

Greenhouse Gas Emissions Inventory Report

Our carbon footprint, prepared in accordance with *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (2004)*

August 2022

Summary of Emissions

Purpose of this report and limitations

This report is a summary of Vector's greenhouse gas inventory. It is intended to inform readers about Vector's business strategy with respect to greenhouse gas emissions, but it is not earnings guidance nor financial advice for investors.

While Vector has taken all due care in preparing this report and has taken efforts to ensure that assumptions and input data have a reasonable basis and are coherent and robust (including basing them on modelling, public scientific information, market knowledge, government guidance, supplier information and reasonable/expert opinions), assessments of greenhouse gas emissions are still a developing field. Modelling assumptions, emission intensity factors and third-party data are expected to evolve as the discipline progresses.

To the greatest extent possible under NZ law, Vector expressly disclaims all liability for any direct, indirect or consequential loss or damage occasioned from the use or inability to use this report, whether directly or indirectly resulting from inaccuracies, defects, errors, omissions, out of date information or otherwise.

We recommend you seek independent advice before acting or relying on any information in this report.



In FY22, Vector's greenhouse gas emissions across Scope 1, 2 and 3 amount to 1,513,447 tCO₂e. This is a 16.5% reduction from FY20, Vector's base year. Table 1 summarises yearly emissions by Scope, Table 2 shows total Scope 1 and 2 emissions split by Kyoto Gas, and Table 3 breaks down emissions into Scope and category.

Table 1: Emissions trend by Scope in tCO₂e

EMISSIONS CATEGORY	FY20	FY21	FY22	CHANGE FROM FY20 BASELINE
Total Scope 1, 2, 3	1,812,082	1,601,643	1,513,447	-16.5%
Scope 1	23,669	19,330	20,294	-14%
Scope 2*	33,439	34,520	40,069	20%
Scope 3**	1,754,974	1,547,793	1,453,084	-17%

Table 2: Scope 1 and 2 FY22 emissions by greenhouse gas in tCO₂e***

SCOPE	CO ₂	CH ₄	N ₂ O	HFC	SF ₆	TOTAL TCO ₂ E
Total FY22	44,696	13,539	133	136	1,859	60,363
Scope 1	5,747	12,502	50	136	1,859	20,294
Scope 2*	38,949	1,037	83	N/A	N/A	40,069

* Location-based.

** A recalculation of Scope 3 was undertaken for FY20 and FY21 to remove emissions from Vector's investment in Treescape. For details see [Section 1: Organisational Boundaries](#).

*** PFCs and NF₃ are not listed here as they are not relevant to Vector activities.

**** For the production year 21/22 (April 2021 to March 2022), 5,958 NZECS certificates were redeemed against Vector's electricity consumption. This spans across the group's FY21 and FY22 GHG emissions inventories. Emissions from additional electricity used during both financial years in NZ as well as in Australia are calculated using residual grid mix factors for each country.

SUMMARY	ORGANISATIONAL BOUNDARIES	OPERATIONAL BOUNDARIES	DATA COLLECTIONS AND QUANTIFICATION	EMISSION RESULTS	EMISSION REDUCTIONS
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Table 3: GHG inventory by Scope and Category in tCO₂e. Colours highlight changes from the FY20 baseline.

EMISSIONS CATEGORY	FY20	FY21	FY22
TOTAL SCOPE 1, 2*, 3	1,812,082	1,601,643	1,513,447
Scope 1	23,669	19,330	20,294
Natural Gas Distribution Fugitive Emissions	16,368	12,074	11,453
Gas Metering Fugitive Emissions	934	1,082	1,161
SF₆ Fugitive Emissions	426	592	1,859
Other Fugitive Emissions	146	146	138
Stationary Combustion	3,558	2,971	3,348
Vehicle Fleet	2,237	2,465	2,335
Scope 2	33,439	34,520	40,069
Electricity Consumption (location-based)	934	898	991
<i>Electricity Consumption (market-based) ****</i>	739	940	515
Electricity Distribution Losses	32,505	33,622	39,078
Scope 3	1,754,974	1,547,793	1,453,084
C1: Purchased Goods & Services			
Upstream Purchased Natural Gas	227,569	170,442	136,821
Upstream Purchased LPG	46,555	47,609	52,806
Fuel used by FSPs	9,934	10,256	9,487
C3: Fuel- and Energy-Related Activities	1,471	1,381	1,530
C4: Upstream Transportation	2,717	2,557	3,225
C6: Business Travel	424	156	125
C11: Use of Sold Products			
Distributed Natural Gas AKL	772,265	760,185	711,337
Sold Natural Gas - AKL	151,603	115,578	57,149
Shipped Natural Gas - AKL	-	-	55,245
Other Distributed Natural Gas - AKL	620,662	644,607	598,943
Sold Natural Gas – non-AKL	562,567	381,871	231,127
Shipped Natural Gas – non-AKL	-	47,002	183,614
Sold LPG	131,385	126,245	122,904
C15: Investments			
Liquigas	87	89	108
Biogenic CO₂	162	134	150

Table 4: Definition and glossary of terms

TERM	DESCRIPTION
API	American Petroleum Institute
Carbon footprint	Vector's GHG emissions covered by the Kyoto Protocol, calculated in tonnes of carbon dioxide equivalent (tCO ₂ e).
CO ₂	Carbon dioxide
EGF	Electricity, Gas, Fibre
Emissions	GHG emissions
EV	Electric vehicle
FSP	Field service provider
FY	Financial year
GHG	Greenhouse gas For the purposes of this report, GHGs are the seven gases listed in the Kyoto Protocol. These are currently: carbon dioxide (CO ₂), methane (CH ₄), nitrous oxide (N ₂ O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF ₆), and nitrogen trifluoride (NF ₃).
GWP	Global warming potential, a measure of how much energy the emissions of 1 tonne of a greenhouse gas will absorb over a given period, relative to the emissions of 1 tonne of carbon dioxide (CO ₂).
HFC	Hydrofluorocarbon
HVAC	Heating, ventilation, and air conditioning
LPG	Liquefied petroleum gas
NZ	New Zealand
NZECS	New Zealand Energy Certificate System
NZ ETS	New Zealand Emissions Trading Scheme
NZU	New Zealand Units
NGT	Natural Gas Trading
SBTi	Science Based Targets initiative
SF ₆	Sulphur hexafluoride
T&D	Transmission and distribution
TCFD	Task Force on Climate-Related Financial Disclosures
tCO ₂ e	Tonnes of carbon dioxide equivalent
The GHG Protocol	The Greenhouse Gas Protocol, a partnership between World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). The GHG Protocol develops standards and guidance, such as the Corporate Standard and the Corporate Value Chain (Scope 3) Standard, both used as guidance for this report.
Vector	Vector Limited Group
WTT	Well-to-tank

Introduction

This report is for the Vector Limited Group ("Vector" or "the group"). The group comprises Vector Limited and its subsidiaries. Vector Limited is NZX listed and 75.1% owned by Entrust, a private community trust. A list of all subsidiaries can be found in [Appendix 1](#).

The purpose of this document is to transparently disclose Vector's greenhouse gas ("GHG") emissions, how they are quantified, how we're tracking towards our reduction targets and steps planned to further reduce GHG emissions ("emissions").

This GHG inventory report is for Vector for the year ended 30 June 2022. The inventory covered in this report is a complete and accurate quantification of the amount of GHG emissions that can be attributed to Vector's operations within the declared boundary and scope for the specified reporting period. Any exclusions from reporting are disclosed and justified.

This report has been prepared in accordance with *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard* [1] ("The GHG Protocol Standard") and with guidance from *The Greenhouse Gas Protocol: Corporate Value Chain (Scope 3) Accounting and Reporting Standard* [2] ("The GHG Protocol Value Chain Standard").

Statement of intent

Vector reports on its GHG emissions on an annual basis and has been calculating its carbon footprint since 2017.

Vector's GHG inventory has been calculated in accordance with The GHG Protocol Standard [1] and with guidance from The GHG Protocol Value Chain Standard [2].

Its intended users are all interested stakeholders, including shareholders, investors, regulators, communities, employees, customers, and contractors.

This GHG inventory report has been reasonably assured by KPMG, [see Appendix 2](#).

Reporting period covered

This GHG inventory report covers Vector's financial year 1 July 2021 to 30 June 2022 ("FY22"). A summary of emissions can be found in both Vector's Annual Report 2022 and TCFD Report 2022.

Variations:

As SF₆ losses are calculated for the calendar year to align with New Zealand Emissions Trading Scheme ("NZ ETS") reporting requirements, SF₆ emissions refer to January – December 2021.

In FY20 and FY21, the GHG inventory calculation used electricity distribution losses published as part of the electricity information disclosure (EID), covering the electricity regulatory year from April to March. From FY22, electricity distribution losses will additionally be calculated for the financial year, to align with Vector's GHG emissions reporting. The difference in emissions is not significant to require a restatement of previous years' GHG inventories.

The purpose of this document is to transparently disclose Vector's greenhouse gas emissions, how they are quantified, how we're tracking towards our reduction targets, and steps planned to further reduce GHG emissions



1. Organisational Boundaries

Description of Vector

Vector is an innovative New Zealand energy company which runs a portfolio of businesses delivering energy and communication services to more than one million homes and commercial customers across Australasia and the Pacific. Vector is creating a new energy future through its Symphony strategy which puts customer at the heart of the energy system.

The primary operations of the group are electricity and gas distribution, natural gas and LPG sales, metering, telecommunications and new energy solutions. For further information visit www.vector.co.nz.

Organisational boundaries

Vector uses the operational control approach, as defined by The GHG Protocol Standard. This approach was chosen as it allows a focus on emissions over which the group has greatest control, and thereby can influence most with emission reduction measures.

For carbon accounting purposes, emissions are categorised into the business areas as outlined in Figure 1. A detailed list of all subsidiaries and shareholdings under Vector and their relevance for carbon accounting can be found in [Appendix 1](#).

Treatment of investments

In addition to these business areas, Vector has investments in a number of businesses that complement our network businesses and strengthen our capabilities in the energy services field. This subsection discusses the treatment of emissions from those businesses.

For carbon accounting purposes, Vector has set a threshold for equity investments of 20%, unless significant influence can be evidenced.

Liquigas Limited (60.25%)

Liquigas is New Zealand's leading company for tolling, storage, and distribution of bulk LPG. It is not considered to be under Vector's operational control, because Vector does not have "full authority to introduce and implement its operating policies at the operation" (definition of operational control per The GHG Protocol Standard). As a result, Liquigas' Scope 1 and 2 emissions are included under Vector's Scope 3 - Category 15 - Investments, with a 60.25% equity share.

mPrest Systems Limited (8.1%)

Vector holds an 8.1% shareholding in mPrest Systems (2003) Limited. The mPrest technology allows companies to better monitor, analyse, and control

energy networks and connect traditional infrastructure like electricity lines and substations with new technology like solar and battery energy solutions.

Emissions from mPrest are excluded from Vector's carbon footprint due to Vector's share in mPrest sitting below the equity investment threshold of 20%.

Treescape Limited (50% - sold early FY22)

Treescape is one of Australasia's largest specialist tree and vegetation management companies, with depots throughout New Zealand and in Queensland and New South Wales. Vector held a 50% shareholding in the company until 31 August 2021, and in FY20 and FY21 accounted for 50% of the company's Scope 1 & 2 emissions under Scope 3 - Category 15 - Investments. Although these emissions are below the significance threshold (<5%, see [Section 4](#)) and a recalculation of Vector's carbon baseline thereby not compulsory, we have voluntarily decided to restate previous years' inventories to exclude these emissions for reasons of clarity.

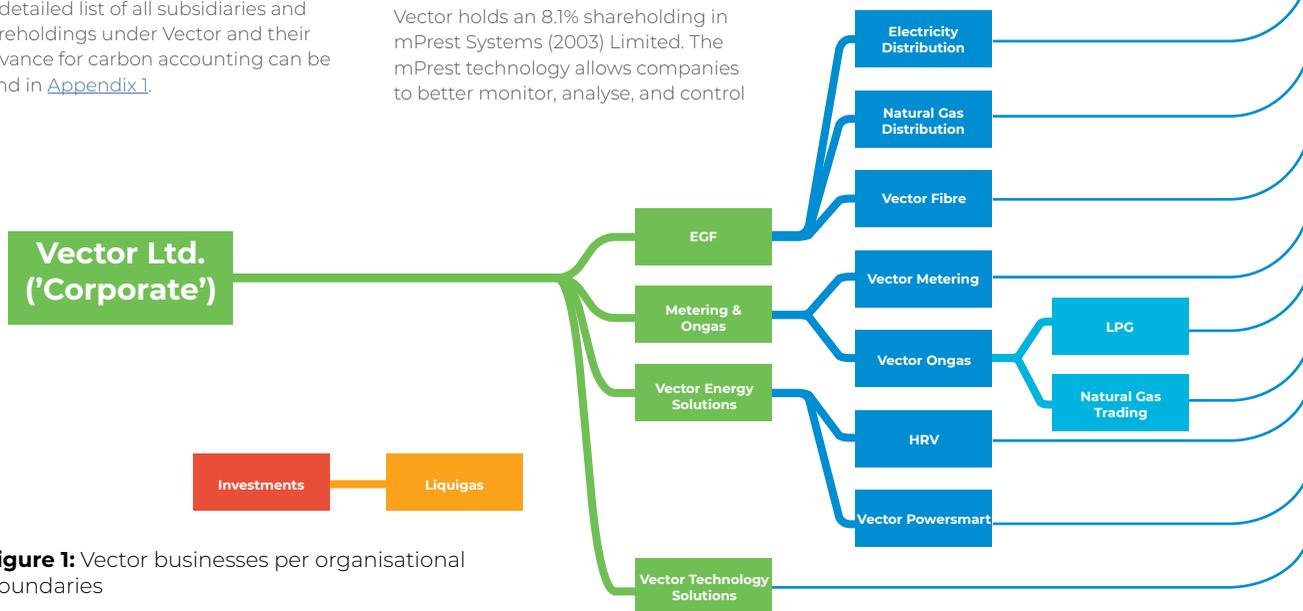


Figure 1: Vector businesses per organisational boundaries

VECTOR BUSINESS	DESCRIPTION
Electricity Distribution	Owens and operates the electricity network within the wider Auckland region. This consists of more than 19,000km of electricity lines, delivering power to more than 600,000 homes and businesses.
Natural Gas Distribution	Owens and operates the gas distribution network in the wider Auckland region, supplying gas to over 117,000 installed connection points, through more than 6,700km of pipelines, distributing around 14PJ of gas per year.
Vector Fibre	Designs, builds and maintains data networks in the wider Auckland region.
Vector Metering	Manages around two million advanced electricity and gas meters across New Zealand and Australia, providing data services that enable new and innovative retail products that give customers large and small the ability to make smarter decisions and deliver future-ready energy solutions.
Vector Ongas - LPG	Distributes and sells Liquefied Petroleum Gas ("LPG") to residential, commercial and industrial customers throughout Aotearoa, through bottled LPG products and piped LPG networks.
Vector Ongas - Natural Gas Trading ("NGT")	Supplies piped natural gas to industrial and commercial businesses in the North Island including customers in the agriculture, horticulture and manufacturing industries.
HRV	Provides energy efficient solutions covering home ventilation, home heating, and water filtration systems, as well as electric vehicle charging.
Vector Powersmart	Vector Powersmart has delivered some of the largest solar photovoltaic and energy storage systems in New Zealand and the Pacific Islands. More recently Vector Powersmart has also been providing expert consultancy for large-scale solar developments.
Vector Technology Solutions ("VTS")	A digital solutions business that takes solutions to market developed internally as part of Vector's digital transformation journey. VTS is exploring opportunities in New Zealand and globally for key priority solutions including cyber security, and the New Energy Platform co-developed through our strategic alliance with Amazon Web Services. VTS is working with X the moonshot factory (formerly Google X) to co-develop network virtualisation and simulation tools to support the transformation of the energy sector and decarbonisation goals.



New Zealand's first floating solar farm built by Vector Powersmart for Watercare

2. Operational Boundaries

Operational boundaries

The GHG Protocol Standard splits emissions into three categories:

Scope 1 – Emissions Vector directly controls, such as vehicle fleet fuel combustion, diesel back-up generators, methane leaks, and SF₆ leaks.

Scope 2 – Vector's consumption of purchased electricity, and electricity distribution losses along the network.

Scope 3 – All other indirect value chain emissions, such as customer energy consumption and supply chain emissions.

Scope 2 emissions include both Vector's purchased electricity consumption (offices, electricity use in substations, and Vector's network of free EV chargers) as well as electricity distribution losses that occur on Vector's electricity network across Auckland.

The GHG Protocol splits Scope 3 emissions into 15 categories. To gain a more comprehensive understanding of our emissions, in 2020 Vector commissioned an external review of its carbon accounting methodology, which included a Scope 3 screening exercise to identify applicable and material categories and activities across Vector's supply chain. 14 categories were determined applicable to Vector, of which two were defined as material. The threshold at which a Scope 3 category is considered as material is set to 1% of total Scope 3 emissions.

During the screening process, emissions were calculated for 11 Scope 3 categories, with emissions from the remaining three categories considered to be included in other categories of the inventory (2, 8) or to be zero (12). However, we have chosen to externally report only on emissions categories that are material (1, 11) or where data is deemed robust (3, 4, 6, 15).

Excluded Scope 3 categories:

Category 2 – Capital Goods: Included in Category 1 as it was not possible

to separate out new infrastructure construction from maintenance of existing infrastructure.

Category 5 – Waste Generated in Operations: Immaterial. Aside from office waste, the majority of obsolete items across Vector's businesses are recycled, but if they do reach landfill they are inert so do not produce methane emissions.

Category 7 – Employee Commuting: Immaterial. Screening estimation based on Stats NZ only. Collection of more accurate data in planning.

Category 8 – Upstream Leased Assets: Included in Scope 1 & 2, as leased assets are expected to be under Vector's operational control.

Category 9 – Downstream Transportation and Distribution: Immaterial.

Category 12 – End-of-Life Treatment of Sold Products: Expected to be zero.

Category 13 – Downstream Leased Assets: Immaterial.

Category 14 – Franchises: Immaterial.

GHG emission source inclusions

Table 5 provides an overview of all emission sources included in Vector's GHG inventory, including their data sources and calculation methods.

For completeness, Vector is reporting on well-to-tank ("WTT") emissions for fuel used by field service providers ("FSP") under Category 1 and 4 as well as on emissions from gas distributed via Vector's gas network under Category 11 ('Other Distributed Natural Gas'). The later one is optional under The GHG Protocol Standard, but required according to guidance from the Science Based Target initiative ("SBTi").

As some gas sold or shipped by Natural Gas Trading is transported via Vector's gas distribution network, these volumes are subtracted from the overall 'Other

Distributed Natural Gas' amount (previously called 'Distributed Gas') to avoid double counting. To increase transparency on overall emissions on Vector's gas distribution network, from FY22 we are further breaking down our emissions from sold products into the following sub-categories:

Category 11 – Use of Sold Products:

- Distributed Natural Gas - Auckland
 - Sold Natural Gas - Auckland
 - Shipped Natural Gas - Auckland
 - Other Distributed Natural Gas - Auckland
- Sold Natural Gas – non-Auckland
- Shipped Natural Gas – non-Auckland
- Sold LPG

Other emissions – biogenic CO₂

Vector uses a 5% biodiesel blend in generators used by Vector Fibre and on the electricity distribution network. In FY22, Vector's combustion of biodiesel blend created 150 tonnes of biogenic emissions. This is a reduction of 7% from FY20.

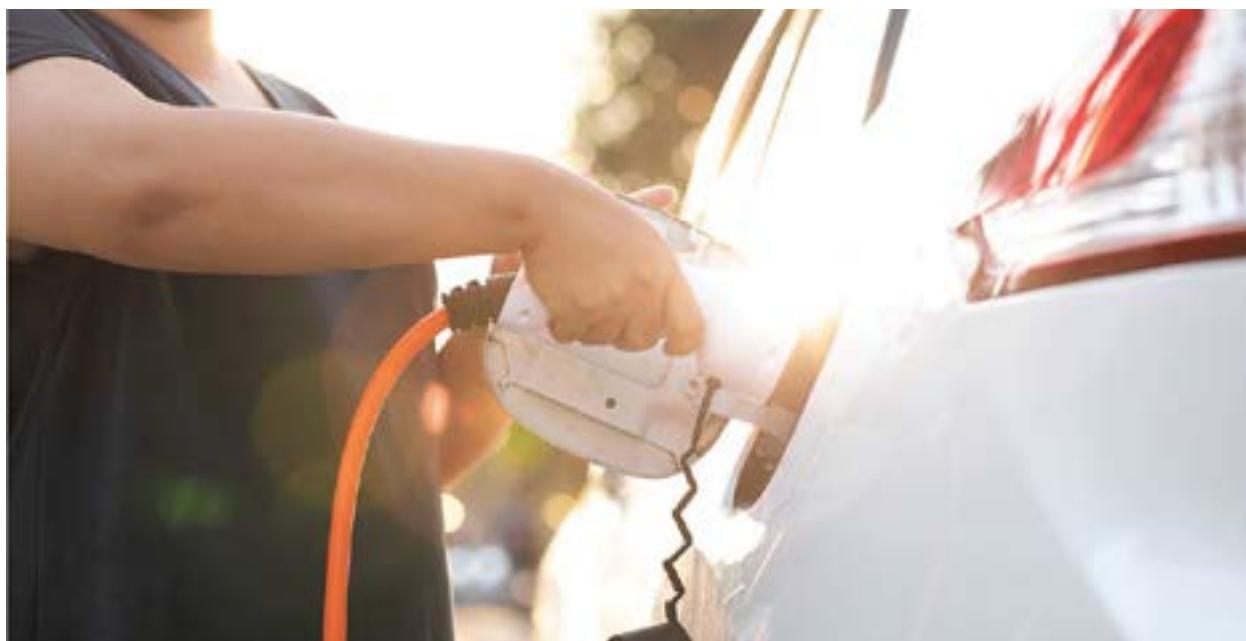
Exclusions from GHG inventory

Table 6 shows Scope 3 emissions sources that were excluded from reporting (in addition to the excluded categories listed previously), and the reasoning behind this.

Vector aims to gain a better understanding of emissions in these areas in the future by working with its suppliers to increase data availability and quality. We also intend to engage with suppliers to encourage and support them in reducing emissions.

Table 5: Emission calculation methods and data sources

EMISSIONS CATEGORY	EMISSIONS ACTIVITY	CALCULATION METHOD	DATA SOURCE
Scope 1			
Natural Gas Distribution Fugitive Emissions	Fugitive natural gas across Vector's distribution network	See Section 3	FSP records; company records on asset data
Gas Metering Fugitive Emissions	Gas losses from gas meters throughout New Zealand	See Section 3	FSP records; company records on response time callouts
SF ₆ Fugitive Emissions	SF ₆ leaks in switchgear	Top-up method	Gas recovery records; FSP SF ₆ cylinder records' log sheets
Other Fugitive Emissions	LPG losses from venting, HVAC leaks (offices, substations, vehicle fleet), CO ₂	Top-up method for substation HVAC, LPG, and CO ₂ ; screening method for office & vehicle HVAC	Service records; invoices; inventory lists
Biodiesel Stationary Combustion	Biodiesel used in generators	Fuel-based method	Provider records
Diesel Stationary Combustion	Diesel used in forklifts and generators	Fuel-based method	Invoices
LPG Stationary Combustion	LPG used in forklifts, flaring and vaporisers	Fuel-based method	Invoices
Natural Gas Stationary Combustion	Water and space heating	Fuel-based method	Invoices
Diesel Combustion	Diesel used in vehicle fleet	Fuel-based method	Fuel records by lease providers
Petrol Combustion	Petrol used in vehicle fleet	Fuel-based method	Fuel records by lease providers
Scope 2			
Electricity Consumption from Grid (location-based)	Electricity use at offices, substations, public EV chargers	Location-based method	Invoices by retailers
Electricity Consumption from Grid (market-based)	Electricity use at offices, substations, public EV chargers	Market-based method	Invoices by retailers; NZECS certificate
Electricity Distribution Losses	Electricity losses along the network	Location-based method	Transpower & distributed generators (ingoing); retailers (outgoing)



SUMMARY	ORGANISATIONAL BOUNDARIES	OPERATIONAL BOUNDARIES	DATA COLLECTIONS AND QUANTIFICATION	EMISSION RESULTS	EMISSION REDUCTIONS
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Table 5-continued: Emission calculation methods and data sources

EMISSIONS CATEGORY	EMISSIONS ACTIVITY	CALCULATION METHOD	DATA SOURCE
Scope 3			
C1 - Upstream Purchased Natural Gas	Natural gas purchased	Hybrid method and average-data method	Invoices
C1 - Upstream Purchased LPG	LPG purchased	Hybrid method and average-data method	Cost of sales report
C1 - Fuel Used by FSPs	Fuel used by FSPs on behalf of Vector, incl. WTT	Supplier-specific method	Fuel data provided by FSPs
C3 - Fuel- and Energy-Related Activities	T&D and WTT emissions from the group's electricity and fuel use	Average-data method	Same invoice data as fuel and electricity use in Scope 1 & 2
C4 - Upstream Transportation	Fuel used by LPG providers, from FY22 incl. WTT	Fuel-based method	Fuel data provided by service providers
C6 - Business Travel	Air travel, hotels, rental cars, mileage claims, taxis	Distance-based method	Records provided by booking agents and expense claims
C11 - Sold Natural Gas – Auckland	Natural gas sold via the Vector network, directly by NGT or via retailers	Direct use-phase method – fuel	Invoices to Auckland customers and retailers; downstream allocation reports
C11 - Shipped Natural Gas - Auckland	Natural gas transported via the Auckland network	Direct use-phase method – fuel	Invoices to Auckland customers
C11 - Other Distributed Natural Gas	Gas distributed via Auckland network, excl. NGT amounts	Direct use-phase method – fuel	Firstgas Oatis system
C11 - Sold Natural Gas – non-Auckland	Natural gas sold outside of Auckland network	Direct use-phase method – fuel	Invoices to customers and retailers outside of Auckland; downstream allocation reports
C11 - Shipped Natural Gas – non-Auckland	Gas transported outside of Auckland network	Direct use-phase method – fuel	Invoices to customers outside of Auckland
C11 - Sold LPG	LPG sold	Direct use-phase method – fuel	Sales report
C15 - Liquigas	60.25% of Scope 1 and 2 emissions from Liquigas	Investment-specific method	Invoice based records provided by Liquigas

Table 6: Excluded emission sources from reporting

EMISSIONS CATEGORY	EMISSIONS ACTIVITY	REASONS FOR EXCLUSION
C1 – Upstream Purchased Materials & Products*	Cradle-to-gate emissions from purchased materials and products (e.g. materials used on networks)	Low data quality due to limited data availability and mixed calculation methods
C1 – Fuel Used by FSPs	Emissions from FSP fuel use where fuel amount is <1% of overall FSP fuel use	Emissions immaterial; data difficult to obtain
C4 – Upstream Transportation	Some third-party transportation and distribution services paid by Vector incl. transportation of C1 – Upstream purchased Materials & Products.	Emissions immaterial; low data quality using spend- and distance-based methods during screening
C11 – Use of Sold Products*	Use of sold HVAC units	Limited data availability, conservative estimations

* Although excluded from quantitative reporting, it has to be noted that the screening process identified both cradle-to-gate emissions from purchased products (Scope 3 – Category 1) and emissions from the use of sold HRV products (Scope 3 – Category 11) as possibly material. However, the calculations were based on numerous assumptions, estimations, and, in the case of purchased products, a mix of methodologies, making it difficult to quantify these emissions to satisfactory validity for disclosure.

3. Data Collection and Quantification

Information management procedures

Vector uses an internal process guideline for GHG emissions accounting to ensure consistency in the preparation of its GHG inventory. This was developed following a screening of Vector's full supply chain emissions, and setting the base year to FY20. The document outlines responsibilities, defines thresholds, calculation methods and recalculation policy, amongst other details that ensure conformance with The GHG Protocol Standard over time.

Vector uses the software solution CSR to collect data and calculate our carbon footprint. Activity data is collected and uploaded either by Vector staff from each business and our finance team, or directly by suppliers. All data is reviewed by the GHG accounting team before final upload onto the system. Emissions are calculated automatically within CSR, by multiplying the provided activity data with each applicable emission factors. These factors are updated every year as required, by Vector's GHG accounting team.

Prior to KPMG assurance, the inventory is analysed by the GHG accounting team for trends and missing data. Upon completed assurance, Vector's executive team and board are informed of changes in emissions over time. Both the internal GHG emissions accounting guide as well as our reduction strategy to reach Vector's reduction target are reviewed and updated as required on an annual basis.

Methodologies

Most of Vector's GHG emissions are calculated by multiplying activity data with appropriate emission factors. Examples of activity data include kilo-Watt-hour (kWh) of electricity used, quantity of fuel used, or giga-Joules (GJ) of gas sold. Most activity data is based on consumption data sourced from invoices provided by suppliers, or internal sales

reports. An overview of sources used per category is included in Table 5 on the previous page.

Except as stated below, emission factors used were sourced from the most recent publications (at FY end) by New Zealand's Ministry for the Environment ("MfE") [3], the UK's Department of Environment, Food and Rural Affairs ("DEFRA") [4], or Australia's Department of Industry, Science, Energy and Resources ("DISER") [5].

- The emissions factor for additional processing emissions at Kapuni for both Ongas LPG and Natural Gas Trading has been sourced from Table 10 of the *Climate Change (Stationary Energy and Industrial Processes) Amendment Regulations 2009* [6], by subtracting 'Kapuni' emissions from 'Kapuni LTS' emissions. These additional emissions are to account for removal of extra CO₂ at this gas field to meet the nationally required standard.
- The market-based emissions for NZ electricity consumption are based on the purchase of renewable energy certificates. Emissions from electricity use in NZ which is not covered by this product has been disclosed using the Residual Supply Mix emission factor as disclosed by the New Zealand Energy Certificate System [7]. This residual factor is calculated for the production year period April – March.
- The market-based emission factor for Australian electricity consumption is based on methodology described in the *Climate Active Technical Guidance Manual* [8], though the national emission factor used includes Scope 2 emissions only, with upstream and T&D emissions included in Vector's Scope 3.
- The emissions factor applied for LPG

fugitive emissions has been sourced from the *Intergovernmental Panel on Climate Change ("IPCC") Fourth Assessment Report* [9] ("AR4"), for a 50:50 mix of Butane and Propane. Including these emissions is voluntary, and accounted for under carbon dioxide (CO₂) in Table 2.

All calculations in this report are expressed in total tonnes of carbon dioxide equivalent ("tCO₂e"). Australian emission factors extracted from DISER use the global warming potential ("GWP") from the *Intergovernmental Panel on Climate Change Fifth Assessment Report* [10] ("AR5"). All other quantities of each greenhouse gas are converted to tCO₂e using the GWP from the IPCC AR4. This is also true for the calculations described below. The time horizon in all cases is 100 years.

Fugitive emissions from gas distribution and gas meters are subject to more complex calculations that are described in the following two subsections.

Gas metering fugitive emissions

Vector's metering business has developed its own standard for the quantification of natural gas emissions from its gas meter asset base. Emissions are caused by:

- Methane vented to the atmosphere during the commission, decommissioning, and maintenance of natural gas meters.
- Fugitive leaks by the meters based on the number of valves, controllers, connections, and pressure relief valves. Approximated using the American Petroleum Institute ("API") *Compendium of Greenhouse Gas Emissions* [11].
- Meter failure leading to continuous discharge of methane until repaired.

The emissions are linked to the gas meter type. Gas meters are categorised as

<= E750: Domestic meters

- <= AL1000: Small commercial meters
- <= G160: Commercial meters
- <=G400: Large commercial meters
- >G400: Industrial meters

As it is not feasible to measure every variable in this calculation the following assumptions are made:

- During meter failure, the flow rate of methane released to the atmosphere is assumed to be based on the maximum flow rate of the gas meter's regulator.
- The volume of natural gas vented during maintenance, commissioning, and decommissioning is approximated by meter category. For example, the decommissioning of a small commercial meter releases approximately 0.009m³ of methane.
- The number of disconnections and reconnections of gas meters was approximately 20,000 for FY20 and FY21, and 25,000 for FY22, based on data provided by metering FSPs.

Gas distribution fugitive emissions

In FY21, Vector undertook a comprehensive study to model methane leaks on our gas network. The model created a fluid-dynamics based, quasi-digital twin of the network, which enabled us to identify and quantify methane leaks.

Vector has implemented the guidelines of the Technical Association of the European Gas Industry, Marcogaz [12], which was found to be the most comprehensive and applicable to Vector's gas network. Marcogaz is currently in the process of integrating these guidelines into the CEN/TC 234 European Technical Standard for Gas Infrastructure.

This quantification method requires Vector to split the gas network into groups of assets and corresponding categories of emissions that can be expected from these groups. The

emission categories can be defined as:

Pipe permeation: Permeation of gas through the membrane material of the polyethylene pipes.

Leaks detected by systematic surveys: Found using Street Evaluation Laser Methane Assessment (SELMA), that are conducted on an annual basis.

Operational / maintenance emissions: Vented natural gas during commission, decommissioning, and pipeline maintenance.

Third party damages

Public reported escapes: Leaks detected by members of the public.

District regulator stations: Operational emission approximated using the API *Compendium of Greenhouse Gas Emissions* [11].

Valves and fittings: Additional leaks from seal failures of valves and fittings.

As it is not feasible to measure every variable, key assumptions are made. The following assumptions have a material impact on the overall data:

- Duration of leak when detected during systematic surveys: When a leak is found on a routine survey, there is no knowledge of when

the leak started. However, we do know when the pipe was last surveyed, and assuming a gaussian distribution, can state that on average the duration of leak is half the time since the last survey point. For example, Vector runs routine surveys annually. We can therefore approximate that the average leak duration is six months. This is in alignment with Marcogaz guidelines.

- Average size of leak found on routine survey: Most of the historical records of the detected leaks have been due to lose fittings. Vector has conducted several review sessions internally and across the industry and found that the most applicable assumption is in the RR630-HSE, UK standard. Within that, we take a conservative estimate of a hole size of 2mm².

- Average size of leak found from third party damages: Normalised across all third-party damages to 30mm, based on measured samples.

- Permeability of the ground: 6,700km of pipes run through various ground and geological formations. An estimation of soil permeability is made according to ISBN 0-486-65675-6, and based on NZ soil map, however, further testing is planned to verify the assumptions.

Table 6: Breakdown of gas distribution fugitive emissions by category in tCO₂e

EMISSION SOURCE	FY20	FY21	FY22
Total	16,368	12,074	11,453
Pipe permeation	49	49	49
Leaks detected in systematic survey	10,709	6,023	4,505
Operational emissions / maintenance	8	13	8
Third-party damages	4,199	4,685	5,582
Public reported escapes	20	15	19
District regulator stations (DRS) (maintenance and operation)	759	665	661
Valves and fittings	624	624	629

4. GHG Emission Calculation and Results

Base year

Vector's base year for emissions reporting is FY20, 1 July 2019 to 30 June 2020. This is the first year that the GHG inventory included an in-depth screening of Scope 3 emissions, and it forms the base year for Vector's science-aligned reduction target.

Due to divesture from Kapuni in March 2020, emissions from activities at this location have been excluded in the updated FY20 base year footprint calculation. This is in line with The GHG Protocol Standard's recommendations for base year recalculations, and facilitates comparison to future years with FY20 as Vector's target base year for emission reductions.

Changes to historic base year

Vector recalculates its historic base year emissions if the inventory is affected by changes that add up to at least 5% (significance threshold). These changes can be structural (e.g. acquisitions or divestments), changes in the way the inventory is calculated, or discovery of errors. The threshold can be reached through cumulative changes across multiple years. Vector might decide to update the base year for changes below the threshold for other reasons such as constancy or clarity.

Vector decided to voluntarily restate the base year and FY21 to exclude emissions from the sold Treescapes business from Scope 3 – Category 15 – Investments, for reasons of clarity.



FY22 results

In FY22, GHG emissions for Vector came to 1,513,447 tCO₂e. This is a reduction of 5.5% from FY21, and 16.5% from our base year in FY20.

Scope 1

Vector's direct emissions in FY22 amount to 20,294 tCO₂e, a reduction from our base year by 14%, but an increase from FY21 emissions by 5%. Explanations on the most notable changes in emissions across Scope 1 are outlined below.

Natural Gas Distribution fugitive emissions

Methane emissions continued to decrease in FY22 from FY20 due to proactive pipeline surveying. Increasing the survey frequency allows Vector to find leaks faster, and thus reduce emissions. However, more gas was lost in FY22 than ever before from third-party damages to Vector's pipelines, i.e. damage through accidental digging or driving into gas infrastructure.

SF₆ emissions

Vector experienced a 4-fold increase in SF₆ emissions compared to FY20. This was mostly driven by leaks in two sub transmission switchgears. Delays in replacement part deliveries hindered Vector's ability to repair these leaks immediately, leading to sustained SF₆ emissions. The parts have now arrived, and are undergoing replacements.

To mitigate this risk in the future, Vector has enacted a pre-emptive stock management plan by purchasing additional spare components so that leaks can be repaired as they happen.

Biodiesel use in generators

To avoid leaving residential consumers and reopening businesses without power during and after lockdown periods, more generation was employed in FY22 compared to FY21. In addition, upgrades to large switchgear infrastructure in central Auckland required prolonged periods of generation. With an increased focus on reducing the need for biodiesel to generate electricity, it is expected that these emissions will drop again in the future (see [Section 5](#)).

Scope 2

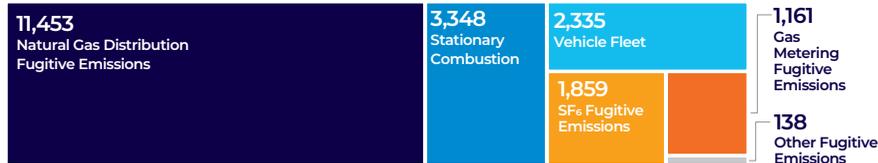
Scope 2 emissions are split in emissions from Vector's own consumption of electricity from the grid, and emissions from distribution losses across Vector's network. Electricity distribution losses have seen another increase in FY22, which is likely due to a continued shift from commercial consumption to residential usage, where feeders are generally longer and less efficient. Emissions from the group's own consumption of electricity has increased as well, however, this is due to a large part due to an increase in emissions intensity from NZ electricity while consumption increased only slightly.

Scope 3

Supply chain emissions have decreased for Vector in FY22, by 6% from FY21 or 17% from our base year. The biggest drop can be observed across the group's gas businesses, where the volume of gas on Vector's distribution network has been decreasing since FY19, and both our Natural Gas Trading as well as the LPG business have reduced the amounts of gas purchased and resold.

Vector has installed free public charging stations to support the accelerated uptake of electric vehicles. Electricity emissions from public chargers are included in our Scope 2 Electricity Consumption emissions.

Scope 1



Scope 2



Figure 2: Vector FY22 GHG emissions inventory, Scope 1, 2 only

Scope 3



Figure 3: Vector FY22 GHG emissions inventory, Scope 1, 2, 3

5. GHG Emission Reductions

Measuring Vector’s emissions inventory in this detail has enabled us to put together a strategy to reduce our footprint, through setting a science-aligned reduction target and identifying steps each business can take that will help to achieve our target most efficiently.

Science-aligned target

Vector is targeting a reduction of absolute Scope 1 & 2 GHG emissions (excluding electricity distribution losses) of 53.5% by FY30, from a FY20 base year. The target is aligned with Science Based Target initiative methodology and consistent with reductions required to keep global warming to 1.5C. Biogenic emissions are included in Vector’s reduction target.

In addition, Vector has committed to having net carbon zero operational emissions (Scope 1 and 2 excluding electricity distribution losses) by 2030.

A recalculation of the target is triggered by a recalculation of Scope 1 and 2 base year emissions.

As of FY22, emission reductions towards Vector’s science-aligned carbon sit at 13%. This is an increase compared to FY21. A large quantity of Vector’s Scope 1 emissions are volatile by nature, such as 3rd party damages, which fluctuates year on year. FY22 had an emission reduction through direct carbon abatement activities, but an increase in emissions from volatility.

Exclusion of electricity distribution losses from our targets

Although electricity distribution losses account for almost 57% of overall Scope 1 and 2 emissions (based on FY20 data), they are excluded from Vector’s science-aligned target. This is because the reduction of electricity loss emissions is achieved internationally by reducing the emission intensity of generation assets. However, in New Zealand, transmission

and distribution companies do not generate electricity due to regulatory limitations. This means that actions to reduce distribution losses is out of the operational scope for transmission and distribution companies. In addition, as electrification is a key component in New Zealand’s emissions reduction plan, networks are expected to grow, and with it the overall electricity conveyed. Therefore Vector, along with other electricity distribution businesses and Transpower, have excluded electricity losses from their emission reduction targets.

Emission reduction initiatives

This year, we developed a carbon abatement cost curve to help achieve our reduction targets (Scope 1 and 2 excluding electricity distribution losses). This important work identifies the financial impact of potential carbon reduction activity across Scope 1 and 2 emissions, using a carbon cost of \$140 per tCO₂e which aligns with Climate Change Commission recommendations [13] as a comparative “do nothing” cost.

Through this work, we identified emissions that could be reduced while saving money for the group (approximately 6%), others that were close to cost neutral (approximately 45%), with the balance assessed as being more complex to abate given the availability of current alternatives. By way of example, we describe four initiatives that are expected to reduce emissions in the long-term below:

- Already actioned: Surveying gas pipelines annually instead of 2-yearly, allowing Vector to identify and suppress gas leaks faster. Between FY20 to FY22, this resulted in a drop in emissions by over 6,200 tCO₂e. We are now exploring reducing survey times to 6-monthly.
- In process: All passenger cars are to be replaced with electric or plug-in hybrid alternatives at the end of

current leases.

- Trial phase complete: Utilising mobile transformers instead of diesel generators during planned outages. The first two trials have saved an estimated 154 tCO₂e, calculated using load monitoring meters. The data collected through these will allow us to apply a load factor to our generator fuel calculator to estimate savings in the future. From FY23 mobile transformers have entered business as usual practice, and aside from emission reductions the change has led to reduced noise levels, atmospheric particulate pollution as well as increased health & safety of the workforce.
- Planned for FY23: Shifting offices to a ‘6 Green Star’ rated building to reduce electricity consumption as well as refrigerant emissions.

We expect this curve to change annually as new technologies reach the market, new business innovations are trialled, and the costs of the abatement strategies change.

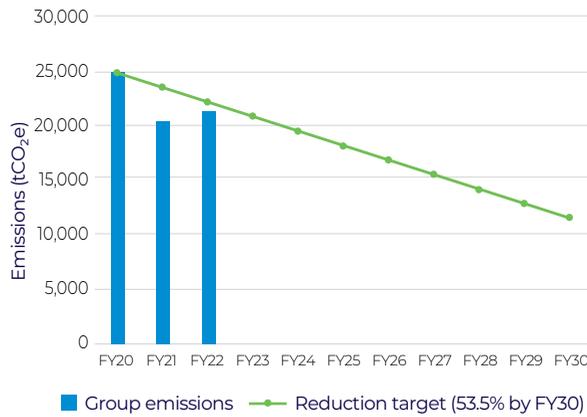
Additional information

Under the New Zealand Emissions Trading Scheme (NZ ETS), Vector is obligated to surrender New Zealand Units (NZUs) for emissions related to fugitive SF₆.

NZ ETS reporting is by calendar year, whilst Vector GHG emissions reporting is by financial year (1 July - 30 June). For the 2021 calendar year, Vector surrendered NZUs to the value of 1,858 tCO₂e related to fugitive SF₆ gases.

Mobile transformers have been successfully trialled as an alternative to diesel generation





As of FY22, emission reductions towards Vector's science-aligned carbon sit at 13%

Figure 4: Scope 1 + 2 (excl. electricity distribution losses) + biogenic emissions in tCO₂e

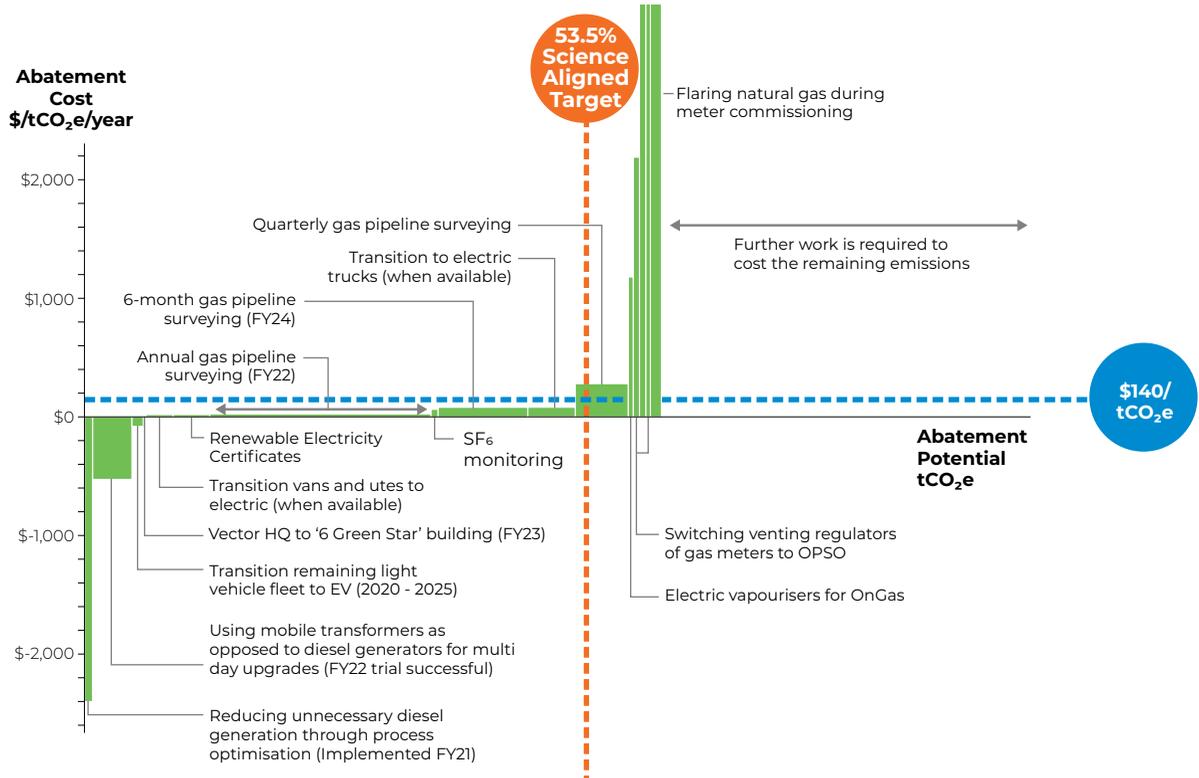


Figure 5: Vector's marginal carbon cost abatement curve

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Appendix 1: Vector subsidiaries

#	WHOLLY OWNED AND JOINT OPERATIONS	TREATMENT FOR GHG EMISSIONS CALCULATION	INTEREST HELD	PRINCIPAL ACTIVITY	VECTOR BUSINESS AREA	HOLDING COMPANY NAME
1	Vector Ltd	Operational control approach (100% for Vector's Scope 1,2,3)	100%	Parent company	Corporate; Electricity & Natural Gas Distribution	N/A
2	NGC Holdings Ltd	No emissions from operations	100%	Holding Company	N/A - Holding Company	Vector Ltd
3	Vector Gas Trading Ltd	Operational control approach (100% for Vector's Scope 1,2,3)	100%	Natural Gas Trading and Processing	Vector Ongas - Natural Gas Trading	NGC Holdings Ltd
4	Liquigas	No operational control. Proportional (60.25%) Scope 1 & 2 emissions accounted for under Scope 3, Category 15	60.25%	Bulk LPG storage, distribution and management	N/A	NGC Holdings Ltd
5	Ongas Ltd	Operational control approach (100% for Vector's Scope 1,2,3)	100%	LPG sales and distribution	Vector Ongas - LPG	NGC Holdings Ltd
6	Advanced Metering Assets Ltd	Operational control approach (100% for Vector's Scope 1,2,3)	100%	Metering Services	Vector Metering	NGC Holdings Ltd
7	Vector Advanced Metering Assets (Australia) Ltd	Operational control approach (100% for Vector's Scope 1,2,3)	100%	Metering Services	Vector Metering	NGC Holdings Ltd
8	Vector Metering Data Services Ltd	No emissions from operations	100%	Holding Company	N/A - Holding Company	NGC Holdings Ltd
9	Vector Advanced Metering Services (Australia) Pty Ltd	Operational control approach (100% for Vector's Scope 1,2,3)	100%	Metering Services	Vector Metering	Vector Metering Data Services Ltd
10	Advanced Metering Services Ltd	Operational control approach (100% for Vector's Scope 1,2,3)	100%	Metering Services	Vector Metering	Vector Ltd
11	Arc Innovations Ltd	Operational control approach (100% for Vector's Scope 1,2,3)	100%	Metering Services	Vector Metering	Vector Ltd
12	Vector Communications Ltd	Operational control approach (100% for Vector's Scope 1,2,3)	100%	Telecommunications	Vector Fibre	Vector Ltd
13	Vector Energy Solutions Ltd	No emissions from operations	100%	Holding Company	N/A - Holding Company	Vector Ltd

SUMMARY	ORGANISATIONAL BOUNDARIES	OPERATIONAL BOUNDARIES	DATA COLLECTIONS AND QUANTIFICATION	EMISSION RESULTS	EMISSION REDUCTIONS	
14	Powersmart NZ Ltd	Operational control approach (100% for Vector's Scope 1,2,3)	100%	Energy solutions services	Vector Powersmart	Vector Energy Solutions Ltd
15	E-Co Products Group Ltd	No emissions from operations	100%	Holding Company	N/A - Holding Company	Vector Energy Solutions Ltd
16	Cristal Air International Ltd (HRV)	Operational control approach (100% for Vector's Scope 1,2,3)	100%	Ventilation, heating and water systems sales and assembly	HRV	E-Co Products Group Ltd
17	Ventilation Australia Pty Ltd	Not trading, will close this year	100%	Holding Company	N/A - Holding Company	Cristal Air International Ltd
18	HRV Australia Pty Ltd	Not trading, will close this year	100%	Ventilation systems and parts sales	N/A	Ventilation Australia Pty Ltd
19	Vector Energy Solutions (Australia) Pty Ltd	No emissions from operations	100%	Energy solutions services	N/A	Vector Energy Solutions Ltd
20	Solpho Ltd	Operational control approach (100% for Vector's Scope 1,2,3)	100%	Energy solution services	Vector Energy Solutions	Vector Energy Solutions Ltd
21	mPrest	Below equity investment threshold. Emissions not accounted for.	8%		N/A	Vector Ltd
22	Vector Technology Solutions Ltd	Operational control approach (100% for Vector's Scope 1,2,3)	100%	Technology services	Vector Technology Solutions Ltd.	Vector Ltd
23	Vector Management Services Ltd	No emissions from operations	100%	Investment & contracting metering data services	N/A	NGC Holdings Ltd
24	Vector ESPS Trustee Ltd	No emissions from operations	100%	Trustee Company	N/A - Trustee Company	Vector Ltd
25	Vector Auckland Property Ltd	No emissions from operations	100%	Assets holding company	N/A - Holding Company	Vector Ltd
26	Vector Northern Property Ltd	No emissions from operations	100%	Assets holding company	N/A - Holding Company	Vector Ltd

Appendix 2: KPMG assurance letter



Independent Reasonable Assurance Report to Directors of Vector Limited

Opinion

Our reasonable assurance opinion has been formed on the basis of the matters outlined in this report.

In our opinion, in all material respects, the Emissions Inventory Report has been prepared in accordance with the Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (2004) for the year ended 30 June 2022.

Information subject to assurance

We have performed an engagement to provide reasonable assurance in relation to Vector Limited and its subsidiaries (the 'Group') Emissions Inventory Report for the year ended 30 June 2022.

Criteria

The Emissions Inventory Report was prepared in accordance with the Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (2004) ('the Greenhouse Gas Protocol' and 'criteria') and as a result, this report may not be suitable for another purpose.

Standards we followed

We conducted our reasonable assurance engagement in accordance with International Standard on Assurance Engagements (New Zealand) 3000 (Revised) *Assurance Engagements other than audits or reviews of historical financial information* and International Standard on Assurance Engagements (New Zealand) 3410 *Assurance Engagements on Greenhouse Gas Statements*. We believe that the evidence we have obtained is sufficient and appropriate to provide a basis for our opinion. In accordance with those standards we have:

- used our professional judgement to assess the risk of material misstatement and plan and perform the engagement to obtain reasonable assurance that the Emissions Inventory Report is free from material misstatement, whether due to fraud or error;
- considered relevant internal controls when designing our assurance procedures, however we do not express an opinion on the effectiveness of these controls; and
- ensured that the engagement team possesses the appropriate knowledge, skills and professional competencies.

How to interpret reasonable assurance and material misstatement

Reasonable assurance is a high level of assurance, but is not a guarantee that it will always detect a material misstatement when it exists.

Misstatements, including omissions, within the Emissions Inventory Report are considered material if, individually or in the aggregate, they could reasonably be expected to influence the relevant decisions of the intended users taken on the basis of the Emissions Inventory Report.



Use of this assurance Report

Our report should not be regarded as suitable to be used or relied on by any party's other than Vector Limited for any purpose or in any context. Any party other than Vector Limited who obtain access to our report or a copy thereof and chooses to rely on our report (or any part thereof) will do so at its own risk.

The report is intended for users who have a reasonable knowledge of GHG related activities, and who have studied the information in the GHG statement with reasonable diligence and understand that the GHG statement is prepared and assured to appropriate level of materiality.

To the fullest extent permitted by law, we accept or assume no responsibility and deny any liability to any party other than Vector Limited for our work, for this independent reasonable assurance report, or for the opinions we have reached.

Management's responsibility for Emissions Inventory Report

The management of the Group are responsible for the preparation of the Emissions Inventory Report in accordance with the Greenhouse Gas Protocol. This responsibility includes such internal control as management determine is necessary to enable the preparation of the Emissions Inventory Report that is free from material misstatement whether due to fraud or error.

Our responsibility

Our responsibility is to express an opinion to the Directors and shareholders of the Group on whether the preparation of the Emissions Inventory Report is, in all material respects, in accordance with the Greenhouse Gas Protocol.

Our independence and quality control

We have complied with the independence and other ethical requirements of Professional and Ethical Standard 1 International Code of Ethics for Assurance Practitioners (Including International Independence Standards) (New Zealand) issued by the New Zealand Auditing and Assurance Standards Board, which is founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behaviour.

The firm applies Professional and Ethical Standard 3 (Amended) and accordingly maintains a comprehensive system of quality control including documented policies and procedures regarding compliance with ethical requirements, professional standards and applicable legal and regulatory requirements.

Our firm has also provided financial audit, regulatory assurance, other assurance and compliance services in relation to R&D tax credits to the Group. Subject to certain restrictions, partners and employees of our firm may also deal with the Group on normal terms within the ordinary course of trading activities of the business of the Group. These matters have not impaired our independence as assurance providers of the Group for this engagement. The firm has no other relationship with, or interest in, the Group.

A large, stylized, blue 'KPMG' logo, similar to the one at the top of the page but with a more artistic, hand-drawn feel.

KPMG
Auckland
25 August 2022

