



# Managing New Zealand's International and Domestic Aviation Emissions

New Zealand's response to the  
International Civil Aviation Organisation  
2010 Assembly Resolution A37-19  
and 2013 Assembly Resolution A38-18

September 2016





## Acknowledgements

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Air New Zealand



Qantas



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## Executive summary

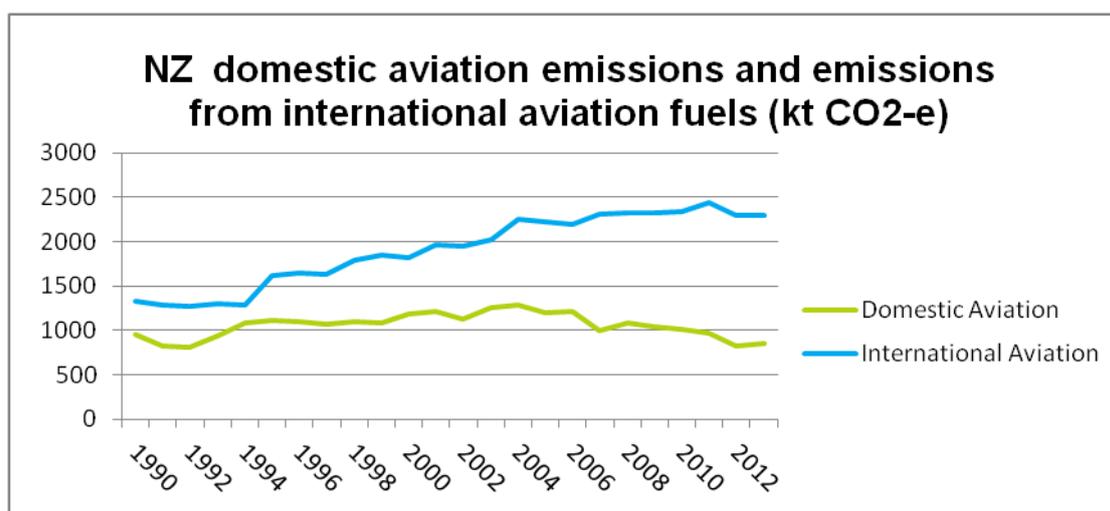
New Zealand is a small island nation in the South Pacific – aviation connects New Zealanders with each other and with the rest of the world.

The economy of New Zealand depends greatly on international trade, mainly with Australia, the European Union, the United States, China, South Korea and Japan. Tourism is a big part of our economy. For the year ended March 2015, tourism generated a direct contribution to GDP of \$10.6 billion, or 4.9 percent of GDP<sup>1</sup>.

### Actual and projected emissions

Since 1990, there has been a general increase in emissions from aviation fuel sold in New Zealand for outbound flights to an international destination. This growth has slowed somewhat in recent years<sup>2</sup>. These aviation emissions are reported as memo items by New Zealand in its National Inventory. During this time period domestic aviation emissions overall have declined slightly.

**Figure 1: New Zealand domestic aviation emissions and emissions from international aviation fuels sold in New Zealand for outgoing flights<sup>3</sup>**



From 1990 to 2013, domestic aviation has recorded a steady decrease in aircraft movements, but domestic air passenger departures have been increasing over a similar period. This reflects the shift to Air New Zealand operating larger aircraft.

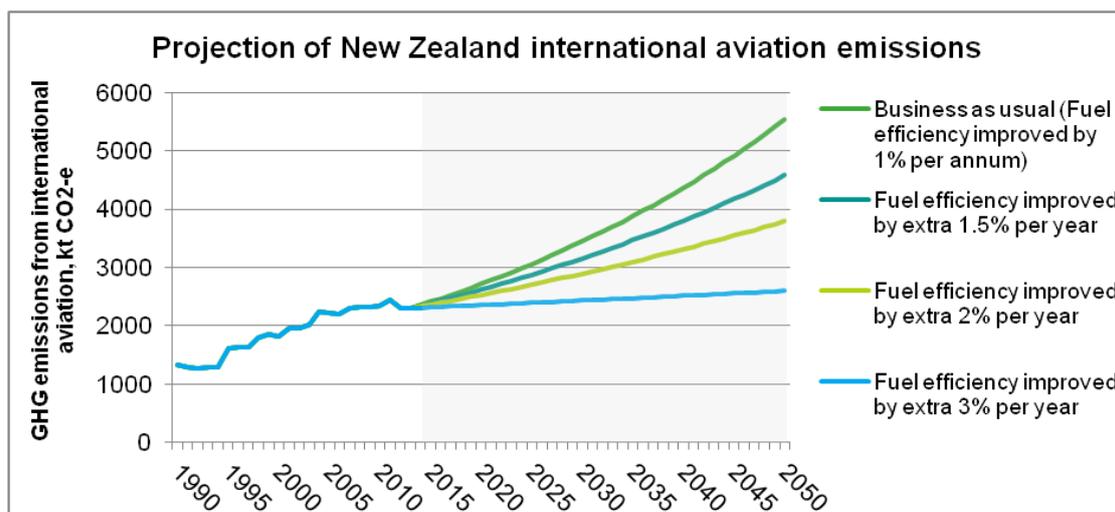
<sup>1</sup> Source: [http://www.stats.govt.nz/browse\\_for\\_stats/industry\\_sectors/Tourism/tourism-satellite-account-2015.aspx](http://www.stats.govt.nz/browse_for_stats/industry_sectors/Tourism/tourism-satellite-account-2015.aspx)

<sup>2</sup> New Zealand accounts for 0.62 percent of total international RTKs. <http://www.icao.int/Meetings/GLADs-2016/Documents/RTK.pdf>

<sup>3</sup> This Ministry of Transport summary graph uses two data sources: <http://www.transport.govt.nz/ourwork/tmif/environmental/ei001/> and <http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/greenhouse-gas-emissions>

During the same time period, emissions from aviation fuel sold in New Zealand for outbound flights to an international destination (hereafter referred to as New Zealand international aviation emissions) have increased. This increase is attributed to favourable economic conditions for international air travel and the growing attractiveness of New Zealand as a visitor destination. International air travel is forecast to continue to grow over time, and the projected impact on New Zealand international aviation emissions is outlined in Figure 2 below. New Zealand’s action plan covers both our international and domestic aviation emissions.

**Figure 2: Ministry of Transport projection of New Zealand international aviation emissions**



### Measures aimed at reducing emissions

New Zealand has implemented and plans to implement a number of measures aimed at reducing emissions from aviation.

New Southern Sky<sup>4</sup> (NSS) is New Zealand’s 10-year programme to modernise its airspace and air navigation system. NSS provides a clear direction for incorporating new technologies into New Zealand’s aviation system to 2023, with a key outcome being reduced emissions from aviation.

At a government level, the New Zealand Government is active in managing emissions overall and has programmes in place across various sectors.

The New Zealand Emissions Trading Scheme (NZ ETS) is the Government’s principal policy response to climate change. The NZ ETS puts a price on greenhouse gas emissions. Emissions associated with domestic aviation fuel use are captured by the NZ ETS, and reporting and offset/surrender obligations are required. The NZ ETS was established by legislation in 2008, and was the first major ETS to affect airlines<sup>5</sup>.

<sup>4</sup> <http://www.nss.govt.nz/>

<sup>5</sup> <http://www.greenaironline.com/news.php?viewStory=1126>

Airways Corporation of New Zealand (Airways), New Zealand's air navigation service provider, is committed to reducing New Zealand's aviation carbon emissions through a number of programmes that use sophisticated aviation systems allowing airlines to fly direct routes with a minimum of delay. These systems are enabling Airways' customer airlines to avoid 37,000 tonnes of CO<sub>2</sub> emissions each year.

The two main international airlines that have aircraft registered in New Zealand are Air New Zealand and JetConnect (a subsidiary of Qantas Group)<sup>6</sup>. Air New Zealand and Qantas Group (the owner of JetConnect), both members of the International Air Transport Association (IATA), have committed to IATA's targets on fuel efficiency and carbon emissions:

- 1.5 percent average annual fuel efficiency improvement between 2010 and 2020.
- Carbon neutral growth from 2020.
- A reduction of 50 percent in net emissions by 2050 compared to 2005 levels.

Air New Zealand gives its customers an opportunity to make a voluntary contribution to the Air New Zealand Environment Trust. Customers can also contribute money towards certified offsets purchased by Air New Zealand.

Additionally, Air New Zealand flew one of the aviation industry's first biofuel test flights back in 2008. This flight saved nine tonnes in CO<sub>2</sub>, and proved the technical feasibility of using alternative fuels. The test flight also provided supporting data for the subsequent ASTM<sup>7</sup> certification of plant-based biofuels for commercial airline operations. In 2016 Air New Zealand and trans-Tasman alliance partner Virgin Australia issued a joint aviation biofuel request for information to the market, seeking a significant supply of aviation biofuel in Australasia from 2020.

Air New Zealand was also the first commercial airline in the world to take delivery of a Boeing 787-9 Dreamliner aircraft. Air New Zealand also implements a range of fuel efficiency measures within its operation, including just-in-time fuelling, and single engine taxi.

Qantas<sup>8</sup> was among the first airlines in the world to introduce a voluntary carbon offset program – Fly Carbon Neutral – in 2009. It is now the largest program of its kind in the world, having offset more than 2 million tonnes in CO<sub>2</sub>, with around 7 percent of customers choosing to offset.

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<sup>6</sup> In the airlines section of this action plan (section 6) the measures of Air New Zealand and Qantas Group (the owner of JetConnect and Jetstar) are covered.

<sup>7</sup> ASTM International (formerly known as the American Society for Testing and Materials) is a globally recognised leader in the development and delivery of voluntary consensus standards.

<sup>8</sup> JetConnect (a subsidiary of Qantas Group) is an international airline with aircraft registered in New Zealand and JetStar (also a subsidiary of Qantas Group) is one of the two dominant operators in New Zealand's domestic aviation market. Qantas Group advances are expected to improve the efficiency of its subsidiaries operations.

Qantas has also commenced a world leading fuel data and analytics partnership with GE Aviation. To reduce fuel consumption and carbon emissions, this work integrates flight data with operational data (flight logs, flight plans and load sheets), weather data, trajectory correction, navigation databases and terrain data. It is expected to deliver innovative ways to monitor and improve operation (how the aircraft is flying and how it is being flown) in specific operational domains.

The New Zealand Government is engaging proactively in the ICAO-led process to establish a market-based mechanism for international aviation emissions.

The measures outlined in this report, along with the commitment of our Government, air navigation service provider, airlines, and airports to ongoing monitoring and research, form the substance of New Zealand's actions to reduce harmful emissions from aviation.

# 1 Introduction

## 1.1 Background

International aviation emissions currently account for less than 2 percent of total global CO<sub>2</sub> emissions, but are projected to grow as a result of the continued development of the sector. While the overall contribution may be small, emissions from international aviation are growing faster than almost any other sector. The aviation industry has been able to achieve significant improvements in fuel efficiency as a result of aircraft technology and more efficient operational procedures (such as more direct flight paths), but these improvements have been offset by even stronger growth in demand for international air transport.

Over the next 20 years, the International Air Transport Association (IATA) predicts fuel efficiency to improve by around 1.5 percent per annum, while air passengers are expected to grow by around 4.5 percent per annum (to 7.4 billion in 2034). The Intergovernmental Panel on Climate Change estimates that aviation's contribution to climate change could grow to 5 percent by 2050 if no action is taken to reduce emissions.

### **International treatment of aviation emissions**

The international aviation and shipping sectors are not included in the recent Paris Agreement, which was negotiated under the United Nations Framework Convention on Climate Change (UNFCCC). The precedent for excluding these sectors from global climate agreements was set in 1998, when both sectors were excluded from national targets established under the Kyoto Protocol. This was largely due to a lack of agreement on how emissions should be attributed to particular States. Instead, the Parties to the Kyoto Protocol agreed to work through the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO), respectively, to pursue emissions reductions in those sectors.

Emissions from aviation fuel sold in New Zealand for outbound flights to an international destination are reported as memo items by New Zealand in its National Inventory. The New Zealand international aviation emissions data presented in this action plan is based on this calculation, which follows the Intergovernmental Panel on Climate Change (IPCC) definition for international traffic.

In terms of emissions from domestic aviation, these are measured based on all aviation fuel purchased for a flight taking off in New Zealand with a destination in New Zealand. Where an international flight has a domestic leg, the domestic leg fuelling will be coded separately from the international leg, and the domestic leg emissions will be counted as domestic emissions.

## Action Plans

In October 2010, the 37<sup>th</sup> ICAO Assembly adopted Resolution A37-19: Consolidated statement on continuing ICAO policies and practices related to environmental protection – Climate change. The provisions in Resolution A37-19 build upon ICAO's past achievements and incorporate new elements relating to international aviation and climate change. One such element is for States to voluntarily prepare and submit action plans to ICAO outlining States' policies and actions to reduce international aviation CO<sub>2</sub> emissions. It is expected the plans will outline the policies and actions that States are pursuing to reduce international aviation emissions, and establish baseline data and projections so that progress can be measured. New Zealand's action plan covers both domestic and international aviation. In October 2013, the 38<sup>th</sup> Assembly reaffirmed Resolution A37-19 through Resolution A38-18.

This document represents New Zealand's aviation emissions action plan. While Air New Zealand flies less than 40 percent of international seats into and out of New Zealand, it is responsible for the majority of international aviation emissions by New Zealand registered airlines<sup>9</sup>. Air New Zealand has already taken a number of actions to reduce its environmental impact (such as investing in more efficient aircraft, auditing fuel use and onboard weight, using just-in-time fuelling, reviewing ground operations to maximise ground power use, and conducting trial flights using biofuels).

New Zealand's action plan covers both our international and domestic aviation emissions.

### 1.2 Brief description of New Zealand

New Zealand is in Oceania, in the South Pacific Ocean, and is remote from global centres of economic activity. It has a land area of 267,710 square kilometres (103,738 sq. mi), making it slightly smaller than Italy and Japan and a little larger than the United Kingdom.

The geography of New Zealand encompasses two main islands (the North and South Islands, Te Ika-a-Māui and Te Waipounamu in Māori) and a number of much smaller islands. New Zealand varies in climate, from cold and wet to dry and subtropical in some areas, and most of the landscape is mountainous.

New Zealand has a mixed economy<sup>10</sup> which operates on free market principles. New Zealand's GDP is about NZ\$250 billion. It has sizeable manufacturing and service sectors complementing a highly efficient agricultural sector. Exports of goods and services account for around one third of real expenditure GDP.

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<sup>9</sup> The other international passenger airline, Jetconnect, operates services between New Zealand and Australia. It has a fleet of eight Boeing 737-800.

<sup>10</sup> An economic system combining private and state enterprise.

The economy of New Zealand depends greatly on international trade, mainly with Australia, the European Union, the United States, China, South Korea and Japan. Air freight carried 0.3 percent of New Zealand's exports by volume, and 14.8 percent by value in the year to December 2015. It also carried 0.5 percent of imports by volume and 21.9 percent of imports by value<sup>11</sup>. Tourism is a big part of our diverse economy, directly contributing \$10.6 billion, or almost 5 percent, to GDP. International aviation makes up 70.3 percent of New Zealand's total international transport emissions based on 2013 levels (with the remainder contributed by international marine transport<sup>12</sup>).

Transport emissions account for 17 percent of New Zealand's domestic greenhouse gas emissions, of which 6 percent come from domestic aviation.

### **1.3 The New Zealand aviation system**

As a remote island state in the South Pacific Ocean, New Zealand relies on aviation links to overcome distance and connect to the rest of the world, and on domestic airlines to fly us between regions and islands. Neither system exists in isolation however, as many journeys include both domestic and international legs.

Approximately 18,400 people (or 16,880 FTEs) were employed in the aviation sector in 2012. The aviation sector had nearly 1,300 business units in 2013, up from 1,000 ten years earlier. The aviation sector contributed \$2,177 million to New Zealand's GDP in 2012. This amounted to 1.1 percent of national GDP<sup>13</sup>.

Few countries depend on international air services as much as New Zealand. International aviation facilitates tourism, business connections and trade. With a commitment to open skies we have one of the most liberal aviation regulatory regimes in the world<sup>14</sup>. Our growing network of air services agreements<sup>15</sup> means most major airlines in the world are able to operate in New Zealand without restriction.

New Zealand's air navigation service provider (Airways) is recognised globally as a progressive organisation that works proactively with airlines to increase flight efficiency and safety.

New Zealand's international tourism market has seen strong growth since 2012 with visitor arrivals increasing year-on-year. Visitor growth from all existing markets is currently strong and in particular, the number of visitors from China, United States and Australia continue to grow strongly.

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<sup>11</sup> <http://www.transport.govt.nz/sea/figs/>

<sup>12</sup> There is no New Zealand-based international shipping. However, New Zealand reports emissions from international shipping in its annual greenhouse gas inventory. These emissions are not added to New Zealand's totals, so are presented as memo items in our reporting tables. Trips by sea are considered "international" if their immediate destination is outside New Zealand, and their emissions are calculated based on fuel purchase before departure from New Zealand.

<sup>13</sup> Source: 'Service IQ' A Profile of the Aviation Sector in New Zealand, 2014

<sup>14</sup> <http://www.transport.govt.nz/air/iatrpolycystatement/internationalairtransportpolicyreview/>

<sup>15</sup> <http://www.transport.govt.nz/air/internationalairservices/newzealandsairserviceagreements/>

Our passenger movements have seen strong growth, a trend predicted to continue into the future. Business travel accounts for 8.8 percent of inbound passengers. Figure 3 shows the rapid rise in short-term overseas visitors by air in recent years.<sup>16</sup>

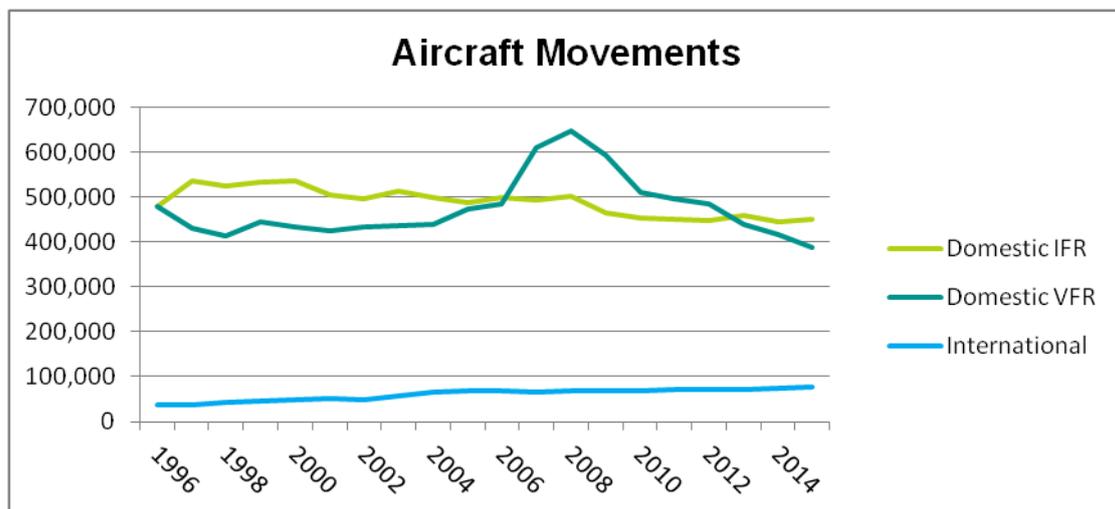
**Figure 3: Short-term visitors by air**



According to official projections, visitor arrivals to New Zealand for 2016-2022 are expected to grow 5.4 percent a year, reaching 4.5 million visitors in 2022 from 3.1 million in 2015. Most of this forecasted growth is expected, given current proportion of the total, to come from holidaymakers and those visiting friends and relatives.

Figure 4<sup>17</sup> shows aircraft movements from 1996–2015.<sup>18</sup> The graph shows increasing international movements. This growth is consistent with the increases in passenger arrivals from overseas, but is offset by the trend towards larger aircraft that can carry more passengers per flight.

**Figure 4: Aircraft movements**



<sup>16</sup> <http://www.transport.govt.nz/ourwork/tmif/transport-volume/tv011/>

<sup>17</sup> <https://www.airways.co.nz/assets/Documents/avimove-stats15.pdf>

<sup>18</sup> A movement is a take-off, landing or missed approach handled by the staff of Airways Corporation of New Zealand Limited.

Domestically, New Zealand’s air transport network is a vital part of the economy. New Zealand has two major islands, the North Island and the South Island, with the capital city, Wellington, and the biggest city, Auckland, located at opposite ends of the North Island. Domestic aviation facilitates a range of connections, allowing people and cargo to move between different cities and towns.

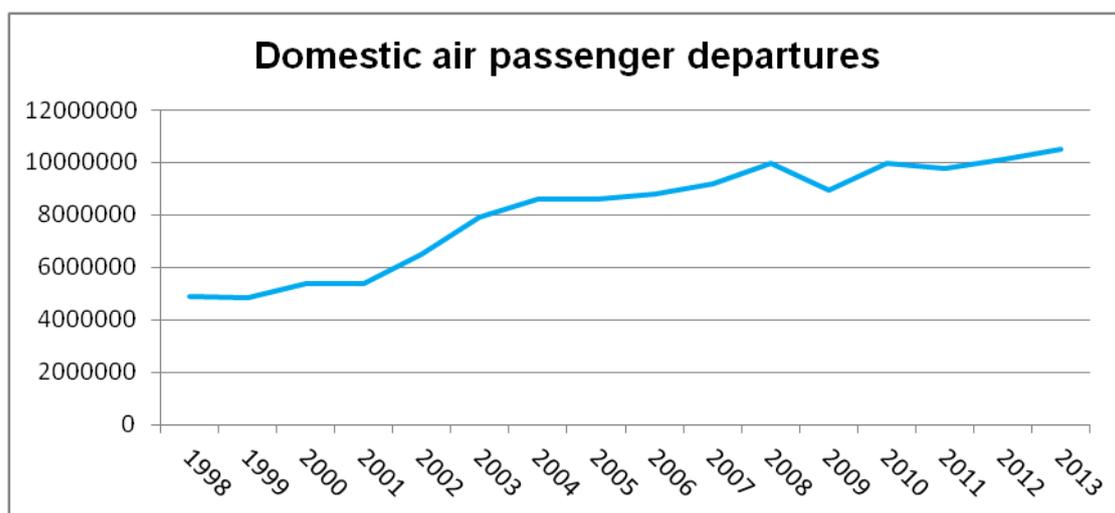
Unlike many countries, New Zealand does not have a passenger rail network outside the commuter networks in the major cities of Auckland and Wellington. Air and road are the only real options for most inter-regional/inter-city travel. For many routes air is the only viable given we have two islands.

Two carriers, Air New Zealand and Jetstar (a subsidiary of Qantas), operate jets on the trunk routes. Below this, Air New Zealand operates the largest fleet of regional aircraft. Other operators operate 61 percent of New Zealand’s domestic passenger aircraft fleet but they provide only 15 percent of the available seating capacity<sup>19</sup>.

The New Zealand domestic air transport network services most of New Zealand. It is possible to connect between all regions in the country using air travel (often through connecting flights via the three main domestic hub airports in Auckland, Wellington and Christchurch).

Figure 4 above shows a steady decrease in domestic IFR<sup>20</sup> aircraft movements, but as Figure 5<sup>21</sup> shows, domestic air passenger departures have been increasing over a similar period. IFR captures most commercial passenger services, with VFR<sup>22</sup> accounting for non-transport air services, including for agriculture, and recreational aviation. New Zealand aviation is notable for having a fleet of over 800 helicopters<sup>23</sup>.

**Figure 5: New Zealand domestic air passenger departures (source: Civil Aviation Authority)**



<sup>19</sup> Source: <http://www.transport.govt.nz/assets/Uploads/About/Documents/Future-Domestic-Airports-Network-Analysis-Report.pdf>

<sup>20</sup> IFR is Instrument Flight Rules, where pilots use aircraft equipment to navigate.

<sup>21</sup> <http://www.transport.govt.nz/research/othertransportresearch/transport-demand-modelling/>

<sup>22</sup> VFR is Visual Flight Rules.

<sup>23</sup> [https://www.caa.govt.nz/Script/Air\\_Class.asp](https://www.caa.govt.nz/Script/Air_Class.asp)

New Zealand also has a strong general aviation industry and passionate recreational pilots. Domestic VFR flights saw a large peak around 2009, but have dropped off sharply. These flights do not contribute a large amount of emissions.

An essential part of this connectivity – both internationally and domestically - is having the regulatory setting in place to give travellers, shippers and operators confidence in the safety and security of New Zealand's aviation system.

The New Zealand aviation system is aligned with the safety standards set by ICAO. New Zealand is one of 190 States that adhere to ICAO standards, and is audited by ICAO.

### **The role of the regulator for the aviation system – the Civil Aviation Authority (CAA)**

New Zealand has a reputation for modern aviation legislation and Rules. Its safety system and certification practices are recognised in bilateral agreements with other States<sup>24</sup>.

Entry and exit from New Zealand's aviation system is controlled through the issue of aviation documents by the CAA. These include pilot licensing, Air Operator's Certificates, aircraft registration, engineer licensing, air traffic controller licensing and aerodrome certification. These are granted only after applicants have demonstrated to the CAA that they meet the standards set in the Civil Aviation Act and Rules.

Further, continued operation is dependent on CAA's ongoing airworthiness auditing and monitoring. For New Zealand registered aircraft, the CAA must be satisfied the aircraft complies with the applicable aircraft engine emission standards specified in the Rules, which incorporate by reference ICAO requirements. CAA also develops the Rules on behalf of the Ministry of Transport and takes into account, amongst other factors, ICAO requirements, including engine emissions.

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<sup>24</sup> [https://www.caa.govt.nz/international/international\\_agreements.htm](https://www.caa.govt.nz/international/international_agreements.htm)

## 2 Aviation’s contribution to greenhouse gas (GHG) emissions in New Zealand

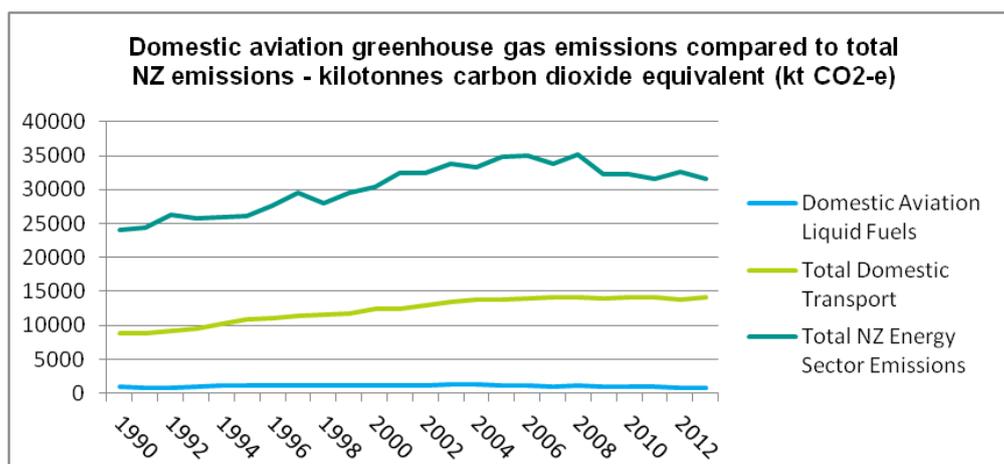
### 2.1 Aviation’s GHG contribution in New Zealand compared to total and other sectors

While transport makes up a significant part of New Zealand’s energy sector emissions, domestic aviation is not a large contributor to energy sector emissions.

Figure 6 below<sup>25</sup> shows that transport emissions made up 44.5 percent of New Zealand’s total energy sector emissions in 2013. Aviation accounts for 6.1 percent of domestic transport emissions, or 2.7 percent of overall energy sector emissions<sup>26</sup>. Domestic aviation accounts for 1.1 percent of New Zealand’s total emissions.

Domestic transport and energy sector emissions trended up from 1990–2008, before flattening out or reducing. Domestic aviation has seen very little emissions growth – in fact, emissions have reduced over the 1990–2013 period. Domestic aviation is covered by NZ ETS, which is discussed further in section 4.2 of this paper.

**Figure 6: Domestic aviation GHG emissions compared to total New Zealand emissions**



New Zealand international aviation emissions exceed gross domestic aviation emissions by a ratio greater than 2.5 to 1, as outlined in Figure 7 below. International aviation makes up 70.3 percent of New Zealand’s total international transport emissions based on 2013 levels (with the remainder contributed by international marine transport).

<sup>25</sup> <http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/greenhouse-gas-emissions>

<sup>26</sup> New Zealand’s gross emissions for 2013 to 2014 increased by 1 percent to 81.1 million tonnes of carbon dioxide equivalent (Mt CO2 – e)

Aviation’s dominant share of emissions for international transport is primarily driven by passenger movements. Airfreight is carried in dedicated freighter aircraft and the bellyhold of passenger aircraft, but passenger aircraft move the majority of New Zealand’s airfreight. The volume of airfreight has changed very little compared to 10 years ago.<sup>27</sup>

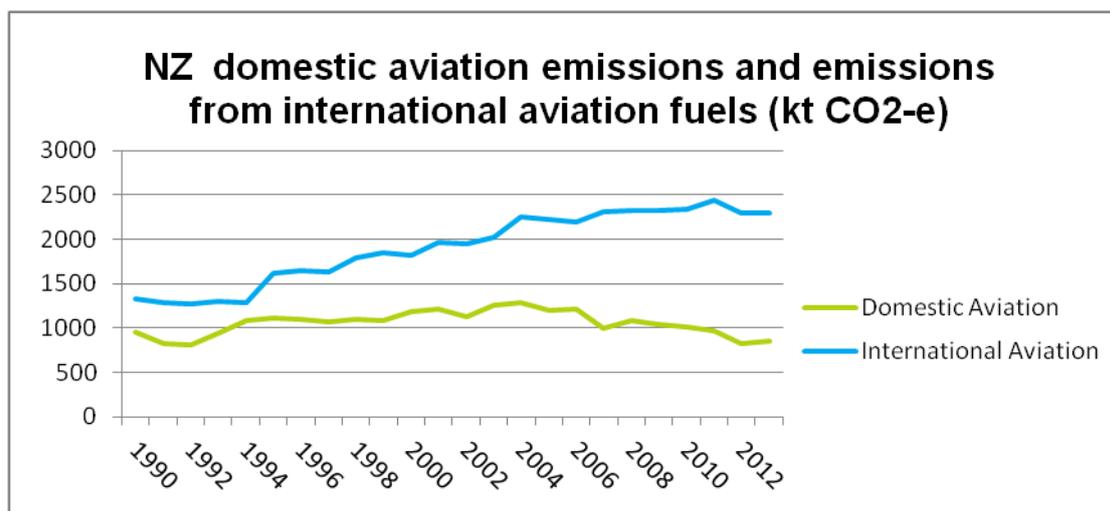
In contrast, the New Zealand Ministry of Transport calculates 91.1 percent of total passenger arrivals in 2015 arrived by air.

## 2.2 Aviation emissions over time

Figure 7 below<sup>28</sup> provides a closer look at New Zealand’s aviation emissions since 1990. It shows a general increase in aviation emissions until 2004, then the rate of growth in New Zealand international aviation emissions slows and domestic aviation emissions decrease.

The dataset goes to 2013, but fuel use data from 2014 and 2015 (see Figure 8) indicates that international emissions have risen over the last 2 years, with domestic emissions likely staying the same. The recent increase in international emissions can be attributed to favourable economic conditions for international air travel, and increased flying to New Zealand as an attractive visitor destination. New Zealand’s international aviation emissions account for all fuel purchased in New Zealand for an outbound flight to an international destination.

**Figure 7: New Zealand domestic aviation emissions and emissions from international aviation fuels sold in New Zealand for outgoing flights<sup>29</sup>**



<sup>27</sup> <http://www.transport.govt.nz/assets/Uploads/Research/Documents/Airfreight-Research-Final-Report-23-March.pdf>

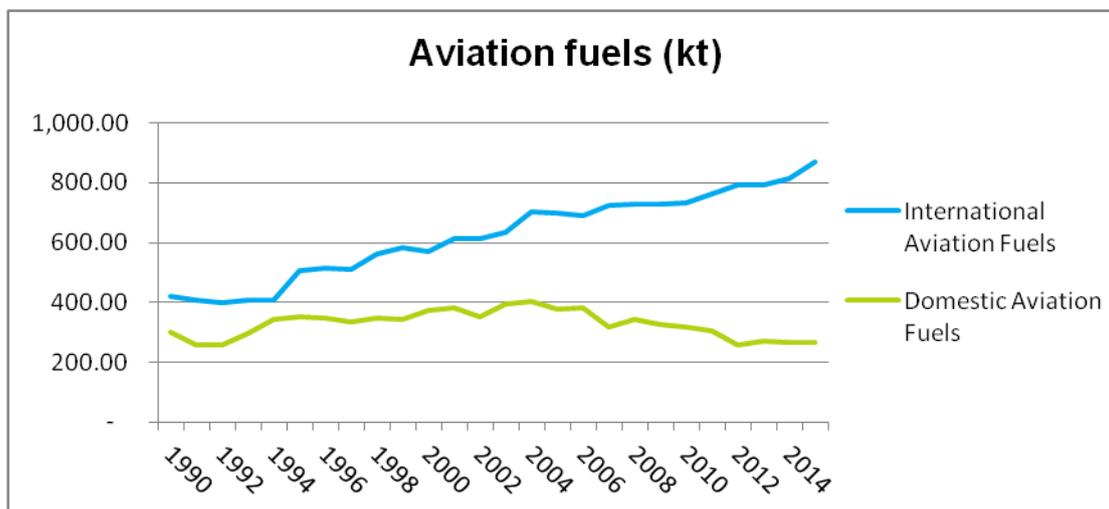
<sup>28</sup> <http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/greenhouse-gas-emissions>

<sup>29</sup> This Ministry of Transport summary graph uses two data sources: <http://www.transport.govt.nz/ourwork/tmif/environmental/ei001/> and <http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/greenhouse-gas-emissions>

## 2.3 Fuel consumption

Fuel consumption<sup>30</sup> is closely linked to emissions. Figure 8 below shows the continuing upward trend in international fuel use.

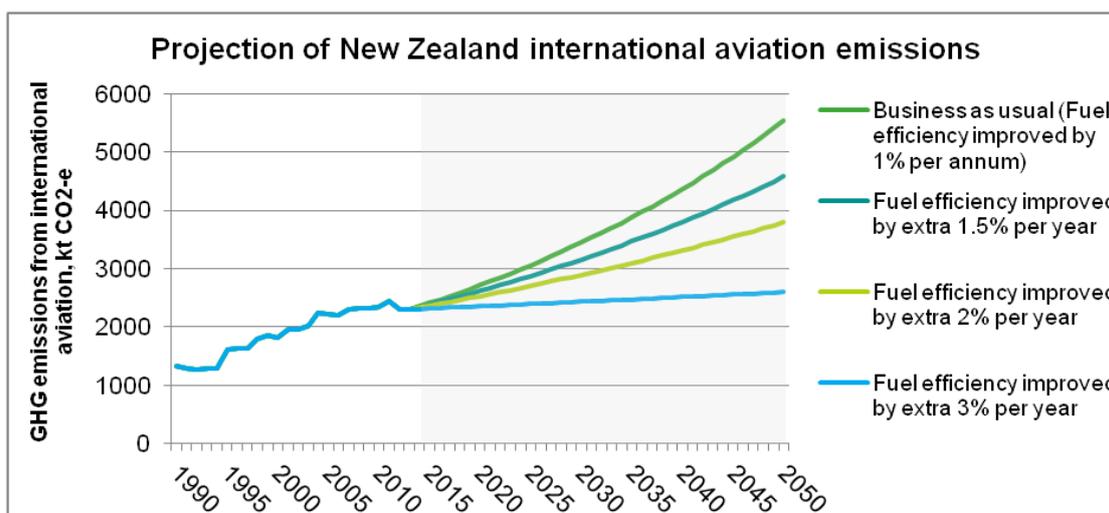
**Figure 8: Domestic and international aviation fuel use**



## 2.4 Projected future CO2 emissions

Figure 9 below presents the Ministry of Transport's forecasts for New Zealand's international aviation emissions to 2050. Different scenarios of air travel activity are not considered. The four scenarios only consider fuel efficiency gains, but not air travel activity changes beyond current trends.

**Figure 9: Ministry of Transport projection of New Zealand international aviation emissions**



<sup>30</sup> <http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/oil>

Research has found<sup>31</sup> that over the last five decades the fuel efficiency of commercial jet aircraft globally has improved by 1.3 percent per annum. Fuel use and GHG emissions growth comes from the growth from air travel activity and is offset by improvement in fuel efficiency. Based on historic trends, the analysis assumes the fuel efficiency of New Zealand international aviation has improved by 1 percent per annum and air travel activity has grown by 3.43 percent per annum, so that the overall GHG emissions have increased by 2.4 percent per annum during the time period of 1990 to 2013. It is on this basis that the business as usual scenario is calculated.

ICAO's 37<sup>th</sup> Assembly in October 2010 set the aspirational goal of keeping net carbon emissions from international aviation at 2020 levels. Figure 9 above shows that the 2020 level, based on current trends, is around 2.8 Mt CO<sub>2</sub> emissions.

Under the business as usual scenario, to remain at 2020 levels, New Zealand would need to offset around 3 Mt of CO<sub>2</sub> emissions from international air transport in 2050.

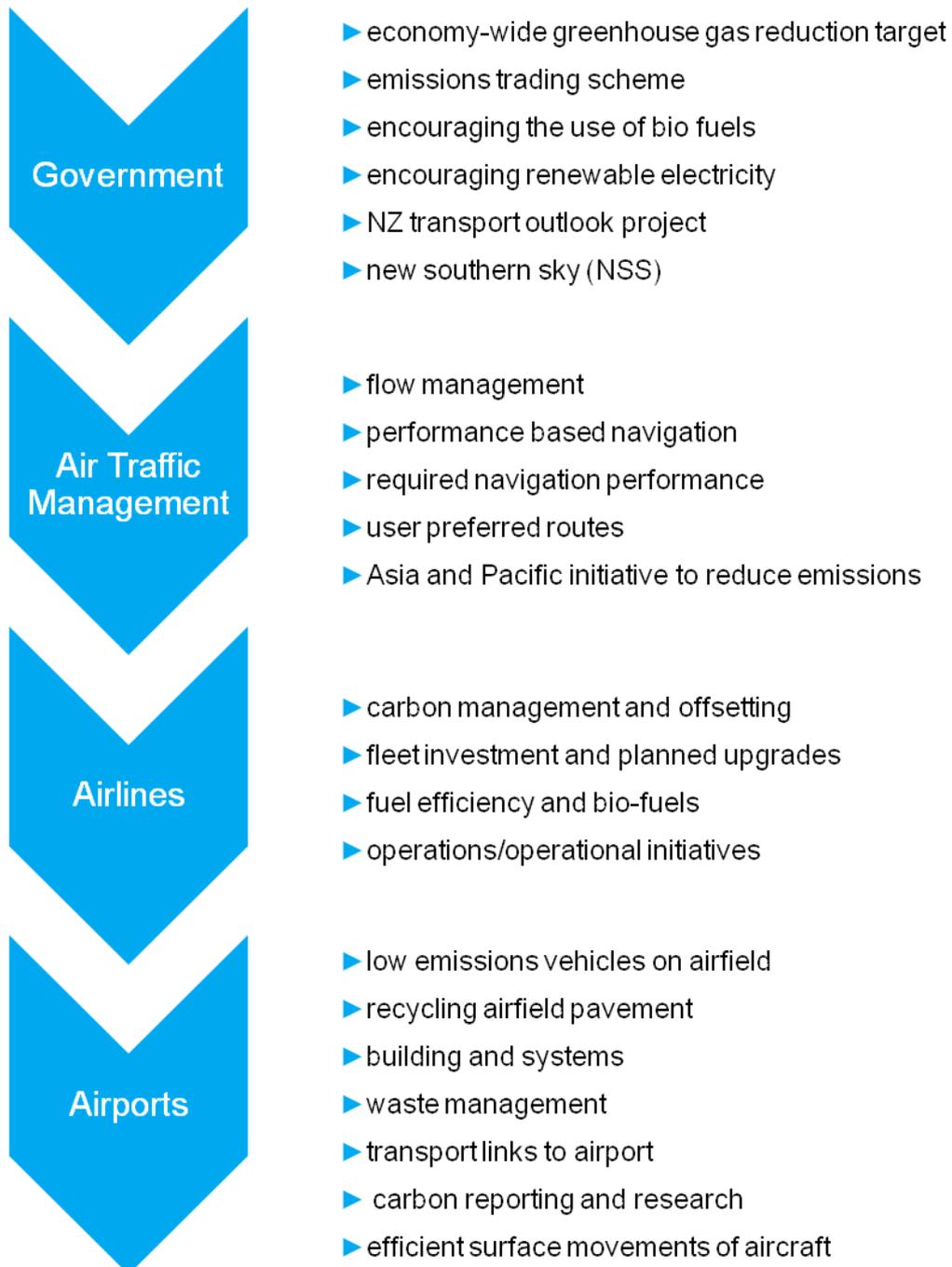
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<sup>31</sup> ICCT, 2015 (<http://www.theicct.org/fuel-efficiency-trends-new-commercial-jet-aircraft-1960-2014>)

### 3 Overview of measures to reduce aviation emissions

#### 3.1 Overview of measures

New Zealand implements a number of measures to reduce emissions.



## 4 Government measures

The New Zealand Government is active in managing emissions overall and has programmes in place across various sectors.

### 4.1 Economy-wide greenhouse gas targets

The Government has four national targets for reducing New Zealand's GHG emissions that cover both the medium and long term:

- a provisional post-2020 target of 30 percent below our 2005 GHG emissions levels by 2030
- an unconditional target of 5 percent below our 1990 greenhouse gas emissions levels by 2020
- a long term target of 50 percent below our 1990 greenhouse gas emissions levels by 2050
- a conditional target range of 10 to 20 percent below our 1990 greenhouse gas emissions levels by 2020, if there is a comprehensive global agreement.

New Zealand will meet these responsibility targets through a mix of domestic emission reductions, the removal of carbon dioxide by forests and participation in international carbon markets.

### 4.2 Emissions Trading Scheme

The NZ ETS supports global efforts to reduce greenhouse gas emissions by assisting New Zealand to meet its international obligations, and by reducing New Zealand's net emissions.

The NZ ETS puts a price on GHG emissions. This provides an incentive for people to reduce emissions, invest in low-emission technologies and practices, and plant and maintain forests to absorb carbon dioxide. Pricing through the NZ ETS covers just over half of New Zealand's GHG emissions, with biological emissions from agriculture the only significant exclusion.

Suppliers of liquid fossil fuels have to report the amount of fuel supplied and submit allowances to cover the GHG emissions from the fuel<sup>32</sup>. These fuels include jet kerosene (jet fuel) and aviation gasoline. The NZ ETS excludes any fuel used for international aviation.

Users of aviation fuel, i.e. airlines, are able to opt-in as NZ ETS participants. This means that the emission obligations are transferred from the fuel supplier to the user. Air New Zealand is a participant in the NZ ETS for its domestic aviation fuel use and meets its reporting and surrender obligation under the NZ ETS.

New Zealand was the first nation to establish an ETS that affects airlines<sup>33</sup>.

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<sup>32</sup> [http://www.icao.int/meetings/environmentalworkshops/documents/wacm-2008/3\\_gurnsey.pdf](http://www.icao.int/meetings/environmentalworkshops/documents/wacm-2008/3_gurnsey.pdf)

<sup>33</sup> <http://www.greenaironline.com/news.php?viewStory=1126>

### 4.3 [Encouraging biofuels](#)

The Energy Efficiency and Conservation Authority (EECA) works to improve the energy efficiency of New Zealand's homes and businesses, and encourages the uptake of renewable energy. EECA encourages the use of biofuels. To date this work has considered on-land and on-water applications, with a watching brief status only on aviation applications.

However, not all biofuels have the same impact on the environment. How sustainable a biofuel is depends on its emissions, the feedstock used to produce the biofuel and emissions from farming, manufacture and transportation of the biofuel.

To provide information on sustainable biofuels, EECA has established a framework that allows biodiesel producers and retailers to report on the environmental credentials of their products. EECA publishes the information created through this mechanism<sup>34</sup>. This currently reports on biofuels that are suitable for use in internal combustion engines (and boilers) only – biofuels suitable for jet fuel replacement are not included (more because of the specialist nature of these and their supply).

### 4.4 [Encouraging renewable electricity](#)

The National Policy Statement for Renewable Electricity Generation 2011 (NPS REG) recognises the national significance of generating renewable energy. Approximately 82 percent of New Zealand's electricity is generated from renewable sources (one of the highest shares in the Organisation for Economic Cooperation and Development)<sup>35</sup>. New Zealand is progressing well towards the target of 90 percent of electricity generated from renewable sources by 2025.

The NPS REG drives a consistent approach to planning for renewable electricity generation in New Zealand. It gives clear government direction on the benefits of renewable electricity generation and requires all regional councils to make provision for it in their plans.

Its objective is to support activities that will help New Zealand meet its national target for renewable electricity generation. New Zealand's renewable energy policy enables our aviation industry to reduce emissions through energy use in buildings, transport links to airports, low emission and electric vehicles being added to ground fleets, electric ground operations, and fixed electrical ground power.

In May of 2015, New Zealand's Minister of Transport, the Honourable Simon Bridges, announced the Government's Electric Vehicle Programme. The Programme aims to increase the uptake of electric vehicles and the supporting infrastructure in New Zealand. The Government has set a target of doubling the number of electric vehicles in New Zealand every year to reach approximately 64,000 by 2021.

Air New Zealand utilises ground power in Auckland and Christchurch as an alternative to auxiliary power units that burn aviation fuel, saving up to 180kg of aviation fuel per hour. Air New Zealand has committed to moving all of its light vehicle fleet of approximately 76 vehicles to electric options by the end of 2017 (or best in class hybrid where fully electric

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<sup>34</sup> <https://www.eecabusiness.govt.nz/technologies/renewable-energy/biofuels/sustainable-biofuels-information/>

<sup>35</sup> <http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/publications/new-zealand-energy-quarterly/#electricity>

options are not feasible). Air New Zealand is also transitioning all airside ground service equipment to electric options by 2020 where options exist.

#### **4.5 New Zealand transport outlook project**

The New Zealand Ministry of Transport is currently undertaking work to project trends in transport with a thirty-year horizon (the Transport Outlook). For aviation, New Zealand is planning to produce and publish the following three-part projection:

- (1) Regional domestic air passenger flows (e.g. how many people fly from Auckland to the West Coast of New Zealand) and international air passenger departures from each region (in New Zealand)
- (2) Domestic aircraft-km travelled
- (3) Fuel use and GHG emissions from domestic air travel.

The projections will give an outlook of future air travel (both passenger and aircraft) at both national and regional levels. The findings will be used to help government and businesses to best plan to mitigate environmental impacts.

#### **4.6 New Southern Sky (NSS)**

In the aviation sector, NSS is New Zealand's 10-year programme to modernise its airspace and air navigation system. NSS provides a clear direction for incorporating new technologies into New Zealand's aviation system to 2023, with a key outcome being reduced emissions from aviation.

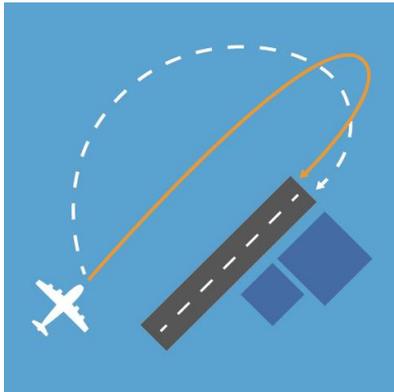
Initiatives under NSS are expected to bring \$2 billion of benefits in the next 20 years, through fuel savings, lower aircraft operating costs and efficiencies for airlines. These initiatives include:

- satellite navigation that enables more efficient flight paths
- satellite surveillance that improves information on aircraft locations
- improved communication that leads to greater awareness and collaboration
- better and more accessible aeronautical information to help decision-making
- more precise air traffic management.

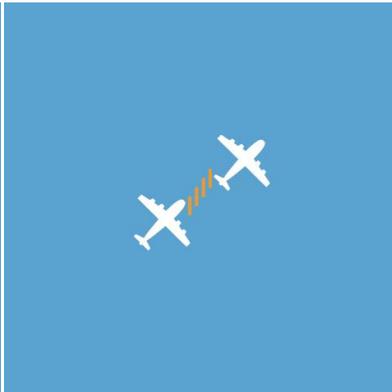
The result of more efficient flight paths, and better information access and communication, is to reduce the amount of time aircraft spend in the air. This reduces fuel burn and emissions from aviation in New Zealand.

### New Southern Sky emission-reducing initiatives

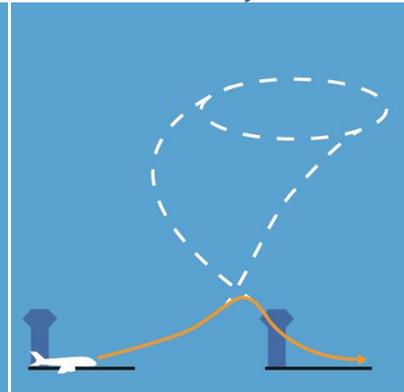
*Satellite navigation means flight paths are shorter and more efficient*



*Satellite surveillance means aircraft can be closer together and remain safe*



*Improved communication and access to information mean aircraft can depart at the right time to avoid delays*



## 5 Air traffic management measures

Airways is New Zealand's air navigation service provider. Airways controls all domestic and international air traffic travelling within New Zealand's Flight Information Region (FIR), which totals 30 million square kilometres – one of the largest areas of airspace in the world.

Airways is renowned globally for leading innovation and development in the aviation sector.

Environmental management is becoming an increasingly important driver globally for airport companies, airlines and air navigation service providers. For New Zealand, issues of our distance and emissions are particularly relevant and this has driven a commitment from Airways to do all it can to reduce aviation's carbon footprint.

Airways is committed to reducing New Zealand's aviation carbon emissions through a number of programmes which use sophisticated aviation systems allowing airlines to fly direct routes with a minimum of delay. These systems are enabling Airways' customer airlines to avoid 37,000 tonnes of CO<sub>2</sub> emissions each year.

Airways is also leading the way with the implementation of satellite-guided approaches and multilateral surveillance systems, and assisting New Zealand to meet ICAO timeframes for the implementation of modern air traffic management technologies.

As an integral part of the Government's NSS national airspace and air navigation programme, Airways is helping to deliver the ICAO vision for a globally interoperable aviation system.

Some of the ways in which Airways contributes to the reduction in emissions are described in the following subsections.

### 5.1 Flow management

Airways operates an integrated flow and arrivals management system called Collaborative Flow Manager (CFM). This component matches airlines' scheduling needs with capacity at the destination, and coordinates arrival slots to lessen airborne delays by avoiding airport congestion.

International arrivals are the largest fuel burners. The CFM system allows Airways to facilitate continuous descent operations for international arrivals, limiting fuel burnt by these aircraft. CFM reduces carbon emissions nationally by 37,000 tonnes per year<sup>36</sup>.

Fuel consumption and GHG emissions decrease through reduced holding patterns in the air and minimised engine idling on the ground.

The system was first implemented at Auckland Airport in 2008 and changed the entire operating environment of domestic passenger flights in New Zealand. When Auckland Airport is operating at peak capacity, 75 percent of traffic experiences in-flight delays of less than 60 seconds and on average incur less than 10 kilograms of additional fuel burn per flight. Overall, half of flights experience no additional flight time due to air traffic congestion.

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<sup>36</sup> CFM also applies to international flights.

Airways is planning for the introduction of a departure management tool to further enhance the air traffic flow management system. This would work in harmony with arrivals function and enable Airways to better sequence arrivals and departures and make best use of capacity.

Other existing flow management capabilities include:

- Arrival Manager (AMAN): Integrated with the system in 2013, AMAN calculates target landing times to ensure the most efficient speed and energy profiles for aircraft arriving into Auckland, based on their predicted trajectories and the available runway capacity at that period.
- Airport Collaborative Decision Making (A-CDM): Auckland Airport and Wellington Airport have recently introduced A-CDM technology and this is now in place for jet operations in Auckland and for both jet and turbo-prop operations in Wellington. The key aim of A-CDM is to facilitate the sharing of operational data to optimise the turnaround process for aircraft. A-CDM has the potential to reduce delays on taxiways and aprons, and hence reduce fuel burn and emissions. The system is being developed to monitor fuel burn from taxiing, and the associated cost and carbon reductions from A-CDM. It is likely to expand to other airports in coming years.

## **5.2 Performance Based Navigation (PBN)**

Airways' PBN implementation programme began in 2008 and covers more than 50 separate projects across the country's 17 controlled aerodromes.

PBN describes a wide range of technologies that are moving aviation away from ground-based navigation aids toward a more satellite-based system, which is more accurate.

This more accurate system enables aircraft to fly increasingly direct routes and allows for shorter approach paths and continuous descent, reducing fuel burn<sup>37</sup>. PBN is a key component of the NSS programme.

## **5.3 Required Navigation Performance (RNP) Authorisation Required (AR) Approaches**

Airways has implemented RNP and PBN procedures in one of New Zealand's most unique airports – Queenstown. Queenstown is challenging to fly into due to it being surrounded by mountains. Since the procedures were implemented in Queenstown, delays have reduced from a maximum of 2600 minutes a month, to on average 330 minutes a month. Airlines flying the procedures have avoided 7,500 tonnes of CO<sub>2</sub> emissions.

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<sup>37</sup> Maintaining passenger comfort may restrict the full extent of savings that can be achieved. For example, the most efficient glidepath and route may not be possible to use due to turbulence/reducing time of exposure to turbulence.

Airways has also undertaken trials<sup>38</sup> of two RNP AR approaches into Auckland Airport – New Zealand’s busiest airport. These approaches reduced fuel burn annually by 241 tonnes and CO<sub>2</sub> emissions by 762 tonnes<sup>39</sup>. These trials are still ongoing ahead of anticipated full rollout. Significant reductions are also expected when the procedures are implemented at Wellington Airport and Christchurch Airport.

#### **5.4 User Preferred Routes (UPR) and Dynamic Airborne Reroute Procedures**

Around 65 percent of air traffic operating in New Zealand’s Oceanic airspace is utilising UPR. UPRs are non-fixed air traffic routes between airports that allow the aircraft to take advantage of favourable winds, reducing flight time and fuel burn. Airways has been able to offer this capability to its full extent since the implementation of its Oceanic Control System in 2001.

The system also allows for capable aircraft to operate Dynamic Airborne Reroute Procedures. These procedures enable an aircraft to modify its flight path during the journey to account for changing atmospheric conditions. Dynamic Airborne Reroute Procedures reduce fuel burn.

#### **5.5 Asia and Pacific Initiative to Reduce Emissions (ASPIRE)**

Airways is a founding member of ASPIRE<sup>40</sup>. ASPIRE partners have the common goal of saving fuel, reducing emissions and ensuring the sustainable future of flight. Under ASPIRE, Airways and its partners work closely with governments, airlines, and other air navigation service providers in the region to develop new technologies, procedures and metrics for measuring and improving environmental efficiency in the aviation industry.

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<sup>38</sup> <http://aucklandflightpathtrial.co.nz/>

<sup>39</sup> These approaches are currently in limited use under trial. Benefits of these approaches can be expected to increase when a greater number of flights are able to use them at the conclusion of the trial.

<sup>40</sup> <http://www.aspire-green.com/>

Following a series of demonstration flights in 2008, extensive data gathering and performance modelling has occurred to allow the success of these 'one-off' test flights to be repeated on a daily basis. The first Daily City Pair was launched on February 21, 2011 between Auckland and San Francisco following an Air New Zealand flight that proved the feasibility. In 2013, Airways helped develop seven new city pairs.

The ASPIRE practices are put into action for all Singapore Airlines flights from Singapore to Auckland, Christchurch, Sydney and Melbourne. In 2015, Singapore Airlines reported that it had realised 2,536 tonnes of annual CO<sub>2</sub> savings for New Zealand and Australia flights.<sup>41</sup>

## **5.6 Future developments**

Airways is developing a comprehensive new system for measuring its performance that will produce highly detailed information about flight time and fuel efficiency on a flight-by-flight basis.

While the current system is considered world best practice, the new system will allow Airways to establish a CO<sub>2</sub> emission baseline for each route between cities. It will allow detailed retrospective analysis as well as predictive capabilities that will enable Airways to proactively implement efficiency improving initiatives and enhance the measures already cited.

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<sup>41</sup> [http://aviationbenefits.org/media/125796/Aviation-Climate-Solutions\\_WEB.pdf](http://aviationbenefits.org/media/125796/Aviation-Climate-Solutions_WEB.pdf)

## 6 Airline measures

The two main international airlines that have aircraft registered in New Zealand are Air New Zealand and JetConnect (a subsidiary of Qantas Group). Air New Zealand and Jetstar (also a subsidiary of Qantas Group) account for almost all of New Zealand's domestic scheduled air transport services.

Air New Zealand has provided the Ministry with detailed information on the measures it is taking to reduce aviation emissions. Information for JetConnect and Jetstar is not readily available. However, given that JetConnect and Jetstar are subsidiaries of the Qantas Group, the information provided in this section is at the Qantas Group level. Jetstar and Air New Zealand domestic operations are subject to the obligations of the NZ ETS.

### 6.1 Airlines' commitment to IATA

Air New Zealand and Qantas Group are both members of IATA and have committed to IATA's targets on fuel efficiency and carbon emissions, being:

- 1.5 percent average annual fuel efficiency improvement between 2010 and 2020.
- Carbon neutral growth from 2020.
- A reduction of 50 percent in net emissions by 2050 compared to 2005 levels.

## Air New Zealand

### 6.2 Carbon management and offsetting

Under the NZ ETS Air New Zealand is responsible for, and has been meeting obligations associated with carbon emissions from domestic aviation fuel use. Furthermore, it gives its customers an opportunity to make a voluntary contribution to an environment trust to supports projects that protect, preserve and enhance the natural environment. Customers can also contribute money towards certified offsets purchased by Air New Zealand.

Air New Zealand has a Sustainability Advisory Panel comprising an internationally renowned group of external subject matter experts who meet twice a year to advise it on all aspects of sustainability. This panel has played a key role in establishing the airline's overall sustainability framework and related goals and has helped to assess and establish the extent of the sustainability challenges faced.

The combination of a modern fleet and operational fuel efficiency measures has resulted in Air New Zealand improving its fuel efficiency by 19.96 percent (on the basis of carbon emissions per RTK) during the period 2006 to 2015.

### 6.3 Fleet

Air New Zealand is investing in a major fleet modernisation programme across both its jet and turbo-prop fleets. In 2014, it was the first airline in the world to take delivery of the Boeing 787-9 Dreamliner, which uses 20 percent less fuel compared to the aircraft it replaced.

Air New Zealand's fleet modernisation programme has resulted in its seat-weighted average fleet age reducing from 9.1 years to 7.8 years from 2014 to 2015, and it is committed to a \$2.2 billion investment in fleet from 2017 to 2020.

#### **6.4 Fuel efficiency<sup>42</sup> and biofuels**

Since 2006, Air New Zealand has embarked on a programme to drive efficiency in carbon emissions from aviation fuels. The fuel efficiency programme includes:

- Reducing aircraft weight through initiatives such as:
  - 'Just-in-time' fuelling where aviation fuel volumes on each aircraft are finalised just prior to the time of departure, once updated loadings, weather and route information is confirmed;
  - Operating a fuel policy whereby aircraft carry only the amount of fuel required for their flight (with operational contingency), rather than aircraft being fuelled beyond their specific flight requirements;
  - Installation of dryers in aircraft, which are reducing moisture weight by up to 100kg between the cabin and aircraft shell.
- Utilising new aircraft technology, such as aerodynamic winglet tips on Boeing 767 aircraft (saving approximately 5 percent fuel).
- Utilising ground power in Auckland and Christchurch as an alternative to auxiliary power units that burn aviation fuel, saving up to 180kgs of aviation fuel per hour.

Air New Zealand flew one of the aviation industry's first biofuel test flights back in 2008. This flight saved nine tonnes in CO<sub>2</sub>, using a jatropha-derived second generation biofuel, which proved the technical feasibility of using alternative fuels. The test flight also provided supporting data for the subsequent ASTM<sup>43</sup> certification of plant-based biofuels for commercial airline operations.

Air New Zealand continues to investigate opportunities, both local and international, to support and potentially procure advanced generation biofuels. It plays an active role in industry bodies such as the Sustainable Aviation Fuel Users Group. In 2016 Air New Zealand and trans-Tasman alliance partner Virgin Australia issued a joint aviation biofuel Request for Information to the market, seeking 200 million litres of aviation biofuel in Australasia per year from 2020.

#### **6.5 Operations/operational initiatives**

In terms of flight operations, significant aviation fuel and emissions savings will continue to be made through route optimisation, continuous descent paths, and through tailored arrivals and departures.

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<sup>42</sup> In terms of fuel savings, a system-wide approach to reducing emissions requires the coordinated input of key agents. The benefits will be measurable overall, although the contribution of each individual intervention cannot always be precisely defined.

<sup>43</sup> ASTM International (formerly known as the American Society for Testing and Materials) is a globally recognised leader in the development and delivery of voluntary consensus standards.

Air New Zealand has achieved significant fuel savings when flying into Auckland Airport by utilising continuous descent paths designed by Airways New Zealand, rather than flying level flight segments, as previously required by standard operating procedures. This change reduced flight approach distance by 46 percent.

Air New Zealand has also invested in electrification of its ground fleet, which includes airside ground service equipment and its light vehicle (road) fleet. By the end of 2017, Air New Zealand aims to have 100 percent of its light vehicles converted to electric options, or where this is not operationally feasible, hybrid or best-in-class emissions efficient vehicles will be used. Air New Zealand has also invested in electric vehicle charging infrastructure at its customer and corporate sites.

Air New Zealand has achieved its 2011-15 target of reducing electricity consumption by 20 percent domestically, through a range of efficiency measures. Major electricity savings have been made through various large-scale projects, such as LED bulb replacements. Air New Zealand's waste minimisation programme continues to evolve with recycling rates from New Zealand ground sites reaching 65 percent diversion from landfill in 2015, up from 32 percent in 2013. It aspires to have zero waste to landfill from Auckland ground sites by 2020.

## **Qantas Group**

### **6.6 Carbon management and offsetting**

Qantas Group was among the first airlines in the world to introduce a voluntary carbon offset program – Fly Carbon Neutral – in 2009. It is now the largest program of its kind in the world, having offset more than 2 million tonnes, with around 7 percent of customers choosing to offset<sup>44</sup>. The carbon offset option is offered by all Qantas Group subsidiaries. In 2014/2015, it also launched a new offsetting program for major corporate customers – the Qantas Future Planet Partnership – allowing corporate customers to shape their offset portfolio to their own social and environmental goals.

### **6.7 Fleet**

Qantas is maximising the benefits of a young fleet, which is more fuel and carbon-efficient than that of most other airlines of comparable size. Jetstar operates the Airbus A320 within New Zealand. It also has the lowest fuel burn, emissions and noise footprint of any aircraft in its class.

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<sup>44</sup> Qantas does not profit from the programme and passes on all funds to the purchase of verified carbon offsets, an annual contribution of more than \$1.2 million.

## **6.8 Fuel efficiency and biofuels**

Since 2009, the Qantas Group's fuel efficiency has improved by 5 percent<sup>45</sup>. This efficiency measurement is based on the efficiency of the entire group, including Jetstar and Jetconnect. While this is below its target of an improvement of 1.5 percent per year, Qantas expects efficiency to improve with continued fleet renewal and ongoing fuel burn reduction initiatives. As part of the Qantas Group Transformation Program, it has accelerated its existing fuel efficiency and optimisation program, which helped reduce total carbon emissions by 2.1 percent during 2014/2015.

Qantas Group has commenced a world leading fuel data and analytics partnership with GE Aviation. To reduce fuel consumption and carbon emissions, this work integrates flight data with operational data (flight logs, flight plans and load sheets), weather data, trajectory correction, navigation databases and terrain data. It is expected to deliver innovative ways to monitor and improve operation (how the aircraft is flying and how it is being flown) in specific operational domains.

Over the longer term, Qantas Group considers biofuels the industry's biggest opportunity to achieve major reductions in carbon emissions. Qantas has led industry research towards a commercially viable aviation biofuel market in Australia, recognising the industry's challenge is to create a market that can generate biofuels on a commercial scale and at a competitive price. Jetstar have conducted biofuel trials.

## **6.9 Operations/operational initiatives**

In terms of flight operations, significant aviation fuel and emissions savings will continue to be made through route optimisation, continuous descent paths, and through tailored arrivals and departures.

Qantas Group is on track to meet and exceed its electricity, water and waste to landfill targets. In 2014/2015, it commenced replacing fluorescent tube lighting with energy efficient LED lights in its airports, hangars, ramp areas, warehouses and flight simulators. This project will reduce energy consumption by more than 13 million kilowatt hours and save more than \$2 million per year on energy costs.

Other measures Qantas Group airlines have implemented and continue to implement include electric ground operations, in-flight recycling, single engine taxi, lightweight cabin equipment, and fixed electrical ground power.

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<sup>45</sup> Source: Qantas operational data

## 7 Airport measures

Airports only directly control a small proportion of aviation emissions, but they can support and enable the efforts by aircraft operators and other parties on the airfield. They can manage and influence non-aviation emissions in airport terminals and on the wider airport campus. New Zealand's major airports at Auckland, Wellington and Christchurch are active in achieving emission reductions on and off their aerodromes, and through planning and research for the future.

### 7.1 Supporting reduced aircraft emissions

The availability and capacity of airport facilities and processes influence aircraft flight and taxiing times and efficiency, and allow reductions in the use of on-board power units. These efforts result in reduced fuel burn and reduced GHG emissions.

New Zealand's airports have an important role to play in enabling performance based navigation, which allows shorter and more direct flight paths, and hence reduced GHG emissions. New flight paths on approach and departure from airports require the aerodrome operator's approval, and airports are actively supporting this major change to air navigation technology, while also ensuring that community concerns around aircraft noise are properly considered.

Aircraft movement and parking area investments, including additional taxiways (Auckland), and additional gates and aircraft parking (Auckland and Wellington) will reduce congestion and taxiing times for aircraft.

Provision of ground power allows the use of aircraft auxiliary power units (and hence fuel burn and emissions) to be avoided. All three major airports have programmes to install and increase the use of ground power units. For example, Christchurch Airport will install additional units this year, which will result in fuel cost savings of approximately \$500,000 annually. Auckland Airport can provide pre-conditioned air (PCA) – which also allows aircraft to reduce fuel use – at all international gates, and Wellington Airport is investigating PCA.

### 7.2 Supporting reduced emissions by vehicles on the airfield

At New Zealand airports, ground service equipment is provided by airlines or their contractors. Charging stations are being developed at Christchurch Airport and Wellington Airport for Air New Zealand as the airline continues to upgrade its ground service equipment to electric vehicles. The use of electric ground service vehicles and associated charging infrastructure is being investigated at Auckland Airport.

Airport fire trucks at Auckland Airport and Wellington Airport comply with new Euro 5 emission standards.

### **7.3 Airfield pavements**

Pavement works at airports can also impact on energy use and emissions, and New Zealand's major airports are active in seeking improvements. Auckland Airport recycles runway and apron concrete in annual pavement work projects. Christchurch Airport is reviewing its construction techniques to extend the longevity of new and recycled asphalt paving.

### **7.4 Buildings and systems**

Christchurch Airport's new terminal building features systems that use artesian water to both heat and cool the building five times more efficiently than standard systems, and eliminate the need for LPG, diesel or cooling tower systems.

The three major airports are each working with EECA to reduce energy consumption in buildings on the wider airport campuses. For example, Christchurch Airport is targeting 5 percent consumption savings, Auckland Airport aims to reduce whole-of-airport campus energy consumption between 2012 and 2017 by 6 gigawatt hours. An EECA review at Wellington Airport will ensure efficient building services are built into the planned new airport hotel, and the terminal building uses smart heating and ventilation management systems and LED lights.

### **7.5 Waste management**

The major airports have all introduced waste minimisation plans that have resulted in reductions in total waste to landfill and greenhouse gas reductions. At Auckland Airport, landfill waste per passenger reduced by 29 percent between 2012 and 2015, while carbon per passenger reduced by 22 percent and energy by 20 percent. At Christchurch Airport, a focus on reducing solid waste disposed to landfill has seen waste diversion from landfill increase from 17 percent in 2008 to 41 percent in 2016.

### **7.6 Transport links to airports**

Wellington and Auckland airports have produced comprehensive transport strategies and work with transport providers and funders to improve and promote public transport options to the airports. Auckland Airport has made provision for rail access to its planned new integrated terminal as part of its airport development plan.

Low emission and electric vehicles are being introduced into airport vehicle fleets, and support for airport visitors using electric vehicles is expanding. Auckland Airport is installing electric vehicle recharging for public use and Air New Zealand has also installed charging infrastructure at key customer sites. Wellington Airport is installing charging points in its new multi-level car park and transport hub, while Christchurch Airport is investigating the installation of charging stations within its current and planned parking facilities. Christchurch Airport has been approached to host a rapid charging station as part of a network of stations to enable electric vehicles to traverse the country.

## **7.7 Research**

Christchurch Airport is carrying out a feasibility study on the use of ammonia-based technology to further reduce reliance on diesel boilers for terminal heating. Auckland and Wellington airports are variously investigating solar power generation, wind power, battery storage and ground heat exchange.

## **7.8 Carbon reporting**

Christchurch Airport is a member of Earthcheck, which considers a wide range of sustainability measures. Auckland Airport publicly discloses its carbon emissions profile under the Carbon Disclosure Project and the Carbon Emissions Management and Reduction Scheme (CEMARS). Since 2012, the airport has been externally audited against the international standard (ISO 14064) for GHG emission reporting.

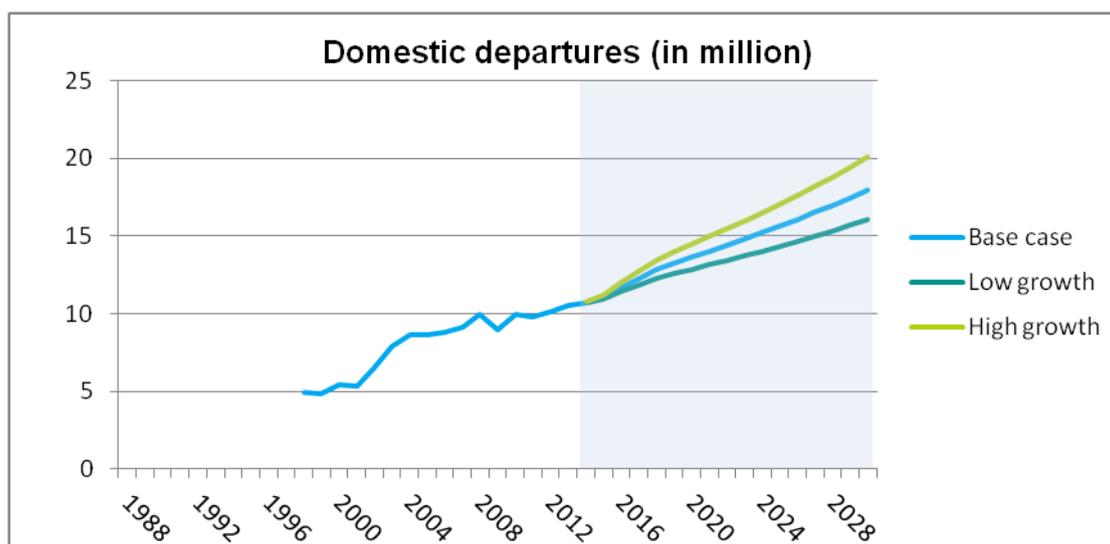
## 8 Future directions

### 8.1 How the NZ aviation system will change/grow

A number of general trends will impact demand and supply for air travel within New Zealand and to and from New Zealand. Overall, total aircraft movements are trending down, but passenger movements are trending up – the industry is shifting to larger aircraft with greater capacity. This should result in less fuel burn per passenger.

In terms of domestic aviation, in 2009 Jetstar started operating on trunk routes (including Christchurch, Wellington, Auckland, Queenstown, and Dunedin). This has resulted in a step-up in aircraft movements. As indicated in Figure 11 below – based on assumptions of stable fuel prices, increasing visitor numbers, and continued economic growth – the trend of increasing domestic passenger movements is projected to continue<sup>46</sup>.

**Figure 11: New Zealand Ministry of Transport forecast for Domestic departures<sup>47</sup>**



For international aviation, New Zealand has experienced large growth over recent years (as illustrated in Figure 3 and Figure 4 earlier in this document). This can be considered in the context of a lagged recovery from the Global Financial Crisis and lower fuel prices. Nineteen new routes were added last year, linking New Zealand with the rest of the world, significantly increasing the number of passenger seats available.

<sup>46</sup> Explanatory variables include international trade value per capita, real GDP per capita, exchange rate, CPI for international air transport based on real airfares (RCPIi), CPI for domestic air transport based on real airfares (RCPIid), Brent crude oil price, and unemployment rate.

<sup>47</sup> Source: <http://www.transport.govt.nz/assets/Uploads/Research/Documents/Demand-Revenue-Modelling/Air-pax-departure-forecast-model-Technical-note-Final3.pdf>

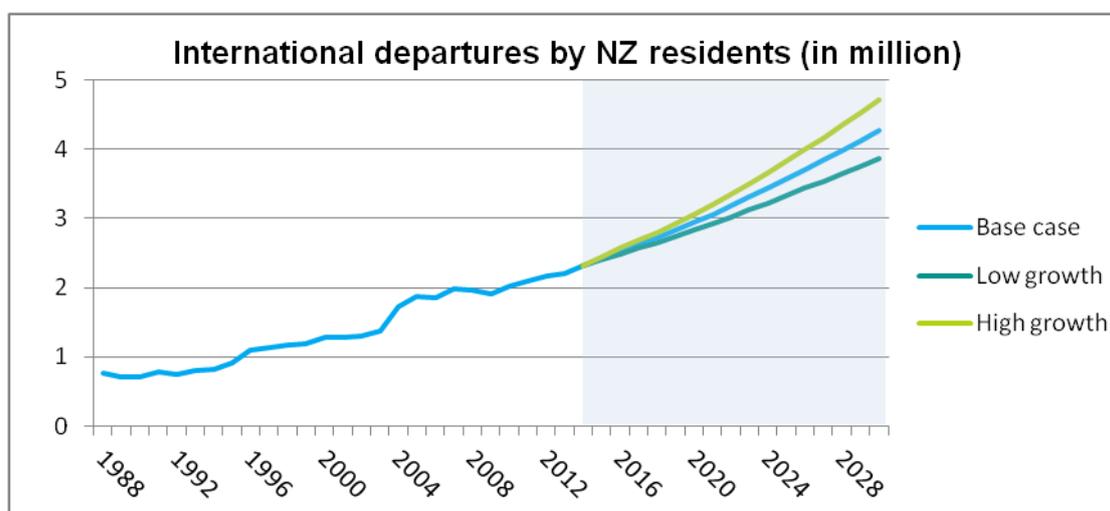
New Zealand’s visitor numbers are boosted by tourists from China, which have been growing at 20 percent year-on-year. With 0.4 percent of Chinese outbound tourism to New Zealand, even a small increase in this percentage will have a big impact on the total number of passenger movements for New Zealand’s aviation industry.

Each year New Zealand’s Ministry of Business Innovation and Employment produces tourism forecasts<sup>48</sup>. For 2016-2022, visitor arrivals to New Zealand are expected to grow 5.4 percent a year, reaching 4.5 million visitors in 2022 from 3.1 million in 2015. Most of this forecasted growth is expected to come from holidaymakers and those visiting friends and relatives. However, 8.8 percent of inbound international travel is for business purposes. Given that international connections account for over 10 percent of the traffic on the domestic network, growth in the international connections is likely to spill over and affect the domestic network.

Australia is New Zealand’s largest visitor market, providing more than 1.3 million visitors in 2015. The forecasts show that this market will continue to be healthy and looks set to grow by 25 percent by 2022.

As for outbound traffic – New Zealanders going overseas – the New Zealand Ministry of Transport expects the trend (Figure 12 below) to continue, provided fuel prices and ticket prices remain stable.

**Figure 12: International departures by New Zealand residents**



For international aviation, on the supply side, our open skies policy makes it likely that new operators will continue to enter the market. New operators entering the market has driven the emergence of new routes in recent times.

Domestic aviation in New Zealand has been deregulated for 30 years. There are no regulatory barriers to entry, provided an operator can satisfy safety requirements. New operators may emerge but the number of operators will be limited by the size of this market.

<sup>48</sup> <http://www.mbie.govt.nz/info-services/sectors-industries/tourism/tourism-research-data/international-tourism-forecasts/2016-2022-forecasts>

## **8.2 Proposed actions in future**

Despite the reduction in carbon emissions possible from continuing current improvements, the carbon footprint of the New Zealand aviation network is expected to grow. New measures will be needed if substantial progress is to be made in counteracting current trends in the growth of the aviation carbon footprint. As covered earlier in this plan, under the business as usual scenario, to remain at 2020 levels, New Zealand would need to offset around 3 Mt of CO<sub>2</sub> emissions from international air transport in 2050.

At present, there are several measures that should further reduce New Zealand's aviation carbon footprint in the future.

### **The near term**

#### **NZ ETS**

The New Zealand Government is taking action to manage the carbon footprint of New Zealand domestic aviation through the NZ ETS.

The NZ ETS puts a price on GHG emissions. This provides an incentive for people to reduce emissions, invest in low emission technologies and practices, and plant and maintain forests to absorb carbon dioxide.

#### **ICAO and global market-based measure**

As discussed below in point 8.3, the New Zealand Government supports resolutions passed at the ICAO General Assembly (most recently in 2013) to develop a framework for a global market-based measure that would cap international aviation emissions from 2020.

#### **ASPIRE**

Airways New Zealand is a founding member of ASPIRE and currently chairs the programme.

Under ASPIRE, Airways and its partners work closely with governments, airlines, and other Airline Navigation Service Providers in the region to develop new technologies, procedures and metrics for measuring and improving environmental efficiency in the aviation industry.

### **The medium term**

#### **Biofuels**

The aviation industry is currently contributing towards the development of sustainable biofuels as an alternative to conventional jet fuel for economic and environmental reasons. IATA has set a target of using 10 percent alternative fuels by 2017. A number of test flights worldwide have demonstrated that specific blends of biofuels and conventional jet fuel can safely power aircraft. On 1 July 2011, 50-50 blends of conventional jet kerosene with hydrotreated renewable jet fuels derived from natural plant oils and animal fats were officially certified for use in commercial flights.

While certification has opened the door to trialling of partly biofuel-powered regular scheduled flights, there is still uncertainty about the timing and availability of commercial supplies of aviation biofuels for widespread use throughout the aviation network. Issues include constraints imposed by factors such as competition for water, impacts on food production, price increases for fertilisers, depletion of arable land, loss of biodiversity and deforestation.

In New Zealand, the development of sustainable aviation biofuels is progressing on several fronts. EECA encourages the use of biofuels. Air New Zealand flew one of the aviation industry's first biofuel test flights back in 2008. Air New Zealand continues to investigate opportunities, both local and international, to support and potentially procure advanced generation biofuels. In 2016 a Request for Information relating to the production of aviation biofuel within Australasia was released to market so that regional opportunities could be assessed.<sup>49</sup> Air New Zealand also plays an active role in industry bodies such as the Sustainable Aviation Fuel Users Group. Qantas is leading industry research towards a commercially viable aviation biofuel market in Australia.

### **Airways – new ways of measuring performance**

Airways is developing a comprehensive new system for measuring its performance that will produce highly detailed information about flight time and fuel efficiency on a flight-by-flight basis.

While the current system is considered world best practice, the new system will allow Airways to establish a CO<sub>2</sub> emission baseline for each route between cities. It will allow detailed retrospective analysis as well as predictive capabilities that will enable Airways to proactively implement efficiency improving initiatives and enhance the measures already cited.

### **Longer term**

The aviation industry has long been at the forefront of the adoption of new technologies and it is expected that they will continue to play an important role in carbon footprint management in the future.

## **8.3 Market-based measures**

The ICAO Council has been tasked with developing a framework for a global market-based measure (GMBM) that would cap international aviation emissions from 2020, and require airlines to offset any emissions over and above their 2020 baseline. How much airlines will be required to offset will be dependent on the final text for the GMBM – and if a fully sector-based approach is used or a more dynamic one.

The New Zealand Government has generally supported resolutions passed at ICAO General Assembly where it was agreed that work on the scheme would be carried out.

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<sup>49</sup> This RFI was released jointly with Air New Zealand's trans-Tasman alliance partner Virgin Australia and sought production of 200 million litres of aviation biofuel per year from 2020.

The impact of the scheme on New Zealand airlines could be significant if large numbers of States are partially or fully exempt from participating in it. New Zealand's primary concern is therefore to ensure that the criteria for any exemptions are well justified and transparent and that there is parity between airlines operating on the same routes. New Zealand wants ICAO to implement a robust solution. We support adoption of a market-based measure that responds to genuine capacity differences but does not arbitrarily exempt developing countries.



# New Zealand Government

