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Genesis Energy

By email: Ellie.Watson@genesisenergy.co.nz

Dear Elinor Watson,

Effects of climate change on Tekapo Power Scheme

The effects of climate change on the Tekapo Power Scheme (TPS) are highly uncertain but are likely to be twofold:

1. Climate change may affect the nature and timing of inflows into Lake Tekapo, for example, by increasing winter inflows.
2. More broadly, in an effort to decarbonise and mitigate climate change, particularly through building wind and solar power, New Zealand's electricity supply is likely to become more volatile, creating a greater need for flexibility.

These points are set out in more detail below.

Firstly, a change in inflows into Lake Tekapo may affect how the TPS is operated (to a degree), but as operations depend on a wide range of factors, there are substantial uncertainties around this.

Climate change is likely to result in less winter precipitation being stored as snow, therefore increasing inflows into Lake Tekapo during winter months.[1] This would lead to more water being available for electricity generation in winter. This will be beneficial to the electricity market, as winter is the period of highest demand.

However, the operation of the TPS depends not just on inflows, but also on a wide range of other factors, such as electricity market arrangements, technological developments, and the wider electricity system. For example, a rise in alternative storage technologies could affect the management of hydro storage (i.e. lake levels).

It is impossible to predict with certainty how inflows and these wider factors will change over time (particularly over the 35-year term of the consent). However, regardless of these uncertainties, the operation of the TPS would still be bound by the constraints of the consent conditions (e.g. minimum flows, ramping rates, and minimum and maximum lake levels).

Secondly, climate change is likely to increase the importance of flexible generation such as the TPS.

[1] See Tekapo Power Scheme – Hydrological and Hydrogeological Analyses prepared by Pattle Delamore Partners at Appendix K of Genesis' application.

New Zealand's electricity system is decarbonising – there has been a notable increase in generation from intermittent sources (i.e. wind and solar) over the last few years, and this trend is expected to continue into the future. For example, some projections expect that by 2050, over 40% of electricity generation will be from wind and solar.[2]

Electricity supply must always match demand. Flexible resources[3] that can ramp up or down are therefore necessary to keep the system in balance. As increasingly more generation comes from intermittent sources, the importance of flexibility resources will increase. In particular, as the percentage of solar on the system increases, increasingly long-duration flexibility (i.e. over a period of multiple months) will be required to manage the exacerbation of the summer-winter differential between demand (winter-focussed) and renewable generation from solar and South Island hydro inflows (both largely summer-focussed, even considering the climate change effects discussed above).

Hydro schemes with large storage reservoirs (such as the TPS) are particularly important flexibility resources, as they can store large amounts of water and therefore provide long-duration flexibility. This function can't be feasibly carried out by batteries – it is uneconomic to build a battery to fill up and release only one to two times a year to meet this long-duration flexibility requirement. The principal alternative to hydro schemes with large storage reservoirs for providing such long-duration flexibility are fossil-fuelled stations. Any change to the operation of hydro schemes which reduces the ability to provide long-duration flexibility will almost certainly be significantly met through increasing the operation of fossil-fuelled stations.

Yours sincerely

Simon Coates
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[2] See Figure 9 of Transpower's Whakamana i Te Mauri Hiko report.
[3] Generally flexible generation plant, although this flexibility can also be provided by demand response.