

## **Investigation of alleged breaches of the Electricity Industry Participation Code 2010 by Transpower New Zealand Limited as the grid owner**

On 31 May 2018 and on 2 July 2018 Transpower New Zealand Limited as the grid owner self-reported to the Authority that it believed on reasonable grounds that on three separate occasions it had breached clause 4(4)(a)(ii) of Technical Code A, Schedule 8.3 of the Electricity Industry Participation Code 2010.

Under regulation 12 of the Electricity Industry (Enforcement) Regulations 2010, on 6 August 2018 the Authority appointed Peter Wakefield as the investigator to investigate the alleged breaches.

Under regulation 16, the investigator must promptly notify the industry participant alleged to have breached the Code of the allegations that are being investigated. On 9 August 2018, the investigator gave the grid owner such notice.

Under regulation 17, at the same time as the investigator sends a notice under regulation 16, the investigator must publicise the information about the matters under investigation, including the content of the notice given under that regulation. The investigator is hereby publicising the matter under investigation, and a copy of the notice given under regulation 16 is attached.

Any participant who considers that it is affected by the matters being investigated, and who wishes to become a party to this investigation, should notify the investigator within 10 working days after publication of this notice.

The investigator's contact details are:

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# NOTICE UNDER REGULATION 16 OF THE ELECTRICITY INDUSTRY (ENFORCEMENT) REGULATIONS 2010

<b>Date:</b>	9 August 2018
<b>Addressee:</b>	Transpower New Zealand Limited as the grid owner
<b>Subject:</b>	The grid owner's protection settings were not selective during faults so that the minimum amount of assets are electrically disconnected.
<b>Investigator:</b>	Peter Wakefield, Senior Investigator, peter.wakefield@ea.govt.nz (appointed investigator under regulation 12 of the Electricity Industry (Enforcement) Regulations 2010 (Regulations)).
<b>Notifying industry participant:</b>	Transpower New Zealand Limited as the grid owner.
<b>Clause allegedly breached:</b>	<p>Clause 4(4)(a)(ii) of Technical Code A, Schedule 8.3. This clause requires an asset owner to design, commission, maintain and apply settings to its protection systems to be selective when operating so that the minimum amount of assets are electrically disconnected.</p>
<b>Circumstances of alleged breaches:</b>	<p><b>Invercargill transformer T3 tripping</b></p> <p>At 02:43 on 8 November 2017, the two in-service upper South Island (USI) 220 kV circuits simultaneously tripped (USI event). Shortly afterwards the 66 kV/110 kV West Coast network tripped as it could not support the total USI load.</p> <p>At 02:44 on 8 November 2017, Invercargill transformer T3 also tripped. Invercargill transformer T5, operating in parallel with T3, remained in service and maintained supply to the load previously supplied by T3.</p> <p>The grid owner's on-site investigation of T3 failed to find any visible fault. The grid owner investigated further and found that the transformer high voltage winding restricted earth fault protection element had incorrectly operated causing T3 to trip. The grid owner found that it had configured the protection element setting incorrectly and the protection element was more sensitive than it should have been.</p> <p>The grid owner had expected the restricted earth fault protection element to only operate for a fault in the protected zone associated with T3. The grid owner's investigation concluded the restrictive earth fault tripping of T3 was due to the over-sensitive setting that was triggered by the significant tripping of the 220 kV circuits in the USI.</p> <p>The grid owner issued a protection setting change to be applied to the restricted earth fault protection element for T3. The grid owner's service provider then applied the setting change and at 16:13 on 8 November 2018 the grid owner returned T3 to service.</p> <p><b>Bombay transformer T2 tripping</b></p> <p>On 26 January 2018, the grid owner replaced Bombay 33 kV circuit breaker 72 with a similar circuit breaker that had previously been used at another grid owner substation.</p> <p>The current transformers in the replacement circuit breaker had different ratios to the</p>

original Bombay current transformers. This required the grid owner to change a protection setting during commissioning.

At 00:12 on 4 February 2018, a fault occurred on feeder circuit breaker 102 supplying Counties Power Limited's (Counties Power) distribution network. The fault was intermittent and circuit breaker 102 successfully auto-reclosed.

At the same time as the fault occurred on circuit breaker 102, the recently replaced circuit breaker 72 also tripped, removing T2 from service. This should not have happened for a feeder fault on circuit breaker 102.

The grid owner's investigation revealed that the restricted earth fault element of the differential protection for T2 had operated incorrectly during the fault on circuit breaker 102. The relay associated with this protection had become unstable during the fault, due to the difference in current transformer ratios between circuit breaker 72 and the transformer neutral current transformer.

The grid owner had recognised this potential issue when preparing the new settings and made allowance for the different ratios. The manufacturer's documentation indicated that the relay had the ability to compensate for different current transformer ratios.

However, the grid owner's investigation found the relays installed at Bombay had an earlier version of firmware installed that did not make sufficient allowance for operating with different current transformer ratios.

At 20:40 on 4 February 2018, the grid owner returned T2 to service after re-instating the relay's original pickup current setting.

On 14 April 2018, the grid owner installed and commissioned a new relay with the latest firmware.

There was no loss of supply to the distributor when T2 tripped, as the parallel transformer T3 continued to supply load on the three 33 kV feeders to Counties Power.

### **Southbrook Transformers T1 and T2 tripping**

At 14:24 on 9 March 2018, the grid owner's Southbrook grid exit point transformers T1 and T2 tripped when a fault occurred in MainPower New Zealand Limited's (MainPower) 11 kV network. MainPower's protection correctly operated and cleared the fault. However, the grid owner's protection also operated and tripped both T1's and T2's high voltage and low voltage circuit breakers.

The transformers' tripping resulted in a loss of 14 MW of 33 kV supply to MainPower.

MainPower isolated the faulted equipment on its network and at 14:52 the grid owner restored supply.

The grid owner investigated the tripping of T1 and T2 and found it had incorrectly designed the 'directional' setting for the back-feed protection element on the T1 and T2 protection relays.

The grid owner describes the Southbrook 33 kV supply as unusual because it does not include a 33 kV busbar (unusual connection arrangement). The Southbrook 33 kV supply from transformers T1 and T2 is directly cabled to MainPower's substation on an adjacent property.

The grid owner considers the unusual connection arrangement contributed to the star point of the current transformers used for the back-feed protection element of the protection being connected to look in the opposite direction to a standard 33 kV installation (non-standard star point connection).

The grid owner believes it overlooked the non-standard star point connection when

designing the protection system, and this oversight resulted in the incorrect operation of the protection system when the fault occurred in MainPower's network on 9 March 2018.

On 22 March and 19 April 2018, the grid owner changed the current transformer star points on transformers T1 and T2 respectively to the standard connection arrangement.

**Date and time of alleged breaches:**

- Invercargill T3: for a period until 8 November 2017
- Bombay T2: 26 January 2018 to 4 February 2018
- Southbrook T1 and T2: 15 August 2015 to 9 March 2018

*Please note, under regulation 16 of the Regulations, you are obliged to respond to this allegation, in writing, to the investigator within 10 working days of receipt of this notice (unless the investigator allows, in writing, a longer period).*

*Please provide your response by return email to the investigator.*

***Include the following in your response:***

***Whether you believe you have breached the Code***

***Whether there is another provision you consider more accurately describes the nature of the event***

***A full explanation of the circumstances surrounding the alleged breaches***

***Identification of any information provided in your response that you consider confidential and that should not be included in the investigator's report under regulation 19 (regulation 15(2)).***