vector

TCFD REPORT 2022

Vector's journey to a new **energy future**

Our climate risks and opportunities based on the recommendations of the Task Force on Climate-related Financial Disclosures

August 2022

Our position on climate change

Purpose of this report and limitations

This report is a summary of Vector's assessment of future climate risks and opportunities and its resulting strategy. It is intended to inform readers about Vector's business strategy with respect to climate risk and opportunity but it is not earnings guidance nor financial advice for investors, and it is unaudited.

Given its focus on future risks and opportunities, this report contains estimates, projections and assumptions about future socio-economic, policy and regulatory, technological, physical climate and other conditions, as at 26th August 2022. Although the use of scenario analysis is rapidly developing to support this future focus, there are limitations to the modelling methodology and available data, and therefore scenario analysis. These limitations are identified throughout this report and in particular are outlined in Sections 2 and 3.

While Vector has taken efforts to ensure that such assumptions have a reasonable basis and are coherent and plausible (including basing them on modelling, public scientific information, market knowledge and projections, government policy proposals, and reasonable/expert opinions), assessments of the future are challenging and inherently uncertain. The assumptions, estimates, projections and modelling relied on in this report may not be realised at the scale and pace anticipated and/or the future may involve circumstances that are different to that anticipated in this report.

In light of the above, while Vector has taken all due care in preparing this report, including its scenarios and assumptions, Vector makes no representation as to the report's accuracy, completeness or reliability, in particular in relation to Vector's assumptions regarding future events.

To the greatest extent possible under New Zealand 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inability to use this report, whether directly or indirectly resulting from inaccuracies, defects, errors, omissions, out of date information or otherwise.

Vector makes no representation as to the accuracy of any information in this report. We recommend you seek independent advice before acting or relying on any information in this report. Vector reserves the right to revise statements made in, or its strategy or business activities described in, this report, without notice.

Vector is well-positioned to enable decarbonisation within New Zealand, the Asia-Pacific region, and globally. We are guided by our vision, which is to create a new energy future. Despite the challenges of climate change today, our integrated Group strategy we call Symphony is preparing us to seize the opportunities of a decarbonised future. Symphony aims to transform the traditional one-way energy chain into an intelligent, multi-directional energy system that gives the customer more choice and control. Fundamentally, it is about creating a decentralised energy system that opens future possibilities, delivering decarbonisation consistent with safe, reliable and affordable energy solutions for customers.

Vector acknowledges the climate change science underpinning this need to act. We welcome the pivotal role we can play in this decarbonisation transition, and we recognise climate risk as a material risk with Board oversight. Vector is a founding member of the Climate Leaders Coalition, a partner of the Sustainable Finance Forum, and member of the Sustainable Business Council. Our participation in these coalitions also includes our commitment to reducing our own carbon emissions to help with New Zealand's transition to a low carbon economy, and is consistent with our support for the Paris Agreement and the establishment of the Climate Change Commission.

Decarbonisation brings both risks and opportunities

Electrification of the energy economy is a key part of global decarbonisation efforts. Vector is one of the leading players in the transformation of the energy sector, identifying, developing, and enabling options that will provide value, choice and service for our customers while delivering sustainable shareholder returns. The impacts of climate change, and more broadly, of global responses to climate change, represent material risks and opportunities for our business, as covered in this disclosure. We are working with policymakers and regulatory bodies and closely monitoring developments in New Zealand and our other key markets around climate action and just transitions [1].

Why the Task Force on Climate-related Financial Disclosures (TCFD) matters to us and our primary users

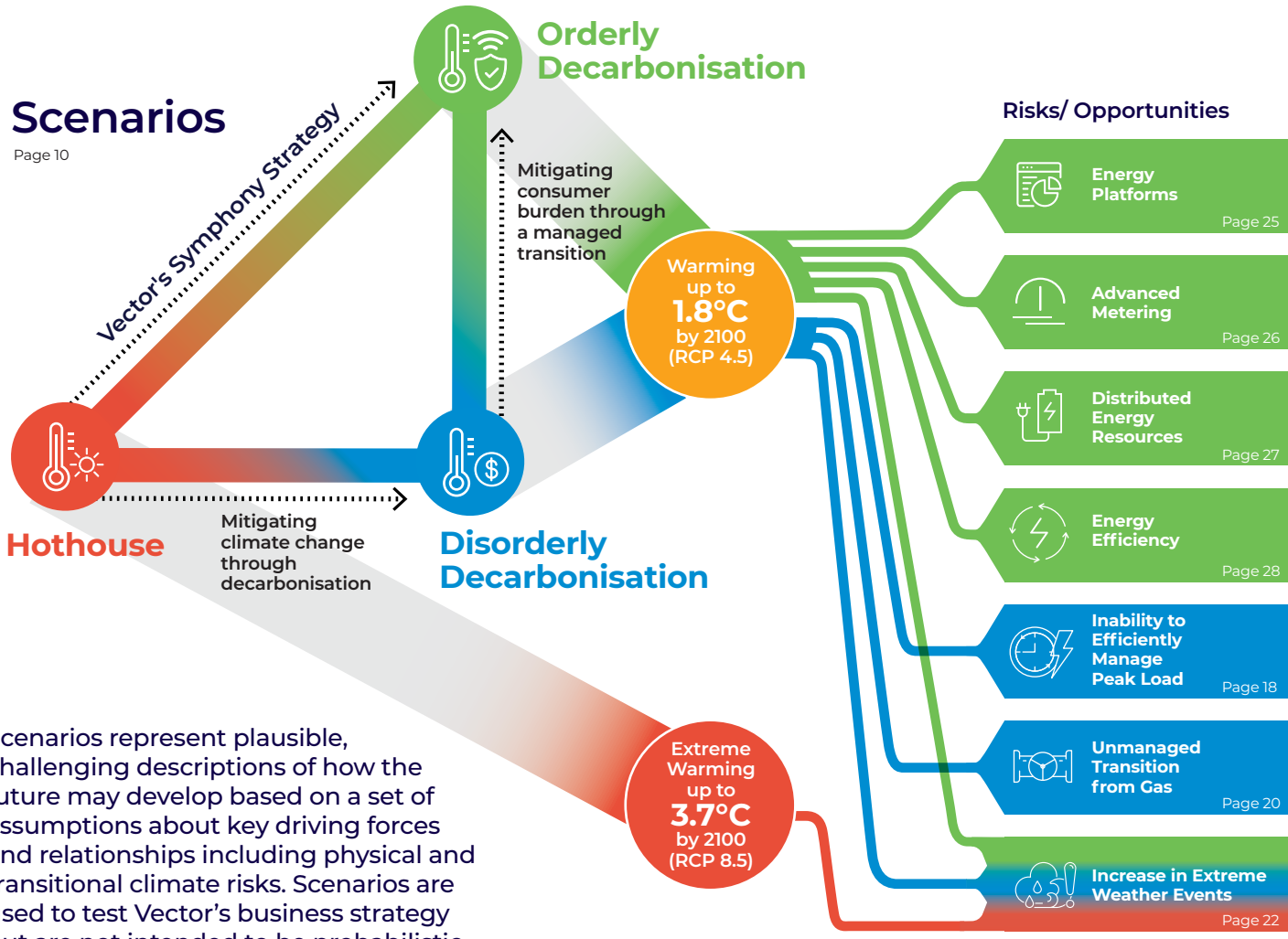
The TCFD framework provides a way for companies to produce consistent climate-related disclosures, demonstrating how climate-related risks and opportunities are incorporated into their risk management and strategic planning processes. Why is this so important? As customers, regulators, policymakers, existing and potential investors, lenders, and other creditors further their understanding of the financial implications associated with climate change, markets will be empowered to channel investment to the solutions, opportunities, and business models needed for a new energy future.

When it launched in 2017, the TCFD recommended that companies make 11 disclosures to identify the possible climate impacts on their business. In October 2021 New Zealand was the first country to pass law to create a mandatory TCFD reporting obligation on major private sector entities. While the External Reporting Board's Climate-related Disclosure Standard remains under development, and those mandatory reporting obligations will only commence from 2023, Vector has nonetheless embarked on this journey in advance. Our reasoning is simple: it is in our interest as a company to lead the transformation of the energy sector and to ensure that the management and maintenance of our physical assets and business strategy takes into account, anticipates, and proactively responds to climate-related risks and opportunities. Vector also sees a clear role for businesses like ours to provide our stakeholders with transparent information that supports robust, long-term business strategy and investment decisions.

Electrification of the energy economy is a key part of global decarbonisation efforts

Vector's climate-related opportunities and risks

Climate change brings both risks and opportunities for Vector, as detailed in this report. With a diverse business portfolio of energy solutions, Vector is well-positioned to lead the energy transition to our customers' advantage. Many of our climate-related opportunities correspond with the role we can play in creating new solutions and driving efficient, sector-wide decarbonisation. Many of our risks emerge from the possibility that decarbonisation occurs in a way that is inefficient and costly, impacting Vector and our customers. In identifying these risks and opportunities, our intentions are more firmly resolved than ever. We are working to be a first-class energy company globally, playing a leading role in enabling a bright future for our customers.



Scenarios represent plausible, challenging descriptions of how the future may develop based on a set of assumptions about key driving forces and relationships including physical and transitional climate risks. Scenarios are used to test Vector's business strategy but are not intended to be probabilistic or predictive or to identify the 'most likely' outcomes.

Time Period	Strategy	
SHORT TERM 0 – 3 years; MEDIUM TERM 3 – 10 years	**Strategic Partnerships**	Developing data-driven products and services with leading technology partners to enable a greater uptake of renewable electricity supply, and electrify energy demand.
SHORT TERM 0 – 3 years	**Unlocking Data**	Working with governments, and regulators to drive the importance of unlocking data from advanced meter uptake in New Zealand and Australia. Vector also partners with distributors, retailers, and global technology platforms to drive energy management innovation.
MEDIUM TERM 3 – 10 years; LONG TERM 10 – 30 years	**Network Virtualisation**	Developing network virtualisation software that uses dynamic simulations to manage the complexities of bi-directional power and therefore enables a greater uptake of distributed energy resources.
SHORT TERM 0 – 3 years; MEDIUM TERM 3 – 10 years; LONG TERM 10 – 30 years	**Technology Management and Innovation**	Ongoing product innovation in building efficiency systems keeps Vector at the forefront of new technology, and new channels to market.
LONG TERM 10 – 30 years	**Enabling and Advocating for Demand Flexibility**	Working on the alignment of regulatory, and policy settings, together with energy industry solutions that leverage digitalisation of the energy sector, to realise energy flexibility.
MEDIUM TERM 3 – 10 years; LONG TERM 10 – 30 years	**Managed Gas Transition**	Working with government, and the wider industry on the Gas Transition Plan, to establish realistic transition pathways for the fossil-gas sector to decarbonise.
SHORT TERM 0 – 3 years; MEDIUM TERM 3 – 10 years; LONG TERM 10 – 30 years	**Network Resilience Plan**	Addressing actual and potential physical risks through a framework that breaks physical resilience into three categories: robustness, resourcefulness, and recovery.

Governance

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Board of Directors

Board Audit Committee | **Board Risk and Assurance Committee**

Executive Management

Climate Change Steering Committee | **Chief Public Policy and Regulatory Officer**

Group Sustainability | **Group Risk and Resilience**

Group Finance | **Group Insights**

Business Level Senior Management

Business Level Risk Partners | **Business Level Insights**

1. Governance

TCFD recommends that organisations:

- Describe the Board's oversight of climate-related risks and opportunities.
- Describe management's role in assessing and managing climate-related risks and opportunities.

Integrated governance for climate change

An integrated approach to climate change-related governance ensures that climate change considerations are built into daily operations. Vector uses a top-down, and bottom-up strategy, known as the "hybrid model", to identify climate-related risks and opportunities. The bottom-up identification strategy is led by the Group Risk and Resilience and Group Sustainability teams across each Vector business unit to identify climate-related risks and opportunities against the three-climate scenarios described in the Risk and Opportunity Management section. The top-down strategy uses insights from the Board, Executive, senior management, and subject matter experts both internally and externally to establish objectives, targets, strategies, and budgets to address climate-related risks and opportunities. This hybridised approach, discussed further in the Risk and Opportunity Management section, encourages staff to take action to address risks and opportunities, while still providing oversight at the Board level.

Board

Board of Directors
Establishes framework for recognising and managing risks and opportunities including those related to climate change. **7 Members**

Board Audit Committee
Assists in the oversight and control of climate-related disclosures, including financial modelling.
6 Members

Board Risk and Assurance Committee
Delegated responsibility for overseeing Vector's risk and assurance practices, including ensuring the enterprise-wide and business-specific climate change risks are identified and managed appropriately. **5 Members**

Executive

Executive Management
Executive leadership and day-to-day management for ensuring delivery and development of the strategic objectives. **8 Members**

Climate Change Steering Committee
Meets monthly with senior management to oversee and accelerate climate change related decisions. **6 Members**

Chief Public Policy and Regulatory Officer
Holds executive oversight and ownership of climate change risk

Group Level

Group Sustainability
Consults business units to explore climate-related opportunities, drives Vector's carbon handprint strategy, and manages carbon accounting and decarbonisation strategy.

Group Risk and Resilience
Responsible for Vector's Group Enterprise Risk Management Framework used to identify and assess climate-related risks and opportunities.

Group Finance
Oversees and analyses financial impacts of material risks and opportunities, and reports on group level metrics.

Group Insights
Conducts scenario analysis, and detailed models of key risks and opportunities.

Business Level

Business Level Senior Management
Leadership and day-to-day business management, with strategic oversight of climate-related risks and opportunities.

Business Level Risk Partners
Remain abreast of the physical/ transitional impacts of climate change and the potential risk and opportunities at the business level. Escalates all risks and opportunities to the group.

Business Level Insights
Responsible for collecting and reporting on business level metrics.

Vector's Board oversight

Vector's Board of Directors is responsible for the governance of Vector's strategic direction, including recognising and managing climate-related risks and opportunities and their impact on that strategic direction. Vector's Board approves the company's strategy and metrics/targets to reduce climate-related risk and take advantage of climate-related opportunities.

The Audit Committee, and Risk and Assurance Committee are sub-committees of the Board with delegated responsibility for ensuring Vector manages its risks and compliance appropriately, including its climate-related risks. Each meets at least four times per year.

The Audit Committee is responsible for oversight of climate-related financial disclosures and reporting which includes financial modelling. The committee meets to comment on key accounting judgements which include TCFD related scenarios, materiality thresholds, consolidated risks and opportunities, as well as greenhouse gas emission quantification. The Audit Committee reviews and recommends the TCFD draft for final Board approval.

The Risk and Assurance Committee is responsible for the oversight of Vector's Enterprise Risk Management Framework, its maturity, and the effectiveness of the management of the framework. It regularly reviews the risk of adverse impacts, government responses, and unexploited opportunities from climate change as part of the group material risks to the delivery of its Symphony Strategy.

The Board Risk and Assurance Committee, and Audit Committee are accountable to the Board and regularly report decisions and recommendations to it. This includes a requirement to ensure that the Board is made aware of matters within the Committee's scope that significantly affect Vector.

Vector's Executive oversight

The Group Chief Executive is responsible for the day-to-day leadership and management of Vector's New Zealand and Australian businesses to ensure the identification and development of business objectives and strategies are delivered.

The Climate Change Steering Committee is a sub-committee of the Executive, consisting of 6 members, and normally meets monthly to identify and manage all climate change related topics including climate change risk, and decarbonisation. The Climate Change Steering Committee is chaired by the Chief Public Policy and Regulatory Officer, who holds ownership of climate change related risks. The Climate Change Steering Committee reports to the CEO.

Vector's Group oversight

Vector Group Risk and Resilience is responsible for the Vector Group Enterprise Risk Management Framework. Risks, including climate-related risks and opportunities, are identified, assessed, and managed across the Group in line with the framework and the Group Risk Assessment Criteria. This is designed to ensure that there is appropriate and regular Board and management oversight of material risks identified to drive informed decision making. Vector's Group Sustainability consults with Vector's diverse business units to drive Vector's climate change strategy. This includes carbon management, internal decarbonisation programmes (carbon footprint), external decarbonisation support (carbon handprint), climate adaptation strategies, consolidation of climate change related metrics and targets, and strategic oversight of climate change related risks and opportunities. Group Sustainability reports to the Chief Public Policy and Regulatory Officer and sets the agenda for the Climate Change Steering Committee. The risks and opportunities are financially evaluated by Group Finance, with analytics conducted by Group Insights.

2. Risk and Opportunity Management

TCFD recommends that organisations:

- Describe the organisation's processes for identifying and assessing climate-related risks.
- Describe the organisation's processes for managing climate-related risks.
- Describe how processes for identifying, assessing, and managing climate-related risks are integrated into the organisation's overall risk management.

Our approach to risk management

We have a comprehensive Group Enterprise Risk Management Framework consistent with the Risk Management Standard ISO 31000:2018. This is embedded in our business through our risk governance, policies, guidelines and risk partnership model that Group Risk and Resilience maintains with the different business units to support Vector's risk management practice. Using the Risk Assessment Criteria supports a consistent approach to risk management across the Vector Group.

Our Board Risk and Assurance Committee has responsibility for overseeing and reviewing our Group Enterprise Risk Management Framework policies and processes and material risks to the Vector Group.

Climate change has been identified as a material risk for the Group since 2019, reinforcing our ongoing work to understand and respond to the evolving impact of climate change on our business, as well as the opportunity to enable our vision of creating a new energy future.

Business Level

1. Group Sustainability and Group Risk and Resilience lead a cross-functional stakeholder group that involves key stakeholders across each business unit to:
   a. Review the climate-related risks and opportunities identified in our previous TCFD report.
   b. Identify what had changed, or what was new.
   c. Update and mature the climate-related transitional and physical risks and opportunities.
2. Regular meetings to raise awareness of the TCFD framework and future reporting standards.
3. Template developed for the identification and evaluation of our climate-related risks and opportunities in accordance with the TCFD framework and integrating our Vector risk management framework.

Group Level

4. Sustainability Partner and Risk Partners work with Business Level stakeholders to identify their risks & opportunities using 3 recognised scenarios (orderly decarbonisation, disorderly decarbonisation and hothouse) for analysis.
5. Risks and Opportunities are categorised into TCFD risk categories.
6. To evaluate the risks we apply, as far as appropriate, our Group Risk Criteria assessment to show risks as Negligible, Low, Medium, High and Very High. Extended time frames and climate change potential consequences are included that go beyond the Group Risk Assessment Criteria.
7. Medium to Very High risks are pulled out, aggregated, and sent for detailed analysis by Group Finance and Group Insights.

Executive

8. Consolidated material climate-related risks & opportunities are presented to the Climate Change Steering Committee and wider senior leadership for review and amendment.
9. Material risks and opportunities are captured in our TCFD report and reviewed by the CEO and executive in the context of the wider reporting framework.

Board

10. Board and/or relevant board committee review of key risks and opportunities, and two reviews of the TCFD draft.

Our process for identifying material risks and opportunities

As noted in the Governance section, Vector uses a top-down and bottom-up strategy, known as the "hybrid model", to identify climate-related risks and opportunities. Risks and opportunities are defined as material if they meet at least one of the following thresholds:

- Are ranked high to very high based on the Group Risk Assessment Criteria.
- Meet Vector's financial materiality threshold being a potential financial impact greater than 5% of Vector's market capitalisation.
- Contributes to or forms a barrier to emission reductions outside of Vector's organisational boundary, that constitutes more than 1% of national emissions (carbon handprint).

The risks and opportunities are then prioritised and consolidated, with oversight from the Climate Change Steering Committee, and approved by the Board.

Our external engagement

Vector acknowledges that the energy transition is a global challenge, and therefore works with key external partners to stay abreast of risks and opportunities. Vector collaborates with international energy partners and regulators to rethink energy systems [2] and holds a strategic alliance with Amazon Web Services. We are also continuing our strategic collaboration with X (formerly Google X). Within New Zealand, Vector initiated an electricity transmission and distribution TCFD working group, initiated the FlexForum, and was a founding member of the Climate Leaders Coalition. Vector proactively works with credit rating agencies due to the criticality of funding metrics and credit ratings as it incorporates Environmental-Social-Governance (ESG) and climate risk frameworks. Vector also works with climate risk experts in the academic sector to keep up to date with the latest metrological science.

Our process for understanding the impacts of risks and opportunities

Physical risks are evaluated with the assistance of geographic information system (GIS) mapping. Vector has procured detailed climate change geospatial maps of the Auckland region that detail:

- Baseline temperature and precipitation
- Extreme rainfall (daily and sub-daily)
- Extreme heat
- Extreme wind
- Sea level rise
- Extreme still high water level

The maps provide Vector with the projected climate change impacts through to 2100. We are currently building capability to understand potential asset exposure and implications for network reliability from increasing physical climate change impact.

To evaluate transitional risks, the Vector Insights team developed a model to forecast the impact of an orderly and disorderly transition on the electrical network. The model enables us to determine growth requirements, plan for network flexibility, and understand the impact this may have on our consumers. Further details, including high-level model assumptions, can be found in Section 3.

We categorise the time frames for these opportunities and risks as follows:

- short term (0-3 years), to reflect our typical business planning cycles;
- medium term (3-10 years), to reflect our Asset Management Plans for gas and electricity networks;
- long term (10-30 years), to account for longer impacts over existing and future planned assets.

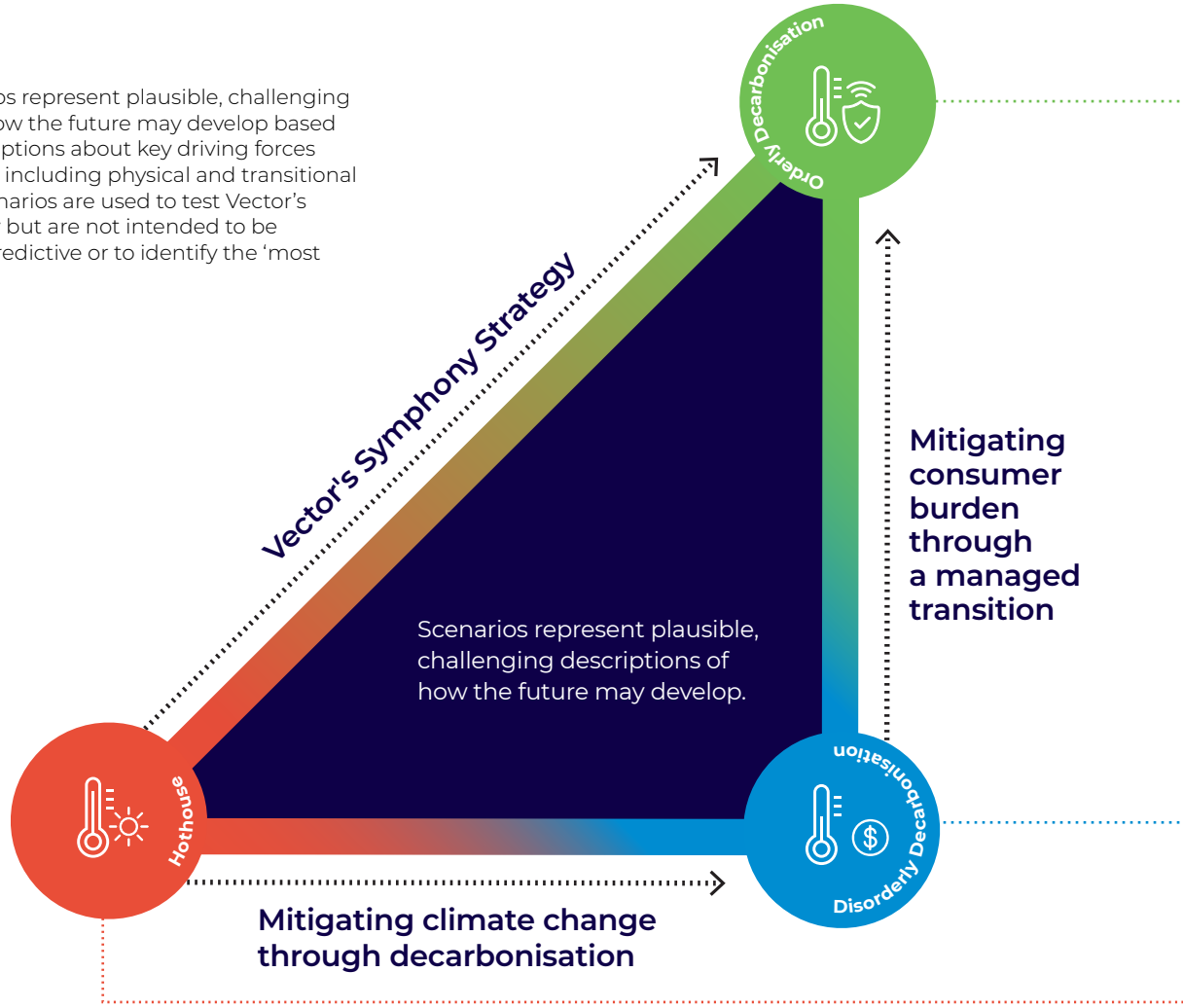
Vector acknowledges that the energy transition is a global challenge, and therefore works with key external partners to stay abreast of risks and opportunities

2. Risk and Opportunity Management (continued)

Our approach to using climate scenarios

Vector has developed three climate scenarios that converge data from the Intergovernmental Panel on Climate Change (IPCC) Assessment Report Five [4] for physical analysis, and the Network for Greening the Financial System [5] (an international network of central banks and supervisory authorities including the Reserve Bank of New Zealand) (NGFS) for transitional analysis. These scenarios are utilised with oversight from the Climate Change Steering Committee.

Figure 1. Scenarios represent plausible, challenging descriptions of how the future may develop based on a set of assumptions about key driving forces and relationships including physical and transitional climate risks. Scenarios are used to test Vector's business strategy but are not intended to be probabilistic or predictive or to identify the 'most likely' outcomes.



The chosen scenarios are relevant to Vector, as they show different sides of the energy transition being undertaken globally. It can be viewed as a triad, see Figure 1. The analysis, first done in 2017 and published in our Electricity Asset Management Plan [3], highlighted key risks with a disorderly transition (previously called 'Pop/Rock'), and significant opportunities of the orderly transition (previously called 'Symphony'*).

Over the course of the following five years, the Symphony scenario became Vector's core corporate strategy and it has highlighted significant opportunities for the Vector Group. Maintaining analytical oversight of this orderly decarbonisation scenario enables Vector's strategy to adapt to be best positioned to mitigate the risks and harness the opportunities of an orderly decarbonised future.

We consider that the IPCC scenarios [4] are best suited for New Zealand physical risk impact analysis due to their data availability, especially for RCP 4.5 and 8.5 models from Assessment Report Five. Work is ongoing by climate scientists in New Zealand to translate Assessment Report Six to the New Zealand context. We expect our scenario modelling, and therefore risk impacts to change as this data and information become available.

* In 2017 'symphony' was a scenario, whereas now Symphony has become the name of our corporate strategy where 'orderly decarbonisation' is the new scenario

VECTOR SCENARIOS		ALIGNING WITH	IPCC [4] SCENARIOS	NGFS [5] SCENARIOS
Orderly Decarbonisation • Net zero by 2050 • 1.8°C world (RCP 4.5) • Transition includes uptake of digital platforms for demand side management • Rapid electrification managed through demand response • Regulations aligned with decarbonisation, and pricing models that manage whole system costs • Ongoing efforts with energy efficiency to reduce demand • Managed transition away from fossil fuel gas	The orderly decarbonisation scenario pushes for net zero emissions by 2050 through clear and early actions that integrate a whole of systems approach. Regulations and policies are aligned with decarbonisation, and pricing models incentivise measures that not only reduce carbon but also long-term costs for consumers. This means that demand side management solutions**, distributed generation, and energy efficiency are prioritised so that the energy sector can manage large-scale electrification and renewable availability. Demand side participation by consumers optimises the use of the network to reduce unnecessary capital expenditure and optimises the wholesale market to leverage the low cost of renewable power. The combined effect keeps electricity prices low, and thus enables an easier transition from fossil fuels to electricity. Natural gas networks undergo a managed transition, where capital asset costs are recovered through early regulatory changes, and consumers are supported throughout their transition to electricity.		**RCP 4.5**	**Orderly – Net Zero 2050**
Disorderly Decarbonisation • Divergent net zero by 2050 • 1.8°C world (RCP 4.5) • Transition focus on large-scale renewable supply with no demand side or digitalisation • Rapid unmanaged electrification • Regulations lag behind decarbonisation efforts and form barriers to efficient decarbonisation • Consumers bear the cost of an expensive unmanaged transition • Unmanaged transition from fossil fuel gas	The disorderly decarbonisation scenario achieves net-zero emissions by 2050, but in a way where failure to coordinate policy stringency across sectors results in a high burden on consumers, exacerbates existing societal inequalities, and creates energy reliability issues. Policies are only focused on large-scale renewable electricity generation and rapid electrification of transportation. The absence of demand side management on electric vehicle charging and industry results in high peak load power requirements, needing large infrastructural upgrades where costs are passed down to consumers. The absence of demand side management also limits consumers' ability to leverage the low price point of renewable electricity. This increases strain on the wholesale market, with dependence on large-scale back-up fossil fuel generation keeping electricity prices high. Such high electricity prices not only intensify energy poverty but also create dependency on government subsidies to achieve the 2050 targets. Natural gas networks are shut down early, without a managed transition, and with no support for consumers to replace their gas appliances and manage the cost implications of alternative energy supply.		**RCP 4.5**	**Disorderly – Divergent Net Zero**
Hothouse • Emissions grow until 2080 • 3.7°C world (RCP 8.5) • Policies revert New Zealand back to the fossil fuel era • Consumers bear the cost of expensive fossil fuel energy • Regulations block decarbonisation spending	The hothouse scenario represents an unlikely, but worst-case scenario, where public frustration of a disorderly transition results in policy changes that reverts New Zealand back to the fossil-fuel era. The rest of the world maintains existing policies which limit decarbonisation until 2080, resulting in a 3.7°C world. Fossil fuel exploration permits are reintroduced, regulations block decarbonisation spending, and initiatives such as 'Warmer Kiwi Homes' and EV rebate schemes are scrapped. Consumers continue to bear the cost of expensive fossil fuel energy.		**RCP 8.5**	**Hothouse**

** See knowledge breakout: Peak power and why managing it is so critical - page 14

3. Strategy

TCFD recommends that organisations:

- Describe the climate-related risks and opportunities the organisation has identified over the short, medium, and long term.
- Describe the impact of climate-related risks and opportunities on the organisation's businesses, strategy, and financial planning.
- Describe the resilience of the organisation's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.

Symphony – Vector's core strategy

Vector's core corporate strategy, known as Symphony, aims to transform the traditional one-way energy chain into an intelligent, multi-directional energy system that gives the customer more choice and control. Central to our strategy is that energy is clean, reliable, and affordable and that all three elements are actively factored into our services and solutions.

Vector is committed to working alongside its stakeholders to transform the energy system, as it is not only critical to our immediate daily lives, but also to our collective future through its role in enabling the decarbonisation of transport and industry. Legacy energy systems across the whole sector are increasingly unable to meet the challenges of transformation and must become vastly more sophisticated and adaptable. Vector is well advanced globally in understanding, developing, and operating emerging technologies with digital platforms to manage these changing requirements. As energy systems are transformed to meet the needs of tomorrow, our view is that many of our climate-related opportunities correspond with the role we can play in creating and enabling new solutions and driving efficient, cost-effective, sector-wide decarbonisation.

Vector's diverse energy portfolio

While many aspects of New Zealand's – and the world's – climate responses are evolving and remain unknown, the diversity of Vector's business portfolio provides us with valuable insights over a range of energy-related issues. This enables us to develop actions and plans towards societal and financial resilience within our sector. We can also use our diverse portfolio to test and integrate multiple technologies, positioning us to create new solutions and drive sector-wide decarbonisation. However, we also recognise the carbon emissions associated with our gas infrastructure. The ability to manage the transition of these assets will be important to ensuring our long-term resilience in a decarbonising economy.

Vector Lights on Auckland Harbour Bridge, lighting up the city with solar-battery technology

VECTOR BUSINESS	DESCRIPTION
Electricity Distribution	Owns 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.
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 Technology Solutions	A digital solutions business that takes solutions to market developed internally as part of Vector's digital transformation journey. Vector Technology Solutions 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. We are continuing our strategic collaboration with X, the moonshot factory (formerly Google X), which is developing technology and tools to accelerate clean and renewable power onto the grid.
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.
HRV	Provides energy efficient solutions covering home ventilation, home heating, and water filtration systems, as well as electric vehicle charging.
Fibre	Designs, builds and maintains data networks in the wider Auckland region.
Natural Gas Distribution	Owns and operates the gas distribution network in the wider Auckland region, supplying gas to over 117,000 installed connection points, through more than 6700km of pipelines, distributing around 14PJ of gas per year.
Vector Ongas	Distributes and sells Liquefied Petroleum Gas (LPG) to residential, commercial and industrial customers throughout New Zealand, through bottled LPG products and piped LPG networks. Vector Ongas also supplies piped natural gas to industrial and commercial businesses in the North Island including customers in the agriculture, horticulture and manufacturing sectors.

Symphony aims to transform the traditional one-way energy chain into an intelligent, multi-directional system

3. Strategy (continued)

Knowledge Breakout: Peak Power and why managing it is so critical

Significant international decarbonisation efforts have focussed on the 'energy' transition, with less focus on the 'power' transition. Sometimes, these two concepts are mixed.

Power is the amount of energy used in a set period; also known as the derivative of energy with respect to time. Power is sometimes referred to as 'capacity'. Energy is often referred to as 'volumes'.

Peak power impacts the electrical system in two ways

1. Transmission and distribution networks are built to handle this peak power load. Any increase in peak power will require network infrastructure upgrades to handle this power increase.
2. The power supply through generation must equal the power demand. Any increase in power demand will require an equivalent real-time increase in power supply to match. Maintaining this delicate system balance is a core role of the transmission system operator and the wholesale electricity market.

Current Status

The graph top-right shows power curves between July – October 2021 in New Zealand. Note that as the x axis is time, the area under the curve represents the total energy.

Orderly Scenario

Intermittent renewable energy sources such as solar and wind are key drivers to electricity generation decarbonisation, however the same rules of 'power supply must equal power demand' still hold.

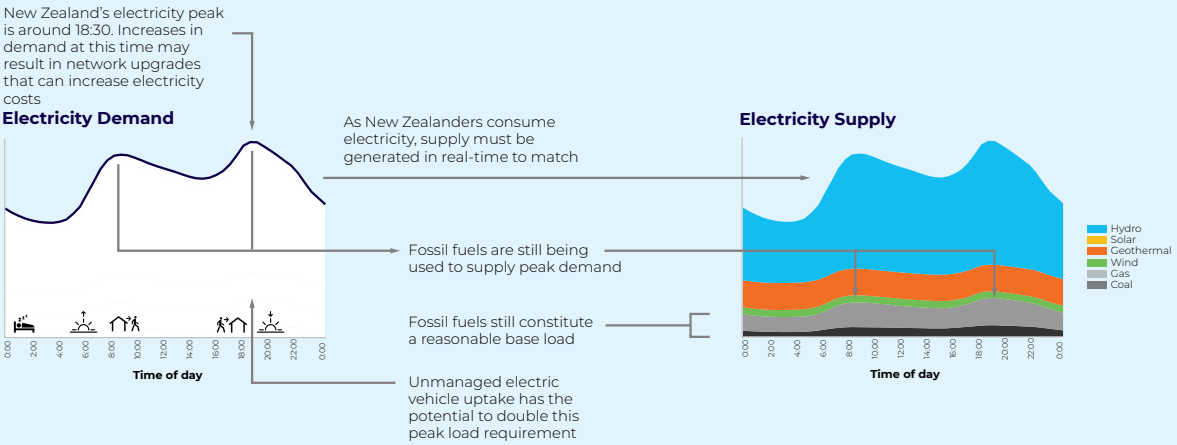
As the supply side becomes less flexible and more dependent on the weather, the traditional roles of the power system may be flipped – in future a more flexible demand side may be able to balance fluctuations in an increasingly inflexible supply side. This can occur through digital services that optimise customer power consumption to maximise consumption when renewable energy supply is available (e.g., through charging car and household batteries at off-peak times), and since the operating costs for renewable energy are low compared to fossil-fuel generation (that have additional fuel costs) it is expected that these will also be times of low wholesale prices. This is discussed in more detail in the Opportunities section.

Furthermore, and in Vector's direct case, flexible power management can also allow for more intelligent utilisation of electricity infrastructure. Distribution networks are built to deliver a certain level of power. With a flatter power demand/supply curve over extended periods (away from peak time), more overall energy (area under the graph) can be distributed with the existing infrastructure. Accordingly, the utilisation and efficiency of the network is improved. Our Symphony Strategy envisions this capability improving, and expanding to include other large consumer loads in Auckland such as electric vehicle charging.

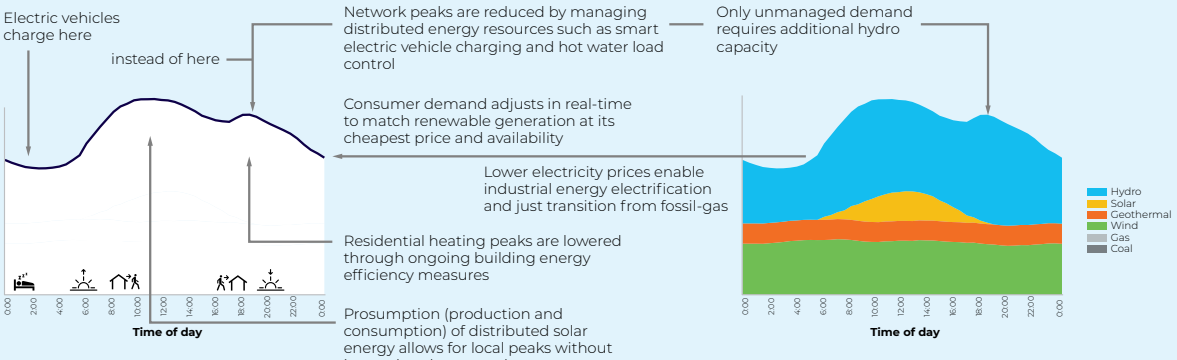
Disorderly Scenario

If the latent flexibility in consumers' demand-side assets cannot be unlocked there are risks to Vector, the customer, and the wider energy sector. New Zealand's current electricity peak occurs in winter between 6:00pm - 9:00pm. Any increases to this peak, such as from electric vehicles charging after returning from work, will require infrastructure and generation upgrades that ultimately increase electricity prices. Furthermore, the cheap renewable electricity from wind and solar may be under-utilised due to its intermittency, and a need for significant investment in grid level storage and back up fossil-fuel based generation will be required. All these contribute to an increase in electricity prices and present a material risk for Vector. This is described in more detail in the Strategy section, *Risk 1: Inability to efficiently manage peak load*.

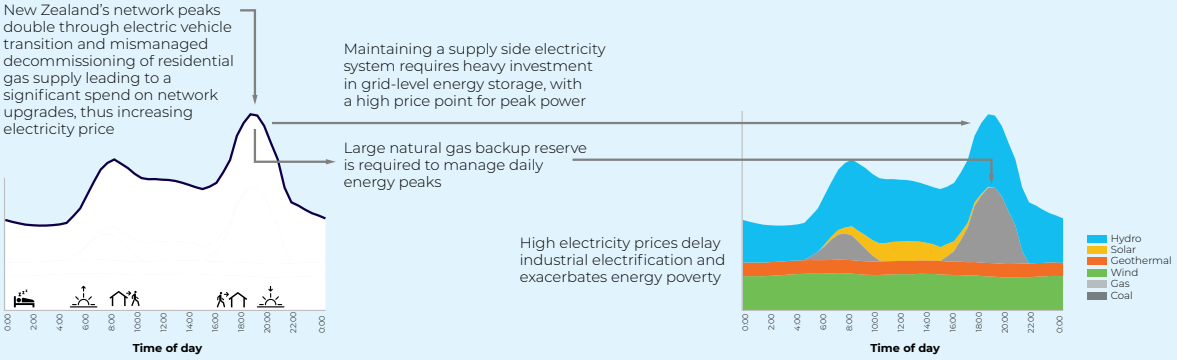
Current Status (July - October 2021)



An Orderly Decarbonised Future



A Disorderly Decarbonised Future



Physical Risks

Vector worked with the National Institute of Water and Atmospheric Research (NIWA), and the University of Auckland for subject matter expertise on the impacts of climate change based on RCP4.5, and RCP8.5 IPCC scenarios. The Auckland Region Climate Change Projections and Impacts report from NIWA [6], and the National Climate Risk Assessment from the Ministry for the Environment [7], provided Vector business units with a base level of knowledge to run a bottom-up scope of physical risks.

Changes in climate pose a risk for Vector's electricity and gas distribution business. Vector maintains a record of unplanned outages during extreme weather events, primarily caused by vegetation falling on power lines and assets. With a projected increase in extreme wind speed, the risk to our overhead lines is expected to increase. Rising sea levels, combined with cyclonic activity also increases the risk of flooding. This not only puts Vector assets at risk, but also consumes resources to disconnect and reconnect power to homes due to the electrical health and safety risks of standing still water. Further details can be found in Risk 3: *Increase in extreme weather events*.

To better understand these impacts, geographic information system (GIS) maps were produced to inform Vector of high-risk assets. The assessments inform Vector's Asset Management Plan, which includes consideration of vegetation management, distribution automation, undergrounding, micro-grid development, and predictive weather outage modelling.

Vector is also aware of risks to our electricity supply chain, such as the increase in drought conditions that may exacerbate existing dry-year risks. Such risks, while not material to Vector's assets, can increase electricity costs and/or interrupt electricity supply which directly impacts our customers.

Transitional Risks

Electrification of transport and industry, combined with enhanced renewable generation, will form a key approach to decarbonising New Zealand's economy. Through our internal modelling, we assessed the orderly and disorderly transition of the future load on the electricity network, to inform both our Asset Management Plan and broader business strategy.

The disorderly decarbonisation scenario models electricity growth with electric vehicle uptake, electrification of industry, transition from fossil natural gas to electricity, and population growth. The network growth is driven through an increase in peak load, for example with electric vehicle charging clustered around peak hours. From a network perspective, our key challenge is ensuring we can meet peak demand while maintaining a transition to renewable energy generation, which is variable by nature. Investing in assets which do not reconcile these factors is likely to result in inefficient allocation of capital. See the knowledge breakout on the previous page for a deeper dive into the intricacies of this risk.

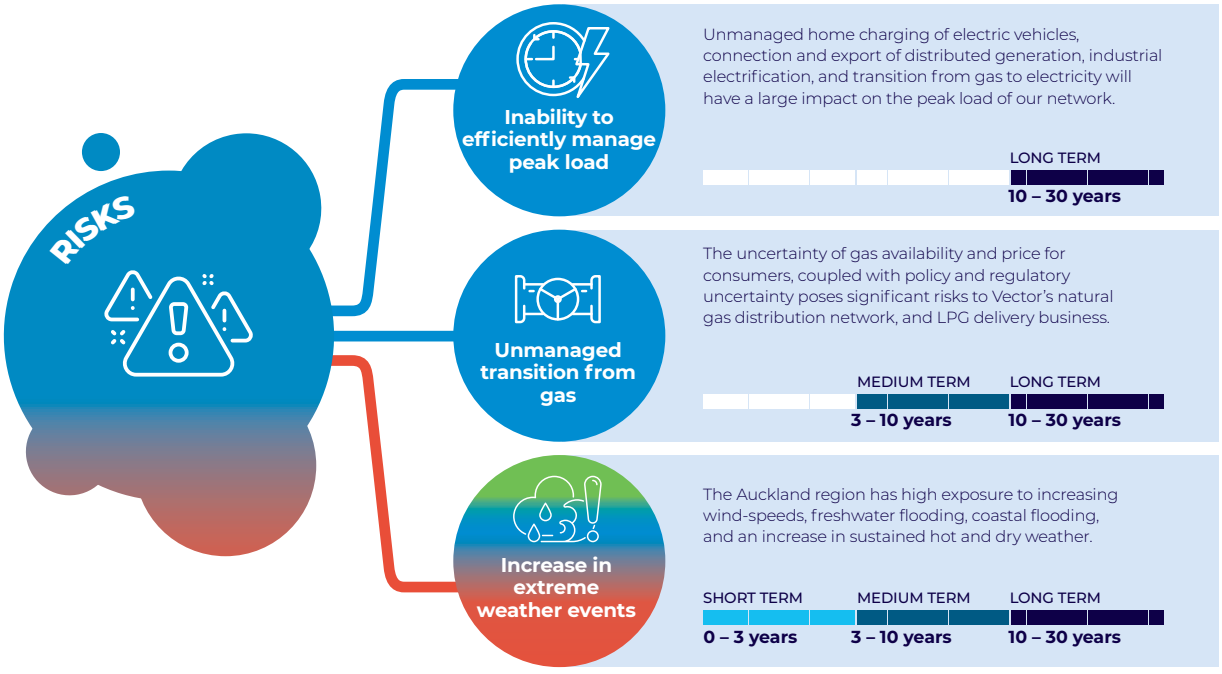
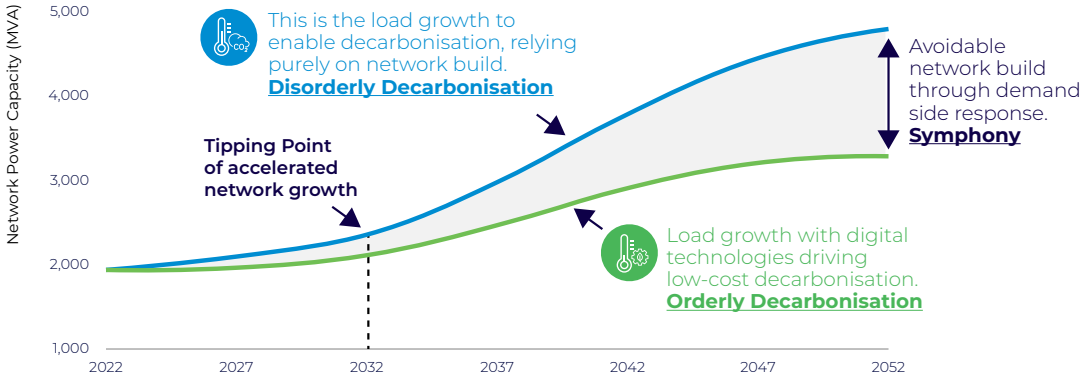


Figure 3: Forecasted growth on the Auckland Network for the disorderly and orderly decarbonisation scenarios.



The orderly decarbonisation scenario models electricity growth with the assumption that all electric vehicles, hot water load, and battery systems come under demand side management, thus allowing for an increase in electrification with less impact on the peak.

These scenarios reveal the importance of decarbonising the energy system in the most efficient, resilient, and cost-effective manner possible. A disorderly decarbonisation transition would require significant network investments that would increase costs for our customers and exacerbate existing inequalities.

Our diverse portfolio represents a strong business advantage for supporting this cost-effective and resilient orderly energy transition. Several of the products and services developed by our businesses can play a role in directly enabling an orderly decarbonisation transition, such as our support through data, digital platforms, and connectivity. To this end, we are working closely with policymakers and regulatory bodies, both in New Zealand and internationally, to advocate that decarbonisation cannot merely focus on adding more large-scale generation. In our view, it must give equal importance to optimised demand side management, energy efficiency, and distributed low-carbon generation. All of this is in the long-term interest of our customers. We are also working to scale the impact of our response through partnerships and collaborations with leading energy and technology partners. Many of these products and services appear as top climate-related opportunities for Vector, which is expanded on in the next section.

Knowledge Breakout: Is a growth in electricity network assets a risk or an opportunity?

An orderly transition should ensure that only the right amount of capital, being a scarce resource, is deployed. Assuming regulatory settings provide the right investment incentives (for example returns are commensurate with risk) then an orderly transition will ensure that contributors of capital receive appropriate returns and consumers pay appropriate prices. Therefore, the growth in electricity assets under an orderly transition can be considered an opportunity.

A disorderly transition results in more scarce capital being deployed than is required under the orderly transition, which is inefficient. While contributors of capital may still earn appropriate returns under a disorderly transition the same cannot be said for consumers. Consumers would pay higher prices under a disorderly transition when compared to an orderly transition to effectively fund the returns required on the excess deployed capital. This is a risk as it could result in intervention by regulators and/or government.

Vector also has a unique ownership model, where it is 75.1% owned by Entrust, a consumer trust which represents more than 350,000 households and businesses in central, east and south Auckland. It is therefore in the interests of our majority shareholder to ensure that energy prices remain low, and consumer burden is mitigated through an orderly transition.

Vector, therefore, considers this unmanaged growth a climate-related risk, and is striving to enable mass electrification, while minimising network impacts through an orderly transition. This is described in more detail in *Risk 1: Inability to efficiently manage peak load*.

Risk 1
Inability to efficiently manage peak load

Efficiently is defined as the ability to maximise network utilisation, minimise network investment, and therefore supply electricity at the most affordable price.

Risk Description

Unmanaged home charging of electric vehicles, connection and export of distributed generation, industrial electrification, and transition from gas to electricity will have a large impact on the peak load of our network.

Potential Impact

Existing regulatory frameworks drive Vector to expand its physical asset base to meet this forecasted peak load, and pass on costs to the consumers in the form of tariffs. The forecasted growth over the next 30 years in a disorderly scenario is unprecedented and will incur significant costs to our consumers and exacerbate energy inequalities.

Financial Impact

Uncertainty around the direction of New Zealand's energy strategy, regulatory reforms, and the sensitivity of variables such as electric vehicle uptake and charging patterns pose challenges in the meaningful financial quantification of this risk. Further work is ongoing.

Time Period

KEY SCENARIO OUTCOME

Disorderly Decarbonisation: Misaligned regulatory and policy frameworks limit utilisation of demand side management, and Vector's ability to drive its Symphony Strategy.

LONG TERM
10 – 30 years

The tipping point of rapid electric growth is forecasted to occur at 2032 as detailed in Figure 3.

Type
Transitional:
Policy Risk

Strategy to address this risk

Vector's strategy to address this risk focuses on achieving alignment of regulatory and policy settings, together with wider energy industry solutions that leverage digitalisation of the energy sector, to realise energy flexibility. Flexibility enables significant diversion of capital infrastructure spend. With sector alignment, this also enables efficient utilisation of the transmission network, and upstream intermittent renewable electricity. We are working closely with policymakers and regulatory bodies to drive this change, participating in sector forums, and driving the uptake of digitalisation with global partners. Examples include:

- Actively engaging in public policy and regulatory consultations such as the Emissions Reduction Plan Discussion Document [8].
- Our strategic alliance with Amazon Web Services to develop innovative new data management capabilities, and strategic collaboration with X, the moonshot factory (formerly Google X), which is developing technology and tools to accelerate clean and renewable power onto the grid. See *Opportunity 1: Energy Platforms*.
- Building capability to on-board consumers onto Vector's Distributed Energy Resource Management Systems (DERMS) platform for demand response.
- Conducting an electric vehicle behavioural trial of close to 200 electric vehicles to understand charging behaviour and evaluate the feasibility and benefits of smart charging.
- Initiating an industry FlexForum to take practical steps towards optimising the system flexibility benefits of distributed resources.
- Increasing low voltage visibility via existing consumer-level advanced meters.
- Trialling electric truck technologies to understand the impact of heavy electric vehicle charging.
- Assessing pricing structures to incentivise customers to charge large-scale electric vehicles outside the period of peak demand on the network.

Based on the above measures that form part of the strategy, Vector's Symphony Strategy is considered to be well placed to manage resilience to this risk. Changes to this strategy may emerge in response to regulatory, technology and market changes, and scientific developments.

Risk 2
Unmanaged transition from gas

Risk Description

The uncertainty of gas availability and price for consumers, coupled with policy and regulatory uncertainty poses significant risks to Vector's natural gas distribution network, and LPG delivery business.

Potential Impact

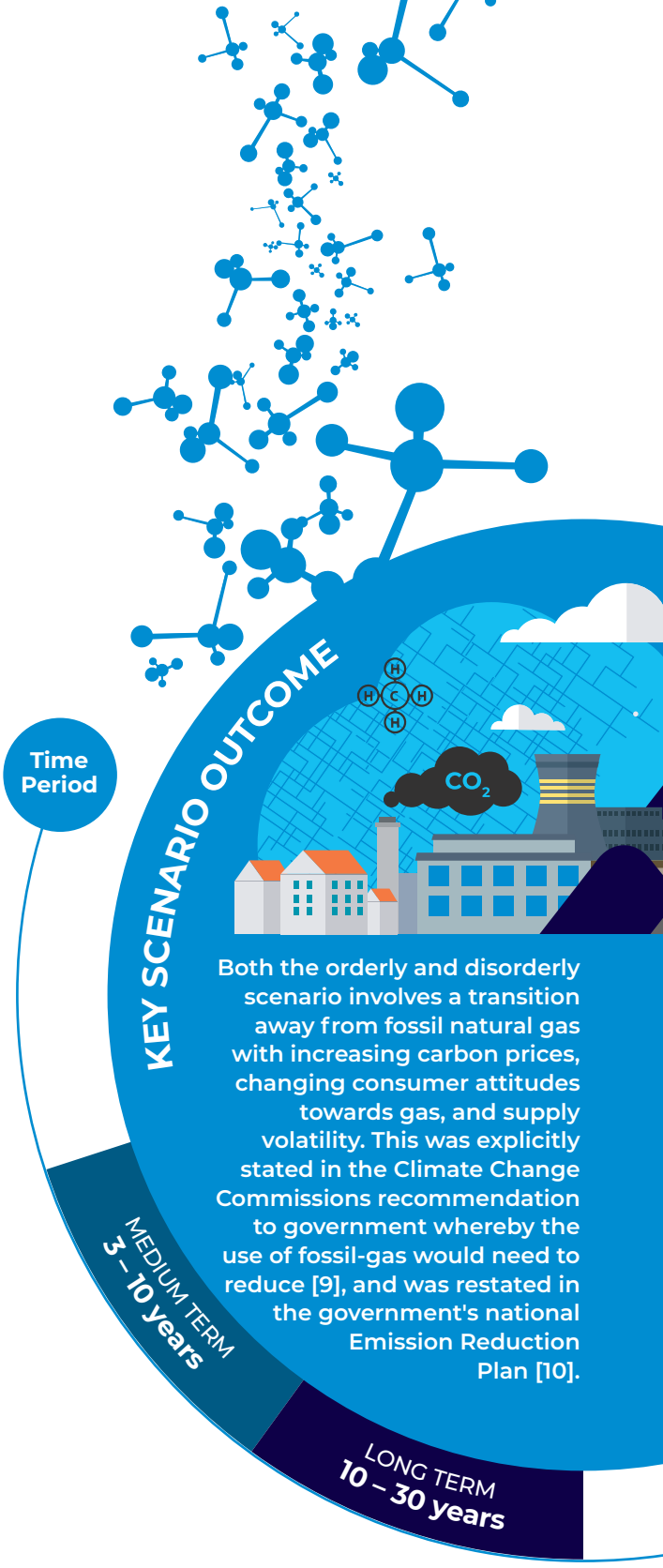
The uncertainty of the future asset life utilisation (capacity and longevity) of gas networks changes the regulatory compact – on which gas network owners invest. Under the disorderly scenario, this introduces a stranded asset risk, as also recognised in the government's Emission Reduction Plan [10], whereby investment recovery is not achieved over the long term.

Vector's LPG business will also be impacted through increasing prices (carbon, commodity and supply chain prices), and customer attitudes towards gas, leading to a decline in customers, volumes and profit margins.

Financial Impact

The carrying value of the natural gas network in Auckland is $604.1 million and the LPG business throughout New Zealand is $74.5 million. Understanding the financial impact of this risk on the carrying value is dependent on the national gas transition plan, which is due for completion by the end of 2023.

While not included in Vector's costs, it is worthwhile mentioning that the cost to customers throughout the country to transition from gas to electrical appliances comes at an estimated cost of $5.3 billion [9].



* Assuming average 2021 whole-sale price of $8.46/GJ, https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-statistics/energy-prices/

** 7.2 PJ using all available feedstocks at a price point of $35-$40.

Type Transitional: Policy Risk, Market Risk

Strategy to address this risk

In 2021 Vector, along with Firstgas and Powerco, and with support from the Ministry of Business Innovation and Employment, formed the Gas Infrastructure Future Working Group. The purpose was to explore scenarios for the end state and transition options for gas infrastructure along with solutions to achieve the objectives of government, infrastructure owners, and consumers [11]. In summary, the report explores:

1. A controlled wind-down (contraction) of gas consumption where gas businesses, like Vector's, recover capital through early regulatory changes, and gas pipelines are systematically shut down as consumers transition to Vector's electricity network.

2. Network repurposing, by transitioning to low carbon alternatives such as bio-methane and green hydrogen.

Network repurposing, by a transition to green-hydrogen or biomethane, is technically feasible, but heavily constrained by feedstock availability and price. In the case of biomethane, a recent study showed that biomethane at a price of $35 - $40 (which is approximately four times the current gas wholesale price*) could supply 4% of the national natural gas supply** [15]. Research currently shows that green-hydrogen also comes at a high price, as it is bound to the price of electricity. A residential consumer would use six times as much renewable electricity creating the green hydrogen required to heat their home, as they would using electricity directly via a heat-pump [12].

Vector already works with large commercial customers to enable their transition from the gas network, to the electricity network. However, as customers disconnect from the gas network, the network's ongoing operational, maintenance, and capital recovery costs will be shared amongst the customers that remain. Many of these customers reported that any significant changes in the cost of energy would have a significant impact on their business or household costs. We are concerned about these impacts – for our gas customers, the value of our assets, and the potential wider economic impact.

Mitigating capital recovery risk requires action by suppliers and regulators to make timely changes that ensure the recovery of capital before an accelerated rate of disconnections puts that capital recovery at risk. Vector has been engaging with the Commerce Commission to ensure regulatory settings support capital recovery. Examples of successful actions taken to reduce the capital recovery risk include:

- Vector requiring 100% customer contributions for new gas connections and associated network growth costs.
- Vector not proceeding with some previously forecast capital projects.
- The Commerce Commission implementing accelerated depreciation from the start of the third default price / quality path commencing 1 October 2022.

These examples highlight Vector's strategy to actively manage resilience to this risk through regulatory engagement. We note that the strategy may be updated in 2023 in response to the Gas Transition Plan.

Risk 3
Increase in extreme weather events

Risk Description

The Auckland region has high exposure to increasing wind-speeds, freshwater flooding, coastal flooding, and an increase in sustained hot and dry weather.

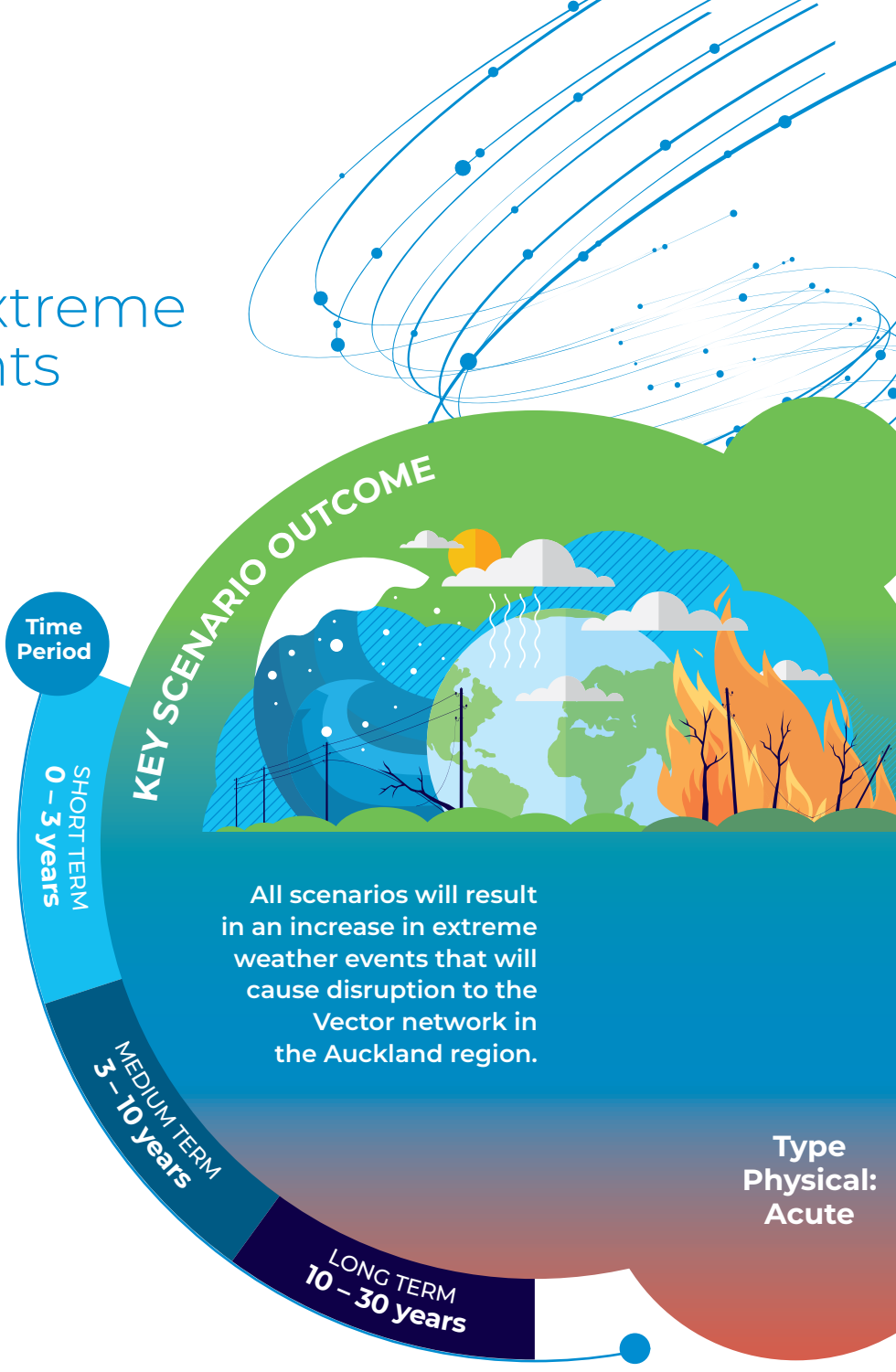
Actual Impact

Vector already has significant actual risks from weather events.

- High windspeeds, storms, and cyclonic events: Responsible for significant power outages on the Vector network.
- Flooding: Results in asset relocation costs, and operational costs to disconnect and reconnect power for the safety of our customers.
- Dry weather: Increases risk of electrical equipment failing or causing bushfires, that is currently mitigated through more expensive manual management.

Potential Impact

The increase in heavy winds and cyclonic activity will increase the potential risk from weather events. Furthermore, the cascading effects of floods with high wind speeds can delay network repair until the water has subsided. Ground mounted Vector assets are also exposed to salt-water damage during future coastal inundation. Increased length of sustained dry weather increases the risk of electrical equipment failing or causing bushfires, thus requiring manual operation that consumes additional resources.



Financial Impact

In April 2018 Auckland was hit with a category 2 tropical cyclone that caused extensive damage to the Vector network, amassing costs to Vector of $6.1 million dollars for this single event. With increasing temperature, there is a trend of tropical cyclones moving further southward at an average of 62km per decade, which increases the frequency and size of major cyclones hitting Auckland [6]. Note that an increase in cyclone category would result in magnitude increases in damage and therefore financial impact.

Vegetation management remains a critical control to minimise storm-related damage, of which $5.4 million was budgeted for privately owned trees in FY22 in addition to the targeted rate applied by Auckland Council for the trees they own[13].

Strategy to address this risk

Vector addresses this risk through the International Energy Agency's conceptual framework for climate resilience [14], detailed in Figure 4 which breaks physical resilience into three categories: robustness, resourcefulness, and recovery. The total investment in these initiatives is covered in Vector's Asset Management Plan[13].

Robustness

Robustness refers to the ability of the network to withstand the gradual long-term changes in climate patterns to continue operations and deliver on customer expectations. The following are examples of actions Vector has taken or is taking currently to contribute to the robustness of the network:

- Pioneering a risk-based approach to vegetation management, supplemented by light detection and ranging (LiDAR) based inspections, independent scoping of high-risk vegetation sections and collaboration with the Auckland Council to improve the management of council trees in the proximity of power lines.
- Hardening the network by selective replacement of bare overhead conductor with aerial bundled and covered conductor to improve the susceptibility during high wind conditions.
- Mitigating the risk of accidental fire starts on extreme fire risk days by utilising data from Fire Services and the National Institute of Water and Atmospheric Research (NIWA) to identify areas at risk; and remotely disabling automatic fault restoring devices on overhead lines to these areas.
- Implementing additional processes for managing equipment ratings during periods of warm and dry weather conditions, to revise the capacity ratings of underground cables. The revised ratings are then used to update the alarms in supervisory and control systems to match it to the loading on the network to avoid an inadvertent overload, which could result in power outages to the community.
- Progressively relocating assets and performing site-specific civil works to manage rising sea, flood, and storm surge levels, and ensuring that new zone substations are above future flood planes.
- Deploying microgrids and trialling vehicle-to-home technology to support local communities during weather-related outages.

Resourcefulness

Resourcefulness refers to the effectiveness of the business continuity plan to support operations during immediate shocks such as extreme weather events. This includes:

- Effective business continuity planning and testing including incorporating lessons learnt by doing post-event reviews.
- Leveraging global partnerships and relationships to learn from others following major international events.
- Maintaining an effective emergency response plan, which includes monitoring potential weather events, proactive deployment, and prioritisation of field resources.
- Investing in an advanced outage management system.
- Civil defence collaboration in preparation for and during events
- Investing in customer communication channels and digital platforms for our customers during events.

Recovery

Recovery refers to the ability to restore the network's function after an interruption resulting from climate hazards and involves:

- Effective management of full-time and temporary resources (e.g. out of region resources) during extended recovery periods.
- Effective stock management to ensure the availability of equipment and spares.
- Effective systems to track and report against restoration progress.
- Ongoing post event reviews and continuous improvement.
- Developing effective communication channels and strategies to keep customers informed during events.

Knowledge Breakout: Undergrounding Power Lines

Vector's electricity network consists of more than 19,000km of electricity lines, which is approximately the distance from New Zealand to England. Currently, 57% of the network is underground, with 43% of the network remaining above ground.

As vegetation fall on power lines is the largest cause of weather-related outages, undergrounding the remaining network appears at first thought to be an effective strategy for storm resilience. However, undergrounding comes at significantly higher costs than overhead power lines, which would substantially increase electricity tariffs. Faults on underground cables are also costly to locate and repair, and can take longer to repair than faults on the overhead network.

It is due to these potential increases to electricity prices, that we consider the various risks and alternative options before deciding on the best network solution, such as power-line strengthening, and proactive vegetation management.

Nevertheless, all new developments in the region have power lines underground as the site works for construction and road building typically provides easy and cost-efficient access to install the lines.

Vector's undergrounding programme is funded as part of an agreement with our major shareholder Entrust, that requires an average of $10.5m to be invested every year in projects in the Entrust region.

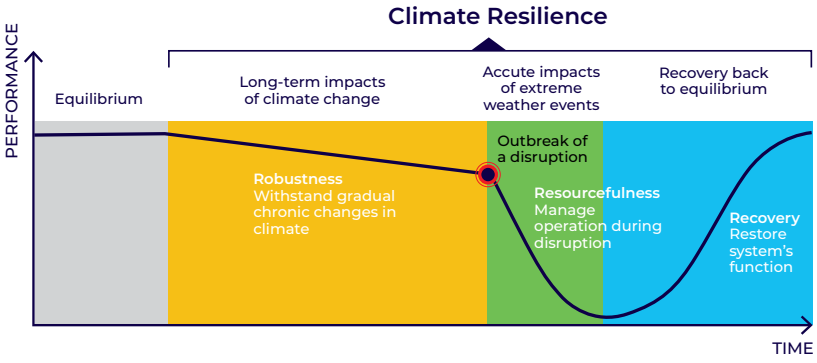


Figure 4: International Energy Agency's conceptual framework for climate resilience

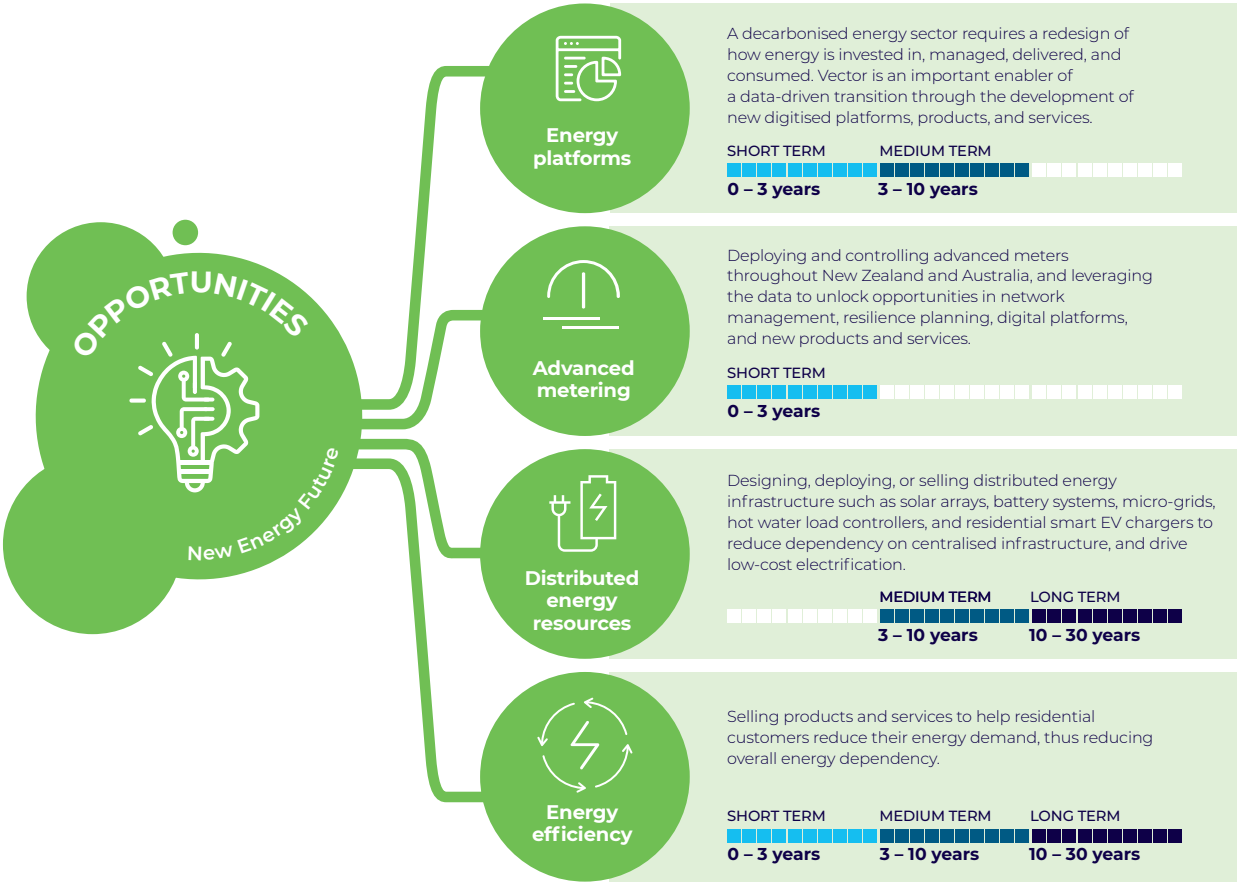
Opportunities

Our innovations enable the transformation of energy systems

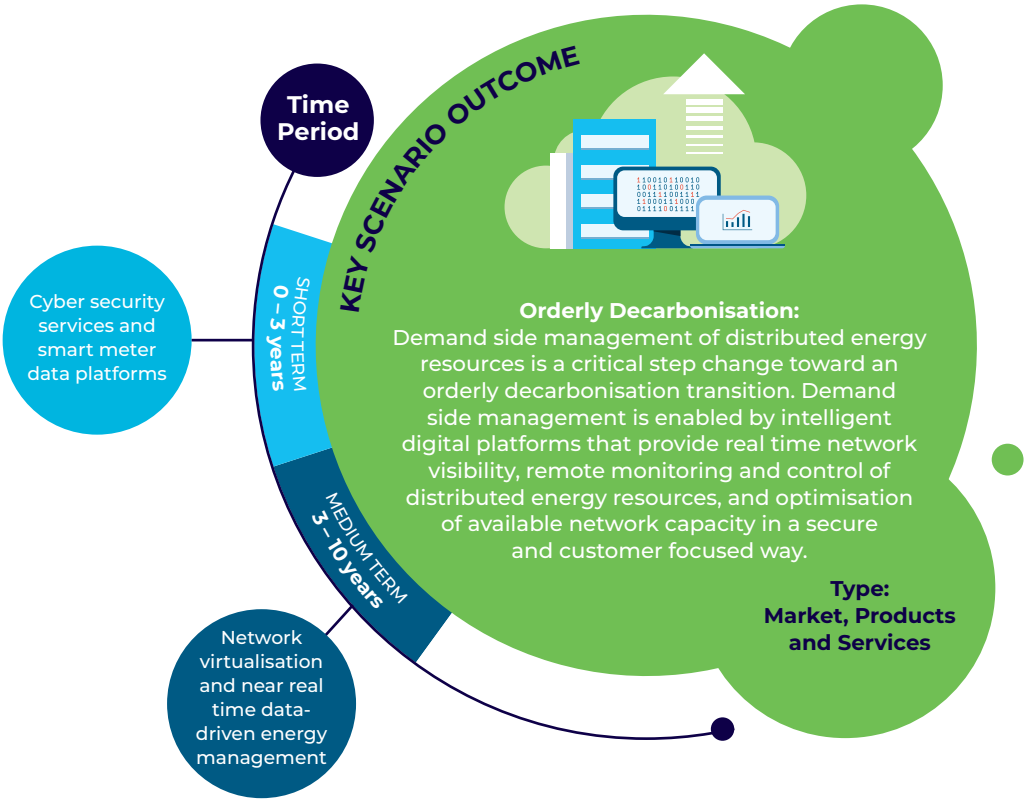
Consumers are demanding cleaner, more reliable, affordable energy. We are taking critical steps to transform how the energy industry operates to support these changes. Our vision is to transform the energy industry by using data to redesign how energy is managed, delivered and consumed. We are actively developing solutions to enable this transformation, partnering with other organisations where we see opportunities to help achieve our goals.

This data-led transformation can displace legacy systems, leveraging a step-change in processing power, flexibility, and accuracy, addressing the rapidly changing requirements of customers, energy retailers, network operators, and other energy market participants. We see this as a critical building block for the transformation of energy systems.

This transformation can be broken down into four opportunities that form part of the future energy value chain.



Opportunity 1
Energy Platforms



Opportunity Description

Vector Technology Solutions has been established to take to market solutions developed as part of Vector's own digital transformation journey. Vector's Symphony Strategy and commitment to addressing climate change related energy industry challenges have created opportunities to work with industry-leading partners to provide innovative energy platforms to support the orderly decarbonisation scenario. We are exploring national and global opportunities for key priority solutions including cyber security, and the New Energy Platform created through our strategic alliance with Amazon Web Services (AWS). We expect this opportunity to evolve alongside new advances in both hardware and software.

Actual Impact

A foundational element of digital transformation to climate change is robust cyber security. Vector is now providing cyber security services to other critical infrastructure providers through Vector Technology Solutions, leveraging Vector's 24/7 security operations centre.

Potential Impact

Energy platforms have a significant potential global opportunity. The need for more, higher quality, and faster energy data is increasing as more electric vehicles, and intermittent renewable generation capacity enters the electricity system. Decarbonisation, decentralisation and democratisation of the energy supply chain are creating global opportunities for energy data platforms that provide higher performance and more flexible processing capability like that offered by the New Energy Platform.

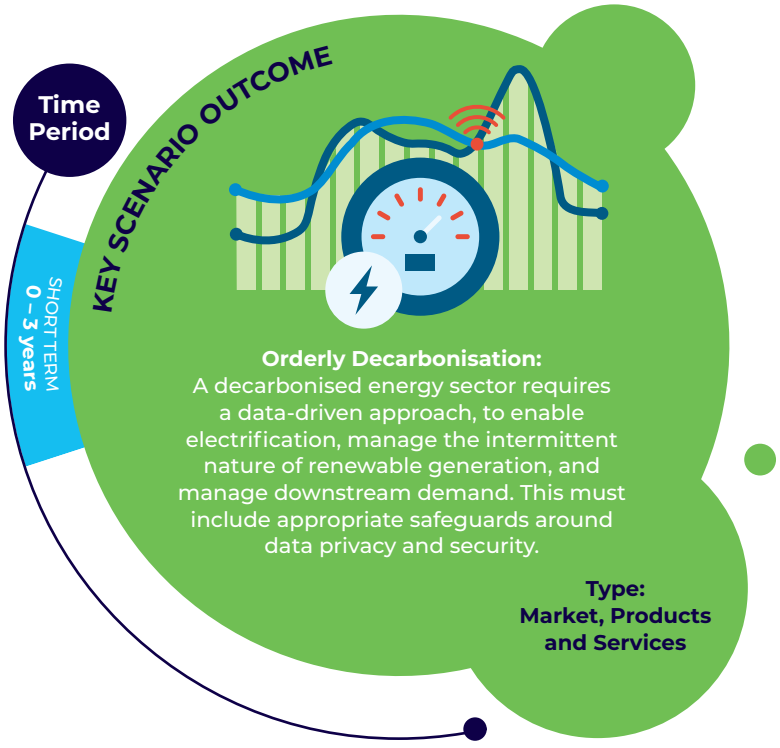
Financial Impact

The financial impact of this opportunity is under analysis.

Strategy to address the opportunity

Vector holds strategic partnerships both locally and internationally. Vector has a strategic alliance with Amazon Web Services to develop the New Energy Platform for data-driven energy management, and a strategic collaboration with X, the moonshot factory (formerly Google X), which is developing technology and tools to accelerate clean and renewable power onto the grid. Vector also maintains relationships with local distributors, retailers, government and regulators, seeking to ensure that the platforms align across the whole ecosystem to best benefit the end consumer and enable widespread decarbonisation.

Opportunity 2
Advanced Metering



Financial Impact

The financial impact of this opportunity is under analysis.

Strategy to address the opportunity

Vector is working closely with government and regulators to drive the importance of unlocking data from advanced meter uptake in New Zealand and Australia, in a way which protects consumer privacy and ensures data security, to help enable orderly decarbonisation. Vector also partners with distributors, retailers, and global technology platforms to drive energy management innovation with a global impact.

Earlier this year Vector announced a strategic review to assess options for the next phase of growth for our smart metering business. The results of this review may impact our strategy going forward.

Opportunity Description

Advanced meters, and the data services they provide, are a key enabler of data-driven decarbonisation. The data can be used for service and product development, network management, resilience planning, and the development of new digital platforms. See *Opportunity 1: Energy Platforms*.

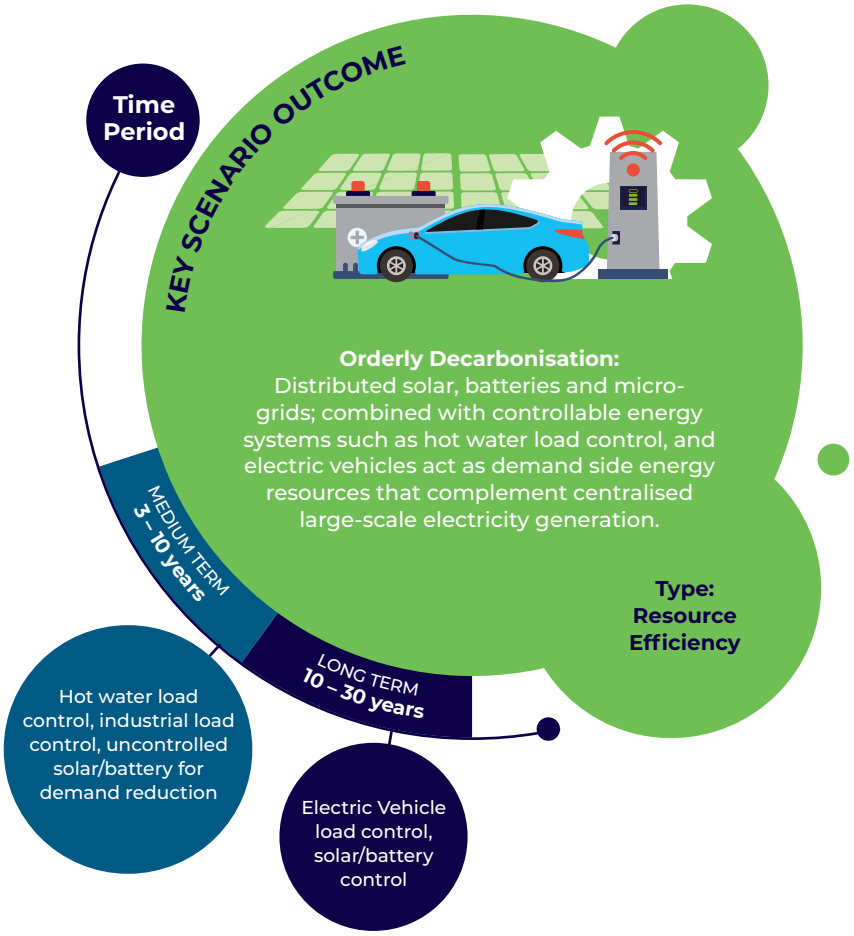
Actual Impact

Vector's metering business has the largest market share of advanced meters in New Zealand, and is expanding through Australia. Metering services are sold to energy retailers, network companies and directly to large energy customers.

Potential Impact

Advanced meters measure a range of electrical variables, of which only energy (kWh) and power (kW) data is currently utilised by energy retailers for mass market customer billing. Other electrical variables, such as voltage, current, active power, and reactive power are of value to other energy participants, such as our distribution network, to manage the integration of customer-owned distributed energy resources. Furthermore, as we see changes in energy markets, such as Australia, moving towards 5-minute settlements of metering data (instead of traditional 30-minute intervals), and with new energy markets, services and opportunities emerging, we envisage the need for and utilisation of advanced metering data will increasingly grow.

Opportunity 3
Distributed Energy Resources



Opportunity Description

Vector Group businesses, such as Powersmart and HRV, install distributed energy systems. These include commercial-scale solar systems, battery storage, micro-grids, and residential smart electric vehicle chargers.

Actual Impact

In parts of the Pacific Islands, Vector Powersmart has deployed a range of micro-grid solutions, that use a solar-battery system as opposed to traditional expensive diesel generation.

In New Zealand, Vector works with commercial customers to accelerate solar generation adoption and to maximise pro-sumption (production and self-consumption) of solar power to reduce network impacts.

At the network level, Vector has installed seven battery energy storage systems on the 22kV and 11kV networks. These are designed to perform multiple functions, including peak load shaving and voltage control.

Beyond generation and network battery storage, consumer load through hot water heating and electric vehicle charging can be time shifted to reduce network peaks. Vector has been controlling customer hot water load in the Auckland regional network for transmission peak shaving, supplying instantaneous reserve capacity to the national network, and responding to contingencies on its network and the national grid.

Potential Impact

In the short to medium term, hot water load control will likely remain the dominant distributed energy resource on the demand side. Our initial modelling shows that from 2032 onwards, the accelerated uptake of electric vehicles will become a large distributed energy resource, see Figure 5.

HRV has entered the electric vehicle smart charging installation market. Our initial electric vehicle charging behavioural trial shows the potential for smart charging without impacting customer satisfaction.

Vector also envisages that the utilisation of other flexibility services, from across the energy value stack, will also contribute to this opportunity. The FlexForum was formed to break through these business silos and take practical steps towards optimising flexibility through distributed energy resources.

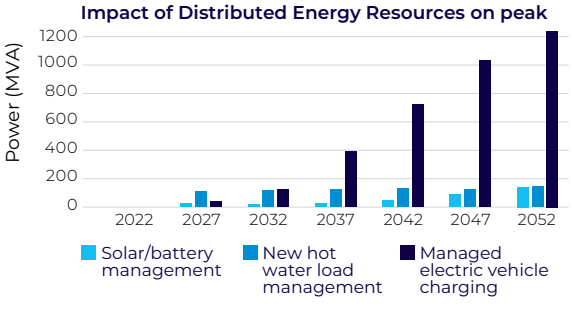
Financial Impact

The financial impact of this opportunity is under analysis.

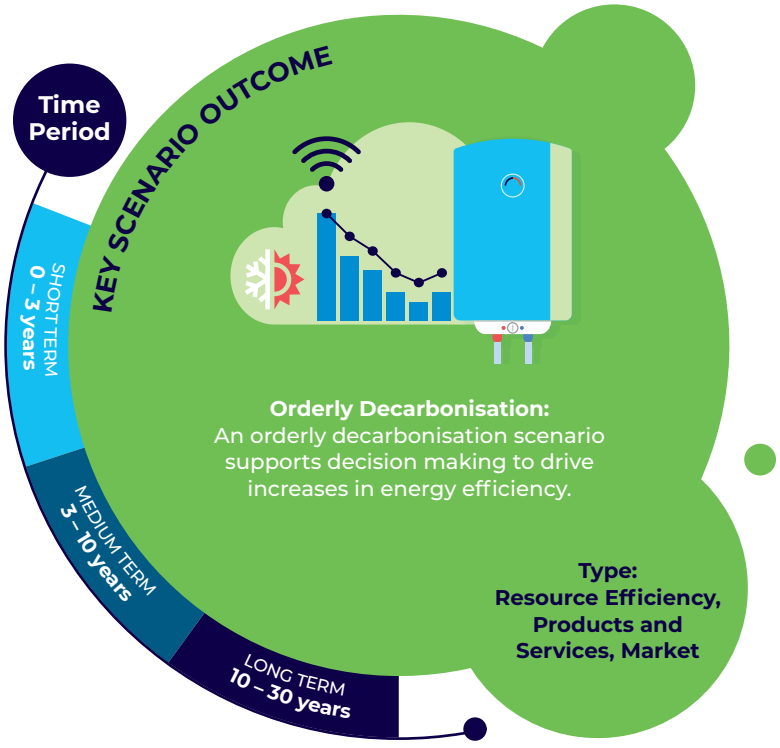
Strategy to address the opportunity

The strategy is related to *Risk 1: Inability to efficiently manage peak load*. It involves the alignment of regulatory and policy settings, together with wider energy industry solutions to leverage the uptake of distributed energy resources. Beyond this, we're continuing our strategic collaboration with X. The work we're doing with X is contributing to their Tapestry project, which is all about accelerating the decarbonisation of electric power systems. Tapestry aims to create highly accurate visualisations and simulations of the grid that can predict how it will behave from nanoseconds to years into the future.

Figure 5: Initial modelling indications of distributed energy resource impacts on the network.



Opportunity 4
Energy Efficiency



Financial Impact

The financial impact of energy efficiency does not meet Vector's financial materiality threshold. However, it is still disclosed as a key opportunity due to the important role it plays in the national energy decarbonisation transition, reduction of peak loads on Vector's electricity network, and improvement of public health outcomes through warmer homes.

Strategy to address the opportunity

Ongoing product innovation of efficiency systems keeps Vector at the forefront of new technology, and new channels or services to market. Vector also strongly advocates for government initiatives such as 'Warmer Kiwi Homes', which provides subsidies for low-income households to gain access to energy efficiency solutions. The expansion of the Warmer Kiwi Homes programme is being explored as part of the Emissions Reduction Plan.

Opportunity Description

There are significant opportunities to reduce demand through energy efficiency measures. New Zealand's peak load is currently driven by residential evening heating during the winter months.

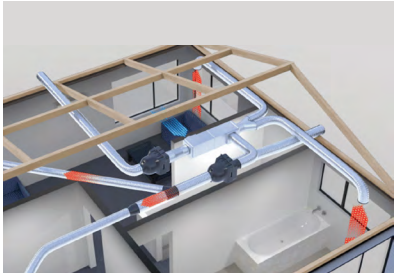
Actual Impact

At a consumer level, HRV installs heat recovery and ventilation systems, as well as heat pumps with a strategy to expand to all-of-home efficiency solutions. HRV also participates in the government 'Warmer Kiwi Homes' programme which supports low-income households obtain energy-efficient heating solutions.

Potential Impact

With the utilisation of digital energy platforms, Vector envisages new markets where an 'energy efficient' model does not just reduce energy consumption at the device level but looks at whole system efficiency. That means using electricity when there is network capacity, and when intermittent renewable energy generation is abundant. These impacts support Vector's electrical network by minimising peak load growth, see *Risk 1: Inability to efficiently manage peak load*.

HRV is already grasping this opportunity, by selling residential heating systems with demand response capability, and smart electric vehicle chargers.



HRV Ventilation systems pump out stale damp air, while recovering the heat.

4. Metrics and Targets

TCFD recommends that organisations:

- Disclose the metrics used by the organisation to assess climate-related risks and opportunities in line with its strategy and risk management process.
- Disclose Scope 1, Scope 2 and, if appropriate, Scope 3 greenhouse gas (GHG) emissions and the related risks.
- Describe the targets used by the organisation to manage climate-related risks and opportunities and performance against targets

Metrics and targets are used to measure and manage climate-related risks and opportunities disclosed in the Strategy section. Within this disclosure we also include our Scope 1, 2 and 3 greenhouse gas emissions, and targets used to reduce select emissions.

Knowledge Breakout: Electricity Distribution Losses

Electricity distribution losses are not like a water or gas leak. They are a characteristic of the electricity distribution network. Although we can measure these losses, and report their associated emissions based on New Zealand's published electricity generation emissions factor, we can never fully remove them. They are largely an unavoidable by-product of electrical conduction, and therefore excluded from our targets.

Greenhouse gas emissions and targets

Vector measures its greenhouse gas emissions in accordance with the Greenhouse Gas Protocol. This splits emissions into three categories:

- Scope 1 – Emissions we directly control such as vehicle fleet fuel combustion, diesel backup 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.

The Greenhouse Gas Protocol splits Scope 3 emissions into 15 categories. A breakdown of Vector's emissions by Scope and category can be found in Table 1. All calculations are expressed in total tonnes of carbon dioxide equivalent (tCO_2e).

Vector uses the operational control approach, as defined by the Greenhouse Gas Protocol, to measure and report emissions. This allows reduction efforts to focus on emissions over which Vector has the greatest control, and thereby can influence most with emissions reductions measures.

Vector's base year for emissions reporting is FY2020, 1 July 2019 to 30 June 2020. This was the first year that the greenhouse gas inventory included an in-depth screening of Scope 3 emissions, and it forms the base year for Vector's science-aligned reduction target. In FY2022, we decided to voluntarily restate the base year and FY2021 to exclude emissions from the sold Treescape business from Scope 3 – Category 15 – Investments, for reasons of clarity.

Emission factors are primarily sourced from the most recent publications (at FY end) by New Zealand's Ministry for the Environment (MfE), the UK's Department of Environment, Food and Rural Affairs (DEFRA), or Australia's Department of Industry, Science, Energy and Resources (DISER).

Additional information on organisational boundaries, including the treatment of investments, operational boundaries, methodologies, and results can be found in Vector's Greenhouse Gas Inventory Report.

Emission Reduction Target

Vector has set an absolute emission reduction target, aligned with a methodology by the Science Based Target initiative (SBTi), of reducing Scope 1 and 2 emissions (excluding electricity distribution losses) by 53.5% by FY2030 from a FY2020 baseline. The target was developed by a third party in 2021, based on the SBTi guidance at the time and includes biogenic carbon. A recalculation of the target is triggered by a recalculation of base year emissions included in the target.

We have achieved a greenhouse gas emission reduction of 13% in FY2022 towards this target against the FY2020 baseline. This is largely due to reductions in our fugitive natural gas emissions through an increase in pipeline monitoring.

Nevertheless, Vector had a slight increase in Scope 1 and 2 emissions compared to FY2021. A large quantity of Vector's emissions are volatile by nature, such as 3rd party damages to gas pipelines, which fluctuate year on year and make up 28% of Vector's Scope 1 emissions in FY2022. A breakdown of emissions split by Scope and a comparison of emissions per Scope since Vector's base year in FY2020 can be found in Table 1. These summaries of emissions have been extracted from Vector's Greenhouse Gas Emissions Inventory FY22 Report [16]. The report is 'reasonably assured' by our third-party assurer.

4. Metrics and Targets (continued)

Table 1: Summary of Vector's total greenhouse gas inventory. FY2020 was Vector's carbon baseline. Emissions highlighted in green indicate a reduction since the baseline, whereas emissions in red show increases.

EMISSIONS CATEGORY	FY2020	FY2021	FY2022
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 [1]	16,368	12,074	**11,453**
Gas Metering Fugitive Emissions [2]	934	1,082	**1,161**
SF_6 Fugitive Emissions [3]	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	934	898	**991**
Electricity Distribution Losses [4]	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 [5]	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 [6]			
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**

1. Decrease in emissions from improved gas pipeline surveying.
2. Increase from deployment of advance gas meters to replace legacy gas meters.
3. Two major leaks in sub transmission switchgear where delays in replacement part deliveries hindered Vector's ability to immediately repair these leaks leading to sustained SF_6 emissions.
4. Residential electricity use has higher distribution losses, than industrial and commercial use. In FY22 there was a shift in electricity consumption from industrial and commercial to residential usage. There was also an increase in New Zealand's grid electricity emission factor published by the Ministry for the Environment. See knowledge breakout on previous page for more information.
5. Overall decrease in LPG sales, but an increase in the upstream emission factor of LPG.
6. Ongoing reduction of natural gas and LPG sales.

Figure 6: Emissions included in Vector's science-aligned target - Scope 1 and 2 excluding electricity distribution losses. (left) Emission breakdown, in tCO_2e (right) Vector's trajectory towards its 53.5% emission reduction target.

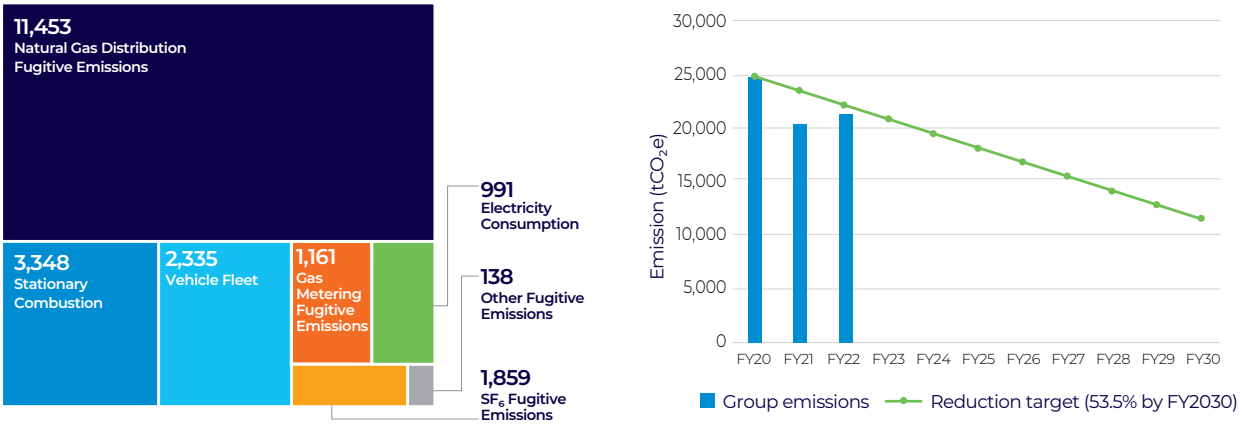
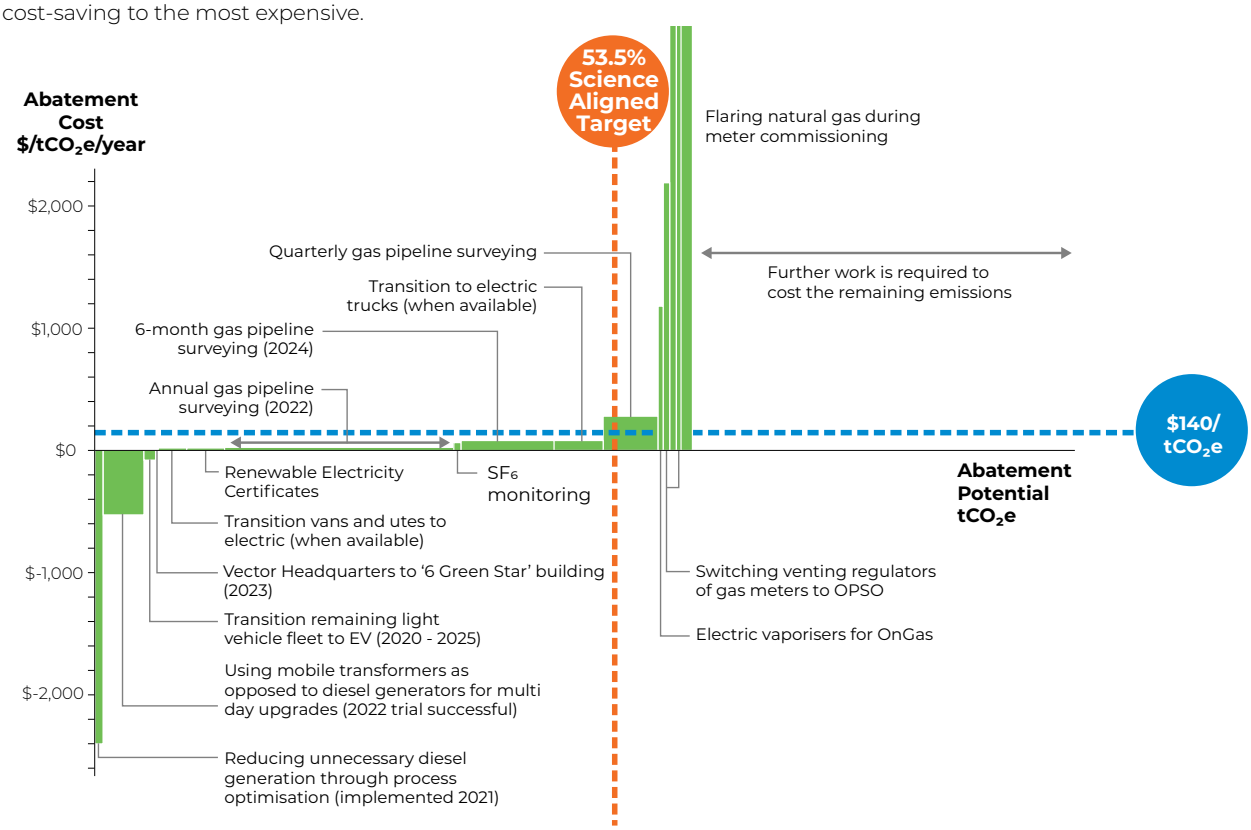


Figure 7: Vector's marginal carbon cost abatement curve. The x-axis corresponds to Vector's total annual emissions. Each bar details a carbon abating initiative where the thickness of the bar details the carbon abated. The y-axis represents the cost, with negative values indicating cost-savings. Initiatives are ordered left to right, from the most cost-saving to the most expensive.



Marginal abatement cost curve

In FY22, Vector developed a carbon abatement cost curve to help achieve our reduction targets (Scope 1 and 2 excluding electricity distribution losses). This work identifies the financial impact of potential carbon reduction activity across Scope 1 and 2 emissions, using a carbon cost of $140 per tCO_2e as a comparative "do nothing" cost. $140 was chosen to align with Climate Change Commission recommendations to Government [9].

Through this work, we identified emissions that could be reduced while saving money for the group (those with negative abatement cost), others that were close to cost neutral (those with bars close to $0/$tCO_2e$/year), with the balance assessed as being more complex to abate given the availability of current alternatives. More information on specific initiatives can be found in Vector's Greenhouse Gas Inventory Report. 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.

4. Metrics and Targets (continued)

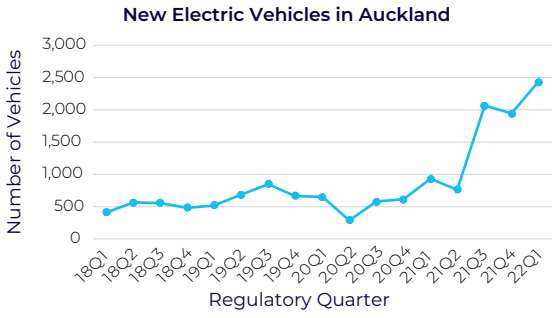
Electric vehicle uptake in Auckland

Related to Risk 1:
Inability to efficiently manage peak load

Related to Opportunity 1:
Energy Platforms

Related to Opportunity 3:
Distributed Energy Resources

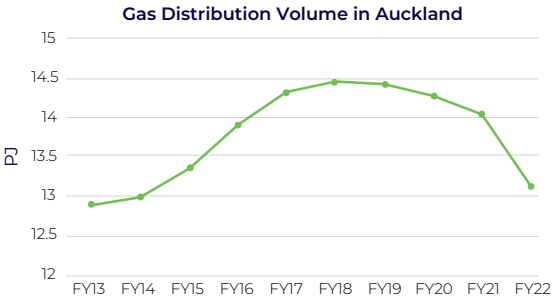
Vector is closely monitoring electric vehicle uptake in Auckland to understand their impact on the network and emerging charging behaviours. We are working towards getting further information on when and where electric vehicles charge, to optimise electricity distribution, and to understand the percentage that are controlled by smart chargers.



Actual gas volumes

Related to Risk 2:
Unmanaged transition from gas

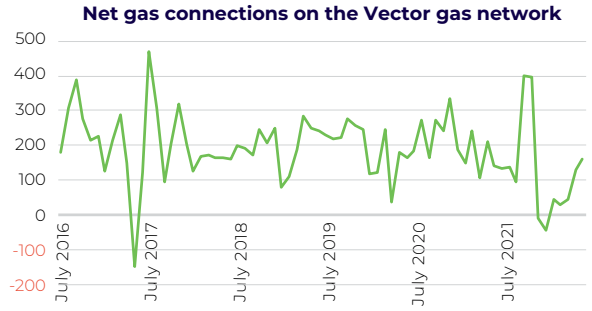
Gas distribution volumes in Auckland have been trending down since FY2018. Note that COVID impacts have also caused a decrease in activity.



Net Gas Connections and Disconnections

Related to Risk 2:
Unmanaged transition from gas

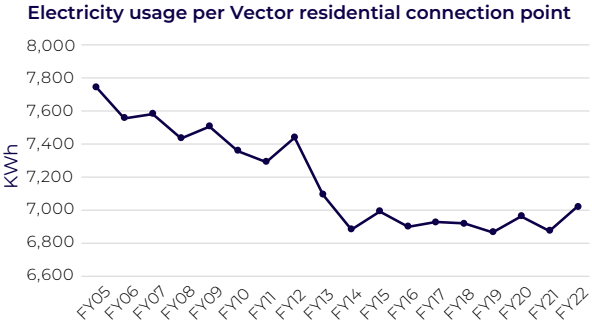
Gas connections on the Vector network continued to grow until FY2021. We observed a decrease in the number of gas connections in FY2022. The number of disconnections has also increased in the past two years.



Average Household Electricity Consumption

Related to Opportunity 4:
Energy Efficiency

Average household energy consumption decreased rapidly through till 2014. The energy consumption increase in FY2020 and FY2022 is likely attributed to an increase in working from home during COVID-related lockdown measures.



Electrical power outages

Related to Risk 3: Increase in extreme weather events

A direct consequence of extreme weather events is an increase in customer outages. Two of the measures the Commerce Commission uses to monitor a reliable standard of service to customers, relates directly to power outages:

- SAIDI (System Average Interruption Duration Index) – Average outage duration for each customer served over the course of a year.
- SAIFI (System Average Interruption Frequency Index) – Total number of interruptions per customer per year.
- Major Event SAIDI – Days of severe weather impacts that breach the SAIDI unplanned boundary value of 4.83 SAIDI minutes. While Major Event SAIDI does not have a target, it's a metric that can indicate an increase in extreme weather events, such as cyclones.

Vector monitors these three metrics throughout the year with the aim of being under the regulatory limits currently set at 104.83 and 1.337 for SAIDI and SAIFI respectively. Note that SAIDI and SAIFI also incorporate non-weather-related outages such as car accidents on power lines. Nevertheless, weather-related impacts still contribute to the majority of outages.

NORMALISED UNPLANNED SAIDI/SAIFI	RY2020	RY2021	RY2022	REGULATORY LIMIT
SAIDI	116.7	86.3	92.42	104.83
Major Event SAIDI	3	0	59.72	-
SAIFI	1.36	1.07	1.05	1.337

Solar uptake in Auckland

Related to Risk 1: Inability to efficiently manage peak load

Related to Opportunity 1: Energy Platforms

Related to Opportunity 3: Distributed Energy Resources

Vector registers photovoltaic solar uptake in the Auckland region. This can be used to understand the uptake of this type of distributed energy resource within Auckland.

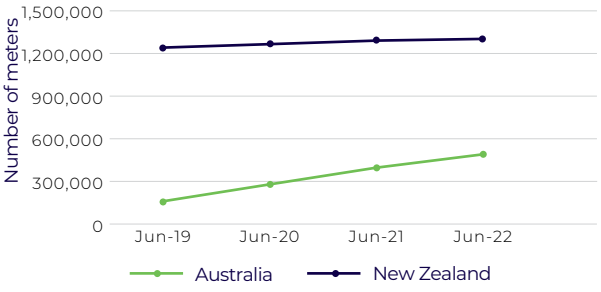
	RY2020	RY2021	RY2022
Cumulative Total Solar Installations	5,056	6,119	7,348

Advanced meter deployment

Related to Opportunity 2: Advanced metering (Data Services)

Vector owns* the largest market share of advanced meters in New Zealand (61%). In New Zealand, advanced meters penetration is high, at 87%. Australia on the other hand has low advanced meter penetration, and therefore has a faster market growth.

Advanced Electricity Meters Owned by Vector



Remuneration: Performance goals

A yearly decarbonisation measure makes up five percent of overall short-term incentive payments to the executive team and their direct reports. The goal is designed annually through the Climate Change Steering Committee and approved by the Board.

* Metric does not include 182,895 advanced meters managed but not owned by Vector

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