions associated with a range of New Zealand-specific accommodation.

The browser's address bar shows the URL 'https://www.toitu.co.nz/tools-and-resources/calculators'. The Windows taskbar at the bottom shows the system tray with a temperature of 16°C, light rain, and the time 1:13 PM on 26/10/2021.

Ekos Calculator

<https://ekos.co.nz/calculator-home-page>



- Suitable for individuals and households wanting to understand the carbon impact of their lifestyle in order to support the global transition towards a net-zero future.
 - Upon completion of the calculator, customers will have the option to contribute towards the establishment and protection of permanent indigenous forests in Aotearoa and the Pacific Islands (embed link) through offsetting their estimated carbon footprint.
 - Will receive an Ekos **Carbon Friendly** certificate.
-

What does it cover

- How we move
- Energy we use

- Does not consider what we eat (or what we buy)

Case Study 1: Apollo Place Shared House

Four person household:
Electricity - 546.67kWh
Gas LPG - 67.5 (1 and half
45kg cylinder)
Rubbish - 39.2kg

Nights away from home - 8:
- 1 camping
- 1 back packers
- 1 doc hut
- 4 hotel

Vehicles:
Flat mate one - 1,280km -
Staff bus to Cardrona
Flat mate two - 654km -
Small Van
Flat mate three - 1,698km -
Small Car
Flat mate four - 0



TOITŪ ENVIROCARE

888771 kg CO₂e

Household Emissions Calculator

Year: 2021
Period: September
Adults: four or more
Kids: one

Home energy

166 kWh (Average)

Help and reduction tips

Electricity: 546.67 kWh (55 kg CO₂e)

Reticulated gas: kWh

Liquid fuels: kg

Solid fuels: kg

LPG: 1.5 Household bottles (45kg) (111 kg CO₂e)

Travel

592 kg CO₂e (Average)

Help and reduction tips

Private vehicle

Medium (1600cc - 2000cc) car: 129 kg CO₂e (654 km)

Small (1350cc - 1600cc) car: 298 kg CO₂e (1698 km)

Air travel: kg CO₂e

Public transport: 110 kg CO₂e (City bus: 1280 kms)

Accommodation: kg CO₂e

Tramping hut: 1 kg CO₂e (1 visitor nights)

Backpackers: 2 kg CO₂e (1 visitor nights)

Hotel, lodge or motor inn: 51 kg CO₂e (4 visitor nights)

Household waste

12 kg CO₂e (Average)

Help and reduction tips

Recycling: kg CO₂e (I recycle used paper: sometimes)

I compost my food and garden waste: kg CO₂e (sometimes)

Rubbish: 39.2 kilograms (12 kg CO₂e)

Case Study 2: Aubrey Road Shared House

- 108 Aubrey Road
- 5 People in Shared House
- Winter – Firewood used for majority of heating, not included in footprint
- Majority Vegetarian Diet – Food embodied carbon not included in footprint

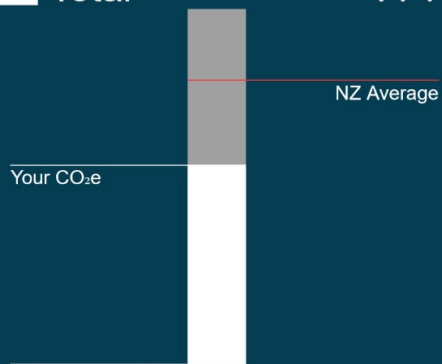
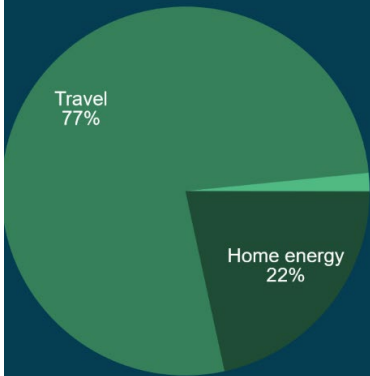
Case Study Comparison

September 2021 Emissions – Apollo Place House

Your CO₂e emissions (kg)

Home energy	166
Travel	592
Household waste	12

Total 771

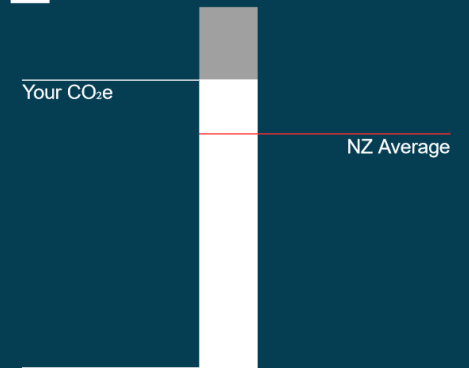
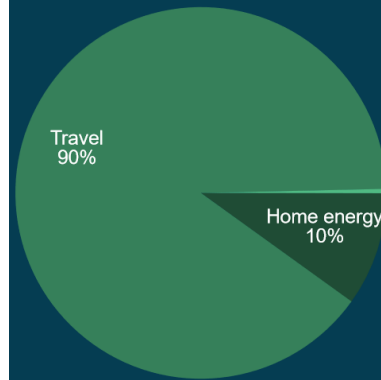


September 2021 Emissions – Aubrey Road House

Your CO₂e emissions (kg)

Home energy	132
Travel	1192
Household waste	5

Total 1328



Toitu Calculator- Feedback

- Easy to use and select between a multitude of different emissions activities – travel particularly is good
- Doesn't factor firewood – significant for warming home in winter in Wanaka
- Doesn't factor diet of household members – embodied carbon in food
- We liked the pie chart showing the % of each emission!

What we Eat

University of Otago Study

Aim: To estimate the greenhouse gas emissions of a variety of foods in the meat and meat alternatives food group produced in New Zealand using Life Cycle Assessment.

<https://ourarchive.otago.ac.nz/handle/10523/4725>

What we Eat

The carbon emissions from each food per kg of raw food were as follows;

- lamb 11.2 kgCO₂e/kg
- beef 10.4 kgCO₂e/kg
- salmon 8.9 kgCO₂e/kg
- pork 6.2 kgCO₂e/kg
- chicken 2.4 kgCO₂e/kg
- eggs (free range) 2.1 kgCO₂e/kg
- eggs (intensive) 1.9 kgCO₂e/kg
- tofu 1.2 kgCO₂e/kg

Emissions of various diets in New Zealand

University of Auckland Study

Aim: To compare the costs and climate impact (greenhouse gas emissions) associated with current and healthy diets and two healthy and environmentally friendly dietary patterns: flexitarian and vegan.

[https://nutrition.bmj.com/content/early/2021/06/09/
bmjnph-2021-000262](https://nutrition.bmj.com/content/early/2021/06/09/bmjnph-2021-000262)

Family of 4 per fortnight

- *Current diet*
 - lowest mean cost NZ\$584
 - highest mean climate impact of 597 kgCO₂e
- **Healthy diet**
 - NZ\$637
 - 452 kgCO₂e
- **Flexitarian diet**
 - NZ\$728
 - 263 kgCO₂e
- **Vegan diet**
 - highest mean cost NZ\$789
 - lowest mean climate impact 203 kgCO₂e

Waste

- Most households have three bins:
 - General Waste – Landfill
 - Glass – Recycling
 - Plastics, Cans, Cardboard - Mixed Recycling
- Other things like e-waste, clothes, scrap metal, tyres, batteries etc – Specialist Treatment at Transfer Stations

QLDC Recycling



Where does recycling go?


Where does our mixed recycling go?



Recycling from the yellow bins goes to our Materials Recovery Facility in Frankton.

Here it is both manually and mechanically sorted into different recycling streams.

In Queenstown Lakes, we send plastics marked  and  to Comspec in Christchurch where items are recycled into industrial plastics like drainage pipe.

We send plastics marked  to Flight Plastics in Wellington, where it is made into food grade packaging.

Cardboard is sent to Indonesia (80%) and South East Asia (20%) and made into new cardboard packaging.

Paper is sent to India and made into paper related products.

Steel and aluminium products are sent to China and Japan and made back into items, including cans. Aluminium can be infinitely recycled.

QLDC Recycling (2)

What happens to glass recycling?



Once glass is picked up from the kerb it's taken to our glass bunkers in Wānaka and Frankton.

From there it goes to the main glass hub in the South Island, called 5R Solutions in Christchurch. Here the glass is manually inspected before its big trip north to Auckland.

In Auckland, the glass heads to Visy Glass – a plant where the glass is sorted by colour, metal bottle sleeves are removed, and the glass is crushed and ready for melting into new products.