Life Cycle Based Environmental Impacts of Future NZ Electricity Supply

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Research Questions

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- What is the environmental profile of the future New Zealand electricity grid mix?
- Will increased renewable electricity generation in New Zealand enable the electricity sector to meet a climate target consistent with limiting global temperature increase to 1.5^{o}C above pre-industrial levels?
- How should future grid electricity be modelled in New Zealand LCA studies of long-lived products and activities?

Methodology

- Based on future electricity scenarios produced by Ministry of Business Innovation and Employment (MBIE) and Interim Climate Change Committee (ICCC)

- LCA model of inputs and emissions associated with:
  - Operational impacts – sourcing fuel; power suppliers' operations
  - Transmission and distribution
  - Construction of new generation infrastructure including distributed solar

- 11 environmental indicators

Electricity Scenarios

- MBIE Reference: **Current Trends Continue**
  - one view of how the electricity system could evolve under current policies and technology trends if no major changes occur
- MBIE Disruptive: **Improved Technologies**
  - new and improved technologies enable rapid electrification of both transport and process heat
  - increased uptake of electric vehicles and solar PV
- ICCC 100% Renewable: **100% Renewable Generation by 2035**
  - aligned to Government target of transitioning to 100% renewable electricity generation in a normal hydrological year

Total Generation per Year by Scenario

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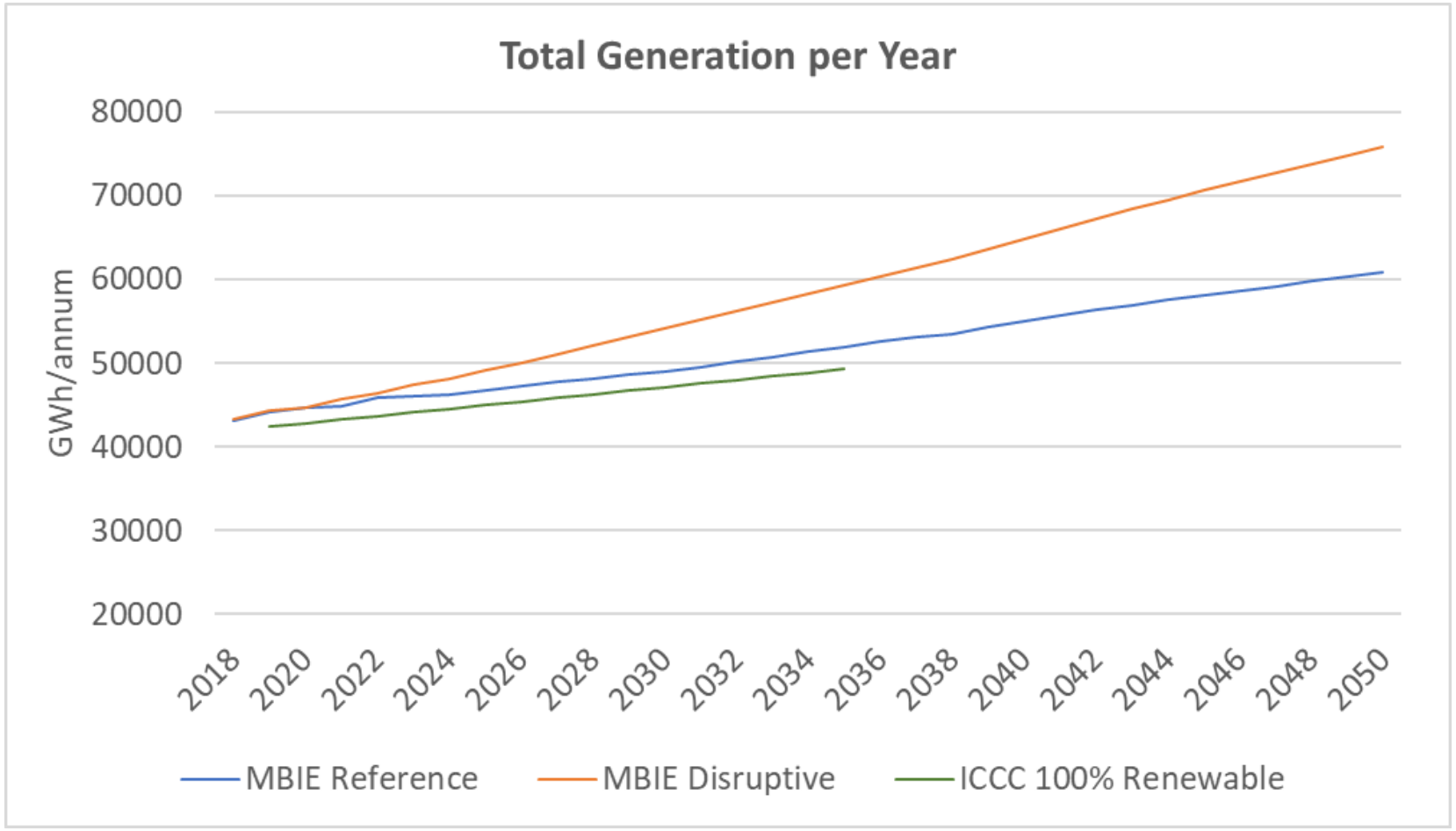

Carbon Footprint of NZ Electricity

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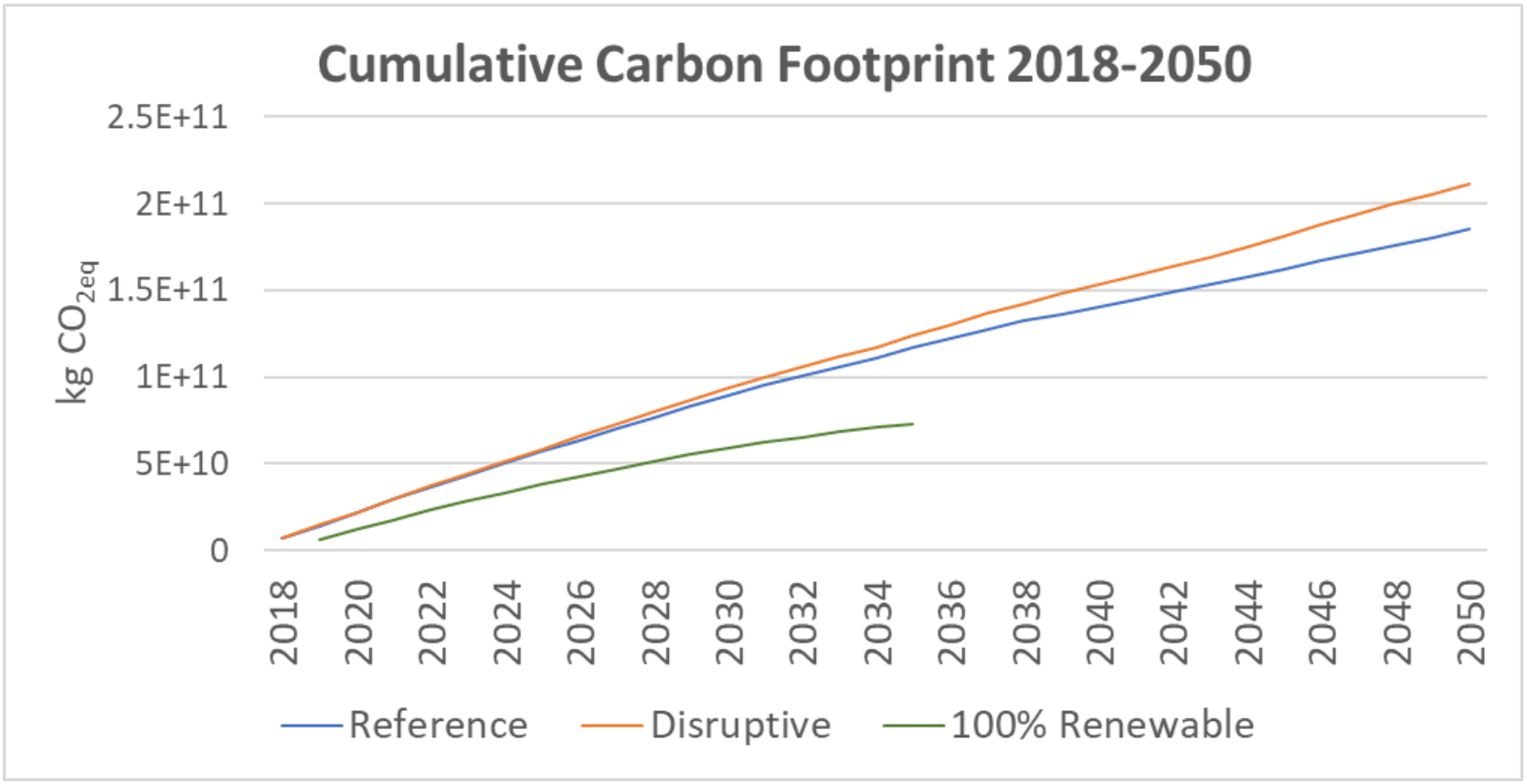

Main Contributors to Carbon Footprint

- Fossil fuel generation
  - Coal and gas: 8-10% of total generation but 50-58% of CF
- Geothermal fugitive emissions
  - 23-24% of total generation and 23-27% of CF
- Embodied carbon of new generation infrastructure
  - 8-12% of CF

Comparison of Carbon Footprint Using LCA vs Operational Emissions Only

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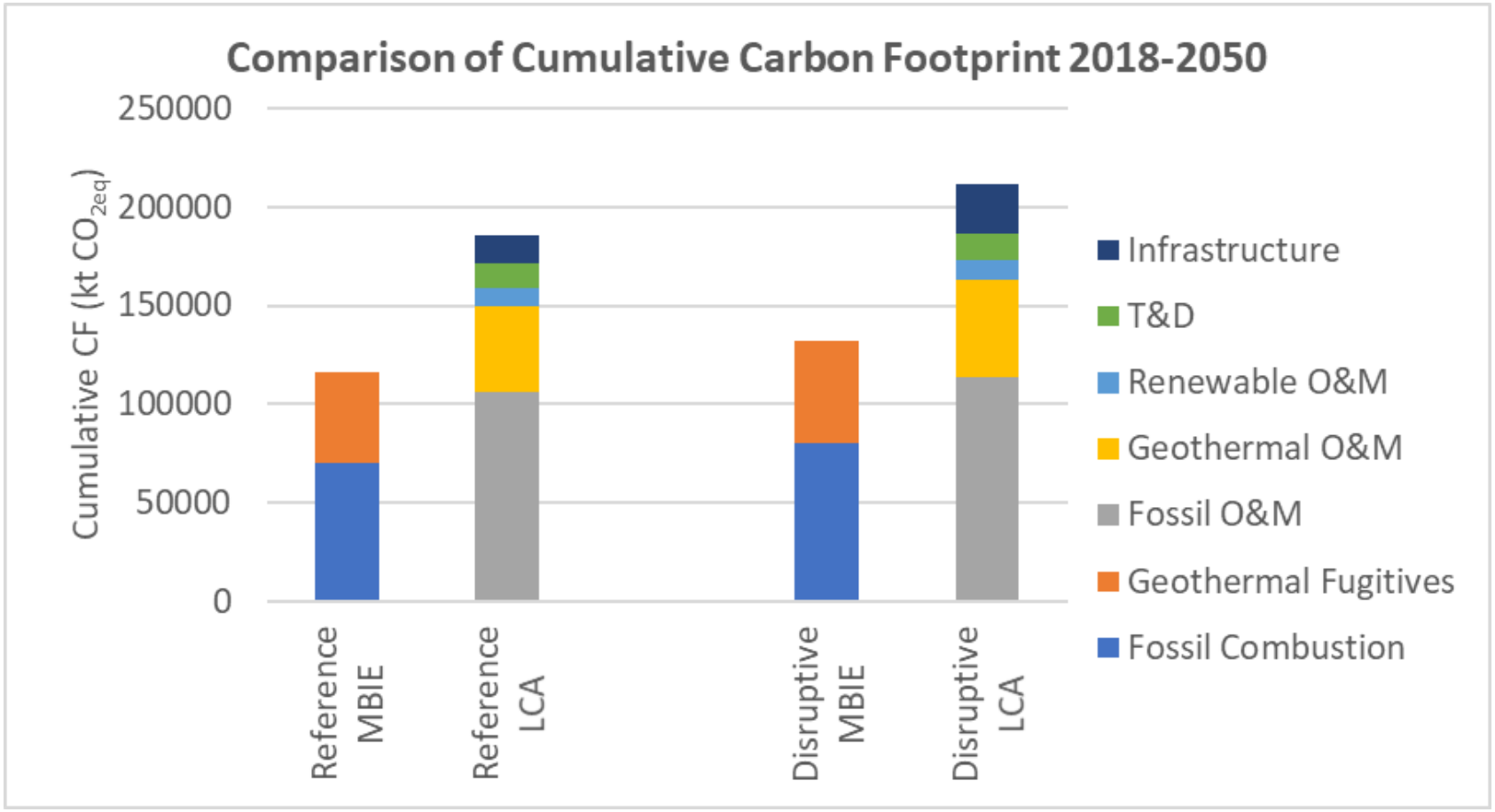

Carbon Footprint of Electricity in Context of 1.5°C Climate Target

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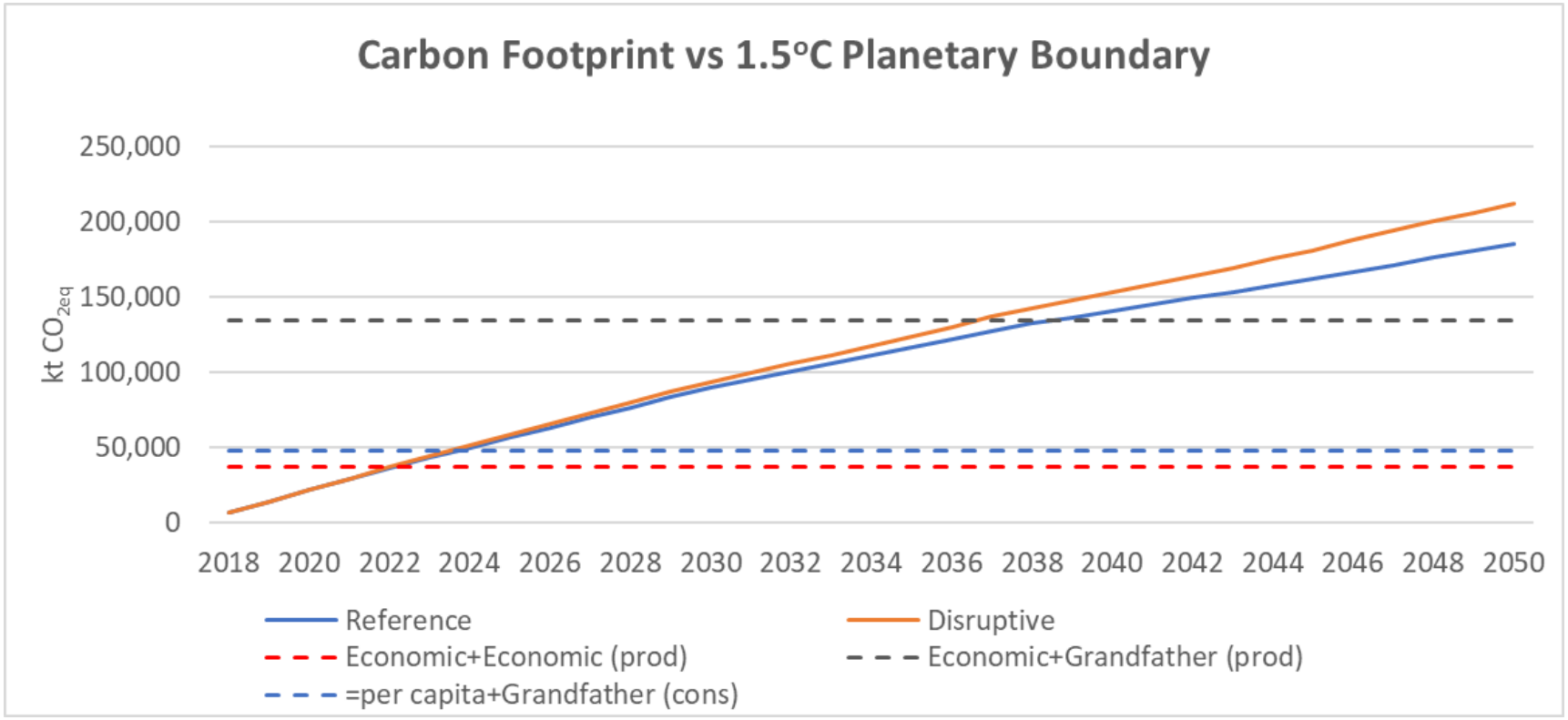

Summary

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- CF of electricity expected to decrease as renewable proportion increases
- CF of 100% renewable generation - geothermal fugitive emissions and embodied carbon of infrastructure
- CF based on operational emissions is 37-39% lower than CF using a life-cycle approach
- None of the scenarios considered are compatible with a Planetary Boundary based on a 1.5^{o}C climate target