He Pou a Rangi
Climate Change Commission

Summary note:
Capital investment in *Ināia tonu nei* scenarios

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Table of Contents

Overview

To support the work of Treasury and Ministry for Environment officials, the Climate Change Commission has provided additional analysis on capital investment requirements in an Excel workbook. This note explains the data and the work undertaken.

We have sought to estimate annual capital investment in the Commission's Demonstration Path and Current Policy Reference (CPR) case, using the ENZ model. This analysis is not comprehensive and is provided with a number of caveats. Nevertheless, we consider it sufficient to provide an initial ballpark estimate of the additional capital investment that could be required across the economy on a path to meet the recommended emissions budgets.

The numbers provided are consistent with the cost analysis and figure presented in Section 8.2.1 (Costs and savings from the energy transition) of the Commission's report, *Ināia tonu nei*. For the purposes of costing the Demonstration Path against the CPR, we have used a sensitivity run in ENZ which:

- Excludes changes in transport demand and mode shift;
- Excludes energy efficiency in buildings and process heat; and
- Assumes the same rate of reduction in the cost of new renewable generation as the CPR.[1]

[1] The CPR assumed a slower rate of reduction than in the Demonstration Path and other scenarios. We consider this a conservative assumption.

We excluded these transport and energy efficiency measures because we are unable to cost the capital investment implications with confidence at this time. By excluding these, we consider that the overall cost estimates provided are likely to be towards the high end. What this would mean for capital investment specifically is harder to say. For example, energy efficiency measures (such as building retrofits) would require capital investment but also reduce the level of investment required in electricity generation. Similarly, mode shift could mean lower capital investment in vehicles if it reduces the size of the fleet (by far the largest source of capital expenditure in our analysis), but may involve additional infrastructure investment which we have not attempted to cost.

Overall, we consider that our numbers should provide a reasonable first order estimate, but efficiency measures in energy and transport would see reallocation of capital investment from energy supply and vehicle purchases to other areas.

Areas included in our capital investment estimates:

- Road transport vehicles and electric vehicle chargers
- Electricity generation (see below for discussion on transmission and distribution costs)
- Space and water heating appliances in buildings, plus 'make-good costs' associated with switching from fossil gas appliances to electric
- Industrial boilers in the food processing sector
- Native afforestation

Together, these areas account for around three-quarters of the abatement in long-lived gas emissions by 2035 under the Demonstration Path.

Areas not included in our capital investment estimates:

- Transport infrastructure (roads, rail, etc)
- Non-road transport vehicles
- Electrification of off-road vehicles and motive power
- Increased biomass collection and conversion (e.g. domestic biofuel plants)
- Other industrial boilers and fuel switching
    - Wood processing – generally already mixed fuel use so capex requirement is likely small, with the exception of installation of a high-efficiency recovery boiler at Kinleith mill (estimated at $600 million, happens in 2030 in the Demonstration Path).
    - Cement – similarly to wood processing, unlikely to entail much capex if any.
    - Other industry – likely to require boiler conversion/installation, but small.
- Investment in gas infrastructure – we would expect this to be lower in the Demonstration path than in the CPR
- Upstream investment in fossil fuel supply
- Land use change to exotic forest – there is no difference in area converted to 2030 between the Demonstration path and CPR. Beyond 2030, lower level of conversion in the Demonstration path will mean lower capital investment. Establishment costs per hectare are an order of magnitude smaller than estimated for native forests.
- Land use change to horticulture – capital intensive, but relatively small area per year.
- On-farm emissions reductions
- Waste recovery
- Landfill gas capture

Electricity system capital cost estimates

Electricity system costs can be broadly disaggregated into:

- Generation costs – the cost of operating, maintaining and expanding electricity generation plant
- Transmission costs – the costs of operating, maintaining and expanding the national transmission grid
- Distribution costs – the costs of operating, maintaining and expanding distribution networks

We are able to give a partial estimate of capital costs to support an expanding electricity system for the Demonstration path and CPR. We have directly modelled generation capital costs and point to Transpower's Integrated Transmission Plan Schedules for an overview of transmission costs. Although we have projected annualised costs for distribution, we are not able to disaggregate this into in-year capital costs at this time.

Transmission costs

Transpower as the operator of the system grid have a planning horizon that extends to 2035. They have undertaken their own projections of electrification of the economy in line with national decarbonisation and have planned and costed the major expenses in their Integrated Transmission Plan 2020. The costing detail can be seen in the Schedules document here.

The electrification scenarios that this plan is based on are largely consistent with the Commision's advice and pathways, and so we consider this source as our best estimate of system capital costs. The costs are summarised for the first three budget periods below.

	2022-2025	2026-2030	2031-2035
Integrated transmission plan 2020	$ 1,037	$ 2,227	$ 2,616

Results

Figure 1 shows the summary results for annual investment relative to the CPR. Further details are provided in the Excel workbook.

We would make two points around the time profile of the investment shown:

- In electricity generation, the model run used constrains the build out to 2025 to be the same as the CPR. Some of the additional investment occurring in the second budget period could instead occur in the first.
- In road transport, EV charging is modelled to expand incrementally in response to demand and the model does not consider the impact of charging availability on uptake. However, particularly for public charging networks, frontloading this investment ahead of demand growth will likely be important to avoid bottlenecks and barriers to uptake.

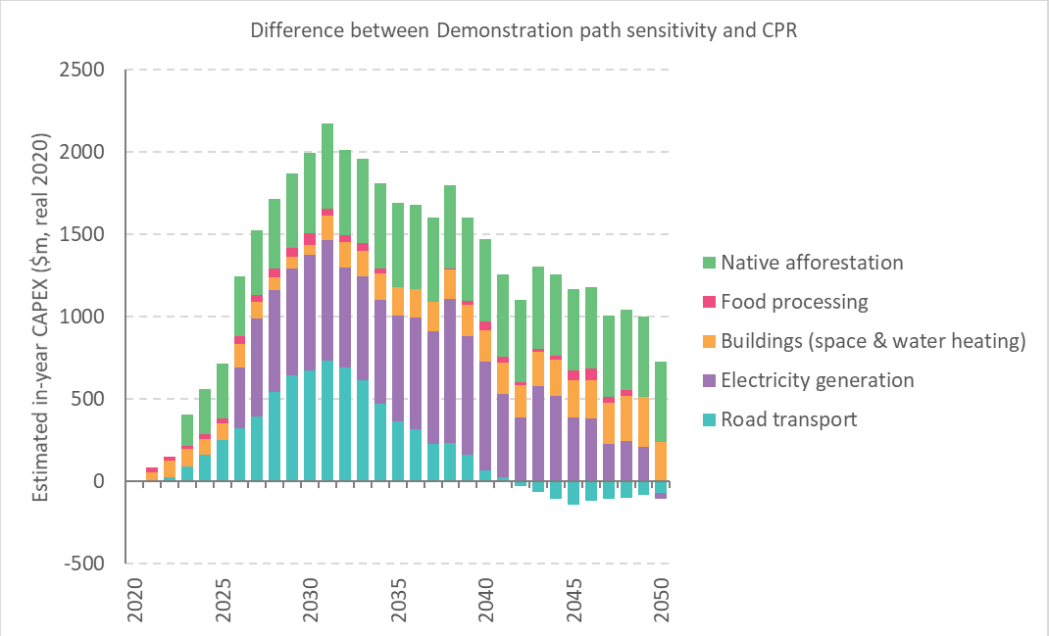

Figure 1: Differences in annual capital investment between the modified Demonstration path (sensitivity described above) and Current Policy Reference case