IMPORTANT

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1 THERMAL WHAT-IF SCENARIOS

This month we have run two additional Hydro Risk Curve (HRC) and Simulated Storage Trajectory (SST) scenarios to investigate the impact of gas disruptions and fuel limitations on New Zealand energy supply. The first scenario models the impact of a gas supply limitation or generation plant failure. The second scenario models a gas pipeline disruption, like that experienced in 2011 when the Maui pipeline was out of service while repairs were made.

The most recently published HRCs and SSTs were produced in February. These charts included a de-rating to thermal generation which reflected the gas supply constraints observed in the market at that time, but did not include any additional thermal fuel scenarios. These charts have been included below as a base-case for comparison. In this chart, the 1%, 4% and 10% HRCs are denoted by 1% Risk, 4% Risk and Emergency Zone respectively. The SSTs are the cluster of 87 sequences that start from 22 February 2019.

In last month’s HRC and SST update, 28% of sequences crossed the 1% HRC, 2% of sequences crossed the 4% HRC, and no sequences crossed the 10% HRC. This means that, although there is a moderate chance of storage dropping below the 1% HRC, there is currently no foreseeable risk of crossing the 10% HRC and an emergency situation occurring.

A set of HRCs and SSTs have been produced for each of the thermal constraint scenarios and are specifically for the purpose of analysing potential future scenarios. It is important to note the SSTs are a complex model that includes many inputs and assumptions, including market behaviours. Certain assumptions around generator behaviours can have major impacts on the results in the SSTs, and therefore while the charts included here may represent one possible outcome of constraints in the gas market, there are many different possible outcomes depending on these assumed behaviours and specific situations modelled.

The South Island HRCs and SSTs for the base-case, as well as the two thermal scenarios, can be seen in the Appendix.
1.1 **GAS SUPPLY SHORTAGE SCENARIO**

In this scenario, one CCGT is de-rated to 50% capacity to represent a decrease in available gas supply for electricity generation or reduction in plant availability. This scenario could arise from a range of situations including, but not limited to, upstream gas supply outages or limitations, or unplanned plant outages.

![NZ Actual Controlled Storage and Risk Curve](image)

This gas constraint impacts both the HRCs and the SSTs. Restricted generation means the HRCs increase by up to 600GWh – the risk of shortage rises when potential generation is reduced. The gas constraint also impacts the SSTs in that the sequences fall to lower storage levels more rapidly as more water is used to meet demand due to reduced thermal generation.

In the chart above, 100% of sequences pass the 1% HRC (although some only very briefly), 11% of sequences cross the 4% HRC, and 2 sequences cross the 10% HRC. In this scenario there is a small chance of an emergency situation occurring due to 2 sequences crossing the 10% HRC.

1.2 **GAS PIPELINE DISRUPTION SCENARIO**

This scenario reflects a major infrastructure failure – the complete loss of gas transmission to major North Island electricity generators for an extended period (from 1 May 2019 to 31 July 2019). This scenario is reflected in the model by reducing Huntly gas-fired generation to zero for 3 months. This is an extreme, but plausible scenario (in 2011 an unplanned outage on the Maui pipeline lasted 5 days) and is designed to test the edge of the envelope in terms of plausible futures.
Similar to the gas constraint scenario, both the HRCs and SSTs are impacted by the loss of gas transmission in the North Island. In this scenario, the HRCs rise by up to 1000GWh. The increase to the HRCs is more pronounced in this scenario due to the scale of the loss of generation. The SSTs also fall at a faster rate, again due to increased hydro generation to cover for a lack of thermal generation.

In the chart above, 100% of sequences pass the 1% HRC, 30% of sequences cross the 4% HRC, and 6 sequences cross the 10% HRC. In this scenario there is now a slightly higher chance of an emergency situation occurring due to 6 sequences crossing the 10% HRC compared to the previous scenario.

1.3 WHAT DOES THIS ALL MEAN?

These scenarios show how a failure of a significant component of the New Zealand energy sector can have a major impact on security of supply. Small changes to the electricity system that occur over time, such as gradually increasing demand, allow for a timely response in the market to keep supply and demand in balance. But in sudden events such as the failure of major equipment, there is little time for a timely market response. Additionally, security of supply is a balance between avoiding emergency situations without over investing in costly generation.
2 APPENDIX: SOUTH ISLAND CHARTS

2.1 MOST RECENTLY PUBLISHED SOUTH ISLAND HRCs AND SSTs
2.2 **South Island HRCs and SSTs for Gas Supply Shortage Scenario**

[Chart showing storage GWh from 1 Jul 18 to 31 Dec 19 with various lines indicating different scenarios and risk levels.]

*For Illustrative Purposes Only*

2.3 **South Island HRCs and SSTs for Gas Pipeline Disruption Scenario**

[Chart showing storage GWh from 1 Jul 18 to 31 Dec 19 with various lines indicating different scenarios and risk levels.]

*For Illustrative Purposes Only*