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Energy Centre
Energy Research Briefings No. 10

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 will climate change impact the cost of decarbonising New Zealand's hydro-led power system?

Climate change doubly complicates planning and investing in renewable energy. Even while driving our switch to renewable sources so as to decarbonise, it changes how available, viable and attractive those sources are. What's more, the future climate path is uncertain, and the direction and size of its impact will vary greatly from place to place. New research* tackles the double complication for New Zealand. It shows how climate change effect on hydro resources may shape both our optimal long-term energy systems planning and costs of decarbonising energy.

Reaching beyond usual New Zealand energy and climate change tools, the researchers modelled the energy system as a whole, not just electricity. Electricity is still crucial though. New Zealand's comes 55–60% from hydro (with little chance of installing more capacity), the lion's share from snowy South Island mountains. The research ran scenarios of climate impact and feasible national greenhouse gas reductions up to 80% below 1990 levels, given the country's net-zero 2050 target.

Results showed that the harder climate change hits, the more the system relies on solar. With warmer temperatures, winter snow in the South Island increasingly falls as rain, all ready to flow into the turbines rather than waiting for the summer melt. Seasonal swings in hydro thus widen. Since the sun shines less in winter and more in summer, solar nicely balances the swings and so displaces wind, which on purely cost assumptions would otherwise be preferable in these blustery isles.

Because energy demand also peaks in winter, decarbonising becomes slightly cheaper. Overall demand rises with population. Electrification increases and oil demand reduces, especially in industry and above all in transport. Interestingly, petrol is phased out and emissions lessen somewhat even without deliberate decarbonising, once EVs simply cost less per vehicle kilometre (that assumes a large-scale charging infrastructure and cleaner electricity from better renewables technology). For energy sector emissions to fall 80%, the carbon price must still rise to about 85–90 NZD/tCO_2 in January 2022 under our Emissions Trading Scheme, although other policy instruments besides carbon price would likely be needed.

What does all this mean for policy? The most cost-effective investment pathway depends on the severity of climate change, which largely turns on global, not New Zealand, action. With more stringent action, wind power would regain pride of place over solar. As both technologies need major investment over the next decae, we can delay the ultimate decision while watching and planning. But doing nothing is not an option. Under every scenario, investments in solar (today less than a miniscule 1% of grid electricity) must quadruple and wind more than double in the coming 10 years. Besides a strong carbon price, the study recommends a clear long-term policy, factoring in climate change impacts. Finally, because those impacts differ so much around the world, other countries and regions are encouraged to test their own energy systems' sensitivity to them.

**For the full article by Kiti Suomalainen, Le Wen, Mingyue Selena Sheng and Basil Sharp, see "Climate change impact on the cost of decarbonisation in a hydro-based power system", Energy 246 (2022) 123369.*

The Energy Centre is located in The University of Auckland's Business School. Its mission is to undertake independent research on energy-related issues important to New Zealand. The Centre's research, education and outreach activities are supported by The Energy Education Trust of New Zealand.