

# 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.

## How do COVID-19 containment measures reshape electricity demand? New Zealand's experience

Drastic COVID-19 containment measures worldwide offer energy policymakers and investors an unprecedented experiment in how demand changes under outside constraints. For instance, huge electricity load reductions in New York State, Italy, India and Australia have been observed. But a timely study\* on New Zealand's (NZ's) lockdowns - among the world's strictest at their peak in 2020 - is one of the few to measure electricity consumption impacts comprehensively with models using economic statistics and econometrics.

The study period, from 27 February 2020 to 23 February 2021, spanned three rounds of restrictions. NZ began on 26th March with a month famously "going hard and early" at Alert Level 4 (only essential services open, people instructed to stay home). It then de-escalated to a fortnight at Level 3 (construction and some non-contact businesses back); three weeks at Level 2 (schools back, workplaces open with social distancing); and from July onwards, predominantly Level 1 (near-normal economic activity but borders still closed). During the second and third rounds to contain resurgent infection, Auckland temporarily re-ran Levels 3-2, with other regions a level below.

Results revealed that average electricity demand fell following a structurally significant pattern. The sharpest fall was 12% during Level 4, comparable to the impact in Spain. Commercial and industrial consumption dropped 16% and 11% respectively, outweighing an 8% rise in residential use. Demand picked up from Level 2 on, when restrictions eased, economic activity recovered, and winter heating was turned on. Interestingly, as people worked from home, 2020 weekday demand coincided with 2019 weekend demand.

By the second and third rounds, business were evidently better adjusted, for instance to Zoom meetings and click-and-collect customer service: no significant changes in electricity consumption occurred versus 2019.

Prices and emissions tell another story. In Level 4, wholesale prices plummeted over 60%, probably because grid operators could rely more on low-cost renewables like wind and NZ's mainstay, hydro, without resorting to dearer thermal generation for demand spikes. But as a historically dry winter and spring depleted hydro reservoirs, both gas and coal thermal came onstream more than in 2019. Prices year-on-year therefore actually bounced up by over 60% in June, and 2020's national greenhouse emissions from electricity generation exceeded 2019's by 11%.

The study provides both a reference point for overseas comparisons mid-pandemic, and ongoing insights into NZ's electricity market. Overall-lower prices due to lockdowns (and more ensued after the study period) may temporarily discourage investment in renewables and delay achieving government targets of 100% renewable electricity by 2030 and net zero carbon by 2050. But seasonal rainfall and demand exert a bigger effect on generation make-up and emissions in a hydro-dominated system, so fixing the "dry year" problem remains the priority. Meanwhile, researchers should also watch for regional heterogeneity and for effects of a likely sustained shift post-COVID towards working from home.

*\*For the full article by Le Wen, Basil Sharp, Kiti Suomalainen, Mingyue Selena Sheng and Fengtao Guang, see "The impact of COVID-19 containment measures on changes in electricity demand", Sustainable Energy, Grids and Networks 29 (2022) 100571.*