NZ Energy Scenarios TIMES-NZ 2.0 Transport Sector

9 July 2021

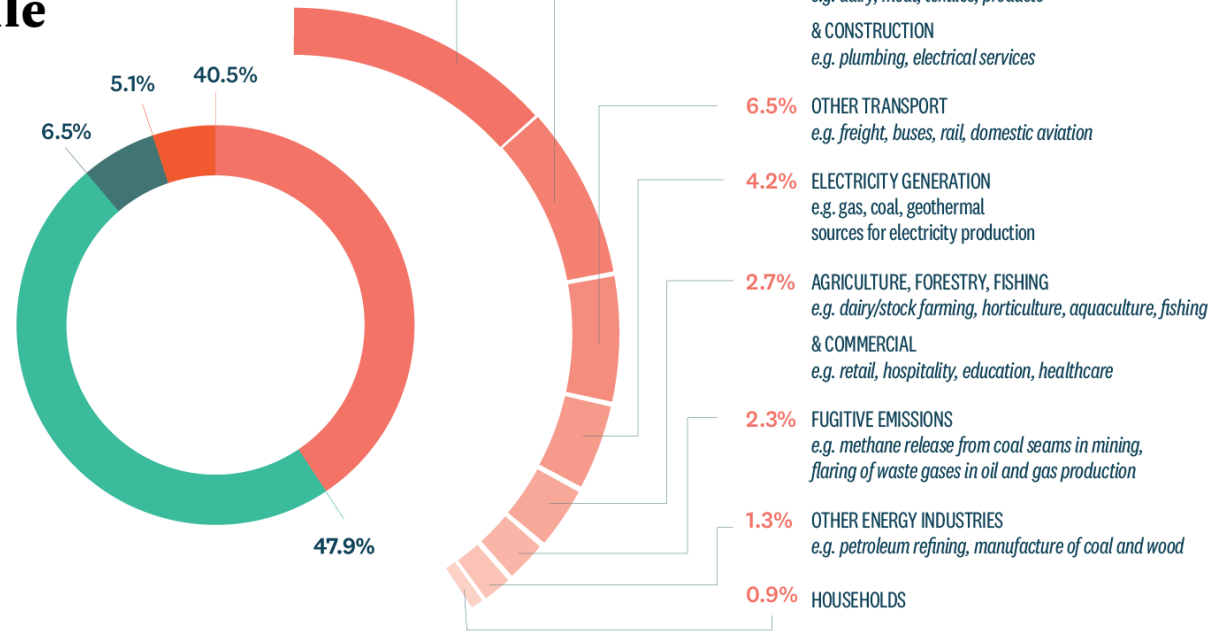
NZ Energy Scenarios TIMES-NZ 2.0

Our work at EECA included creating the data structure, data inputs, modelling, and analysis of the results.

New Zealand Energy Emissions

New Zealand's emissions and energy profile by sector

Nearly 41% of NZ's greenhouse gas emissions come from the energy sector



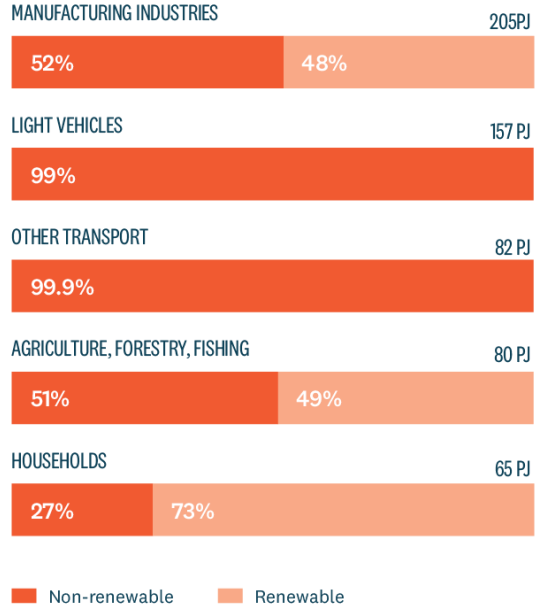
WASTE

ENERGY

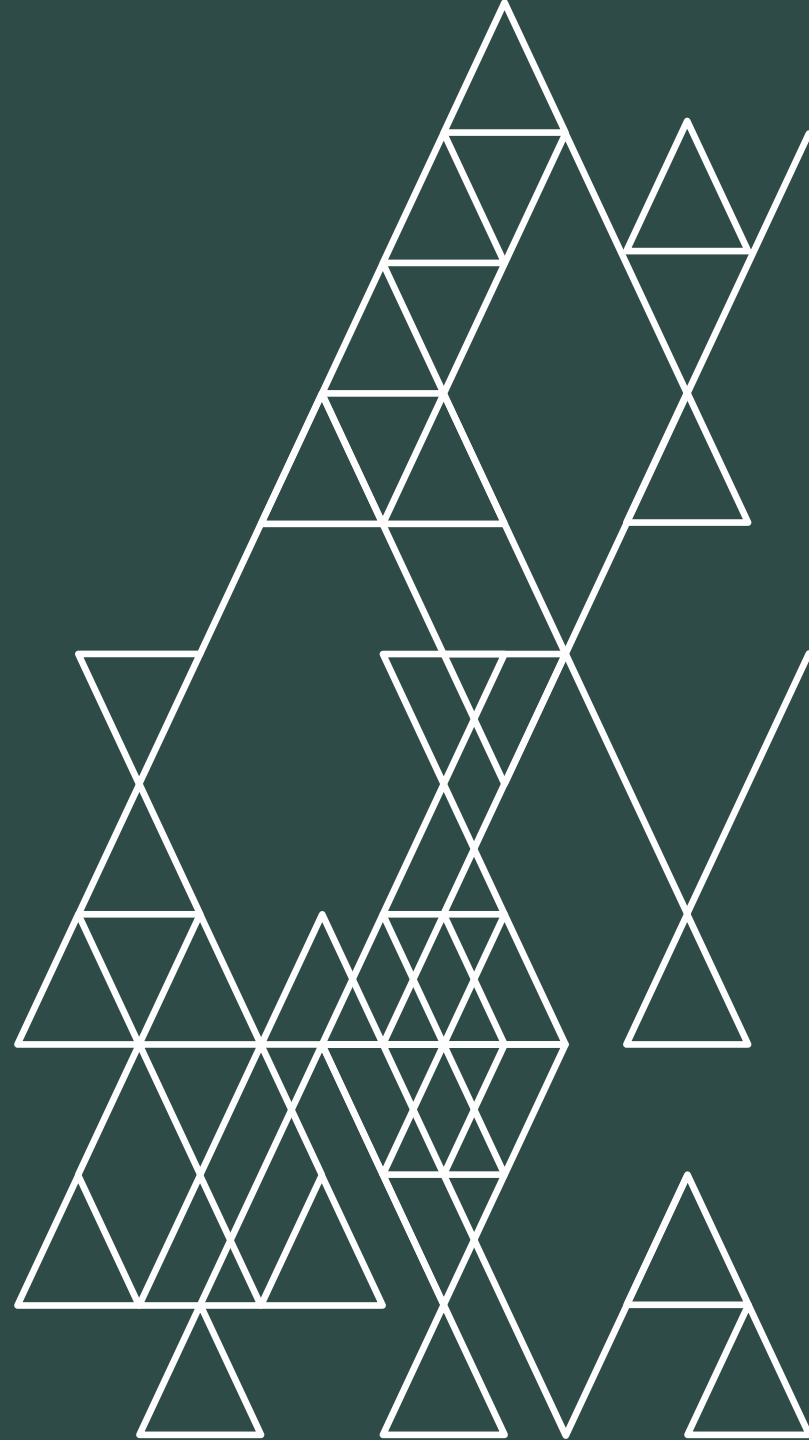
AGRICULTURE

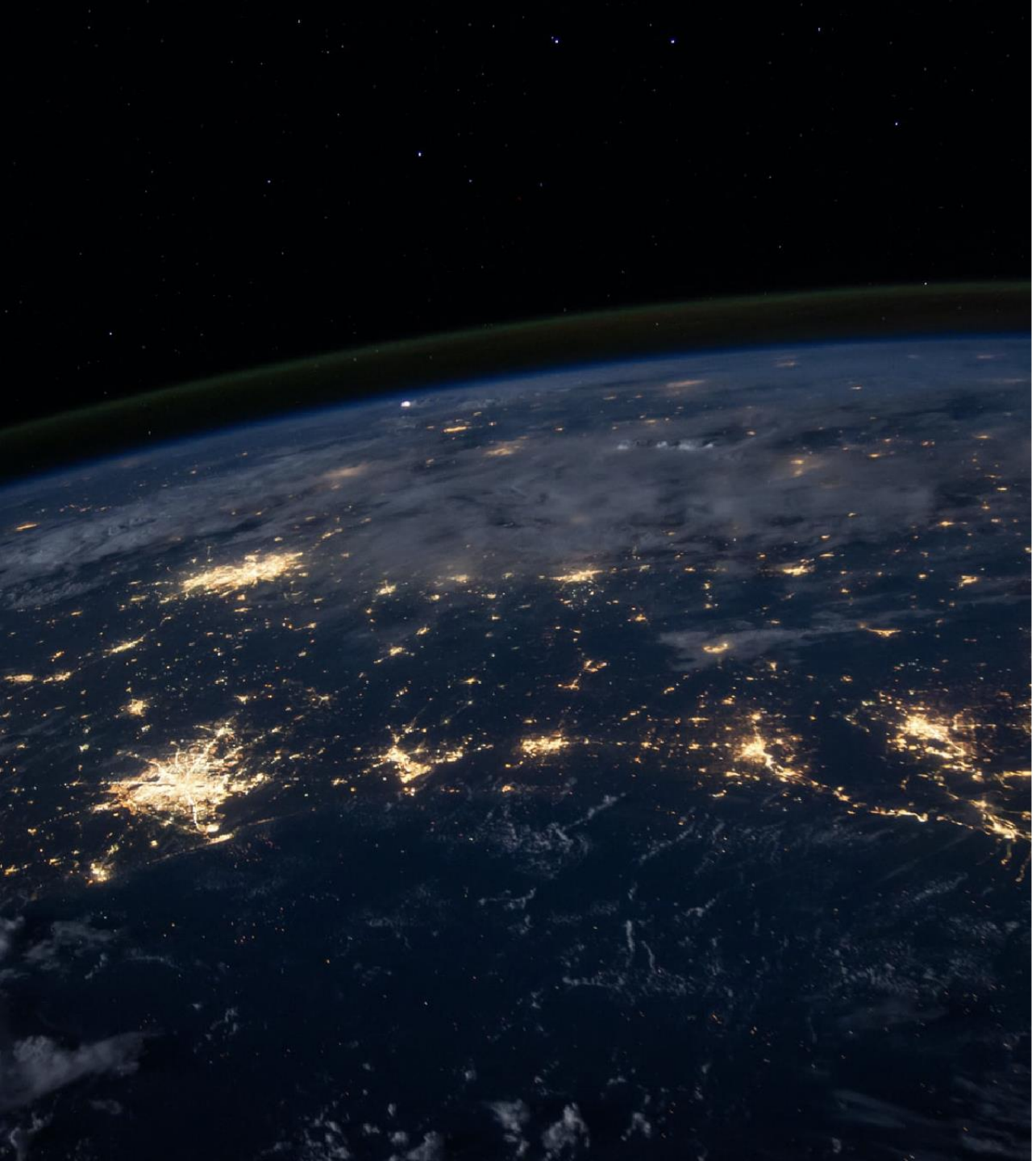
INDUSTRIAL PROCESSES

Over two thirds of the total energy used in New Zealand comes from **non-renewable** energy sources—particularly transport fuels.



TIMES-NZ Overview





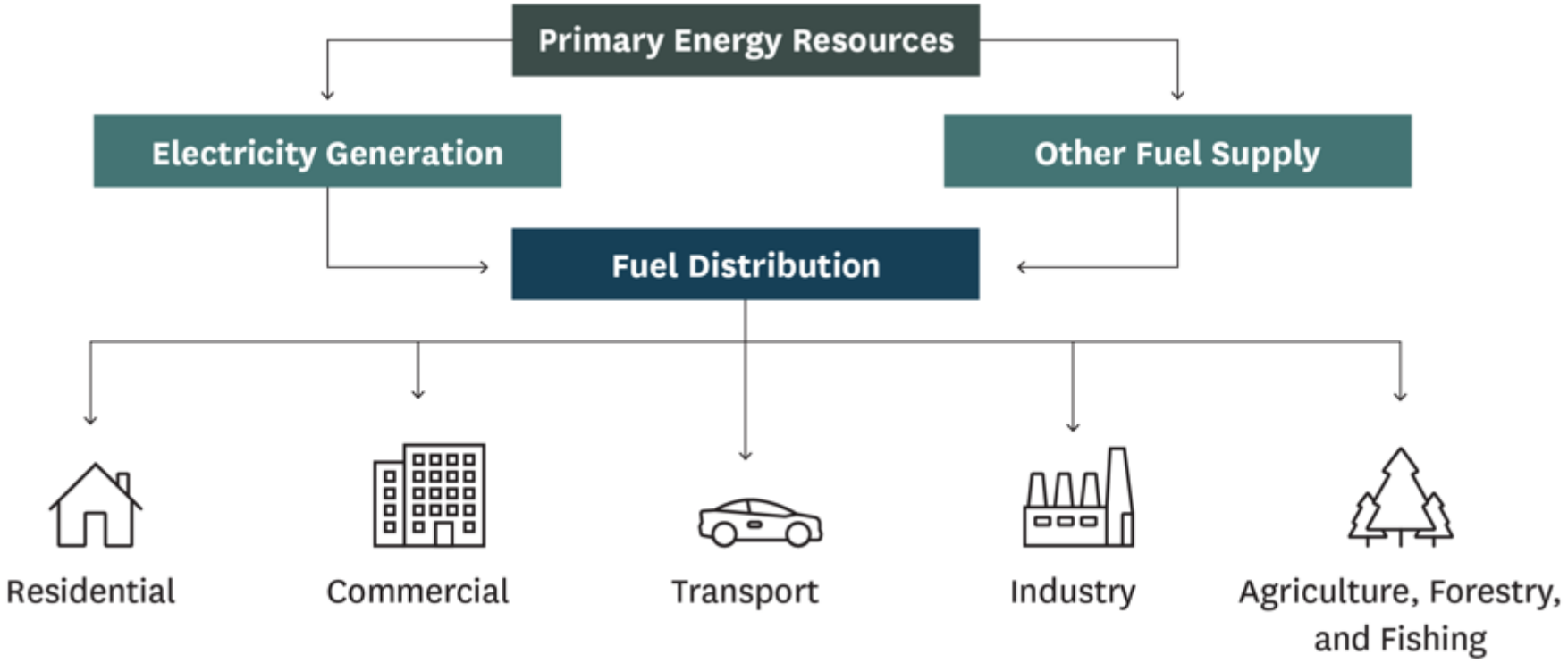
The TIMES-NZ 2.0 model

The TIMES-NZ model is based on the International Energy Agency's (IEA) Energy Technology Systems Analysis Program (ETSAP).

The ETSAP is one of the longest running Technology Collaboration Programmes (TCPs) of the IEA, and used in over 60 countries.

EECA is the New Zealand contracting party for IEA ETSAP.

TIMES-NZ 2.0 Model Structure



TIMES-NZ 2.0 Model Structure

Residential

Detached Dwellings
Joined Dwellings

Commercial

Education
Healthcare
Office blocks
Warehouses Supermarkets and Retail (WSR)
Other

Transport

Light road
Heavy road
Aviation
Shipping
Rail

Industry

Aluminium
Construction
Dairy Product Manufacturing
Food Processing
Iron/Steel Manufacturing
Meat Processing
Metal Product Manufacturing
Methanol Production
Mineral Production
Mining
Petroleum/Chemicals
Refining of petroleum products
Urea Production
Wood Product Manufacturing
Wood Pulp and Paper Processing

Agriculture, Forestry, and Fishing

Dairy Farming
Livestock Farming
Outdoor Horticulture & Arable Farming
Indoor Cropping
Forestry
Fishing

EECA's Energy End Use Database (EEUD) provides a greatly improved input dataset for describing demand sectors.

NZ Energy Scenarios TIMES-NZ 2.0

Kea

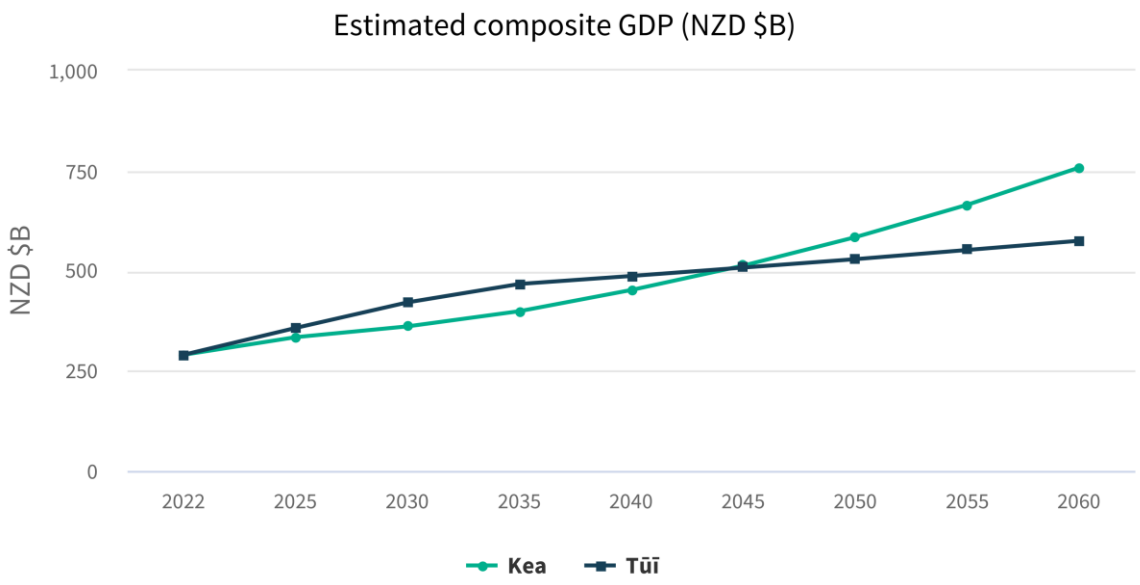
Kea represents a scenario where climate change is prioritised as the most pressing issue and New Zealand deliberately pursues cohesive ways to achieve a low-emissions economy.

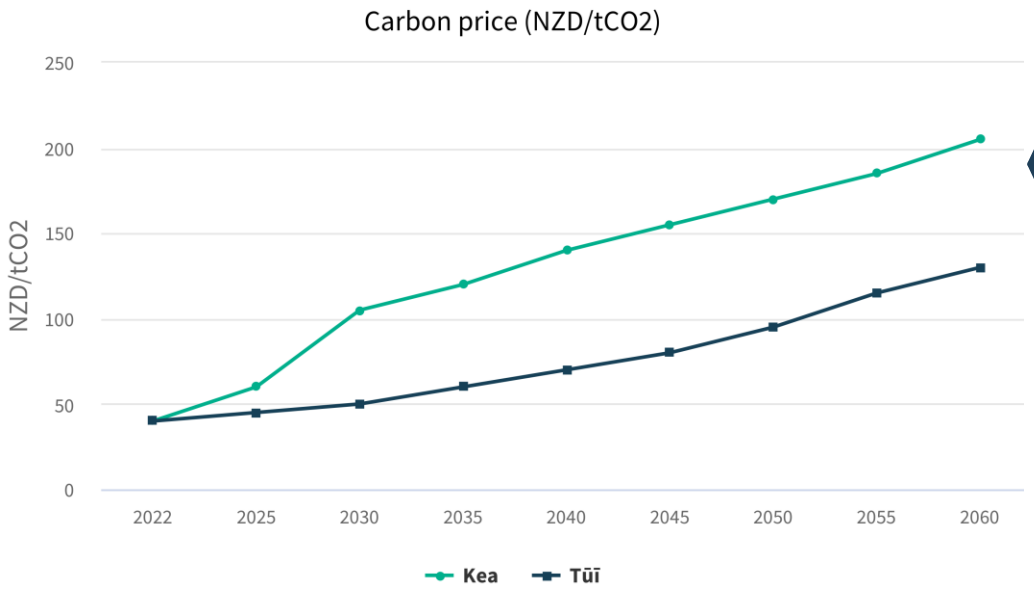
Tūī

Tūī represents a scenario where climate change is an important issue to be addressed as one of many priorities, with most decisions being left up to individuals and market mechanisms.

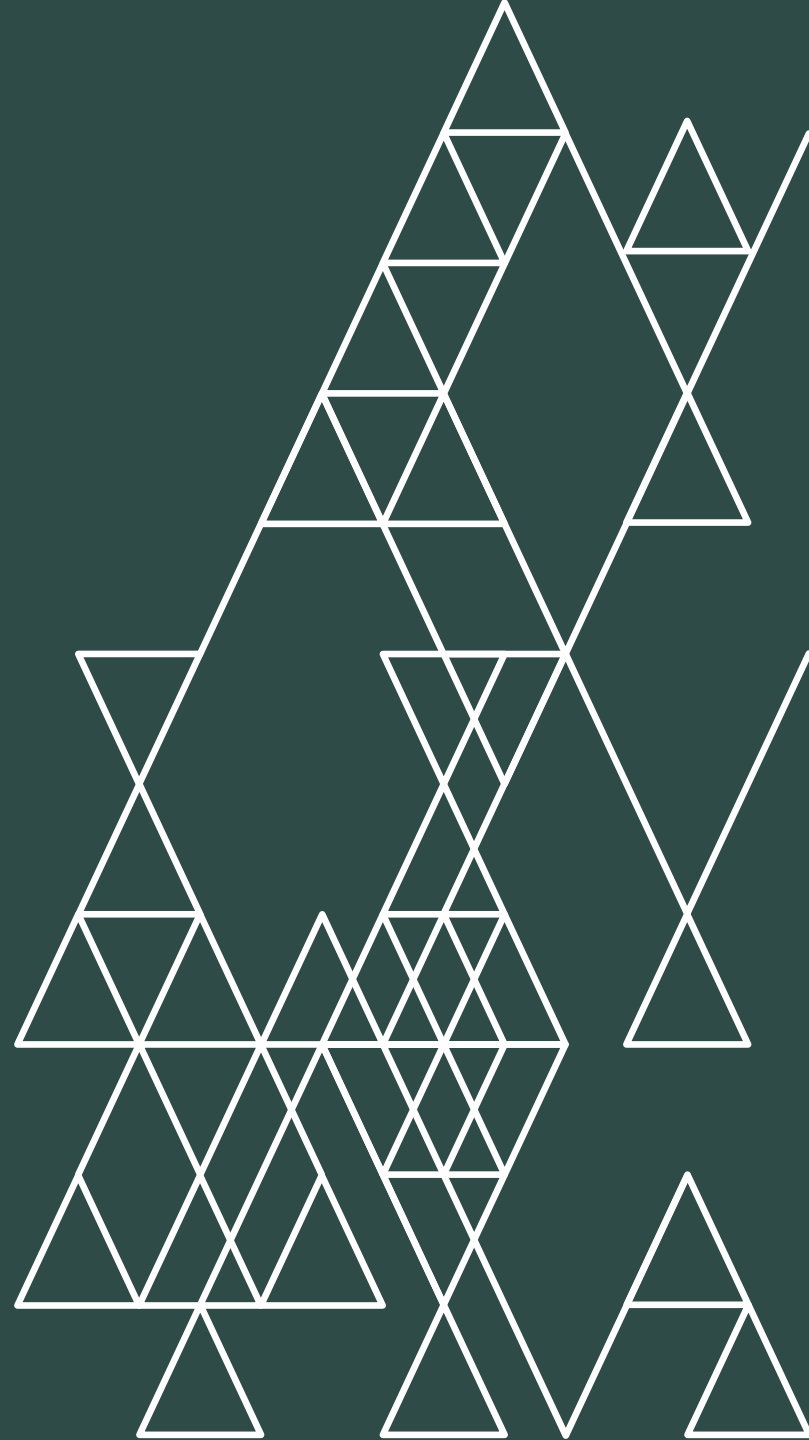
Scenario Parameters

The key model input differences between Kea and Tūī are:





Transport Sector Definitions



Transport

Vehicle Definitions

- **BEV**
  Battery Electric Vehicle e.g. Nissan Leaf

- **PHEV**
  Plug in Hybrid Vehicle e.g. Mitsubishi Outlander

- **Hybrid/HEV**
  Hybrid without plug in capability e.g. Toyota Prius

- **ICE**
  Internal Combustion Vehicle, with no electric assist e.g. Ford Ranger

- **FCEV**
  Fuel Cell Electric Vehicle, fuelled by hydrogen e.g. Toyota Mirai

Transport

Class Structure

- Light private vehicles – cars/SUVs under 3.5t
- Light commercial vehicles – vans/utes under 3.5t
- Medium trucks – vehicles between 3.5t – 10t
- Heavy trucks – vehicles over 10t

- Rail – Passenger and Freight

- Shipping and Aviation - Both International and Domestic are considered, to properly account for oil production and supply, however, only Domestic emissions are counted.

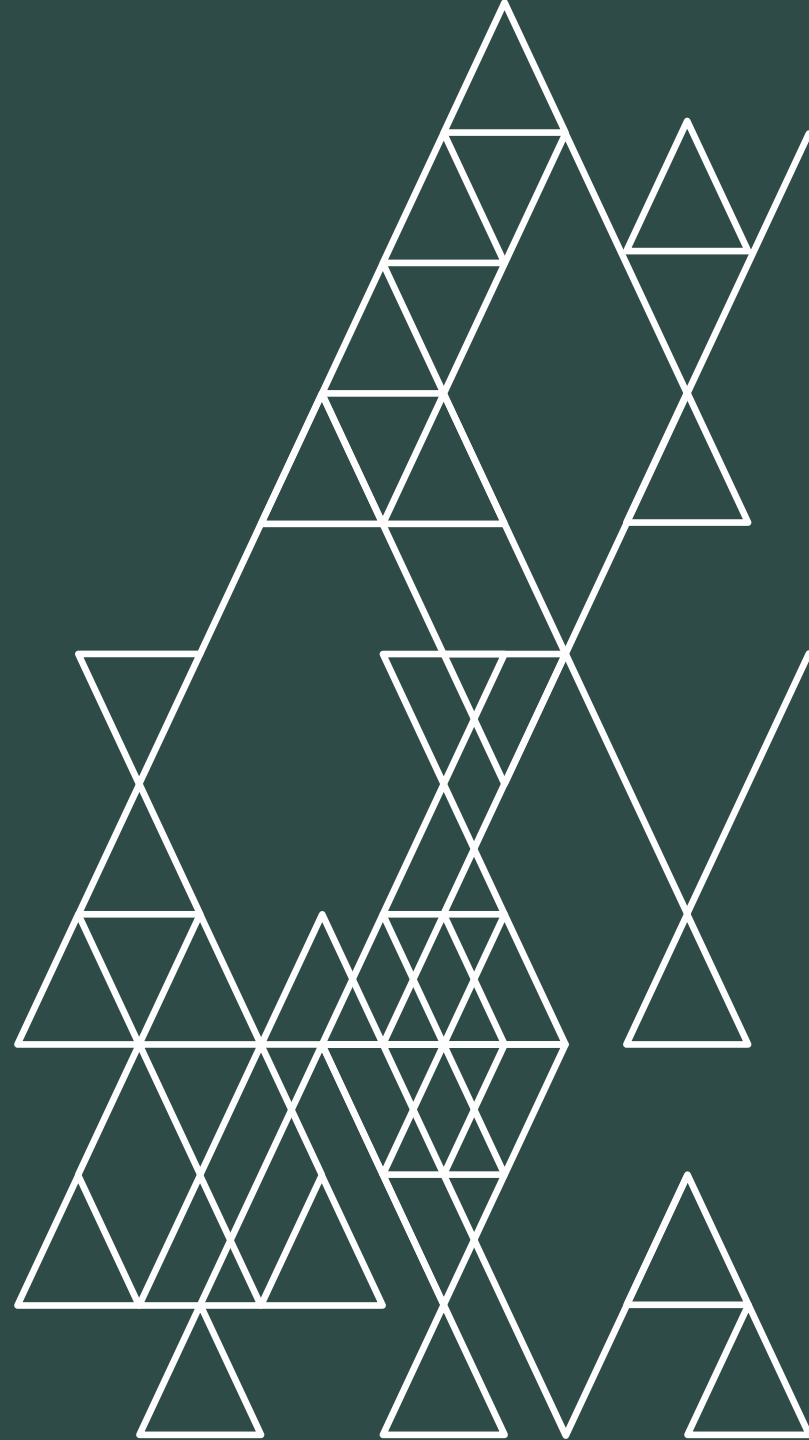
Transport

Supply and Demand of Vehicles

- Demand presented in kilometers travelled, by class
- Vehicles have a maximum annual distance travelled per year
- The model must provide enough vehicles of any fuel type to satisfy this demand

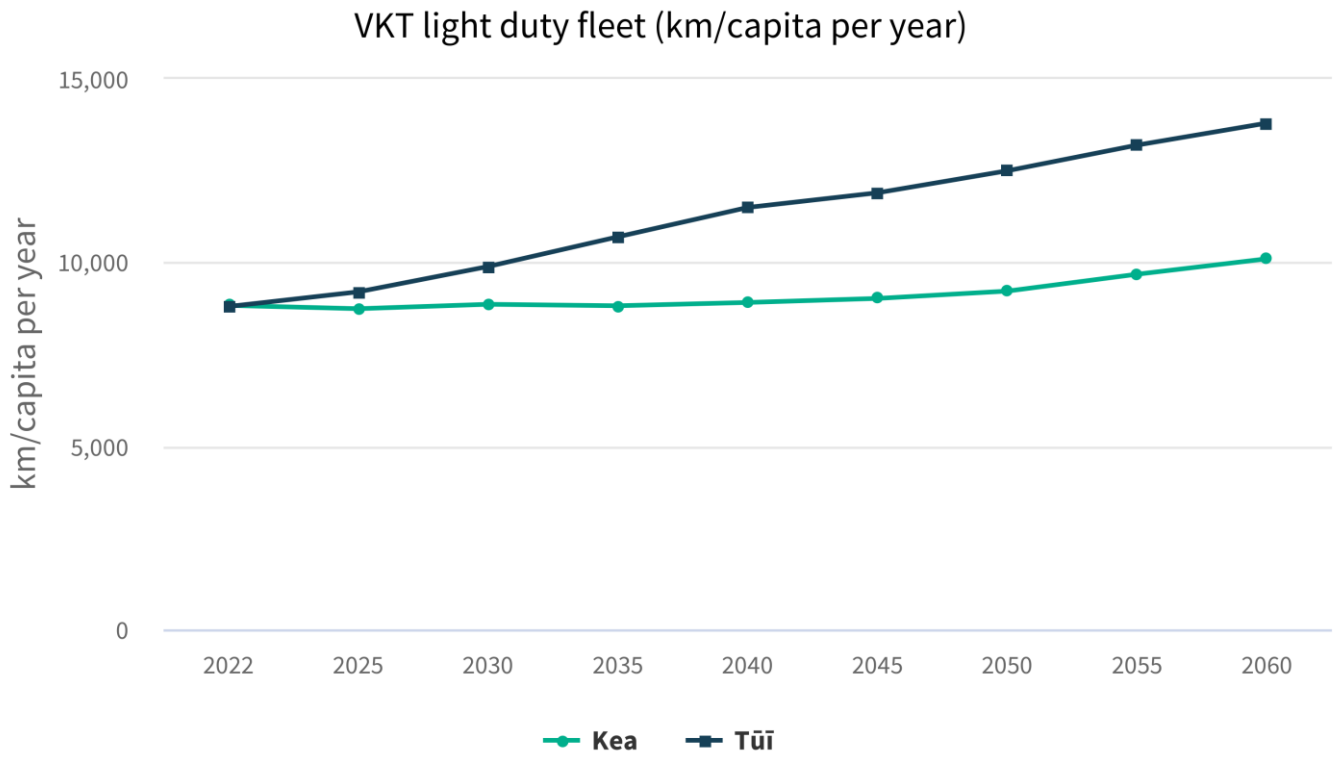
- All vehicles are imported new – used sales and imports are not modelled
- Vehicles have a maximum lifespan, in years, after which they must be scrapped
- This scrappage can occur earlier if determined to be economic

Transport Specific Assumptions

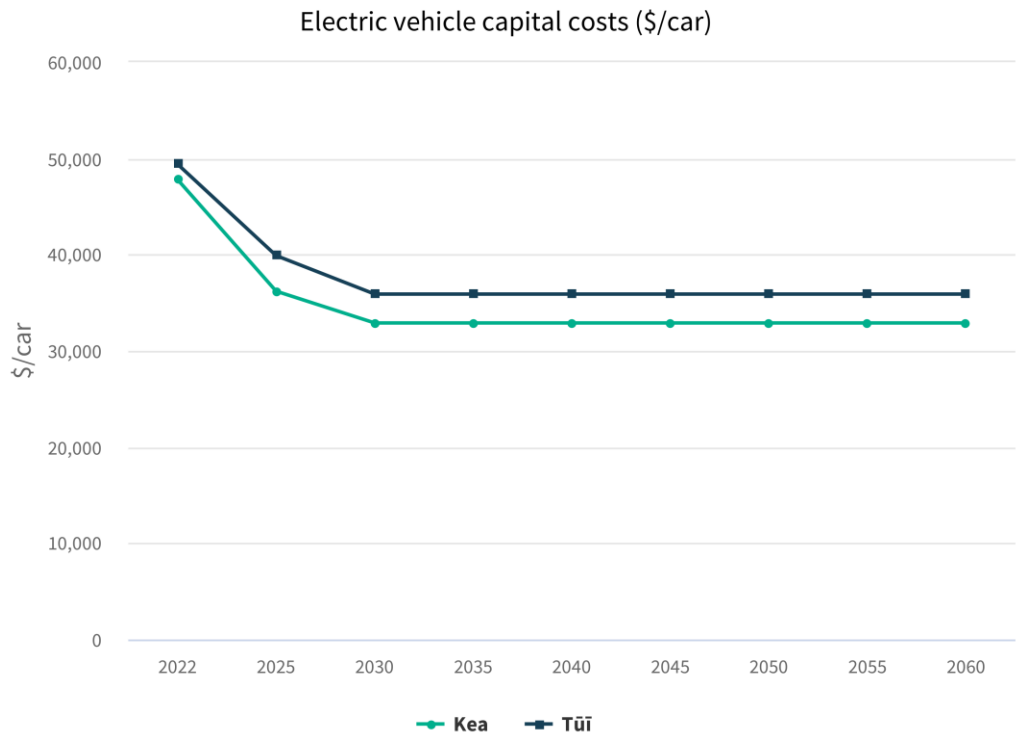


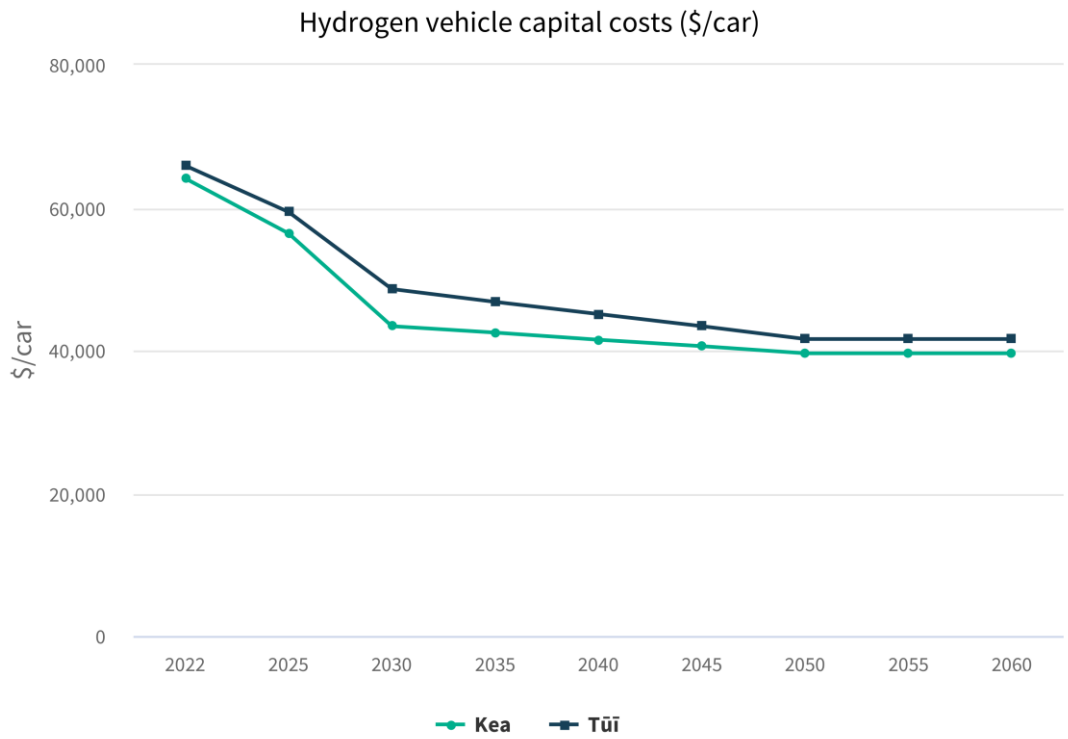
Vehicle Kilometers Travelled

- **Both Kea and Tui use Ministry of Transport Vehicle Fuel Emissions Model Scenarios as inputs**
  - **Kea – Staying Close to the Action**
  - **Tui – Golden Triangle**

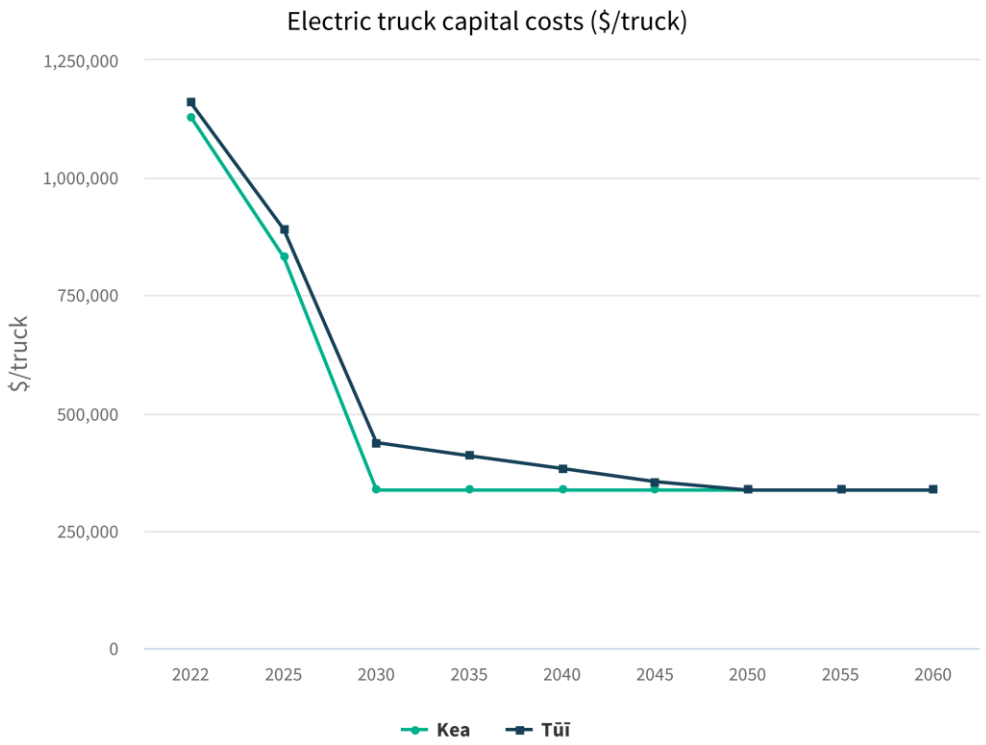


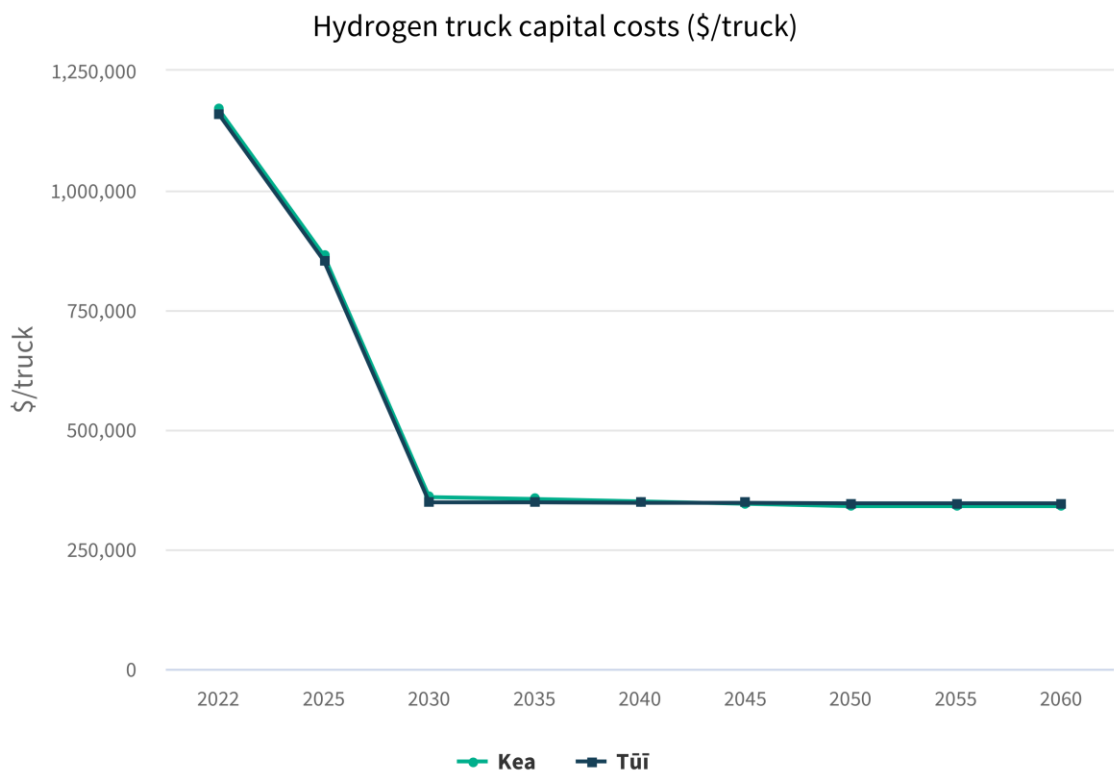
Private Vehicle Costs





Truck Costs


Electric truck capital costs ($/truck)
1,250,000
1,000,000
750,000
500,000
250,000
0
$/truck
2022
2025
2030
2035
2040
2045
2050
2055
2060
Kea
Tūī


Hydrogen truck capital costs ($/truck)
1,250,000
1,000,000
750,000
500,000
250,000
0
$/truck
2022
2025
2030
2035
2040
2045
2050
2055
2060
Kea
Tūī

EV Charging

- Demand over each time slice (i.e. weekday day, weekday night, weekday peak) is represented by load curves
- Uncontrolled EV charging is likely to significantly increase peak demand

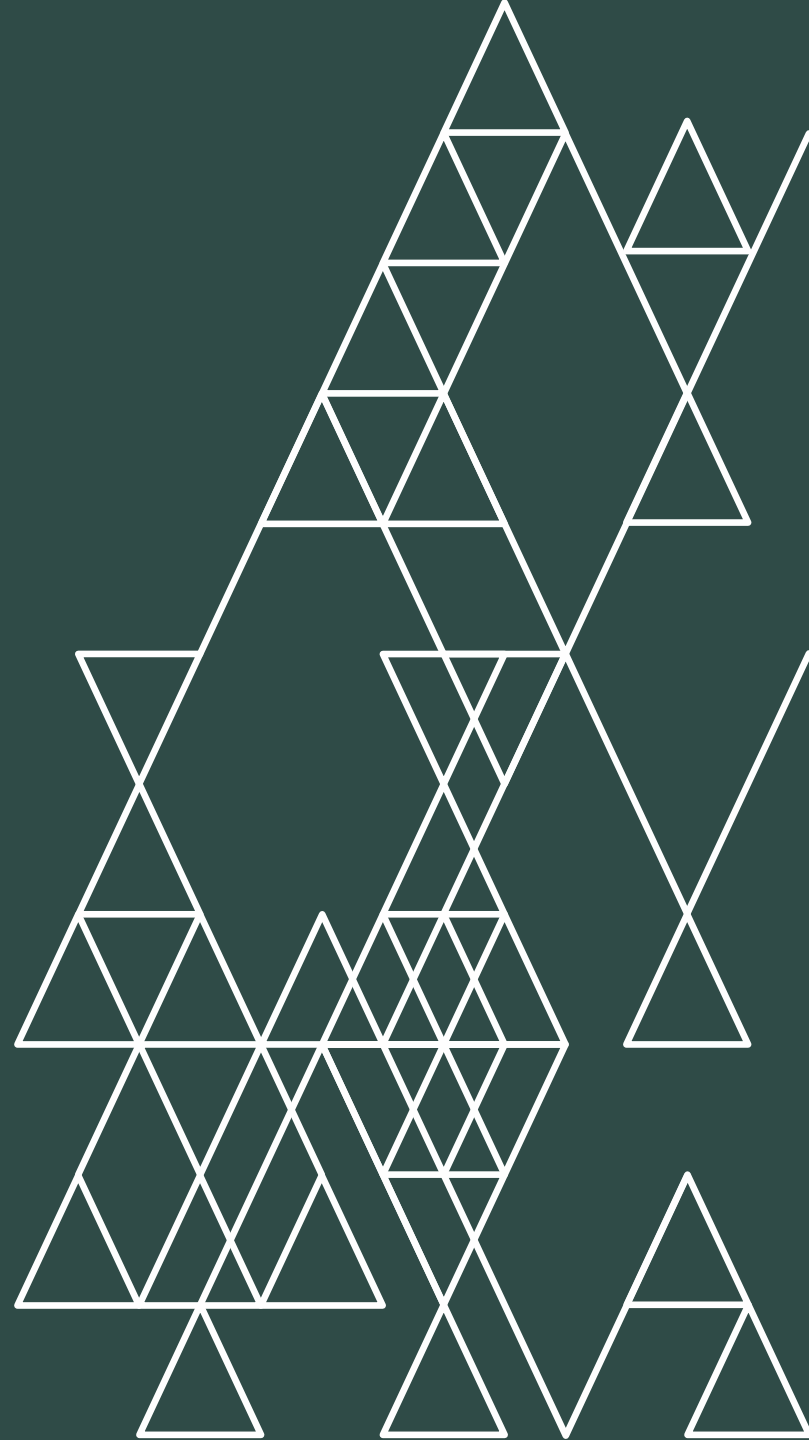
- Tui assumes charging profiles will remain the same as historic, which is primarily night charging
- Kea assumes an uptake in smart charging, by assuming a flat demand profile.

Private Vehicles
EV Supply Constraints

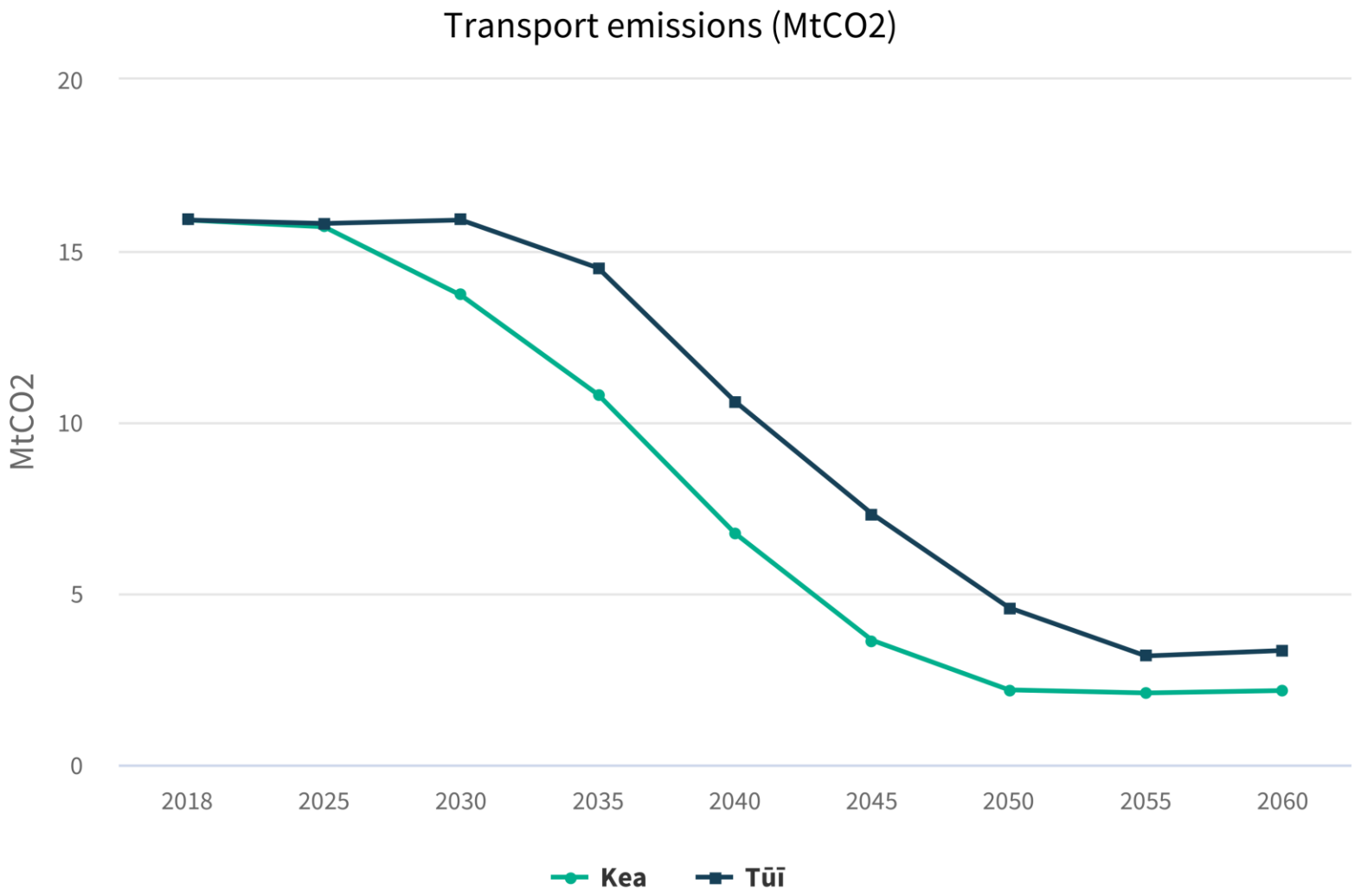
- Supply constraints implemented to represent NZ's spot in the global EV market
- Kea assumes greater access to EV market
- Light commercial vehicles follow the same curve, but both scenarios are delayed another 5 years

Year	Tūī	Kea
2025	3%	11%
2030	11%	42%
2035	42%	100%
2040	100%	100%

Transport Sector Overview



Transport Emissions



Transport Fuels

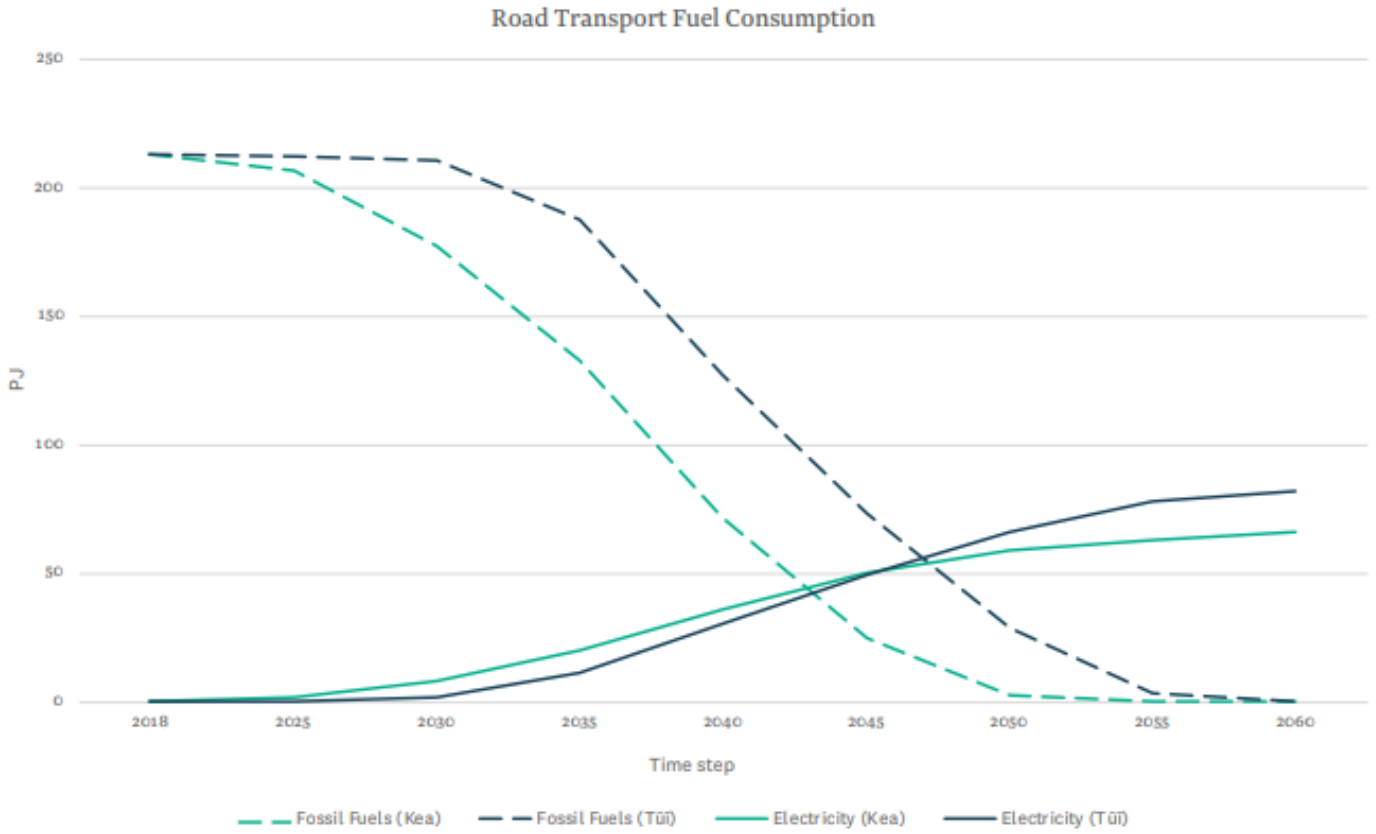


Figure 7: Road transport consumption of fossil fuels and electricity TIMES-NZ 2.0 Kea and Tūī scenarios

Transport Subsectors

TIMES-NZ 2.0 Model Structure

Residential

Detached Dwellings
Joined Dwellings

Commercial

Education
Healthcare
Office blocks
Warehouses Supermarkets and Retail (WSR)
Other

Transport

Light road
Heavy road
Aviation
Shipping
Rail

Industry

Aluminium
Construction
Dairy Product Manufacturing
Food Processing
Iron/Steel Manufacturing
Meat Processing
Metal Product Manufacturing
Methanol Production
Mineral Production
Mining
Petroleum/Chemicals
Refining of petroleum products
Urea Production
Wood Product Manufacturing
Wood Pulp and Paper Processing

Agriculture, Forestry, and Fishing

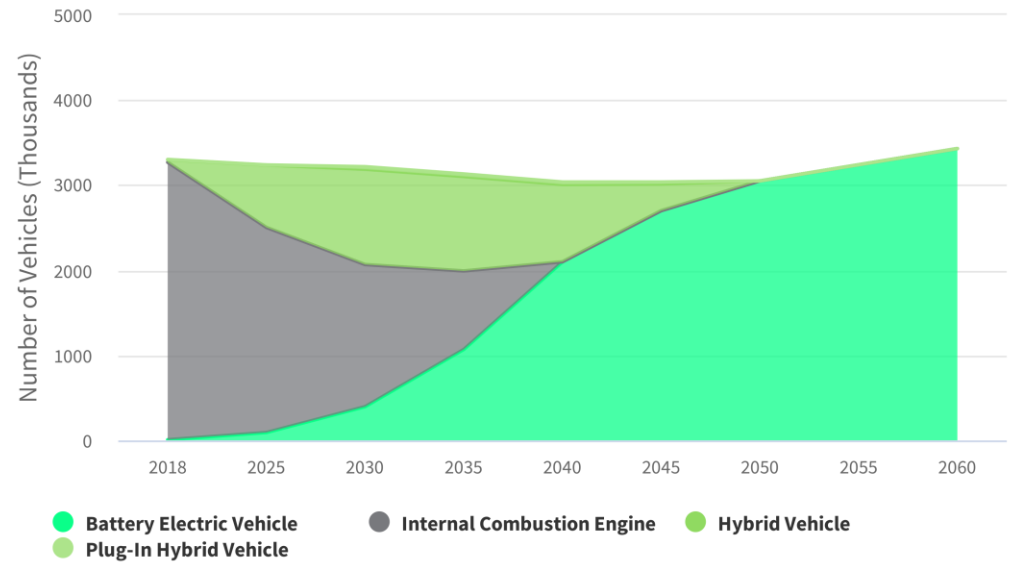
Dairy Farming
Livestock Farming
Outdoor Horticulture & Arable Farming
Indoor Cropping
Forestry
Fishing

EECA's Energy End Use Database (EEUD) provides a greatly improved input dataset for describing demand sectors.

Private Vehicles

Kea

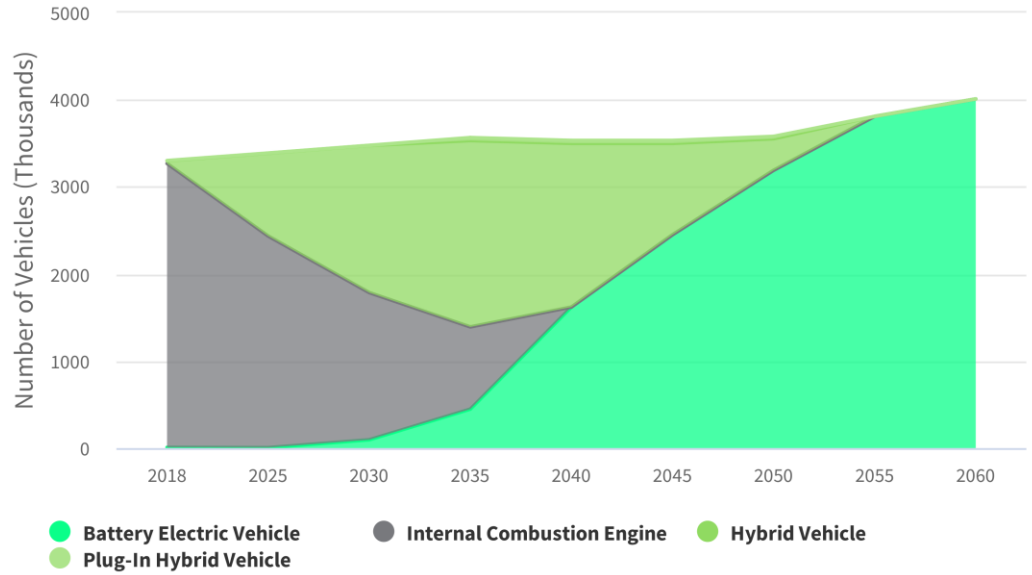
Private Vehicles – Number of Vehicles (000s)



TIMES-NZ 2.0, Scenario: Kea

Tūī

Private Vehicles – Number of Vehicles (000s)

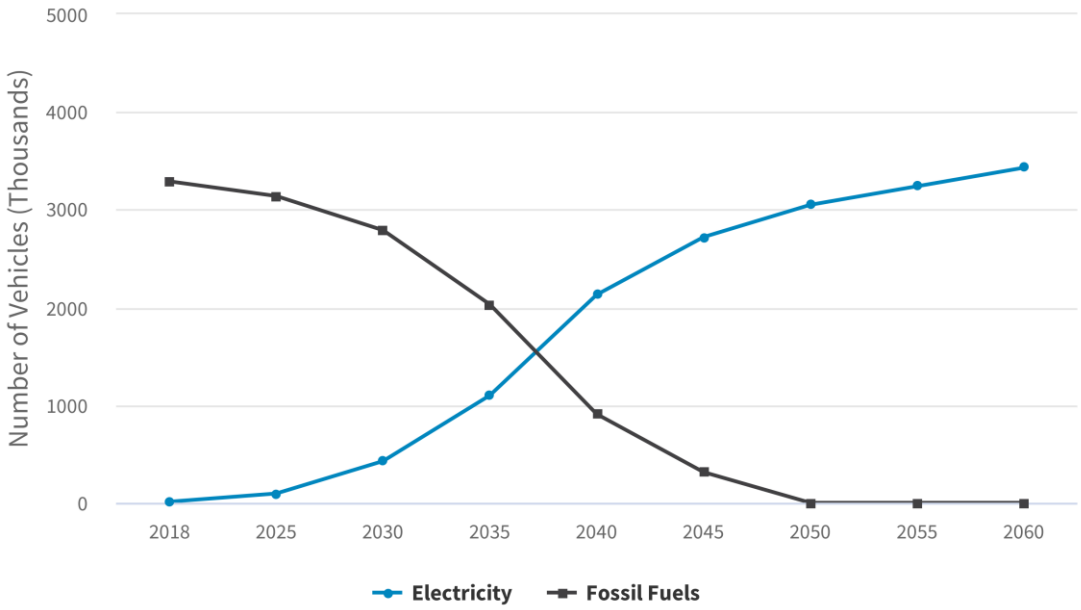


TIMES-NZ 2.0, Scenario: Tūī

Private Vehicles

Kea

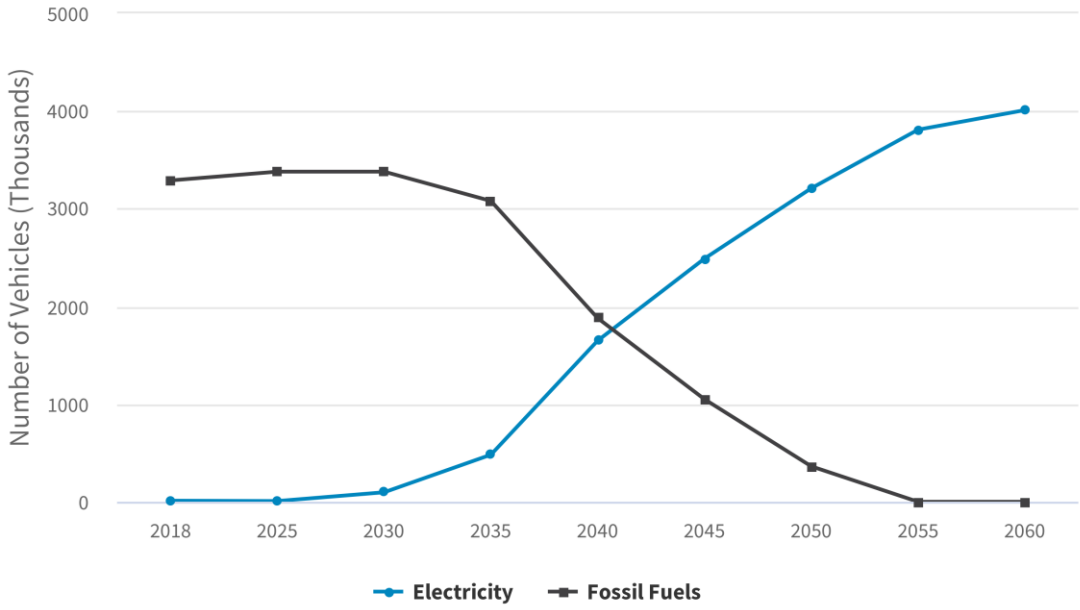
Private Vehicles – Number of Vehicles (000s)



TIMES-NZ 2.0, Scenario: Kea

Tūī

Private Vehicles – Number of Vehicles (000s)

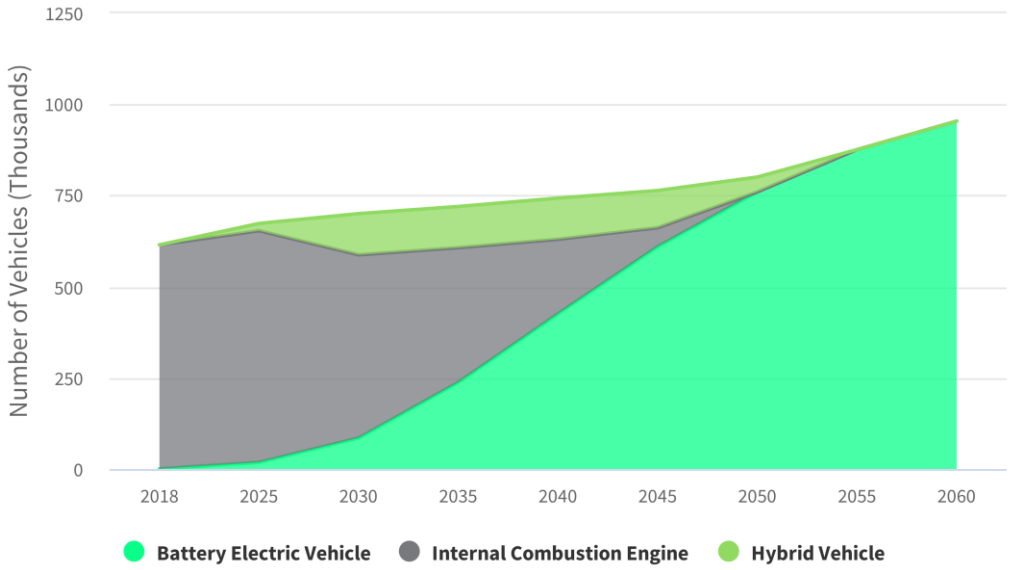


TIMES-NZ 2.0, Scenario: Tūī

Commercial Vehicles

Kea

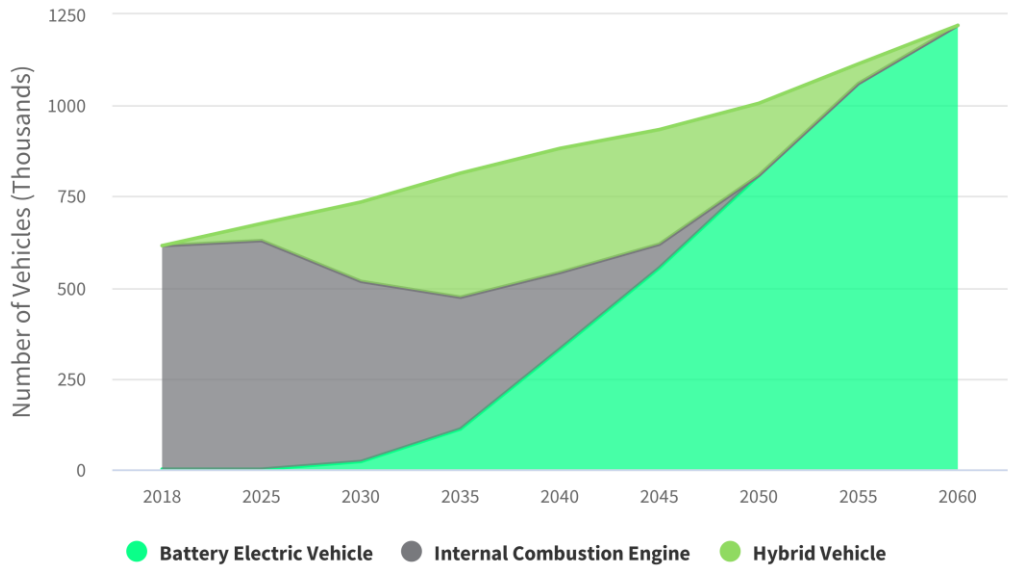
Commercial Vehicles – Number of Vehicles (000s)



TIMES-NZ 2.0, Scenario: Kea

Tūī

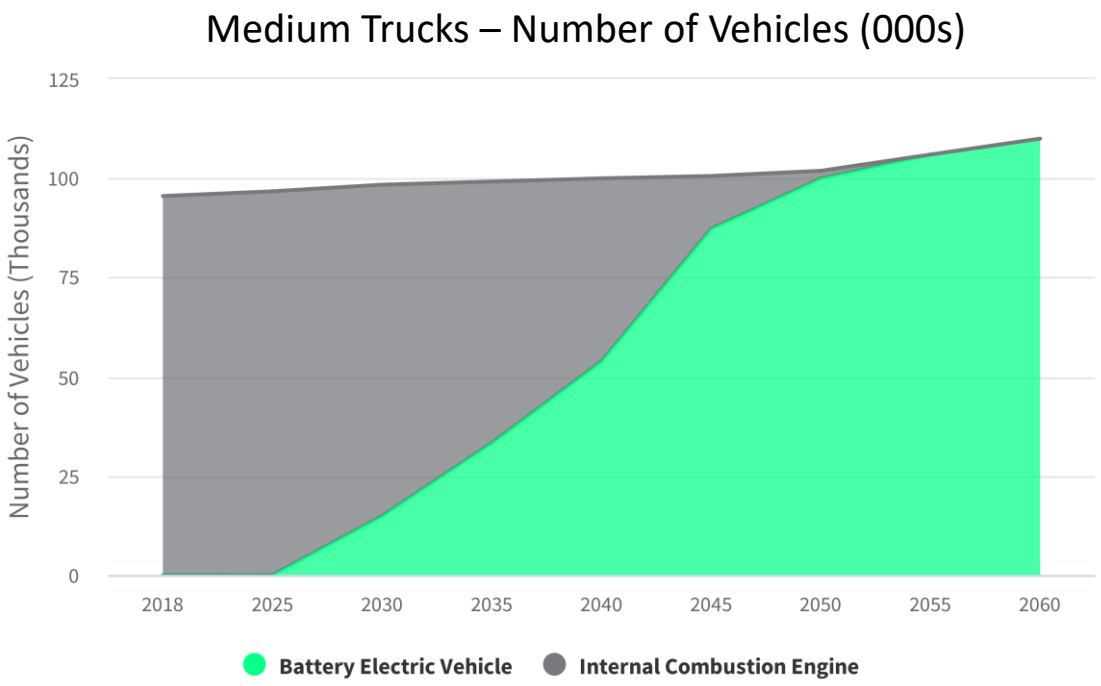
Commercial Vehicles – Number of Vehicles (000s)



TIMES-NZ 2.0, Scenario: Tūī

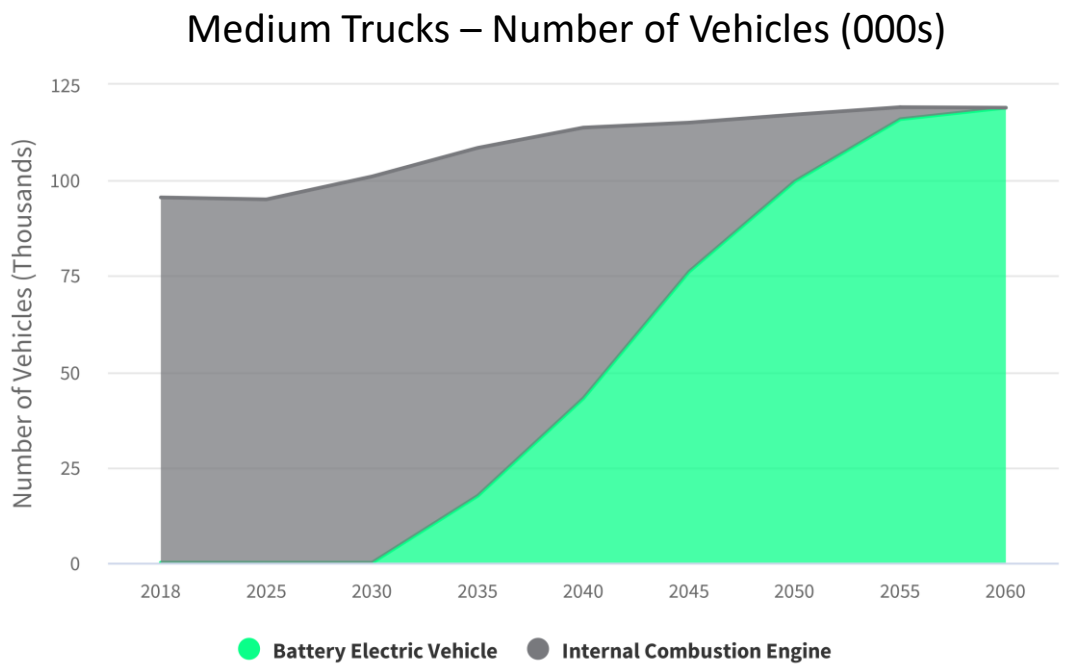
Medium Trucks

Kea



TIMES-NZ 2.0, Scenario: Kea

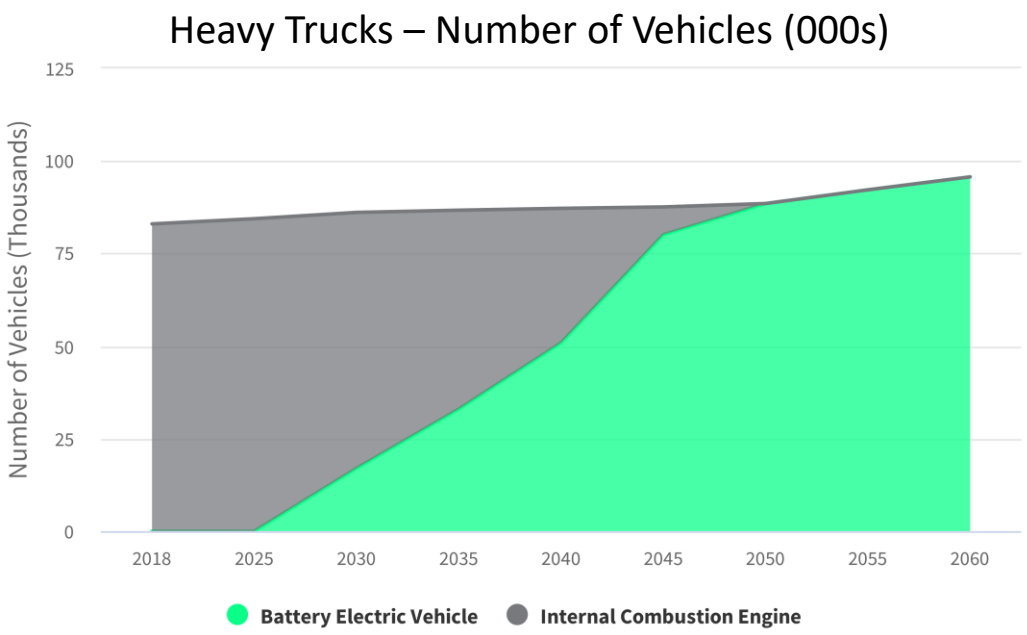
Tūī



TIMES-NZ 2.0, Scenario: Tūī

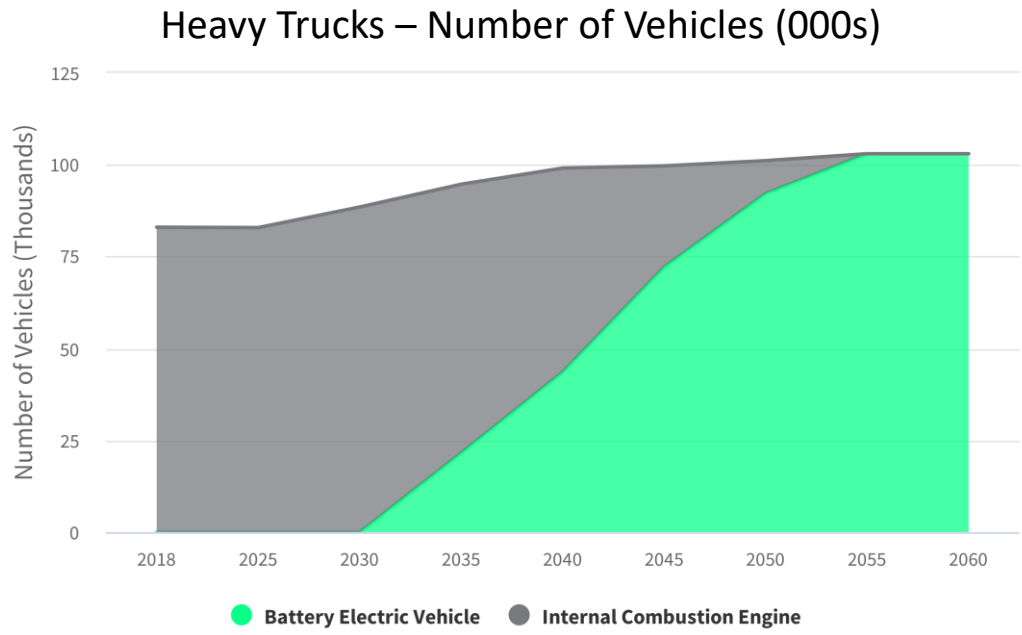
Heavy Trucks

Kea



TIMES-NZ 2.0, Scenario: Kea

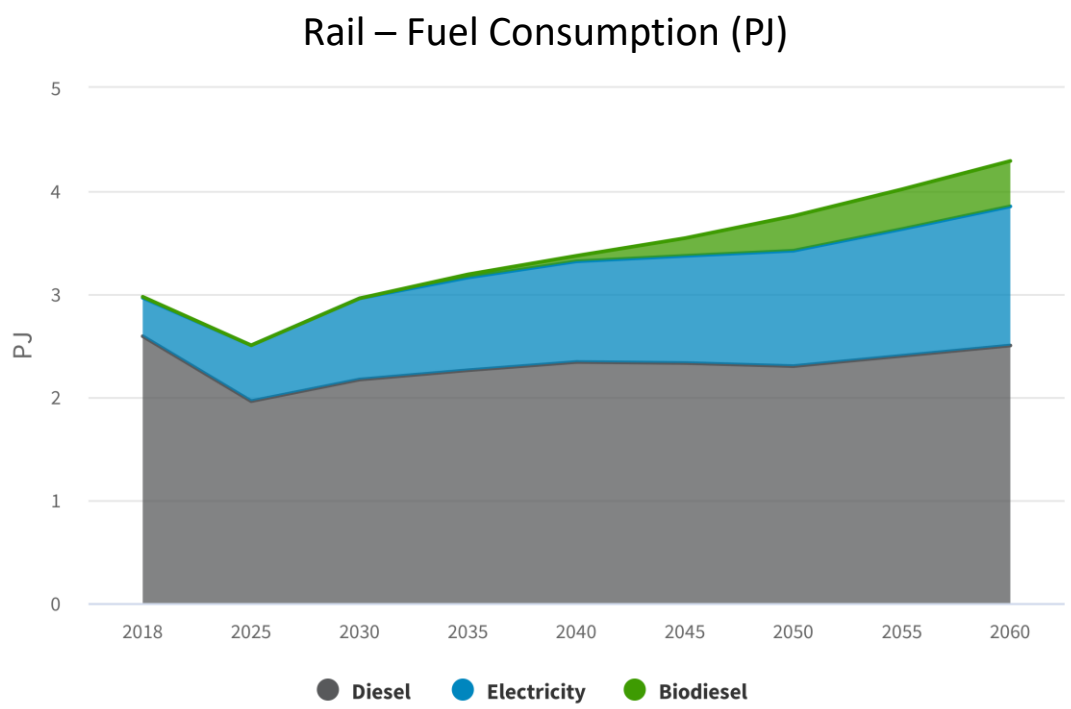
Tūī



TIMES-NZ 2.0, Scenario: Tūī

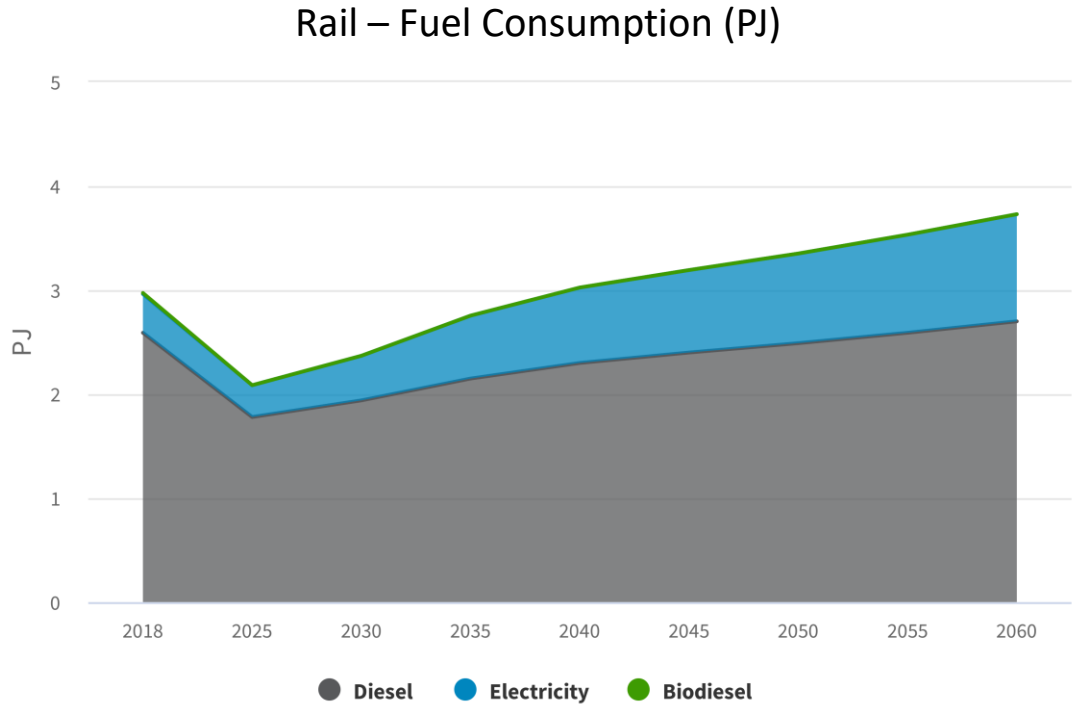
Rail

Kea



TIMES-NZ 2.0, Scenario: Kea

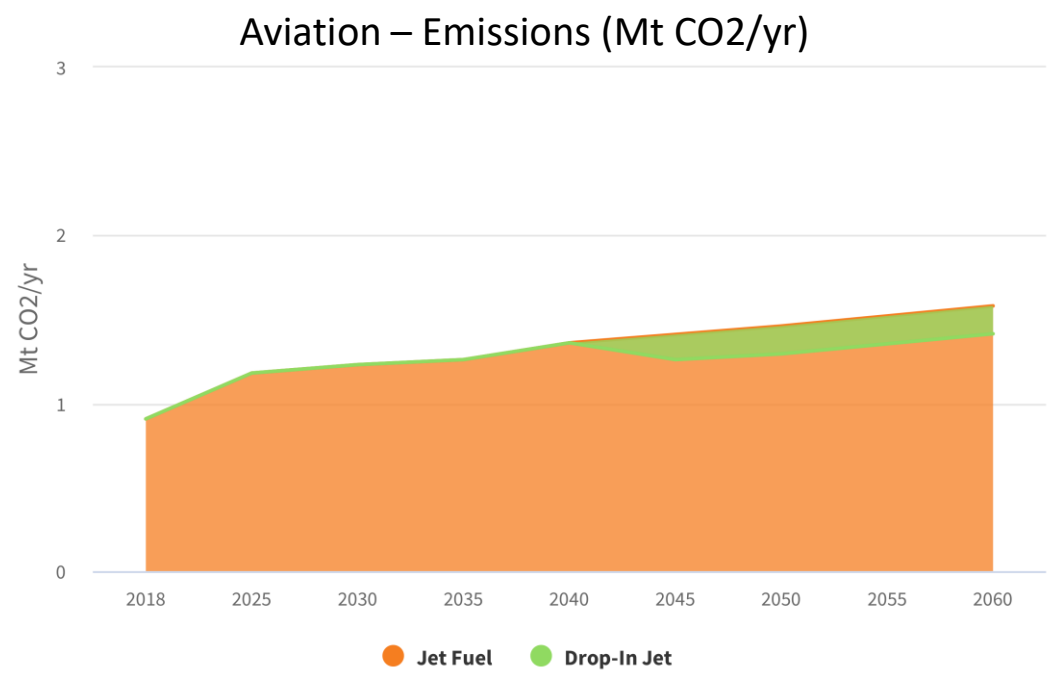
Tūī



TIMES-NZ 2.0, Scenario: Tūī

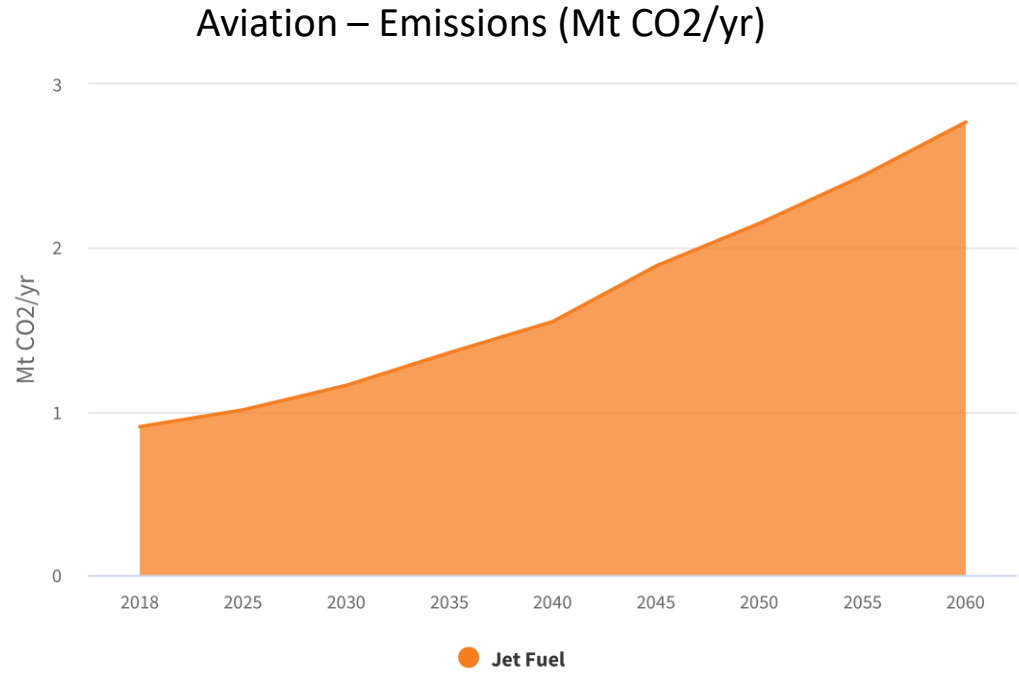
Aviation

Kea



TIMES-NZ 2.0, Scenario: Kea

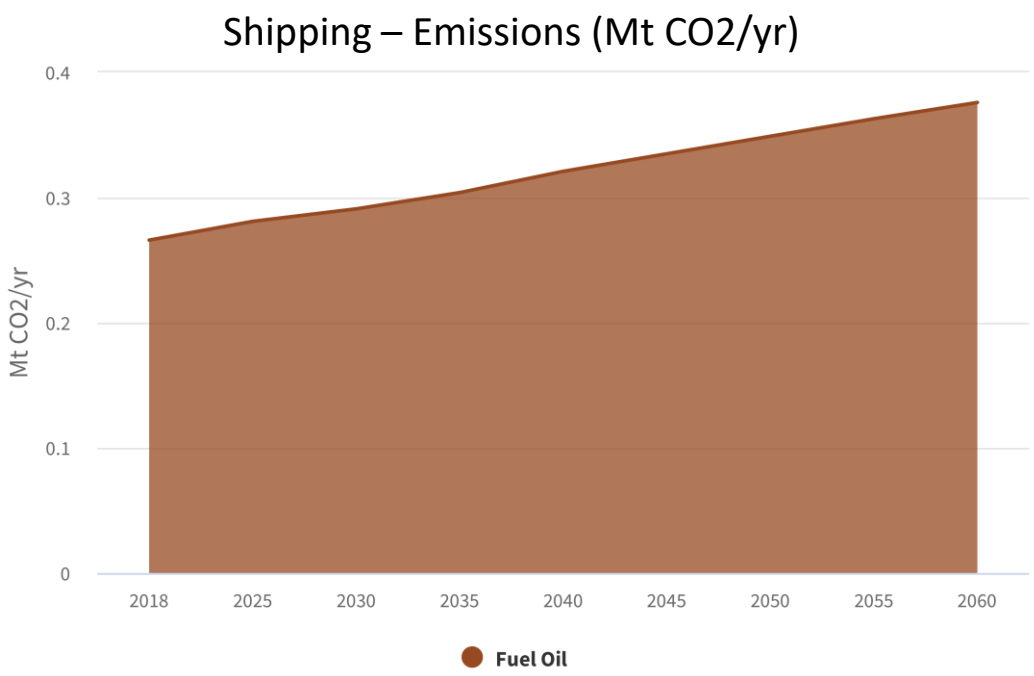
Tūī



TIMES-NZ 2.0, Scenario: Tūī

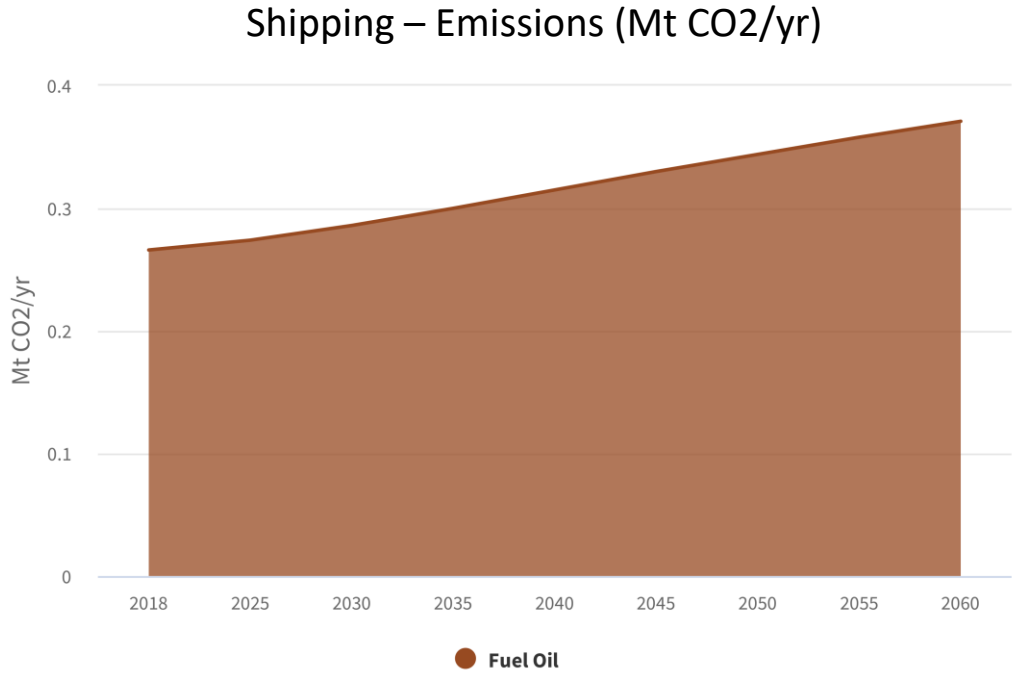
Shipping

Kea



TIMES-NZ 2.0, Scenario: Kea

Tūī

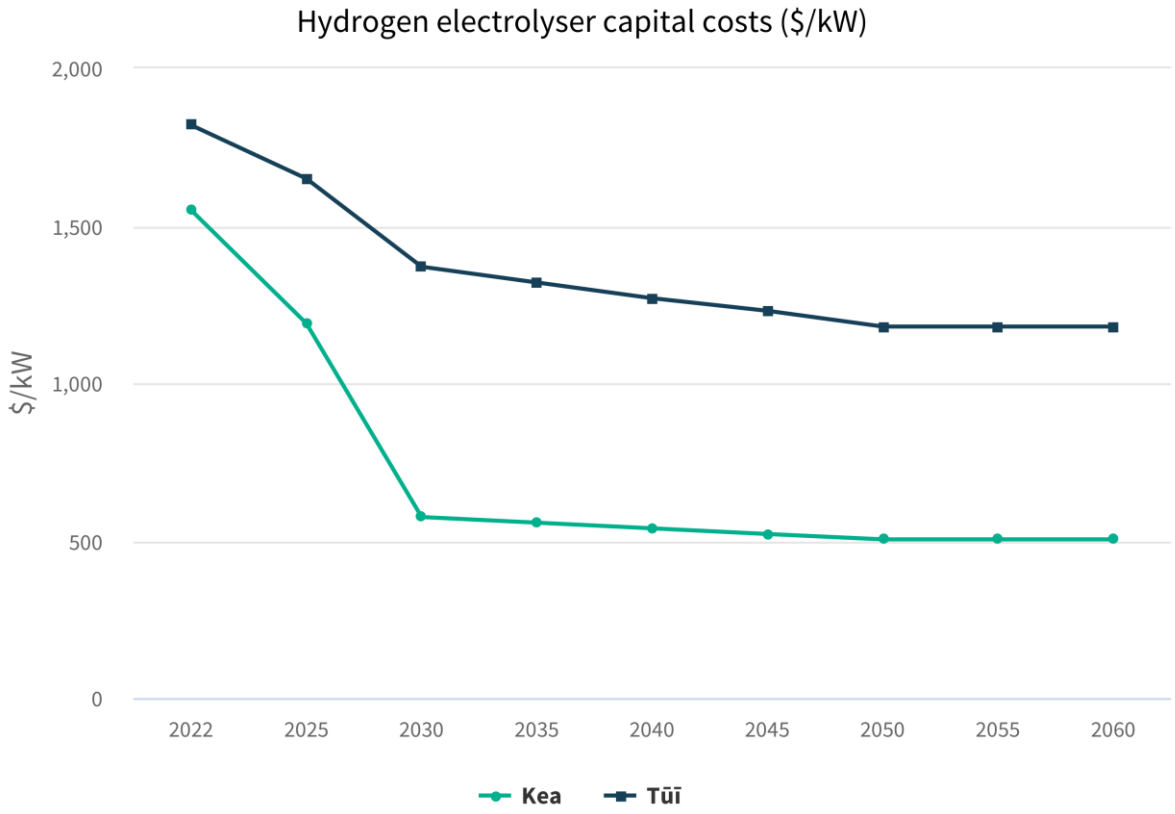


TIMES-NZ 2.0, Scenario: Tūī

Fuels

Hydrogen

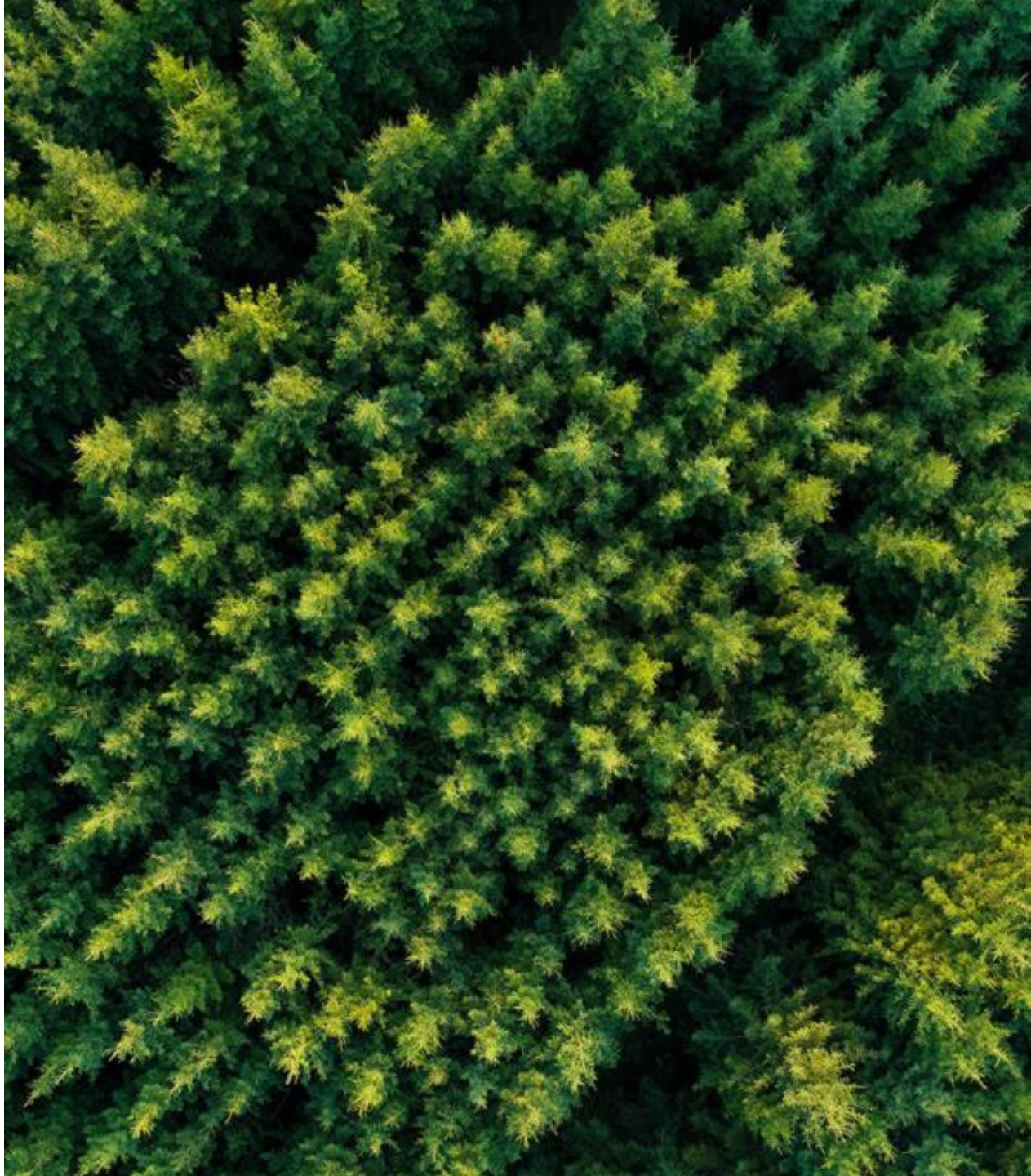
- Green and blue hydrogen available to produce
- Centralised and decentralised distribution – pipelines, tube trailers, liquified trailers
- Electrolysers follow a cost curve, using publicly available figures and discussion with industry
- Kea ends up significantly cheaper – to reflect a greater scale of investment



Biofuels

- Available in three forms in transport:
  - Biodiesel (blended with fossil)
  - Drop-in Diesel
  - Drop-in Jet

- Production and blending of biodiesel happens in both scenarios
- Kea builds local renewable diesel manufacturing facilities, but prioritises its use in industry
- Drop-in Jet is produced as a byproduct, but does not appear to be the driver of production
- Neither scenario imports any biofuels



Summary

Summary

- Electrification the model's clear preference – when possible
- Hybrids help to transition while BEV supply is limited
- Efficiency improvements reduce our fuel use – despite travelling further
- Aviation, Shipping and Rail need further technology development to decarbonise

NZ Energy System Scenarios TIMES-NZ 2.0

Innovative communication

To ensure results are accessible to the community, and clearly communicated, TIMES-NZ 2.0 data have been released as an interactive visualisation app: http://www.eeca.govt.nz/times-nz