# CARBON FOOTPRINT 2016-2017

## FINAL SUMMARY REPORT

**Transpower New Zealand Limited**
September 2018

*Keeping the energy flowing*

TRANSPOWER

Transpower New Zealand Limited The National Grid

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# Executive Summary

### Methodology

Transpower's carbon footprint has been calculated in conformance with the "Greenhouse Gas Protocol: *A Corporate Accounting and Reporting Standard" (GHG Protocol)* (WRI, 2004) which is the widely accepted methodology for organisational carbon accounting and is supported by ISO 14064 (2006). The organisational boundary of this footprint includes the entire operations of Transpower New Zealand Limited. According to the GHG Protocol this report covers total Scope 1 direct and Scope 2 indirect emissions, and a limited number of Scope 3 indirect emissions generated by third parties on Transpower's behalf for which reliable data can be obtained. This reporting approach has been adopted in previous Transpower Carbon Footprint reports.

This year we categorised the way we report our emissions by dividing them into 'National Grid' and 'Corporate' emissions. This reports our emissions in a more targeted way. National grid emissions include transmission losses, sulphur hexafluoride ($SF_6$) gas releases and sub-station electricity consumption, while corporate emissions are mostly office and travel related.

### Greenhouse Gas Emissions

Our total greenhouse gas (GHG) emissions for 2016/17 are estimated at **125,608 $tCO_2e$** (tonnes of carbon dioxide equivalent) – a decrease of 10% from the previous year. National Grid emissions are estimated at a total of **123,761 $tCO_2e$**, and are responsible for 98.5% of the total GHG emissions for 2016/17. National Grid emissions for 2016/17 are 10% lower than last year.

Transmission losses are by far the largest source of emissions, accounting for 94.9% of our overall emissions. Transmitting electricity through transmission lines results in small loses of electricity. This is largely due to resistance, in the form of heat, generated by electricity passing through transmission lines. Extra electricity has to be generated to offset the loss.

Emissions from Transmission losses have been decreasing steadily both in absolute and intensity measures (per GWh transmitted). In 2016/17 transmission loss related emissions per GWh were 8.8% lower than the previous year. These emissions are a result of the amount of electricity transmitted, the transmission distances and the emissions associated with the electricity generation (which is largely determined by the proportion of renewable and non-renewable electricity generation).

$SF_6$ emissions are our second largest source of emissions and continue to be the single largest Scope 1 emission source, contributing 91% of the Scope 1 emissions. $SF_6$ emissions have decreased by 20% compared to the previous year and by 49% over the last decade as a result of continued improvement in the management of $SF_6$ gas leaks.

Corporate emissions are responsible for 1.47% of the total GHG emissions for 2016/17 and are estimated at a total of **1,847 $tCO_2e$**, which is 28% lower than the previous year. Reporting the corporate emissions on a full-time employee (FTE) basis GHG emissions are estimated at **2.5 $tCO_2e$ per FTE** – a 30% reduction from the previous year.

The largest contributor to our 2016/17 corporate emissions is GHG emissions associated with air travel (47% of the corporate emissions). Emissions associated with air travel decreased by 1% compared to the previous year. This was due to improvements in airlines fuel efficiency and consequently lower emission factors. Actual distance travelled (km) increased by 8%.

# 1 2016-17 Emissions Profile

This year we have divided our emissions into two categories: “national grid” and “corporate” emissions. This helps us to clearly differentiate between emissions resulting from the national grid transmission infrastructure and emissions from our corporate business practices (transmission management). The greenhouse gas (GHG) emission sources from the national grid comprise transmission losses, $SF_6$ release[1] and electricity used by substations.

## 1.1 Total Emissions

Our total greenhouse gas (GHG) emissions for 2016/17 are estimated at **125,608 $tCO_2e$** (tonnes of carbon dioxide equivalent).

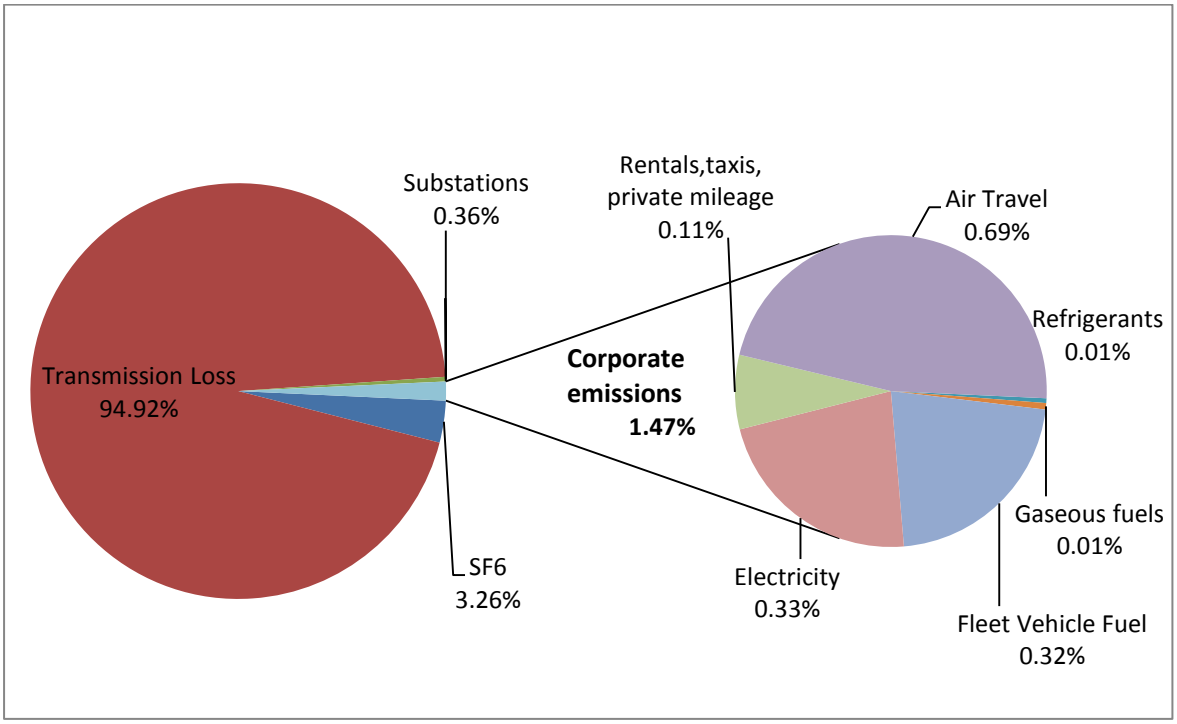


**Figure 1:Breakdown of Transpower greenhouse gas emissions by source (2016-2017).**

Figure 1 outlines our overall carbon footprint and the contributions by activity for the period July 2016 – June 2017. The national grid emissions, which are made up of $SF_6$ release, electricity used by substations and transmission losses, are responsible **123,761** $tCO_2$-e (or 98.53% of the total GHG emissions).

[1] $SF_6$ (Sulphur hexafluoride) is used as a switch gas in substations, due to its excellent electrical insulation properties. It is however a potent GHG, with a Global Warming Potential of 23,500. This means1 kg of $SF_6$ released is equal to 23.5 tonnes of $CO_2$ released into the atmosphere. The emission factor has been sourced from the Fifth Assessment Report of the IPPC. Chapter 8 Table 8.A.1 http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf

The remaining 1.47% is emitted by Transpower's corporate activities at **1,847** $tCO_2$-e. The corporate emissions relate to offices and travel.

Our total greenhouse gas emissions for 2016/17 show a decrease of 10% from the previous year. It is important to note that our GHG emissions are largely influenced by emissions from transmission losses. Transmission losses arise on the national grid network due to conductor resistance and energy lost as thermal heating of conductors. Transmission losses are determined by the quantity of power transmitted, the transmission distances and the emissions associated with the electricity generation. The emissions associated with electricity generation vary depending on the source of electricity (particularly the proportion of renewable and non-renewable electricity generation). The emissions for electricity generation were 21% lower than the previous year and this had an impact on our total GHG emission results.

## 1.2 National Grid Emissions

The national grid GHG emissions include transmission losses, sulphur hexafluoride ($SF_6$) gas leakages and sub-station electricity consumption. Figure 2 outlines the contributions of these three sources to the national grid GHG emissions, with transmission losses accounting for 96% of the national grid emissions. As discussed above, Transmission losses are determined by the quantity of power transmitted, the transmission distances and the emissions associated with the electricity generation which depends on the proportion of renewable and non-renewable electricity generated.

$SF_6$ emissions for the period of 2016/17 are estimated at 4,089 $tCO_2$-e, which accounts for 3.3% of the national grid emissions. Sub-station electricity consumption contributes 0.4% to the national grid emissions at 451 $tCO_2$-e.

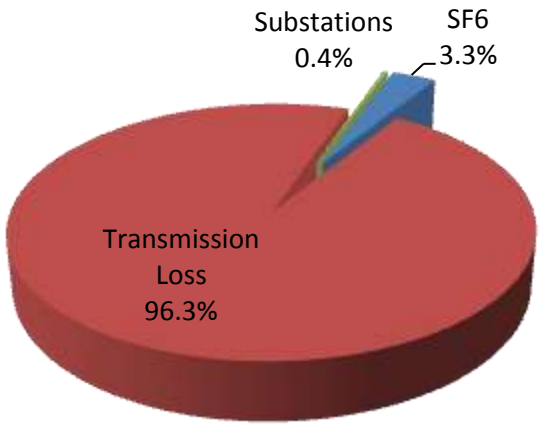


**Figure 2: National grid greenhouse gas emission sources (2016-2017)**

## 1.3 Corporate Emissions

The corporate greenhouse gas (GHG) emissions include air travel, ground travel, electricity use, gas use and refrigerant loss from Heating Ventilation and Air Conditioning (HVAC) systems. Figure 3 outlines the contributions of these six sources to the corporate GHG emissions, with air travel being the largest emission contributor at 47% (868 $tCO_2$-e) of the total corporate emissions for 2016/17.

Electricity used in Transpower offices and other buildings is the second largest contributor to the total corporate emissions at 22% (413 $tCO_2$-e).

The fuel-related emissions from Transpower fleet vehicles were estimated at 402 $tCO_2$-e for the period contributing 22% to the total corporate emissions.

Other ground travel emissions (rental cars, taxis, staff mileage) for the period are estimated at 142 $tCO_2$-e, which accounts for 8% of the total corporate emissions.

The emissions from gas use and refrigerants contribute 0.5% and 0.7% respectively (12 and 9 $tCO_2$-e) to the corporate emissions.

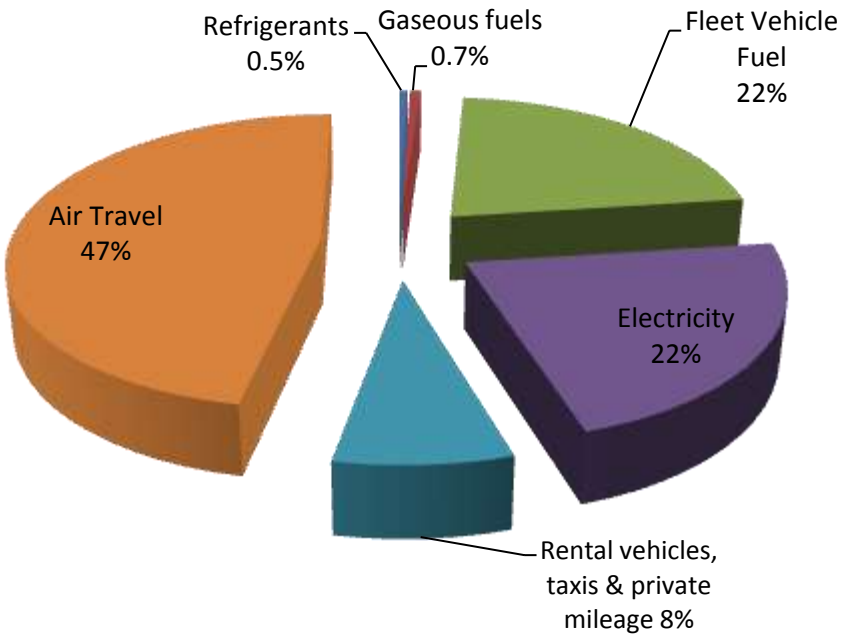


**Figure 3: Corporate greenhouse gas emission sources (2016-2017)**

## 1.4 Emissions by Scope

Scopes 1, 2 and 3 are defined by the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard (WRI, 2004) and are standardised ways of reporting GHG emissions.

- Scope 1 covers the emissions over which we have direct operational control.
- Scope 2 covers the indirect emissions associated with electricity consumption and overall transmission losses in the Transpower National Grid network.
- Scope 3 covers selected indirect emissions generated by third parties on our behalf. Only scope 3 emissions for which reliable data could be obtained have been included. This includes emissions that fall under Category 3 (Fuel and energy related activities), Category 6 (Business travel) and Category 8 (Upstream leased assets). This approach is in line with the methodology adopted in previous reporting years; however we are working on collecting additional data to expand our scope 3 reporting in future years.

Figure 4 shows that Scope 2 emissions, which include transmission losses, dominate our overall emissions profile.

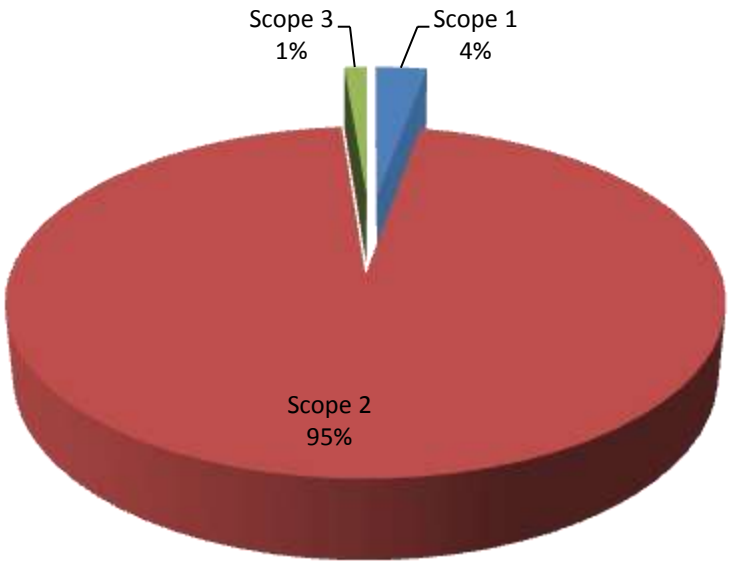


**Figure 4: Transpower greenhouse gas emissions by scope (2016-2017)**

# 2 Key Trends

## 2.1 National Grid Emissions

Our national grid emissions are largely influenced by the quantity of electricity transmitted, the transmission distances and the emissions associated with the electricity generation (i.e. the renewables/non-renewables generation share). These factors are out of our direct control.

Figure 5 shows the amount of transmission loss and substation energy use as a function of total GWh transmitted by Transpower. The percentage lost decreased from 2012 to 2015 but returned to around 3.5% again for the 2016/17 year. It is not possible to attribute a single cause to this effect, being an interplay of hydrology, market behaviour, and some significant commissioning of transmission assets and decommissioning of generation plant.

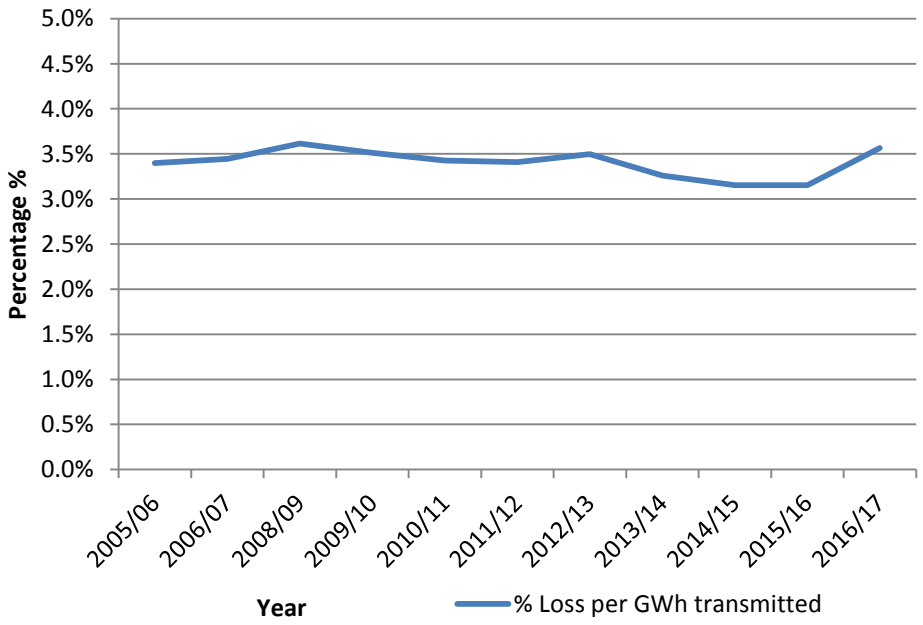


**Figure 5: National Grid transmission efficiency: Loss from transmission lines and substation energy as a percentage of GWh transmitted. (2006/7 – 2016/17)**

## 2.2 Corporate Emissions

Figure 6 shows our corporate emissions per number of full-time Transpower staff (FTE) since 2005/2006. Our corporate emissions are represented in relation to the number of full-time equivalent staff (FTE) to recognise that corporate emissions may decrease or increase due to staff number changes. The corporate emissions per FTE shows an 30% decrease since the previous year, continuing a downward trend since 2010/11-2011/12. The carbon efficiency of our corporate operations has improved by 44% over the last decade.

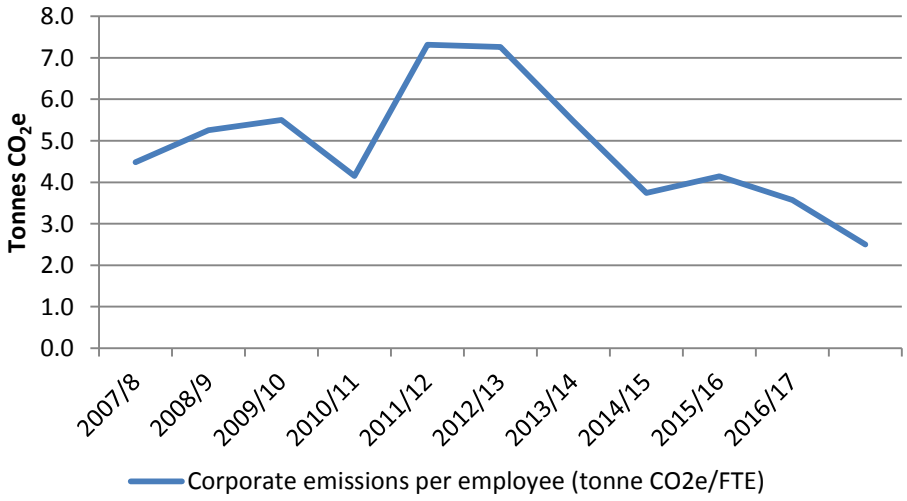


**Figure 6: Transpower corporate carbon intensity (2006/7 – 2016/17)**

# 3 Comparison to Previous Years

## 3.1 All Emission Sources

Figure 7 shows our carbon footprint since 2006/7, split between national grid network emissions (red line) and corporate emissions (blue line). The increase between 2009/10 for corporate emissions was largely due to work on major grid enhancements resulting in increases in three activities: diesel consumed by the staff fleet, domestic flights and international flights. The rise and fall within the national grid emissions are largely impacted by the change in the electricity generation related emissions.

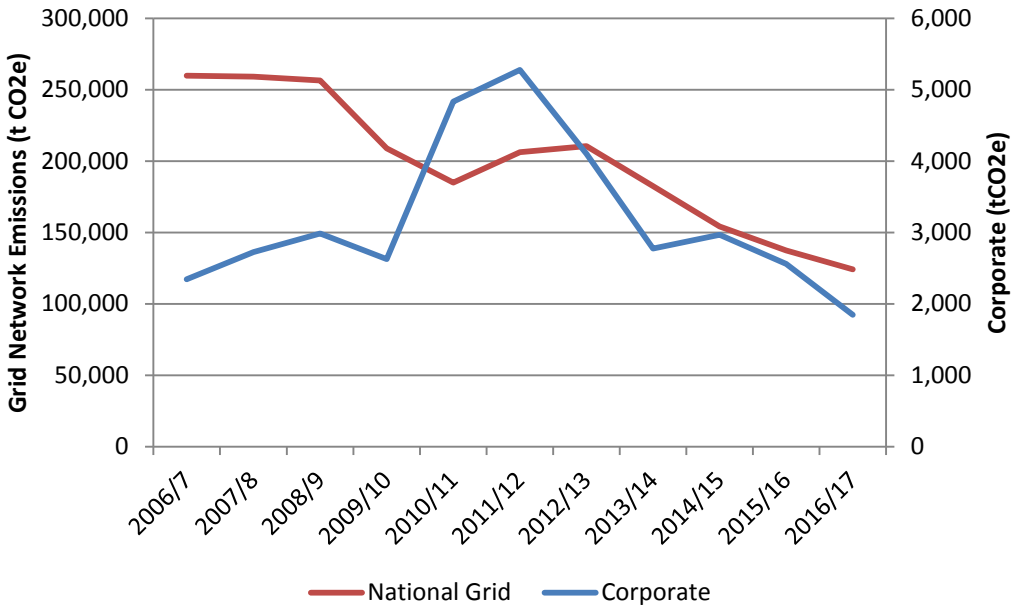


**Figure 7:Transpower GHG emissions since 2006/2007**

## 3.2 National Grid Emissions

### 3.2.1 Carbon Emissions from Transmission Losses

Electricity transmission losses arise due to conductor resistance and the energy is lost as thermal heating of conductors. Electrical resistance and losses can be reduced but not eliminated. Transmission losses result in more electricity generation than would otherwise be required to meet demand. Where generation includes the burning of fossil fuels in power stations, (i.e. coal, oil and gas) this means more carbon dioxide is released from the power stations than would otherwise be the case. (Transmission loss emissions occur at fossil fuel burning power stations generating the transmitted electricity, there are no direct GHG emissions from transmission conductors associated with losses).

Electricity transmission losses are treated like electricity used. In New Zealand the emissions associated with electricity used in any given year depend on the proportion of generation that comes from renewable sources (i.e. wind, solar and geothermal) and a proportion from non-renewable or fossil fuel sources.

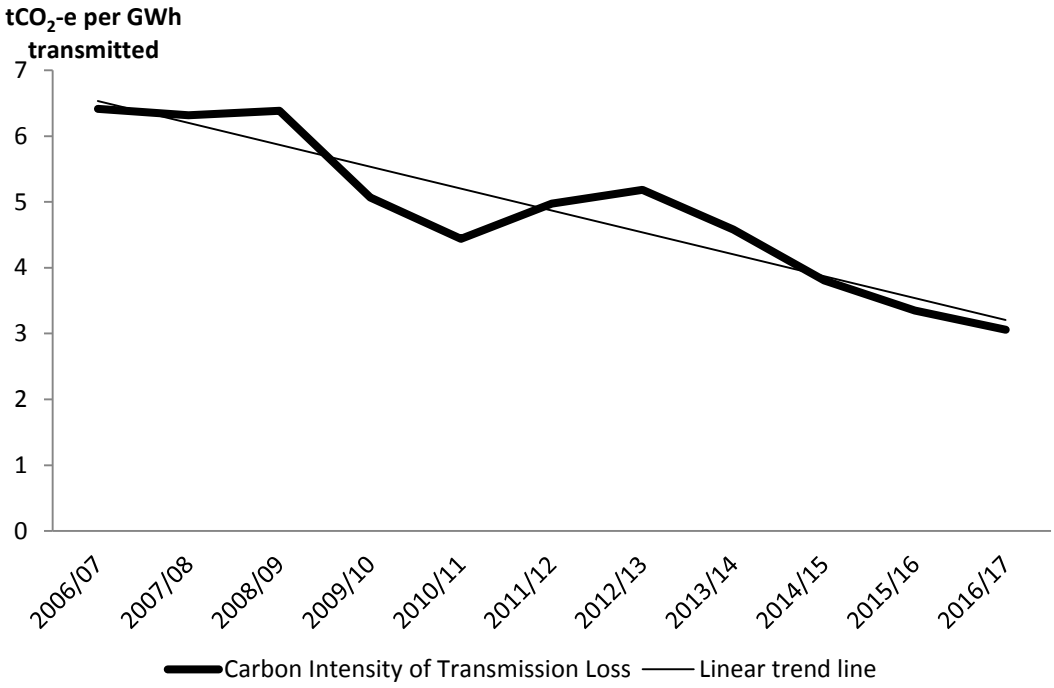


**Figure 8: Carbon intensity of transmission losses since 2006/07**

Figure 8 shows the carbon emissions from transmission losses per GWh of electricity transmitted improved steadily over the past decade. Our emissions associated with transmission losses have reduced by 52% over the past decade, from 250,954 $tCO_2$-e in 2006/07 to 119,221 $tCO_2$-e in 2016/17 (a 8.8% improvement in intensity from the previous year. Changes to emissions from transmission loss are strongly related to the quantity of power transmitted and the emissions from electricity generation. The measured transmission losses (GWh) this year increased by 12% from the previous year.

### 3.2.2 $SF_6$ Emissions

Emissions related to $SF_6$, a potent greenhouse gas, represent our second largest emission source after transmission losses. Figure 9 shows changes in the $SF_6$ emission rate. This year the emission rate was 0.37% (% loss of $SF_6$ installed capacity). The trend line illustrates a downward trend since 2006/07. Reduction in $SF_6$ emissions is due to continued investment in leak reduction initiatives, including leak detection equipment, monitoring, training, and new filling equipment.

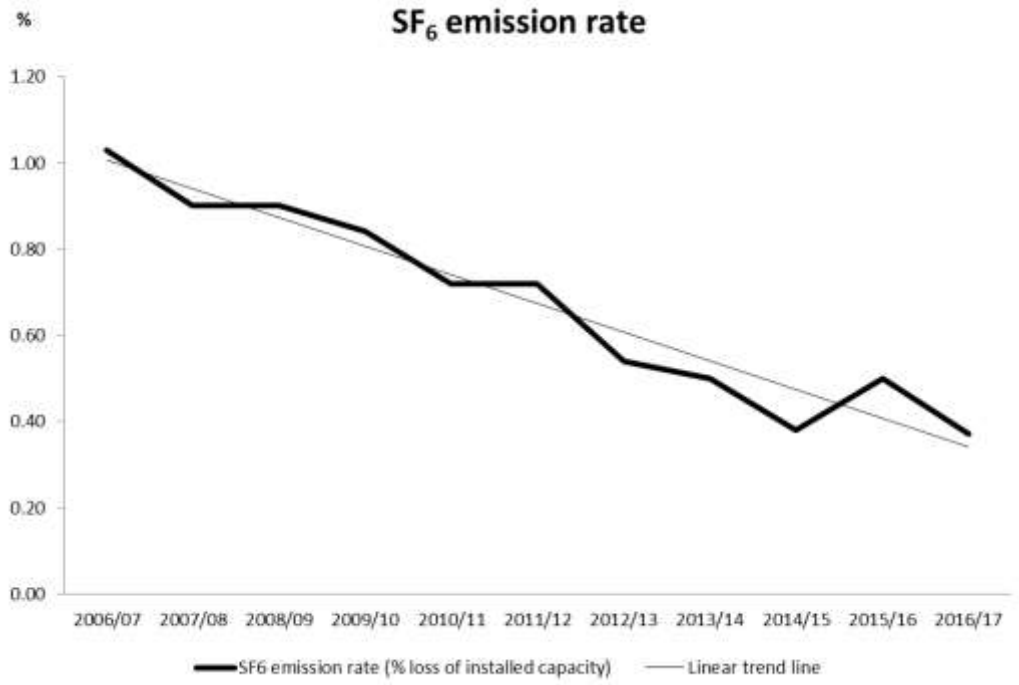


**Figure 9: $SF_6$ emission rate as a percentage loss of $SF_6$ inventory**

In terms of target setting, Transpower has a key environmental goal of reducing emissions to below 0.8% of the total $SF_6$ held in stock. This was achieved in 2007/08 and has been maintained since. In 2016/17, emissions from $SF_6$ loss were equivalent to 0.37% of the total $SF_6$ held in stock. This represents a 20.18% decrease in emissions compared to the $SF_6$ loss reported in the previous year.

## 3.3 Corporate Emissions

### 3.3.1 Air Travel

In 2016/17 air travel was the largest emission contributor at 47% (868 $tCO_2$-e) of the total corporate emissions for 2016/17. Figure 10 illustrates the changes in air travel by Transpower's staff over the last decade. Both domestic and Trans-Tasman travel increased last year, however this was off-set by a reduction in long haul international travel. Overall Transpower staff travelled 8.3% more km by air compared to the previous year; nonetheless the emissions from air travel reduced by 1% due to the improvement in airlines fuel efficiency and consequently lower emissions factors for 2016/17.

The amount of emissions associated with air travel has decreased by 16% over the past decade. Over this period the distance travelled by long haul international air travel has decreased by 53%, Trans-Tasman travel has decreased by 84% but domestic travel has increased by 30%. Since 2006/7, the overall distance travelled via air travel has decreased by 7%. This can partly be attributed to introduction of

enhanced video conferencing, which hopefully will help to continue the trend in emission reduction.

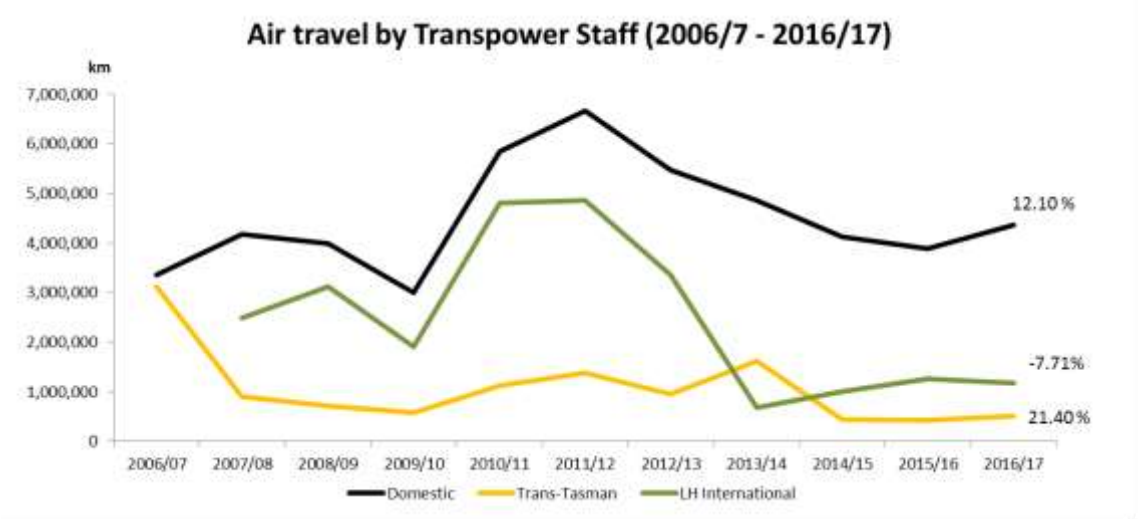


**Figure 10: Air travel by Transpower Staff (2006/7 - 2016/17)**

### 3.3.2 Land Travel Emissions

Figure 11 shows the total carbon footprint of our staff fleet, mileage expenses, and rental and taxi usages. A significant increase was seen in 2010/11 and 2011/12, due to a large increase in the use of diesel powered machinery for various grid upgrade projects, such as the North Island Grid Upgrade Project (NIGUP), and the purchase of additional diesel fleet vehicles. In 2012/13, this trend was reversed and the emissions continue to decrease. In the last reporting year, the emissions from the corporate fleet vehicles decreased by 10%, from taxis usage by 37% and from rentals by 14%. However, the fuel purchases claimed by staff has significantly increased, indicating that staff are using their own cars for work-related travel rather than taxis or rentals.

Overall, the total land travel emissions for 2016/17 have seen a decrease by 5.8% from the previous year.

Transpower has set a target to transition 30% of the company owned vehicles to electric vehicles by the end of 2018 (through low emissions fleet procurement), this is expected to further reduce emissions from land transport.

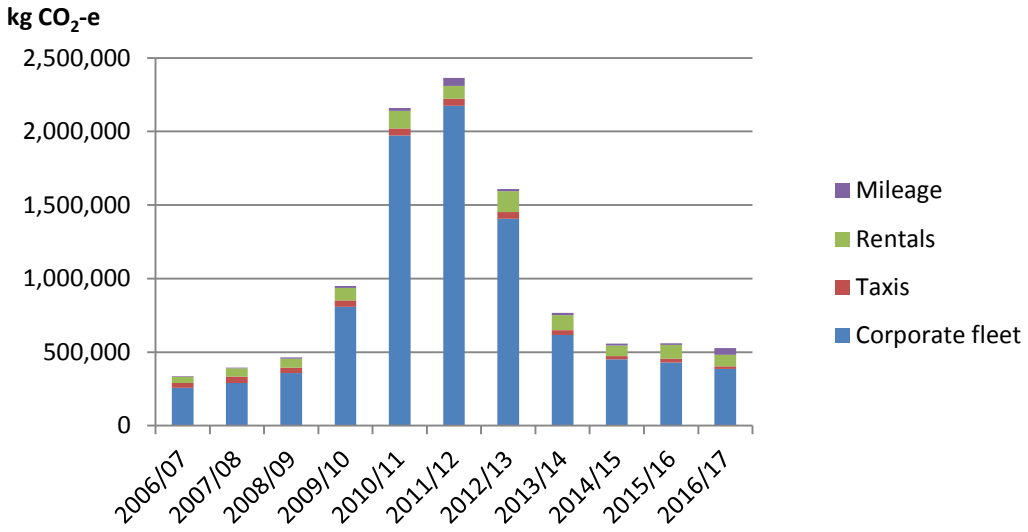


**Figure 11: Total land transport emissions (2006/7 - 2016/17)**

### 3.3.3 Energy Consumption in Offices

Electricity from the Transpower offices is the second largest contributor to the total corporate emissions, with emissions estimated at 413 $tCO_2$-e in 2016/17. Natural gas from the Transpower offices contributes a small amount to the overall corporate emissions, at 12.4 $tCO_2$-e in 2016/17 (0.67 %). The amount consumed has seen a steady decrease since 2014/15. Overall energy use (in kWh) in Transpower offices has decreased by 13%.

Figure 12 illustrates the energy consumption (electricity and gas) of the offices of Transpower over the past decade per FTE and per $m^2$, both of which have decreased since 2014/2015.

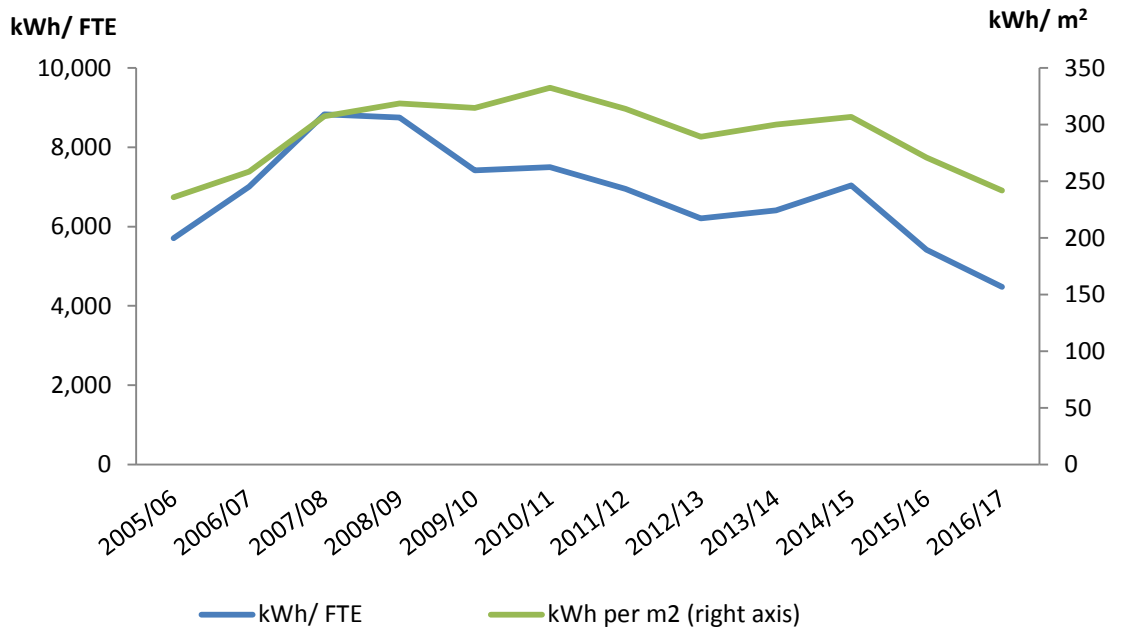


**Figure 12: Energy Consumption in Transpower offices (2006/7- 2016/17)**

Figure 13 shows emissions (kg $CO_2$-e) from Transpower energy use per FTE and $m^2$. The emissions per $m^2$ of office space has decreased significantly since 2014-15. The emissions per FTE display only a slight decrease over the same period but a significant decrease since 2005/6.

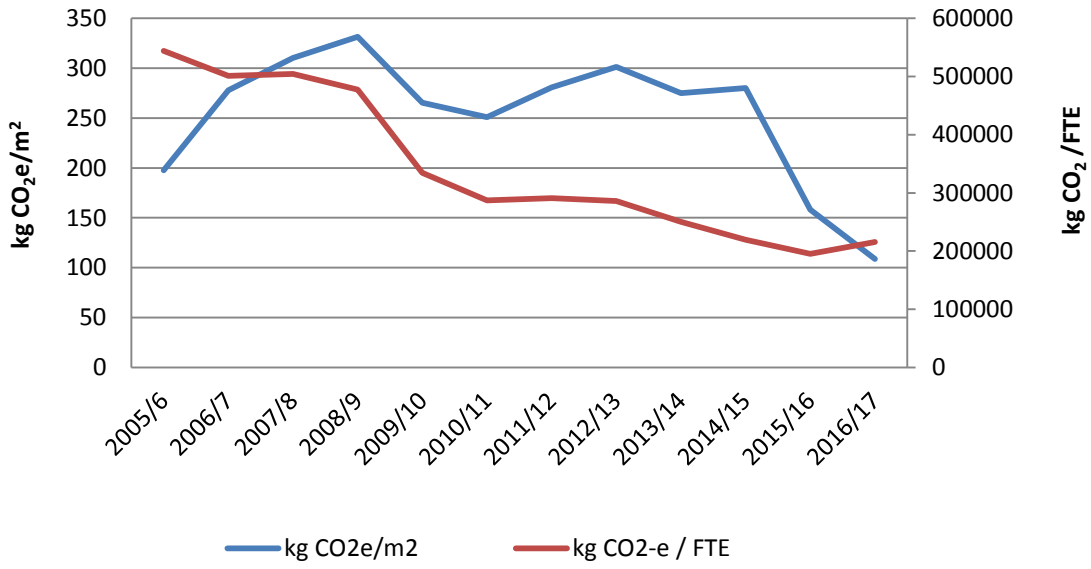


**Figure 13: Transpower emissions associated with office energy use by FTE and $m^2$**

# 4 Full Report & Methodology

This document is a summary report only and is based on analysis contained in the Carbon Calculator 2016-17 final excel spreadsheet, held by Transpower. The analysis was based on information available at the time.

Transpower's carbon footprint has been calculated in conformance with the "Greenhouse Gas Protocol: *A Corporate Accounting and Reporting Standard" (GHG Protocol)* (WRI, 2004). The GHG Protocol is the widely accepted methodology for organisational carbon accounting and is supported by ISO 14064 (2006). The equity share consolidation approach was adopted to determine the organisational boundaries for the carbon footprint. Under the equity share approach an organisation accounts for GHG emissions from operations according to its share of equity in the operation. The selection of the equity share approach was based on ease of application and consistency with financial reporting boundaries.

The organisational boundary of this footprint includes entire operations of Transpower New Zealand Limited. The 2005/06 financial year assessment is considered to be the 'base year' for Transpower's reporting.

In accordance with the GHG Protocol This report covers Scope 1 and 2 emissions and a limited number of Scope 3 category emissions, where reliable data could be obtained including Category 3 (Fuel and energy related activities), Category 6 (Business travel) and Category 8 (Upstream leased assets). Accordingly, the Scope 3 emissions reported do not represent a complete inventory of Transpower's indirect emissions resulting from our supply chain.

Activity data was sourced from relevant suppliers, via third party agents, or from internal financial records. A range of emission factors exist to convert a specific quantity of activity to greenhouse gas emitted. The majority of the emissions used for Transpower's carbon footprint have been sourced from the Ministry for the Environment "Guidance for Voluntary Greenhouse Gas Reporting" (MfE, 2016).

Changes to methodology and assumptions compared to previous years include:

1. Substation electricity data has been calculated based on actual readings and where not available, an estimate. This resulted in a significant drop in the emissions estimate from substations. Substations fed from the transmission network are now included in Transmission losses and warehouses are accounted for separately. This change was made to historical data.
2. In presenting the results we have divided the emissions into 'national grid' and 'corporate'. National grid emissions include transmission losses, substations electricity, $SF_6$ emissions. While corporate emissions are mostly office and travel related.
3. Electricity related emissions, including transmission and distribution losses associated with electricity purchased have been re-estimated using Ministry for Business, Innovation and Employment quarterly electricity consumption,

generation and emissions data (MBIE 2018) for 16/17 and in order to assess trends for the 14/15 and 15/16 years.

Further information including the methodology, assumptions and limitations are presented in the Carbon Calculator 2016-17 final excel spreadsheet.

# 5 References

Greenhouse Gas Protocol Corporate Accounting and Reporting Standard. WRI, 2004

International Standards Organisation, ISO 14064-1:2006

IPPC Fifth Assessment Report of the IPPC. Chapter 8 Table 8.A.1
http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf

Ministry for the Environment “Guidance for Voluntary Greenhouse Gas Reporting” (MfE, 2016).

Study scope and data inventory is documented in the Carbon Calculator 2016-17 final excel spreadsheet. Transpower 2018 (Confidential)

 