IN THE RULINGS PANEL

No:

UNDER	**Regulation 30 of the Electricity Industry (Enforcement) Regulations 2010**
BETWEEN	**The Electricity Authority** Level 7, Aon Centre, 1 Willis Street, PO Box 10041, Wellington 6143 *Complainant*
AND	**Transpower New Zealand Limited** 22 Boulcott Street, PO Box 1021, Wellington 6140 *Respondent*

NOTICE OF FORMAL COMPLAINT

Dated: 5 June 2024

Presented for Filing by:	Luke Cunningham Clere Barristers & Solicitors PO Box 10-357 WELLINGTON	Tel: (04) 472-1050 Fax: (04) 471-2065 (R S May) (43099)

PARTIES

1. The complainant (the **Authority**) is a Crown Entity established under s 12 of the Electricity Industry Participation Act 2010 (the **Act**) and empowered under s 16(d) of the Act to investigate and enforce compliance with the Electricity Industry Participation Code (the **Code**).

2. The respondent (**Transpower**) is the system operator in accordance with s 8(1) of the Act, with functions detailed in Part 7 of the Code.

TECHNICAL BACKGROUND

Voltage stability and VSAT

3. Voltage stability is:

    3.1. the ability of the power system to maintain acceptable voltage under normal conditions and after being subjected to a disturbance; and

    3.2. maintained by the operation of generators operating in "reactive power" mode and/or non-rotating (static) plant that produces reactive power.

4. As part of its principal performance obligation the system operator monitors voltage stability, including by using its Voltage Stability Assessment Tool (**VSAT**) to comply with the Policy Statement incorporated by reference under cl 8.10(1) of the Code.

5. VSAT:

    5.1. is software which draws on information from other systems controlled by the system operator (including the Scheduling, Pricing and Dispatch (**SPD**) tool and node breaker files);

    5.2. calculates voltage stability limits based on those inputs; and

    5.3. monitors proximity to those voltage stability limits.

6. The system operator applies a 5% security margin increase to the load in every VSAT scenario, with the exception of the constant load associated with the aluminium smelter at Tiwai Point, to account for the variability of load in real-time.

7. A node breaker file:

7.1. is used as an input in VSAT to assess voltage stability limits;

7.2. comprises a detailed model of the power system, which models individual nodes, circuit breakers, and other substation topology; and

7.3. identifies circuit breakers with a number at each node.

Constraints

8. A constraint is a limit placed on the load that a system resource or group of resources, usually transmission circuits, can safely manage.

9. Constraints are automatically assigned to every resource on the grid, but can be overridden by the application of a manual constraint when the system conditions mean the default constraints would place the power system, or parts of the system, at risk.

10. Power flows are monitored in the system operator's market systems by way of an equation, comprised of a left hand side (**LHS**) and right hand side (**RHS**):

10.1. the LHS of the equation is the actual power flows being monitored; and

10.2. the RHS of the equation is the constraint, reflecting the power flow limit.

11. Where actual power flows on the LHS approach or reach the constraint on the RHS, the constraint becomes binding.

12. When a constraint binds:

12.1. the system operator needs to dispatch different resources, such as generation, to force a reduction in power flows;

12.2. such generation is not already dispatched, because it is usually more expensive than the generation that is already dispatched; and

12.3. "price separation" results through the market pricing model creating two different prices on either side of the constraint.

Voltage stability constraints

13. Where the operating limits of voltage stability are approached, the system operator looks at whether there are system resources available to be dispatched or whether it can call on generators to increase supply to reduce the system's proximity to the voltage stability limits.

14. Voltage stability constraints are:

    14.1. manual constraints set up in the market system, with power transfer limits set at a high enough level that they do not bind under normal conditions but are lower than the normal constraint so can be used to maintain voltage stability risks; and

    14.2. based on voltage stability limits generated by VSAT.

15. The RHS of the voltage stability constraint equation:

    15.1. shows the power transfer limit, in MW; and

    15.2. can be adjusted up or down in real-time by the system operator based on VSAT results to manage risks depending on outages, generations, and demand.

16. When the LHS equals the RHS of the voltage stability constraint equation:

    16.1. the power system is at or near a safe operating limit and the constraint becomes binding; and

    16.2. support is drawn from other local sources to avoid voltage collapse, with the cost of that support being deprioritised for dispatch purposes.

THE GZ14 VOLTAGE STABILITY CONSTRAINT

Background

17. On 24 January 2022, Transpower identified a voltage stability situation in the lower South Island.

18. This was primarily the result of two events:

    18.1. a planned outage on the Livingston to Naseby (LIV-NSY-1) circuit on 18 January 2022 as a result of the Clutha Upper Waitaki Lines Project, leaving only the two

Clyde to Twizel circuits (CYD-CML-TWZ 1 and 2) connecting Southland Grid Zone 14 (**GZ14**) with the rest of the grid; and

18.2. low hydro-levels in GZ14 causing most of the hydro-generation to shut down (especially overnight) to conserve water, leaving little generation connected to GZ14 to support its load and requiring high generation import into GZ14 through the two CYD-CML-TWZ circuits.

19. This impacted voltage stability in GZ14 because:

19.1. voltage stability would drop if one of the CYD-CML-TWZ circuits tripped and, if there was insufficient connected plant (such as hydro-generators) to arrest the voltage drop, voltage would collapse and risk cascade failure; and

19.2. the higher import of electricity into GZ14 would increase voltage instability because each remaining connected generator within GZ14 would have to do more work to support the voltage.

The Constraint

20. On 28 January 2022, Transpower developed a temporary voltage stability constraint (GZ14_IMPORT STABILITY_T_1) (the **Constraint**).

21. The Constraint was developed to:

21.1. manage voltage stability in GZ14 while the LIV-NSY-1 circuit was out of service and there was limited local hydro-generation;

21.2. limit total southward flows on the two CYD-CML-TWZ circuits to reduce the potential voltage stability risk, by nominally setting the RHS to a lower MW value than the normal value but higher than the forecast power flows to avoid it binding under normal conditions;

21.3. allow for the RHS to be reduced in real-time depending on concurrent outages, reactive plant in service, and the number of active generators in GZ14; and

21.4. increase local power dispatch from generation at Manapōuri and Clutha to reduce the imported power flows when the voltage stability limit was binding.

22. In GZ14, VSAT assumes Tiwai aluminium smelter loads remain constant, and this load is not increased by the 5% security margin with the other loads in GZ14.

23. Where the CYD-CML-TWZ circuits were constrained:

    23.1. they would be flowing at maximum capacity using the lowest cost generation that the market model dispatches; and

    23.2. if additional local and generation was dispatched to relieve the constraint, this generation would be at a higher cost, resulting in an increase in prices.

24. During development of the Constraint:

    24.1. the node breaker file was manually modified which resulted in incorrect file naming conventions, which affected the Tiwai load numbering in the input files; and

    24.2. this resulted in the Constraint:

        (a) not recognising that the Tiwai loads were intended to remain constant; and

        (b) causing the scaling of the Tiwai loads up by 5% with the other GZ14 loads.

25. By scaling the Tiwai loads 5% higher, VSAT assumed:

    25.1. there was more total forecast load in GZ14; and

    25.2. more power would be imported through the CYD-CML-TWZ circuits to supply that forecast load, and there was therefore a higher risk of voltage instability.

26. In response, the RHS of the Constraint was lowered in real-time more than it ought to have been to contain any perceived voltage stability risks.

27. Between 28 January 2022 and 13 April 2022, and as a consequence of this error:

    27.1. the RHS of the Constraint was adjusted down based on VSAT results to an average of 539 MW and a minimum of 467 MW; and

    27.2. the Constraint bound when it should not have, resulting in more expensive GZ14 generation being dispatched for 102 trading periods in GZ14.

28. On 13 April 2022, Transpower:

28.1. identified the error in relation to the Tiwai load; and

28.2. created a new VSAT model that allowed the Tiwai load to remain constant.

Market impact

29. The Authority's assessment of the market impact of Transpower's error was as follows:

29.1. Generators were overpaid by approximately $750,000.

29.2. Purchasers overpaid by approximately $2.96 million.

BREACH OF THE CODE AND CLAUSE 30.1B OF THE POLICY STATEMENT

30. The policy statement is incorporated by reference under cl 8.10(1) of the Code.

31. Clause 8.14 of the Code requires Transpower, as system operator, to comply with the policy statement.

32. Clause 30.1B of the policy statement requires Transpower to:

> Correctly apply security constraints regardless of whether or not the information about the Transpower website about the power system stability limits or security constraints is complete or up to date.

33. Transpower breached cl 30.1B of the Policy Statement, and accordingly the Code, by failing to correctly apply security constraints in the modelling system between 28 January 2022 and 13 April 2022.

34. On 29 May 2023, Transpower self-reported that it likely breached clause 30.1B of the policy statement.

RELIEF CLAIMED

35. The Authority asks that the Rulings Panel determine that Transpower has breached the Code as outlined above and make the following orders:

35.1. A pecuniary penalty order to be made pursuant to s 54(1)(d) of the Act.

35.2. An order that a public warning or reprimand be issued pursuant to s 54(1)(b) of the Act.

35.3. An order that the system operator pays the Authority the reasonable costs of its investigation and these proceedings pursuant to s 54(1)(g) of the Act.

35.4. Any other order the Rulings Panel considers just.

SUPPORTING INFORMATION

36. The following documents are filed and served along with this notice:

36.1. The investigation report prepared under reg 19 of the Regulations.

36.2. The annexures to that report.

37. The contact persons for the parties are as follows:

37.1. Authority: Amy Williams, Senior Legal Counsel (amy.williams@ea.govt.nz)

37.2. Transpower: Chris Birkinshaw, Head of Legal (chris.birkinshaw@transpower.co.nz)