Net Zero Carbon : NZ

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Background

- NZ government Climate Change Act to have “net zero carbon emissions by 2050”.
- Act target to: ”reduce net emissions of all greenhouse gases (except biogenic methane) to zero by 2050”
- AND “reduce emissions of biogenic methane to 24–47 per cent below 2017 levels by 2050, including to 10 per cent below 2017 levels by 2030”
Gross emissions. Agricultural emissions on top left are mostly Methane (42%) and Nitrous Oxide (11%) (top right).

Rest of economy contributes to CO2 emissions (47%)

Methane is not included in zero carbon target

N2O is in the net zero carbon target
Projected net emissions are much lower than gross due to planned forest plantings of 1 billion trees.
Background

• NZ projected net emissions by 2050 are 32mt $\text{CO}_2^e$ not too far from climate Change Act target of between 18-26 mt $\text{CO}_2^e$ a year!

• Much of the modelling work done for the bill was for more ambitious target of net zero including methane.

• Zero carbon is still feasible!
Background

- NZ government initial policy “net zero carbon emissions by 2050”
Background

- Strategy.
- Reduce energy emissions - close to zero.
- Large scale forestry as agricultural emissions hard to reduce
- Electrify transport and industry

- Productivity Commission released thorough report
Low-emissions economy

Video:
https://www.youtube.com/watch?time_continue=1&v=ja75QgXuZyk
Emissions profile

Half of New Zealand’s **greenhouse gas emissions** come from agriculture. This is the highest share in the OECD.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Agriculture</td>
<td>49%</td>
</tr>
<tr>
<td>Transport</td>
<td>17%</td>
</tr>
<tr>
<td>Manufacturing &amp; construction</td>
<td>14%</td>
</tr>
<tr>
<td>Energy industry and other</td>
<td>6%</td>
</tr>
<tr>
<td>Industrial processes</td>
<td>5%</td>
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<tr>
<td>Waste</td>
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Transport and Energy (mainly electricity) are 31% of NZ emissions
Fast-track the uptake of low-emissions transport and avoid emissions lock-in

• Transport is second largest source of GHG emissions.

• Low-emissions technologies, particularly EVs, present a significant mitigation opportunity.

• Because New Zealanders hold onto their cars for many years, fast uptake of low-emissions options will be needed to avoid locking in fossil-fuel cars for decades to come.
Transport Policy

• Introduce a “feebate” scheme, in which importers would either pay a fee or receive a rebate, depending on the emissions intensity of the imported vehicle;
• funding for some EV infrastructure projects, to fill gaps in the charging network that are commercially unviable for the private sector;
• raise awareness and promote uptake of low-emissions vehicles through leadership in procurement; and
• require imported new and used fossil-fuel vehicles to meet fleet-wide emissions standards. NZ is one of a handful of developed countries without vehicle emissions standards, and risks becoming a dumping ground for high-emitting vehicles from other countries that are decarbonising their fleets.
Develop an abundant supply of low-emissions electricity

• New Zealand already has a relatively low-emissions electricity system. (80% low carbon) However, electricity generation will likely need to increase by at least 50% by 2050. (Transpower suggest 100% increase)

• An abundant supply of low-cost, low-emissions electricity will be important as other parts of the economy switch from fossil fuels to electricity, particularly transport.

• Regulatory reform to facilitate the expansion of both grid-scale and distributed renewable energy generation

• Need to removal of barriers to innovative technologies that assist consumers to manage their demand during peaks.
Accelerate afforestation

• Land use will need to change substantially if New Zealand is to transition to a low-emissions economy by 2050.

• Land planted in forests will need to increase by between 1.3 million and 2.8 million hectares, mostly converted from marginally profitable beef and sheep land. (currently 1.3 m ha)

• In addition to its recent one billion trees programme, the Government should take other steps to accelerate afforestation including making it easier and less risky for small foresters to participate in the NZ ETS and by providing recognition for carbon sequestered in harvested wood products.
Spotlight - Electricity

• Key for two reasons
• Still major emitter of CO$_2$
• Need green electricity to power the transport fleet and electrify industry
Energy Futures: Take outs

• Electrification will significantly decarbonize the New Zealand economy
• Electricity demand in New Zealand will double by 2050
• The transport future is electric
• Demand will be met by renewable generation and new technologies
• A renewable future is the most affordable
• Winter and peak demand is still the biggest challenge to solve
Identified technologies impacting New Zealand's energy system

- Digital innovations enable new entrants
- Electric cars are becoming economically competitive
- Electric trucks, planes and ships are being developed
- Distributed generation is becoming more accessible and effective
- Utility solar and wind generation are now competitive with conventional generation
- Batteries are now attractive for managing short-term demand peaks
- Unconventional generation and storage solutions are being developed like nano-scale catalysts that convert water to ethanol
- Virtual/augmented reality and autonomous vehicles could reverse travel and urbanisation trends
- Advanced robotics and artificial intelligence could increase structural unemployment
- Smart homes, grids and markets challenge traditional utility business models
Demand doubles due to electrification of transport and industry
Electric vehicles

- Electrification of transport is expected to be highly significant, both in increasing electricity demand and in emissions reductions.
- Electricity for transport will account for 13 TWh of the estimated growth
- EVs reach ~40 per cent market share by 2030 and ~85 per cent by 2050.
- EVs will be cheaper to run, cheaper to buy, cheaper to maintain, and will have a longer lifespan than internal combustion engine vehicles.
- Light vehicles powered by hydrogen fuel cells are also on the horizon but are not as attractive as EVs.
- Heavy land transport is also expected to electrify but there is more uncertainty....maybe hydrogen
It is estimated that 12 TWh of New Zealand’s electricity growth comes from electrification of industry. Coal phased out and 40% of gas phased out by 2050.
E.g. Fonterra uses coal to heat milk and make milk powder currently
Supply—lots of solar!

Exhibit 9: Estimated need for additional supply

Exhibit 10: Estimated sources of new electricity supply
Managing the peaks

• The daily peak in 2050 is not double the 2020 peak for two reasons. Firstly, residential demand, which contributes to a large increase in evening demand, reduces as a share of total demand as electrification of other sectors occurs and industry demand grows.

• Secondly, it is assumed that EV charging is managed or smoothed to avoid mass charging in times of high demand, such as during the evening peak. Instead, charging will occur slowly overnight and during the midday demand trough.
Transpower suggest very flat demand profile. Is this possible?

Exhibit 5: Average daily winter load profile estimated

Note: Analysis based on average winter day, not the most “peaky” day of the year.
Winter peak: need distributed (roof PV systems), EV and utility batteries

Exhibit 12: Estimated winter evening peak supply required and supply

- Evening peak supply required
- Utility storage
- Electric vehicle storage
- Distributed storage
- New generation
- Existing generation

Year:
- 2015: GW 9
- 2020: GW 10
- 2030: GW 15
- 2040: GW 19
- 2050: GW 20
Seasonal problem
Seasonal and dry year storage problem

Exhibit 15: Monthly supply and demand estimate for normal year

Several potential technical solutions for managing New Zealand's unique winter and dry-year energy issue have been identified but none appears definitely feasible and economically attractive.
Conclusion: The opportunities are considerable, and the challenges are very real. It’s time to start!

“If the energy opportunities facing New Zealand are to be realized, it will require a level of engagement, participation, innovation and commitment to a common goal from all participants: government, investors, consumers and the people of this industry who every day generate and distribute the lifeblood of New Zealand’s economy – electricity”