Planning for change: Navigating uncertain climate futures

KiwiRail’s first climate scenarios, risk and opportunity assessment 2025

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1. Introduction – Planning for a low emissions, climate resilient future

As a leader in low-emissions transport and a critical infrastructure provider it is important for KiwiRail to be prepared for the impacts that climate change may bring. This report outlines our first steps towards planning how our business can successfully transition to a low-emissions, climate-resilient future. It describes:

- climate scenarios we have developed to help inform our future planning
- key climate risks and opportunities for KiwiRail that arise from these scenarios
- our initial response to these risks and opportunities and how we will further integrate these into our future business strategy and planning.

2. Our climate scenarios

Climate change and the global response to it create deep uncertainty. To support KiwiRail in planning for this uncertainty, we have developed three climate scenarios, building on the transport sector scenarios that were published by the Aotearoa Circle in 2024[1].

Scenarios describe how the future may develop based on a set of assumptions relating to both physical parameters (e.g., temperature, sea level rise) and transitional parameters (e.g., social, political, technological and legal) and how these will change over time. They draw on sources such as the IPCC sixth assessment reports, NIWA's climate change projections, and the Climate Change Commission's modelling of emissions reductions pathways.

The scenarios are not intended to be predictive or to identify the 'most likely' outcomes of climate change. Instead, they allow KiwiRail to test the resilience of our business against a wide range of potential futures. They help us understand the potential risks and opportunities that climate change may bring for us in future and consider how we can successfully position ourselves to navigate these changes. We have developed three scenarios:

- **On-Track** (orderly transition): International efforts lead to rapid decarbonisation and warming is limited to 1.5 degrees C by 2100
- **Slow-Coach** (disorderly transition): After a slow start, aggressive decarbonisation policies limit warming to 1.6 degrees C by 2100
- **Off-the-Rails** (hot-house world): Nations focus on developing resilience to climate impacts rather than decarbonisation. Greenhouse gas (GHG) emissions continue to rise and warming reaches 3 plus degrees by 2100, with more severe physical climate impacts.

For all three scenarios we considered three timeframes: 2030 (short-term), 2040 (medium-term), 2050 (long-term). In our 'Off the rails' or hot-house scenario, we also included an extension scenario to 2100 to help us better understand the physical impacts of warming in a 3 degrees C plus world.

[1] Transport sector: Climate change scenarios. *The Aotearoa Circle, June 2024.* *Transport Sector Climate Scenarios — The Aotearoa Circle*

Key quantitative parameters we considered included:

- extreme heat
- extreme rainfall
- carbon price
- population growth
- GDP
- likely trends in rail freight mode share
- predicted total rail freight volumes carried (net tonne kms)

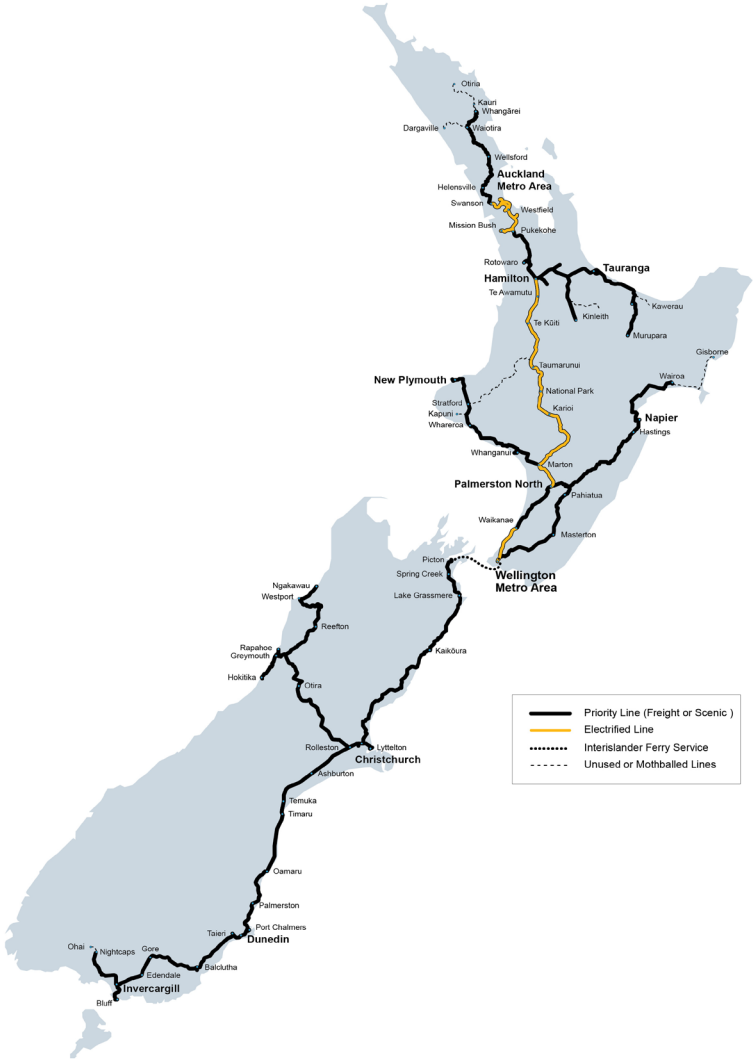
Our predictions of rail freight volumes and mode share, were supported by considering key drivers of rail freight demand including:

- predicted dairy herd size
- livestock herd size
- harvested timber volumes
- coal demand.

The scenarios were developed through a collaborative planning process involving workshops with staff representing a wide range of divisions across KiwiRail. Teams included Finance, Infrastructure, Asset Management, Environment, Strategy and Customer and Growth.

For each scenario, we have visualised how KiwiRail's rail network may change over time – developing maps that show how our network may evolve. These are shown below, alongside a more detailed description of each scenario.

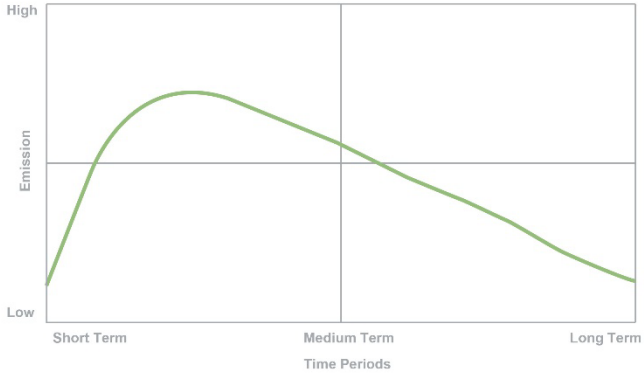
Figure 1. Our rail network today



2.1. On Track scenario

ON TRACK - ORDERLY
1.6˚C warming by 2050
Rapid and planned transition

LONG TERM
2050



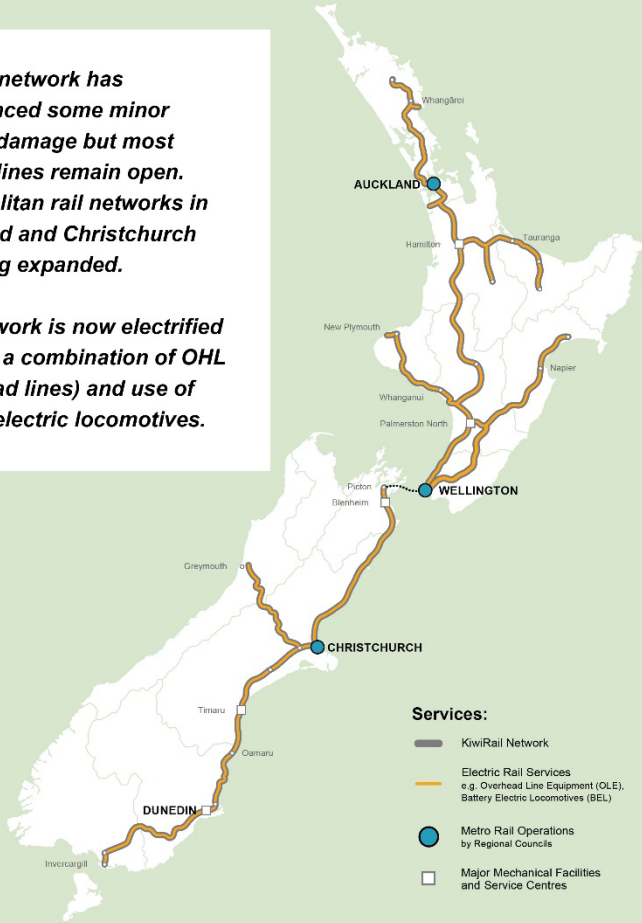
By 2050 the world reaches its net zero targets. There is a fast, but globally coordinated and orderly, transition to a low carbon future. While the worst severe weather events are prevented, long term chronic climate impacts still occur.

Advances in technology and strong customer demand for low carbon solutions create an opportunity for KiwiRail to electrify much of our rail system, through either overhead lines or battery-electric locomotives. However, drops in demand for carbon-intensive commodities in the 2030s, like coal create a challenge to KiwiRail's financial sustainability.

KiwiRail struggles to attract skilled staff and meet government and public demand to expand the rail network rapidly at first, but by the 2040s KiwiRail's capacity has increased, and they are on track to expand the rail system. Minor physical climate impacts cause some rail network damage which worsens by the 2040s, but strong demand for low carbon products makes repairing lines economically viable.

The rail network has experienced some minor climate damage but most priority lines remain open. Metropolitan rail networks in Auckland and Christchurch are being expanded.

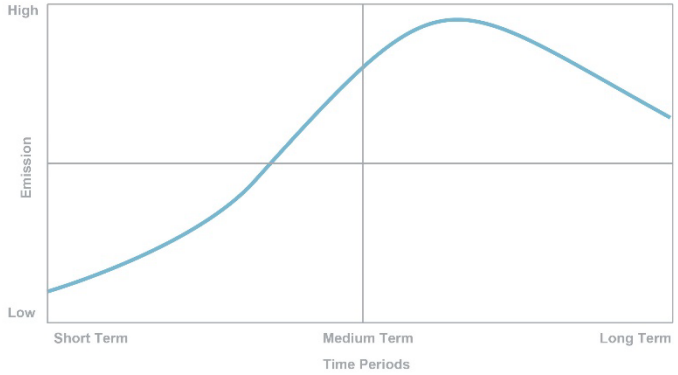
The network is now electrified through a combination of OHL (overhead lines) and use of battery electric locomotives.



2.2. Slow Coach scenario

SLOW COACH - DISORDERLY
1.7˚C warming by 2050
Delayed then rushed transition

LONG TERM
2050



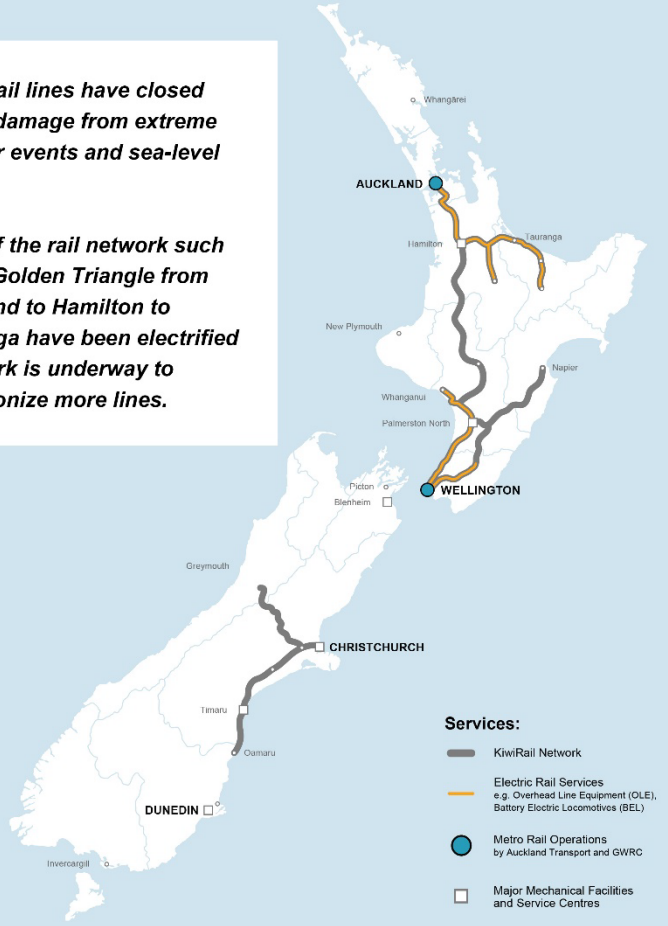
Minimal efforts are made to decarbonise before 2030. An abrupt rise in public concern about climate change in the early 2030s is followed by rapid and extreme national and international efforts to decarbonise. Following disruption, the world nears net zero by 2050.

KiwiRail benefits from the dramatic rise in demand for low carbon products in the early 2030s. However, new decarbonisation policies, such as bans on coal exports and high carbon tariffs on international flights, disrupt KiwiRail's business and cause social unrest.

KiwiRail struggles in the 2030s to meet public demand to expand the rail network rapidly, creating a risk of rushed and poorly coordinated investment decisions. Moderate physical climate impacts cause some network damage. Lack of demand for low carbon products in the 2020s and worsening weather in the 2030s and 40s potentially lead to some line and site closures, as assets become uneconomic to repair.

Some rail lines have closed due to damage from extreme weather events and sea-level rise.

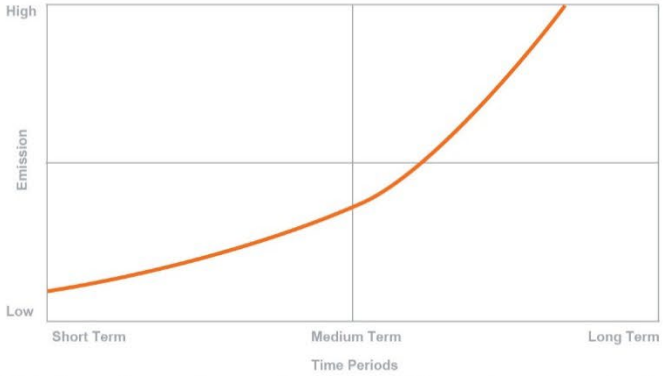
Parts of the rail network such as the Golden Triangle from Auckland to Hamilton to Tauranga have been electrified and work is underway to decarbonize more lines.



2.3. Off the Rails scenario

OFF THE RAILS - HOT HOUSE
2.1˚C warming by 2050
3.9˚C warming by 2100
Focus on resilience - minimal decarbonisation

EXTENSION
2100



Global warming reaches nearly +4°C by 2100, causing severe climate impacts domestically and overseas. There is minimal focus on decarbonisation throughout the 21st century and weather impacts worsen. Governments focus on building climate resilience and adaptation.

In the 2020s and 2030s, KiwiRail has an opportunity to collaborate with New Zealand Transport Agency and councils to enhance the resilience of rail assets to flooding, sea level rise and other risks. This increases rail reliability in the 2030s. The population also grows rapidly due to climate migration, increasing freight volumes. However, there is low demand for low carbon transport products such as rail.

Moderate physical climate impacts cause some network damage in the 2020s and 2030s. This worsens from the 2040s onwards as extreme weather events, flooding, slips and sea level rise intensity. Many parts of the rail network are damaged beyond repair between 2050 and 2100.

Significant parts of the rail network have been closed due to extreme weather events and sea-level rise in the latter half of the century.

Keeping the remaining lines open requires significant ongoing investment to maintain resilience of assets.

3. Our climate risks and opportunities

We have used our scenarios to assess key risks and opportunities that may arise for KiwiRail due to climate change over different scenarios and time periods.

Table 3.1. Climate risks and opportunities for KiwiRail across scenarios and time periods

Key physical climate risks *	Scenarios	Consequences for KiwiRail
Risk to KiwiRail assets (such as our rolling stock, rail track, yards, container sites, structures, ferries and terminals) - From climate impacts including flooding, landslides, extreme wind and weather events, coastal inundation, coastal erosion, hot days and wildfires.	Most prominent in Disorderly and Hot-house scenarios. Risk increases in later time periods – 2040 to 2050, and 2050 to 2100	Damage to assets leads to declining service reliability (freight, passenger and tourism services), loss of customers and revenue, increased cost of building and renewing assets to higher resilience standards, unplanned repairs to assets, potential line or site closures, potential need to relocate sites or realign segments of rail track and reputational damage.
Secondary physical risk - Rail assets do not support reliable services - Inability of KiwiRail to adequately invest in, and maintain, rail network assets to deliver reliability and quality of services expected by customers. Note - Compounding drivers include historical under-investment, backlog of renewals, increasing rates of climate damage.	Risk prominent across all scenarios, and all time periods. Risk worsens in hot-house scenario, particularly from 2050 to 2100	Declining service reliability (freight, passenger and tourism services), loss of customers and revenue, missed opportunities to attract further investment into rail, reputational damage, unplanned repairs to assets, potential line or site closures.
Risk to people (including our staff, customers and the public) – From climate impacts, such as extreme wind/weather, flooding, landslides, wildfires, hot days. **Our physical climate risks are discussed in more depth in our Climate Adaptation Plan (available on our website).*	Most prominent in Disorderly and Hot-house scenarios. Risk increases in later time periods – 2040 to 2050, and 2050 to 2100	People harmed during acute events on land or at sea, staff exposed to chronic risks at work (e.g., heat stroke), potential regulatory action or litigation, reputational damage - loss of trust in safety of our services, customers choose other transport options.
Key transitional climate risks	**Scenarios**	**Consequences for KiwiRail**
Commodity change - Risk that volumes of freight carried by rail drop significantly due to reduction in demand for some key emissions-exposed (carbon-intensive) commodities.	Most prominent in Orderly scenario and Disorderly scenario (from 2030s onwards). Risk most prominent in 2020s and 2030s.	Rapid drop in revenue may affect financial sustainability of KiwiRail, reducing our ability to maintain quality and reliability of services and leading to compounding losses of revenue.
Decarbonisation efforts too slow - KiwiRail cannot meet government requirements / stakeholder expectations to rapidly	Most prominent in Orderly scenario and Disorderly scenario	Reputational damage and missed opportunities to attract further investment and customers to rail, loss of insurance or

decarbonise own operations or our value chain (e.g., key products purchased or transported by rail).	(from 2030s onwards). Risk from 2020s to 2050s	access to finance (if we cannot meet insurers/lenders climate standards), litigation by environmental advocacy groups.
Low carbon technologies for road freight (e.g., battery electric vehicles) develop and are adopted rapidly, creating a risk that customers no longer perceive rail as a low-carbon transport mode.	Most prominent in Orderly scenario and Disorderly scenario (from 2030s onwards). Risk from 2020s to 2040s	Reduced customer demand for rail freight, loss of revenue.
Drop in international tourism - Risk of decreased demand from international visitors for scenic rail or Interislander passenger services, due to growing awareness of the carbon impact of international flights/carbon tariffs on aviation	Most prominent in Orderly scenario and Disorderly scenario (from 2030s onwards). Risk from 2020s to 2040s	Drop in revenue from international travellers using our services.
Failure to grow rapidly - Inability of KiwiRail to rapidly improve/expand freight services and metropolitan rail networks, due to challenges attracting skilled staff and operational constraints. Only occurs in scenarios where there is a desire to rapidly expand the rail network / services.	Most prominent in Orderly scenario and Disorderly scenario (from 2030s onwards). Risk most prominent in 2020s and 2030s.	Inability to meet customer, local government and stakeholder expectations for rapid expansion of rail network/services leads to reputational damage, missed opportunities to attract further investment into rail, risk of poorly planned and executed infrastructure projects.
Key opportunities	**Scenarios**	**Consequences for KiwiRail**
Demand for low carbon solutions - Opportunity to increase volumes of freight carried and provision of passenger rail services, expand metropolitan rail infrastructure, due to increased customer demand for low carbon transport and higher carbon prices.	Most prominent in Orderly scenario and Disorderly scenario (from 2030s onwards).	Increased revenue for KiwiRail, enhanced reputation, potential for additional investment into rail infrastructure and rolling stock.
New low-carbon rail technology - Opportunity to transition from diesel to electric locomotives (either through electrifying rail network or running battery electric locomotives). This reduces operational costs and makes rail more appealing to customers. Advances in battery technology create an opportunity for KiwiRail to decarbonise rail system at lower cost than overhead line electrification.	Most prominent in Orderly scenario and Disorderly scenario (from 2030s onwards).	Increased revenue for KiwiRail, enhanced reputation, rail maintains competitive low carbon advantage, potential for additional investment into rail infrastructure and rolling stock.
New low-carbon fuels or technology for ferries - Opportunity to decarbonise to low or zero carbon ferries which reduces operational costs and makes service more appealing to customers*. (*subject to availability of technology / fuels)	Most prominent in Orderly scenario and Disorderly scenario (from 2030s onwards).	Increased revenue for KiwiRail, enhanced reputation, Interislander gains a competitive low carbon advantage.

4. Our response to key climate risks and opportunities

Overall, our climate scenarios present a range of risks and opportunities for KiwiRail. The opportunities for KiwiRail, as a low carbon transport provider are more obvious in the '**On-Track** (orderly)' and **Slow Coach** (Disorderly) scenario, ranging from increased demand for low-carbon freight services to potential use of new technologies such as battery-electric locomotives to electrify our network more rapidly.

Our Rautaki Whakauka: Sustainability Strategy 2025-2028, which is published on our website, outlines some of the steps we will take to capitalise on these climate opportunities and grow our freight and tourism business over the next three years, supporting decarbonisation of New Zealand's economy. Our plans for how we will decarbonise our organisation and capitalise on the climate opportunities that arise from new technologies, such as battery electric locomotives, are outlined in our Carbon Reduction Plan (available on our website).

The **On-Track** and **Slow Coach scenarios** also present some risks to KiwiRail. For example, some key commodities that KiwiRail carries are exposed to transitional climate risk (i.e., potential changes in climate policy or consumer demand). A large proportion of our freight business also comes from a relatively small number of key commodities (dairy, meat, timber and coal). We will continue to actively search for new customers and opportunities to carry a more diverse range of commodities, including in the domestic freight market, while continuing to provide superior customer service for our current customers. We will pursue opportunities for KiwiRail to carry materials that support the transition to a low carbon economy, such as biomass, scrap metal and waste materials for recycling.

Another potential risk that arises from our scenarios is that in a rapidly decarbonising world there may be a drop in international tourism due to carbon tariffs on aviation. Since roughly half of our passengers are international tourists, this could affect our business. To mitigate this risk, KiwiRail will continue to focus on delivering quality tourism experiences that appeal to both domestic and international tourists. We will ensure that our package tours benefit regional communities, using local tourism operators and visiting local businesses.

In the **Hot-House scenario**, due to a government and business wide focus on climate adaptation, KiwiRail continues to enhance the resilience of our rail network to climate impacts such as flooding and sea-level rise in the earlier decades. Over the longer-term, however, our physical and transitional climate risks become most prominent in this scenario, due to the significant physical climate impacts we expect to see by 2100. While it is hard to forecast exactly what the implications may be for society of over 3°C of warming, there is a consensus that the impacts on global economic conditions will be highly negative, impacting the types and volumes of freight that KiwiRail carries.

This scenario highlights the importance of effectively managing our physical climate risks and planning for future change. Our response to our physical risks is outlined in more depth in our Climate Adaptation Plan, which is available on our website. This outlines some of the actions we will proactively take to prepare for and manage physical climate impacts such as flooding, slips and coastal inundation.