

Energy Centre Energy Research Briefings

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The Energy Centre's research team targets top international peer-reviewed journals as their benchmark. The Energy Research Briefings series translates their work into plain language summaries for businesses, government agencies and the community, highlighting the impacts for practice and policy.

Mixes of Electric Vehicle Types to Minimise Energy Consumption and Greenhouse Gas Emissions in Australia and New Zealand

Drivers and policymakers, take note! The share of electric vehicles in New Zealand's and Australia's light duty vehicle fleets is due to rocket from 0.3% and an even more meagre 0.05% respectively to 95% and (by passenger vehicle sales) 65% by 2050. "EVs" of various types are key to cutting energy consumption and greenhouse gas emissions (GHGs), provided enough of the electricity comes from renewable sources. But policy must also consider the pros and cons of those different types and reduce barriers like price.

New research* fills a gap for Oceania by comparing the two countries' current emissions and energy efficiency in cars and other light duty vehicles, and projecting 2050 GHG emissions for three uptake mixes of pure battery models (BEVs), plug-in hybrids, and fuel cell EVs (FCEVs), versus conventional internal combustion vehicles. Notably, while their driving cultures are similar, New Zealand's electricity generation is already 80% renewable, whereas Australia's is still 60% coal-fired.

BEVs such as the Nissan Leaf currently dominate the EV fleet, followed by hybrids like Toyota's Prius. Last, and least known, come FCEVs. Whereas batteries store electricity, fuel cells convert a non-fossil fuel that is already onboard. This study chose hydrogen. The study predicted "green" hydrogen, obtained by electrolysis splitting water molecules, would make a major contribution by 2026. "Blue" hydrogen, which "reforms" the fossil fuel natural gas, currently dominates.

Tailpipe emissions are zero for BEVs and, in this study, FCEVs. However, the analysis counted energy and emissions from obtaining and transporting fuels as well as driving.

Results showed BEVs currently consume 73% less energy and emit a staggering 90% less GHGs per km than New Zealand's second-best option, hybrids; and consume 53% less energy than hybrids and emit 40% less GHGs than FCEVs in Australia.

The 2050 emissions projections modelled total EV uptake based on government targets and historical sales. They also applied New Zealand and Australia's renewable generation targets of 100% by 2035 and over 75% by 2040 respectively. In all three scenarios run, emissions would peak in 2030 then fall, provided most EVs are BEVs, FCEVs (run by green hydrogen, and optimally in gas not liquid form) increase, and renewable generation rises. BEV:hybrid:FCEV ratios of 85:10:5, 50:20:30 and 50:30:20 respectively would yield least, middle and most GHGs.

Overall, BEVs perform best on both per km energy and emissions short term, but FCEVs will also be crucial long term. Policy should strategically manage supply and demand of these two types to overcome uptake barriers. Charging and refuelling station infrastructures require proper investment and regulation. More renewable electricity generation is certainly vital. But commercialising hydrogen, given its energy-thirsty production, also requires "soft" demand-side policies inducing drivers to switch. Discounted energy bills, rebates on upfront cost and preferential parking fees could all further help realise the EV transport transformation.

**For the full article by Mingyue Selena Sheng, Ajith Viswanath Sreenivasan, Basil Sharp and Bo Du, see "Well-to-wheel analysis of greenhouse gas emissions and energy consumption for electric vehicles: A comparative study in Oceania", Energy Policy 158 (2021) 112552.*