Modelling New Zealand’s transition to net-zero emissions

Geoff Lewis, New Zealand Productivity Commission
IAEE Asia-Oceania Conference 2020
13 February 2020
In 2017 the NZ Government asked the Productivity Commission to inquire into: How can NZ transition to a low-emissions economy, while at the same time continuing to grow incomes and wellbeing?
The inquiry process

- Received and analysed 403 submissions
- Attended numerous industry & other conferences and events
- Research note on the UK Climate Change Act
- Published an issues paper in August 2017, a draft report in April 2018 & the final report in August 2018
- Two-phased modelling of the transition, including a focus on uncertainty
- Commissioned expert advice on the future of the electricity sector
- 120+ engagement meetings
The final report in August 2018 had five parts:

1: Setting the scene
Introduces the inquiry and describes context for NZ’s low-emissions transition (eg, key emitting sources and trends, and NZ’s emission targets)

2: Low-emissions pathways
Identifies possible future pathways (from modelling commissioned for the inquiry) and examines the needed major economic and social transitions

3: Policies and institutions
Focuses on cross-cutting policies and institutions pervasive across the economy (eg, laws, emissions pricing, innovation, a just transition)

4: Emissions sources and opportunities
Analyses mitigation opportunities in land use, transport, electricity, heat and industrial processes, waste and the built environment

5: Achieving a low-emissions economy
Focuses on the immediate actions that Government should take to achieve a successful transition
Main findings
To achieve a low-emissions economy NZ needs:

STABLE AND CREDIBLE CLIMATE POLICY AND INSTITUTIONS
The four key policy and institutional pillars are:

1. EMISSIONS TRADING SCHEME
2. LEGISLATION AND INSTITUTIONS
3. COMPLEMENTARY REGULATIONS AND POLICIES
4. INVESTMENT AND INNOVATION
Four pillars

**Emissions pricing**
- Reform the structure of the NZ ETS, (eg, through setting yearly caps) and increase its coverage to include N$_2$O from agriculture
- Price biogenic CH$_4$ (either in a dual-cap NZ ETS or a CH$_4$ quota system)

**Laws & institutions**
- New climate legislation, with separate long-term targets and emissions budgets for short- and long-lived gases
- An independent Climate Change Commission to advise government

**Regulation & policies**
- Use prices (eg, feebate scheme for transport and increase the level of the waste disposal levy)
- But other supportive regulation will be needed eg, in electricity distribution, process heat, transport and waste

**Innovation & investment**
- Substantially increase funding for innovation into clean technologies and agricultural emissions mitigation
- Promote low-emissions investments (eg, by mandatory financial disclosure of climate risks)
Modelling pathways to low emissions
NZ’s challenge to get to net-zero emissions

- Waste
- Agriculture
- Industrial processes and product use
- Energy
  - Electricity generation
  - Industrial heat
  - Other
- Forestry and other land uses

Gross emissions
Net emissions

Mt CO₂e

2018
2050
25 Mt
Net-zero

New Zealand Productivity Commission
Why undertake modelling?

• Modelling can throw light on:
  – complex systems in order to solve complicated problems
  – whether an emissions target is feasible
  – measures to achieve an emissions target at least cost
  – alternative pathways depending on available technologies
  – quantitative estimates of key variables
  – the opportunities, choices and risks that may lie ahead
The modelling explored 3 scenarios ...

• ...about technology and the ability to reduce GHG emissions

1. The Policy Driven scenario
   – Technological change is slow
   – So need to rely on high emissions prices to drive behaviour change ...
   – to stop doing emissions-intensive things; & start doing low-emissions things (largely using existing technologies)
The 2\textsuperscript{nd} scenario is **Disruptive Decarbonisation**

- Rapid technological change that disrupts current economic structures
The 3rd scenario is **Stabilising Decarbonisation**

- Rapid technological changes that “preserve” existing industries by reducing their emissions
3 scenarios and 2 targets give us 6 pathways that the modelling describes

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Net emissions target in 2050</th>
<th>Pathway</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Policy Driven</td>
<td>25 MtCO₂e</td>
<td>PD-25</td>
</tr>
<tr>
<td>2. Policy Driven</td>
<td>Net zero</td>
<td>PD-0</td>
</tr>
<tr>
<td>3. Destructive Decarbonisation</td>
<td>25 MtCO₂e</td>
<td>DD-25</td>
</tr>
<tr>
<td>4. Destructive Decarbonisation</td>
<td>Net zero</td>
<td>DD-0</td>
</tr>
<tr>
<td>5. Stabilising Decarbonisation</td>
<td>25 MtCO₂e</td>
<td>SD-25</td>
</tr>
<tr>
<td>6. Stabilising Decarbonisation</td>
<td>Net zero</td>
<td>SD-0</td>
</tr>
</tbody>
</table>
Insight 1: both targets look feasible
Insight 2: Emissions prices climb steadily from current levels ...
Emissions prices are mainly in the range expected in other developed countries.
Insight 3: Transformational technology number one is...
Insight 4: Extensive (but not radical) land-use change is required
Forestry is not a ‘get-out-of-jail-free’ card

- Forestry credits principally accrue when we **add** land area under forestry
- If NZ stops planting new trees ...
  - ...its sequestration from tree growth will eventually stop, and net emissions will jump right back up to gross emissions
- So how do we achieve our net zero emissions after 2050?
Insight 5: Transformational technology number two is ...
EVs are coming anyway but will they come fast enough?

EVs as proportion of light passenger fleet
The pace of change needs to be rapid

Proportion of light passenger vehicles entering NZ which are EVs
Insight 6: Electricity is key, and capacity will need to expand a lot.
Insight 6: Electricity is key, and capacity will need to expand a lot

- Decline in fossil generation, but some remaining for seasonal and ‘dry-year’ duties
- Significant growth in new renewables to meet demand growth (and displace ‘baseload’ fossil generation)
Summarising the insights from the modelling ...

• Achieving net zero by 2050 is possible but, without help from technology, will require very high emissions prices
• Expansion of forestry is a low-cost measure, but poses a challenge post-2050
• Dairy output does not change much, but sheep & beef sees a significant decline
• Expanding the light vehicle EV fleet and clean electricity generation also important (but don’t aim for zero- emissions electricity)