ZERO CARBON PLAN 2030

2023

DUNEDIN CITY COUNCIL | kaunihera a-rohe o Ōtepoti

CONTENTS

PART 1: INTRODUCTION

WHAT MIGHT A ZERO CARBON ŌTEPOTI DUNEDIN LOOK LIKE?

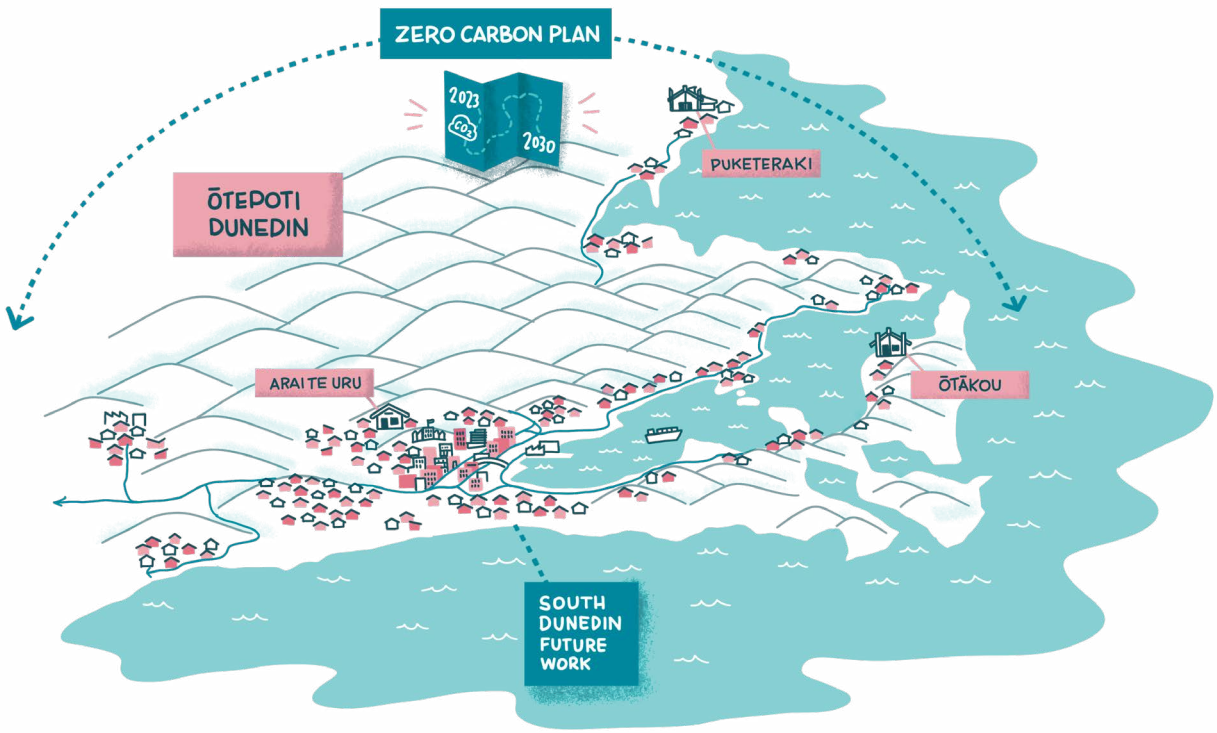
It is the year 2030, and life in a Zero Carbon Ōtepoti feels a bit different to the way it did seven years ago.

A diverse range of low carbon lifestyles are enabled and embraced. More of us are living in warm and healthy homes, which cost less to run. Many of us are getting to school or work in electric buses, and there are some speedy, convenient options for public transport to other parts of the South Island. More kids feel confident walking safely to school, and more residents feel able to commute by bike along a comprehensive network of safer, more pleasant roads and cycleways. Some of us still need or prefer to commute by car – but for an increasing number of people, that commute might be in an electric vehicle, or perhaps sharing with others in the community.

Streets in the city are people-friendly, and neighbourhood centres bustle with residents making the most of local shops and services. People are better connected to each other and to experiences in nature, in part because communities have the support they need to innovate, co-create and share resources in vibrant local spaces.

Businesses are better supported and connected around low-emissions solutions – waste is far less common, and new business models have sprung up as Dunedin's best minds have embraced economic opportunities in the transition to a low carbon economy.

By reducing our emissions here in Dunedin, we're joining cities from all over the world working towards a positive climate future, while also improving the wellbeing of our communities.



WHAT IS THE ZERO CARBON PLAN?

The Zero Carbon Plan maps out the changes Ōtepoti Dunedin needs to become a Zero Carbon city, and the actions the Dunedin City Council (DCC) will take to help bring about those changes. The Zero Carbon Plan builds on work already underway and identifies additional actions that are needed for Ōtepoti Dunedin to achieve its emissions reduction goals.

WHY IS IT IMPORTANT TO BECOME A ZERO CARBON CITY?

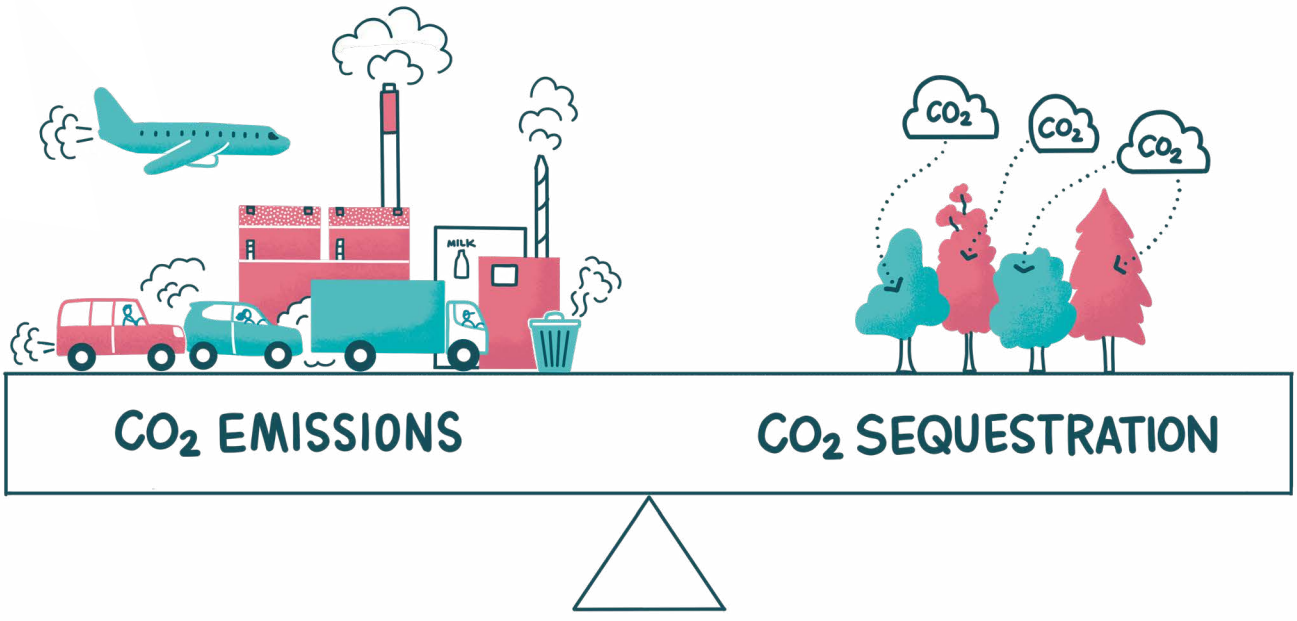
Climate change is one of the biggest challenges facing humanity. It is already affecting communities in many ways.

Ōtepoti Dunedin isn't immune to climate change and its impacts - the city is experiencing more extreme weather, sea levels are rising, ecosystems are under pressure, and communities are being disrupted by new hazards and risks.

Adapting to climate change is important. However, successful adaptation will only be possible if emissions are also reduced to limit the severity of climate change.

As a global community, we have a short window of time to reduce emissions sufficiently to avoid the worst impacts of climate change. If we can limit global warming to 1.5°C above pre-industrial levels, we can avoid the worst impacts of climate change.

Although small on a world scale, Ōtepoti Dunedin has an important part to play to slow down climate change. New Zealanders generate more emissions per person than residents of most other countries. Taking action to reduce emissions will help meet the Paris Agreement (external website) and other global agreements.



THE JOURNEY SO FAR

Ōtepoti Dunedin's Zero Carbon Plan is another step on a journey that is already underway.

2002 Parliament passes the Climate Change Response Act.

2012 **The DCC's first emissions inventory enables the DCC to understand and reduce its emissions.**

2016 Aotearoa New Zealand ratifies the Paris Accord and Ōtepoti Dunedin joins the Global Covenant of Mayors for Climate and Energy.

2017 The DCC's first Carbon Management Policy.

2019 **Ōtepoti Dunedin declares a climate emergency and sets the Zero Carbon 2030 target.**

2019 Parliament:

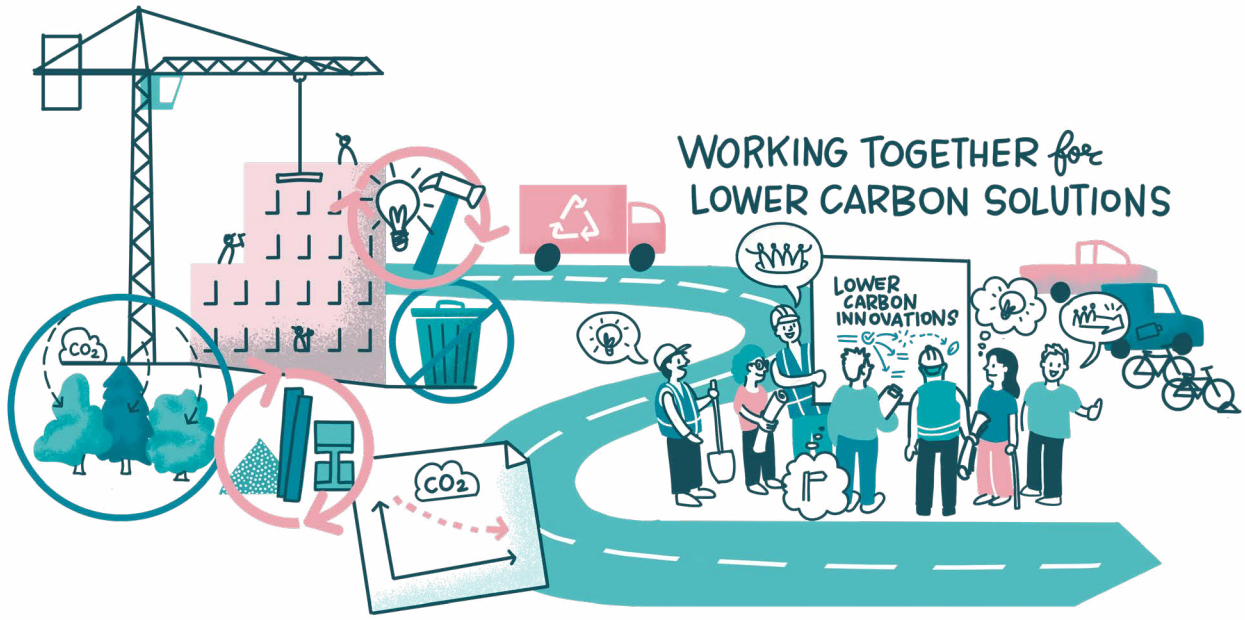
- Sets a target of net zero emissions by 2050
- Introduces a legal requirement for national emissions budget and reduction plans
- Establishes He Pou a Rangi Climate Change Commission.

2022 Parliament adopts Aotearoa New Zealand's first nationwide emissions budgets and emissions reduction plan.

2022 **The DCC adopts the Zero Carbon Policy - a refresh of the Carbon Management Policy.**

2023 **Ōtepoti Dunedin's first emissions reduction plan: the Zero Carbon Plan 2030.**

The DCC's climate emergency declaration committed Ōtepoti Dunedin to becoming a net zero carbon (i.e. carbon neutral) city by 2030. The Council acknowledged that all levels of government need to act, and that a business-as-usual transition to a low carbon economy is inadequate. Reducing emissions must be one of Ōtepoti Dunedin's highest priorities.



People and businesses in Ōtepoti Dunedin are already taking action.

84% of people in Ōtepoti Dunedin self-identify as having taken some form of climate action on a regular or ongoing basis.[1] There are many examples of work already underway in Ōtepoti Dunedin's communities and businesses to reduce demand for transport and energy. These include a shift to low emissions transport options, electrification of energy processes, growth of the renewable energy sector and efforts to minimise waste. The plan builds on the foundations already laid down, not only by the DCC but by everyone who is already taking action here in this city.

Zero Carbon by 2030 is achievable if the city works together with courage and urgency.

The DCC's modelling shows that while there is a long way to go to achieve emissions reduction targets, net zero emissions by 2030 is possible if organisations, businesses and communities in Ōtepoti Dunedin collectively pull all the available levers as hard as possible to achieve the scale of change required.

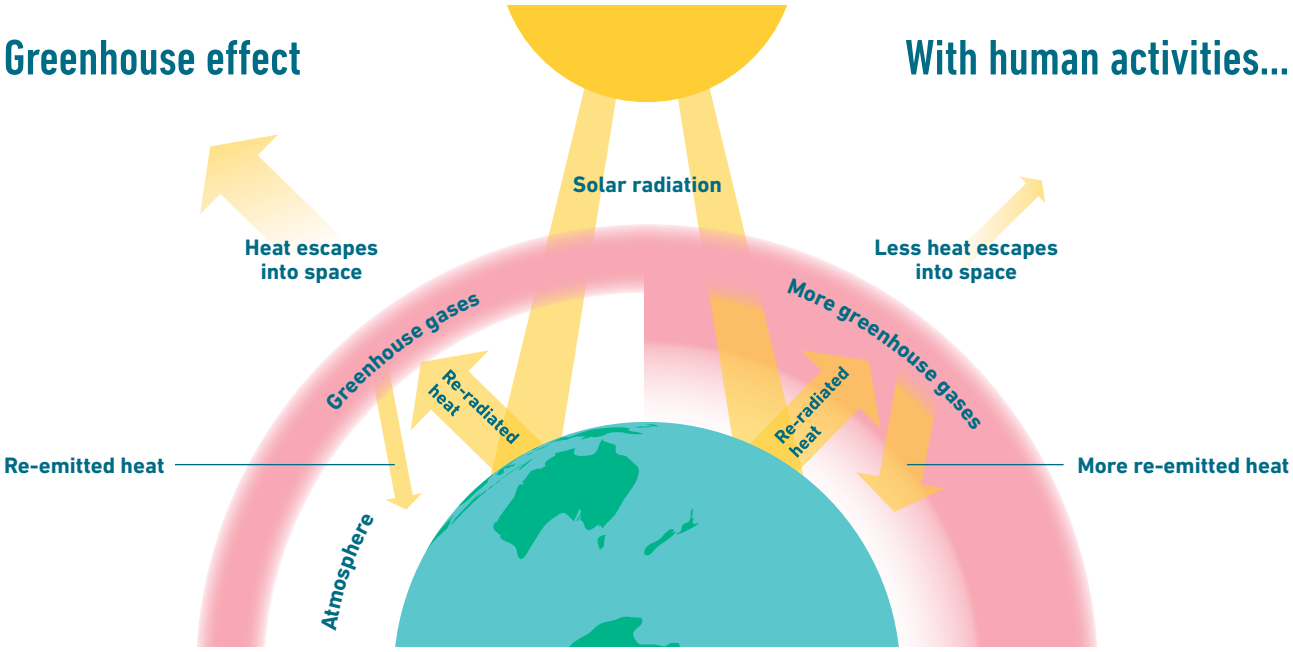
CLIMATE CHANGE AND GREENHOUSE GASES

What is climate change?

The Earth's atmosphere is made up of naturally occurring gases. The right balance of these gases traps just the right amount of heat from the sun, keeping the planet at an optimal temperature for living things. The trapping of heat in the atmosphere is called the greenhouse effect, and that is why some of these naturally occurring gases are called greenhouse gases. As human activities emit more greenhouse gases, it tips the balance of these gases in the atmosphere, resulting in global warming and climate change. Global warming is a long-term heating of Earth's surface, and climate change is a long-term shift in weather patterns.

What are greenhouse gases?

Greenhouse gases are gases that trap heat in the atmosphere. The most well-known type of greenhouse gas is carbon dioxide (CO_2). It is emitted from burning fossil fuels like coal, diesel, and liquefied petroleum gas (LPG). There are many other types of greenhouse gases, and each type has a different global warming potential (GWP). In Aotearoa New Zealand, carbon dioxide and methane are the most emitted gases. International scientific convention is to measure emissions in a standardised way – tCO_2e, tonnes of carbon dioxide equivalent.



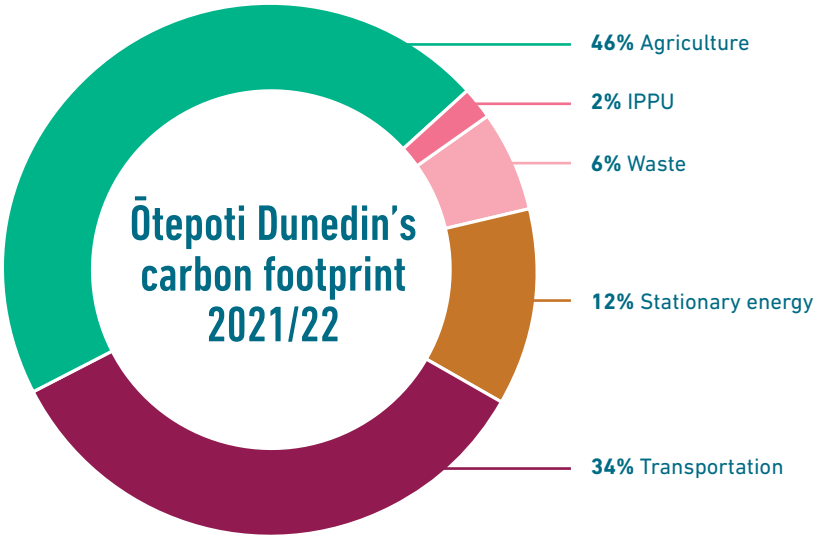
1 NielsenIQ. (2022). Quality of Life Survey 2022: results for Dunedin. A report prepared on behalf of Dunedin City Council. Page 3.

OUR CARBON FOOTPRINT

To explore how much Ōtepoti Dunedin needs to reduce emissions by to become a Zero Carbon city, a 'baseline year' has been used – the year against which progress is measured. For Ōtepoti Dunedin, the baseline year is 2018/19.

In the 2018/19 year, activities in the city generated 1,697,000[2] tCO_2e gross emissions, and forests absorbed 361,300 tCO_2e. The DCC measured the city's emissions again in 2021/22, and gross emissions had reduced by 9% despite the population having increased over the same period.

In 2021/22, about half of Ōtepoti Dunedin's emissions came from agriculture (46%), followed by transport (34%), stationary energy use (12%), waste (6%), and industrial processes and product use (IPPU) (2%).



WHAT ARE OUR ZERO CARBON TARGETS?

The DCC has set two overarching targets for Ōtepoti Dunedin's emissions.

1 Net zero carbon by 2030 (excluding biogenic methane):

Net zero carbon means that any greenhouse gases (excluding biogenic methane) emitted into the atmosphere in Ōtepoti Dunedin are in balance with the amount of carbon absorbed out of the atmosphere by trees, also known as sequestration.

2 Reducing biogenic methane emissions

The city's biogenic methane reduction targets are the same as the central government targets:

- 10% reduction from 2017 levels by 2030.
- 24-47% reduction from 2017 levels by 2050.

To align with best practice for developed countries and with what scientists suggest is necessary to avoid the worst impacts of climate change, the DCC has chosen to focus this Zero Carbon Plan on achieving reductions in gross emissions where possible, rather than large amounts of sequestration.

2 All tCO_2e figures included in this plan are approximate, and have been rounded on the following basis: Figures in excess of 1 million have been rounded to the nearest 1,000; figures between 100,000 and 999,999 have been rounded to the nearest 100; figures between 1,000 and 9,999 have been rounded to the nearest 10.

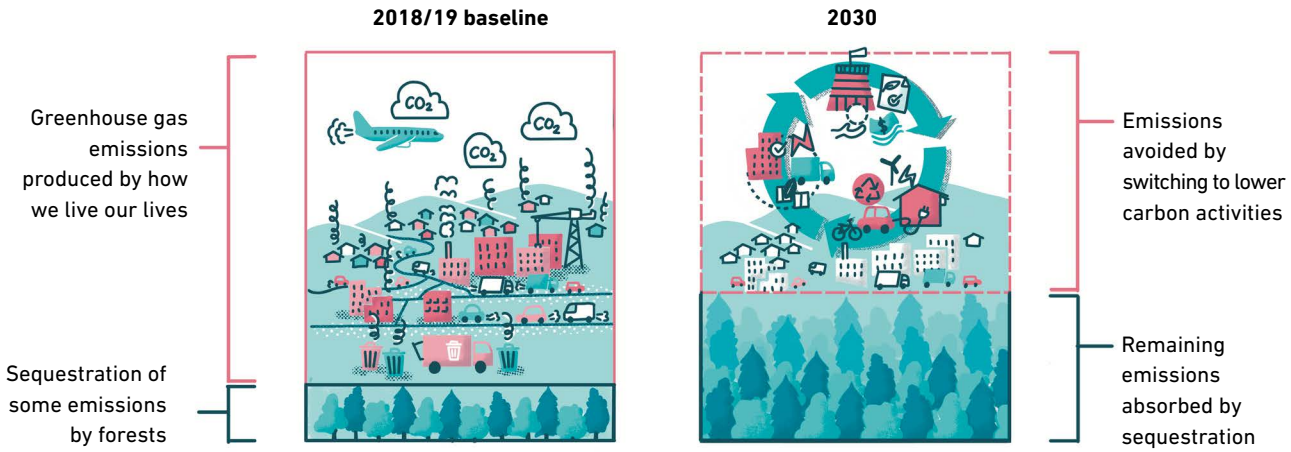
HOW FAR DO WE HAVE TO GO?

Ōtepoti Dunedin's emissions have already reduced since 2018/19. Fewer emissions are being generated, and the city's forests have grown, absorbing more carbon. However, to reach net zero, much more needs to be done, quickly.

Overall, Ōtepoti Dunedin needs to both significantly reduce the amount of emissions produced, and increase sequestration.

Because Ōtepoti Dunedin has two overarching targets – net zero carbon and reducing biogenic methane – how much emissions reduction is needed from each sector depends on the type of greenhouse gas produced from each sector.

How could net zero carbon be achieved by 2030?



Agriculture N_2O

2030: ↓11%

(↓3% between 18/19 and 21/22)

IPPU

2030: ↓15%

(↓1% between 18/19 and 21/22)

Transport

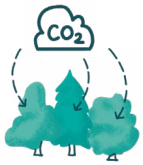
2030: ↓42%

(↓16% between 18/19 and 21/22)

Stationary energy

2030: ↓61%

(↓12% between 18/19 and 21/22)



Sequestration

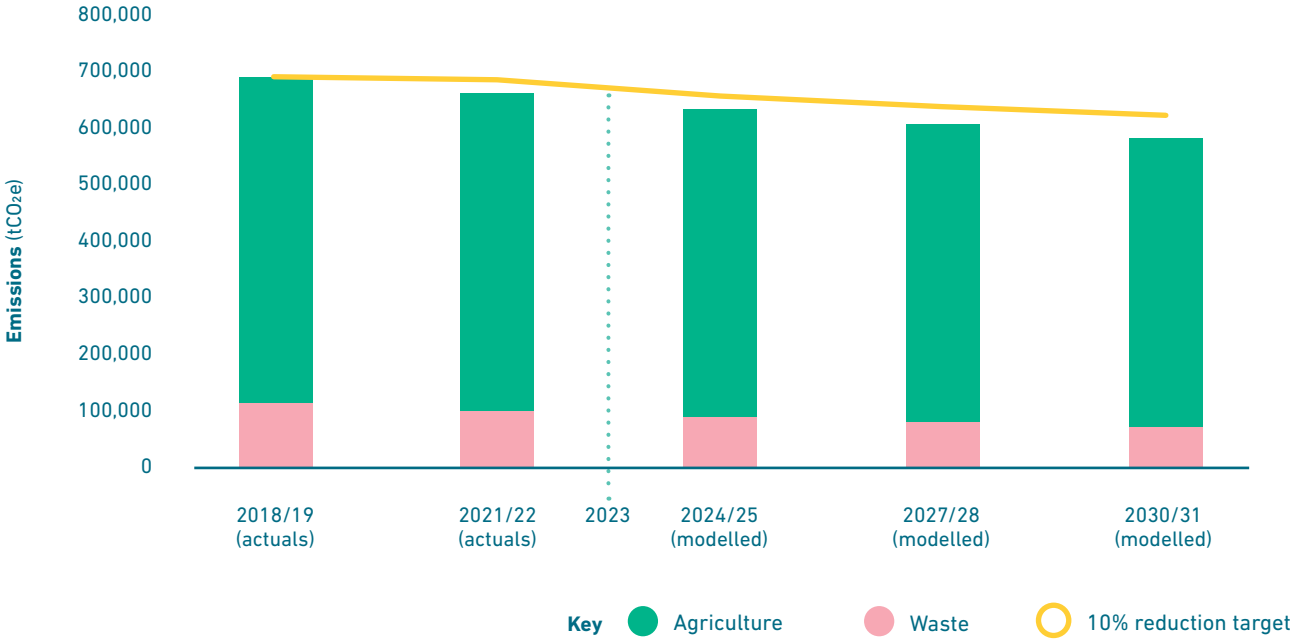
2030: ↑64%

(↑36% between 18/19 and 21/22)

The DCC's modelling shows that net zero can be achieved with an overall 40% reduction in greenhouse gases excluding biogenic methane. This would require significant reductions in emissions from transport, stationary energy, agriculture, and industrial processes, building off reductions achieved over the last three years. Even with these reductions in emissions, the city would still be producing 594,000 tCO_2e of greenhouse gases excluding biogenic methane. To balance out these emissions, sequestration would also need to be increased by 64% above 2018/19 levels.

The gross emissions reduction in the model falls short of a science-based 'fair share' approach that would see Ōtepoti Dunedin reducing its gross emissions by 61% below 2018/19 levels by 2030. As the plan is implemented and updated, the DCC will look for ways to further reduce the city's gross emissions.

How could a 10% reduction in biogenic methane be achieved by 2030?



Agriculture CH_4

2030: ↓11%

(↓3% between 18/19 and 21/22)

Waste

2030: ↓37%

(↓13% between 18/19 and 21/22)

The DCC's modelling suggests it is possible for Ōtepoti Dunedin to exceed its biogenic methane target by 2030, reducing emissions by 15% below 2018/19, to 584,000 tCO_2e. This would involve reductions in emissions from the agriculture and waste sectors.

The DCC has a role to play, but the transition will require actions by residents, businesses and organisations right across the city.

The DCC's role

For Ōtepoti Dunedin to achieve the net zero carbon target, the DCC needs to show leadership and work alongside partners, local communities and other stakeholders.

The DCC has a number of roles it can play to support Ōtepoti Dunedin's transition to a low carbon future. For example, the DCC can provide services (e.g. food scraps collection); build infrastructure (e.g. cycleways); fund community activities (e.g. community gardens); facilitate change alongside partners, stakeholders and communities; and undertake some forms of regulation (e.g. planning rules). The DCC will also lobby and advocate to the central government to enable emissions reduction. Some actions are out of scope of the DCC's legal authority (e.g. many types of regulation and legislation).

This plan identifies the changes that are needed across the whole city, but focuses on what the DCC can do to support the transition beyond continuing work already underway.

Emphasis has been placed on action areas that:

- reduce gross emissions
- address large emissions sources
- leverage the DCC's strongest opportunities to influence change.

PART 2: THE PLAN

HOW TO NAVIGATE THIS PLAN

This part of the plan builds on the modelling undertaken by the DCC and considers how the Zero Carbon targets could be achieved.

While the changes required are all connected, this plan groups them into five chapters:

1. **Resource Use and Waste**
2. **Transport and Urban Form**
3. **Buildings, Energy and Industry**
4. **Forestry, Land and Agriculture**
5. **Communities and Economies**

Key shifts identify the changes needed at a city level.

Within each of those key shifts, **action areas** for the DCC have been identified – things the DCC can do to bring about the changes required.

Each action area has been assessed for **emissions reduction potential** and **wellbeing co-benefits potential**. The outcome of this assessment is highlighted in each chapter under each action area. Details of how the assessment was approached is included in *Appendix 2: How the plan was developed*.

The Zero Carbon Plan is focused on tools and initiatives that have been proven to work in other cities or suggested through community engagement, because achieving the city's targets means taking action now. Future updates of the Zero Carbon Plan will reflect the roles of new tools and technologies as they emerge, offering further emissions reduction opportunities.

The **implementation plan** sets out the actions the DCC will take in 2023/24. The implementation plans for 2024/25 and beyond will be considered by the DCC through development of its 10 Year Plan 2024-34 in early 2024.

THE PLAN IN A NUTSHELL

To become a Zero Carbon city, Ōtepoti Dunedin will...

CHAPTER 1

RESOURCE USE AND WASTE

This chapter is about stuff: the objects, materials, gadgets and resources we use and own – and what we do when we have finished using them.

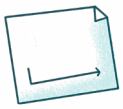
In Ōtepoti Dunedin, waste and wastewater generate 6% of gross emissions. The use of resources involved in creating something before it becomes 'waste' also generates emissions, often beyond Ōtepoti Dunedin's borders – but these emissions are not yet quantified.

CHAPTER OVERVIEW

To achieve 2030 targets, Ōtepoti Dunedin needs to make **resource use more circular** and **reduce emissions from waste by 37%** below 2018/19 levels.

Achieving this will involve significant changes in the way that resources are used and waste is managed:

95% diversion of food, garden, timber



80% diversion of paper

30% diversion of textiles

10% reduction in waste production per capita

Reduction in per capita wastewater emissions

Ōtepoti Dunedin will need to:

- Use resources in a more circular way
- Divert more waste from landfill
- Improve landfill and wastewater management

To support achievement of these key shifts, **the DCC** will:

- Enable communities to reuse and recycle resources
- Support collaboration for circularity
- Enable food and garden organics to be composted
- Enable construction waste to be reduced, reused and recycled
- Divert biosolids & minimise wastewater emissions
- Enhance waste minimisation education and facilities
- Improve data on resource use and waste
- Improve landfill and wastewater gas capture

Moderate emission reduction potential action areas

Minor emission reduction potential action areas

HOW DO RESOURCE USE AND WASTE PRODUCE EMISSIONS?

There are three main ways resource use and waste generate emissions: resource production and use, waste decaying in landfill, and wastewater treatment.

Resource use

It is estimated that about 70% of global emissions come from material supply chains – including production, handling, and use. Globally, only 7.2% of global resources are reused or recycled. Each day 33kg per person of raw materials is extracted, yet most of this (about 30.5kgs) is not reused.

The emissions from extracting and processing resources are not yet measured in the city's carbon footprint but these are significant – Aotearoa New Zealand generates one of the highest amounts of waste per person in the OECD and has poor recycling rates. In addition, the use of resources shows up directly in the city's footprint in other ways, such as freight movements in the transport sector.

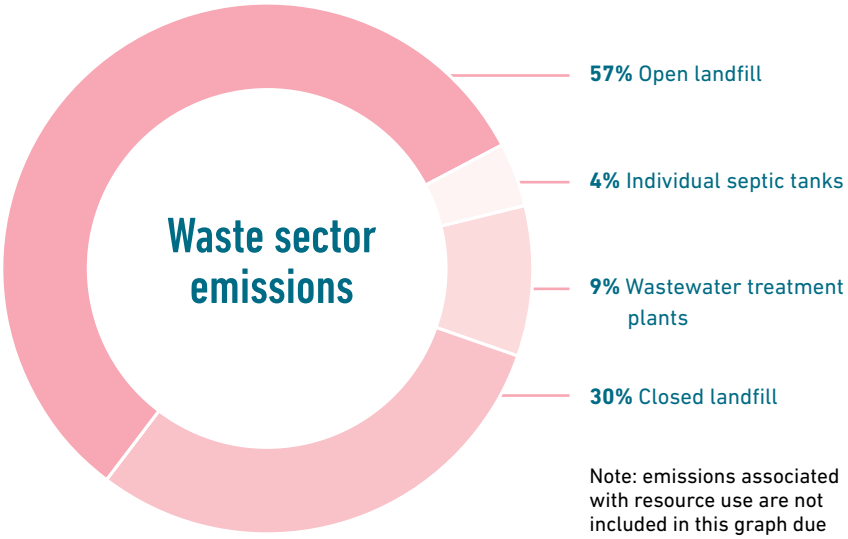
Waste decaying in landfill

Waste decaying in landfill produces 87% of waste sector emissions.

Open landfills produce the most emissions. Closed landfills also continue to generate emissions because waste in landfills takes a long time to decay.

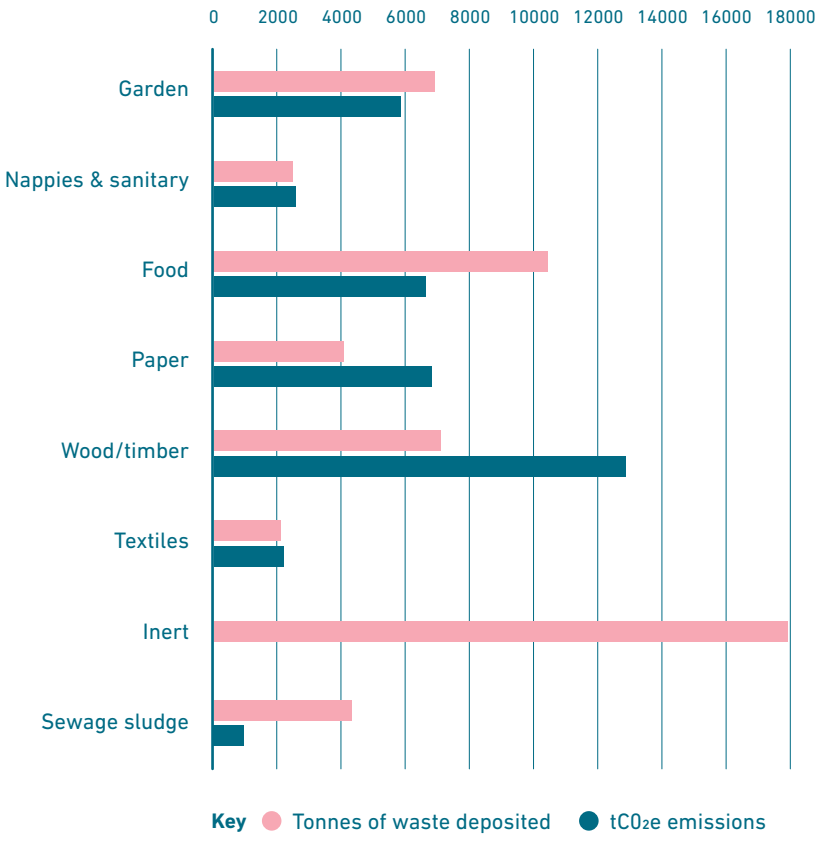
Data suggests almost half (46%) of waste entering Green Island landfill could have been given a second life through reuse or recycling.

Different types of resources decaying in landfill emit different amounts of greenhouse gases. The biggest emitters are wood, paper, food and garden waste.



Note: emissions associated with resource use are not included in this graph due to data limitations

Waste deposited at Green Island Landfill 2021/22



Wastewater treatment

Wastewater treatment generates 13% of waste sector emissions.

Most people (85%) are connected to the wastewater treatment plant network which generates 9% of waste sector emissions. Septic tanks generate 4% of waste sector emissions and produce more emissions per quantity of wastewater than centralised treatment plants.

CHANGES IN EMISSIONS SINCE 2018/19

Emissions from the waste sector **reduced by 13%** between 2018/19 and 2021/22.

- Emissions from landfills **reduced by 15%** due to improvements in gas capture at landfills, and because less gas is released by historic now-closed landfills as more of their contents have decayed.
- This was offset by a **4% increase** in Ōtepoti Dunedin's total wastewater emissions mostly due to an increase in the population.

KEY SHIFTS FOR THE CITY & ACTION AREAS FOR THE DCC

Three **key shifts** are required to reduce emissions produced by resource use and waste production in Ōtepoti Dunedin:

Under each key shift, **action areas** for the DCC are identified. Additionally, the DCC will also lobby and advocate to the central government to enable emissions reduction.

KEY SHIFT

1 Use resources in a more circular way

Rethinking and redesigning will be necessary to reduce resource use and to keep resources in use for longer. Resources then need to be reused, repaired, re-purposed and finally recycled to recover their value. This shift will result in fewer resources entering the waste management system for recycling, processing, or disposal. If a circular economy were in place across key systems globally, virgin material extraction could be reduced by one-third and reduce global emissions enough to limit global temperature rise to 2°C degrees. This shift could also reverse the overshoot of other planetary boundaries.

KEY SHIFT

2 Divert more waste from landfill

Management of residual waste from resources at their end-of-life needs to be improved. This includes increasing the city's ability to divert waste from landfill and recycling greater types and volumes of waste.

ACTION AREA 1 Enable communities to reuse and recycle resources

◯ **Minor** emissions reduction potential ● **Very high** co-benefits potential

The DCC provides kerbside recycling services, recycling hubs, transfer stations in some rural centres, and a resource recovery park at Green Island Landfill. In the city there are also many community-led initiatives that support reuse and repair/upcycling of resources and used goods.

Elsewhere in Aotearoa New Zealand, community-led resource/recycling centres embedded in local towns and neighbourhoods have significantly reduced waste and associated emissions – as well as provide communities with revenue, employment, skill learning opportunities, and spaces in which to connect.

Local engagement and survey data suggest a network of community-led resource/recycling centres in local neighbourhoods would be welcomed by communities and would help people reduce the amount of waste they send to landfill.

The DCC will partner with communities to initially establish three community-led resource/recycling centres and to investigate the feasibility of establishing a wider network. The DCC will also develop a central city location for recyclable materials and sale of diverted items (rummage store). The DCC will also continue to support and run local events such as repair workshops and implement rural recycling collection/services.

At the Waikouaiti Transfer Station, local community group One Coast have two shipping containers filled with donated items – from furniture and clothing to bikes that they have repaired in their Bike Shed. Community members can take home things for free from one container. From the other, people can purchase things at a bargain price. The funds collected currently go towards improving One Coast infrastructure, to enable more goods to be received and stored, and services expanded.

In Tāmaki Makaurau Auckland, a community-led resource/recycling centre network supported by Auckland Council is working well. An expanding network of centres in suburbs across the city enable the reuse, repair, up-cycle, and recycling of waste that would have otherwise gone to landfill. These centres divert around 70% of waste from landfill. Each centre looks a bit different to the next, reflecting each community's unique resources, context, and opportunities.

ACTION AREA 2 Support collaboration for circularity

Moderate emissions reduction potential **High** co-benefits potential

Local engagement suggests leadership is an important enabler for circular resource use, and that collaboration between communities and businesses is also vital.

The DCC will convene a collaborative group(s) of key partners and stakeholders to help move the city towards circularity. This may involve identifying ways to connect those with surplus/needed resources, identifying gaps in local infrastructure and planning how to meet these, and celebrating those implementing circular initiatives.

The DCC is also collaborating with other councils in the region to develop a regional network of waste minimisation infrastructure.

The DCC will also incorporate circular practices and waste minimisation in its business-as-usual operations, as well as ensuring that major contracts minimise waste (see Communities and Economies chapter for more detail).

Recycle a Device (RAD) is an initiative set up by Digital Future Aotearoa alongside two young New Zealanders – one of whom is now a University of Otago student. The initiative matches young people in need of a laptop with a donated device refurbished by rangatahi. This programme not only keeps resources in circulation and provides benefit to those receiving devices, but also useful and employable skills in digital technology to those who are trained in how to repair the donated devices.

The DCC recently awarded RAD a waste minimisation community grant to enable rangatahi in Ōtepoti Dunedin to learn how to refurbish laptops.

ACTION AREA 3 Enable food and garden organics to be composted

Moderate emissions reduction potential **High** co-benefits potential

Food and garden organic waste are high emitters if they go to landfill. In 2021/22 food and garden organic waste emitted approximately 12,500 tCO_2e in Green Island landfill. Food scraps are a focus for central government's emissions reduction efforts: by 2030, councils must provide food scraps collection in urban areas and businesses are likely to be required to separate food scraps in the future.

The DCC's kerbside collection of waste will be expanded to include food and garden organics collection. Collecting this waste separately will enable it to be composted, which emits less than landfilling and also produces a useful resource. Once this service is in place, the DCC will investigate other ways to further reduce food/organic waste entering DCC-managed landfills.

The DCC provides free composting workshops and subsidises bokashi bins for residents. The DCC will also continue to support food waste reduction education and food rescue organisations, as this is the best way to reduce emissions and it provides additional co-benefits.

ACTION AREA 4 Enable construction waste to be reduced, reused and recycled

Moderate emissions reduction potential **High** co-benefits potential

Construction materials are a major source of emissions – due to emissions from new resource production (like concrete and steel) and some types of construction and demolition waste (such as timber) decaying in landfill. A new house build results in about 4.5 tonnes of waste.

The best way to reduce construction and demolition emissions is firstly to maximise use and re-use of existing building stock (e.g. retrofitting), then through design and material choice for new builds. At the demolition stage, undertaking deconstruction rather than demolition enables materials to be given another life in another building, or to be more easily separated for recycling. Designing for deconstruction can ensure this is a more viable option.

The DCC will support design, demolition, and construction industries to reduce waste. The DCC will also work to increase the city's ability to store, process, and reuse construction and demolition waste.

Green Gorilla in Tāmaki Makaurau Auckland has established a construction and demolition waste processing facility that diverts more than 75% of construction and demolition waste from Auckland's landfills.

Also in Tāmaki Makaurau/Auckland, TROW group deconstructs (rather than demolishing) buildings and upcycles more than 90% of all salvaged materials.

Both initiatives have other positive co-benefits, such as:

- hiring local youth
- training young Pasifika and Māori and creating job pathways
- providing materials, fixtures, fittings, and furniture to community organisations in Aotearoa New Zealand and the Pacific
- giving treated wood another use as biofuel, untreated wood for animal bedding and landscaping chips, and gypsum for horticultural and agricultural use.

ACTION AREA 5 Enhance waste minimisation education and facilities

Minor emissions reduction potential **High** co-benefits potential

It is important that residents and businesses understand how to best use resources and what to do with them at their end-of-life. This knowledge enables waste processing facilities and services to be successful.

The DCC will continue to provide and expand waste education, and provide information in a range of different ways to ensure it is accessible. Additional DCC actions include an online information hub, a mobile waste education unit and delivering a business education programme.


KŌHUHŪ
HOROEKA
KOROMIKO
Karaehe
Glass
Brown - Bottles & Jars

ACTION AREA 6 Improve data on resource use and waste

◯ **Minor** emissions reduction potential ○ **Moderate** co-benefits potential

Good data about resource use and waste streams is important because it informs how to best reduce different types of waste. The DCC does not yet have enough information about some areas of resource use and waste.

The DCC will undertake research and data gathering projects to fill these gaps and inform the development of targeted waste reduction initiatives. This includes developing an emissions footprint for Ōtepoti Dunedin's imported resources and assessing in more detail the composition and sources of paper and textiles sent to Green Island landfill.

KEY SHIFT

3 Improve landfill and wastewater management

The management of emissions from waste already decaying in landfills and from wastewater need to be further improved.

ACTION AREA 7 Divert biosolids from landfill and minimise emissions from wastewater treatment

◯ **Minor** emissions reduction potential ◉ **High** co-benefits potential

The processing of wastewater generates 1% of city emissions.

Biosolids and sludge from wastewater treatment plants is currently sent to landfill. The DCC is investigating alternative solutions for the material that will enable it to be diverted from landfill and its nutrient resources to be reused.

As part of longer-term planning, the DCC is also considering ways to minimise emissions from the 3 Waters network and wastewater treatment processes.

ACTION AREA 8 Improve landfill and wastewater gas capture

○ **Moderate** emissions reduction potential ◯ **Minor** co-benefits potential

Most of the gas released by waste decomposing in landfill is methane, a potent greenhouse gas. Wastewater treatment proesses also release methane. Green Island landfill is equipped with a landfill gas capture system to capture and burn methane. Approximately 38% of total landfill gas is currently captured and flared.[3] Flaring methane is important because it converts the gas to carbon dioxide, which is a less potent greenhouse gas than methane. Electricity can also be generated when the gas is burnt in a gas engine.

Work is underway to improve the landfill gas capture system by upgrading the gas engine and gas flare at Green Island to enable more gas to be flared. Design of the new Smooth Hill landfill will maximise landfill gas capture and destruction.

Improvements to gas capture and destruction at wastewater treatment plants will also reduce emissions.

3 Using the methodology spcified in the Climate Change (Unique Emissions Factors) Regulations 2009

WHAT MIGHT 2030 LOOK LIKE FOR RESIDENTS?

Today

"I live in an apartment building so I can't compost my kitchen waste."

"I'd like to grow my own food but I don't know where to start."

"I often have stuff I don't need but don't know what to do with, so I end up throwing them away."

"I feel unmotivated to recycle properly. I once heard lots of things we put in the recycling bin don't actually get recycled anyway."

In 2030

"It's easy to separate my food scraps and the DCC collects them weekly."

"I met my neighbour at the local community garden. She teaches me how to grow veggies."

"I can take things I don't know what to do with to our community resource-sharing centre. "

"I understand how our city manages waste, so I feel motivated to sort my waste properly."

CHAPTER 2

TRANSPORT AND URBAN FORM

This chapter is about making it easy, safe and enjoyable for people to move around Ōtepoti Dunedin in low carbon ways – to access the things they need, the places they want to go and the people they want to see.

Moving people and goods to, from and around the city generates 34% of Ōtepoti Dunedin's gross emissions.

CHAPTER OVERVIEW

To achieve 2030 targets, Ōtepoti Dunedin needs to **reduce emissions from transport by at least 42%** below 2018/19 levels.

This requires significant changes in the way the city is organised and the way people get around:

↓24% light fleet travel per capita

18% all trips by bike

21% all trips on foot

18% all trips public transport

20% road freight by rail

↓5% land freight demand

31% light fleet electrified

14% heavy fleet electrified

↑6.7% fuel efficiency

↓40% emissions from marine

↓50% emissions from aviation

Ōtepoti Dunedin will need to:

Live well locally

- Nurture low emissions urban form
- Target closer visitor markets, encourage local destinations, and inspire longer stays
- Unlock remote solutions

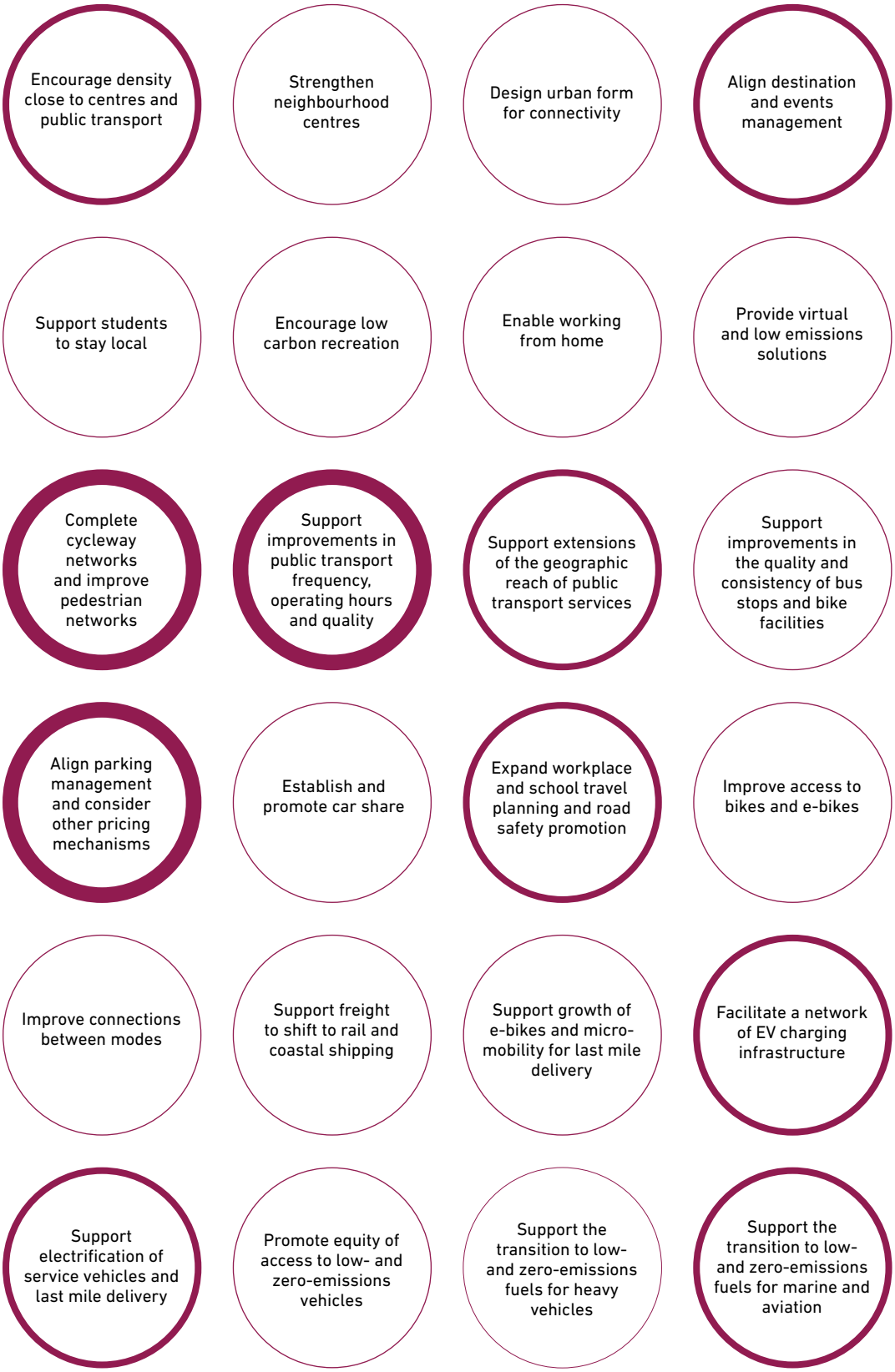
Shift to low carbon transport

- Develop convenient and attractive cycling and walking networks and public transport services
- Boost travel demand management to support use of active and public modes

Improve the fleet

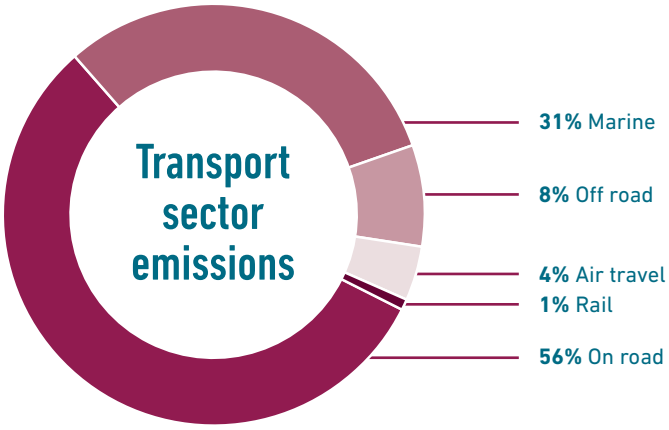
- Shift freight to low emissions modes
- Electrify light vehicles
- Decarbonise heavy vehicles, marine and aviation

To support achievement of these key shifts, **the DCC** will:



HOW DO TRANSPORT AND URBAN FORM PRODUCE EMISSIONS?

There are five key emissions sources within the transport sector: on-road transport, marine, off-road transport, aviation and rail.



56% On-road transport

On-road transport generates 56% of transport sector emissions.

Cars generate almost half of all on-road emissions. Many more trips are taken by car than by commercial vehicles (e.g. light trucks, SUVs), but petrol (used by most cars) is less carbon intensive than diesel (used by most commercial vehicles).[4]

A further third of emissions are generated by trips taken in light commercial vehicles. Trips by heavy vehicles and buses make up the remainder.

31% Marine transport

Marine transport generates 31% of transport sector emissions. Marine emissions are primarily generated by the movement of vessels to/from Port Otago.

Port Otago is export-dominated, with imports mainly being bulk fuels. Most of the freight exported through the port originates from Clutha and Southland. The most significant volume of exports originating from within the city's boundaries is logs. For most vessels, Port Otago is their first or last port of call in Aotearoa New Zealand.

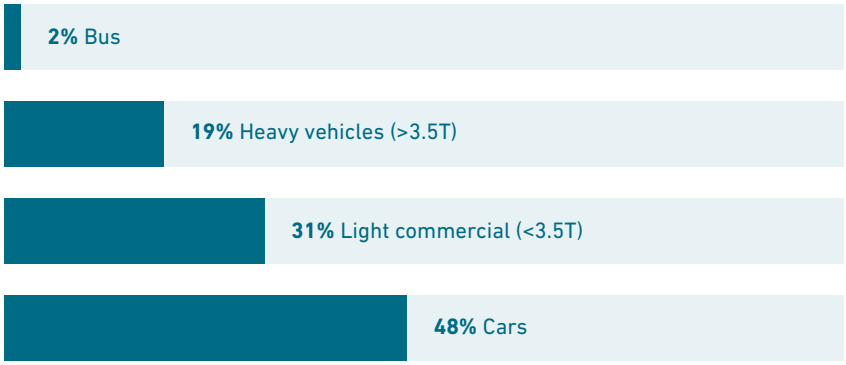
Cruise vessels aren't currently included in Ōtepoti Dunedin's emissions footprint due to data limitations, but the number of cruise vessels calling at Port Chalmers suggests they are a significant source of emissions for the city.

8% Off-road transport

Off-road transport generates 8% of transport sector emissions. It consists of all fuel used for vehicle movement off roads (agricultural tractors and vehicles, forklifts, etc.). It also includes sales of fuels at petrol stations used for smaller marine craft e.g. recreational vessels.

National off-road transport data suggests that diesel is the main fuel used (representing 95% of off-road transport emissions) and that agriculture is the highest emitting sector (producing 27% of all off-road transport emissions). The next highest emitting sectors are building and construction, commercial, and industrial users.

On-road emissions by vehicle type



4% Air transport

Aviation generates 4% of transport sector emissions. The vast majority of emissions are generated by flights arriving and departing Dunedin Airport (currently all domestic). International flights generate significantly more emissions.

1% Rail transport

Rail movements generate 0.8% of transport sector emissions.

4 Vehicle classification is by type, not ownership. **Cars** includes passenger cars and sports utility vehicles (SUVs), including those used for commercial purposes (e.g. taxis, fleet vehicles). **Light commercial vehicles** includes utes and vans that are in private ownership.

CHANGES IN EMISSIONS SINCE 2018/19

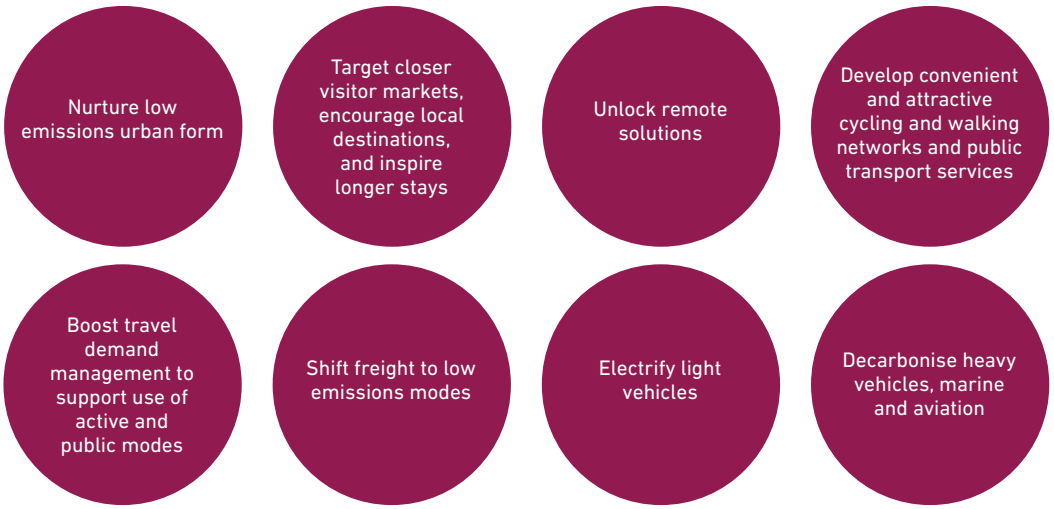
Emissions from the transport sector **reduced 16%** between 2018/19 and 2021/22.

- On-road transport emissions **reduced 14%**, despite a 2% increase in vehicle kilometres travelled in the city over the same period. Emissions from off-road transport **reduced 9%** over the same period. The COVID-19 lockdowns had short but significant impacts on fuel consumption, but longer-term changes in individual and commercial transport and vehicle efficiency also play a role.
- Emissions from marine transport **reduced 17%** due to a drop in freight movements from Port Chalmers.
- Air transport emissions **reduced 38%**, primarily because international flights to Ōtepoti Dunedin ceased during the pandemic.
- Rail transport emissions **reduced 7%**, due to changes in freight movements.

KEY SHIFTS FOR THE CITY & ACTION AREAS FOR THE DCC

Three main **themes** cover how Ōtepoti Dunedin's transport emissions can be reduced in three main ways – by supporting people to live well locally, by enabling businesses and people to shift to low carbon transport modes, and by improving the vehicle fleet.

There are eight **key shifts**:



Under each key shift, **action areas** for the DCC are identified. Additionally, the DCC will also lobby and advocate to the central government to enable emissions reduction.

THEME 1: LIVING WELL LOCALLY

KEY SHIFT

1 Nurture low emissions urban form

The closer people live to their work or education and the services they need in their daily lives, the shorter their commute is likely to be. Shorter commutes allow people to have more options for travel, particularly active modes.

Ōtepoti Dunedin's urban form is relatively compact compared to other centres in Aotearoa New Zealand. Data suggests that on average the city's residents have less reliance on car travel than most other main centres. However, accessibility varies between neighbourhoods, and for many residents, driving a car is still necessary to access key daily needs.

To achieve and maintain emissions reduction goals, Ōtepoti Dunedin needs more mixed-use urban development at medium and high densities close to centres. This development needs to be closely linked to active and public transport networks.

The DCC's Second Generation District Plan (2GP) is supporting further densification around existing centres and in areas with access to public transport. While the 2GP also rezoned some greenfield areas, this is mostly in areas where data suggests emissions from travel will be relatively lower.

ACTION AREA 1 Encourage density close to centres and public transport

Moderate emissions reduction potential **Very high** co-benefits potential

Overall, densification enabled by the 2GP is likely to continue to promote shorter commutes and greater use of public and active modes. However, enabling density in planning frameworks doesn't mean it will happen. Development needs to be attractive and there needs to be supporting services like water networks.

In some areas of the city, 2GP-enabled densification is not able to be realised due to 3 Waters network capacity issues. Work is planned to address these constraints, and the Zero Carbon targets are being taken into account.

To support the attractiveness of medium density housing and housing choice, the DCC will consider how to improve public spaces and amenities in areas zoned for medium density development. There is also a need for additional planning provisions that support high quality housing with good on-site amenity and low emissions options for residents/tenants, and to manage the effects of medium density development on streetscape character and amenity. Possible support actions include reinstating the urban trees establishment programme, and investigating the need for an overarching public/community spaces plan.

The DCC is also taking account of Zero Carbon targets in its spatial planning for the city, including the need for density close to centres and public transport. An example of this is assessing commute-related emissions from proposed development areas as part of the city's Future Development Strategy.

ACTION AREA 2 Strengthen neighbourhood centres

Minor emissions reduction potential **Very high** co-benefits potential

Ōtepoti Dunedin has many neighbourhood centres, some of which have struggled in recent years. Revitalising these centres will help re-establish local options for residents who might prefer to meet their daily needs locally.

The 2GP enables mixed use in neighbourhood centres, and recent research suggests there is no shortage of land zoned for this purpose. The DCC is planning an upgrade of neighbourhood centres focused on transport and amenity improvements and will also consider additional incentives for building owners to encourage building improvements and enable local businesses/residents to succeed in centres.

Distributing key DCC services across neighbourhood centres can also help strengthen local communities and provide services closer to people's homes. The DCC's public library and pool networks already follow this model to a degree, with further distribution just complete (Te Puna o Whakaehu – the new pool in Mosgiel) or planned (South Dunedin Library and Community Complex). The DCC will integrate Zero Carbon considerations, including distribution of services, in upcoming reviews of DCC networks and services.

ACTION AREA 3 Design urban form for connectivity

Minor emissions reduction potential **Very high** co-benefits potential

Even in lower density suburbs the design of the urban environment can have a significant impact on how much residents want to walk, cycle or take public transport, or use other low-emissions modes.

In areas where additional greenfield development may be supported, 2GP requirements enable the DCC to consider urban design and amenity, and integration with/provision for public and active transport networks. The DCC has also recently established a proactive approach to urban design advice for large greenfields developments. There is a need to explore whether additional planning provisions are required to ensure appropriate provision for low emissions vehicles and shared mobility solutions.

KEY SHIFT

2 Target closer markets, encourage local destinations, and inspire longer stays

People travel to and from Ōtepoti Dunedin for tourism, business and conference activities, visiting friends and family, and specific purposes such as sports, festivals and events. The University and the Hospital also induce trips – for education and graduations, health appointments and medical treatment. Visitors travelling to the city and residents leaving the city to travel elsewhere all generate emissions, with trips to/from international locations emitting the most.

Reducing emissions from these sources will involve marketing to closer visitor markets, encouraging residents to consider closer destinations, and inspiring longer stays in the city.

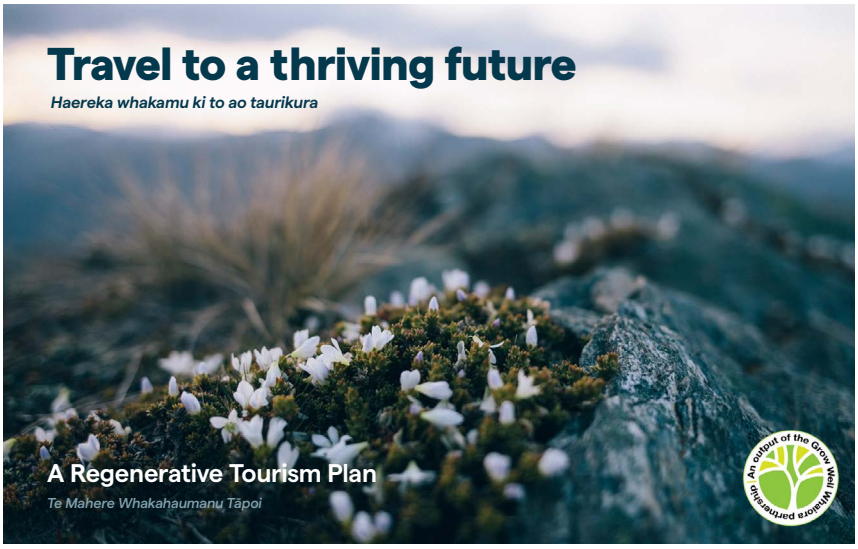
ACTION AREA 4 Align destination and events management

Moderate emissions reduction potential **High** co-benefits potential

Future destination strategy will need to respond to emissions reduction targets for aviation, and vehicle kilometre travelled (VKT) reduction targets from land transport. Once quantified, emissions from the cruise sector will need to reduce, at minimum 40% by 2030.

The DCC's *Destination Management Plan* includes evaluating the benefits and burdens of the cruise sector, and development of a cruise action plan including exploration of the consequences of capping cruise ship visits to the city. The DCC will review target markets and explore packaging of regional experiences to encourage longer length of stay.

The DCC will also explore opportunities to align Study Dunedin and events marketing with Zero Carbon ambitions.



Queenstown Lakes' destination management plan *Travel to a Thriving Future* aims to achieve regenerative tourism and a carbon zero visitor economy by 2030 (including emissions from air travel and land transport). The first priority in the plan is to rapidly cut emissions. Strategies include deploying existing clean-energy solutions and technology, understanding optimal visitation and evolving marketing plans to attract lower carbon-intensity markets, and investing in sequestration.

ACTION AREA 5 Support students to stay local

◯ **Minor** emissions reduction potential ◉ **High** co-benefits potential

Over 20,000 tertiary students reside in Ōtepoti Dunedin each year. Many students travel from other regions or internationally to study in the city, generating emissions.

The DCC will work with Zero Carbon Alliance partners to investigate and address barriers for those students who would like to stay in the city during breaks in the tertiary education calendar, but currently travel out of the city during those times.

ACTION AREA 6 Encourage low carbon recreation

◯ **Minor** emissions reduction potential ◉ **High** co-benefits potential

Low carbon recreation has a greater focus on local communities and opportunities, and relies on local recreational opportunities being accessible and attractive to local people, and well-publicised to the local market.

The DCC is improving playgrounds and tracks, and will also explore opportunities to optimise promotion of local destinations and recreation opportunities to local residents.

Pursuing development of rural and regional cycleways is one potential opportunity to further encourage low carbon recreation. Five of Aotearoa New Zealand's national Great Ride cycle trails are in Otago; two terminate within Ōtepoti Dunedin's boundaries. Recent years have seen a significant growth in these trails, with further growth projected. Many users of the trails are local residents, and the vast majority are Aotearoa New Zealand residents.

Improving cycling infrastructure provides significant opportunities for local tourism and recreation, but is also important for equity reasons (refer Shift 4: Develop convenient and attractive cycling and walking networks and public transport services).

By completing the Tunnels Trail, the DCC will establish a cycle link between Ōtepoti Dunedin and Mosgiel – a step towards achieving a link with the Clutha Gold trail. *Ōtepoti Dunedin Pathways* will identify regional connector cycleways, and clarify the support available to community groups from the DCC to establish them.

KEY SHIFT

3 Unlock remote solutions

Travel demand needs to be reduced by enabling remote working and providing online and low emissions mobile services.

ACTION AREA 7 Enable working from home

◯ **Minor** emissions reduction potential ◉ **High** co-benefits potential

The COVID-19 pandemic response enabled many people to work effectively at home, and surveys undertaken when restrictions eased found many people wished to continue to work from home at least part time. Data suggests that the number of people working from home remains above pre-2020 levels.

Working from home can be enabled by workplace policies. Like many employers in Ōtepoti Dunedin, the DCC has developed a Flexible Working Policy. The DCC will explore ways to promote flexible working with its existing partners.

ACTION AREA 8 Provide virtual and low emissions mobile solutions

◯ **Minor** emissions reduction potential ◉ **High** co-benefits potential

Online and mobile services reduce the need for people to travel and improve convenience for residents.

The DCC public library service already provides mobile services and a book bus service which takes library services into many neighbourhoods that do not have a library. The book bus service is in the process of being electrified. The DCC will explore how the coverage of these services can best align with Zero Carbon goals.

The DCC's e-Services programme will also enable members of the Ōtepoti Dunedin community to interact digitally with the DCC 24/7, reducing the need to travel to service centres.

THEME 2: SHIFT TO LOW CARBON TRANSPORT MODES

Mode shift occurs when people choose to take journeys by foot, bike, or public transport rather than by car. For freight, mode shift is using coastal shipping, rail or other low carbon modes (e.g. cargo bikes), rather than trucks or vans. These changes reduce emissions by reducing trips and total vehicle kilometres travelled (VKT) by motor vehicles.

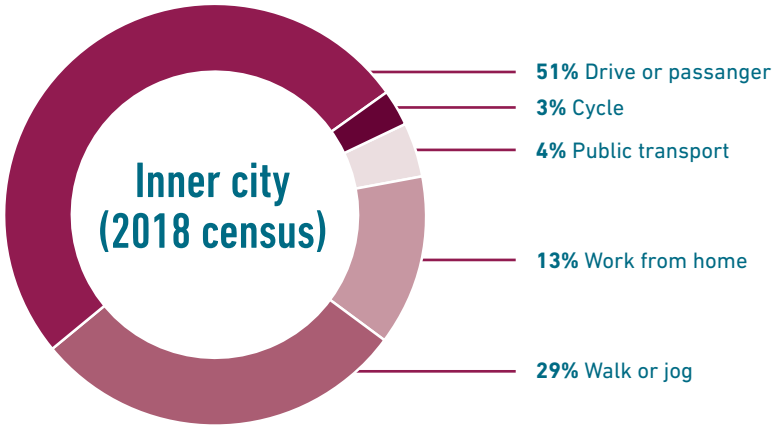
There is a national focus on enabling mode shift in cities. Central government transport strategy, policy and investment aim to make it more attractive for people to walk, cycle or use shared or public transport, and easier for businesses to use lower carbon freight options.

A related national focus is road safety. Aotearoa New Zealand's Road Safety Strategy has strong links with emissions reduction goals. Meeting road safety targets requires significant safety improvements around key destinations such as schools and shops. As safety is a concern for many people, these improvements will support people of all ages and abilities to use active modes.

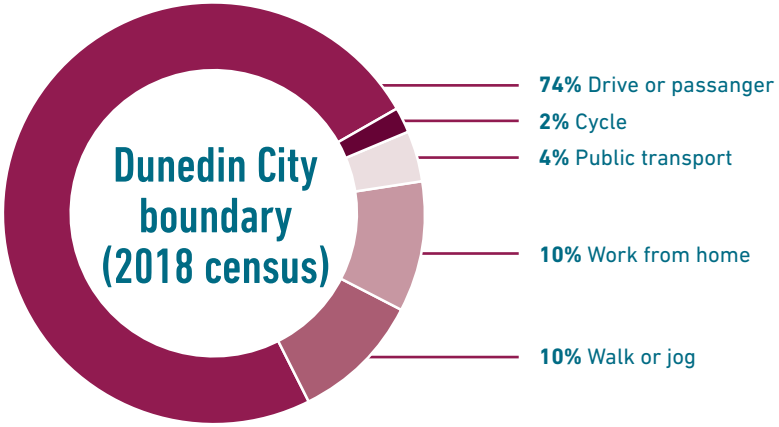
In Ōtepoti Dunedin, current rates of walking, cycling and public transport use vary by suburb. Residents of inner-city suburbs with shorter commutes to work or education have high rates of walking to work and education. Overall, the city has significantly higher rates of walking than the national average. However, rates of cycling only just exceed the national average even in the centre city, and public transport use is below the national average for both travel to work and travel to education.

To support and enable mode shift, a package of actions is required – spanning both infrastructure and education.

Travel to work mode share



Travel to work mode share



KEY SHIFT

4 **Develop convenient and attractive cycling and walking networks and public transport services**

Residents and visitors to Ōtepoti Dunedin need to be supported and enabled to use active modes, particularly for shorter journeys. Walking and cycling doesn't just reduce emissions. It also unlocks significant benefits for health and wellbeing and is also a lower cost transport option.

The frequency, quality and geographic reach of public transport in Ōtepoti Dunedin also needs to be improved. Local surveys suggest that public transport is seen as the most viable alternative to private motor vehicles for the largest number of residents.

The potential for mode shift is high – Ōtepoti Dunedin has had very high public transport patronage in the past, and 75% of respondents to a recent Otago Regional Council (ORC) survey said they would consider catching the bus, or catching it more often, to work/education. Despite bus driver shortages and COVID-related issues having caused significant disruption to services, bus patronage in the city is 18% higher than it was pre-pandemic.

To achieve Zero Carbon targets, increasing use of public transport is particularly important in suburbs where residents have longer commutes. In Ōtepoti Dunedin, improving the service for residents of Mosgiel and commuter suburbs to the south needs to be a particular focus. Mosgiel is the source of a large number of trips to the centre city and is undergoing significant growth.

From 1879 an extensive network of tram, train, bus and cable car networks were developed throughout Ōtepoti Dunedin. By 1924 there were 23 million passenger trips per year.

In the second half on the 20th century patronage declined due to changes in land use, demographics and increasing car ownership. The last cable cars and trams ran in the 1950s and commuter rail services ended in 1982.

Patronage remained low until an increased focus and investment in the 21st century saw increasing levels of service, and the opening of the bus hub in 2019. Patronage began to increase again from 1.9 million passenger trips per year in 2005/06 to 2.8 million in 2022/23.

Dunedin City Corporation, Tram (c.1950). Hocken Digital Collections

ACTION AREA 9 Complete urban cycleway networks and improve priority pedestrian networks

High emissions reduction potential **Very high** co-benefits potential

The DCC is responsible for ongoing operation, maintenance and renewals of the local road network, including footpaths and cycleways, as well as the development of walking and cycling networks.

Cycleway networks

In recent years cycleways have been developed around Otago Harbour and there are separated cycleways along the central city one-way system. However, many major routes still lack protected cycleways. There are also significant gaps in the existing network, so few routes have safe cycling infrastructure along the entire route.

International evidence and national guidance suggest a comprehensive, safe, connected network of cycleways is a critical enabling factor for residents wishing to travel by bike, and without this network significant cycle mode shift will not be achieved. This was also clear in local engagement – residents who currently drive to work/education identified safer roads (58%), and more and safer cycleways (27%) as the interventions most likely to lead them to cycle. Provision of cycleway networks is also a very cost-effective way of reducing transport emissions.

Ōtautahi Christchurch is Aotearoa New Zealand's most connected city for cycling and is over halfway through delivery of a planned 101-kilometre cycleway network. Overall ridership has grown by 80% since 2016, and the proportion of women cycling has increased from 32% to 41%. There has also been significant growth in e-bikes: from 4% of all bikes in 2017, to 25% today.

Pedestrian networks

A high-quality pedestrian network is particularly important for vulnerable groups, including older people, families and children, and people with disabilities. Recent work undertaken for the DCC found the safety and adequacy of pedestrian crossings was the biggest shortcoming in the pedestrian network.

Travel to schools, centres, and public transport hubs

Prioritising safe walking and cycling routes around schools, to town centres and public transport hubs improves road safety and helps reduce emissions.

Research suggests that safe walking routes to these locations is most likely to lead to an increase in walking, with speed management, traffic calming and lighting improvements also important.

A focus on safe active transport for schools also enables mode choice for parents. International evidence and local engagement show that the need to transport others (particularly school children) is a key reason why many employees drive to work.

In line with national direction, the DCC is amending urban speeds to improve safety, with immediate improvements scheduled around schools, and further improvements planned for other parts of the city.

A comprehensive plan

The DCC is completing Ōtepoti Dunedin Pathways, a walking and cycling plan, that will determine the scale and sequencing of walking and cycle infrastructure, including in priority locations around schools, in centres and public transport hubs. Implementing Ōtepoti Dunedin Pathways will include delivery of existing funded urban cycleway projects, coupled with new projects to achieve significant increases in network coverage, and gap-filling across the existing network. It will also complement other DCC key infrastructure improvement projects already in train (e.g. the Shaping Future Dunedin Transport programme, the Central City Plan, the South Dunedin Schools programme, and the Tertiary Precinct Project later in the decade).

ACTION AREA 10 Support improvements in public transport service frequency, operating hours and quality, while maintaining affordability for users

High emissions reduction potential **High** co-benefits potential

The ORC is responsible for providing public transport in Ōtepoti Dunedin. The DCC, as the local road controlling authority, has a support role – providing public transport infrastructure such as bus stops, and priority measures for buses. Existing collaboration has been reinforced by recent legislative changes that have strengthened requirements for the councils to work together on public transport planning, service delivery, and supporting infrastructure.

International evidence and local surveys suggest that to significantly increase the number of people taking public transport, it must be reliable, frequent and fast relative to the same trip by private vehicles. Local engagement showed that service operating hours is an additional issue for shift workers.

There is strong national emphasis on maintaining affordability for equity reasons. Local engagement suggests there is limited public appetite for fare increases.

Reliability, frequency and relative speed of the current public transport service all fall short of what is required to achieve Zero Carbon targets. The ORC is exploring potential increases to frequency and operating hours and an associated fare structure to meet the agreed 8% public transport mode share target adopted as part of the Shaping Future Dunedin Transport programme. The DCC is working with the ORC on this work – there is a potential co-funding role for the DCC to ensure improvements can be achieved while maintaining affordability for users of the service.

However, further improvements to the public transport service, infrastructure and policy settings will be required to achieve Zero Carbon targets. As next steps, the DCC will:

- work with the ORC to further improve the efficiency and reliability of buses on key routes, and
- complete a feasibility study into passenger rail, with an initial emphasis on a service between Mosgiel and Ōtepoti Dunedin (as there is strong community interest in restoring passenger rail services, with rail seen as more attractive than buses).

ACTION AREA 11 Support extensions to the geographic reach of public transport services

Moderate emissions reduction potential **High** co-benefits potential

Ōtepoti Dunedin's bus system connects large parts of the city, but there are gaps to the south (beyond Mosgiel towards the airport and Milton) and west (towards Middlemarch and Hyde). Inter-regional public transport options are currently limited to commercial providers.

Community engagement raised a need for public or school transport options to/from the Edgar Centre after school, as it is a key hub for after school sports but does not currently have any public transport connections. The DCC will encourage and support the ORC to align public transport services to better meet the needs of students and staff travelling to school and after school sports.

Planned priorities for extensions to Ōtepoti Dunedin's current public transport network include services linking Clutha District with the city, and potential demand-responsive services for areas where sustaining a scheduled service may be difficult. The DCC will encourage and support the ORC to implement these planned public transport service extensions.

Establishing competitive intra- and inter-regional public transport would provide a viable low emissions alternative to short-haul aviation, provide security of access to Dunedin Hospital for residents of wider Otago, and an alternative low emissions option for local residents travelling out of the city. Barriers to using existing commercial coach and shuttle services include cost, low frequency, and journey time. The DCC will continue to encourage and support central government investigation and implementation of inter-regional public transport.

ACTION AREA 12 Support improvements in the quality and consistency of bus stops and bike facilities

Minor emissions reduction potential **High** co-benefits potential

The quality of bus stops impacts public transport use. It is particularly important for demographics for whom safety and security is of greater concern e.g. older people, women, and people with disabilities. However, engagement suggests there is general dissatisfaction with the quality of the city's bus stops – many cite their inability to provide adequate protection from the weather, security issues, inadequate seating, and lack of real-time bus information.

National direction also emphasises the importance of bike parking at key destinations such as shops, schools and public transport stations.

Currently, bus stop improvements are implemented by the DCC, but paid for by the ORC. The ORC is exploring a potential upgrade to super stops at key locations and the Bus Hub to provide greater amenity, access to information, increased capacity and ability for passengers to transfer – the DCC will work with the ORC to progress these improvements. The DCC will also continue to carry out bus stop improvements alongside other capital works where possible.

However, to improve the quality of overall service provision, there is a need for an overall audit and plan for the city's bus stop network – starting with priority and high frequency routes. The DCC will work with the ORC to achieve this.

The DCC will establish bike hubs (including parking and end of trip facilities) across the central city and will continue to improve bike parking as part of other cycleway and centres upgrade projects.

KEY SHIFT

5 Boost travel demand management to support use of active and public modes

International research suggests that to provide genuine transport choices active and public transport modes must be at least as convenient as private vehicles. Local surveys confirm that convenience is the strongest motivator for local residents when choosing their mode of travel.

Providing transport choice requires a complete package: supporting infrastructure with education and alignment of other policies. The package of supporting measures is known as travel demand management. As well as supporting emissions reduction, travel demand management can help reduce congestion and improve air quality.

ACTION AREA 13 Align parking management and consider other pricing mechanisms

High emissions reduction potential **High** co-benefits potential

Pricing mechanisms can play an effective role in helping reflect the full costs and externalities of driving private vehicles. While these can take many forms, parking management is one example.

Parking management can contribute to mode shift by enabling more compact urban form, reducing price subsidies for parking and freeing up street space for people on foot and using buses/bikes. Consistent with national direction, the DCC is currently developing a Parking Management Policy for Ōtepoti Dunedin, which will take into account Zero Carbon goals.

Low emission zones limit access to certain vehicle types and are common internationally. Aotearoa New Zealand's first 'Essential Vehicles Area' was launched on Queen St in Auckland in 2022, and the Christchurch City Council has signalled its intention to consider their use. Legislative changes currently underway would make it easier for local governments to introduce these zones. Other pricing tools have been effectively applied overseas (e.g. congestion charging) but there is currently no legislative mechanism for local governments to apply these tools in Aotearoa New Zealand.

The DCC will encourage and support the central government to expand and align pricing and enforcement tools with emissions reduction goals, and will explore the costs and benefits of applying any newly available pricing and enforcement tools in Ōtepoti Dunedin.

ACTION AREA 14 Establish and promote car share

Minor emissions reduction potential **High** co-benefits potential

Aotearoa New Zealand has one of the highest rates of car ownership in the OECD, yet cars are only used 5% of the time. Car share schemes (a car rental model for short periods e.g. by the hour) reduce reliance on individual car ownership and help promote use of active/public transport modes, with the added benefit of reducing parking demand and enabling more options for use of road space. They also broaden options for residents (especially those who may not be able to afford a car), and for businesses (which can manage fleet needs via subscription).

The DCC is facilitating establishment of a car share service in the city. Key shift 7 in this chapter includes discussion of the potential roles for the DCC in communities where commercial car share schemes may not be viable. Potential district plan changes may also be required to encourage infrastructure for shared mobility in new residential development.

Pōneke Wellington's first car share service was launched in 2016. By March 2023 the number of people using car share services in the city reached 33,000, split across several service providers. Research on users of Pōneke Wellington's car share services suggest that every car share vehicle on the road replaces 11 private vehicles.

ACTION AREA 15 Expand workplace and school travel planning, and road safety promotion

Moderate emissions reduction potential **High** co-benefits potential

The DCC's current Travel Demand Management and Road Safety Promotion programmes include support for:

- five major workplaces and 19 schools to develop and implement staff and student travel plans
- cycle skills training in 47 schools
- e-bike schemes in workplaces
- road driver safety messages and programmes for the wider public.

The DCC will expand its Travel Demand Management programme, to help manage the new hospital construction disruption and to support change in how people travel to and within the central city.

The South Dunedin Schools programme will be delivered during 2024. This is a package of cycle/bus/scooter training, infrastructure improvements, and other school travel planning initiatives for 12 schools in the area. There is potential to expand this programme to ensure the roll-out of physical improvements around schools or workplaces is supported with timely behaviour change initiatives and travel planning for staff and/or students.

ACTION AREA 16 Improve access to bikes and e-bikes

Minor emissions reduction potential **High** co-benefits potential

Local surveys suggest that access to affordable bikes and e-bikes is another potential enabler of cycling.

In particular, e-bikes are broadening the appeal of cycling including to those with lower fitness levels, to older people and people with mobility challenges. They enable cycling in a wide range of situations – including in hilly terrain, for longer trips, commercial purposes, shopping and for child transport. E-bikes are a more affordable alternative to electric cars, but the high up-front cost is still a significant barrier to uptake.

Several community-based programmes and services in Ōtepoti Dunedin provide free or heavily subsidised access to bikes, but e-bikes are not a strong feature of these. There is also no public bike library or bike share scheme in Ōtepoti Dunedin, although there are commercial e-bike hire services and a number of businesses that sell new e-bikes and/or convert regular bikes to e-bikes.

The DCC will explore with community partners the potential to develop a local pilot initiative focused on enhancing access to e-bikes by lowering cost barriers.

ACTION AREA 17 Improve connections between modes

◯ **Minor** emissions reduction potential ◉ **High** co-benefits potential

Better integration of active modes with the public transport network increases the number of people that can access public transport services. In other countries and elsewhere in Aotearoa New Zealand, public transport connection points also provide e-bike charging, sheltered bike parking, shared mobility schemes (e.g. e-bikes, e-scooters and carshare) and other options for completing or extending a journey.

The DCC will deliver Park-and-Ride facilities at Mosgiel and Burnside, including consideration of connection between modes. Further consideration of the connections between active modes and the public transport network could be included in any future audit and plan for the city's bus stop network discussed under key shift 4.

To improve low carbon options for visitors, there is also a need to improve public transport links to Dunedin Airport and Port Otago and inter-regional bus connections at the Bus Hub. The DCC will use its existing partnerships and relationships to encourage and support improvement of connections between modes at these transport hubs.

KEY SHIFT

6 Shift freight to low emissions modes

Ōtepoti Dunedin needs to move as much freight as possible by low emissions modes. Transporting goods by rail generates about a quarter of the emissions as long-haul trucking, and over 100 times fewer emissions than air freight. Emissions from freight transported by coastal shipping are nearly as low as transporting by rail. In urban areas, cargo bikes and micro-mobility provide low emissions alternatives for last mile delivery.

ACTION AREA 18 Support freight to shift to rail and coastal shipping

◯ **Minor** emissions reduction potential ◉ **High** co-benefits potential

Ensuring Ōtepoti Dunedin's rail network and adjacent infrastructure can support significant growth in freight movements (and the possible future introduction of a passenger rail service) is important to the achievement of the Zero Carbon targets.

Zero Carbon considerations, including proximity to rail, will be taken into account in assessing potential locations for any future expansion of commercial or industrial land.

The Main South Line between Wingatui and Caversham has some capacity issues. It is the only capacity constraint on this route, and during peak dairy export season, volume is significantly constrained between Fonterra's Mosgiel factory and Port Otago.

A rail loop at Wingatui has been identified as a key enabler of potential commuter rail services between Mosgiel and Ōtepoti Dunedin, and an inland port to the south to enable the transfer of logs by rail.

A rail transfer terminal located in the southern Dunedin/northern Clutha area has been identified as a way to further increase opportunities for freight on rail, with a primary user likely to be the forestry sector. Studies investigating the potential for a facility of this kind have concluded local or the central government would likely have to cover capital costs, because the key benefits that would be realised from the facility would be improved safety on roads and lower environmental impacts.

The DCC is progressing a further feasibility study into the potential rail loop and the viability of a rail transfer terminal south of the city. Further exploration of freight volumes and movements is required to clarify other potential emissions reduction pathways.

ACTION AREA 19 Support growth of e-bikes and micro-mobility for last mile delivery

◯ **Minor** emissions reduction potential ◉ **High** co-benefits potential

Growth in online shopping is driving marked increases in demand for delivery services, which in turn has the potential to significantly increase emissions. In Aotearoa New Zealand, online shopping in 2022 was up 62% on 2019 levels.

Amongst the options for last-mile freight delivery are e-cargo bikes, which are being embraced internationally as a particularly efficient, cost-effective, low emissions solution.

Pedals Dunedin was established in November 2022, with a focus on reducing central city congestion. The business provides cycle courier services across Ōtepoti Dunedin. Within six months of their launch, Pedals Dunedin has signed up over 100 business customers. Their e-bikes can carry up to 90kg at a time, and are able to navigate quickly and easily around the central city.

By using services like that of Pedals Dunedin, businesses can reduce their carbon footprint, but also help reduce air pollution and free up road space for ambulances, emergency services and people with disabilities who need to rely on cars can get to places more easily.

In addition to other measures that promote a supportive environment for active modes discussed in this chapter under key shift 4, local delivery and micro-mobility hubs may help companies better coordinate freight movements and logistics. Other guidance suggests ensuring regulatory, policy and urban design settings facilitate the safe and easy pick-up and drop-off of deliveries via e-bikes and micro-mobility.

The DCC will consider the needs of low emissions last-mile delivery modes in the Central City Upgrade and other centres upgrades and will explore barriers to the use of bikes and micro-mobility for last mile delivery with local stakeholders.

THEME 3: IMPROVING OUR FLEET

KEY SHIFT

7 Electrify light vehicles

31% of Ōtepoti Dunedin's light vehicle fleet (private and commercial cars, utes and vans) needs to be electrified by 2030, several years ahead of national targets. This is particularly the case for high-use vehicles such as commercial vehicles, taxis and shared fleets.

Uptake of EVs in Ōtepoti Dunedin has been among the highest in the country, but EVs still make up only a small fraction of the overall fleet. Uptake has risen since the introduction of the central government's Clean Car Discount scheme.

ACTION AREA 20 Facilitate a network of EV charging infrastructure

Moderate emissions reduction potential **High** co-benefits potential

The majority of EV charging occurs at home or at work. However, significant growth in the availability of public charging infrastructure will be required to enable charging for longer journeys and for those unable to charge at home. Increasing the number of public charging stations also helps address range anxiety, which is a key barrier to EV uptake.

Central government is supporting the roll out of public fast chargers throughout the country. The DCC has played a role in the establishment of several of the public EV chargers currently available in the city, by making DCC-owned or managed land available to commercial providers and waiving licence fees for an initial period.

The DCC will consider taking an active role in the provision of EV charging infrastructure by identifying and making available sites on DCC-managed land and facilities to private sector charging providers. The DCC will also work with relevant stakeholders to identify wider investment needs for public EV charge infrastructure in the city, to promote electricity network capability, and ensure regional coverage of EV charging infrastructure.

The DCC will also consider working with electricity distributors on options for reducing costs for EV charging infrastructure and whether changes to the 2GP are needed to improve access to EV charging infrastructure.

ACTION AREA 21 Support electrification of service vehicles and last-mile delivery

Moderate emissions reduction potential **High** co-benefits potential

Service vehicles and vehicles used in last-mile delivery represent the largest current opportunity to decarbonise freight and logistics, because there are a wider range of low or zero carbon alternatives for lighter vehicles travelling shorter distances.

Early discussions with city businesses involved in last mile delivery suggest that many are interested in decarbonising. The DCC will work with relevant stakeholders to explore barriers and opportunities for use of low emissions vehicles for last-mile delivery. The DCC will also encourage decarbonisation of light service vehicles through its procurement processes and invest in infrastructure to support continued DCC fleet electricifation.

As discussed under key shift 5 in this chapter, initiatives such as low emission zones in key delivery areas may be required to encourage adoption of low emissions modes for delivery services. These have been shown to be effective internationally.

ACTION AREA 22 Promote equity of access to low-and zero-emissions vehicles

◯ **Minor** emissions reduction potential ◉ **High** co-benefits potential

EVs are a more affordable way to get around for trips that aren't possible by other modes such as public transport, walking or biking. However, due to the high upfront costs associated with EV ownership, there are barriers for low-income households wishing to access EVs.

The introduction of a car share service to the city discussed in this chapter under key shift 5 will enable residents to access EVs, without the need to own their own car. A commercial service may, however, not be viable in some outlying settlements. The DCC will explore community EV share schemes to support mobility for communities and settlements poorly served by commercial providers.

If EV ownership does not accelerate sufficiently, or uptake is found to be highly inequitable, the DCC will explore the possibility of a social leasing scheme for EVs, in addition to any potential community scheme to enhance equity of access to e-bikes (discussed under key shift 5 in this chapter). These schemes target investment in higher needs communities where the ability to own an EV is limited.

KEY SHIFT

8 Decarbonise heavy vehicles, marine and aviation

14% of Ōtepoti Dunedin's heavy vehicles need to be electrified by 2030, several years ahead of national targets. Overall freight demand also needs to be reduced by 5%.

ACTION AREA 23 Support transition to low- and zero-emission fuels for heavy vehicles

◯ **Minor** emissions reduction potential ◯ **Moderate** co-benefits potential

Public transport

Buses generate about 10% of the city's heavy vehicle emissions.

Central government has mandated that, from 2025 onwards, all new public buses must be zero emissions. The ORC has successfully trialled electric buses in the city and will progressively introduce these on all routes as contracts are renewed. By 2030, all the public buses in the city should be powered by zero emission fuels – but at the latest this will be achieved in 2035, the year the government aims to have decarbonised public bus fleets nationwide.

The DCC will encourage and support the ORC to fast-track planned shifts to zero emissions fuels for contracted public transport services.

Other heavy vehicles

Low emissions options are currently more limited for other heavy vehicles, though the landscape is rapidly changing. Central government is supporting some of Aotearoa New Zealand's largest companies to develop and/or introduce battery-electric heavy vehicles into their fleets. Partnerships between local government and suppliers are electrifying heavy vehicle fleets for services like waste management. One trucking company is trialling hydrogen hybrid trucks to achieve significant cuts in emissions. Central government has recently committed to increasing the sales of zero emissions heavy vehicles to 30% by 2030, and 100% by 2040.

Research suggests that battery electric trucks are likely to be the predominant fuel in the future rather than hydrogen due to the higher efficiency of electricity generation compared to hydrogen manufacture. Depot charging is likely to provide for the majority of future electric truck and bus charging, but fast public chargers will be needed to support longer distance trips. The DCC will support freight fuel decarbonisation for heavy vehicles by planning for EV charging infrastructure that enables heavy vehicles to charge efficiently. The DCC will also encourage decarbonisation of suppliers' heavy vehicles through its procurement processes.

ACTION AREA 24 Support transition to low- and zero-emission fuels for marine an aviation

Moderate emissions reduction potential **Moderate** co-benefits potential

Marine

The international nature of shipping means global efforts are needed to reduce emissions from shipping. The International Maritime Organisation (IMO) has targets to reduce the emissions intensity of international shipping 40% by 2030 and to reduce emissions 20-30% in absolute terms by 2030 (all from 2008 levels). Achieving these targets will require improvements in ship efficiency and use of zero emission fuels.

As most visiting ships don't currently refuel while in Ōtepoti Dunedin, it's unlikely that Port Otago will need to build refuelling infrastructure for zero emission fuels. However, provision of shore power could be investigated for powering vessels while docked, and would contribute to reducing the overall emissions impact of marine transport. Shore power could eliminate the use of fossil fuels while in port for ships that are capable of receiving shore power. Although vessel capacity to receive shore power varies, it is more common in newer vessels. For example, almost all cruise ships that operate in Aotearoa New Zealand can receive shore power.

Shore power is currently rare internationally (with no provision for it in Aotearoa New Zealand) but central government has signalled that exploring the feasibility of constructing green shore power infrastructure may be a future area of focus. Shore power would have the co-benefit of reducing air-pollution around Port Chalmers, but the capacity of the electricity network is a key factor in any future provision.

Through existing partnerships and relationships the DCC will encourage and support exploration the provision of shore power at Port Chalmers.

The DCC also has a role to play in encouraging and supporting central government to take action to reduce emissions from shipping.

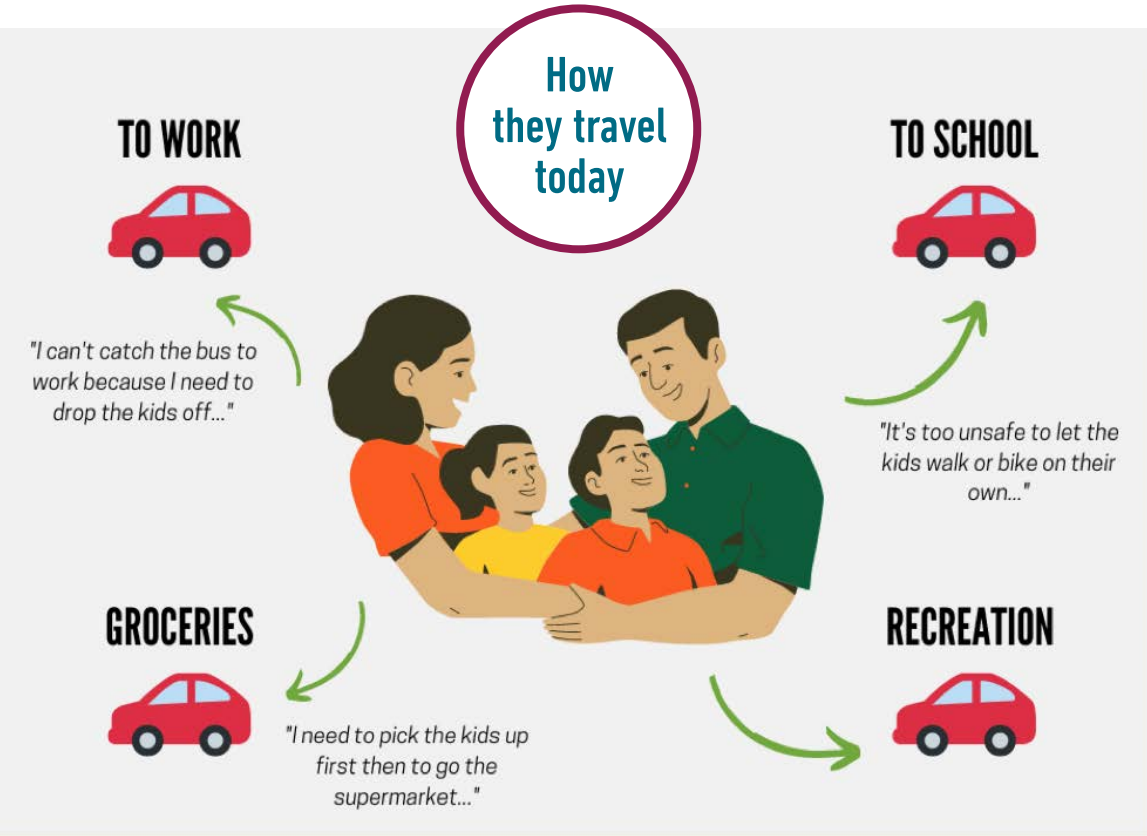
Aviation

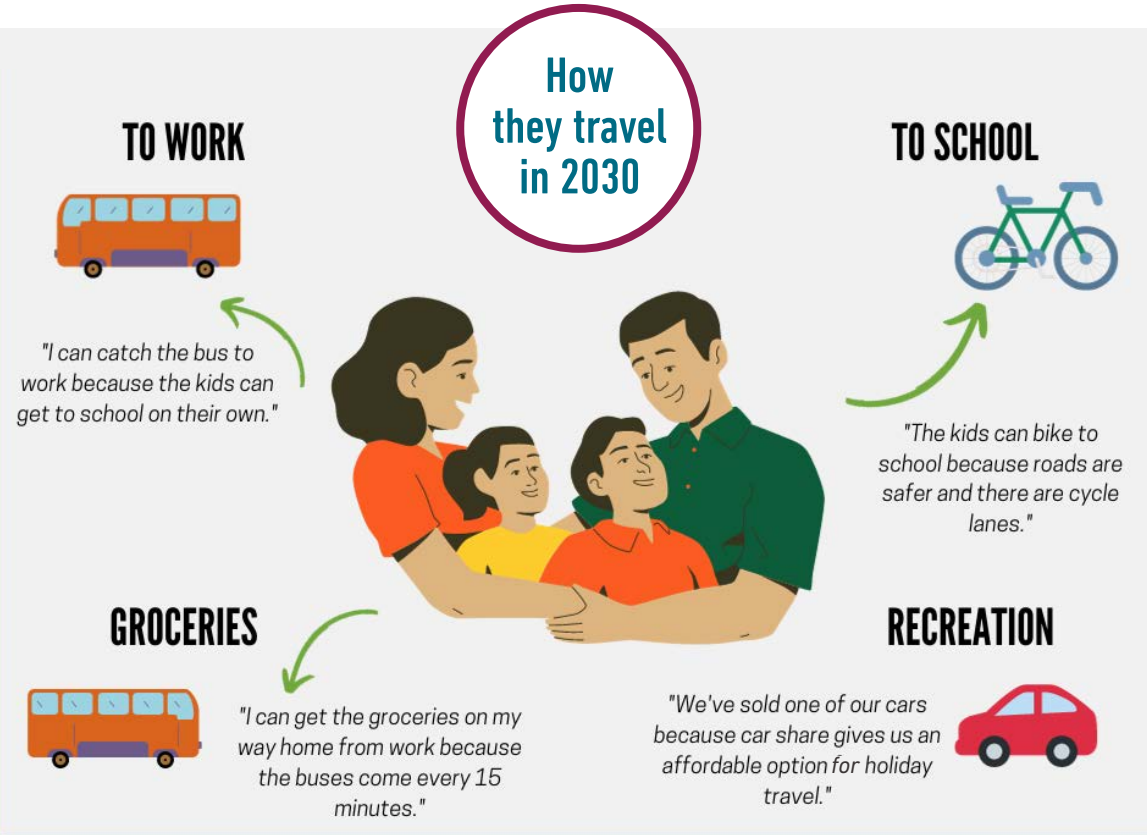
Improving fuel efficiency and emissions intensity of aviation fuels will be essential to achieving targeted emissions reduction from aviation. National plans to decarbonise aviation include a combination of biofuels ('sustainable aviation fuels', or SAF), hydrogen and electric energy. Electric flights are more likely to be feasible for short haul domestic flights.

The government and Air New Zealand are co-funding feasibility studies into the domestic production of SAF, and are exploring the introduction of a SAF mandate, whereby airlines departing from or within Aotearoa New Zealand would be required to use a certain percentage of SAF in their aircraft, with the percentage increasing incrementally over time.

The DCC will support and encourage Dunedin Airport to position for early adoption of low carbon aviation fuels, and central government to take action to reduce emissions from aviation.

WHAT MIGHT 2030 LOOK LIKE FOR RESIDENTS?



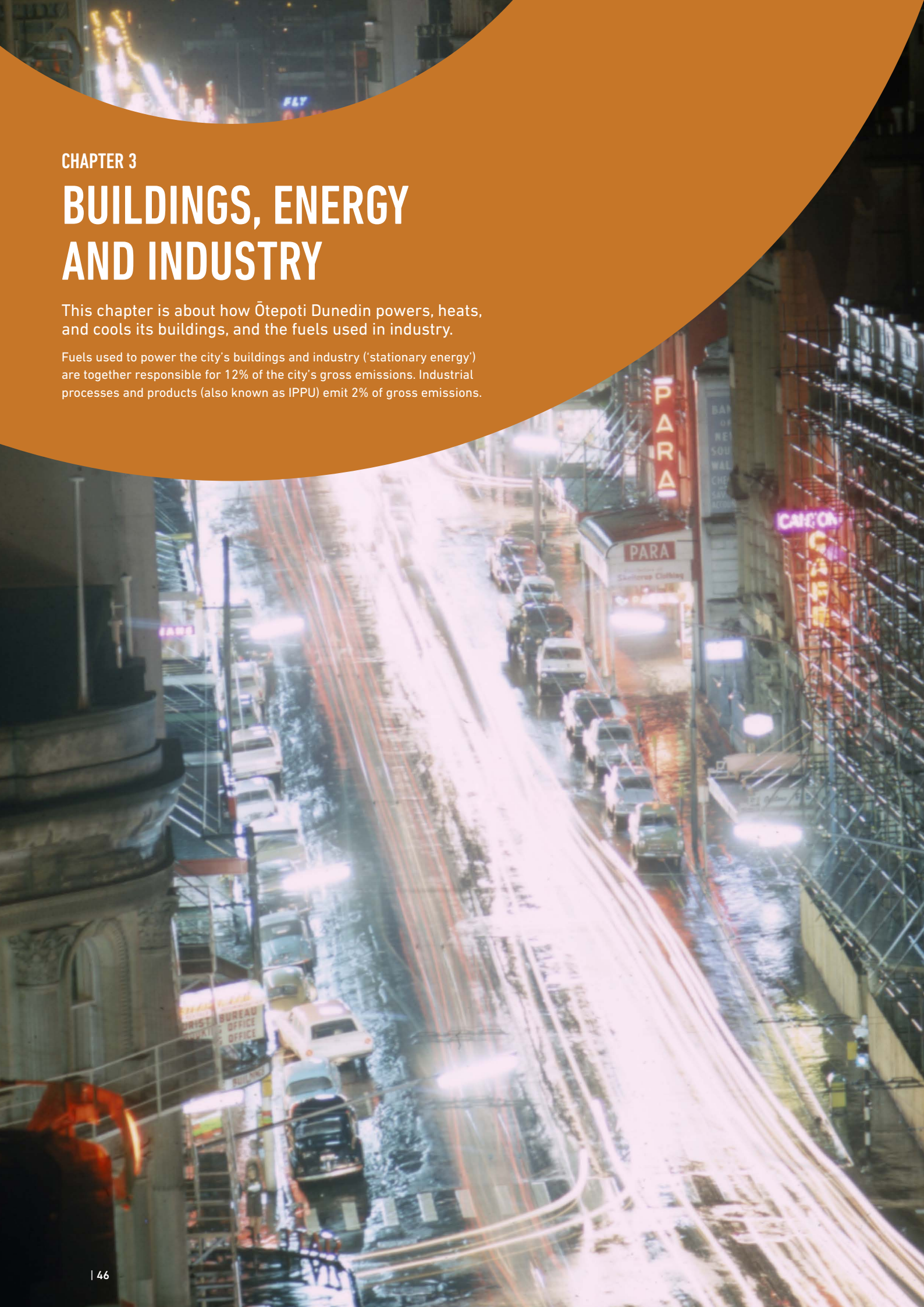


CHAPTER 3

BUILDINGS, ENERGY AND INDUSTRY

This chapter is about how Ōtepoti Dunedin powers, heats, and cools its buildings, and the fuels used in industry.

Fuels used to power the city's buildings and industry ('stationary energy') are together responsible for 12% of the city's gross emissions. Industrial processes and products (also known as IPPU) emit 2% of gross emissions.



CHAPTER OVERVIEW

To achieve 2030 targets, Ōtepoti Dunedin needs to reduce emissions from **stationary energy use by 61%** and **industrial processes and product use by 15%** from 2018/19 levels.

Achieving this relies on central government achieving its goal of a 100% renewable national electricity grid by 2030, and some significant changes in the way homes, schools, organisations and businesses are designed, heated and powered:

Renewable national grid

Phase out coal use

↓65% LPG use

↓41% stationary diesel use

Improve energy efficiency

Increased local renewable energy

Reduced refrigerant emissions

Ōtepoti Dunedin will need to:

- Switch to low carbon energy sources
- Improve energy efficiency of buildings and industry
- Increase local renewable generation
- Reduce emissions from refrigerants

To support achievement of these key shifts, **the DCC** will:

- Support the transition to fossil-fuel free process heat
- Replace fossil fuels and improve energy efficiency of DCC facilities
- Support energy efficiency and the transition away from fossil fuels in homes
- Grow renewable energy generation from DCC-owned assets
- Grow renewable energy generation in the community
- Reduce refrigerant emissions and liabilities

Moderate emission reduction potential action areas

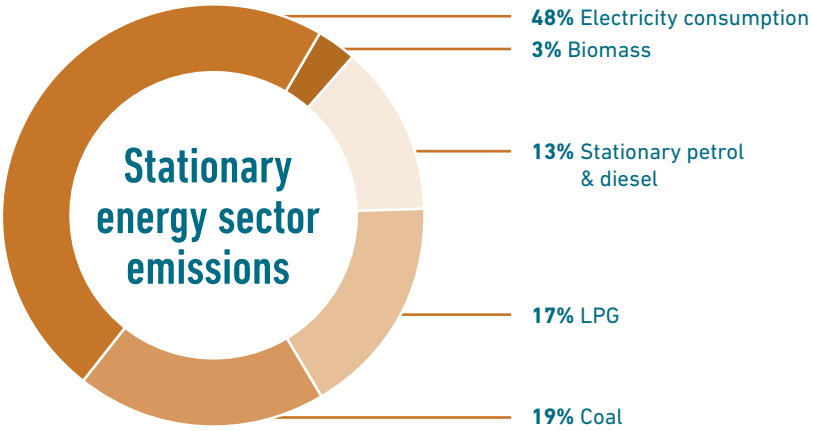
Minor emission reduction potential action areas

HOW DO BUILDINGS, ENERGY AND INDUSTRY PRODUCE EMISSIONS?

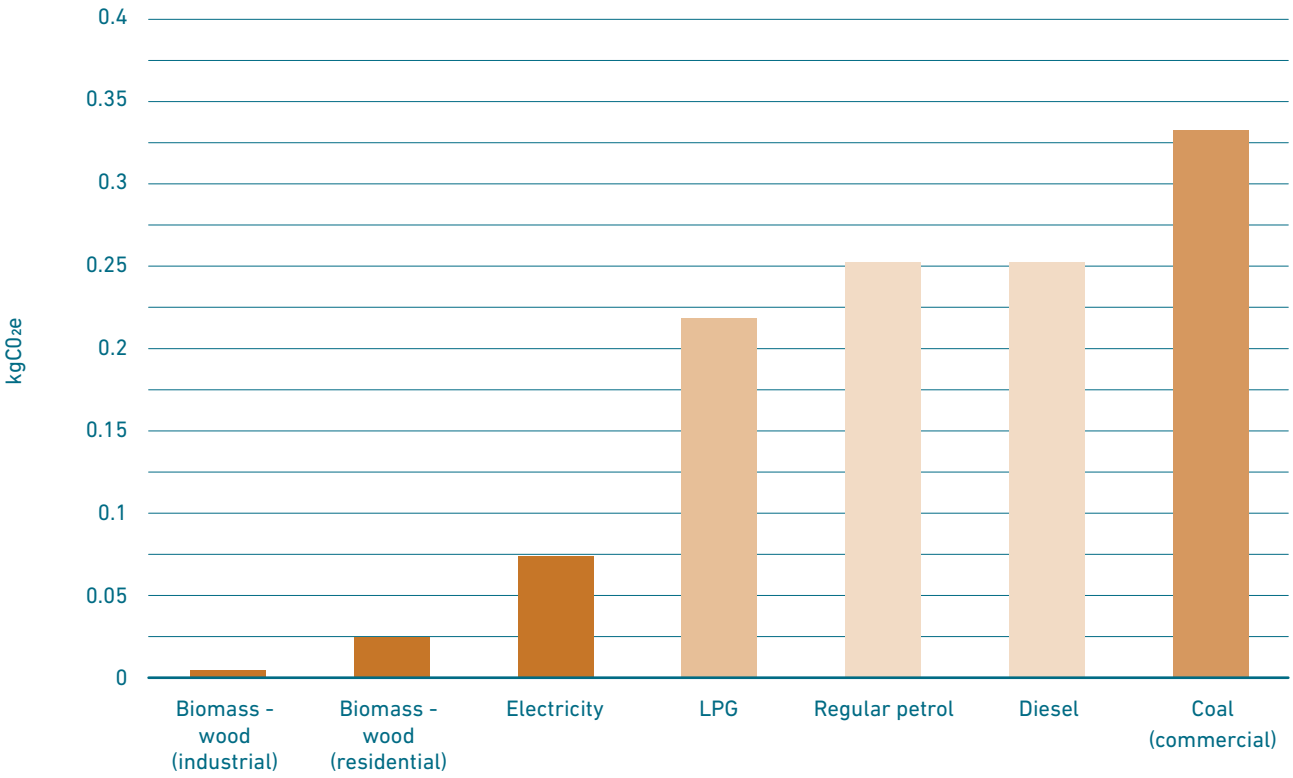
Stationary energy

Stationary energy is energy used for an activity in one place – any energy except for transport.

In Ōtepoti Dunedin, most of the stationary energy used is electricity (68%), followed by biomass (wood). However, because coal, LPG and diesel produce far greater emissions per unit of energy, they generate much more emissions in the city. Most of Dunedin's electricity comes from the national grid, which is not yet powered by 100% renewable sources, so this energy generates some emissions.



Emissions per kWh of energy



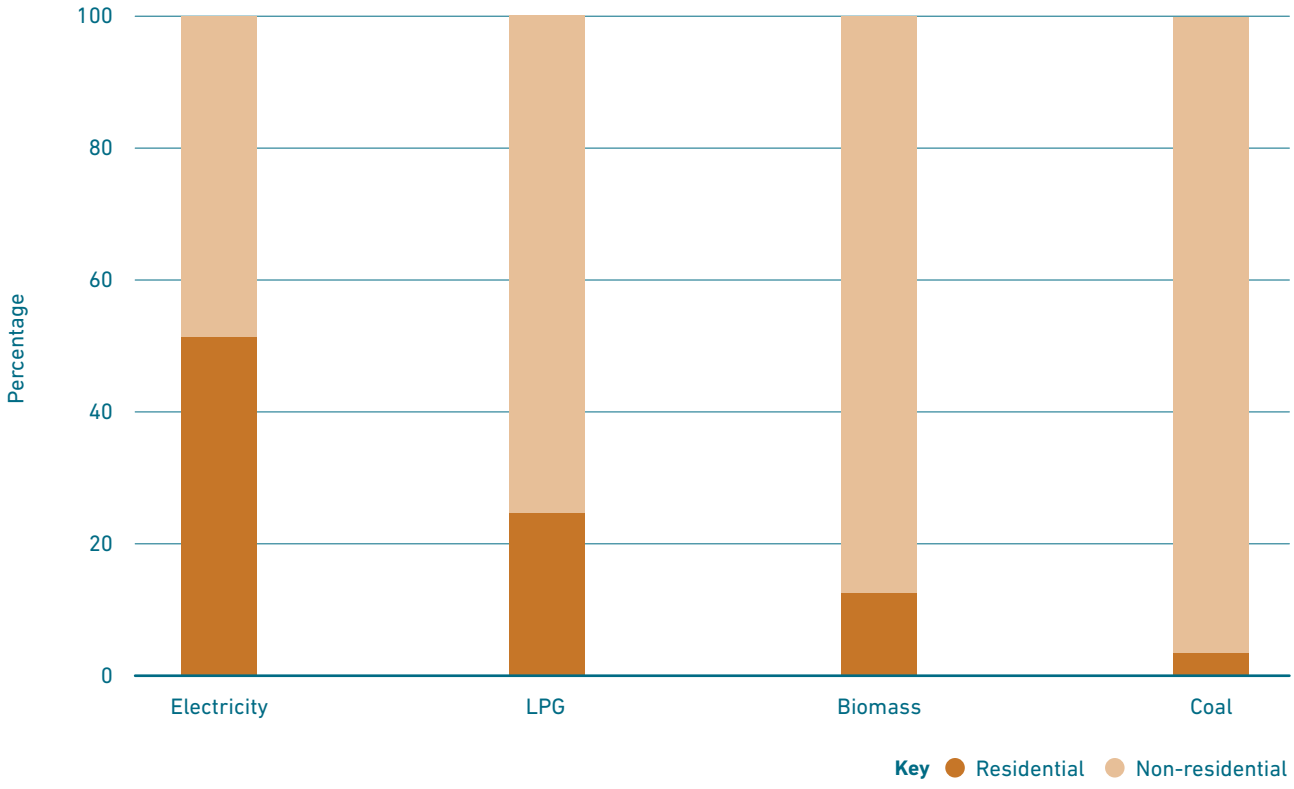
Local small-scale renewable electricity generation either contributes to the national grid or is used locally, reducing the demand on the national grid. There are around 500 solar/wind small-scale renewable systems connected to the electricity network in Dunedin. The number of connections has increased by about 60 per year.

The city's use of coal, LPG, stationary petrol and stationary diesel generates considerably more emissions per unit of energy (kWh) than electricity and wood.

About half of the electricity used in Ōtepoti Dunedin is consumed in residential homes around the city. For coal, biomass and LPG, users are primarily commercial and industrial. The split for stationary diesel use is not known.

There have been positive trends in emissions from energy use in the city in recent years. Despite an increase in overall energy use, since 2016 the emissions intensity of energy use in Ōtepoti Dunedin has reduced almost 12%. This is a trend that is likely to continue due to increasing electrification and use of biomass instead of coal.

Proportion of Dunedin energy use by user type



Industrial Processes and Product Use (IPPU)

Industrial processes and product use generates an estimated 2% of Ōtepoti Dunedin's total gross emissions. As it is difficult to calculate IPPU emissions from the city, the estimate is based on the city's population and nationally reported IPPU emissions. IPPU emissions do not include industrial energy use; these emissions are included in the stationary energy section of the city's footprint, discussed above.

IPPU emissions are caused by industrial products and gases – such as refrigerants, foam blowing, fire extinguishers, aerosols, and metered dose inhalers. Refrigerants emit over 90% of IPPU emissions. Refrigerants are gases which typically have a high global warming potential (GWP). These gases are often used in heating and cooling – for example in fridges, heat pumps, air conditioning systems, and chilled food transportation. Refrigerants are usually stored securely inside devices – but if a device leaks the harmful gases are released into the atmosphere.

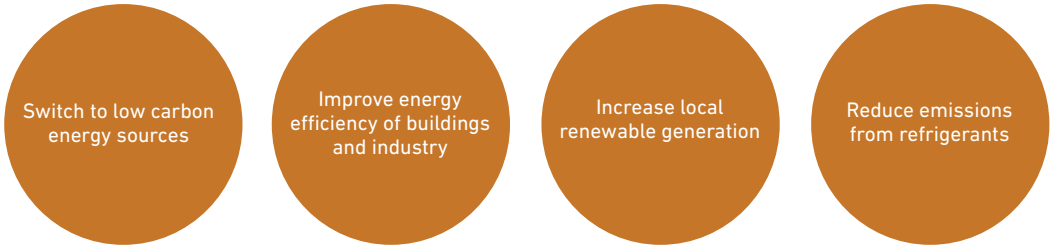
CHANGES IN EMISSIONS SINCE 2018/19

Stationary energy emissions **decreased by 12%** due to a reduction in coal consumption and the national electricity grid being more renewable.

Based on national-level data, it is estimated that IPPU emissions **decreased by 1%**.

KEY SHIFTS FOR THE CITY & ACTION AREAS FOR THE DCC

Four **key shifts** are required to reduce emissions produced by stationary energy and IPPU in Ōtepoti Dunedin:



Under each key shift, **action areas** for the DCC are identified. Additionally, the DCC will also lobby and advocate to the central government to enable emissions reduction.

KEY SHIFT

1 Switch to low carbon stationary energy sources

Ōtepoti Dunedin needs to support the decarbonisation of the national grid and replace local use of high-emitting fossil fuels used for stationary energy (coal, gas, and diesel) with electricity or biomass. Shifting away from fossil fuels also helps reduce air pollution.

Central government has made significant commitments to decarbonising stationary energy, including aiming for a 100% renewable national electricity grid by 2030. If this target is achieved, it will significantly reduce the city's emissions.

Central government also has substantial work underway to transition major industrial, commercial and public sector users from coal and LPG to renewable alternatives. The DCC, businesses and other stakeholders in Ōtepoti Dunedin can encourage this transition to happen as quickly as possible, including by supporting the growth of supply chains for alternative fuels.

KEY SHIFT

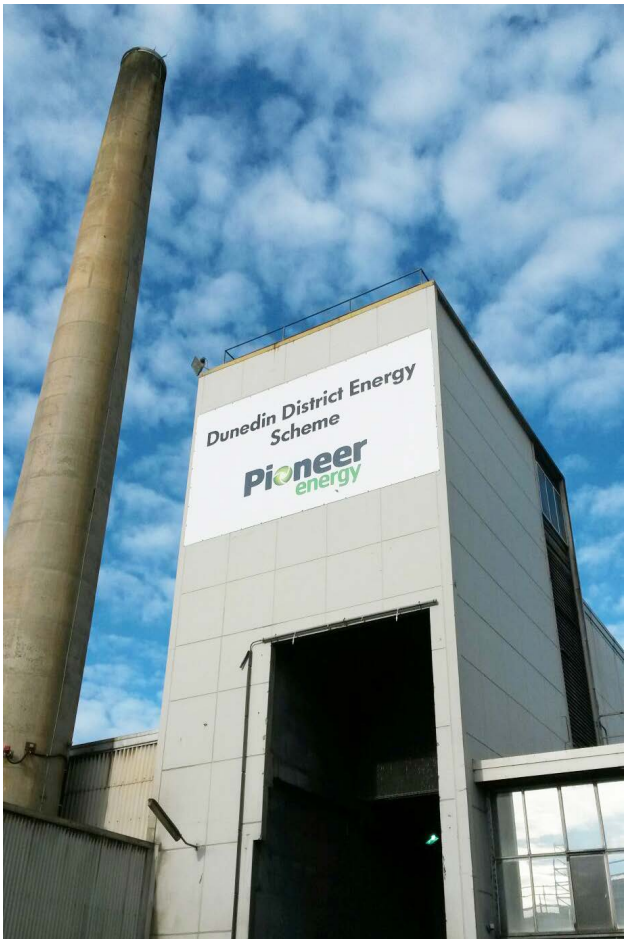
2 Improve energy efficiency of buildings and industry

As well as switching fuels, continued efforts are required to improve the energy efficiency of Ōtepoti Dunedin's buildings and industry. Increasing energy efficiency reduces overall energy consumption and has co-benefits such as lower energy bills and warmer homes that support better health.

In industry, achieving energy efficiency improvements often requires solutions tailored to the particular processes and equipment involved. In residential and commercial buildings, energy efficiency can be improved through better insulation and more efficient devices such as heat pumps and LED lightbulbs.

Central government has a programme of work underway to increase energy efficiency of new builds. This work includes the Building for Climate Change Programme and recent changes to the Building Code.

The University of Otago and Te Whatu Ora Southern have made significant changes to the way campus and hospital buildings are heated. The Dunedin Energy Centre, owned by Pioneer Energy, runs four boilers that supply heat to several hospital and campus buildings, as well as other local users of the heat. The boilers are being converted from coal to woodchip that can be sourced from local forestry residue. Investment by the University has already resulted in the conversion of one boiler, and Te Whatu Ora has secured central government funding to ensure all boilers will be run on woodchip by 2025. This change will support the city's emissions reduction efforts.



ACTION AREA 1 Support the transition to fossil-fuel free process heat

Moderate emissions reduction potential **Minor** co-benefits potential

In Ōtepoti Dunedin, most coal, LPG and diesel is used in non-residential settings, primarily to generate process heat.

'Process heat' is energy used for warming spaces and industrial processes. Many businesses, schools and public sector organisations in the city currently rely on fossil fuels for this purpose. Central government, through the Energy Efficiency and Conservation Authority (EECA), is financially supporting a large number of organisations and businesses to transition to use of biomass/biofuels or electricity.

Central government programmes will ensure coal use is phased out of the city's public sector buildings by 2025. EECA transition support programmes are being expanded, and the DCC has a role in ensuring relevant local businesses and property managers are aware of the opportunities and supports available to decarbonise their facilities and processes.

EECA is also coordinating work to identify and address the local barriers to process heat decarbonisation, particularly supply chain constraints (e.g. availability of biofuels, upgrades to electricity infrastructure). Following this work, DCC will consider implementing initiatives to support development of these low carbon alternatives for process heat, including through the Dunedin City Holdings Limited (DCHL) Carbon Roadmap (discussed under key shift 2 in the Communities and Economies chapter).

Opportunities to support the establishment and growth of bioeconomies will also be explored as the DCC refreshes Ōtepoti Dunedin's economic development strategy (discussed in Communities and Economies under key shift 3).

ACTION AREA 2 Replace fossil fuels and improve energy efficiency of DCC facilities

Minor emissions reduction potential **Moderate** co-benefits potential

The DCC uses significant amounts of LPG to heat buildings and pool facilities and to power the crematorium. Diesel is used at the Tahuna Wastewater Treatment Plant and other wastewater facilities, and in pumps associated with the 3 Waters network. A number of DCC facilities also consume large amounts of electricity.

The DCC will continue to phase out fossil fuels and increase energy efficiency at its facilities, with an initial focus on facilities with the highest energy demand.

ACTION AREA 3 Support energy efficiency and the transition away from fossil fuels in homes

Minor emissions reduction potential **Moderate** co-benefits potential

2018 census data shows there are still around 2,000 households in Ōtepoti Dunedin that rely on coal for heating, and over 3,000 that use gas heaters. Coal and gas heaters not only generate emissions but can also be harmful to health.

Central government's Warmer Kiwi Homes scheme helps households in lower income areas and those with a Community Services Card by funding the costs of insulation, LED lightbulbs, energy-efficient heaters, minor repairs, and efficient shower heads. However, there are many ineligible households that cannot access this support.

The DCC Energy Advisor provides free advice to property owners, developers, and tenants about how to improve the energy efficiency of their homes and new builds, including what funding they may be eligible for.

The DCC will explore how best to complement existing programmes with further measures that increase residential and community energy efficiency and address energy hardship. This could include promoting energy efficient builds and retrofits, supporting and encouraging measures that could be taken by central government and the ORC, as well as direct supports for households to improve energy efficiency and transition away from fossil fuel heating and cooking.

KEY SHIFT

3 Increase local renewable energy generation

The nationwide shift from fossil fuels to electricity will increase demand on the national electricity grid. Ōtepoti Dunedin can support national decarbonisation and improve the city's energy resilience by increasing local renewable energy generation.

ACTION AREA 4 Grow renewable energy generation from DCC-owned assets

◯ **Minor** emissions reduction potential ◯ **Moderate** co-benefits potential

A gas engine currently generates electricity from Green Island landfill gas.

The DCC will explore further opportunities for renewable generation associated with 3 Waters infrastructure and a solar farm on the Green Island landfill, once it is closed. Options for renewable energy generation associated with other DCC assets will be explored as part of ongoing energy efficiency and decarbonisation work programmes.

ACTION AREA 5 Grow renewable energy generation in the community

◯ **Minor** emissions reduction potential ◯ **Moderate** co-benefits potential

Uptake of household solar photovoltaics (PV) has increased in Ōtepoti Dunedin in recent years, and increasingly investors are considering larger scale solar farms. Solar has a potential role to play in improving the resilience of communities, particularly in the context of increasing numbers of electric vehicles.

Council controlled organisations may have a role in supporting the growth of renewable energy generation in the city. The DCC will explore opportunities through development of the DCHL Carbon Roadmap. The DCC will also explore options to promote or incentivise renewable energy generation on community assets and residential property.

KEY SHIFT

4 Reduce emissions from refrigerants

Many refrigerants used in heating/cooling systems have extremely high global warming potential (GWP) – some thousands of times more potent than carbon dioxide. There are lower GWP refrigerants available. Central government is progressing actions to reduce high GWP refrigerant imports and develop training for those handling and disposing refrigerants.

ACTION AREA 6 Reduce refrigerant emissions and liabilities

◯ **Minor** emissions reduction potential ◯ **Minor** co-benefits potential

Like many buildings in the city, the DCC owns facilities that have refrigerants. The DCC is working to reduce emissions from refrigerants as part of its ongoing asset management and renewals. The DCC will also publish information and guidance about refrigerant use and disposal and explore options to promote or incentivise low-GWP refrigerant conversions in commercial buildings.

WHAT MIGHT 2030 LOOK LIKE FOR RESIDENTS?

Today

"We're not sure what's worth spending money on so that our house is warmer."

"Burning coal is the cheapest way we can keep our house warm."

"We heard there might be subsidies for getting insulation, but where do we apply? "

"We're worried we'll get sick because our house is too cold."

In 2030

"It's easy for us to find out what subsidies and schemes are out there."

"We found a way to finance a new heatpump, which is much easier for us to manage and just as cheap as burning coal."

"We're about to move to a new home, built to a higher standard with an electric stove rather than gas. It's also better insulated."

CHAPTER 4

FORESTRY, LAND AND AGRICULTURE

This chapter is about land outside of urban areas and settlements – forests, farms, and other land uses. It is also about removing carbon from the atmosphere (offsetting or sequestration).

Agriculture produces 46% of Ōtepoti Dunedin's gross emissions, making it the city's largest emissions source. The forestry sector absorbs significantly more carbon than it emits, sequestering almost a third of the city's gross emissions.

CHAPTER OVERVIEW

The primary focus of this plan is to reduce emissions from activities in Ōtepoti Dunedin. However, reducing gross emissions takes time and some activities are harder to reduce than others. Some emissions sources will continue into the future – for example, waste already in landfill emits over many years as it decays. Offsetting may therefore be required to balance the amount of carbon emitted with what is absorbed from the atmosphere.

There are several types of offsetting. At a high level, these include: the city sequestering carbon within its boundary (for example, by planting trees) or purchasing offset "credits" from beyond its boundary. Further work and decisions by Council are required to determine the preferred approach to achieving the net zero target.

Regardless of decisions around offsetting, sequestration of carbon by Ōtepoti Dunedin's forests will play an important role in addressing climate change and the achievement of Zero Carbon targets – they already absorb a lot of emissions, helping to offset emissions released in other sectors. Sequestration in the city has increased significantly since the baseline year (and the amount of sequestration in the 2018/19 baseline year was also the lowest in the last five years).

To achieve 2030 targets without purchasing offset credits, Ōtepoti Dunedin would need to continue to increase sequestration to reach levels 20% above 2021/22 sequestration (which is 64% above 2018/19 levels). This increase in sequestration is aligned with the level He Pou a Rangi Climate Change Commission forecasted to occur between 2018 and 2030 under current policy settings. It is well below the 83% increase over the same period in the Climate Change Commission's demonstration path to meet national net emissions budgets.

Ōtepoti Dunedin also needs to reduce agricultural emissions by 11% (for both biogenic methane and nitrous oxide). This follows the Climate Change Commission's demonstration path for the period to 2030.

By 2030, **Ōtepoti Dunedin** will need to**:**

To support achievement of these key shifts, **the DCC** will**:**

HOW DO FORESTS INFLUENCE EMISSIONS?

Forests sequester (absorb) carbon from the atmosphere as trees grow. In 2021/22, Ōtepoti Dunedin's native forests absorbed 183,700 tCO_2e and exotic forests like pine absorbed 584,800 tCO_2e.

Harvesting of timber generates emissions because carbon that had been absorbed in trees and soil gets released. Emissions from forestry fluctuate over time because harvesting exotic forests is often cyclical, depending on the timing of trees maturing and the economics of harvesting. In 2021/22, emissions from harvesting were 275,300 tCO_2e.

In 2021/22, forests absorbed more carbon than was released by harvesting, sequestering 493,200 tCO_2e (equivalent to 32% of the city's gross emissions).

CHANGES IN EMISSIONS SINCE 2018/19

Gross agriculture emissions **reduced 3%** between 2018/19 and 2021/22, primarily due to an 8% reduction in the number of sheep in the city.

Emissions from fertilisers on land also **decreased 19%** due to a reduction in liming and dolomite fertiliser use.

Over this time, emissions from cows **increased 3%** due to an increase in cattle numbers.

Forestry emissions fluctuate due to planting and harvesting cycles. In 2021/22, sequestration was **36% higher** than 2018/19 because harvesting decreased and more trees were planted. The area of land covered by exotic forestry increased 6%.

KEY SHIFTS FOR THE CITY & ACTION AREAS FOR THE DCC

Two **key shifts** are required to reduce emissions from agriculture and increase sequestration of emissions in Ōtepoti Dunedin:

Under each key shift, **action areas** for the DCC are identified. Additionally, the DCC will also lobby and advocate to the central government to enable emissions reduction.

KEY SHIFT

1 Reduce emissions from agriculture

Unlike other high emissions industries, agriculture is not covered by the Emissions Trading Scheme (ETS). Central government has been working in partnership with the agricultural industry and Māori through He Waka Eke Noa, aiming to find practical solutions to reduce Aotearoa New Zealand's emissions from agriculture.

He Waka Eke Noa recommended that all farms over a certain size calculate their emissions and pay a levy for these emissions, to incentivise taking action to reduce emissions and increase on-farm sequestration. The money raised by the levy would then be invested back into agricultural emissions research and technology development. As at time of writing, no decisions had been made by the government about implementing these recommendations.

Beyond He Waka Eke Noa, there is research underway on various approaches to reduce emissions from animal digestion, including feeds and vaccines that may reduce methane from animal digestion and breeding animals that produce less methane. While there have been some promising results, further research is required.

Research shows that various farm management practices and infrastructure can reduce emissions. For example: effluent collection and biogas destruction (which can also be used to generate electricity); reduced/no cropping; reducing milking frequency; and reducing or stopping nitrogen fertiliser use. The government and industry bodies provide advice to farmers on farm management and ways to reduce emissions. However, there may be barriers to adopting these methods, including financial investment for infrastructure, time required and changing farm practices.

The ORC develops Land and Water Regional Plans and grants resource consents for agricultural activities, including expanding irrigation, changing pre-existing land use and effluent discharge. As a city council, the DCC does not have direct responsibilities relating to regulating farm management practices.

ACTION AREA 1 Support emissions reduction in agriculture

○ **Moderate** emissions reduction potential ◉ **High** co-benefits potential

The DCC will continue to work with the ORC on the development of a regional climate strategy, and through that, explore options to encourage and support emissions reductions from agriculture.

KEY SHIFT

2 Grow sequestration that aligns with mana whenua and community values

The primary focus of this plan is to reduce emissions from activities in Ōtepoti Dunedin. However, reducing gross emissions takes time and some activities are harder to reduce than others. Regardless of decisions around offsetting, sequestration of carbon by the city's forests will play an important role in addressing climate change and the achievement of Zero Carbon targets – they already absorb a lot of emissions, helping to offset emissions released in other sectors.

Science and national policies around sequestration are evolving. National policies such as the ETS have incentivised exotic forestry planting over recent years. The exotic forestry sector has helped to absorb carbon from the atmosphere, but ETS settings have also meant it is cheaper to plant trees to offset emissions than it is to reduce gross emissions.

Relying on increasing forest cover alone (without reducing gross emissions) is not an answer to the climate problem because the city will quickly run out of land to plant more trees. There can also be unintended impacts from exotic forestry, such as wilding trees and challenges relating to the management of slash. Native forests offer co-benefits such as for biodiversity, water quality, resilience to extreme weather events, and recreation. However, they tend to be slower growing (and therefore slower at absorbing carbon) than exotic forestry.

The government is reviewing ETS settings, including considering the role of permanent exotic forestry. On-farm sequestration is also being considered as part of He Waka Eke Noa.

International research has shown that wetlands, marine and coastal ecosystems (like mangroves and kelp) can soak up more carbon than land-based forests. This is called "blue carbon". Research is underway in Aotearoa New Zealand to better understand sequestration beyond forestry, including deep-sea kelp and coastal saltmarshes.

National and regional policies and strategies can influence local sequestration by offering incentives. How carbon capture is counted nationally/regionally is also important to consider because best practice for organisations wishing to offset is to ensure sequestration is additional (not double counted). However, city-level rules and methodologies are different to those for organisations.

Overall, it is important that local sequestration is responsive to local needs and values. As national and regional opportunities and policies become clearer, further engagement with mana whenua and the community will be required.

ACTION AREA 2 Support growth of sequestration that aligns with mana whenua and community values

High emissions reduction potential **High** co-benefits potential

The DCC is collaborating with other territorial authorities in Otago to investigate opportunities to sequester carbon across the region. This work includes the role of different types of sequestration, risks facing current carbon stocks, and potential implications and risks associated with growing different types of sequestration in the region. A related piece of work in development is the ORC's climate change strategy.

Following on from this work, the DCC will explore options to encourage and support growth in sequestration that aligns with mana whenua and community values, including the role of DCC and DCHL offsetting (if any).

CHAPTER 5

COMMUNITIES AND ECONOMIES

This chapter is about people – communities, networks, trading, services, employment, and relationships. It is also about food, as it is central to building strong local communities.

Activities undertaken in the city's communities and by the city's economies generate the emissions described in other chapters of this plan.

CHAPTER OVERVIEW

It is the actions of people – individuals and households, organisations and businesses – that ultimately generate and reduce emissions. Emissions from community and economic activities occur in each sector in this plan and have not been separately quantified in our city footprint.

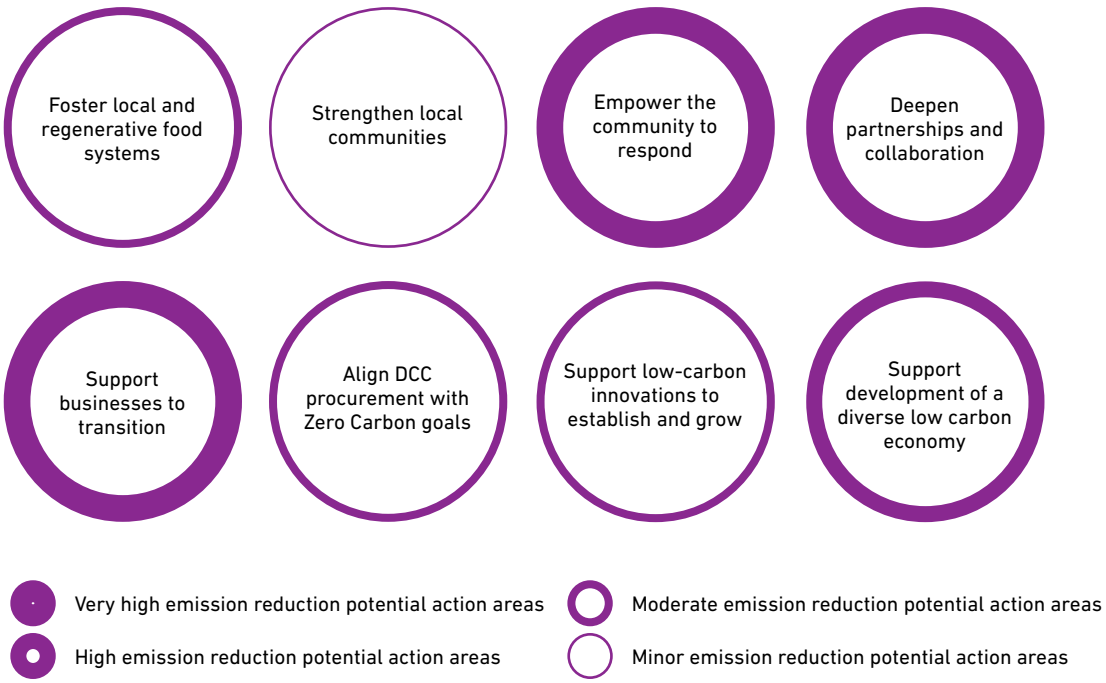
Climate change requires actions both at a systemic level and at a community level. To be successful, climate solutions must be appropriate for the local context and work for local people.

This chapter considers how to put the needs and ambitions of people at the heart of the city's climate response. It focuses on themes highlighted through community engagement and research, and covers communities, local businesses, local economy and other emerging forms of 'economies' (such as the sharing economy).

Ōtepoti Dunedin will need to:

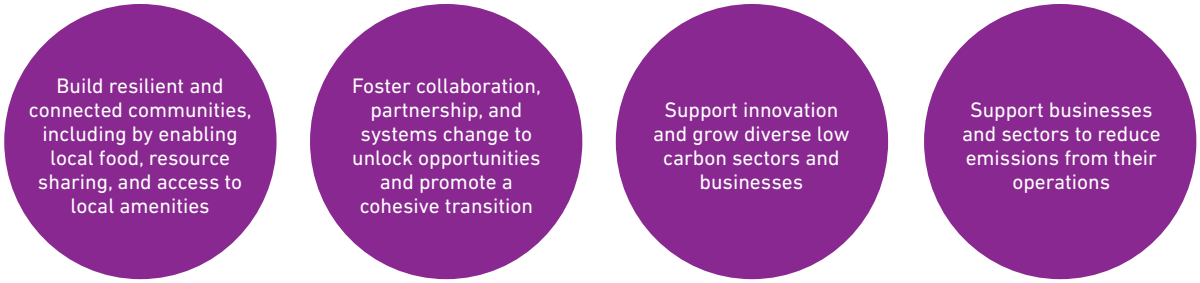
- Build resilient and connected communities, including by enabling local food, resource sharing, and access to local amenities
- Foster collaboration, partnership, and systems change to unlock opportunities and promote a cohesive transition
- Support innovation and grow diverse low carbon sectors and businesses
- Support businesses and sectors to reduce emissions from their operations

To support achievement of these key shifts, **the DCC** will:



KEY SHIFTS FOR THE CITY & ACTION AREAS FOR THE DCC

Four **key shifts** are required to reduce emissions produced by communities and economies in Ōtepoti Dunedin:



Under each key shift, **action areas** for the DCC are identified. Additionally, the DCC will also lobby and advocate to the central government to enable emissions reduction.

KEY SHIFT

1 Build resilient and connected communities, including by enabling local food, resource sharing, and access to local amenities

Connected, resilient communities are important for climate mitigation and adaptation. The spatial arrangement of communities is also an important enabler of emissions reduction as well as community connection and social cohesion (discussed under key shift 1 in the Transport and Urban Form chapter).

Many parts of the city have well-connected communities and place-based organisations that work together to support the local people. However, through engagement communities expressed a desire for greater community connection, collaboration, and resilience, something they see as key to unlocking opportunities for emissions reduction.

ACTION AREA 1 Foster local and regenerative food systems

Moderate emissions reduction potential **Very high** co-benefits potential

While emissions from Ōtepoti Dunedin's food supply have not yet been calculated, it is estimated that food systems contribute to 20-30% of total global emissions. A desire to be able to grow, prepare and share food together in communities was a key theme captured through community engagement.

There are limited fruit, vegetables and grains grown locally in Ōtepoti Dunedin. Supporting local and regenerative food systems will reduce emissions from food distribution and increase food resilience and provide opportunities for economic development. The DCC will continue its work to foster the growth of local and regenerative food systems by connecting food stakeholders, supporting innovation, developing 'produce local' and 'buy local' campaigns, and supporting food businesses and growers to access marketplaces.

ACTION AREA 2 Strengthen local communities

Minor emissions reduction potential **Moderate** co-benefits potential

Local engagement suggested that building community is very important to the city's residents. Research also suggests re-localising and increasing the sustainability and resilience of local and regional economies may contribute to a low carbon economy.

The DCC will continue to support community building through grants, events and its work with the community. It will consider additional funding to support community building, including ensuring there is direct support available to communities wanting to progress their own emissions reduction solutions. Many other actions in this plan will also support the growth of stronger local communities, for example, through actions around food, community resource hubs, and active transport.

ACTION AREA 3 Empower the community to respond

Very high emissions reduction potential **Moderate** co-benefits potential

Many of the actions listed in this plan are enabling: services or infrastructure the DCC can provide to support residents and businesses to reduce emissions. For example, the DCC will provide a kerbside organics collection service.

However, emissions reduction will only be realised when services and infrastructure are used by members of the community. A key theme to emerge from engagement was the need for clearer information about the most effective actions local people can take to reduce emissions, and the services and infrastructure available to support them in those actions. Many stakeholders reinforced the importance of working directly with schools and community groups to make information directly relevant to people. The DCC will work with the community to catalyse emissions reduction with clear, targeted communication.

KEY SHIFT

2 Foster collaboration, partnership and systems change to unlock opportunities and promote a cohesive transition

Achieving wide-scale decarbonisation across the economy requires a systems approach. For example, businesses and communities cannot effectively decarbonise without access to renewable energy and low-emissions transport infrastructure, but these solutions often cannot be developed without community support and investment. Achieving this systemic change requires coordination, collaboration, and partnerships.

ACTION AREA 4 Deepen partnerships and collaboration

Very high emissions reduction potential **High** co-benefits potential

Partnerships and collaboration are important enablers of the transition to a low carbon future – very few actions in this plan can be achieved by the DCC alone, and Zero Carbon targets will only be achieved through actions of the whole community.

Ensuring that all DCC activities minimise emissions and contribute to the achievement of emissions reduction targets will maximise the DCC's opportunities to support and influence emissions reduction at a city-wide scale. This is being achieved through implementation of the DCC's Zero Carbon Policy.

A key cross-cutting partnership in the city is the Zero Carbon Alliance (members currently include the University of Otago, Te Whatu Ora – Southern, Te Pūkenga - Dunedin Campus, the ORC and the DCC). The Alliance is focused on collaboration to reduce both organisational and city emissions. The DCC will continue to support and collaborate with Alliance members, to expand the focus of work, and to support growth of the Alliance as appropriate.

The DCC will also continue to encourage and support council-controlled organisations to reduce emissions and contribute to city-wide emissions reduction efforts, including supporting implementation of the DCHL Carbon Roadmap. The DCC will work with other councils in the Otago region to advance regional emissions reduction strategy and opportunities.

The DCC has many other existing partnerships that will help reduce emissions in the city. Many action areas in other chapters of this plan require the DCC to support and work alongside partners, stakeholders and the community. Some actions specifically aim to enable collaboration, such as supporting a new collaborative group to develop strengthened circular economies (discussed under key shifts 1 and 2 in the Resource Use and Waste chapter) or involve supporting and encouraging existing partners to take emissions reduction actions (discussed in relation to a number of key shifts under the Transport and Urban Form chapter).

KEY SHIFT

3 Support innovation and grow diverse low carbon sectors and businesses

Reaching a low carbon future will require everyone to do things differently: finding or learning different ways to solve the problems traditionally solved with fossil fuels. To enable this change, a wide array of innovations needs to spread rapidly and at scale. A low carbon economy, that is also resilient to the impacts of climate change, needs to be diverse.

The national emissions reduction plan includes a focus on developing a portfolio of climate-focused innovation, as well as scaling up and reorienting existing central government-funded programmes to generate the knowledge and technologies needed to tackle climate change, including through science and research.

Innovation spans areas including business models, processes, services and technology. Innovation is not just about invention; it starts with a concept and continues to the point of widespread adoption. Often there are significant barriers in the adoption phase.

ACTION AREA 5 Support low carbon innovations to establish and grow

○ **Moderate** emissions reduction potential ◉ **High** co-benefits potential

Innovations may be progressed by start-ups, commercial enterprise, social enterprise, or communities. In Ōtepoti Dunedin, there are several start-ups that support emissions reduction – from reducing textile waste to landfill, converting petrol/diesel vehicles to EVs, converting bicycles to e-bikes, to providing food to those in need while diverting hundreds of tonnes of commercial food from landfill every month. These are success stories, but engagement suggested that local residents, organisations and businesses seeking to innovate around emissions reduction face significant barriers to realising their ideas.

The DCC will develop a programme to support services/projects with high or innovative emissions reduction potential to establish or expand in the city. This support will focus on innovation for emissions sources for which there are no current solutions in Ōtepoti Dunedin, and on making progress on action areas in this plan with potential for significant impact. This support may be financial (grants) as well as in-kind (for example, support from staff or to lease property). The DCC will also explore ways to incentivise entrepreneurs to tackle emissions and support start-ups that aim to contribute significantly to emissions reduction goals.

ACTION AREA 6 Support development of a diverse low carbon economy

◉ **High** emissions reduction potential ○ **Moderate** co-benefits potential

A low carbon economy is made up of businesses and sectors that contribute to the economy but do not produce significant amounts of carbon.

The DCC supported the establishment of the Centre of Digital Excellence (CODE) which aims to enable the expansion of an equitable and sustainable video game development industry.

The DCC will explore opportunities to support the establishment and growth of diverse low carbon sectors in the city, such as sharing and circular economies, or bioeconomies, as it refreshes Ōtepoti Dunedin's economic development strategy. This includes opportunities to work with the private sector because achieving economic diversification will require input, expertise, and investment from the private sector.

The Bikes at SYD programme run by Southern Youth Development involves working with young people to restore bikes that may have otherwise ended up in landfill, so they can be gifted back to those who need them. The programme, supported by the DCC, saves at least 500 bikes a year from landfill and make active transport options more accessible to many people in Dunedin. The rangatahi involved are empowered with skills in how to use tools safely and care for a bike.

KEY SHIFT

4 Support businesses and sectors to reduce emissions from their operations

Globally, the transition to a low carbon economy is accelerating – so not taking climate action (or acting too slowly) is becoming riskier for high-emitting businesses. For example, many customers and trading partners are aiming to reduce emissions from their supply chains and are focusing more on emissions from goods they purchase. There may also be changes to national policy and regulatory settings to speed up decarbonisation, for example changes to the Emissions Trading Scheme (ETS), or procurement settings.

Central government agencies are now mandated to consider emissions reduction through procurement, and to prioritise specific low emissions technologies in procurement.

Prioritising support for smaller firms is important because larger and more mature firms are more resilient to shocks and often have the ability to dedicate staff to understanding and navigating the transition. In Ōtepoti Dunedin, most business units are small-to-medium enterprises (SMEs).

ACTION AREA 7 Support businesses to transition

● **Very high** emissions reduction potential ○ **Moderate** co-benefits potential

Assisting businesses to transition to low carbon operations will not only reduce the city's emissions, but also help businesses to be more resilient to climate-related demand or regulatory changes.

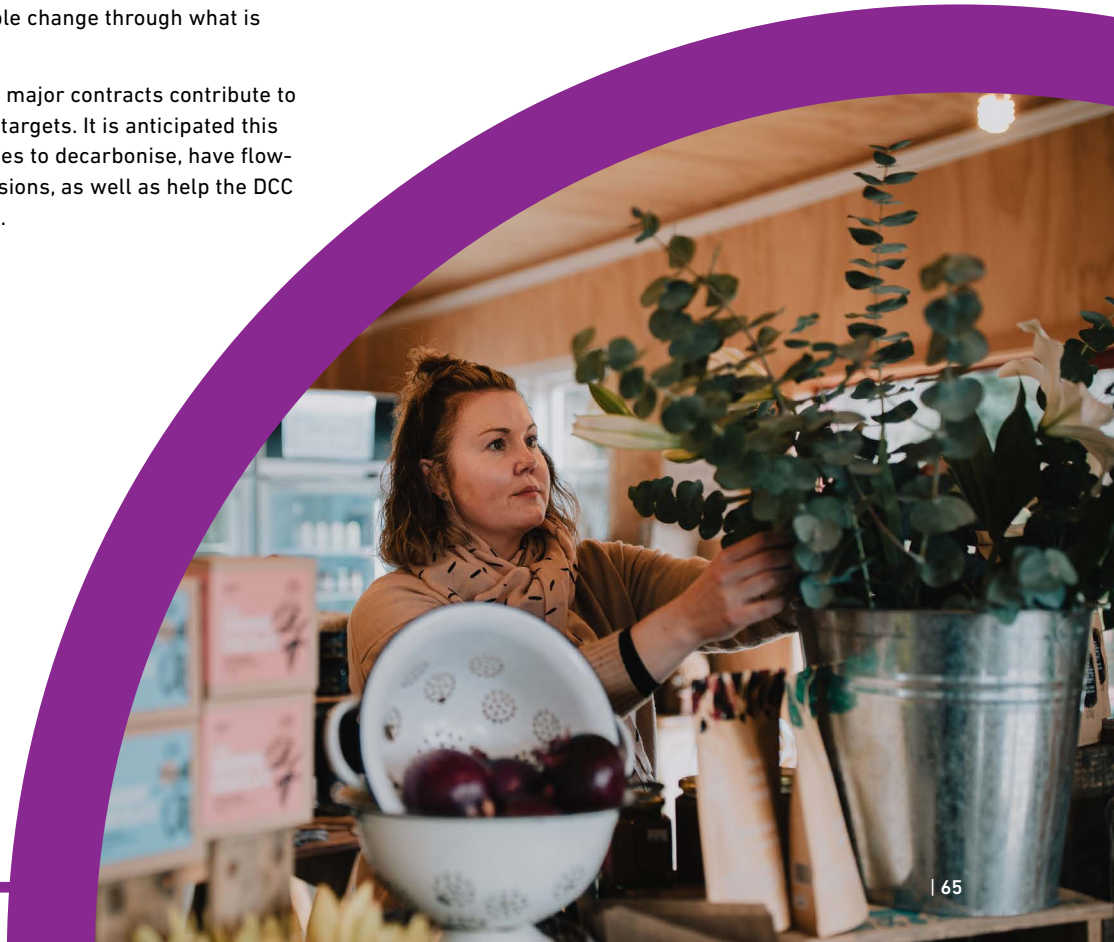
Local government programmes elsewhere have successfully supported local businesses to measure and plan to reduce emissions, for example the Great South Carbon Neutral Advantage. The DCC will work with community partners to develop a business support programme for local businesses, providing guidance around measuring and reducing emissions from their operations, including showcasing successful low-carbon businesses and supporting businesses to access funding from third parties.

ACTION AREA 8 Align DCC procurement with Zero Carbon goals

○ **Moderate** emissions reduction potential ◯ **Minor** co-benefits potential

The public sector is a significant purchaser of goods and services, and therefore can enable change through what is purchased.

The DCC is working to ensure its major contracts contribute to the achievement of Zero Carbon targets. It is anticipated this work will support local businesses to decarbonise, have flow-on reductions for the city's emissions, as well as help the DCC to reduce its emissions footprint.



PART 3: APPENDICES

Appendix 1: Glossary

Bioeconomies	An economy that involves using renewable biological resources sustainably to produce food, energy, services and goods.
Biogenic methane; methane	Methane produced from biological (plant and animal) sources. Methane is a type of greenhouse gas that is short-lived in the atmosphere but with a global warming potential 34 times that of carbon dioxide.
Biosolids	Solid organic matter recovered from the wastewater treatment process.
Carbon footprint	The total amount of greenhouse gases emitted from an organisation, a geographical area or an activity over a period of time. Also referred to as greenhouse gas emissions inventory.
Circular economy, circularity	A model of production and consumption that involves designing out waste, sharing and using and reusing resources for as long as possible.
Co-benefits	Added benefits derived from an activity, for example, in terms of public health, social wellbeing, etc.
Composting	The natural process of recycling organic matter that returns the nutrients to the soil.
Demonstration path	Refers to the New Zealand Climate Change Commissions' modelling of how the country could reach its emissions reduction targets.
Dunedin City Holdings Limited (DCHL)	A council controlled organisation owned by the DCC, which oversees eight subsidiary and associate companies that own and manage key city assets and provide benefit to the city.
Energy Efficiency and Conservation Authority (EECA)	A government agency of Aotearoa New Zealand, responsible for promoting energy efficiency and conservation.
Emissions	The production of greenhouse gases, or simply greenhouse gases produced by human activity.
Emission inventory	The total amount of greenhouse gases emitted from an organisation, a geographical area or an activity over a period of time. Also referred to as carbon footprint.
Emissions Trading Scheme (ETS)	A market-based approach employed by the government of Aotearoa New Zealand to reduce the country's greenhouse gas emissions. It puts a price on emissions by charging certain sectors of the economy for the greenhouse gases they emit. Further details can be found at www.epa.govt.nz/industry-areas/emissions-trading-scheme/about-the-nzets
'Fair share' approach to emissions reduction	A 'fair share' approach includes considering both global emissions budgets and the country/city's relative development (for example, the Human Development Index).
Fossil fuel	A hydrocarbon-containing material derived from the remains of dead plants and animals extracted from the Earth's crust, that is burned as fuel. Examples include coal, oil and natural gas.

Global warming potential (GWP)	A measure of how much heat a greenhouse gas emitted to the atmosphere would absorb over a period of time (how much it heats the atmosphere) compared to carbon dioxide. GWP for carbon dioxide is 1. All tCO_2e figures included in this plan are based on the Intergovernmental Panel on Climate Change's (IPCC) AR5 100 year GWPs with climate carbon feedback.
Greenhouse gas	A gas that absorbs and emits heat in the Earth's atmosphere. Examples include carbon dioxide, methane, water vapour, nitrous oxide and ozone.
Gross emissions	The total amount of greenhouse gases produced through human activity over a period of time by an organisation, a geographical area or another type of entity. They include emissions from agriculture, transport, stationary energy, waste, and industrial processes and product use. Gross emissions exclude sequestration.
He Waka Eke Noa	A partnership programme that aims to support farmers and growers to reduce primary sector emissions through empowering farmers and growers to measure, manage and reduce on-farm emissions, and maintain or increase sequestration on farms. Also known as the Primary Sector Climate Action Partnership.
Industrial processes and product use (IPPU)	Greenhouse gases produced from industrial processes, the use of greenhouse gases in products, and from non-energy uses of fossil fuels. Examples include gasses emitted from refrigerants, foam blowing, fire extinguishers, aerosols, metered dose inhalers and electrical insulation.
Intergovernmental Panel on Climate Change (IPCC)	The Intergovernmental Panel on Climate Change is an intergovernmental body of the United Nations. Its job is to advance scientific knowledge about climate change caused by human activities.
Inter-regional travel	Refers to travel between regions, such as travel between Dunedin/Otago to Christchurch/Canterbury.
Intra-regional travel	Refers to travel within a particular region, such as Otago.
Liquefied petroleum gas (LPG)	A type of fossil fuel gas commonly used in heating appliances, cooking equipment and vehicles.
Methane	Methane (CH_4) is a type of greenhouse gas that is short-lived in the atmosphere but with a global warming potential 34 times than that of carbon dioxide. It can be produced from biogenic sources (see biogenic methane) and non-biogenic sources (such as burning fossil fuels).
Mixed use	A type of urban design and zoning classification that allows for multiple uses such as residential, commercial, cultural, etc.
Net emission	The sum of gross emissions and sequestration (amount emitted – amount sequestered).
Net zero	Net zero emissions refers to a state of overall balance between gross emissions and sequestration, when net emissions = 0.
Nitrous oxide	Nitrous oxide is a type of greenhouse gas that is long-lived in the atmosphere with a global warming potential 298 times that of carbon dioxide. It is emitted in land use, agricultural, industrial, and wastewater processes.

Organisation for Economic Co-operation and Development (OECD)	An intergovernmental organisation that aims to stimulate economic progress and world trade.
Pre-industrial	The reference period of 1850 to 1900, as referred to by the Intergovernmental Panel for Climate Change (IPCC).
Process heat	Heat used during industrial processes and for warming buildings/spaces.
Recycling	The process of converting waste into new materials and objects.
Regional Land Transport Plan (RLTP)	Statutory plan that sets out a region's land transport objectives, policies, and measures as well as providing a statement of transport priorities for the region.
Regional Public Transport Plan (RPTP)	Statutory plan that sets out a region's objectives and policies for delivering public transport, as well as details of the current and proposed future public transport network over a 10 year period.
Renewable energy generation	Energy made from natural resources that replenish more quickly than they are used. Examples include energy generated by sunlight and wind.
Resource	Physical materials and objects.
Sector	Overarching sources of emissions. In the Zero Carbon Plan, Dunedin's emissions are categorised into emissions from the waste sector, transport sector, stationary energy sector, agricultural sector, and industrial processes and product use (IPPU) sector.
Sequestration	The absorption of carbon dioxide from the Earth's atmosphere by trees and other plants.
Sharing economy	A socio-economic system in which assets and services are shared.
Shore power	The provision of energy at ports to power ship at berth while its main engines are shut down.
Solar photovoltaics (PV)	The conversion of light into electricity through the use of semiconducting materials. Solar panels are made up of cells constructed from semiconducting materials. A type of renewable energy generation.
tCO_2e	Short for tonnes of carbon dioxide equivalent, it is a standard unit to measure the quantities of greenhouse gases.
Vehicle Kilometres Travelled (VKT)	A measure of transport activities in terms of distances travelled by vehicles.

Appendix 2: How the plan was developed

The Zero Carbon Plan was developed in a number of overlapping steps.

1 Review of iwi and other cities' plans

Other emission reduction plans, particularly those developed by local government and iwi in Aotearoa New Zealand, were reviewed to provide insights into plan development, structure, and possible actions. Over 16 plans were reviewed.

2 Update of Dunedin's carbon footprint

An update to Dunedin's carbon footprint was completed, including improvements to methodology, to ensure that the Plan was based on an up-to-date understanding of the city's emissions sources and trends.

3 Emissions pathways modelling

Modelling was undertaken to determine the order of magnitude of emissions reduction required from each sector to achieve Ōtepoti Dunedin's Zero Carbon targets, and to approximate the degree of change required from key emissions sources or activities within each sector (for example, in the Transport chapter, the model included a 42% reduction in transport emissions, with 18% of all trips by bike by 2030). A model used by other councils to develop emissions reduction plans was updated to reflect Ōtepoti Dunedin's context. Feedback on initial versions of the modelling was sought from external and internal experts and stakeholders. The model was further refined based on to optimise achievability while still aligning with the Zero Carbon targets. The final version of the model was reviewed by external technical experts.

4 Public and stakeholder engagement

Engagement and outreach to inform Zero Carbon Plan development focused on understanding barriers and opportunities to emissions reduction for residents, organisations and businesses. A public survey was conducted that received over 1300 responses. DCC staff spoke directly with over 50 community groups, businesses and organisations. Feedback received by the DCC from the public via other avenues was also taken on board (e.g. Annual Plan submissions, Future Development Strategy engagement, public form presentations). Engagement also involved a number of subject matter experts. The DCC is grateful to everyone who contributed to the development of this Plan.

Insights and suggestions have been incorporated into the Plan. Key overarching themes from engagement included the following.

- Many people would like Dunedin to have better public and active transport, and better waste systems.
- There are a lot of barriers for people to adopting lower carbon lifestyles. These barriers differ across communities, both geographic and demographic, but there are common themes, including limitations of infrastructure/services and personal time/capability/knowledge.
- People and businesses seeking to innovate around solutions also identify barriers, especially access to funding/support, and access to land/buildings.
- Providing clear information, and working directly with schools and communities, will be essential for success.

5 Research and insights on key shifts

Research and analysis was undertaken to inform the identification of actions for each sector. Sources included the following.

- 2021/22 Dunedin City emissions footprint report and data.
- Additional data about key emissions sources and activities (for example studies of waste composition at Green Island Landfill, consenting data).
- Other relevant modelling undertaken by the DCC, government agencies and He Pou a Rangi Climate Change Commission (e.g. transport, emissions modelling).
- Academic articles and articles authored by experts in relevant fields and conversations with experts.
- Government plans and policies relating to emissions reduction or key emissions sources.
- Plans and reports about emissions reduction actions in other cities/countries.
- Government publications about emissions reduction modelling.
- Government publications that show government emissions reduction modelling and assumptions.
- Government publications about strategic priorities for different sectors, direction for local authorities, and what government actions are underway or planned.

6 Working with teams across the DCC, and key stakeholders

The DCC team developing the plan have worked closely with other teams across the DCC, and other key stakeholders e.g. Zero Carbon Alliance partners. This work included considering the emissions reduction potential of existing plans and actions, as well as plans and actions that are currently in development (e.g. *Ōtepoti Dunedin Pathways – a walking and cycling action plan*). It also involved identifying additional actions that might be required to support achievement of targets, and reviewing draft Plan content.

7 Developing and applying a measurement framework for action areas

The DCC's action areas have been assessed in a number of ways:

i Emissions reduction potential

This assessment evaluated the potential impact of each DCC action area, on emissions reduction outcomes. The assessment considered the following.

- The total emissions reduction from each emissions source under the modelled net zero 2030 scenario.
- How much could DCC realistically influence the modelled emissions reduction from each source.
- The relative contribution of each DCC action area to reducing emissions from each source.

From this assessment, an overall emissions reduction potential score was developed to reflect the contribution of each action area to emissions reduction targets.

ii Co-benefits potential

This assessment evaluated the co-benefits that could be realised through DCC work on each action area. Potential impacts on social, economic, environmental, and cultural wellbeing were assessed. These assessments were combined into an overall co-benefit score.

iii Other considerations

DCC action areas were also assessed to determine:

- alignment with the Māori Strategic Framework
- feasibility and timing
- type of role for the DCC
- funding and resourcing status
- potential partners and co-funders for new action actions.

Appendix 3: How progress will be measured

The DCC reports on its activities and outcomes in a number of ways. For example, the 10 Year Plan includes Levels of Service and progress against these is reported on in Annual Reports. Staff also provide publicly accessible update reports to the Council about progress against work programmes.

The city's emissions footprint will continue to be measured at least triennially to track changes in emissions. However, because changes in infrastructure and behaviour take time, changes in some emissions sources may not immediately be seen. Emissions reduction may also not be linear; for example, a completed network of cycleways will have a larger impact on travel choice than the addition of a single stand-alone cycleway.

A more detailed measurement framework will be developed to assist with reporting on the Zero Carbon Implementation Plan, and will be reported to the Council on an annual basis. These measurements are likely to be focused on the delivery of anticipated outputs.

We would like to thank all those that have contributed and provided feedback as part of developing this plan.

For ongoing updates please visit **www.dunedin.govt.nz/zerocarbon**

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