Transmission Assumptions in the Electricity Risk Curves

Transmission lines throughout New Zealand have limits to the electricity they can transmit. These limits can change depending on the time of year, and can impact the capability of the national transmission network depending on which generators are generating and where demand is highest. These factors are important for the ERCs because the derivation of the ERCs includes a nodal model of the New Zealand power system. We include specific transmission line constraints in the derivation which will affect the ability of generators to transmit their generation, and thus may constrain generation. This could mean that thermal generators which are brought online to conserve hydro generation may not be able to generate at full capacity because doing so may overload lines or compromise security standards on the power system. We include security constraints in the derivations of the ERCs that have the potential to constrain generation, particularly in a dry year.

The following table outlines the constraint equations and the transfer limits for each constraint. The pre-contingent steady state power flow on the two circuits listed must not exceed the transfer limit. These equations generally reflect what is observed in the wholesale market. However, as we generate constraints dynamically in the market using the Simultaneous Feasibility Test (SFT), the equations below will differ from those in the wholesale market. We do not consider there to be any material impact of these differences for the purposes of security of supply modelling.

An example of how to interpret the equation constraints is as follows. The power flow from Hamilton to Karapiro on the circuits HAM_KPO2.2 multiplied by a factor of -1.06, plus the power flow from Hamilton to Karapiro on the circuit HAM_KPO1.2 multiplied by a factor of -0.89, must not exceed 60MW (summer rating). These equations are based on an engineering assessment of transmission capability, including stability constraints. You can read more about this in the System Security Forecast.

Table 1: Security constraints included in ERC modelling

Constraint	Transfer Limit		
	Summer	Shoulder	Winter
0.86*BOB_OTA2.2 + 1.09*BOB_OTA1.2	121		
-1.06*HAM_KPO2.2 + -0.89*HAM_KPO1.2	60	67	74
-1.05*HAM_KPO2.1 + -0.89*HAM_KPO1.1	63	67	73
-1.24*OHK_WRK.1 + -1.01*ATI_WKM.1	427	444	462
-1.03*KIN_TRK1.2 + -1.02*KIN_TRK2.2	51	57	64
-1.36*BRK_SFD1.1 + -0.42*BRK_SFD2.1	327		
RDF_T3 + RDF_T4	129		
-1.04*FHL_RDF2.1 + -0.92*FHL_RDF1.1	52	59	66
-1.28*BPE_TKU1.1 + -0.5*BPE_TKU2.1	410	424	444
1.4*RPO_TNG1.1 + -0.24*BPE_TKU2.1	342	378	415

Constraint	Transfer Limit		
	Summer	Shoulder	Winter
1*BPE_WDV1.1 + -0.04*HAY_LTN1.1	55	55	64
1*BPE_HAY1.1 + 1*BPE_HAY2.1 + -1*HAY_LTN1.1 + 1*BPE_WIL1.2 + -1*MGM_WDV1.1	1046		
1*LIV_NSY.1 + -0.42*CYD_TWZ1.2	304		
-1.23*AVI_BEN2.1 + -0.89 * AVI_BEN1.1	255	278	302
-1.12*GOR_ROX.1 + -0.06*INV_ROX1.1	77	n/a	n/a
-1.05*EDN_INV.1 + -0.65*GOR_ROX.1	77	n/a	n/a

We also account for limits in HVDC transfer by modelling maximum transfer in both the north and south direction, and including any upcoming HVDC outages.

Table 2: HVDC Transfer Limits

HVDC	Limit (MW)
North Flow (BEN_HAY)	1000
South Flow (HAY_BEN)	550

Typically, North Island generation will be relied upon to support South Island demand in a dry year. This is because most of the generation in the South Island is controlled hydro, so in a situation where there is very low hydro storage, hydro generation would be restricted. In order for North Island generation to support South Island load, the HVDC must be utilised to transfer this electricity. Maximum south transfer is 550MW, so only up to 550MW of electricity can be delivered to the South Island.