Transpower Line Rating Project
Brief Commentary on the TPNZ Conductor/Line Rating Methodology

Pursuant to clauses 12.112(1)(b)(i)(A)and (B) of the Electricity Industry Participation Code 2010, Transpower is changing the rating of some of its circuits using the interim Variable Line Rating methodology where a resulting down-rating of the circuit results. In accordance with clause 12.112(3) of the Code, a summary of Transpower's analysis is set out below.

The methodology to be adopted for calculating the conductor steady state thermal ratings of Transpower's lines is based in part on the procedure detailed in CIGRE Technical Brochure TB207:2002 but with some refinements to allow for skin effect and magnetic heating in ACSR conductors. This is in turn based on the common heat balance equation. The TPNZ method is also similar to the Australian TNSP and IEEE methods.

Comparisons of ratings have been made with other methods such as the Australian TNSP and IEEE methods. All methods generally indicate higher ratings at higher design operating temperatures for larger conductors compared to ratings calculated by the Latta method, and is generally true at times of low or no solar radiation. However, some lines with smaller conductors and lower design operating temperatures will give lower ratings compared to those from Latta.

The main difference between the TPNZ and other modern conductor rating methods is that the TPNZ method will use probabilistic weather data provided by NIWA for ambient temperatures (95^{th} percentile), low wind speeds (5^{th} percentile) as well as solar radiation (95^{th} percentile), whereas the other methods generally calculate solar radiation based on the line location.

The NIWA probabilistic data has been provided for each two hour period during the day by month for the whole country, giving 144 weather parameter sets for the year.

By comparison, the historic Latta method presently used by Transpower makes several assumptions as follows:

- heating (heat absorbed) from solar radiation is completely ignored;
- ambient temperatures only range between 20 and 30°C; and,
- the wind speed is set as 0.61m/s (originally 2ft/sec).

A line rating is based on the ground and other obstacle clearance requirements and the design maximum operating temperature of the line/conductor and therefore maximum sag. Additional solar radiation and ambient temperature will increase the conductor temperature and sag and therefore reduce the available rating, while additional wind speed will reduce the conductor temperature and sag and therefore increase the available rating.

Therefore where the probabilistic ambient temperature is less than 30/20°C and/or where the wind speed is greater than 0.61m/s the inherent conductor temperature and sag will be less and therefore there is additional rating potential. During the day the probabilistic solar radiation will affect the extent of additional rating potential.

As a consequence, where the probabilistic ambient temperature is greater than 20/30°C and/or the probabilistic wind speed is less than 0.61m/s, and/or the probabilistic solar radiation is greater than a nominal amount, the inherent conductor temperature will be higher than that calculated by the Latta method and there would need to be an effective down rating of the line to ensure the maximum design conductor temperature is not exceeded and safety clearances are maintained.

Using the TPNZ method, some lines during the middle part of the day, will have slightly lower ratings than the existing ratings calculated using the Latta method.