Generator Outages in the Hydro Risk Curves

In the previous HRC 101 on generation assumptions, we discussed how generator behaviour is included in the HRC modelling. But it is equally as important to consider when these generators will not be operating. We only include specific generator outages in the HRC model, and this HRC 101 will discuss how we choose which outages to include and why.

What outages do we look at?

In each monthly HRC update, we look at all of the generation outages over the next months that have been listed in the Planned Outage Coordination Process (POCP), but only some outages are included in the HRC model according to a specific set of criteria.

First, as the HRCs are a model of market behaviour in an emergency situation, we only consider outages that could not be deferred if an emergency situation were to occur. We assume that any generator outages that can be deferred in an emergency situation will be deferred, so the maximum possible generation fleet is available to prevent hydro storage levels dropping any lower.

Second, we typically only consider outages in the next 8 months. This window allows us to capture any confirmed major outages that could impact security of supply. We automatically consider any outages within the next two months—we assume that it is unlikely outages within two months will be cancelled for logistical and scheduling reasons. For outages further out, we check with each of the generators, and we only include large outages (more than 30 MW, and for longer than 7 days).

Finally, and most importantly, we only include outages that will result in a loss of energy. The HRCs do not model generation capacity, but the energy available in the system. They are a reference against which actual stored energy (in the form of controlled storage) can be compared, and thus we only include outages that will increase hydro generation and thus storage consumption. For example, if one unit of a four-unit hydro generator is on outage, it is unlikely to have any impact on the amount of hydro generation used. The HRC model already assumes a low level of hydro generation, so taking that unit out will likely not make a difference. In the rare case it is required, then taking it out will typically mean hydro generation from elsewhere is used, meaning the total amount of hydro generation used is the same regardless.

In addition to regular generator outages, in some HRC updates we have also included outages or de-ratings of thermal generators when we believe there is insufficient thermal fuel supply to support assumed thermal generation. For more information on how we calculate this, see the previous HRC 101 on Thermal Assumptions.

Which outages do we include?

Once we have extracted the list of outages from POCP, we select which ones to include according to the criteria described above. These criteria are interpreted differently for each fuel type, as discussed below:

- Thermal and Geothermal
  - All thermal and geothermal outages are included. When these generators are on outage, more hydro storage will need to be consumed to cover for the loss of generation.
Wind
- Wind farm outages are included if there is a loss of more than 50% of capacity. Wind farms typically rotate the use of their turbines to allow for maintenance, and this is included in the capacity factor we use for that specific wind farm. Any outage that is under this threshold will typically not impact the modelled capacity as it will already have been accounted for. That is, a 40% capacity factor for a specific wind farm will include allowances for small single turbine outages.

Run-of-river hydro
- Run-of-river hydro generators do not have controlled storage, and thus when there is an outage, any water is not being used to generate, and this source of potential generation lost. This means that more controlled storage from stored hydro generators must be used to replace this generation, and thus all run-of-river hydro outages are included in the HRC model unless otherwise advised.

Controlled Hydro
- As described above, when there is an outage of a controlled hydro generator, the amount of hydro generation used in the model is usually unaffected. The only time when we count controlled hydro outages is when the outage will result in spill. In this case, potential generation in the form of stored hydro is being lost, and this outage would be included in the HRC model.

We also include any HVDC outages, which are shown in section 2.10 of the HRCs assumptions document. An HVDC outage will restrict the transfer between the North and South Island. Most of the controlled hydro storage in New Zealand is in the South Island, with most of the demand in the North Island. In the case when hydro storage is low, HVDC transfer will be in the south direction, with North Island generation supporting South Island demand. An outage of the HVDC will restrict the ability of North Island generation to provide for South Island demand, meaning that more South Island generation will need to be used, and resulting in increased hydro storage consumption.

What impacts do outages have on the HRCs?

Each outage included in the HRCs can have a different impact on the shape of the curves, depending on the size and duration of the outage. Generally, if plant is removed from the model, the HRCs will increase. However, sometimes previously modelled outages will be cancelled or deferred, resulting in a decrease in the HRCs. Each outage is slightly different, and sometimes other assumptions are updated each month at the same time, so it can be difficult to determine the impact of individual outages on the HRCs. We will take a detailed look at the impact of outages and other HRC assumptions on the HRCs in a future HRC 101.

The next edition in this series will talk about the Risk Meter, which is our key indicator for risk status.