New zealand thermal energy storage

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The Government target for renewable energy resources’ contribution to the electricity grid may be debated, but all the scenario modelling outcomes now being presented suggest at least 90 percent within the next decade and around 95 percent within the next two to three.

This is in light of an expected growth in electricity demand of anywhere between 20 and 45 percent, with all the uncertainties associated with projected population and economic growth, and technology developments. These developmentsincludepotential electricity intensification of our residential, commercial, industrial and transportation sectors, and the drive for sustainability transitions in general.

The International Energy Agency (IEA), in its country review of 2017, highlighted the importance of storage considerations given our country’s geographic isolation, the limitations of our hydro capacity with climate variations, and the increasing contribution of intermittent wind. In terms of the latter, the Ministry of Business, Innovation and Employment (MBIE) estimates returns on investment in wind will diminish when wind penetration is around 25 percent is currently between 5and 7percent.

So what are our storage options to facilitate this transition to an even higher renewables-based grid? Some of the opportunities are due to global trends, but others are New Zealand-specific and there for the taking.

This range of applications across the electricity value chain is echoed in a Transpower document of 2017 and we’ve subsequently seen uptake in New Zealand, from the Tesla Powerpack 2 grid-scale battery in South Auckland to the mainstreaming of Tesla Powerwall (and other) products in households and commercial buildings.

Many research efforts are ongoing, particularly through the MacDiarmid Institute for Advanced Materials and Nanotechnology, to develop this technology platform further and position New Zealand in the global marketplace.

This is certainly an option to extend our geothermal resources to meet the variable demands of the electricity market and needs further investigation and demonstration locally, similar to what the National Renewable Energy Laboratory has undertaken in the United States.

Undervalued in many ways, biomass is (potentially) another low-cost storage option. The Biofuels Roadmap, which the Crown research institute Scion released in 2018, shows some of the options from certain feedstocks, but the utilisation across different scales can be enormous, from replacing or augmenting large-scale thermal generation to onsite combined heat and power, with Fonterra moving in the right direction, to biogas digestors at water treatment plants and for on-farm and community usage.

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For the period between 2016 and 2018, the International Renewable Energy Agency reported earlier this year an installed, stable (or base) capacity of 77 megawatts from solid biomass and a reasonably stable 41MW from biogas for New Zealand. A comparison with the total installed capacity of around 850MW in Australia, and considering our agriculture-intensive economy, suggests we can move more aggressively into this space.

A pumped storage hydropower scheme between the Onslow-Manorburn basin and Lake Roxburgh in central Otago, with realisable potential energy in excess of 10,000 gigawatt hours to buffer the country’s electricity system during a dry year and address the intermittency of wind, has been suggested for nearly two decades and the Government is now making some headway.

Innovations around mechanical storage, specifically fly wheels, super capacitors and others, are ongoing internationally and in New Zealand. These, with the well-established technology platforms briefly discussed here, will together pave the way for a just transition of our energy system.

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