Energy Centre

*Energy Research Briefings*

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# World-first Modelling Can Inform Wind Farm Investment Choices in New Zealand

To lift renewables' share in electricity from some 80% to the target of 90% by 2025, New Zealand will need to exploit its natural advantage in wind, currently producing just 5%. But exactly how much should be invested and where? Since the government does not subsidise renewables, private investment must be financially viable. Recent modelling* offers insights for investors and policymakers.

The researchers worked off New Zealand's pricing arrangements. Throughout each day, generating companies offer electricity at varying bid prices to the national grid operator Transpower from their roughly 250 generating nodes. These combine hydro, thermal (coal and gas), geothermal – and, at about 20 nodes where we see the familiar farms of twirling turbines, wind. Transpower continually selects the cheapest combination that meets demand, setting the wholesale price.

Wind is generally efficient, but fickle. When wind blows at a certain node and is cheaper than other sources it naturally displaces them. The researchers' insight was that increasing wind input from one node, thus lowering price there, would "spill over" regionally to neighbouring nodes, which effectively import surplus. Modelling those spillovers, a world first, used an application of economic statistics known as spatial econometrics.

Simulation results showed that offering wind-generated electricity to the market cut wholesale prices. The cut was biggest during the peak hours 6–11am and 5–9pm when we are mostly at home running appliances: up to $3.55 per megawatt hour wholesale.

This article contributes to understanding wholesale price dynamics and has practical implications for wind's viability and location. Nationally, wind generation will very likely grow given the country's blustery blessing in that resource. To incentivise investment towards 20% as envisioned by the New Zealand Wind Energy Association, demand must rise, but further electrifying transport may achieve this. Adding inherently intermittent wind generation will make prices more volatile and require buffering by battery storage and hydro, since dams are effectively a form of storage, and perhaps quick-to-ramp-up, but expensive, gas plants. A major indirect challenge becomes low rainfall years – especially topical now since the North Island is in drought.

Spillovers are associated with, and depend on, the location and capacity of the distribution network. Consenting may ignore other sites' efficiency and is subject to community resistance under the Resource Management Act 1991. Then-All Black rugby player Anton Oliver famously championed opposition derailing a farm planned for Central Otago in 2012. The modelling suggested a Central North Island wind node was most worth growing.

After the article, phase-out was announced of the country's only aluminium smelter, at remote Tiwai Point. It uses about 13% of national electricity, direct from Lake Manapouri hydro in the Southern Alps. Manapouri was excluded in the study. However, this major, uncertain complication – for freed-up capacity cannot simply be redirected because transmission lines will take years – makes reassessing wind among other sources doubly urgent.

*For the full article by Le Wen, Basil Sharp and Erwann Sbai see "Spatial Effects of Wind Generation and Its Implication for Wind Farm Investment Decisions in New Zealand", The Energy Journal 2020, vol 41(2): 47–72.

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